BIOS-SCOPE survey biogeochemical data as collected on Atlantic Explorer cruises (AE1614, AE1712, AE1819, AE1916) from 2016 through 2019

Website: https://www.bco-dmo.org/dataset/861266
Data Type: Cruise Results
Version: 1
Version Date: 2021-10-17

Project
» Bermuda Institute of Ocean Sciences Simons Collaboration on Ocean Processes and Ecology (BIOSSCOPE)

Contributors	Affiliation	Role
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Abstract
This dataset includes analyses from Niskin bottle samples collected on R/V Atlantic Explorer cruises as part of the BIOS-SCOPE campaign. Included are CTD data, and survey biogeochemical samples including inorganic nutrients, particulate organic carbon and nitrogen, dissolved organic carbon, dissolved organic nitrogen, total dissolved amino acids, bacterial abundance and production.

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Coverage

Spatial Extent: **N**:32.179 **E**:-64.1576 **S**:31.6641 **W**:-64.5399
Temporal Extent: 2016-07-09 - 2019-07-11

Methods & Sampling

Sampling
From July 2016 through July 2019, samples were collected from CTD samplers and Niskin bottles during R/V Atlantic Explorer cruises to understand ocean processes and ecological interactions in the open ocean waters near Bermuda. The BATS program provided monthly collections, while BIOS-SCOPE process cruises provided more detailed information from around-the-clock sampling for the hydrographic variables. Plankton tows were used to assess the temporal and vertical variability of organic and inorganic nutrients, vitamins, metabolites, microbial biomass and production, bacterial and viral DNA, and zooplankton biomass at depths over 1000

meters. In situ sequential filtration pumps collected particles for molecular and isotopic characterization of organic particles that spanned four biologically-relevant size classes over 12 depths. Numerous shipboard experiments were conducted to evaluate zooplankton and microbial respiration, as well as organic matter transformation by bacterioplankton (free living bacteria).

Between February 2017 and September 2018, time series of physical and biogeochemical properties were acquired near the BATS site using three separate Slocum G2 gliders deployed in 10 consecutive missions. Each glider carried a science payload that included a pumped CTD, WetLabs ECOpuck (ChlF and Bp700) and Aanderaa O2 optode, and was programmed to spiral around a 0.5 km box (essentially holding station) and profile between 0 and ~900 meters depth. For five missions the glider was additionally equipped with a Submersible Underwater Nitrate Analyzer (SUNA). Monthly, co-located ship-based CTD and water sample profiles were used to calibrate each of the sensors. These time series demonstrate the relationship between vertical zones, seasons and biogeochemical property distributions.

Analysis
BIOS-SCOPE cruise samples were analyzed at UCSB using the following instruments and methods:

Flow injection analysis was performed on a Lachat QuikChem 8500 series 2 to obtain concentration data for nitrate, nitrite, NO3 + NO2, ortho-phosphate, ammonium, and silicate.

Particulate organic carbon (POC) and particulate organic nitrogen (PON) were measured by combustion analysis using a CEC 440HA elemental analyzer. Additional methodology, calibrations, precision and accuracy, and methodological references are detailed at the UCSB MSI Analytical Lab Website:
http://www.msi.ucsb.edu/services/analytical-lab.

Dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) were measured using high temperature catalytic oxidation (HTCO) on a Shimadzu TOC-V system with TNM-1 unit (Carlson et al., 2010).

Bacterioplankton abundance was obtained using Olympus BX51 epifluorescent microscope (Porter & Feig, 1980). Heterotrophic bacterial production was analyzed using 3H-leucine uptake (Smith & Azam, 1992).

Total Dissolved Amino Acids (TDAA) and individual amino acids were measured using HPLC (high performance liquid chromatography) following the methods of Liu et al. (2020). The amino acids include alanine, arginine, aspartic acid, beta-alanine, gamma-aminobutyric acid, glutamic acid, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, serine, taurine, threonine, tyrosine, and valine.

