Comeau 2017 PRSB: TA anomaly calcification

Website: https://www.bco-dmo.org/dataset/754766
Data Type: Other Field Results
Version: 1
Version Date: 2019-02-01

Project
» RUI: Ocean Acidification- Category 1- The effects of ocean acidification on the organismic biology and community ecology of corals, calcified algae, and coral reefs (OA_Corals)
» Collaborative Research: Ocean Acidification and Coral Reefs: Scale Dependence and Adaptive Capacity (OA coral adaptation)

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

Contributors	Affiliation	Role
Carpenter, Robert	California State University Northridge (CSUN)	Principal Investigator
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Abstract
These data were published in (Comeau et al. 2017).

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Coverage

Temporal Extent: 2014-03-31 - 2014-12-04

Methods & Sampling

Alkalinity anomaly technique [27] was used to differentiate short-term (approx. 30 min) calcification in the light

and dark at the end of the two week incubation period. After 10 days of incubation, nubbins were chosen randomly from the tanks and placed in separate 100 ml glass beakers containing seawater from the respective incubation tanks. Light incubations were performed in the morning after corals were exposed to a minimum of 1 h of light. Dark incubations were performed at the end of the night on corals that were acclimated to darkness for more than 8 h.

See Comeau et al. (2017) for a detailed overview of the methodology.

Location:
Centre Scientifique de Monaco

Data Processing Description

R packages:
Jean-Pierre Gattuso, Jean-Marie Epitalon, Heloise Lavigne and James Orr . seacarb: Seawater Carbonate Chemistry. https://CRAN.R-project.org/package=seacarb

BCO-DMO Data Manager Processing Notes:
* Data submitted as sheet "TA anomaly calcification" in original excel file "comeau et al. 2017_proceedings_data.xlsx" exported as csv with the formatting that was set in Excel.
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions: only A-Za-z0-9 and underscore allowed. Can not start with a number. (spaces, +, and - changed to underscores).

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Related Publications

Comeau, S., Tambutté, E., Carpenter, R. C., Edmunds, P. J., Evensen, N. R., Allemand, D., ... Venn, A. A. (2017). Coral calcifying fluid pH is modulated by seawater carbonate chemistry not solely seawater pH. Proceedings of the Royal Society B: Biological Sciences, 284(1847), 20161669. doi:10.1098/rspb.2016.1669
Results

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Related Datasets

IsRelatedTo

Carpenter, R., Edmunds, P. J., Comeau, S. (2020) **Comeau 2017 PRSB: Buoyant weight calcification.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-12-02 http://lod.bco-dmo.org/id/dataset/754794 [view at BCO-DMO]
Relationship Description: Data from the same experiment.

Carpenter, R., Edmunds, P. J., Comeau, S. (2020) **Comeau 2017 PRSB: Carbonate chemistry.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-12-02 http://lod.bco-dmo.org/id/dataset/754818 [view at BCO-DMO]
Relationship Description: Data from the same experiment.

Carpenter, R., Edmunds, P. J., Comeau, S. (2020) **Comeau 2017 PRSB: Photosynthesis.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-12-02 http://lod.bco-dmo.org/id/dataset/754782 [view at BCO-DMO]
Relationship Description: Data from the same experiment.

Carpenter, R., Edmunds, P. J., Comeau, S. (2020) **Comeau 2017 PRSB: Snarf pH.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-12-02 http://lod.bco-dmo.org/id/dataset/754806 [view at BCO-DMO]
Relationship Description: Data from the same experiment.

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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	Mettler Toledo T50
Generic Instrument Name	Titrator
Dataset-specific Description	TA: Mettler Toledo T50
Generic Instrument Description	Titrators are instruments that incrementally add quantified aliquots of a reagent to a sample until the end-point of a chemical reaction is reached.

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Project Information

RUI: Ocean Acidification- Category 1- The effects of ocean acidification on the organismic biology and community ecology of corals, calcified algae, and coral reefs (OA_Corals)

Coverage: Moorea, French Polynesia

While coral reefs have undergone unprecedented changes in community structure in the past 50 y, they now may be exposed to their gravest threat since the Triassic. This threat is increasing atmospheric CO2, which equilibrates with seawater and causes ocean acidification (OA). In the marine environment, the resulting decline in carbonate saturation state (Omega) makes it energetically less feasible for calcifying taxa to mineralize; this is a major concern for coral reefs. It is possible that the scleractinian architects of reefs will cease to exist as a mineralized taxon within a century, and that calcifying algae will be severely impaired. While there is a rush to understand these effects and make recommendations leading to their mitigation, these efforts are influenced strongly by the notion that the impacts of pCO2 (which causes Omega to change) on calcifying taxa, and the mechanisms that drive them, are well-known. The investigators believe that many of the key processes of mineralization on reefs that are potentially affected by OA are only poorly known and that current knowledge is inadequate to support the scaling of OA effects to the community level. It is vital to measure organismal-scale calcification of key taxa, elucidate the mechanistic bases of these responses, evaluate community scale calcification, and finally, to conduct focused experiments to describe the functional relationships between these scales of mineralization.

