

CTD profiles of temperature, oxygen, salinity, fluorescence, beam attenuation and transmission, PAR, and pH collected in the Salish Sea on R/V Rachel Carson cruises RC0078, RC0104, and RC0138 during 2022, 2023 and 2025

Website: <https://www.bco-dmo.org/dataset/997362>

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

This dataset contains CTD profiles of temperature, oxygen, salinity, fluorescence, beam attenuation and transmission, PAR, and pH collected in the Salish Sea on R/V Rachel Carson cruises RC0078, RC0104, and RC0138 during 2022, 2023 and 2025.

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Coverage

Location: Puget Sound and the broader Salish Sea

Spatial Extent: N:48.82716 E:-122.37444 S:47.2767 W:-123.40608

Temporal Extent: 2022-06-03 - 2025-06-22

Methods & Sampling

CTD data were collected from the near surface to 5-10 m off the seafloor in the Salish Sea on R/V Rachel Carson cruises RC0078, RC0104, and RC0138 during 2022, 2023 and 2025. They were collected using a Sea-Bird SBE9 CTD profiler equipped with a pH sensor (SBE 18), oxygen sensor (SBE 43), fluorometer (WETLabs ECO-AFL), transmissometer (WETLabs C-Star), PAR sensor (LI-COR Biospherical PAR Sensor), and 12 Niskin bottles.

Data Processing Description

CTD data from near surface to 5-10 m off the seafloor were processed using Sea Bird software to create 1-m data bins. The .cnv files were exported as .csv files.

BCO-DMO Processing Description

- Loaded 65 CSV files from the one_meter_binned directory using filenames as resource names; missing values defined as empty strings and "nd"
- Concatenated all 65 resources into a single resource named ctd_all, mapping fields: year_month_day, Cruise, Station, Cast, LAT, LON, PRS, Depth, TMP, SAL, OXY, OXYsat, Beam.Attenuation, Beam.Transmission, Fluorescence, PAR, pH, and file_name; source file paths added as new column path_name
- Applied find/replace on path_name to strip directory path, retaining only the filename (e.g., RC0078_S3_C2.csv)
- Renamed file_name to filename_cnv (contains .cnv filenames) and path_name to filename_csv (contains .csv filenames converted from original SBE .cnv CTD profile files)
- Reordered fields to move both filename fields to the end: Date, Cruise, Station, Cast, LAT, LON, PRS, Depth, TMP, SAL, OXY, OXYsat, Beam.Attenuation, Beam.Transmission, Fluorescence, PAR, pH, filename_cnv, filename_csv
- Renamed year_month_day to Date
- Renamed Beam.Attenuation to Beam_Attenuation and Beam.Transmission to Beam_Transmission by replacing dots with underscores
- Reordered fields to final column order: Date, Cruise, Station, LAT, LON, Cast, PRS, Depth, TMP, SAL, OXY, OXYsat, Beam_Attenuation, Beam_Transmission, Fluorescence, PAR, pH, filename_cnv, filename_csv
- Corrected LAT values at rows 2013 and 2014 by negating them (0 - LAT)
- Corrected LON value at row 2013 by negating it (0 - LON)
- Output written to 997362_v1_salish_sea_ctd.csv

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Related Publications

Sacks, J. S., Carlson, L. T., Finch, A. H., Ferrer-González, F. X., Boysen, A. K., Heal, K. R., Karl, D. M., White, A. E., Sosa, O. A., & Ingalls, A. E. (2025). The cycling of glycine betaine and homarine in marine microbial communities: Quantitative flux measurements and the role of competitive uptake inhibition. *Limnology and Oceanography Letters*, 11(1). Portico. <https://doi.org/10.1002/lol2.70069>
Results

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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
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)
OXYsat	Oxygen saturation, Garcia & Gordon	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
filename_cnv	Original SBE .cnv CTD profile file name with one meter bins	unitless
filename_csv	Filename of .csv files converted from the Original SBE .cnv CTD profile files with one meter bins	unitless

