Datasets: Diverse metrics to assess the condition and provisioning of habitat of oyster reefs at four Reserves along the southeastern US Atlantic coast

This document provides detailed information about datasets that were generated through a 2023-2024 catalyst project titled *Evaluating Oyster Reefs as Habitat: Comparing the Utility of Ecological Metrics to Assess Ecosystem Function.* This [webpage](#) provides information about the project. The project was supported by the National Estuarine Research Reserve System (NERRS) Science Collaborative, which is funded by the National Oceanic and Atmospheric Administration. All Science Collaborative supported projects that collect new data adhere to federal data sharing and archiving requirements.

About the Associated Project

Project page: https://nerrssciencecollaborative.org/project/Kimball23
Grant Type: Catalyst
Focus Area(s): Ecosystem Service Valuation
Keyword(s): oyster reef, nekton, monitoring, Stable Isotopes Analysis, eDNA, acoustic imaging, disease assays

Reserve(s): North Inlet-Winyah Bay, SC, Guana Tolomato Matanzas, FL; North Carolina; North Inlet-Winyah Bay, SC; Sapelo Island, GA

Project Duration: October 2023 - September 2024
Grant Amount: $199,943.00
Project Contacts:
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Project Partners
North Carolina State University, Georgia Southern University, University of Georgia, University of South Carolina Beaufort

Project Description
Intertidal oyster reefs provide key habitat for a diverse and productive community of estuarine fauna, yet have declined drastically due to overfishing and disease outbreaks. With increased conservation and restoration efforts for intertidal oyster reefs, there is a need for more efficient ways of assessing oyster reefs as well as more holistic understandings of how oyster reefs function as habitats for other estuarine animals. However, assessing the ecosystem benefits of intertidal oyster reefs is challenging because the reefs occupy a dynamic tidal environment

characterized by highly turbid water. Established sampling techniques for assessing intertidal oyster reefs are labor intensive and therefore difficult to replicate at multiple sites, limiting the ecological information they can provide, especially at large scales. In contrast, emerging techniques prove promising for examining intertidal oyster reef community structure and ecosystem function.

Collaborating with four reserves and five universities, this project compared established sampling techniques for assessing intertidal oyster reefs with four emerging methods that each provide unique ecological information:

1. High-Resolution Acoustic Imaging
2. Stable Isotope Analysis
3. eDNA Metabarcoding
4. Oyster Disease Assays

The project team applied these methods alongside traditional methods for collection of free-swimming marine organisms via nets/traps at four reserves in the southeastern U.S. Afterwards, the team convened with their partners and intended users to examine the results and evaluate the potential utility and feasibility of incorporating the emerging methods into their research and monitoring programs. Users overwhelmingly expressed that expanded application of these emerging techniques could improve the assessment of the function of multiple different oyster reef types. The results of this Catalyst project, along with the collaborative network that project has built, bolsters technical capacity at reserves and state agencies to understand the function of critical habitats.

Overview of Datasets

Ecological metrics were collected on oyster reef habitat structure and associated fauna across four estuaries at Reserves along the southeastern US Atlantic coast in North Carolina (NC), South Carolina (NI-WB), Georgia (SI), and Florida (GTM). Field data collection occurred in fall 2023 (October - November) and focused on one reef type, natural fringing intertidal reefs, and examined multiple reefs (n = 3) in each Reserve.

At each reef, the biophysical structure of reefs was characterized, and traditional nekton direct capture techniques were paired with the four emerging techniques of acoustic imaging, stable isotope analyses, oyster disease assays, and eDNA metabarcoding.

All data will be archived and available through the NERRS Centralized Data Management Office (CDMO) after an embargo period of one year to allow for publishing in the scientific literature. In addition, following publication of manuscripts associated with this project, processed datasets will be archived in a Zenodo repository. Each dataset will have a permanent digital object identifier (DOI) which will be referenced in the associated paper.

A detailed dataset description is provided below.

Questions about these data can be directed to:
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About the Project Datasets

Dataset: Reef Ecological Metrics

The complete dataset includes (as one Excel file) includes a "**Metadata**" tab as well as individual tabs (n = 8) for reef information, reef characteristics, oyster lengths, percent cover, nekton direct capture, acoustic imaging, stable isotopes, and oyster disease (each described below).

- **Reef Information:** Information on each reef sampled including date sampled and GPS location.
- **Reef Characteristics**: Oyster reef biophysical characteristics (e.g., reef height, rugosity, oyster density, etc.).
- **Oyster Lengths**: Length data for up to 50 oysters collected from each sampling quadrat.
- **Percent Cover:** The percent cover of shell versus sand on each reef. Raw images (.jpg files) of oyster reef percent cover are in an associated folder (approximately n = 5 images per reef, thus n = 15 per Reserve; n = 59 total because one image was not collected at the middle marsh reef at NC).
- **Nekton Direct Capture:** Abundance and length information for all fish and crustaceans collected with nets and traps on each reef.
- **Acoustic Imaging:** Abundance (count) and length information for all individuals observed with an Adaptive Resolution Imaging Sonar (ARIS) on each reef. Raw imaging recordings (.aris files) are in an associated folder (approximately n = 1, 10-12 minute recording per reef, thus n = 3 per Reserve; n = 12 total).
- **Stable Isotopes:** Data on carbon, nitrogen, and sulfur stable isotopes collected for primary producers and oyster reef consumers in each Reserve.
- **Oyster Disease:** Data on the prevalence and intensity of MSX, Dermo, and macroparasites on each reef.

