Water characteristics measured in Narragansett Bay over two years, from March 2021 to March 2023

Website: https://www.bco-dmo.org/dataset/906562
Data Type: Other Field Results
Version: 1
Version Date: 2023-08-21

Project
» Collaborative research: Characterization of Synechococcus-cyanophage interactions across phylogenetic and temporal scales (NB_Syn_cyanophage)

Contributors	Affiliation	Role
Ahlgren, Nathan A.	Clark University	Co-Principal Investigator
Marston, Marcia	Roger Williams University (RWU)	Co-Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset includes basic water characteristics measured in Narragansett Bay (Rhode Island, USA) over two years as part of a study of the dynamics of marine cyanobacteria (Synechococcus) and viruses infecting cyanobacteria (cyanophage) in this estuarine ecosystem. The project principal investigators include Nathan Ahlgren (Clark University) and Marcie Marston (Roger Williams University), and the latter collected the data and water with the assistance of students and/or technicians. Water was sampled and measured once per week for a span of two years in total. Water was sampled from a dock located on the campus of Roger Williams University (RWU) at an approximate latitude and longitude coordinates of 41.649737, -71.256378. Water was collected on an incoming tide in the morning and the following parameters were measured: water temperature, salinity, in situ chlorophyll a, nitrate + nitrite, phosphate, and silicate. Water samples were collected and preserved for measurement of Synechococcus abundance by flow cytometry at a later date.

Table of Contents

Coverage

Spatial Extent: **Lat**:41.649737 **Lon**:-71.256378
Temporal Extent: 2021-03-10 - 2023-03-29

Methods & Sampling

Water was collected at the reported time, and water collection was in nearly all cases taken on the incoming tide. Water was collected from a dock in a 1 liter (L) bottle, from which water temperature, salinity, and chlorophyll a was measured. Water samples for macronutrients were also taken from the 1 L sample bottle and filtered through a 0.45-micrometer (µm) filter and collected in duplicate and stored in 60-milliliter (mL) HDPE bottles at -20 degrees Celsius before being sent for analysis. Macronutrients (silicate, orthophosphate, ammonium, nitrite, and nitrate + nitrite) were measured from duplicate samples by the Center for Coastal Studies using a nutrient autosampler system. Duplicate 1 mL water samples were preserved with 0.125% EM

grade glutaldehyde and frozen and stored at -80 degrees Celsius for flow cyometry analysis at a later time. Water temperature and salinity were measured with certified instruments. In situ chlorophyll a was measured by reading fluorescence of a whole water sample on a calibrated instrument.

Know Issues or Problems:
Sampling was done weekly in nearly all cases, and in most cases sampling was done on Wednesdays. There are a few exceptions and an additional sample on 2021-07-30 was taken two days after the 'normal' weekly sampling.

Data Processing Description

Duplicate samples for macronutrient measurements were made. This dataset reports the mean value of duplicate measurements when both measurements were above the detection limit (flag=0). In rare cases where one duplicate was measured as below detection limit and the other duplicate value was above the detection limit, the latter was reported and a flag value for that measurement is provided (flag=1).

BCO-DMO Processing Description

- Imported original file named "RWU_cyanophage_timeseries_env_data.csv" into the BCO-DMO system.
- Renamed fields to comply with BCO-DMO naming conventions (replaced "." with underscore).
- Converted the original date/time field to ISO 8601 format (local time zone of EST/EDT).
- Created a date/time field in ISO 8601 format in UTC time zone.
- Removed the original date/time field.
- Added columns for the sampling site latitude and longitude.
- Saved the final file as "906562_v1_narragansett_bay_time-series.csv".

[table of contents | back to top]

Data Files

File	
906562_v1_narragansett_bay_time-series.csv	(Comma Separated Values (.csv), 9.83 KB) MD5:f861e10be10f01ffa222b81cc107b377
Primary data file for dataset ID 906562, version 1.	

[table of contents | back to top]

Parameters

Parameter	Description	Units
ISO_DateTime_Local	Date and approximate time of water sampling in the local time zone (EST/EDT) in ISO 8601 format	unitless
ISO_DateTime_UTC	Date and approximate time of water sampling in UTC in ISO 8601 format	unitless
WaterTemp	Water temperature	degrees Celsius
AirTemp	Air temperature	degrees Celsius
Salinity	Water salinity	practical salinity units (PSU)
ChlA	Chlorophyll a	micrograms per liter (ug/L)
NO2NO3	Water nitrate plus nitrite; BDL = below detection limit	micromolar (uM)
PO4	Water orthophosphate; BDL = below detection limit	micromolar (uM)
SiO4	Water silicate; BDL = below detection limit	micromolar (uM)
NH4	Water ammonium; BDL = below detection limit	micromolar (uM)
NO2	Water nitrite; BDL = below detection limit	micromolar (uM)
NH4_flag	Flag for ammonium data. 0 = mean of duplicate measurements; 1 = value of one of the duplicates, the other duplicate was BDL.	unitless
Latitude	Approximate latitude where sample was collected	decimal degrees
Longitude	Approximate longitude where sample was collected	decimal degrees

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	bottle
Generic Instrument Name	Bottle
Dataset-specific Description	Water was collected from a dock in a 1 L bottle.
Generic Instrument Description	A container, typically made of glass or plastic and with a narrow neck, used for storing drinks or other liquids.

