

Dimethylsulfoniopropionate (DMSP) concentrations and turnover during a deployment of the Environmental Sample Processor in Fall, 2014 in Monterey Bay, CA

Website: <https://www.bco-dmo.org/dataset/662421>

Data Type: Cruise Results

Version:

Version Date: 2016-10-25

Project

» [Bacterial Taxa that Control Sulfur Flux from the Ocean to the Atmosphere](#) (OceanSulfurFluxBact)

Program

» [Dimensions of Biodiversity](#) (Dimensions of Biodiversity)

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Methods & Sampling

Glycine betaine, an inhibitor of bacterial DMSP uptake, was added at 5 micromolar concentrations to triplicate samples; triplicate controls had no addition. Subsamples were removed at the initial time point and at 2 hr intervals up to 6 hrs. Samples were analyzed for remaining DMSPd and the difference between glycine betaine and control incubations was calculated to estimate DMSP consumption rate.

For methodology details, see:

Varaljay, V., et al. Single-taxon field measurements of bacterial gene regulation controlling DMSP fate. The ISME Journal (2015), 1-10. doi:10.1038/ismej.2015.23

Rellinger, A., et al. Occurrence and turnover of DMSP and DMS in deep waters of the Ross Sea, Antarctica. Deep-Sea Research I 56 (2009) 686–702. doi:10.1016/j.dsr.2008.12.010

Li, C., et al, Assessment of DMSP turnover reveals a non-bioavailable pool of dissolved DMSP in coastal waters of the Gulf of Mexico. Environ. Chem. (2015) <http://dx.doi.org/10.1071/EN15052>

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
- added lat and lon of ESP mooring for mapping purposes

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Data Files

File
dmsp.csv (Comma Separated Values (.csv), 906 bytes) MD5:b6d71dd3b7a3dc93081ffb5633cd11be Primary data file for dataset ID 662421

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Parameters

Parameter	Description	Units
date	date; Pacific time zone	year-month-day
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
DMSPt_nM	dimethylsulfoniopropionate (DMSP) concentration	nanoMoles
DMSPt_stdev	DMSP concentration standard deviation	nanoMoles
DMSPd_consumption	DMSPd consumption rate based on glycine betaine inhibition: the difference between glycine betaine and control incubations	nanoMoles/day (nM/day)
comments	comments	unitless

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Instruments

Dataset-specific Instrument Name	Shimadzu GC-2014 gas chromatograph equipped with a Chromosil 330 column and a flame photometric detector for quantification
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	To measure DMSP concentrations
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)

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Deployments

Moran_Monterey_2014

Website	https://www.bco-dmo.org/deployment/662989
Platform	Univ_Georgia
Start Date	2014-09-08
End Date	2014-09-08
Description	Microbial collections and environmental data collected by moored ESP and CTD.

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Project Information

Bacterial Taxa that Control Sulfur Flux from the Ocean to the Atmosphere (OceanSulfurFluxBact)

Surface ocean bacterioplankton preside over a divergence point in the marine sulfur cycle where the fate of dimethylsulfoniopropionate (DMSP) is determined. While it is well recognized that this juncture influences the fate of sulfur in the ocean and atmosphere, its regulation by bacterioplankton is not yet understood. Based on recent findings in biogeochemistry, bacterial physiology, bacterial genetics, and ocean instrumentation, the microbial oceanography community is poised to make major advances in knowledge of this control point. This research project is ascertaining how the major taxa of bacterial DMSP degraders in seawater regulate DMSP transformations, and addresses the implications of bacterial functional, genetic, and taxonomic diversity for global sulfur cycling.

The project is founded on the globally important function of bacterial transformation of the ubiquitous organic sulfur compound DMSP in ocean surface waters. Recent genetic discoveries have identified key genes in the two major DMSP degradation pathways, and the stage is now set to identify the factors that regulate gene expression to favor one or the other pathway during DMSP processing. The taxonomy of the bacteria mediating DMSP cycling has been deduced from genomic and metagenomic sequencing surveys to include four major groups of surface ocean bacterioplankton. How regulation of DMSP degradation differs among these groups and maps to phylogeny in co-occurring members is key information for understanding the marine sulfur cycle and predicting its function in a changing ocean. Using model organism studies, microcosm experiments (at Dauphin Island Sea Lab, AL), and time-series field studies with an autonomous sample collection instrument (at Monterey Bay, CA), this project is taking a taxon-specific approach to decipher the regulation of bacterial DMSP degradation.

This research addresses fundamental questions of how the diversity of microbial life influences the geochemical environment of the oceans and atmosphere, linking the genetic basis of metabolic potential to taxonomic diversity. The project is training graduate students and post-doctoral scholars in microbial biodiversity and providing research opportunities and mentoring for undergraduate students. An outreach program is enhance understanding of the role and diversity of marine microorganisms in global elemental cycles among high school students. Advanced Placement Biology students are participating in marine microbial research that covers key learning goals in the AP Biology curriculum. Two high school students are selected each year for summer research internships in PI laboratories.

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Program Information

Dimensions of Biodiversity (Dimensions of Biodiversity)

Website: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503446

Coverage: global

(adapted from the NSF Synopsis of Program)

Dimensions of Biodiversity is a program solicitation from the NSF Directorate for Biological Sciences. FY 2010 was year one of the program. [\[MORE from NSF\]](#)

The NSF Dimensions of Biodiversity program seeks to characterize biodiversity on Earth by using integrative, innovative approaches to fill rapidly the most substantial gaps in our understanding. The program will take a broad view of biodiversity, and in its initial phase will focus on the integration of genetic, taxonomic, and functional dimensions of biodiversity. Project investigators are encouraged to integrate these three dimensions to understand the interactions and feedbacks among them. While this focus complements several core NSF programs, it differs by requiring that multiple dimensions of biodiversity be addressed simultaneously, to understand the roles of biodiversity in critical ecological and evolutionary processes.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1342694

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