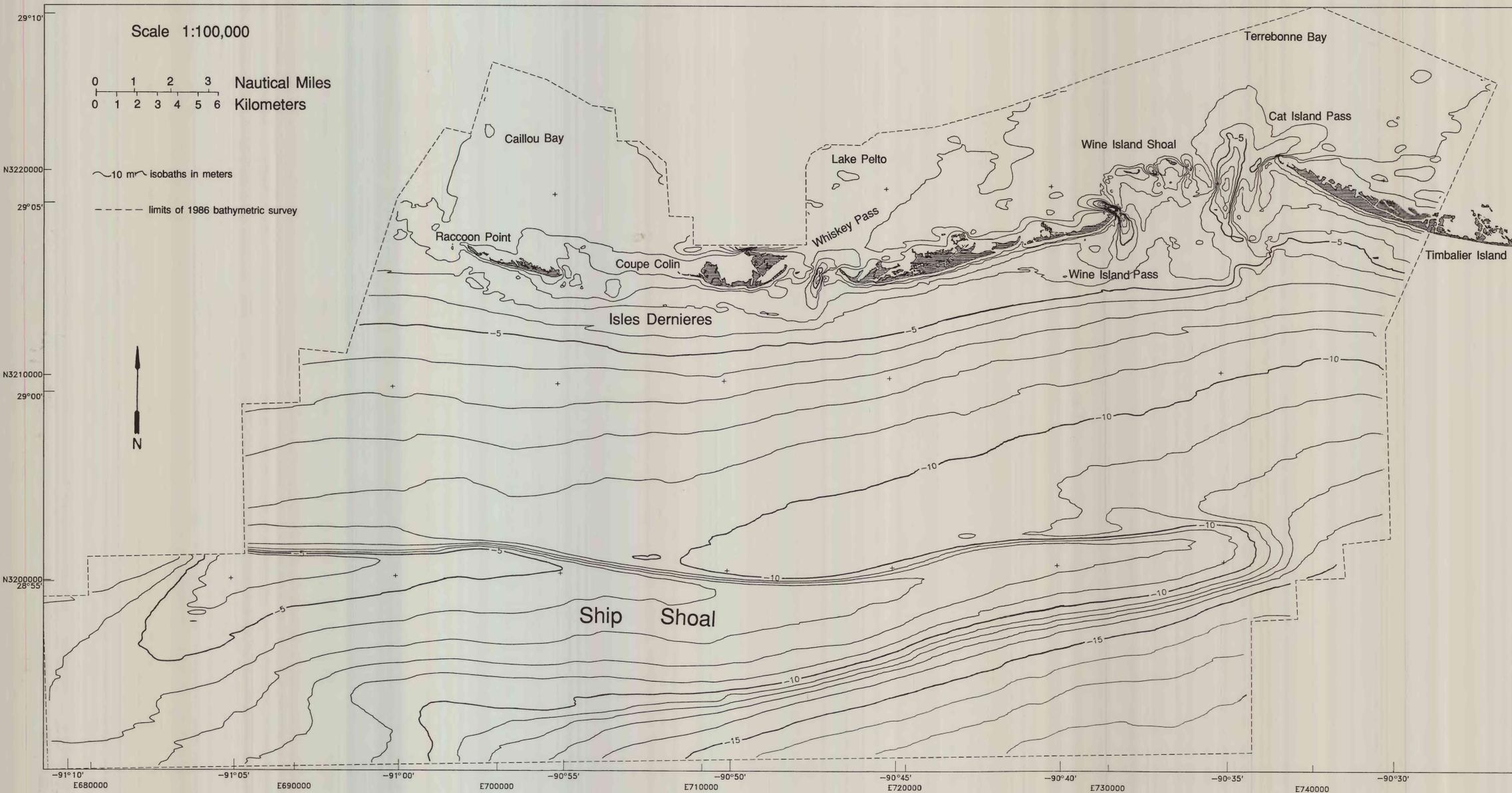


U.S. Geological Survey



INTRODUCTION

Since 1986, the U.S. Geological Survey, in cooperation with the Louisiana Geological Survey, has conducted a program of research on the conditions and geologic processes causing widespread and rapid barrier island erosion along the Louisiana delta-plain coast (Sallenger and others, 1987). Within the study area extending from the Isles Dernieres to Sandy Point, long-term erosion rates average 10-20 m/yr while short-term erosion due to hurricanes has been as great as 40 m over a period of several days. The primary factors responsible for such rapid and pervasive erosion are long-term rise in relative sea level at rates of 1 cm/yr, due mostly to sediment compaction and subsidence; a paucity of sand-size sediment along the coast; and the frequent passage of tropical storms and winter cold fronts. A summary of the geologic development and evolution of Louisiana delta plain is in a recent publication by Penland, Boyd and Suter (1988).

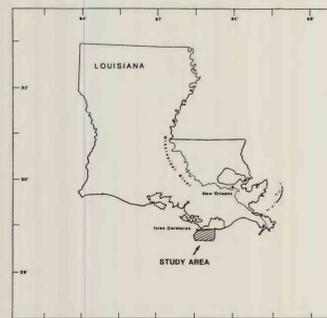
As a part of this study, information from topographic and hydrographic surveys and historic accounts dating back to the 1850's is being used to assess and measure changes in the geomorphology of the coastal barriers and the nearshore parts of the sea floor. Early hydrographic surveys off the Isles Dernieres were conducted by the U.S. Coast and Geodetic Survey (now NOAA-NOS) in 1853, in the 1890's, and most recently in the mid-1930's. Sounding data from the smooth map sheets from these surveys have been incorporated into a digital data base described recently by Jaffe and others (1988). To compare the geomorphic changes that have occurred from the 1930's to the present, the USGS contracted for a precision hydrographic survey and controlled aerial photography of the coast during the summer of 1986. This is the most recent hydrographic survey of the region since 1936. This report describes the survey and presents the resulting bathymetric map.

