

Water chemistry from discrete seawater samples collected from 2012-2016 at Jarvis Island

Website: <https://www.bco-dmo.org/dataset/775834>

Data Type: Other Field Results

Version: 1

Version Date: 2019-09-30

Project

» [Skeletal Records of Coral Reef Bleaching in the Central Equatorial Pacific](#) (Coral Bleaching Skeletal Records)

Contributors	Affiliation	Role
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Abstract

This dataset contains information about discrete seawater samples collected from 2012-2016 on Jarvis Island for salinity, nutrients, total alkalinity (TA), and dissolved inorganic carbon (DIC) during each sampling period.

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Coverage

Spatial Extent: N:-0.3627 E:-159.937 S:-0.4269 W:-160.0789

Temporal Extent: 2012-09-13 - 2016-05-23

Dataset Description

These data were published in Barkley *et al.*, 2018.

This dataset contains information about discrete seawater samples collected from 2012-2016 on Jarvis Island for salinity, nutrients, total alkalinity (TA), and dissolved inorganic carbon (DIC) during each sampling period.

Methods & Sampling

Discrete seawater samples were collected during each sampling period for salinity, nutrients, total alkalinity (TA), and dissolved inorganic carbon (DIC). Temperature and depth were recorded with HOBO temperature loggers (September 2012) and Sensus Ultra dive data loggers (2015-2016). TA and DIC analyses were performed using a Versatile Instrument for the Determination of Total inorganic carbon and titration Alkalinity (VINDTA, Marianda Analytics and Data) and standardized using certified reference materials obtained from Andrew Dickson (Scripps Institution of Oceanography).

Salinity samples were analyzed at WHOI using a Guildline autosal salinometer, and nutrient samples were run at the WHOI Nutrient Analytical Facility.

Seawater samples, and in situ instrument time series were collected during seven expeditions to Jarvis Island between 2008 and 2017, aboard:

- NOAA ship Hi'ialakai (27–29 March 2008, 2–4 April 2010, 3–5 May 2012, 2–5 April 2017)
- Pangaea Exploration S/V Sea Dragon (13–16 September 2012)
- R/V Machias (12–15 November 2015)
- NOAA ship Oscar Elton Sette (17–23 May 2016)

Research activities and sample collection were conducted under U.S. Fish and Wildlife Service Pacific Reefs National Wildlife Refuge Complex Research and Monitoring Special Use Permits

- 12521-10001 (effective date: 15 Jan 2010; expiration date: 30 May 2010)
- 12521-12001 (effective date: 7 Feb 2012; expiration date: 31 Dec 2012)
- 12521-12005 (effective date: 29 Aug 2012; expiration date: 30 June 2014)
- 12521-14001 (effective date: 1 Jan 2015; expiration date: 31 Dec 2015)
- 12513-15001 (effective date: 11 Nov 2015; expiration date: 31 Dec 2015)

and in compliance with Presidential Proclamation 8336.

Data Processing Description

Full CO₂ system parameters were calculated from temperature, salinity, TA, and DIC using CO₂SYN with the constants of Mehrbach et al. (1973) refit by Dickson and Millero (1987). Nutrient and carbonate chemistry values were consistent down to 20 m depth, and samples collected between 0 m and 20 m were averaged.

BCO-DMO processing:

- Added ISO_DateTime_UTC column
- Updated column headers
- Standardized the format of columns "date_UTC" and "time_UTC"

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Data Files

File
water_chemistry.csv (Comma Separated Values (.csv), 17.06 KB) MD5:f61a6657271370b6893970025e9af7dd Primary data file for dataset ID 775834

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Related Publications

Barkley, H. C., Cohen, A. L., Mollica, N. R., Brainard, R. E., Rivera, H. E., DeCarlo, T. M., ... Luu, V. H. (2018). Repeat bleaching of a central Pacific coral reef over the past six decades (1960–2016). *Communications Biology*, 1(1). doi:[10.1038/s42003-018-0183-7](https://doi.org/10.1038/s42003-018-0183-7)
Results

Dickson, A. G., & Millero, F. J. (1987). A comparison of the equilibrium constants for the dissociation of carbonic acid in seawater media. *Deep Sea Research Part A. Oceanographic Research Papers*, 34(10), 1733–1743. doi:[10.1016/0198-0149\(87\)90021-5](https://doi.org/10.1016/0198-0149(87)90021-5)
Methods

Mehrbach, C., Culberson, C. H., Hawley, J. E., & Pytkowicz, R. M. (1973). Measurement of the apparent dissociation constants of carbonic acid in seawater at atmospheric pressure. *Limnology and Oceanography*, 18(6), 897–907. doi:[10.4319/lo.1973.18.6.0897](https://doi.org/10.4319/lo.1973.18.6.0897)
Methods

Parameters

Parameter	Description	Units
date.UTC	Date in UTC (mm/dd/yyyy)	unitless
time.UTC	Time in UTC (hh:mm:ss)	unitless
latitude	Latitude of sampling location; north = positive	decimal degrees
longitude	Longitude of sampling location; east = positive	decimal degrees
salinity	Salinity	unitless
temperature	Water temperature	degrees Celsius
pressure	Pressure	decibars (dbar)
PO4	Phosphate (PO ₄ ---) concentration	micromoles per kilogram (umol/kg)
NO3_NO2	Nitrate/nitrite (NO ₃ -/NO ₂ -) concentration	micromoles per kilogram (umol/kg)
TALK	Total alkalinity	micromoles per kilogram (umol/kg)
DIC	Dissolved inorganic carbon	micromoles per kilogram (umol/kg)
nTALK	Salinity normalized total alkalinity (to sal = 35)	micromoles per kilogram (umol/kg)
nDIC	Salinity normalized dissolved inorganic carbon (to sal = 35)	micromoles per kilogram (umol/kg)
pH	pH	unitless
pCO2	Partial pressure of carbon dioxide	micro-atmospheres (uatm)
bicarbonate	Bicarbonate ion (HCO ₃ -) concentration	micromoles per kilogram (umol/kg)
carbonate	Carbonate ion (CO ₃ 2-) concentration	micromoles per kilogram (umol/kg)

