Acropora cervicornis growth rates under different pH and temperature treatments from experiments at Summerland Key, Florida in September of 2016

Website: https://www.bco-dmo.org/dataset/712377
Data Type: experimental
Version: 1
Version Date: 2017-10-05

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

This dataset contains Acropora cervicornis calcification data from experiments conducted in tanks at Summerland Key, Florida (24.6616,-81.4538) between 2016-09-02 and 2016-09-10 with corals from a nursery located near Looe Key Reef (24.5636, -81.2786).

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Coverage

Spatial Extent: **N**:24.661603 **E**:-81.2786 **S**:24.5636 **W**:-81.453789
Temporal Extent: 2016-09-02 - 2016-09-10

Dataset Description

This dataset contains Acropora cervicornis calcification data from experiments conducted in tanks at Summerland Key, Florida (24.6616,-81.4538) between 2016-09-02 and 2016-09-10 with corals from a nursery located near Looe Key Reef (24.5636, -81.2786).

Methods & Sampling

Physiological Methods

Photosynthesis, respiration, and calcification measurements were performed on each fragment using 300 mL temperature-controlled respirometry chambers filled with seawater from the treatment aquaria that was continuously stirred with a magnetic stir bar. The chambers were used to assess the rates of respiration (Rd) in the dark and rates of photosynthesis (Pn) and calcification in the light. Light was supplied by a series of blue and red LEDs with adjustable intensity (150 uMol quanta m-2 sec-1). Water samples were taken from each

chamber prior to a cycle and also at the end of both dark and light incubations (60 minutes each) for measurements of pHT (pH on the total scale) and total alkalinity (AT) as described in Martin and Gattuso (2009).

Calcification - Total alkalinity (TA) values were measured using an automatic potentiometric titrator (Metrohm 807 Titrando, Riverview, FL) to the second end point of a 15.3-g accurately weighed seawater sample. Total alkalinity values were then computed using the Gran equation (DOE, 1994) with pH values lower than 3.9 for creating the Gran plot. The pH electrodes (Metrohm 807 Titrando) were calibrated daily as described above. The acid titrant concentration was 0.05N HCl (JT Baker, Phillipsburg, NJ). Alkalinity was calculated using the first derivative of the curve for the evaluation of the exact end point. Standards for total seawater alkalinity and provided by Dickson were run daily (Dickson, 2007). The differences between duplicate samples and standards were less than 5 uEq kg-1 (for calibration of the titrator, differences were measured between triplicate samples). Water samples were analyzed immediately or stored in darkness at 4C and processed within 24 hours of collection.

Dickson AG, Sabine CL, and Christian JR (2007) Guide to best practices for ocean CO2 measurements: PICES Special Publication. 3, 191 p.

Martin S and Gattuso J-P (2009) Response of Mediterranean coralline algae to ocean acidification and elevated temperature. Glob Change Biol 15:2089-2100.
Marubini F and Thake B (1999) Bicarbonate addition promotes coral growth. Limnol and Oceanogr 44: 716-720.

Riebesell U, Fabry VJ, Hansson L, and Gattuso JP (2010) Guide to best practices for ocean acidification research and data reporting. European Commission, European Research Area. Brussels. 258 p

Data Processing Description

Calcification values were calculated using the alkalinity anomaly method (Riebesell et al., 2010). Calcification rates were normalized to surface area.
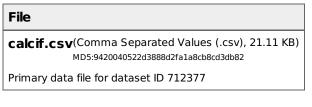
Riebesell U, Fabry VJ, Hansson L, and Gattuso JP (2010) Guide to best practices for ocean acidification research and data reporting. European Commission, European Research Area. Brussels. 258 p.

BCO-DMO Data Manager Processing Notes:
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions
* calcification values rounded to three decimal places

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Data Files

File
calcif.csv(Comma Separated Values (.csv), 21.11 KB)   MD5:9420040522d3888d2fa1a8cb8cd3db82   Primary data file for dataset ID 712377

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Parameters

Parameter	Description	Units
pH	Treatment pH level; ambient = 8.1 pH; hCO2 = 7.7 pH	unitless
Temp	Treatment temperature level	Celsius
Tank	Tank number that held the particular coral fragment	unitless
Chamber	Chamber number that held the coral fragment during the light and dark cycle	unitless
Genotype	Genotype number of the coral animal for each fragment	unitless
Cycle	Characterizes whether the coral was exposed to light or held in the dark prior to final measurements	unitless
Calcification	Rate at which the coral is utilizing calcium carbonate for skeletal growth	micromoles of calcium carbonate per centimeter squred per hour (CaCO3/cm2/h)
Date	Date in format yyyy-mm-dd	unitless

Instruments

Dataset-specific Instrument Name	Metrohm 807 Titrando
Generic Instrument Name	Automatic titrator
Generic Instrument Description	Instruments that incrementally add quantified aliquots of a reagent to a sample until the end-point of a chemical reaction is reached.

Dataset-specific Instrument Name	Mettler Toledo SevenGo Pro
Generic Instrument Name	pH Sensor
Generic Instrument Description	An instrument that measures the hydrogen ion activity in solutions. The overall concentration of hydrogen ions is inversely related to its pH. The pH scale ranges from 0 to 14 and indicates whether acidic (more H+) or basic (less H+).

Dataset-specific Instrument Name	YSI Pro 2030
Generic Instrument Name	YSI Professional Plus Multi-Parameter Probe
Dataset-specific Description	temperature measured with YSI Pro 2030
Generic Instrument Description	The YSI Professional Plus handheld multiparameter meter provides for the measurement of a variety of combinations for dissolved oxygen, conductivity, specific conductance, salinity, resistivity, total dissolved solids (TDS), pH, ORP, pH/ORP combination, ammonium (ammonia), nitrate, chloride and temperature. More information from the manufacturer.

Deployments

Muller_Looe_Key_Reef_Acropora

Website	https://www.bco-dmo.org/deployment/716319
Platform	Mote Offshore Coral Nursery
Start Date	2016-07-01
End Date	2017-09-30
Description	approximate dates of coral sample collection

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.

Funding

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