Organic Matter Content and Grain Size Analysis in Seagrass Sediments

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Introduction

- Seagrass meadows provide numerous ecosystem services and recently have been emphasized for their importance in sequestering and storing carbon in their sediments for thousands of years (Greiner et al. 2013).
- Meadows attenuate tidal currents and wave energy promoting the deposition of suspended sediment (Reidenbach and Thomas, 2018). Particles trapped and deposited are often high in organic matter (OM) (Greiner et al. 2013).
- In the early 1930s, the coastal bay area of Virginia saw a local extinction of seagrasses due to disease and storm disturbance (McGlathery et al., 2012).
- In the late 1990s there was a large-scale effort to restore these seagrass sediments. Efforts have resulted in a recovery of seagrass shoot density within the bay (McGlathery et al., 2012).

Methods

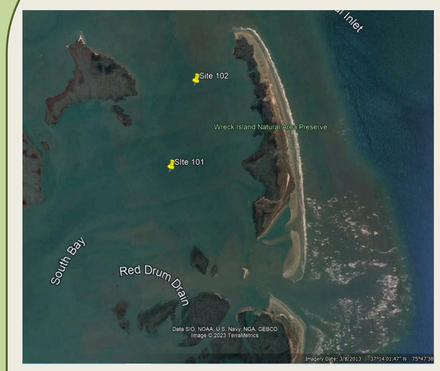

Figure 1. Sediment Core Sample locations in the South Bay, Virginia

- Cores were collected in June of 2022, from South Bay within the Virginia Coast (Fig, 1).
- Subsamples were extracted for particle size analysis and carbon content
- Comparison maps of seagrass density were created for 2006, 2010 and 2021(Fig, 4) using the VIMS interactive seagrass map (https://www.vims.edu/research/units/programs/sav/access/maps/index.php) to determine how increasing seagrass meadow acreage has affected sediment particle size and organic matter percentage.

Results/ Discussion

- Cores showed a fining of sediments in the upper 20 cm, coarsest material was observed from 20-30 cm (Fig, 2).
- Sediment cores from all sites where found to be fine sands or smaller classes (< 250 μm). Fining of grain size below <63 μm (very fine sand and silt) in the upper centimeters was seen possibly due to meadow development (McGlathery et al., 2012).

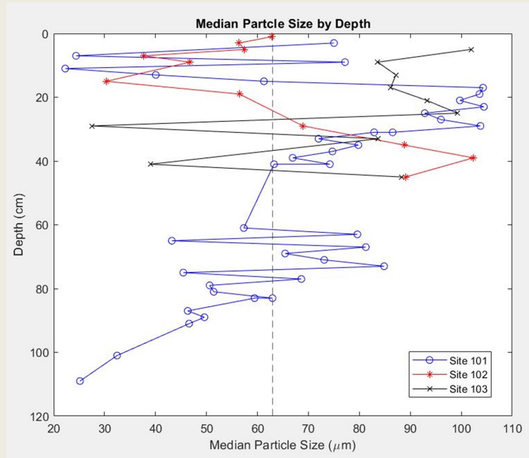

Figure 2. Median Particle Size by Depth. Cores showed fining of sediment within the top centimeters with an increase in particle size with depth. Line indicates boundary of fine sand and silt (<63 μm)

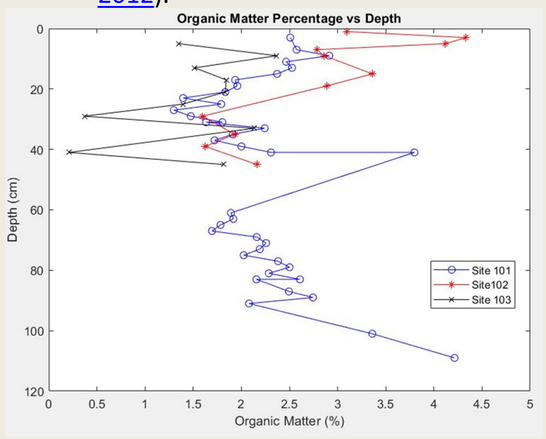

Figure 3. Organic Matter Content (%) with depth. Cores showed greater OM% in the top centimeters with a decrease with depth.

- For site 101 OM% was greatest at depth (110 cm), a decrease in OM% was seen from 60-90 cm, with percentages around 2.5-3% in the top 20 cm (Fig, 3).
- Site 102 and 103 showed higher OM% in top 20 cm that decreased with depth (Fig 3).
- Organic matter generally is greatest in shallow sediments with a decrease with depth (Greiner et al., 2013).

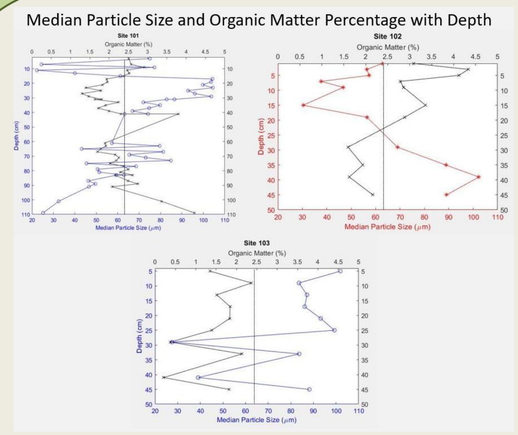

Figure 4. Median Particle Size and Organic Matter with Depth. Cores showed that finer sediments held more OM than coarser sediments. Line indicates boundary of fine sand and silt (<63 μm)

- Finer sediments showed more OM% in sites 101 and 102 (Fig, 4), site 103 did not exhibit this behavior (Fig, 4).
- Previous work has shown that sediment will be affected by seagrass restoration in the top few centimeters and unaffected below 10 centimeters (Greiner et al., 2013).
- Variations in particle size and organic matter percentage with depth may be due to spatial and seasonal differences observed in seagrass meadows (Zhu et al., 2022).

Figure 5. Seagrass Density Comparison Maps. 2006 (left) showed the lowest seagrass density. Restoration efforts have greatly increased seagrass density. 2010 (middle). 2021 (right).

- Comparison of seagrass densities in the years of 2006, 2010 and 2021 showed a significant increase (Fig 5) .
- There is no observed difference in OM % between vegetated and no vegetated areas 1-2 years after seeding and an increasing trend in OM content after 4-7 years and a significant increase after 9 years (McGlathery et al., 2012).
- Future work should focus on resolving spatial erosion and deposition patterns within seagrass meadows (Zhu et al., 2022).

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