Nutrient concentrations and microbial counts from Niskin bottle collections on R/V Atlantic Explorer A1703 in the Bermuda Atlantic Time-series Study site from Mar/April 2016

Website: https://www.bco-dmo.org/dataset/753679
Data Type: Cruise Results
Version: 1
Version Date: 2019-01-23

Project
» Dissolved Organic Carbon Cycling by SAR11 Marine Bacteria (Bacterial DOC cycling)

Contributors	Affiliation	Role
Giovannoni, Stephen	Oregon State University (OSU)	Principal Investigator
Carlson, Craig A.	University of California-Santa Barbara (UCSB-MSI)	Co-Principal Investigator
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Nutrient concentrations and microbial counts from Niskin bottle collections on R/V Atlantic Explorer A1703 in the Bermuda Atlantic Time-series Study site from Mar/April 2016.

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Coverage

Spatial Extent: **N**:32.53 **E**:-64.138 **S**:31.656 **W**:-77.427
Temporal Extent: 2017-03-30 - 2017-04-04

Dataset Description

Nutrient concentrations and microbial counts from Niskin bottle collections on R/V Atlantic Explorer A1703 in the Bermuda Atlantic Time-series Study site from Mar/April 2016.

Methods & Sampling

See Supplemental Documents below.

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
- replaced blank cells with 'nd' (no data)
- changed sign of longitude (lon) so negative values represent west

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Data Files

File
AE1703_bottle.csv (Comma Separated Values (.csv), 74.04 KB) MD5:fb2b8c7dce3dfde303debd9fe15f38ab Primary data file for dataset ID 753679

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Supplemental Files

File
DOC and TDN methodology (UCSB) filename: DOC-TDN_UCSB_method.pdf (Portable Document Format (.pdf), 122.71 KB) MD5:310f5c86b897d43276e8ad27a3873e50 Methodology for measuring Dissolved Organic Carbon and Total Dissolved Nitrogen
Methodology for bacterial abundance - DAPI filename: bact_abun_DAPI_method.pdf (Portable Document Format (.pdf), 70.83 KB) MD5:3393f21489687d12bc5c6621ebbb23ac Determination of Bacterial Abundance using DAPI DNA binding stain and Epifluorescence microscopy
Methodology for bacterial production measurement filename: BactProd_method.pdf (Portable Document Format (.pdf), 128.90 KB) MD5:181de3ce9c9037073127e41d36a2219b Microcentrifuge Method Protocol for Determination of Bacterial Production Rates via 3H-Leucine incorporation

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Related Publications

BATS Methods Manual. Chapter 17. Determination of Bacterial Abundance.Updated by K.Orcutt 4/1997, pp. 111-114.version 4. http://eprints.soton.ac.uk/id/eprint/361194
http://eprints.soton.ac.uk/id/eprint/361194#chapter17
Methods

Carlson, C. A., Hansell, D. A., Nelson, N. B., Siegel, D. A., Smethie, W. M., Khatiwala, S., Meyers, M. M., Halewood, E. (2010). Dissolved organic carbon export and subsequent remineralization in the mesopelagic and bathypelagic realms of the North Atlantic basin. Deep Sea Research Part II: Topical Studies in Oceanography, 57(16), 1433–1445. doi:10.1016/j.dsr2.2010.02.013
Methods

Hansell, D. A. (2005). Dissolved Organic Carbon Reference Material Program. Eos, Transactions American Geophysical Union, 86(35), 318. doi:10.1029/2005eo350003
Methods

Hansell, D. A., & Carlson, C. A. (1998). Deep-ocean gradients in the concentration of dissolved organic carbon. Nature, 395(6699), 263–266. doi:10.1038/26200
Methods

Knap, A.H., Michaels, A.F., Steinberg, D.K., Bahr, F., Bates, N.R., Bell, S., Countway, P., Close, A.R., Doyle, A.P., Dow, R.L., Howse, F.A., Gundersen, K., Johnson, R.J., Kelly, R., Little, R., Orcutt, K., Parsons, R., Rathburn, C., Sanderson, M. and Stone, S. (1997) BATS Methods Manual, Version 4 Woods Hole, MA, US. U.S. JGOFS Planning Office 136pp. *Chapter 16. Determination of Dissolved Organic Carbon by a High Temperature Combustion/Direct Injection Technique.* Updated by R.Parsons 4/1997, pp. 99-109. https://eprints.soton.ac.uk/361194/#chapter16
Methods

