Isotopic composition of phospholipid-linked fatty acids (PLFAs) in the surface sediments of three marsh ponds in PIE-LTER (Rowley, MA) from 2014.

Website: https://www.bco-dmo.org/dataset/738142
Data Type: Other Field Results
Version: 1
Version Date: 2018-06-05

Project
» Eutrophication Effects on Sediment Metabolism and Benthic Algal-bacterial Coupling: An Application of Novel Techniques in a LTER Estuary (Benthic_PP_at_TIDE)

Contributors	Affiliation	Role
Spivak, Amanda	Woods Hole Oceanographic Institution (WHOI)	Principal Investigator
Ake, Hannah	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Isotopic composition of phospholipid-linked fatty acids (PLFAs) in the surface sediments of three marsh ponds in PIE-LTER (Rowley, MA). Data were collected over 11 weeks in the summer and fall of 2014.

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Coverage

Spatial Extent: **Lat**:42.738349 **Lon**:-70.809432
Temporal Extent: 2014 - 2014

Dataset Description

Isotopic composition of phospholipid-linked fatty acids (PLFAs) in the surface sediments of three marsh ponds in PIE-LTER (Rowley, MA). Data were collected over 11 weeks in the summer and fall of 2014.

Methods & Sampling

The three ponds are located in the high marsh (1.43-1.46 m above North American Vertical Datum of 1988) of the Plum Island Ecosystems – Long Term Ecological Research (PIE-LTER) site. Surface sediments were collected weekly June 25-August 13 and November 11-25, 2014. Cores (5 cm diameter x 2 cm deep) were collected from three 1 m^2 quadrats placed at random locations along two crisscrossing transects in each pond. Sediments were combined in combusted glass vials to form composite samples and stored (-80 °C) until analysis. Lipid biomarker compounds were extracted using a modified Bligh & Dyer (1959) method (Spivak and Reeve 2015). Sediments were extracted with a methanol : chloroform : phosphate buffer saline mixture (2:1:0.8, v:v:v) using a microwave-accelerated reaction system (MARS6); samples were heated to 80°C for 10

min with continuous stirring. Samples were then partitioned and the organic phase removed. The total lipid extract was concentrated under N_2 and samples were eluted on silica gel columns with chloroform, acetone (F1/2), and methanol (F3) (Guckert et al. 1985). The F3 (phospholipids) was dried under N_2 and saponified with 0.5 M NaOH at 70°C for 4 h. Saponified samples were acidified and extracted 3 times with hexane. The extract was methylated with acidic methanol (95:5 methanol:HCl) and heated overnight at 70°C to form fatty acid methyl esters (FAME). Samples were analyzed with an Agilent 7890 gas chromatograph with the effluent split ~70:30 between a 5975C mass spectrometer and a flame ionization detector. Compounds were separated on an Agilent DB-5 ms column (60 m, 0.25 mm inner diameter, 0.25 µm film). FAME concentrations were quantified using methyl heneicosanoate as an internal standard. FAs are designated A:BωC, where A is the number of carbon atoms, B is the number of double bonds, and C is the position of the first double bond from the aliphatic '*ω*' end of the molecule. Iso- and anteiso refer to whether the methyl group of branched compounds is attached to the penultimate or antepenultimate carbon atom. Stable carbon isotope ratios of FAMEs were determined by the WHOI Organic Mass Spectrometry Facility with a Hewlett-Packard 6890 GC coupled to a DeltaPlus isotope-ratio-monitoring gas chromatography-mass spectrometer (IRM-GCMS) via a GCCIII combustion interface held at 850 °C with a constant oxygen trickle. Isotopic values of phospholipid-linked fatty acids (PLFAs) were derived from the isotopic composition of FAMEs and corrected for the $\delta^{13}C$ of the carbon added during methylation using a mass balance approach as well as for a -3‰ fractionation during lipid synthesis (Bouillon and Boschker 2006; Hayes 2001). The $\delta^{13}C$ of PLFA subclasses was calculated as concentration weighted averages (Spivak and Ossolinski 2016).

