HCRI Year 4 Final report

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Providing Managers with Critical Tools for Assessing Reef Algae

II. Abstract

Quantitative methods for describing and monitoring benthic algal communities and for measuring growth in a green alga, *Halimeda incrassata* using a staining technique to mark calcium deposition were two method that were developed and tested for feasibility and implementation by researchers and field to managers of marine resources. In addition, preliminary benthic surveys were conducted at various sites around the state in conjunction with ongoing DAR activities. Educational activities included an algal turf workshop with printed materials for public distribution and the development of a methods manual for managers.

III. Executive Summary

Growth rates of macroalgae are a useful and important measure of the health of the environment near corals reefs and potentially a more quickly noticed indicator of physical factors impacting the environment such as the decline in photosynthetic capabilities owing to poor light intensities, lowering salinities, lack of water motion, increasing turbidity, or changes in nutrient levels. A simple staining technique, easily replicated, allows us to measure growth in a common green alga, *Halimeda incrassata*, of distinctive morphology and easily identified. We have conducted preliminary site selection and baseline surveys with the Division of Aquatic Resources (DAR) in Kona, Hawaii in conjunction with their West Hawaii Aquarium Project (WHAP) to quantify algal communities in correlation with changing aquarium fish populations in areas closed to fish collection. Surveys have been conducted with the DAR at Anahola, Kauai to establish pre-project baselines before starting a project to reestablish native edible algae.

IV. Purpose

IV.A. Problems or impediments of research project: none

IV.B. Objectives of project:

IV.B.1. To enhance monitoring and assessment capacity through development and implementation of quantitative monitoring methods, including a quantitative benthic survey method and a method for measuring growth rates of key algal species as a detection mechanism for changes in the reef environment.

IV.B.2 To develop educational materials and hold seminars for the training of managers in algae identification and ecology.

IV.B.3. To provide a comprehensive checklist of common macroalgae based upon collections at DLNR locations and other uncollected sites. These collections will be supported by voucher collections to be housed at Bishop Museum Herbarium. These checklists will be provided to all Federal and State agencies to be used for their own purposes, and will be web accessible.

V. Approach

Continuing monitoring of selected sites, most proposed by the Division of Aquatic Resources as likely to change due to different usages, and others chosen because they are unlikely to change usages. Second, we propose to use light sensors and sediment traps in conjuction with growth measurements to record response capabilities of selected indicator macroalgal species, and to train resource managers to read and interpret the data from them. Third, we wish to tag the perennial green alga, *Halimeda* to measure its growth rates in order to have that yardstick to judge the health of the habitat and how other algal species might be evaluated. We believe that the tools we are introducing, the first of their kinds in Hawaiian waters, are simple, easily explained and conducive of producing valuable data for helping to manage coral reef systems.

V.A. Detailed description of the work performed.

V.A.1. To enhance monitoring and assessment capacity:

***Halimeda* growth study:** To test an algal growth study as a method for assessing environmental change, *Halimeda* plants were randomly selected and tagged for either control and treatment. Treatment plants were nutrient enriched, and all plants alizarin stained. Stained plants were collected one week later and growth measured. In addition, light meters and sediments traps were deployed to determine any correlations of growth to light and sediment loading. The method was tested at Oahu at two locations, then performed quarterly in an area known for *Cladophora* blooms near Kahekili, Maui. Plants were treated and results compared at two depths: 30ft and 50ft. The method is intended as an assessment tool for determining nutrient enrichment levels with a keystone species.

Quantitative Survey Method: A rapid ecological assessment and monitoring method using a digital camera, photoquadrats, and specimen collection was developed to assist managers in assessing and monitoring benthic reef communities to detect possible change and/or impact.

Quantitative algal transects: A number of sites on Maui, Kauai and Hawaii were surveyed and baseline data collected for ongoing monitoring activity. Permanent transects from shore to 20 m depths were positioned or coordinated with other ongoing studies. Relative percent cover was determined with quadrat or photoquadrat methods, and specimen collection was done for voucher specimens and algal species list.

V.A.2 Educational materials and seminars:

Educational Seminar: An Algal Turf workshop was held in June 2002. Managers were introduced to the ecology of turf algae, an important and dominant algal form on coral reefs. They were also taught the identification and microscope techniques necessary for the identification of these small algal species. A series of three posters that illustrate aspects of the ecology of turf algae and other algae were developed and distributed for display for public education.

Methods Manual: The initial design was completed and submitted for approval to the HCRI administrative office. The manual is in development, with illustrations, photograph and copy being compiled into a technical manual for managers' use. The methods described in the manual include the *Halimeda* growth study with alizarin staining and nutrient enrichment techniques, sediment traps and light sensors; algal specimen collection, handling and preservation; and a complete description of the quantitative photoquadrat method.

V.A.3. Algal collections were completed on Oahu, Kauai, Maui, Kahoolawe, and Hawaii at 15 new sites. The samples were brought back to the laboratory for identification and preservation as voucher specimens. Species lists by site were compiled and will be submitted to the Bishop Museum.

V.B. Project management.
Dr. Abbott, Dr. Smith and Dr. McDermid, principal investigators, conducted the turf workshop, with the assistance of Ryan Okano and Linda Preskitt, graduate assistants. Ryan Okano and Linda Preskitt also conducted the field experiments and data analyses for the *Halimeda* growth study and the benthic surveys, carried out the algal specimen collections and prepared educational materials under the supervision of Dr. Abbott, Dr. Smith and Dr. McDermid.

VI. Findings

VI.A.

VI.A.1. *Halimeda* study: In the preliminary test study at Kualoa (impact) and Hunakai (control), Oahu, there was significant difference in the growth of plants by location. The more comprehensive *Halimeda* study at Kahekili Park, Maui, showed significant differences in growth between depths and significant differences in growth between treatments at the 50 ft depth but not at the 30ft depth in 2 of the 3 quarterly studies. The last study did not have significant differences between depths.

VI.A.2. The three day seminar has 28 attendees from federal and state agencies, including Division of Aquatic Resources (DLNR), National Parks Services, University of Hawaii at Hilo, University of Hawaii at Manoa, Maui Community College, West Oahu Community College and National Marine Fisheries Service.

VI.A.3. 780 species of macro and filamentous algae were collected, identified and added to specimen lists for their respective islands. In addition, in excess of 2000 herbarium sheets were also submitted to the Bishop Museum for processing as voucher specimens.

VI.B. Significant problems: none

VI.C. Description of need for additional work.
Baseline surveys were conducted on the permanent transects deployed on the four islands listed above. Monitoring by photoquadrat and sample collections need to be continued quarterly.

VII. Evaluation

VII.A. All objectives were met. Two new monitoring methods were developed and tested, and used in the baseline assessment of a number of sites around the state. Educational materials in the form of posters and manuals were developed and a seminar held for state managers and educators. Finally, algal collections continued around the state with many new records added to algal lists at Bishop Museum.

VII.B.As required, data will be submitted to the NOAA Data Archive. Specimen lists and voucher specimens were deposited with the Bishop Museum.

VIII. _____
Principal Investigator