

along the inlet baseline reached its minimum value of 4,440 feet. During the period from February 1984 to March 1986 (Figures 3.7 and 3.8), the inlet was characterized by two ebb channels of disproportionate size. By November 1988, the two channels had merged with the single large channel positioned along the Bogue Banks shoulder of the inlet.

3.5. During the past three decades, the morphology of the inlet has changed substantially. Several distinct periods of change can be recognized each with unique migration trends and morphologic characteristics. Information derived from the inspection of Figures 3.4 to 3.6 and 3.7 to 3.9 suggests three basic phases of inlet change can be recognized. The initial phase covers the period between 1973 and 1981 when the ebb channel was moving to the west, subsequent to the shore-normal reorientation and formation of a single ebb channel in 1975. The net westward movement of the ebb channel was 1,895 feet during this initial phase of change. The second stage of inlet evolution occurred between 1981 and 1988. During this time, the single well-defined ebb channel migrated to the east a distance exceeding 830 feet (rate = 119 feet/year) and a wide marginal flood channel developed on the Bear Island shoulder. The expansion of the flood channel promoted the development of the swash platform and the mid inlet shoal. For the period from February 1984 to September 2001, the midpoint of the channel moved to the east at a rather steady rate of 93.3 feet/year (Figure 3.4). Little significant change has occurred in the morphology of the platform and mid inlet shoal during this interval with the exception of the emergence of ephemeral “islands” (Islands 1 and 2) that developed on the linear margin bars and in vicinity of the flood ramp (Figure 3.9D). For the entire period of analysis (December 1973 to September 2001) the net movement of the ebb channel was 2,253 feet to the east or an average rate of 81.2 feet/year.

3.6. Inlet Shoreline Changes. The inlet shoreline changes along Bogue Banks and Bear Island since 1973 are depicted on Figure 3.11. The movement (erosion or accretion) of

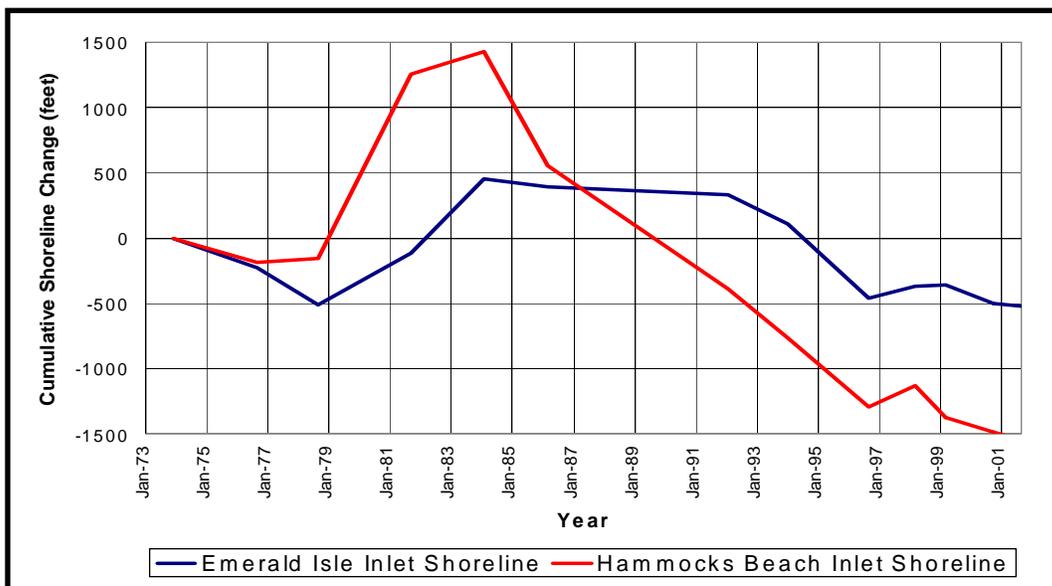


Figure 3.11 Cumulative Changes in the Emerald Isle and Hammocks Beach State Park Inlet Shorelines (Dec 1973 to Sep 2001)

