

# West-Central Florida Coast

## Limited sand resources for eroding beaches



U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

### Issue

Beach erosion is a major concern on the highly developed west-central Florida coast. The region between Anclote Key in southern Pasco County and Venice Inlet in central Sarasota County contains 18 barrier islands and inlets spanning 130 km of coastline, much of which has undergone significant change within the past century.

Under natural conditions, barrier islands shift in response to storms, sediment supply and changes in sea-level. Man-made structures such as sea walls, jetties, and even buildings and roads can alter the influence of these natural processes. Consequently, some areas have experienced rapid beach erosion, resulting in narrow beaches that are insufficient for recreational use or protection of upland properties. Beach erosion and loss of protective dunes has left the coast susceptible to damage from storms and hurricanes. A 1992 report issued by the Florida Department of Natural Resources designated 65% of west Florida beaches as "critical erosion areas". In response, several sections of the coast have undergone nourishment projects to restore beach widths to previous dimensions. This method of beach maintenance is expensive, typically costing well over a million dollars for each mile of beach, and needs to be repeated as often as every four years. While beach nourishment is becoming the most common means of addressing beach erosion, it may not provide a cost effective long-term solution, as sand resources for nourishment are limited along much of the west Florida coast.



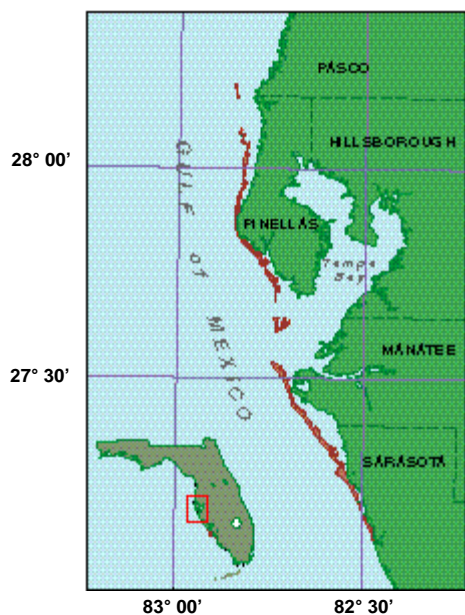
A recent beach nourishment project at Sand Key is an increasingly common counter-measure to beach erosion in highly developed coastal regions.

In 1992, Congress directed the U.S. Geological Survey (USGS) to initiate a five-year study of this region in order to better understand the recent geologic history of the barrier island system and the processes that control the distribution and transport of sediment on the inner shelf. The West-Central Florida Coastal Studies Project is a cooperative effort between the USGS, the University of South Florida, and Eckerd College.

