Development and survivorship of juvenile red abalone

Website: https://www.bco-dmo.org/dataset/714014
Version:

Project
» Ocean Acidification: Collaborative Research: Interactive effects of acidification, low dissolved oxygen and temperature on abalone population dynamics within the California Current (CA Current MS Abpop)

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

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Table of Contents

Dataset Description

[2017-08-28]: The metadata for this dataset page is in progress. Data will also be made available by clicking the "get data" button on this page.

This dataset contains code and results from Darlly Carlson's Honors Thesis at Stanford University in 2017: The Impacts of Ocean Acidification on the Development and Survivorship of Juvenile Abalone (Haliotis rufescens).

The code, and originally submitted data, and thesis abstract are available to download as a .zip file: Carlson_Honors_Thesis_2017_Stanford.zip

These files are also available in the following GitHub repository: Carlson_Honors_Thesis_2017_Stanford (release 1.1).

Methods & Sampling

A gas-controlled aquarium (GCA) system housed at Monterey Bay Aquarium Research Institute was utilized, 64 tanks that are individually and randomly delivered water from each of 4 predefined treatments: (1) ambient pH with ambient temperature (control); (2) reduced pH with ambient temperature (OA individually); (3) ambient pH with heated temperature (OW individually); and (4) low pH with heated temperature (OA and OW). Ambient seawater was collected from an intake in Monterey Bay. Offset values from ambient were used as opposed to

constant treatments to achieve fluctuation that matched the degree of natural daily/seasonal fluctuations in Monterey. Low pH was defined as a - 0.5 pH unit offset from ambient to represent potential OA conditions projected for the year 2100, exacerbated by upwelling. Erroneous system functioning caused unexpected spiking of temperature within temperature treated tanks, thus these treatments were not utilized in analysis. 256 juvenile H. rufescens (post-settlement, <1 yr) of 2 size classes were weighed and photographed for later measurement of initial shell length and surface area using ImageJ. Individuals were randomly distributed into GCA system tanks in groups of 4, 2 of each size class. After 28 days, abalone were once again photographed and weighed. Shells and tissue were separated, and shells were dried and measured for final dry shell weight. There was a significant interaction between pH and size class, $F(1,124) = 4.31$, $p = 0.04$. The small size class in low pH was significantly different in change in surface area from the other group means, with a mean change of -0.006 ± 0.039 cm2 (mean ± SD) while all others had positive average changes. Final dry shell weight varied with size class and pH, $F(1,124) = 422.9$, $p < 0.001$, and $F(1,124) = 6.61$, $p = 0.01$, respectively. The small size class in high pH had a significantly higher average final dry shell weight, 0.138 ± 0.052 g (mean ± SD), than that of the small size class in low pH, 0.104 ± 0.034 g (mean ± SD), $p = 0.027$. Size class significantly predicted mortality, $z = 2.515$, $p = 0.012$.

Data Processing Description

BCO-DMO data manager processing notes:

Originally submitted GitHub repository https://github.com/upwelling/Carlson_Honors_Thesis_2017_Stanford was forked to https://github.com/BCODMO/Carlson_Honors_Thesis_2017_Stanford for curation purposes and tagged with release 1.1 which corresponds with this dataset submission. Note that original repository may have continued updates.

[table of contents | back to top]

Parameters

Parameters for this dataset have not yet been identified

[table of contents | back to top]

Project Information

Ocean Acidification: Collaborative Research: Interactive effects of acidification, low dissolved oxygen and temperature on abalone population dynamics within the California Current (CA Current MS Abpop)

Coverage: Southern Monterey Bay, CA, USA: 36.6205 N, 121.9045 W; Isla Natividad, Mexico: 27.8758 N, 115.1847 W

Ocean acidification is increasingly recognized as a significant driver of change in marine ecosystems. In particular, ecosystems in eastern boundary current systems, including the California Current Large Marine Ecosystem (CCLME), routinely experience upwelling driven low pH, low dissolved oxygen (DO) waters in shallow near shore habitats, and these occurrences have been increasing in magnitude and duration over the past decade.

The goal of this project is to study the consequences of ocean acidification and other climate-related changes (dissolved oxygen(DO), temperature) in oceanographic conditions on near shore marine communities over a large scale oceanographic gradient in the CCLME. Understanding how the effects of ocean acidification combined with other climate-related changes on individual marine organisms or life stages will cascade to populations and the services they provide is a high priority for science, management, and policy. By integrating the results of oceanographic field measurements and laboratory experiments in a demographic and bio-economic modeling framework, the present project will advance our understanding of the role of oceanographic variability on the dynamics of marine populations and fisheries. In particular, this research will

provide key insights regarding the interactive influences of simultaneous changes in pH, DO, and temperature on nearshore populations and fisheries. By investigating the effects of multiple stressors on coastal marine ecosystems, the project will allow us to better anticipate possible ecological and fishery impacts of increasing frequency and/or intensity of low pH and low DO events. A deeper understanding of the linkages among ocean acidification, coastal oceanographic processes and the health of nearshore marine ecosystems in the CCLME will inform adaptation strategies for future ocean conditions.

The research program will implement a novel individual- to population-level approach to specifically investigate how the direct effects of ocean acidification, alone or in combination with low DO and temperature, on two model species of great ecological and commercial relevance, red and pink abalone, will manifest at the population level, and ultimately, the services these species provide to humans. Researchers will: 1) measure and characterize the temporal variability of pH, DO and temperature in nearshore abalone habitat in Monterey Bay, Central California, and Isla Natividad, Mexico, particularly in relation to the duration and intensity of extreme low pH, low DO events, under alternative scenarios of future climate change, 2) conduct laboratory experiments to investigate the effects of low pH, low DO conditions on the reproductive success, growth, calcification, and survival of juvenile red and pink abalone, and 3) develop demographic and bio-economic models to estimate the impacts of environmental and local anthropogenic stressors on the resilience of abalone populations and to assess what management and conservation strategies, including the implementation of networks of marine reserves, may contribute to buffering the negative effects of increased frequency and/or intensity of low pH and low DO events expected under near-future climate scenarios.

[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-1416877
NSF Division of Ocean Sciences (NSF OCE)	OCE-1416837
NSF Division of Ocean Sciences (NSF OCE)	OCE-1416934

[table of contents | back to top]