In situ dissolved oxygen of experimental chambers and ambient sensors acquired in the shallow subtidal shore-accessible site in Bon Secour Bay, Mobile Bay, Alabama, USA between August 7-12, 2021

Website: https://www.bco-dmo.org/dataset/941205
Version: 1
Version Date: 2024-10-23

Project
» CAREER: Mechanisms of bioturbation and ecosystem engineering by benthic infauna (Bioturbation and Ecosystem Engineering)

Contributors	Affiliation	Role
Gadeken, Kara	University of South Alabama; and Dauphin Island Sea Lab (USA-DISL)	Student, Contact
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Abstract
This dataset is part of a field study examining the effect of diel oxygen cycling on faunal activity, and in turn sediment oxygen demand. The field experiment used in situ flow-through benthic chambers to measure oxygen consumption, as described in the methods paper Gadeken et al 2023. The chambers were deployed and retrieved in three ~24 hour deployments in a shallow subtidal area of Bon Secour Bay in Mobile Bay, AL, in August 2021. This dataset contains streamlined data from the HOBO dissolved oxygen (DO) loggers and the log time of when the chamber system flushes the overlying water in the chamber and starts a new incubation.

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Coverage

Location: Shallow subtidal shore-accessible site in Bon Secour Bay, Mobile Bay, AL, USA
Spatial Extent: **Lat**:30.239478 **Lon**:-87.894094
Temporal Extent: 2021-08-05 - 2021-08-12

Methods & Sampling

This dataset is part of a field study examining the effect of diel oxygen cycling on faunal activity, and in turn sediment oxygen demand. The field experiment used in situ flow-through benthic chambers to measure oxygen consumption, as described in the methods paper Gadeken et al 2023.

The chambers were deployed and retrieved in three ~24 hour deployments in a shallow subtidal area of Bon Secour Bay in Mobile Bay, AL, in August 2021.

These data are streamlined data from the HOBO dissolved oxygen (DO) loggers combined with the log the time of each occasion when the chamber system flushes the overlying water in the chamber and starts a new incubation.

Upon completion of the 24 hour deployment, the chambers were extracted and oxygen data offloaded from the chamber loggers.

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Related Publications

Gadeken, K. J., Lockridge, G., & Dorgan, K. M. (2023). An in situ benthic chamber system for improved temporal and spatial resolution measurement of sediment oxygen demand. Limnology and Oceanography: Methods, 21(11), 645–655. Portico. https://doi.org/10.1002/lom3.10571
Results

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Related Datasets

IsSourceOf

Gadeken, K. (2024) **Processed dissolved oxygen and infauna of experimental chambers and ambient sensors acquired in the shallow subtidal shore-accessible site in Bon Secour Bay, Mobile Bay, Alabama, USA between August 7-12, 2021.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-10-21 http://lod.bco-dmo.org/id/dataset/940735 [view at BCO-DMO]
Relationship Description: Combined processed dissolved oxygen and infauna data from sediment chamber experiment

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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	benthic incubation chamber
Dataset-specific Description	This project used a custom built field deployable benthic chamber system. Construction and functioning of the system are outlined in Gadeken et al 2023 L&O:Methods.
Generic Instrument Description	A device that isolates a portion of seabed plus overlying water from its surroundings. Either returns the entire system to the surface or incorporates sampling devices and/or in-situ sensors.

Dataset-specific Instrument Name	Onset HOBO DO loggers (U26-001)
Generic Instrument Name	Onset HOBO U26-001 Dissolved Oxygen Data Logger
Generic Instrument Description	A dissolved oxygen sensor, temperature sensor, and integrated data logger. The HOBO U26-001 can be used in freshwater and saltwater conditions, and outputs dissolved oxygen (mg/L) and temperature (degC) measurements.

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Project Information

CAREER: Mechanisms of bioturbation and ecosystem engineering by benthic infauna (Bioturbation and Ecosystem Engineering)

Coverage: Dauphin Island Sea Lab, Dauphin Island, AL

NSF Award Abstract:
Marine sediments are important habitats for abundant and diverse communities of organisms that are important as food sources for higher trophic levels, including commercially important species. Through burrowing, constructing tubes, and feeding on sediments, these animals modify their physical and chemical environments to such an extent that they are considered ecosystem engineers. Bioturbation, the mixing of sediments by animals, is important in regenerating nutrients and transporting pollutants and carbon bound to mineral grains. Despite its importance, our ability to predict bioturbation rates and patterns from the community structure is poor, largely due to a lack of understanding of the mechanisms by which animals mix sediments. This project builds on earlier work showing that animals extend burrows through muddy sediments by fracture to test the hypothesis that the mechanical properties of sediments that affect burrowing mechanics also affect sediment mixing. More broadly, this project examines the relative contributions of (i) the functional roles of the organisms in the community, (ii) the mechanical properties of sediments, and (iii) factors that might increase or decrease animal activity such as temperature and food availability to bioturbation rates. Burrowing animals modify the physical properties of sediments, and this project quantifies these changes and tests the hypothesis that these changes are ecologically important and affect community succession following a disturbance. In addition to this scientific broader impact, this project involves development of instrumentation to measure sediment properties and includes a substantial education plan to introduce graduate, undergraduate, and middle school students to the important role that technology plays in marine science.

Through burrowing and feeding activities, benthic infauna mix sediments and modify their physical environments. Bioturbation gates the burial of organic matter, enhances nutrient regeneration, and smears the paleontological and stratigraphic record. However, current understanding of the mechanisms by which infaunal activities mix sediments is insufficient to predict the impacts of changes in infaunal community structure on important sediment ecosystem functions driven by bioturbation. This project tests specific hypotheses relating infaunal communities, bioturbation, and geotechnical properties with the ultimate goal of understanding the dynamic changes and potential feedbacks between infauna and their physical environments. This project integrates field and lab experiments to assess the relative importance of infaunal community structure and activities to bioturbation rates. Additionally, this project builds on recent work showing that muddy sediments are elastic gels through which worms extend burrows by fracture to propose that geotechnical properties of sediments mediate bioturbation by governing the release of particles from the sediment matrix during burrow extension. Finite element modeling determines how the release of particles by fracture during burrowing depends on the fracture toughness (cohesion) and stiffness (compaction) of sediments and complements laboratory experiments characterizing the impact of geotechnical properties on burrowing behaviors. The proposed research also aims to determine whether impacts of infauna on geotechnical properties are ecologically important. Changes in infaunal communities and geotechnical properties following an experimental physical disturbance address the hypothesis that ecosystem engineering of bulk sediment properties facilitates succession.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1844910

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