OM_ar	The saturation state of seawater with respect to aragonite.	unitless
ISO_DateTime_UTC	Date/Time (UTC) ISO formatted [YYYY-mm-ddTHH:MM:SSZ (UTC time)}	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	MARIANDA VINDTA 3C total inorganic carbon and titration alkalinity analyser
Generic Instrument Description	The Versatile INstrument for the Determination of Total inorganic carbon and titration Alkalinity (VINDTA) 3C is a laboratory alkalinity titration system combined with an extraction unit for coulometric titration, which simultaneously determines the alkalinity and dissolved inorganic carbon content of a sample. The sample transport is performed with peristaltic pumps and acid is added to the sample using a membrane pump. No pressurizing system is required and only one gas supply (nitrogen or dry and CO2-free air) is necessary. The system uses a Metrohm Titrino 719S, an ORION-Ross pH electrode and a Metrohm reference electrode. The burette, the pipette and the analysis cell have a water jacket around them. Precision is typically +/- 1 umol/kg for TA and/or DIC in open ocean water.

Dataset-specific Instrument Name	
Generic Instrument Name	Salinometer
Dataset-specific Description	Guildline autosal salinometer
Generic Instrument Description	A salinometer is a device designed to measure the salinity, or dissolved salt content, of a solution.

Dataset-specific Instrument Name	
Generic Instrument Name	Temperature Logger
Dataset-specific Description	Temperature and depth were recorded with HOBO temperature loggers (September 2012) and Sensus Ultra dive data loggers (2015-2016)
Generic Instrument Description	Records temperature data over a period of time.

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Deployments

HI0803

Website	https://www.bco-dmo.org/deployment/780533
Platform	R/V Hi'ialakai
Start Date	2008-12-03
End Date	2008-12-04

HA1001-03

Website	https://www.bco-dmo.org/deployment/780536
Platform	R/V Hi'ialakai
Start Date	2010-03-27
End Date	2010-04-24
Description	HA1001, Leg 3

HA1201-04

Website	https://www.bco-dmo.org/deployment/780539
Platform	R/V Hi'ialakai
Start Date	2012-04-27
End Date	2012-05-24
Description	HA1201, Leg 4

HA1701-01

Website	https://www.bco-dmo.org/deployment/780542
Platform	R/V Hi'ialakai
Start Date	2017-03-26
End Date	2017-04-29
Description	HA1701, Leg 1

SeaDragon-2012

Website	https://www.bco-dmo.org/deployment/780663
Platform	Sea Dragon
Start Date	2012-09-13
End Date	2012-10-02

Machias_2015

Website	https://www.bco-dmo.org/deployment/780708
Platform	R/V Machias
Start Date	2015-11-12
End Date	2015-11-15

SE1602-02

Website	https://www.bco-dmo.org/deployment/780633
Platform	NOAA Ship Oscar Elton Sette
Start Date	2016-05-11
End Date	2016-05-31
Description	SE1602, Leg 2

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Project Information

Skeletal Records of Coral Reef Bleaching in the Central Equatorial Pacific (Coral Bleaching Skeletal Records)

Coverage: Central Equatorial Pacific

NSF Award Abstract:

Ocean warming kills corals and efforts are underway to identify and protect coral reefs that may withstand the projected 21st century rise in tropical ocean temperatures. Coral reefs in the central equatorial Pacific (CEP) have been exposed to episodes of extreme warmth every 3-7 years for centuries, if not millennia, yet remain highly productive ecosystems. Initial data obtained by the investigator from stress signatures archived in the skeletons of long lived coral species, suggests that CEP reefs lose their symbiotic algae or bleach, sometimes severely, during warm episodes. The observation that CEP reefs bleach repetitively yet remain productive implies uncommon resilience to ocean warming. The investigator will use laboratory experiments and field observations to validate skeletal records of historical bleaching. A successful outcome will provide novel and valuable insights into the resilience of the CEP reefs and a new tool with which to identify thermally tolerant coral reef ecosystems across the tropics. Additionally, this project includes mentorship of a postdoc and six undergraduate or high school students, outreach through presentations and media, and expansion of publically available software for coral stress band analysis.

Ocean warming projections indicate severe impacts to coral reefs will occur on an annual basis within the next few decades. Consequently, a coordinated effort is underway to identify reefs that might survive these changes. The investigator will test the hypothesis that such reefs exist at the epicenter of influence of the El Niño-Southern Oscillation (ENSO), where strong inter-annual temperature variability creates conditions conducive for the development of thermal resilience. The project uses laboratory-based bleaching experiments and actual stress signatures accreted by wild corals during the 2015 El Niño to validate signatures of historical bleaching archived in the skeletons of massive reef building corals. In addition the investigator will use new, long cores from the CEP to build a robust dataset of historical bleaching back to the 1800's. A successful outcome will increase confidence in the interpretation of skeletal stress bands as quantitative bleaching proxies and enable the reconstruction of the history of coral reef bleaching and recovery in the CEP.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1737311

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