

# Raw Shuck Data from UCSB Mussel Growth study from multiple sites in the California Current System starting 2008 (OMEGAS-II project)

**Website:** <https://www.bco-dmo.org/dataset/639223>

**Version:** 25 February 2016

**Version Date:** 2016-02-25

## Project

» [OMEGAS II - Linking ecological and organismal responses to the ocean acidification seascape in the California Current System](#) (OMEGAS-II)

## Program

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

Contributors	Affiliation	Role
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## Dataset Description

Mussel Growth Data - UCSB - Body size measurements of Mytilus - Raw Shuck Data

### Site Information

Code   Site name

ALG   Alegria

LOL   Lompoc Landing

BML   Bodega Marine Lab

VD   Van Damme

HOP   Hopkins

SOB   Soberanes - Note: SOB mussels are the easiest to insert scalpel in. They are not as tightly closed as other sites

CPA   Cape Arago

SH   Strawberry Hill

FC   Fogerty Creek

### Treatment Information

Treatment   pCO<sub>2</sub>(uatm)   Temperature (C)

R1   300   14

R2   650   12

R3   1200   8

R4   350   18

## Methods & Sampling

Mussel body size was measured using calipers. Body mass (wet) was determined using a top loading balance.

## Data Processing Description

None -The file contains raw numbers

## BCO-DMO Processing Notes

- Generated from original file: "Mussel\_datasheet\_UCSB.xlsx", sheet: "Raw Shuck data" contributed by Gretchen Hofmann
- Parameter names edited to conform to BCO-DMO naming convention found at [Choosing Parameter Name](#)
- Lat/Lon of sites added from existing mooring metadata
- "nd" (no data) inserted into blank cells
- "NA" replaced with "nd" for consistency
- Dates reformatted to YYYYMMDD
- Times reformatted to HHMM
- Duplicate sampleID column removed

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## Parameters

Parameter	Description	Units
sampleID	sampleID	text
ID_Replicate	ID_Replicate	text
SITE	Site Id	text
Latitude	Latitude (South is negative)	decimal degrees
Longitude	Longitude (West is negative)	decimal degrees
Replicate	Replicate	dimensionless
Treatment	Treatment	text
DATE	DATE	YYYYMMDD
Run_No	Run_No	dimensionless
ARC_Start_Time	ARC_Start_Time	HHMM

Shuck_Time	Shuck_Time	HHMM
width	width	mm
depth	depth	mm
length	length	mm
notchtop	notchtop	mm
tin	tin	grams
shell	shell	grams
wetwt_tin	wetwt_tin	grams
drywt_tin	drywt_tin	grams
growth	growth	mm
pct_growth	pct_growth	percentage
wetwt	wetwt	grams
drywt	drywt	grams
Notes	Notes	text

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## Deployments

### OMEGAS-CARX00-GIFET

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/58809">https://www.bco-dmo.org/deployment/58809</a>
<b>Platform</b>	PISCO Cape Arago Ecological Time-Series Station
<b>Report</b>	<a href="http://omegas.science.oregonstate.edu/?q=sites">http://omegas.science.oregonstate.edu/?q=sites</a>
<b>Start Date</b>	2008-04-01
<b>End Date</b>	2020-01-01
<b>Description</b>	surf-zone PAR, chlorophyll fluorescence, and temperature sensors

**OMEGAS-FCKX00-GIFET**

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/58808">https://www.bco-dmo.org/deployment/58808</a>
<b>Platform</b>	PISCO Fogarty Creek Intertidal Long-Term Ecological Research Site
<b>Report</b>	<a href="http://omegas.science.oregonstate.edu/?q=sites">http://omegas.science.oregonstate.edu/?q=sites</a>
<b>Start Date</b>	2011-04-17
<b>End Date</b>	2020-01-01
<b>Description</b>	Intertidal (surf-zone) station See also: OMEGAS moorings site page

**OMEGAS-IBODXX-GIFET**

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/58893">https://www.bco-dmo.org/deployment/58893</a>
<b>Platform</b>	Bodega Head State Marine Reserve Intertidal Long-Term Ecological Research Site
<b>Report</b>	<a href="http://omegas.science.oregonstate.edu/?q=sites">http://omegas.science.oregonstate.edu/?q=sites</a>
<b>Start Date</b>	2011-05-20
<b>End Date</b>	2020-01-01
<b>Description</b>	Intertidal (surf-zone) station See also: OMEGAS moorings site page