Porter, K. G., & Feig, Y. S. (1980). The use of DAPI for identifying and counting aquatic microflora. Limnology and Oceanography, 25(5), 943–948. doi:10.4319/lo.1980.25.5.0943
Methods

Simon, M., & Azam, F. (1989). Protein content and protein synthesis rates of planktonic marine bacteria . Marine Ecology Progress Series, 51, 201–213. doi:10.3354/meps051201
Methods

Smith, D.C. and F. Azam (1992). A simple, economical method for measuring bacterial protein synthesis rates in seawater using 3H-leucine. Marine Microbial Food Webs 6:107-114 http://www.gso.uri.edu/dcsmith/page3/page19/assets/smithazam92.PDF
Methods

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Parameters

Parameter	Description	Units
sample_id	Unique Identified Code for each sample collected	unitless
Cruise	cruise name	unitless
Cast	cast number	unitless
Niskin	Niskin bottle number	unitless
date	Date (yyyymmdd)	unitless
date_decyr	Date (decimal year)	unitless
time_UTC	Timestamp (UTC) hh:mm	unitless
lat	Latitude; north is positive	decimal degrees
lon	Longitude; east is positive	decimal degrees
Depth	Sampling depth in meters	meters
Temp	CTD temperature	degrees celsius
CTD_S	CTD salinity	pratical salinity units (PSU)
Pressure	CTD Pressure	decibars
Sigma_theta	CTD sigma theta (potental density)	kilogram/meter^3
Conductivity	CTD Conductivity	Siemens per meter
Fluor	CTD Fluorescence	milligram per Liter
Par	CTD photosynthetically available radiation	micro-Einsteins/meter^2/second (uE/m^2/sec)
O2	CTD Oxygen	millimole per kilogram
beam_trans_CStarTr0	CTD beam transmission as percent	unitless
NO3_NO2	Nitrate+Nitrite concentration by flow injection autoanalyzer (Lachat QuikChem 8000)	millimole per Liter
NO3_NO2_QF	Quality Flags (QF): 0 good; 1 unknown; 4 questionable measurement; 8 bad measurement	unitless

PO4	ortho-Phosphate concentration by flow injection autoanalyzer (Lachat QuikChem 8000)	millimole per Liter
PO4_QF	Quality Flags (QF): 0 good; 1 unknown; 4 questionable measurement; 8 bad measurement	unitless
NH4	Ammonium ion concentration by flow injection autoanalyzer (Lachat QuikChem 8000)	millimole per liter
NH4_QF	Quality Flags (QF): 0 good; 1 unknown; 4 questionable measurement; 8 bad measurement	unitless
POC_mg_L	Particulate organic carbon measured by combustion analysis (CEC 440HA). Collected on Glass fiber filter type GF/F (Whatman)	milligram per Liter
POC_mmol_L	Particulate organic carbon	millimole per Liter
POC_QF	Quality Flags (QF): 0 good; 1 unknown; 4 questionable measurement; 8 bad measurement	unitless
PON_mg_L	Particulate organic nitrogen measured by combustion analysis (CEC 440HA). Collected on Glass fiber filter type GF/F (Whatman)	milligram per Liter
PON_mmol_L	Particulate organic nitrogen	millimole per Liter
PON_QF	Quality Flags (QF): 0 good; 1 unknown; 4 questionable measurement; 8 bad measurement	unitless
DOC	Dissolved organic carbon concentration by HTCO. Glass fiber filtrate type GF/F (Whatman). Methodological reference is Carlson et al. 2010 DSRII	micromolar
DOC_QF	Quality Flags (QF): 0 good; 1 unknown; 4 questionable measurement; 8 bad measurement	unitless
TDN	Total dissolved nitrogen concentration by HTCO. Glass fiber filtrate type GF/F (Whatman).	micromolar
TDN_QF	Quality Flags (QF): 0 good; 1 unknown; 4 questionable measurement; 8 bad measurement	unitless
Bact	Bacterioplankton abundance by microscopy. Methodological reference: K.G. Porter and Y.S. Feig (1980). The use of DAPI for identifying and counting aquatic microflora. Limnol. Oceanogr 25(5): 943-948.	cells per milliliter
Bact_QF	Quality Flags (QF): 0 good; 1 unknown; 4 questionable measurement; 8 bad measurement	unitless
Bact_Prod	Heterotrophic bacterial production by 3H Leu uptake. Methodological reference: Smith DC & Azam F (1992) A simple economical method for measuring bacterial protein synthesis rates in seawater using 3H-leucine. Mar Microb Food Webs 6: 107_114.	picomoles per liter per hour
Bact_Prod_QF	Quality Flags (QF): 0 good; 1 unknown; 4 questionable measurement; 8 bad measurement	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	CTD - profiler
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934.

