Chapter 4

Analysis of Barrier Shoreline Change in Louisiana from 1853 to 1989

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INTRODUCTION

Sandy, open-ocean barrier shorelines commonly exhibit rapid movement in response to natural and human forces. Unconsolidated beach sediment can respond instantly to winter storms and tropical cyclones (Hayes. 1967: Leatherman and others. 1977: Nummedal and others, 1980; Penland and others. 1980; Sexton and Moslow, 1981; Kahn and Roberts, 1982; Byrnes and Gingerich, 1987: Leatherman. 1987: Roberts and others, 1987; Ritchie and Penland, 1988: Penland and others, 1989a) or gradually to normal wave and current processes and relative sea level fluctuations (Morgan and Larimore, 1957; Penland and Boyd, 1981: Griffin and Henry. 1983: Morgan and Morgan. 1983; Everts and others. 1983: May and others. 1983: Shabica and others, 1984: Byrnes and others, 1989: Foster and Savage, 1989a, b; Anders and Reed. 1989: McBride and others, 1989a). Access canals, levees. oil and gas activities. seawalls, and jetties are just a few of the human disturbances that have exacerbated the rapid shoreline change problem in Louisiana (Larson and others, 1980; van Beek and Meyer-Arendt, 1982: Davis, 1986; Meyer-Arendt and Davis. 1988: Davis. 1990). Together these factors control the evolution of Louisiana‘s barrier shoreline.

The Louisiana coastline is extremely low lying (<3 m) and consists of unconsolidated sediment deposited by the Mississippi River during the past 8,000 years (Fisk. 1944; Kolb and Van Lopik, 1966: Frazier. 1967: Coleman. 1988). Louisiana’s outer coast. which directly borders the Gulf of Mexico. extends from the Texas border at Sabine Pass to the Mississippi border at the mouth of the Pearl River and is approximately 624 km long (fig. 1). If measured around the numerous bays and estuaries. however. the shoreline is about 1,488 km long (Morgan and Larimore, 1957). Located along the Mississippi River delta plain are four barrier systems totalling about 240 km. These systems formed in response to reworking of abandoned deltas and play an integral role in the evolution of Louisiana’s complex deltaic estuarine system (Penland and others. 1988). These features provide the first line of defense against destructive nearshore processes that would otherwise directly impact productive estuarine environments in the coastal zone. Each kilometer of barrier shoreline in Louisiana protects approximately 30 km² of estuarine habitat in the delta plain. Louisiana’s four barrier systems are the Isles Dernieres. Bayou Lafourche (Timbalier and East Timbalier islands, Caminada-Moreau Headland. and Grand Isle). Plaquemines. and Chandeleur Islands (north and south) (fig. 1). The largest proportion of these systems is dominated by barrier islands. as defined by Oertel (1985). with a much smaller proportion characterized by abandoned deltaic headlands. This chapter presents methods and procedures for mapping shoreline change with cartographic data sources and near-vertical aerial photography: accurate maps of shoreline change along barrier systems of Louisiana from 1853 to 1989: and a quantitative compilation of linear. area. and width measurements and their rates of change. In addition. it identifies long-term trends for predicting future coastal change in response to wind. waves. and water level.

SHORELINE MAPPING

With the implementation of computer processing and computer cartography. shoreline mapping techniques have evolved extensively over the past 10 years. Powerful mapping and geographic information system (GIS) software packages for personal computers and work stations have revolutionized traditional cartographic techniques. However. computers and mapping software are only as good as the data sources utilized. Computer technology enables coastal scientists to produce maps faster and more precisely. but for mapping shoreline change, the most important step is accurately interpreting the high-water shoreline position on aerial photography. An inaccurately delineated shoreline will remain inaccurate regardless of the precision of the computer mapping system.

Prior to the use of aerial photography. the high-water shoreline was measured using standard field surveying techniques (Shalowitz, 1964). Much care was taken to ensure accurate measurements representing this boundary. but these data were neither continuous nor synoptic due to time- and labor-intensive collection procedures. Monitoring the high-water-line position from aerial photographs is continuous and regionally synoptic, but interpretation of location is more subjective than direct measurement. Accurate delineation of the land-water interface depends on a thorough understanding of coastal processes and human activities. and their effects on the coastline.

Compilation of shoreline change maps involves a variety of techniques and different data sources. which include maps. charts. aerial photographs. and satellite imagery (Karo, 1961: Shalowitz, 1964: Morton. 1977, 1979; Dolan and Hayden. 1978: Dolan and others, 1979, 1980: Leatherman. 1983: Clow and Leatherman. 1984; Shabica and others, 1984: Ritchie and others. 1988: Byrnes and others. 1989: McBride, 1989a, b; Anders and Byrnes, 1991). Differing scales. datums, projections. ellipsoids. and coordinate systems complicate the superimposition of these data. Furthermore. other potential errors are inherent to all shoreline mapping projects (table 1). Recognizing and minimizing these problems ensure more accurate shoreline change data. The following sections discuss the methods, materials. techniques. and sources of error associated with shoreline mapping along the Louisiana barrier shoreline.

MATERIALS AND TECHNIQUES

Shorelines compiled in this atlas were derived from either topographic or near-vertical aerial surveys conducted between 1853 and 1989 (table 2) The high-water line is used as the official shoreline on cartographic data (Shalowitz, 1964; Anders and Byrnes, 1991) and is interpreted and determined on near-vertical aerial photographs according to the location of the wet- and dry-beach contact or the high-water debris line. Because the upper foreshore represents the landward limit of influence by normal wave and current processes. the high-water line is the most appropriate reference for measuring change in shoreline position (Langfelder and others. 1968). Fortunately. it is also the steepest portion of the foreshore. and a small change in water elevation produces a relatively small horizontal displacement of the shoreline.

Several primary data sources were used to establish a shoreline change data base for the barrier systems. Shoreline data compiled prior to 1951 were digitized directly from mylar-based topographic sheets (T-sheets) published by the U.S. Coast and Geodetic Survey. currently known as the National Ocean Service (NOS) within the National Oceanic and Atmo-

TABLE 1.—*Potential errors associated with shoreline mapping (modified from Anders and Byrnes, 1991)*

ACCURACY		PRECISION
Maps and Charts	Aerial Photographs	
scale	interpretation of high-water line	association of high-water line
horizontal datum changes	location of control points	digitizing equipment
shrink/stretch	quality of control points	temporal data consistency
surveying standards	aircraft tilt and pitch	media consistency
publication standards	altitude changes (scale)	operator consistency
photogrammetric standards	topographic relief	
projection	negatives vs. contact prints	
datum		
ellipsoid		

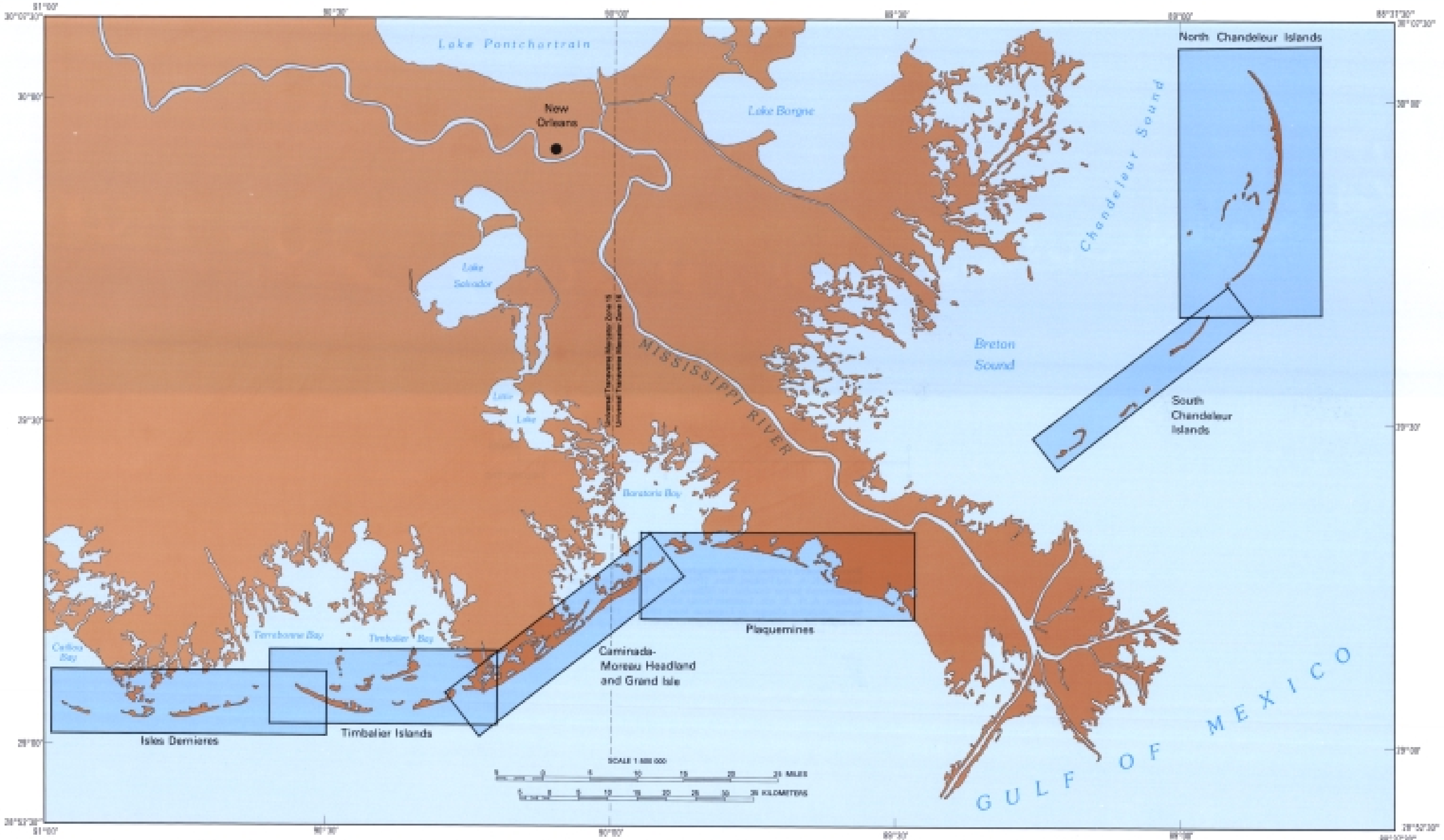


FIGURE 1.—The four barrier island systems along Louisiana's coastline: Isles Dernieres, Bayou Lafourche (Timbalier and East Timbalier Islands, Caminada-Moreau Headland and Grand Isle), Plaquemines, and Chandeleur Islands (north and south).

