HPLC pigment data from samples collected during R/V Savannah cruises conducted in the South Atlantic Bight off the coast of Georgia from 2015-2017

Website: https://www.bco-dmo.org/dataset/816216
Data Type: Cruise Results
Version: 1
Version Date: 2020-06-19

Project
» RUI: Vitamin B12 and nitrogen regulation of oceanic dimethylsulfoniopropionate and dimethylsulfide (B12 Impacts on DMSP)

Contributors	Affiliation	Role
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Abstract
HPLC pigment data collected during several R/V Savannah cruises conducted from 2015 to 2017 along a transect from shelf waters to oligotrophic waters in the South Atlantic Bight off the coast of Georgia (Navy Op Area NA06).

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Coverage

Spatial Extent: **N**:31.42113 **E**:-76.343633 **S**:31.031829 **W**:-81.121513
Temporal Extent: 2015-03-16 - 2017-01-27

Dataset Description

HPLC pigment data collected during several R/V Savannah cruises conducted from 2015 to 2017 along a transect from shelf waters to oligotrophic waters in the South Atlantic Bight off the coast of Georgia (Navy Op Area NA06).

Acquisition Description

Algal HPLC samples were collected by filtration under low vacuum through GF/F filters and frozen at -80C for on-shore analysis. Samples were extracted in acetone and analyzed using an Agilent 1100 HPLC system equipped with autosampler, photodiode array, and fluorescence detectors. The gradient elution

program utilized was a slight modification of the Zapata et al. method (2000). Complete details of the HPLC method are described in DiTullio and Geesey 2003.

Processing Description

Pigment concentrations were determined using standard peak integration procedures with Agilent's ChemStation (version B.03.02), and entered into Microsoft Excel spreadsheets for submission to BCO-DMO. Pigment concentrations (ng/L) reported are: chlorophyll c3, chlorophyllide, magnesium-2,4-divinyl phaeoporphyrin a5 monomethyl ester, chlorophyll c2, chlorophyll c1, peridinin, 19-prime butanoyloxyfucoxanthin, fucoxanthin, neoxanthin, prasinoxanthin, violaxanthin, 19-prime hexanoyloxyfucoxanthin, diadinoxanthin, cis-fucoxanthin, alloxanthin, diatoxanthin, monadoxanthin, zeaxanthin, lutein, crocoxanthin, chlorophyll b, chlorophyll c2-like, chlorophyll a-like, divinyl chlorophyll a, chlorophyll a, pheophytin a, carotene-alpha and carotene-beta.

BCO-DMO Processing:
- renamed fields;
- added date/time field in ISO8601 format.

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Related Publications

DiTullio, G., & Geesey, M. E. (2003). Photosynthetic Pigments in Marine Algae and Bacteria. Encyclopedia of Environmental Microbiology. doi:10.1002/0471263397.env185
Methods

Zapata, M., Rodríguez, F., & Garrido, J. (2000). Separation of chlorophylls and carotenoids from marine phytoplankton:a new HPLC method using a reversed phase C8 column and pyridine-containing mobile phases. Marine Ecology Progress Series, 195, 29–45. doi:10.3354/meps195029
Methods

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Parameters

Parameter	Description	Units
Cruise_ID	Cruise Identifier	unitless
Station	Station number	unitless
UTC_Date	Start date for sample collection; Coordinated Universal Time; Format: MM/DD/YYYY	unitless
UTC_Time	Start time for sample collection; Coordinated Universal Time; Format: hh:mm:ss	unitless
ISO_DateTime_UTC	Start date and time of sample collection formatted to ISO8601 standard: YYYY-MM-DDThh:mm:ssZ	unitless
Latitude	Start latitude for sample collection; Negative = South	decimal degrees North
Longitude	Start longitude for sample collection; Negative = West	decimal degrees East
Bottom_Depth	Bottom depth from ship's sonar	meters (m)

