

**REPORT TO THE UNIVERSITY OF HAWAI‘I AT HILO MARINE OPTION
PROGRAM**

**Gaining Experience in Ocean Resource Management and Education Through Moon Phase
Project Internship**

Kamaki Maluo-Huber
Marine Science
University of Hawai‘i at Hilo

MOP ADVISOR:
Lisa Parr
University of Hawai‘i at Hilo

INTERNSHIP ADVISOR:
Kanani Fraizer
Moon Phase Project

Table of Contents

Abstract	1
Introduction	1
Objectives	2
Materials and Methods	2
Discussion	5
Literature Cited	9

Abstract

Traditional fisheries in Hawai‘i are being used as a sustainable resource in Hawaiian communities. *Haleolono* fishpond, located in Keaukaha, Hawai‘i, is one that is being restored which is where I did my internship. Activities during this internship with the Moon Phase Project and *Haleolono* fishpond ranged from working with rocks for the wall surrounded the ocean facing side of the fishpond to cleaning up the area of both man-made rubbish and green waste. These types of activities were a daily routine while others were weekly. Results of this internship were a cleaner and better managed fishpond. The second result was a better data base for the Moon Phase Project with a gallery of photos in comparison of before and after for *Haleolono* fishpond during the internship.

Introduction

Fishponds have been utilized by many cultures around the world, including Taiwan, India, Pakistan, Japan, China, and Egypt (Kikuchi 1973). In the Hawaiian Islands, fishponds or *loko i‘a* have a purpose: feed local communities and families. Upon the arrival of Captain James Cook in 1778, there were over 350 functioning fishponds throughout the Hawaiian Islands (Wyban & Wyban 1989). Maintaining fish stocks was the primary goal of fishpond managers (Kikuchi 1973). Management responsibilities were placed on the caretakers or *kia‘i*. *Kia‘i* maintained the walls, sluice gates, biomass accumulation, and fishpond stock (Nishimoto 2007).

In the early 1990s, there was an increase of interest in traditional practices, such as fishponds. Cultural revival was more encouraged and community involvement increased local marine resource management. Marine resource management was heavily emphasized to be used with Hawaiian cultural practices (Friedlander et al. 2002). The duties of fishpond managers include managing the pond to encourage growth of algae, bacteria, and other microorganisms, maintaining water quality, and controlling diseases and pathogens (Moriarty 1997). Revitalization of traditional practices have only increased since then.

In many places around the world, there are stories of how the moon affects people and their surroundings. Understanding the traditional Hawaiian lunar cycle assists in understanding patterns and behavior of flora and fauna (Honohononui Kalaninui‘iamamao Research Team 2012) including tides. The traditional Hawaiian Lunar cycle consists of 30 “*pō mahina*” or moon phases (Kanahele 2011). The association of events or seasons influenced the creation of lunar calendars in many cultures. This sort of information can be vital to traditional Hawaiian fishponds for reasons such as: planning work days, determining times to harvest, keep track of tides, swells, organisms’ behavior and spawning, and many more. By monitoring and managing the fishpond, we can create a self-sustainable system that can be used to feed local communities and potentially schools. Organizations in Hawaii, such as the Moon Phase Project, work closely with communities to correlate moon phases with natural phenomenon around the state.

The goal of the Moon Phase Project is to promote and simplify environmental observations and record keeping. The project consists of a team of roughly twenty people statewide, who record and organize observations during particular lunar phases. The Moon Phase

project utilizes social media, website blogs, printed journals, and planners to promote these observations. Future goals include: 1) Creating a sharing platform of where knowledge can be accessed 2) Creating partnerships with schools and communities on utilizing traditional knowledge to better understand our environment. The project has no home base office, so for my project the Moon Phase Project partnered up with the Edith Kanakaole Foundation at Haleolono *loko i'a* in Keaukaha, Hawai'i.

