Microscopy cell counts from multivariate mesocosm experiments conducted with a natural phytoplankton community from Narragansett Bay, RI

Website: https://www.bco-dmo.org/dataset/848977
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
Anderson, Stephanie I.	University of Rhode Island (URI-GSO)	Principal Investigator, Contact
Franzè, Gayantonia	Institute of Marine Research (Bergen, Norway) (IMR)	Co-Principal Investigator
Hutchins, David A.	University of Southern California (USC)	Co-Principal Investigator
Kling, Joshua D.	University of California-Berkeley (UC Berkeley)	Co-Principal Investigator
Kremer, Colin T.	University of California-Los Angeles (UCLA)	Co-Principal Investigator
Litchman, Elena	Michigan State University (MSU)	Co-Principal Investigator
Menden-Deuer, Susanne	University of Rhode Island (URI-GSO)	Co-Principal Investigator
Rynearson, Tatiana A.	University of Rhode Island (URI-GSO)	Co-Principal Investigator
Wilburn, Paul	Michigan State University (MSU)	Co-Principal Investigator
Heyl, Taylor	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset represents microscopy cell counts 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).

At the onset and conclusion of the incubation experiments, the microplankton community was identified and quantified to discern treatment effects on community composition. Aliquots from each incubation were fixed in triplicate with 2% acid Lugol's solution for microscopy, final concentration. Cell enumeration was conducted by performing cell counts ~>10 micrometer (µm) on a 1 milliliter (ml) Sedgewick cell-counting chamber (Structure Probe Inc.) using an Eclipse E800 microscope (Nikon).

These data were assessed as part of "The Interactive Effects of Temperature and Nutrients on a Spring Phytoplankton Community" (Anderson et al, in prep).

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	
microscopy_cell_counts.csv	(Comma Separated Values (.csv), 5.69 KB) MD5:93c4d6bf74809c9dad3b258ccb8d7864
Primary data file for dataset ID 848977	

[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

[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) **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]

[table of contents | back to top]

Parameters

Parameter	Description	Units
Treatment	Treatment identification. Letter corresponds to temperature treatment, L=low (-5_C), M=medium (2.6_C), H=high (6_C); and symbol describes whether macronutrients were added (+) or not (-). T0 is initial community.	days
Replicate	Biological replicate identification	unitless
Temperature	Nutrient treatment in which incubation was conducted	degrees celcius (iC)
Nutrient	Nutrient treatment in which incubation was conducted	unitless
Total_abundance	Total cell abundance	cells per liter (cells/L)
Alexandrium_sp	Species abundance	cells per liter (cells/L)
Asterionellopsis_glacialis	Species abundance	cells per liter (cells/L)
Bacteriastrum_sp	Species abundance	cells per liter (cells/L)
Cerataulina_pelagica	Species abundance	cells per liter (cells/L)
Chaetoceros_affinis	Species abundance	cells per liter (cells/L)

Chaetoceros_atlanticus	Species abundance	cells per liter (cells/L)
Chaetoceros_compressus	Species abundance	cells per liter (cells/L)
Chaetoceros_costatus	Species abundance	cells per liter (cells/L)
Chaetoceros_danicus	Species abundance	cells per liter (cells/L)
Chaetoceros_debilis	Species abundance	cells per liter (cells/L)
Chaetoceros_decipiens	Species abundance	cells per liter (cells/L)
Chaetoceros_diadema	Species abundance	cells per liter (cells/L)
Chaetoceros_didymus	Species abundance	cells per liter (cells/L)
Chaetoceros_laciniosus	Species abundance	cells per liter (cells/L)
Chaetoceros_mitra	Species abundance	cells per liter (cells/L)
Chaetoceros_similis	Species abundance	cells per liter (cells/L)
Chaetoceros_spp	Species abundance	cells per liter (cells/L)
Chaetoceros_subtilis	Species abundance	cells per liter (cells/L)
Chaetoceros_winghamii	Species abundance	cells per liter (cells/L)
Coscinodiscus_spp	Species abundance	cells per liter (cells/L)
Cylindrotheca_closterium	Species abundance	cells per liter (cells/L)
Dactyliosolen_blavyanus	Species abundance	cells per liter (cells/L)

Dactyliosolen_fragilissimus	Species abundance	cells per liter (cells/L)
Diatom_unknown	Species abundance	cells per liter (cells/L)
Dictyocha_speculum	Species abundance	cells per liter (cells/L)
Dinoflagellates_unknown	Species abundance	cells per liter (cells/L)
Ditylum_brightwellii	Species abundance	cells per liter (cells/L)
Flagellate_unknown	Species abundance	cells per liter (cells/L)
Guinardia_delicatula	Species abundance	cells per liter (cells/L)
Gymnodinium_spp	Species abundance	cells per liter (cells/L)
Gyrodinium_spp	Species abundance	cells per liter (cells/L)
Heterocapsa_rotundata	Species abundance	cells per liter (cells/L)
Heterocapsa_triquetra	Species abundance	cells per liter (cells/L)
Leptocylindrus_danicus	Species abundance	cells per liter (cells/L)
Leptocylindrus_minimus	Species abundance	cells per liter (cells/L)
Licmophora_spp	Species abundance	cells per liter (cells/L)
Melosira_spp	Species abundance	cells per liter (cells/L)
Odontella_spp	Species abundance	cells per liter (cells/L)
Paralia_sulcata	Species abundance	cells per liter (cells/L)

Pennate_unknown	Species abundance	cells per liter (cells/L)
Phaeocystis_spp	Species abundance	cells per liter (cells/L)
Pleurosigma_spp	Species abundance	cells per liter (cells/L)
Prorocentrum_spp	Species abundance	cells per liter (cells/L)
Protoperidinium_spp	Species abundance	cells per liter (cells/L)
Pseudonitzschia_spp	Species abundance	cells per liter (cells/L)
Rhabdonema_adriaticum	Species abundance	cells per liter (cells/L)
Rhizosolenia_pungens	Species abundance	cells per liter (cells/L)
Rhizosolenia_setigera	Species abundance	cells per liter (cells/L)
Rhizosolenia_spp	Species abundance	cells per liter (cells/L)
Rhizosolenia_styliformis_imbricata	Species abundance	cells per liter (cells/L)
Skeletonema_spp	Species abundance	cells per liter (cells/L)
Thalassionema_nitzschioides	Species abundance	cells per liter (cells/L)
Thalassiosira_nordenskioeldii	Species abundance	cells per liter (cells/L)
Thalassiosira_rotula	Species abundance	cells per liter (cells/L)
Thalassiosira_spp	Species abundance	cells per liter (cells/L)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Eclipse E800 microscope (Nikon)
Generic Instrument Name	Microscope - Optical
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

[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]