Benthic Ecosystem and Acidification Measuring System (BEAMS) data from two Bermuda sites collected during 2015 (BEAMS project)

Website: https://www.bco-dmo.org/dataset/719743
Data Type: Other Field Results
Version: 1
Version Date: 2017-11-21

Project
» Quantifying the potential for biogeochemical feedbacks to create 'refugia' from ocean acidification on tropical coral reefs (BEAMS)

Contributors	Affiliation	Role
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Abstract
This dataset was collected using the Benthic Ecosystem and Acidification Measuring System (BEAMS) at Hog Reef and Bailey's Bay, Bermuda in 2015.

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Coverage

Spatial Extent: **N**:32.457 **E**:-64.725 **S**:32.35 **W**:-64.845
Temporal Extent: 2015-07-21 - 2015-07-29

Dataset Description

This dataset was collected using the Benthic Ecosystem and Acidification Measuring System (BEAMS) at Hog Reef and Bailey's Bay, Bermuda in 2015.

Related publication:
Takeshita, Y., Cyronak, T., Martz, T. R., Andersson, A. 2017. Drivers of variability of coral reef carbonate chemistry across different functional scales, *In prep*.

Methods & Sampling

This dataset was collected using the Benthic Ecosystem and Acidification Measuring System (BEAMS). The details of this technique and dataset can be found in the reference provided below (Takeshita et al. 2016), but are also summarized briefly here.

BEAMS uses autonomous sensors to quantify mean gradients of pH and O2 and the current velocity profile in the benthic boundary layer (BBL) to calculate benthic fluxes of O2 (NCP) and TA (NCC). The NCP and NCC provided here represent metabolic rates under completely natural (e.g. flow and light) conditions.

Data Processing Description

Questionable rates have been removed through a quality control procedure described in Takeshita et al. 2016. Briefly, 1) measurements when the benthic boundary layer was stratified were removed, and 2) Spikes in the data were removed based on the observed delta pH/ delta O2 relationship.

BCO-DMO Processing:
- replaced "NaN" with "nd" (no data);
- combined 2 datasets (one from each site) into one file;
- Added site lat/lon values from the metadata provided;
- Converted original Date_Time field to ISO_DateTime.

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Data Files

File
BEAMSdata_Bermuda.csv (Comma Separated Values (.csv), 152.53 KB) MD5:09daade73d57d26c78b4a8a398ac809a Primary data file for dataset ID 719743

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Related Publications

Takeshita, Y., McGillis, W., Briggs, E. M., Carter, A. L., Donham, E. M., Martz, T. R., … Smith, J. E. (2016). Assessment of net community production and calcification of a coral reef using a boundary layer approach. Journal of Geophysical Research: Oceans, 121(8), 5655–5671. doi:10.1002/2016jc011886
https://doi.org/10.1002/2016JC011886
Methods

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Parameters

Parameter	Description	Units
site	Identifier of the site where data were collectd.	unitless
site_name	Full name of the site where data were collectd.	unitless
lat	Latitude of the site; N is positive.	decimal degrees

lon	Longitude of the site; E is positive.	decimal degrees
ISO_DateTime	Date and time data were collected; formatted to ISO8601 standard: yyyy-mm-ddTHH:MM:SS	unitless
pH_0_7m	in situ pH on the total hydrogen ion scale at 0.7 m above benthos	unitless (pH scale)
pH_0_4m	in situ pH on the total hydrogen ion scale at 0.4 m above benthos	unitless (pH scale)
pH_0_2m	in situ pH on the total hydrogen ion scale at 0.2 m above benthos	unitless (pH scale)
Temperature_0_7m	Temperature in Celsius at 0.7 m above benthos	degrees Celsius
Temperature_0_4m	Temperature in Celsius at 0.4 m above benthos	degrees Celsius
Temperature_0_2m	Temperature in Celsius at 0.2 m above benthos	degrees Celsius
DOXY_0_7m	Dissolved O2 at 0.7 m above benthos	micromoles O2 per kilogram (umol kg-1)
DOXY_0_4m	Dissolved O2 at 0.4 m above benthos	micromoles O2 per kilogram (umol kg-1)
DOXY_0_2m	Dissolved O2 at 0.2 m above benthos	micromoles O2 per kilogram (umol kg-1)
PAR	Photosynthetically Available Radiation	micromoles photons per square meter per second (umol photons m-2 s-1)
Pressure	Pressure	decibars
U0	Current speed at 1.0 m above benthos	meters per second (m s-1)
SAL	Practical salinity	unitless
NCP	Net Community Production	millimoles O2 per square meter per hour (mmol O2 m-2 hr-1)
NCC_Q_0_8	Net Community Calcification calculated using Q of 0.8	millimoles CaCO2 per square meter per hour (mmol CaCO3 m-2 hr-1)

