Assessment of polyps per area of Acropora cervicornis genotypes sampled July 2020 for fecundity analysis at Mote Marine Laboratory

Website: https://www.bco-dmo.org/dataset/868308
Data Type: Other Field Results, experimental
Version: 1
Version Date: 2022-03-16

Project
» CAREER: Applying phenotypic variability to identify resilient Acropora cervicornis genotypes in the Florida Keys (Resilient Acerv)

Contributors	Affiliation	Role
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Abstract
Primary fecundity was assessed for Acropora cervicornis corals with known disease susceptibility. This dataset presents information on the number of polyps per area from linear branches of five colonies with 12 genets held in Mote Marine Lab's spawning nurseries.

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - Data Processing Description
- Data Files
- Supplemental Files
- Related Publications
- Related Datasets
- Parameters
- Instruments
- Project Information
- Funding

Coverage

Spatial Extent: **N**:24.56257 **E**:-81.4001 **S**:24.4578 **W**:-81.8859
Temporal Extent: 2020-07-03

Dataset Description

This dataset is part of a larger study of *Acropora cervicornis* (staghorn) corals studied at Mote Marine Lab's Elizabeth Moore International Center for Coral Reef Research and Restoration. The different analyses are listed here, and links to other data from this study can be found in the Related Datasets section below.

Analyses undertaken include:

1. Total Population (Colony size dataset)
2. Morphometric Assessment (Colony size dataset)
3. Primary Fecundity Analysis (Population subset of Colony size dataset; and **this Polyps dataset**)
4. Dissections (Oocyte number dataset, Oocyte size dataset)
5. Secondary Fecundity Analysis (Gamete bundle dataset)

See Related Datasets section below for links to above mentioned datasets.

Methods & Sampling

Sampling of *Acropora cervicornis* coral genotypes took place at Mote Marine Lab's spawning nurseries at Sand Key (24.45782, -81.88595) and Looe Key (24.56257, -81.40009).

Sampling for Primary Fecundity Analysis
On July 3, 2020, from 5 colonies of every genet, 3 linear branches (~10 cm in length) were sampled using bone cutters from the central portion of each colony (N=180 branches). Using a ruler, the number of polyps per 1 cm^2 was recorded from every branch near the base of the fragment. The top ~2 cm (sterile zone) of every branch was removed before placing into a 50 mL falcon tube with 10% formalin to fix tissues. After 2 days, the formalin solutions were replaced with a 5% HCl solution, with every branch and tube triple rinsed with DI water in between to remove excess formalin. After 3 days, the 5% HCl solution in every tube was replaced with 10% HCl and subsequently refreshed every 2-3 days until branches were completely decalcified. Once decalcified, samples were triple rinsed in DI water and returned to their tubes with 70% EtOH for storage until dissection.

Dissections
Under a dissecting microscope, every fragment was dissected using a scalpel and forceps to haphazardly select 5 polyps per fragment (N = 900 polyps) to count the total number of oocytes within each polyp (Oocyte Number dataset, https://www.bco-dmo.org/dataset/867314). From those, 5 oocytes were randomly selected to measure their size (Oocyte Size Dataset: https://www.bco-dmo.org/dataset/843067)

Data Processing Description

Data processing:
Data were compiled into Excel (Microsoft Office) and analyzed using R version 4.0.3 (2020-10-10) -- "Bunny-Wunnies Freak Out". Nonparametric statistical and correlation analyses were conducted.

BCO-DMO Processing:
- separated Latitude and Longitude into separate columns
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions

[table of contents | back to top]

Data Files

File
polyps.csv (Comma Separated Values (.csv), 9.03 KB) MD5:f12908cd2b4ac9bb04fa8c51bf951709 Primary data file for dataset ID 868308

[table of contents | back to top]

Supplemental Files

File
Disease_Susceptibility_Table filename: Disease_Susceptibility_Table.pdf (Portable Document Format (.pdf), 64.24 KB) MD5:b155930985bd0c9e954a1f0eeacc78a1 Acropora cervicornis genotypes and susceptibility to white-band disease

