Water quality metrics collected from 10 meter reefs from around the U.S. Virgin Islands during April 2022 (Multi-scale multi-host disease spread project)

Website: https://www.bco-dmo.org/dataset/986266
Data Type: Other Field Results
Version: 1
Version Date: 2025-10-07

Project
» A multi-scale approach to predicting infectious multi-host disease spread in marine benthic communities (Multi-scale multi-host disease spread)

Contributors	Affiliation	Role
Apprill, Amy	Woods Hole Oceanographic Institution (WHOI)	Co-Principal Investigator
Brandt, Marilyn	University of the Virgin Islands Center for Marine and Environmental Studies (UVI)	Co-Principal Investigator
Correa, Adrienne M.S.	Rice University	Co-Principal Investigator
Holstein, Daniel	Louisiana State University (LSU)	Co-Principal Investigator
Mydlarz, Laura	University of Texas at Arlington (UT Arlington)	Co-Principal Investigator
Bloomberg, Jeanne	Woods Hole Oceanographic Institution (WHOI)	Student
Newman, Sawyer	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
These data include water quality metrics collected at 10-meter reef sites in the U.S. Virgin Islands (USVI) during April 2022. Two reefs were located near St. John (Haulover Bay and Coral Bay) and two near St. Croix (Cane Bay and Buck Island). Physical parameters were measured using an EXO Sonde, while water samples collected approximately 2 meters above the reefs were analyzed for inorganic nutrient concentrations, microbial cell abundances, total organic carbon (TOC), and total nitrogen (TN). Characterizing the physical and chemical properties of reef waters provides important context for understanding microbial community dynamics and their potential role in coral reef health and disease processes.

Table of Contents

Coverage

Location: St. John and St. Croix, U.S. Virgin Islands
Spatial Extent: **N**:18.34424 **E**:-64.6072403 **S**:17.77388 **W**:-64.8135
Temporal Extent: 2022-04-05 - 2022-04-15

Methods & Sampling

Sampling locations were accessed via day-trips aboard a University of the Virgin Islands powerboat in the U.S. Virgin Islands in April 2022. At each sampling location, reef seawater was collected to characterize water quality metrics, including microbial community composition, inorganic nutrient concentrations, total organic carbon (TOC), total nitrogen (TN), and microbial cell abundances.

Water samples were collected by SCUBA divers approximately 2 meters above the reef. Temperature, salinity, dissolved oxygen, pH, and turbidity were measured from the boat using an EXO2 multiparameter sonde. Sample processing and analytical procedures will follow previously published methods (Becker et al., 2020; Weber et al., 2020). Each site was sampled in replicate on two separate days.

BCO-DMO Processing Description

* Removed blank spaces from parameter names and replaced them with underscores ("_").
* The format of the time column was changed from %H:%M:%S %p to %H:%M:%S. The time values have also been converted from Atlantic Standard time (UTC-4) to UTC+0.
* Removed special characters and units from parameter names. DO_mg/L was changed to DO_Concentration to differentiate it from the DO_Percent values.
* Converted the date field from %m-%d-%y to %Y-%m-%d.
* Added a new field called ISO_DateTime_UTC by combining the date and Time_of_sonde fields; if a row does not contain both a date and Time_of_sonde value, there is no corresponding value in ISO_DateTime_UTC.
* NA data values were removed from the data file and replaced with blank values.

Problem Description

YSI EXO Sonde (YSI Inc./Xylem Inc.) was not available for use on 8 April 2022. This resulted in the following parameters not being made on that date: Time_of_sonde, Temp, mmHG, DO_Percent, DO_Concentration, SPC, C, SAL, pH, NTU, TSS, DEP.

