Measurements of per-capita growth and carrying capacity of five different genotypes of Symbiodinium microadriaticum in culture at three different temperatures

Website: https://www.bco-dmo.org/dataset/874619
Data Type: experimental
Version: 1
Version Date: 2022-05-31

Project
» RUI: Collaborative Research: Genetic variation as a driver of host and symbiont response to increased temperature on coral reefs (Host Symbiont Temp Response)

Contributors	Affiliation	Role
terHorst, Casey	California State University Northridge (CSUN)	Principal Investigator, Contact
Moffat, Jennica		Scientist
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 includes measurements of per-capita growth and carrying capacity of five different genotypes of Symbiodinium microadriaticum in culture at three different temperatures. This work was conducted in laboratory growth chambers in Los Angeles, California, USA, in May and July 2019.

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Coverage

Temporal Extent: 2019-05 - 2019-07

Methods & Sampling

To investigate the population dynamics of isolated symbiont genotypes to temperature, we grew replicate cultures of each of the five genotypes in growth chambers set to 26°C, 30°C, and 32°C. The mean temperatures (+/- 1 s.d.) in the three chambers were 25.5°C (+/- 0.5), 30.1°C (+/- 0.3), and 31.6°C (+/- 0.2). We initiated 12 replicate cultures of each genotype in sterile flasks with 75mL of sterile f/2 media with 750,000 cells (10,000 cells/mL) from the appropriate stock culture. Replicate cultures of each genotype were randomly distributed among three identical growth chambers (Percival I-36LLVL) set to each of the three temperatures (n=4 replicate cultures of each genotype at each temperature). We systematically rotated the position of cultures in the growth chamber daily to minimize the effect of any small differences in light and temperature within the chamber. Lights were set on a 12:12 day:night cycle, with an average illumination during the day of 4533 (+/- 456) Lux. We performed this experiment in May and July of 2019.

We quantified the density of cells in each culture three times per week using the average of four replicate hemacytometer counts. We fit a growth curve to the density of cells in each replicate over 20 days using the growthcurver package in R (v. 4.0.3) and extracted the maximum growth rate (r) and carrying capacity (K).

Data Processing Description

Data Processing:
We used general linear models with type III SS to test for the effects of algal genotype, temperature, and their interaction on growth rate and carrying capacity. All variables were transformed to meet assumptions of normality and homoscedasticity.

BCO-DMO Processing:
- Added a conventional header with dataset name, PI names, version date

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Data Files

File
pop_growth.csv (Comma Separated Values (.csv), 4.00 KB) MD5:7941a0d80ca48a2b54a5ef994501be6f Primary data file for dataset ID 874619

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Parameters

Parameter	Description	Units
Round	One of the two rounds (replicates) of the experiment	unitless
Genotype	One of five genotypes	unitless
Flask	Flask number	unitless
Temp	Growth temperature	degrees celsius
K	Estimated carrying capacity	cells
r	Estimated per-capita growth rate	cells per cell per day

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Instruments

Dataset-specific Instrument Name	Leica compound microscope
Generic Instrument Name	Microscope - Optical
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".

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Project Information

RUI: Collaborative Research: Genetic variation as a driver of host and symbiont response to increased temperature on coral reefs (Host Symbiont Temp Response)

Coverage: Florida Keys, Caribbean

Description from NSF award abstract:
On coral reefs, mutualisms with single celled algae (Symbiodinium) and reef species literally and figuratively form the foundation of reef ecosystems. Coral reefs are among the most threatened ecosystems under a changing climate and are rapidly declining due to increasing levels of environmental stress, namely increased temperatures. Climate change is resulting in even warmer ocean temperatures that threaten associations between Symbiodinium and their hosts. In this project the investigators examine the genetic diversity of Symbiodinium and the potential for this important species to evolve in response to temperature. The project will also address whether the ecological and evolutionary dynamics of the Symbiodinium population affect the performance of their host. If so, this suggests that the evolution of microscopic organisms with short generation times could confer adaptation to longer-lived host species on ecologically and economically vital coral reefs. Given that diversity is already being lost on many reefs, considering how evolutionary changes in Symbiodinium will affect reef species is crucial for predicting the responses of reefs to future climate change. This project provides training for two graduate students and several undergraduates at a Hispanic-serving institution. This work includes outreach to the students and the general public through the Aquarium of Niagara, local K-12 schools, and web-based education modules.

The effects of evolution on contemporary ecological processes are at the forefront of research in evolutionary ecology. This project will answer the call for experiments elucidating the effects of genetic variation in Symbiodinium performance and the effect on the response of the holobiont (host and symbiont) to increased temperature. These experiments examine the effects of temperature through both ecological and evolutionary mechanisms and will determine the relative importance of adaptation and acclimatization in replicated experimental populations. The investigators will examine how genetic variation within a species (Symbiodinium antillogorgium) affects symbiont performance in culture and in the host and how this affects the response of the holobiont to increased temperature. Further, the project examines whether holobiont response to increased temperature associated with climate change depends on particular GxG host-symbiont combinations. Moreover, the investigators will examine the effects of symbiont history on mutualist hosts, which have been largely ignored in eco-evolutionary studies. These experiments provide a first step in predicting whether invertebrate hosts on coral reefs will respond to global change via adaptation of their symbionts.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1559105

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