Annual Progress Report

A. Grant Number: NA05NOS4261157

B. Amount of Grant: $64,533

C. Project Title: Propagation of Hawaiian corals for reef restoration

D. Grantee: Cynthia L. Hunter

E. Award Period: From: January 2006  To: February 2007

F. Period Covered by this Report: From: January 2006  To: May 2006

G. Summary of Progress and Expenditures to Date:

1. Work Accomplishments: (as related to project objectives and schedule for completion)
   a. Provide a brief summary of progress, including results obtained to date, and their relationship to the general goals of the grant;

The project has six specific objectives, progress on each of the objectives are listed below:

**Objective 1.) Develop protocols for rescue, quarantine and rehabilitation of corals that would otherwise face mortality;** We are collaborating closely with the Richmond laboratory at UH-Kewalo Marine lab (KML). Previously, coral colonies at the lab (mostly *Porites, Pocilopora* and *Montipora*) have been maintained under marginal water flow and light conditions. We have constructed new coral propagation facilities at KML, including two large tanks with surge towers to provide adequate water flow. Coral colonies were cleaned and photographed prior to fragmentation and attachment. We have been experimenting with several methods for culturing small fragments, such as suspension by fishing line and attachment with various epoxies.

An additional source of colonies for this study has been recently identified. We have been in contact with Cates International, a company that operates large (moi) fish pens in 130 feet of water off the south coast of Oahu. Hundreds of coral colonies have naturally settled and grown on the rim of the pens. We are planning to relocate some of these corals to an experimental mid-water suspended nursery at the same site.

**Objective 2.) Determine optimal environmental conditions (lighting, temperature, and water motion) for rapid propagation in a coral nursery;** Data from a preliminary experiment conducted at the Waikiki Aquarium (3/05-12/05) has recently been compiled and analyzed. The experiment provided data on the upper limits of light and water motion tolerance for *Porites* species. We will continue to experiment with optimal conditions for growing coral in an inland facility. Our immediate focus will shift to examine the effects of organic and inorganic nutrients on the growth and survival of Hawaiian corals.

**Objective 3.) Experimentally test a novel method of growing nubbins to rapidly encrust and fuse over a large surface area;** This experiment began in May 2006 and will continue until November 2006. Ten small concrete “pyramids” were constructed, with surfaces covered by glossy ceramic tile. The pyramids were planted with 60 nubbins each, in two different spacing patterns, in order to determine which spacing pattern results in regrowth over a greater surface area with the least mortality.
Objective 4.) Experimentally determine the colony size necessary for out-planting with high survivorship; We are planning to meet this objective by transplanting a range of fragment sizes to an experimental mid-water nursery to be constructed near the moi fish pens. We are also discussing the potential to perform experiments on transplanted fragments using various sizes and attachment methods at the barren artificial reef structures at the Atlantic submarine site.

Objective 5.) Provide source material for a “head-start” mitigation after alien algal removal from reef areas; Source material is currently available in the form of nubbins and mosaics of nubbins grown at our ex-situ nursery. The nubbins were produced from previous experiments and will continue to increase in size until they are needed for other work. The corals growing on the rim of the moi fish pens are an additional potential source of material.

Objective 6.) Examine alternative methods for culturing corals, such as from settlement tiles, or ex-situ sexual reproduction; The older flow-through tanks at KML have several juvenile colonies Porites spp. and Pocillopora spp. that have naturally settled in the tanks, apparently coming in through the unfiltered sea water system. During spawning season, we will attempt to breed several colonies in a large communal tank. For a period of two weeks after spawning, a filter will be placed over the tank outflows to retain larvae so that they will settle on experimental substrata placed in the tank. We are currently monitoring the coral colonies for gonad development, so that spawning dates can be anticipated.

The work over the next year will be enhanced as a result of recent developments. A potential partnership with Cates International can provide new “surplus” coral source material and a new field site. This also creates a unique opportunity to examine the role of nutrient enrichment on coral growth. A preliminary experiment on the effects of organic and inorganic nutrients on coral growth is currently underway at KML. We will work to meet the objectives stated in our original proposal (as listed above) in addition to beginning work on coral nutrition and growth.

2. Applications:
   a. Publications, presentations, workshops;
      The following publication has recently been accepted for publication (ZHF was supported 50% FTE by a previous HCRI grant):


      The following invited talk and poster were given at the first international Asia Pacific Coral Reef Symposium in Hong Kong, June 2006 (based on last years’ HCRI work)

b. Applications to management or research;
   We have developed and tested culturing methods that have resulted in greater than 90% survival of coral fragments as small as 1 cm². In addition, we have identified the upper threshold of light and water motion for maximal growth of Hawaiian corals in *ex situ* nursery conditions. We have trained students in culturing coral, and in constructing and maintaining culturing facilities for conducting research projects. These methods and protocols will be disseminated to other researchers and resource managers.

c. Data and/or information products;
   Digital photographs of weekly coral growth have been recorded; growth data will be compiled and analyzed at the end of the year’s project.

d. Partnerships established with other federal, state, or local agencies, or other research institutions (other than those already described in the original proposal).

The *ex situ* coral nurseries have been transferred from the Waikiki Aquarium to Kewalo Marine Lab. We have been in communication with Cates International, and conducted a reconnaissance dive to survey coral growth on the fish cages. We have also been in contact with Atlantis Adventures Inc. and surveyed possible experimental sites from their submarines. We are working on further arrangements with Cates and Atlantis, and will continue to work closely with DLNR-DAR staff as these plans move forward.
3. Expenditures:
   a. Describe expenditures scheduled for this period.

   (for entire grant period)
   Salary: $ 
   Materials & Supplies: $ 
   Travel: $ 

   b. Describe actual expenditures this period.

   Salary: $? 
   Materials & Supplies: $? 
   Travel: $? 

c. Explain special problems, differences between scheduled and actual expenditures, etc.

Prepared By:

Signature of Principal Investigator       Date

NOAA COP Annual Progress Report Form
Subsequently, all NOAA COP recipients with approved grants will be asked to file a COP Annual Progress Report in the specified format. The first section of the proposed format is taken from the COP implementation plan and has some advantages in that previously-funded investigators will be familiar with the format. Consistency in reporting requirements for competitive research grant programs is desirable and this is behind COP’s efforts in proposing a standardized format. This annual report format will enable COP program staff to monitor each project supported by an award.

Public reporting burden for this collection of information is estimated to average 300 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed and completing and reviewing the collection of information.

Send comments regarding this burden estimate or any other aspects of this collection of information, including suggestions for reducing this burden, to the National Ocean Service, CSCOR/COP Office, 1315 East-West Highway, Silver Spring, MD 20910. Grant files are subject to the Freedom of Information Act (FOIA). Confidentiality will not be maintained—the information will be made available to the public. However, unpublished research results shall not be published without prior permission from the recipient.

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