[table of contents | back to top]

Data Files

File	
986266_v1_10m_virgin_island_reef_water_quality_metrics.csv	(Comma Separated Values (.csv), 2.26 KB) MD5:a4b606421309d9f52a353760608424c5
Primary data file for dataset ID 986266, version 1	

[table of contents | back to top]

Related Publications

Apprill, A., & Rappé, M. (2011). Response of the microbial community to coral spawning in lagoon and reef flat environments of Hawaii, USA. Aquatic Microbial Ecology, 62(3), 251–266. doi:10.3354/ame01471
Methods

Becker, C., Weber, L., Suca, J., Llopiz, J., Mooney, T., & Apprill, A. (2020). Microbial and nutrient dynamics in mangrove, reef, and seagrass waters over tidal and diurnal time scales. Aquatic Microbial Ecology, 85, 101–119. https://doi.org/10.3354/ame01944
Methods

Weber, L., González-Díaz, P., Armenteros, M., Ferrer, V. M., Bretos, F., Bartels, E., Santoro, A. E., & Apprill, A. (2019). Microbial signatures of protected and impacted Northern Caribbean reefs: changes from Cuba to the Florida Keys. Environmental Microbiology, 22(1), 499–519. Portico. https://doi.org/10.1111/1462-2920.14870 https://doi.org/doi:10.1111/1462-2920.14870
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
Mission	Name of the project when these data were collected.	unitless
Site	Name of the reef site in the U.S. Virgin Islands where these data were collected.	unitless
Latitiude	Latitude of the reef site.	decimal degrees
Longitude	Longitude of the reef site.	decimal degrees
ISO_DateTime_UTC	Date and time of the Sonde deployment in UTC.	unitless
Date	Date of data collection.	unitless
Sampling_depth	Depth of sampling for non-Sonde samples.	meters (m)
Time_of_sonde	Time of sonde measurements in UTC collected with multiparameter water quality sonde from the UVI Environmental Analysis Lab.	unitless
Temp	Temperature in celcius collected with multiparameter water quality sonde from the UVI Environmental Analysis Lab.	degrees Celcius
mmHg	Millimeters of mercury collected with multiparameter water quality sonde from the UVI Environmental Analysis Lab.	millimeters of mercury (mmHg)
DO_Percent	Dissolved oxygen as percent collected with multiparameter water quality sonde from the UVI Environmental Analysis Lab.	unitless
DO_Concentration	Dissolved oxygen as concentration collected with multiparameter water quality sonde from the UVI Environmental Analysis Lab.	miligrams per liter (mg/L)

SPC	Specific conductance collected with multiparameter water quality sonde from the UVI Environmental Analysis Lab.	microSiemens per centimeter (uS/cm)
C	Conductivity collected with multiparameter water quality sonde from the UVI Environmental Analysis Lab.	microSiemens per centimeter (uS/cm)
SAL	salinity in parts per thousand collected with multiparameter water quality sonde from the UVI Environmental Analysis Lab.	parts per thousand (ppt)
pH	pH collected with multiparameter water quality sonde from the UVI Environmental Analysis Lab.	unitless
NTU	Turbidity (Nephelometric Turbidity Units) collected with multiparameter water quality sonde from the UVI Environmental Analysis Lab.	Nephelometric Turbidity Units (NTU)
TSS	Total suspended solids collected with multiparameter water quality sonde from the UVI Environmental Analysis Lab.	miligrams per liter (mg/L)
DEP	Depth in m (of sonde, not of samples) collected with multiparameter water quality sonde from the UVI Environmental Analysis Lab.	meters (m)
Lab_ID_for_inorganic_nutrients	Internal lab identity given to inorganic nutrients sample.	unitless
PO4	Phosphate concentration measured from 30 ml samples collected 2 meters above the reef.	micrometer (um)
NO3_NO2	Nitrate and nitrate combined concentration measured from 30 ml samples collected 2 meters above the reef.	micrometer (um)
Silicate	Silicate concentration measured from 30 ml samples collected 2 meters above the reef.	micrometer (um)
NO2	Nitrite concentration measured from 30 ml samples collected 2 meters above the reef.	micrometer (um)
NH4	Ammonium concentration measured from 30 ml samples collected 2 meters above the reef.	micrometer (um)
Lab_ID_for_cell_abundances	Internal lab identity given to cell abundance samples.	unitless

