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

Website: https://www.bco-dmo.org/dataset/712366
Data Type: experimental
Version: 1
Version Date: 2017-08-08

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 oxygen change rates under dark and light conditions from 12 Acropora cervicornis genotypes previously exposed to different pH and temperature treatments. The coral surface area during photosynthesis and respiration experiments is included. The experiments were 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 oxygen change rates under dark and light conditions from 12 Acropora cervicornis genotypes previously exposed to different pH and temperature treatments. The coral surface area during photosynthesis and respiration experiments is included. The experiments were 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).

Acquisition Description

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).

Processing Description

Photosynthesis and Respiration - The concentration of dissolved oxygen (O2, umol L-1) was continuously measured inside the chambers using optrodes (Oxy-4, Presense, Germany) to determine Rd (oxygen consumption) and Pn (oxygen production) in umol O2 cm-2 h-1. Rd rates were measured during incubation in complete darkness (60 minutes). Subsequently, light intensity was increased to 100 umol photons m-2 s-1 and Pn rates were measured (60 minutes). Rd and Pn were calculated as: Pn (or Rd) O2 = (sO2 x V)/S where sO2 is the slope of the linear regression line for change in O2 over time (umol L-1 h-1), V is the volume of the chamber (l) and S is the surface area of the fragment (cm2).

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

* renamed dark..umol.O2.h. light..umol.O2.h. to "O2_rate_dark" and "O2_rate_light" due to characer restrictions (no periods).

* rounded O2_rate dark and light to three decimal places
* "NA" and "na" changed to "nd" for "no data"

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Parameters

Parameter	Description	Units
date	Day the measurement took place in format yyyy-mm-dd	unitless
O2_rate_dark	Rate of change (slope) in oxygen levels as coral sat in the dark for 60 minutes	micromoles of oxygen per hour (umol/h)
O2_rate_light	Rate of change (slope) in oxygen levels as coral sat in light conditions for 60 minutes	micromoles of oxygen per hour (umol/h)
genotype	Genotype number of the coral animal for each fragment	unitless
tank	Tank number that held the particular coral fragment	unitless
temp	Treatment temperature level	Celsius
pH	Treatment pH level; ambient = 8.1 pH; hCO2 = 7.7 pH	unitless
area	Surface area of the coral	centimeters squared (cm2)

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Instruments

Dataset-specific Instrument Name	YSI Pro 2030
Generic Instrument Name	YSI Professional Plus Multi-Parameter Probe
Dataset-specific Description	Temperature, salinity, and dissolved oxygen 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.

Dataset-specific Instrument Name	Mettler Toledo SevenGo Pro
Generic Instrument Name	pH Sensor
Generic Instrument Description	General term for an instrument that measures the pH or how acidic or basic a solution is.

Dataset-specific Instrument Name	optodes (Oxy-4, Presense, Germany)
Generic Instrument Name	Optode
Generic Instrument Description	An optode or optrode is an optical sensor device that optically measures a specific substance usually with the aid of a chemical transducer.

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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

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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°

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.

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Funding

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

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