

Benthic Ecosystem and Acidification Measuring System (BEAMS) data from two sites on the western terrace of the Palmyra Atoll collected during 2014 (BEAMS project)

Website: <https://www.bco-dmo.org/dataset/666280>

Data Type: Other Field Results

Version: 1

Version Date: 2016-11-29

Project

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

| Contributors | Affiliation | Role |
|-------------------------------------|---|---------------------------------|
| Takeshita, Yuichiro | Carnegie Institution for Science (CIS) | Principal Investigator, Contact |
| Martz, Todd R. | University of California-San Diego (UCSD-SIO) | Co-Principal Investigator |
| McGillis, Wade | Columbia University | Co-Principal Investigator |
| Price, Nichole N. | Bigelow Laboratory for Ocean Sciences | Co-Principal Investigator |
| Smith, Jennifer | University of California-San Diego (UCSD-SIO) | Co-Principal Investigator |
| Ake, Hannah | Woods Hole Oceanographic Institution (WHOI BCO-DMO) | BCO-DMO Data Manager |

Abstract

Benthic Ecosystem and Acidification Measuring System (BEAMS) data from two sites on the western terrace of the Palmyra Atoll collected during 2014 (BEAMS project)

Table of Contents

- [Coverage](#)
 - [Dataset Description](#)
 - [Methods & Sampling](#)
 - [Data Processing Description](#)
 - [Data Files](#)
 - [Related Publications](#)
 - [Parameters](#)
 - [Instruments](#)
 - [Deployments](#)
 - [Project Information](#)
 - [Funding](#)
-

Coverage

Spatial Extent: N:5.883 E:-162.119 S:5.877 W:-162.122

Temporal Extent: 2014-09-07 - 2014-09-23

Dataset Description

Benthic Ecosystem and Acidification Measuring System (BEAMS) data from two sites (LL and RT4) on the western terrace of the Palmyra Atoll. The data was collected in 2014.

Methods & Sampling

This dataset was collected using the Benthic Ecosystem and Acidification Measuring System (BEAMS). The

details of this technique and dataset can be in the reference provided below. BEAMS uses autonomous sensors to quantify mean gradients of pH and O₂ and the current velocity profile in the 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 detail in the reference above. Briefly, 1) measurements when the benthic boundary layer was stratified were removed, and 2) Spikes in the data were removed based on the observed $\Delta\text{pH}/\Delta\text{O}_2$ relationship.

BCO-DMO Data Processing Notes:

- combined 2 datasets (one from each site) into one file
- replaced "NaN" with "nd"
- separated date and time into two columns
- reformatted column names to comply with BCO-DMO standards

[[table of contents](#) | [back to top](#)]

Data Files

| File |
|---|
| BEAMSdata.csv (Comma Separated Values (.csv), 432.02 KB) MD5:7c4343e08d55d23c8a421bd130a52ee8 |
| Primary data file for dataset ID 666280 |

[[table of contents](#) | [back to top](#)]

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

[[table of contents](#) | [back to top](#)]

Parameters

| Parameter | Description | Units |
|-----------|---|----------|
| site | Site in Palmyra where data were collected. | unitless |
| date | Date data were collected; mm/dd/yy | unitless |
| time | Time data were collected; HH:MM | unitless |
| pH_1_1m | In situ pH on the total hydrogen ion scale; 3 x n matrix; data collected at 1.1m above the benthos. | pH |
| pH_0_5m | In situ pH on the total hydrogen ion scale; 3 x n matrix; data collected at 0.5m above the benthos. | pH |
| pH_0_3m | In situ pH on the total hydrogen ion scale; 3 x n matrix; data collected at 0.3m above the benthos. | pH |