CTD_bottle	Niskin bottle number from CTD rosette	unitless
Depth	Sample depth from CTD readout	meters (m)
Chl_c3	Chlorophyll c3 concentration	nanograms per liter (ng/L)
Chl_ide	Chlorophyllide concentration	ng/L
MgDVP	Magnesium-2,4-divinyl phaeoporphyrin a5 monomethyl ester concentration	ng/L
Chl_c2	Chlorophyll c2 concentration	ng/L
Chl_c1	Chlorophyll c1 concentration	ng/L
Peridinin	Peridinin concentration	ng/L
But_19	19-prime butanoyloxyfucoxanthin concentration	ng/L
Fuco	Fucoxanthin concentration	ng/L
Neo	Neoxanthin concentration	ng/L
Prasino	Prasinoxanthin concentration	ng/L
Viola	Violaxanthin concentration	ng/L
Hex_19	19-prime hexanoyloxyfucoxanthin concentration	ng/L
DD	Diadinoxanthin concentration	ng/L
cis_fuco	Cis-fucoxanthin concentration	ng/L
Allo	Alloxanthin concentration	ng/L
Diato	Diatoxanthin concentration	ng/L
Monad	Monadoxanthin concentration	ng/L
Zeax	Zeaxanthin concentration	ng/L
Lutein	Lutein concentration	ng/L
Croco	Crocoxanthin concentration	ng/L
Chl_b	Chlorophyll b concentration	ng/L
Chl_c2_like	Chlorophyll c2-like concentration	ng/L
Chl_a_like	Chlorophyll a-like concentration	ng/L
DV_Chl_a	Divinyl-chlorophyll a concentration	ng/L
Chl_a	Chlorophyll a concentration	ng/L
Ph_tin	Pheophytin a concentration	ng/L
a_Car	Carotene-alpha concentration	ng/L
b_Car	Carotene-beta concentration	ng/L

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Instruments

Dataset-specific Instrument Name	Niskin bottle
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	SBE-25 CTD
Generic Instrument Name	CTD Sea-Bird 25
Generic Instrument Description	The Sea-Bird SBE 25 SEALOGGER CTD is battery powered and is typically used to record data in memory, eliminating the need for a large vessel, electrical sea cable, and on-board computer. All SBE 25s can also operate in real-time, transmitting data via an opto-isolated RS-232 serial port. Temperature and conductivity are measured by the SBE 3F Temperature sensor and SBE 4 Conductivity sensor (same as those used on the premium SBE 9plus CTD). The SBE 25 also includes the SBE 5P (plastic) or 5T (titanium) Submersible Pump and TC Duct. The pump-controlled, TC-ducted flow configuration significantly reduces salinity spiking caused by ship heave, and in calm waters allows slower descent rates for improved resolution of water column features. Pressure is measured by the modular SBE 29 Temperature Compensated Strain-Gauge Pressure sensor (available in eight depth ranges to suit the operating depth requirement). The SBE 25's modular design makes it easy to configure in the field for a wide range of auxiliary sensors, including optional dissolved oxygen (SBE 43), pH (SBE 18 or SBE 27), fluorescence, transmissivity, PAR, and optical backscatter sensors. More information from Sea-Bird Electronics: http:www.seabird.com.

Dataset-specific Instrument Name	Sea-Bird Scientific SBE 911 CTD carousel
Generic Instrument Name	CTD Sea-Bird 911
Generic Instrument Description	The Sea-Bird SBE 911 is a type of CTD instrument package. The SBE 911 includes the SBE 9 Underwater Unit and the SBE 11 Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with 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	High Performance Liquid Chromatograph (HPLC) Agilent 1100
Generic Instrument Name	High Performance Liquid Chromatograph
Dataset-specific Description	High Performance Liquid Chromatograph (HPLC) Agilent 1100 equipped with autosampler, photodiode array, and fluorescence detectors.
Generic Instrument Description	A High-performance liquid chromatograph (HPLC) is a type of liquid chromatography used to separate compounds that are dissolved in solution. HPLC instruments consist of a reservoir of the mobile phase, a pump, an injector, a separation column, and a detector. Compounds are separated by high pressure pumping of the sample mixture onto a column packed with microspheres coated with the stationary phase. The different components in the mixture pass through the column at different rates due to differences in their partitioning behavior between the mobile liquid phase and the stationary phase.