the east shoulder (Bogue Banks) and west shoulder (Bear Island) generally follow a pattern of change related to the direction of movement of the channel within the inlet throat. The exception to this is a period in the mid to late 1970's when the inlet morphology was changing rapidly and adjusting to the ebb channel reorientation/repositioning that occurred in 1975. During this interval of time, the ebb channel was migrating in a westward direction at variable rates (1976-81 = 34 to 125 feet/year) following channel repositioning. Concurrent with the initial westward trek of the ebb channel, the Bogue Banks inlet shoreline eroded as much as 509 feet (1973 to 1978 on Figure 3.11).

3.7. Between 1978 and 1984, the Bogue Banks inlet shoreline prograded 957 feet for a net gain since December 1973 of 448 feet. Inspection of the data (Figure 3.10) shows that the ebb channel reversed its movement in 1981 and began its eastward migration that continues to present. The pattern of shoulder accretion was reversed by 1984 when erosion became the norm. Between February 1984 and September 1996, the Bogue Banks shoulder eroded 912 feet. The majority of these losses occurred between January 1994 and September 1996, a period of time characterized by increased storm activity (Hurricanes Bertha and Fran). By September 1996, the net inlet shoreline change amounted to 446 feet of erosion. An additional 46 ft of shoreline loss occurred between September 1996 and September 2001. For the period from February 1984 to September 2001, the average rate of erosion of the Emerald Isle shoreline was 62.0 feet/year. The rate of shoreline erosion appeared to accelerate somewhat between February 1992 and September 2001 during which time the average rate was 87.6 feet/year. Again, the higher rate of erosion during this more recent period may have been due in part to the increase in tropical storm activity.

3.8. The pattern for the inlet shoreline changes along the Bear Island shoulder is somewhat similar to that for the Bogue Banks, but the scale of change is significantly greater (Fig. 3.11). The movement of the west shoulder (Bear Island) generally follows the pattern of initial progradation and subsequent recession recorded for the Bogue Banks shoulder. The Bear Island shoulder (spit growth) initially experienced a period of progradation when the ebb channel began its easterly migration in the early 1980s. Following a period of minor erosion (183 feet) between 1973 and 1976, the western margin of the inlet prograded 1,609 feet in an easterly direction between 1976 and 1984. With the exception of the brief interval between 1996 and 1998, the Bear Island inlet shoreline has continued to recede in a westerly direction. The recession of the Bear Island shoulder coupled with erosion of the Bogue Banks shoulder has effectively led to a general widening of the inlet throat since 1984. Since the mid 1980's the Bear Island shoulder has eroded approximately 2,975 feet (169 feet/year).

3.9. Oceanfront Shoreline Change. Oceanfront shoreline changes on Bogue Banks and Hammocks Beach State Park between 1973 and 2001 for each of the baseline transects shown on Figure 3.2 are depicted on Figure 3.12. As shown on Figure 3.12, there were dramatic net differences in the shoreline change patterns along the Bogue Banks and Hammocks Beach oceanfront between 1973 and 2001. Significant net coastwise accretion has occurred along the Bogue Banks shoreline. The average progradation along

this oceanfront shoreline segment (transects 1-14) ranged from 56 to 409 feet. The greatest shoreline accretion occurred along the oceanfront near the inlet between transects 10-13 and reached a maximum of 410 feet at transect 12. For reference purposes, transect 11 is located near the intersection of Coast Guard Drive and Inlet Drive. The net progradation of the entire Bogue Banks shoreline and is directly attributable to the eastward movement of the ebb channel over the past several decades.