Season was derived from the Slocum G2 glider time series data. The glider data had longer deployment periods marking the seasonal changes, so the CTD sampling dates were lined up with the glider data using date/timestamp. Each CTD/bottle profile was assigned a season code based on the alignment with the known seasons and dates from the glider data. Season designations are 1=Mixed, 2=Spring transition, 3=Stratified, 4=Fall transition (for more information, see the Physical Framework document on the Project page)

Slocum G2 glider data. Determined from the glider time series in each year, then each CTD/bottle profile is assigned a season code based on those dates. Season designation. Season = 1 : Mixed   2: Spring transition 3: Stratified 4: Fall transition (see Physical Framework document)

Genomic DNA samples were amplified and sequenced using universal primer sets for 16S and 18S with 'general' Illumina overhang adapters at Center for Genome Research and Biocomputing (Oregon State University) Corvallis, OR. These data have been deposited with links to BioProject accession number PRJNA769790 in the NCBI BioProject database.

Related dataset with NCBI sequence information and links is (BCO-DMO dataset number TBD)

Data Processing Description

Quality Flags:
0=good
1=unknown/below detection limit
4=questionable/high error
8=bad quality/outlier

- -

Mixed Layer Depth (MLD):

Overview in de Boyer Montegut (2004). The CTD, bottle, and glider profiles are labeled with three definitions of MLD which reflect processes that affect stratification on different time scales:

ML_dens125
- ML_dens125 is defined as the depth where sigma-theta is greater than the surface density by 0.125 kg m-3
- ML_dens125 reflects deepest reach of seasonal convective mixing
- ML_dens125 exhibits LOWEST frequency variability
- ML_dens125 is DEEPEST of three MLD
- refer to Suga et al (2004)

ML_densT2
- ML_densT2 is defined as the depth where sigma-theta exceeds the surface density +0.2*alpha (where alpha is the thermal expansion coefficient)
- ML_densT2 marks intermediate episodes of convective mixing;
- ML_desnsT2 marks intermediate episodes of convective mixing;
- ML_densT2 exhibits MEDIUM variability
- ML_densT2 has depths between the other two definitions.
- refer to Sprintall & Tomczak (1992)

ML_bvfrq
- ML_bvfrq is defined as the depth where the buoyancy frequency (N2) first exceeds the standard deviation of N2.
- ML_bvfrq responds to diurnal scales of restratification/mixing (and has been adopted by the NAAMES program).
- ML_bvfrq exhibits HIGHEST frequencies
- ML_bvfrq has SHALLOWEST depth
- refer to Mojica & Gaube (in review)

See PhysicalFramework.pdf on Project page for plots comparing these parameters.

BCO-DMO Processing:

- converted latitude and longitude to decimal degrees (south and west are negative)
- combined date and time columns into a single ISO 8601 formatted datetime
- modified parameter (column) names to conform with BCO-DMO naming conventions
- added conventional header with dataset name, PI name, version date
- missing data identifier "-999" in the original source file was replaced with BCO-DMO default missing data identifier, which varies depending on the type of file that is downloaded from the BCO-DMO data system. For example, missing data will be shown as blank (null) values in the csv files. In MATLAB .mat files it will be displayed as NaN. When viewing data at BCO-DMO the missing value will be shown as "nd" meaning "no data."

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Data Files

File
survey_biogeochemical.csv (Comma Separated Values (.csv), 470.61 KB) MD5:ed94742f15a9158af199e04642b4ce12 Primary data file for dataset ID 861266

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Supplemental Files

File
BIOSSCOPE_Table1_Vertical_Zones filename: Table_1_Vertical_Zones.pdf (Portable Document Format (.pdf), 162.01 KB) MD5:eed5471cb0b8222f9467ba6b7b6bb568 Table 1. Vertical Zones Vertical layers 0 to 10 defined by dynamical and biogeochemical criteria

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Related Publications

Burd, A. B., Hansell, D. A., Steinberg, D. K., Anderson, T. R., Arístegui, J., Baltar, F., Beaupré, S. R., Buesseler, K. O., DeHairs, F., Jackson, G. A., Kadko, D. C., Koppelmann, R., Lampitt, R. S., Nagata, T., Reinthaler, T., Robinson, C., Robison, B. H., Tamburini, C., & Tanaka, T. (2010). Assessing the apparent imbalance between geochemical and biochemical indicators of meso- and bathypelagic biological activity: What the @$♯! is wrong with present calculations of carbon budgets? Deep Sea Research Part II: Topical Studies in Oceanography, 57(16), 1557–1571. https://doi.org/10.1016/j.dsr2.2010.02.022
General