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Deployments

SAV-15-04

Website	https://www.bco-dmo.org/deployment/815737
Platform	R/V Savannah
Start Date	2015-03-15
End Date	2015-03-21
Description	More information is available from Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/SAV-15-04

SAV-15-16

Website	https://www.bco-dmo.org/deployment/815853
Platform	R/V Savannah
Start Date	2015-06-20
End Date	2015-06-26
Description	More information is available from Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/SAV-15-16

SAV-15-20

Website	https://www.bco-dmo.org/deployment/815880
Platform	R/V Savannah
Start Date	2015-08-07
End Date	2015-08-13
Description	More information is available from Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/SAV-15-20

SAV-15-26

Website	https://www.bco-dmo.org/deployment/672531
Platform	R/V Savannah
Start Date	2015-10-13
End Date	2015-10-19
Description	More information is available from Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/SAV-15-26

SAV-16-06

Website	https://www.bco-dmo.org/deployment/672529
Platform	R/V Savannah
Start Date	2016-03-06
End Date	2016-03-12
Description	More information is available from Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/SAV-16-06

SAV-16-22

Website	https://www.bco-dmo.org/deployment/672589
Platform	R/V Savannah
Start Date	2016-06-21
End Date	2016-06-27
Description	More information is available from Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/SAV-16-22

SAV-16-28

Website	https://www.bco-dmo.org/deployment/815964
Platform	R/V Savannah
Start Date	2016-08-15
End Date	2016-08-21
Description	More information is available from Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/SAV-16-28

SAV-17-02

Website	https://www.bco-dmo.org/deployment/815980
Platform	R/V Savannah
Start Date	2017-01-21
End Date	2017-01-27
Description	More information is available from Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/SAV-17-02

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Project Information

RUI: Vitamin B12 and nitrogen regulation of oceanic dimethylsulfoniopropionate and dimethylsulfide (B12 Impacts on DMSP)

Coverage: North Atlantic Ocean in the South Atlantic Bight off the coast of Georgia; Navy Op Area NA06

Description from NSF award abstract: Vitamin B12 and nitrogen are nutrients critical to phytoplankton growth. Since B12 is produced solely by bacteria, phytoplankton must acquire their B12 from bacteria. Nitrogen is used to produce the amino acid methionine and B12 is required by the enzymes that form methionine. Methionine is the precursor to the algal metabolite dimethylsulfoniopropionate (DMSP). Bacteria degrade this compound to the climatically-active compound dimethylsulfide (DMS). Subsequent DMS transfer into the atmosphere is considered a significant driver of cloud formation and a possible climate feedback mechanism. DMSP can also be degraded via a secondary pathway to form methylmercaptopropionate (MMPA), which is not released to the atmosphere. Consequently, DMSP formation and the extent of DMSP degradation to DMS or MMPA are susceptible to B12 availability. Nitrogen availability influences this effect by controlling methionine production. Thus, the overarching premise for this study is that B12 availability regulates oceanic DMSP and DMS formation, and is synergistically impacted by nitrogen limitation. By providing a mechanistic understanding of relevant biogeochemical parameters this study will significantly improve the incorporation of sulfur-related microbial processes into climate models. This project will combine established biogeochemistry-based measurements with cutting-edge metabolomics, transcriptomics and proteomics techniques in laboratory and field studies. Culture experiments will examine the interactive effect of B12 and nitrogen availability on DMSP formation in several ecologically-relevant phytoplankton taxa. Second, the microbial degradation of DMSP and DMS in relation to B12 availability will be examined using several environmentally-important bacteria and archaea. Finally, field studies will examine the seasonal variability of B12, DMSP and DMS, and the relative importance of DMS and MMPA formation in the South Atlantic Bight. Gene and protein expression will be assessed at each level of this study to identify gene products, metabolic pathways, and cellular mechanisms underlying the interconnections between B12, sulfur, and nitrogen cycles. The results generated will have a major impact on current understanding of the role of B12 and nitrogen on the DMSP and DMS cycling, as well as the potential role of these stressors in global climate change. In addition to providing evidence for microbe-based mechanisms behind the modulation of oceanic DMS, this project will (1) furnish an explanation for "summer DMS paradox", thus having significant implications for the development of future DMS models, (2) assess the interactive impact of B12 and nitrogen availability on intracellular DMSP production and (3) provide insight as to whether B12 may play a far more critical role in modulating climate feedback mechanisms on phytoplankton productivity.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1436458

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