

Plan Overview

A Data Management Plan created using DMPTool

Title: Ecosystem Service Development in Restored Intertidal Oyster Reef Habitat in the Southern Indian River Lagoon and St Lucie Estuary

Creator: Emily Surmont

Affiliation: University of Florida (ufl.edu)

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Project abstract:

Oyster reefs provide vital ecosystem services including water quality improvement, shoreline protection, and fisheries habitat. Historically, the southern Indian River Lagoon (IRL) and St Lucie Estuary (SLE) supported expansive oyster reef habitat, however, diminished water quality led to a collapse of intertidal oyster reefs resulting in widespread reef restoration with the goal of restoring ecosystem services. However, many reef restoration projects are not assessed with quantifiable, science-based tools at timescales that capture ecosystem service recovery. Our research works to quantify ecosystem service development in human-made oyster reefs located in the southern IRL and SLE, Florida, USA. Oyster health and productivity, shoreline protection, and habitat provisioning will be analyzed in new (1-3 year old (yo)), young (4-8 yo), and mature (9-12 yo) restored reefs and compared to natural reefs. By evaluating oyster reef structural and functional attributes at different developmental stages, we will document the trajectory of ecosystem service recovery in aging reef restoration projects. The products of this project include a Quick Assessment Monitoring Guide published through EDIS of UF/IFAS, creation of a local data repository for oyster reef restoration monitoring in southern IRL and SLE, and at least one publication of a peer-reviewed journal article. This project is structured with an open science framework, employing open data management structure as much as possible.

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Ecosystem Service Development in Restored Intertidal Oyster Reef Habitat in the Southern Indian River Lagoon and St Lucie Estuary

Data collected is organized into 3 overarching categories; oyster recruitment and development (a), shoreline protection and sediment accumulation (b), and faunal utilization and benthic diversity (c).

a) Oyster recruitment and development data includes adult density of oysters, spat recruitment, Condition Index, and prevalence and intensity of Dermo. Adult density of oysters includes observational data taken from a total of 72 quadrats (36 quadrats per summer over 2 summer samplings (2023, 2024)). Spat recruitment includes oyster shell taken back to the lab for processing from a total of 288 spat collectors (144 spat collectors per summer over 2 summer samplings (2023, 2024)). Condition Index includes 120 oyster samples taken back to the lab for processing (samples taken during one summer sampling event (2024)). Prevalence and intensity of Dermo includes 60 oyster samples taken back to the lab for processing (samples taken during one summer sampling (2024)). All oyster recruitment and development data will be manually input into spreadsheets and saved in a nonproprietary file format (csv).

b) Shoreline protection and sediment accumulation includes wave gauge measurements, reef size, rugosity measurements, and sediment plates and cores. Wave gauge measurements include observational data from 36 wave gauges (samples taken during one 2-week summer sampling (2024)). Reef size includes observational data collected via RTK GPS totaling 24 shapefiles (GPS data collected for 12 reefs over 2 summer sampling seasons (2023, 2024)). Rugosity measurements include observational data from 72 measurements (36 measurements per summer over two summer samplings (2023, 2024)). Sediment plates and cores include 288 total measurements (144 sediment cores and 144 sediment plate measurements over one summer sampling season (2024)). All data, whether processed in the lab, offloaded in the lab, or collected in the field will be saved in nonproprietary file formats (csv or kml appropriately).

c) Faunal utilization and benthic diversity includes data from habitat trays. 36 habitat trays will be processed in the field over one summer sampling (2024). Observational data will be manually input into spreadsheets and saved in nonproprietary file formats (csv).

Water quality data (salinity and temperature) will be provided by Indian River Lagoon Observatory Network (IRLON) (continuous stations). Additional water quality data may be sourced from Florida Oceanographic Society (FOS) (grab samples), South Florida Water Management District (SFWMD) (continuous stations and grab samples), and US Geological Survey (USGS) (continuous stations and grab samples). Data from IRLON can be found at irlon.org online data repository, and data from SFWMD and USGS can be found at DBHYDRO online data repository.

All data will be stored in nonproprietary formats to allow open access. List of non-proprietary formats are outlined by University of Maryland Baltimore County (2023). Folders and files will be named according to guidelines provided in Hart et al. (2016) using ISO 8601 standard dates in dataset names for version control (DataType-SiteID-ResearcherInitials-YYYYMMDD). Quality assurance processes include replicate samples and data entry validation. GitHub will be utilized to archive all source code, data processing, and data analysis protocols to create a living repository and permanent record of data, QA/QC protocols, and analysis procedures.

Metadata based on Michener et al. (1997) will accompany each dataset throughout all analysis and made available as nonproprietary files.

Any data obtained from other researchers and organizations/institutions will be cited appropriately according to

methods outlined by the Data Citation Synthesis Group (2014).

This project is a collaboration between Anna Braswell from University of Florida (UF), Lorae Simpson from Florida Oceanographic Society (FOS), and Emily Surmont from Indian River Lagoon Aquatic Preserves (IRLAP). All data created by this project can be reused by others as long as credit is given to the creators. Water quality data from IRLON and DBHydro will be cited appropriately to ensure credit is given to creators. If data is obtained from any other organizations or researchers, they will be cited appropriately as well.

Physical samples include oyster shells for spat recruitment, oysters for Condition Index, oysters for prevalence and intensity of Dermo, and sediment samples. All physical samples will be properly labeled (Hart et al. 2016) and stored for transport and lab storage (SampleType-SiteID-ResearcherInitials-YYYYMMDD). Replicate samples are collected from each site according to experimental design. Samples will be stored for at least 5-10 years at FOS, IRLAP, and UF labs.