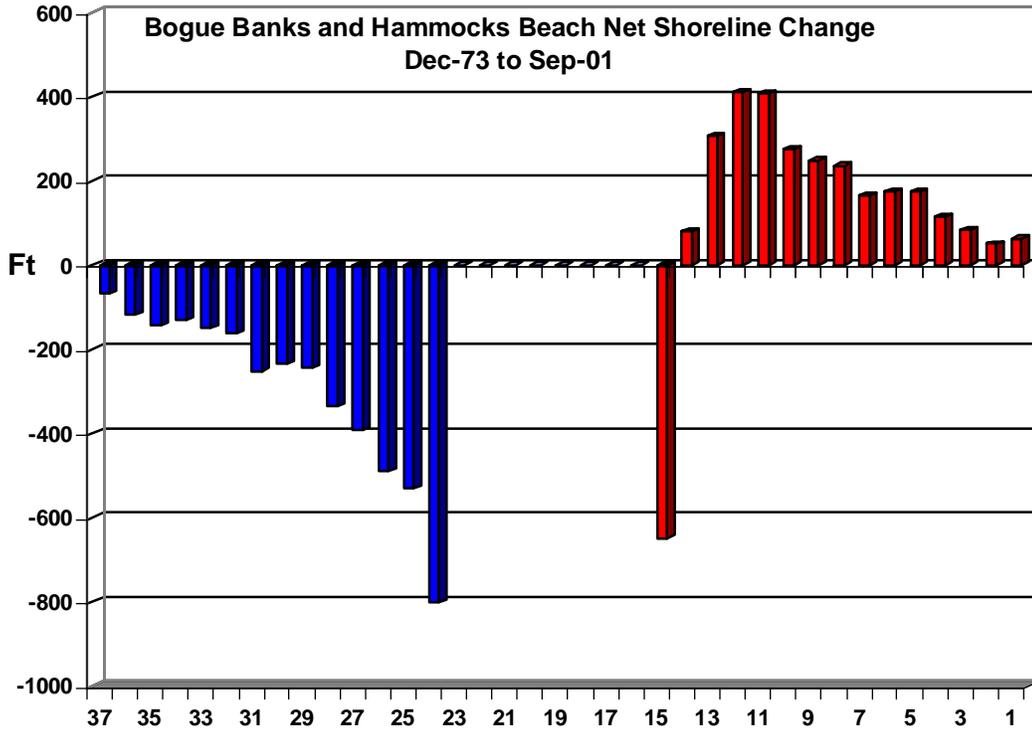
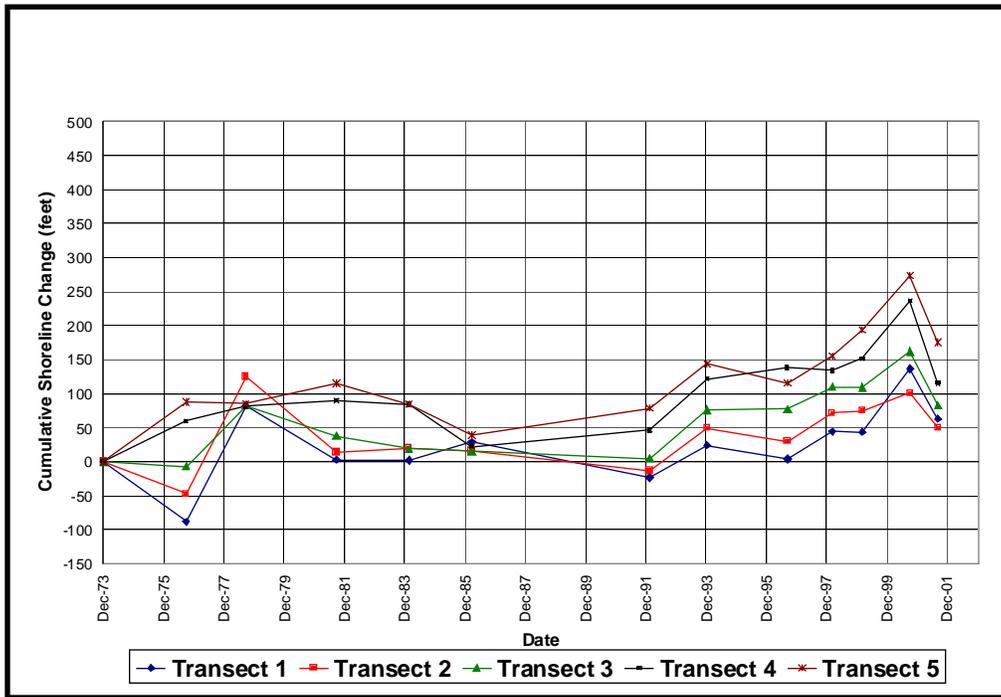


