SUBAQUEOUS SOILS AND SUBTIDAL WETLANDS IN RHODE ISLAND

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ABSTRACT OF THESIS

Shallow subtidal habitats occur adjacent to shorelines of estuaries and are a vital component of the coastal ecosystem. Substrates in these habitats function as soil and have recently been recognized as soil instead of sediment. These subaqueous soils develop below the intertidal zone to water depths of <2.5 m at low tide in low-energy estuarine environments. Subaqueous soils support a diverse floral and faunal assemblage including beds of submerged aquatic vegetation (SAV) dominated by *Zostera marina.* Traditionally, shallow subtidal systems have not been considered wetlands. In this study subtidal wetlands, subaqueous soils, and eelgrass distributions were examined in a Rhode Island coastal lagoon. The goals of my research were: 1) to demonstrate that shallow subtidal estuarine areas should be considered wetlands, 2) to evaluate the usefulness of elevation and bathymetric data to create topographic base maps for subaqueous soil inventories; 3) to inventory and delineate subaqueous soil types based on landscape and soil characteristics; and 4) to relate subaqueous soil distributions and properties to eelgrass distribution patterns. I found that shallow subtidal habitats have hydric soils, hydrophytic vegetation, and wetland hydrology, and that these areas have similar functions and values to traditional wetlands. Therefore, shallow subtidal habitats should be officially considered part of the coastal wetland zone in the U.S. I propose new estuarine and marine subsystems within the U.S. Fish and Wildlife Service classification that would differentiate subtidal wetlands from deep subtidal habitats. I created a contour map of a 116-ha, subtidal area of Ninigret Pond in southern Rhode Island using traditional transect-elevation survey methods. This map was compared to maps created using bathymetric data collected by boat (National Oceanic and Atmospheric Administration, NOAA) and by helicopter (Army Corp of Engineers, ACOE). The NOAA map compared favorably to the elevation map I created, and either one can be used as a base map for subaqueous soil surveys. The ACOE data proved inaccurate for Ninigret Pond. Fourteen subaqueous soil map units were delineated. Soils were identified within eight subgroup and six great group classifications. Overall, there was a strong relationship between soil map units and subgroup classifications. Common great group classifications included Fluvaquents, Hydraquents, Endoaquents, and Sulfaquents. High eelgrass cover was related to soil landscapes with increasing levels of acid volatile sulfides (AVS $\geq$ 80 ug/g), salinity ($\geq$ 34 ppt), clay ($\geq$ 8%), silt ($\geq$ 21%), and total nitrogen (TN $\geq$ 0.15 %). A predictive sequential linear regression model indicated that eelgrass distribution could mostly be explained by AVS, TN, and organic carbon ($R^2 = 0.85$). Four subaqueous soil mapping units had particularly high eelgrass cover (>60 %): Barrier Cove, Shallow Lagoon Bottom, Flood-tidal Delta Slope, and Lagoon Bottom, while nine units had little or no eelgrass, indicating a strong relationship between soil-mapping units and eelgrass cover. Ecological parameters such as water quality, water depth, and surface soil texture and composition will most likely be constant within each soil-mapping unit. Therefore, efforts to restore eelgrass should be concentrated within a single soil-mapping unit. My study suggests that coastal managers should recognize shallow subtidal habitats as wetlands, and begin to use subaqueous soil inventories to aid in the restoration and conservation of these complicated and stressed estuarine habitats.