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

De Boyer Montégut, C. (2004). Mixed layer depth over the global ocean: An examination of profile data and a profile-based climatology. Journal of Geophysical Research, 109(C12). doi:10.1029/2004jc002378 https://doi.org/10.1029/2004JC002378
Methods

Liu, S., Parsons, R., Opalk, K., Baetge, N., Giovannoni, S., Bolaños, L. M., Kujawinski, E. B., Longnecker, K., Lu, Y., Halewood, E., & Carlson, C. A. (2020). Different carboxyl-rich alicyclic molecules proxy compounds select distinct bacterioplankton for oxidation of dissolved organic matter in the mesopelagic Sargasso Sea. In Limnology and Oceanography (Vol. 65, Issue 7, pp. 1532–1553). Wiley. https://doi.org/10.1002/lno.11405
Methods

Lomas, M. W., Bates, N. R., Johnson, R. J., Knap, A. H., Steinberg, D. K., & Carlson, C. A. (2013). Two decades and counting: 24-years of sustained open ocean biogeochemical measurements in the Sargasso Sea. Deep Sea Research Part II: Topical Studies in Oceanography, 93, 16–32. doi:10.1016/j.dsr2.2013.01.008
Related Research

Mojica, K.D. and Gaube, P. (in review) Estimates of mixing and mixed layer depth in Western North Atlantic https://github.com/nbaetge/naames_export_ms/blob/master/Rmd/ARGO.md
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

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

Sprintall, J., & Tomczak, M. (1992). Evidence of the barrier layer in the surface layer of the tropics. Journal of Geophysical Research, 97(C5), 7305. doi:10.1029/92jc00407 https://doi.org/https://doi.org/10.1029/92JC00407
Methods

Steinberg, D. K., Carlson, C. A., Bates, N. R., Johnson, R. J., Michaels, A. F., & Knap, A. H. (2001). Overview of the US JGOFS Bermuda Atlantic Time-series Study (BATS): a decade-scale look at ocean biology and biogeochemistry. Deep Sea Research Part II: Topical Studies in Oceanography, 48(8–9), 1405–1447. https://doi.org/10.1016/s0967-0645(00)00148-x
Related Research

Steinberg, D. K., Goldthwait, S. A., & Hansell, D. A. (2002). Zooplankton vertical migration and the active transport of dissolved organic and inorganic nitrogen in the Sargasso Sea. Deep Sea Research Part I: Oceanographic Research Papers, 49(8), 1445–1461. doi:10.1016/s0967-0637(02)00037-7 https://doi.org/10.1016/S0967-0637(02)00037-7
Related Research

Suga, T., Motoki, K., Aoki, Y., & Macdonald, A. M. (2004). The North Pacific Climatology of Winter Mixed Layer and Mode Waters. Journal of Physical Oceanography, 34(1), 3–22. doi:10.1175/1520-0485(2004)034<0003:tnpcow>2.0.co;2 https://doi.org/10.1175/1520-0485(2004)034<0003:TNPCOW>2.0.CO;2
Methods

Treusch, A. H., Vergin, K. L., Finlay, L. A., Donatz, M. G., Burton, R. M., Carlson, C. A., & Giovannoni, S. J. (2009). Seasonality and vertical structure of microbial communities in an ocean gyre. The ISME Journal, 3(10), 1148–1163. doi:10.1038/ismej.2009.60
Related Research