Figure 3.12 Bogue Banks and Hammocks Beach Shoreline Changes (Dec 1973 to Sep 2001)

3.10. In contrast to the net accretion recorded along Bogue Banks, chronic erosion has been the norm along the Bear Island oceanfront since 1973. Net erosion ranged from 68 feet at transect 37 to 531 feet at transect 25. In general the net erosion increased toward the inlet and reached its maximum along the northeastern-most portion of the Bear Island spit. The maximum shoreline erosion recorded occurred at transect 25 adjacent to the inlet (530 feet) while the minimum net shoreline loss was recorded for transect 37 at the western boundary of the study area. The aforementioned relatively high values of shoreline recession along the spit reflect the negative influence of the easterly migration of Bogue Inlet. The cumulative average erosion that occurred along the Bear Island oceanfront since 1973 is approximately equal to the net shoreline accretion along the Bogue Banks oceanfront.

3.11. **Emerald Isle Ocean Shoreline Changes.** The cumulative shoreline changes for transects 1 to 13 on Emerald Isle are shown on Figures 3.13 to 3.15 with the average

cumulative shoreline changes for transects 1 to 5, 6 to 10, and 11 to 13 shown on Figure 3.16. Note that transects 14 and 15 are not included due to the erosion of the inlet shoreline associated with the eastward movement of the channel at these locations. The temporal history of the Emerald Isle shoreline changes summarized on Figure 3.16 indicates that the transects closest to the inlet (transects 11 to 13) began to experience significant accretion around 1983. Transects 6 to 10 began to accrete around 1985 while the transects furthest from the inlet (transects 1 to 5) only began to experience accretion around 1991. These temporal and spatial changes in the shoreline response on Emerald Isle are directly correlated with the movement of the ebb channel to the east. As discussed above, the channel began to move to the east around 1981 and assumed a position adjacent to the west end of Emerald Isle around 1983. The channel has continued to move to the east at a fairly steady rate since that time. As demonstrated by the average cumulative shoreline changes shown on Figure 3.16, the impact of this eastward migration of the ebb channel was first felt in the area immediately adjacent to the inlet (transects 11 to 13) and has gradually migrated to the east in response to continued channel migration to the east. For the period beginning in 1978, when the ebb channel was centered midway between the two islands and the channel oriented perpendicular to the adjacent shoreline, to 2001, the shoreline between transects 1 and 5 accreted an average of 6 feet while the shoreline between transects 6 and 10 accreted 148 feet and the shoreline between transects 11 and 13 accreted 347 feet.



