Series 1C: Supplemental experiments on Tp-1335: Determination of dark acclimatization time of the diatom Thalassiosira pseudonana

Website: https://www.bco-dmo.org/dataset/714552
Data Type: experimental
Version: 1
Version Date: 2017-09-11

Project
» Collaborative Research: Effects of multiple stressors on Marine Phytoplankton (Stressors on Marine Phytoplankton)

Contributors	Affiliation	Role
Passow, Uta	University of California-Santa Barbara (UCSB-MSI)	Principal Investigator
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Experiments to investigate the combined effect of light and temperature changes on the growth rate (mu) of Thalassiosira pseudonana CCMP 1335. This dataset includes the dark acclimatization time.

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Coverage

Temporal Extent: 2015-04-11

Dataset Description

Experiments were conducted to investigate the combined effect of light and temperature changes on the growth rate (mu) of *Thalassiosira pseudonana* CCMP 1335. *T. pseudonana* was grown in artificial seawater (ASW) (Kester et al.1967), enriched as in f/2 (Guillard 1975). Each of five experiments per series was conducted at a different temperature (13.4; 18.5; 24.4; 26.5; 22.5 C). At each temperature, cultures were kept on a 12-hour light 12-hour dark cycle under eight light intensities ranging from 35 umol/m^2/S to 140 umol/m^2/s. Optical density measurements (OD680 and OD720), dark-adapted Instantaneous Chlorophyll Fluorescence (F0) and the quantum yield (QY=Fv/Fm, where Fv is the maximal variable fluorescence and Fm is the maximal fluorescence intensity) and cell concentrations were determined daily at the end of the dark period. Cell counts were conducted in a hemocytometer on a microscope.

Methods & Sampling

To measure dark adapted instantaneous chlorophyll fluorescence (F0) and quantum yield (QY=Fv/Fm, where Fv is the maximal variable fluorescence and Fm is the maximal fluorescence intensity) dark adaptation time needs to be determined. *Thalassiosira pseudonana* CCMP 1335 is extremely sensitive to small amounts of even green or red light and a successful curve can only be conducted in complete darkness. Dark adaptation times were tested over a 30-minutes period.

Data 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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Data Files

File
Tp_dark_adapt.csv(Comma Separated Values (.csv), 322 bytes) MD5:e50e111af64e0e62c8e1b95441d0a9b2 Primary data file for dataset ID 714552

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Parameters

Parameter	Description	Units
Time	initial time	unitless
minutes	elapsed time between measurements	minutes
F0_replicate1	Instantaneous chlorophyll fluorescence (F0)- replicate 1	relative units
F0_replicate2	Instantaneous chlorophyll fluorescence (F0) - replicate 2	relative units
F0_replicate3	Instantaneous chlorophyll fluorescence (F0) - replicate 1	relative units

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Instruments

Dataset-specific Instrument Name	Z985 Cuvette Aquapen (Qubit Systems)
Generic Instrument Name	Fluorometer
Dataset-specific Description	Used to measure instantaneous chlorophyll fluorescence (F0). AquaPen settings: f = 30, F=71, A = 50.
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

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Project Information

Collaborative Research: Effects of multiple stressors on Marine Phytoplankton (Stressors on Marine Phytoplankton)

The overarching goal of this project is to develop a framework for understanding the response of phytoplankton to multiple environmental stresses. Marine phytoplankton, which are tiny algae, produce as much oxygen as terrestrial plants and provide food, directly or indirectly, to all marine animals. Their productivity is thus important both for global elemental cycles of oxygen and carbon, as well as for the productivity of the ocean. Globally the productivity of marine phytoplankton appears to be changing, but while we have some understanding of the response of phytoplankton to shifts in one environmental parameter at a time, like temperature, there is very little knowledge of their response to simultaneous changes in several parameters. Increased atmospheric carbon dioxide concentrations result in both ocean acidification and increased surface water temperatures. The latter in turn leads to greater ocean stratification and associated changes in light exposure and nutrient availability for the plankton. Recently it has become apparent that the response of phytoplankton to simultaneous changes in these growth parameters is not additive. For example, the effect of ocean acidification may be severe at one temperature-light combination and negligible at another. The researchers of this project will carry out experiments that will provide a theoretical understanding of the relevant interactions so that the impact of climate change on marine phytoplankton can be predicted in an informed way. This project will engage high schools students through training of a teacher and the development of a teaching unit. Undergraduate and graduate students will work directly on the research. A cartoon journalist will create a cartoon story on the research results to translate the findings to a broader general public audience.

Each phytoplankton species has the capability to acclimatize to changes in temperature, light, pCO_2, and nutrient availability - at least within a finite range. However, the response of phytoplankton to multiple simultaneous stressors is frequently complex, because the effects on physiological responses are interactive. To date, no datasets exist for even a single species that could fully test the assumptions and implications of existing models of phytoplankton acclimation to multiple environmental stressors. The investigators will combine modeling analysis with laboratory experiments to investigate the combined influences of changes in pCO_2, temperature, light, and nitrate availability on phytoplankton growth using cultures of open ocean and coastal diatom strains (Thalassiosira pseudonana) and an open ocean cyanobacteria species (Synechococcus sp.). The planned experiments represent ideal case studies of the complex and interactive effects of environmental conditions on organisms, and results will provide the basis for predictive modeling of the response of phytoplankton taxa to multiple environmental stresses.

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Funding

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