

Experimental results of effects of acidification on corals and calcified algae collected from the Richard B Gump Research Station during 2011, in French Polynesia (MCR LTER project, OA_Corals project)

Website: <https://www.bco-dmo.org/dataset/3814>

Data Type: experimental

Version: 2012-12-03

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

Carbonate chemistry components of various seawater treatments used during experiments involving the coral *Porites rus* and alga *Hydrolithon onkodes*. These data are part of a larger data set containing light, dark, and mean calcification rates, which in turn are part of experiments performed during July-August 2011 in French Polynesia to test the effect of various concentrations of carbonate and bicarbonate ions on the calcification of a coral and a calcifying alga.

Related References:

- Comeau, S., Carpenter, R. C., & Edmunds, P. J. (2013). Coral reef calcifiers buffer their response to ocean acidification using both bicarbonate and carbonate. *Proceedings of the Royal Society B: Biological Sciences*, 280(1753), 20122374. doi:10.1098/rspb.2012.2374

Related datasets:

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

Methods & Sampling

Seawater pH was measured once or twice a day (08:00 hrs and 18:00 hrs) in each incubation tank, using a pH meter (Orion, 3-stars mobile) or an automatic titrator (T50, Mettler-Toledo) 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 following water changes, 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 4.0 µmol kg⁻¹ of the nominal value (SD = 4.1 µmol kg⁻¹; n = 12). 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 [HCO₃⁻] and [CO₃²⁻] using the seacarb package (Lavigne and Gattuso 2011) running in R software (R Foundation for Statistical Computing).

Data Processing Description

BCO-DMO Processing Notes:

Original data file: "Raw_data_Comeau_et_al_PRSB-1.xls" contained three spreadsheets. This file was split into three separate datasets. Resultant datasets were edited in excel by BCO-DMO. The following edits were made to the file carbonate_chemistry.dat:

- Added BCO-DMO header
- edited 'Date' to 'date_local', removed alphanumeric 'date_local' from final view
- edited 'Dissolved Inorganic Carbon' to 'DIC'
- edited 'Total Alkalinity' to 'TALK'
- edited 'Temperature' to 'temp'
- replaced spaces in condition text with underscores
- Added 'day_local', 'month_local', 'year' to served view
- Added 'lat' and 'lon' column of experiment site (Richard B. Gump Research Site, Moorea) to file
- Added title, version and PI lines

-2012.12.07 Data contact S. Comeau submitted an updated file with corrected dates.

-2013.09.29 Header parameter names edited/corrected as per S. Comeau.

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Data Files

File
carbonate_chemistry.csv (Comma Separated Values (.csv), 59.14 KB) MD5:d9a3ee99ee7c262d5880bd72062b3d54
Primary data file for dataset ID 3814

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Parameters

Parameter	Description	Units
lat	Latitude component of geographic position where experiments were conducted.	decimal degrees
lon	Longitude component of geographic position where experiments were conducted.	decimal degrees
year	Four-digit year.	yyyy
month_local	Two-digit month of the year in local time.	mm
day_local	Two-digit day in local time.	dd
condition	Experimental treatment of various concentrations of carbonate and bicarbonate ions used to test the effects of various carbonate chemistry regimes on coral and calcifying alga.	dimensionless
pH	Measure of the acidity of a solution based upon the log of the hydrogen ion concentration.	dimensionless; pH scale
pCO2	Partial pressure of CO2 in seawater.	micro atmospheres
CO3	Carbonate ion concentration.	mol/kg
HCO3	Bicarbonate ion concentration.	mol/kg
DIC	Dissolved inorganic carbon.	mol/kg
TALK	Total Alkalinity; a measure of the ability of a solution to neutralize acids to the equivalence point of carbonate or bicarbonate, equal to the sum of the bases in solution.	mol/kg
temp	Water temperature.	degrees Celsius
deploy_id	Unique descriptor for experiments, indicating physical location where they were conducted (lab), lead investigator and lab location.	dimensionless
yday_local	Day of year in local time.	ddd

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Instruments

Dataset-specific Instrument Name	automatic titrator
Generic Instrument Name	Automatic titrator
Dataset-specific Description	A Mettler-Toledo T50 model automatic titrator was employed to analyze samples for total alkalinity using open cell, potentiometric titration.
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	Benchtop pH Meter
Generic Instrument Name	Benchtop pH Meter
Dataset-specific Description	An Orion, 3-star mobile pH meter was used to measure pH in each incubation tank.
Generic Instrument Description	An instrument consisting of an electronic voltmeter and pH-responsive electrode that gives a direct conversion of voltage differences to differences of pH at the measurement temperature. (McGraw-Hill Dictionary of Scientific and Technical Terms) This instrument does not map to the NERC instrument vocabulary term for 'pH Sensor' which measures values in the water column. Benchtop models are typically employed for stationary lab applications.

