FINAL REPORT

Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 – Updated Shoreline Compilation and Change Assessment, 1880s to 2015

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In Cooperation with CDM Smith

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Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 – Updated Shoreline Compilation and Change Assessment, 1880s to 2015

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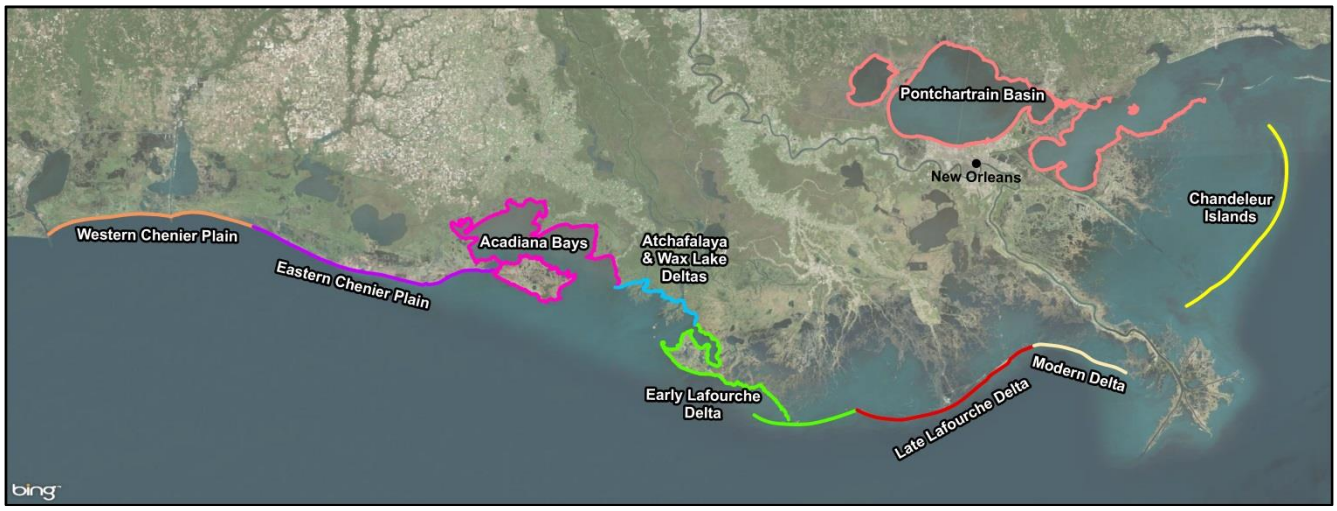

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Authors:

Mark R. Byrnes (Applied Coastal) was the primary author of this report and Principal Investigator for the project. He was responsible for project management and execution, including data analyses, interpretations, and report preparation. **Jennifer L. Berlinghoff** (Applied Coastal) conducted quality assurance and control efforts regarding shoreline mapping and geodatabase development, completed all shoreline change analyses, prepared maps and figures, and contributed to written sections of the report. **Sarah F. Griffee** (Applied Coastal) compiled historical shoreline positions, conducted quality assurance and control analyses, and contributed to report preparation. **Darin M. Lee** was the CPRA project manager and technical lead, and contributed report sections on the BICM program.

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Executive Summary

The Barrier Island Comprehensive Monitoring Program (BICM) provides integrated, comprehensive data on Louisiana shorelines, aiding in planning, design, maintenance, and evaluation of restoration projects. The primary goal of this BICM-Phase 2 effort was to revise and update existing BICM historical shoreline change data (Phase 2 - Byrnes et al., 2017; Phase 1 – Martinez et al., 2009) for coastal Louisiana from the mid-1800s to 2015. The principal addition to the existing Phase 2 data set was the 2015 regional shoreline derived from orthoimagery from the U.S. Department of Agriculture (National Agriculture Imagery Program [NAIP]). Backbarrier shorelines for the 1998, 2004, 2005, 2008, 2012, and 2015 periods also were digitized for establishing geomorphic polygons for habitat change analysis within the broader BICM program. Coastal structure locations were digitized for the 2015 epoch as well. As an update to existing Phase 2 shorelines, topographic maps for the 1930s were digitized and integrated with existing 1930s shorelines for more complete coverage in the Acadiana Bays and Pontchartrain Basin Regions. Finally, 1950s shoreline data previously interpreted from smaller-scale maps/photographs were re-interpreted from higher-resolution imagery for portions of the Late Lafourche Delta, Modern Delta, and Chandeleur Islands Regions.

Once shorelines were compiled and attributed, the USGS Digital Shoreline Analysis System (DSAS version 4.3) was used to quantify changes in shoreline position for six epochs: 1) 1880s to 1930s, 2) 1930s to 1950s, 3) 1950s to 1998, 4) 1998 to 2015, 5) 2004 to 2012, and 6) 1880s to 2015. Shoreline change analysis was completed for nine geomorphic regions and 83 shoreline reaches by establishing region-specific baselines and shore-perpendicular transects at 50-m (164-ft) longshore intervals.