| | | |
|------------------|---|---|
| temp_1_1m | Temperature in Celsius; 3 x n matrix; data collected at 1.1m above the benthos. | celsius |
| temp_0_5m | Temperature in Celsius; 3 x n matrix; data collected at 0.5m above the benthos. | celsius |
| temp_0_3m | Temperature in Celsius; 3 x n matrix; data collected at 0.3m above the benthos. | celsius |
| DO_1_1m | Dissolved O2; 3 x n matrix; data collected at 1.1m above the benthos. | umol/kg |
| DO_0_5m | Dissolved O2; 3 x n matrix; data collected at 0.5m above the benthos. | umol/kg |
| DO_0_3m | Dissolved O2; 3 x n matrix; data collected at 0.3m above the benthos. | umol/kg |
| OMEGA_1_1m | Aragonite Saturation State; 3 x n matrix; data collected at 1.1m above the benthos. | unitless |
| OMEGA_0_5m | Aragonite Saturation State; 3 x n matrix; data collected at 0.5m above the benthos. | unitless |
| OMEGA_0_3m | Aragonite Saturation State; 3 x n matrix; data collected at 0.3m above the benthos. | unitless |
| PAR | Photosynthetically Available Radiation | umol photons m ⁻² s ⁻¹ |
| pressure | Pressure; 3 x n matrix. | decibars |
| current_speed | Current speed at 1.4 m above benthos. | meters per second |
| salinity | Salinity | practical salinity units |
| NCP | Net Community Production | mmol O2 m ⁻² hr ⁻¹ |
| NCC_Q_0_8 | Net Community Calcification; 5 x n matrix; NCC value calculated using Q of 0.8 | mmol CaCO3 m ⁻² hr ⁻¹ |
| NCC_Q_0_9 | Net Community Calcification; 5 x n matrix; NCC value calculated using Q of 0.9 | mmol CaCO3 m ⁻² hr ⁻¹ |
| NCC_Q_1_0 | Net Community Calcification; 5 x n matrix; NCC value calculated using Q of 1.0 | mmol CaCO3 m ⁻² hr ⁻¹ |
| NCC_Q_1_1 | Net Community Calcification; 5 x n matrix; NCC value calculated using Q of 1.1 | mmol CaCO3 m ⁻² hr ⁻¹ |
| NCC_Q_1_2 | Net Community Calcification; 5 x n matrix; NCC value calculated using Q of 1.2 | mmol CaCO3 m ⁻² hr ⁻¹ |
| ISO_DateTime.UTC | Date/Time (UTC) ISO formatted | unitless |
| lat | Latitude; N is positive. | decimal degrees |
| lon | Longitude; E is positive | decimal degrees |

[[table of contents](#) | [back to top](#)]

Instruments

| | |
|---|---|
| Dataset-specific Instrument Name | Flow meter |
| Generic Instrument Name | Flow Meter |
| Dataset-specific Description | Used by the Benthic Ecosystem and Acidification Measuring System (BEAMS) |
| 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 | Light Meter |
| Generic Instrument Name | Light Meter |
| Dataset-specific Description | Used by the Benthic Ecosystem and Acidification Measuring System (BEAMS) |
| Generic Instrument Description | Light meters are instruments that measure light intensity. Common units of measure for light intensity are $\mu\text{mol}/\text{m}^2/\text{s}$ or $\mu\text{E}/\text{m}^2/\text{s}$ (micromoles per meter squared per second or microEinsteins per meter squared per second). (example: LI-COR 250A) |

| | |
|---|--|
| Dataset-specific Instrument Name | autonomous oxygen sensor |
| Generic Instrument Name | Oxygen Sensor |
| Dataset-specific Description | Used by the Benthic Ecosystem and Acidification Measuring System (BEAMS) |
| Generic Instrument Description | An electronic device that measures the proportion of oxygen (O_2) in the gas or liquid being analyzed |

| | |
|---|--|
| Dataset-specific Instrument Name | autonomous pH sensor |
| Generic Instrument Name | pH Sensor |
| Dataset-specific Description | Used by the Benthic Ecosystem and Acidification Measuring System (BEAMS) |
| 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^+). |

[[table of contents](#) | [back to top](#)]

Deployments

BEAMS_Palmyra

| | |
|--------------------|---|
| Website | https://www.bco-dmo.org/deployment/666435 |
| Platform | shoreside Palmyra |
| Start Date | 2014-09-07 |
| End Date | 2014-09-24 |
| Description | Sites where Benthic Ecosystem and Acidification Measuring System (BEAMS) data were collected. |

[[table of contents](#) | [back to top](#)]

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.

[[table of contents](#) | [back to top](#)]

Funding

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

[[table of contents](#) | [back to top](#)]