Carbon and Nitrogen isotopes in an experimental benthic chamber, Maunalua, O'ahu, Hawai'i, 2015-2016

Website: https://www.bco-dmo.org/dataset/822239
Data Type: experimental
Version: 1
Version Date: 2020-08-27

Project
» Collaborative Research: Dissolved organic matter feedbacks in coral reef resilience: The genomic & geochemical basis for microbial modulation of algal phase shifts (Coral DOM2)

Contributors	Affiliation	Role
Nelson, Craig E.	University of Hawai'i at Mānoa (HIMB)	Principal Investigator
La Valle, Florybeth F.	University of Hawai'i at Mānoa (HIMB)	Contact
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Carbon and Nitrogen isotopes in an experimental benthic chamber, Maunalua, O'ahu, Hawai'i, 2015-2016

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Coverage

Spatial Extent: **N**:21.275824 **E**:-157.760472 **S**:21.27273 **W**:-157.76335
Temporal Extent: 2015-10-09 - 2016-11-03

Dataset Description

This dataset carbon and nitrogen isotope ratios from experiments conducted at the University of Hawaii, Manoa in 2015.

Experiment CRANE (Coral Reef Acclimation to Nutrient Enrichment) identifies a month-long mesocosm incubation study designed to understand the response of the coral reef community to long-term nutrient exposure.

Methods & Sampling

Parameter
Method

Final_mass_algae_g
All of the algal biomass was taken from the benthos covered by the benthic chamber at the end of the experiment. Algae was taken back to the lab, sorted by species, cleaned of sediment and epiphytes with DI water. Algae was dried at 60 degrees Celsius for 3 days and a final dry weight was taken by species.

L_filtered
0.5-1.14L of seawater was taken out of the benthic chamber and filtered through a 0.2 um previously combusted glass fiber filter.

Weight_mg
Sample is weighed during processing using a microbalance.

C, N
Algal and phytoplankton samples were dried for 3 days at 60 degrees Celsius. Analysis of samples for carbon [ug C] and nitrogen [ug N], and isotopic composition [d13C (permil vs. PDB) and d15N (permil vs. AIR)] was done using the following instrumentation: Costech ECS 4010 Elemental Combustion System/Zero Blank Autosampler /ThermoFinnigan MAT Conflo IV/ThermoFinnigan DeltaXP.

Data Processing Description

BCO-DMO Processing:
- modified parameter names to conform with BCO-DMO naming conventions

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Data Files

File
cn_isotopes.csv (Comma Separated Values (.csv), 11.21 KB) MD5:8f8671037448b8c6ccd2b7d9aaf52e84 Primary data file for dataset ID 822239

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Parameters

Parameter	Description	Units
Exp_ID	Identification for experiment; corresponds to Exp ID in La Valle_Wailupe productivity macroalgae and phytoplankton_2015-2016.xlsb	NA
sample_id	Identification for isotope sample (algal tissue or phytoplankton on a filer).	NA
species	Macroalgal species or phytoplankton designation	NA
Ambient_or_Enriched	Ambient refers to a sample taken before the enrichment at the beginning of the experiment. Enriched refers to a sample taken at the end of the experiment.	NA
Final_mass_algae_g	Final dry weight of algal species in the benthic chamber. No value for phytoplankton.	gram (g)
L_filtered	Sea water volume filtered.	Liter (L)
Weight_mg	weight of sample given by lab	milligram (mg)
ug_N	concentration of nitrogen sample given by lab	micrograms of Nitrogen (ug N)
d15N_permil_vs_AIR	delta 15N of sample given by lab; permil vs. air	unitless
ug_C	concentration of carbon sample given by lab	micrograms of Carbon (ug C)
d13C_permil_vs_PDB	delta 13C of sample given by lab; permil vs. PDB	unitless

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Instruments

Dataset-specific Instrument Name	Costech ECS 4010 Elemental Combustion System/Zero Blank Autosampler /ThermoFinnigan MAT Conflo IV/ThermoFinnigan DeltaXP
Generic Instrument Name	Laboratory Autosampler
Dataset-specific Description	For analysis of samples for carbon [_g C] and nitrogen [_g N], and isotopic composition [d13C (â vs. PDB) and d15N (â vs. AIR)].
Generic Instrument Description	Laboratory apparatus that automatically introduces one or more samples with a predetermined volume or mass into an analytical instrument.

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Project Information

Collaborative Research: Dissolved organic matter feedbacks in coral reef resilience: The genomic & geochemical basis for microbial modulation of algal phase shifts (Coral DOM2)

Coverage: Pacific Coral Reefs

NSF award abstract:
Coral reef degradation, whether driven by overfishing, nutrient pollution, declining water quality, or other anthropogenic factors, is associated with a phase shift towards a reefs dominated by fleshy algae. In many cases managing and ameliorating these stressors does not lead to a return to coral dominance, and reefs languish in an algal-dominated state for years. Nearly a decade of research has demonstrated that trajectories toward increasing algal dominance are restructuring microbial community composition and metabolism; the investigators hypothesize that microbial processes facilitate the maintenance of algal dominance by metabolizing organic compounds released by algae thereby stressing corals through hypoxia and disease. The resilience of reefs to these phase shifts is a critical question in coral reef ecology, and managing reefs undergoing these community shifts requires developing an understanding of the role of microbial interactions in facilitating algal overgrowth and altering reef ecosystem function. The research proposed here will investigate the organics produced by algae, the microbes that metabolize the organics, and the impacts of these processes on coral health and growth. This research has implications for managing reef resilience to algal phase shifts by testing the differential resistance of coral-associated microbial communities to algae and defining thresholds of algal species cover which alter ecosystem biogeochemistry. This project provides mentoring across multiple career levels, linking underrepresented undergraduates, two graduate students, a postdoctoral researcher, and a beginning and established investigators.

This project will integrate dissolved organic matter (DOM) geochemistry, microbial genomics and ecosystem process measurements at ecologically-relevant spatial and temporal scales to test hypothetical mechanisms by which microbially-mediated feedbacks may facilitate the spread of fleshy algae on Pacific reef ecosystems. A key product of this research will be understanding how the composition of corals and algae on reefs interact synergistically with complex microbial communities to influence reef ecosystem resilience to algal phase shifts. Emerging molecular and biogeochemical methods will be use to investigate mechanisms of microbial-DOM interactions at multiple spatial and temporal scales. This project will leverage the background environmental data, laboratory facilities and field logistical resources of the Mo'orea Coral Reef Long Term Ecological Research Project in French Polynesia and contribute to the mission of that program of investigating coral reef resilience in the face of global change. The investigators will quantify bulk diel patterns of DOM production and characterize the composition of chromophoric components and both free and acid-hydrolyzable neutral monosaccharides and amino acids from varying benthic algae sources. The team will also characterize planktonic and coral-associated microbial community changes in taxonomic composition and gene expression caused by algal DOM amendments in on-site controlled environmental chambers using phylogenetics and metatranscriptomics, including tracking algal exudate utilization by specific microbial lineages. Field-deployed 100 liter tent mesocosms will be used to examine in situ diel patterns of coupled DOM production and consumption, microbial community genomics and ecosystem metabolism over representative benthic communities comprising combinations of algal and coral species. Together these experimental results will guide interpretation of field surveys of centimeter-scale spatial dynamics of planktonic and coral-associated microbial genomics and metabolism at zones of coral-algal interaction, including boundary layer dynamics of oxygen, bacteria and DOM using planar optodes, high-throughput flow cytometry and fluorescence spectroscopy.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1538393

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