Dissolved Organic Carbon concentrations collected at the Mo'orea LTER forereef and back reef sites during the 2019 coral bleaching event.

Website: https://www.bco-dmo.org/dataset/819601
Data Type: Other Field Results
Version: 1
Version Date: 2021-07-09

Project
» RAPID: Ecosystem impact of a coral bleaching event: The role of coral exudates in shifting oligotrophic biogeochemistry and reef microbiomes. (Ecosystem Impacts of Coral Bleaching)

Contributors	Affiliation	Role
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Abstract
Dissolved Organic Carbon (DOC) concentrations collected at the Mo'orea LTER forereef and back reef sites during the 2019 coral bleaching event.

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Coverage

Spatial Extent: **N**:-17.46983333 **E**:-149.8023833 **S**:-17.48237222 **W**:-149.8496067
Temporal Extent: 2019-04-30 - 2019-05-10

Methods & Sampling

Samples were collected either via Niskin bottle or by hand on SCUBA at Mo'orea, French Polynesia during the 2019 coral bleaching event (April, May). Time is approximate (within + or - 2 hours) because the time reported is the dive time, not the exact time of sample collection.

In all cases new Whirl Pak bags were used to collect the water samples, which were immediately put on ice and transported back to the lab. The water samples were filtered through precombusted Whatman GF/Fs and the water that passed through was collected in an acid washed container, and then frozen. All filtration equipment was acid washed and Milli-Q washed, and then flushed with sample water prior to sample filtration and water collection.

Samples were kept frozen at -20 degrees C until analysis. All analyses were completed within 6 months of collection by Nutrient Analytical Services at the Chesapeake Biological Laboratory of the University of Maryland

Center for Environmental Science.

Samples were acidified and sparged with ultra-pure carrier-grade air to drive off inorganic carbon and analyzed with a high-temperature combustion (680 C) method on the Shimadzu TOC-L. Operating procedures followed those outlined for 'Total and Dissolved Organic Carbon Method' (https://www.umces.edu/nasl/methods). In short, all carbon compounds are broken down into CO2 which is carried by ultra-pure air to a non-dispersive infrared detector (NDIR) for detection. The system was calibrated before and after each run with potassium hydrogen phthalate standards (6-point curve, 0-20 mg C/L) and referenced against a certified reference control sample (Scp Science Accuspec Toc Standard), a spike (20 ppm) and a blank every 10 samples. The acceptance criteria used was 0.995.

Data Processing Description

BCO-DMO processing notes:
- Renamed column headers to comply with database requirements
- Rounded latitude and longitude fields to 7 decimal places
- Combined date and local time fields, then converted to ISO 8601 format (UTC)

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Data Files

File
rapid_doc.csv (Comma Separated Values (.csv), 6.61 KB) MD5:009c52040847d764096b35ebc21a7793 Primary data file for dataset ID 819601

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Parameters

Parameter	Description	Units
ISO_DateTime_UTC	Collection and/or dive time in ISO 8601 format	units
Latitude	Latitude, south is negative	units
Longitude	Longitude, west is negative	units
Unique_Sample_Identifier	Unique sample identifier	units
Site_Name	Refers to the Mo'orea Long Term Ecological Research site where the sample was collected. Offshore sites are due north of the LTER sites.	unitless
Water_Depth	Depth at which the water sample was collected	units
Reef_Type	Type of reef over which the water sample was collected. Back_Reef = island side of the reef crest, Forereef = ocean side of the reef crest, Offshore = away from the reef	units
DOC	Dissolved Organic Carbon	units
Date	Date of sample collection	units
Local_Time	Local time of sample collection and/or dive time	units

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Instruments

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Samples were collected either via Niskin bottle or by hand on SCUBA at Mo'orea, French Polynesia
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	SCUBA
Generic Instrument Name	Self-Contained Underwater Breathing Apparatus
Dataset-specific Description	Samples were collected either via Niskin bottle or by hand on SCUBA at Mo'orea, French Polynesia
Generic Instrument Description	The self-contained underwater breathing apparatus or scuba diving system is the result of technological developments and innovations that began almost 300 years ago. Scuba diving is the most extensively used system for breathing underwater by recreational divers throughout the world and in various forms is also widely used to perform underwater work for military, scientific, and commercial purposes. Reference: http://oceanexplorer.noaa.gov/technology/diving/diving.html

