Urchin Fertilization Studies from Levin laboratory at Scripps Institute of Oceanography from 2009 to 2012 (SeapHOx project)

Website: https://www.bco-dmo.org/dataset/4056
Version: 10 October 2013
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Project
» Macrophyte-induced variability in coastal ocean pH and consequences for invertebrate larvae (SeapHOx)

Program
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
Frieder, Christina	University of California-San Diego Scripps (UCSD-SIO)	Principal Investigator, Contact
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Dataset Description

This dataset presents fertilization success of *Strongylocentrotus franciscanus* and *S. purpuratus* from experiments that manipulated pH, sperm-egg ratio, and sire identity.

Related files and references:
Frieder CA (2013) Evaluating low oxygen and pH variation and its effects on invertebrate early life stages on upwelling margins. Dissertation. University of California San Diego.

Methods & Sampling

Sampling and Analytical Methodology:
Spawning was induced by injecting 0.55 M KCl through the peristomal membrane. Oocytes were collected in dishes of filtered seawater (FSW, 0.22 µm). Number of adults used in each experiment ranged from 2 – 5 females and 3 – 5 males. Sperm were collected dry from the gonopores of males and placed in a small vial and kept on ice until use. A 0.1% dilution from dry sperm was made to verify sperm motility, and then preserved in formalin to count sperm densities with a hemacytometer in order to calculate the amount of diluted sperm required to attain desired sperm-egg ratios and sperm densities for each treatment. Oocytes from multiple females were mixed and egg densities determined by counting 8 x 20 µl aliquots. Eggs were added to experimental beakers at a density of 5 eggs ml^{-1}, and incubated in experimental conditions for 10 min before sperm were added. Dry sperm was diluted immediately before addition to experimental beakers. Following sperm addition the seawater in each replicate was gently stirred. Fertilization proceeded for 20 min and was arrested by transferring the contents of each replicate to a 1% formalin solution. The fertilization ratio, defined as the proportion of eggs fertilized, was determined by counting the frequency of occurrence of a fertilization envelope in at least 100 eggs per replicate. All experiments were carried out in the Scripps experimental aquarium facility during the spring of 2013. 500 ml glass beakers were used, and there were three replicates

per treatment level.

Data Processing Description

BCO-DMO Processing Notes
Original file: "Fertilization_FINAL.txt" contributed by Christina Frieder
- Approx Lat/Lon of Levin Lab appended to enable data discovery in MapServer
- Parameter names edited to conform to BCO-DMO parameter naming conventions

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Data Files

File
Fertilization_Data.csv (Comma Separated Values (.csv), 15.10 KB) MD5:14599a47e0cf3206ee4c361118acdcae Primary data file for dataset ID 4056

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Parameters

Parameter	Description	Units
Lab_Id	Lab Id	text
Latitude	Approximate Latitude of the Lab; South is negative	decimal degrees
Longitude	Approximate Longitude of the Lab; West is negative	decimal degrees
Expt	Experiment Number = 1-3	dimensionless
Species	Species = *S. Franciscanus* or *S. Purpuratus*	text
pH	pH = pH of treatment (total scale; 15C)	total scale
Sperm2Egg_Ratio	Sperm:Egg = sperm-egg ratio used for treatment	ratio
Sire_Identity	Sire Identity = male identity (only used in Expt. 3)	dimensionless
Rep	Replicate Id	dimensionless
Fertilization_Ratio	Fertilization Ratio = ratio of fertilization eggs to total eggs	ratio

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Instruments

Dataset-specific Instrument Name	Hemocytometer
Generic Instrument Name	Hemocytometer
Dataset-specific Description	Sperm were collected dry from the gonopores of males and placed in a small vial and kept on ice until use. A 0.1% dilution from dry sperm was made to verify sperm motility, and then preserved in formalin to count sperm densities with a hemacytometer in order to calculate the amount of diluted sperm required to attain desired sperm-egg ratios and sperm densities for each treatment.
Generic Instrument Description	A hemocytometer is a small glass chamber, resembling a thick microscope slide, used for determining the number of cells per unit volume of a suspension. Originally used for performing blood cell counts, a hemocytometer can be used to count a variety of cell types in the laboratory. Also spelled as "haemocytometer". Description from: http://hlsweb.dmu.ac.uk/ahs/elearning/RITA/Haem1/Haem1.html.

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Deployments

lab_SIO_Levin

Website	https://www.bco-dmo.org/deployment/59108
Platform	SIO Levin
Report	http://levin.ucsd.edu/
Start Date	2009-10-01
End Date	2012-08-31
Description	Macrophyte-induced variability in coastal ocean pH and consequences for invertebrate larvae

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Project Information

Macrophyte-induced variability in coastal ocean pH and consequences for invertebrate larvae (SeapHOx)

Coverage: Coastal CA; San Diego La Jolla Kelp Forest; 32.8 N; 117.3 W

Increased concentrations of atmospheric carbon dioxide are acidifying the marine environment at unprecedented rates. However, relative to the open ocean, predictions of ocean acidification for the coastal ocean are confounded by the greater inherent variability of carbonate chemistry which includes macrophyte photosynthesis and respiration. This proposal addresses the interplay between anthropogenically driven pH changes and the inherently variable coastal ocean carbonate chemistry, and will directly test the implications for a potentially sensitive life form, invertebrate larvae.

The objectives of this study are to measure the impact of key coastal habitats on natural pH variance, and to evaluate the implications these pH regimes have for developing invertebrate larvae. To achieve these objectives the investigators will characterize temporal and spatial carbonate chemistry variability inside and outside kelp forests in San Diego, California. With discrete water samples for the determination of total alkalinity and dissolved inorganic carbon, and continuous autonomous instruments which measure pH, dissolved oxygen, salinity, and temperature, a statistical characterization of carbonate chemistry variability will identify diurnal, seasonal and spatial trends as well as frequencies of maximum variation, rates of change, lowest potential pH (extreme statistics), and biologically-significant thresholds. Subsequently, prominent macrophyte-induced pH regimes will be mimicked in laboratory experiments and incorporated with ocean acidification predictions to test effects of (a) decreased pH, (b) varying pH about the mean, (c) changing variance about mean pH, and (c) pulsed exposure to extreme low pH, on larval survivorship, growth, and calcification responses of multiple species. Together, these laboratory and field studies will offer a mechanistic understanding of the effects of natural variance of carbonate chemistry in the context of ocean acidification for marine invertebrate larvae.

Four moorings identified as SeapHOx Moorings have been deployed in the San Diego La Jolla Kelp Forest in the vicinity of 32.8 N 117.3 W.

Mooring Locations

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Program Information

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0927445

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