Porites growth, respiration, and photophysiology and seawater carbonate chemistry from Richard B Gump Research Station - Moorea LTER, French Polynesia from 2011 (MCR LTER project)

Website: https://www.bco-dmo.org/dataset/526785
Version: 2014-08-22

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

Program
» Long Term Ecological Research network (LTER)

Contributors	Affiliation	Role
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Dataset Description

This data set tested the effect of 3 pCO2 levels on the metabolism of juvenile massive Porites spp. Conducted in Moorea, French Polynesia in April-May 2011. Aerobic dark respiration, skeletal weight (i.e., calcification), biomass, and chlorophyll fluorescence were measured as well as the experimental seawater carabonate parameters.

These data were published in Edmunds PJ. (2012) Effect of pCO_2 on the growth, respiration, and photophysiology of massive *Porites* spp. in Moorea, French Polynesia. Marine Biology 159: 2149-2160.

Download data (Excel file)

Methods & Sampling

Hypothesis: that high pCO2 (76.6 Pa and 87.2 Pa vs. 42.9 Pa) has no effect on the metabolism of juvenile massive Porites spp. after 11 days at 28 °C and 545 µmol quanta/m^2/s. The response was assessed as aerobic dark respiration, skeletal weight (i.e., calcification), biomass, and chlorophyll fluorescence. Corals were collected from the shallow (3-4 m) back reef of Moorea, French Polynesia (17°28.614'S, 149°48.917'W), and experiments conducted during April and May 2011. An increase in pCO2 to 76.6 Pa had no effect on any dependent variable, but 87.2 Pa pCO2 reduced area-normalized (but not biomass-normalized) respiration 36%, as well as maximum photochemical efficiency (Fv/Fm) of open RCIIs and effective photochemical efficiency of RCIIs in actinic light (Delta F/F'm); neither biomass, calcification, nor the energy expenditure coincident with calcification (J/g) was effected. These results do not support the hypothesis that high pCO2 reduces coral calcification through increased metabolic costs and, instead, suggest that high pCO2 causes metabolic depression and photochemical impairment similar to that associated with bleaching. Evidence of a pCO2 threshold between 76.6 and 87.2 Pa for inhibitory effects on respiration and photochemistry deserves further attention as it might signal the presence of unpredictable effects of rising pCO2.

Full methodology description

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Data Files

File
porites.csv (Comma Separated Values (.csv), 6.33 KB) MD5:362ec14a6aac7252059b807935273ed0 Primary data file for dataset ID 526785

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Parameters

Parameter	Description	Units
lab	laboratory	unitless
lat	latitude; north is positive	degrees
lon	longitude; east is positive	degrees
species	Species	unitless
treatment	Treatment: LT-AC = ambient pCO2; LT-MC = medium pCO2; LT-HC = high pCO2	unitless
date_TLC	Date of temperature, light, carbonate chemistry measurements. Note: the respiration, growth and photophysiology measurements followed beginning a day after these were done.	unitless
tank	Water source identification number	unitless
pH	pH: spectrophotometric method	pH units
pCO2	Partial pressure of carbon dioxide (water) at sea surface temperature (wet air); Calculated using CO2SYS (URI: http://cdiac.ornl.gov/oceans/co2rprt.html)	atm
TA	Total alkalinity: potentiometric titration	mol/kg
omega_Arg	Aragonite saturation state; Calculated using CO2SYS (URI: http://cdiac.ornl.gov/oceans/co2rprt.html)	unitless
irradiance	Irradiance	E/m^2/s
temp	Water temperature	degrees Celsius
surface_area	Surface area of coral tissue	cm^2
respiration_area	Respiration rate per area in dark	mol/cm^2/h
growth_area	Calcification rate of calcium carbonate	mg/cm^2/day
metab_exp	Metabolic expenditure	J/g
respiration_mass	Dark respiration normalized to biomass	mol/mg/h
growth_mass	Calcification rate of calcium carbonate	mg/mg/day
biomass	biomass of coral	mg/cm^2
phi_PS_II	Effective photochemical quantum yield	unitless
Fv_Fm	Maximum photochemical quantum yield of photosystem II	unitless
Qm	Excitation pressure	unitless
F_prime	Fluorescence yield in actinic light	arbitrary units
Fm_prime	Maximum fluorescence yield in actinic light	arbitrary units
Fo	Fluorescence yield in darkness	arbitrary units
Fm	Maximum fluorescence yield in darkness	arbitrary units

