**Shallow Water Coconut Drifter**

OCN 418 Proposal

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The biological, physical, and geo-chemical processes within and around He’eia Fishpond are of great interest for restoration of the pond and sustainable management of the greater National Estuarine Research Reserve (NERR). Knowing the water circulation patterns in the pond is important for further detailed research. Previous research has quantified water exchange between the pond, He’eia stream, and Kaneohe Bay through the six mākāhā channels. From this, pond water residence time has been calculated assuming horizontal homogeneity. I hypothesize that due to the mākāhās locations along the stream to the north and along the bay to the east and with mangrove forests on the western flank horizontal pond water mixing is limited. If mixing is limited to the extent that the pond can be divided into two distinct regions, one of well mixed and one of poorly mixed, then new residence time calculations can estimated.

In order to determine the circulation patterns of the fishpond I intend to develop simple surface drifters comprised of a GPS unit, microprocessor, and battery pack, with telemetric capabilities for real time remote tracking. Each unit will be housed in a coconut shell that has been cut in half, cleaned out, and resealed after assembly. He’eia Fishpond is on average about one meter in depth. Traditional drifters have a water profile that pierce too deep for effective measurements in this shallow environment. The coconut drifters will be mostly submerged, with only a small portion above the surface limiting wind influence. Their water profile would be approximately 15 cm deep. Due to possible complications using a coconut shell as a housing as well as limited by reusability, PVC can be used to construct the housing.

Drifters will be deployed at low slack tide at each mākāhā, ideally simultaneously. They will be left to drift through the pond until they run aground or shortly prior to their battery life expectancy, which will be estimated upon development. Three deployment cycles will take place. If successful, future deployments can be made along the southwest perimeter and along a longitudinal central axis deployed either by hand or air dropped via drone.

If successful, water circulation patterns will be identified. This will help with the study of other processes including exchange of nutrients and sediment into and out of the pond. This can then aid in fishpond and NERR managerial decision making such as closing off specific mākāhās at certain tidal conditions.

A project that developed low cost drifters and deployed them in Mobile Bay, Alabama was completed using Arduino Microprocessors (Lockridge *et al*., 2016). Theses drifters were developed for open water and measured position, conductivity, and temperature. The proposed coconut drifters will only track position via GPS so weight and power requirements will be minimal allowing for a smaller instrument.

Reference

Lockridge, G., Dzwonkowski, B., Nelson, R., and S. Powers, 2016. Development of a low-cost arduino-based sonde for coastal applications. *Sensors* 16(4): 528