This project is a 4-y effort focused on the effects of Ocean Acidification (OA) on coral reefs at multiple spatial and functional scales. The project focuses on the corals, calcified algae, and coral reefs of Moorea, French Polynesia, establishes baseline community-wide calcification data for the detection of OA effects on a decadal-scale, and builds on the research context and climate change focus of the Moorea Coral Reef LTER.

This project is a hypothesis-driven approach to compare the effects of OA on reef taxa and coral reefs in Moorea. The PIs will utilize microcosms to address the impacts and mechanisms of OA on biological processes, as well as the ecological processes shaping community structure. Additionally, studies of reef-wide metabolism will be used to evaluate the impacts of OA on intact reef ecosystems, to provide a context within which the experimental investigations can be scaled to the real world, and critically, to provide a much needed reference against which future changes can be gauged.

Datasets listed in the "Dataset Collection" section include references to results journal publications published as part of this project.

Collaborative Research: Ocean Acidification and Coral Reefs: Scale Dependence and Adaptive Capacity (OA coral adaptation)

Website: http://mcr.lternet.edu

Coverage: Moorea, French Polynesia

Extracted from the NSF award abstract:

This project focuses on the most serious threat to marine ecosystems, Ocean Acidification (OA), and addresses the problem in the most diverse and beautiful ecosystem on the planet, coral reefs. The research utilizes Moorea, French Polynesia as a model system, and builds from the NSF investment in the Moorea Coral Reef Long Term Ecological Research Site (LTER) to exploit physical and biological monitoring of coral reefs as a context for a program of studies focused on the ways in which OA will affect corals, calcified algae, and coral reef ecosystems. The project builds on a four-year NSF award with research in five new directions: (1) experiments of year-long duration, (2) studies of coral reefs to 20-m depth, (3) experiments in which carbon dioxide will be administered to plots of coral reef underwater, (4) measurements of the capacity of coral reef organisms to change through evolutionary and induced responses to improve their resistance to OA, and (5) application of emerging theories to couple studies of individual organisms to studies of whole coral reefs. Broader impacts will accrue through a better understanding of the ways in which OA will affect coral reefs that are the poster child for demonstrating climate change effects in the marine environment, and which provide income, food, and coastal protection to millions of people living in coastal areas, including in the United States.

This project focuses on the effects of Ocean Acidification on tropical coral reefs and builds on a program of research results from an existing 4-year award, and closely interfaces with the technical, hardware, and information infrastructure provided through the Moorea Coral Reef (MCR) LTER. The MCR-LTER, provides an unparalleled opportunity to partner with a study of OA effects on a coral reef with a location that arguably is better instrumented and studied in more ecological detail than any other coral reef in the world. Therefore, the results can be both contextualized by a high degree of ecological and physical relevance, and readily integrated into emerging theory seeking to predict the structure and function of coral reefs in warmer and more acidic future oceans. The existing award has involved a program of study in Moorea that has focused mostly on short-term organismic and ecological responses of corals and calcified algae, experiments conducted in mesocosms and flumes, and measurements of reef-scale calcification. This new award involves three new technical advances: for the first time, experiments will be conducted of year-long duration in replicate outdoor flumes; CO2 treatments will be administered to fully intact reef ecosystems in situ using replicated underwater flumes; and replicated common garden cultivation techniques will be used to explore within-species genetic variation in the response to OA conditions. Together, these tools will be used to support research on corals and calcified algae in three thematic areas: (1) tests for long-term (1 year) effects of OA on growth, performance, and fitness, (2) tests for depth-dependent effects of OA on reef communities at 20-m depth where light regimes are attenuated compared to shallow water, and (3) tests for beneficial responses to OA through intrinsic, within-species genetic variability and phenotypic plasticity. Some of the key experiments in these thematic areas will be designed to exploit integral projection models (IPMs) to couple organism with community responses, and to support the use of the metabolic theory of ecology (MTE) to address scale-dependence of OA effects on coral reef organisms and the function of the communities they build.

The following publications and data resulted from this project:

Comeau S, Carpenter RC, Lantz CA, Edmunds PJ. (2016) Parameterization of the response of calcification to temperature and pCO2 in the coral Acropora pulchra and the alga Lithophyllum kotschyanum. Coral Reefs 2016. DOI 10.1007/s00338-016-1425-0.
calcification rates (2014)
calcification rates (2010)

Comeau, S., Carpenter, R.C., Edmunds, P.J. (2016) Effects of pCO2 on photosynthesis and respiration of tropical scleractinian corals and calcified algae. ICES Journal of Marine Science doi:10.1093/icesjms/fsv267.
respiration and photosynthesis I
respiration and photosynthesis II

Evensen, N.R. & Edmunds P. J. (2016) Interactive effects of ocean acidification and neighboring corals on the growth of Pocillopora verrucosa. Marine Biology, 163:148. doi: 10.1007/s00227-016-2921-z
coral growth
seawater chemistry
coral colony interactions

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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)

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

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1041270
NSF Division of Ocean Sciences (NSF OCE)	OCE-1415268

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