Prochlorococcus in situ growth rates from cell cycle analysis from RV Cape Hatteras cruises CH0409 and CH0510 in the Western Sargasso Sea in 2009 and 2010.

Website: https://www.bco-dmo.org/dataset/717001
Data Type: Cruise Results
Version: 1
Version Date: 2017-10-12

Project
» Top-Down Regulation of Picophytoplankton in the Sargasso Sea: Application of a Reciprocal Transplant / Dilution Approach (Picophytoplankton_Regulation)

Contributors	Affiliation	Role
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Abstract
Prochlorococcus in situ growth rates from cell cycle analysis from RV Cape Hatteras cruises CH0409 and CH0510 in the Western Sargasso Sea in 2009 and 2010.

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Coverage

Spatial Extent: **N**:30.9082 **E**:-71.8634 **S**:30.1464 **W**:-72.8769
Temporal Extent: 2009-05-27 - 2010-05-31

Dataset Description

Prochlorococcus in situ growth rates from cell cycle analysis.

These data were published in:

Hynes et al., 2015

Rhodes, 2019.

Other relevant files and publications:

Braunwarth & Sommer, 1985

Liu et al., 1997

McDuff & Chrisholm, 1982

Methods & Sampling

Prochlorococcus growth rates were calculated from diel time courses of the cell cycle phase fractions in data set ProCellCyclePhase from this project, as described in McDuff & Chisholm (1982) and modified by Liu et al. (1997). These calculations require an estimate of Td, the duration of the terminal cell cycle phase (in this case the combined duration of S and G2). Td is derived here using the areal median of the S and G2 time series (Braunwarth and Sommer 1985) as recommended by Hynes et al. (2015).

Data Processing Description

BCO-DMO Data Processing Notes:

- separated dateTime columns from Time.Start.UTC and Time.End.UTC to date_start_UTC and time_start_UTC and date_end_UTC and time_end_UTC (created 2 new columns)
- replaced all decimal points in column names with underscores
- reformatted date from mm/dd/yy to yyyy/mm/dd and time from AM/PM to 24hr time
- added ISO_DateTime_UTC column

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Data Files

File
progrowthcc.csv (Comma Separated Values (.csv), 1.49 KB) MD5:1e758c91c4c80f3a52c3142185dfb869 Primary data file for dataset ID 717001

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Related Publications

Braunwarth, C., & Sommer, U. (1985). Analyses of the in situ growth rates of Cryptophyceae by use of the mitotic index technique. Limnology and Oceanography, 30(4), 893–897. doi:10.4319/lo.1985.30.4.0893
Methods

Hynes, A. M., Rhodes, K. L., & Binder, B. J. (2015). Assessing cell cycle-based methods of measuringProchlorococcusdivision rates using an individual-based model. Limnology and Oceanography: Methods, 13(11), 640–650. doi:10.1002/lom3.10054
General

Liu, H., Nolla, H., & Campbell, L. (1997). Prochlorococcus growth rate and contribution to primary production in the equatorial and subtropical North Pacific Ocean. Aquatic Microbial Ecology, 12, 39–47. https://doi.org/10.3354/ame012039
Methods

McDuff, R. E., & Chisholm, S. W. (1982). The calculation of in situ growth rates of phytoplankton populations from fractions of cells undergoing mitosis: A clarification1. Limnology and Oceanography, 27(4), 783–788. doi:10.4319/lo.1982.27.4.0783
Methods

Rhodes, K.L. (2009). The Role of Physiology in the Formation of Prochlorococcus Sub-Surface Maxima in the Sargasso Sea (Master's Thesis). University of Georgia, Athens, GA.
General

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Parameters

Parameter	Description	Units
Cruise	R/V Cape Hatteras Cruise Designation	unitless
Wx	Experiment Designation	unitless
Depth	Sample depth	meters
date_start_UTC	Starting date; yyyy/mm/dd	unitless
time_start_UTC	Starting time; hh:mm	unitless
date_end_UTC	End date; yyyy/mm/dd	unitless
time_end_UTC	End time; hh:mm	unitless
lat_min	Lowest Latitude among set of stations	decimal degrees
lat_max	Highest Latitude among set of stations	decimal degrees
lon_min	Lowest Longitude among set of stations	decimal degrees
lon_max	Highest Longitude among set of stations	decimal degrees
Td	Calculated duration of terminal cell cycle phase	days
pro_gr_cc	Prochlorococcus growth rate based on cell cycle	day -1
ISO_DateTime_UTC	DateTime UTC; ISO formatted	unitless

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Deployments

CH0409

Website	https://www.bco-dmo.org/deployment/716831
Platform	R/V Cape Hatteras
Report	https://ezid.cdlib.org/id/doi:10.7284/902620
Start Date	2009-05-20
End Date	2009-06-02
Description	Project: Top-Down Regulation of Picophytoplankton in the Sargasso Sea: Development and Application of a Reciprocal Transplant/Dilution Approach

CH0510

Website	https://www.bco-dmo.org/deployment/716833
Platform	R/V Cape Hatteras
Report	https://ezid.cdlib.org/id/doi:10.7284/901958
Start Date	2010-05-20
End Date	2010-06-02
Description	Project: Top-Down Regulation of Picophytoplankton in the Sargasso Sea: Development and Application of a Reciprocal Transplant/Dilution Approach

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Project Information

Top-Down Regulation of Picophytoplankton in the Sargasso Sea: Application of a Reciprocal Transplant / Dilution Approach (Picophytoplankton_Regulation)

Coverage: Western Sargasso Sea (vicinity of 30 N 72 W)

The intellectual merit of the research is to extend our understanding of the biology and ecology of marine picophytoplankton, a group of microbes that are responsible for a large proportion of the total photosynthetic carbon fixation that occurs in the world's oceans. The importance of picophytoplankton as the dominant primary producers in open-ocean ecosystems is well-established. However, the factors that regulate the distribution and abundance of these populations remain poorly understood. The investigators will explore the dynamics of top-down (grazer-mediated) regulation of picophytoplankton populations in a specific context: the maintenance of summertime subsurface maxima in the pico-cyanobacterium Prochlorococcus (but not Synechococcus) in the Sargasso Sea. This phenomenon represents a relatively simple and predictable model system within which to test hypotheses about the regulation of oceanic picophytoplankton in general.
Recent results suggest that despite their abundance, Prochlorococcus in the subsurface maxi-mum are growing (and being grazed) rather slowly, as compared to the smaller population at the surface. In order to understand the factors responsible for this apparent paradox, this project will use a combination of field and laboratory studies to characterize and compare the interactions between Prochorococcus and its protozoan grazers at these two contrasting depths, and in relation to Synechococcus, which forms no such sub-surface maximum.
The broader impacts include training for graduate and undergraduate students. In addition, given the significance of picophytoplankton as primary producers at the base of oceanic microbial food webs, the results of this project should inform efforts to describe and model the broader oceanic ecosystem, and ultimately to understand its role in the global carbon cycle.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0751672

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