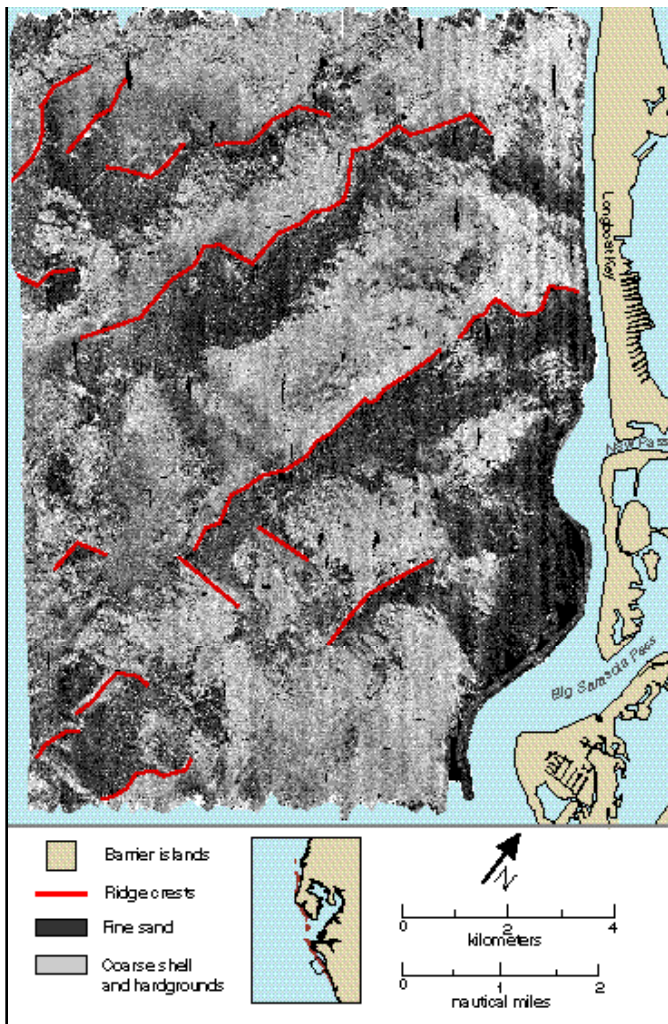
### Geologic Setting

The west-central Florida coast barrier-island chain sits near the center of a broad, gently sloping carbonate platform. The continental shelf is underlain by limestone bedrock with a thin, discontinuous cover of sand deposits of both quartz and carbonate origin. Prior to the initiation of this project, it was generally believed that sand resources were evenly distributed on the continental shelf. Early results, however, have demonstrated that sand is concentrated in specific, near-shore areas and is of limited thickness.

USGS scientists and collaborators have systematically mapped the thickness of sand deposits near the coast through seismic surveys and jet-probing. The first phase was a regional mapping with widely spaced geophysical and sample data which found that most beach quality sand is concentrated in active ebb-tidal deltas located just off tidal inlets and in long, linear ridges found on the inner shelf. Across the entire study area, bottom samples and core samples have been collected, and are being analyzed to develop a map of sea-floor sediment types. This research indicates that although there is coarse biogenic carbonate sand being produced in the modern environment, there is little or no modern source of beach quality quartz sediment in this region.



Map of study area showing location of barrier islands.



Side-scan sonar imagery in an area off Sarasota, FL reveals that fine sand (dark grey) is concentrated in long linear ridges, and in ebb tidal deltas located off tidal inlets. Light grey areas consist of coarse, shelly material or hardgrounds.

In addition to the reconnaissance mapping, USGS scientists and collaborators have completed detailed studies in two localities, one north and one south of the entrance to Tampa Bay. Detailed side-scan sonar maps were made of localized areas which are being used to understand the variability in sediment distribution of beach quality sand, carbonate shell material, and hardgrounds and shed new light on the processes that shape the inner shelf.

### Coastal Processes and Morphodynamics

The west-central Florida barrier island and inlet system is among the most varied in the world. The combination of low wave energy and microtidal conditions produces a wide range in barrier and inlet morphologies. Barrier islands and inlets in this region are affected by a complex suite of processes including sediment availability, impacts of storms and hurricanes, circulation, and underlying geologic control. For example, analysis of core samples and seismic data indicate that in some areas along the coast the underlying limestone bedrock exerts a significant control on the location of the

barrier islands. Processes affecting the barrier island and inlet system have been active throughout recent geologic history, evidenced by the range in ages of barrier islands, from greater than 4,600 years at Siesta Key in the southern part of the study area, to less than a decade at 3-Rooker Bar in the north. There is also evidence that the location of some islands have shifted considerably landward over thousands of years.

Researchers are also examining dominant oceanographic processes, how they influence sediment transport, and how they affect sand distribution in this region. Several methods are being utilized to examine circulation patterns on the inner shelf including deploying instruments that measure winds, currents, temperature, and salinity. Early results have demonstrated the importance of seasonal variations in the mean circulation and in sea level, and have identified coastal upwelling of colder, deeper water following storms.

Data collected by current meters and satellite imagery are being utilized in the development of 3-D numerical circulation models. These models help to describe the responses of the entire west Florida continental shelf circulation and sea level to storms and seasonally varying conditions.



Researchers take vibracore samples to examine sediments lying below the sea-floor.

### Research Applications

The west-central Florida coast is a highly populated region with an economy closely tied to its natural resources. The results of this project will allow planners and managers to better understand the effects of land-use decisions based upon a scientific understanding of the natural coastal processes.

#### For more information please contact:

Guy Gelfenbaum  
U. S. Geological Survey  
600 4th St. S.  
St. Petersburg, FL 33701  
(813) 893-3100

internet: "guy@wayback.er.usgs.gov"

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