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Instruments

Dataset-specific Instrument Name	Sea-Bird SBE9 CTD profiler
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	Instrument Description: Sea-Bird SBE9 CTD profiler equipped with a pH sensor (SBE 18), oxygen sensor (SBE 43), fluorometer (WETLabs ECO-AFL), transmissometer (WETLabs C-Star) PAR sensor (LI-COR Biospherical PAR Sensor) and 12 Niskin bottles.
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	WETLabs ECO-AFL
Generic Instrument Name	Fluorometer
Dataset-specific Description	Instrument Description: Sea-Bird SBE9 CTD profiler equipped with a pH sensor (SBE 18), oxygen sensor (SBE 43), fluorometer (WETLabs ECO-AFL), transmissometer (WETLabs C-Star) PAR sensor (LI-COR Biospherical PAR Sensor) and 12 Niskin bottles.
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	LI-COR Biospherical PAR Sensor
Generic Instrument Name	LI-COR Biospherical PAR Sensor
Dataset-specific Description	Instrument Description: Sea-Bird SBE9 CTD profiler equipped with a pH sensor (SBE 18), oxygen sensor (SBE 43), fluorometer (WETLabs ECO-AFL), transmissometer (WETLabs C-Star) PAR sensor (LI-COR Biospherical PAR Sensor) and 12 Niskin bottles.
Generic Instrument Description	The LI-COR Biospherical PAR Sensor is used to measure Photosynthetically Available Radiation (PAR) in the water column. This instrument designation is used when specific make and model are not known.

Dataset-specific Instrument Name	Niskin bottles
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Instrument Description: Sea-Bird SBE9 CTD profiler equipped with a pH sensor (SBE 18), oxygen sensor (SBE 43), fluorometer (WETLabs ECO-AFL), transmissometer (WETLabs C-Star) PAR sensor (LI-COR Biospherical PAR Sensor) and 12 Niskin bottles.
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 18
Generic Instrument Name	pH Sensor
Dataset-specific Description	Instrument Description: Sea-Bird SBE9 CTD profiler equipped with a pH sensor (SBE 18), oxygen sensor (SBE 43), fluorometer (WETLabs ECO-AFL), transmissometer (WETLabs C-Star) PAR sensor (LI-COR Biospherical PAR Sensor) and 12 Niskin bottles.
Generic Instrument Description	An instrument that measures the hydrogen ion activity in solutions. The overall concentration of hydrogen ions is inversely related to its pH. The pH scale ranges from 0 to 14 and indicates whether acidic (more H+) or basic (less H+).

Dataset-specific Instrument Name	SBE 43
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Dataset-specific Description	Instrument Description: Sea-Bird SBE9 CTD profiler equipped with a pH sensor (SBE 18), oxygen sensor (SBE 43), fluorometer (WETLabs ECO-AFL), transmissometer (WETLabs C-Star) PAR sensor (LI-COR Biospherical PAR Sensor) and 12 Niskin bottles.
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	WETLabs C-Star
Generic Instrument Name	Transmissometer
Dataset-specific Description	Instrument Description: Sea-Bird SBE9 CTD profiler equipped with a pH sensor (SBE 18), oxygen sensor (SBE 43), fluorometer (WETLabs ECO-AFL), transmissometer (WETLabs C-Star) PAR sensor (LI-COR Biospherical PAR Sensor) and 12 Niskin bottles.
Generic Instrument Description	A transmissometer measures the beam attenuation coefficient of the lightsource over the instrument's path-length. This instrument designation is used when specific manufacturer, make and model are not known.

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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

RC0104

Website	https://www.bco-dmo.org/deployment/997367
Platform	R/V Rachel Carson (UW)
Start Date	2023-08-31
End Date	2023-09-06
Description	Project: DON-2023

RC0138

Website	https://www.bco-dmo.org/deployment/997369
Platform	R/V Rachel Carson (UW)
Start Date	2025-06-16
End Date	2025-06-22
Description	Project: Resolving the production and fate of nitrogenous metabolites in the surface ocean

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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.

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Funding

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

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