Temperature from seagrass wasting disease mesocosm experiments at Bodega Marine Laboratory in June-July 2015

Website: https://www.bco-dmo.org/dataset/883037
Data Type: experimental
Version: 1
Version Date: 2022-10-27

Project
» CAREER: Linking genetic diversity, population density, and disease prevalence in seagrass and oyster ecosystems (Seagrass and Oyster Ecosystems)

Contributors	Affiliation	Role
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Abstract
This dataset includes seawater temperature measurements from mesocosms. Data were collected as part of a mesocosm study at the Bodega Marine Laboratory examining the independent and interactive effects of warming, host genotypic identity, and host genotypic diversity on the prevalence and intensity of infections of seagrass by the wasting disease parasite Labyrinthula zosterae. These data were plotted in Schenck et al (2022) as Figure S1. And Bois et al., 2021 as Figure 1.

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Coverage

Spatial Extent: **Lat**:38.31753 **Lon**:-123.06572
Temporal Extent: 2015-07-01 - 2015-09-14

Methods & Sampling

We used a substitutive design to test the effects of eelgrass (Zostera marina) genotypic identity (eight genotypes), diversity (monocultures of 1 genotype vs. polycultures of 4 genotypes), and temperature (ambient or + 3.2° C) on the prevalence and intensity of *Labyrinthula* over eight weeks in an array of flow-through 120-L mesocosms at the Bodega Marine Laboratory in Bodega Bay, CA. We assigned ten pots - two unique polyculture combinations and each of the eight monocultures - to each of ten mesocosms, with five mesocosms per temperature treatment (see DuBois et al. 2020 for a diagram of the experimental set up). All

mesocosms received sand-filtered flow-through seawater at a rate of approximately 0.8-1.0 L min^{-1}. We allowed the plants to acclimate for one month prior to initiating the temperature treatments. We maintained an ambient temperature treatment by cooling flow-through seawater in a head tank by approximately 1˚C using an Aqua Logic Delta Star in-line titanium chiller. Seawater in the elevated temperature treatment was raised approximately 3˚C above the ambient treatment in a separate header tank using Process Technologies titanium immersion heaters. This level of warming mimicked the 2014-15 extreme warming events in the Northern Pacific called “The Blob”, which raised summer ocean temperatures three standard deviations above the long-term average (Sanford et al. 2019).

Life Sciences Identifiers (LSID) for taxonomic names:
Zostera marina (urn:lsid:marinespecies.org:taxname:145795)
Labyrinthula zosterae (urn:lsid:marinespecies.org:taxname:395093)
Labyrinthula (urn:lsid:marinespecies.org:taxname:119090)

Data Processing Description

Code that includes temperature analysis associated with this experiment: All code was written and run in R (version 3.6.1, www.R-project.org). Github repository link: https://github.com/schenckf/BWE_Experiment and Zenodo DOI: https://doi.org/10.5281/zenodo.7129500. A general description of the code is included in the repository release.

BCO-DMO Processing:

* Imported data from source file "mesocosm_warming_temperature_data.csv" into the BCO-DMO data system.
Data file imported using missing data identifier "NA".
* Modified parameter (column) names to conform with BCO-DMO naming conventions.
* ISO_DateTime_UTC column added from date_time (local timezone). converted to ISO 8601 format

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Data Files

File
temp.csv (Comma Separated Values (.csv), 6.42 MB) MD5:12492def8f17cb4d7bdd39b49cdd019b Primary data file for dataset ID 883037

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Related Publications

DuBois, K., Williams, S. L., & Stachowicz, J. J. (2020). Experimental Warming Enhances Effects of Eelgrass Genetic Diversity Via Temperature-Induced Niche Differentiation. Estuaries and Coasts, 44(2), 545–557. https://doi.org/10.1007/s12237-020-00827-9
Results

R Core Team (2019). R: A language and environment for statistical computing. R v3.6.1. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/
Software

Sanford, E., Sones, J. L., García-Reyes, M., Goddard, J. H. R., & Largier, J. L. (2019). Widespread shifts in the coastal biota of northern California during the 2014–2016 marine heatwaves. Scientific Reports, 9(1). https://doi.org/10.1038/s41598-019-40784-3
Methods

Schenck, F. R. (2022). *schenckf/BWE_Experiment: The effect of warming on seagrass wasting disease depends on host genotypic identity and diversity - Analyses* (Version V2.0.0) [Computer software]. Zenodo. https://doi.org/10.5281/ZENODO.7129500
Software

Schenck, F. R., DuBois, K., Kardish, M. R., Stachowicz, J. J., & Hughes, A. R. (2023). The effect of warming on seagrass wasting disease depends on host genotypic identity and diversity. Ecology, 104(3). Portico. https://doi.org/10.1002/ecy.3959
Results

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Related Datasets

IsRelatedTo

Schenck, F., DuBois, K., Kardish, M., Stachowicz, J. J., Hughes, A. R. (2022) **Microbial taxa (amplicon sequence variant or ASV) statistical analyses for two seagrass genotypes from wasting disease mesocosm experiments at Bodega Marine Laboratory in July-Sept of 2015.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-10-27 doi:10.26008/1912/bco-dmo.883070.1 [view at BCO-DMO]
Relationship Description: Data collected as part of the same experiment.

Schenck, F., DuBois, K., Kardish, M., Stachowicz, J. J., Hughes, A. R. (2022) **Quantitative PCR cell count estimates from samples of DNA extracted from seagrass wasting disease parasite, Labyrinthula zosterae from wasting disease mesocosm experiments at Bodega Marine Laboratory in July-Sept of 2015.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-10-27 doi:10.26008/1912/bco-dmo.883055.1 [view at BCO-DMO]
Relationship Description: Data collected as part of the same experiment.

