

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

Conservation and Outreach Efforts for Wai‘ōpae Tide Pools on Big
Island, Hawai‘i

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ABSTRACT

Coral reefs are a vital environmental, economical, and medical resource that is experiencing high degradation rates. Mitigated conservation and outreach efforts are needed to combat issues contributing to their decline. The Wai'ōpae tide pools located on Big Island, Hawai'i are one of the most frequently visited Marine Life Conservation Districts (MLCD) on the island. Although protected, the tide pools are experiencing stress from both anthropogenic and environmental factors. This project focused on outreach efforts for the conservation of the Wai'ōpae tide pools via student and community collaborative efforts, resulting in a poster for the kiosk located at the entrance to the tide pools, illustration and design of an outreach sticker, and coral health surveys for the expansion of a long-term data set for Dr. Misaki Takabayashi's research. The project objective aimed to cultivate relationships between the scientific community and the general public, bridging a collective understanding of reef sustainability and its importance.

INTRODUCTION

Coral reefs, though covering less than one percent of the planet, are an ecosystem that supply both environmental and economical resources (Cesar and Beukering 2004). Healthy reef structures support biodiversity of the sea, buffer against environmental stressors including floods, storms, and erosion, economically advance tourism and sustainable fishing practices (Waddell and Clark 2008), and insure an opportunity to discover natural products for human health development (Bruckner 2002). However, coral reefs are currently one of the most threatened ecosystems on the planet (Hoegh-Guldberg et al. 2007, Bellwood et al. 2004, Knowlton N 2008), experiencing elevated degradation rates attributed from environmental and anthropogenic disturbances (Pandolfi et al. 2003). For ecological, environmental, and economical success, the preservation and conservation of coral reefs is vital. Coral reef sustainability and conservation are promoted through mitigated actions (Hughes et al. 2003, Pandolfi et al. 2003). Mitigated conservation and outreach efforts begin to guard against exploitation of coral reefs as a unique ecosystem. Conservation initiatives in the state of Hawai'i include but are not limited to, the establishment of Marine Life Conservation Districts (MLCD), conservation boards at reef habitats, and research projects that assess current sustainability.

Hawai'i is one of the most isolated archipelagos on the planet, and the origin of many endemic species that are not found anywhere else in the world (Aeby et al. 2011, Friedlander et al. 2008). Coral reefs in Hawai'i have been of cultural and historical significance (Friedlander et al. 2008) as well as contributed to economical and environmental advantages. To preserve reefs, Hawai'i's Division of Aquatic Resources designates MLCD's through the states Department of Land and Natural Resources, mitigating adverse affects from recreational fishing practices. MLCD's preserve marine resources via prohibiting the taking of live or non-living material, allowing time for reefs to replenish their resources. The surrounding perimeters of an MLCD are expected to experience positive regrowth or substantiation of marine biodiversity when monitored correctly. However, there is an ecological demand for fish consumption, as a quarter of the worlds small-scale fisherman harvest from coral reefs (Waddell and Clark 2008), and the recorded revenue for U.S. fisheries from reefs is over 100 million dollars (Waddell and Clark 2008). Thus, an MLCD's boundaries are subject to decrease if an ecological demand persists. Therefore assessment of heavily visited tide pools across the main Hawaiian islands may elucidate areas that should be conserved due to the endemic species overall health and sustainability.

Monitoring the health of coral reefs is necessary to assist in the identification and response to both present and emerging coral reefs. As corals are foundation builders, their health is critical to assess when determining reef health. Common health factors inhibiting coral regeneration and growth include trematodiasis, bleaching, predation, growth anomaly, macro algae, endolithic algae, and pigmentation response. Recognizing the trends of these diseases and maintaining long-term data sets will aid in illustrating the possible consequences of current coral colony conditions (Aeby et al. 2011). However, there is limited awareness and recognition by the general public of reef health importance and implications (Aeby et al. 2011). Coupling data collection with outreach initiatives brings awareness of reef health implications and importance.

Conservation and outreach efforts may promulgate ocean stewardship in Hawai'i when conducted at popular and most frequently visited tide pools. The MLCD region of the Wai'ōpae tide pools, located on Big Island, Hawai'i receive constant visitation from travelers and locals. Assessment of MLCD's health is requisite for appraising how the areas beyond the MLCD zone are withstanding anthropogenic interaction. A long-standing collection of data will augment the documentation of how the reef health is progressing. This data may reflect and/or highlight other possible issues with Hawaiian coral reefs beyond the scope of Wai'ōpae that could give rise to future studies.

