Earthwatch 2016 Annual Field Report

RESEARCH ON ENDANGERED CORALS AND RESTORATION POTENTIAL ON LITTLE CAYMAN, CAYMAN ISLANDS

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REPORT FOR 2016 PROGRAM

Dear Earthwatch Volunteers,

In 2015, the Central Caribbean Marine Institute (CCMI) joined forces with Earthwatch to enlist citizen scientists as volunteers in our effort to help endangered corals in Little Cayman, Cayman Islands. With your help we have grown our coral restoration research program to include over 1000 corals from an original five individuals. The experiments that were made possible due to Earthwatch expedition volunteers help included support in the expansion of the number of genotypes from 5 to 14 in our nursery and from one shallow nursery to one shallow and one deep nursery.

We demonstrated that we could successfully fragment and grow corals both in the nursery and in the wild. Earthwatch volunteers found 88 Evolutionarily Distinct and Globally Endangered (EDGE) corals as part of our effort to map EDGE species around the island as a measure of reef resilience. Volunteers helped assess the health status and recovery of 139 corals following a high-temperature induced bleaching event which impacted approximately 60% of the corals around Little Cayman. All of this work were the first steps in Long-term Assessment and Monitoring Projects (LAMP) aimed at restoring EDGE coral populations locally and ultimately, throughout the Caribbean.

We thank each and every one of you for supporting this innovative and groundbreaking work.

Sincerely,

Dr. Carrie Manfrino, CCMI Founder and President

Disclaimer/Authors' Note

This project has been developed over a series of 5 years and as the team have produced new information, field studies have been updated and modified so that no two programs were the same. The authors reserved the right to include the broader results from the larger programme to understand how to most effectively grow corals in specific habitats in Little Cayman, Cayman Islands. The intent of the work was to inform policy and practice of coral restoration, rather than to restore coral reef habitats.

Summary

In 2012, CCMI began a coral restoration pilot study as a collaboration with the Cayman Islands Department of Environment (DoE). The goal was to understand the processes required to establish a coral nursery and to assess the capacity for coral restoration. As a result, a new policy was enacted by the Cayman Islands DOE so that coral restoration could expand across the three islands under a new permitting process. As a result of this project, Earthwatch volunteers have assisted us with completed numerous studies that have led to publications and training in coral restoration. CCMI and our collaborators including Earthwatch volunteers are pioneers in coral restoration work in the Cayman Islands.

Goals, Objectives, and Results

A three-year study began in 2016 to scientifically understand the conditions supporting coral reef resilience and ecosystem biodiversity through coral restoration.

In 2016, we had three primary goals related to research, education, and conservation.

1) Research goals: Identifying, collecting, and propagating resistant corals (resistant to a major coral bleaching event that occurred in 2015 and early 2016), that would be used as our next generation of more resilient corals in a series of experiments.

2) Education and Outreach goals: Transform the knowledge gained from the research into action and stewardship through education programs that teach children ocean literacy; train current and future leaders in ocean sciences; and disseminate cutting-edge research through collaborations and public awareness programs.

3) Conservation goals: Increase the number of individuals and biodiversity of corals in the nursery by increasing the number of genotypes from 5 to 14, add a second species (*Acropora palmata*, elkhorn coral) of nursery–reared corals, and raising awareness through citizen science programs.

Results

By gradually staging 84 coral fragments from three individuals (genotypes) into shallower environments, volunteers examined the potential to increase survival rates of nursery reared corals once outplanted onto shallow reef sites. Corals were moved from the coral nursery (6 meter water depth) directly to the shallow reef crest (<1m) where light intensity, temperature, and wave energy was high. A second 'graduated' treatment moved the corals first to 3m water depth and then to the shallow reef crest.

Results

- The corals in the 'graduated' treatment resulted in less breakage or loss of apical polyps (new growth tips) despite periodic heavy storm surge than corals outplanted directly from the nursery.
- More than half of the fragments outplanted in the spring experienced bleaching stress during the summer and have since have recovered. While waters warmed substantially this summer the bleaching event was shorter as October storms decreased water temperatures.

- Genotypic differences are also evident between the three genotypes in regards to growth rate, strength (decreased fragmentation), and paling.
- Overall, growth of the coral fragments is slower in the outplant sites compared to in the nursery site, however all fragments are growing and producing new apical tips.
- Successful fragmentation (asexual reproduction) is occurring at the site and new fragments have become established independently.

Project Impacts

Report contributions in the categories below for the past fielding year.

1. **Increasing Scientific Knowledge**
    a. **Total citizen science research hours -** provide an estimate for the number of hours per day that volunteers spent collecting data or being trained to collect data in the field.

    8 hours / day

    b. **Peer-reviewed publications**

    - Lohr, K., Bejarano, S., Lirman, D., Schopmeyer, S., **Manfrino, C.,** (2015) Optimizing the productivity of a coral nursery focused on staghorn coral *Acropora cervicornis, Endangered Species Research 27:243-250.*
    - Lohr KE, Cook McNab AA, **Manfrino C**, Patterson, JT (2016) Assessment of wild and restored Staghorn coral *Acropora cervicornis* in three reef zones at Little Cayman, Cayman Islands. Regional Studies in Marine Science 9C (2017) pp. 1-8 DOI information: 10.1016/j.rsma.2016.11.003
    - Crawford Drury, Stephanie Schopmeyer, Dave Gilliam, Erich Bartels, Meaghan Johnson, Diego Lirman K. Maxwell, K. Nedymier, V. Galvan, **C. Manfrino**, and L. Carne (2016) Patterns of genetic diversity in *Acropora cervicornis* show extensive population structure and variable genetic diversity, Submitted.

    c. **Presentations** – indicate if this was an invited paper, panel presentation, keynote speech, plenary address, or other.

