VARIATION IN RECENT MARSH ACCRETION ALONG DELAWARE AND BARNEGAT BAYS.

Kirk Raper[1], Tracy Elsey-Quirk[1,4], David Velinsky[1], Danielle Kreeger[2], Angela Padeletti[2], and Martha Maxwell-Doyle[3]

[1]Patrick Center for Environmental Research, The Academy of Natural Sciences of Drexel University, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103

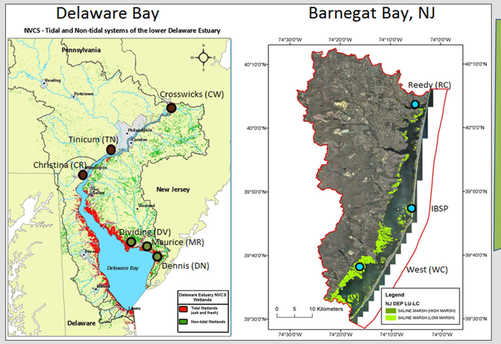
[2]Partnership for the Delaware Estuary, 110 South Poplar Street, Suite 202, Wilmington, DE 19801

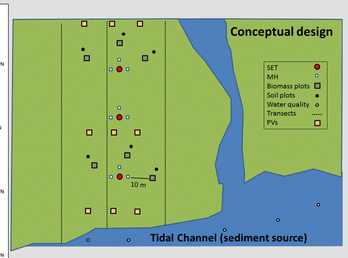
[3]Barnegat Bay Partnership, Ocean County College, College Drive, Toms River, NJ 08754

[4]Current: Ocean and Coastal Sci, Louisiana State University, Baton Rouge, LA

Overview

Tidal wetlands provide valuable ecosystem services including nutrient and carbon burial. The rate of nutrient and carbon burial is related to the rate at which both mineral and organic material accumulates on the marsh surface. As part of a larger regional wetland monitoring program in marshes ranging from saline lagoonal to urban tidal freshwater, short-term marsh surface accretion has been measured along with potential influential factors that include elevation, % organic matter (OM), and total suspended solids (TSS). Spatial variation in surface accretion rates were high, as predicted, with rates that ranged from 0 ± 1 mm/yr in a salt marsh on a barrier island in Barnegat Bay, NJ to 12 ± 2 mm/yr in a tidal freshwater wetland in the upper Delaware Estuary. Tidal freshwater wetlands had higher accretion rates than saline marshes. Many factors influenced this variation including geomorphic setting, elevation, and sediment availability.

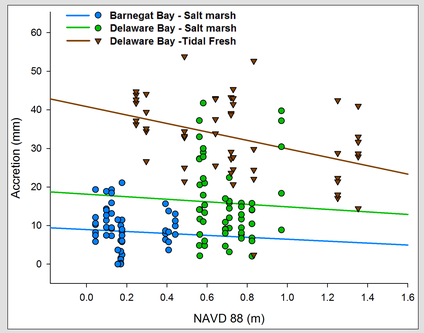




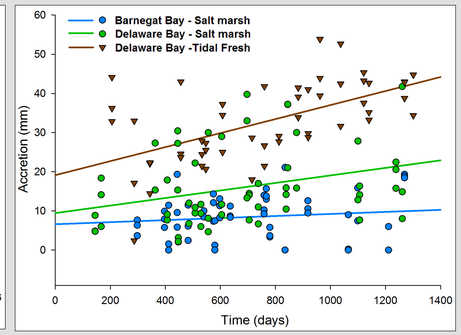
Methods

Surface accretion is a measurement of the organic and mineral vertical accumulations over time. At three points from the marsh interior to the marsh edge, three replicate marker horizon plots were installed using feldspar on the surface of the marsh at each site (9 total plots per site). At least twice per year accretion was determined by carefully removing a section and measuring the distance from the top of the feldspar to the marsh surface on three of four sides. The percent organic and inorganic matter was determined in the lab by mass loss on ignition after 4 hours in a furnace at 500° C.

Results

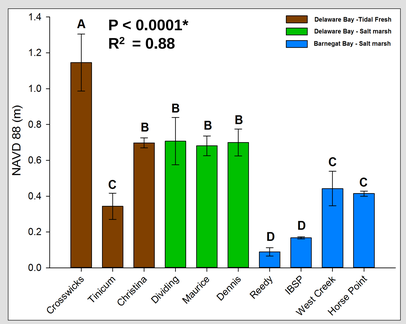


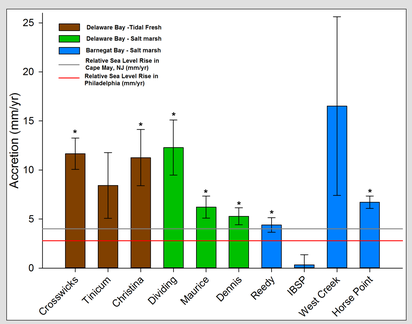
Accretion had an inverse relationship with elevation. This relationship was significant only for the tidal freshwater setting ($P = 0.0045$, $R^2 = 0.15$).

