Biogeochemical data collected during the Flower Garden Banks Rapid Response Cruise, FGB-RR16, on R/V Manta in the Flower Garden Banks National Marine Sanctuary from July to August 2016

Website: https://www.bco-dmo.org/dataset/787575
Data Type: Cruise Results
Version: 1
Version Date: 2020-01-16

Project
» RAPID: Collaborative Research: Impact of freshwater runoff from Hurricane Harvey on coral reef benthic organisms and associated microbial communities (Rapid Reefs Harvey)

Contributors	Affiliation	Role
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Abstract
This dataset combines the biogeochemical data collected during the Flower Garden Banks Rapid Response Cruise which occurred following the discovery of the localized mortality event.

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Coverage

Spatial Extent: **N**:28.033 **E**:-93.517 **S**:27.75 **W**:-93.93
Temporal Extent: 2016-07-31 - 2016-08-01

Dataset Description

This dataset combines the biogeochemical data collected during the Flower Garden Banks Rapid Response Cruise which occurred following the discovery of the localized mortality event.

Methods & Sampling

The CTD (SBE-25) was equipped with 6 4L niskin bottles and was used to measure temperature and salinity. Niskins were used to collect water samples for carbonate chemistry (i.e., DIC and TA), oxygen, and nutrients. Water samples for DIC and TA were collected according to the methods in Dickson et al. (2007), and analyzed

at TAMU using a VINDTA 3C. Certified Reference Materials (CRMs) were provided by A. Dickson at Scripps Institute of Oceanography (Dickson et al. 2007) and were used to calibrate for TA and DIC. The reproducibility of these samples was 1.43 ± 1.07 µmol kg-1 for TA and 2.64 ± 1.24 µmol kg-1 for DIC. Dissolved oxygen (DO) was measured using Winkler titrations. After collecting the water from the Niskin into flasks, aliquots of manganese chloride and sodium hydroxide-sodium iodide were added. The titration was performed directly after water collection using sodium thiosulfate; Winkler titration was performed with an amperometric dead-stop endpoint determination with a double platinum electrode. Nutrient samples (nitrate, nitrite, ammonium, phosphate, and silicate) were collected into polycarbonate flasks after filtration through GF/C 0.7-um pore size filters, frozen, and analyzed ashore using standard World Ocean Circulation Experiment (WOCE) segmented flow methodologies using an Astoria Analyzer (Astoria-Pacific) (Gordon 1994).

Sampling gaps are reported as "nd" in the dataset.

Data Processing Description

BCO-DMO Processing:
- renamed fields (removed spaces and units);
- formatted date column to yyyy-mm-dd (was m/d/yy);
- corrected year value of 2006 to 2016 (in row 128);
- added ISO_DateTime column
- replaced "nan" with "nd" (no data)

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Data Files

File
biogeochem_fgbrr16.csv (Comma Separated Values (.csv), 20.11 KB) MD5:99e52d1e78ae95e787ad791a376ba53f Primary data file for dataset ID 787575

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Related Publications

Dickson, A.G., Sabine, C.L. and Christian, J.R. (Eds.) 2007. Guide to best practices for ocean CO2 measurements. PICES Special Publication 3, 191 pp. ISBN: 1-897176-07-4. URL: https://www.nodc.noaa.gov/ocads/oceans/Handbook_2007.html https://hdl.handle.net/11329/249
Methods

Gordon, L.I., Jennings, J.C., Ross, A.A., & Krest, J.M. World ocean circulation experiment. WOCE operations manual. Volume 3. The observational programme. Section 3.1. WOCE hydrographic programme. Part 3.1.3. WHP operations and methods. (revision 1). United States. https://www.osti.gov/biblio/149787-world-ocean-circulation-experiment-woce-operations-manual-volume-observational-programme-section-woce-hydrographic-programme-part-whp-operations-methods-revision
Methods

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Parameters

Parameter	Description	Units
Cast	cast number	unitless

Salinity	salinity	unitless
Depth	depth	meters (m)
Date	Date; format: yyyy-mm-dd	unitless
GMT_Time	Time (GMT); format: hh:mm:ss	unitless
Local_Time	Local time; format: hh:mm:ss	unitless
Lat	latitude	decimal degrees
Long	longitude	decimal degrees
Temp	temperature	degrees Celsius
DIC	dissolved inorganic carbon	micromoles per kilogram (umol kg-1)
TA	total alkalinity	micromoles per kilogram (umol kg-1)
pH	pH	total scale
fCO2	carbon dioxide fugacity	microatmospheres (uatm)
Omega_Ar	aragonite saturation state	unitless
p_dens	potenial density	kilograms per cubic meter (kg m-3)
O2	dissolved oxygen	milliliters per liter (ml l-1)
NO3	nitrate	micromolar (uM)
HPO4	phosphate	micromolar (uM)
HSIO3	silicate	micromolar (uM)
NH4	ammonia	micromolar (uM)

NO2	nitrite	micromolar (uM)
Urea	urea	micromolar (uM)
ISO_DateTime_GMT	Date and time (GMT) formatted to ISO 8601 standard. Format: yyyy-mm-ddTHH:MM:SSZ	yyyy-MM-dd'T'HH:mm:ss

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Instruments

Dataset-specific Instrument Name	VINDTA 3C
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	4L niskin bottles
Generic Instrument Name	Niskin bottle
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	Astoria Analyzer
Generic Instrument Name	Nutrient Autoanalyzer
Generic Instrument Description	Nutrient Autoanalyzer is a generic term used when specific type, make and model were not specified. In general, a Nutrient Autoanalyzer is an automated flow-thru system for doing nutrient analysis (nitrate, ammonium, orthophosphate, and silicate) on seawater samples.

