Nutrients and dissolved organic carbon bottle data from R/V Rachel Carson RC0078 cruise in the Salish Sea in June 2022

Website: https://www.bco-dmo.org/dataset/997299
Data Type: Cruise Results
Version: 1
Version Date: 2026-04-22

Project
» Collaborative Research: Resolving the production and fate of nitrogenous metabolites in the surface ocean (Nitrogenous Metabolites)

Contributors	Affiliation	Role
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Abstract
Nutrients (phosphate, silicate, nitrate, nitrite, and ammonium) and dissolved organic carbon bottle data were collected during R/V Rachel Carson cruise RC0078 in the Salish Sea, Washington, from 2022-06-03 to 2022-06-08. Seawater samples were collected from a CTD rosette and analyzed at the University of Washington Marine Chemistry Laboratory.

Table of Contents

Coverage

Location: Puget Sound and the broader Salish Sea
Spatial Extent: **N**:48.827166666667 **E**:-122.46633333333 **S**:47.818166666667 **W**:-123.179
Temporal Extent: 2022-06-03 - 2022-06-08

Methods & Sampling

Seawater for nutrients and dissolved organic carbon (DOC) analyses were typically collected from the CTD rosette in triplicate from different rosette bottles from two or three depths per cast.

For dissolved organic carbon (DOC) concentration measurements, seawater was collected directly from CTD bottles into a filtration apparatus consisting of a glass syringe connected to a filter unit loaded with 25 mm carbon-cleaned GF/F filter (combusted at 450 °C for 4 hours.) 2–30 mL of seawater was filtered into a 40 mL glass TOC “EPA” pre-chilled glass vials (about ½ to 3/4 full). Vial moisture/condensation was wiped off of the outside of the vial and immediately placed in the freezer (upright). Samples were shipped frozen to the University of Washington Marine Chemistry Laboratory for analysis.

Seawater samples for nutrient concentration analysis (phosphate, silicate, nitrate, nitrite, and ammonium) were collected from CTD bottles into 60 ml plastic syringes loaded with a surfactant-free cellulose membrane (25

mm, 0.45 micron pore size, Nalgene). Syringes and 60 ml HDPE sample collection bottles were rinsed twice with sample water. About 45-50 ml of seawater was filtered into the collection bottles after rinsing again with 5 mL of filtered water. Samples were frozen for storage.

BCO-DMO Processing Description

- Loaded "RC0078_bottle_nutrients_doc.csv" as resource "rc0078_bottle_nutrients_doc" (CSV format, row 1 headers), treating "", "nd", and "NA" as missing values
- Renamed fields: "year_month_day" to "Date", "Beam.Attenuation" to "Beam_Attenuation", "Beam.Transmission" to "Beam_Transmission"
- Reordered fields to: Date, Cruise, Station, LAT, LON, Cast, DOC, PO4, SiO4, NO3, NO2, NH4, PRS, Depth, TMP, SAL, OXY, Beam_Attenuation, Beam_Transmission, Fluorescence, PAR, pH
- Output to "997299_v1_rc0078_bottle_nutrients_doc.csv"

[table of contents | back to top]

Parameters

Parameter	Description	Units
Date	Date of CTD casts (UTC)	unitless
Cruise	Cruise ID	unitless
Station	Cruise station number	unitless
LAT	Latitude, positive is North	decimal degrees
LON	Longitude, negative is West	decimal degrees
Cast	Station cast number	unitless
DOC	Dissolved organic carbon	mg C/l
PO4	Phosphate	umol/l
SiO4	Silicate	umol/l
NO3	Nitrate	umol/l
NO2	Nitrite	umol/l
NH4	Ammonium	umol/l