[table of contents | back to top]

Related Publications

Borger, J. L., & Colley, S. (2010). The effects of a coral disease on the reproductive output of Montastraea faveolata (Scleractinia: Faviidae). Revista de biologia tropical, 58 Suppl 3, 99–110.
Related Research

Foster, N., Box, S., & Mumby, P. (2008). Competitive effects of macroalgae on the fecundity of the reef-building coral Montastraea annularis. Marine Ecology Progress Series, 367, 143–152. https://doi.org/10.3354/meps07594
Related Research

Graham, J. E., & van Woesik, R. (2013). The effects of partial mortality on the fecundity of three common Caribbean corals. Marine Biology, 160(10), 2561–2565. doi:10.1007/s00227-013-2248-y
Related Research

Muller, E. M., Bartels, E., & Baums, I. B. (2018). Bleaching causes loss of disease resistance within the threatened coral species Acropora cervicornis. eLife, 7. doi:10.7554/elife.35066 https://doi.org/10.7554/eLife.35066
Methods

Okubo, N., Motokawa, T., & Omori, M. (2006). When fragmented coral spawn? Effect of size and timing on survivorship and fecundity of fragmentation in Acropora formosa. Marine Biology, 151(1), 353–363. doi:10.1007/s00227-006-0490-2
Related Research

Pratchett, M. S., Hoey, A. S., Tan, C.-H., Kuo, C.-Y., Bauman, A. G., Kumaraswamy, R., & Baird, A. H. (2019). Spatial and Temporal Variation in Fecundity of Acropora spp. in the Northern Great Barrier Reef. Diversity, 11(4), 60. doi:10.3390/d11040060
Related Research

R Core Team (2020). R: A language and environment for statistical computing. R v4.0.3. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/
Software

Smith, L.E., & Hughes, T.P. (1999). An experimental assessment of survival, re-attachment and fecundity of coral fragments. Journal of Experimental Marine Biology and Ecology, 235(1), 147–164. doi:10.1016/s0022-0981(98)00178-6 https://doi.org/10.1016/S0022-0981(98)00178-6
Related Research

Teo, A., Guest, J. R., Neo, M. L., Vicentuan, K., & Todd, P. A. (2016). Quantification of coral sperm collected during a synchronous spawning event. PeerJ, 4, e2180. doi:10.7717/peerj.2180
Related Research

Vargas-Ángel, B., Colley, S. B., Hoke, S. M., & Thomas, J. D. (2005). The reproductive seasonality and gametogenic cycle of Acropora cervicornis off Broward County, Florida, USA. Coral Reefs, 25(1), 110–122. doi:10.1007/s00338-005-0070-9
Related Research

[table of contents | back to top]

Related Datasets

IsRelatedTo

Koch, H., Azu, Y., Bartels, E., Muller, E. (2022) **Colony sizes and morphometric assessments of Acropora cervicornis genotypes sampled July 2020 for fecundity analysis at Mote Marine Laboratory.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-03-23 doi:10.26008/1912/bco-dmo.843028.1 [view at BCO-DMO]

Koch, H., Azu, Y., Bartels, E., Muller, E. (2022) **Fecundity and number of oocytes from Acropora cervicornis genotypes measured July 2020 at Mote Marine Lab.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-03-14 doi:10.26008/1912/bco-dmo.867314.1 [view at BCO-DMO]

Koch, H., Azu, Y., Bartels, E., Muller, E. (2022) **Fecundity and oocyte sizes of Acropora cervicornis genotypes measured July 2020 at Mote Marine Lab.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-03-23 doi:10.26008/1912/bco-dmo.843067.1 [view at BCO-DMO]

Koch, H., Azu, Y., Bartels, E., Muller, E. (2022) **Fecundity assessment of Acropora cervicornis colonies from spawning observations and gamete bundle analysis in August 2020 at Mote Marine Laboratory.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-03-15 doi:10.26008/1912/bco-dmo.868493.1 [view at BCO-DMO]

[table of contents | back to top]