Data collected via instruments include wave gauge data, reef size, and water quality data. Data will be offloaded to researcher computer hard drive. Data will be copied to two secure locations by researcher; Google Drive and IRLAP Drive.

Data recorded on waterproof paper include adult density of oysters, rugosity measurements, measurements of sediment plates, and biobox fauna. Datasheets will be scanned to computer and saved as PDFs to computer hard drive and copies will be saved to Google Drive and IRLAP Drive. Data will be put into spreadsheets, and spreadsheets will also be saved to computer hard drive, Google Drive and IRLAP Drive.

Data should be backed up each time new data is added. Manual backups are performed by saving copies of all files to Google Drive and IRLAP Drive from computer hard drive. Backups should be checked on a monthly basis when data is not being used. During data entry and analysis, backups should be checked weekly. Each researcher is responsible for performing backups. As the researcher in charge of the DMP, Emily Surmont will ensure all project data is saved to her computer hard drive, the Google Drive, and IRLAP Drive weekly when being used and monthly when not being used during the duration of the project.

Copies of data are stored on computer hard drive, IRLAP cloud storage, and Google Drive cloud storage. Both IRLAP Drive and Google Drive are cloud based backups. All file types will be saved in nonproprietary formats.

Physical samples can be accessed by IRLAP, FOS, and UF staff where stored. IRLAP Drive can be accessed by IRLAP staff and Florida Department of Environmental Protection (DEP) IT. Google Drive can be accessed by Emily Surmont, Anna Braswell, and Lorae Simpson. IRLAP, FOS, UF, and DEP IT can be contacted via email and phone.

Project data (from all 3 categories) should be stored for long term to encourage collaboration and creation of an inventory of oyster reef restoration monitoring data in the SLE and southern IRL. This will allow for researchers from different institutions to better compare results and encourage long term monitoring of restoration projects in the area.

A local online data repository will be hosted on Anna Braswell's lab website and on a shared google drive to encourage local comparison of restored reef data. Data storage costs have been accounted for and covered by the IRLNEP grant award. Project data will be published to a longer term well-known repository (e.g. Harvard Dataverse) with a DOI link once QA/QC is complete and a manuscript has been accepted by academic journal. As previously mentioned, code workflow will be archived to GitHub to allow for reproducibility, and metadata will

accompany all data.

Publication of data in local repository (Anna Braswell lab website) and IRLNEP GIS map is expected September 2025. Storage in the local data repository and IRLNEP GIS map will allow for sharing of all data collected in the project with researchers in the region. All researchers using the local repository will be encouraged to include metadata according to Michener et al. (1997) and file names according to Hart et al. (2016). Data will be shared in a longer term more well-known repository (e.g. Harvard Dataverse) with DOI upon publication in an academic journal. Metadata should accompany all data.

There are no restrictions on data sharing required. Others are free to reuse data so long as credit is given to the creator.

Emily Surmont is responsible for implementing the DMP, and ensuring it is reviewed and implemented by all researchers. She will ensure all project data is saved to her computer hard drive, the Google Drive, and IRLAP Drive and assist Anna Braswell is assuring that all cleaned data and metadata are stored in data local repository.

Lorae Simpson is responsible for oyster recruitment and development data collection during summer 2024 for 9 restored reef sites. This data includes adult density of oysters, spat recruitment, Condition Index, and prevalence and intensity of Dermo. Dr. Simpson is responsible for data capture, metadata production, data quality, storage and backup, data archiving and data sharing for this data.

Anna Braswell is responsible for shoreline protection and sediment accumulation data collection during summer 2024 for 12 reef sites. This data includes wave gauge measurements, reef size, rugosity measurements, and sediment plates and cores. Dr. Braswell is responsible for data capture, metadata production, data quality, storage and backup, data archiving and data sharing for this data. Additionally, Anna Braswell is responsible for hosting the local data repository.

Emily Surmont is responsible for faunal utilization and benthic diversity data collection during summer 2024. This is data collected from habitat trays. Emily Surmont is also responsible for data collection during summer 2023 including adult density of oysters, spat recruitment, reef size, and rugosity measurements, as well as oyster recruitment and development data for 3 natural reef sites during summer 2024 sampling. She will be responsible for data capture, metadata production, data quality, storage and backup, data archiving and data sharing for this data.

Existing knowledge and resources from FOS, UF, and IRLAP will be pooled, as well as funding from IRLNEP to accomplish all data management tasks listed.

Planned Research Outputs

Text - "Quick Assessment Monitoring Guide"

The guide will contain detailed protocols for methods used to determine ecosystem service recovery, a benthic invertebrate identification appendix, a recommended timeline and approach for monitoring, and how to analyze results. The guide will be published through EDIS (electronic data information source) of UF/IFAS.

Interactive resource - "Data repository"

To encourage data sharing, we will set up a website where collected data can be deposited, creating an inventory of aging restoration projects across the IRL and SLE. The repository will be hosted on Anna Braswell's laboratory website (<https://braswelllab.weebly.com/>) and data will be saved to a shared Google Drive.

Planned research output details

| Title | Type | Anticipated release date | Initial access level | Intended repository(ies) | Anticipated file size | License | Metadata standard(s) | May contain sensitive data? | May contain PII? |
|-----------------------------------|----------------------|--------------------------|----------------------|--------------------------|-----------------------|------------------------------------------------|------------------------------------|-----------------------------|------------------|
| Quick Assessment Monitoring Guide | Text | 2025-09-29 | Open | None specified | | Creative Commons Attribution 4.0 International | EML (Ecological Metadata Language) | No | No |
| Data repository | Interactive resource | 2024-09-14 | Open | None specified | | Creative Commons Attribution 4.0 International | EML (Ecological Metadata Language) | No | No |