REPORT FOR THE UNIVERSITY OF HAWAIʻI AT HILO

MARINE OPTION PROGRAM

Beneath the waves with the Sea Surveying, Training, and Response Squad

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REPORT DATE

May 2017

ABSTRACT: The UH Hilo Sea Surveying, Training, and Response Squad (SeaSTARS) was designed for QUEST Field School graduates to continue science diver training through monthly surveys around the Island of Hawai`i. With threats to coral reefs continuing to rise, the SeaSTARS hope to prepare and further train research divers with fast-paced, hands-on learning experiences. As the program continued to develop, I joined as SeaSTARS co-coordinator as an internship through the Marine Option Program. Throughout my internship as a coordinator, I further developed the program by helping advance current divers' training through skills workshops, created protocol for future SeaSTARS recruitment, collaborated with outside agencies, actively engaged with the community, and gathered data to share with citizen science programs (REEF, Eyes of the Reef, and REEF Network).

Keywords: SCUBA diving, science diving, diver training, coral reef

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INTRODUCTION

An idea that was quoted famously by Jacque Cousteau “The best way to observe a fish is to become a fish” marks the importance of SCUBA diving to the science community. SCUBA diving is far more efficient and safer than freediving and allows researchers the ability to explore new depths of the ocean. Since the advancement of SCUBA, previous research has shown that four to five times more species have been discovered in tropical environments (Lang 2007). It is important that these methods continue to be practiced as coral reefs are becoming increasingly threatened by environmental stressors such as global climate change, ocean acidification, and eutrophication (Hoegh-Guldberg et al, 2007). Natural and anthropogenic disturbances such as hurricanes, invasive species, urbanization, and climate change can dramatically alter coral reefs making them unstable ecosystems (McIlwain & Jones 1997; Hughes et al. 2003). The protection of coral reefs is vital as they are some of the most biologically diverse habitats in the world and are home to over 25% of all marine fish species (Hixon, 2001; Moberg et al, 1999).

Research diving projects are advancements in science and underwater surveys allow researchers to gain a better understanding of the reef or environment one may be studying. Science divers use their academic expertise to study the underwater environment. SCUBA diving is being used as a research method which becomes part of the project itself (Lang, 2007). SCUBA diving allows researchers to enter their environment to obtain a level of accuracy unachievable through virtual surveys.

The Sea Surveying, Training, and Response Squad (SeaSTARS) is a scientific diving program organized by the Marine Option Program at the University of Hawai`i at Hilo that promotes the education of underwater surveys through training and active field research. Hands-on learning is designed to help embed information into a student's mind (Tudor 2013). The SeaSTARS diving program's goal is to integrate students into the scientific diving community through monthly surveys and provide hands-on training. For safety and data accuracy concerns, all SeaSTARS divers must have completed the two-week underwater surveying course, Quantitative Underwater Ecological Surveying Techniques (QUEST). Student divers use QUEST as a foundation for their scientific diving knowledge. To continue their science diving education, the SeaSTARS was created to provide active training to build upon current divers' skills.

The program was developed in the fall 2015 semester, with the first dive conducted on November 29, 2015, and since the program has had great success. However, we have future goals and ideas for the program that we as coordinators hope to implement throughout the next years as we continue to grow. As a SeaSTARS coordinator, I further developed the program by developing student diver portfolios, implementing calibration survey training, incorporating fellow MOP students through boat-based water quality sampling, creating future SeaSTARS’ protocols for recruiting new divers, and publicly presenting to communicate our efforts to the public.

METHODS

SeaSTARS dives have been conducted at three sites around the island of Hawai‘i. One site located on the western shores at Honaunau Bay and two on the east side at Hilo Bay’s Blonde Reef and Wai‘olena Beach Park. All three locations have well-established reefs between 3-27m where surveys are conducted.

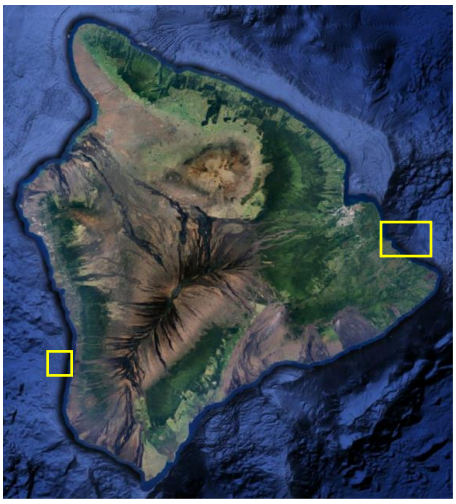

Image 1: Sitemap of our dive site at Hilo Bay and Waiʻolena Beach Park on the East side and Honaunau Bay on the West side of Hawaiʻi, HI, USA.