Objectives

My first objective was to develop a “*huli 'ia* sheet” or an observation sheet for Haleolono fishpond in Keaukaha, HI. Workers at the fishpond will be able to utilize this information for planning future events such as workdays and workshops, all the way to best time for harvesting and cleaning along with everything in between. My second objective was to help with the restoration of the fishpond itself.

Materials and Methods

Study site:

The location for my internship was the Haleolono fishpond located in Keaukaha, Hawai'i. The area of which I managed ranged from Haleolono fishpond to Kamokuna, from Carlsmith Beach to Onekahakaha Beach Park. The fishpond is owned by Kamehemeha Schools which is leased to the Edith Kanakaole Foundation. The hawaiian emersion school, Ka 'Umeke, uses the fishpond as an educational tool for students to learn traditional practices and fishpond management. Specific features and site names within the district of Honohononui related to this project include: *loko nui, loko 'ukele, loko 'auwai, loko hapawai, and loko waena.*



Figure 1: Section of district Honohononui including Haleolono to Kamokuna located in Keaukaha, Hawai‘i where study site is located.

Huli ‘ia:

Observations

Taking observations required close attention to detail of surroundings and events occurring at the pond. The word “*kilo*” literally translates to stargazer, but also means to observe what is happening in the environment. I recorded the things that stuck out to me and what I thought what was important for best management practices of the fishpond. While working I took time to look up and observe fish behavior, seaweeds were present or absent, varying water conditions, and tides changes throughout the day.

Restoration:

Landscaping

Plants found within the fishpond are both native and non-native. There are invasive plants that can be found within the pond as well. Some of which are invasive are *hau* (hau bush), *laua ‘e* (maile-scented fern), and *kukunaokalā* (mangrove). Invasive plants, though they make great ground cover, take nutrients from other plants, block sun from plants below, and add biomass to the ponds making it shallower. Landscaping duties were also utilized throughout this summer. I cleared a lot of invasive species and problem some plants. These were plants that were near or hanging in the pond assisting in the accumulation of biomass at the bottom of the pond. The

removal of these plants also opened up new places to walk or potentially plant native species. This also allowed us to walk through the dry spots of the pond, places that were not able to before. The green waste was accumulated at the back of the property, where it will later be weighed for grant purposes.

It was my responsibility along with others to cut back these invasive plants and remove them from the pond. We used machetes, handsaws, loppers, and other tools which assisted with the work that was done. This helped to open new areas for observations along the pond and new places for predator eradication. What this also assisted with was cutting down and reducing the amount of natural biomass that fell into the pond accumulating at the bottom.

Rockwall

At Haleolono, one of the distinguishing features there are the rock walls and the *kuapā*, the outside wall. This feature could not have been done without the rocks that were gathered and the help provided. The rocks that went into the walls were gathered from within the same area as the fishpond. This is a traditional style, as far as in Keaukaha, of utilizing the resources from that area. The *kuapā* is managed by utilization of a wall strategically placed in the water allowing the water within the pond to rise and fall accordingly with the tides. Another feature of the fishpond is the “*mākāhā*” or sluice gate, allowing fish to swim in freely but once big, they are unable to swim back out. The *mākāhā* also allows the pond to have a consistent flow of water within the pond, assisting with nutrient exchange and food for the fish within.

Working on the rock wall required both skill and labor. Before starting on any wall, we needed to make sure that there were enough rocks to work with, this meant harvesting rock. All rock sizes were used and each size had a purpose. Starting from the *niho*, or the foundation rocks. These were important set properly and ensure it didnt move. If these *niho* stones were to move, the rest of the wall will not be stable. The next size rocks are the *po‘o* sized rocks or roughly about the size of ones head. These are used to fill in the back and inside of the wall. The *po‘o* stones are what helps to make the wall come up, but is still sturdy. The last type of stones are *hakahaka*, or the space-filling rocks. These were used for the smaller spaces to fill in and support rocks.