pro	Prochlorococcus concentration measured with flow cytometry from 1 mL samples collected 2 meters above the reef.	cells per mL
syn	Synechococcus concentration measured with flow cytometry from 1 mL samples collected 2 meters above the reef.	cells per mL
peuk	Picoeukaryote concentraiton measured with flow cytometry from 1 mL samples collected 2 meters above the reef.	cells per mL
hbact	Heterotrophic Bacteria and Archaea concentrations measured with flow cytometry from 1 mL samples collected 2 meters above the reef.	cells per mL
Lab_ID_for_TON_TOC	Internal lab identity given to total carbon and nitrogen sample.	unitless
npoc	Total organic carbon concentration measured from 10 mL samples collected 2 meters above the reef.	micrometer (um)
tn	Total nitrogen concentration concentration measured from 10 mL samples collected 2 meters above the reef.	micrometer (um)
Lab_ID_for_chlorophyll	Internal lab identity given to chlorophyll samples.	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Alpkem RGA 300 Rapid Flow Analyzer (Alpkem)
Generic Instrument Name	Continuous Flow Analyzer
Dataset-specific Description	Inorganic nutrient concentrations were measured using a Technicon AutoAnalyzer II (SEAL Analytical) and an Alpkem RFA 300 Rapid Flow Analyzer (Alpkem) following the methods of Apprill and Rappé (2011).
Generic Instrument Description	A sample is injected into a flowing carrier solution passing rapidly through small-bore tubing.

Dataset-specific Instrument Name	Beckman-Coulter Altra Flow Cytometer (Beckman Coulter Life Sciences)
Generic Instrument Name	Flow Cytometer
Dataset-specific Description	A Beckman-Coulter Altra flow cytometer (Beckman Coulter Life Sciences) attached to a Harvard Apparatus syringe pump was used to measure cell abundances. Samples were collected in acid-washed and seawater-rinsed HDPE bottles (Nalgene, Thermo Fisher Scientific), preserved in 2 mL cryovials (Corning) with 1% paraformaldehyde (Electron Microscopy Sciences), and stained with Hoechst 33342 DNA stain (1 µg mL^{-1} final concentration). Cells were excited co-linearly by 488 nm (1 W) and UV (~350 nm, 200 mW) lasers (Becker et al., 2020).
Generic Instrument Description	Flow cytometers (FC or FCM) are automated instruments that quantitate properties of single cells, one cell at a time. They can measure cell size, cell granularity, the amounts of cell components such as total DNA, newly synthesized DNA, gene expression as the amount messenger RNA for a particular gene, amounts of specific surface receptors, amounts of intracellular proteins, or transient signalling events in living cells. (from: http://www.bio.umass.edu/micro/immunology/facs542/facswhat.htm)

Dataset-specific Instrument Name	Shimadzu TOC-VCSH Analyzer
Generic Instrument Name	Shimadzu Total Organic Carbon Analyzer TOC-VCPH
Dataset-specific Description	A Shimadzu TOC-VCSH analyzer was used to measure total organic carbon and total nitrogen concentrations, with concentrated phosphoric acid used during processing.
Generic Instrument Description	The Shimadzu Total Organic Carbon Analyzer TOC-VCPH is a PC-controlled, total organic carbon analyzer (high-sensitivity model), designed to measure total carbon (TC), inorganic carbon (IC), total organic carbon (TOC), and non-purgeable organic carbon (NPOC); an optional accessory enables the measurement of particulate organic carbon (POC) and total nitrogen (TN) as well. The instrument uses the 680 degrees Celsius combustion catalytic oxidation method to analyze aqueous samples, and optionally solid and gas samples.

Dataset-specific Instrument Name	Technicon AutoAnalyzer II (SEAL Analytical)
Generic Instrument Name	Technicon AutoAnalyzer II
Dataset-specific Description	Inorganic nutrient concentrations were measured using a Technicon AutoAnalyzer II (SEAL Analytical) and an Alpkem RFA 300 Rapid Flow Analyzer (Alpkem) following the methods of Apprill and Rappé (2011).
Generic Instrument Description	A rapid flow analyzer that may be used to measure nutrient concentrations in seawater. It is a continuous segmented flow instrument consisting of a sampler, peristaltic pump, analytical cartridge, heating bath, and colorimeter. See more information about this instrument from the manufacturer.