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Parameters

Parameter	Description	Units
Program	Program name	unitless
Cruise_ID	Vessel and cruise number	unitless
Cast	Cast number according to CTD log sheets	unitless
Niskin	Niskin bottle number according to CTD log sheets	unitless
decy	Date in decimal year	decimal years
ISO_DateTime_UTC	Date and UTC Time in ISO8601 format	unitless
Latitude	Latitude at start of cast	decimal degrees
Longitude	Longitude at start of cast (West is negative)	decimal degrees
Depth	CTD bottle collection depth	meters (m)
Nominal_Depth	Target depth	meters (m)
Temp	Standard CTD temperature profiling	degrees Celsius
CTD_SBE35T	Temperature from SeaBird 35 CTD which has 8 second average taken at time of the bottle fire. This sensor has an accuracy of 0.0001C as compared to the standard profiling units which have an accuracy of 0.002C.	degrees Celsius
Conductivity	Conductivity	Siemens per meter (S/m)
CTD_S	Salinity measured by CTD	practical salinity units (PSU)
Pressure	Pressure	decibars (dbar)
sig_theta	Sigma-theta	kilograms per cubed meter (kg/m^3)
O2	CTD Oxygen	micromole per kilogram (umol/kg)
BAC	Beam attenuation coefficient	per meter
Fluo	CTD Fluorescence	microgram per liter (ug/L)

PAR	CTD Photosynthetically active radiation	microEinsteins per second per square meter (uE/m^2/sec)
Pot_Temp	Potential temperature	degrees Celsius
Niskin_temp	modeled Niskin temperature when it gets back on deck	degrees Celsius
NO3_plus_NO2	Nitrate plus nitrite concentration	micromole per kilogram (umol/kg)
NO3_plus_NO2_QF	Nitrate plus nitrite quality flag	unitless
NO3	Nitrate concentration	micromole per kilogram (umol/kg)
NO3_QF	Nitrate quality flag	unitless
NO2	Nitrite concentration	micromole per kilogram (umol/kg)
NO2_QF	Nitrite quality flag	unitless
PO4	Ortho-phosphate concentration	micromole per kilogram (umol/kg)
PO4_QF	Ortho-phosphate quality flag	unitless
NH4	Ammonium concentration	micromole per kilogram (umol/kg)
NH4_QF	Ammonium quality flag	unitless
SiO2	Silicate concentration	micromole per kilogram (umol/kg)
SiO2_QF	Silicate quality flag	unitless
POC	Particulate organic carbon	micrograms per kilogram (ug/kg)
POC_QF	Particulate organic carbon quality flag	unitless
PON	Particulate organic nitrogen	micrograms per kilogram (ug/kg)
PON_QF	Particulate organic nitrogen quality flag	unitless
DOC	Dissolved organic carbon concentration	micromole per kilogram (umol/kg)
DOC_QF	Dissolved organic carbon quality flag	unitless
TDN	Total dissolved nitrogen concentration	micromole per kilogram (umol/kg)
TDN_QF	Total dissolved nitrogen quality flag	unitless
Bact	Bacterioplankton abundance from microscopy with DAPI stain	cells times 100 million per kilogram (cells*10^8/kg)
Bact_QF	Bacterioplankton abundance quality flag	unitless
BP_Leu	Heterotrophic bacterial production based on 3H leucine incorporation	picomole per liter per hour (pmol/L/hr)
BP_Leu_QF	Bacterial production quality flag	unitless
TDAA	Total dissolved amino acid	nanomole per liter (nmol/L)
TDAA_QF	Total dissolved amino acid quality flag	unitless