The objectives for this Marine Option Program (MOP) project were to:

- 1) Create a conservation poster for a new kiosk being built at the entrance to the Wai'ōpae tide pools, with the intention of educating the general public on tide pool etiquette, common species awareness, and location of the MLCD zone.
- 2) Design and illustrate an outreach sticker, promoting reef health awareness and understanding of what/how humans contribute to toxic build up in tide pools.
- 3) Contribute to an ongoing longterm data set that Dr. Misaki Takabayashi developed for coral health and disease of colonies present at Wai'ōpae via health surveys.

The project objectives aimed to cultivate relationships between the scientific community and the general public on reef health importance so that the Wai'ōpae tide pools on Big Island may continue to be beneficial ecologically, environmentally, and economically.

METHODS AND MATERIALS

The site location for the MOP project was at the Wai'ōpae tide pools, also known as Kapoho tide pools, located at 19.4878° N and 154.8216° W. Wai'ōpae was established as an MLCD in 2003. Having a basalt ridge on the seaward side, the tide pools receive water circulation from the northeastern trade winds, and large swells that support coral growth. Wai'ōpae thus has dense coral coverage, with an unusual abundance of juvenile fish, making Wai'ōpae an important nursery. The pools are easily accessible, and experience visits from the local community and tourists.



Fig. 1. The Wai'ōpae tide pool MLCD region.

Conservation Poster

The Wai'ōpae Neighborhood Community Committee (WNCC) requested a 3x4.5 meter kiosk to be built at the entrance of the Wai'ōpae tide pools. A local contractor finished construction by December 2016. In contribution to this kiosk, the development and design of a conservation poster expressing tide pool etiquette and awareness of common species was completed through this MOP project (Appendix 1; Figure 1).

Performance included organizing a team of student volunteers, coordinating design meetings and task assignments. Tasks included, photographing tide pool species, written statements on tide pool etiquette, map making, choosing the 'Ōlelo No'eau, overall design, formatting using Adobe Photoshop, and communication with the WNCC.

Outreach Sticker

To bring awareness of what chemicals are spread through anthropogenic interaction, a 4.5x4.5 outreach sticker was illustrated and designed. The content of the sticker design included a slogan, Hawaiian coral species, a swimmer, and a website to learn further information, which was www.coralatlas.com. The sketch was created using drawing pencils on sketch paper (Appendix 2; Figure 1-3) and redrawn on tracing paper to eliminate smudges. After scanning the sticker into Adobe Photoshop, Adobe was used to distort, move, size, or add text to the design (Appendix 2; Figure 4). Once finalized, the design was uploaded to stickergiant.com for printing.

A campaign booth was presented at the Tropical Conservation Biology and Environmental Sciences (TCBES) conference where the stickers were distributed to the student body.

Coral Health Surveys at Wai‘ōpae

Surveys are conducted to evaluate and estimate reef conditions. For this MOP project, coral surveys were used as the main reef health assessment. Surveys required transect lines, printed data sheets on water proof paper attached to clip boards, and an underwater camera for photographing coral colonies. Each coral survey consisted of recording the species, colony size, and overall health.

My role during surveys of coral colonies for Dr. Takabayashi’s research in the 12 designated pools was gear deployment and data collection. The objective was to identify *Pocillopora meandrina*, *Montipora capitata*, *Montipora patula*, *Montipora flabellata*, *Pavona varians*, and *Porites lobata* colonies, and survey for trematodiasis (TR), bleaching (BL), predation (PR), growth anomalies (GA), pigmentation response (PR), macro algae (MA), and endolithic algae cover (EA). Data were transcribed in percentages, with 25 percent representing the periphery of the colony, and 75 percent representing the central portion of the colony. Abbreviations were used to efficiently transcribe data. Example:

| Transect (m) | Colony | Central | | Peripheral | |
|--------------|------------|---------|--------|------------|--------|
| | | Percent | Number | Percent | Number |
| 4.5 | Mont. Cap. | 20/BL | 14 | 10/BL | 7 |

Information was transcribed on underwater paper while snorkeling along 25 meter transects. Only colonies that were directly in line with the transect were recorded. Anything that was unusual was documented using an underwater camera. There was no given time frame for each transect. If the transects were not completed, a second field day was scheduled for that month.

