

# PUAKŌ hawai'i

## WHAT'S IN OUR WATER?

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.

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

Using a combination of tools, including stable nitrogen isotopes and DNA-based tools which are able to identify the presence of human waste, the research confirms what has long been suspected: cesspools are leaching untreated sewage underground to Puakō's beaches, tide pools, and reef.

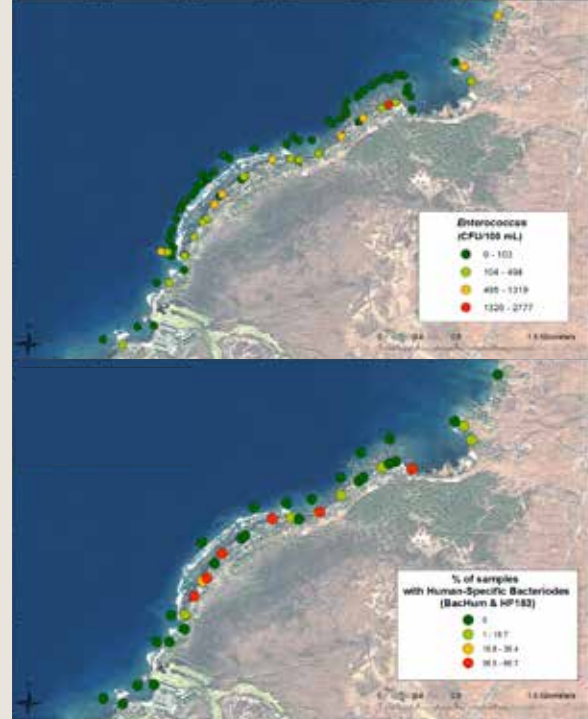
## KEY FINDINGS

- Nutrients are elevated at coastal springs and seeps, as evidenced by high nitrates across 66% of the sites. Measurements were especially high in areas with high levels of submarine groundwater.
- Stable nitrogen isotope measurements in seaweed ( $> +7\%$ ) are indicative of sewage pollution at several locations, with the highest values observed at the southern and northern end of Puakō's shoreline.
- Elevated levels of stable nitrogen isotopes at several reef stations are indicative of sewage reaching the reef.
- Stable nitrogen isotope measurements showed that groundwater became increasingly polluted with sewage moving downslope to the shoreline, with the highest values being measured within Puakō and lower values found at Waikaloa Village.



## KEY FINDINGS *(continued)*

- Between 2014 and 2016, measurements at 76% of shoreline sites exceeded Hawai'i Department of Health standard (single sample maximum, 104 CFUs/100ml) for *Enterococcus* concentrations in coastal waters.
- Like the stable nitrogen isotope data, *Enterococcus* concentrations were lower over the reef compared to the shoreline but were relatively high (36-91 CFUs/100ml) at 20% of the reef stations, also suggesting that sewage pollution is reaching some locations along the reef.
- Using DNA-based tools, researchers found that 36-67% of the samples collected during 2015, contained bacteria only found in the human gut, suggesting frequent exposure to sewage pollution.
- Similar to the stable nitrogen isotope seaweed data, the highest values were found in the northern and southern portions of Puakō.



## CONCLUSIONS

Ongoing research provides strong evidence of sewage pollution along Puakō's shoreline and reef. Minimizing the flow of untreated sewage into Puakō's waters by investing in clean, long-term sewage treatment alternatives will reduce risks to human health and to marine life. Our research constitutes a baseline against which reductions in pollution levels can be measured if wastewater treatment improves.

## IMPACTS ON PEOPLE AND OCEAN LIFE

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. At *Enterococcus* concentrations of 35 CFU/100ml, like those documented at Puakō, recreational water users have a 3.6% chance of contracting gastroenteritis. Sewage pollution also increases disease risk in reef marine 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.

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## FOR ADDITIONAL INFORMATION

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