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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

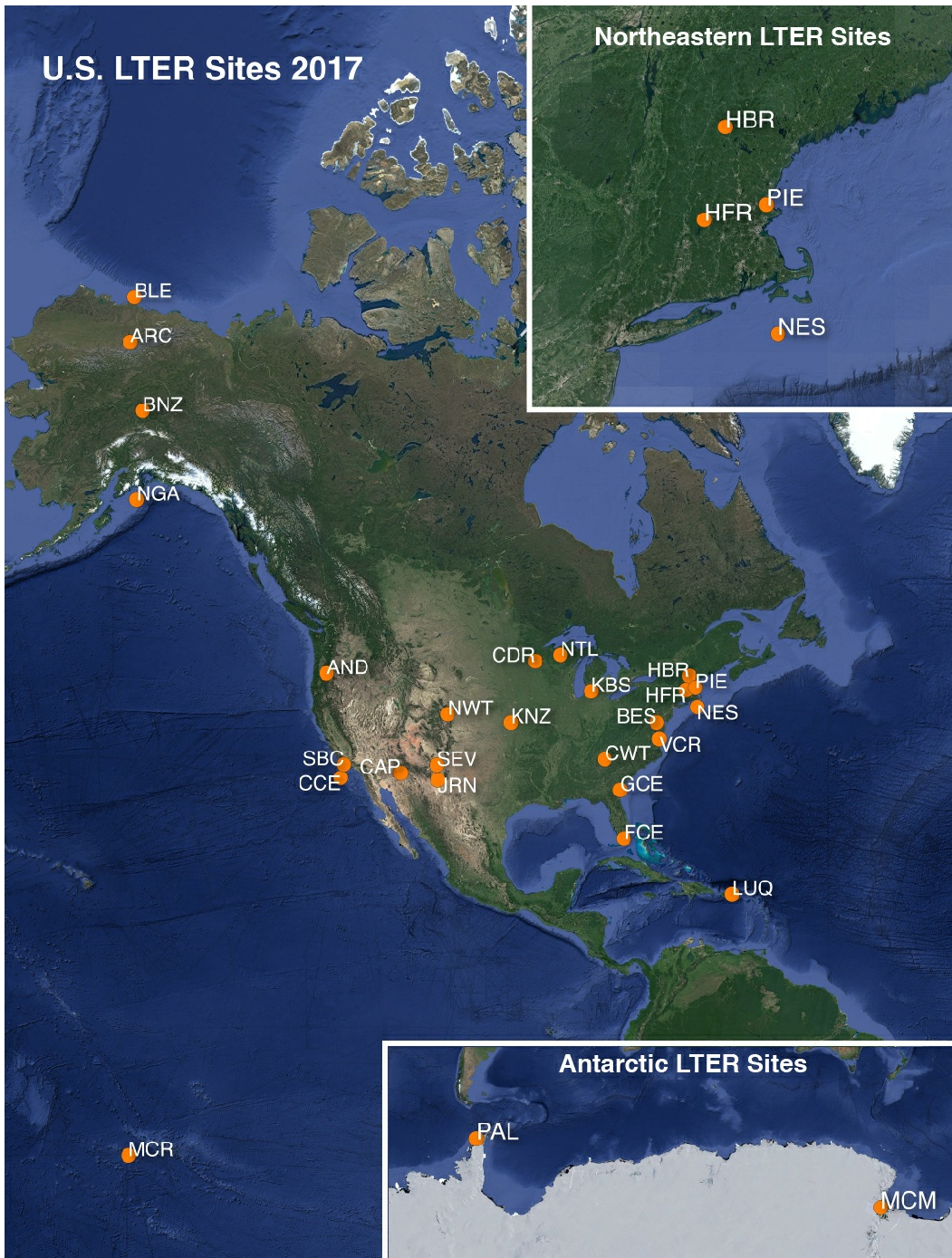
Long Term Ecological Research network (LTER)

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.



Site Codes	
AND	Andrews Forest LTER
ARC	Arctic LTER
BES	Baltimore Ecosystem Stu
BLE	Beaufort Lagoon Ecosystems LTER
BNZ	Bonanza Creek LTER
CCE	California Current Ecosystem LTER
CDR	Cedar Creek Ecosystem Science Reserve
CAP	Central Arizona-Phoenix LTER
CWT	Coweeta LTER
FCE	Florida Coastal Everglades LTER
GCE	Georgia Coastal Ecosystems LTER
HFR	Harvard Forest LTER
HBR	Hubbard Brook LTER
JRN	Jornada Basin LTER
KBS	Kellogg Biological Station LTER
KNZ	Konza Prairie LTER
LUQ	Luquillo LTER
MCM	McMurdo Dry Valleys LT
MCR	Moorea Coral Reef LTER
NWT	Niwot Ridge LTER
NTL	North Temperate Lakes I
NES	Northeast U.S. Shelf LTER
NGA	Northern Gulf of Alaska I
PAL	Palmer Antarctica LTER
PIE	Plum Island Ecosystems LTER
SBC	Santa Barbara Coastal L
SEV	Sevilleta LTER
VCR	Virginia Coast Reserve L

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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