Dataset-specific Instrument Name	Turner Designs C-FLUOR Probe (Model: 2120-000)
Generic Instrument Name	Fluorometer
Dataset-specific Description	Used to measure in situ chlorophyll a; Fluorometer model: Turner Designs C-FLUOR Probe (Model: 2120-000) coupled with a Turner Designs DataBank Datalogger.
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	nutrient autosampler
Generic Instrument Name	Nutrient Autoanalyzer
Dataset-specific Description	Macronutrients (silicate, orthophosphate, ammonium, nitrite, and nitrate + nitrite) were measured from duplicate samples by the Center for Coastal Studies using a nutrient autosampler system.
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	Portable Refractometer
Generic Instrument Name	Refractometer
Dataset-specific Description	Used to measure salinity; Portable Refractometer: Model RHS-10ATC.
Generic Instrument Description	A refractometer is a laboratory or field device for the measurement of an index of refraction (refractometry). The index of refraction is calculated from Snell's law and can be calculated from the composition of the material using the Gladstone-Dale relation. In optics the refractive index (or index of refraction) n of a substance (optical medium) is a dimensionless number that describes how light, or any other radiation, propagates through that medium.

Dataset-specific Instrument Name	VEEGEE Scientific encapsulated thermometer model #80704E
Generic Instrument Name	Water Temperature Sensor
Dataset-specific Description	Used to measure water temperature; Thermometer model: VEEGEE Scientific encapsulated thermometer model #80704E.
Generic Instrument Description	General term for an instrument that measures the temperature of the water with which it is in contact (thermometer).

[table of contents | back to top]

Project Information

Collaborative research: Characterization of Synechococcus-cyanophage interactions across phylogenetic and temporal scales (NB_Syn_cyanophage)

Coverage: Narragansett Bay (dock at Roger Williams University): 41°38’59”N, 71°15’24”W

NSF Award Abstract:
Viral infection influences the flow of nutrients in the oceans and the diversity and structure of ecologically important microbial communities. Understanding which viruses infect which hosts is critical to understanding the exact impact of viruses, but there are still critical gaps in knowledge about how widely viruses can infect specific bacteria types and how this can change over time. This project includes the isolation and characterization of hundreds of co-occurring photosynthetic bacteria (cyanobacteria from the genus Synechococcus) and viruses that infect them (cyanophage) from Narragansett Bay, Rhode Island to assess the degree to which they can infect each other and identify specific genes that control cross-infection. DNA collected for over 10 years from Narragansett Bay is used to track Synechococcus and cyanophage communities to determine how virus-host interactions play out in shaping the diversity of natural Synechococcus and cyanophage communities over seasonal cycles and from year to year. This work provides knowledge of how individual viral-host interactions in a natural community can lead to the stable co-existence of particular species of viruses and bacteria in a coastal ecosystem over time. This project supports 15 undergraduate student researchers, a graduate student and a postdoctoral fellow who also receives training in effective practices in science teaching. Integration of the study's results into undergraduate courses and outreach activities facilitates authentic opportunities for students to contribute to research and engagement of local junior and senior high school students.

The team of scientists and students are conducting a phylogenetically-informed study of natural communities of co-occurring Synechococcus and cyanophage, a model tractable system in Narragansett Bay, to characterize phage-host interactions across different scales of diversity and time. The team's goal is to isolate a large collection of ~100 Synechococcus and ~200 cyanophage from Narragansett Bay and to conduct infection assays and comparative genomics on these isolates. They employ amplicon sequencing of highly variable loci for both Synechococcus and cyanophage to characterize community dynamics across broad to fine genetic scales - ecotypes to within-species variants - for 10 years of archived monthly samples and a new weekly time-series over two years. These studies address the following three key questions: 1) Are there inherent boundaries of genetic relatedness (i.e. ecotype, species, or finer levels) at which the patterns of infection networks fundamentally shift from being mostly nested to mostly modular? (2) What are the underlying mechanisms and genetic loci that determine the boundaries of infection, i.e., host range and phage susceptibility? and, (3) How do host-phage interactions at different phylogenetic levels influence community structure over short (weeks to months) and long (year-to-year) time scales? Results from this project help to better understand how phytoplankton and bacterioplankton communities are shaped by viral predation and how host and phage diversity is created, maintained, and structured in the oceans.

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-2023175

[table of contents | back to top]