Figure 2: Two of PIPES interns, Crispin Nakoa and Kamaki Maluo-Huber, harvesting rock from outside of Haleolono fishpond to assist in reinforcing of outer walls.

Aloha 'āina

The waves and tides bring in all sorts of trash and plastic from local and outside areas. There is also waste that could have originated from others leaving it in these areas or improperly disposing it. These trash can be found hanging out near the shorelines and sometimes still in the water. These things threaten the health and wellbeing of surrounding marine life.

During my internship, I walked along the shoreline, usually once or twice a week, from Haleolono fishpond to Kamokuna. This included taking observations and picking up trash. Observations were of anything that I found interesting and worth taking notes of. These observations were of what really stuck out during my time there. I also brought either a trash bag or a five-gallon bucket that I filled with trash while walking the shorelines. Glass and aluminum were saved for recycling and the rest were disposed of properly.

Discussion

Our first task for the summer was to add a *mākāhā* before the pond loko 'auwai. I moved rocks from the far side of the pond to help support making this new *mākāhā* and to later make a *kū'ula* or an alter. Rocks were harvested from outside and inside the pond in Keaukaha to help reinforce the outer walls. At the end of the first month working there, we had rock wall

practitioners from all over the state, come to assist in reinforcing the outside wall. This was a three-day workshop finishing the South facing section of the wall. Using this knowledge, Crispin Nakoa and I were able to finish more sections of the wall even after these practitioners had left.



Figure 3: (Left) Photograph of the back pond, loko ‘ukele, prior to the cleaning and removal of green waste (right)

During the internship I was also responsible to keep track of what was going on in my surroundings and to “kilo” or make observations. These were not of just regular day observations, but they were of the different things that happened. With this information I was able to produce an observation chart for Haleolono. Things that were noted were of anything that really stuck out. While there I had seen a lot of things happen and change. There were a lot of before/after pictures that I took. This was usually when we worked on a big project. I liked to see how it affected the things around the pond, even though they were unintentional. Sections for the table are *i’a* (marine organisms), *limu* (seaweed), *wai* (fresh and saltwater), and the tides. The blanks in the sheet are because of the days that I was either not at the pond or because there wasn’t anything that stuck out to me enough to record as an observation.