    Lohr, 2016 ICRS, Honolulu, POSTER.
    Cook, 2016 ICRS, Honolulu, POSTER

2. **Mentoring**
    a. **Graduate students** – list graduate students doing thesis work on the project

Student Name	Graduate Degree	Project Title	Anticipated Year of Completion
Paul Maneval	Masters of Science	TBD (University of Florida & CCMI)	2017
Daniel Varas	Masters of Science	TBD (University of Florida & CCMI)	2019

b. Community members – provide details on how you have supported the development of environmental leaders in the community in which you work.

Name of school, organization, or group	Education level	Participants local or non-local
SeaCamp Session 1: 2016	High School	Local & Non-local
SeaCamp Session 2: 2016	High School	Local & Non-local
SeaCamp Session 3: 2016	High School	Local & Non-local
SeaCamp Session 1: 2017	High School	Local & Non-local
SeaCamp Session 2: 2017	High School	Local & Non-local
YELC students 2016	High School	local
YELC students 2017	High School	local
Winter Interns 2017	Undergraduate and Graduate Students	Non-local
Rutgers Interns 2016	Undergraduate Students	Non-local
Rutgers Interns 2017	Undergraduate Students	Non-local
Dive with Heroes 2016	Varied (adults)	Non-local
Dive with Heroes 2017	Varied (adults)	Non-local
REU Interns 2016	Undergraduate Students	Non-local
EDGE Team 1: 2016	Varied (adults)	Non-local
EDGE Team 2: 2016	Varied (adults)	Non-local
Denver Divers 2017	Varied (adults)	Non-local

Details on contribution(s)/activity(ies):

Restoration volunteers have helped with the cleaning, fragmentation, and outplanting of nursery reared corals either while snorkeling or while on SCUBA. Many volunteers have also had the additional opportunity to assist with the monitoring of previously outplanted corals in the form of photo documentation, measuring total linear extension (colony growth), and assessing the general health of each colony.

3. Partnerships – list your current active professional partnerships that contribute to your project and indicate the type of support these partners provide

Partner	Support Type(s)[1]	Years of Association (e.g. 2006-present)
Cayman Islands Department of Environment (DoE)	Permitting and field support	2000-present
University of Florida	Masters Level Resesarch	2010-present?

4. **Contributions to management plans or policies -** list the management plans/policies to which your project contributed this year

Plan/Policy Name	Type[2]	Level of Impact[3]	New or Existing?	Primary goal of plan/policy[4]	Stage of plan/policy[5]	Description of Contribution
National conservation	policy	national	NEW	Species restoration	adopted	Collaborator in pilot study

5. **Conserving natural and sociocultural capital**
   a. **Conservation of taxa -**
      i. List any focal study species that you did not list in your most recent proposal

Species	Common name	IUCN Red List category	Local/regional conservation status	Local/regional conservation status source
Acropora spp.	Staghorn coral & Ekhorn coral	threatened	endangered & protected	USA Endangered Species Act (for the surrounding Caribbean Sea) and DoE

      ii. In the past year, has your project helped conserve or restore populations of species of conservation significance? If so, please describe below.

Species	IUCN Red List category	Local/regional conservation status	Local/regional conservation status source	Description of contribution	Resulting effect[6]
Acropora spp.	threatened	endangered	protected	Policy & restoration	Increased numbers in two nurseries and increased colonies in the wild.

   b. **Conservation of ecosystems** - in the past year, has your project helped conserve or restore habitats? If so, please describe below.

Habitat type	Habitat significance[7]	Description of contribution	Resulting effect[8]
Coral reef	critical component for ecosystem	Increased awareness of threatened species	Increased nurseries to 5 across all three Cayman islands

c. **Ecosystem services** – Indicate which ecosystem service categories you are directly studying in your Earthwatch research and provide further details in the box below.

☒Food and water ☐Flood and disease control
☒Spiritual, recreational, and cultural benefits ☐Nutrient cycling

Details:

Socio-economic benefits through tourism, education, and conservation. Food source as a larger and healthier coral reef ecosystem provides more fish for recreational and local fishers.

d. **Conservation of cultural heritage** – provide details on intangible or tangible cultural heritage components that your project has conserved or restored in the past year.

Cultural heritage component[9]	**Description of contribution**	**Resulting effect**
Many species living in the reef system are fundamental to local culture (eg green turtles)	Providing training to local dive shops and volunteers to help test restoration success	New knowledge about threats to reef habitats and related risk to local culture

Acknowledgements

Earthwatch expedition volunteer teams are acknowledged for their field support especially during the needed coral bleaching surveys.

Anything Else – is there any other information you would like to provide Earthwatch?

Volunteer surveys helped us expand the range (area) for this study.

This report summarizes the outputs of this work and includes a longer term outlook that will require a new focus.