Elemental composition of phytoplankton communities from multivariate mesocosm experiments conducted with a natural phytoplankton community from Narragansett Bay, RI.

Website: https://www.bco-dmo.org/dataset/848587
Data Type: Other Field Results
Version: 1
Version Date: 2021-04-26

Project
» Dimensions: Collaborative Research: Genetic, functional and phylogenetic diversity determines marine phytoplankton community responses to changing temperature and nutrients (Phytoplankton Community Responses)

Program
» Dimensions of Biodiversity (Dimensions of Biodiversity)

Contributors	Affiliation	Role
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Abstract
This dataset reports the elemental composition of phytoplankton communities from multivariate mesocosm experiments conducted with a natural phytoplankton community from Narragansett Bay, RI. These data were assessed in Anderson et al. The Interactive Effects of Temperature and Nutrients on a Spring Phytoplankton Community (in prep).

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Coverage

Spatial Extent: **Lat**:41.57 **Lon**:-71.39
Temporal Extent: 2017-03-20

Methods & Sampling

The elemental composition of phytoplankton communities was analyzed via multivariate mesocosm experiments conducted with a natural phytoplankton community from Narragansett Bay, RI. Water was incubated in triplicate at -0.5ºC, 2.6ºC, and 6ºC for 10 days. At each temperature, treatments included both nutrient amendments (N, P, Si addition) and controls (no macronutrients added).

At the onset and conclusion of the incubation for all treatments, and additionally at each dilution time point for 2.6 and 6ºC amended treatments, each biological incubation replicate was assessed for particulate organic carbon (POC) and nitrogen (PON), and biogenic silica (BSi) content. POC and PON were evaluated in triplicate by harvesting cells onto 25 millimeter (mm) GF/F filters which had been pre-combusted at 450ºC for 24 hours. Filters were then analyzed on a Costech Elemental Combustion System (Costech Analytical Technologies Inc.). BSi content was assessed by filtering cells in triplicate onto 2 micrometer (µm) polycarbonate filters and analyzing them on a Barnstead Turner SP-830 spectrophotometer, following the methods of Strickland and Parsons (1972). Additionally, nutrient analyses of ammonium, phosphate, silicate, and nitrite/nitrate (total inorganic nitrogen) were evaluated using a Lachat Quikchem 8500 analyzer (Hach) at the University of Rhode Island Marine Science Research Facility.

For complete methodology, see “The Interactive Effects of Temperature and Nutrients on a Spring Phytoplankton Community” (Anderson et al, *in prep*).

Note: Due to operator error, one replicate of POC and PON had to be discarded from the 6ºC amended incubation.

Data Processing Description

BCO-DMO processing:
- Adjusted field/parameter names to comply with database requirements
- Missing data identifier ‘NA’ and ‘N/A’ replaced with 'nd' (BCO-DMO's default missing data identifier)
- Added a conventional header with dataset name, PI names, version date
- Columns: uM_Si, uM_C, uM_N, CN, SiC were rounded to the thousandth decimal place

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Data Files

File
phyto_elemental_composition.csv (Comma Separated Values (.csv), 1.97 KB) MD5:63e7cc3c60762121c0f113ffa46ed8bc Primary data file for dataset ID 848587

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Related Publications

Anderson, S. I., Franzè, G., Kling, J. D., Wilburn, P., Kremer, C. T., Menden-Deuer, S., Litchman, E., Hutchins, D.

A., & Rynearson, T. A. (2022). The interactive effects of temperature and nutrients on a spring phytoplankton community. Limnology and Oceanography, 67(3), 634–645. Portico. https://doi.org/10.1002/lno.12023
Results

Strickland, J. D. H. and Parsons, T. R. (1972). A Practical Hand Book of Seawater Analysis. Fisheries Research Board of Canada Bulletin 157, 2nd Edition, 310 p.
Methods

