Symbiont community structure in Orbicella faveolata from Mermaid Reef and Sandy Cay Reef in Abaco, The Bahamas in January 2019

Website: https://www.bco-dmo.org/dataset/855439
Data Type: Other Field Results
Version: 1
Version Date: 2021-11-12

Project
» Collaborative Research: Assessing the changing symbiotic milieu on Caribbean coral reefs under climate change: magnitude, tradeoffs, interventions, and implications (Symbiont Shifts on Reefs)

Contributors	Affiliation	Role
Cunning, Ross	Shedd Aquarium	Principal Investigator, Contact
Parker, Katie	Shedd Aquarium	Co-Principal Investigator
Heyl, Taylor	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset contains results from genus-specific qPCR assays to quantify the abundance of Symbiodinium, Breviolum, Cladocopium, and Durusdinium symbionts relative to coral cells in Orbicella faveolata from Abaco, The Bahamas in January 2019. Bulk genomic DNA was extracted from tissue scrapings collected by SCUBA divers, and used as a template for qPCR assays. Resulting CT values were used to calculate symbiont to host cell ratios for each symbiont genus within each coral. The publication based on these data can be found here: http://dx.doi.org/10.1007/s00338-020-01948-0.

Table of Contents

Coverage

Spatial Extent: **N**:26.5536 **E**:-76.989 **S**:26.3989 **W**:-77.0535
Temporal Extent: 2019-01-24

Methods & Sampling

Tissue samples from colonies of *O. faveolata* were collected from Mermaid Reef and sensitive Sandy Cay Reef between 21 and 24 January 2019. Genomic DNA from each coral sample was extracted and assayed using qPCR targeting loci specific to *O. faveolata* and each of four symbiont genera (*Symbiodinium, Breviolum, Cladocopium, and Durusdinium*). All reactions were performed on a QuantStudio 3 Real-Time PCR system (Life Technologies, Foster City, CA, USA). The resulting cycle threshold (CT) values at a set threshold of delta Rn = 0.01 were used for data analysis.

Data Processing Description

Cycle threshold (CT) data were imported into R v3.6.0 using the steponeR package (Cunning 2018). Symbiont to host cell ratios for each algal symbiont genus were calculated adjusting for differences in target locus copy number, DNA extraction efficiency, and probe fluorescence intensity following Cunning & Baker (2013) and converted to relative abundance within each sample.

This dataset was generated using code available at Zenodo DOI 10.5281/zenodo.3827500, which contains code for amplicon sequencing data QA/QC, dada2 ASV generation and taxonomic assignment, phyloseq analysis and removal of chloroplast and mitochondrial ASVs, visualization of taxonomic data, and diversity estimates using breakaway and divnet.

BCO-DMO Processing:
- Adjusted field/parameter names to comply with BCO-DMO naming conventions;
- Missing data identifiers "NA" and "NAN" replaced with 'nd' (BCO-DMO's default missing data identifier);
- Changed dates incorrectly entered as "2019-01-21" to "2019-01-24";
- Added columns for Latitude and Longitude;
- Added a conventional header with dataset name, PI names, version date.

[table of contents | back to top]

Data Files

File
qpcr.csv (Comma Separated Values (.csv), 13.19 KB) MD5:cfbc2c62e978dc1b03369e4d3a33c129 Primary data file for dataset ID 855439

[table of contents | back to top]

Related Publications

Cunning, R. (2018). Steponer: R Package For Importing Qpcr Data From Stepone™ Software. Zenodo. https://doi.org/10.5281/ZENODO.1173322
Software

Cunning, R., & Baker, A. C. (2013). Excess algal symbionts increase the susceptibility of reef corals to bleaching. Nature Climate Change, 3(3), 259–262. doi:10.1038/nclimate1711
Methods

Parker, K. E., Ward, J. O., Eggleston, E. M., Fedorov, E., Parkinson, J. E., Dahlgren, C. P., & Cunning, R. (2020). Characterization of a thermally tolerant Orbicella faveolata reef in Abaco, The Bahamas. Coral Reefs, 39(3), 675–685. doi:10.1007/s00338-020-01948-0
Results

[table of contents | back to top]

Related Datasets

IsRelatedTo

Parker, K., & Cunning, R. (2020). Data for: Characterization of a thermally tolerant Orbicella faveolata reef in Abaco, The Bahamas (Version v1.0) [Computer software]. Zenodo. https://doi.org/10.5281/ZENODO.3827500 https://doi.org/10.5281/zenodo.3827500

[table of contents | back to top]

