Fish fertilize corals and seagrasses, but not the way you think

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Credit: Sean Mattson

Fish are like underwater gardeners, fertilizing the coral reefs, kelp forests and seagrasses where they reside. Their fertilizer of choice—their own pee.

But, fish communities are facing many changes. Warming oceans mean tropical fish can venture into areas they couldn't before when the waters were cooler. And then there are the human impacts, including fishing and habitat destruction.

Will Wied, a Ph.D. student in Justin Campbell's lab in the FIU Institute of Environment, wants to get to the bottom of how these different factors are altering the all-important nutrient balance. And he's going straight to the No. 1 source of these nutrients—fish waste.

"I'm not just looking at how the fish may be eating a lot more, but also how their excretion is then recycled. Are they no longer hanging out in the seagrass beds, so now the seagrasses don't have a source of nutrients?" Wied said. "It's about picking at different pieces of that overall question of how community structure dictates the quality and quantity of nutrients."

Fish waste—excreted through the gills, in addition to the most obvious source—has a lot of beneficial and life-sustaining nutrients, including nitrogen and phosphorous. If fish numbers dwindle and the steady supply of urine slows, these ecosystems suffer.

The vast majority of Wied's research happens in South Florida. Currently, a normal day of fieldwork means he is out on Biscayne Bay catching fish and putting them in containers filled with filtered water. Then, it's a wait and see if they pee situation. And they usually do. As Wied points out, if someone snagged you from your home, it would certainly scare the pee straight out of you.

Wied keeps the fish for a maximum of 12 hours, frequently monitoring their health before releasing them. Then, he examines the water to calculate the rate of excretion to show the potential of how much and what type of nutrients they could be contributing to a certain location.

"Just like you'd put fertilizer on a garden, the same process is happening with fish pee. But now we need to think about where that fertilizer is going. Is there one area the fish really like, so they are hanging out there more," Wied said. "I want to map this at the larger ecosystem scale and

see how fish movements are connecting the system and how certain fish alter what nutrients are available."

Wied found his way to studying fish excretion through his research in Panama at the Smithsonian Tropical Research Institute. There, he studied a heavily overfished area where bigger catches were sparse, but there was an abundance of tiny fish, including silver sides and bay anchovies. Wied wanted to see how big of an impact the little fish had on nutrient levels. This became the springboard for his current work.

One of the things Wied loves about his research is its versatility and how it's translated across many different ecosystems and species. He even lends a hand to help fellow Ph.D. candidates in other labs, like Megan Kelley from FIU's Predator Ecology and Conservation Lab, who wants to study the effects of nurse shark pee.

"I really enjoy working across different systems, because there's so much to be offered, and I don't want to restrict myself. I want to do as much as I can to figure out these bigger questions," Wied said. "And I've really enjoyed being the local fish pee expert and applying my knowledge to many different systems."

Provided by Florida International University

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