Schenck, F., DuBois, K., Kardish, M., Stachowicz, J. J., Hughes, A. R. (2022) **Seagrass metrics from from seagrass wasting disease mesocosm experiments conducted at Bodega Marine Laboratory from July-September 2015.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-10-06 doi:10.26008/1912/bco-dmo.879749.1 [view at BCO-DMO]
Relationship Description: Data collected as part of the same experiment.

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Parameters

Parameter	Description	Units
temperature_treatment	Descriptor of the temperature treatment applied to seawater: ambient (cooled flow-through seawater by approximately 1oC); elevated (heated flow-through seawater by approximately 3oC)	unitless
bin	Unique identifier number assigned to each of the ten 120 L mesocosms at the Bodega Marine Laboratory supplied with flow-through seawater	unitless
date_time	Date and time of temperature measurement (Time zone: PST/PDT)	unitless
temperature	Seawater temperature	Degrees Celsius
ISO_DateTime_UTC	Date and time of temperature measurement (Time zone: UTC) in ISO8601 format.	unitless

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Instruments

Dataset-specific Instrument Name	flow through tanks
Generic Instrument Name	Aquarium
Generic Instrument Description	Aquarium - a vivarium consisting of at least one transparent side in which water-dwelling plants or animals are kept

Dataset-specific Instrument Name	Aqua Logic Delta Star in-line titanium chiller
Generic Instrument Name	Aquarium chiller
Dataset-specific Description	We maintained an ambient temperature treatment by cooling flow-through seawater in a head tank by approximately 1˚C using an Aqua Logic Delta Star in-line titanium chiller.
Generic Instrument Description	Immersible or in-line liquid cooling device, usually with temperature control.

Dataset-specific Instrument Name	Process Technologies titanium immersion heater
Generic Instrument Name	Immersion heater
Dataset-specific Description	Seawater in the elevated temperature treatment was raised approximately 3˚C above the ambient treatment in a separate header tank using Process Technologies titanium immersion heaters
Generic Instrument Description	Submersible heating element for water tanks and aquaria.

Dataset-specific Instrument Name	Onset Hobo Pendant Temperature Data Loggers
Generic Instrument Name	Onset HOBO Pendant Temperature/Light Data Logger
Generic Instrument Description	The Onset HOBO (model numbers UA-002-64 or UA-001-64) is an in-situ instrument for wet or underwater applications. It supports light intensity, soil temperature, temperature, and water temperature. A two-channel logger with 10-bit resolution can record up to approximately 28,000 combined temperature and light measurements with 64K bytes memory. It has a polypropylene housing case. Uses an optical USB to transmit data. A solar radiation shield is used for measurement in sunlight. Temperature measurement range: -20 deg C to 70 deg C (temperature). Light measurement range: 0 to 320,000 lux. Temperature accuracy: +/- 0.53 deg C from 0 deg C to 50 deg C. Light accuracy: Designed for measurement of relative light levels. Water depth rating: 30 m.

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Project Information

CAREER: Linking genetic diversity, population density, and disease prevalence in seagrass and oyster ecosystems (Seagrass and Oyster Ecosystems)

Coverage: Coastal New England

NSF Award Abstract:
Disease outbreaks in the ocean are increasing, causing losses of ecologically important marine species, but the factors contributing to these outbreaks are not well understood. This 5-year CAREER project will study disease prevalence and intensity in two marine foundation species - the seagrass Zostera marina and the Eastern oyster Crassostrea virginica. More specifically, host-disease relationships will be explored to understand how genetic diversity and population density of the host species impacts disease transmission and risk. This work will pair large-scale experimental restorations and smaller-scale field experiments to examine disease-host relationships across multiple spatial scales. Comparisons of patterns and mechanisms across the two coastal systems will provide an important first step towards identifying generalities in the diversity-density-disease relationship. To enhance the broader impacts and utility of this work, the experiments will be conducted in collaboration with restoration practitioners and guided by knowledge ascertained from key stakeholder groups. The project will support the development of an early career female researcher and multiple graduate and undergraduate students. Students will be trained in state-of-the-art molecular techniques to quantify oyster and seagrass parasites. Key findings from the surveys and experimental work will be incorporated into undergraduate courses focused on Conservation Biology, Marine Biology, and Disease Ecology. Finally, students in these courses will help develop social-ecological surveys and mutual learning games to stimulate knowledge transfer with stakeholders through a series of workshops.

The relationship between host genetic diversity and disease dynamics is complex. In some cases, known as a dilution effect, diversity reduces disease transmission and risk. However, the opposite relationship, known as the amplification effect, can also occur when diversity increases the risk of infection. Even if diversity directly reduces disease risk, simultaneous positive effects of diversity on host density could lead to amplification by increasing disease transmission between infected and uninfected individuals. Large-scale field restorations of seagrasses (Zostera marina) and oysters (Crassostrea virginica) will be utilized to test the effects of host genetic diversity on host population density and disease prevalence/intensity. Additional field experiments independently manipulating host genetic diversity and density will examine the mechanisms leading to dilution or amplification. Conducting similar manipulations in two marine foundation species - one a clonal plant and the other a non-clonal animal - will help identify commonalities in the diversity-density-disease relationship. Further, collaborations among project scientists, students, and stakeholders will enhance interdisciplinary training and help facilitate the exchange of information to improve management and restoration efforts. As part of these efforts, targeted surveys will be used to document the perceptions and attitudes of managers and restoration practitioners regarding genetic diversity and its role in ecological resilience and restoration.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1652320

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