TABLE 2.—*Cartographic and aerial photography data sources used in this study.*

DATE	MAP NAME	MAP NO.	PROJECTION	SCALE	PHOTOGRAPHY TYPE	PHOTOGRAPHERS
ISLES DERNIERES						
1853		T-410	Polyconic	1:10,000		
		H-643	Polyconic	1:200,000		
1887		T-1981	Polyconic	1:20,000		
		T-1782	Polyconic	1:20,000		
		T-1783	Polyconic	1:20,000		
1906		T-2750	Polyconic	1:20,000		
1934		T-5291	Polyconic	1:20,000		
		T-5295	Polyconic	1:20,000		
1956	West Dernieres	T-9978	Polyconic	1:20,000		
	Dernieres	T-9979	Polyconic	1:20,000		
	Gulf Dernieres	T-9980	Polyconic	1:20,000		
	Cat Island Pass	T-9981	Polyconic	1:20,000		
1978	Western Isles Dernieres	253-c	Polyconic	1:24,000		
	Central Isles Dernieres	253-d	Polyconic	1:24,000		
	Eastern Isles Dernieres	253-c	Polyconic	1:24,000		
	Cat Island Pass	253-d	Polyconic	1:24,000		
1/21/88		—	—	1:15,000	9" x 9" Black & white vertical aerial photography	Gulf Coast Aerial Mapping, Inc.
BAYOU LAFOURCHE Timbalier Islands						
1887		T-1784	Polyconic	1:20,000		
		T-1785	Polyconic	1:20,000		
1934		T-5299	Polyconic	1:20,000		
		T-5300	Polyconic	1:20,000		
		T-5300	Polyconic	1:20,000		
1956	Timbalier Island	254-c	Polyconic	1:24,000		
	Calumet Island	254-d	Polyconic	1:24,000		
	Belle Pass	255-c	Polyconic	1:24,000		
1978	Timbalier Island	254-c	Polyconic	1:24,000		
	Calumet Island	254-d	Polyconic	1:24,000		
	Belle Pass	255-c	Polyconic	1:24,000		
1/21/88		—	—	1:15,000	9" x 9" Black & white vertical aerial photography	Gulf Coast Aerial Mapping, Inc.
Caminada-Moreau Headland						
1877		T-1468a	Polyconic	1:20,000		
1887		T-1785	Polyconic	1:20,000		
		T-1786	Polyconic	1:20,000		
1934		T-5302	Polyconic	1:20,000		
		T-5303	Polyconic	1:20,000		
		T-5311	Polyconic	1:20,000		
1956	Leeville	255-a	Polyconic	1:24,000		
	Caminada Pass	255-b	Polyconic	1:24,000		
	Belle Pass	255-c	Polyconic	1:24,000		
	Grand Isle	256-a	Polyconic	1:24,000		
	Barataria Pass	242-c	Polyconic	1:24,000		
1975	Leeville	255-a	Polyconic	1:24,000		
	Caminada Pass	255-b	Polyconic	1:24,000		
	Belle Pass	255-c	Polyconic	1:24,000		
	Grand Isle	256-a	Lambert Conformal	1:24,000		
	Barataria Pass	242-c	Lambert Conformal	1:24,000		
1/21/88		—	—	1:15,000	9" x 9" Black & white vertical aerial photography	Gulf Coast Aerial Mapping, Inc.
PLAQUEMINES						
1877		T-1468a	Polyconic	1:20,000		
1883		T-1646	Polyconic	1:20,000		
1884		T-1666	Polyconic	1:20,000		
1892		T-2011	Polyconic	1:20,000		
		T-6432	Polyconic	1:20,000		
		T-6433	Polyconic	1:20,000		
		T-6432	Polyconic	1:20,000		
1956	Bay Ronquille	262-d	Polyconic	1:24,000		
	Bastian Bay	261-c	Polyconic	1:24,000		
	Buras	261-d	Polyconic	1:24,000		
	Bay Coquette	257-b	Polyconic	1:24,000		
	Pass Tante Phine	258-a	Polyconic	1:24,000		
1973	Bay Ronquille	262-d	Lambert Conformal	1:24,000		
	Bastian Bay	261-c	Lambert Conformal	1:24,000		
	Buras	261-d	Lambert Conformal	1:24,000		
	Bay Coquette	257-b	Lambert Conformal	1:24,000		
	Pass Tante Phine	258-a	Lambert Conformal	1:24,000		
1/21/88		—	—	1:15,000	9" x 9" Black & white vertical aerial photography	Gulf Coast Aerial Mapping, Inc.
CHANDELEUR ISLANDS South Chandeleur Islands						
1869		T-1090	Polyconic	1:20,000		
		T-1091	Polyconic	1:20,000		
1922		T-3911	Polyconic	1:20,000		
		T-3920	Polyconic	1:20,000		
		T-3980	Polyconic	1:20,000		
		H-4033	Polyconic	1:80,000		
1951	Grand Gosier Island	257-c	Polyconic	1:24,000		
	Stake Islands	239-a	Polyconic	1:24,000		
	Breton Island	239-a	Polyconic	1:24,000		
1978		—	—	1:24,000	23" x 23" Color infrared vertical aerial photography	National Aeronautics & Space Administration (NASA)
2/89		—	—	1:24,000	23" x 23" Color infrared vertical aerial photography	NASA
North Chandeleur Islands						
1855		T-548	Polyconic	1:20,000		
		T-549	Polyconic	1:20,000		
1922		T-3917	Polyconic	1:20,000		
		T-3918	Polyconic	1:20,000		
		T-3919	Polyconic	1:20,000		
		T-3980	Polyconic	1:20,000		
1951	Chandeleur Light	193-d	Lambert Conformal	1:24,000		
	North Islands	198-b	Polyconic	1:24,000		
	Freemason Islands	199-c	Polyconic	1:24,000		
	New Harbor Islands	199-d	Polyconic	1:24,000		
1978		—	—	1:24,000	23" x 23" Color infrared vertical aerial photography	NASA
2/89		—	—	1:24,000	23" x 23" Color infrared vertical aerial photography	NASA

spheric Administration (NOAA). Cartographic shorelines between 1951 and 1978 were recorded from NOS T-sheets and U.S. Geological Survey (USGS) 7.5-minute quadrangle maps. Aerial photography. dated January 1988 and taken at a scale of 1:15,000, was used to construct a shoreline west of the mouth of the Mississippi River from Raccoon Point to Sandy Point. To the east, the 1978 and 1989 Chandeleur Islands shorelines were compiled using National Aeronautic and Space Administration (NASA) high-altitude photography enlarged to scales of 1:33,000 and 1:24,000, respectively. Although aerial photography shorelines can be registered in several ways (Leatherman, 1983). shoreline position for the delta plain was registered to USGS 7.5-minute quadrangle maps using a Bausch and Lomb Zoom Transfer Scope. These data together with cartographic shorelines were digitized by Intergraph's VAX-based Interactive Graphics Design System (IGDS) or work station-based MicroStation software (Wright, 1989, 1990a, b) at a 1:l scale according to original projection, ellipsoid, and North American Datums (NAD) (fig. 2). Intergraph's World Mapping System (WMS) software can generate 21 map projections or coordinate systems; reference 20 ellipsoid types; convert coordinate systems, datums (NAD 27 and NAD 83 [Morgan. 1987: Wade, 1986; Shalowitz, 1964]), and associated data; and perform area. distance, and perimeter calculations.

WMS software generates a latitude-longitude grid, or graticule, based on the same cartographic parameters as the map being digitized (Intergraph Corporation, 1987). This graticule is mathematically correct and free of any distortion that may be present on printed maps. At least four well-spaced primary control points on the map are registered to equivalent points on the graticule to provide a best fit between the map and the independently generated graticule. Maps digitized for this study are characterized by either Polyconic or Lambert Conformal projections (see Synder, 1987). Using WMS software, shoreline data for each year were converted to a common projection (Polyconic), coordinate system (latitude-longitude), datum (NAD 27). and ellipsoid (Clarke 1866) and superimposed for analysis (McBride, 1989a, b). Shoreline data were then converted to Universal Transverse Mercator (UTM) projection (Zones 15 and 16) for atlas production.

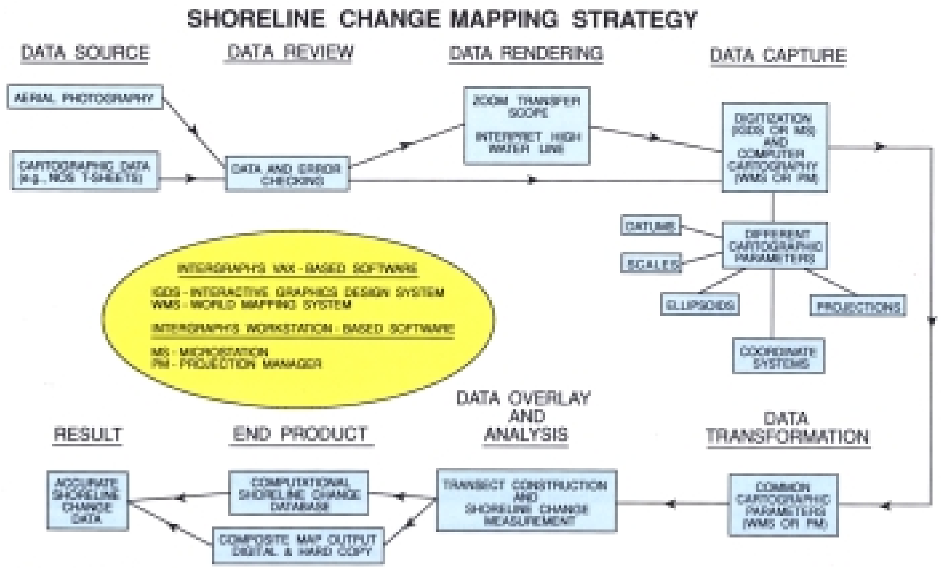


FIGURE 2.—Shoreline change mapping procedures and strategy at the Louisiana Geological Survey.

To evaluate change in shoreline position, shore-normal transects were constructed at approximately 15-second intervals of longitude or latitude, depending on shoreline orientation. Isles Dernieres, Bayou Lafourche, and Plaquemines barrier systems (east-west shorelines) were analyzed using 15-second (about 404 m) intervals of longitude, while the Chandeleur Islands (north-south shorelines) were examined using 15-second (about 462 m) intervals of latitude. Also, information is provided about the location of transects near entrance areas (for example, tidal inlets, distributaries, etc.). Measurements of shoreline movement and change in island width were taken along transects perpendicular to the composite shoreline trend (fig. 3). A plus sign indicates progradation while a minus sign indicates recession (fig. 4). Average rates of movement and area change were calculated by dividing absolute measurements by elapsed time (year, month, and day-where available). For this study, shoreline change maps were produced to determine the spatial and temporal distribution of shoreline movement (magnitude, direction, and rate of change) and document geomorphologic evolution.