DISCUSSION

All of the objectives for this MOP project were met successfully, and resulted in a permanent conservation kiosk displayed at the entrance to the Wai‘ōpae tide pools showcasing the poster from this project, an outreach sticker which was distributed to 300 students, and expansion of the mass coral data set for Wai‘ōpae.

The conservation kiosk joined in collaborative efforts for sustaining the tide pools of Wai‘ōpae, allowing for training in team dynamics when designing an outreach effort. For example, the poster design team joined underclassman, upperclassman, and a master student, while kiosk construction incorporated neighborhood community members. Photo identification of organisms on the poster were based off of the most common or popularly seen animals at Wai‘ōpae. Hawaiian species names were included to preserve the traditional names originally from the Hawaiian language. In addition to preserving the language, an ‘Ōlelo No‘eau, which is a poetic proverb passed down generationally to preserve culture and history, was included on the poster to acknowledge the importance of Wai‘ōpae as a sacred place and one of cultural importance. Being culturally conscious while informing and encouraging the general public to abide by reef etiquette, helped to develop skills on communicating and sharing knowledge with the general public while bridging a gap in scientific, general public, and cultural relationships.

The positive feedback from the general public towards reef conservation resulted in the continuation of outreach efforts through a sticker design.

The student body and local community have now been informed of chemicals spreading in the ocean from anthropogenic disturbance through a campaign booth prepped at the TCBES mid-spring semester conference. Stickers were free to the student body and brought awareness and recognition of coral health diseases and chemicals being spread at Wai‘ōpae, particularly the chemical oxybenzone from sunscreen. The sticker has been used on cars, water bottles, laptops, and miscellaneous items, which has expanded awareness beyond the student body and into the community. More recently, there have been requests coming from websites that are requesting interviews or article submissions on the importance of reef-safe sunscreen. Additionally, the sticker has encouraged more students to volunteer at Wai‘ōpae to help expand Dr. Takabayashi’s research, or start new projects of their own.

Coral health surveys during this MOP project focused on *Pocillopora meandrina*, *Montipora capitata*, *Montipora patula*, *Montipora flabellata*, *Pavona varians*, and *Porites lobata* species. Unfortunately, after careful consideration from both field studies and data analysis, many of the original colonies had to be replaced because of die off. Colonial fatality primarily occurred in *Montipora flabellata*, *Pocillopora meandrina*, and *Montipora patula*. The most common stressors were bleaching, macro algal over growth, and tissue loss. Data trends have helped predict the possible fate of Wai‘ōpae, and the mitigations that need to be taken to resolve the oncoming health issues.

Mitigated conservation and outreach efforts to preserve coral reefs are encouraged by teamwork, planning, design, and implementation. Initiatives were taken in these areas throughout the completion of the Conservation and Outreach Efforts for Wai‘ōpae Tide Pools on Big Island, Hawai‘i MOP project. Future conservation and outreach efforts will continue to instill awareness, knowledge, attitudes, skills, and participation (Jacobson et al. 2006). As protecting the environment is both a social and biological challenge, recognizing reef diseases that cause the most fatalities and studying their trends helps elucidate further hypothesis of future outbreaks. Thus, the continuation of coherent communication with the public, as was done in this project, along with policy-makers will aid in the acquisition towards more sustainable reef systems.

Many project opportunities exist for Wai‘ōpae. Branching from the projects mentioned here, there is need for a survey that determines the effectiveness of the kiosk, poster, and sticker on beach goers, a kiosk pamphlet design that effectively discusses reef health and disease at Wai‘ōpae, and reef model projections for past future and present conditions at Wai‘ōpae. Ideas for beginning these projects include: collaboration with a TCBES master student on a survey, pooled photographs from Misaki Takabayashi’s mass data set of colony images for a pamphlet, and collaborative assistance from Jon Burns to illustrate model projections as he specializes in software and imagery development of reef plots. All other outreach effort ideas can be discussed with Misaki Takabayashi, who is open and available for MOP projects related to Wai‘ōpae.

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APPENDIX I



Fig 1. Finalized conservation poster for the Wai'ōpae kiosk.

APPENDIX II



Fig 1. First rough sketch of outreach sticker design.