Parameters

Parameter	Description	Units
Location	Location of coral sampling site	unitless
Latitude	Latitude of spawning nursery	decimal degrees
Longitude	Longitude of spawning nursery	decimal degrees
Date_measured	Date when measurements were taken (local time)	unitless
Genotype	Mote Marine Lab genet that was sampled (1, 3, 7, 13, 31, 34, 41, 44, 47, 50, 62, 63)	unitless
Phenotype	Phenotype that was sampled (S = white band disease susceptible, R = white band disease resistant)	unitless
Replicate_Colony	Which of the five replicate colonies of the genet was sampled for analysis	unitless
Replicate_Fragment	Which of the three replicate fragments per replicate colony was sampled for analysis	unitless
Number_Polyps	Number of polyps measured within a one square centimeter area of a coral fragment	polyps per square centimeter

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Calcutta metal pliers
Generic Instrument Name	bone cutter
Dataset-specific Description	Each ramet was cut from the donor colony using metal pliers (Calcutta bone cutters).
Generic Instrument Description	A bone cutter is a surgical instrument used to cut bones or coral fragments.

Dataset-specific Instrument Name	ruler
Generic Instrument Name	ruler
Dataset-specific Description	the dimensions of length, width, and height (L x W x H) in centimeters were measured.
Generic Instrument Description	A device used for measuring or for drawing straight lines, consisting of an elongated piece of rigid or semi-rigid material marked with units for measurement. Device that allows one or more physical dimensions of a sample or specimen to be determined by visible comparison against marked graduations in units of measurement of dimension length.

[table of contents | back to top]

Project Information

CAREER: Applying phenotypic variability to identify resilient Acropora cervicornis genotypes in the Florida Keys (Resilient Acerv)

Coverage: Florida Keys, Summerland Key, FL 24.563595°, -81.278572°

NSF Award Abstract:
Caribbean staghorn coral was one of the most common corals within reefs of the Florida Keys several decades ago. Over the last 40 years disease, bleaching, overfishing and habitat degradation caused a 95% reduction of the population. Staghorn coral is now listed as threatened under the U.S. Endangered Species Act of 1973. Within the past few years, millions of dollars have been invested for the purpose of restoring the population of staghorn coral within Florida and the U.S. Virgin Islands. Significant effort has been placed on maintaining and propagating corals of known genotypes within coral nurseries for the purpose of outplanting. However, little is known about the individual genotypes that are currently being outplanted from nurseries onto coral reefs. Are the genotypes being used for outplanting resilient enough to survive the three major stressors affecting the population in the Florida Keys: disease, high water temperatures, and ocean acidification? The research within the present study will be the first step in answering this critically important question. The funded project will additionally develop a research-based afterschool program with K-12 students in the Florida Keys and U.S. Virgin Islands that emphasizes an inquiry-based curriculum, STEM research activities, and peer-to-peer mentoring. The information from the present study will help scientists predict the likelihood of species persistence within the lower Florida Keys under future climate-change and ocean-acidification scenarios. Results of this research will also help guide restoration efforts throughout Florida and the Caribbean, and lead to more informative, science-based restoration activities.

Acropora cervicornis dominated shallow-water reefs within the Florida Keys for at least the last half a million

years, but the population has recently declined due to multiple stressors. Understanding the current population level of resilience to three major threats - disease outbreaks, high water temperatures, and ocean acidification conditions - is critical for the preservation of this threatened species. Results from the present study will answer the primary research question: will representative genotypes from the lower Florida Keys provide enough phenotypic variation for this threatened species to survive in the future? The present proposal will couple controlled laboratory challenge experiments with field data and modeling applications, and collaborate with local educators to fulfill five objectives: 1) identify *A. cervicornis* genotypes resistant to disease, 2) identify *A. cervicornis* genotypes resilient to high water temperature and ocean acidification conditions, 3) quantify how high water temperature and ocean acidification conditions impact disease dynamics on *A. cervicornis*; 4) determine tradeoffs in life-history traits because of resilience factors; and 5) apply a trait-based model, which will predict genotypic structure of a population under different environmental scenarios.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1452538

[table of contents | back to top]