Dataset-specific Instrument Name	Shimadzu TOC-L
Generic Instrument Name	Shimadzu TOC-L Analyzer
Dataset-specific Description	A high-temperature combustion (680C) method on the Shimadzu TOC-L following operating procedures outlined in: Total and Dissolved Organic Carbon Method: https://www.umces.edu/nasl/methods was used to analyse the samples.
Generic Instrument Description	A Shimadzu TOC-L Analyzer measures DOC by high temperature combustion method. Developed by Shimadzu, the 680 degree C combustion catalytic oxidation method is now used worldwide. One of its most important features is the capacity to efficiently oxidize hard-to-decompose organic compounds, including insoluble and macromolecular organic compounds. The 680 degree C combustion catalytic oxidation method has been adopted for the TOC-L series. http://www.shimadzu.com/an/toc/lab/toc-l2.html

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Project Information

RAPID: Ecosystem impact of a coral bleaching event: The role of coral exudates in shifting oligotrophic biogeochemistry and reef microbiomes. (Ecosystem Impacts of Coral Bleaching)

Coverage: Mo’orea, French Polynesia

NSF Award Abstract:
Shallow tropical reefs are biodiversity hotspots. Their ecosystem services make them key areas of economic, ecological, and cultural importance. Yet coral reefs are under significant threat due to both local and global stressors which can lead to coral bleaching, disease, and eventually coral death. When corals bleach, they release materials such as dead tissue, mucus, bacteria, and viruses that may affect the entire ecosystem. This project uses a wide-spread bleaching event at a Long Term Ecological Research site in French Polynesia to explore how these released materials impact the reef ecosystem The water chemistry and microbes associated with the corals and surrounding water are examined. This research aims to better understand how corals interact with their environment and how this interaction changes when corals are stressed. Throughout this project two female graduate students are being trained and interactive programs are used to communicate results to elementary, high school, and undergraduate students in Oregon. A 20-minute documentary for web release focusing on the reef scale impact of coral bleaching is in preparation together with film students.

Coral exudates include particulate and dissolved material (sloughed tissue, mucus, bacteria, viruses) that together add limiting nutrients and carbon compounds to the reef, fueling auto- and heterotrophic bacterial production. In recent experiments, coral-bleaching derived exudates were observed to themselves cause rapid bleaching, and often mortality, of previously healthy corals. Importantly, these negative impacts of coral exudate exposure were far greater than thermal stress. These experiments provided insight into a novel mechanism in which bleaching corals can adversely affect the health of adjacent corals. This project leverages these data and an extensive and ongoing bleaching event on the island of Mo?orea to quantify the cascading effects of coral exudates on reef ecosystems. It is hypothesized that during widespread bleaching: (1) DOC is significantly elevated across the reefscape; (2) coral holobiont components become enriched in the pelagic microbiome; (3) the water column microbial community shifts in function to increased heterotrophy and pathogenicity; and (4) coral holobionts diverge from their previous stable state leading to coral reef dysbiosis and/or disease and mortality. Sampling throughout the course of an ongoing bleaching event in Mo?orea is used to quantify the effects of this bleaching event on DOM dynamics and reef health. Mo'orea is situated in the MCR Long Term Ecological Research (MCR LTER) site. The rare reef-scale bleaching event at this well-studied location provides the unusual opportunity to quantify the impact of coral exudates on reef health and to better understand the temporal and spatial impacts of an island-wide bleaching event in an oligotrophic ecosystem. Measurement of the amount of organic matter released per unit area of coral on an island where the reef ecosystem is well parameterized over time and space allows development of a model of the impact of bleaching events on the island carbon budget.

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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1933165

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