Experimental results: summary of microcosm data from Dauphin Island Cubitainer Experiment (DICE) from samples collected by R/V E.O. Wilson in the Gulf of Mexico, Alabama (En-Gen DMSP Cycling project)

Website: https://www.bco-dmo.org/dataset/3857
Data Type: experimental
Version: 1
Version Date: 2012-11-19

Project
» En-Gen: A Functional Genomics Approach to Organic Sulfur Cycling in the Ocean (En-Gen DMSP Cycling)

Contributors	Affiliation	Role
Moran, Mary Ann	University of Georgia (UGA)	Principal Investigator
Kiene, Ronald	Dauphin Island Sea Lab (DISL)	Co-Principal Investigator
Whitman, William	University of Georgia (UGA)	Co-Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Summary of parameters measured in experimental and control microcosms as part of the Dauphin Island Cubitainer Experiment (DICE).

Table of Contents

- Deployments
- Project Information
- Funding

Coverage

Spatial Extent: **Lat**:30.05068 **Lon**:-87.99513
Temporal Extent: 2006-10 - 2006-10

Dataset Description

Summary of parameters measured in experimental and control microcosms as part of the Dauphin Island Cubitainer Experiment (DICE).

Experimental design, methods, and results are further described in Howard et al. (2010) and Rinta-Kanto et al. (2011).

Acquisition Description

See Howard et al. 2011 and Rinta-Kanto et al. 2011 for detailed methods, summarized below:

"In October 2006, seawater was collected from surface waters (<1 m deep) in the Gulf of Mexico off the coast of Dauphin Island, AL (lat: 30 03.041N; lon: 87 59.708W). Water was filtered through a 200-um mesh into six 20-liter polyethylene Cubitainers with minimal headspace.

Three microcosms were amended with 10 um sodium nitrate (NaNO3) and 0.6 um potassium phosphate (K2HPO4) to serve as the experimental microcosms. Three microcosms were left untreated to serve as the control. The Cubitainers were maintained at 27 degrees C on a 12-hour light/dark cycle for the duration of the experiment.

Chemical and activity measurements were collected from the microcosms at the beginning of the experiment (Day 0) and every day for the duration of the experiment at the same time. Chlorophyll-a samples were collected by filtration on Whatman GF/F fiters. The filters were extracted in 90% acetone for 24 hours at -20 degrees C. The extracts were quantified by fluorometry on a Turner Designs TD-700.

Samples for dissolved dimethylsulfoniopropionate (DMSPd) were collected by filtration through GF/F filters. Total dimethylsulfoniopropionate (DMSP), dissolved + particulate, was measured by acidifying whole seawater with 5 ul per ml of 50% H2SO4. Dissolved and total DMSP were quantified as dimethylsulfide (DMS) after alkaline hydrolysis. Bacterial production was

measured by [3H]leucine incorporation.

Rates of DMSPd consumption were determined by multiplying the DMSPd concentrations by their respective DMSPd loss rate constant from parallel samples. DMSPd consumption rate constants were determined by measuring the loss of tracer levels of [35S]-DMSP from the dissolved (< 0.2 um) pool over time. DMS production and DMS yield (ratio of DMS production to DMSPd consumption) were measured as described in Vila-Costa et al. (2008)"

References:
Vila-Costa, M., Kiene, R.P., and Simó, R. (2008) Seasonal variability of the dynamics of dimethylated sulfur compounds in a coastal northwest mediterranean site. Limnol Oceanogr 53: 198–211.

Processing Description

BCO-DMO made the following changes:
- Modified parameter names to conform with BCO-DMO naming conventions.
- Replaced blanks with 'nd' to indicate 'no data'.
- Added the site coordinates provided in the publications above.