Kaulana Mahina	Date	I'a	Limu	Wai	Tides
Hilo	5-Jun				
Hoaka	6-Jun	'ōpae gathered around new makaha	limu stuck on walkway	freshwater spring found	0.3 @ 11:30 am / 2.9 @ 3:30 pm
Kūkahī	7-Jun	pua'ama gathered around log in 'auwai	turf algae floating	oil residue from plants on water	-0.4 @ 10:16 am / 2.8 @ 5:30 pm
Kūlua	8-Jun	Puhi hunting during high tide			-0.1 @ 10:59 am / 2.6 @ 6:14 pm
Kūkolu	9-Jun	mosquito fish hang out in hau leaves	'ukele limu all stirred up		0.1 @ 11:46 am / 2.3 @ 7:00 pm
Kūpau	10-Jun				0.4 @ 12:39 pm / 2.1 @ 7:47 pm
'Olekūkahī	11-Jun				1.1 @ 9:00 am / 0.7 @ 1:48 pm
'Olekūlua	12-Jun				1.3 @ 10:30 am / 0.9 @ 3:20 pm
'Olekūkolu	13-Jun	new manini recruits			1.6 @ 11:36 am / 1.0 @ 4:52 pm
'Olepau	14-Jun	fish feed on sediment stirred up	lack of floating limu in loko 'auwai	red dye in loko 'auwai from roots	0.1 @ 5:18 am / 1.8 @ 12:25 pm
Huna	15-Jun		limu 'ele'ele found in loko nui		-0.0 @ 5:52 am / 2.1 @ 1:02 pm
Mōhalu	16-Jun	āholehole and pua'ama gather by kaupō mākāhā		rough swells later in the day	-0.1 @ 6:25 am / 2.3 @ 1:37 pm
Hua	17-Jun				-0.3 @ 6:58 am / 2.4 @ 2:11 pm
Akua	18-Jun				-0.3 @ 7:31 am / 2.6 @ 2:44 pm
Hōkū	19-Jun				-0.4 @ 8:05 am / 2.7 @ 3:18 pm
Māhealani	20-Jun	aholehole feeding on grass islands	turf algae floating	high tide came up quickly	-0.4 @ 8:39 am / 2.7 @ 3:52 pm
Kulu	21-Jun	fish aggressive near makaha	no limu around loko 'auwai	murky water all day	-0.4 @ 9:4 am / 2.8 @ 4: 27 pm
Lā'aukūkahī	22-Jun	weke'ā feeding on pathway	limu stuck on walkway	stong currents in mākāhā	-0.3 @ 9:50 am / 2.7 @ 5:04 pm
Lā'aukūlua	23-Jun	Hapawai less frequent in pond			-0.2 @ 10:30 am / 2.7 @ 5:43 pm
Lā'au'pau	24-Jun				1.2 @ 5:32 am / 0.0 @ 11.13 am
'Olekūkahī	25-Jun				1.2 @ 6:40 am / 0.3 @ 12:05 pm
'Olekūlua	26-Jun				1.3 @ 8:03 am / 0.6 @ 1:12 pm
'Olepau	27-Jun	aholehole and pua'ama hang near floating beds	limu floating in loko 'ukele	most ponds clear/not murky	1.5 @ 9:35 am / 0.8 @ 2:43 pm
Kāloakūkahī	28-Jun		invasive species found in loko nui		1.8 @ 10:57 am / 0.9 @ 4:25 pm
Kāloakūlua	29-Jun	fish within kuapā werent within the wall		sediment stirred up	-0.2 @ 4:51 am / 2.1 @ 12:01 pm
Kāloapau	30-Jun	'ala'ihī kept near loko nui mākāhā		sediment stirred up	-0.3 @ 5:39 am / 2.5 @ 12:52 pm
Kāne	1-Jul	ama'ama swam past after finished kuapā		pond cleared after finished	-0.5 @ 6:26 am / 2.7 @ 1:41 pm
Lono	2-Jul				-0.6 @ 7:11 am / 2.9 @ 2:26 pm
Mauli	3-Jul				-0.6 @ 7:55 am / 3.0 @ 3:07 pm
Muku	4-Jul				-0.6 @ 8:38 am / 3.0 @ 3:47 pm

Figure 4: Observation calendar that was made for Haleolono fishpond in Keaukaha, Hawai'i consisting four different coulums *i'a* (marine organisms), *limu* (seaweed), *wai* (water) and the tides (high and low of the work day).

Throughout my internship, I had successes and challenges. I learned a lot about the fishpond and what it takes to be a *kia'i* or caretaker of the pond. Most of the things that I dealt with were very hands-on and required physical labor. The challenges that I faced sometimes were starting the day. Sometimes it took me a while to warm up to the task at hand, just because of body aches from the past days' work. Some other challenges were seeing what we worked hard to do, such as building walls, collapse after the weekend. This I learned that it is all part of the job anyways encouraging me to work harder. The waves will still find a way to somehow bring it down, but I kept working. One thing that I learned from this experience is that it is a lot easier to maintain the wall than trying to rebuild it.

Despite these challenges there were also a lot of successful things that happened this internship. I learned a lot from a lot from different people about rock stacking as well as helping summer youth programs. The other was seeing the results of a hard day's work.

At the end of June, we had a *ho'okua* workshop where rock wall practitioners had come to help us reinforce the outside walls to combat the recent higher tides and the swells that are about to come in this winter's seasons. Previous to this I had built a *mākāhā* and part of a wall near one of the outside *mākāhā*. This was still new to us and thought we had done a decent job. After I had learned how to properly stack I looked back at our walls and laughed at the previous work that I had done. We then rebuilt it again and lasting longer and holding through different sized swells. It was a lot bigger and stronger in comparison to what I had built previously. Looking at the wall that we did during the workshop and after everyone left, I felt quite proud of it and it held up.

