Dissolved organic carbon data from laboratory cultures of Crocosphaera watsonii, Micromonas commoda, Prochlorococcus marinus , Synechococcus, Gephyrocapsa huxleyi, and Thalassiosira pseudonana collected from September to December 2022

Website: https://www.bco-dmo.org/dataset/991509
Data Type: experimental
Version: 1
Version Date: 2025-01-16

Project
» Phytoplankton Exometabolites (C-CoMP Phytoplankton Exometabolites)

Program
» Center for Chemical Currencies of a Microbial Planet (C-CoMP)

Contributors	Affiliation	Role
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Abstract
Dissolved organic carbon (DOC) data from laboratory cultures of Gephyrocapsa huxleyi CCMP371, Crocosphaera watsonii WH8501, Micromonas commoda RCC299, Prochlorococcus marinus MIT9301, Synechococcus WH8102, and Thalassiosira pseudonana CCMP1335 were collected. Cultures were harvested during the exponential growth phase. Cell count data (available at BCO-DMO project 984095) were used to determine growth rates. DOC data were used in support of exometabolite concentration data (available at BCO-DMO project 984095) harvested from these cultures.

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Methods & Sampling

See related datasets for a description of the culture methods.

5 milliliters (mL) of filtrate samples and media blanks were diluted with 25 mL of Milli-Q water, acidified to pH~3 with concentrated hydrochloric acid, and stored at 4 degrees Celsius (°C) until processed on a Shimadzu TOC-L total organic carbon analyzer. Measurements were made using potassium hydrogen phthalate as a standard solution.

Data Processing Description

DOC concentration was determined by subtracting the instrument blank area from the average peak area and dividing by the slope of the standard curve. Comparison with consensus reference material purchased from the Hansell lab at the University of Miami was conducted regularly to ensure the accuracy of these measurements.

BCO-DMO Processing Description

- Imported original file "DOC in culture filtrate and media blank.xlsx" into the BCO-DMO system.
- Saved the final file as "991509_v1_pxm1_doc.csv"

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Related Publications

Longnecker, K. (2022) Collecting samples for Dissolved Organic Carbon (DOC) analysis V.2 https://www.protocols.io/view/collecting-samples-for-dissolved-organic-carbon-do-4r3l24b8qg1y/v2?step=3 *Methods*

Zhu, Y., Anderson, H. S., Salcedo, E., Miller, S. E., Longnecker, K., Soule, M. C. K., Haley, S. T., Swarr, G. J., Braakman, R., Dyhrman, S. T., & Kujawinski, E. B. (2025). Characterization of Phytoplankton-Excreted Metabolites Mediating Carbon Flux through the Surface Ocean. https://doi.org/10.1101/2025.11.04.686593 *Results*

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Related Datasets

IsRelatedTo

Zhu, Y., Anderson, H., Gray, L., Kujawinski, E., Dyhrman, S. T., Braakman, R. (2026) **Phytoplankton cell count data from laboratory cultures of Crocosphaera watsonii, Micromonas commoda, Prochlorococcus marinus, Synechococcus, Gephyrocapsa huxleyi, and Thalassiosira pseudonana collected from September to December 2022.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2026-01-14 http://lod.bco-dmo.org/id/dataset/991400 [view at BCO-DMO]

Zhu, Y., Anderson, H., Kujawinski, E., Dyhrman, S. T., Braakman, R., Gray, L. (2026) **Phytoplankton exometabolite concentrations from laboratory cultures of Crocosphaera watsonii, Micromonas commoda, Prochlorococcus marinus, Synechococcus, Gephyrocapsa huxleyi, and Thalassiosira pseudonana collected from September to December 2022.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2026-01-14 http://lod.bco-dmo.org/id/dataset/991360 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
Sample	species name and the type of sample (filtrate or media)	unitless
strain	strain identifier of the phytoplankton species	unitless
NPOC	non-purgeable organic carbon, a measurement of dissolved organic carbon	micromoles per liter (µmol/L)

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Instruments

Dataset-specific Instrument Name	Shimadzu TOC-L total organic carbon analyzer
Generic Instrument Name	Shimadzu TOC-L Analyzer
Dataset-specific Description	Samples were processed on a Shimadzu TOC-L total organic carbon analyzer.
Generic Instrument Description	A Shimadzu TOC-L Analyzer measures DOC by high temperature combustion method. Developed by Shimadzu, the 680 degree C combustion catalytic oxidation method is now used worldwide. One of its most important features is the capacity to efficiently oxidize hard-to-decompose organic compounds, including insoluble and macromolecular organic compounds. The 680 degree C combustion catalytic oxidation method has been adopted for the TOC-L series. http://www.shimadzu.com/an/toc/lab/toc-l2.html