[table of contents | back to top]

Related Publications

Howard, E. C., Sun, S., Reisch, C. R., del Valle, D. A., Bürgmann, H., Kiene, R. P., & Moran, M. A. (2010). Changes in Dimethylsulfoniopropionate Demethylase Gene Assemblages in Response to an Induced Phytoplankton Bloom. Applied and Environmental Microbiology, 77(2), 524–531. doi:10.1128/AEM.01457-10

Rinta-Kanto, J. M., Bürgmann, H., Gifford, S. M., Sun, S., Sharma, S., del Valle, D. A., … Moran, M. A. (2010). Analysis of sulfur-related transcription by Roseobacter communities using a taxon-specific functional gene microarray. Environmental Microbiology, 13(2), 453–467. doi:10.1111/j.1462-2920.2010.02350.x

[table of contents | back to top]

Parameters

Parameter	Description	Units

exp_id	Name of the experiment. DICE = Dauphin Island Cubitainer Experiment.	text
lat	Latitude of the sample collection site. North = Positive.	decimal degree
lon	Longitude of the sample collection. West = Negative.	decimal degree
site_desc	Description of the sample collection site.	text
microcosm	Identifier for the microcosm experiment. C1 and C2 were control microcosms containing Gulf of Mexico seawater. E1 and E2 were experimental microcosms containing Gulf of Mexico seawater amended with inorganic N and P.	text
microcosm_type	Type of microcosm. Experimental or Control.	text
exp_day	Sequential day of the experiment. Day 0 = start of the experiment.	integer
leu_inc_rate	Amount of leucine incorporated into bacterial protein per day.	nM/d
leu_inc_rate_sd	Standard deviation of leu_inc_rate.	nM/d
chl_a	Concentration of chlorophyll a.	ug/L
chl_a_sd	Standard deviation of chl_a.	ug/L
Fv_to_Fm	Ratio of Fv to Fm; chlorophyll fluorescence.	dimensionless
Fv_to_Fm_sd	Standard deviation of Fv_to_Fm.	dimensionless
sulfate_yield	DMS consumption - sulfate = percent of radiolabeled DMS released into the medium as sulfate.	%
sulfate_yield_sd	Standard deviation of sulfate_yield.	%
DMSP_tot	Concentration of total dimethylsulfoniopropionate (DMSP). This is the sum of particulate and dissolved DMSP (DMSPp + DMSPd).	nM
DMSP_tot_sd	Standard deviation of DMSP_tot.	nM
DMSO	Dimethylsulfoxide (DMSO) concentration.	nM
DMSO_sd	Standard deviation of DMSO.	nM

DMSO_yield	A measure of dimethylsulfide (DMS) consumption. DMSO yield = percent of radiolabeled DMS released into the medium as dimethylsulfoxide (DMSO).	%
DMSO_yield_sd	Standard deviation of DMSO_yield.	%
DMSPd	Dissolved dimethylsulfoniopropionate (DMSPd) concentration.	nM
DMSPd_sd	Standard deviation of DMSPd.	nM
DMSPd_rate_const	Dissolved dimethylsulfoniopropionate (DMSPd) rate constant; the fraction of DMSPd removed per day.	1/d
DMSPd_rate_const_sd	Standard deviation of DMSPd_rate_const.	1/d
DMSPd_consump	Dissolved dimethylsulfoniopropionate (DMSPd) consumption rate; amount of DMSPd removed per day.	nM/d
DMSPd_consump_sd	Standard deviation of DMSPd_consump.	nM/d
DMSPd_assim	A measure of dissolved dimethylsulfoniopropionate (DMSPd) consumption. assimilation = percent of radiolabeled DMSPd assimilated into bacterial biomass.	%
DMSPd_assim_sd	Standard deviation of DMSPd_assim.	%
DMSPd_uptake	A measure of dissolved dimethylsulfoniopropionate (DMSPd) consumption. uptake = percent of radiolabeled DMSPd transported into the cell.	%
DMSPd_uptake_sd	Standard deviation of DMSPd_uptake.	%
DMS	Concentration of dimethylsulfide (DMS).	nM
DMS_sd	Standard deviation of DMS.	nM
DMS_rate_const	Dimethylsulfide (DMS) rate constant; fraction of DMS removed per day.	1/d
DMS_rate_const_sd	Standard deviation of DMS_rate_const.	1/d
DMS_consump	Dimethylsulfide (DMS) consumption rate; amount of DMS removed per day.	nM/d
DMS_consump_sd	Standard deviation of DMS_rate.	nM/d