Data collection period:
October 2023 to November 2023

Geographic extent:
Field sampling occurred at four estuaries at Reserves along the southeastern US Atlantic coast in North Carolina (NC), South Carolina (North Inlet-Winyah Bay; NI-WB), Georgia (Sapelo Island; SI), and Florida (Guana Tolomato Matanzas; GTM). The full name and code for each reef in each Reserve and the date it was sampled is listed below along with the exact location (latitude and longitude coordinates).

| Reserve	Reef Name	Reef Code	Date Sampled	Latitude	Longitude
NC	Deep Creek	DC	11/27/2023	34.71006	-76.64518
NC	Middle Marsh	MM	11/28/2023	34.69283	-76.61182
NC	Treasure Island	TI	11/28/2023	34.70235	-76.63957
NI-WB	Clambank	CB	12/13/2023	33.329017	-79.192569
NI-WB	Bly Creek	BC	12/12/2023	33.341849	-79.17914
NI-WB	Old Man Creek	OM	12/12/2023	33.342086	-79.174756
SI	Duplin North	DN	10/26/2023	31.45476	-81.28214
SI	Duplin Mid	DM	10/27/2023	31.44261	-81.29115
SI	Duplin South	DS	10/27/2023	31.42068	-81.29694
GTM	Guana North	GN	10/30/2023	30.00816	-81.32605
GTM	Guana Mid	GM	10/29/2023	29.99186	-81.32065
GTM	Guana South	GS	10/29/2023	29.98687	-81.32498

File format:
OysterCatalyst_AllData.xlsx is an Excel file with multiple tabs. The "Percent Cover" and "Acoustic Imaging" tabs have raw imagery files associated with each of them that are each in associated folders. Percent cover files (n = 59) are in .jpg format and can be viewed using image viewing software (e.g., imageJ). Acoustic imaging recording files (n = 12) are in .aris format and must be viewed using ARIS Fish software from Sound Metrics Corp (http://www.soundmetrics.com/).

Data access and archival:
All data will be archived and available through the NERRS Centralized Data Management Office (CDMO) after an embargo period of one year to allow for publishing in the scientific literature. In addition, following publication of manuscripts associated with this project, processed datasets will be archived in a Zenodo repository. Each dataset will have a permanent digital object identifier (DOI) which will be referenced in the associated paper.

Maps and schematics for data collection:
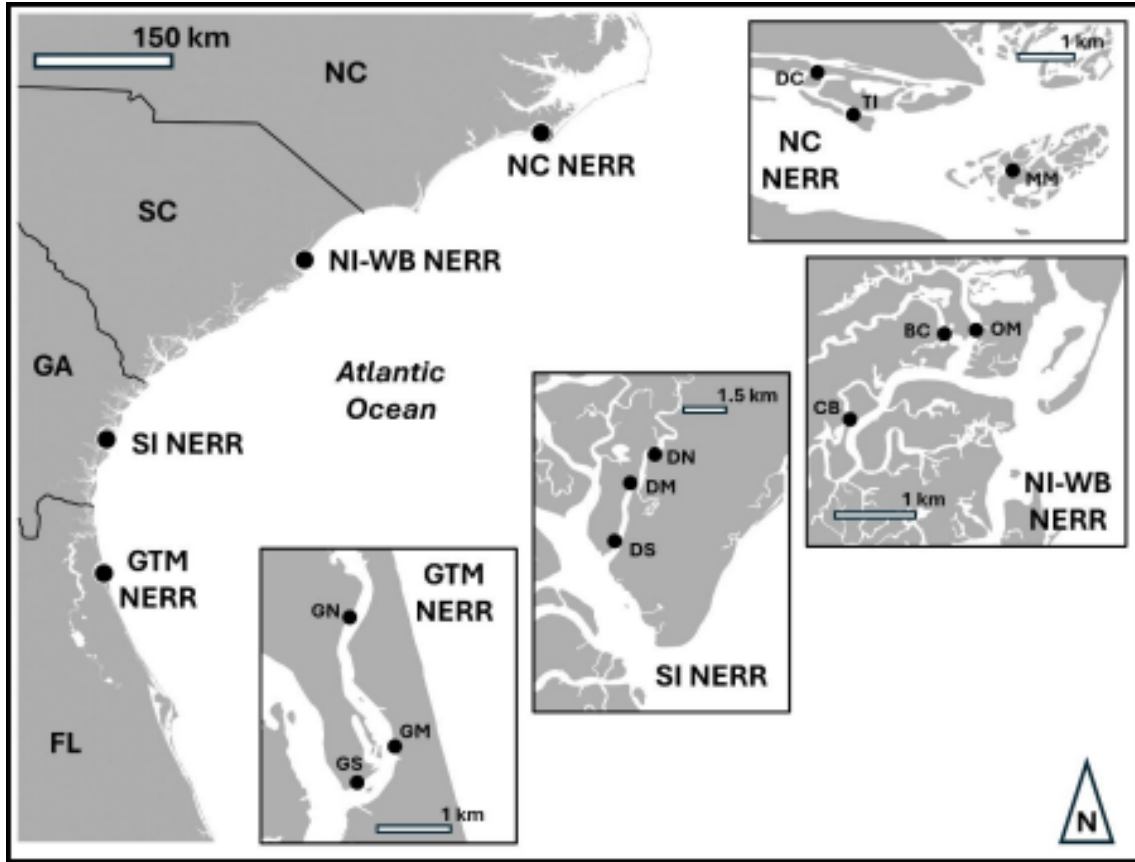
A map showing the locations of the fringing intertidal oyster reefs (black dots with reef code) examined in the North Carolina (NC), North Inlet-Winyah Bay (NI-WB), Sapelo Island (SI), and Guana Tolomato Matanzas (GTM) Reserves along the southeastern US Atlantic coast in North Carolina (NC), South Carolina (SC), Georgia (GA), and Florida (FL).