Dissolved organic carbon concentrations in seawater samples collected from Project "DaVINCi" incubations in the Gulf of Naples, Italy from April to May 2022

Website: https://www.bco-dmo.org/dataset/984974
Data Type: Other Field Results, experimental
Version: 1
Version Date: 2025-09-23

Project
» Shunt or shuttle? Nutrient-driven biogeochemical consequences of diatom host-virus interactions (Shunt or Shuttle)

Contributors	Affiliation	Role
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Abstract
Dissolved organic carbon concentrations were measured in 0.2-micrometer-filtered seawater collected from nutrient amendment incubation experiments conducted on surface water collected at the Long-Term Ecological Monitoring Station, MareChiara, in the Gulf of Naples, Italy, between April 20 and May 19, 2022. These incubations were part of a field study on "Diatom Virus Infection of Natural Communities" (DaVINCi) and were aimed at understanding the role of silicon limitation in driving diatom viral infection and lysis.

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Coverage

Location: Station MareChiara, Gulf of Naples, Italy
Spatial Extent: **Lat**:40.81667 **Lon**:14.25
Temporal Extent: 2022-04-30 - 2022-05-19

Methods & Sampling

Samples for DOC analysis were collected directly from each incubation bag into acid-washed Nalgene polycarbonate bottles following filtration using 0.22-micrometer (µm) polyethersulfone (PES) filters and stored at -20 degrees Celsius (°C) until analysis. DOC analysis was carried out by high-temperature catalytic oxidation with a Shimadzu TOC analyzer (TOC-Vcsn) following Sugimura, Y. & Suzuki (1988).

BCO-DMO Processing Description

- Imported original file "Incubations_DOC.csv" into the BCO-DMO system.
- Renamed fields to comply with BCO-DMO naming conventions.
- Converted Date column to YYYY-MM-DD format.
- Saved the final file as "984974_v1_incubations_doc.csv".

Problem Description

No problems were encountered with these data.

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Data Files

File
984974_v1_incubations_doc.csv (Comma Separated Values (.csv), 1.65 KB) MD5:befdb9f9b65f09fa6011435525da3419 Primary data file for dataset ID 984974, version 1

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Related Publications

Campese, L., Russo, L., Abagnale, M., Alberti, A., Bachi, G., Balestra, C., Bellardini, D., Buondonno, A., Cardini, U., Carotenuto, Y., Checcucci, G., Chiusano, M. L., D'Ambra, I., d'Ippolito, G., Di Capua, I., Donnarumma, V., Fontana, A., Furia, M., Galarza-Verkovitch, D., … Montresor, M. (2024). The NEREA Augmented Observatory: an integrative approach to marine coastal ecology. Scientific Data, 11(1). https://doi.org/10.1038/s41597-024-03787-y
Methods

Sugimura, Y., & Suzuki, Y. (1988). A high-temperature catalytic oxidation method for the determination of non-volatile dissolved organic carbon in seawater by direct injection of a liquid sample. Marine Chemistry, 24(2), 105–131. doi:10.1016/0304-4203(88)90043-6
Methods

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Parameters

Parameter	Description	Units
Date	Date sample was collected	unitless
Incubation	Incubation number identifier	unitless
Bag	Bag number	unitless
Treatment	Nutrient status consisting of either ambient (unamended), replete (amended with 30 uM N, 1.87 uM P, and 30 uM Si), or Si-limited (amended with 30 uM N, 1.87 uM P, 10 uM Si)	unitless
Replicate	Replicate bag number	unitless
Incubation_Timepoint_d	Timepoint during the incubation the sample was collected	day
DOC	dissolved organic carbon concentration	millimoles per cubic meter (mmol m-3)

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Instruments

Dataset-specific Instrument Name	Shimadzu TOC analyzer (TOC-Vcsn)
Generic Instrument Name	Shimadzu TOC-V Analyzer
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

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Project Information

Shunt or shuttle? Nutrient-driven biogeochemical consequences of diatom host-virus interactions (Shunt or Shuttle)

Coverage: Gulf of Naples, Italy approx. 40 degrees N, 14 degrees E

NSF abstract:

Diatoms are a type of microscopic marine algae that form the base of the ocean food web and generate about 20% of the oxygen on the planet. Admired since the Victorian age, these organisms are often referred to as the ‘glass houses of the sea’ because of the intricate architecture of their cell walls made of silicon dioxide, or glass. When these organisms die, the cellular-associated carbon and other elements can be either recycled and reused by other phytoplankton or, because glass is heavier than seawater, lost by sinking out of the surface ocean. Thus, the contribution diatoms make to carbon cycling is dictated by the balance between the factors that facilitate recycling and those that stimulate export. As the most abundant entity in the ocean, viruses have, for decades, been characterized as efficient recyclers, acting as ‘shunts’ by preventing the transfer of

energy up the food chain through host mortality and lysis. However, it has been suggested that viruses may also act as ‘shuttles’ to the deep ocean, stimulating cellular processes that facilitate sinking. This project is testing this emerging hypothesis and determining how different nutrient regimes influence the fate of diatoms through impacts on viral infection dynamics and death. This is particularly timely given major national and international initiatives currently seeking to quantify how ecosystem interactions regulate carbon export in the ocean. Results of this project have the potential to challenge the canonical role of diatom viruses in carbon cycling and transform the understanding of host-virus interactions in the ocean. This project provides critical funding support for a soft-money, underrepresented, female oceanographer, as well a graduate student and undergraduates. Proposed fieldwork leverages a Rutgers and European Union-funded project, fostering ongoing collaborations with researchers at the Stazione Zoologica Anton Dohrn in Naples, Italy. To facilitate ocean literacy, the PIs are working with the Rutgers’ Education and Outreach team to conduct a series of Teen Cafes focused on carbon cycling, phytoplankton, and viruses utilizing the ‘Tools of Science’ (ToS), a series of educational videos and lesson plans designed to introduce middle, high school, and undergraduate students in underrepresented and underserved communities to core scientific practices.

Diatoms contribute almost 40% of marine primary productivity, dominating the biological pump and disproportionately contributing to carbon export due to the ballasted nature of a silica-based cell wall. The contribution of diatoms to carbon sequestration is dictated by the balance between upper ocean remineralization and sinking, yet we still cannot explain widespread spatio-temporal variability in diatom-mediated export. As the most abundant predatory entities in the ocean, viruses play a critical role in shaping microbial ecosystems and driving global biogeochemical cycles. The premise of this proposal is that nutrient regimes drive the biogeochemical consequences of diatom host-virus interactions. For decades, the role of viruses as ‘shunts’, redirecting particulate matter away from higher trophic levels and into the dissolved fraction through host lysis, has dominated microbial ecology and marine virology. However, the idea that viruses may also act as ‘shuttles’, facilitating carbon export by stimulating aggregation and/or ballast production, is now emerging as a potential mechanism for carbon flux. This project is conducting laboratory-based studies on diverse diatom host-virus systems and manipulative studies on natural diatom communities to compare the impact of viral infection on processes that facilitate sinking – mineral ballast production and particle aggregation – to those that stimulate remineralization – bacterial-mediated hydrolysis and subsequent remineralization of diatom particulate organic matter and silica. Taken together, this work is characterizing the relative balance between these diametrically opposing outcomes within the ecophysiological context of nutrient regime (specifically, silicon and iron limitation), ultimately elucidating the impact of viral infection on the fate of diatom organic matter in the ocean.

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-2049386

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