

Using Beach Nourishment Projects to Study Coastal Processes and Evaluate Their Environmental Impact

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The inner continental shelf (or shoreface) of barrier islands plays a critical role in determining sediment availability and exchange between the beach and the continental shelf, and may serve as both a source and a sink for beach sediment. At Fire Island, NY, decade-scale beach monitoring data, wave modeling and sediment budget calculations suggest that shoreface-attached sand ridges are an important source of sediment to the beach. Ridge morphology and distribution may control alongshore patterns of erosion and accretion by focusing shoreward sediment flux at discrete locations, dissipating or focusing wave energy, or a combination of these processes. Shoreface sand bodies are presently used or targeted as a source for large-scale beach nourishment projects at several locations on the U.S. Atlantic coast (e.g., northern Outer Banks, NC, Assateague Island and Ocean City, MD, Fenwick Island, DE, Fire Island, NY). Our results from Fire Island suggest that the removal of shoreface sand bodies by mining could have a measurable impact on accretion or erosion of the adjacent shoreline at these locations. Strip-mining of shoreface sand bodies will also likely have impacts on benthic habitats.

Evidence from two nourished beaches suggests that the inner shelf can also become a sink for beach sediment at the storm-event to decade time scales relevant to beach nourishment. The dispersal of nourishment sediment off Folly Beach, SC onto the inner shelf has been linked to episodic cross-shore transport during storm events over the course of several years. At Wrightsville Beach, NC, over 35 years of large-scale beach nourishment (~8 million cubic meters) appears to have exceeded the storage space available in the shoreface sedimentary prism, resulting in the accumulation of nearly 2 million cubic meters of nourishment sediment on the lower shoreface and inner shelf in water depths >9 m. Some of the nourishment sediment is traversing and/or accumulating on nearshore hardbottoms. The time and space scales of this sediment transport and storage are clearly of engineering interest for the design, long-term maintenance, and environmental impact evaluation of nourished beaches.