SOURCES OF ERROR

Errors are inherent to the compilation and analysis of shoreline change maps and occur from 1) interpretation of the shoreline position, 2) resolution of source material. and 3) precision of digitizing equipment. Superimposing cartographic data and near-vertical aerial photography can cause large potential errors as a result of the different techniques used to delineate shoreline position. On early historical NOS T-sheets, the high-water line was mapped to within 10 m horizontally, but in many cases, these measurements were probably more accurate (Shalowitz, 1964). On aerial photography. the high-water line is determined by interpreting the wet-and-drybeach contact or the high-water debris line. This boundary will vary throughout the year depending on tide cycle, beach slope, sediment supply, wind direction, wave conditions, and human activities (Stafford, 1971: Morton, 1977). An aerial survey of an eroding shoreline could depict accretion simply from changes in wind direction at the time of the survey. Normal wind shifts can depress or elevate the water surface in several hours and cause the water line to move horizontally tens of meters. Therefore, to develop realistic cause-and-effect relationships, it is important to understand the impact of local processes on system response.

Interpretation of shoreline position along the bay side poses some additional difficulties. Because emergent vegetation is mapped as land regardless of actual water depth, a minimum density and size of individual stands of vegetation must be established and mapped consistently. Therefore, delineating the shoreline becomes subjective without extensive ground truthing when a mixture of vegetation, sand, and water exists, or when the water line is hidden by lush vegetation. Aerial video surveys, however, can provide an alternative to ground truthing (Penland and others, 1988, 1989b, McBride and others, 1989b). This low-oblique color footage is taken at about 70 m and is viewed during air photo interpretation to aid in determining coastal habitats and delineating the high-water line along the gulf and bay sides. Although ground truthing is time consuming and expensive, it should be conducted in conjunction with any overflight.

Pen-line width is another source of error during air photo interpretation. A typical pen width of 0.25 mm results in a potential error of 2.5 m at 1:10,000 scale, 6.0m at 1:24,000 scale, or 16.3m at 1:65,000 scale. A pen line 0.18 mm wide was used on the 1978 photography (1:33,000 scale) for the Chandeleur Islands, a potential error of 5.9 m. This is comparable to the potential error of 6.0 m on the 1989 photography (1:24,000 scale). In this study, a photo interpreter centered the pen line along the wetted boundary to delineate its position and subsequently digitized along the center of the pen line. The digitizer is precise and accurate to within 0.1 mm, a potential error of 2.4 m at a scale of 1:24,000. Errors associated with the digitizing equipment are amplified by operator error.

Loss of control points along a rapidly changing coastline also impedes accurately mapping shoreline change. Potential errors have been minimized by overlaying many different controlled shoreline data sources and by field checking when no other method was satisfactory. A controlled survey for the Chandeleur Islands was completed in 1951: however, considerable erosion and landward barrier island migration have occurred since then as a result of Hurricanes Betsy (1965), Camille (1969). Frederic (1979), Elena (1985). Juan (1985). and Florence (1988). These events removed all but a few control points along the southern half of the barrier chain (Penland and others, 1989b; McBride and others, 1989b). Grand Gosier, for example. has migrated about 1 km west since 1951.

The 1978 and 1989 Chandeleur shorelines were constructed from NASA high-altitude, color-infrared aerial photography and interpreted at 1:33,000 and 1:24,000 scales, respectively. Because a limited number of control points were available, the Zoom Transfer Scope could not be used. Therefore, photomosaics of the 1978 and 1989 shorelines were constructed and photographically scaled. To minimize error, the two shorelines were overlaid with the most recent topographic maps, using the few available control points. Large oil platforms. visible on both sets of photographs, were used as additional control points. These positions were registered on 7.5-minute quadrangle maps by latitude and longitude acquired in the field using a Loran-C navigation system, calibrated to known points in the study area. The largest margin of mapping error along the Louisiana shoreline is found where lack of control points is common from the southern portion of Chandeleur Island to Breton Island. In these isolated areas of minimal control, shoreline position may be in error by as much as 50 m.

Cartographic data sources for this study were digitized using a graticule digitizer setup. Intergraph mapping software provides an error calculation associated with the digitizer setup. The average error and maximum error of the digitizer setup are expressed as percentages. This represents the difference among control points placed on the digitizer table (map) using the cursor and corresponding points located in the graphics file coordinate system (latitude-longitude). If the coordinate system in the graphics file is identical to the coordinate system on the map. error is negligible. Larger setup errors can occur for a number of other reasons. including shrink and swell of the original map (older mylar T-sheets are actually copies of original paper maps on a stable base); errors in plotted positions on the map; and errors in point placement during digitizer setup.

For an Intergraph digitizer setup, a 0.01 percent error corresponds to 1 m of displacement in a distance of 10,000 m on the ground. Because NOS T-sheets are generally no larger than 1.2 m, a maximum distance of approximately 12,000 m is covered by a map at 1:10,000 scale. Thus, a 0.01 percent digitizer setup error would give a maximum error of 1.2 m on a 1:10,000 scale map. This error, however, will decrease with proximity to digitizer setup points, thus assuring that setup errors will be considerably less than this maximum. Digitizing errors associated with NOS T-sheets will be within National Map Accuracy standards (5 m at 1:10,000) (Ellis, 1978). In contrast, USGS 7.5-minute quadrangle maps measure approximately 20" X 23" (0.5 m X 0.6 m), and a maximum distance of approximately 14,400 m is covered by a map at 1:24,000 scale. Thus, a 0.01 percent digitizer setup error would give a maximum error of 1.44 m on a 1:24,000 scale map. and digitizing errors would be within National Map Accuracy standards (12.2 m at 1:24,000) for the location of the shoreline on USGS 7.5-minute quadrangle maps (Ellis, 1978). Although errors in map construction cannot be completely removed. they can be quantified and minimized during this digitizer setup. A combined error of 0.01 percent (approximately 1 m of displacement at a 1: 10,000 scale) or less is usually attained for NAD 27 maps. Errors of greater than 0.03 percent (about 3 m) are unacceptable on NAD 27 maps. For North American datum maps. setup errors of greater than 0.05 percent (about 5 m) are not allowed. and the criterion for pre-North American datum maps is no greater than 0.07 percent setup error (about 7 m). The majority of maps used have a digitizer setup error of 0.04 percent (about 4 m) or less.

Other potential errors associated with factors listed in table 1 have been addressed in detail by Motion (1977, 1979), Tanner (1978), Anders and Leatherman (1982). and Anders and Byrnes (1991). These include photogrammetry problems, surveying standards, temporal data consistency. natural and human impacts of coastal processes. and others. These errors can be minimized by making sensible decisions about data sources (comparing data sources that are seasonally consistent) and interpretation techniques (using the center 2 inches of the photo and annotating with small pen line width).

Because total potential error is a result of time-independent variables (data source. measurement technique, interpretation of high-water line. etc.) and the magnitude of change is a time-dependent (1887 vs. 1934). long-term rates of shoreline movement will have the lowest rate of potential error. and short-term rates will have the highest. The maximum potential error for this study was ±52 m, when quantifying the difference between shorelines, but one shoreline will have a potential error of ±26 m. Root mean square of this value is ±13 m (see Merchant, 1987 for discussion of root mean square). The maximum value includes error associated with shoreline placement, line width. digitizer setup, operator inconsistencies, and equipment. Therefore. the maximum rate of potential error for long-term rates (>lOO years) is ±0.4 to ±0.5 m/yr; short-term rates (10 to 15 years) are accurate to within ±3.4 to ±5.1 m/yr.

Finally, shorelines published in this atlas are drafted representations of the original digital shorelines used for quantitative measurements. They have been subjected to the printing process. which involves hand scribing at a scale of 1:100,000. They contain no gross errors, but these representations cannot approach the accuracy of the original computer-generated shorelines mapped at larger scale.

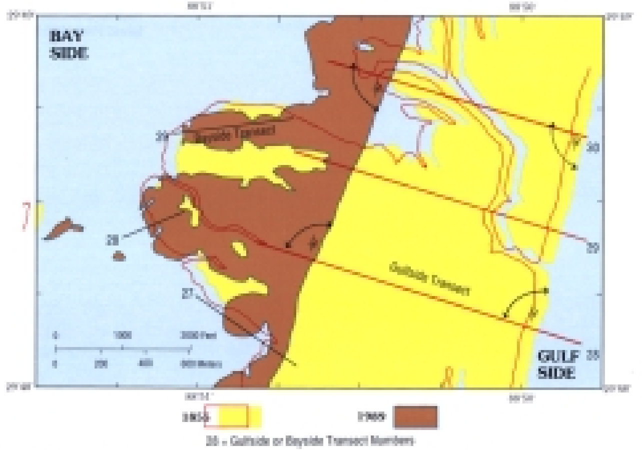


FIGURE 3.—Shore-normal transects used to measure linear distances between shoreline positions. Transects were placed at 15-second intervals of latitude or longitude along the gulf and bay sides.

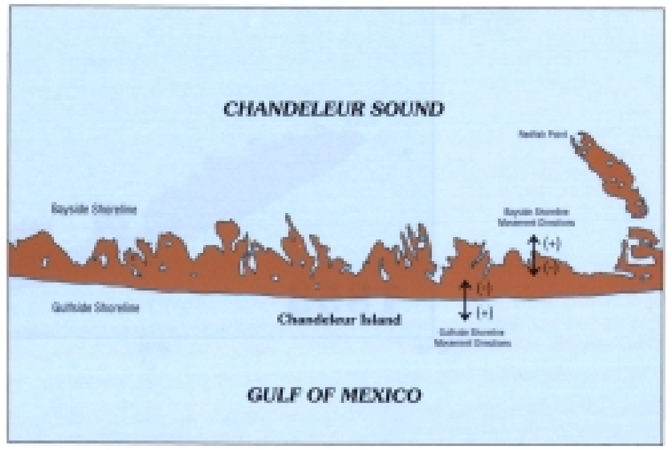


FIGURE 4.—Explanation of shoreline retreat or advance along the bay or gulf side.