PRS	Pressure	db
Depth	Depth	meters
TMP	Temperature (ITS-90)	degrees Celsius
SAL	Salinity, Practical	PSU
OXY	Oxygen, SBE 43	milligrams per liter (mg/l)
Beam_Attenuation	Beam attenuation	per meter
Beam_Transmission	Beam transmission	percent
Fluorescence	Fluorescence, WET Labs ECO-AFL/FL	milligrams per cubic meter (mg/m^3)
PAR	PAR/ Irradiance, Biospherical/Licor	micromoles photons per square meter per second (umol photons/m^2/s^1)
pH	pH	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	CTD
Generic Instrument Name	CTD - profiler
Dataset-specific Description	Methods Description: Seawater for nutrients and dissolved organic carbon (DOC) analyses were typically collected from the CTD in triplicate from different rosette bottles from two or three depths per cast.
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	Seal Analytical AA3
Generic Instrument Name	Nutrient Autoanalyzer
Dataset-specific Description	Instrument Description: Nutrients (phosphate, silicate, nitrate, nitrite, & ammonia) analyses and calibration follow the protocols of the WOCE Hydrographic Program using a Seal Analytical AA3.
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	Shimadzu TOC-Vcsh DOC analyzer
Generic Instrument Name	Total Organic Carbon Analyzer
Dataset-specific Description	Instrument Description: Dissolved organic carbon aqueous concentration was measured on a Shimadzu TOC-Vcsh DOC analyzer.
Generic Instrument Description	A unit that accurately determines the carbon concentrations of organic compounds typically by detecting and measuring its combustion product (CO2). See description document at: http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/bs116.pdf

[table of contents | back to top]

Deployments

RC0078

Website	https://www.bco-dmo.org/deployment/997314
Platform	R/V Rachel Carson (UW)
Start Date	2022-06-03
End Date	2022-06-09
Description	Project: DON-2022

[table of contents | back to top]

Project Information

Collaborative Research: Resolving the production and fate of nitrogenous metabolites in the surface ocean (Nitrogenous Metabolites)

NSF Award Abstract:
Photosynthetic microbes provide food for nearly all other life in the ocean. Their metabolism produces organic molecules called metabolites that can leak out of cells, be intentionally excreted into seawater, or be released during cell death. Once outside the cell, these metabolites are the basis for specific interactions among microbes and determine community structure and activity. Yet, current understanding of metabolites in the

ocean is limited by a historical lack of ability to measure them. The work proposed here will expand current knowledge of metabolite structures, concentrations, and production rates using recently developed analytical methods. These methods have already led to the discovery that homarine, a substituted pyridine first found in lobster in 1933, is the most abundant detectable metabolite in microbial communities of the North Pacific Ocean. While homarine is known as a predator deterrent, osmoprotectant, methyl donor, and antibiofouling agent, studies of its role in microbial community dynamics are lacking. The work proposed will clarify the role of homarine in the ocean's microbial communities. This work will create an open-source metabolite database that will serve the broader field of metabolomics, a growing area in environmental, engineering, and medical sciences. This collaboration will also promote the careers of a graduate student and a postdoctoral researcher as well as an early career professor from an underrepresented group at a primarily undergraduate institution (PUI). Undergraduates from both institutions will contribute to project development and implementation, local cruises on the R.V. Carson, lab work, and dissemination of results. This research will be integrated into a curriculum-based research experience for undergraduates in a 200-level genetics course at the PUI, University of Puget Sound.

The proposed work will carry out field studies and laboratory experiments to test the hypothesis that metabolites are quantitatively significant forms of carbon and nitrogen flowing through microbial communities. The identity, quantity, and production rates of metabolites will also be determined. For homarine, the enzymes and organisms responsible for its transformations will be determined. Specific proposed activities will 1) Quantify nitrogenous metabolite pools and their net production rates (particulate and dissolved) in phytoplankton cultures and in marine surface water communities; 2) Isolate homarine consuming heterotrophic bacteria and use mutagenesis techniques, transcriptomics, and stable isotope assisted metabolomics to annotate genes and characterize the biochemical reactions involved in the degradation of homarine; 3) Carry out incubations of stable isotope labeled homarine in phytoplankton cultures, heterotrophic bacterial cultures sensitive to homarine, and natural communities to quantitatively evaluate the effect of homarine on growth, track homarine through metabolic pathways, and determine the kinetics of homarine uptake; 4) Identify homarine consumers and biochemical pathways for homarine use in the environment by mining existing environmental metatranscriptomes for homarine catabolism genes. The combination of these approaches will provide better understanding of the flow of nitrogen containing metabolites through marine microbial ecosystems. Results from this work will be disseminated through peer reviewed open-source publications as well as presentations to the scientific community and the general public.

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.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2125886
NSF Division of Ocean Sciences (NSF OCE)	OCE-2124712

[table of contents | back to top]