Experiment Tank Conditions during a thermal stress experiment using reef building corals collected in Kāne'ohe Bay, O'ahu, Hawai'i.

Website: https://www.bco-dmo.org/dataset/886196
Data Type: experimental
Version: 1
Version Date: 2023-01-31

Project
» NSFOCE-BSF: COLLABORATIVE RESEARCH: Elucidating adaptive potential through coral holobiont functional integration (Holobiont Integration)

Contributors	Affiliation	Role
Putnam, Hollie	University of Rhode Island (URI)	Co-Principal Investigator
Strand, Emma	University of Rhode Island (URI)	Student
Soenen, Karen	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Experimental tank conditions through the four day acclimation period and five week thermal stress experiment. Temperature in each tank was logged every 10 minutes as well as discrete measurements of temperature, pH, salinity, and conductivity made twice daily. Flow rates of each tank were measured once a day, and light (PAR) was measured once daily in the morning.

Table of Contents

Methods & Sampling

Cultivation of coral nubbins:From the waters of Kāne‘ohe Bay, HI, four colonies of each coral species *M. capitata* and *P. acuta* were identified and collected under SAP 2019-60. Each of the four colonies for each species was fragmented into 30 pieces at the Hawai‘i Institute of Marine Biology, located on Moku o Lo‘e in Kāne‘ohe Bay, HI, and hot-glued to labeled plugs. The 30 glued nubbins of each genotype were then randomly distributed among six tanks (~32 liters; 48.3 cm by 38.1 cm by 17.8 cm; $L \times W \times H$), leaving five replicates per genotype in each tank for a total of 40 coral nubbins per tank and 120 coral nubbins per species. Tanks were placed in a flow-through system that had a steady supply of water directly from Kāne‘ohe Bay with an average flow rate of (173.8 ± 73 liters hour−1, mean ± SD). Each tank was fitted with a submersible pump (Hydor 200 gph), a HOBO Water Temp Pro temperature logger (operation range, −40° to 70°C; resolution, 0.02°C at 25°; accuracy, ±0.21°C from 0° to 50°C; Onset Computer Corp.), an Apex temperature probe (Neptune Systems), and two heaters (Aqueon 300-W Heater set to 31°C and DaToo 300-W Glass Heater set to 34°C). The temperature in the tanks was controlled by powering off and on the heaters based on set points in the Apex aquarium controller (Neptune Systems). Light was set for a 12-hour light/12-hour dark cycle using Arctic T247 lights (Ocean Revive).

[table of contents | back to top]

Data Files

File
thermal_experiment_conditions.csv (Comma Separated Values (.csv), 5.89 MB) MD5:278f1079369e0b4fc82d465b9ca97496 Primary data file for dataset ID 886196

[table of contents | back to top]

Related Datasets

IsRelatedTo

Strand, E., Putnam, H. (2023) **Metabolomic data collected during a thermal stress experiment using reef building corals collected in Kāne'ohe Bay, O'ahu, Hawai'i.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-01-31 doi:10.26008/1912/bco-dmo.886420.1 [view at BCO-DMO]
Relationship Description: Dataset is part of the same experiment.

Strand, E., Putnam, H. (2023) **Physiology color score extracted from pictures taken during a thermal stress experiment using reef building corals collected in Kāne'ohe Bay, O'ahu, Hawai'i.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-01-31 doi:10.26008/1912/bco-dmo.884220.1 [view at BCO-DMO]
Relationship Description: Dataset is part of the same experiment.

Strand, E., Putnam, H. (2023) **Untargeted metabolomic data collected during a thermal stress experiment using reef building corals collected in Kāne'ohe Bay, O'ahu, Hawai'i.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-01-31 doi:10.26008/1912/bco-dmo.886427.1 [view at BCO-DMO]
Relationship Description: Dataset is part of the same experiment.

[table of contents | back to top]

Parameters

Parameter	Description	Units
Date	Date of measurement	unitless
PPFD_Time	Time of light measurement	unitless
Tank	Tank ID	unitless
Position	Position in the tank of light measurement	unitless
PPFD	PAR light value measured	nm (nanometers)
Avg_flowrate	Average flow rate measured (n=2)	mL/seconds
HOBO_Time	Time of temperature measurement from HOBO logger	unitless
HOBO_Temperature	Temperature measurement from HOBO logger	degrees Celsius (°C)
Calibration_date	Date of calibration to Tris measurement	unitless
Discrete_measurement_time	Time of the discrete measurement (Temperature, pH.MV, Salinity, Conductivity)	unitless
Treatment	High or ambient temperature treatment	unitless
Temperature	Temperature	degrees Celsius (°C)
pH_MV	pH value	millivolts
Salinity	Salinity	parts per thousand (ppt)
Conductivity	Conductivity	millisemens

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	MQ-510 Full Spectrum Underwater Quantum Meter, Apogee
Generic Instrument Name	Biospherical PAR sensor
Dataset-specific Description	underwater cosine light sensor and meter (MQ-510 Full Spectrum Underwater Quantum Meter, Apogee)
Generic Instrument Description	Unspecified Biospherical PAR. An irradiance sensor, designed to measure Photosynthetically Active Radiation (PAR).