During this internship, I had a chance to work with the Kamehameha Schools program, Ho‘olauna. This gave me a chance to share what I know about the fishpond with the younger generation. While I was working with them I felt that they were not only learning from me, but I was also learning from them. I had a great time working with them.

The smaller side of everything though was seeing the progress and the difference that I made to the pond every day. I think as small as it sounds, this was one of the bigger successes that I felt I have had during this internship. I liked to step back at the end of the day to admire the changes that I had done for the fishpond. This could have been from as small as clearing out a section of green waste, or harvesting rock. Regardless, the work from that day was always something visible and was neat to admire. I liked how it felt that the work that I did was so beneficial for the pond regardless of how big the job was.

Born and raised in Hawai‘i, I am heavily surrounded and influenced by the marine environment. During summers, I visited my grandfather in Kawaihae, Hawaii Island. There he taught me how to dive, throw net, and live off of what the marine environment provides. I learned that we treat the ocean with respect and in return, the ocean will provide these wonderful ecosystem services. For a long time, I noticed these resources were being depleted. It is clear to me that times are changing and so are our natural resources. This is the sort of work that we have ahead and with the extra efforts in conservation, we can protect our natural resources. The importance of *loko i‘a* like Haleolono are to help us utilize sustainable resources for a sustainable lifestyle. Through kilo and taking observations, the changes either good or bad, allows us to identify what is happening in our environment. By connecting *loko i‘a* and *kilo*, we can identify better ways to manage our ocean resources.

Acknowledgements

There are many people who contributed to this project. I’d like to send out my gratitude to everyone that had made this experience the best it could be. The first being the Marine Options Program (MOP) at Hilo. They helped to get me started looking for potential internships and had also gotten me interested in the program that I ended up doing. The MOP program assisted me through a lot of the written components of the project. The Pacific Internship Programs for Exploring Sciences (PIPES), for connecting me with the resources and giving me the opportunity to work on a project that I closely relate to. They also helped me to work through some of the writing components of my project. I’d next like to send my appreciation to my mentor and the host agencies, Kanani Frazier and her agency, The Moon Phase Project. I also worked closely with Luka and Kalā Mossman alongside with the Edith Kanaka‘ole Foundation. Through them I have met and had the privilege to work with many others on projects for the fishpond and the project.

Literature Cited

- Friedlander A, Poepoe K, Poepoe K, Helm K, Bartram P, Maragos J, Abbott I (2002) Application of Hawaiian traditions to community-based fishery management. In: Proceedings of the Ninth International Coral Reef Symposium, Bali, 23-27 October 2000
- Honohononui Kalaninui'iamamao Research Team. (2012). Ethnohistorical Study of Honohononui, Hilo, Hawaii Island. Edith K. Kanakaole Foundation, Hilo, Hawaii.
- Kikuchi W.K. (1973) Hawaiian Aquacultural System. PhD dissertation, University of Arizona, Tucson, AZ
- Kanahele P.K., Kanahele-Mossman H, Nuuhiwa K, Hanahale K.H. (2011) Mahina. Edith K. Kanakaole Foundation, Hilo, Hawaii.
- Moriarty DJ (1997) The role of microorganisms in aquaculture ponds. *Aquaculture* 151:333-349
- Nishimoto RT, Shimoda TE, Nishiura LK (2007) Mugilids in the Muliwai: A tale of two mullets. *Biology of Hawaiian Streams and Estuaries. Bishop Museum Bulletin in Cultural and Environmental Studies* 3:143-156
- Wyban J.A., Wyban C.A (1989) Aquaculture in Hawaii: Past, Present and Future. In: *Advances in Tropical Aquaculture*. Vol 9 p 37-43