In situ sediment characteristics 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/940989
Data Type: Other Field Results
Version: 1
Version Date: 2024-10-02

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 sediment characteristic information from three cores taken within 10m of the deployment location.

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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

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.

This dataset contains sediment characteristic information from three cores taken within 10m of the deployment location. The coring was done with 10 cm diameter polycarbonate cores pushed into the sediment to extract 8 cm depth of sediment. This file documents the calculation process for porosity and organic matter (LOI).

BCO-DMO Processing Description

* Added approximate sampling location (latitude & longitude) to dataset

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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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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Sediment Corer
Generic Instrument Description	A generic term for a coring device that allows for relatively undisturbed penetration of the sediment. Generally, core samplers consist of a core barrel (a hollow pipe or box) and a core cutter (or cutting head), located at the advancing end of the core barrel to facilitate the sampler's advancement into the sediment. Core catchers are commonly inserted into the cutting head to prevent sample loss during retrieval.

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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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