

Discrete carbonate chemistry from samples collected in Whiskey Creek Shellfish Hatchery, Netarts Bay, OR, USA in 2009 (Mechanisms of bivalve response to acidification project)

Website: <https://www.bco-dmo.org/dataset/541271>

Version: 03 Dec 2014

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Project

» [A mechanistic understanding of the impacts of ocean acidification on the early life stages of marine bivalves](#)
(Mechanisms of bivalve response to acidification)

Program

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

Contributors	Affiliation	Role
Waldbusser, George G.	Oregon State University (OSU-CEOAS)	Principal Investigator
Hales, Burke	Oregon State University (OSU-CEOAS)	Contact
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Table of Contents

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

Dataset Description

Discrete carbonate chemistry samples from Whiskey Creek Shellfish Hatchery 2009. Barton et al. 2012 contains all information on data collection, analytical procedures, and uncertainties.

For more information, refer to:

Barton, A., Hales, B., Waldbusser, G.G., Langdon, C., & Feely, R.A. 2009. The Pacific oyster, *Crassostrea gigas*, shows negative correlation to naturally elevated carbon dioxide levels: Implications for near-term ocean acidification effects. *Limnol. Oceanogr.*, 57(3), 698-710. doi: [10.4319/lo.2012.57.3.0698](https://doi.org/10.4319/lo.2012.57.3.0698)

Methods & Sampling

Sampling and analytical methods are included in Barton et al. 2012. ω_A and pH_{tot} are calculated from measured PCO₂ and TCO₂ as noted in paper. Analytical uncertainty in these values are estimated at 5% in ω_A and 0.02 in pH_{tot}.

Data Processing Description

Saturation state (ω_A) and pH are calculated values from thermodynamic relationships outlined in Barton et al. 2012.

BCO-DMO edits made:

- modified parameter names to conform with BCO-DMO naming conventions;
- calculated month, day, and time using year and julian_day values.

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

Data Files

File
barton_pH_CO2.csv (Comma Separated Values (.csv), 2.83 KB) MD5:ac63af82e5671466f4f8ad65534e9943
Primary data file for dataset ID 541271

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

Parameters

Parameter	Description	Units
julian_day	Julian day of the year. Named 'DOY_CO2' in original data file.	unitless
month	2-digit month of year. Calculated from julian_day.	unitless
day	2-digit day of month. Calculated from julian_day.	unitless
year	4-digit year.	unitless
time	Time formatted as 2-digit hour, 2-digit minutes, and decimal minutes; 24-hour clock. Calculated from julian_day.	unitless
omega_A	Saturation state with respect to aragonite.	unitless
pH_tot	pH on the seawater scale. Named 'pHtotal' in original data file.	unitless
temp	Temperature of the sample when collected. Named 'T_CO2' in original data file.	degrees Celsius
sal	Salinity of the sample when collected. Named 'S_CO2' in original data file.	practical salinity units (PSU)

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

Deployments

Waldbusser_WCSH

Website	https://www.bco-dmo.org/deployment/541508
Platform	Whiskey Creek Shellfish Hatchery
Start Date	2009-05-09
End Date	2011-08-01
Description	Whiskey Creek Shellfish Hatchery is a commercial shellfish hatchery located in Netarts Bay, a small bay on the northern Oregon coast.

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

Project Information

A mechanistic understanding of the impacts of ocean acidification on the early life stages of

marine bivalves (Mechanisms of bivalve response to acidification)

Coverage: Coastal and estuarine waters of Oregon, U.S.A.

Extracted from the NSF award abstract:

The shift in the carbonate chemistry of marine waters, as a result of direct anthropogenic CO₂ addition and climate-driven changes in circulation, poses a threat to many organisms. A rapidly expanding body of literature has shown that increasing levels of carbonic acid and decreasing carbonate ion levels will have deleterious effects on many marine organisms; however little is known about the mode of action of these changes in water chemistry on marine bivalves. Many marine organisms, particularly bivalves, depend critically on the production of calcium carbonate mineral, and this material becomes thermodynamically unstable under more acidic conditions. The actual mineral precipitation, however, takes place within interstitial volumes intermittently separated from ambient seawater by biological membranes. Therefore, abiotic relationships between solid phase minerals and seawater thermodynamics are oversimplified representations of the complex interplay among seawater chemistry, bivalve physiology, and shell growth processes.

In this integrative, multi-disciplinary project we will develop and apply novel experimental approaches to elucidate fundamental physiological responses to changes in seawater chemistry associated with ocean acidification. The four primary objectives of this project are to: 1) develop a novel experimental approach and system capable of unique combinations of pCO₂, pH, and mineral saturation state (Ω), 2) conduct short-term exploratory experiments to determine bivalve responses to different carbonate system variables, 3) conduct longer-term directed studies of the integrated effects of different carbonate system variables over early life history of bivalves, and 4) compare these biological responses among a group of bivalve species that differ in shell mineralogy and nativity to the periodically acidified upwelling region of the Pacific Northwest coast of North America. By isolating the effects of different components of the carbonate system on the early life stages of marine bivalves, e.g. does an oyster larvae respond more strongly to pCO₂ or mineral saturation state?, we can begin to identify the mechanisms behind bivalve responses as well as understand how these organisms survive in transiently corrosive conditions.

Laboratory based experiments on three primary taxa (oyster, mussel, clam) having native and non-native species pairs to Oregon's coastal waters: oysters *Ostrea lurida* and *Crassostrea gigas*; mussels *Mytilus californianus* and *Mytilus galloprovincialis*; and clams *Macoma nasuta* and *Ruditapes philippinarum*, will allow for species comparisons among different shell mineralogy, microstructure, life-history, and adaptability. High-precision pCO₂ and dissolved inorganic carbon (DIC) instruments will be used in experiments to control and properly constrain the carbonate chemistry. A complement of response variables will be measured across the early life stages of these species that include tissue acid-base balance, shell mineralogy and chemistry, respiration rate, and behavior. Additionally, our emphasis will be placed on observation of development, growth, and shell structure by directly linking observational data with other measured response data. An adaptive strategy using short-term experiments to determine the most salient variables in the carbonate system to manipulate in longer-term studies is being employed. This approach allows us to evaluate acute effects, mimicking diurnal changes to carbonate variables often found in coastal areas, and integrated chronic effects mimicking a more gradual acidification due to the rise in atmospheric CO₂.

[[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

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).

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

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1041267

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