Isles Dernieres Barrier Svstem-1853 to 1988

Isles Dernieres is located about 100 km west of the mouth of the Mississippi River and about 120 km southwest of New Orleans (fig. 1). The island arc is 36 km long and extends from Raccoon Point to Wine Island Shoal (chapter 1, fig. 17). Tidal inlet development has fragmented the Isles Dernieres into an arc comprising five smaller islands: Raccoon, Whiskey, Trinity. and East islands and Wine Island Shoal. These islands range from 0.25 to 2 km wide and are separated by five tidal inlets: Coupe Colin, Whiskey Pass. Coupe Carmen. Coupe Juan, and Wine Island Pass. The inlets range from 0.3 to 6.0 km wide and are 2 to 16 m deep. The barrier shoreline is undergoing rapid geomorphologic change and severe coastal erosion (Peyronnin, 1962; Kwon, 1969; Neese, 1982; Penland and others, 1985, 1989a; McBride and others, 1989a; Ritchie and others. 1989; Dingier and Reiss, 1990).

Maps presented in this section show morphologic changes along the Isles Dernieres for the years 1853, 1887, 1906, 1934, 1956, 1978, and 1988. All maps referenced in the text are labelled by date. Although the 1853 shoreline represents a reconnaissance of the area surveyed by the U.S. Coast and Geodetic Survey at a scale of 1:200,000, the map provides important morphologic information. This source of information, however. was not used for quantitative purposes. The gulf side was surveyed in 1887, and the remaining bay side was finished in 1906. Because these surveys were incomplete, the 1887 and 1906 shorelines were combined and are referred to as the 1890‘s shoreline. Linear, area. and width measurements were obtained, and rates of change were calculated to determine the extent of modification for the 134-year period.

BARRIER SYSTEM MORPHOLOGY

Isles Dernieres experienced significant erosion and fragmentation between 1853 and 1988. In 1853, the barrier island arc was a continuous shoreline except for Wine Island. which was located to the east of Wine Island Pass (1853 map). By 1887, an unnamed tidal inlet had developed along the island’s west central portion. Meanwhile, submergence enlarged Lake Pelto to result in marsh deterioration (1890's map).

By 1934, Whiskey Pass had formed in the center portion of Isles Dernieres, possibly in response to major hurricanes that struck the Louisiana coast in 1909, 1915, and 1926 (1934 map) (Neumann and others, 1985). Between 1934 and 1956, Coupe Colin developed to the west of the unnamed tidal inlet (1956 map). Continued widening of existing tidal inlets and further deterioration of the interior marsh caused significant land loss and landscape change. As a result of Hurricane Carmen, Coupe Carmen formed on the eastern portion of the arc (1978 map). Along the western Isles Dernieres, the land area between Coupe Colin and the unnamed inlet became subaqueous, and most of Wine Island had become a shallow sandy shoal. The inlet referred to as Coupe Juan emerged when Hurricane Juan (1985) breached Isles Dernieres east of Coupe Carmen. By 1988, the once continuous barrier island had deteriorated into five narrow barrier islands separated by wide tidal inlets (1988 map).

SHORELINE MOVEMENT

The Isles Demieres shoreline is one of the most rapidly deteriorating barrier shorelines in the United States. A comparison of shoreline positions is made for five periods: 1890's vs. 1934, 1934 vs. 1956, 1956 vs. 1978, 1978 vs. 1988, and 1890’s vs. 1988. The magnitude of change. island width, and rate of change were obtained from 184 shore-normal transects at approximately 15-second intervals of longitude along both the gulf and bay shorelines (transects map, tables 3, 4, 5, 6, and 7).

The average rate of bayside change was 0.8 m/yr between 1906 and 1934, while the average gulfside rate of change for Isles Dernieres between 1887 and 1934 was -11.7m/yr (tables 5 and 7). The gulfside rate decreased to -7.8 m/yr between 1934 and 1956, and the gulf and bay shorelines remained relatively constant through 1978. The gulfside rate, however. increased to -19.2 m/yr between 1978 and 1988, and the rate of bay shoreline retreat increased to 5.2 m/yr, presumably in response to repeated hurricane impacts in 1985 (figs. 5 and 6) (see Penland and others. 1989a).

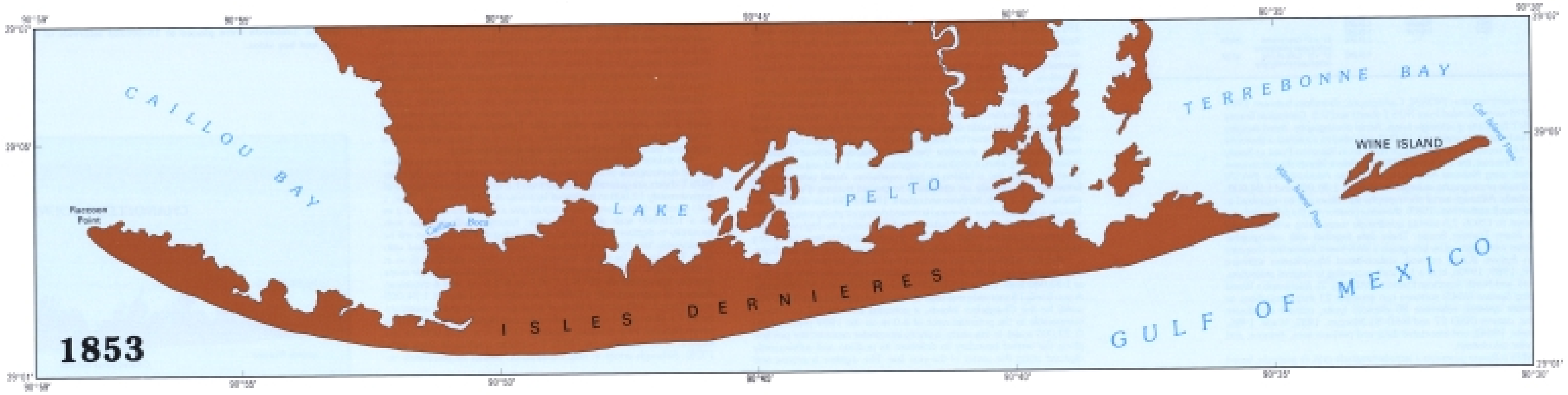
The 1890's vs. 1988 map illustrates land loss and summarizes cumulative quantitative changes along the gulf and bay shorelines. The gulf shoreline retreated between 1887 and 1988, except for the eastern end of East Island. and movement ranged from 3.4 to -23.2 m/yr to produce an average rate of -11.1 m/yr (table 7). Between 1906 and 1988, the rate of bay shoreline change ranged from 23.5 to -4.9 m/yr, with an average retreat rate of -0.6 m/yr (table 5). As a result. the gulf and bay shorelines are converging.

AREA AND WIDTH CHANGE

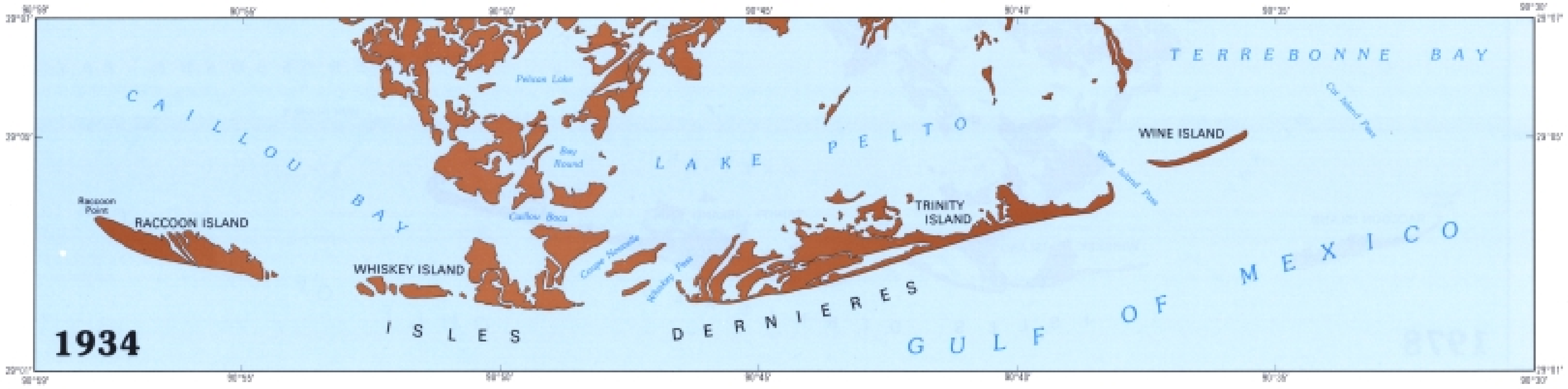
Changes in island area are a function of length and width adjustments in the barrier system. For the 1890’s map, island width along the barrier arc ranged between 52 and 3,203 m (table 6). In general. the barrier island arc was narrower at both ends and widest in the middle, with an average width of 1,171 m. The average rate of land loss between the 1890’s and 1934 was 35.8 ha/yr (table 8). By 1934, the complex had narrowed to 815 m wide. Slow but steady deterioration of the system continued through 1978 when its average width decreased to 585 m. The average rate of land loss decreased to a low of 9.8 ha/yr between 1956 and 1978. Island width decreased dramatically between 1978 and 1988 to result in an average width of 375 m and an increase in land loss to 47.2 ha/yr (fig. 7). This period of high rate of area loss included Hurricanes Danny and Juan in 1985.

