Viral and bacterial counts from filtered water, stained with SYBR Green and counted using epifluorescent microscopy, from samples collected on R/V Knorr cruise KN210-04 in the Western Atlantic Ocean in 2013 (Deep Atlantic DOM project)

Website: https://www.bco-dmo.org/dataset/528510
Data Type: Cruise Results
Version: 1
Version Date: 2014-08-08

Project
» Dissolved Organic Matter Composition in the Deep Atlantic Ocean (Deep Atlantic DOM)

Programs
» Center for Chemical Currencies of a Microbial Planet (C-CoMP)
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Abstract
Viral and bacterial counts from filtered water, stained with SYBR Green and counted using epifluorescent microscopy, from samples collected on R/V Knorr cruise KN210-04 in the Western Atlantic Ocean in 2013.

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Coverage

Spatial Extent: **N**:9.703869 **E**:-23.999036 **S**:-38.0026 **W**:-55.304343
Temporal Extent: 2013-03-26 - 2013-05-06

Dataset Description

Viral and bacterial counts from filtered water, stained with SYBR Green and counted using epifluorescent microscopy. Duplicates were collected at each depth during the KN210-04 cruise.

Methods & Sampling

Samples for viral and bacterial counts were collected in 50 mL Falcon tubes, held at 4 degrees C until

processing, and processed within two hours. SYBR slides were prepared according to Noble and Fuhruman (Noble and Fuhrman, 1998). Briefly, samples were fixed in v/v 2% formalin and then filtered over a 25 mm 0.02 um anodisc filter (Whatman). Varying volumes were fixed depending on the depth of sample collection (surface and DCM: 3 ml; mesopelagic: 10 ml; AAIW, NADW and AABW: 20 ml). The filter was stained with 2.5x10-3 SYBR Green 1 dilution in nuclease free water, and mounted on a slide with antifade solution (0.1% p-phenylenediamine in 1:1 PBS:Glycerol) and stored at -20 degrees C until enumeration. Under epifluorescence microscopy 10 fields of view were selected at random and >200 viruses and >200 bacteria were counted. Calculations for total number or viruses and bacteria in a sample account for volume filtered, magnification and size of the grid included while counting.

Samples from station 1 and 2 were fixed with the wrong concentration of antifade and therefore faded before accurate counts could be made.

References:
Noble, R. T., and Fuhrman, J. A. (1998). Use of SYBR Green I for rapid epifluorescence counts of marine viruses and bacteria. Aquat Microb Ecol *14*, 113-118. doi:10.3354/ame014113

Data Processing Description

Any missing values and/or depths indicate that the slide was not countable, either due to fading or cracked filters in transit.

BCO-DMO Processing Notes:
- Parameter names were modified to conform with BCO-DMO naming conventions.
- lat_start and lon_start were added by joining the data to the event log and matching on the unique event number.
- Replaced missing values with 'nd' to indicate 'no data'.
- 22 Nov 2017: made dataset public (was previously restricted).

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Data Files

File
viral_bact_counts.csv (Comma Separated Values (.csv), 164.35 KB) MD5:5aee8c0eeab841beb6b8a2fa8a2d9931 Primary data file for dataset ID 528510

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Related Publications

Noble, R., & Fuhrman, J. (1998). Use of SYBR Green I for rapid epifluorescence counts of marine viruses and bacteria. Aquatic Microbial Ecology, 14, 113–118. doi:10.3354/ame014113
Methods

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Parameters

Parameter	Description	Units
cast	Consecutive cast number for the instrument.	dimensionless
station	Identification number of the sampling station.	dimensionless
date_start_utc	Date (UTC) given as 4-digit year - 2-digit month - 2-digit day.	YYYYmmdd
time_start_utc	Time (UTC) given as hour - minute.	HHMM
event_start	The event number from the ELOG maintained during the cruise.	dimensionless
lat_start	Latitude at the time the event started (from the cruise event log).	decimal degrees
lon_start	Longitude at the time the event started (from the cruise event log).	decimal degrees
niskin	Niskin bottle number.	dimensionless
depth	Depth.	meters (m)
press	Pressure.	decibars (db)
lab_sticker	Lab identification number.	dimensionless
vir_abund	Viral abundance.	viral abundance per milliliter (per mL)
vir_abund_SE	Standard error associated with viral abundance.	viral abundance per milliliter (per mL)
bact_abund	Bacterial abundance.	bacterial abundance per milliliter (per mL)
bact_abund_SE	Standard error associated with bacterial abundance.	bacterial abundance per milliliter (per mL)
VBR	Virus to bacteria ratio (virus:bacteria).	dimensionless

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Instruments

Dataset-specific Instrument Name	Epifluorescent microscope
Generic Instrument Name	Fluorescence Microscope
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.

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Deployments

KN210-04

Website	https://www.bco-dmo.org/deployment/59057
Platform	R/V Knorr
Start Date	2013-03-25
End Date	2013-05-09
Description	Western Atlantic cruise started at Montevideo, Uruguay and ended at Bridgetown, Barbados. Science Objectives: 1. Characterize deep ocean dissolved organic matter in water masses of western Atlantic Ocean. 2. Characterize microbial community at selected stations and at selected depths. 3. Characterize metabolic capabilities of surface, mesopelagic and bathypelagic microbial consortia vis-a-vis the degradation of organic matter from each zone. 4. Examine metabolic and phylogenetic links between microbes in different marine zones (surface, meso-pelagic and bathypelagic depths). Science Activities: 1. Collection of discrete water samples by Niskin-bottles. 2. Collection of microbial communities from these water samples, by in-situ pumping, or by net-traps and net-tows. 3. Incubation experiments in lab and on deck. 4. Underway mass spectrometry and flow cytometry, from seawater intake. More information is available from the WHOI Cruise Planning Synopsis. Additional cruise information and original data are available from the NSF R2R Data Catalog.

