Size-fractionated chlorophyll a from multivariate mesocosm experiments conducted with a natural phytoplankton community from Narragansett Bay, RI

Website: https://www.bco-dmo.org/dataset/848948
Data Type: Other Field Results
Version: 1
Version Date: 2021-04-14

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 size-fractionated chlorophyll a 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).

Table of Contents

Coverage

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

Methods & Sampling

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

Community size structure from incubation experiments was assessed using size-fractionated chlorophyll a. At each dilution time point, whole incubation water was filtered in triplicate onto 25 mm Whatman GF/F filters (GE Healthcare), 5 µm polyester filters, or pre-filtered through a 20 µm mesh and then filtered onto 25 mm GF/F filters. This allowed for the calculation of the following size fractions: 0.7-5 µm, 5-20 µm, and >20 µm. Chlorophyll was then extracted in 90% acetone for 24 hours at -20ºC. Fluorescence was read on a 10-AU fluorometer (Turner Designs) and data was analyzed according to the techniques described in Graff and Rynearson (2011).

Data Processing Description

BCO-DMO processing description:

- 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

[table of contents | back to top]

Data Files

File
chl_a.csv (Comma Separated Values (.csv), 2.32 KB) MD5:7dcdea15eddc743f06ccd747f07b1adc Primary data file for dataset ID 848948

[table of contents | back to top]

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

Graff, J. R., & Rynearson, T. A. (2011). Extraction method influences the recovery of phytoplankton pigments from natural assemblages. Limnology and Oceanography: Methods, 9(4), 129–139. doi:10.4319/lom.2011.9.129
Methods

[table of contents | back to top]

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) **Elemental composition of phytoplankton communities 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 2021-04-26 doi:10.26008/1912/bco-dmo.848587.1 [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) **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]

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]

[table of contents | back to top]

Parameters

Parameter	Description	Units
Time	Day of experiment in which sample was collected	days
Temperature	Temperature treatment in which incubation was conducted	degrees celsius (ºC)
Nutrients	Nutrient treatment in which incubation was conducted	unitless
Replicate	Biological replicate identification	unitless
Mesh	Filter pore size. If 20, sample went through a 20 µm mesh prior to filtration over 0.7 µm filter	micrometers (µm)
Chlorophyll_a	Chlorophyll in sample	micrograms per liter (µg/L)
Phaeo	Phaeophytin in sample	micrograms per liter (µg/L)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	10-AU fluorometer (Turner Designs)
Generic Instrument Name	Turner Designs Fluorometer 10-AU
Generic Instrument Description	The Turner Designs 10-AU Field Fluorometer is used to measure Chlorophyll fluorescence. The 10AU Fluorometer can be set up for continuous-flow monitoring or discrete sample analyses. A variety of compounds can be measured using application-specific optical filters available from the manufacturer (read more from Turner Designs, turnerdesigns.com, Sunnyvale, CA, USA).

[table of contents | back to top]

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.

[table of contents | back to top]

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.

[table of contents | back to top]

Funding

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

[table of contents | back to top]