Measurements of nutrient flux and denitrification in clam aquaculture sediments.

Website: https://www.bco-dmo.org/dataset/700800
Data Type: experimental
Version: 1
Version Date: 2017-05-23

Project
» Microbial Regulation of Greenhouse Gas N2O Emission from Intertidal Oyster Reefs (Oyster Reef N2O Emission)

Contributors	Affiliation	Role
Song, Bongkeun	Virginia Institute of Marine Science (VIMS)	Principal Investigator, Contact
Brush, Mark J.	Virginia Institute of Marine Science (VIMS)	Co-Principal Investigator
Piehler, Michael F.	University of North Carolina at Chapel Hill (UNC-Chapel Hill)	Co-Principal Investigator
Tobias, Craig	University of Connecticut (UConn - Avery Point)	Co-Principal Investigator
Ake, Hannah	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Measurements of nutrient flux and denitrification in clam aquaculture sediments.

Table of Contents

Coverage

Spatial Extent: **Lat**:37.3083333 **Lon**:-76.0166667
Temporal Extent: 2013-05 - 2013-11

Dataset Description

Measurements of nutrient flux and denitrification and DNRA rates in clam aquaculture sediments.

Methods & Sampling

In May and July 2013, 16 randomly selected clam beds and 4 uncultivated sites and in November 2013, 7 randomly selected clam beds and 3 uncultivated sites were sampled at the Cheerystone Inlet of VA Eastern Shore. Uncultivated sites were located approximately 20 m from the clam beds, a distance chosen to reduce any influence of aquaculture on the control sediments and at a water depth similar to that of the clam beds. 60 cores were collected in May and July (20 total sites during each month), and 30 cores were collected in November (10 total sites). Cores were not treated as replicates, but were used to conduct concurrent

incubations to measurement of denitrification and DNRA rates by isotope-pairing techniques. The details of methods are published in Murphy et al. (2016). DOI: 10.1002/lno.10305.

Data Processing Description

Nutrients and isotopic composition of N2 and NH4+ were used to calculate the fluxes and rates as reported in Murphy et al (2016). DOI: 10.1002/lno.10305.

BCO-DMO Processing Notes:

- column names reformatted to comply with BCO-DMO naming standards.
- nd used to replace all blank cells with no data.

[table of contents | back to top]

Data Files

File
nutrients.csv (Comma Separated Values (.csv), 12.97 KB) MD5:f93b3eab4c69ad9fb2c5592313adbf38 Primary data file for dataset ID 700800

[table of contents | back to top]

Related Publications

Murphy, A. E., Anderson, I. C., Smyth, A. R., Song, B., & Luckenbach, M. W. (2016). Microbial nitrogen processing in hard clam (Mercenaria mercenaria) aquaculture sediments: the relative importance of denitrification and dissimilatory nitrate reduction to ammonium (DNRA). Limnology and Oceanography, 61(5), 1589–1604. doi:10.1002/lno.10305
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
month	Month that sampling took place	unitless
treatment	Treatment description	unitless
ID	PI issued ID	unitless
light_dark	Light or dark treatment	unitless
DIC	Concentration per hour	millimoles per meter squared per hour
Nox	Concentration per hour	micromoles per meter squared per hour
NH4	Concentration per hour	micromoles per meter squared per hour
PO4	Concentration per hour	micromoles per meter squared per hour
dark_DON	Concentration per hour	unitless
DO	Concentration per hour	millimoles per meter squared per hour
D14	Concentration per hour	micromoles per meter squared per hour
DNRAt	Concentration per hour	micromoles per meter squared per hour
D15	Concentration per hour	micromoles per meter squared per hour
Dw	Concentration per hour; Cherry WC Nox	micromoles per meter squared per hour
Dn	Concentration per hour; Cherry WC Nox	micromoles per meter squared per hour
DNRAw	Concentration per hour; Cherry WC Nox	micromoles per meter squared per hour
DNRAn	Concentration per hour; Cherry WC Nox	micromoles per meter squared per hour

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	IRMS
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Core
Generic Instrument Name	Multi Corer
Dataset-specific Description	Used to collect core samples
Generic Instrument Description	The Multi Corer is a benthic coring device used to collect multiple, simultaneous, undisturbed sediment/water samples from the seafloor. Multiple coring tubes with varying sampling capacity depending on tube dimensions are mounted in a frame designed to sample the deep ocean seafloor. For more information, see Barnett et al. (1984) in Oceanologica Acta, 7, pp. 399-408.

[table of contents | back to top]

Deployments

Cheerystone_Inlet

Website	https://www.bco-dmo.org/deployment/700947
Platform	shoreside Virginia
Start Date	2013-05-01
End Date	2013-07-31
Description	Cheerystone Inlet of the Eastern Shore of Virginia: N37°18’30” and W76°1’0”

[table of contents | back to top]

Project Information

Microbial Regulation of Greenhouse Gas N2O Emission from Intertidal Oyster Reefs (Oyster Reef N2O Emission)

Extracted from the NSF award abstract:

Oyster reefs are biogeochemical hot spots and prominent estuarine habitats that provide disproportionate ecological function. Suspension-feeding eastern oysters, Crassostrea virginica, are capable of improving water quality and diminishing eutrophication by filtering nutrients and particles from the water and depositing them in the sediments. Remineralization of these deposits may enhance sedimentary denitrification that facilitates nitrogen removal in tidal estuaries. However, the scientific underpinning of oyster reef function has been

challenged in various studies. In addition, recent studies of filter feeding invertebrates reported the production of nitrous oxide (N2O), a greenhouse gas, as an end product of incomplete denitrification by gut microbes. C. virginica could be another source of N2O flux from intertidal habitats. Preliminary work indicated substantial N2O production from individual oysters. The estimated N2O production from high density oyster reefs may exceed the N2O flux measured from some estuaries. With the new discovery of N2O emission and uncertainty regarding eutrophication control, the ecological value of oyster reef restoration may become equivocal.

This project will quantify N2O fluxes to understand the factors controlling N2O emission from oyster reefs. Sedimentary N processes will be examined to develop an oyster reef N model to estimate N2O emission from tidal creek estuaries relative to other N cycling processes. The PIs hypothesize that intertidal oyster reefs are a substantial source of N2O emission from estuarine ecosystems and the magnitude of emission may be linked to water quality. If substantial N2O flux from oyster reefs is validated, ecological benefits of oyster reef restoration should be reevaluated. This interdisciplinary research team includes a microbial ecologist, a biogeochemist, an ecologist and an ecosystem modeler. They will utilize stable isotope and molecular microbiological techniques to quantify oyster N2O production, elucidate microbial sources of N2O emission from oysters and sediments, and estimate seasonal variation of N2O fluxes from oyster reefs. Measurements from this study will be integrated into a coupled oyster bioenergetics-sediment biogeochemistry model to compare system level rates of N cycling on oyster reefs as a function of oyster density and water quality. Modeling results will be used to assess the relative trade-offs of oyster restoration associated with N cycling. They expect to deliver the following end products:1) estimation of annual N2O flux from oyster reefs as an additional source of greenhouse gases from estuaries, 2) a better understanding of the environmental and microbial factors influencing N2O and N2 fluxes in tidal estuaries, 3) transformative knowledge for the effect of oyster restoration on water quality enhancement and ecosystem function, 4) direct guidance for oyster restoration projects whose goals include water quality enhancement, and 5) a modeling tool for use in research and restoration planning.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1233372

[table of contents | back to top]