Cell counts of symbionts in Muricea atlantica, M. elongata, and Plexaurella dichotoma across the 2015 Bleaching event (May 2015 to August 2017) at Long Key in the Florida Keys

Website: https://www.bco-dmo.org/dataset/718585
Data Type: Other Field Results
Version: 3
Version Date: 2017-11-29

Project
» RAPID: Variations in symbiont diversity in octocoral across seasons and a predicted bleaching event (Octocoral symbiont diversity)

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Abstract
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Table of Contents

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

Coverage

Spatial Extent: **N**:24.82463 **E**:-80.68645 **S**:24.74507 **W**:-80.77988
Temporal Extent: 2015-09 - 2017-08

Methods & Sampling

Location:
Two patch reefs in the vicinity of Long Key in the Florida Keys (CMF-N24.44.704, W 80 46.793 and SC2- N24 49.478 W80 41.187).

Sampling and Analytical Methodology:
Except for M. atlantica, which was not sampled in May 2015, tagged colonies were sampled in September 2015 (during bleaching), November 2015, March 2016, May 2016, September 2016, November 2016, March 2017 and August 2017 (after bleaching). Symbiont density within coral tissues was determined for each collection. Coral tissue was preserved in 1.0 ml of 5% formalin. For each sample, the length and diameter of each sample were measured to the nearest 0.1 mm using vernier calipers, and the tissue then homogenized in distilled water. The density of symbiont cells in the homogenate was counted at least 4 consecutive times, using standard hemocytometer procedures and converted to cells per tissue volume using the formula for a cylinder to calculate tissue volume.

Taxonomic identifiers (Genus species, LSID):
Muricea atlantica, urn:lsid:marinespecies.org:taxname:287554
Muricea elongata, urn:lsid:marinespecies.org:taxname:287559
Plexaurella dichotoma, urn:lsid:marinespecies.org:taxname:290812

Data Processing Description

Mean x 10000 were calculated from the counts and mean cell counts per volume was calculated using the formula for a cylinder to calculate tissue volume.

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- added species, year_collection, lat, and lon columns
- blank values were replaced with no data value 'nd'

Version 2: 2017-11-29 replaces version 1: 2017-11-02 which only contained M. atlantica counts.

Version 3: 2023-06-05 replaces version 2: 2017-11-29
* Version 2 included the first year of the study, version 3 includes all years of the study. Researchers should not use the previous version as it may contain errors. Eunicea flexuosa removed from dataset.
* Combined all subtables within the three Cell Count<species>_ALL.xlsx files that were submitted 2023-05-22 with subtables by species, and collection month. Submitter made further edits to the combined data and the resulting table contained within Cell_Counts_ALL_BCO-DMO_REVISED.xlsx was uploaded to BCO-DMO as the primary table in this dataset.
* Additional columns species,month_collection, year_collection, added from information in suitable headers.
* "Column" column added and "DEAD" values in height column moved there and removed from height column.
* lat lon in decimal degree columns extracted from degrees decimal minutes provided within text of "site" column.
* rounded lat and lon to 5 decimal places
* rounded volume to 2 decimal places as was used in the original excel formatting.

[table of contents | back to top]

Data Files

File
cell_counts.csv (Comma Separated Values (.csv), 73.49 KB) MD5:9f10e2f9ce4e48ff525882d18025133f Primary data table for dataset 718585 version 3.

[table of contents | back to top]

Related Publications

ANDRAS, J. P., KIRK, N. L., & DREW HARVELL, C. (2011). Range-wide population genetic structure of Symbiodinium associated with the Caribbean Sea fan coral, Gorgonia ventalina. Molecular Ecology, 20(12), 2525–2542. https://doi.org/10.1111/j.1365-294x.2011.05115.x https://doi.org/10.1111/j.1365-294X.2011.05115.x
Methods

Coffroth, M. A., Lasker, H. R., Diamond, M. E., Bruenn, J. A., & Bermingham, E. (1992). DNA fingerprints of a gorgonian coral: a method for detecting clonal structure in a vegetative species. Marine Biology, 114(2), 317–325. doi:10.1007/bf00349534 https://doi.org/10.1007/BF00349534
Methods

Coffroth, M.A., Buccella L., Eaton K. M., Franklin H., Gooding A. T., Lasker, H. R. (submitted) Octocoral thermotolerance may signal resilience to major bleaching events: roles of symbiont and host. Submitted to

Global Change Biology
Results

Pettay, D. T., & Lajeunesse, T. C. (2007). Microsatellites from clade B Symbiodinium spp. specialized for Caribbean corals in the genus Madracis. Molecular Ecology Notes, 7(6), 1271–1274. doi:10.1111/j.1471-8286.2007.01852.x
Methods

Santos, S. R., Gutierrez-Rodriguez, C., & Coffroth, M. A. (2003). Phylogenetic identification of symbiotic dinoflagellates via length heteroplasmy in Domain V of chloroplast Large Subunit (cp23S)-Ribosomal DNA Sequences. Marine Biotechnology, 5(2), 130–140. doi:10.1007/s10126-002-0076-z
Methods