Ala	Amino acid alanine concentration	nanomole per liter (nmol/L)
Arg	Amino acid arginine concentration	nanomole per liter (nmol/L)
Asp	Amino acid aspartic acid concentration	nanomole per liter (nmol/L)
Beta_Ala	Amino acid beta-alanine concentration	nanomole per liter (nmol/L)
GABA	Amino acid gamma-aminobutyric acid concentration	nanomole per liter (nmol/L)
Glu	Amino acid glutamic acid concentration	nanomole per liter (nmol/L)
Gly	Amino acid glycine concentration	nanomole per liter (nmol/L)
His	Amino acid histidine concentration	nanomole per liter (nmol/L)
Ile	Amino acid isoleucine concentration	nanomole per liter (nmol/L)
Leu	Amino acid leucine concentration	nanomole per liter (nmol/L)
Lys	Amino acid lysine concentration	nanomole per liter (nmol/L)
Met	Amino acid methionine concentration	nanomole per liter (nmol/L)
Phe	Amino acid phenylalanine concentration	nanomole per liter (nmol/L)
Ser	Amino acid serine concentration	nanomole per liter (nmol/L)
Tau	Amino acid derivative taurine concentration	nanomole per liter (nmol/L)
Thr	Amino acid threonine concentration	nanomole per liter (nmol/L)
Tyr	Amino acid tyrosine concentration	nanomole per liter (nmol/L)
Val	Amino acid valine concentration	nanomole per liter (nmol/L)
V1V2_ID	Sequence ID for 16S amplicon V1V2 region	unitless
V4_18s_ID	Sequence ID for 18S V4 region	unitless
Sunrise	Time of sunrise in UTC derived from CTD data and computed from geographic position and date	unitless
Sunset	Time of sunset in UTC derived from CTD data and computed from geographic position and date	unitless
MLD_dens125	Mixed layer depth defined by surface density plus 0.125 kilograms per cubed meter (see Acquisition description)	meters (m)
MLD_bvfrq	Depth of "active mixing" defined by buoyancy frequency after Mojica & Gaube (see Acquisition description)	meters (m)
MLD_densT2	MLD from Thermal Expansion Coeff, and dT=0.2 deg C (see Acqusition description)	meters (m)
DCM	Depth of chlorophyll maximum (from CTD fluorometer)	meters (m)

VertZone	Vertical Zone designation where vertical layers 0 to 10 are defined by dynamical and biogeochemical criteria (see Table 1 under Supplemental Files)	unitless
Season	Season designation where 1=Mixed, 2=Spring Transition, 3=Stratified, 4=Fall Transition	unitless

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Instruments

Dataset-specific Instrument Name	Aanderaa O2 optode
Generic Instrument Name	Aanderaa Oxygen Optodes
Dataset-specific Description	Slocum G2 glider carried a science payload that included Aanderaa oxygen optode.
Generic Instrument Description	Aanderaa Oxygen Optodes are instrument for monitoring oxygen in the environment. For instrument information see the Aanderaa Oxygen Optodes Product Brochure.

Dataset-specific Instrument Name	CEC 440HA combustion analyzer
Generic Instrument Name	CHN Elemental Analyzer
Dataset-specific Description	CEC 440HA combustion analyzer was used to measure particulate organic carbon and particulate organic nitrogen
Generic Instrument Description	A CHN Elemental Analyzer is used for the determination of carbon, hydrogen, and nitrogen content in organic and other types of materials, including solids, liquids, volatile, and viscous samples.

Dataset-specific Instrument Name	CTD SeaBird 911+
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	CTD SeaBird 911+ was deployed to measure temperature, conductivity, salinity, pressure, oxygen, and fluorescence.
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	Lachat QuikChem 8500 series 2
Generic Instrument Name	Flow Injection Analyzer
Dataset-specific Description	Lachat QuikChem 8500 series 2 was used to measure nitrate, nitrite, ortho-phosphate, ammonium, and silicate by flow injection analysis
Generic Instrument Description	An instrument that performs flow injection analysis. Flow injection analysis (FIA) is an approach to chemical analysis that is accomplished by injecting a plug of sample into a flowing carrier stream. FIA is an automated method in which a sample is injected into a continuous flow of a carrier solution that mixes with other continuously flowing solutions before reaching a detector. Precision is dramatically increased when FIA is used instead of manual injections and as a result very specific FIA systems have been developed for a wide array of analytical techniques.

Dataset-specific Instrument Name	Olympus BX51 epifluorescent microscope
Generic Instrument Name	Fluorescence Microscope
Dataset-specific Description	Olympus BX51 epifluorescent microscope was used to obtain bacterioplankton abundance in 10^8 cells per kilogram.
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	MOCNESS
Generic Instrument Name	MOCNESS
Dataset-specific Description	Mesozooplankton sampling will be carried out seasonally via a Multiple Opening/Closing Net and Environmental Sensing System (MOCNESS) equipped with 200 µm nets during the mid-day and mid-evening.
Generic Instrument Description	The Multiple Opening/Closing Net and Environmental Sensing System or MOCNESS is a family of net systems based on the Tucker Trawl principle. There are currently 8 different sizes of MOCNESS in existence which are designed for capture of different size ranges of zooplankton and micro-nekton Each system is designated according to the size of the net mouth opening and in two cases, the number of nets it carries. The original MOCNESS (Wiebe et al, 1976) was a redesigned and improved version of a system described by Frost and McCrone (1974).(from MOCNESS manual) This designation is used when the specific type of MOCNESS (number and size of nets) was not specified by the contributing investigator.