**Figure 3.13 Cumulative Shoreline Changes - 1973 to 2001
Transects 1 to 5 on Emerald Isle**

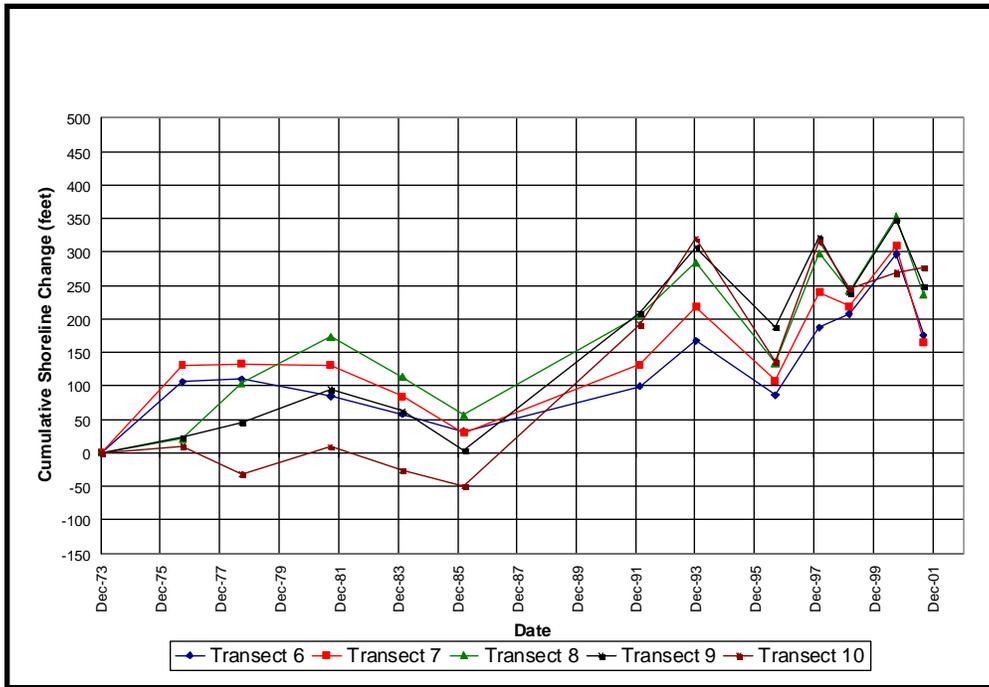


Figure 3.14 Cumulative Shoreline Change – 1973 to 2001
Transects 6 to 10 on Emerald Isle

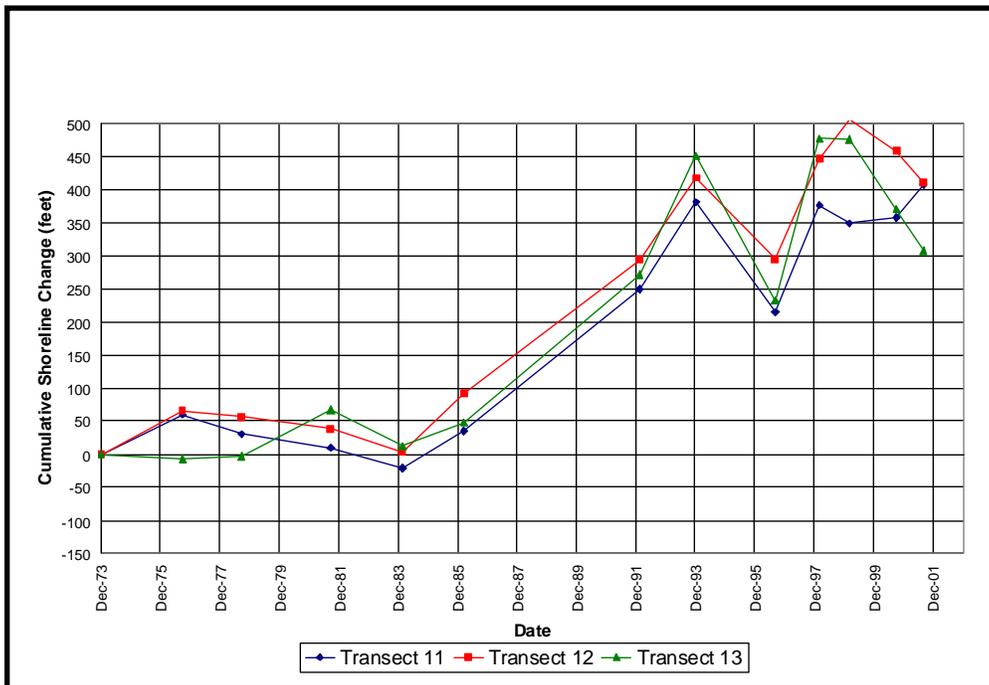


Figure 3.15 Cumulative Shoreline Change – 1973 to 2001
Transects 11 to 13 on Emerald Isle

