Dissolved nutrients from Espelandsvegen Fjord, Bergen Norway, May 2017

Website: https://www.bco-dmo.org/dataset/752737
Data Type: Other Field Results, experimental
Version: 1
Version Date: 2021-01-06

Project
» Light-dependent regulation of coccolithophore host-virus interactions: mechanistic insights and implications for structuring infection in the surface ocean (Light-dependent host virus interactions)

Contributors	Affiliation	Role
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Abstract
This dataset includes dissolved nutrient concentrations from seawater collected in the Norwegian National Mesocosm Centre at the Espegrend (Espeland) Marine Biological Station near Bergen, Norway, in May 2017.

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Coverage

Spatial Extent: **Lat**:60.27083 **Lon**:60.269602
Temporal Extent: 2017-05-08 - 2017-05-31

Dataset Description

This dataset includes dissolved nutrient concentrations from seawater collected in the Norwegian National Mesocosm Centre at the Espegrend (Espeland) Marine Biological Station near Bergen, Norway, in May 2017.

Methods & Sampling

Samples for dissolved nutrient analysis were collected by filtering through a pre-combusted GF/F filter (pore size ~ 0.7 µm) into acid washed Falcon tubes. Samples were frozen at -20°C and analyzed for nitrate+nitrite, ammonium, and orthophosphate at the Rutgers University Nutrient Analysis Facility.

Data Processing Description

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- re-formatted date from d-Mon-yy to yyyy-mm-dd
- replaced commas with semicolons
- reordered columns; sorted records by Treatment, Bag#, Depth
- changed column name Depth to Depth_description (shallow, deep) and added column Depth (1, 5)

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Data Files

File
nutrients.csv (Comma Separated Values (.csv), 18.91 KB) MD5:d6ad0a2c02238d354593bd41e5bb2349 Primary data file for dataset ID 752737

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Parameters

Parameter	Description	Units
Treatment	nutrient amendment and/or manipulation: Fjord = water sampled directly from fjord adjacent to mesocosm bags Ambient = unamended P-limited=N:P (66:1; 4 µmol L-1 sodium nitrate:0.06 µmol L-1 sodium phosphate) added on 13-May, 14-May, 15-May- Redfield = N:P (16:1; 4 µmol L-1 sodium nitrate:0.25 µmol L-1 sodium phosphate) added on 13-May, 14-May, 15-May Redfield/Shaded = N:P (16:1; 4 µmol L-1 sodium nitrate:0.25 µmol L-1 sodium phosphate) added on 13-May, 14-May, 15-May-; bags shaded to 20% surface irradiance on 24-May-2017)	unitless
Bag	Bag #	unitless
Date	Date formatted as yyyy-mm-dd	unitless
Nitrate_Nitrite_uM	nitrate plus nitrite concentration; bd = below detection	micromol/liter
Ammonium_uM	ammonium concentration; bd = below detection	micromol/liter
Orthophosphate_uM	orthophosphate concentration; bd = below detection	micromol/liter
Depth	sampling depth	meters
Depth_description	depth of sampling: surface = ~1 m; deep = ~5 m	unitless

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Instruments

Dataset-specific Instrument Name	Lachat QuickChem8500 Nutrient Analyzer Flow Injection Analysis System
Generic Instrument Name	Nutrient Autoanalyzer
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.

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Deployments

MesoHux_2017

Website	https://www.bco-dmo.org/deployment/752756
Platform	National Mesocosm Centre
Start Date	2017-05-01
End Date	2017-05-31
Description	Mesocosm experiments on bacteria and viruses.

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Project Information

Light-dependent regulation of coccolithophore host-virus interactions: mechanistic insights and implications for structuring infection in the surface ocean (Light-dependent host virus interactions)

Coverage: Norwegian National Mesocosm Centre at the Espegrend Marine Biological Station (60 16'25N, 5 14'10E)

Description from the NSF award abstract:
Phytoplankton, microscopic photosynthetic algae, form the basis of marine foodwebs and are responsible for producing nearly half the oxygen on the planet, yet represent <1% of Earth's biomass. Steady-state maintenance of a high production to biomass ratio implies that, on average, these organisms grow, die and are replaced once every week. Predatory infection by viruses has emerged as the primary mechanism responsible for the high mortality rates of phytoplankton populations. Despite the importance of viral mortality in structuring marine microbial ecosystems, little is known about the fundamental mechanisms that regulate host-virus interactions. Phytoplankton are inherently dependent on light and photosynthesis. Given the need for host resources, the viruses that infect these organisms must, therefore, also fundamentally depend on light and photosynthesis. This project will explore the relationship between light and viral infection to develop a framework for how light influences viral infection and phytoplankton mortality in the surface ocean. The widespread phytoplankton species Emiliania huxleyi, and its associated virus, Coccolithovirus, has emerged as the prominent model system for investigating algal-viral interactions due to its ecological relevance and collective mechanistic insight from numerous physiological, molecular, biochemical, genomic, and field studies. Laboratory-based culture studies will be used to elucidate the role light plays in mediating infection in E. huxleyi, specifically addressing whether light is required for viral infection as well as identifying the light-regulated host metabolic processes that viruses may co-opt for successful infection and production. These observations will then be extended to natural populations using manipulative, field-based experiments to elucidate the role light plays in structuring infection in the surface ocean. This project provides hands-on training for a Rutgers University undergraduate student, as well as a postdoctoral researcher. To facilitate ocean literacy,

researchers will work with the Education and Public Outreach staff and Tilapia Film, LLC to develop an educational video based on research findings and the Next Generation Science Standards. This video, aimed at middle, high school, and undergraduate students, expands on an already successful video series that highlights scientific practices through real research investigations. It will be open access and disseminated through existing connections to the New Jersey Science Teacher Association, the National Science Teachers Association, the National Marine Educators Association, and the National Biology Teachers Association.

Predatory infection by viruses is the primary mechanism responsible for the high lysis rates observed in phytoplankton populations. As the most abundant biological entities in aquatic environments, viruses turn over more than a quarter of the photosynthetically-fixed carbon, thereby fueling microbial foodwebs and short-circuiting carbon export to higher trophic levels and the deep sea. Despite its importance, estimates of viral-induced mortality are rarely included in global models of net primary productivity and deep carbon export, in part because we lack a mechanistic understanding of the fundamental factors that regulate host-virus interactions. For viruses infecting obligate photoautotrophs, there is an inherent and fundamental interaction between light and the infection process, as well as a dependence on light-regulated host metabolic processes that may be required for viral replication. Using the model algal host, Emiliania huxleyi and its associated Coccolithovirus, this project addresses the hypotheses that: 1) infection dynamics in E. huxleyi are driven through light-dependent processes, specifically that light mediates viral entry and replication, and that viruses redirect host energy to maximize viral replication, and 2) light increases viral decay relieving hosts of viral pressure. This mechanistic, cellular framework will then be used to elucidate the role light plays in structuring infection in natural coccolithophore populations using manipulative field-based experiments. Given that light is one of the most fundamental, readily, and easily measured features of the ocean, this work will ultimately provide a context for modeling the biogeochemical impact of viral infection in the global ocean.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1559179

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