Daily water chemistry measurements from a larval growth experiment culturing Olympia oysters in 50 unique combinations of temperature, salinity, and pCO2 over up to 17 days of larval life.

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Data Type: experimental
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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
Daily water chemistry measurements from a larval growth experiment culturing Olympia oysters in 50 unique combinations of temperature, salinity, and pCO2 over up to 17 days of larval life.

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Coverage

Temporal Extent: 2018-05-04 - 2018-05-21

Dataset Description

Daily water chemistry measurements from a larval growth experiment culturing Olympia oysters in 50 unique combinations of temperature, salinity, and pCO2 over up to 17 days of larval life.

Acquisition Description

We cultured Olympia oyster larvae in 50 unique combinations of temperature, salinity, and pCO2. Larval methods are described in growth experiment dataset, but to collect water samples, we measured water temperature and salinity with an Orion Star A329 conductivity meter every two days prior to water changes. We collected pH samples in 20ml plastic scintillation vials, poisoned them 10 µl of mercuric chloride, and stored at room temperature. Roughly one month later, we measured samples for pH using a diode array spectrophotometer (Agilent 8453A UV-VUS) and DIC with a DIC analyzer (Appolo SciTech AS-C3). We then used all parameters collected to calculate pCO2 and Aragonite Saturation with CO2SYS.

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
- re-formatted date from mdyy to yyyy-mm-dd
- reduced number of significant digits of pH, pCO2, and Ar to reflect sampling precision methods

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Parameters

Parameter	Description	Units
Cup	Treatment label. Each cup represents a unique temperature/salinity/pCO2 combination	unitless
Date	Sample date from May 4 - May 21 2018; formatted as yyyy-mm-dd	unitless
Cup_Date	Concatenated cup label and date; formatted as Label_mmddyy	unitless
Temp	Temperature of culture cup water	degrees Celsius
Sal	Salinity measurement of culture cup water	Practical Salinity Units (PSU)
pH	pH of culture cup water; collected and measured after experiment completion	unitless
pCO2	pCO2 of culture cup water; calculated with pH and DIC in CO2SYS	parts per million (ppm)
Ar	Aragonite saturation state; calculated in CO2SYS	unitless
Color	Color treatment of cup tubing. Colors represent treatment levels of high-CO2 air bubbled into treatment cups: yellow=400; blue=800; green=1200; red=1600 ppm CO2 air bubbled into each cup [note: ppm of water doesn't always equilibrate fully depending on other water parameters].	unitless

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Instruments

Dataset-specific Instrument Name	Agilent 8453A UV-VUS diode array spectrophotometer
Generic Instrument Name	Spectrophotometer
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.

Dataset-specific Instrument Name	Orion Star A329
Generic Instrument Name	Conductivity Meter
Generic Instrument Description	Conductivity Meter - An electrical conductivity meter (EC meter) measures the electrical conductivity in a solution. Commonly used in hydroponics, aquaculture and freshwater systems to monitor the amount of nutrients, salts or impurities in the water.

Dataset-specific Instrument Name	Appolo SciTech AS-C3 DIC analyzer
Generic Instrument Name	Apollo SciTech AS-C3 Dissolved Inorganic Carbon (DIC) analyzer
Generic Instrument Description	A Dissolved Inorganic Carbon (DIC) analyzer, for use in aquatic carbon dioxide parameter analysis of coastal waters, sediment pore-waters, and time-series incubation samples. The analyzer consists of a solid state infrared CO2 detector, a mass-flow controller, and a digital pump for transferring accurate amounts of reagent and sample. The analyzer uses an electronic cooling system to keep the reactor temperature below 3 degrees Celsius, and a Nagion dry tube to reduce the water vapour and keep the analyzer drift-free and maintenance-free for longer. The analyzer can handle sample volumes from 0.1 - 1.5 milliliters, however the best results are obtained from sample volumes between 0.5 - 1 milliliters. It takes approximately 3 minutes per analysis, and measurement precision is plus or minus 2 micromoles per kilogram or higher for surface seawater. It is designed for both land based and shipboard laboratory use.

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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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