Cross-Coast Comparison: How Do Intertidal Oyster Reefs in Apalachicola Bay Compare to Live, Dead, and Restored Reefs in Mosquito Lagoon, FL?

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Introduction:

•Oyster reefs function as vital biogeochemical hotspots, carrying out processes that are essential to life such as carbon, nitrogen, and phosphorus cycling and sequestration (Chambers et al. 2017).

•Factors ranging from overharvesting to displacement by boat wakes and diseases have contributed to the rapid decline of oyster reefs globally (Jackson et al. 2001; Wall et al. 2005).

•Beginning around 2010 Apalachicola Bay oysters experienced a catastrophic decline followed by a 5-year closure of the fishery by the state of Florida beginning in 2020 (Radabaugh et al. 2019).

•By measuring the sedimentary record of organic matter and nutrients, we hope to identify a historic record of the productivity of these oyster reefs as biogeochemical hotspots and estimate their condition at different points in time.

•This creates an opportunity to develop a long-term understanding of the effects of human activity on these organisms that are a vital piece of the ecology of this region.

Methodology:

Collection:

•Removed top 6 cm of large shell and 55cm core taken by driving into the reef.
•Sectioned into 1cm depth intervals; shell fragments >2cm were removed; dried for 72 hours and weighed to calculate bulk density (g cm^{-3}) for each interval.

Grain Size Analysis:

•Each section was weighed and passed through a 2mm sieve and weighed to determine the percentage of large shell fragments.

Composition Analysis:

•Total amounts of Carbon (**TC**) and Nitrogen (**TN**) present in each interval were determined via analysis on an Elementar Vario Micro Cube CHNS Analyzer (Elementar Americas Inc., Mount Laurel, NJ).

•Organic Matter (**OM**) was determined via loss-on-ignition (LOI), 1g of each section was combusted at 550 ˚C for 4 hours. Calcium Carbonate ($CaCO_3$) was determined by repeating this process at 990 ˚C for 1.5 hours.

•Total amount of Phosphorus (**TP**) was determined via a three-step process. After 0.4g of each interval underwent LOI, samples were acidified with 6.0M HCL, boiled, filtered, and diluted.

•Samples were then processed on a Smart Chem 200 Discrete Analyzer (Mandel Scientific Company Inc., Guelph, Ontario, ON N1G 4N4, Canada).

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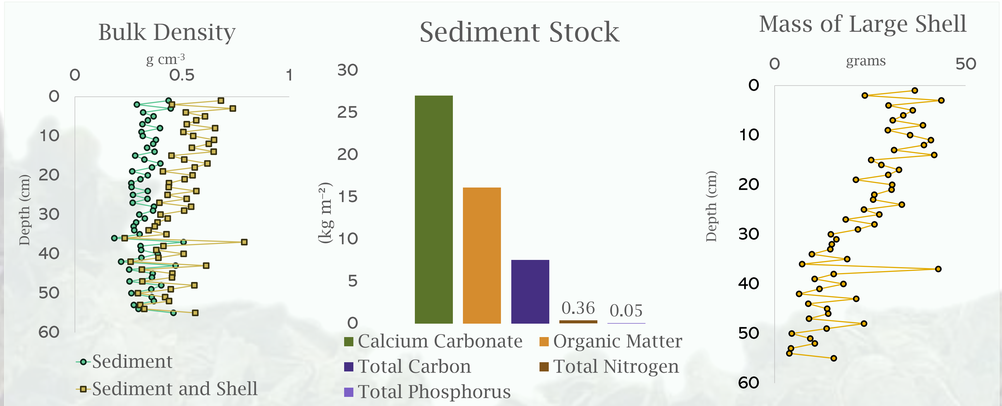
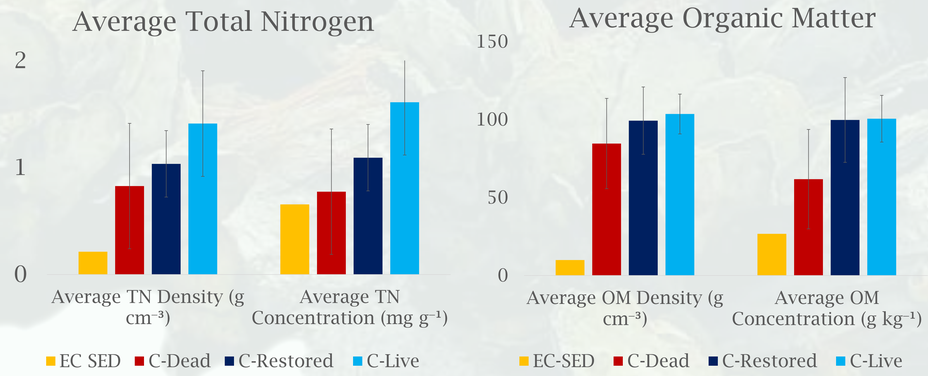
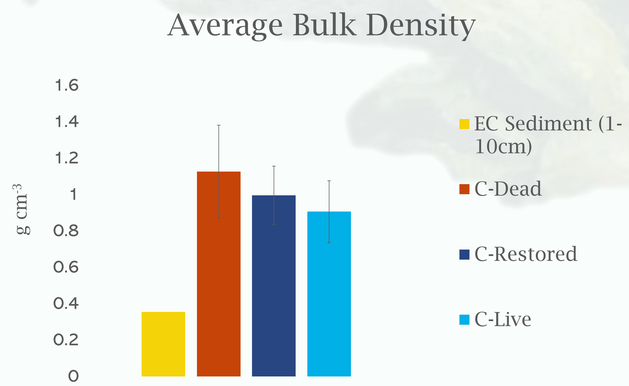
Preliminary Results:

Core Composition:



Comparisons: East Cove vs Mosquito Lagoon (Chambers et al. 2017):





Preliminary Conclusions:

- Trend in bulk density of sediment and large shell fragments, suggest that the amount of shell decreases at greater depths which is supported by the decreasing mass of large shell fragments as depth increases.
- These results can be compared with the findings of similar studies at other sites in varying conditions, such as Chambers et al. 2017, to determine the effects of poor overall reef health on accretion, nutrient sequestration, and organic matter sequestration.
- Intertidal oyster reef sediments at East Cove have a similar nitrogen concentration to dead reefs in other areas, indicating that there is a need for restoration efforts at this site.
- East Cove bulk density is only 29% of the dead reef bulk density, however further interpretation requires further sampling.
- Further investigations can use similar methods to determine if these patterns are equivalent in different areas of an individual reef and across multiple reefs within a single site.

References:

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