

Carrie Bow Caye, Belize temperature data near Acroporid corals from August to September 2016 (Coral Hybridization project)

Website: <https://www.bco-dmo.org/dataset/666418>

Data Type: Other Field Results

Version: 1

Version Date: 2016-12-01

Project

» [Collaborative research: Is hybridization among threatened Caribbean coral species the key to their survival or the harbinger of their extinction?](#) (Coral Hybridization)

Contributors	Affiliation	Role
Fogarty, Nicole	Nova Southeastern University	Principal Investigator
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Methods & Sampling

Temperature collections in “hybrid zone” at 0.6m of water were collected using a Hobo Pendant Temperature/Light Data Logger UA-002-64 with +/- 0.53 degrees C accuracy. Data collected in the parental zones at 1.5-2m feet of water were collected with Hobo Pro v2 Data Logger U22-001 with +/- 0.2 degrees C accuracy.

Data Processing Description

BCO-DMO Processing notes:

- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- re-formatted date from m/d/yyyy to yyyy-mm-dd
- replaced spaces with underscores
- converted latitude and longitude to decimal degrees
- added columns for ISO_DateTime and yearday

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Data Files

File
Belize_temp_2016.csv (Comma Separated Values (.csv), 540.70 KB) MD5:02999578982498a427922f36bcb73312
Primary data file for dataset ID 666418

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Parameters

Parameter	Description	Units
date	UTC date formatted as yyyy-mm-dd	year-month-day
time	UTC time formatted as HH:MM	hour-minute
ISO_DateTime.UTC	Date/Time (UTC) ISO formatted based on ISO 8601:2004(E) with format YYYY-mm-ddTHH:MM:SS[.xx]Z	year;month;day;hour;minute;second
yrday_utc	UTC day and decimal time:eg. 326.5 for the 326th day of the year or November 22 at 1200 hours (noon)	julian day and fraction of day
temp	water temperature	degrees Celsius
dominant_species	the dominant coral species in the area	unitless
depth	sampling depth	meters
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees

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Instruments

Dataset-specific Instrument Name	Hobo Pendant Temperature/Light Data Logger UA-002-64 and Hobo Pro v2 Data Logger U22-001
Generic Instrument Name	Temperature Logger
Dataset-specific Description	Used to measure water temperature
Generic Instrument Description	Records temperature data over a period of time.

Deployments

Fogarty_Belize_2016

Website	https://www.bco-dmo.org/deployment/666442
Platform	Belize_reefs
Start Date	2016-08-21
End Date	2016-09-07

Project Information

Collaborative research: Is hybridization among threatened Caribbean coral species the key to their survival or the harbinger of their extinction? (Coral Hybridization)

Coverage: Caribbean and North-West Atlantic

NSF Award Abstract:

Reef-building acroporid corals form the foundation of shallow tropical coral communities throughout the Caribbean. Yet, the once dominant staghorn coral (*Acropora cervicornis*) and the elkhorn coral (*A. palmata*) have decreased by more than 90% since the 1980s, primarily from disease. Their continuing decline jeopardizes the ability of coral reefs to provide numerous societal and ecological benefits, including economic revenue from seafood harvesting and tourism and shoreline protection from extreme wave events caused by storms and hurricanes. Despite their protection under the U.S. Endangered Species Act since 2006, threats to the survival of reef-building acroporid corals remain pervasive and include disease and warming ocean temperatures that may lead to further large-scale mortality. However, hybridization among these closely related species is increasing and may provide an avenue for adaptation to a changing environment. While hybrids were rare in the past, they are now thriving in shallow habitats with extreme temperatures and irradiance and are expanding into the parental species habitats. Additional evidence suggests that the hybrid is more disease resistant than at least one of the parental species. Hybridization may therefore have the potential to rescue the threatened parental species from extinction through the transfer of adapted genes via hybrids mating with both parental species, but extensive gene flow may alter the evolutionary trajectory of the parental species and drive one or both to extinction. This collaborative project is to collect genetic and ecological data in order to understand the mechanisms underlying increasing hybrid abundance. The knowledge gained from this research will help facilitate more strategic management of coral populations under current and emerging threats to their survival. This project includes integrated research and educational opportunities for high school, undergraduate and graduate students, and a postdoctoral researcher. Students in the United States Virgin Islands will take part in coral spawning research and resource managers will receive training on acroporid reproduction to apply to coral restoration techniques.

Current models predict the demise of reefs in the next 200 years due to increasing sea surface temperatures and ocean acidification. It is thus essential to identify habitats, taxa and evolutionary mechanisms that will allow some coral species to maintain their role as foundation fauna. Hybridization can provide an avenue for adaptation to changing conditions. Corals hybridize with some frequency and results may range from the introduction of a few alleles into existing parent species via introgression, to the birth of a new, perhaps better adapted genetic lineage. The only widely accepted coral hybrid system consists of the once dominant but now threatened Caribbean species, *Acropora cervicornis* and *A. palmata*. In the past, hybrid colonies originating from natural crosses between elkhorn and staghorn corals were rare, and evidence of hybrid reproduction was limited to infrequent matings with the staghorn coral. Recent field observations suggest that the hybrid is increasing and its ecological role is changing throughout the Caribbean. These hybrids appear to be less affected by the disease that led to the mass mortality of their parental species in recent decades. Hybrids are also found thriving in shallow habitats with high temperatures and irradiance suggesting they may be less susceptible to future warming scenarios. At the same time, they are expanding into the deeper parental species habitats. Preliminary genetic data indicate that hybrids are now mating with each other, demonstrating

the potential for the formation of a new species. Further, hybrids appear to be capable of mating with both staghorn and elkhorn coral, perhaps leading to gene flow between the parent species via the hybrid. Research is proposed to address how the increase in hybridization and perhaps subsequent introgression will affect the current ecological role and the future evolutionary trajectory of Caribbean acroporids. Specifically, this collaborative project aims to answer the following questions: 1) What is the historic rate, direction, and degree of introgression across species ranges and genomes? Linkage block analysis based on genome-wide SNP genotyping across three replicate hybrid zones will answer this question. 2) What is the current extent and future potential of later generation hybrid formation? Morphometric and genetic analyses combined with in vitro fertilization assays will be used. 3) What mechanisms allow hybrids to thrive in hot, shallow waters? A series of manipulative in situ and ex situ experiments will determine whether biotic or abiotic factors favor hybrid survival in shallow waters. 4) Are hybrids more disease resistant than the parentals species? Disease transmission assays in reciprocal transplant experiments and histological analysis to determine the extent of disease will be conducted. A multidisciplinary approach will be taken that combines traditional and cutting edge technology to provide a detailed analysis of the evolutionary ecology of Caribbean corals.

Note: PI Nicole Fogarty's original award OCE-1538469 was issued while at Nova Southeastern University. This was replaced by OCE-1929979 upon moving to the University of North Carolina Wilmington.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1538469

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