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Related Datasets

IsRelatedTo

Anderson, S. I., Franze, G., Kling, J. D., Wilburn, P., Kremer, C. T., Menden-Deuer, S., Litchman, E., Hutchins, D. A., Rynearson, T. A. (2021) **Microscopy cell counts from multivariate mesocosm experiments conducted with a natural phytoplankton community from Narragansett Bay, RI.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-04-14 doi:10.26008/1912/bco-dmo.848977.1 [view at BCO-DMO]

Anderson, S. I., Franze, G., Kling, J. D., Wilburn, P., Kremer, C. T., Menden-Deuer, S., Litchman, E., Hutchins, D. A., Rynearson, T. A. (2021) **Size-fractionated chlorophyll a from multivariate mesocosm experiments conducted with a natural phytoplankton community from Narragansett Bay, RI.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-04-14 doi:10.26008/1912/bco-dmo.848948.1 [view at BCO-DMO]

Franzè, G., Menden-Deuer, S., Anderson, S. I., Kling, J. D., Wilburn, P., Hutchins, D. A., Litchman, E., Rynearson, T. A. (2023) **Herbivorous protist abundances under simultaneous manipulation of temperature and nutrients from the Long-term Plankton Time Series site in Narragansett Bay, RI in 2017.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-04-10 doi:10.26008/1912/bco-dmo.893414.1 [view at BCO-DMO]

Franzè, G., Menden-Deuer, S., Anderson, S. I., Kling, J. D., Wilburn, P., Hutchins, D. A., Litchman, E., Rynearson, T. A. (2023) **Temperature and nutrient dependent phytoplankton growth and herbivorous protist grazing rates from the Long-term Plankton Time Series site in Narragansett Bay, RI in 2017.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-04-12 doi:10.26008/1912/bco-dmo.893500.1 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
Sample	Sample identification number	unitless
Replicate	Biological replicate identification	unitless
Date	Day of experiment in which sample was collected	days
Temperature	Temperature treatment in which incubation was conducted	degrees celsius (°C)
Nutrient	Nutrient treatment in which incubation was conducted	unitless
uM_Si	Biogenic silica in sample	micromoles per liter (µmol/L)
uM_C	Particulate organic carbon in sample	micromoles per liter (µmol/L)
uM_N	Particulate organic nitrogen in sample	micromoles per liter (µmol/L)
CN	Ratio of carbon to nitrogen in sample	unitless
SiC	Ratio of biogenic silica to carbon in sample	unitless

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Instruments

Dataset-specific Instrument Name	Costech Elemental Combustion System
Generic Instrument Name	Costech International Elemental Combustion System (ECS) 4010
Generic Instrument Description	The ECS 4010 Nitrogen / Protein Analyzer is an elemental combustion analyser for CHNSO elemental analysis and Nitrogen / Protein determination. The GC oven and separation column have a temperature range of 30-110 degC, with control of +/- 0.1 degC.

Dataset-specific Instrument Name	Lachat Quikchem 8500 analyzer
Generic Instrument Name	Flow Injection Analyzer
Dataset-specific Description	Lachat Quikchem 8500 analyzer (Hach)
Generic Instrument Description	An instrument that performs flow injection analysis. Flow injection analysis (FIA) is an approach to chemical analysis that is accomplished by injecting a plug of sample into a flowing carrier stream. FIA is an automated method in which a sample is injected into a continuous flow of a carrier solution that mixes with other continuously flowing solutions before reaching a detector. Precision is dramatically increased when FIA is used instead of manual injections and as a result very specific FIA systems have been developed for a wide array of analytical techniques.

Dataset-specific Instrument Name	Turner SP-830 spectrophotometer
Generic Instrument Name	Spectrophotometer
Dataset-specific Description	Turner SP-830 spectrophotometer (Barnstead International)
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

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Project Information

Dimensions: Collaborative Research: Genetic, functional and phylogenetic diversity determines marine phytoplankton community responses to changing temperature and nutrients (Phytoplankton Community Responses)

Coverage: Narragansett Bay, RI and Bermuda, Bermuda Atlantic Time-series Study (BATS)

NSF Award Abstract:

