

## HISTORICAL SHORELINE EROSION: DEADMAN'S ISLAND

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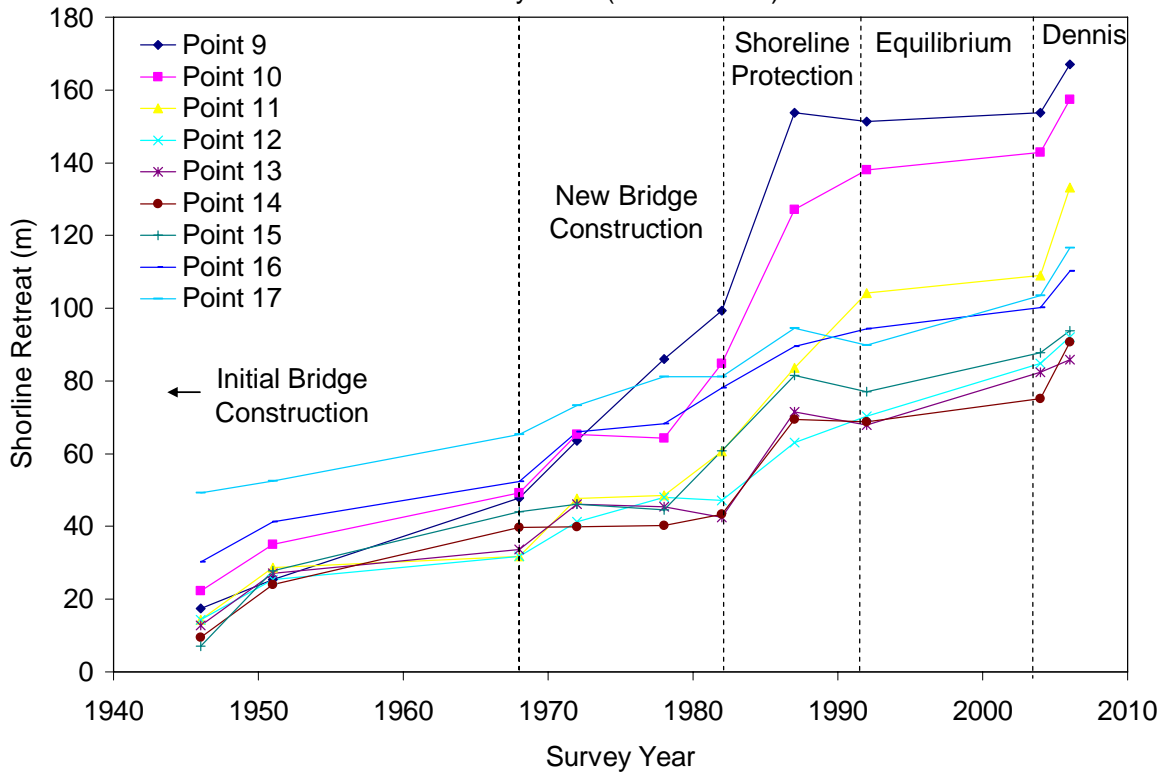
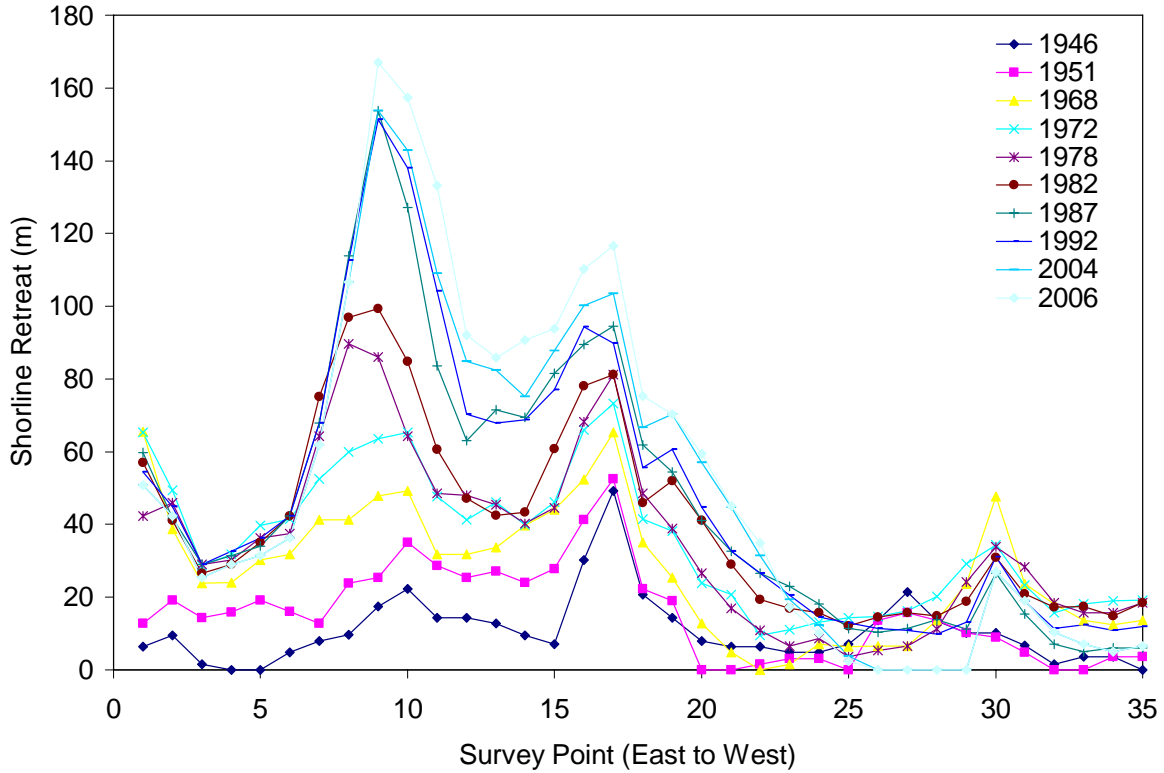
This short summary does not provide a detailed description of shoreline change for each year in which an aerial photograph is available (as completed previously by Morgan), but is in an update and a new interpretation from that earlier study.