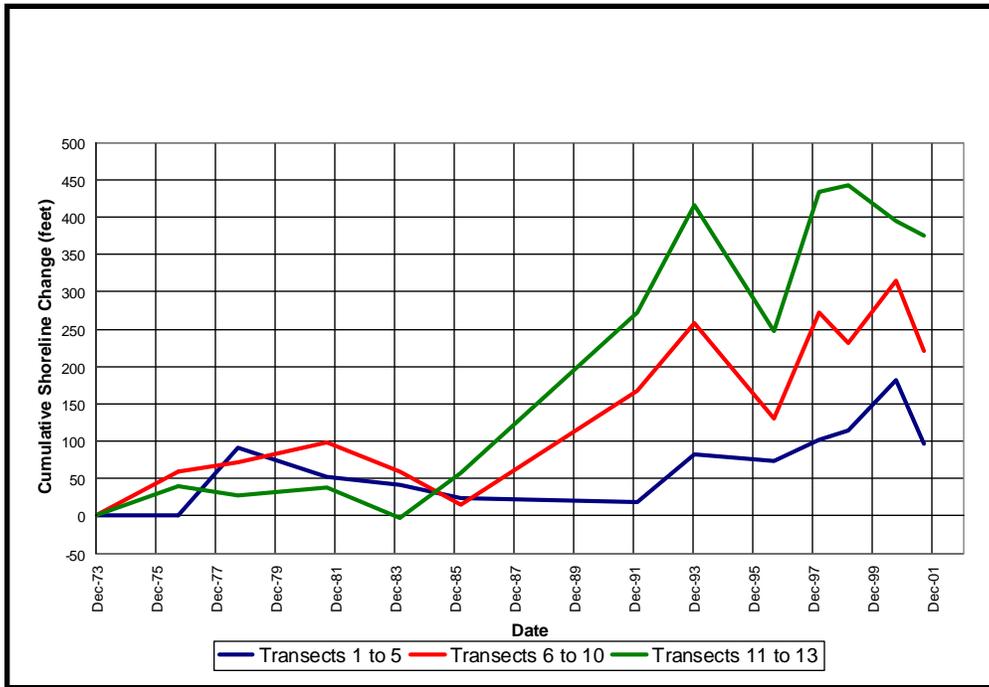


Figure 3.16 Average Cumulative Shoreline Change – 1973 to 2001 for: Transects 1 to 5; 6 to 10; and 11 to 13 – Emerald Isle

3.12. Hammocks Beach Ocean Shoreline Changes. The cumulative shoreline changes for transects 25 to 37 on Hammocks Beach State Park are shown on Figures 3.17 to 3.19 with the average cumulative shoreline changes for transects 33 to 37, 28 to 32, and 25 to 27 shown on Figure 3.20. For the group of transects located closest to the inlet (transects 25 to 27 on Figure 3.20) the shoreline was fairly stable up until 1985 at which time the shoreline began to erode at a rapid rate. Rapid erosion of shoreline located farther to the west on Hammocks Beach, represented by transects 28 to 32 and transects 33 to 37 on Figure 3.20, did not begin until around 1991 and 1993 respectively. This temporal and spatial shoreline response is consistent with the time history associated with the eastern