DMS_assim	A measure of dimethylsulfide (DMS) consumption. assimilation = percent of radiolabeled DMS transported into the cell and assimilated into bacterial biomass.	%
DMS_assim_sd	Standard deviation of DMS_assim.	%
DMS_yield	A measure of dissolved dimethylsulfoniopropionate (DMSPd) consumption. DMS yield = percent of radiolabeled DMSP released as dimethylsulfide (DMS).	%
DMS_yield_sd	Standard deviation of DMS_yield.	%

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	bucket
Generic Instrument Name	bucket
Dataset-specific Description	Water was collected in the field using a clean bucket.
Generic Instrument Description	A bucket used to collect surface sea water samples.

Dataset-specific Instrument Name	Turner Designs 700 Laboratory Fluorometer
Generic Instrument Name	Turner Designs 700 Laboratory Fluorometer
Generic Instrument Description	The TD-700 Laboratory Fluorometer is a benchtop fluorometer designed to detect fluorescence over the UV to red range. The instrument can measure concentrations of a variety of compounds, including chlorophyll-a and fluorescent dyes, and is thus suitable for a range of applications, including chlorophyll, water quality monitoring and fluorescent tracer studies. Data can be output as concentrations or raw fluorescence measurements.

[table of contents | back to top]

Deployments

DMSP_Dauphin_Island

Website	https://www.bco-dmo.org/deployment/58888
Platform	R/V E.O. Wilson
Description	October 2006 deployment in the Gulf of Mexico approximately 20 km off the coast of Dauphin Island, AL to collect surface water for the project "En-Gen: A Functional Genomics Approach to Organic Sulfur Cycling in the Ocean". (Latitude: 30°03.041′N, Longitude: 87°59.708′W)

[table of contents | back to top]

Project Information

En-Gen: A Functional Genomics Approach to Organic Sulfur Cycling in the Ocean (En-Gen DMSP Cycling)

Coverage: Sapelo Island, GA, USA, 31.4° N Lat, 81.3° W Lon / Dauphin Island, AL, USA, 30.3 ° N Lat, 88.1° W Lon

The recent discovery of key genes that mediate competing pathways at a critical juncture in the marine sulfur cycle has allowed biogeochemists to make rapid advances in understanding where and when sulfur transformations occur in the ocean, and most importantly, what factors regulate them. This project describes an environmental functional genomics project that will rapidly increase our knowledge of the role that bacterioplankton play in dimethylsulfoniopropionate (DMSP) cycling in ocean surface waters, focusing particularly on biological controls of volatile sulfur exchange across the ocean/atmosphere boundary. The investigators have asked three critical hypotheses to explain the regulation of bacterial DMSP degradation: that involve investigations on the energy constraints of DMSP cycling, the role that DMSP concentration in the oceans plays, and the sulfur requirements for bacterial growth. These research areas serve as the focus for hypothesis-driven laboratory and field studies using functional genomics approaches that will track patterns in gene expression in relation to sulfur metabolism. The hypotheses will be tested with: 1) chemostat systems with a model marine bacterium Silicibacter pomeroyi; 2) microcosm experiments with Gulf of Mexico seawater; and 3) field studies at various sites in the Gulf of Mexico. Marine bacterioplankton play a key role in regulating the flux of DMSP-derived sulfur to the atmosphere, a process of

great importance for global climate regulation and marine productivity. The investigators will also be involved in graduate and undergraduate student education, and two post-doctoral associates will be trained to address multidisciplinary challenges in environmental microbiology. High school biology students in Athens, GA will participate in marine microbial biology research that includes bacterial diversity and discovery studies in coastal Georgia, follow-up training in molecular tools and bioinformatics in their own classroom, and summer internships at the University of Georgia and Dauphin Island Sea Laboratory. (The description above is from the NSF Award Abstract).

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0724017

[table of contents | back to top]