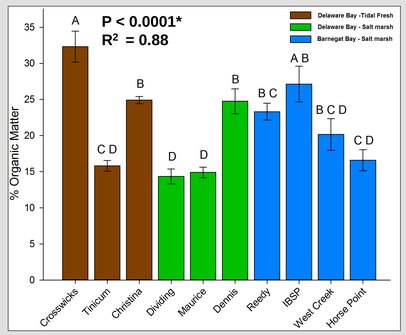


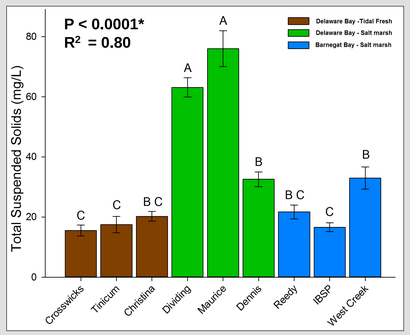
Accretion over time varied among geomorphic setting and was significant for tidal freshwater and salt marshes in the Delaware Bay.

*Note. For the above figures and analyses, West Creek was excluded due to high accretion from OMWM.

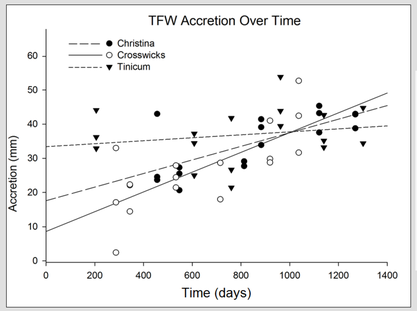






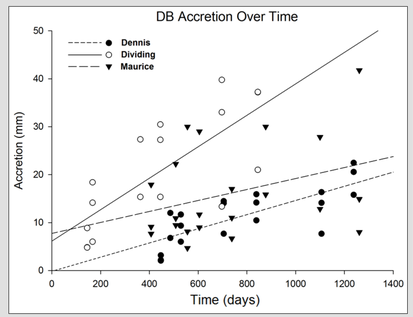


Accretion rates varied across sites, but had no significant relationships with % OM or TSS. There were significant differences in elevation, % OM, and TSS across sites, which are indicated in the above figures by letters from Tukey Post Hoc Tests.



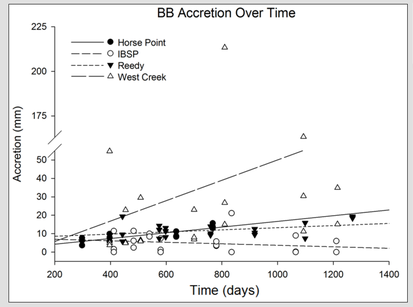
P < 0.0001*
R^2 = 0.33

Tidal freshwater wetlands had significantly greater accretion over time than in other settings. Crosswicks and Christina had significant accumulations of 12 ± 2 and 11 ± 3 mm/yr, respectively. Accretion at Tinicum was not statistically significant, but accreted 8 ± 3 mm/yr.



P = 0.0188*
R^2 = 0.09

Delaware Bay salt marshes sites all had significant accretion over time, although lower on average than tidal freshwater marshes. Moving down bay, Dividing Creek had accumulations of 12 ± 3 mm/yr, Maurice River had 6 ± 1 mm/yr, and Dennis Creek had 5 ± 1 mm/yr.



P = 0.1917
R^2 = 0.01

Barnegat Bay salt marshes overall did not have significant accretion over time. However, two sites, Reedy Creek and Horse Point, had significant accumulations of 4 ± 1 mm/yr and 7 ± 1 mm/yr, respectively. IBSP and West Creek were not significant with 0 ± 1 mm/yr and 17 ± 9 mm/yr, respectively.

Conclusions

Most wetlands in this study are showing significant accretion over time, with higher rates in tidal freshwater sites. Accretion was higher in lower elevations, particularly in freshwater sites. Barnegat Bay had the lowest accretion rates, which could indicate higher vulnerability to sea level rise. TSS and % OM were not significant predictors for accretion. However, some trends may not be apparent in these first few years of data collection. With a larger dataset over time, we anticipate increased understanding of the factors influencing accretion.

Future analyses of accretion and elevation change will include relative position to mean high water, biomass productivity, and water and soil chemistry.

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