Developed student diver portfolios. Diver portfolios were developed to outline a diver's skills and abilities for outside organizations to view. Portfolio templates were sent out to current SeaSTARS divers and were to be filled in by the divers themselves. Profiles showcase a diver's total number of dives to date, total amount and types of surveys a diver has conducted, their depth authorization, the highest level of diver training, gas and equipment training, and their dive computer authorization.

Developed calibration dives/snorkels. Collecting accurate data as science divers is important to ensure sound science. To certify quality sampling, calibration training sessions were created to hone divers' surveying skills. Artificial corals and fishes were made and pre-sized, so divers could test their abilities. Coral props were of known length, width and percent cover, while fish were identifiable to species and of known fork length. 20 coral and 10 fish props were created using 4mm corrugated plastic, permanent marker and a projector for tracing fish and coral measurements. Transects were laid out in a pool and coral and fish props were placed along the transects. Surveyors then swam along, estimating measurements to the best of their abilities. The surveyor's data was then compared to the actual measurements of the coral and fish props. Surveyors could re-test their abilities with a new set of coral and fish training materials during the second set of surveys.

Incorporated fellow MOP students through boat-based water quality sampling. As the SeaSTARS initiative progressed, there became interest in expanding the data set to include abiotic parameters. To do this, fellow MOP students who were interested in scientific diving were recruited to accompany divers on the boat as a water quality team. The water quality team helped collect water samples and assessed temperature, dissolved oxygen, salinity, and turbidity. Temperature, salinity, and dissolved oxygen measurements were taken using a multiparameter probe (YSI Pro2030 Professional Series) while turbidity water samples were collected by a diver via syringe and brought to the surface for analysis using a turbidimeter.

Created a SeaSTARS authorization plan for future divers. Throughout the academic year of 2016-2017, interest in authorizing new SeaSTARS divers developed. Also, during this time a new cohort of QUEST 264 graduates and scientific divers-in-training were working with the UH Hilo Diving Safety Program to become fully authorized scientific divers, which is a

requirement for SeaSTARS. During this process, SeaSTARS coordinators created a protocol and application that could be implemented when new scientific divers were ready to become MOP SeaSTARS divers.

Publicly presented the SeaSTARS to communicate our efforts. On January 24th, 2017, SeaSTARS coordinators gave a publicly open presentation at the Mokupāpapa Discovery Center to inform the community of the program's continuous efforts to contribute to the scientific and local communities. Through coordination with the center's event coordinator, the presentation was opened to the community and university members. The talk outlined the programs current accomplishments and efforts. Data that reflected the effects of sedimentation and coral bleaching on corals in Hilo Bay were highlighted for the community.

TIMELINE

SeaSTARS' Event Schedule	
November 29, 2015	Hilo Bay, Blonde Reef- Coral Bleaching Surveys
December 18, 2015	Hilo Bay, Blonde Reef- Coral Bleaching Surveys
January 16, 20.16	Honaunau Bay- Monthly Assessment of Marine Organisms Dive
February 20, 2016	Honaunau Bay- Monthly Assessment of Marine Organisms Dive
March 12, 2016	Honaunau Bay- Monthly Assessment of Marine Organisms Dive
April 2, 2016	Hilo Bay, Blonde Reef- Sedimentation Assessment
April 9, 2016	Hilo Bay, Blonde Reef- High School Outreach Event
September 10, 2016	Waiʻolena Beach Park- Monthly Assessment of Marine Organisms Dive
October 1, 2016	Hilo Bay, Blonde Reef- Coral Bleaching and Sedimentation Reassessment
October 15, 2016	Hilo Bay, Blonde Reef- Coral Bleaching and Sedimentation Reassessment
October 23, 2016	University of Hawaiʻi at Hilo Student Life Center- Calibration Snorkel
January 24, 2017	Mokupāpapa Discovery Center- Public Presentation
January 29, 2017	Hilo Bay, Blonde Reef, Monthly Assessment of Marine Organisms Dive
February 11, 2017	Waiʻolena Beach Park- Monthly Assessment of Marine Organisms Dive
March 12, 2017	University of Hawaiʻi at Hilo Student Life Center- Calibration Snorkel
March 19, 2017	Hilo Bay, Blonde Reef, Monthly Assessment of Marine Organisms Dive
April 8, 2017	34th Annual Marine Option Program Student Symposium- Oral Presentation

DISCUSSION

Throughout this project, I have been able to practice my leadership and organizational skills through my coordinator position. When I joined SeaSTARS, the diving program was very new and had areas open for development. I have been able to help further evolve the program, along with improving my own professional and diving abilities.

Creating the student diver portfolios will help the program grow beyond the university. These portfolios are meant to be accessible for viewing by science-diving agencies. The portfolios outline our divers' best qualities and showcase their abilities as professionals in the science-diving community. Diver portfolios can communicate to employers that our divers are highly qualified to dive on an array of research projects.

