

# Carbonate chemistry associated with copepod experiments with varying CO<sub>2</sub> (OA-Copepod\_PreyQual project)

**Website:** <https://www.bco-dmo.org/dataset/675199>

**Data Type:** experimental

**Version:**

**Version Date:** 2017-01-18

## Project

» [Impacts on copepod populations mediated by changes in prey quality](#) (OA-Copepod\_PreyQual)

## Program

» [Science, Engineering and Education for Sustainability NSF-Wide Investment \(SEES\): Ocean Acidification \(formerly CRI-OA\)](#) (SEES-OA)

Contributors	Affiliation	Role
<a href="#">Olson, M Brady</a>	Western Washington University (WWU)	Principal Investigator
<a href="#">Keister, Julie E.</a>	University of Washington (UW)	Co-Principal Investigator
<a href="#">Love, Brooke</a>	Western Washington University (WWU)	Co-Principal Investigator
<a href="#">Copley, Nancy</a>	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

## Table of Contents

- [Dataset Description](#)
  - [Methods & Sampling](#)
  - [Data Processing Description](#)
- [Data Files](#)
- [Parameters](#)
- [Instruments](#)
- [Deployments](#)
- [Project Information](#)
- [Program Information](#)
- [Funding](#)

## Dataset Description

This dataset includes carbonate chemistry data from copepod grazing and egg production experiments with varying pCO<sub>2</sub> levels, from 2014 and 2015 studies.

## Methods & Sampling

DIC samples were very gently filtered through a GFF syringe filter on the morning of the experimental day, then stored in air tight vials which were overflowed to minimize air exposure and allowed to come to room temperature until analysis on the same day using an Apollo SciTech DIC Analyzer AS-C3 which incorporates the LI-7000 CO<sub>2</sub>/H<sub>2</sub>O Analyzer, then corrected for density based on temperature and salinity. Samples for pH were collected in a similar fashion to DIC, and also run on the same day after reaching 25 degrees in a temperature controlled water bath. Samples were carefully transferred from the vials to a jacketed 5 cm cuvette. pH was determined via spectrophotometric methods, with the addition of 20 uL of m-cresol blue to each sample after taking a baseline measurement. The ratio of the two absorbance peaks was corrected based on samples in which two dye additions were made. Other parameters were calculated with CO<sub>2</sub>sys. Some samples for total alkalinity were also run for QC purposes. These were preserved with HgCl<sub>2</sub> and stored in 120 ml glass bottles with Teflon lined screw cap seals. Alkalinity was measured by gran titration using a Titrando 888, and 0.1 N HCl titrant, in a temperature controlled titration vessel.

## Data Processing Description

Unprocessed raw data.

### BCO-DMO Processing Notes:

- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- combined data for all 2014 and 2015 grazing experiments
- added columns for year and experiment
- replaced spaces with underscore

[ [table of contents](#) | [back to top](#) ]

---

## Data Files

File
<b>carb_chem.csv</b> (Comma Separated Values (.csv), 65.91 KB) MD5:ea384dd84c3dbb427a155d2efc341f83 Primary data file for dataset ID 675199

[ [table of contents](#) | [back to top](#) ]

---

## Parameters

Parameter	Description	Units
year	experiment year	unitless
expt	experiment number	unitless
sample	sample code used in experiment	unitless
date	date sample was taken	unitless
experiment	copepod egg production experiment for the associated chemical sample	unitless
sample_type	chemical sample from: Algae for feeding copepods; Female jars in CO2 chambers; Blank jars with no copepods in CO2 chambers; Tanks used for storing equilibrated media; Development jars with copepod eggs; or Grazing bottles with copepods having algae grazing measured.	unitless
treatment	The CO2 treatment for the given sample type.	unitless
temp	Temperature	degrees Celsius
DIC	Dissolved inorganic carbon	micromoles/kilogram (umol/kg)
TA	Total alkalinity	equivalents/kilogram(ueq/kg)
pH	pH of sample	unitless
pCO2	measured pCO2 of sample	microatmospheres (uatm)

[ [table of contents](#) | [back to top](#) ]

---

## Instruments

<b>Dataset-specific Instrument Name</b>	Titrand 888
<b>Generic Instrument Name</b>	Automatic titrator
<b>Dataset-specific Description</b>	To measure alkalinity
<b>Generic Instrument Description</b>	Instruments that incrementally add quantified aliquots of a reagent to a sample until the end-point of a chemical reaction is reached.

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

<b>Dataset-specific Instrument Name</b>	
<b>Generic Instrument Name</b>	Spectrophotometer
<b>Dataset-specific Description</b>	To measure pH
<b>Generic Instrument Description</b>	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.