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Deployments

Edmunds_MCR_2011

Website	https://www.bco-dmo.org/deployment/526735
Platform	Richard B Gump Research Station - Moorea LTER
Start Date	2011-04-13
End Date	2011-05-06

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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

NSF Award Abstract:

Coral reefs provide important benefits to society, from food to exceptional biodiversity to shoreline protection and recreation, but they are threatened by natural perturbations and human activities, including those causing global-scale changes. These pressures increasingly are causing coral reefs to undergo large, often abrupt, ecological changes where corals are being replaced by seaweeds or other undesirable organisms. Historically, the major agent of disturbance to coral reefs has been powerful storms, but in recent decades, episodes of mass coral bleaching from marine heat waves have become more frequent and severe as the temperature of ocean surface waters continues to rise. Coral reefs are further stressed by local human activities that cause nutrient pollution and deplete herbivorous fishes that control growth of seaweeds. Studying how coral reefs respond to these two types of disturbance under different levels of nutrient pollution and fishing provides essential information on what affects the ability of coral reefs to buffer environmental change and disturbances without collapsing to a persistent, degraded condition. The fundamental goals of the Moorea Coral Reef Long Term Ecological Research program (MCR LTER) are to understand how and why coral reefs change over time, to assess the consequences of these changes, and to contribute scientific knowledge needed to sustain coral reef ecosystems and the important societal services they provide. This research improves understanding and management of coral reefs, which benefits all groups concerned with the welfare of this ecologically, economically and culturally important ecosystem. In addition to academic communities, scientific findings are communicated to interested individuals, non-governmental organizations, island communities and governmental entities. These findings also are integrated into K-12, undergraduate, graduate and public education activities through a multi-pronged program that includes inquiry-based curricula, interactive and media-based public education programs, and internet-based resources. MCR?s research, training, education and outreach efforts all emphasize broadening participation in STEM fields and strengthening STEM literacy.

New research activities build on MCR LTER?s powerful foundation of long-term observations and broad ecological understanding of oceanic coral reefs to address the following core issues: How is the changing disturbance regime (recurrent heat waves in addition to cyclonic storms) altering the resilience of coral reefs, and what are the ecological consequences of altered resilience? Research activities are organized around a unifying framework that explicitly addresses how reef communities are affected by the nature and history of coral-killing disturbances, and how those responses to disturbance are influenced by the pattern of local human stressors. New studies answer three focal questions: (1) How do different disturbance types, which either remove (storms) or retain (heat waves) dead coral skeletons, affect community dynamics, abrupt changes in ecological state, and resilience? (2) How do local stressors interact with new disturbance regimes to create spatial heterogeneity in community dynamics, ecosystem processes, and spatial resilience? And (3) What attributes of coral and coral reef communities influence their capacity to remain resilient under current and future environmental conditions? These questions provide an unparalleled opportunity to test hypotheses and advance theory regarding ecological resilience and the causes and consequences of abrupt ecological change, which is broadly relevant across aquatic and terrestrial ecosystems.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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

