

Experimental results of calcification rates of corals at variable pCO2 from the Richard B Gump Research Station, Moorea, French Polynesia in 2011 (MCR LTER project, OA_Corals project)

Website: <https://www.bco-dmo.org/dataset/518462>
Data Type: experimental
Version: 2014-07-09

- Project**
» [Moorea Coral Reef Long-Term Ecological Research site](#) (MCR LTER)
» [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)

- Programs**
» [Long Term Ecological Research network](#) (LTER)
» [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

These data were obtained during an experiment performed in August-September-October 2011 and 2012 in French Polynesia. Calcification rates were measured in 8 corals (*Porites rus*, massive *Porites*, *Porites irregularis*, *Pocillopora damicornis*, *Pocillopora verrucosa*, *Psammacora profundacella*, *Pavona cactus*, *Acropora pulchra*) at 6 pCO2.

Related References:

Comeau, S., Edmunds, P. J., Spindel, N. B., Carpenter, R. C. (2014). Fast coral reef calcifiers are more sensitive to ocean acidification in short-term laboratory incubations. *Limnology and Oceanography*, 59(3), 1081–1091. doi:10.4319/lo.2014.59.3.1081

Comeau, S., Edmunds, P. J., Spindel, N. B., Carpenter, R. C. (2013) The responses of eight coral reef calcifiers to increasing partial pressure of CO2 do not exhibit a tipping point. *Limnol. Oceanogr.* 58, 388–398.

Related datasets:

[algae calcification](#)
[carbonate chemistry](#)
[light dark calcification](#)
[mean calcification](#)
[calcification rates - flume expt](#)
[carbonate chemistry - flume expt](#)

Methods & Sampling

For the carbonate chemistry:

Seawater pH was measured twice a day (08:00 hrs and 18:00 hrs) in each incubation tank, using a pH meter (Orion, 3-stars mobile) calibrated every 2-3 d on the total scale using Tris/HCl buffers (Dickson, San Diego, USA) with a salinity of 34.5. Total alkalinity of the seawater in the tanks was measured every 2 d, using single samples drawn from each tank in glass-stoppered bottles (250 mL). Samples were analyzed for total alkalinity within 1 d using open cell, potentiometric titration and an automatic titrator (T50, Mettler-Toledo). Titrations were conducted on 50-mL samples at ~ 24 °C, and total alkalinity calculated as described by Dickson et al. [2007]. Titrations of certified reference materials (CRM) provided by A. G. Dickson (batch 105) yielded total alkalinity values within 3.8 umol kg⁻¹ of the nominal value (SD = 3.1 umol kg⁻¹; n = 19). Salinity in the experimental tanks was measured every 2 d using a conductivity meter (YSI 3100). Total alkalinity, pH on the total scale (pHT), temperature, and salinity were used to calculate the carbonate chemistry using the seacarb package (Lavigne and Gattuso 2012) running in R software (R Foundation for Statistical Computing).

Calcification:

Buoyant weight (± 1 mg) was recorded before and after the 15 d of incubation (following 15 d of acclimation), and the difference between the two was converted to dry weight using an aragonite density of 2.93 g cm⁻³ for corals. Calcification was normalized to surface area estimated using aluminum foil for corals.

Data Processing Description

Parameters of the carbonate system in seawater were calculated from salinity, temperature, AT and pHT using the R package seacarb (Lavigne and Gattuso 2011).

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Data Files

File
coral_calc.csv (Comma Separated Values (.csv), 42.65 KB) MD5:236a36683e3205dc755dca43bafb83ee
Primary data file for dataset ID 518462

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Parameters

Parameter	Description	Units
species_coral	Coral species used during experiment.	dimensionless
treatment_pCO2	pCO2 concentration for each species treatment.	microatmospheres
rate_calcification	Calcification in corals normalized by surface area.	mg CaCO3 cm-2 d-1
lab	Name of laboratory where experiments were conducted.	dimensionless
lat	Latitude component of geographic location of laboratory.	decimal degrees
lon	Longitude component of geographic location of laboratory.	decimal degrees

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Instruments

Dataset-specific Instrument Name	Automatic titrator
Generic Instrument Name	Automatic titrator
Generic Instrument Description	Instruments that incrementally add quantified aliquots of a reagent to a sample until the end-point of a chemical reaction is reached.