Parameters

Parameter	Description	Units
sample_id	unique identifier for samples of each coral colony	unitless
site	reef site location of coral colony	unitless
Latitude	location of sample site	decimal degrees
Longitude	location of sample site	decimal degrees
genus	coral colony genus	unitless
species	coral colony species	unitless
colony_tag	number on tag affixed to coral colony in the field	unitless
colony_depth	depth of sampled coral colony on the reef	meters
date_sampled	date that the coral sample was collected	unitless
A_CT_mean	qPCR cycle threshold value for Symbiodinium (clade A) assay, mean of technical replicates	cycles
B_CT_mean	qPCR cycle threshold value for Breviolum (clade B) assay, mean of technical replicates	cycles
C_CT_mean	qPCR cycle threshold value for Cladocopium (clade C) assay, mean of technical replicates	cycles
D_CT_mean	qPCR cycle threshold value for Durusdinium (clade D) assay, mean of technical replicates	cycles
Orb_CT_mean	qPCR cycle threshold value for Orbicella assay, mean of technical replicates	cycles
A_CT_sd	Standard deviation of cycle threshold values for Symbiodinium (clade A) assay technical replicates	cycles
B_CT_sd	Standard deviation of cycle threshold values for Breviolum (clade B) assay technical replicates	cycles
C_CT_sd	Standard deviation of cycle threshold values for Cladocopium (clade C) assay technical replicates	cycles
D_CT_sd	Standard deviation of cycle threshold values for Durusdinium (clade D) assay technical replicates	cycles
Orb_CT_sd	Standard deviation of cycle threshold values for Orbicella assay technical replicates	cycles
A_Orb	Symbiodinium symbiont to host ratio calculated from qPCR assays	unitless
B_Orb	Breviolum symbiont to host ratio calculated from qPCR assays	unitless
C_Orb	Cladocopium symbiont to host ratio calculated from qPCR assays	unitless
D_Orb	Durusdinium symbiont to host ratio calculated from qPCR assays	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	qPCR Thermal Cycler
Generic Instrument Description	An instrument for quantitative polymerase chain reaction (qPCR), also known as real-time polymerase chain reaction (Real-Time PCR).

[table of contents | back to top]

Project Information

Collaborative Research: Assessing the changing symbiotic milieu on Caribbean coral reefs under climate change: magnitude, tradeoffs, interventions, and implications (Symbiont Shifts on Reefs)

Coverage: Coral reefs of the Caribbean and Western Atlantic

NSF Award Abstract:
Climate change represents an existential threat to coral reef ecosystems worldwide, with coral bleaching driven by continued ocean warming presenting the most pressing challenge to the persistence of these ecosystems over the next few decades. Given the severity and urgency of this threat it is critical to investigate mechanisms by which some corals might survive warming, assess the degree to which this is happening on reefs, and apply these discoveries to inform conservation interventions that might improve survival trajectories wherever possible. This project aims to fulfill these objectives by testing whether reef corals in the Caribbean are undergoing shifts in their algal symbionts in favor of more heat-tolerant types, what the consequences of these shifts might be for coral reef ecosystems, and the way in which we might use this information to help conserve them. Scientific objectives will be leveraged to improve the effectiveness of reef restoration efforts in the Caribbean by applying findings to ongoing intervention trials which aim to seed outplanted corals (both adult fragments raised in nurseries, and sexually derived coral recruits) with heat tolerant algae that are climate-resistant. It also takes advantage of emerging opportunities at two major public aquariums to highlight the plight of coral reefs to engaged public audiences primed to receive this message and learn about the role of science in both understanding and mitigating the problem. Finally, numerous high school, undergraduate, and graduate students will receive mentorship during this project, helping to train the next generation of marine scientists.

This project tests whether continued climate warming is causing heat-tolerant algal symbionts (such as *Durusdinium trenchii*) to become increasingly common on coral reefs in the Caribbean. Understanding the changing symbiotic "milieu" in the region, the processes underlying the spread of *D. trenchii*, and the consequences of this spread, are very timely questions that have the potential to help us understand future reef states. This project will: (1) Manipulate coral symbioses in the laboratory, including a number of Caribbean coral species never before attempted, to assess in a standardized way their relative ability to acquire heat-tolerant symbionts; (2) Outplant corals with manipulated symbiont communities to reefs to assess real-world ecophysiological tradeoffs to heat tolerance, such as reduced growth rate; (3) Introduce heat-tolerant symbionts to coral colonies in the field using tissue implants in order to understand environmental controls on the persistence or loss of introduced symbionts; (4) Evaluate transgenerational feedbacks in the symbiotic milieu by investigating the roles of temperature and *D. trenchii* availability on the acquisition and establishment of these symbionts in newly settled coral larvae; and (5) Quantify changes in the incidence and relative abundance of heat-tolerant symbionts in the Caribbean over the last ~20 years using unique archived samples dating back to 1995-2002 from Florida, Bahamas, Belize, and Bermuda.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851305

[table of contents | back to top]