

NĀ WAI MOMONA O MEHEANU:
CORRELATING HE'EIA FISHPOND PLANKTON COMMUNITY ABUNDANCE AND DISTRIBUTION
WITH ENVIRONMENTAL CONDITIONS

A THESIS SUBMITTED TO THE GLOBAL ENVIRONMENTAL SCIENCE UNDERGRADUATE DIVISION IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

BACHELOR OF SCIENCE

IN

GLOBAL ENVIRONMENTAL SCIENCE

MAY 2019

By
No'eau Machado

Thesis Advisor
Rosanna Alegado

ABSTRACT

The state of Hawai'i is overwhelmingly reliant on imported food. Improving Hawai'i's food security and sustainability, require advancements in local food production systems. Native Hawaiian fishponds (loko i'a) are historically important systems of aquaculture. Fish production in these systems rely on nutrient availability and physical factors (dissolved oxygen, water temperature, salinity, conductivity, pH), that influence plankton community composition at the base of the loko i'a food web. Runoff carries allochthonous nutrients from land to the nearshore. We hypothesize that the majority of loko i'a were built at the base of watersheds to take advantage of nutrient fluxes that would stimulate primary production. This project examines the relationship between physical and geochemical parameters and plankton communities within He'eia Fishpond on O'ahu. Between October 2017-February 2019, discrete nutrient sampling of dissolved inorganic nutrients and direct cell counts of autotrophic and heterotrophic plankton were undertaken to characterize the physical and biogeochemical conditions from 14 sites within He'eia Fishpond and 2 control sites in He'eia Stream and nearby reef. As coastal loko i'a were brackish water ecosystems, we predict that fishpond sampling sites with salinity ranging from 15-25 PSU will have the highest autotroph abundance. While understanding autotroph abundance is of importance to loko i'a stewards, diatoms - the primary food source for juvenile fish are of greatest concern. We found that heterotrophs dominated sites nearest He'eia Stream whereas autotrophs dominated sites nearest to Kāne'ohe Bay. The relative abundance of diatoms was only 3-8% with highest values at sites with salinity ~ 5-15 PSU, adjacent to He'eia Stream. As restoration has lead to increased mixing of the loko i'a and decreased salinity, we predict that the relative abundance of diatoms will increase, increasing the carrying capacity for fish production. This research improves our understanding of the complex relationship between plankton biogeography and physicochemical parameters so that fishpond stewards can identify conditions that promote maximal fish productivity.