

Understanding the consequences of land-based pollutants on coral health in South Kohala

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PROJECT OVERVIEW

The Puakō-Mauna Lani reef system is one of the most well-developed fringing reefs on the Island of Hawai'i, providing countless ecological, economic and cultural resources to Hawai'i. During the last 50 years, Puakō has experienced substantial changes in overall reef health, with a 50% decline in coral cover since the 1970's. While the causes of this decline are poorly understood, land-based pollution (LBP) is thought to be a major contributor to the degradation of coral health. LBP is of particular concern along the Puakō-Mauna Lani coastline of South Kohala due to extensive land use change, high recreational use, ineffective sewage treatment and vulnerability to pollution due to its highly porous rock and high volume of underground freshwater discharge, which can deliver LBP to near shore reefs. This project seeks to understand the impacts of land-based pollution on coral reef health, a priority strategy identified by community members and other stakeholders in the South Kohala Conservation Action Plan.

PROJECT GOALS AND OBJECTIVES

To better understand the contribution of land based pollution (LBP) to overall coral health and address a priority management issue we:

- (1) Surveyed the coral, algal and reef fish communities at 37 sites throughout the Puakō-Mauna Lani reef to determine broad patterns in coral reef health.
- (2) Identified 12 sites across a range of LBP input and characterized water quality (temperature, salinity, nutrients, and proxies of productivity and sewage contamination) across these sites.
- (3) Characterized spatial patterns in coral disease and compromised coral health and determined whether these patterns were correlated with water quality parameters.
- (4) Prioritized regions for with impaired water quality and degraded coral health for corrective action.

RESULTS

- We identified four areas for targeted management action: the reef between sites 4 and 6, Pau'oa Bay/Mauna Lani (near 13 and 14), the reef between sites 2 and 3 and Paniaiu (Fig. 1).
- The abundance of *Enterococcus*, an indicator of human sewage, was 7 times higher in shoreline waters compared to reef waters and exceeded the EPA standard for marine waters at 75% of shoreline sites.
- Enterococci abundance was higher in freshwater flows, suggesting that freshwater coming from land may serve as one delivery mechanism of LBP.
- Overall, 24% of corals were diseased and 27% showed signs of compromised health (algal overgrowth, discoloration, physical damage and bleaching), with degraded coral health primarily driven by skeletal deformities and overgrowth by algae.
- Elevated nutrient concentration was the strongest predictor of disease, with more skeletal deformities on reefs with higher nutrient levels (i.e., elevated silica and nitrate + nitrate concentration).

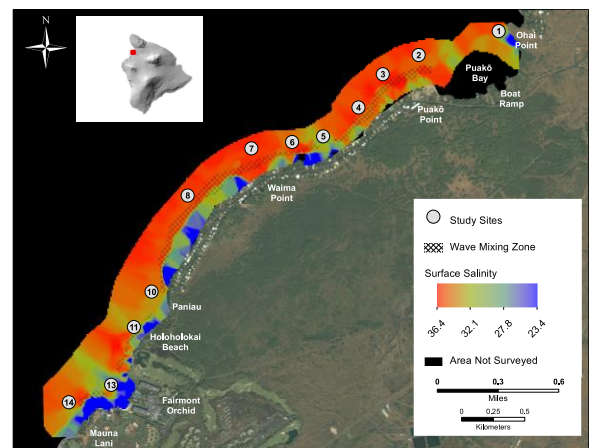


Figure 1. Map showing underground freshwater discharge onto study reefs in December 2013, and the 12 coral health and water quality study sites.

MANAGEMENT OUTCOMES

This study shows that exposure to groundwater may be linked with impaired coral health, and identifies sites that would most benefit from management actions to improve water quality. In light of interest within the Puakō community to improve sewage treatment, additional focus should be devoted to addressing LBP and coral health at the 4 target areas (see Results). Future efforts should also focus on reducing nutrient pollution across the watershed, establishing the causal link between nutrients and coral health, and addressing other pollutants (e.g. chemicals) that may be flowing onto reefs and degrading coral health.