Microzooplankton biomass estimates from PUA (polyunsaturated aldehydes) experiments, Virginia Coastal Bays and Bay of Napoli, Mar-July 2015

Website: https://www.bco-dmo.org/dataset/774033
Data Type: experimental
Version: 1
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Project
» The effects of diatom-produced polyunsaturated aldehydes on the microbial food web in temperate and polar waters (DiatomAldehydes)

Contributors	Affiliation	Role
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Abstract
Microzooplankton biomass estimates from PUA (polyunsaturated aldehydes) experiments, Virginia Coastal Bays and Bay of Napoli, Mar-July 2015.

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Coverage

Spatial Extent: **N**:40.808 **E**:14.25 **S**:37.1656 **W**:-75.9866
Temporal Extent: 2015-03-23 - 2015-07-02

Dataset Description

This dataset reports the microzooplankton biomass for polyunsaturated aldehydes (PUA) experiments. Samples were from Virginia coastal bays and the Bay of Napoli, and were conducted between March and July, 2015.

Methods & Sampling

Experiments were conducted by collecting raw seawater, filtering it through 200µm mesh sieves into 20L

carboys, and then dispensing it into experimental jars. Triplicates bottles were used for each treatment. Treatments included whole seawater (control), whole seawater plus copepods (Zooplankton), and the same treatments plus PUA additions (Heptadienal, Octadienal, Decadienal, and Mixed PUA). PUA were dissolved in methanol and added to experimental bottles for a final concentration of 21 nM; for the mixed PUA treatment this was 7nM of each type of PUA.

Initial samples were collected from the carboy for microzooplankton as described below. Final samples were collected from each treatment and control bottle as described below.

Microzooplankton samples were collected by gently decanting 100ml of each treatment bottle into a sample bottle and preserved with 2% acid Lugol's solution (final concentration). Identification and sorting of microzooplankton was done by settling 10-25 ml of sample in Utermöhl chambers and counting with an Olympus IX-70 inverted microscope equipped with differential interference contrast (DIC), epifluorescence, and a digital camera. Microzooplankton biovolumes were calculated from their dimensions and approximate shapes (Sun and Liu 2003), and converted to carbon using published empirical relationships (Menden-Deuer and Lessard 2000). Tintinnid volumes were calculated based on their cell dimensions.

All data were processed in Microsoft Excel.

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
- reduced some Chla values from 15 to 4 decimal places
- replaced blank cells with 'nd' (no data)
- corrected taxon and phylum names according to WoRMS (World Registry of Marine Species) taxa matching tool

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Data Files

File
PUA_biomass.csv (Comma Separated Values (.csv), 146.02 KB) MD5:143b5bd07c7337a40a675dee66d12411 Primary data file for dataset ID 774033

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Related Publications

Franzè, G., Pierson, J. J., Stoecker, D. K., & Lavrentyev, P. J. (2017). Diatom-produced allelochemicals trigger trophic cascades in the planktonic food web. Limnology and Oceanography, 63(3), 1093–1108. doi:10.1002/lno.10756
Results

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Methods

Lavrentyev, P., Franzè, G., Pierson, J., & Stoecker, D. (2015). The Effect of Dissolved Polyunsaturated Aldehydes on Microzooplankton Growth Rates in the Chesapeake Bay and Atlantic Coastal Waters. Marine Drugs, 13(5), 2834–2856. doi:10.3390/md13052834
Results

Menden-Deuer, S., & Lessard, E. J. (2000). Carbon to volume relationships for dinoflagellates, diatoms, and other protist plankton. Limnology and Oceanography, 45(3), 569–579. doi:10.4319/lo.2000.45.3.0569
Methods

Sun, J. (2003). Geometric models for calculating cell biovolume and surface area for phytoplankton. Journal of

Plankton Research, 25(11), 1331–1346. doi:10.1093/plankt/fbg096
Methods

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Parameters

Parameter	Description	Units
Experiment	Name of the Experiment	unitless
Bottle_ID	ID name for a given treatment including both treatment and replicate tags	unitless
Treatment	Treatment name	unitless
Rep	Replicate	unitless
Taxa	Taxonomic name of microzooplankton type identified	unitless
Phylum	Phylum name for the taxa identified	unitless
ESD	Mean size of the taxa; given as equivalent spherical diameter (ESD)	micrometers
Biomass	Biomass of the given taxa	micrograms carbon/liter

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Instruments

Dataset-specific Instrument Name	Olympus IX-70 inverted microscope
Generic Instrument Name	Inverted Microscope
Dataset-specific Description	The microscope was equipped with differential interference contrast (DIC), epifluorescence, and a digital camera. Biomass estimates for microzooplankton were determined after counting cells on an inverted microscope and converting volume estimates, from measurements with a reticle in the objective lens, to carbon concentrations using known conversion factors.
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.

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Project Information

The effects of diatom-produced polyunsaturated aldehydes on the microbial food web in temperate and polar waters (DiatomAldehydes)

Description from NSF award abstract:
This project will conduct a set of field/laboratory experiments to address the following hypotheses with respect to microzooplankton (consumers between 20-200 um) and diatom- produced polyunsaturated aldehydes:
I. Aldehydes will impair microzooplankton herbivory on diatoms and non-diatom phytoplankton.
II. Aldehydes will reduce the growth rates of microzooplankton and non PUA-producing phytoplankton.
III. In the presence of aldehyde-producing diatoms, copepods will switch to microzooplankton, whereas non-(mildly)- toxic diatoms will be an important food source for copepods.
IV. The effects of aldehydes on microzooplankton and copepods will depend on the grazers' prior exposure to PUA.

The experiments will include natural plankton, captured copepods, cultured Skeletonema marinoi (SM), including its aldehyde-producing strain, and synthetic aldehydes. To gain insights into complex interactions within planktonic communities, detailed information on their composition, abundance, and dynamics will be obtained using microscopy, flow-cytometry, and cytological methods. This approach will allow the PIs to draw conclusions about the role of diatom-produced aldehydes in phytoplankton-microzooplankton- copepod trophic interactions. The PIs will coordinate efforts and exchange information with the PUA study group at the Stazione Zoologica Anton Dohrn (Naples, Italy).

Diatoms are dominant autotrophic plankton in the ocean. Recent evidence indicates that microzooplankton are the dominant herbivores, whereas copepods often rely on microzooplankton as food, except during peak diatom production. The ability of microzooplankton to feed on large diatoms and grow as fast as their algal prey leads to the question of what allows diatoms to escape microzooplankton grazing control during the initial phases of their blooms and maintain the blooms until nutrient resources are depleted? Allelopathy is wide

spread among phytoplankton. The cosmopolitan bloom-forming SM produces several aldehydes and has become a model organism in plankton allelopathy studies. Most studies on diatom cytotoxicity have been dedicated to inhibitory effects on reproduction and development of marine invertebrates, whereas surprisingly little information exists on its impact on key diatom grazers, microzooplankton. Preliminary results in the Chesapeake Bay show that aldehydes may induce cascading effects within planktonic communities. The proposed study will: (1) Improve our knowledge of the critical diatom-microzooplankton-copepod links in the coastal ocean; (2) Generate novel data on the effects of allelopathy on marine food webs; (3) Contribute to our understanding of broader patterns of marine ecosystems by comparing plankton structure and dynamics in the temperate Atlantic waters; (4) Advance biological oceanography through international collaboration.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1357168
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