Dataset-specific Instrument Name	pH Sensor
Generic Instrument Name	pH Sensor
Generic Instrument Description	An instrument that measures the hydrogen ion activity in solutions. The overall concentration of hydrogen ions is inversely related to its pH. The pH scale ranges from 0 to 14 and indicates whether acidic (more H+) or basic (less H+).

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Deployments

lab_Carpenter_Moorea

Website	https://www.bco-dmo.org/deployment/58885
Platform	Richard B Gump Research Station - Moorea LTER
Start Date	2011-07-17
End Date	2011-08-12
Description	Laboratory experiments carried out by R. Carpenter and P. Edmunds of California State University Northridge at the Richard B. Gump Research Station in French Polynesia, for the 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".

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Project Information

Moorea Coral Reef Long-Term Ecological Research site (MCR LTER)

Website: <http://mcr.lternet.edu/>

Coverage: Island of Moorea, French Polynesia

From <http://www.lternet.edu/sites/mcr/> and <http://mcr.lternet.edu/>:

The Moorea Coral Reef LTER site encompasses the coral reef complex that surrounds the island of Moorea, French Polynesia (17°30'S, 149°50'W). Moorea is a small, triangular volcanic island 20 km west of Tahiti in the Society Islands of French Polynesia. An offshore barrier reef forms a system of shallow (mean depth ~ 5-7 m), narrow (~0.8-1.5 km wide) lagoons around the 60 km perimeter of Moorea. All major coral reef types (e.g., fringing reef, lagoon patch reefs, back reef, barrier reef and fore reef) are present and accessible by small boat.

The MCR LTER was established in 2004 by the US National Science Foundation (NSF) and is a partnership between the University of California Santa Barbara and California State University, Northridge. MCR researchers include marine scientists from the UC Santa Barbara, CSU Northridge, UC Davis, UC Santa Cruz, UC San Diego, CSU San Marcos, Duke University and the University of Hawaii. Field operations are conducted from the UC Berkeley Richard B. Gump South Pacific Research Station on the island of Moorea, French Polynesia.

MCR LTER Data: The Moorea Coral Reef (MCR) LTER data are managed by and available directly from the MCR project data site URL shown above. The datasets listed below were collected at or near the MCR LTER sampling locations, and funded by NSF OCE as ancillary projects related to the MCR LTER core research themes.

This project is supported by continuing grants with slight name variations:

- LTER: Long-Term Dynamics of a Coral Reef Ecosystem
- LTER: MCR II - Long-Term Dynamics of a Coral Reef Ecosystem
- LTER: MCR IIB: Long-Term Dynamics of a Coral Reef Ecosystem
- LTER: MCR III: Long-Term Dynamics of a Coral Reef Ecosystem
- LTER: MCR IV: Long-Term Dynamics of a Coral Reef Ecosystem

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.

