

What's in Our Water?

SEWAGE THREATENS HUMAN AND CORAL HEALTH IN WEST HAWAI'I

In Puakō, a residential community of 160 homes along 2.2 miles of coastline in West Hawai'i, ocean waves spill peacefully across a fringing coral reef and yellow tang dart through the water. But the coral is dying. The fish communities are in decline.

Noticing the changes and suspecting that sewage from old cesspools leaching into groundwater was harming the reefs, the community asked for the Conservancy's help in 2007. Scientific surveys revealed that over the last 40 years Puakō had lost more than half of its once vibrant coral cover.

"Coral reefs are incredibly complex ecosystems that are typically degraded by multiple threats," says Chad Wiggins, the Conservancy's Hawai'i Island marine director. "The community wanted to isolate the impact of sewage at Puakō, so we commissioned a wastewater report that triggered a host of new research."

In 2013, research by Cornell University confirmed that sewage pollution was reaching Puakō's shoreline, and a presentation to the community by Dr. Drew Harvell inspired a movement to replace Puakō's aging cesspools. The new question became, to what degree were cesspools affecting coral?

"We made a decision to go deep on the science," says Wiggins. "Since then, a diverse, strong and collaborative partnership has brought exciting new science to inform community action." This partnership includes the Puakō Community Association, The Nature Conservancy, Cornell University, California State University Monterey Bay, and the University of Hawai'i (UH).

In 2014, the science team captured a broad range of data to establish connections between

land-based pollutants (including sewage), groundwater discharge, marine water quality and coral health. To determine how fast sewage travels, scientists at UH-Hilo added a non-toxic dye to the cesspools. Emerging from underground streams, fluorescent-green plumes of dye reached the reefs after just six hours.

"This indicator was so visual, it was scary," says Dr. Courtney Couch, a postdoctoral researcher at UH's Hawai'i Institute of Marine Biology, whose work has been supported by The Nature Conservancy since 2013.

"We found that coral growth anomalies—tumor-like growths on coral skeletons—were highest on reefs with elevated nutrients," says Couch. In addition, red filamentous algae were overgrowing and killing coral tissue across many of the study sites. "But we also found that the health of the reef varies widely," says Couch. "In some places, the corals are quite healthy and abundant. By 2015 we started compiling all these research components to create a single 'sewage indicator' map, identifying 'hot spots' where the separate indicators converge."

Meanwhile, water samples taken throughout the year from 12 different sites indicated high bacterial counts associated with sewage along the shoreline. Nutrients in groundwater can come from various land-based sources, including fertilizers, animal manure and human wastewater. Bacteria can also come from different sources. "The next big challenge for the science team was to make these distinctions," says Couch.

Microbiologists have now confirmed that bacteria entering the reefs from shore are associated with fecal matter, and analysis of nutrients in the seaweed found nitrate



Yellow tangs and other fish on Puakō reef.

TNC



Puakō coastline.

Chad Wiggins

"fingerprints" indicative of sewage. In fact, water samples taken from nearshore reefs had twice the nutrient concentrations than groundwater samples further inland. At some sites, bacteria levels were 26 times higher than Hawai'i Department of Health acceptable limits.

The team is conducting further investigations to confirm that the fecal bacteria come from humans. But what has been learned so far is already helping Puakō residents make informed decisions on wastewater treatment alternatives.

"The scientific research has been absolutely helpful," says Puakō resident Mike O'Toole. "It's a no-brainer that we need to do something, even if it's complicated. All of us at Puakō snorkel a lot, and we don't want to lose the beauty of the reef, the water's clarity."

They don't have to. With sound science, a commitment to restore the marine environment, and effective wastewater treatment, the Puakō community can once again safely enjoy thriving coral reefs. 🌿 - *Sophia V. Schweitzer*

Testing Puakō's water quality.

Courtney Couch



nature.org/hawaii

Courtney Couch in lab.

Rebecca Most