To make sure our divers our conducting sound science and collecting accurate data, we developed a calibration snorkel. These calibrations allow our divers, and other university

students, to test their abilities and calibrate their surveying skills by estimating measurements on artificial corals and fish. Surveys were conducted on October 23, 20,16 and March 19, 2017. After completing the calibration, surveyors were aware of their surveying errors and felt more confident when conducting sizing measurements.

Another opportunity that was made available for non-SeaSTARS divers was participation in boat-based water quality sampling. SeaSTARS divers recently began collecting water quality samples to add an extra parameter to the dataset. To help collect this data, students who are interested in QUEST and/or the SeaSTARS can join us on the boat and analyze water samples. This opportunity allows students the ability to gain experience in field research and observe the scientific diving protocol.

We continue to provide opportunities for future SeaSTARS divers as we are eager to get new divers authorized onto our dive plan. During the academic year of 2016-2017, several university diving students have been working with the Dive Safety Program to complete their science diver qualifications. In preparation for a wave of new science divers, we created a protocol that will quickly authorize new divers onto our dive plan, that also ensures our new divers are safety oriented and confident in their surveying abilities.

Our goal as a program is to continue to train divers to conduct sound science and collect data that can be used to positively impact the community. As the program continued to develop, we wanted to make sure these efforts were being communicated to the community. Our presentation at the Mokupāpapa Discovery Center allowed us to connect with community members and provide the opportunity for them to ask questions and portray their concerns to us. Throughout the process, we also made connections for future collaboration projects regarding community outreach that can help our coastal ecosystem.

Though the SeaSTARS diving program has grown significantly since I joined as co-coordinator, we have many future objectives we hope to implement in years to come. These objectives will continue to challenge our divers with new skills, make data easily accessible, and strengthen our relationship with the public.

The SeaSTARS have conducted a total of eight different surveying methods to date, most of which are taught through the QUEST field school. Many agencies like the Division of Aquatic Resources, The Nature Conservancy, and the National Oceanic and Atmospheric Administration use these same methods, but also conduct an array of their own. We hope to reach out to these agencies and bring on guest training divers through reciprocity and learn new surveying methods. This would make our divers more equipped to work for these agencies beyond graduation while challenging them with new skills.

Coral health surveys require the most background and knowledge of the species and diseases being surveyed out of all the surveys conducted by the SeaSTARS. Coral health workshops would provide the background and information needed to prepare students for the field. A series of activities and practice identification quizzes would allow divers to feel more comfortable and competent when performing coral health surveys. We hope to develop these workshops and make them available in future years.

As a group of seasoned divers, we focus greatly on safety and improving our training abilities. Implementing live stream video camera into our dives would add an extra safety parameter and allow for new training techniques. Live videos would provide real-time imagery

to the surface support and would allow for immediate action in the event of an emergency. This same feature would also provide the opportunity for lead divers to demonstrate new underwater skills to training divers at the surface. With technology rapidly advancing, we hope to be able to purchase a cordless, live stream camera at an affordable price for ultimate safety and efficiency.

Community outreach is important in any new organization. With the community's support, programs can grow at a much more efficient rate. We want to go beyond our presentation at the Mokupāpapa Discovery Center and reach out to other communities around the state of Hawai‘i It is important for community members to be aware of the research being done in their waters as well as making young ocean enthusiasts aware of the types of opportunities available. By reaching out to the other UH campuses statewide, we hope to inspire their scientific diving communities to have their own science diving initiatives within the diving safety program.

The SeaSTARS have conducted a total of 125 surveys to date with more surveys rapidly approaching. We hope to organize our data and create scientific reports or periodicals that outline the methods sed, results of our data, and a brief discussion for each of our dives or datasets. These periodicals would also make data available for MOP students to use for their own MOP projects. Additionally, we hope this process will allow the opportunity to format our data in a way that we can share it with the citizen science programs. Citizen sciences rely on public data that can later be analyzed and used for scientific reports. By contributing our data, we will be providing valuable information to important ongoing research.

Throughout the past year, the SeaSTARS diving program has developed in ways that have provided more training opportunities for current divers, showcased our diver's abilities to open more doors for future opportunities, created protocols that will expand our program by recruiting new divers, provided research opportunities for potential SeaSTARS divers, and made stronger connections between the community and the science diving programs. Even with our new developments, we are excited to introduce new initiatives into our program as we continue to grow.

ACKNOWLEDGMENTS

A special thank you to Matthew Connelly and Julia Stewart for developing the SeaSTARS and for your advising throughout my internship as coordinator. I thank Lisa Parr, Jennifer Sims and Dr. Steven Colbert for your guidance through MOP and your paper and presentation assistance. I also thank the University of Hawai‘i Diving Safety Program for your continued support through diving and safety training and the UH Hilo Boating Program for donating your time on the water. None of this would be possible without the continued support of my education from the Marine Sciences Department.

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