Dataset-specific Instrument Name	Niskin bottles
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	Submersible Underwater Nitrate Analyzer (SUNA)
Generic Instrument Name	Nutrient Autoanalyzer
Dataset-specific Description	For five missions the glider was additionally equipped with a Submersible Underwater Nitrate Analyzer (SUNA)
Generic Instrument Description	Nutrient Autoanalyzer is a generic term used when specific type, make and model were not specified. In general, a Nutrient Autoanalyzer is an automated flow-thru system for doing nutrient analysis (nitrate, ammonium, orthophosphate, and silicate) on seawater samples.

Dataset-specific Instrument Name	Reeve net
Generic Instrument Name	Reeve Net
Dataset-specific Description	During the winter and the summer cruises a Reeve net (1 m mouth, 150 µm mesh) will be towed obliquely from 150 m to the surface at the start of each evening when the echo-sounder indicates that the DVM zooplankton have returned to the surface, and late evening (~ 4 am) prior to the descent of the DVM layer.
Generic Instrument Description	A Reeve Net is a conventional ring net with a very large acrylic cylindrical cod-end (30 liters) designed to collect fragile gelatinous animals. The net is lowered to a particular depth and then hauled slowly back to the surface (5-10 m/min). Reeve (1981) also described a double net system with no bridle and flotation at the net mouth that is attached to a roller mechanism that rides on a tow wire. The roller system is locked in place by a pressure release device. Once below a set pressure, the roller and nets are released and they float slowly up the wire, gently collecting the zooplankton, without being influenced by the motion of the vessel and associated vertical wire movements. (from Wiebe and Benfield, 2003)

Dataset-specific Instrument Name	Shimadzu TOC-V
Generic Instrument Name	Shimadzu TOC-V Analyzer
Dataset-specific Description	High temperature catalytic oxidation (HTCO) was performed on a Shimadzu TOC-V system with TNM-1 chemiluminescent detector assembly
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

Dataset-specific Instrument Name	Slocum G2 glider
Generic Instrument Name	Slocum G2 glider
Dataset-specific Description	Time series of physical and biogeochemical properties were acquired near the BATS site using three separate Slocum G2 gliders
Generic Instrument Description	A long-range autonomous underwater vehicle (AUV) based on buoyancy. It is used for remote water column sampling. It uses hydraulic buoyancy change to alter the vehicle density in relation to the surrounding water thereby causing the vehicle to either float or sink. Given an appropriate dive or climb angle, the wings and body lift and convert some of this vertical motion into a forward saw tooth horizontal motion. Periodically, the glider surfaces and calls via Iridium Satellite Phone (anywhere in world) or Free Wave RF Modem (line of sight) in to Dockserver (auto attendant computer) to relay navigational fix, data and receive further instructions for command and control. The glider is capable of storm sampling and can be flown in a coordinated fleet. It is 1.5 m in length, has a hull diameter of 22 cm and mass of 54 kgs. It has an exchangeable payload (capacity up to 6 L) which is capable of housing a variety of environmental sensors such as nitrate and oxygen. It uses lithium or alkaline batteries. It has a deployment range of 600-6000 km, a deployment length of 15 days to 12 months and an operating depth range of 4-1000m. Navigation is via GPS waypoints, a pressure and altimeter sensor. Maximum speed is .35 m/s. It transmits via RF modem, Iridium (RUDICS), ARGOS or acoustic modem.