Photosynthetic marine microbes, phytoplankton, contribute half of global primary production, form the base of most aquatic food webs and are major players in global biogeochemical cycles. Understanding their community composition is important because it affects higher trophic levels, the cycling of energy and elements and is sensitive to global environmental change. This project will investigate how phytoplankton communities respond to two major global change stressors in aquatic systems: warming and changes in nutrient availability. The researchers will work in two marine systems with a long history of environmental monitoring, the temperate Narragansett Bay estuary in Rhode Island and a subtropical North Atlantic site near Bermuda. They will use field sampling and laboratory experiments with multiple species and varieties of phytoplankton to assess the diversity in their responses to different temperatures under high and low nutrient concentrations. If the diversity of responses is high within species, then that species may have a better chance to adapt to rising temperatures and persist in the future. Some species may already be able to grow at high temperatures; consequently, they may become more abundant as the ocean warms. The researchers will incorporate this response information in mathematical models to predict how phytoplankton assemblages would reorganize under future climate scenarios. Graduate students and postdoctoral associates will be trained in diverse scientific approaches and techniques such as shipboard sampling, laboratory experiments, genomic analyses and mathematical modeling. The results of the project will be incorporated into K-12 teaching, including an advanced placement environmental science class for underrepresented minorities in Los Angeles, data exercises for rural schools in Michigan and disseminated to the public through an environmental journalism institute based in Rhode Island.

Predicting how ecological communities will respond to a changing environment requires knowledge of genetic, phylogenetic and functional diversity within and across species. This project will investigate how the interaction of phylogenetic, genetic and functional diversity in thermal traits within and across a broad range of species determines the responses of marine phytoplankton communities to rising temperature and changing nutrient regimes. High genetic and functional diversity within a species may allow evolutionary adaptation of that species to warming. If the phylogenetic and functional diversity is higher across species, species sorting and ecological community reorganization is likely. Different marine sites may have a different balance of genetic and functional diversity within and across species and, thus, different contribution of evolutionary and ecological responses to changing climate. The research will be conducted at two long-term time series sites in the Atlantic Ocean, the Narragansett Bay Long-Term Plankton Time Series and the Bermuda Atlantic Time Series (BATS) station. The goal is to assess intra- and inter-specific genetic and functional diversity in thermal responses at contrasting nutrient concentrations for a representative range of species in communities at the two sites in different seasons, and use this information to parameterize eco-evolutionary models embedded into biogeochemical ocean models to predict responses of phytoplankton communities to projected rising temperatures under realistic nutrient conditions. Model predictions will be informed by and tested with field data, including the long-term data series available for both sites and in community temperature manipulation experiments. This project will provide novel information on existing intraspecific genetic and functional thermal diversity for many ecologically and biogeochemically important phytoplankton species, estimate generation of new genetic and functional diversity in evolution experiments, and develop and parameterize novel eco-evolutionary models interfaced with ocean biogeochemical models to predict future phytoplankton community structure. The project will also characterize the interaction of two major global change stressors, warming and changing nutrient concentrations, as they affect phytoplankton diversity at functional, genetic, and phylogenetic levels. In addition, the project will develop novel modeling methodology that will be broadly applicable to understanding how other types of complex ecological communities may adapt to a rapidly warming world.

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Program Information

Dimensions of Biodiversity (Dimensions of Biodiversity)

Website: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503446

Coverage: global

(adapted from the NSF Synopsis of Program)
Dimensions of Biodiversity is a program solicitation from the NSF Directorate for Biological Sciences. FY 2010

was year one of the program. [MORE from NSF]

The NSF Dimensions of Biodiversity program seeks to characterize biodiversity on Earth by using integrative, innovative approaches to fill rapidly the most substantial gaps in our understanding. The program will take a broad view of biodiversity, and in its initial phase will focus on the integration of genetic, taxonomic, and functional dimensions of biodiversity. Project investigators are encouraged to integrate these three dimensions to understand the interactions and feedbacks among them. While this focus complements several core NSF programs, it differs by requiring that multiple dimensions of biodiversity be addressed simultaneously, to understand the roles of biodiversity in critical ecological and evolutionary processes.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1638834

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