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Program Information

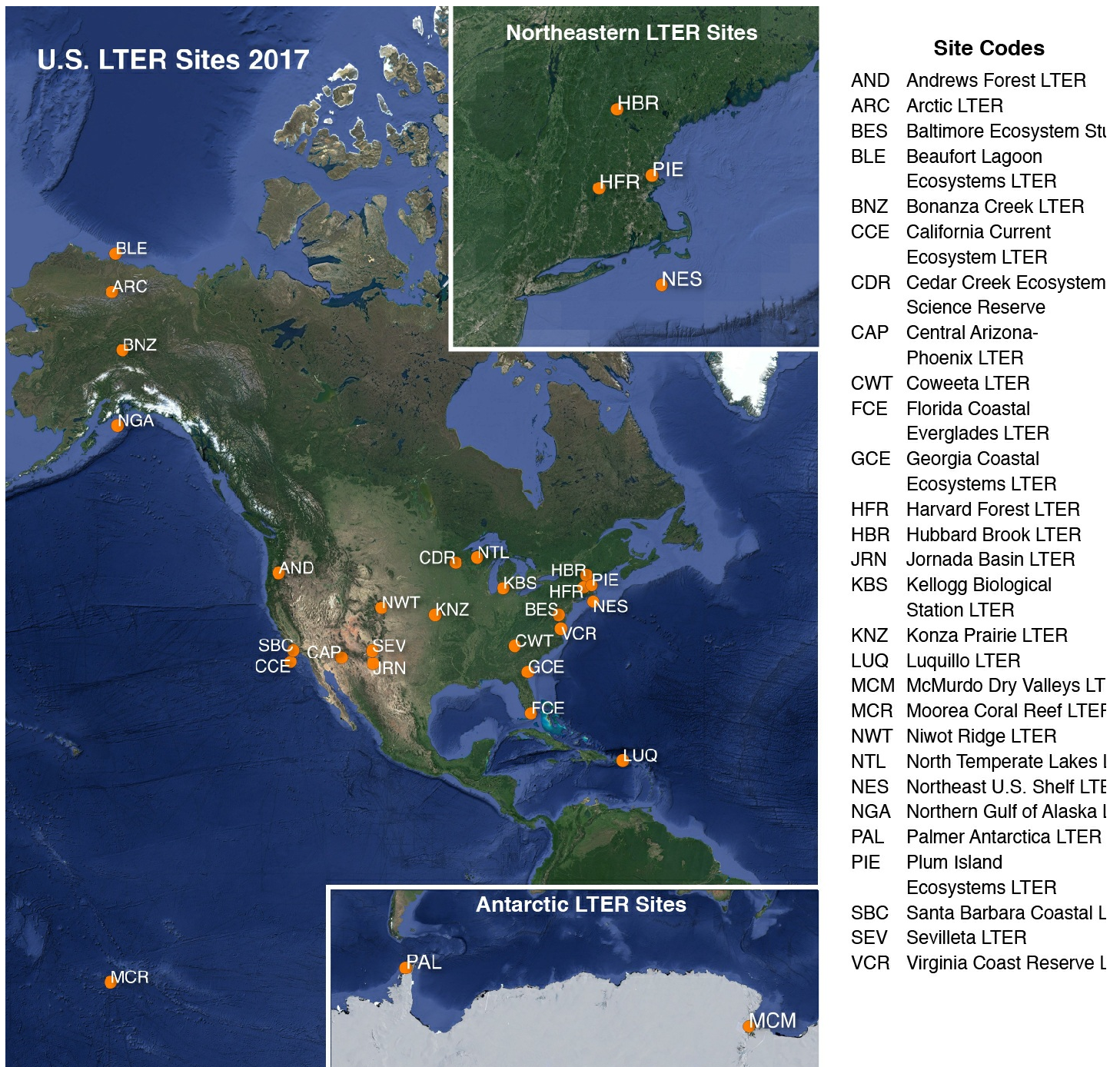
Long Term Ecological Research network (LTER)

Website: <http://www.lternet.edu/>

Coverage: United States

adapted from <http://www.lternet.edu/>

The National Science Foundation established the LTER program in 1980 to support research on long-term ecological phenomena in the United States. The Long Term Ecological Research (LTER) Network is a collaborative effort involving more than 1800 scientists and students investigating ecological processes over long temporal and broad spatial scales. The LTER Network promotes synthesis and comparative research across sites and ecosystems and among other related national and international research programs. The LTER research sites represent diverse ecosystems with emphasis on different research themes, and cross-site communication, network publications, and research-planning activities are coordinated through the LTER Network Office.



2017 LTER research site map obtained from <https://lternet.edu/site/lter-network/>

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-1041270

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