Data Processing Description

BCO-DMO Data Processing Notes:

-reformatted column names to comply with BCO-DMO standards
-filled in blank cells with "nd"

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Data Files

File
PLFA_CSIA.csv (Comma Separated Values (.csv), 1.57 KB) MD5:17ec351808ddd5f13247a9544813a2ea Primary data file for dataset ID 738142

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Related Publications

Spivak, A. C., Gosselin, K. M., & Sylva, S. P. (2018). Shallow ponds are biogeochemically distinct habitats in salt marsh ecosystems. Limnology and Oceanography. doi:10.1002/lno.10797
Results
,
Methods

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Parameters

Parameter	Description	Units
Season	Season at time of sampling	unitless
Tide	Tide type	unitless
Week	Week number	unitless
Pond	Site number	unitless
BrFA	Branched fatty acids; sum iso- anteiso (C13, C15, C17)	per mil
Methyl_10_C16	Concentration 10 methyl C16	per mil
C18_1	Concentration C18 1	per mil
C18_2	Concentration C18 2	per mil
PUFA	Polyunsaturated fatty acids; sum(C20:4, C20:5, C22:5, C22:6)	per mil
C18_4	Concentration C18 4	per mil
C18_2_2	Concentration C18 2	per mil

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Instruments

Dataset-specific Instrument Name	Agilent 7890 gas chromatograph
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	Used to analyze samples
Generic Instrument Description	Instrument separating gases, volatile substances, or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay. (from SeaDataNet, BODC)

Dataset-specific Instrument Name	Hewlett-Packard 6890 GC
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	Used to determine stable carbon isotope ratios of FAMEs
Generic Instrument Description	Instrument separating gases, volatile substances, or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay. (from SeaDataNet, BODC)

Dataset-specific Instrument Name	5975C mass spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Extracted and analyzed samples
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	DeltaPlus isotope-ratio-monitoring gas chromatography-mass spectrometer (IRM-GCMS)
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Used to determine stable carbon isotope ratios of FAMEs
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Corer
Generic Instrument Name	Push Corer
Dataset-specific Description	Used to collect sediment samples
Generic Instrument Description	Capable of being performed in numerous environments, push coring is just as it sounds. Push coring is simply pushing the core barrel (often an aluminum or polycarbonate tube) into the sediment by hand. A push core is useful in that it causes very little disturbance to the more delicate upper layers of a sub-aqueous sediment. Description obtained from: http://web.whoi.edu/coastal-group/about/how-we-work/field-methods/coring/

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Deployments

Plum_Island

Website	https://www.bco-dmo.org/deployment/669365
Platform	shoreside Massachusetts
Start Date	2012-07-27
End Date	2012-08-15
Description	Plum Island, MA; LTER sites

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Project Information

Eutrophication Effects on Sediment Metabolism and Benthic Algal-bacterial Coupling: An Application of Novel Techniques in a LTER Estuary (Benthic_PP_at_TIDE)

Coverage: Plum Island Estuary, Rowley Massachusetts

Extracted from the NSF award abstract:
This project will address how rates of benthic microalgal production respond to eutrophication and geomorphological changes in human-impacted tidal creeks. Excess nutrient loading increases benthic algal biomass and likely stimulates production rates but the magnitude of nutrient and geomorphological effects on rates of production is unknown. Will changes in benthic algal productivity affect algal-bacterial coupling? Furthermore, how is algal-bacterial coupling affected by geomorphological changes, which may be exacerbated by excess nutrient loading but can also occur in pristine marshes?

This project will take advantage of the infrastructure of the TIDE project, a long-term saltmarsh eutrophication experiment at the Plum Island Ecosystem - Long Term Ecological Research site in Northeastern Massachusetts. Specifically, the PIs will measure benthic metabolism and examine algal- bacterial coupling in fertilized and ambient nutrient tidal creeks in the first field season. The following field season, they will compare sediment metabolism and carbon dynamics on slumped tidal creek walls (i.e. areas where low marsh has collapsed into the tidal creek) to that on the bottom of tidal creeks. In both years, gross and net production will be determined using an innovative triple oxygen isotope technique and traditional dissolved oxygen and inorganic carbon flux measurements. Comparisons between these methods will be useful in informing studies of sediment metabolism. Lipid biomarkers will be used to characterize the sources of organic matter to creek sediments, and stable isotope analysis of bacterial specific biomarkers to identify the sources of organic carbon utilized by sediment bacteria. The biomarkers will reveal whether sediment bacteria use organic matter substrates, such as benthic microalgal carbon, selectively or in proportion to availability. Overall, results from the proposed study will provide important information about how sediment carbon dynamics in shallow tidal creeks respond to long term eutrophication. Furthermore, findings will enhance understanding of the role of tidal creeks in coastal biogeochemistry.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1233678

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