Dataset-specific Instrument Name	CTD SBE-25
Generic Instrument Name	Sea-Bird SBE 25 Sealogger CTD
Generic Instrument Description	The Sea-Bird SBE 25 SEALOGGER CTD is battery powered and is typically used to record data in memory, eliminating the need for a large vessel, electrical sea cable, and on-board computer. All SBE 25s can also operate in real-time, transmitting data via an opto-isolated RS-232 serial port. Temperature and conductivity are measured by the SBE 3F Temperature sensor and SBE 4 Conductivity sensor (same as those used on the premium SBE 9plus CTD). The SBE 25 also includes the SBE 5P (plastic) or 5T (titanium) Submersible Pump and TC Duct. The pump-controlled, TC-ducted flow configuration significantly reduces salinity spiking caused by ship heave, and in calm waters allows slower descent rates for improved resolution of water column features. Pressure is measured by the modular SBE 29 Temperature Compensated Strain-Gauge Pressure sensor (available in eight depth ranges to suit the operating depth requirement). The SBE 25's modular design makes it easy to configure in the field for a wide range of auxiliary sensors, including optional dissolved oxygen (SBE 43), pH (SBE 18 or SBE 27), fluorescence, transmissivity, PAR, and optical backscatter sensors. More information from Sea-Bird Electronics: http:www.seabird.com.

Dataset-specific Instrument Name	Winkler titration
Generic Instrument Name	Winkler Oxygen Titrator
Generic Instrument Description	A Winkler Oxygen Titration system is used for determining concentration of dissolved oxygen in seawater.

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Deployments

FGB-RR16

Website	https://www.bco-dmo.org/deployment/787672
Platform	R/V Manta
Report	https://datadocs.bco-dmo.org/docs/Rapid_Reefs_Harvey/data_docs/fgbrr16cruisereport.pdf
Start Date	2016-07-30
End Date	2016-08-02

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Project Information

RAPID: Collaborative Research: Impact of freshwater runoff from Hurricane Harvey on coral reef benthic organisms and associated microbial communities (Rapid Reefs Harvey)

Coverage: Flower Garden Banks National Marine Sanctuary, Northwest Gulf of Mexico

NSF Award Abstract:
Coral reefs are ecologically and economically important ecosystems, and are threatened by a variety of global

(climate change) and local (overfishing, pollution) stressors. Anthropogenic climate change is increasing the frequency and severity of storms, which can physically damage reef structures and reduce reef health through changes in seawater quality. In August of 2017, Hurricane Harvey caused widespread flooding in southeast Texas when it released more than 50 trillion liters of rain, which then accumulated along the Texas Shelf. This runoff is expected to impact nearby coral reefs in the Flower Garden Banks National Marine Sanctuary (FGBNMS, northwest Gulf of Mexico) via eddies and jets that transport coastal waters offshore. Findings from this project will allow managers to quickly predict whether extreme storm events are likely to induce reef mortality and ecosystem decline due to freshwater accumulation, by tracking of low salinity water masses coupled with microbial community characterization and metrics of coral health. These data are critical to managing coastal ecosystems, including the high coral cover reefs in the FGBNMS, and will help stakeholders (e.g., diving and fishing communities) plan for and minimize disruption to their livelihoods following these storms. Results will be communicated broadly across scientific arenas, in graduate and undergraduate education and training programs, and to the general public through outreach. The investigators have seven 7 square meter 2-D Reef Replicas from 2014 depicting representative FGBNMS reef bottoms, and will construct additional 2-D Reef Replicas from both banks following the arrival of Harvey runoff, allowing the public to directly experience and quantify the effects of Hurricane Harvey on local reefs using quadrats and identification guides. This project will also synergize with NSF REU programs at Boston University and Texas A&M University, providing transformative research experiences for undergraduates. One post-doctoral scholar, four graduate students, a technician and more than 5 undergraduates will be involved in all aspects of the research. All datasets will be made freely available to the public, and will serve as an important set of baselines for future lines of inquiry into the processes by which hurricanes and other extreme storms impact reef health.

Hurricanes and other extreme storm events can decimate coral reefs through wave-driven physical damage. Freshwater runoff from extreme storms is also potentially detrimental to reefs but has received comparatively less attention. This research will provide unprecedented resolution on how hurricanes and other extreme storm events may trigger cascading interactions among water chemistry, declines in metazoan health and shifts in their associated microbial communities, ultimately resulting in coral reef decline. The freshwater runoff initiated by Hurricane Harvey is likely to impact reefs within the FGBNMS, one of the few remaining coral-dominated reefs in the greater Caribbean. The effects of Harvey runoff will be compared to a previously documented storm-driven runoff event that was associated with invertebrate mortality on the same reef system. Sampling seawater chemistry, microbial communities (water column and benthic), and host gene expression and proteomics before, immediately after, and six months after Harvey runoff enters the FGBNMS will allow us to identify commonalities among large-scale freshwater runoff events and track the response of benthic invertebrate health, microbial community diversity, and the trajectory of reef community recovery or decline. The investigators will determine if changes in water chemistry induce pelagic microbial shifts, if microbial communities typically associated with corals and sponges are altered, and whether feedbacks occur between these potential drivers of benthic invertebrate mortality.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1800913

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