Erosion of the gulf and bay shorelines is causing the island to narrow. From the 1890's to 1988, the barrier width decreased 796 m (figs. 8 and 9). This represents an average narrowing rate of 8.6 m/yr for approximately the last century Similarly. the area of Isles Dernieres decreased continuously from 3,532 ha in the 1890’s to 771 ha in 1988 (fig. 10). This is a land loss of 78 percent or 2,761 ha at an average rate of 28.2 ha/yr (table 8)

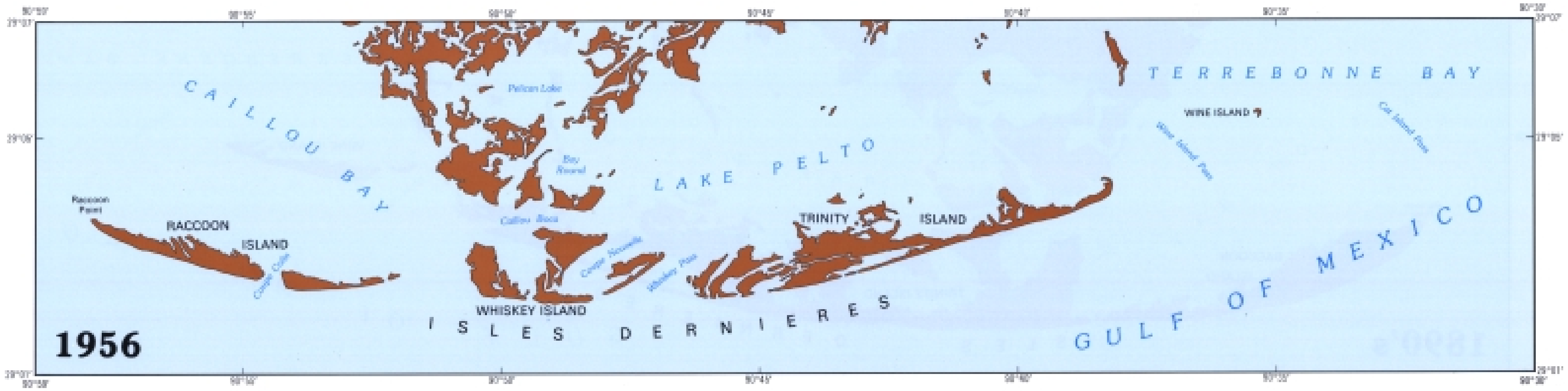
• Historic Shorelines •

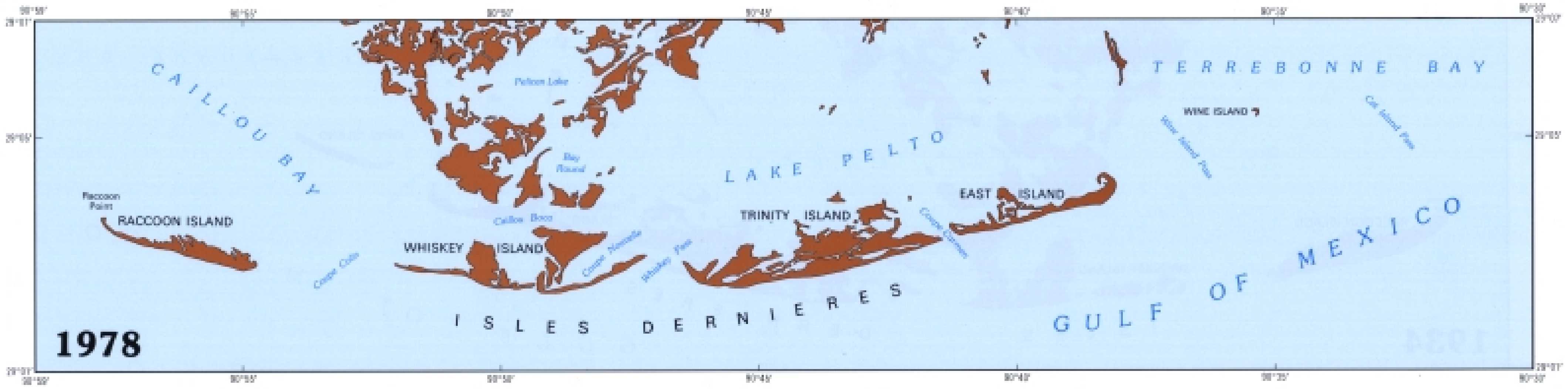


Isles Dernieres

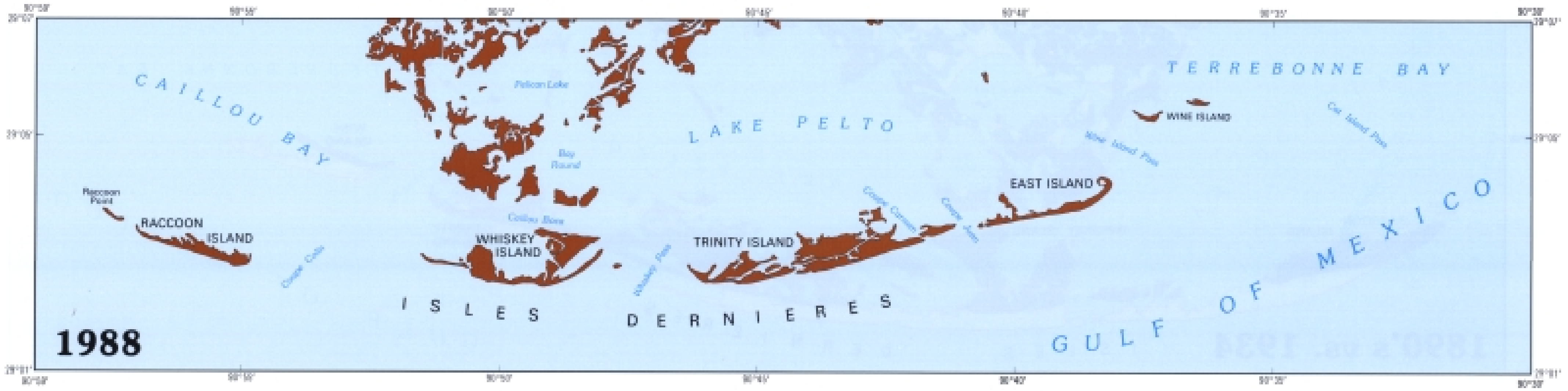


Isles Dernieres





Isles Dernieres



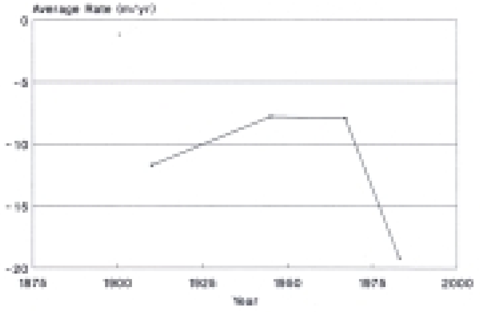


FIGURE 5.—Average gulfside rate of change along Isles Dernieres between 1887 and 1988.

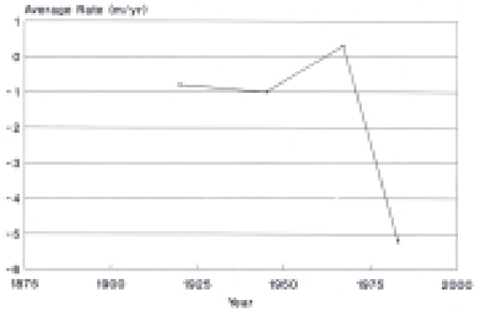


FIGURE 6.—Average bayside rate of change along Isles Dernieres between 1906 and 1988.

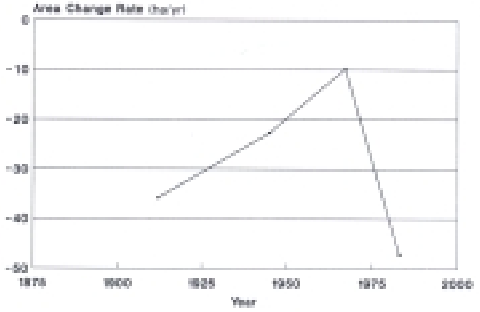


FIGURE 7.—Rate of area change for Isles Dernieres between the 1890's and 1988.

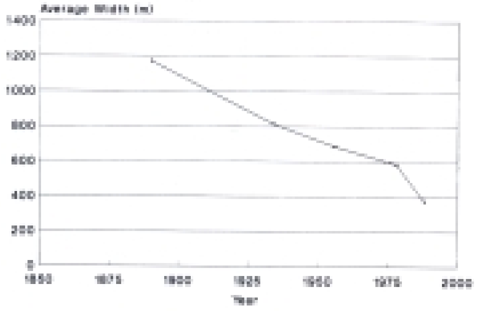
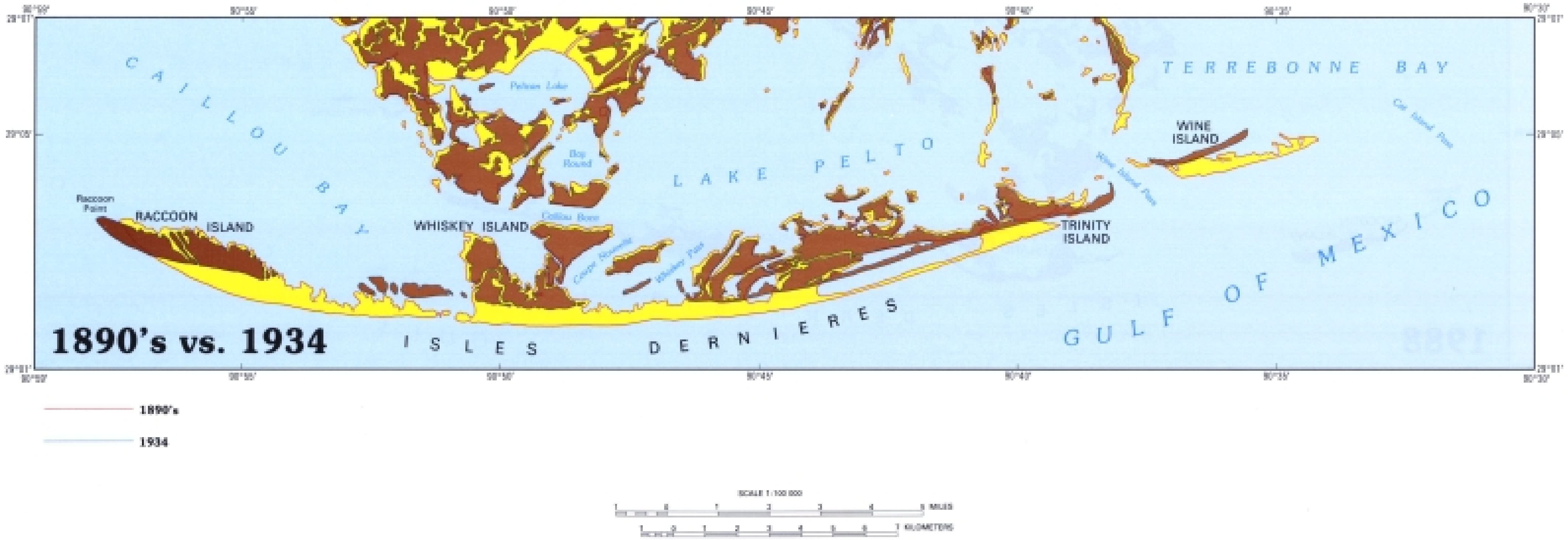
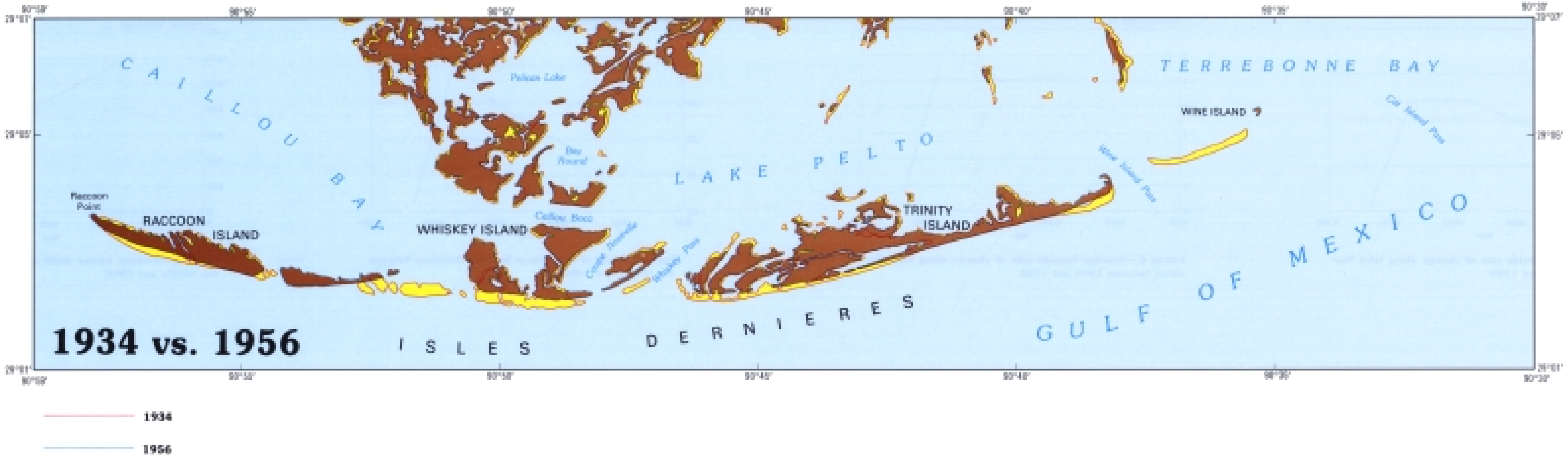