**ANALYSIS OF SHORELINE RETREAT:** Historical shorelines from 1940 through 2006 are shown in the satellite photograph below. Since 1940, both the northern and the western shorelines have retreated, with little to no change along the southwestern section of the island.



**Figure 1.** Satellite photograph of Deadman's Island (from 2004) showing historical and modern (2006) shorelines based on the analysis of aerial photographs.

The amount of shoreline retreat for 35 equally-spaced points (from east to west) is shown in the following graph. Significant erosion (of 49 m) was first evident at the (northwestern) tip of the island, while the average shoreline loss was only 10 m. While this point continued to erode by a further 67 m through 2006 the rate of change was only  $1.2 \text{ m yr}^{-1}$ . In comparison, the northeastern extent of the island exhibited relatively little erosion between 1940 and 1946 ( $17.5 \text{ m}$  or  $3 \text{ m yr}^{-1}$ ), the erosion continued at an average rate of  $2.7 \text{ m yr}^{-1}$ . However, the erosion was constant between 1940 and 2006. Between 1940 and 1982, it was  $2.3 \text{ m yr}^{-1}$  but increased dramatically to  $11 \text{ m yr}^{-1}$  between 1982 and 1987. After 1987, little shoreline change was observed at this location. This increased in erosion between 1982 and 1987 is consistent for all survey points (1-17) along the northern part of the spit.



**Figure 2.** Alongshore variation in shoreline retreat (from 1940) at 35 equally spaced survey points starting at the bluffs immediately east of the site. Also shown (b) is the shoreline retreat by survey year for the northern shoreline (points 9-17).

**DISCUSSION:** Erosion results from an imbalance in the sediment budget- more sediment is transported out of a control volume by waves and currents then is brought in from either cliff erosion or alongshore and cross-shore sediment transport. While Morgan suggests that the sediment supply for Deadman's Island is from the bluffs immediately east of the site, the large offshore shoal and the results of the statistical analysis suggests that sediment is supplied along the entire length of the shoreline from Naval Live Oaks (Butcherpen Cove) to the bluffs immediately east of the site. Sediment is eroded from these sites in response to continuing sea-level rise since the last low-stand and in response to storm activity, and sediment is transported alongshore (to the west) in response to alongshore currents during frontal storms. As the source of sediment is limited, Deadman's Island will erode. An examination of the sedimentary structures along the northern part of the island suggests that part of the shoreline retreat is the result of sediment overwash and island rollover during large storms (see Figure 3) with north winds. Erosion is also evident following small frontal storms when north winds generate sizeable "chop" over Escambia Bay (see Figure 4).



**Figure 4.** Shoreline erosion following a small frontal storm in October 2005.



**Figure 3.** Sedimentary structures (near survey point 9) along the northern shoreline of Deadman's Island. The upper band of dark sediment is a response to Hurricane Dennis, while the bottom layer is a response to either Hurricane Opal or Erin.

Based on the analysis of shoreline retreat, there are 3 changes to the updrift supply of sediment that could be responsible for the erosion of Deadman's Island. The initial erosion of the site may be a response to the initial construction of "Three-Mile Bridge", which would have restricted all sediment from Butcherpen Cove reaching Deadman's Island. When the modern version of 3 Mile Bridge was completed the sediment may have been further restricted by the extension of the bridge ramp. Finally, construction of protective structures along the bluffs immediately east of the site in the 1980's would have removed the "local" supply of sediment. These changes to the sediment supply of Deadman's Island are apparent (and identified) in Figure 2b.