Oyster density and size distribution from the coast of North Carolina in 2010

Website: https://www.bco-dmo.org/dataset/704333
Data Type: experimental
Version: 1
Version Date: 2017-06-06

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

Contributors	Affiliation	Role
Piehler, Michael F.	University of North Carolina at Chapel Hill (UNC-Chapel Hill)	Principal Investigator, Contact
Brush, Mark J.	Virginia Institute of Marine Science (VIMS)	Co-Principal Investigator
Song, Bongkeun	Virginia Institute of Marine Science (VIMS)	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
Oyster density and size distribution from the coast of North Carolina in 2010

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Coverage

Spatial Extent: **N**:34.6951 **E**:-76.6081 **S**:34.6804 **W**:-76.626
Temporal Extent: 2010 - 2010

Dataset Description

Oyster reef data from several landscapes in coastal North Carolina.

Methods & Sampling

Methodology from **Smyth, A. R., Piehler, M. F. and Grabowski, J. H. (2015), Habitat context influences nitrogen removal by restored oyster reefs. J Appl Ecol, 52: 716–725. doi:10.1111/1365-2664.12435**

Sediment cores (contained in 6·4-cm-diameter by 17-cm-long polycarbonate tubes, 10 cm depth) were collected adjacent to each reef habitat (n = 3) and control habitat (without reefs, n = 3) in each context at low tide on 28 June 2010. Cores collected from oyster reefs did not contain live oysters. Additionally, ~100 L of water was collected for use in the laboratory incubations. Following collection, sediment cores and water were transported to an environmental chamber (Bally, Inc.,

Morehead City, NC, USA) at The University of North Carolina Institute of Marine Sciences in Morehead City, NC. Surface water measurements of dissolved O2, salinity and water temperature (YSI 600 Series Sonde and Model 650 data logger; Yellow Springs Instruments, Yellow Springs, OH, USA) were also collected. Oyster density in the reef was determined by placing a 0·25-m2 quadrat on each reef (one quadrat per reef) and counting all the oysters present with a shell length >25 mm (Powers et al. 2009).

Data Processing Description

Methodology from **Smyth, A. R., Piehler, M. F. and Grabowski, J. H. (2015), Habitat context influences nitrogen removal by restored oyster reefs. J Appl Ecol, 52: 716–725. doi:10.1111/1365-2664.12435**

Statistical analyses were performed using r 2.13.1 (R Foundation for Statistical Computing 2011). Linear mixed-effects models (lme in R nlme package), where habitat nested in sampling location was included as a random effect for the intercept, were used to investigate the effects of oyster reef presence, habitat context, nitrate concentration (ambient vs. elevated) and the interaction between these factors on response variables. Fluxes of N2, NOx ([math formula] + [math formula]) [math formula] , denitrification efficiency and SOD were analysed using all three fixed effects. For sediment organic matter, only habitat context and reef presence were included as fixed effects. The effects of ambient vs. elevated nitrate concentration and habitat context on oyster reef-mediated changes in denitrification were also analysed with a mixed-effects model (fixed effects: nitrate concentration × habitat context; random effects: habitat nested in location). Relationships between oyster density and habitat context were made using a mixed-effects model (fixed effects: habitat context; random effects: habitat nested in location). Comparisons were conducted using linear contrasts and judged against an alpha level of 0·05. Interactions were assessed using Tukey's HSD (lsmeans in R lsmeans package). Assumptions of homogeneity were tested using Levene's tests. Regression analyses were used to investigate the effect of oyster density on denitrification. Models with the lowest Akaike's information criterion corrected for small sample sizes (AICc) were chosen.

BCO-DMO Processing Notes:

- column names reformatted to comply with BCO-DMO naming standards.
- lat and lon columns added to correspond with locations.

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Data Files

File
oysters.csv (Comma Separated Values (.csv), 809 bytes) MD5:aabf5010bc3674327ce46a3704b725f3 Primary data file for dataset ID 704333

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Related Publications

Smyth, A. R., Piehler, M. F., & Grabowski, J. H. (2015). Habitat context influences nitrogen removal by restored oyster reefs. Journal of Applied Ecology, 52(3), 716–725. doi:10.1111/1365-2664.12435
Methods

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Parameters

Parameter	Description	Units
reef_ID	PI issued site ID	unitless
habitat	Type of substrate where oysters were measured	unitless
location	PI issued location IDs that correspond to specific coordinates and experimental treatments	unitless
lat	Latitude	decimal degrees
lon	Longitude	decimal degrees
bucket	PI issued ID of oyster collection measured	unitless
weight_ttl	Total weight of oysters	kilograms
weight_liveOyster	Weight of live oysters	kilograms
weight_shell	Weight of oyster shells	kilograms
count	Oyster count in each bucket sample	count
density	Density of oysters in each sample	count per meter
length_avg	Average length of each oyster in the sample	centimeters
length_stDev	Standard deviation from the mean of oyster lengths	unitless
length_median	Median oyster length from the sample	centimeters

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Instruments

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.

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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”

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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.

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Funding

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

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