Bacterial cell counts during CDOM monoculture experiment

Website: https://www.bco-dmo.org/dataset/748415
Data Type: experimental
Version: 1
Version Date: 2018-10-17

Project
» Collaborative Research: Planktonic Sources of Chromophoric Dissolved Organic Matter in Seawater (PlankDOM)

Contributors	Affiliation	Role
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Abstract
This dataset is from a laboratory experiment. Four phytoplankton cultures and their associated bacterial communities were incubated in replicate roller bottles (1.9 L) over 3-6 weeks under laboratory conditions. Bacterial dynamics in the culture bottles were measured and correlated with geochemical parameters to determine the role of bacterial activities on the formation of CDOM in the cultures (Kinsey et al., 2018, see below). The data include bacterial cell counts during CDOM monoculture experiment. The phytoplankton cultures were Skeletonema sp., Leptocylindrus sp., Phaeocystis sp. and Coscinodiscus sp. Growth stages were initial, exponential, stationary, and degradation.

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Coverage

Temporal Extent: 2016-08 - 2017-03

Dataset Description

This dataset is from a laboratory experiment. Four phytoplankton cultures and their associated bacterial communities were incubated in replicate roller bottles (1.9 L) over 3-6 weeks under laboratory conditions. Bacterial dynamics in the culture bottles were measured and correlated with geochemical parameters to determine the role of bacterial activities on the formation of CDOM in the cultures (Kinsey et al., 2018, see below).

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Methods & Sampling

Bacterial cells were enumerated by flow cytometry. At each sampling point 1 mL of experimental or control

water was fixed with 0.1% glutaraldehyde (final concentration) for 10 min at room temperature in the dark, and stored frozen at -80 °C. Prior to analysis, thawed samples were pipetted through a cell strainer (Flowmi, 70 µm porosity) and stained with SYBR Green I for 15 min on ice in the dark. Counts were performed with a FACSCalibur flow cytometer (Becton-Dickson) using fluorescent microspheres (Molecular Probes) of 1 µm in diameter as internal size standard. Cells were enumerated according to their right angle scatter and green fluorescence using the FloJo 7.6.1 software.

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
- repeated data in 'taxa' and 'time_point_day' columns to create a flat file

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Data Files

File
cell_counts.csv (Comma Separated Values (.csv), 5.31 KB) MD5:dd199f77fb797e523cc4d642847e5685 Primary data file for dataset ID 748415

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Related Publications

Kinsey, J. D., Corradino, G., Ziervogel, K., Schnetzer, A., & Osburn, C. L. (2018). Formation of Chromophoric Dissolved Organic Matter by Bacterial Degradation of Phytoplankton-Derived Aggregates. Frontiers in Marine Science, 4. doi:10.3389/fmars.2017.00430. Table 3.
Results

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Parameters

Parameter	Description	Units
taxon	phytoplankton	unitless
time_point_day	growth phase (initial/exponential/stationary/degradation) and the number of days since the start of the experiment	days
time_start	time at start of experiment	unitless
time_end	time at end of experiment	unitless
cell_count	bacterial cell count as determined by flow cytometry	cells
flow_rate	flow rate of the sample	microliters/minute
time_elapsed_min	flow count duration	minutes
volume	volume of sample	microliters
concentration_uL	bacterial cell concentration	cells/microliter
concentration_mL	bacterial cell concentration	cells/milliliter

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Instruments

Dataset-specific Instrument Name	FACSCalibur flow cytometer (Becton-Dickson)
Generic Instrument Name	Flow Cytometer
Dataset-specific Description	Used to make cell counts.
Generic Instrument Description	Flow cytometers (FC or FCM) are automated instruments that quantitate properties of single cells, one cell at a time. They can measure cell size, cell granularity, the amounts of cell components such as total DNA, newly synthesized DNA, gene expression as the amount messenger RNA for a particular gene, amounts of specific surface receptors, amounts of intracellular proteins, or transient signalling events in living cells. (from: http://www.bio.umass.edu/micro/immunology/facs542/facswhat.htm)

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Project Information

Collaborative Research: Planktonic Sources of Chromophoric Dissolved Organic Matter in Seawater (PlankDOM)

Coverage: Northern Atlantic Ocean, 34.65 N, 69.63 W

NSF abstract:

Chromophoric dissolved organic matter (CDOM) is a small but important fraction of the marine carbon pool that interacts with solar radiation and thus affects many photochemical and biological processes in the ocean. Despite its importance, the chemical basis for the formation of oceanic CDOM remains unclear. CDOM may be formed from two possible sources: 1) heterotrophic bacterial transformations of primary productivity (plankton-derived), or 2) terrestrially-derived. This project will examine the role of phytoplankton as a source of CDOM in the ocean by utilizing a powerful, new technique to measure particulate organic matter absorbance and fluorescence, discrete chemical measurements of probable precursors to planktonic CDOM, and enzymatic assays. Results of this research will provide new insights into the origin and production of planktonic CDOM and its transformation by heterotrophic bacteria. This research on CDOM will be shared broadly through a module at a North Carolina Aquarium, and streaming live feeds of shipboard activities to elementary school classrooms.

Terrestrial and oceanic dissolved organic matter (DOM) differ in their chemical composition. Laboratory and open-ocean observations suggest that bacterial transformation of phytoplankton DOM produces humic-like CDOM signals that are visually similar to those in terrestrial CDOM. However, prior studies of oceanic CDOM using absorbance and fluorescence fit an electronic interaction (EI) model of intramolecular charge transfer (CT) reactions between donor and acceptor molecules common to partially-oxidized terrestrial molecules found in humic substances. This project will test the hypothesis that phytoplankton and bacteria provide a source of donors and acceptors that are microbially-transformed and linked, enabling CT contacts between them and creating oceanic CDOM. To address this, researchers will systematically study phytoplankton growth, including marine snow formation. A new technique for measuring base-extracted POM (BEPOM) absorbance and fluorescence will be used to incorporate planktonic CDOM results into the EI model, and supplemented with measurements of its probable chemical precursors. These experiments will improve understanding of how the production of CDOM in the ocean is linked to the optics and chemistry of planktonic CDOM formation. Determining the time course and extent of phytoplankton POM and DOM transformation by heterotrophic

bacteria during the same phytoplankton growth experiments will provide an in-depth understanding as to how bacterial transformation of marine snow-associated planktonic organic matter drives CDOM production throughout the ocean.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1459406

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