Measurements of polysaccharide hydrolase activities in large volume mesocosm incubations RV/Endeavor EN584, July 2016 (Patterns of activities project)

Website: https://www.bco-dmo.org/dataset/717495
Data Type: experimental
Version: 1
Version Date: 2017-10-20

Project
» Latitudinal and depth-related contrasts in enzymatic capabilities of pelagic microbial communities: Predictable patterns in the ocean? (Patterns of activities)

Contributors	Affiliation	Role
Arnosti, Carol	University of North Carolina at Chapel Hill (UNC-Chapel Hill)	Principal Investigator
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Abstract
Measurements of polysaccharide hydrolase activities in large volume mesocosm incubations RV/Endeavor EN584, July 2016. See Niskin Bottle and Cast List EN584 to link specific casts and bottles to each experiment: https://www.bco-dmo.org/dataset/717427.

Table of Contents

Coverage

Spatial Extent: **N**:36 **E**:-58 **S**:33.75 **W**:-76.75
Temporal Extent: 2016-06-29 - 2016-07-13

Dataset Description

See Niskin Bottle and Cast List EN584 to link specific casts and bottles to each experiment: https://www.bco-dmo.org/dataset/717427.

Methods & Sampling

For mesocosm (large volume) incubation experiments (referred to as “LV” incubations), a 30L Niskin bottle rosette was used to collect the water. Separate casts were used to collect surface water, bottom water, and water from the depth at which oxygen showed a minimum, according to the CTD. From each depth, 20L seawater from single Niskin bottles was dispensed using cleaned silicon tubing into a single carboy. Prior to filling, carboys were rinsed 3x with water from the same Niskin bottle used to fill the carboy. Four carboys were filled at each depth. Triplicate 20L carboys were amended with ca. 500 mg (exact mass was recorded for each addition) of HMW Thalassiosira; unamended single carboys were used for controls. All mesocosms were

incubated in the dark at near in-situ temperatures. Mesocosms were sub-sampled at the start of incubation (0 days), and then after 2 d, 7d, and 16d for the following assays: bacterial production using 3H-Leucine, dissolved organic carbon (DOC), nutrients, bacterial cell counts, peptidase and glucosidase activity measurements. At the 16d subsampling timepoint, polysaccharide hydrolase activity measurements were initiated, using fluorescently labeled polysaccharides (Arnosti 2003). These polysaccharide incubations were sampled at time points of 0, 2, 5, 10, 17, and 30 days (with the zero-time sample being at the 16-day timepoint of the mesocosm experiment).

The hydrolysis of high molecular weight substrate to lower molecular weight hydrolysis products was measured using gel permeation chromatography with fluorescence detection, after the method of Arnosti [1996, 2003]. In short, the subsample was injected onto a series of columns consisting of a 21 cm column of G50 and a 19 cm column of G75 Sephadex gel. The fluorescence of the column effluent was measured at excitation and emission wavelengths of 490 and 530 nm, respectively. Hydrolysis rates were calculated from the change in molecular weight distribution of the substrate over time, as described in detail in Arnosti [2003].

Data Processing Description

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- removed 'cast00' and 'stn0' from data records for the cast and station columns

[table of contents | back to top]

Data Files

File
EN584_LV_hydrolysis.csv (Comma Separated Values (.csv), 57.24 KB) MD5:af7e19bd65c3cb8bc4414d0513daa797 Primary data file for dataset ID 717495

[table of contents | back to top]

Related Publications

Arnosti, C. (1996). A new method for measuring polysaccharide hydrolysis rates in marine environments. Organic Geochemistry, 25(1-2), 105–115. doi:10.1016/s0146-6380(96)00112-x https://doi.org/10.1016/S0146-6380(96)00112-X
Methods

Arnosti, C. (2003). Fluorescent derivatization of polysaccharides and carbohydrate-containing biopolymers for measurement of enzyme activities in complex media. Journal of Chromatography B, 793(1), 181–191. doi:10.1016/s1570-0232(03)00375-1 https://doi.org/10.1016/S1570-0232(03)00375-1
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
cruise_id	cruise identifier	unitless
cast	cast number	unitless
station	station number	unitless
depth_id	depth description: sequence of depths sampled with 1 is surface and higher numbers at greater depths	unitless
depth_m	actual depth at which water collected	meters
treatment	LV experiments treatments: amended or not with Thalassiosira	unitless
meso_no	Large volume experiment mesocosm number	unitless
substrate	substrates for measurement of enzymatic activities: ara = arabinogalactan; chn = chondroitin sulfate; fuc = fucoidan; lam = laminarin; pul = pullulan; xyl = xylan	unitless
timepoint	sampling time point (0; 1; 2; etc.) post-incubation	unitless
time_elapsed_hr	hours elapsed to reach a specific timepoint	hours
rep1_rate	replicate 1 hydrolysis rate	nanomol monosaccharide/liter/hour
rep2_rate	replicate 2 hydrolysis rate	nanomol monosaccharide/liter/hour
rep3_rate	replicate 3 hydrolysis rate	nanomol monosaccharide/liter/hour
average	average of the 3 hydrolysis rates	nanomol monosaccharide/liter/hour
std_dev	standard deviation of the 3 hydrolysis rates	nanomol monosaccharide/liter/hour

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Fluorometer
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	
Generic Instrument Name	Gel Permeation Chromatograph
Generic Instrument Description	Instruments that separate components in aqueous or organic solution based on molecular size generally for molecular weight determination. Gel permeation chromatography (GPC) is a type of size exclusion chromatography (SEC), that separates analytes on the basis of size.

Dataset-specific Instrument Name	30 liter Niskin bottles
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Used to collect water for large volume mesocosm experiments
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

[table of contents | back to top]

Deployments

EN584

Website	https://www.bco-dmo.org/deployment/717087
Platform	R/V Endeavor
Start Date	2016-06-29
End Date	2016-07-13
Description	Latitudinal and Depth-related Contrasts in Enzymatic Capabilities of Pelagic Microbial Communities. Cruise track obtained from rvdata.us control-point navigation, (http://www.rvdata.us/catalog/EN584)

[table of contents | back to top]

Project Information

Latitudinal and depth-related contrasts in enzymatic capabilities of pelagic microbial communities: Predictable patterns in the ocean? (Patterns of activities)

Coverage: Atlantic Ocean, Arctic Ocean, Pacific Ocean, Greenland

NSF Award Abstract:
Heterotrophic microbial communities are key players in the marine carbon cycle, transforming and respiring

organic carbon, regenerating nutrients, and acting as the final filter in sediments through which organic matter passes before long-term burial. Microbially-driven carbon cycling in the ocean profoundly affects the global carbon cycle, but key factors determining rates and locations of organic matter remineralization are unclear. In this study, researchers from the University of North Carolina at Chapel Hill will investigate the ability of pelagic microbial communities to initiate the remineralization of polysaccharides and proteins, which together constitute a major pool of organic matter in the ocean. Results from this study will be predictive on a large scale regarding the nature of the microbial response to organic matter input, and will provide a mechanistic framework for interpreting organic matter reactivity in the ocean.

Broader Impacts: This study will provide scientific training for undergraduate and graduate students from underrepresented groups. The project will also involve German colleagues, thus strengthening international scientific collaboration.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1332881

[table of contents | back to top]