Nutrient and metabolic fluxes on oyster reefs from the Choptank River and Harris Creek, Maryland data from June through August of 2017 (published in Jackson et al., 2018)

Website: https://www.bco-dmo.org/dataset/870783
Data Type: experimental
Version: 1
Version Date: 2022-03-14

Project
» Coastal SEES Collaborative Research: Oyster fisheries in the Chesapeake Bay: Integrating stakeholder objectives with natural system models to promote sustainable policy (Chesapeake Bay Oyster Fisheries)

Contributors	Affiliation	Role
Cornwell, Jeffrey	University of Maryland Center for Environmental Science (UMCES/HPL)	Principal Investigator
Jackson, Melanie	National Oceanic and Atmospheric Administration (NOAA)	Contact
Heyl, Taylor	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset contains the nutrient and metabolic fluxes data that was published in Jackson et al. (2018) that compared two methods of measuring nutrient and metabolic fluxes on restored oyster reefs: incubations including intact segments of oyster reef and incubations containing oyster clumps without underlying sediments.

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Coverage

Spatial Extent: **Lat**:38.785833 **Lon**:-76.458611
Temporal Extent: 2017-06 - 2017-08

Methods & Sampling

Experiments were conducted in early and late summer (June and August) 2017 using the in situ equilibration of intact segments of oyster reef (hereafter “reef segments”) with ex situ incubation approach. As part of the larger project, reef segments were incubated first in the dark, then with illumination.

After these incubations were complete, a subset of these samples (4 samples in June and 6 samples in August) was selected for additional study based upon whether the sample had at least one oyster over ~75 mm visible

on the surface sediment. For each tray selected, the live oysters and oyster clumps were carefully removed from each tray, placed in clean and empty incubation chambers, aerated for ~1 h, and incubated in the dark. Solutes (NH4+, NO2/3-, SRP) and dissolved gases (O2, N2, Ar, DIC = [H2CO3]+[HCO3-]+[CO32-]) were collected approximately every 45 minutes (4 times total) during each set of incubations from a sampling tube fitted in the lid, while a water replacement tube pulled water from the water bath. Dissolved gases were preserved with 10µl of 50% saturated HgCl2, tightly sealed, submerged in water, and held at or slightly below incubation temperature until analysis. Solute samples were filtered through a 0.45 µm pore-size filter and kept frozen for analysis. N2, O2, and Ar concentrations were measured on a membrane-inlet mass spectrometer within 2 weeks of collection. DIC concentrations were measured using an infrared-based analyzer (Apollo SciTech). Phenol/hypochlorite colorimetry was used to determine NH4+ concentrations. NO2/3-was analyzed spectrophotometrically following Doane and Howarth, while a composite reagent of molybdic acid, ascorbic acid, and trivalent antimony were used to determine SRP concentrations.

Refer to Jackson et al. (2018) for complete methods.

Data Processing Description

BCO-DMO processing description:
- Converted dates to date format (yyyy-mm)
- Adjusted field/parameter names to comply with BCO-DMO naming conventions
- Added a conventional header with dataset name, PI names, version date

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Data Files

File	
summary_oyster_clumps_june_aug2017_withmetadata-2.csv	(Comma Separated Values (.csv), 1.92 KB) MD5:e668d728080944f2ba9e17a8277b3bd7
Primary data file for dataset ID 870783	

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Related Publications

Doane, T. A., & Horwáth, W. R. (2003). Spectrophotometric Determination of Nitrate with a Single Reagent. Analytical Letters, 36(12), 2713–2722. https://doi.org/10.1081/al-120024647 https://doi.org/10.1081/AL-120024647
Methods

Jackson, M., Owens, M. S., Cornwell, J. C., & Kellogg, M. L. (2018). Comparison of methods for determining biogeochemical fluxes from a restored oyster reef. PLOS ONE, 13(12), e0209799. https://doi.org/10.1371/journal.pone.0209799
Results

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Parameters

Parameter	Description	Units
tray	Number of the tray that oysters were equilibrated on in situ	unitless
incubation_type	Type of incubation: oysters = oysters only; oysters + sed = oysters and sediment.	unitless
sampling_period	Month and year when sampling and incubations occurred in format YYYY-MM.	unitless
oyster_biomass	Biomass of oysters used in ex situ incubations	g DW m^-2
N2_flux	Flux of di-nitrogen during the incubation	mmol N2-N m^-2 h^-1
O2_flux	Flux of oxygen during the incubation	mmol O2 m^-2 h^-1
NH4	Flux of ammonium during the incubation	mmol NH4+ m^-2 h^-1
Nox	Flux of combined nitrate and nitrite during the incubation	mmol Nox m^-2 h^-1
SRP	Flux of soluble reactive phosphorus during the incubation	mmol SRP m^-2 h^-1
DIC	Flux of dissolved inorganic carbon during the incubation	mmol DIC m^-2 h^-1