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Program Information

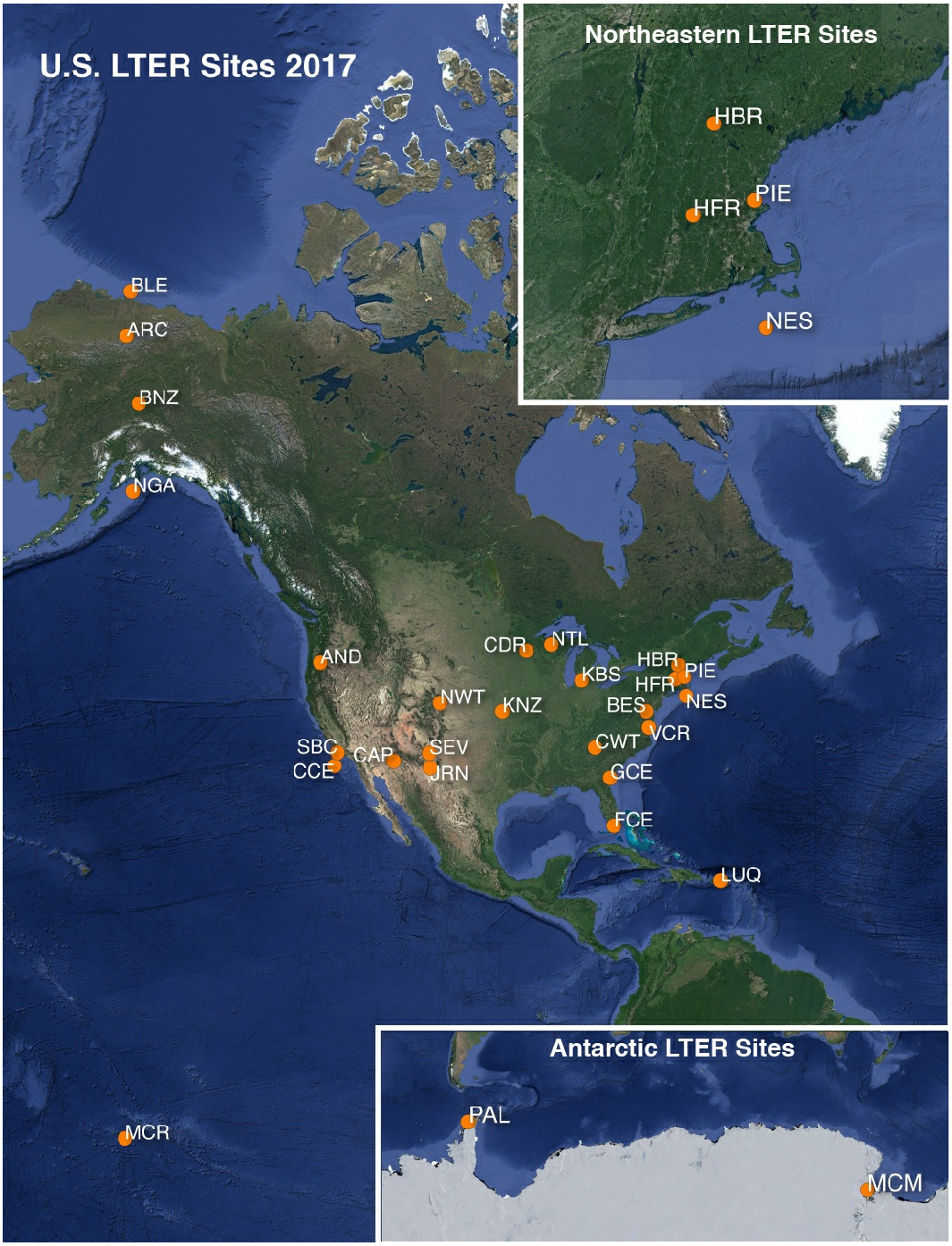
Long Term Ecological Research network (LTER)

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/

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 LTEF
NWT	Niwot Ridge LTER
NTL	North Temperate Lakes I
NES	Northeast U.S. Shelf LTE
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

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0417412
NSF Division of Ocean Sciences (NSF OCE)	OCE-1236905

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