

MS Thesis Defense

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Title: Salt-Marsh Change in a Barrier-Island System: Parramore and Cedar Island, VA, from 1957 to 2012

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ABSTRACT

Salt marshes can accrete and maintain their elevation with rises in sea level up to a certain rate before becoming inundated and converting to open water. This study examined the backbarrier salt marshes of the Parramore and Cedar barrier-island system along Virginia's Eastern Shore of the southern Delmarva Peninsula to determine whether they are maintaining their areal extent in the face of increasing relative sea-level rise. Based on NOAA tide gauge stations, relative sea-level rise rates along the Delmarva Peninsula range from 3.60 mm/yr for 1951 to 2014 at Kiptopeke, VA to 5.73 mm/yr for 1975 to 2014 at the Ocean City Inlet, MD to 6.02 mm/yr for 1975 to 2014 at the Chesapeake Bay Bridge Tunnel, VA. The Kiptopeke, VA tide gauge rates may be subdued by geological complexities of the underlying Chesapeake Bay Impact Crater, making the relative sea-level rise rate lower than neighboring stations. The rate of salt-marsh change was determined using historical aerial photographs from 1957, 1994, and 2012. The rate of total salt-marsh loss was 9.3 ha yr⁻¹ (0.20% yr⁻¹) from 1957 to 1994 and increased to 13.6 ha yr⁻¹ (0.32% yr⁻¹) from 1994 to 2012. The increase in the marsh loss rate is attributed to the barrier fringe marsh, primarily along the landward edge of Cedar Island, VA because of overwash processes and landward island rollover. The barrier fringe marsh loss rate increased from 0.35% yr⁻¹ (1957-1994) to 0.95% yr⁻¹ (1994-2012). The other two types of marsh, island marsh and mainland marsh, had near constant marsh loss rates over the two incremental time

periods, $0.17\% \text{ yr}^{-1}$ and $0.16\% \text{ yr}^{-1}$, respectively. The short-term barrier fringe marsh loss rate ($0.95\% \text{ yr}^{-1}$) is similar to one sample area from a previous study in the region (Kastler and Wiberg, 1996) at $0.93\% \text{ yr}^{-1}$. However, the same study estimated an island marsh loss rate of $0.27\% \text{ yr}^{-1}$, higher than the loss rate found in this study ($0.17\% \text{ yr}^{-1}$). For the period 1852-1962, Knowlton (1971) found an island marsh loss rate of $0.16\% \text{ yr}^{-1}$, similar to this study's island marsh loss rate ($0.17\% \text{ yr}^{-1}$) from 1957 to 2012. Therefore, the island marsh loss rate is not increasing over time. The stability in marsh loss rates in two out of the three marsh types during a period of increasing sea-level rise does not support the three-stage runaway transgression model for mixed-energy barrier islands as proposed by FitzGerald et al. (2006) at this time.