Dataset-specific Instrument Name	Epifluorescence microscope
Generic Instrument Name	Fluorescence Microscope
Dataset-specific Description	Used to enumerate bacterial abundance
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of fluorescence and phosphorescence instead of, or in addition to, reflection and absorption of visible light. Includes conventional and inverted instruments.

Dataset-specific Instrument Name	
Generic Instrument Name	Liquid Scintillation Counter
Dataset-specific Description	Used to count microbial cells
Generic Instrument Description	Liquid scintillation counting is an analytical technique which is defined by the incorporation of the radiolabeled analyte into uniform distribution with a liquid chemical medium capable of converting the kinetic energy of nuclear emissions into light energy. Although the liquid scintillation counter is a sophisticated laboratory counting system used the quantify the activity of particulate emitting (ß and a) radioactive samples, it can also detect the auger electrons emitted from 51Cr and 125I samples.

Dataset-specific Instrument Name	
Generic Instrument Name	Niskin bottle
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.

Dataset-specific Instrument Name	Shimadzu High Temperature Combustion system
Generic Instrument Name	Shimadzu TOC-V Analyzer
Dataset-specific Description	Used to measure non-purgeable Organic Carbon (NPOC) and Total Dissolved Nitrogen (TDN)
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

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Deployments

AE1703

Website	https://www.bco-dmo.org/deployment/753484
Platform	R/V Atlantic Explorer
Report	https://datadocs.bco-dmo.org/docs/Bacterial_DOC_cycling/data_docs/Cruise_Report_Giov_1703.pdf
Start Date	2017-03-29
End Date	2017-04-04
Description	Cruise for project "Dissolved Organic Carbon Cycling by SAR11 Marine Bacteria".

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Project Information

Dissolved Organic Carbon Cycling by SAR11 Marine Bacteria (Bacterial DOC cycling)

Coverage: Western Sargasso Sea, Bermuda Atlantic Time Series Site: Hydrostation S

SAR11 (Pelagibacterales) are the most abundant group of bacterioplankton in the oceans. Globally, they are estimated to oxidize to carbon dioxide (CO2) between 5 and 22% of all the organic carbon produced by photosynthesis each day. The activities of bacterioplankton such as SAR11 determine the residence times of different forms of organic carbon, and ultimately shape the composition of dissolved organic pools in the oceans, which rival atmospheric CO2 in mass. Accurate and detailed information about the oceanic carbon cycle is used in models that are valued for their potential to predict and understand future changes in ocean ecosystems. This grant supports analyses of genomic data that predict the carbon oxidation functions of SAR11 cells, and supports experiments with cells in culture, where high-resolution mass spectrometry

technology is applied to discover new organic carbon oxidation biochemistry. To assess the importance of SAR11 carbon oxidation functions in ocean ecosystems, this project includes four short oceanographic cruises to the Bermuda Atlantic Time-series Study (BATS) site, in the western Sargasso Sea. On these cruises the concentrations and oxidation rates of organic compounds will be measured, and linked to variation in planktonic SAR11 populations.

It is a paradox that SAR11 cells are the most abundant in the oceans, but also have among the smallest genomes known. The central goal of this proposal is to understand what types of dissolved organic matter (DOM) are oxidized to CO2 by SAR11. Implicit to this approach is the perspective that some abundant chemoheterotrophic bacterioplankton taxa, particularly those with small genomes, have evolved specialist strategies for oxidizing organic matter. Understanding these strategies can lead to a more detailed and accurate understanding of the biological processes that recycle biological production to CO2. Major project aims are: 1) investigate SAR11 genomes and assay cells in culture with high-resolution mass spectrometry approaches and isotopic labeling to identify the range of compounds these cells can oxidize to CO2; 2) at BATS, measure biological oxidation rates of DOM compounds used by SAR11; 3) link spatiotemporal SAR11 genome variation to patterns of DOM oxidation in the ocean surface layer (0-300 m). This projects includes four short cruises to BATS that target the four microbial plankton community types at this site: upper euphotic zone, deep chlorophyll maximum, spring bloom and upper mesopelagic. Products of this activity will include new information about variation in labile DOM oxidation across the surface layer, and specific links to genome features that will improve the accuracy of interpretation of global ocean metagenomic data.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1436865

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