Results of an experiment on recruitment and succession on a tropical benthic reef community in response to in-situ ocean acidification in Puerto Morelos, Quintana Roo, Mexico from 2010-2011 (CalcificationLowSatSeawater project)

Website: https://www.bco-dmo.org/dataset/564766
Data Type: Other Field Results
Version: 1
Version Date: 2015-09-09

Project
» Calcification in low saturation seawater: What can we learn from organisms in the proximity of low pH; undersaturated submarine springs (CalcificationLowSatSeawater)

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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Abstract
Results of an experiment on recruitment and succession on a tropical benthic reef community in response to in-situ ocean acidification in Puerto Morelos, Quintana Roo, Mexico from 2010-2011.

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Coverage

Spatial Extent: **N**:20.87923 **E**:-86.86092 **S**:20.87768 **W**:-86.86098
Temporal Extent: 2010-08-28 - 2011-10-19

Dataset Description

Percent cover of all taxa associated with a year-long recruitment experiment on a tropical benthic reef community in response to ocean acidification. Study conducted at Puerto Morelos, Quintana Roo, Mexico in water 200 m offshore.

Methods & Sampling

The purpose of this study was to determine how ocean acidification impacts recruitment and development of a benthic reef community using a field site that experiences naturally low drops in saturation state. To mimic the natural karst substrate of the Yucatan, the investigators deployed 40 limestone tiles (15 x 15 cm), acquired from a quarry near Puerto Morelos. Twenty tiles were deployed at each of two sites (Ojo Gorgos and Ojo Laja); 10 in a low saturation zone (Ωarag ~ 1.5) in the direct vicinity of the spring discharge (Center), and 10 in an ambient zone (Ωarag ~ 3.8) about 5 m from the springs (Control). The tiles were bolted to concrete masonry blocks. The investigators deployed the tiles on 28 August 2010, and removed subsets of three randomly selected tiles from each treatment after 3 months (25 November 2010) and 6 months (14 March 2011), and removed the four remaining tiles after 14 months (19 October 2011). Upon removal, the tiles were photographed, fixed in a 4% formalin solution for 48 hours, and then stored in 70% ethanol until analyzed.

The main focus of this study was to determine how acidification may impact community level changes, and specifically, to determine functional differences between the communities inside and outside of the springs. Organisms on the tiles were assigned to eleven functional groups. The tiles were divided into 1.5 x 3 cm subplots on the edges and 3 x 3 cm subplots on the face of the tiles for visual estimates of percent cover. Subplot estimates were then summed for total percent cover. Encrusting foraminifera, molluscs, and polychaetes were counted and measured using a Celestron digital microscope (0.1 mm accuracy).

Sampling and analytical methodology are modeled after:
Kroeker KJ, Micheli F, Gambi MC. 2012. Ocean acidification causes ecosystem shifts via altered competitive interactions. Nature. doi: 10.1038/NCLIMATE1680

Data Processing Description

Data reported are the percent cover estimates for each functional group found on the tiles. All three replicate tiles are provided. For the polychaete, vermetid molluscs, and foraminifera, mean diameters are given, based on 0.1 mm accuracy.

BCO-DMO Processing Notes:
- Modified parameter names to conform with BCO-DMO naming conventions;
- Replaced blanks (missing data) with 'nd' to indicate 'no data';
- Added site lat and lon values provided by dataset contact person.

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Data Files

File	
Recruit_Success.csv	(Comma Separated Values (.csv), 28.22 KB) MD5:429577bc9d9c4d6b54e494fbfd4ca0c6
Primary data file for dataset ID 564766	

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Related Publications

Kroeker, K. J., Micheli, F., & Gambi, M. C. (2012). Ocean acidification causes ecosystem shifts via altered competitive interactions. Nature Climate Change, 3(2), 156–159. doi:10.1038/nclimate1680
https://doi.org/10.1038/NCLIMATE1680
Methods

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Parameters

Parameter	Description	Units
taxa	Name of the taxa/functional group.	text
month	Number of months passed from tile deployment. Tiles were deployed on 28 August 2010, and three randomly selected tiles from each treatment were removed after 3 months (25 November 2010) and 6 months (14 March 2011), and the four remaining tiles were removed after 14 months (19 October 2011).	integer
site	There were two sites: Ojo Gorgos (Gorg) and Ojo Laja (Laja).	text
zone	There are two zones within each site: Control (Con) or Center (Cen).	text
tile	Tile number (replicate).	integer
pcnt_cover	Percent cover estimate (not provided for polychaete, vermetid molluscs, and foraminifera).	percent (%)
num_per_tile	Number per tile. (Provided only for polychaete, vermetid molluscs, and foraminifera.)	number per tile
mean_diameter	Mean diameter, based on 0.1 mm accuracy. (Provided only for polychaete, vermetid molluscs, and foraminifera.)	millimeters (mm)
lat	Site latitude.	decimal degress
lon	Site longitude.	decimal degrees

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Deployments

Paytan_2010-11

Website	https://www.bco-dmo.org/deployment/565778
Platform	Puerto_Morelos_Reef
Start Date	2010-08-28
End Date	2011-10-19

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Project Information

Calcification in low saturation seawater: What can we learn from organisms in the proximity of low pH; undersaturated submarine springs (CalcificationLowSatSeawater)

Coverage: Puerto Morelos, Quintana Roo, Mexico

NSF Abstract:
To date scientists have primarily used short-term single species experiments to study responses of organisms to increased pCO2. While these experiments are important, they represent an artificial situation, being isolated from many of the biological interactions. Moreover, these experiments do not truly reflect the effects on organisms over longer timescales in actual field situations.

In this study, researchers at the University of California at Santa Cruz will assess the utility of low pH submarine springs as field study sites for investigating calcification at low aragonite saturation. It has been reported that many reef-building corals cease calcification at saturation as high as 2.0; around these springs calcifying corals inhibit waters well below this value. Work will take place at a series of springs in Mexico where discharging water pH ranges from 8.07 to 7.25 and saturation from less than 0.5 to 5. While these springs are

by no means analogs for future ocean calcification they can still provide a natural laboratory to study controls on coral calcification. Field observations are usually confounded by the presence of many potentially important variables in addition to saturation. Moreover, it is not trivial to quantify the natural spatial and temporal variability of the parameters of interest. Thus it is not clear how useful this setting might be for conducting extensive field based calcification research (high risk). Accordingly, the research team will conduct field surveys to map the chemical and physical characteristics of the water around the springs (and corals) and describe population and community patterns along the saturation gradient. They will install probes to capture the temporal and spatial variability. These observations should allow assessment of the site's utility for researching processes that sustain calcification at low saturation and for future manipulative experiments.

Background publications:
Crook ED, Potts D, Rebolledo-Vieyra M, Hernandez L, Paytan A. 2011. Calcifying coral abundance near low pH springs: implications for future ocean acidification. Coral Reefs, 31(1): 239-245.
Paytan A, Crook ED, Cohen AL, Martz T, Takeshita Y et al. 2014. Reply to Iglesias-Prieto et al.: Combined field and laboratory approaches for the study of coral calcification. Proc Natl Acad Sci USA, 111 (3): E302-E303.
Crook ED, Cohen AL, Rebolledo-Veiyra M, Hernandez L, Paytan A. 2013. Reduced calcification and lack of acclimatization by coral colonies growing in areas of persistent natural acidification. Proc Natl Acad Sci USA, 110 (27): 1044-1049.

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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

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)

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1040952

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