Elemental carbon and nitrogen data for Skeletonema species as analyzed in Anderson and Rynearson, 2020

Website: https://www.bco-dmo.org/dataset/780386
Data Type: experimental
Version: 1
Version Date: 2019-10-30

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
Elemental concentrations for Skeletonema species (n=2), as analyzed in Anderson and Rynearson, 2020. This dataset includes carbon, nitrogen, and volume measurements for S. marinoi (n=3) and S. pseudocostatum (n=4) evaluated at the thermal minimum, maximum, and optimum for each strain. Strains were isolated from Narragansett Bay, Rhode Island.

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Coverage

Spatial Extent: **Lat**:41.566 **Lon**:-73.064
Temporal Extent: 2015-03-03 - 2016-06-13

Dataset Description

This dataset includes carbon and nitrogen concentrations of Skeletonema cultures maintained at six temperatures. Strains were collected at Narragansett Bay, Rhode Island.

Methods & Sampling

Complete methods are outlined in Anderson and Rynearson, 2020, in press.

Elemental Analyses: From each culture and during exponential growth phase, >1 x 107 cells were filtered in triplicate onto precombusted 25-mm GF/F filters, and rinsed with 10 ml F/2 media. Blanks were made to correct for any elemental contribution from filters or media. Filters were dried at 60 degrees C for 24 hrs. The mass of the filter, total volume filtered, and cell counts were utilized to determine the number of cells analyzed. Elemental composition was assessed on an elemental analyzer.

Cell volume: Linear measurements of height and diameter were recorded for 30 live cells from each strain and used to calculate cell volume using the volume of a cylinder (Montagnes and Franklin 2001).

All data processing was carried out in R 3.4.1(R-Core-Team 2015).

Data Processing Description

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- re-formatted date from m/d/yyyy to yyyy-mm-dd

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Data Files

File
CHN.csv (Comma Separated Values (.csv), 2.86 KB) MD5:5a19430eb2211db6b26643d1b80c2ae6 Primary data file for dataset ID 780386

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Related Publications

Anderson, S. I., & Rynearson, T. A. (2020). Variability approaching the thermal limits can drive diatom community dynamics. Limnology and Oceanography, 65(9), 1961–1973. Portico. https://doi.org/10.1002/lno.11430
Results

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Parameters

Parameter	Description	Units
Species	Species	unitless
Strain	Strain	unitless
GenBank	GenBank Accession Number associated with each strain	unitless
Collection_date	Date of collection from the environment; formatted as yyyy-mm-dd	unitless
Isolation_Lat	Latitude of strain isolation; north is positive	degrees
Isolation_Lon	Longitude of strain isolation; east is positive	degrees
Isolation_Temperature	Sea surface temperature (SST) at time and position of isolation	degrees C
Temperature	Experimental temperature at which measurements were recorded	degrees C
meanC	Mean carbon per cell	picomol carbon per cell
seC	Standard error of carbon per cell	picomol carbon per cell
meanN	Mean nitrogen per cell	picomol nitrogen per cell
seN	Standard error of nitrogen per cell	picomol nitrogen per cell
meanCN	Average molar ratio of carbon to nitrogen per cell	unitless
seCN	Standard error of molar carbon to nitrogen per cell	unitless
meanV	Mean cell volume	cubic micrometers (um3)
seV	Cell volume standard error	cubic micrometers (um3)
mean_cd	Mean carbon density per cell	femtomol/cubic micrometers (fmol um-3)
se_cd	Carbon density per cell standard error	femtomol/cubic micrometers (fmol um-3)
mean_nd	Mean nitrogen density per cell	femtomol/cubic micrometers (fmol um-3)
se_nd	Nitrogen density per cell standard error	femtomol/cubic micrometers (fmol um-3)

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Instruments

Dataset-specific Instrument Name	Elemental analyzer (CE-440, Exeter Analytical, North Chelmsford, MA)
Generic Instrument Name	CHN Elemental Analyzer
Dataset-specific Description	Used for elemental analyses.
Generic Instrument Description	A CHN Elemental Analyzer is used for the determination of carbon, hydrogen, and nitrogen content in organic and other types of materials, including solids, liquids, volatile, and viscous samples.

Dataset-specific Instrument Name	Eclipse E800 microscope (Nikon, Tokyo, Japan)
Generic Instrument Name	Microscope - Optical
Dataset-specific Description	Used t measure cell volume.
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".

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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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