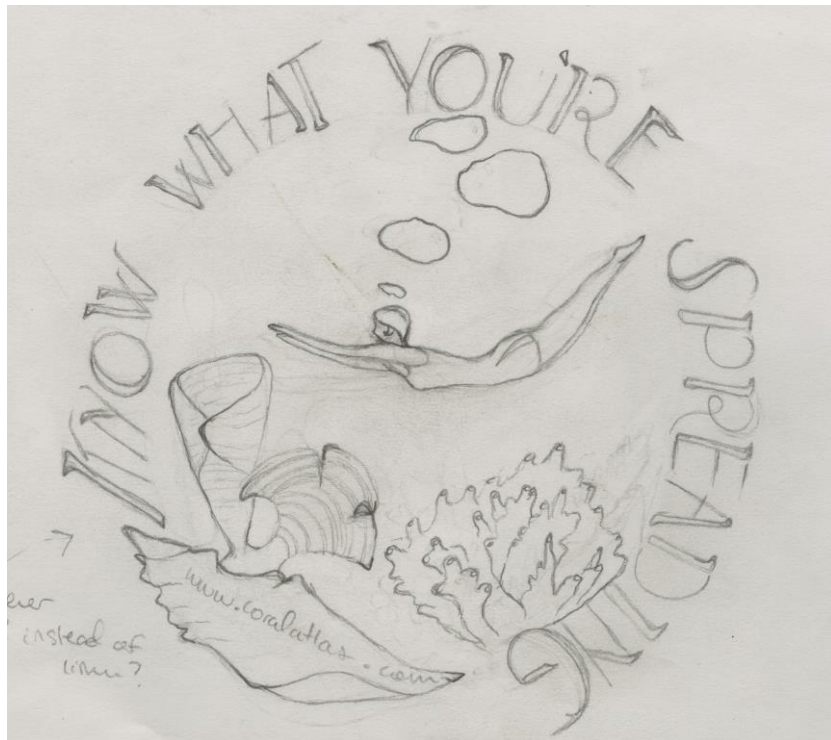


Fig 2. Second rough sketch of outreach sticker design.

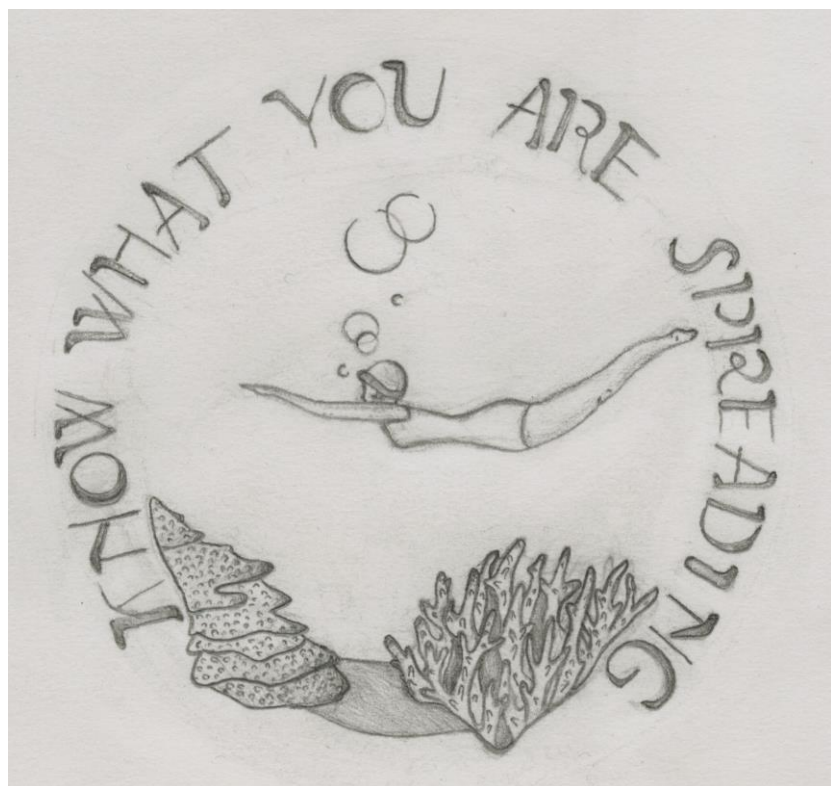


Fig 3. Final design of outreach sticker.



Fig 4. Example of sticker after Adobe Photoshop edits.

