Depth profile data from R/V Atlantic Explorer AE1319 in the NW Atlantic from Aug-Sept. 2013

Website: https://www.bco-dmo.org/dataset/829797
Data Type: Cruise Results
Version: 1
Version Date: 2020-11-18

Project
» Biological Controls on the Ocean C:N:P ratios (Biological C:N:P ratios)

Programs
» Dimensions of Biodiversity (Dimensions of Biodiversity)
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Abstract
Depth profile data including temperature, salinity, oxygen chlorophyll, and PAR from R/V Atlantic Explorer AE1319 in the NW Atlantic from Aug-Sept. 2013.

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Coverage

Spatial Extent: **N**:55 **E**:-40.01 **S**:31.67 **W**:-69.21
Temporal Extent: 2013-08-15 - 2013-09-08

Methods & Sampling

Sampling and analytical procedures:

Temperature, salinity, oxygen concentration, and PAR were measured using a Sea-Bird SBE-911+ CTD platform equipped on the rosette deployment system.

Chlorophyll a was measured using a WetLabs FLNTU combination fluorometer and turbidity sensor equipped on the CTD rosette.

For data processing information see https://www.rvdata.us/search/cruise/AE1319 for further details.

For published methodologies please see the Related Publications section.

Data Processing Description

BCO-DMO Processing:
- data submitted in Excel file "AE1319_BCODMO.xlsx" sheet "SHEET1" extracted to csv
- added conventional header with dataset name, PI name, version date
- renamed columns to conform with BCO-DMO naming conventions (removed spaces)
- rounded yrday_utc to 2 decimal places

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Data Files

File
AE1319_ctd.csv (Comma Separated Values (.csv), 9.86 KB) MD5:54c762c75c7e5ac4b0779a536f727c94 Primary data file for dataset ID 829797

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Related Publications

Baer, S. E., Lomas, M. W., Terpis, K. X., Mouginot, C., & Martiny, A. C. (2017). Stoichiometry of Prochlorococcus, Synechococcus, and small eukaryotic populations in the western North Atlantic Ocean. Environmental Microbiology, 19(4), 1568–1583. doi:10.1111/1462-2920.13672
Methods

Cetinić, I., Poulton, N., & Slade, W. H. (2016). Characterizing the phytoplankton soup: pump and plumbing effects on the particle assemblage in underway optical seawater systems. Optics Express, 24(18), 20703. doi:10.1364/oe.24.020703 https://doi.org/10.1364/OE.24.020703
Methods

Kent, A. G., Baer, S. E., Mouginot, C., Huang, J. S., Larkin, A. A., Lomas, M. W., & Martiny, A. C. (2018). Parallel phylogeography of Prochlorococcus and Synechococcus. The ISME Journal, 13(2), 430–441. doi:10.1038/s41396-018-0287-6
Results

Knap, A., Michaels, R., Dow, R., Johnson, K., Gundersen, J., Sorensen, A., ... & Waterhouse, T. (1993). Bermuda Atlantic time-series study methods manual (Version 3). Bermuda Biological Station for Research, US JGOFS. https://www.researchgate.net/publication/245583966_Bermuda_Atlantic_Time-series_Study_Methods_Manual_Version_3
Methods

Lomas, M. W., Bonachela, J. A., Levin, S. A., & Martiny, A. C. (2014). Impact of ocean phytoplankton diversity on phosphate uptake. Proceedings of the National Academy of Sciences, 111(49), 17540–17545. doi:10.1073/pnas.1420760111
Methods

Martiny, A. C., Ustick, L., A. Garcia, C., & Lomas, M. W. (2020). Genomic adaptation of marine phytoplankton populations regulates phosphate uptake. Limnology and Oceanography, 65(S1). doi:10.1002/lno.11252
Methods

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Parameters

Parameter	Description	Units
Cruise	Cruise ID	unitless
ISO_DateTime_UTC	Date/Time (UTC) ISO formatted yyyy-mm-ddTHH:MMZ	unitless
yrday_utc	UTC day and decimal time: 326.5 for the 326th day of the year or November 22 at 1200 hours (noon)	unitless
Station	Station ID number	unitless
Cast	Cast number	unitless
Latitude	Sampling Site Latitude (North is positive)	decimal degrees
Longitude	Sampling Site Longitude (West is negative)	decimal degrees
Depth	Water sample depth	meters
Temperature	Temperature	degrees Celsius
Salinity	Salinity	Practical Salinity Units (PSU)
Oxygen	Oxygen concentration	micromol/kilogram (umol/kg)
CTD_Chla	Chlorophyll a concentration; measured off a CTD platform	microgram/liter (ug/L)
CTD_PAR	Photosynthetically Active Radiation; measured off a CTD platform	micromol/meter^2/second (umol/m^2/s)

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Instruments

Dataset-specific Instrument Name	Sea-Bird SBE-911+
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Generic Instrument Description	The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

Dataset-specific Instrument Name	
Generic Instrument Name	WETLabs ECO-FLNTU
Generic Instrument Description	The ECO FLNTU is a dual-wavelength, single-angle sensor for simultaneously determining both chlorophyll fluorescence and turbidity.

