Literature compilation of thermal growth rates from four phytoplankton functional types

Website: https://www.bco-dmo.org/dataset/839696
Data Type: Other Field Results
Version: 1
Version Date: 2021-02-04

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
Rynearson, Tatiana A.	University of Rhode Island (URI-GSO)	Principal Investigator
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Abstract
Literature compilation of thermal growth rates from four phytoplankton functional types assessed in Anderson et al., Marine Phytoplankton Functional Types Exhibit Diverse Responses to Thermal Change. (in review).

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Dataset Description

Literature compilation of phytoplankton thermal growth rates for diatoms, dinoflagellates, coccolithophores, and cyanobacteria. Study selection followed the criteria outlined in Thomas et al. (2012) and Anderson et al. (in review). Original experimental methods can be found in cited literature.

Complete information on each isolate can be found in the related dataset, https://www.bco-dmo.org/dataset/839689, and in cited literature.

Data Processing Description

BCO-DMO Processing:
- replaced "NA" with "nd" as missing data value;
- renamed fields (replaced periods with underscores);
- removed commas from the "study" column.

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Data Files

File
growth_rates.csv (Comma Separated Values (.csv), 279.60 KB) MD5:053323af5d1bb338d4bb78ea18b77bb4 Primary data file for dataset ID 839696

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Related Publications

Thomas, M. K., Kremer, C. T., Klausmeier, C. A., & Litchman, E. (2012). A Global Pattern of Thermal Adaptation in Marine Phytoplankton. Science, 338(6110), 1085–1088. doi:10.1126/science.1224836
Methods

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Related Datasets

IsRelatedTo

Rynearson, T. A. (2021) **Estimated thermal traits for phytoplankton.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-02-04 doi:10.26008/1912/bco-dmo.839689.1 [view at BCO-DMO]
Relationship Description: Contains complete information on each isolate.

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Parameters

Parameter	Description	Units
isolate_code	Isolate code identifier adpated from Thomas et al. (2012). Full isolate information contained in related dataset https://www.bco-dmo.org/dataset/839689	unitless
study	Published studies from which growth values were originally recorded	unitless
genus	taxonomic classification, genus name	unitless
species	taxonomic classification, species name	unitless
name	Strain identifier	unitless
group	Phytoplankton functional type	unitless
temperature	Temperature at which growth was measured	degrees Celsius
r	Growth rate recorded at each temperature	per day

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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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