

Dissolved organic compound (DOS, DOP, DOBr, DOI) depth profiles collected at the Bermuda Atlantic Time Series Station (BATS) in August 2019 and at the Hawaii Ocean Time Series Station Aloha in July 2021

Website: <https://www.bco-dmo.org/dataset/986596>

Data Type: Cruise Results

Version: 1

Version Date: 2025-11-05

Project

» [The fate of lysis products of picocyanobacteria contributes to marine humic-like chromophoric dissolved organic matter](#) (Picocyanobacteria CDOM)

Contributors	Affiliation	Role
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Abstract

This dataset contains the Dissolved organic sulfur (DOS), dissolved organic phosphorus (DOP), dissolved organic bromine (DOBr) and dissolved organic iodine (DOI) data obtained ICP-MS analysis of solid-phase extracted samples collected at the BATS station (August 2019) and HOT station ALOHA (July 2021). These data are complementary to the fluorescence data set that was sampled at 200 m depth intervals in both the Central North Atlantic (BATS) and Central North Pacific (ALOHA). While the focus of study is to better understand a marine source of fluorescent dissolved organic matter (DOM) (i.e., picocyanobacteria), these data were collected to evaluate whether these heteroatoms within DOM follow the same trends with depth as the fluorescent components determined by parallel factor analysis of 3D fluorescence spectra. Briefly, DOM was isolated by solid phase extraction from 10L seawater samples that were collected from the surface to the seafloor at each station, resulting in 10 mL methanolic extracts for each sample. Extracts were stored at -20 degrees C until analysis in our home laboratory. Portions of these extracts were dried completely and re-dissolved in ultrapure water prior to DOS, DOP, DOBr, or DOI analysis by inductively coupled plasma-mass spectrometry.

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Coverage

Location: Depth profiles were collected from the surface to the bottom at the BATS station (31.8333 N

64.1667 W) and at HOT station ALOHA (22.75 N 158 W).

Spatial Extent: N:31.833333 E:-64.166667 S:22.75 W:-158

Temporal Extent: 2019-08-08 - 2021-07-06

Methods & Sampling

This dataset contains the dissolved organic sulfur (DOS), dissolved organic phosphorus (DOP), dissolved organic bromine (DOBr) and dissolved organic iodine (DOI) data from solid-phase extracted (Agilent Bond Elut PPL) samples following the methods described in Gonsior et al. (2024) (doi:10.1039/D3VA00361B) for DOS and DOP and in Powers et al. (2024) (doi: 10.1016/j.scitotenv.2023.169292) for dissolved organic bromine (DOBr) and dissolved organic iodine (DOI).

Water samples were collected using the ship's CTD profiler and 12 L Niskin bottles. 10 L water samples from each depth were then transferred into 5 gallon polycarbonate water bottles, passed through combusted 0.7 micron glass fiber filters and extracted.

The solid-phase extracted methanolic sample was dried under nitrogen and re-dissolved in pure water prior to DOS, DOP, DOBr, and DOI analysis by ICP-MS. Samples for DOBr and DOI analysis were also passed through silver cartridges prior to analysis to remove residual halides. DOS and DOP were analyzed by ICP-MS/MS using oxygen as the reaction gas and DOBr and DOI were analyzed by ICP-MS/MS with no gas in the Octopole Reaction System.

Data Processing Description

All data are scaled for extraction volume and dilution. No further processing was performed.

BCO-DMO Processing Description

* Table within submitted file "BATS_Aloha_dates_DOS_DOP_DOBr_DOI.csv" was imported into the BCO-DMO data system for this dataset. Values "NaN" imported as missing data values. Table will appear as Data File: 986596_v1_dissolved-organic-profiles.csv (along with other download format options).

Missing Data Identifiers:

* In the BCO-DMO data system missing data identifiers are displayed according to the format of data you access. For example, in csv files it will be blank (null) values. In Matlab .mat files it will be NaN values. When viewing data online at BCO-DMO, the missing value will be shown as blank (null) values.

* Column names adjusted to conform to BCO-DMO naming conventions designed to support broad re-use by a variety of research tools and scripting languages. [Only numbers, letters, and underscores. Can not start with a number]

* Date converted to ISO 8601 format

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Data Files

File
986596_v1_dissolved-organic-profiles.csv (Comma Separated Values (.csv), 5.56 KB) MD5:54a42b4c107dc9a10b20660fbb9861b6
Primary data file for dataset ID 986596, version 1

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Related Publications

Gonsior, M., Lahm, M., Powers, L., Chen, F., McCallister, S. L., Liang, D., Guinan, G., & Schmitt-Kopplin, P. (2024). Optical properties and molecular differences in dissolved organic matter at the Bermuda Atlantic and Hawai'i ALOHA time-series stations. *Environmental Science: Advances*, 3(5), 717–731.
<https://doi.org/10.1039/d3va00361b> <https://doi.org/10.1039/D3VA00361B>
Results