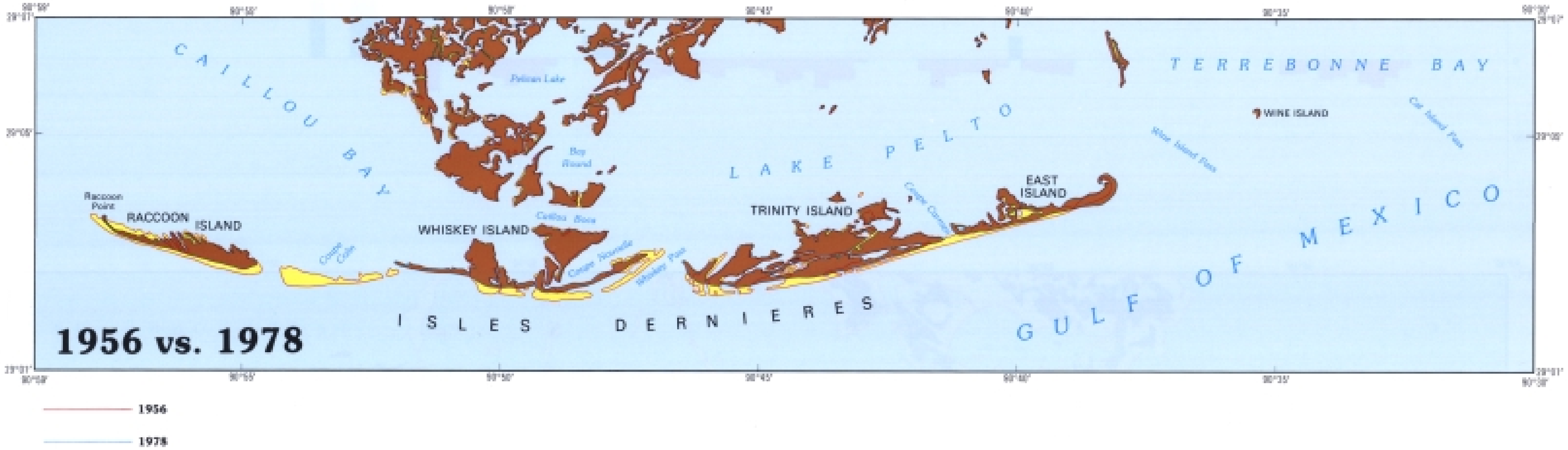
FIGURE 8.—Average barrier width of Isles Dernieres between the 1890's and 1988.

