

Summary of Findings

Impacts of Land-Based Pollutants on Coral Health: Puakō

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Meandering underground streams flowing beneath Puakō and entering the ocean through springs and seeps once nourished an abundant fishery and vibrant coral reefs. So, when residents began noticing declines in fish and corals, they enlisted partners to help them understand why these changes were occurring.

The Nature Conservancy is working with Cornell University, the University of Hawai'i at Hilo Marine Science Department, the Hawai'i Institute of Marine Biology, and the Puakō Community Association to identify causes of the declines and solutions for restoring coral reef health at Puakō.

Domestic wastewater was suspected as one of the threats to the reef. Research found outdated cesspools leaching untreated sewage through permeable rock to beaches, tide pools, and the reef, impacting nearshore water quality.

How far offshore does the sewage travel from the nearshore seeps? How quickly does sewage from cesspools enter nearshore waters? What are the impacts of sewage to the reef ecosystem? These are the questions currently being addressed by research groups.

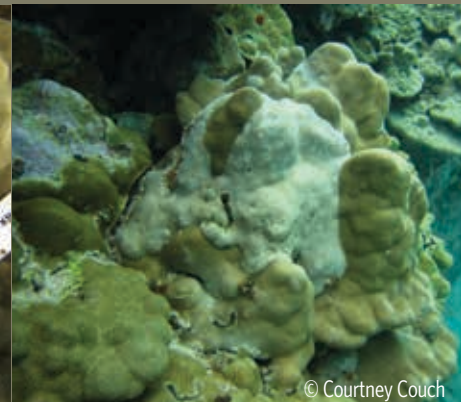
Coral Growth Anomalies

While specific causes of the coral disease observed at Puakō are currently unknown, research on other coral reefs corroborates what we found here: that growth anomalies are more common in areas with higher human activity and land-based sources of pollution.

Coral cover is one of the most common indicators of reef health and though these findings do not prove that the declines in coral cover documented at Puakō are solely the result of changes in groundwater, they strongly suggest that actions to improve water quality would benefit coral health.



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Coral growth anomalies like the lighter colored areas on these lobe corals were the most prevalent coral disease at Puakō. The anomalies are cause for concern because they impede a coral's ability to grow and reproduce, and may mean a slow death for the animal.

Key Findings

Indicators of domestic wastewater have been found in coastal and marine areas where they are likely impacting people, coral reefs, and other marine life:

- Dye tracer studies found that sewage from cesspools reached seeps along the Puakō coast within six hours.
- At some shoreline locations, levels of two bacteria associated with sewage (*Enterococcus*) often exceeded Hawai'i Department of Health standards.
- High bacteria counts were documented at shoreline sites and not at sites in deeper waters.
- Coral growth anomalies, which are tumor-like growths on coral skeletons, were highest on reefs with evidence of groundwater input and elevated nutrients.
- Studies conducted across the region show Puakō's reefs have especially high levels of red filamentous algae, which overgrow and can kill corals.

Impacts on People and Ocean Life

Sewage carries pathogens (bacteria, protozoa, and viruses), pharmaceuticals, nutrients (nitrates and phosphates), cleaning chemicals, and other pollutants into groundwater, onto beaches, and into the ocean. These pollutants have been found in Puakō in areas where people swim, surf, dive, and fish.

Exposure to sewage can cause skin, urinary, blood, and abdominal infections like gastroenteritis, Hepatitis A, conjunctivitis, salmonellosis, and cholera. Children and the elderly are particularly susceptible to these infections.

Sewage also increases disease risk in reef animals and can shift the balance in favor of fast-growing invasive algae, which smother corals and reduce oxygen levels necessary for other animals to survive.

Conclusions

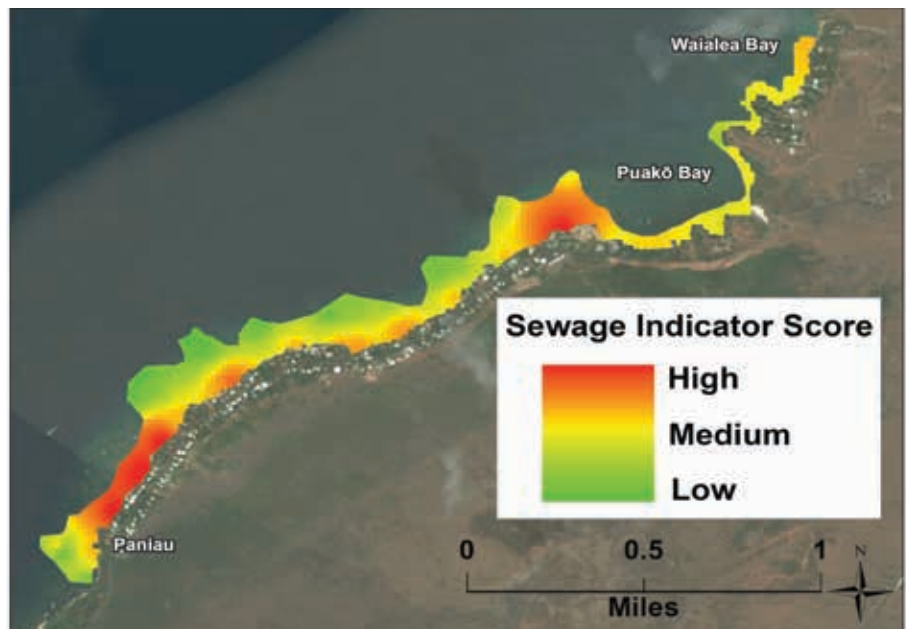
The continued use of domestic wastewater systems that do not treat sewage (e.g. cesspools) exposes recreational water users, coral reefs, and other marine life to significant health risks. Minimizing the flow of untreated sewage into Puakō's waters is critical to reducing these risks and making corals more resilient to ocean warming and acidification. Investing in clean, long-term sewage treatment alternatives will not only benefit the coral reef, but all of us who use and care for the ocean.

For Additional Information

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Dr. Courtney Couch analyzes water samples for bacteria associated with sewage.



The sewage indicator score was created by combining multiple water quality metrics to show where the highest sewage inputs are occurring along the Puakō coastline.

Mahalo

Mahalo to the Puakō Community Association, the Hawai'i Institute of Marine Biology, the Division of Aquatic Resources, the South Kohala Coastal Partnership, the National Oceanic and Atmospheric Administration, the University of Hawai'i at Hilo and all of the project funders, partners, and volunteers working hard to promote reef health in Puakō.