Phytoplankton abundance 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/984885
Data Type: Other Field Results, experimental
Version: 1
Version Date: 2025-09-22

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

Contributors	Affiliation	Role
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Abstract
Phytoplankton abundance was measured on Lugol's-fixed seawater samples collected from nutrient amendment 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. Phytoplankton were counted on an inverted microscope following Utermhöl settling. 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.

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Coverage

Location: Station MareChiara, Gulf of Naples, Italy
Spatial Extent: **Lat**:40.81667 **Lon**:14.25
Temporal Extent: 2022-04-27 - 2022-05-19

Methods & Sampling

Samples were fixed with 1% Lugol's. The quantitative analysis is carried out using an inverted microscope after the settling of a variable volume of sample (Utermhöl, 1958). The settled volumes vary in relation to the number of cells present in the sample, which is estimated on the basis of the chlorophyll a concentration or of the depth of the Secchi Disk. The counting is carried out on various proportions of the sedimentation chamber (transects, random fields or the entire chamber), depending on the characteristics of the sample.

The abundance of phytoplankton cells present in the sample is calculated by applying the following general

formula:

C = N × factor × 1000/v

where C = concentration of phytoplankton expressed as cells per liter (cells L-1);
N = number of cells counted;
v = volume of settled sample (milliliters (mL));
factor = ratio between the total area of the chamber and the explored area.

Instruments: Samples from incubation bottle treatments were collected after gently mixing bottles and dispensing 250 mLs into a dark glass bottle containing 1% Lugol's solution and stored in the dark at 4 degrees Celsius.

BCO-DMO Processing Description

- Imported original file "Incubation_PhytoCellCounts.csv" into the BCO-DMO system.
- Flagged "NA" as a missing data value (missing data are empty/blank in the final CSV file).
- Renamed fields to comply with BCO-DMO naming conventions.
- Converted Date column to YYYY-MM-DD format.
- Saved the final file as "984885_v1_phytoplankton_cell_abundance.csv".

Problem Description

No problems were encountered with these data.

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Data Files

File	
984885_v1_phytoplankton_cell_abundance.csv	(Comma Separated Values (.csv), 1.60 KB) MD5:149c9e6b06235bb09f447a8e21880516
Primary data file for dataset ID 984885, 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

Utermöhl, H. (1958). Zur Vervollkommnung der quantitativen Phytoplankton-Methodik. SIL Communications, 1953-1996, 9(1), 1–38. https://doi.org/10.1080/05384680.1958.11904091
Methods

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Parameters

Parameter	Description	Units
Date	Date sample was collected	unitless
Incubation	Incubation number identifier	unitless
Bag	Bag number	unitless
Incubation_Timepoint_d	Timepoint during the incubation the sample was collected	day
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
Diatoms	Diatom cell abundance	cells per liter (cells/L)
Dinoflagellates	Dinoflagellate cell abundance	cells per liter (cells/L)
Coccolithophores	Coccolithophore cell abundance	cells per liter (cells/L)
Other_flagellates	Other flagellates cell abundance	cells per liter (cells/L)

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Instruments

Dataset-specific Instrument Name	inverted microscope
Generic Instrument Name	Inverted Microscope
Generic Instrument Description	An inverted microscope is a microscope with its light source and condenser on the top, above the stage pointing down, while the objectives and turret are below the stage pointing up. It was invented in 1850 by J. Lawrence Smith, a faculty member of Tulane University (then named the Medical College of Louisiana). Inverted microscopes are useful for observing living cells or organisms at the bottom of a large container (e.g. a tissue culture flask) under more natural conditions than on a glass slide, as is the case with a conventional microscope. Inverted microscopes are also used in micromanipulation applications where space above the specimen is required for manipulator mechanisms and the microtools they hold, and in metallurgical applications where polished samples can be placed on top of the stage and viewed from underneath using reflecting objectives. The stage on an inverted microscope is usually fixed, and focus is adjusted by moving the objective lens along a vertical axis to bring it closer to or further from the specimen. The focus mechanism typically has a dual concentric knob for coarse and fine adjustment. Depending on the size of the microscope, four to six objective lenses of different magnifications may be fitted to a rotating turret known as a nosepiece. These microscopes may also be fitted with accessories for fitting still and video cameras, fluorescence illumination, confocal scanning and many other applications.

Dataset-specific Instrument Name	Secchi Disk
Generic Instrument Name	Secchi Disc
Generic Instrument Description	Typically, a 16 inch diameter white/black quadrant disc used to measure water optical clarity

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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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