Prochlorococcus and Synechococcus cell counts in dilution experiment treatments from samples collected on RV Cape Hatteras cruises CH0409 and CH0510 in 2009 and 2010.

Website: https://www.bco-dmo.org/dataset/716979
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)

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Abstract
Prochlorococcus and Synechococcus cell counts in dilution experiment treatments from samples collected on RV Cape Hatteras cruises CH0409 and CH0510 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 - 2010

Dataset Description

Prochlorococcus and Synechococcus cell counts in dilution experiment treatments.

Methods & Sampling

Dilution Experiments: For an overview of the purpose and interpretation of dilution experiments see Landry (1993) and Worden & Binder (2003). Seawater samples were taken with Go-Flo bottles suspended on non-metallic cable. A portion of this water was gravity-filtered through 0.2 um pore-size capsule filters (Whatman Polycap 36 TC), and appropriate volumes of filtered and unfiltered seawater were added to 500 ml polycarbonate bottles to achieve the indicated dilutions. Time-0 (T0) samples were removed from each bottle and preserved for later flow cytometric analysis as described below. Incubation bottles were then distributed to nylon mesh bags and resuspended in the water column at the depths indicated. After 24 hours, the bottles were recovered and sampled for time-final (TF) counts. All sampling gear, filters, and incubation bottles were acid-washed per Fitzwater et al. (1982). The dates, times, and locations of the experiments were as follows:

Cruise	Exper	Date (UTC)	T0 (UTC)	E Long	N Lat
CH0409	X1	26-May-09	17:58:30	-71.998	30.171
CH0409	X2	29-May-09	13:28:09	-72.002	30.173
CH0510	X2	27-May-10	13:33:30	-72.683	30.699

Flow Cytometric Cell Counts: Samples were 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 flow cytometry on a modified Coulter-EPICS 753 flow cytometer (Binder et al. 1996). Samples were chosen in random order and defrosted in a 30 deg C water bath (just long enough to melt, ~5 min). Prior to analysis, polystyrene fluorescent beads (Flow Check® 0.494 um “BB”; Polysicences Inc., Washington, PA, USA), were added to each sample, and used to normalize cellular light scatter and fluorescence. Samples were typically run at an infusion rate of 20 uL min-1 for 1 to 20 min, depending on cell abundance within the sample. A minimum of 1,000 Prochlorococcus cells were analyzed, except for samples in which low cell concentrations made this impractical. Final cell concentrations tabulated here were calculated from 1-7 replicate counts (Count.n).

Data Processing Description

BCO-DMO Data Processing Notes:

- removed rows that had all blank cells
- replaced all decimal points in column headers with underscores
- removed units from column names

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Data Files

File
dilutionexpercellcounts.csv (Comma Separated Values (.csv), 10.78 KB) MD5:97750ea595800c88d60c78a6775d65be Primary data file for dataset ID 716979

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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

Fitzwater, S. E., Knauer, G. A., & Martin, J. H. (1982). Metal contamination and its effect on primary production measurements1. Limnology and Oceanography, 27(3), 544–551. doi:10.4319/lo.1982.27.3.0544
Methods

Landry, M.R. (1993). Estimating rates of growth and grazing mortality of phytoplankton by the dilution method In P.F. Kemp, B.F. Sherr, E.B. Sherr, J.J. Cole (eds) Handbook of methods in aquatic microbial ecology (pp. 715–722). Boca Raton, FL: Lewis Publishers.
Methods

Worden, A., & Binder, B. (2003). Application of dilution experiments for measuring growth and mortality rates among Prochlorococcus and Synechococcus populations in oligotrophic environments. Aquatic Microbial Ecology, 30, 159–174. doi:10.3354/ame030159
Methods

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Parameters

Parameter	Description	Units
Cruise	R/V Cape Hatteras Cruise Designation	unitless
Exper	Experiment Designation	unitless
Bottle	Unique incubation bottle identifier	unitless
Depth_Sample	Depth of source water	meters
Depth_Incubate	Depth of incubation	meters
Dilution	Fraction of unfiltered seawater in bottle	number
Time	Sampling time; timepoints	unitless
Pro	Prochlorococcus Cell Concentration	cells per milliliter
Syn	Synechococcus Cell Concentration	cells per milliliter
Count	Number of counts underlying cell concentrations	number

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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	Go-flo bottle
Generic Instrument Name	GO-FLO Bottle
Dataset-specific Description	Used to take seawater samples
Generic Instrument Description	GO-FLO bottle cast used to collect water samples for pigment, nutrient, plankton, etc. The GO-FLO sampling bottle is specially designed to avoid sample contamination at the surface, internal spring contamination, loss of sample on deck (internal seals), and exchange of water from different depths.

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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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