Water chemistry data collected from a laboratory experiment to investigate the interactive effects of temperature and pCO2 conditions on the behavior of sand dollar larvae (Dendraster excentricus)

Website: https://www.bco-dmo.org/dataset/752931
Data Type: experimental
Version: 1.1
Version Date: 2019-01-14

Project
» RUI: Will climate change cause 'lazy larvae'? Effects of climate stressors on larval behavior and dispersal (Climate stressors on larvae)

Contributors	Affiliation	Role
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Abstract
These water chemistry data were collected from a laboratory experiment designed to investigate the interactive effects of temperature and pCO2 conditions on the behavior of sand dollar larvae (Dendraster excentricus.

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Coverage

Temporal Extent: 2017-07-13 - 2017-07-26

Dataset Description

Water chemistry data collected from a laboratory experiment to investigate the interactive effects of temperature and pCO2 conditions on the behavior of sand dollar larvae (*Dendraster excentricus*) during July 2017.

Methods & Sampling

To assess the interactive effects of temperature and pCO2 on *Dunaliella excentricus* feeding behavior, we reared the larvae (2 individuals mL^{-1}) in six treatment conditions. The treatment conditions combined three levels of pCO2 bubbled into individual 3-L jars: 400 ppm (ambient atmospheric level), 800 ppm (moderate atmospheric level), and 1,500 ppm (high atmospheric level), and two temperatures maintained in incubators: 12°C (ambient) and 17°C (high). We also maintained pre-equilibrated ambient, moderate, and high pCO2

treatment water in tanks within the same incubators as the treatment jars for periodic water changes. We measured the water chemistry of each treatment jar and tank over the course of the experiment.

DIC samples were gently filtered through a GFF syringe filter, stored in airtight vials, and analyzed on the same day with an Apollo SciTech DIC Analyzer AS-C3 which incorporates the LI-7000 CO2/H2O Analyzer. Measures were then corrected for density based on temperature and salinity. pH samples were also gently filtered through a GFF syringe filter, stored in airtight vials, and analyzed on the same day using a spectrophotometric method. Samples were placed in a temperature-controlled water bath to reach 25°C, carefully transferred to jacketed 5-cm cuvettes, and analyzed with a spectrophotometer. An absorbance measurement was taken after the addition of 20-uL of m-cresol blue to compare with a baseline measurement to determine the pH of each sample. The ratio of the two absorbance peaks was corrected based on samples with two dye additions.

This dataset includes unprocessed data.

Data Processing Description

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- reformatted date from m/d/yy to yyyy-mm-dd

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Data Files

File	
WaterChemistry_OA_Expt2017.csv	(Comma Separated Values (.csv), 7.92 KB) MD5:86387ac9cfca0a8237a47e150a39a1ad

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Parameters

Parameter	Description	Units
date	Date that water was collected for measurements formatted as yyyy-mm-dd	unitless
temp_C	Temperature of treatment water	degrees Celcius
treatment	Targeted pCO2 of treatment water: "low" is 400ppm; "medium" is 800ppm; "high" is 1500ppm	unitless
tank_id	Two replicate tanks per treatment water labeled a and b	unitless
jar_id	Four replicate jars per treatment condition labeled 1 through 4	unitless
pH	Measured pH of the sample (total scale)	pH (total scale)
pCO2	Measured pCO2 of the sample	microatmospheres (uatm)
DIC	Dissolved inorganic carbon of the sample	micromoles per kg (umol/kg)

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Instruments

Dataset-specific Instrument Name	Apollo SciTech DIC Analyzer AS-C3 with LI-7000 CO2/H2O Analyzer
Generic Instrument Name	CO2 Analyzer
Dataset-specific Description	Used to measure dissolved inorganic carbon (DIC).
Generic Instrument Description	Measures atmospheric carbon dioxide (CO2) concentration.

Dataset-specific Instrument Name	
Generic Instrument Name	Spectrophotometer
Dataset-specific Description	Used to measure pH.
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

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Project Information

RUI: Will climate change cause 'lazy larvae'? Effects of climate stressors on larval behavior and

dispersal (Climate stressors on larvae)

Coverage: Coastal Pacific, USA

In the face of climate change, future distribution of animals will depend not only on whether they adjust to new conditions in their current habitat, but also on whether a species can spread to suitable locations in a changing habitat landscape. In the ocean, where most species have tiny drifting larval stages, dispersal between habitats is impacted by more than just ocean currents alone; the swimming behavior of larvae, the flow environment the larvae encounter, and the length of time the larvae spend in the water column all interact to impact the distance and direction of larval dispersal. The effects of climate change, especially ocean acidification, are already evident in shellfish species along the Pacific coast, where hatchery managers have noticed shellfish cultures with 'lazy larvae syndrome.' Under conditions of increased acidification, these 'lazy larvae' simply stop swimming; yet, larval swimming behavior is rarely incorporated into studies of ocean acidification. Furthermore, how ocean warming interacts with the effects of acidification on larvae and their swimming behaviors remains unexplored; indeed, warming could reverse 'lazy larvae syndrome.' This project uses a combination of manipulative laboratory experiments, computer modeling, and a real case study to examine whether the impacts of ocean warming and acidification on individual larvae may affect the distribution and restoration of populations of native oysters in the Salish Sea. The project will tightly couple research with undergraduate education at Western Washington University, a primarily undergraduate university, by employing student researchers, incorporating materials into undergraduate courses, and pairing marine science student interns with art student interns to develop art projects aimed at communicating the effects of climate change to public audiences

As studies of the effects of climate stress in the marine environment progress, impacts on individual-level performance must be placed in a larger ecological context. While future climate-induced circulation changes certainly will affect larval dispersal, the effects of climate-change stressors on individual larval traits alone may have equally important impacts, significantly altering larval transport and, ultimately, species distribution. This study will experimentally examine the relationship between combined climate stressors (warming and acidification) on planktonic larval duration, morphology, and swimming behavior; create models to generate testable hypotheses about the effects of these factors on larval dispersal that can be applied across systems; and, finally, use a bio-physically coupled larval transport model to examine whether climate-impacted larvae may affect the distribution and restoration of populations of native oysters in the Salish Sea.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1538626

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