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Apollo SciTech AS-C3 Dissolved Inorganic Carbon (DIC) analyzer
Generic Instrument Description	A Dissolved Inorganic Carbon (DIC) analyzer, for use in aquatic carbon dioxide parameter analysis of coastal waters, sediment pore-waters, and time-series incubation samples. The analyzer consists of a solid state infrared CO2 detector, a mass-flow controller, and a digital pump for transferring accurate amounts of reagent and sample. The analyzer uses an electronic cooling system to keep the reactor temperature below 3 degrees Celsius, and a Nafion dry tube to reduce the water vapour and keep the analyzer drift-free and maintenance-free for longer. The analyzer can handle sample volumes from 0.1 - 1.5 milliliters, however the best results are obtained from sample volumes between 0.5 - 1 milliliters. It takes approximately 3 minutes per analysis, and measurement precision is plus or minus 2 micromoles per kilogram or higher for surface seawater. It is designed for both land based and shipboard laboratory use.

Dataset-specific Instrument Name	
Generic Instrument Name	Membrane Inlet Mass Spectrometer
Generic Instrument Description	Membrane-introduction mass spectrometry (MIMS) is a method of introducing analytes into the mass spectrometer's vacuum chamber via a semipermeable membrane.

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Project Information

Coastal SEES Collaborative Research: Oyster fisheries in the Chesapeake Bay: Integrating stakeholder objectives with natural system models to promote sustainable policy (Chesapeake Bay Oyster Fisheries)

Website: https://oysterfutures.wordpress.com/

Coverage: Chesapeake Bay

NSF Award Abstract:
Researchers will use the oyster fisheries in the Chesapeake Bay as a test case for collaborative policy development that is grounded in sound science. Environmental policies often create controversy and can be difficult to enforce, particularly when people do not understand the reason for the rules or do not consider the rules to be fair. Natural resources can be better sustained by policies developed cooperatively among all affected stakeholders, scientists, and government representatives. In a systematic approach, the project team will hold a series of workshops in which a full set of stakeholders will work with scientists to guide development of a model, select policy objectives, and apply the model to make policy recommendations. A collaborative modeling approach will ensure that stakeholders have an opportunity to incorporate their values, objectives, and knowledge into the model of the estuarine ecosystem which will include many benefits from the natural system such as commercial and recreational fishing, safe swimmable water, and other ecosystem services. Researchers will study the sociology and economics that influence stakeholder involvement and policy formation in order to better understand the human dimensions, improve the process, and enhance the implementation success of recommended policies. The lessons learned regarding the oyster ecosystem and fishery will advance the tools and practices of sustainable management of shellfisheries. The policy recommendations from the stakeholder workshops will be evaluated by state and federal agencies, and if implemented, would be an outcome that would directly enhance coastal sustainability. One Ph.D. student, two masters students, and one postdoctoral researcher will be trained in the science of coupled natural-human systems. This project is supported as part of the National Science Foundation's Coastal Science, Engineering, and Education for Sustainability program - Coastal SEES.

This research aims to improve the utility of predictive models for shaping natural resource policy and management. The research team will build an innovative natural systems model that integrates three-dimensional hydrodynamic, water quality and larval transport models with oyster demographics, human uses, and economics at a scale that is applicable to restoration and management. The modeling system developed will substantially advance methods for investigating, and understanding, natural systems with complex feedbacks between physical conditions, vital rates of organisms, and humans. Researchers will include stakeholder values, objectives, and knowledge in the model design process. Through a series of workshops, stakeholders will select the policy objectives and the integrated model will project how well policies are expected to meet these objectives. This iterative process will ensure that the natural system model will incorporate the complex human uses of the ecosystem. A targeted effort will be made to study the socioeconomic drivers of stakeholder involvement, information flow, use and influence, and the policy formation in order to improve the process and enhance the implementation success of recommended policies. By doing so, this research will advance understanding of the human dimensions needed to create sustainable policy as well as provide important new strategies for integrating natural and social sciences, and scientists, in sustainable resource management. This generalizable research component provides an important complement to the research on oysters, both of which will advance the tools and practices of sustainable management of shellfisheries.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1427019

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