Dataset-specific Instrument Name	YSI EXO Sonde (YSI Inc./Xylem Inc.)
Generic Instrument Name	YSI EXO multiparameter water quality sondes
Dataset-specific Description	A YSI EXO Sonde (YSI Inc./Xylem Inc.) was deployed from the ship at 10 meters to measure temperature, salinity, dissolved oxygen, pH, and turbidity at each reef site from the research vessel.
Generic Instrument Description	Comprehensive multi-parameter, water-quality monitoring sondes designed for long-term monitoring, profiling and spot sampling. The EXO sondes are split into several categories: EXO1 Sonde, EXO2 Sonde, EXO3 Sonde. Each category has a slightly different design purpose with the EXO2 and EXO3 containing more sensor ports than the EXO1. Data are collected using up to four user-replaceable sensors and an integral pressure transducer. Users communicate with the sonde via a field cable to an EXO Handheld, via Bluetooth wireless connection to a PC, or a USB connection to a PC. Typical parameter specifications for relevant sensors include dissolved oxygen with ranges of 0-50 mg/l, with a resolution of +/- 0.1 mg/l, an accuracy of 1 percent of reading for values between 0-20 mg/l and an accuracy of +/- 5 percent of reading for values 20-50 mg/l. Temp ranges are from-5 to +50 degC, with an accuracy of +/- 0.001 degC. Conductivity has a range of 0-200 mS/cm, with an accuracy of +/-0.5 percent of reading + 0.001 mS/cm and a resolution of 0.0001 - 0.01 mS/cm.

[table of contents | back to top]

Project Information

A multi-scale approach to predicting infectious multi-host disease spread in marine benthic communities (Multi-scale multi-host disease spread)

Coverage: United States Virgin Islands

NSF Award Abstract:
Marine diseases have devastating impacts on ocean ecosystems and this work will directly examine the framework for understanding disease transmission in the ocean. A team of ecologists, ocean connectivity and disease modelers, microbiologists, and coral immunologists (from the University of Virgin Islands (UVI), Louisiana State University (LSU), Rice University, University of Texas-Arlington and the Woods Hole Oceanographic Institution) will develop a model that predicts transmission of a devastating Caribbean coral disease that has the potential to impact the economic value of coral reefs, including those located in the U.S. This project will support multidisciplinary field and laboratory research experiences of graduate students at multiple minority-serving institutions, and will provide undergraduate students with hands-on training in modeling, ecological and molecular analysis techniques. UVI and LSU are in EPSCoR jurisdictions and have diverse student bodies, including numerous under-represented minority (URM) students. The research team will collaboratively provide URM students with research experiences in STEM fields. Project findings will be broadly communicated through virtual public programming, and through the Virgin Islands Coral Disease Advisory Committee with updates on the vicoraldisease.org website. A coral disease response workshop for the U.S. Virgin Islands will also be held, in which project results will be presented and used to support disease response planning.

Over the last four decades, marine diseases have decimated ecosystem engineers in marine coastal ecosystems, including the rocky intertidal, seagrasses and coral reefs. The pathogens driving these diseases have frequently been challenging to isolate, characterize and confirm, in part because they affect multiple host species and can spread by ocean currents, as well as through individual contact. Here, we propose a multi-scale epidemic model for studying marine disease that addresses both within-host and within-patch disease dynamics, and explicitly acknowledges the dispersal of pathogens between populations. Our interdisciplinary research team of ecologists, connectivity and disease modelers, microbiologists, and coral immunologists will integrate the largest set of predictors of marine disease spread to date: individual host species traits that allow

for disease resistance or susceptibility, local transmission within communities that may have unique community structure, and hydrodynamic connectivity among susceptible communities. Modeling will be supported with rich data sets of within- and among-patch population characteristics and disease dynamics as well as molecular data on species-level disease responses. This project will advance knowledge of infectious diseases by integrating multidimensional scales and differential host susceptibilities into existing epidemiological models. This model will particularly advance the framework for studying marine diseases and has the potential to elucidate the transmission properties of a devastating Caribbean coral disease (stony coral tissue loss disease) that fits the most confounding and notorious hallmarks of marine diseases: infection of multiple hosts by an elusive pathogen.

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.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2109622

[table of contents | back to top]