Laboratory results on the rate of tissue loss in corals with Montipora White Syndrome with exposure to temperature and nutrient stressors; samples collected in Kaneohe Bay, Oahu, Hawaii during 2014

Website: https://www.bco-dmo.org/dataset/544910
Data Type: experimental
Version: 2014-08-28

Project
» Host-environment-pathogen interactions in a model coral disease system (coral-pathogen interaction)

Contributors	Affiliation	Role
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Dataset Description

Measurement of the rate of tissue loss on coral fragments exposed to elevated temperatures and nutrients.

Access to this dataset is restricted until publication, approximately July 2016.
This data was made public on 2017-09-25.

Related datasets:

Montipora antibacterial-aqueous
Montipora antibacterial-mucus
Montipora antibacterial-organic
Montipora chemical fingerprints
MWS accession numbers

Methods & Sampling

Coral fragments displaying cMWS were collected off reefs on Coconut Island, Kaneohe Bay, Oahu. A paired designed was used whereby one fragment was exposed to a stressor in aquaria and 2nd fragment from the same coral colony exposed to ambient conditions as a control. Three experiments were run testing the effect of stressors on the rate of tissue loss on fragments: elevated temperature (28C vs. 25C), nutrient stress (ambient water vs. 10MM nitrate) and combined elevated temperature x nitrate. Photographs of all fragments were taken weekly and tissue loss measured via digital analysis.

Data Processing Description

BCO-DMO Processing:
- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard or to match other datasets in project
- replaced blanks with underscores

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Data Files

File
tissue_loss.csv (Comma Separated Values (.csv), 5.61 KB) MD5:66416ae1d2574f108f3ab91141c80e13 Primary data file for dataset ID 544910

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Parameters

Parameter	Description	Units
coral	coral fragment identification	unitless
treatment	control or experimental	unitless
color_morph	color morph of coral	unitless
expt_id	elevated temperature or nutrients or both	unitless
tissue_loss	average % tissue loss/day	percent change/day

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Deployments

Aeby_2014

Website	https://www.bco-dmo.org/deployment/544868
Platform	Hawaii_reef
Start Date	2010-06-01
End Date	2014-05-31
Description	Coral reef pathogen studies.

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Project Information

Host-environment-pathogen interactions in a model coral disease system (coral-pathogen interaction)

Coverage: Kaneohe Bay, Oahu, Hawaii (21 26' N, 157 47' W)

Extracted from the NSF award abstract:

Diseases of marine organisms have emerged as a serious problem contributing to the decline of coral reef resources worldwide. Loss of coral reef habitats carry social and economic implications especially in island states, such as Hawaii, which depend on reefs for food, shoreline protection and tourism. Our ability to manage coral diseases is hampered by a lack of knowledge of which environmental variables affect disease, mechanisms of host defense, and the etiology of most of the numerous described coral diseases. The PIs of this project discovered a coral disease system that can be used as a model to explore many components of the host-environment-pathogen triangle of disease causation. Montipora white syndrome (MWS) is an infectious disease that results in progressive tissue loss on colonies of Montipora capitata, and has been found on reefs throughout the Hawaiian archipelago. It is particularly prevalent in Kaneohe Bay, Oahu, which has a long history of reduced water quality, and this suboptimal environment sets the stage where host-pathogen interactions occur. In Kaneohe Bay, M. capitata is a major reef-building species, and is found in two color morphs (red and orange) that harbor different clades of zooxanthellae. During preliminary surveys, the PIs discovered intraspecific variability in response to MWS between color morphs. Although the red morph was dominant within survey transects (80% of the colonies), the orange morph was disproportionately affected by MWS (70% of the affected colonies). Microbial studies found a shift in bacterial communities on MWS-affected and healthy M. capitata and allowed identification of potential pathogens. Numerous bacterial strains were cultured and screened for pathogenicity and three strains, which produced lesions, were identified as potential pathogens. Two of the putative pathogens (Vibrio spp.) produced diffuse tissue whereas the other bacterial strain (Pseudoalteromonas sp.) produced acute tissue loss.

In the field, the PIs also observed two patterns of tissue loss on M. capitata; a slow, chronic pattern of tissue loss, which they followed through time with tagged colonies (chronic MWS), but also a rapid onset of acute tissue loss (acute MWS). Thus they discovered an infectious coral disease that results in significant coral mortality that has the unique component of differences in disease susceptibility among color morphs. The PIs identified three potential bacterial pathogens that will be used to investigate underlying factors affecting the coral-environment-pathogen triad of disease causation. The Hawaii Institute of Marine Biology (HIMB) is located within Kaneohe Bay allowing year-round access to reefs for research on Montipora white syndrome. The goal of this project is to investigate the host- environment-pathogen triangle of disease causation for Montipora white syndrome. The objectives of this research will be to: 1) investigate mechanisms contributing to differential disease resistance in red (less susceptible) vs. orange (more susceptible) morphs of M. capitata. The PIs will compare antimicrobial activity in the holobiont, mucus and mucus-associated bacteria of the two color morphs of M. capitata, and will compare the natural coral-associated microbial flora between the two color morphs; 2) use manipulative aquarium studies to determine whether environmental stressors (elevated temperature, nutrient stress) differentially affect the progression or transmission efficiency of MWS in red vs. orange morphs of M. capitata; 3) use challenge experiments to confirm the role of bacterial pathogens as causative agents of MWS, and to determine the response of red vs. orange morphs of M. capitata to three putative pathogens. This project will involve a multidisciplinary team to provide a broader perspective of coral disease processes. This will be the first comprehensive study conducted on a coral disease in Hawaii.

Related Publications:

Ushijima, B, Videau, P, Burger, A, Shore-Maggio, A, Runyon, C, Sudek, M, Aeby, G and S. Callahan. 2014. Vibrio coralliilyticus strain OCN008 is an etiological agent of acute Montipora white syndrome. Applied & Environ Microbiology doi:10.1128/AEM.03463-13.

Ushijima B, Videau P, Aeby GS, Callahan SM. 2013. Draft Genome Sequence of Vibrio coralliilyticus Strain OCN008, Isolated from Kane'ohe Bay, Hawai'i. Genome Announc. 2013 Oct 3;1(5). doi:pii: e00786-13. 10.1128/genomeA.00786-13. PMID: 24092784

Ushijima B, Smith A, Aeby GS, Callahan SM (2012) Vibrio owensii Induces the Tissue Loss Disease Montipora White Syndrome in the Hawaiian Reef Coral Montipora capitata. PLoS ONE 7: e46717.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0961814

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