METHODS AND EQUIPMENT

During the summer of 1986 (May-August), Geodetic International, Inc. under contract no. 14-08-001-23038, carried out a precision hydrographic survey in the vicinity of the Isles Dernieres, Timbalier Island, and Ship Shoal off the coast of Terrebonne Parish, Louisiana. The general limits of the area surveyed were long. 91°10' - 90°28' W and lat. 29°05' and 28°50' N. The surveys were done using two different survey vessels. The GEODETTIC, 24 ft (7 m) long with a 10-in (25 cm) draft, was used for the shallow water, nearshore survey portion, while the RV ACADIANA, 57-ft (17 m) long and 3.5-ft (1 m) draft, was used for surveying the deeper water areas. Both survey vessels followed a rectangular grid pattern landward and seaward of the coastal barriers as well as in the tidal inlets and inshore as shallow as possible, normally to 2 to 3 ft (1-m) water depths. The shore-normal survey tracklines were spaced nominally at 2,500 ft (762 m); shore-parallel tie lines were spaced 6,000 ft (1,829 m) apart. The line spacing in the tidal inlets is approximately 700 ft (213 m). A total of approximately 1,500 line-nautical miles of survey trackline were surveyed and a total of 100,000 depth soundings with navigation control were digitally recorded.

Navigation Positioning System

To assure highly accurate horizontal control of the survey data, a Sercel Syledis, UHF-type radio positioning system was used for all survey lines. Syledis, which has a permanent network of shorebase stations operated in a range-range mode, the accuracy of which was 3 to 10 ft (1-3 m) depending on the distances and geometry of the survey vessel to the shore stations. Five control stations were used, three onshore and two offshore in the vicinity of Ship Shoal.



Locator map showing study area on the inner continental shelf off central Louisiana

Precision Depth Recorder

All depth soundings were recorded using a Krupp-Atlas, model 20, high-precision, dual-frequency fathometer. The equipment was operated at a frequency of 210 kHz, and the acoustic signals were corrected for transducer motion due to wave action by a TSS model 316 heave filter. The filter compensates for vessel motion by accepting the digital data directly from the fathometer and processing it internally using a recursive filter algorithm.

To calibrate for temporal fluctuations in water temperature, salinity, and suspended sediment concentrations, the fathometer was bar checked daily.

DATA REDUCTION

Following the surveys, the data were post-processed to remove vertical changes due to lunar tidal fluctuations. Tidal recordings obtained at hourly intervals from the NOAA gauge at Grand Isle, Louisiana were used to reduce the measured water depth to Mean Lower Low Water (MLLW) on the NOAA-NOS National Geodetic Vertical Datum of 1929. This datum also corresponds to Mean Low Water for the Grand Isle tidal gauge for 1986. The latitude and longitude of the navigation data were adjusted to the North American Datum of 1927 (NAD 27). The corrected bathymetric data and accompanying navigation information were finally transferred onto 9-track tapes and delivered to the USGS for further processing and plotting of maps.

Bathymetric Map

The bathymetric map shown here was generated using a computer surface-modeling program. Using a 1-m contour interval, a number of geomorphic features are evident. Several of the island segments of the Isles Dernieres are separated by deep tidal-inlet troughs, two of which (Cat Island Pass and Wine Island Pass) exceed 8 m in water depth. The offshore seaward of the 5-m contour is gently sloping and regular in relief seaward to Ship Shoal; however, the shoreline between the 5-m contour and the barrier shoreline has an irregular surface morphology marked by broad and seaward protruding platforms at the major inlets.

Ship Shoal, one of the most prominent and distinctive of several sand bodies on the Louisiana inner shelf, is clearly defined by its shore-parallel orientation, tapered shape toward the east and asymmetrical longitudinal profile. Maximum dimensions of Ship Shoal are approximately 50 km long, 8 to 12 km wide, and has 3 to 6 m of relief above the adjacent sea floor and axial crest elevations of 3.8 to 8 m.

Comparisons of this 1986 map with the historical data dating back to 1853 as discussed by Jaffe and others (1988) are being conducted and will be the subject of future publications. They will contain maps showing net changes (erosion and accretion) in sea-floor elevation and shoreline position, and will discuss the geologic processes responsible for the changes observed over the past 130 years.

COMPANION COMPUTER TAPES

The USGS is making the hydrographic data described in the report available to the public on 9-track computer tapes through the NOAA National Geophysical Data Center (NGDC). Inquiries should be made to:

National Geophysical Data Center  
NOAA/NEEDS E/GC 3  
325 Broadway  
Boulder, CO 80303

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MAP SHOWING PRECISION BATHYMETRY OF THE SOUTH-CENTRAL LOUISIANA NEARSHORE, ISLES DERNIERES AND SHIP SHOAL REGION

By

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Universal Transverse Mercator (UTM) projection used. Tick Marks indicate latitude and longitude (positive = north of east, negative = south of west) and UTM coordinates in meters. This information is not intended for navigation purposes.

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or nomenclature. Use of trade names in this publication is for descriptive purposes only and does not imply endorsement by the USGS or the Louisiana Geological Survey.