Series 3B: Supplemental experiments on T. pseudonana (CCMP1014) - growth under bubbling stress: A-pulse raw fluorescence data

Website: https://www.bco-dmo.org/dataset/748930
Data Type: experimental
Version: 1
Version Date: 2018-10-31

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

Contributors	Affiliation	Role
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Abstract
Experiments were conducted to determine the optimal actinic light pulse (A-pulse) setting for NPQ1 protocols of the AquaPen for assessment of non-photochemical quenching in Thalassiosira pseudonana CCMP 1014 cultures grown at different light environments. These are the raw fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C at four light levels and pulsed at eight light levels.

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Coverage

Temporal Extent: 2018-07-03 - 2018-07-06

Dataset Description

Experiments were conducted to determine the optimal actinic light pulse (A-pulse) setting for NPQ1 protocols of the AquaPen for assessment of non-photochemical quenching in Thalassiosira pseudonana CCMP 1014 cultures grown at different light environments.

Methods & Sampling

Experiments were conducted in the lab at the University of California Santa Barbara to determine the optimal actinic light pulse (A-pulse) setting for NPQ1 protocols of the AquaPen for assessment of non-photochemical quenching in Thalassiosira pseudonana CCMP 1014 cultures grown at different light environments. TP1014 stock cultures were maintained in artificial sea water (Kester et. al 1967), enriched as with f/2 media (Guillard

1975). For the experiment, 5 ml of the TP1014 stock cultures was inoculated into 75 ml of ASW in four tubes. The tubes were incubated in a Multicultivator MC-1000 OD unit (Qubit Systems), at 25°C and light intensities of 200, 400, 600 and 800 µmol photons·m-2·sec-1 respectively, set at a 12:12 day:night cycle for four days. All samples were bubbled with air at 60 ml·min-1 through a 0.2 µm stainless steel carbonating stones. Samples were collected from each tube after three days and analyzed used for assessment of photochemistry using the Aquapen-C AP-C 100 (Photon Systems Instruments). Three ml samples were placed in the dark at 25°C for a minimum of 30 minutes prior to measuring photochemistry. The NPQ1 protocol on the instrument was used for assessment of non-photochemical quenching in samples. The NPQ1 protocol administers 5 light pulses over 60 seconds during actinic light exposure, followed by 3 light pulses over 88 seconds during recovery in the dark. Blue light (455 nm) was used as actinic light in these experiments. Baseline measurements were made at f-pulse settings of 0.03 µmol · m-2 · s-1, Saturating pulses were set at 2100 µmol · m-2 · s-1, and actinic light pulses (for the NPQ1 protocol only) were set at 100, 200, 300, 400, 500, 600, 700, and 800 µmol photons·m-2·sec-1 respectively for each sample.

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
3B_Apulse_test_raw.csv (Comma Separated Values (.csv), 25.91 KB) MD5:b6613bd4186672f7c51c51fc18e44f11 Primary data file for dataset ID 748930

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Related Publications

Guillard, R. R. L. (1975). Culture of Phytoplankton for Feeding Marine Invertebrates. Culture of Marine Invertebrate Animals, 29–60. doi:10.1007/978-1-4615-8714-9_3
Methods

Kester, D. R., Duedall, I. W., Connors, D. N., & Pytkowicz, R. M. (1967). Preparation of Artificial Seawater 1. Limnology and Oceanography, 12(1), 176–179. doi:10.4319/lo.1967.12.1.0176
Methods

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Parameters

Parameter	Description	Units
Time	time elapsed in between fluorescence measurements	microseconds
flr_T200_AP100	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 200 micromole photons/meter^2/second and a pulse setting at 100 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T200_AP200	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 200 micromole photons/meter^2/second and a pulse setting at 200 micromol photons/meter^2/second	Relative fluorescence units (RFU)

flr_T200_AP300	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 200 micromole photons/meter^2/second and a pulse setting at 300 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T200_AP400	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 200 micromole photons/meter^2/second and a pulse setting at 400 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T200_AP500	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 200 micromole photons/meter^2/second and a pulse setting at 500 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T200_AP600	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 200 micromole photons/meter^2/second and a pulse setting at 600 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T200_AP700	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 200 micromole photons/meter^2/second and a pulse setting at 700 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T200_AP800	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 200 micromole photons/meter^2/second and a pulse setting at 800 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T400_AP100	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 400 micromole photons/meter^2/second and a pulse setting at 100 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T400_AP200	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 400 micromole photons/meter^2/second and a pulse setting at 200 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T400_AP300	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 400 micromole photons/meter^2/second and a pulse setting at 300 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T400_AP400	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 400 micromole photons/meter^2/second and a pulse setting at 400 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T400_AP500	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 400 micromole photons/meter^2/second and a pulse setting at 500 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T400_AP600	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 400 micromole photons/meter^2/second and a pulse setting at 600 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T400_AP700	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 400 micromole photons/meter^2/second and a pulse setting at 700 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T400_AP800	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 400 micromole photons/meter^2/second and a pulse setting at 800 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T600_AP100	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 600 micromole photons/meter^2/second and a pulse setting at 100 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T600_AP200	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 600 micromole photons/meter^2/second and a pulse setting at 200 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T600_AP300	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 600 micromole photons/meter^2/second and a pulse setting at 300 micromol photons/meter^2/second	Relative fluorescence units (RFU)

flr_T600_AP400	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 600 micromole photons/meter^2/second and a pulse setting at 400 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T600_AP500	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 600 micromole photons/meter^2/second and a pulse setting at 500 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T600_AP600	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 600 micromole photons/meter^2/second and a pulse setting at 600 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T600_AP700	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 600 micromole photons/meter^2/second and a pulse setting at 700 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T600_AP800	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 600 micromole photons/meter^2/second and a pulse setting at 800 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T800_AP100	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 800 micromole photons/meter^2/second and a pulse setting at 100 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T800_AP200	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 800 micromole photons/meter^2/second and a pulse setting at 200 micromol photons/meter^2/second	Relative fluorescence units (RFU)
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flr_T800_AP700	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 800 micromole photons/meter^2/second and a pulse setting at 700 micromol photons/meter^2/second	Relative fluorescence units (RFU)
flr_T800_AP800	fluorescence measurements of T.pseudonana CCMP 1014 cultures grown at 25°C and 800 micromole photons/meter^2/second and a pulse setting at 800 micromol photons/meter^2/second	Relative fluorescence units (RFU)

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Instruments

Dataset-specific Instrument Name	Multicultivator MC-1000 OD (Qubit Systems)
Generic Instrument Name	Cell Cultivator
Dataset-specific Description	Used for incubation of TP1014 cultures.
Generic Instrument Description	An instrument used for the purpose of culturing small cells such as algae or bacteria. May provide temperature and light control and bubbled gas introduction.

Dataset-specific Instrument Name	Aquapen-C AP-C 100 (Photon Systems Instruments)
Generic Instrument Name	Fluorometer
Dataset-specific Description	Used to measure fluorescence. A hand-held cuvette version of the FluorPen fluorometer equipped with a blue and red LED emitter. Blue excitation light (455 nm) is intended for chlorophyll excitation, i.e., for measuring chlorophyll fluorescence in algal cultures. Red-orange excitation light (620 nm) is intended for excitation through phycobilins and is suitable for measuring in cyanobacteria.
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, pCO2, 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 pCO2, 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

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1538602

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