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Deployments

AE1319

Website	https://www.bco-dmo.org/deployment/537979
Platform	R/V Atlantic Explorer
Report	http://dmoserv3.whoi.edu/data_docs/Bio_CNP_Ratios/AE1319_Cruise_Report_09182013_reduced2.pdf
Start Date	2013-08-14
End Date	2013-09-11
Description	Cruise for project 'Dimensions of Biodiversity: Biological Controls on the Ocean C:N:P ratios'.

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Project Information

Biological Controls on the Ocean C:N:P ratios (Biological C:N:P ratios)

Coverage: western North Atlantic; 60N to 20N along 66W longitude; 20N to 15S in the tropical Pacific

One of the fundamental patterns of ocean biogeochemistry is the Redfield ratio, linking the stoichiometry of surface plankton with the chemistry of the deep ocean. There is no obvious mechanism for the globally consistent C:N:P ratio of 106:16:1 (Redfield ratio), especially as there is substantial elemental variation among plankton communities in different ocean regions. Thus, knowing how biodiversity regulates the elemental composition of the ocean is important for understanding the ocean and climate as a whole -- now and in the future.

The conceptual hypotheses for this study are as follows: 1. The C:N:P ratio of a cell is constrained by its broad taxonomic group, which determines, for example, whether it has an outer shell, its size, functional metabolism, membrane lipid composition. 2. Within a taxon, there is high genetic diversity. Some of this genetic diversity is potentially laterally transferred, or can be lost within taxa, and confers various functional abilities (organic phosphate assimilation, nitrate assimilation, photoheterotrophy, etc.). Functional diversity provides the cell with further flexibility, such as the ability to respond to varying nutrient supply rates/ratios, and affects a cell's C:N:P ratio within the range specified by the taxon. 3. Given these taxonomic and genetic constraints, a cell is physiologically plastic and modifies how it allocates cellular resources in response to nutrient supply rates/ratios in the environment. 4. The microbial diversity (taxonomic, genetic, and functional) of the surface ocean varies over time and space, driven by many factors in addition to nutrients. The sum of this mixture composes the ecosystem C:N:P, the ratio that Redfield described.

Based on this framework, the CoPIs will make field observations of taxon-specific stoichiometry and growth rates, genomic analyses, and conduct laboratory chemostat experiments to improve understanding of how ocean taxonomic, genetic, and functional biodiversity control the stoichiometry of the surface ocean plankton. Their analyses of these data would lead to a mechanistic understanding of variations in the Redfield ratio, both spatially and temporally.

This study will greatly expand knowledge of the genomic diversity among ocean microbes and how this diversity affects biogeochemistry. The stoichiometry of the ocean's microbes is a parameter that nearly every chemical or biological oceanographer uses, from converting measurements made in one element to another, to estimating regional and global nitrogen budgets. The research also has important implications for the global carbon budget and any changes that might result from climate change.

To understand mechanistically temporal and spatial variability of the plankton C:N:P ratio, biodiversity must be studied not only at the traditional taxonomic level, but at the genetic and functional levels which dictate organism response to their environment. Data will be integrated into a combined ocean ecological, evolutionary, and biogeochemical model, with flexible stoichiometry, including cellular biochemical allocations. Seeding a coupled physical-biological model of the oceans with multiple competing genotypes enables the exploration of ecological and evolutionary patterns of resource acquisition and C:N:P ratios. Developing a more mechanistic examination of the course of ecology and evolution, in which laboratory and field data define tradeoffs between different growth and nutrient acquisition strategies, would estabblish the framework of adaptive dynamics for determining "evolutionarily convergence". Finally, model outcomes will be evaluated against field data.

The field work planned for this project includes several cruises: BV46 (September/October 2011), BV48 (September 2012), a June 2013 cruise from Bermuda to the Labrador Sea, and a cruise from Hawaii to Tahiti (May 2014). Additionally, samples will be be acquired during cruises of opportunity.

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Program Information

Dimensions of Biodiversity (Dimensions of Biodiversity)

Website: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503446

Coverage: global

(adapted from the NSF Synopsis of Program)
Dimensions of Biodiversity is a program solicitation from the NSF Directorate for Biological Sciences. FY 2010 was year one of the program. [MORE from NSF]

The NSF Dimensions of Biodiversity program seeks to characterize biodiversity on Earth by using integrative, innovative approaches to fill rapidly the most substantial gaps in our understanding. The program will take a broad view of biodiversity, and in its initial phase will focus on the integration of genetic, taxonomic, and functional dimensions of biodiversity. Project investigators are encouraged to integrate these three dimensions to understand the interactions and feedbacks among them. While this focus complements several core NSF programs, it differs by requiring that multiple dimensions of biodiversity be addressed simultaneously, to understand the roles of biodiversity in critical ecological and evolutionary processes.

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1046001
NSF Division of Ocean Sciences (NSF OCE)	OCE-1046368
NSF Division of Ocean Sciences (NSF OCE)	OCE-1046297
NSF Division of Ocean Sciences (NSF OCE)	OCE-1045966

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