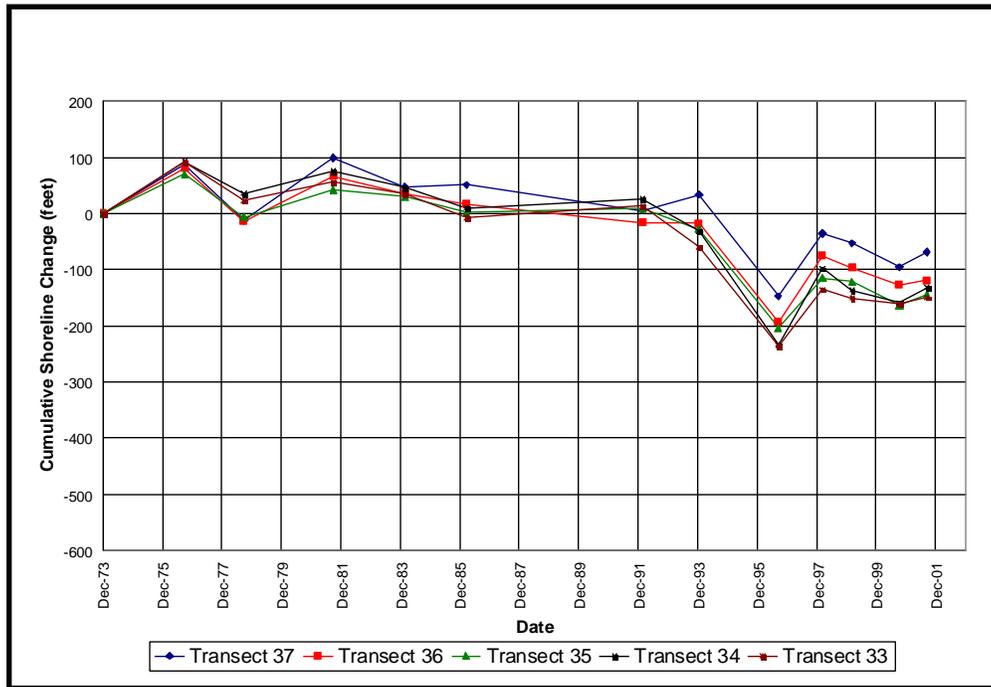


Figure 3.17 Cumulative Shoreline Change – Hammocks Beach State Park
Transects 33 to 37

