Quantitative PCR data from samples collected on the R/V Sarmiento de Gamboa cruise in the subtropical North Atlantic Ocean between January and March 2011 (Microbial associations in zooplankton project)

Website: https://www.bco-dmo.org/dataset/680935
Data Type: Cruise Results
Version: 1
Version Date: 2017-02-02

Project
» Microbial associations in zooplankton: significance for the marine nitrogen cycle (Microbial associations in zooplankton)

Contributors	Affiliation	Role
Moisander, Pia	University of Massachusetts Dartmouth (UMASSD-SMAST)	Principal Investigator
Benavides, Mar	Université de Toulon	Co-Principal Investigator
Ake, Hannah	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Quantitative PCR data from samples collected on the R/V Sarmiento de Gamboa cruise in the subtropical North Atlantic Ocean between January and March 2011 (Microbial associations in zooplankton project)

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Coverage

Spatial Extent: **N**:27.8 **E**:-13.3 **S**:24.5 **W**:-65.7
Temporal Extent: 2011-01-28 - 2011-03-09

Dataset Description

Quantitative PCR targeting Trichodesmium, UCYN-A, UCYN-B, gamma-24774A11, and Het1, based on the nifH gene.

Methods & Sampling

Samples were collected from Niskin bottles, filtered, and processed for DNA analyses. For detailed methods see Benavides et al. 2016.

Data Processing Description

For qPCR methods, see Benavides et al. 2016.

BCO-DMO Data Processing Notes:
-Reformatted column names to comply with BCO-DMO standards
-Added ISO_DateTime_UTC column
-Filled in blank cells with nd
-Reformatted date to YYYY/MM/DD

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Data Files

File
qPCR.csv (Comma Separated Values (.csv), 4.77 KB) MD5:2dbb0d7b04f119ca316bf4ca18d17c31 Primary data file for dataset ID 680935

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Related Publications

Benavides, M., Moisander, P. H., Daley, M. C., Bode, A., & Arístegui, J. (2016). Longitudinal variability of diazotroph abundances in the subtropical North Atlantic Ocean. Journal of Plankton Research, 38(3), 662–672. doi:10.1093/plankt/fbv121
Methods

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Parameters

Parameter	Description	Units
number	Sample ID number	unitless
project	PI issued project name	unitless
date	Date of sampling; YYYY/mm/dd	unitless
time	Time of sampling; HH:MM	unitless
station	Station where sampling occurred	unitless
lat	Latitude; N is positive	decimal degrees
lon	Longitude; E is positive	decimal degrees
size_fraction	Filter size	microns
UCYN_A	UCYN-A gene copy concentration	genes per liter
Gamma_24774A11	Gamma 24774A11 gene copy concentration	genes per liter
group_B	Group B gene copy concentration	genes per liter
Tricho	Tricho gene copy concentration	genes per liter
Het1	Het1 gene copy concentration	genes per liter
ISO_DateTime_UTC	Date/Time (UTC) ISO formatted	unitless

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Instruments

Dataset-specific Instrument Name	PCR
Generic Instrument Name	Thermal Cycler
Dataset-specific Description	Used to process PCR samples
Generic Instrument Description	A thermal cycler or "thermocycler" is a general term for a type of laboratory apparatus, commonly used for performing polymerase chain reaction (PCR), that is capable of repeatedly altering and maintaining specific temperatures for defined periods of time. The device has a thermal block with holes where tubes with the PCR reaction mixtures can be inserted. The cycler then raises and lowers the temperature of the block in discrete, pre-programmed steps. They can also be used to facilitate other temperature-sensitive reactions, including restriction enzyme digestion or rapid diagnostics. (adapted from http://serc.carleton.edu/microbelife/research_methods/genomics/pcr.html)

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Deployments

Malaspina_2011

Website	https://www.bco-dmo.org/deployment/680974
Platform	R/V Sarmiento de Gamboa
Start Date	2011-01-28
End Date	2011-03-09

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Project Information

Microbial associations in zooplankton: significance for the marine nitrogen cycle (Microbial associations in zooplankton)

Coverage: Sargasso Sea, Eastern and Western North Atlantic.

Description from NSF award abstract:
Nitrogen (N2) fixation is a key biogeochemical process providing new N for the marine ecosystem. Current estimates of the global rates suggest that the inputs and outputs of N are not in balance, leaving an apparent deficiency in N2 fixation in the oceanic N budget. Based on recovery of N2 fixation gene fragments, however, numerous potential N2-fixing microbes are present in the euphotic layer and below, yet evidence for their contribution to N2-fixation is lacking. The goal of this study is to identify and determine the importance of potentially diazotrophic, heterotrophic prokaryotes occupying a previously unstudied niche in the upper ocean.

This project PIs hypothesize that N2 fixation in zooplankton-associated microbial communities is an important source of new N in the open ocean contributing to the oceanic N budget. In oligotrophic, N-limited open ocean waters, zooplankton are faced with the same low N availability in their diets that limits growth of primary producers and heterotrophic microbes in the open ocean. Zooplankton guts would be a particularly suitable

environment for heterotrophic N2-fixers as the nitrogenase enzyme is inhibited by oxygen. In many terrestrial insects, N2 fixation by gut microbes serves as a source of N. The aim of this study is to investigate whether similar associations occur in marine zooplankton that live on N-limited phytoplankton. The PIs will investigate specific associations between copepods from N-limited and non-N limited oceanic waters with microorganisms that are potentially or actively fixing N. They will also investigate the fate of this N to study whether the new N is incorporated into the zooplankton host. The main research objectives are to determine whether:

1. diazotrophic microflora exist in copepods and what is their seasonal and spatial variability,

2. microbial communities associated with copepods are actively fixing N2,

3. diazotroph communities contribute to the N nutrition of their zooplankton hosts.

Monthly samples will be collected in the oligotrophic Sargasso Sea, in association with BATS sampling cruises. In addition, experiments and field studies will be conducted in Bermuda during the summer. For comparison to a site that is not severely N limited, and for methods development, additional studies will be carried out in coastal Gulf of Maine waters. Selected copepod species and their fecal pellets will be analyzed for the presence of nifH genes and their expression using cloning and sequencing and Reverse Transcriptase-PCR. Quantitative PCR will be employed to investigate the seasonal distributions of dominant phylotypes. Anaerobic cultivation will be used for the enrichment of the gut microflora. Zooplankton will be incubated with 15N2 to quantify microbial N2 fixation activity and its fate of N through zooplankton overall 15N content and nanoSIMS determination of 15N localization. Products of this study will include novel microbial isolates or consortia, evidence regarding taxa-specific expression of N2 fixation in these microhabitats, and a first estimate for the importance of this process for the oceanic N budget.

This project addresses fundamental issues regarding the sources of oceanic nitrogen and will test hypotheses regarding previously overlooked diazotrophic niches. As open ocean productivity is frequently N limited, characterization of new sources of N will have global impacts.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1130495

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