Nutrients, microbiology, trace metals, and environmental conditions from seeded microcosm experiments

Website: https://www.bco-dmo.org/dataset/682298
Data Type: experimental
Version: 1
Version Date: 2016-11-09

Project
» Vibrio as a model microbe for opportunistic heterotrophic response to Saharan dust deposition events in marine waters (Vibrio-dust deposition)

Contributors	Affiliation	Role
Lipp, Erin K.	University of Georgia (UGA)	Principal Investigator
Landing, William M.	Florida State University (FSU - EOAS)	Co-Principal Investigator
Ottesen, Elizabeth	University of Georgia (UGA)	Co-Principal Investigator
Wetz, Michael	Texas A&M University (TAMU)	Co-Principal Investigator
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Nutrients, microbiology, trace metals, and environmental conditions from seeded microcosm experiments.

Table of Contents

Coverage

Spatial Extent: **N**:24.74287 **E**:-80.68487 **S**:24.54322 **W**:-81.41115
Temporal Extent: 2014-07-22 - 2015-05-09

Dataset Description

This dataset includes nutrients from 2014 and 2015 experiments using Saharan source material and water from the lower Florida Keys to create microcosms for natural seawater communities. For full details, see Westrich et al (2016) PNAS, DOI: 10.1073/pnas.1518080113.

Methods & Sampling

Samples were collected offshore from Alligator Reef (2014) and Looe Key Reef (2015). The experimental treatments included additions of dust and iron in 2014 with a control of acidified water. In 2015, treatments included additions of dust from Barbados, iron, nitrates, phosphates, and carbon with controls of acidified water and leachate.

Nutrients data went through internal lab QAQC process. BDL means below detection limit. The method detection limit (MDL) was determined using 9 samples on two different runs and correct student-T value.

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
- nd (no data) was entered into all blank cells
- reduced number of significant digits of Vibrio and nutrient values to 2 digits to right of decimal and lat/lon to 5 digits.
- re-formatted date from m/d/yyyy to yyyy-mm-dd
- replaced spaces with underscores

[table of contents | back to top]

Data Files

File
Vibrio_nuts.csv (Comma Separated Values (.csv), 37.00 KB) MD5:b3953416ba35803d3ba2236cdbca51b0 Primary data file for dataset ID 682298

[table of contents | back to top]

Related Publications

Clesceri, Lenore S., Arnold E. Greenberg, and Andrew D. Eaton. "Standard methods for the examination of water and wastewater." APHA, AWWA and WPCF, Washington DC(1996). 978-0875532356
Methods

Westrich, J. R., Ebling, A. M., Landing, W. M., Joyner, J. L., Kemp, K. M., Griffin, D. W., & Lipp, E. K. (2016). Saharan dust nutrients promoteVibriobloom formation in marine surface waters. Proceedings of the National Academy of Sciences, 113(21), 5964–5969. doi:10.1073/pnas.1518080113
Results

[table of contents | back to top]

Parameters

Parameter	Description	Units
year	year of measurement	year
expt	experiment identifier	unitless

treatment	experimental treatments: For 2014: control acidified water; dust= dust leachate from Whatman41 filters used to collect dust aerosols from Barbados (added to provide +1 nM Fe); FeCl = FeCl3 (added to provide +1 nM Fe) For 2015: control acidified water; 2nMFe: 2 nM Fe provided by FeCl3 20nMFe: 20 nM Fe provided by FeCl3 control_leachate: control leachate (leached from Whatman41 blank filter); dust_barbados: dust leachate from Whatman41 filters used to collect dust aerosols from Barbados (added to provide +2 nM Fe); Fe: FeCl3 (added to provide +1 nM Fe); NO3: HNO3 added to provide +0.2 uM N; PO4: K2HPO4 added to provide +0.01 uM P; C: Pyruvate added to provide +10 uM C; FeCNP: mix of FeCl3 (+2 nM Fe), pyruvate (+10 uM C), HNO3 (+0.2 uM), and K2HPO4 (+0.01 uM)	unitless
light_dark	whether experiment took place in the light or dark	unitless
vessel	sample vessel identifier	unitless
replicate	replicate identifier	unitless
time_elapsed_hr	time since start of experiment	hours
sample	sample identifier: 'year_treatment_light or dark_vessel number_replicate_time	unitless
Vibrio	Vibrio concentration: determined by spread plating on TCBS agar and countng ager 18-24 incubation at 30 C. Limit of detection was 3.3 CFU/ml (determined using 100 ul spread volume in triplicate). The data uses a value of 0.0 for below detection limit.	colony forming units/milliliter (CFU/ml)
Chl_a	Chlorophyll-a concentration: determined by acetone freeze thaw using EPA method 445.0 (non-acidificaton). Data went through internal lab QAQC process. BDL= below detection limit.	microgram/liter (ug/L)
DOC	Dissolved organic carbon concentration: determined using oxidatve high temperature combuston-infrared analysis. MDL is 11.16 micro mol/L.	micromol/liter C (umol/L)
DON	Dissolved organic nitrogen concentration: determined the same as DOC samples but the sample is converted to nitrogen monoxide and measured by a chemoluminescence gas analyzer. The analyte sampled is TDN and the inorganic values are subtracted to get DON. MDL is 5.38 micro mol/L.	micromol/liter N (umol/L)
NH4	Ammonium concentration: determined by the automated phenate method 4500-NH3G. 20th Edition Std. Meth. MDL is 0.3 micro gram/L.	micromol/liter N (umol/L)
NO3	Nitrate concentration: determined by the automated cadmium reducton method 4500-NO3- F. 20th Edition Std. Method. MDL is 0.3 micro gram/L.	micromol/liter N (umol/L)
NO2	Nitrite concentration: determined as with Nitrate without running the sample through a cadmium column. 20th Edition Std. Meth. MDL is 0.1 micro gram/L.	micromol/liter N (umol/L)
Orthophosphate	Orthophosphate concentration: determined by the automated ascorbic acid reducton method 4500-P F. 20th Edition Std. Meth. MDL is 0.2 micro gram/ L.	micromol/liter P (umol/L)
SiO4	Silicate concentration: determined by the automated molybdate-reactve silica method 4500-SiO2 E. 20th Edition Std. Meth. MDL is 0.3 micro gram/L.	micromol/liter Si (umol/L)
dFe	dissolved iron concentration: determined in the 0.2 um filtered fracton using ICP-MSas described in Milne et al. 2010. Analytca Chimera Acta 665: 200-207	nanoMolar (nM)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	chemoluminescence gas analyzer
Generic Instrument Name	Gas Analyzer
Dataset-specific Description	To measure dissolved organic nitrogen
Generic Instrument Description	Gas Analyzers - Instruments for determining the qualitative and quantitative composition of gas mixtures.