[ [table of contents](#) | [back to top](#) ]

## Deployments

### Lab Olson B

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/521277">https://www.bco-dmo.org/deployment/521277</a>
<b>Platform</b>	WWU
<b>Start Date</b>	2011-03-31
<b>End Date</b>	2016-09-15
<b>Description</b>	laboratory experiments

[ [table of contents](#) | [back to top](#) ]

## Project Information

### Impacts on copepod populations mediated by changes in prey quality (OA-Copepod\_PreyQual)

**Coverage:** Puget Sound, Salish Sea

Research shows that ocean acidification (OA) has physiological consequences for individual organisms, even those lacking calcium carbonate skeletal structures. However, this existing research does not adequately address how OA effects to individuals are linked across trophic levels. Pelagic copepods are critical players in most marine biogeochemical cycles. Their consumption of phytoplankton and microzooplankton is the primary

mechanism by which bacterial and phytoplankton production is transferred to higher trophic levels. Despite their high abundance and ecological importance, copepods have received little research attention concerning OA. The few extant studies focused on direct acute effects to copepods (e.g. egg hatching, survival) under elevated pCO<sub>2</sub>, and few significant effects have been observed at predicted future pCO<sub>2</sub>. However, there is increasing recognition that OA significantly affects their phytoplankton prey, including elevating growth rates, increasing cell sizes, altering nutrient uptake and ratios, and chemical composition. Because copepod grazing, egg production, and hatching success all can vary with these prey characteristics, OA mediated changes in phytoplankton quality may be an important indirect mechanism through which OA acts on copepod populations and, ultimately, marine food webs.

This study that will advance our understanding of how copepod populations may be affected by OA, specifically through OA induced changes in phytoplankton quality. Our core objective is to determine how changes in phytoplankton physiology and biochemistry (e.g. lipid composition) affect copepod egg production, hatching, and ontogenetic development of nauplii. We will also include a subset of experiments to test whether OA affects copepod reproductive output independent of changes to prey. To achieve these research goals, the diatom, *Ditylum brightwellii*, and dinoflagellate, *Prorocentrum micans*, will be cultured semi-continuously under several pCO<sub>2</sub> concentrations, during which time we will characterize changes in their physiology and biochemistry. The copepods, *Calanus pacificus*, a large, high lipid-bearing marine species, and *Acartia clausi*, a smaller, low lipid-bearing estuarine species, will be maintained across varying pCO<sub>2</sub> concentrations and fed these pCO<sub>2</sub>-acclimated prey, and their grazing and reproductive capability quantified. The copepods and phytoplankton used in this study will be collected from the Salish Sea, a region already experiencing periods of high pCO<sub>2</sub>/H<sup>+</sup> (>1000 ppm, pH 7.5) on varying timescales. Therefore, this research addresses a question of how future climate change may impact marine ecosystems, but also is relevant to pCO<sub>2</sub>/H<sup>+</sup> variability presently experienced in coastal environments.

[ [table of contents](#) | [back to top](#) ]

---

## Program Information

### Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

**Website:** [https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=503477](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503477)

**Coverage:** global

NSF Climate Research Investment (CRI) activities that were initiated in 2010 are now included under Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES). SEES is a portfolio of activities that highlights NSF's unique role in helping society address the challenge(s) of achieving sustainability. Detailed information about the SEES program is available from NSF ([https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=504707](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707)).

In recognition of the need for basic research concerning the nature, extent and impact of ocean acidification on oceanic environments in the past, present and future, the goal of the SEES: OA program is to understand (a) the chemistry and physical chemistry of ocean acidification; (b) how ocean acidification interacts with processes at the organismal level; and (c) how the earth system history informs our understanding of the effects of ocean acidification on the present day and future ocean.

#### Solicitations issued under this program:

[NSF 10-530](#), FY 2010-FY2011

[NSF 12-500](#), FY 2012

[NSF 12-600](#), FY 2013

[NSF 13-586](#), FY 2014

NSF 13-586 was the final solicitation that will be released for this program.

#### PI Meetings:

[1st U.S. Ocean Acidification PI Meeting](#) (March 22-24, 2011, Woods Hole, MA)

[2nd U.S. Ocean Acidification PI Meeting](#) (Sept. 18-20, 2013, Washington, DC)

3rd U.S. Ocean Acidification PI Meeting (June 9-11, 2015, Woods Hole, MA - Tentative)

## **NSF media releases for the Ocean Acidification Program:**

[Press Release 10-186 NSF Awards Grants to Study Effects of Ocean Acidification](#)

[Discovery Blue Mussels "Hang On" Along Rocky Shores: For How Long?](#)

[Discovery nsf.gov - National Science Foundation \(NSF\) Discoveries - Trouble in Paradise: Ocean Acidification This Way Comes - US National Science Foundation \(NSF\)](#)

[Press Release 12-179 nsf.gov - National Science Foundation \(NSF\) News - Ocean Acidification: Finding New Answers Through National Science Foundation Research Grants - US National Science Foundation \(NSF\)](#)

[Press Release 13-102 World Oceans Month Brings Mixed News for Oysters](#)

[Press Release 13-108 nsf.gov - National Science Foundation \(NSF\) News - Natural Underwater Springs Show How Coral Reefs Respond to Ocean Acidification - US National Science Foundation \(NSF\)](#)

[Press Release 13-148 Ocean acidification: Making new discoveries through National Science Foundation research grants](#)

[Press Release 13-148 - Video nsf.gov - News - Video - NSF Ocean Sciences Division Director David Conover answers questions about ocean acidification. - US National Science Foundation \(NSF\)](#)

[Press Release 14-010 nsf.gov - National Science Foundation \(NSF\) News - Palau's coral reefs surprisingly resistant to ocean acidification - US National Science Foundation \(NSF\)](#)

[Press Release 14-116 nsf.gov - National Science Foundation \(NSF\) News - Ocean Acidification: NSF awards \\$11.4 million in new grants to study effects on marine ecosystems - US National Science Foundation \(NSF\)](#)

[ [table of contents](#) | [back to top](#) ]

---

## **Funding**

<b>Funding Source</b>	<b>Award</b>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1220664</a>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1220381</a>

[ [table of contents](#) | [back to top](#) ]