Ka Wai Ola

Indigenous Water Hydrology Study in Comprehensive Strategic Community Planning

INTRODUCTION

CONDENSED ABSTRACT

Ka Wai Ola integrates Indigenous hydrology, kilo observations, and western water quality testing to understand environmental change at Kaʻehu. The project aims to support community-led restoration, climate resilience planning, and loko iʻa management.

BACKGROUND

Kaʻehu is a culturally significant coastal site in Wailuku, Maui, containing a traditional **loko iʻa puʻuone (sand-dune fishpond)** and **ʻauwai (waterway)** system. Once abundant and central to food production, it has been impacted by development and climate change. Community restoration now uses **kilo (observation)**, cultural practices, and scientific monitoring to support ecosystem recovery and resilience.

HYPOTHESIS

- Indigenous kilo observations will correlate strongly with measured scientific parameters.

OBJECTIVES

- Integrate Indigenous Knowledge with Hydrological Monitoring
- Establish Long-Term Water Quality Baselines
- Produce Community-Centered Data for Strategic Planning

RESEARCH

Method

- Sampling conducted across mauka-makai gradient: Inflow, Bridge, Top, North, South, Muli.
- Parameters measured: nutrients (NO_3+NO_2, NO_2, SiO_2, PO_4, NH_3, TN, TP), pH, turbidity, salinity, temperature, dissolved oxygen.
- Cultural observation notes recorded: debris, fish movement, duckweed, vegetation, water clarity.
- Averages calculated across all available years for each variable.

The oral history component of **Ka Wai Ola: Indigenous Water Hydrology Study** centers community knowledge as an essential form of data. Through interviews with kūpuna, lineal descendants, and longtime community members, we documented changes in land and water use at Kaʻehu. These narratives provide critical context that complements our quantitative water-quality monitoring and helps identify culturally grounded restoration benchmarks. By integrating Indigenous knowledge with scientific data, the project strengthens long-term, community-informed freshwater management and strategic planning.

ANALYSIS

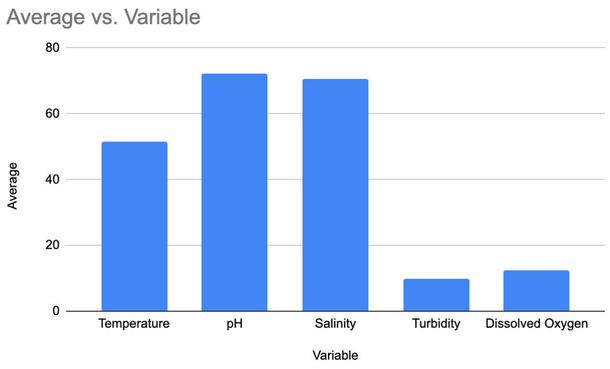
Water quality and nutrient data from 2022–2025 were compiled across all sampling sites and averaged to identify long-term hydrological patterns. Spatial comparisons were made between **mauka (upland)** sites and **makai (coastal)** sites to assess freshwater–saltwater interactions. Event-driven datasets, including the **August 2025 tsunami**, were analyzed separately to evaluate rapid shifts in turbidity, salinity, and debris load.

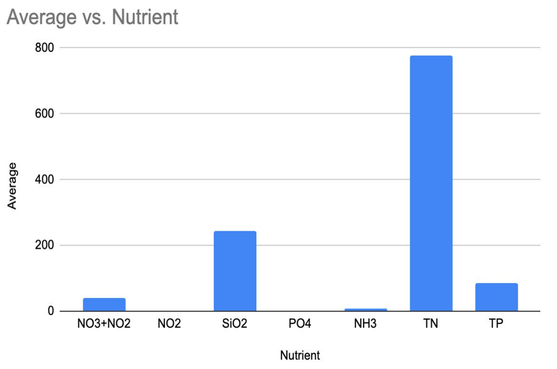
RESULTS

Long-term averages show distinct differences between **mauka (freshwater)** and **makai (coastal)** sites. Makai areas consistently exhibited **higher nutrient concentrations** (especially NO_3+NO_2, TN, and SiO_2) and **greater salinity**, indicating strong mixing and reduced flushing. Mauka sites showed **lower nutrients** and more stable pH.

Across years, **turbidity** increased during storm events, while **dissolved oxygen** varied with flow and vegetation density. The **August 2025 tsunami** produced immediate changes, including elevated turbidity, debris load, and unexpected **salinity intrusion** into typically freshwater ʻauwai areas. These shifts aligned with kilo observations documenting water level rise, vegetation disturbance, and stagnant flow.

Overall, the data reveal clear spatial patterns, long-term baseline conditions, and measurable hydrological responses to extreme events.





CONCLUSION

Ka Wai Ola shows that integrating Indigenous kilo with scientific hydrology reveals clear spatial patterns and strong environmental responses to storms and the August 2025 tsunami. These insights support community-led restoration and strengthen climate resilience planning at Kaʻehu.

DISCUSSION

Differences between mauka and makai sites reflect natural freshwater–saltwater mixing, with higher nutrients and salinity near the coast. The 2025 tsunami caused rapid increases in turbidity and salinity intrusion, showing the system's sensitivity to extreme events. Kilo observations supported these patterns, reinforcing the importance of combining Indigenous knowledge with hydrological data to guide restoration at Kaʻehu.

Acknowledgment

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