

Diel series of pico-cyanobacteria concentration and cell properties from the RV Cape Hatteras cruises CH0409 and CH0510 in the Western Sargasso Sea in 2009 and 2010.

Website: <https://www.bco-dmo.org/dataset/716814>

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

Diel series of pico-cyanobacteria concentration and cell properties from the 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: 2009-05-26 - 2010-05-31

Dataset Description

Diel series of pico-cyanobacteria concentration and cell properties.

These data were published in Hynes et al., 2015 and Rhodes K.L., 2009

Other relevant publication: Binder et al., 1996

Methods & Sampling

Samples were taken using a rosette of Niskin bottles, fixed with freshly titrated paraformaldehyde (pH 7.4–8.1, 0.1% final concentration), held in the dark for 10 min, frozen in liquid nitrogen, and stored in a -80 deg C freezer (CH0409 samples) or in liquid nitrogen (CH0510 samples) until analysis. Preserved samples were analyzed by dual beam flow cytometry on a modified Coulter-EPICS 753 flow cytometer (Binder et al. 1996). Samples were chosen in random order, defrosted in a 30°C water bath (just long enough to melt, ~5 min), and

stained with the DNA-specific stain Hoechst 33342 (0.5 ug mL⁻¹ final concentration) (Invitrogen, Carlsbad, California) for a minimum of 20 min in the dark. Prior to analysis, polystyrene fluorescent beads (0.5 um and 1.0 um diameter Flow CheckVR ; Polysciences, Washington, Pennsylvania), were added to each sample, and used to normalize cellular light scatter and red (chlorophyll-derived) fluorescence. Samples were run at an infusion rate of 10 uL min⁻¹ for 10–50 min, depending on cell abundance within the sample.

Mean red fluorescence and forward angle light scatter for each cell type in each sample are linearized and normalized to 1.0 um and 0.5 um diameter beads (see above), respectively. Thus the measurements are relative, and are only meaningful for comparisons of cellular properties within this data set.

Data Processing Description

BCO-DMO Data Processing Notes:

- separated Time.UTC column into two columns - date.UTC and time.UTC
- reformatted date to yyyy/mm/dd and time to 24hr time
- reformatted column names to comply with BCO-DMO standards
- added ISO_DateTime.UTC column

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Data Files

File
picoplankton.csv (Comma Separated Values (.csv), 25.05 KB) MD5:6c5920e0b4fd2bc13d945f211fe81b55
Primary data file for dataset ID 716814

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Related Publications

Binder, B.J., Chisholm, S.W., Olson, R.J., Frankel, S.L., Worden, A.Z. (1996). Dynamics of picophytoplankton, ultraphytoplankton, and bacteria in the central equatorial Pacific. *Deep-Sea Res. II* 43:907-931.

Methods

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

General

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
date.UTC	Sampling date; yyyy/mm/dd	unitless
time.UTC	Sampling time; hh:mm	unitless
Lat	Sampling latitude; E is positive	decimal degrees
Lon	Sampling longitude; N is positive	decimal degrees
Depth	Sample depth	meters
pro	Prochlorococcus cellular concentration	cells per milliliter
syn	Synechococcus cellular concentration	cells per milliliter
pro_red	Mean Prochlorococcus cellular red fluorescence	relative
pro_fals	Mean Prochlorococcus cellular forward angle light scatter	relative
syn_red	Mean Synechococcus cellular red fluorescence	relative
syn_fals	Mean Synechococcus cellular forward angle light scatter	relative
ISO_DateTime.UTC	DateTime UTC; ISO formatted	unitless

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Instruments

Dataset-specific Instrument Name	Coulter-EPICS 753 flow cytometer
Generic Instrument Name	Flow Cytometer
Dataset-specific Description	Used to analyze preserved samples
Generic Instrument Description	Flow cytometers (FC or FCM) are automated instruments that quantitate properties of single cells, one cell at a time. They can measure cell size, cell granularity, the amounts of cell components such as total DNA, newly synthesized DNA, gene expression as the amount messenger RNA for a particular gene, amounts of specific surface receptors, amounts of intracellular proteins, or transient signalling events in living cells. (from: http://www.bio.umass.edu/micro/immunology/facs542/facswhat.htm)

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Used to take samples in rosette
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

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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 maximum 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 *Prochlorococcus* 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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