

Feces from coral-eating fish may act as 'probiotics' for reefs

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Until recently, fish that eat coral—corallivores—were thought to weaken reef structures, while fish that consume algae and detritus—grazers—were thought to keep reefs healthy. But scientists

have discovered that feces from grazers leave large lesions on coral, possibly because they contain coral pathogens. By contrast, feces from corallivores may provide a source of beneficial microbes that help coral thrive.

"Corallivorous fish are generally regarded as harmful because they bite the corals," said Dr. Carsten Grupstra of Rice University, lead author of the study published in *Frontiers in Marine Science*. "But it turns out that this doesn't tell the whole story. Corallivore feces contain many of the bacterial taxa that associate with healthy corals under normal conditions, potentially resulting in the natural dispersal of 'coral [probiotics](#),' analogous to fecal microbiota transplantation therapy in humans."

Good bacteria for healthy reefs?

Tropical coral reefs harbor lots of fish, which defecate all the time. Although fish feces disperse nutrients which may help support a healthy coral reef, they also contain pathogens and sediments that can smother parts of living coral, and these dying patches of coral are called [lesions](#). To protect delicate coral reef ecosystems, we need to understand how this cycle of waste and nutrients works.

Grupstra and colleagues studied the effects of feces from both corallivores and grazers on live coral. They placed pieces of coral in jars with sterile seawater and applied feces from corallivore and grazer fish to different jars. Some samples were sterilized, to determine whether the physical characteristics of the feces alone caused the lesions. After the experiment, each piece of coral was examined and categorized as apparently healthy, containing lesions, or dead.

Finally, the scientists sampled the feces of several corallivore and grazer species to find out what bacteria they contained. This helped them understand what kinds of bacteria might be contributing to the effects

seen on the coral, whether the feces contained specific coral pathogens, and whether their results from the feces addition experiment could be generalized to other fish that also ate coral or algae and detritus.

Keeping coral healthy

Adding feces to the jars sometimes caused lesions on coral pieces, and potentially even the death of the fragment; fragments without any feces remained healthy. Feces from grazers caused lesions or death in all coral pieces, while feces from corallivores caused fewer and smaller lesions and rarely caused death. Sterilized feces from either type of fish caused little harm, comparable to the low levels of damage caused by corallivore feces.

The scientists suspected that this was because of the greater abundance of coral pathogens found in the fresh feces of grazers, and the higher abundance of beneficial microbes found in the fresh feces of corallivores. The fish previously assumed to be harmful may thus be contributing to important processes that promote coral reef health.

"More research needs to be done to test how fish feces affect corals to see how we might use these feces in management efforts to support coral reef health," said Grupstra.

The scientists pointed out that the lesion effects of feces may not be so severe under real-world conditions and may not be evenly distributed. The territories and behaviors of fish affect where and when they defecate; feces could disintegrate in the water, limiting lesion formation. Some feces are eaten by other fish, and organisms that live on coral may also move remaining feces that fall on corals, potentially diminishing [feces](#) effects.

"Together, these findings result in a more nuanced understanding of the

roles of [fish](#) on [coral reefs](#) and may help us better understand the interactions that are happening on reefs around the world," said Grupstra. "Both corallivores and grazers have important ecological roles and understanding these roles can help us better manage and conserve these important ecosystems."

More information: Consumer feces impact coral health in guild-specific ways, *Frontiers in Marine Science* (2023). [DOI: 10.3389/fmars.2023.1110346](#). www.frontiersin.org/articles/10.3389/fmars.2023.1110346/full

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