Powers, L. C., Schmitt-Kopplin, P., & Gonsior, M. (2024). Evaluating the photochemical reactivity of disinfection byproducts formed during seawater desalination processes. *Science of The Total Environment*, 912, 169292.
<https://doi.org/10.1016/j.scitotenv.2023.169292>
Methods

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Related Datasets

IsRelatedTo

Gonsior, M., Chen, F. (2023) **Fluorescence data from a depth profile collected at 200 m depth intervals at the Bermuda Atlantic Time Series Station (BATS) in August 2019 and at the Hawaii Ocean Time Series Station Aloha in July 2021**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-09-18 doi:10.26008/1912/bco-dmo.905149.1 [[view at BCO-DMO](#)]

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Parameters

Parameter	Description	Units
location	Sampling station (BATS or Aloha)	unitless
start_date	Cruise start date	unitless
latitude	Sampling latitude, south is negative	decimal degrees
longitude	Sampling longitude, west is negative	decimal degrees
depth	Sampling depth	meters (m)
DOS	dissolved organic sulfur	nanomolar (nM)
DOP	dissolved organic phosphorus	nanomolar (nM)
DOBr	dissolved organic bromine	nanomolar (nM)
DOI	dissolved organic iodine	nanomolar (nM)

Instruments

Dataset-specific Instrument Name	Agilent 8900 ICP-QQQ
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
Dataset-specific Description	Agilent 8900 ICP-QQQ inductively coupled plasma mass spectrometer (ICP-MS/MS)
Generic Instrument Description	An ICP Mass Spec is an instrument that passes nebulized samples into an inductively-coupled gas plasma (8-10000 K) where they are atomized and ionized. Ions of specific mass-to-charge ratios are quantified in a quadrupole mass spectrometer.

Deployments

AE1920

Website	https://www.bco-dmo.org/deployment/905112
Platform	R/V Atlantic Explorer
Start Date	2019-08-08
End Date	2019-08-13

KM2110

Website	https://www.bco-dmo.org/deployment/905115
Platform	R/V Kilo Moana
Start Date	2021-07-06
End Date	2021-07-11

Project Information

The fate of lysis products of picocyanobacteria contributes to marine humic-like chromophoric dissolved organic matter (Picocyanobacteria CDOM)

Coverage: Bermuda Atlantic Time Series Station (BATS) and station Aloha, Hawaii

NSF Award Abstract:

This study focuses on the sources and composition of colored dissolved organic matter (CDOM) in the ocean. CDOM is a part of water that absorbs sunlight. This material is important because it filters out harmful ultraviolet radiation. Scientists use it to track the movement of carbon and other important biological and chemical processes in the ocean. Organisms such as algae living in the open ocean have been shown to be

sources of CDOM, but the chemical composition of these algal natural products remains to be discovered. Recent results from studying common algae show that viruses may break down algal cells and release material that looks like CDOM. This study will use new tools to find out if viruses and algae are creating this material and study its chemical makeup. This project will support two graduate students and provide summer internships for undergraduates through the NSF Research Experiences for Undergraduates (REU) program. The investigators will participate in a range of education and outreach activities.

The sources and structural nature of marine CDOM within the oceans remain unclear and continue to be a subject of debate. Marine in situ sources of CDOM have been suggested and some have been confirmed, but thus far none could explain the ubiquitous appearance of the so called "humic-like" CDOM component. Unique features of this component include its unusual exponential behavior in ultraviolet-visible (UV-Vis) absorbance with the absorbance extending well above 400 nm, and the large Stoke's shift in fluorescence spectroscopy. Picocyanobacteria are ubiquitous in the World's Oceans and make up 50 % of the autotrophic marine primary production. Preliminary results showed that the picocyanobacteria *Synechococcus* and *Prochlorococcus* release CDOM that matched the "humic-like" appearance of globally observed marine CDOM after virus-induced lysis. The main focus of this study is the characterization of the optical properties and molecular composition of viral-lysed DOM (VDOM) from different strains of *Synechococcus* and *Prochlorococcus* and additionally *Trichodesmium* which was shown in a previous study to also release CDOM. Associations between the chemical characterization information and metagenomics and transcriptomics data will be investigated for picocyanobacteria in the Pacific and Atlantic Oceans. This study includes long-term incubation experiments to determine the persistence of picocyanobacteria-derived CDOM as well as changes in microbial communities and processes (gene expression) that are related to the degradation of VDOM during the incubation period.

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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1829888

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