**OMEGAS-IHOPXX-GIFET**

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/472472">https://www.bco-dmo.org/deployment/472472</a>
<b>Platform</b>	PISCO-OMEGAS Hopkins Ecological Research Site
<b>Report</b>	<a href="http://omegas.science.oregonstate.edu/?q=sites">http://omegas.science.oregonstate.edu/?q=sites</a>
<b>Start Date</b>	2012-04-24
<b>End Date</b>	2020-01-01
<b>Description</b>	Intertidal (surf-zone) station See also: OMEGAS moorings site page

**OMEGAS-ILOLXX-GIFET**

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/58894">https://www.bco-dmo.org/deployment/58894</a>
<b>Platform</b>	PISCO Lompoc Landing Intertidal Long-Term Ecological Research Site
<b>Report</b>	<a href="http://omegas.science.oregonstate.edu/?q=sites">http://omegas.science.oregonstate.edu/?q=sites</a>
<b>Start Date</b>	2011-05-05
<b>End Date</b>	2020-01-01
<b>Description</b>	Intertidal (surf-zone) station See also: OMEGAS moorings site page

**OMEGAS-ISOPXX-GIFET**

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/559904">https://www.bco-dmo.org/deployment/559904</a>
<b>Platform</b>	PISCO Soberanes Ecological Time-Series Station
<b>Report</b>	<a href="http://omegas.science.oregonstate.edu/?q=sites">http://omegas.science.oregonstate.edu/?q=sites</a>
<b>Start Date</b>	2013-04-01
<b>End Date</b>	2020-01-01
<b>Description</b>	surf-zone PAR, chlorophyll fluorescence, and temperature sensors

### OMEGAS-IVDPXX-GIFET

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/58896">https://www.bco-dmo.org/deployment/58896</a>
<b>Platform</b>	Van Damme State Park Intertidal Long-Term Ecological Research Site
<b>Report</b>	<a href="http://omegas.science.oregonstate.edu/?q=sites">http://omegas.science.oregonstate.edu/?q=sites</a>
<b>Start Date</b>	2011-05-09
<b>End Date</b>	2020-01-01
<b>Description</b>	Intertidal (surf-zone) station See also: OMEGAS moorings site page

### OMEGAS-SHLX00-GIFET

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/58807">https://www.bco-dmo.org/deployment/58807</a>
<b>Platform</b>	PISCO Strawberry Hill Intertidal Long-Term Ecological Research Site
<b>Report</b>	<a href="http://omegas.science.oregonstate.edu/?q=sites">http://omegas.science.oregonstate.edu/?q=sites</a>
<b>Start Date</b>	2011-04-17
<b>End Date</b>	2020-01-01
<b>Description</b>	Intertidal (surf-zone) station See also: OMEGAS moorings site page

### OMEGAS-ALEX-01-GIFET

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/639614">https://www.bco-dmo.org/deployment/639614</a>
<b>Platform</b>	PISCO Alegria Ecological Time-Series Station
<b>Start Date</b>	2010-01-01
<b>End Date</b>	2013-12-31

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## Project Information

### OMEGAS II - Linking ecological and organismal responses to the ocean acidification seascape in the California Current System (OMEGAS-II)

**Website:** <http://omegas.science.oregonstate.edu>

**Coverage:** California Current Large Marine Ecosystem, Oregon, California

#### *Project abstract:*

This project is a renewal of an existing ocean acidification (OA) grant supporting an interdisciplinary research team (called OMEGAS) with expertise in oceanography, ecology, biogeochemistry, molecular physiology, and molecular genetics. Research to date has documented a dynamic oceanographic mosaic in the inner shelf of the California Current System (CCS) that spans 1,200+ km and varies at tidal, diurnal, event, and seasonal temporal scales at local to ocean basin spatial scales. In OMEGAS II, the project seeks to better understand the drivers of this striking time-space variability, and to link the OA seascape to the physiological and ecological performance of a key member of this ecosystem, the mussel *Mytilus californianus*. In addition, the investigators will explore the influence of this oceanographic mosaic on species interactions and community organization. As a dominant habitat-forming species, strong interactor, and major space occupant, *M. californianus* is arguably the core component of the rocky intertidal ecosystem along the upwelling-dominated