NCC_Q_0_9	Net Community Calcification calculated using Q of 0.9	mmol CaCO3 m-2 hr-1
NCC_Q_1_0	Net Community Calcification calculated using Q of 1.0	mmol CaCO3 m-2 hr-1
NCC_Q_1_1	Net Community Calcification calculated using Q of 1.1	mmol CaCO3 m-2 hr-1
NCC_Q_1_2	Net Community Calcification calculated using Q of 1.2	mmol CaCO3 m-2 hr-1

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Flow Meter
Generic Instrument Description	General term for a sensor that quantifies the rate at which fluids (e.g. water or air) pass through sensor packages, instruments, or sampling devices. A flow meter may be mechanical, optical, electromagnetic, etc.

Dataset-specific Instrument Name	
Generic Instrument Name	Light Meter
Generic Instrument Description	Light meters are instruments that measure light intensity. Common units of measure for light intensity are umol/m2/s or uE/m2/s (micromoles per meter squared per second or microEinsteins per meter squared per second). (example: LI-COR 250A)

Dataset-specific Instrument Name	
Generic Instrument Name	Oxygen Sensor
Generic Instrument Description	An electronic device that measures the proportion of oxygen (O2) in the gas or liquid being analyzed

Dataset-specific Instrument Name	
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

BEAMS_Bermuda

Website	https://www.bco-dmo.org/deployment/719765
Platform	shoreside Bermuda
Start Date	2015-07-12
End Date	2015-07-31
Description	Sites where Benthic Ecosystem and Acidification Measuring System (BEAMS) data were collected.

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Project Information

Quantifying the potential for biogeochemical feedbacks to create 'refugia' from ocean acidification on tropical coral reefs (BEAMS)

Description from NSF award abstract:
Rising sea surface temperatures and ocean acidification (OA) may threaten the ability of calcified organisms to build carbonate reefs, but it is unclear if particular reefs have the capacity to tolerate global change. Current understanding of the effects of OA on coral reefs originates from single-species laboratory studies largely focused on scleractinian corals. Traditionally, these experiments attempt to mimic static future conditions under the assumption that coastal regimes are as constant as -- and will acidify at the same rate as -- open ocean surface waters. Predictions based on these oversimplified scenarios are unrealistic because numerous benthic organisms, including calcifiers and primary producers, significantly alter the bulk seawater carbonate chemistry over a diurnal cycle. Further, the prevalence of recently appreciated extreme diel fluctuations in pH across some reefs suggests that benthic species may be acclimated to future carbonate conditions.

To look for potential OA refugia on reefs, a research team from the Scripps Institute of Oceanography (University of California at San Diego) and the Lamont Dougherty Earth Observatory (Columbia University) will undertake a unique mechanistic study on Palmyra Atoll, a remote uninhabited island in the central Pacific that lacks degradation from local human influence. They will explore the strengths and controls of biogeochemical feedbacks from coral reef benthic community assemblages to the seawater chemistry above and experimentally determine how this natural fluctuation affects physiological responses of key taxa to OA. Specifically they will: (1) tightly integrate a novel benthic flux technique in situ that allows continuous, high-temporal resolution measurements of net ecosystem metabolic rates (production and calcification) with an ongoing high spatial resolution benthic community dynamics study to quantify feedbacks of known species assemblages to observed natural spatiotemporal variability in seawater carbonate chemistry; and (2) use small scale common garden CO2 enrichment experiments and productivity/respiration assays in the lab paired with reciprocal transplant experiments in situ to empirically quantify the effects of elevated and/or fluctuating pCO2

on growth, calcification and photophysiology of common framework building organisms and their benthic competitors. This should allow them to examine the coupled interactions between OA and diverse benthic coral reef organisms in their natural environment in the absence of other confounding human impacts.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1316006
NSF Division of Ocean Sciences (NSF OCE)	OCE-1316047

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