• Shoreline Change and Land Loss •



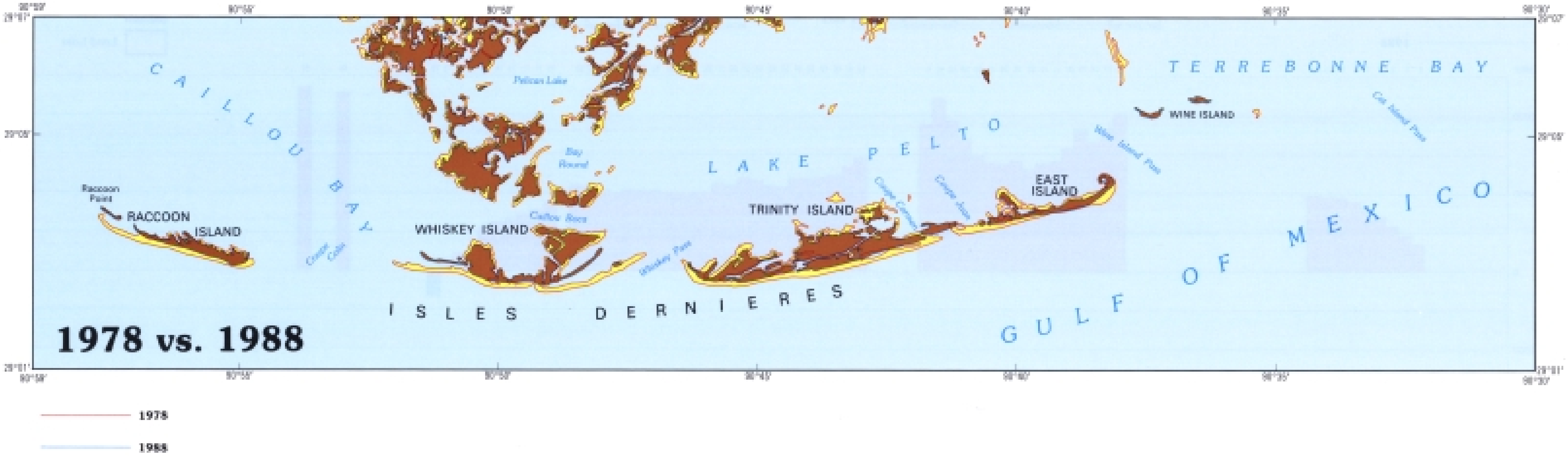


Isles Dernieres

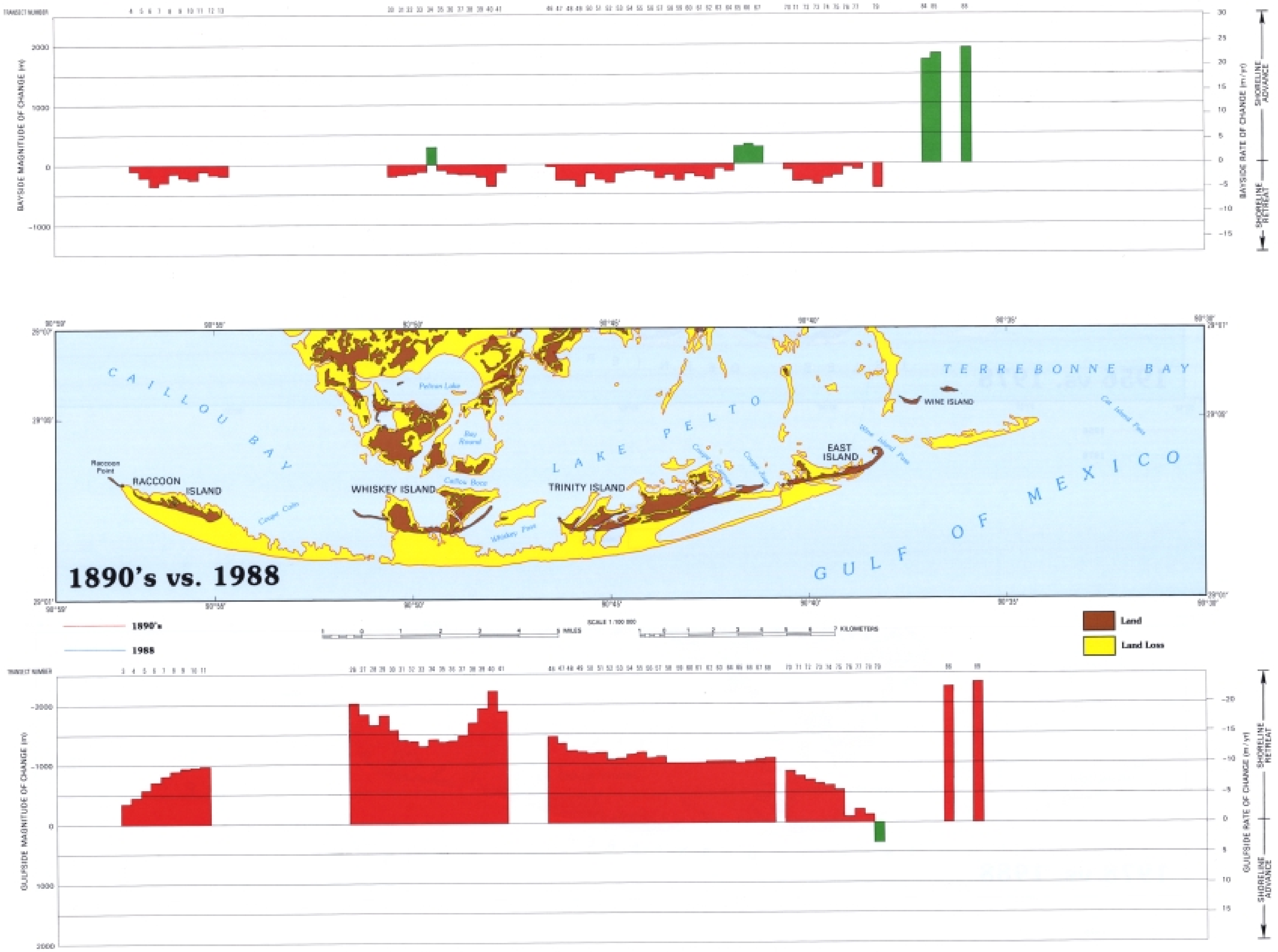


🟫 Land

🟨 Land Loss



Isles Dernieres



Isles Dernieres

TABLE 3.—*Isles Dernieres bayside magnitude of change (meters)*

Transect #		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Transect coordinate		90° 57' 45"	30"	15"	90° 57' 00"	45"	30"	15"	90° 56' 00"	45"	30"	15"	90° 55' 00"	45"	30"	15"	90° 54' 00"	45"	30"	15"	90° 53' 00"	45"	30"	15"	90° 52' 00"
Y	1906-1934	n.a.	n.a.	-142	-172	-88	-108	-45	-2	-42	-110	-4	-99	-10	8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	214	141	683	722
e	1934-1956	-88	-67	-18	-74	-11	-16	-215	-64	-12	-82	-30	-29	-42	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	107	73	21	429
a	1956-1978	145	-89	-157	-111	-198	-155	183	-66	-10	-4	-6	-14	4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	255
r	1978-1988	223	274	n.a.	237	89	20	-218	-8	-148	-42	-58	-41	-127	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
s	1906-1988	n.a.	n.a.	n.a.	-120	-207	-259	-294	-140	-212	-238	-98	-183	-175	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Transect #		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Transect coordinate		45"	30"	15"	90° 51' 00"	45"	30"	15"	90° 50' 00"	45"	30"	15"	90° 49' 00"	45"	30"	15"	90° 48' 00"	45"	30"	15"	90° 47' 00"	45"	30"	15"	90° 46' 00"
Y	1906-1934	614	836	651	872	896	-115	-43	-74	-218	-204	-65	-58	-85	-60	-83	-96	-41	-61	-27	-39	n.a.	-752	-85	-24
e	1934-1956	n.a.	n.a.	n.a.	n.a.	n.a.	-6	-35	-24	2	207	4	-23	-45	-34	-19	-71	12	-94	-26	-48	n.a.	524	-33	-73
a	1956-1978	n.a.	n.a.	n.a.	n.a.	n.a.	-10	-7	-7	-8	117	-8	-6	-4	4	-8	-11	-67	-38	-48	n.a.	n.a.	160	-18	-3
r	1978-1988	n.a.	434	261	228	338	-65	-83	-55	108	219	-27	-65	-43	-75	-94	-180	-33	n.a.	n.a.	n.a.	n.a.	20	-138	-172
s	1906-1988	n.a.	1279	1556	1801	1618	-196	-168	-160	-116	339	-96	-152	-177	-165	-204	-358	-129	n.a.	n.a.	n.a.	n.a.	-48	-274	-272

Transect #		49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
Transect coordinate		45"	30"	15"	90° 45' 00"	45"	30"	15"	90° 44' 00"	45"	30"	15"	90° 43' 00"	45"	30"	15"	90° 42' 00"	45"	30"	15"	90° 41' 00"	45"	30"
Y	1906 - 1934	-45	-26	-26	-32	-33	-38	-49	-56	-37	-34	-20	-25	-71	-35	-29	-24	-41	-53	-49	-66	-17	-28
e	1934 - 1956	-72	10	-6	-74	-40	-35	-29	3	-24	-27	-10	-24	-26	-67	-54	-54	-73	-18	-80	-97	-34	-30
a	1956 - 1978	-13	-12	-27	-24	11	11	18	-6	-4	-6	-6	-3	-4	-3	21	8	22	n.a.	254	299	8	17
r	1978 - 1988	-149	-124	-231	-187	-73	-60	-48	-56	-168	-110	-243	-102	-114	-156	-21	-60	384	n.a.	33	n.a.	n.a.	-44
s	1906 - 1988	-279	-152	-290	-317	-135	-122	-108	-115	-233	-177	-279	-154	-215	-261	-83	-130	292	324	288	n.a.	n.a.	-81

Transect #		71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
Transect coordinate		15"	90° 40' 00"	45"	30"	15"	90° 39' 00"	45"	30"	15"	90° 38' 00"	45"	30"	15"	90° 37' 00"	45"	30"	15"	90° 36' 00"	45"	30"	15"	90° 35' 00"
Y	1906 - 1934	-67	-98	-80	-87	-83	-153	-401	n.a.	-649	n.a.	n.a.	74	74	112	188	227	488	389	659	752	847	n.a.
e	1934 - 1956	-64	-53	-54	-55	-58	-49	322	182	291	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
a	1956 - 1978	-8	17	29	22	29	234	37	37	-8	-12	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
r	1978 - 1988	-151	-148	-142	-107	-66	-91	-53	-99	-3	1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
s	1906 - 1988	-290	-282	-247	-227	-178	-59	-95	n.a.	-369	n.a.	n.a.	n.a.	n.a.	1749	1438	n.a.	n.a.	1821	n.a.	n.a.	n.a.	n.a.

Isles Dernieres bayside summary

Years	Sum	Avg	STD	Total	Range	Count
1906 - 1934	-1655	-23.6	237.0	848	-752	70
1934 - 1956	-888	-15.8	104.1	429	-215	62
1956 - 1978	502	8.2	82.3	299	-198	61
1978 - 1988	-2879	-51.4	126.1	384	-243	56
1906 - 1988	-2894	-51.7	474.9	1801	-369	56

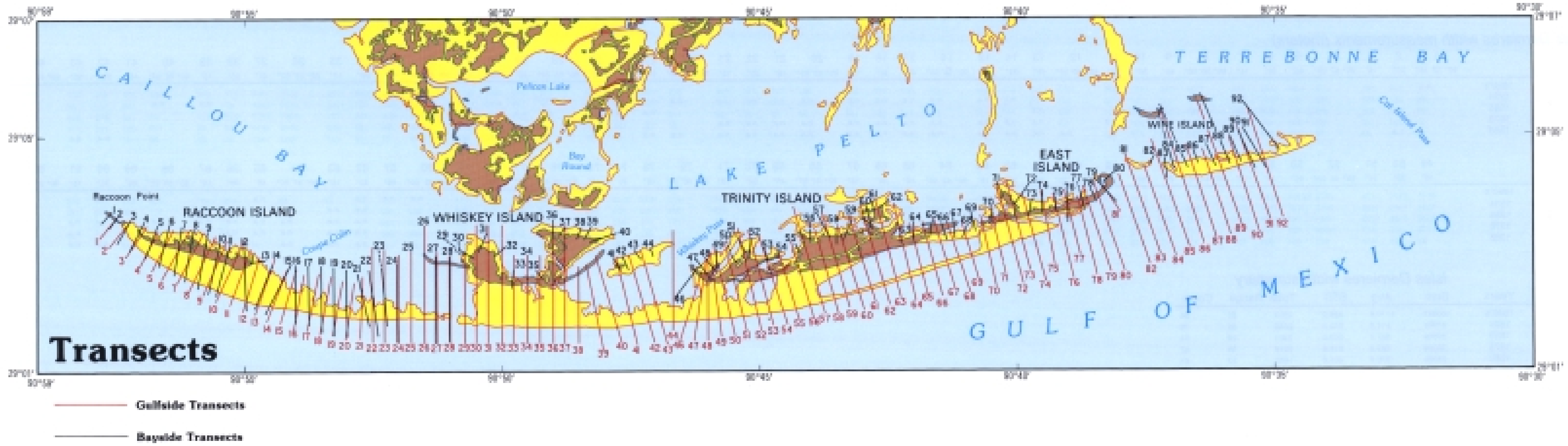


TABLE 4.—*Isles Dernieres gulfside magnitude of change (meters)*

Transect #		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Transect coordinate		90° 57' 45"	30"	15"	90° 57' 00"	45"	30"	15"	90° 56' 00"	45"	30"	15"	90° 55' 00"	45"	30"	15"	90° 54' 00"	45"	30"	15"	90° 53' 00"	45"	30"	15"	90° 52' 00"
Y	1887-1934	n.a.	432	218	61	-70	-216	-370	-480	-585	-607	-732	-764	-443	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-618	-745	-920	n.a.
e	1934-1956	-30	-95	-184	-226	-250	-215	-162	-108	-42	-7	23	-7	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-254	-424	-443	n.a.
a	1956-1978	-140	-68	-87	-84	-94	-111	-103	-140	-147	-130	-144	-219	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-321
r	1978-1988	-300	n.a.	-292	-192	-154	-158	-159	-137	-145	-82	-125	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
s	1887-1988	n.a.	n.a.	-342	-441	-570	-700	-796	-865	-919	-826	-978	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Transect #		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Transect coordinate		45"	30"	15"	90° 51' 00"	45"	30"	15"	90° 50' 00"	45"	30"	15"	90° 49' 00"	45"	30"	15"	90° 48' 00"	45"	30"	15"	90° 47' 00"	45"	30"	15"	90° 46' 00"
Y	1887-1934	-606	-576	-662	-735	-612	-1209	-855	-874	-724	-979	-584	-502	-575	-643	n.a.	n.a.	-948	-1060	-1260	n.a.	n.a.	-651	-602	-668
e	1934-1956	n.a.	n.a.	n.a.	n.a.	n.a.	-67	-322	-339	-228	-311	-299	-287	-305	-203	n.a.	n.a.	-339	-418	-448	n.a.	n.a.	-380	-278	-221
a	1956-1978	n.a.	n.a.	n.a.	n.a.	n.a.	-89	-254	-222	-239	-153	-311	-276	-241	-372	-379	-386	-407	-282	-339	n.a.	n.a.	-239	-312	-323
r	1978-1988	n.a.	-929	-214	-289	-274	-122	-157	-141	-115	-179	-172	-281	-365	-468	-563	-652	-182	n.a.	n.a.	n.a.	n.a.	-162	-153	-109
s	1887-1988	n.a.	-2112	-1923	-1957	-1914	-1488	-1588	-1576	-1306	-1622	-1366	-1346	-1487	-1686	-1829	-2222	-1876	n.a.	n.a.	n.a.	n.a.	-1432	-1345	-1321

Transect #		49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
Transect coordinate		45"	30"	15"	90° 45' 00"	45"	30"	15"	90° 44' 00"	45"	30"	15"	90° 43' 00"	45"	30"	15"	90° 42' 00"	45"	30"	15"	90° 41' 00"	45"	30"
Y	1887-1934	-623	-492	-464	-581	-581	-620	-598	-549	-558	-559	-576	-540	-574	-589	-584	-835	-643	-833	-800	-893	-979	-682
e	1934-1956	-223	-253	-293	-165	-612	-116	-123	-107	-122	-82	-101	-132	-97	-70	-83	-48	-19	-14	-35	-17	-11	13
a	1956-1978	-262	-248	-176	-210	109	-283	-292	-248	-182	-166	-128	-143	-137	-140	-126	-125	-135	-178	-172	n.a.	-178	-115
r	1978-1988	-180	-182	-230	-115	-99	-133	-177	-188	-253	-187	-177	-176	-177	-221	-233	-230	-204	-197	-252	n.a.	n.a.	-173
s	1887-1988	-1288	-1175	-1163	-1071	-1183	-1152	-1190	-1091	-1113	-994	-982	-991	-985	-1020	-1026	-1238	-1001	-1222	-1259	-1262	n.a.	-957

Transect #		71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
Transect coordinate		15"	90° 40' 00"	45"	30"	15"	90° 39' 00"	45"	30"	15"	90° 38' 00"	45"	30"	15"	90° 37' 00"	45"	30"	15"	90° 36' 00"	45"	30"	15"	90° 35' 00"
Y	1887-1934	-555	-501	-448	-442	-394	38	-83	54	592	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-663	-687	-887	-673	-750	-822	n.a.
e	1934-1956	23	22	3	-8	-15	-31	-118	-211	-311	-262	-182	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
a	1956-1978	-66	-74	-43	-68	-118	-118	-90	-8	89	132	108	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
r	1978-1988	-174	-153	-121	-102	-18	37	60	47	-28	-199	-217	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
s	1887-1988	-772	-706	-609	-620	-545	-74	-231	-118	342	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-2370	n.a.	n.a.	-2348	n.a.	n.a.	n.a.