CCS. Using an interdisciplinary, spatially extensive approach integrating inner shelf oceanography with ecology, physiology, and eco-mechanics, the interdisciplinary team will study the response of juvenile mussels *M. californianus* to OA. The studies span levels of biological organization, thereby allowing assessment of how the cost of forming a shell under field conditions might influence physiological performance and resistance to predation. This investigation will include modeling to link to larger-scale ecosystem and oceanographic dynamics in the CCS and beyond.

Results from OMEGAS I show that the growth, survival, and shell strength of mussel larvae are strongly negatively affected by elevated pCO<sub>2</sub>, and that growth of adult mussels varied among sites within regions and between regions. Emerging data on natural variability in seawater conditions will allow a deeper exploration of the organismal response of *M. californianus*, and the ecological consequences of traits, such as reduced shell thickness and strength. The present project will expand and strengthen the existing oceanographic network to increase our understanding of the coastal OA regime, and provide the environmental context for ecological and physiological research. Specifically, this project will (1) conduct field and laboratory experiments on the influence of OA on the growth, shell accretion, and resistance to predation of juvenile mussels collected from 10 sites spanning 1,400 km of coastline, (2) link the OA-sensor oceanographic "backbone" to an existing database of community structure via ecological modeling to assess the influence of OA on coastal variation in community organization, (3) determine the physiological responses of juvenile mussels following field deployments and culture under common garden conditions to evaluate mechanistic underpinnings to the responses observed in mussels from different sites, (4) explore the physiological and transcriptomic response of mussels in lab mesocosms to field-documented variability in pCO<sub>2</sub>, and (5) using modified ROMS models, evaluate the linkage between basin-scale oceanography and local-scale variation in inner-shelf oceanography to evaluate the relative influences of large-to-local scale factors on OA variability. This research aims to understand how coastal ecosystems will respond to OA, and thus to develop our capacity to predict the future impact of OA on coastal ecosystems.

#### **PUBLICATIONS PRODUCED AS A RESULT OF THIS RESEARCH**

Hettinger, A., E. Sanford, T. M. Hill, J. D. Hoffelt, A. D. Russell, and B. Gaylord.. "The influence of food supply on the response of Olympia oyster larvae to ocean acidification.," *Biogeosciences*, v.10, 2013, p. 6629.

Hettinger, A., E. Sanford, T.M. Hill, E.A. Lenz, A.D. Russell, and B. Gaylord. "Larval carry-over effects from ocean acidification persist in the natural environment.," *Global Change Biology*, 2013.

Hofmann, G. E., T. G. Evans, M. W. Kelly, J. L. Padilla-Gamiño, C. A. Blanchette, L. Washburn, F. Chan, M. A. McManus, B. A. Menge, B. Gaylord, T. M. Hill, E. Sanford, M. LaVigne, J. M. Rose, L. Kapsenberg, and J. M. Dutton.. "Exploring local adaptation and the ocean acidification seascape ? studies in the California Current Large Marine Ecosystem.," *Biogeosciences Discussions*, v.10, 2013, p. 11825.

LaVigne, M. T.M. Hill, E. Sanford, B. Gaylord, A.D. Russell, E.A. Lenz, J.D. Hoffelt, M.K. Young.. "The elemental composition of purple sea urchin (*Strongylocentrotus purpuratus*) calcite and potential effects of pCO<sub>2</sub> during early life stages.," *Biogeosciences*, v.10, 2013, p. 3465.

Pespeni, M.H., E. Sanford, B. Gaylord, T. M. Hill, J. D. Hoffelt, H. Jaris, M. LaVigne, E. A. Lenz, A. D. Russell, M. K. Young, S. R. Palumbi.. "Evolutionary change during experimental ocean acidification.," *Proceedings National Academy of Sciences*, v.110, 2013, p. 6937.

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## **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 \(NSF\)](#)

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## **Funding**

<b>Funding Source</b>	<b>Award</b>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1220359</a>

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