Coral physiology data from a short-term heating experiment using samples collected from Nikko Bay and Rebotel Reef in Palau in the spring of 2018

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Project
» Collaborative Research: Stability, flexibility, and functionality of thermally tolerant coral symbioses (Thermally tolerant coral)

Contributors	Affiliation	Role
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Abstract
This dataset examines coral physiology data from a short-term heating experiment using samples collected from Nikko Bay and Rebotel Reef in Palau in the spring of 2018.

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Coverage

Spatial Extent: **N**:7.541333 **E**:134.8223 **S**:7.248333 **W**:134.2538
Temporal Extent: 2021-05-18 - 2021-06-02

Methods & Sampling

On-land experiments were run at the Palau International Coral Reef Center (PICRC). Coral fragments were originally collected from Nikko Bay, Palau (7°14.93′N, 134°14.149′E) at 5 meters depth, and Rebotel Reef, Palau (7°32.48′N, 134° 49.34′E) at 7.5 meters depth.

Coral collection and heating experiments were run in the same fashion as detailed in the Hoadley et al. (2019) (see related reference listed below), with the following exceptions:

The experimental system was held indoors, and lighting was provided by LEDs (CREE LED XP-G3, cool white) set to diurnal intensity ramping by digital controllers (Storm X, Coralux). Corals were supplied with a continuous flow of seawater (at 1 liter per minute) with water flow in each treatment bin supplemented with a submersible powerhead pump (Sicce Micra – 90 gallons per hour). Coral skeletal surface area was calculated by 3-D scanning (HDI 120, LMI Technologies)

Data Processing Description

All sampling methods and analytical procedures used for collecting this data have been previously presented in Hoadley et al. (2019), referenced below. The one additional procedure that deviates from this is the 3-D scanning of coral skeletons that is described above.

Coral skeleton scans were converted to 3D surface area mesh maps in FlexScan 3D software (Polyga)

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Related Publications

Hoadley, K. D., Lewis, A. M., Wham, D. C., Pettay, D. T., Grasso, C., Smith, R., Kemp, D. W., LaJeunesse, T. C., & Warner, M. E. (2019). Host–symbiont combinations dictate the photo-physiological response of reef-building corals to thermal stress. Scientific Reports, 9(1). https://doi.org/10.1038/s41598-019-46412-4
Methods

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Parameters

Parameter	Description	Units
Species	Coral species tested. Psammacora digitata or Pocillopora verrucosa	unitless
Date	Month Day Year	unitless
Day	Time of measurement	unitless
Treatment	Control at 28 degrees Celsius or Heated at 32 degrees Celsius	unitless
Location	Original collection location. Offshore – Rebotel Reef, Inshore – Nikko Bay	unitless
Colony	Colony number (1–8 for each species)	unitless
Frag	Colony fragment number	unitless
Symbiont	Symbiotic dinoflagellate ID based on ITS2 nomenclature or formal genus and species	unitless
Fq_Fm	efficiency of photosystem II in the light activated state measured by PAM fluorometer (relative units)	unitless
Fv_Fm	efficiency of photosystem II in the light activated state measured by PAM fluorometer (relative units)	unitless
Qm	Excitation pressure of photosystem II measured by PAM fluorometer (relative units)	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	3D scanner
Generic Instrument Description	A 3D scan captures digital information about the shape of an object with equipment that uses a laser or light to measure the distance between the scanner and the object.

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Project Information

Collaborative Research: Stability, flexibility, and functionality of thermally tolerant coral symbioses (Thermally tolerant coral)

Coverage: Coral Reefs of Palau, Micronesia

NSF abstract:

All reef-building corals require large numbers of internal symbiotic microalgae (called Symbiodinium) for their survival and growth. These mutualisms have shown considerable sensitivity to changes in the environment in recent decades, especially due to global increases in ocean temperatures. When exposed to severe thermal stress, corals loose their symbionts and often die. However, recent experiments show that some symbionts may be more stress-tolerant. Corals with these heat-resistant symbionts continue to receive high amounts of algal derived nutrients and grow under elevated temperatures. If the global trend in seawater warming continues to increase, these heat-resistant symbioses may become more ecologically prevalent on reef systems around the world and could play a critical role in maintaining healthy and productive coral communities. This project will examine the ecological and physiological attributes of stress-tolerant symbioses from the Indo Pacific where coral communities are the largest, most diverse, and productive in the world. The researchers will conduct a series of experiments to (1) evaluate host and symbiont attributes that contribute to thermal tolerance and (2) characterize the relative flexibility and functionality of various corals and symbionts exposed to typical ambient and stressful temperatures. Broader impacts of the project include the training of several Ph.D. students, undergraduates, and high school students in the disciplines of physiology and ecology. The researchers will partner with Global Ocean Exploration, Inc. to communicate this research to the general public through short documentary videos, editorials, and podcasts. An interactive K-5 program, "Invertebrates on the Road," will introduce elementary students in Pennsylvania to marine invertebrate diversity. Research results will also be disseminated to the public at the University of Delaware via educational seminars, as well as through hands-on research displays and demonstrations presented at the annual open house "Coast Day" festival in each year of the project.

This project will examine several attributes important to the functional ecology of coral-dinoflagellate symbioses. Specifically, the research team seeks to understand the interplay between coral and symbiont physiologies under different environmental conditions and determine the relative influence of biotic factors crucial to the performance of stress tolerant symbioses. Results from recent experiments on Indo-west Pacific corals found that Clade D (S. trenchii) symbionts are stress-tolerant. These symbionts are able to maintain function and provide nutrients to their hosts under high temperatures that typically elicit the breakdown of symbioses involving many other species of symbiont. A number of questions arise about how enhanced thermal tolerance symbioses may be aided by a combination of factors; for example: Are symbionts physiologically hardier in corals that are routinely feeding? Do host genotypes that are adapted to high temperatures affect the physiology of their symbionts in ways that make the partnership more stress-tolerant? A series of experiments over three years will examine the functionality of different coral-symbiont pairings exposed to ambient and high temperatures. Reciprocal transplants between inshore (stress-tolerant) and offshore (stress-susceptible) reef sites will be used to produce specific host-symbiont parings. Controlled experiments will test the relative importance of coral trophic status (nutrient content) while holding symbiont type constant and how changes in both coral trophic status and symbiont species identity of the resident affect thermal tolerance. Tank experiments on shore will track rates of photosynthesis as well as carbon translocation and assimilation from symbiont to host tissues and skeletons. Long-term growth rates via skeletal density, linear extension, and biomass gain will also be measured. This project will help elucidate how

biochemical, physiological and ecological differences among host-symbiont pairings may respond to rising ocean temperatures and enhance the future viability of coral reefs.

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Funding

Funding Source	Award
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