Dataset-specific Instrument Name	TNM-1 chemiluminescent detector assembly
Generic Instrument Name	Total Nitrogen Analyzer
Dataset-specific Description	High temperature catalytic oxidation (HTCO) was performed on a Shimadzu TOC-V system with TNM-1 chemiluminescent detector assembly that permits Total Nitrogen measurements.
Generic Instrument Description	A unit that accurately determines the nitrogen concentrations of organic compounds typically by detecting and measuring its combustion product (NO). See description document at: http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/totalnit.pdf

Dataset-specific Instrument Name	WetLabs ECOpuck (ChlF and Bp700)
Generic Instrument Name	Wet Labs ECO Puck
Dataset-specific Description	Slocum G2 glider carried a science payload that included WetLabs ECOpuck (ChlF and Bp700)
Generic Instrument Description	The Puck is a miniature version of the ECO series of sensors, specifically designed for use in AUVs, profiling floats, and Slocum gliders with a dry science bay. This compact optical sensor is available in combinations of backscattering and fluorescence measurements. Manufacturer's website: https://www.seabird.com/auv-rov-sensors/eco-puck/family?productCategoryI...

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Deployments

AE1614

Website	https://www.bco-dmo.org/deployment/853444
Platform	R/V Atlantic Explorer
Report	https://datadocs.bco-dmo.org/docs/305/BIOSSCOPE/data_docs/AE1614_CS_narrative_FINAL.pdf
Start Date	2016-07-09
End Date	2016-07-12

AE1712

Website	https://www.bco-dmo.org/deployment/857372
Platform	R/V Atlantic Explorer
Report	https://datadocs.bco-dmo.org/docs/305/BIOSSCOPE/data_docs/AE1712_CS_narrative.pdf
Start Date	2017-07-08
End Date	2017-07-11
Description	Project BIOS-SCOPE

AE1819

Website	https://www.bco-dmo.org/deployment/857784
Platform	R/V Atlantic Explorer
Report	https://datadocs.bco-dmo.org/docs/305/BIOSSCOPE/data_docs/AE1819_CS_narrative_v1.pdf
Start Date	2018-07-03
End Date	2018-07-06
Description	Project BIOS-SCOPE

AE1916

Website	https://www.bco-dmo.org/deployment/861272
Platform	R/V Atlantic Explorer
Report	https://datadocs.bco-dmo.org/docs/305/BIOSSCOPE/data_docs/AE1916_CS_narrative_FINAL.pdf
Start Date	2019-07-08
End Date	2019-07-11
Description	Project BIOS-SCOPE

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Project Information

Bermuda Institute of Ocean Sciences Simons Collaboration on Ocean Processes and Ecology (BIOSSCOPE)

Website: http://scope.bios.edu/

Coverage: North Atlantic Subtropical Gyre, Bermuda Atlantic Time Series (BATS) site

The aim of BIOS-SCOPE is to expand knowledge about the BATS ecosystem and achieve a better understanding of ocean food web sources, sinks and transformations of DOM. Advances in knowledge and technology now poise us to investigate the specific mechanisms of DOM incorporation, oxidation and transformation by zooplankton and the distinct microbial plankton communities that have been discovered at BATS.

The overarching goal of the BIOS-SCOPE is to form and foster collaborations of cross disciplinary science that utilize a broad suite of genomic, chemical, ecological, and biogeochemical approaches to evaluate microbial process, structure and function on various scales. These scales will range from organism-compound and organism-organism interactions to large biogeochemical patterns on the ecosystem scale. For this purpose we have assembled a cross-disciplinary team including microbial oceanographers (Carlson and Giovannoni), a chemical oceanographer (Kujawinski), biological oceanographer / zooplankton ecologists (Maas and Blanco-Bercial) and microbial bioinformatician (Temperton) with the expertise and technical acuity that are needed to study complex interactions between food web processes, microbes and DOM quantity and quality in the oligotrophic ocean. This scientific team has a vision of harnessing this potential to produce new discoveries that provide a mechanistic understanding of the carbon cycle and explain the many emergent phenomenon that have yet to be understood.

For additional details:

- ***BIOS-SCOPE Narrative****:* *https://datadocs.bco-dmo.org/docs/302/BIOSSCOPE/data_docs/BIOS-SCOPE_Narrative_FINAL.pdf*
- ***Physical Framework****:* *https://datadocs.bco-dmo.org/docs/302/BIOSSCOPE/data_docs/Physical_Framework.pdf*

BIOSSCOPE I: November 1st, 2015 through October 31st, 2020
Current: November 1st, 2020 to October 31st, 2025

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Funding

Funding Source	Award
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