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Project Information

Dissolved Organic Matter Composition in the Deep Atlantic Ocean (Deep Atlantic DOM)

Coverage: Western Atlantic Ocean

Transformations of dissolved organic matter (DOM) in the deep ocean have profound impacts on the global carbon cycle due to the sequestration of carbon dioxide (CO2) away from the atmosphere. Although research has been conducted on the high molecular weight component of this material, the same cannot be said for low molecular weight DOM because the needed analytical techniques have not been available to determine its composition and reactivity.

In recent years, a research team at Woods Hole Oceanographic Institution has acquired the necessary analytical capability. As such, in this project, they will carry out the first systematic survey of deep ocean DOM in the western Atlantic Ocean to characterize the low molecular weight fraction of DOM in southward flowing North Atlantic Deep Water (NADW), northward flowing Antarctic Bottom Water (AABW), and Antarctic Intermediate Water (AAIW). Using ultrahigh resolution mass spectrometry and multi-stage fragmentation coupled to liquid chromatography, the scientists will determine the spatial variability in the composition of DOM

along the flow path of the water masses, as well as assess the source water, transport, and surface processes that contribute to temporal changes in DOM composition. These results will be augmented with structural elucidation and quantitative assays of unique marker compounds for each water mass. Results will provide important insights into the biogeochemical reactions that govern DOM dynamics in the deep ocean.

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Program Information

Center for Chemical Currencies of a Microbial Planet (C-CoMP)

Website: https://ccomp-stc.org/

Coverage: North Atlantic, BATS, global/other

Functions carried out by microscopic inhabitants of the surface ocean affect every aspect of life on our planet, regardless of distance from the coast. Ocean phytoplankton are responsible for half of the photosynthesis on Earth, the first step in a complex system that annually withdraws 50 billion metric tons of carbon from the atmosphere to sustain their growth. Of this, 25 billion metric tons participate in a rapid cycle in which biologically reactive material is released into seawater and converted back into carbon dioxide by marine bacteria within hours to days. The chemical-microbe network at the heart of this fast cycle remains poorly constrained; consequently, its primary currencies and controls remain elusive; its sensitivities to changing ocean conditions are unknown; and its responses to future climate scenarios are not predictable. The Center for Chemical Currencies of a Microbial Planet (C-CoMP) integrates research, education and knowledge transfer activities to develop a mechanistic understanding of surface ocean carbon flux within the context of a changing ocean and through increased participation in ocean sciences. C-CoMP supports science teams that merge biology, chemistry, modeling, and informatics to close long-standing knowledge gaps in the identities and dynamics of organic molecules that serve as the currencies of elemental transfer between the ocean and atmosphere. C-CoMP fosters education, outreach, and knowledge transfer activities that engage students of all ages, broaden participation in the next generation of ocean scientists, and extend novel open-science approaches into complementary academic and industrial communities. The Center framework is critical to this mission, uniquely facilitating an open exchange of experimental and computational science, methodological and conceptual challenges, and collaborations that establish integrated science and education partnerships. With expanded participation in ocean science research and ocean literacy across the US society, the next generation of ocean scientists will better reflect the diverse US population.

Climate-carbon feedbacks on the marine carbon reservoir are major uncertainties for future climate projections, and the trajectory and rate of ocean changes depend directly on microbial responses to temperature increases, ocean acidification, and other perturbations driven by climate change. C-CoMP research closes an urgent knowledge gap in the mechanisms driving carbon flow between ocean and atmosphere, with global implications for predictive climate models. The Center supports interdisciplinary science teams following open and reproducible science practices to address: (1) the chemical currencies of surface ocean carbon flux; (2) the structure and regulation of the chemical-microbe network that mediates this flux; and (3) sensitivity of the network and its feedbacks on climate. C-CoMP leverages emerging tools and technologies to tackle critical challenges in these themes, in synergy with existing ocean programs and consistent with NSF’s Big Ideas. C-CoMP education and outreach activities seek to overcome barriers to ocean literacy and diversify participation in ocean research. The Center is developing (1) initiatives to expand ocean literacy in K-12 and the broader public, (2) ocean sciences undergraduate curricula and research opportunities that provide multiple entry points into research experiences, (3) post-baccalaureate programs to transition undergraduates into graduate education and careers in ocean science, and (4) interdisciplinary graduate student and postdoctoral programs that prepare the next generation of ocean scientists. The C-CoMP team includes education faculty who evaluate the impacts of education and outreach activities and export successful STEM initiatives to the education community. C-CoMP is revolutionizing the technologies for studying chemical transformations in microbial systems to build understanding of the outsized impact of microbes on elemental cycles. Open science, cross-disciplinary collaborations, community engagement, and inclusive practices foster strategic advances in critical science problems and STEM initiatives. C-CoMP science, education, and knowledge-transfer themes are efficiently addressed through a sustained network of scientists addressing critical research challenges while broadening the workforce that will tackle multi-disciplinary problems with

academic, industrial and policy partners.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

The Program's Data Management Plan (DMP) is available as a PDF document.

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-1154320

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