C:N ratios of two heat-tolerant populations of Chaetoceros simplex and control and ancestral populations, at different temperatures

Website: https://www.bco-dmo.org/dataset/778926
Data Type: experimental
Version: 1
Version Date: 2019-10-07

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

Contributors	Affiliation	Role
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Abstract
C:N ratios of the two 34C-tolerant populations of Chaetoceros simplex and control and ancestral populations, at different temperatures.

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Coverage

Temporal Extent: 2016-06 - 2016-10

Dataset Description

C:N ratios of the two 34C-tolerant populations of *Chaetoceros simplex* and control and ancestral populations, at different temperatures.

Acquisition Description

Chaetoceros simplex cultures, were obtained from population strain CCMP 200 (National Center for Marine Algae and Microbiota, NCMA).

C : N elemental analyses:
We measured the elemental composition of the two 34 °C-tolerant populations and the control and ancestral populations, at different temperatures. From each culture during exponential growth, we filtered 10–20 mL duplicate subsamples onto pre-combusted GF/F filters. The filters were then dried at 60 °C for 24 h, packed in aluminium tins and kept in a desiccator. Blanks were 10–20 mL of the medium filtered and processed as other samples. Particulate C and N were measured with a CHN analyzer (Costech ECS 4010) and ratios were calculated from weight percentage of each element after the subtraction of the corresponding blank.

More details in Aranguren-Gassis et al. 2019, Ecology Letters.

Processing Description

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions

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Related Publications

Aranguren-Gassis, M., Kremer, C. T., Klausmeier, C. A., & Litchman, E. (2019). Nitrogen limitation inhibits marine diatom adaptation to high temperatures. Ecology Letters.

doi:10.1111/ele.13378

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Parameters

Parameter	Description	Units
Temperature	Culture maintenance temperature	Celsius degrees
CN_ratio	Carbon:Nitrogen ratio	percent
treatment	Experimental treatment: Evolved = populations raised 34C; Control = populations maintained at 25C	unitless

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Instruments

Dataset-specific Instrument Name	CHN analyzer (Costech ECS 4010)
Generic Instrument Name	CHN Elemental Analyzer
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.

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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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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1638958
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