Genotypes of symbionts in Muricea atlantica, M. elongata, and Plexaurella dichotoma across the 2015 Bleaching event (May 2015-August 2017) in the Florida Keys

Website: https://www.bco-dmo.org/dataset/896886
Data Type: Other Field Results
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Project
» RAPID: Variations in symbiont diversity in octocoral across seasons and a predicted bleaching event (Octocoral symbiont diversity)

Contributors	Affiliation	Role
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Abstract
Alleles at four microsatellite loci, genotype based on these, fragment size of hypervariable region of the chloroplast 23S rDNA and genus of symbionts in Muricea atlantica, M. elongata, and Plexaurella dichotoma across the 2015 Bleaching event (May 2015-August 2017).

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Coverage

Spatial Extent: **N**:24.8246 **E**:-80.6864 **S**:24.7451 **W**:-80.7799
Temporal Extent: 2015-05 - 2017-08

Methods & Sampling

Methodology by organism type:

M.elongata:
Tagged colonies were sampled in May 2015 (before bleaching), September 2015 (during bleaching), and after bleaching - November 2015, March 2016, May 2016, September 2016, November 2016, March 2017 and August 2017. Tissue was preserved in 95% ethanol. DNA was extracted from symbiont cells following Coffroth et al. (1992) and re-suspended in TE buffer (5-15µl, diluted to a concentration of 5ng/µl). Symbionts were characterized using four polymorphic microsatellite loci, B7SYM15, B7SYM34, B7Sym8, and SYM 155 following the protocols of Pettay and LaJeunesse (2007) and Andras et al (2009). Cp-type were determined following the protocols outline in Santos et al (2003). Putative species identity was based on cp-type or Breviolum microsatellites as noted above.

P. dichotoma:
Tagged colonies were sampled in May 2015 (before bleaching), September 2015 (during bleaching), and after bleaching - November 2015, March 2016, May 2016, September 2016, November 2016, March 2017 and

August 2017. Tissue was preserved in 95% ethanol. DNA was extracted from symbiont cells following Coffroth et al. (1992) and re-suspended in TE buffer (5-15µl, diluted to a concentration of 5ng/µl). Symbionts were characterized using four polymorphic microsatellite loci, B7SYM15, B7SYM36, B7Sym9, and CA6.38 following the protocols of Pettay and LaJeunesse (2007), Andras et al (2009) and Santos et al (2003a) Cp-type were determined following the protocols outline in Santos et al (2003b). Putative species identity was based on cp-type were available.

M. atlantica:
Tagged colonies were sampled in September 2015 (during bleaching), and after bleaching - November 2015, March 2016, May 2016, September 2016, November 2016, March 2017 and August 2017 and tissue preserved in 95% ethanol. DNA was extracted from symbiont cells following Coffroth et al. (1992) and re-suspended in TE buffer (5-15µl, diluted to a concentration of 5ng/µl). Symbionts were characterized using four polymorphic microsatellite loci, B7SYM15, B7SYM34, B7Sym8, and SYM 155 following the protocols of Pettay and LaJeunesse (2007) and Andras et al (2009). Cp-type were determined following the protocols outline in Santos et al (2003). Putative species identity was based on cp-type or Breviolum microsatellites as noted above.

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)

Coral 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

Endosymbiont taxonomic identifiers (Genus species, LSID):
Breviolum, urn:lsid:marinespecies.org:taxname:1391356
Cladocopium, urn:lsid:marinespecies.org:taxname:1491877

Data Processing Description

BCO-DMO Processing Notes:
* File ALL_BleachOcto_genotype_BCO-DMO_REVISED.xlsx that were submitted 2023-06-22 was imported data into the bco-dmo data system.
* 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

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Data Files

File
bleached-genotypes.csv (Comma Separated Values (.csv), 67.58 KB) MD5:30fb5a492ccca055a5d4cde873ac677b This is the primary data table for dataset 896886.

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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

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Parameters

Parameter	Description	Units
Species	Species of each octocoral host monitored in the study	unitless
Sample_ID	Identification of the octocoral colony that was sampled across the study	unitless
Month	Month in which the sample was collected	unitless
Year	Year in which the sample was collected	unitless
SITE	Latitude and longitude where were sample collected	unitless
lat	Latitude where were sample collected	decimal degrees
lon	Longitude where were sample collected	decimal degrees
Comment	"DEAD" indicates colony missing or skeleton located but dead. "no sample" indicates colony was not sampled.	unitless
B7SYM15	Microsatellite locus allele size. Base pairs (bp). Format examples ("248" "252+248" "248, 256" "219+(229)"). Allele sizes in parentheses indicate a weak band and an allele size followed by "st?" indicates that the second band may be the result of stutter.	unitless
B7SYM34	Microsatellite locus allele size. Base pairs (bp). Format examples ("248" "252+248" "248, 256" "219+(229)"). Allele sizes in parentheses indicate a weak band and an allele size followed by "st?" indicates that the second band may be the result of stutter.	unitless
B7SYM8	Microsatellite locus allele size. Base pairs (bp). Format examples ("248" "252+248" "248, 256" "219+(229)"). Allele sizes in parentheses indicate a weak band and an allele size followed by "st?" indicates that the second band may be the result of stutter.	unitless
SYM155	Microsatellite locus allele size. Base pairs (bp). Format examples ("248" "252+248" "248, 256" "219+(229)"). Allele sizes in parentheses indicate a weak band and an allele size followed by "st?" indicates that the second band may be the result of stutter.	unitless
Assigned_Genotype	Multilocus genotype assigned based on the allele(s) present at each locus	unitless
CP_type	Fragment length of the hypervariable region of Domain V of symbiont 23S rDNA (Santos et al 2003a) or in cases where cp-type not available, based on the ability to amplify sample with Breviolum microsatellites. NA= No amplification after three attempts.	unitless
Genus	Symbiont genus based on cp-type (comma delimited if more than one Genus)	unitless

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Instruments

Dataset-specific Instrument Name	LI-COR NEN Global IR2
Generic Instrument Name	Automated DNA Sequencer
Dataset-specific Description	Fragment analysis was performed on a LI-COR NEN Global IR2 DNA Sequencer.
Generic Instrument Description	General term for a laboratory instrument used for deciphering the order of bases in a strand of DNA. Sanger sequencers detect fluorescence from different dyes that are used to identify the A, C, G, and T extension reactions. Contemporary or Pyrosequencer methods are based on detecting the activity of DNA polymerase (a DNA synthesizing enzyme) with another chemoluminescent enzyme. Essentially, the method allows sequencing of a single strand of DNA by synthesizing the complementary strand along it, one base pair at a time, and detecting which base was actually added at each step.

Dataset-specific Instrument Name	BioRad T100 thermal cycler
Generic Instrument Name	Thermal Cycler
Dataset-specific Description	DNA amplifications were performed on a BioRad T100 thermal cycler.
Generic Instrument Description	A thermal cycler or "thermocycler" is a general term for a type of laboratory apparatus, commonly used for performing polymerase chain reaction (PCR), that is capable of repeatedly altering and maintaining specific temperatures for defined periods of time. The device has a thermal block with holes where tubes with the PCR reaction mixtures can be inserted. The cycler then raises and lowers the temperature of the block in discrete, pre-programmed steps. They can also be used to facilitate other temperature-sensitive reactions, including restriction enzyme digestion or rapid diagnostics. (adapted from http://serc.carleton.edu/microbelife/research_methods/genomics/pcr.html)

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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.

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Funding

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

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