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Project Information

Phytoplankton Exometabolites (C-CoMP Phytoplankton Exometabolites)

Website: https://ccomp-stc.org/

Coverage: Lab study

The Center for Chemical Currencies of a Microbial Planet (C-CoMP) is focused on understanding marine chemical currencies. This project examines exometabolites released from representative taxa of marine phytoplankton to better characterize the composition of labile marine dissolved organic matter and understand the biological sources of these metabolites to the marine environment. Specifically, this project integrates novel metabolomics, genomics, transcriptomics, and proteomics methods to identify extracellular metabolites and link them with their production pathways under environmentally relevant conditions.

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Program Information

Center for Chemical Currencies of a Microbial Planet (C-CoMP)

Website: https://ccomp-stc.org/

Coverage: North Atlantic, BATS, global/other

Functions carried out by microscopic inhabitants of the surface ocean affect every aspect of life on our planet, regardless of distance from the coast. Ocean phytoplankton are responsible for half of the photosynthesis on Earth, the first step in a complex system that annually withdraws 50 billion metric tons of carbon from the atmosphere to sustain their growth. Of this, 25 billion metric tons participate in a rapid cycle in which biologically reactive material is released into seawater and converted back into carbon dioxide by marine bacteria within hours to days. The chemical-microbe network at the heart of this fast cycle remains poorly constrained; consequently, its primary currencies and controls remain elusive; its sensitivities to changing ocean conditions are unknown; and its responses to future climate scenarios are not predictable. The Center for Chemical Currencies of a Microbial Planet (C-CoMP) integrates research, education and knowledge transfer activities to develop a mechanistic understanding of surface ocean carbon flux within the context of a changing ocean and through increased participation in ocean sciences. C-CoMP supports science teams that merge biology, chemistry, modeling, and informatics to close long-standing knowledge gaps in the identities and dynamics of organic molecules that serve as the currencies of elemental transfer between the ocean and atmosphere. C-CoMP fosters education, outreach, and knowledge transfer activities that engage students of all ages, broaden participation in the next generation of ocean scientists, and extend novel open-science approaches into complementary academic and industrial communities. The Center framework is critical to this mission, uniquely facilitating an open exchange of experimental and computational science, methodological and conceptual challenges, and collaborations that establish integrated science and education partnerships. With expanded participation in ocean science research and ocean literacy across the US society, the next generation of ocean scientists will better reflect the diverse US population.

Climate-carbon feedbacks on the marine carbon reservoir are major uncertainties for future climate projections, and the trajectory and rate of ocean changes depend directly on microbial responses to temperature increases, ocean acidification, and other perturbations driven by climate change. C-CoMP research closes an urgent knowledge gap in the mechanisms driving carbon flow between ocean and atmosphere, with global implications for predictive climate models. The Center supports interdisciplinary science teams following open and reproducible science practices to address: (1) the chemical currencies of surface ocean carbon flux; (2) the structure and regulation of the chemical-microbe network that mediates this flux; and (3) sensitivity of the network and its feedbacks on climate. C-CoMP leverages emerging tools and technologies to tackle critical challenges in these themes, in synergy with existing ocean programs and consistent with NSF’s Big Ideas. C-CoMP education and outreach activities seek to overcome barriers to ocean literacy and diversify participation in ocean research. The Center is developing (1) initiatives to expand ocean literacy in K-12 and the broader public, (2) ocean sciences undergraduate curricula and research opportunities that provide multiple entry points into research experiences, (3) post-baccalaureate programs to transition undergraduates into graduate education and careers in ocean science, and (4) interdisciplinary graduate student and postdoctoral programs that prepare the next generation of ocean scientists. The C-CoMP team includes education faculty who evaluate the impacts of education and outreach activities and export successful STEM initiatives to the education community. C-CoMP is revolutionizing the technologies for studying chemical transformations in microbial systems to build understanding of the outsized impact of microbes on elemental cycles. Open science, cross-disciplinary collaborations, community engagement, and inclusive practices foster strategic advances in critical science problems and STEM initiatives. C-CoMP science, education, and knowledge-transfer themes are efficiently addressed through a sustained network of scientists addressing critical research challenges while broadening the workforce that will tackle multi-disciplinary problems with academic, industrial and policy partners.

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.

The Program's Data Management Plan (DMP) is available as a PDF document.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2019589

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