Santos, S. R., Gutierrez-Rodriguez, C., Lasker, H. R., & Coffroth, M. A. (2003). Symbiodinium sp. associations in the gorgonian Pseudopterogorgia elisabethae in the Bahamas: high levels of genetic variability and population structure in symbiotic dinoflagellates. Marine Biology, 143(1), 111–120. doi:10.1007/s00227-003-1065-0
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
species	Host coral colony species	unitless
year_collection	Year in which the sample was collected.	unitless
month_collection	Month in which the sample was collected (Full month name).	unitless
Colony	Identification of the octocoral host colony that was sampled across the study	unitless
Site	Location where collected (lat and lon in degrees decimal minutes)	unitless
lat	Latitude where were sample collected	decimal degrees
lon	Longitude where were sample collected	decimal degrees
height	Height/length of the tissue sample that was used for cell counts	millimeters (mm)
diameter	Diameter of the tissue sample that was used for cell counts	millimeters (mm)
vol	Volume of the tissue sample that was used for cell counts – calculated as that of a cylinder	cubic millimeters (mm^3)

count_1	First replicate of sample counted	unitless
count_2	Second replicate of sample counted	unitless
count_3	Third replicate of sample counted	unitless
count_4	Fourth replicate of sample counted	cells per 0.1 microliter (Cells/0.1 uL)
count_avg	Mean of counts	cells per 0.1 microliter (Cells/0.1 uL)
count_stdev	Standard deviation of count	cells per 0.1 microliter (Cells/0.1 uL)
total_cells_in_sample	Mean adjusted to total cells per ml in which the tissue homogenized	cells per 0.1 milliliter (Cells/0.1 mL)
cells_vol_tissue	Total cells in sample based on sample tissue volume	cells per cubic centimeter of tissue (Cells/cm3 tissue)
comment	"DEAD" or "dead" indicate colony missing or skeleton located but dead. Comments also indicate if "no sample."	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Microscope - Optical
Dataset-specific Description	Used to count symbiont cells
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

[table of contents | back to top]

Project Information

RAPID: Variations in symbiont diversity in octocoral across seasons and a predicted bleaching event (Octocoral symbiont diversity)

Coverage: Florida Keys

Description from NSF award abstract:
Within the marine environment microorganisms form one of the most important marine symbioses in the world: the symbiosis between corals and photosynthetic single-celled algal symbionts. In nutrient poor waters of the tropics, this symbiosis maintains the coral's high productivity, allowing corals to flourish and provides the foundation of the coral reef ecosystem. However, these reefs are currently threatened by anthropogenic-induced perturbations (i.e., global warming, overfishing, pollution). In fact, corals and their associated biodiversity on reefs are being lost at an alarming rate, especially in the Caribbean, where coral cover has declined by 80% over the last thirty years. Much of this decline has been attributed to coral bleaching, a loss of these algal symbionts in response to increase ocean temperatures. Octocorals, in contrast, do not show this decline and are increasing in relative abundance and importance in the Caribbean as scleractinian corals decline. Part of this has been attributed to the fact that bleaching is rarer among octocorals. However, during recent warming events (2005, 2010 and 2014) bleaching was reported in many octocoral host species. Although a great deal is known about bleaching among scleractinian (hard) corals, virtually nothing is known of this phenomenon among octocorals (sea fans, sea whips, sea feathers, etc.). Their growing importance on Caribbean reefs and the lack of knowledge of their response to "bleaching" creates an urgency to understand the dynamics of these algal symbiont populations within octocorals during periods of scleractinian bleaching. Bleaching susceptibility varies among host species and this has been attributed in part to the type of algal symbiont that they contain. In this project, specific octocoral colonies will be followed over the course of a year and symbiont type determined using molecular techniques. These data will be used to determine if bleaching susceptibility is related to symbiont type. This project will significantly add to an understanding of cnidarian-algal symbioses that form the foundation of the coral reef ecosystem. Octocorals dominate many Caribbean reefs and serve as structure and habitat for numerous fish and invertebrates. These data will contribute to our understanding of how these symbioses function and allow for a comparative study with bleaching among other cnidarians. This work will include the training of undergraduate and graduate students, dissemination of the findings to the general public through a collaboration with the Aquarium of Niagara, and sharing of an extensive symbiont culture collection with the scientific community.

Coral bleaching has been an important component of the dynamics on coral reefs for the past 3 decades. Although a great deal is known about bleaching among scleractinian corals, virtually nothing is known of this phenomenon among octocorals. As scleractinian abundance is declining, the relative abundance of octocorals has remained more constant. Part of that success is likely due to a seemingly lower sensitivity of these cnidarians to bleaching conditions. However, the contrast in octocoral bleaching between the 20th century events and those of more recent years suggests that thermal events of increasing frequency and/or intensity will affect octocorals as well and that octocoral sensitivity does vary between species. Thus projecting how octocoral communities will fare requires a greater understanding of variation in their sensitivity to bleaching and the basis of that variation. One potential source of that variation is in the algal symbiont type that these species harbor. Symbiont diversity among Caribbean octocorals is lower than that of scleractinian species with the vast majority of Caribbean octocorals harboring symbionts in the B1-ITS2 lineage which is composed of multiple Symbiodinium species. The aim of this project is to identify symbiont variation within octocoral species before, during and after a predicted bleaching event and to compare symbiont type with bleaching susceptibility. To do this, specific octocoral colonies will be followed over the course of a year and symbiont density and phylotype determined. Colonies from three host species, Plexaurella dichotoma, Muricea muricata and Eunicea flexuosa will be tagged (20 per species at each of 2 reefs) and sampled every 3 months. Symbiont density will be determined through cell counts using a hemocytometer and symbiont phylotype identified using markers that resolve among the different symbiont species in the B1 lineage (i.e., Sym15 flanker, ITS and chloroplast 23S rDNA). If bleaching is not observed in these colonies, these data will inform the diversity within an understudied group and provide information on seasonal change in these symbionts and variation within and between host species. Understanding the dynamics of octocoral bleaching is important. If octocorals are more resistant to bleaching, this may explain observations of increasing abundance. As coral cover declines, these species represent more of the living cover and are often the visually dominant organism on reefs. Furthermore, octocorals are fast growing and have the potential to colonize open space and help to stabilize the ecosystem by providing habitat for other reef organisms.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1552949

[table of contents | back to top]