Dataset-specific Instrument Name	
Generic Instrument Name	plate reader
Dataset-specific Description	To measure colony counts
Generic Instrument Description	Plate readers (also known as microplate readers) are laboratory instruments designed to detect biological, chemical or physical events of samples in microtiter plates. They are widely used in research, drug discovery, bioassay validation, quality control and manufacturing processes in the pharmaceutical and biotechnological industry and academic organizations. Sample reactions can be assayed in 6-1536 well format microtiter plates. The most common microplate format used in academic research laboratories or clinical diagnostic laboratories is 96-well (8 by 12 matrix) with a typical reaction volume between 100 and 200 uL per well. Higher density microplates (384- or 1536-well microplates) are typically used for screening applications, when throughput (number of samples per day processed) and assay cost per sample become critical parameters, with a typical assay volume between 5 and 50 µL per well. Common detection modes for microplate assays are absorbance, fluorescence intensity, luminescence, time-resolved fluorescence, and fluorescence polarization. From: http://en.wikipedia.org/wiki/Plate_reader, 2014-09-0-23.

[table of contents | back to top]

Deployments

Lipp_2014-16

Website	https://www.bco-dmo.org/deployment/663738
Platform	Florida Keys National Marine Sanctuary
Start Date	2014-07-22
End Date	2015-05-09
Description	Microbial studies

[table of contents | back to top]

Project Information

Vibrio as a model microbe for opportunistic heterotrophic response to Saharan dust deposition events in marine waters (Vibrio-dust deposition)

Coverage: Florida Keys, FL, USA

Description from NSF award abstract:
Dust and mineral aerosols are a significant source of micro and macronutrients to oligotrophic ocean surface waters. Evidence is growing that heterotrophic microbes may play key roles in processing deposited minerals and nutrients. Yet it is not known which components of dust stimulate the heterotrophic bacteria, which cellular mechanisms are responsible for the utilization of those components and how the activity of these bacteria affect the availability and utilization of dust-derived minerals and nutrients by marine autotrophs. Knowledge of these factors is key to understanding how dust deposition impacts carbon cycles and for predicting the response of tropical oceans to future changes in the frequency and intensity of dust deposition events. The objective of this project is to examine the specific effects of aeolian dust on heterotrophic microbes in a tropical marine system under controlled conditions. The central hypothesis is that in oligotrophic tropical systems numerically minor opportunistic bacteria are the first responders to influx of dust constituents and respond primarily by rapidly accessing soluble trace metals and limiting nutrients that are deposited with Saharan dust. The project will focus on two specific aims: 1) Quantify changes in community structure, composition and transcriptional activity among marine microbial populations upon exposure to dust, and 2) Identify key components in Saharan dust aerosols that stimulate or repress growth and/or activity in Vibrio, a model opportunistic marine heterotrophic group. The study will use a series of controlled experiments designed to identify and quantify heterotrophic microbial response to dust deposition events using both natural communities and model bacteria (Vibrio) through metagenomics, transcriptomics and atmospheric and marine biogeochemical techniques. This innovative approach will identify the most critical (reactive) components leached from dust aerosols on the microbial community as well as elucidate potential mechanisms of response.

There is great interest in the biological response to dust aerosols given its potentially large influence on biogeochemical cycling, but there has been relatively little work that has addressed the mechanisms of response (especially among the heterotrophic microbial fraction) or identified the relative importance of specific constituents of dust aerosols. A detailed framework for microbial response (focusing on opportunistic heterotrophs) will facilitate efforts to link autotrophic and heterotrophic processing. This contribution is significant because it will provide one of the first end-to-end (chemistry to physiology to ecology) mechanistic pathways for marine biological response to desert dust aerosols.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1357423

[table of contents | back to top]