Isles Dernieres gulfside summary

Years	Sum	Avg	STD	Total	Range	Count
1887 - 1934	-39568	-549.6	309.9	592	-1260	72
1934 - 1956	-10753	-176.7	144.2	23	-612	61
1956 - 1978	-10732	-173.1	104.4	189	-407	62
1978 - 1988	-11547	-192.5	105.6	60	-929	60
1887 - 1988	-67136	-1118.9	527.8	342	-2348	60

See page 46 for explanation of numbers.

Isles Dernieres

TABLE 5.—*Isles Dernieres bayside rate of change (meters per year)*

Transect #		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Transect coordinate		90° 57' 45"	30"	15"	90° 57' 00"	45"	30"	15"	90° 56' 00"	45"	30"	15"	90° 55' 00"	45"	30"	15"	90° 54' 00"	45"	30"	15"	90° 53' 00"	45"	30"	15"	90° 52' 00"	45"	30"	15"	90° 51' 00"	45"	30"	15"	90° 50' 00"	45"	30"	15"	90° 49' 00"	45"	30"	15"	90° 48' 00"	45"	30"	15"	90° 47' 00"	45"	30"	15"	90° 46' 00"
Y	1906-1934	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
e	1934-1956	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
a	1956-1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
r	1978-1988	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
s	1906-1988	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Transect #		49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
Transect coordinate		45"	30"	15"	90° 45' 00"	45"	30"	15"	90° 44' 00"	45"	30"	15"	90° 43' 00"	45"	30"	15"	90° 42' 00"	45"	30"	15"	90° 41' 00"	45"	30"	15"	90° 40' 00"	45"	30"	15"	90° 39' 00"	45"	30"	15"	90° 38' 00"	45"	30"	15"	90° 37' 00"	45"	30"	15"	90° 36' 00"	45"	30"	15"	90° 35' 00"
Y	1906 - 1934	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
e	1934 - 1956	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
a	1956 - 1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
r	1978 - 1988	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
s	1906 - 1988	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Isles Dernieres bayside summary

Years	Sum	Avg	STD	Total Range		Count
1906 - 1934	-89.1	-0.8	8.5	33.9	-28.9	76
1934 - 1956	-82.3	-1.0	8.7	14.8	-8.6	82
1956 - 1978	17.5	0.3	4.1	18.1	-8.0	81
1978 - 1988	-288.8	-8.2	12.8	38.4	-24.3	56
1906 - 1988	-33.3	-0.6	5.8	23.5	-4.9	56

TABLE 6.—*Isles Dernieres width measurements (meters)*

Transect #		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Transect coordinate		90° 57' 45"	30"	15"	90° 57' 00"	45"	30"	15"	90° 56' 00"	45"	30"	15"	90° 55' 00"	45"	30"	15"	90° 54' 00"	45"	30"	15"	90° 53' 00"	45"	30"	15"	90° 52' 00"	45"	30"	15"	90° 51' 00"	45"	30"	15"	90° 50' 00"	45"	30"	15"	90° 49' 00"	45"	30"	15"	90° 48' 00"	45"	30"	15"	90° 47' 00"	45"	30"	15"	90° 46' 00"
Y	1890's	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
e	1934	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
a	1956	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
r	1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
s	1988	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Transect #		49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
Transect coordinate		45"	30"	15"	90° 45' 00"	45"	30"	15"	90° 44' 00"	45"	30"	15"	90° 43' 00"	45"	30"	15"	90° 42' 00"	45"	30"	15"	90° 41' 00"	45"	30"	15"	90° 40' 00"	45"	30"	15"	90° 39' 00"	45"	30"	15"	90° 38' 00"	45"	30"	15"	90° 37' 00"	45"	30"	15"	90° 36' 00"	45"	30"	15"	90° 35' 00"
Y	1890's	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
e	1934	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
a	1956	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
r	1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
s	1988	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Isles Dernieres width summary

Years	Sum	Avg	STD	Total Range		Count
1890's	100887	1179.4	828.2	3293	52	86
1934	61958	814.8	663.8	2888	48	76
1956	50886	687.3	558.0	2281	28	74
1978	39298	586.2	512.8	2016	38	67
1988	24080	376.0	401.0	1663	23	64

TABLE 7.—*Isles Dernieres gulfside rate of change (meters per year)*

Transect #		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Transect coordinate		90° 57' 45"	30"	15"	90° 57' 00"	45"	30"	15"	90° 56' 00"	45"	30"	15"	90° 55' 00"	45"	30"	15"	90° 54' 00"	45"	30"	15"	90° 53' 00"	45"	30"	15"	90° 52' 00"	45"	30"	15"	90° 51' 00"	45"	30"	15"	90° 50' 00"	45"	30"	15"	90° 49' 00"	45"	30"	15"	90° 48' 00"	45"	30"	15"	90° 47' 00"	45"	30"	15"	90° 46' 00"
Y	1887-1934	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
e	1934-1956	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
a	1956-1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
r	1978-1988	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
s	1887-1988	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Transect #		49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
Transect coordinate		45"	30"	15"	90° 45' 00"	45"	30"	15"	90° 44' 00"	45"	30"	15"	90° 43' 00"	45"	30"	15"	90° 42' 00"	45"	30"	15"	90° 41' 00"	45"	30"	15"	90° 40' 00"	45"	30"	15"	90° 39' 00"	45"	30"	15"	90° 38' 00"	45"	30"	15"	90° 37' 00"	45"	30"	15"	90° 36' 00"	45"	30"	15"	90° 35' 00"
Y	1887-1934	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
e	1934-1956	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
a	1956-1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
r	1978-1988	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
s	1887-1988	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Isles Dernieres gulfside summary

Years	Sum	Avg	STD	Total Range		Count
1887 - 1934	-841.9	-11.7	6.8	12.6	-27.6	72
1934 - 1956	-488.8	-7.8	6.8	1.0	-23.3	63
1956 - 1978	-487.7	-7.8	8.7	8.8	-18.8	62
1978 - 1988	-1154.7	-19.2	12.7	8.0	-64.3	60
1887 - 1988	-685.3	-11.1	6.2	3.4	-23.2	60

EXPLANATION

Description of shoreline change data

1439	Shoreline advance or island width as measured at points subject to the influence of entrances (e.g., tidal inlets, bayous, bays, etc.)
158	Shoreline advance or island width as measured at points not subject to the influence of entrances
0	Black zeroes, italicized or non-italicized, represent no shoreline movement
-345	Shoreline retreat as measured at points not subject to the influence of entrances
-942	Shoreline retreat as measured at points subject to the influence of entrances

Abbreviations in shoreline change data tables

n.a.	No shoreline data exist because of entrance location
n.a.	No bayside shoreline exists (e.g., headland areas)
n.d.	No survey exists or maps unavailable

Isles Dernieres

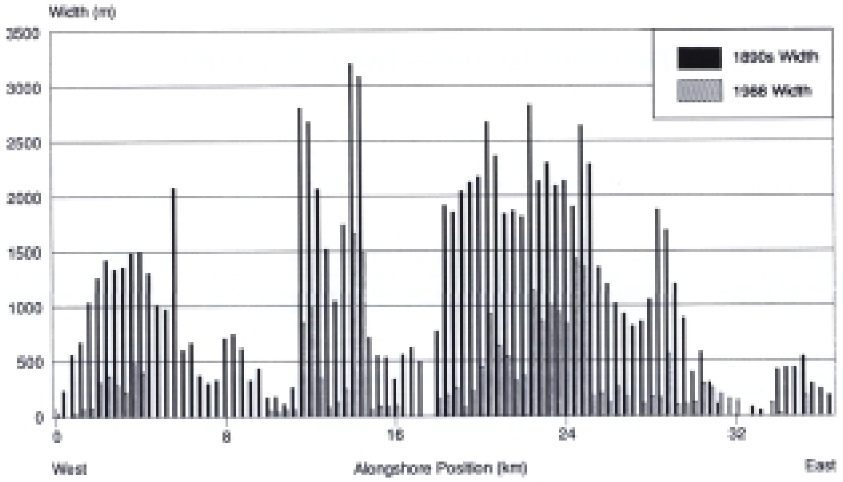


FIGURE 9.—Comparison of the 1890's and 1988 barrier widths for Isles Dernieres.

TABLE 8.—Area changes for Isles Dernieres from the 1890's to 1988

Date	Area (ha)	Change (ha)	% Change	Rate (ha/yr)	Projected Date of Disappearance
1890's	3,532				
1934	1,958	-1,574	-45%	-35.8	1989
1934	1,958				
1956	1,458	-500	-26%	-22.7	2020
1956	1,458				
1978	1,243	-215	-15%	-9.8	2105
1978	1,243				
1988	771	-472	-38%	-47.2	2004
1890's	3,532				
1988	771	-2,761	-78%	-28.2	2015

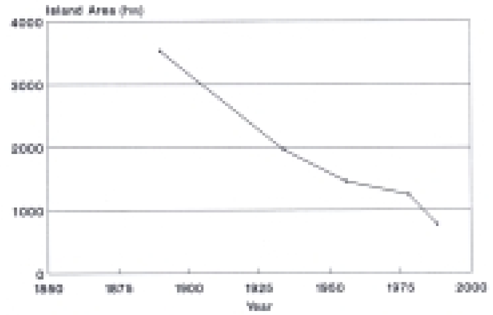


FIGURE 10.—Area change for Isles Dernieres between the 1890's and 1988.