

# PUA (polyunsaturated aldehydes) experiments: Experimental Conditions, Virginia Coastal Bays and Bay of Napoli, Mar-July 2015

**Website:** <https://www.bco-dmo.org/dataset/773979>

**Data Type:** experimental

**Version:** 1

**Version Date:** 2019-07-31

## 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

PUA (polyunsaturated aldehydes) experiments: Experimental Conditions, 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 describes the experimental conditions of copepods, bacteria, dinoflagellates, and ciliates under varying environmental conditions and concentrations of particulate and dissolved polyunsaturated aldehydes (PUA).

## Methods & Sampling

Data for experimental conditions were collected from the station locations where water and zooplankton were

collected. Temperature and salinity were determined using a YSI ProDO2020.

Laboratory 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 polyunsaturated aldehydes (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. In addition, nutrients were added to all experimental bottles in the form of phytoplankton growth media, to ensure that autotroph growth was not limited by available nutrients in the experimental bottles.

Samples for PUA analysis were collected and processed according to the procedures described in Lavrentyev et al. 2015 & Franzé et al. 2018. These samples were then frozen and shipped to Texas for analysis.

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
- re-formatted date from m/d/yyyy to yyyy-mm-dd

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## Data Files

File
<b>PUA_expt_design.csv</b> (Comma Separated Values (.csv), 882 bytes) MD5:f9ec500ac323c657da91326718dc91a4 Primary data file for dataset ID 773979

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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](https://doi.org/10.1002/lno.10756)

*Results*

,

*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](https://doi.org/10.3390/md13052834)

*Results*

,

*Methods*

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## Parameters

Parameter	Description	Units

Experiment	Name of the Experiment	unitless
Location	Name of the Location	unitless
Longitude	Longitude; east is positive	decimal degrees
Latitude	Latitude; north is positive	decimal degrees
Date	Local date; formatted as yyyy-mm-dd	unitless
Temperature	Water Temperature	degrees Celsius
Salinity	Water Salinity	PSU
Light_Dark_Cycle	Light:Dark Cycle used for the experiments (hours:hours)	unitless
Medium	Type of medium used for added for nutrients in experiments	unitless
Copepod_spp	Copepod species used for the experiments	unitless
Number_Copepods	Number of copepods added to each zooplankton treatment jar for each experiment	copepods
Bacteria	Mean initial bacteria concentrations from experiments	cells per ml
Chl_a	Mean initial Chlorophyll a concentrations	micrograms/liter
Dinoflag	Mean initial Dinoflagellate biomass concentrations	micrograms Carbon/liter
Ciliate	Mean initial Ciliate biomass concentrations	micrograms Carbon/liter
HepD	Mean initial Dissolved Heptadienal concentrations	nanoMolar
HepP	Mean initial Particulate Heptadienal concentrations	nanoMolar
OctD	Mean initial Dissolved Octadienal concentrations	nanoMolar
OctP	Mean initial particulate octadienal concentrations	nanoMolar

DecD	Mean initial Dissolved decadienal concentrations	nanoMolar
DecP	Mean initial Particulate decadienal concentrations	nanoMolar
Tot	Total mean initial PUA concentrations	nanoMolar

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## Instruments

<b>Dataset-specific Instrument Name</b>	YSI ProDO2020
<b>Generic Instrument Name</b>	Water Temperature Sensor
<b>Dataset-specific Description</b>	Used to measure temperature and salinity at stations.
<b>Generic Instrument Description</b>	General term for an instrument that measures the temperature of the water with which it is in contact (thermometer).

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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
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1357168</a>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1357169</a>

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