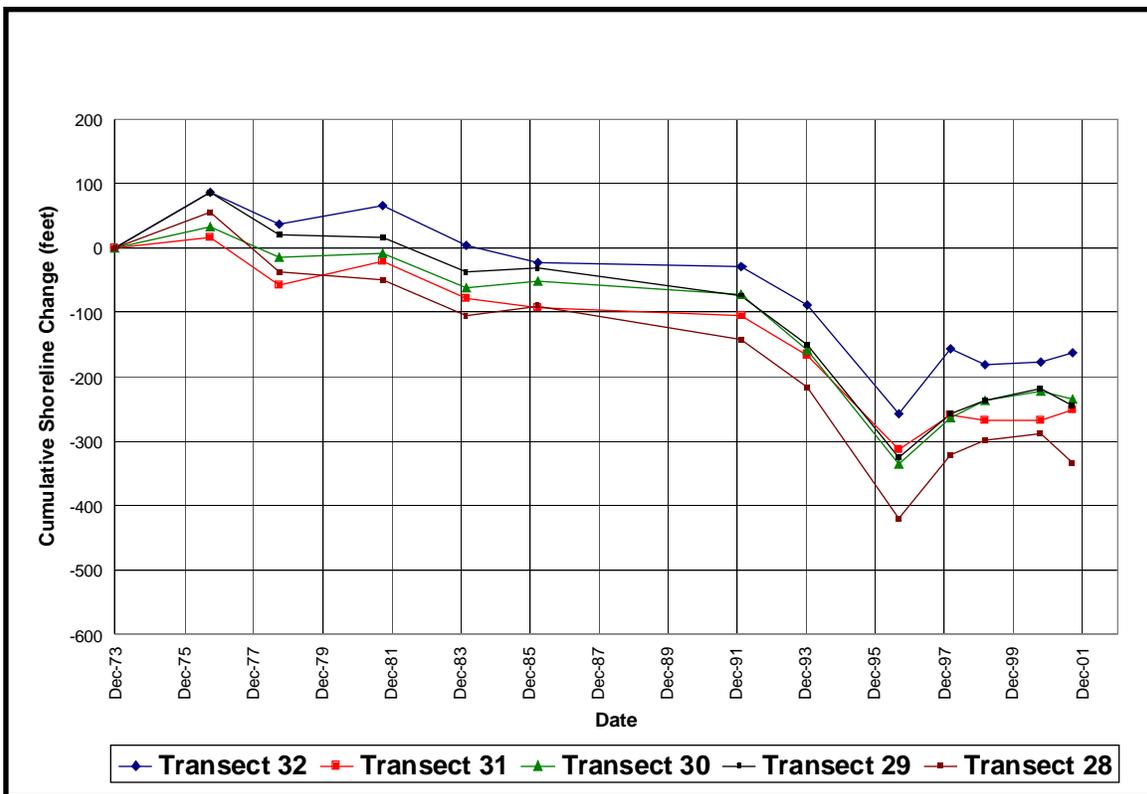


Figure 3.18 Cumulative Shoreline Change – Hammocks Beach State Park Transects 28 to 32

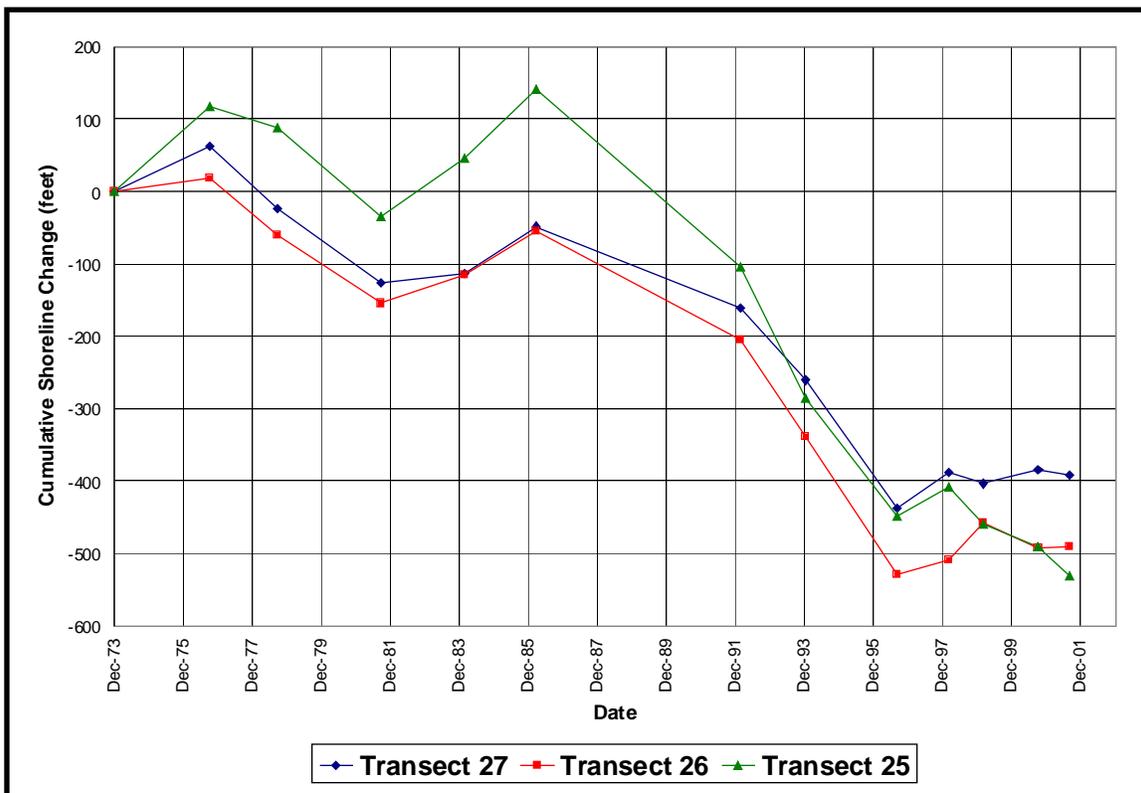


Figure 3.19 Cumulative Shoreline Change – Hammocks Beach State Park Transects 25 to 27