Dataset-specific Instrument Name	
Generic Instrument Name	digital thermometer
Dataset-specific Description	handheld digital certified thermometer (Control Company accuracy, ± 0.05°C; resolution, 0.001°C)
Generic Instrument Description	An instrument that measures temperature digitally.

Dataset-specific Instrument Name	MQ-510 Full Spectrum Underwater Quantum Meter, Apogee
Generic Instrument Name	Multi Parameter Portable Meter
Generic Instrument Description	An analytical instrument that can measure multiple parameters, such as pH, EC, TDS, DO and temperature with one device and is portable or hand-held.

Dataset-specific Instrument Name	
Generic Instrument Name	Onset HOBO Pro v2 temperature logger
Dataset-specific Description	HOBO Water Temp Pro temperature loggers (operation range, −40° to 70°C; resolution, 0.02°C at 25°; accuracy, ±0.21°C from 0° to 50°C; Onset Computer Corp.)
Generic Instrument Description	The HOBO Water Temp Pro v2 temperature logger, manufactured by Onset Computer Corporation, has 12-bit resolution and a precision sensor for ±0.2°C accuracy over a wide temperature range. It is designed for extended deployment in fresh or salt water. Operation range: -40° to 70°C (-40° to 158°F) in air; maximum sustained temperature of 50°C (122°F) in water Accuracy: 0.2°C over 0° to 50°C (0.36°F over 32° to 122°F) Resolution: 0.02°C at 25°C (0.04°F at 77°F) Response time: (90%) 5 minutes in water; 12 minutes in air moving 2 m/sec (typical) Stability (drift): 0.1°C (0.18°F) per year Real-time clock: ± 1 minute per month 0° to 50°C (32° to 122°F) Additional information (http://www.onsetcomp.com/) Onset Computer Corporation 470 MacArthur Blvd Bourne, MA 02532

Dataset-specific Instrument Name	submersible pump (Hydor 200 gph)
Generic Instrument Name	Pump
Generic Instrument Description	A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps

Dataset-specific Instrument Name	Apex temperature probe (Neptune Systems)
Generic Instrument Name	Water Temperature Sensor
Generic Instrument Description	General term for an instrument that measures the temperature of the water with which it is in contact (thermometer).

[table of contents | back to top]

Project Information

NSFOCE-BSF: COLLABORATIVE RESEARCH: Elucidating adaptive potential through coral holobiont functional integration (Holobiont Integration)

Website: https://sites.rutgers.edu/coralbase/

Coverage: Hawaii, Rhode Island, New Jersey, Israel

NSF Abstract:

The remarkable success of coral reefs is explained by interactions of the coral animal with its symbiotic microbiome that is comprised of photosynthetic algae and bacteria. This total organism, or "holobiont", enables high ecosystem biodiversity and productivity in coral reefs. These ecosystems are, however, under threat from a rapidly changing environment. This project aims to integrate information from the cellular to organismal level to identify key mechanisms of adaptation and acclimatization to environmental stress. Specific areas to be investigated include the role of symbionts and of epigenetics (molecular "marks" on coral DNA that regulate gene expression). These aspects will be studied in Hawaiian corals to determine whether they explain why some individuals are sensitive or resistant to environmental perturbation. Results from the proposed project will also provide significant genomic resources that will contribute to fundamental understanding of how complex biological systems generate emergent (i.e., unexpected) properties when faced with fluctuating environments. Broader impacts will extend beyond scientific advancements to include postdoctoral and student training in Science, Technology, Engineering and Mathematics (STEM). Data generated in the project will be used to train university students and do public outreach through live videos of experimental work, and short stop-action animations for topics such as symbiosis, genomics, epigenetics, inheritance, and adaptation. The research approaches and results will be shared with the public in Hawaii through the Hawaii Institute of Marine Biology education department and presentations at Hawaiian hotels, as well as at Rutgers University through its 4-H Rutgerscience Saturdays and 4-H Rutgers Summer Science Programs.

Symbiosis is a complex and ecologically integrated interaction between organisms that provides emergent properties key to their survival. Such is the case for the relationship between reef-building corals and their microbiome, a meta-organism, where nutritional and biogeochemical recycling provide the necessary benefits that fuel high reef productivity and calcification. The rapid warming and acidification of our oceans threatens this symbiosis. This project addresses how relatively stress resistant and stress sensitive corals react to the environmental perturbations of increased temperature and reduced pH. It utilizes transcriptomic, epigenetic, and microbial profiling approaches, to elucidate how corals respond to environmental challenges. In addition to this profiling, work by the BSF Israeli partner will implement powerful analytical techniques such as network theory to detect key transcriptional hubs in meta-organisms and quantify biological integration. This work will generate a stress gene inventory for two ecologically important coral species and a (epi)genome and microbiome level of understanding of how they respond to the physical environment. Acknowledgment of a role for epigenetic mechanisms in corals overturns the paradigm of hardwired genetic control and highlights the interplay of genetic and epigenetic variation that may result in emergent evolutionary and ecologically relevant properties with implications for the future of reefs. Furthermore, clarifying the joint contribution of the microbiome and host in response to abiotic change will provide an important model in metazoan host-microbiome biotic interactions.

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-1756623

[table of contents | back to top]