Although shoreline change variability is large for all geomorphic regions, regional changes isolate areas of large and chronic loss that have been the primary focus of shoreline restoration. Mean shoreline position change for the entire coast of Louisiana varied between -9.5 and -13.5 ft/yr (see Table below). Most vulnerable geomorphic regions include the Eastern Chenier Plain, Early Lafourche Delta, Late Lafourche Delta, Modern Delta, and Chandeleur Islands. As expected, primarily protected shorelines of the Acadiana Bays, Atchafalaya and Wax Lake Deltas, and Pontchartrain Basin regions recorded relatively small mean shoreline recession rates. For open-Gulf shorelines, mean shoreline change varied between -10.5 and -21.7 ft/yr. These regions absorb the greatest impact from storms, thereby requiring greatest potential for shoreline restoration to provide protection to interior shorelines. For semi-protected coastal areas, a smaller range in mean shoreline recession was documented (5.8 to 8.6 ft/yr). Further, variability in shoreline change rates was much lower in semi-protected coastal areas away from the direct impact of open-Gulf waves and currents (see Table below).

Smallest average shoreline changes for open-Gulf regions occurred between the 1930s and 1950s (-10.5 ft/yr) when hurricane occurrence and intensity were lowest. Conversely, the epoch with greatest average shoreline changes (1998 to 2015; -21.7 ft/yr) recorded 10 hurricanes impacting the coast, including two Category 3 (Hurricanes Katrina and Rita) and four Category 2 events (~5.9 per decade). Although the 1880s to 1930s epoch contained a large number of Category 3 and 2 storms, the frequency of hurricane impact was lower (~3.4 hurricanes per decade) resulting in an average shoreline change of -17.1 ft/yr for the open-Gulf coast. The 1950s to 1998 epoch experienced the greatest number of hurricane impacts; however, the frequency of occurrence was similar to that for the 1880s to 1930s epoch (~3.5 per decade), as was mean shoreline change (-17.6 ft/yr). Although the 1998 to 2015 epoch incurred significant storm impacts over a relatively short period, this epoch also was a time of increased shoreline

and barrier island restoration, with millions of cubic yards of sand added to barrier island systems, increasing the resilience of restored shorelines. Coastal Louisiana shoreline response is driven primarily by tropical cyclone impacts; however, the magnitude of change varies substantially depending on shoreline exposure, orientation, and tropical cyclone characteristics.

Coast-wide variations in shoreline response were driven by regional changes in erosion along the most vulnerable coastal reaches, particularly those associated with the barrier shorelines of the Early and Late Lafourche Deltas, Modern Delta, and Chandeleur Islands. These beaches bear the brunt of direct storm wave impacts from the Gulf of Mexico, resulting in chronic erosion, barrier beach overtopping, and island migration and deterioration. Rockefeller Refuge and Mulberry Island coastal reaches of the Eastern Chenier Plain geomorphic region experience similar high rates of shoreline recession (20 to 40 ft/yr) as barrier beaches of the delta plain. However, dominant west-directed sediment transport to downdrift beaches along the entire chenier plain tempers the magnitude and direction of shoreline change along the Western Chenier Plain coast. The remaining coastal regions are protected to varying degrees from open-Gulf wave processes, although most experience net shoreline recession (5.8 to 6.5 ft/yr) in response to locally-generated storm waves (i.e., those generated within coastal lakes and bays) and relative sea-level rise.

Average Shoreline Change (ft/yr) by Geomorphic Region and Epoch

Geomorphic Region	1880s to 1930s	1930s to 1950s	1950s to 1998	1998 to 2015	2004 to 2012	1880s to 2015
Western Chenier Plain	5.1	7.6	-2.1	1.7	-2.2	3.4
Eastern Chenier Plain	-16.8	-12.3	-18.8	-25.3	-25.3	-18.4
Acadiana Bays	-8.7	-7.5	-8.8	-7.9	-8.2	-8.2
Atchafalaya and Wax Lake Deltas	-12.0	-17.9	-7.6	8.8	29.8	-8.5
Early Lafourche Delta	-19.4	-12.4	-16.5	-16.7	-15.9	-19.6
Late Lafourche Delta	-34.2	-22.2	-22.4	-18.9	-20.5	-27.3
Modern Delta	-15.7	-13.0	-24.8	-12.4	-21.1	-19.3
Chandeleur Islands	-28.4	-16.0	-33.9	-94.0	-135.2	-31.3
Pontchartrain Basin	-4.4	-5.7	-8.6	-6.2	-8.2	-5.5
Louisiana Coast	-10.7	-9.5	-13.5	-12.3	-12.0	-10.4
Open-Gulf Exposure	-17.1	-10.5	-17.6	-21.7	-21.5	-16.5
Semi-Protected Coast	-5.9	-8.1	-8.6	-5.9	-5.8	-6.5

When one isolates shoreline changes by epoch for the central barrier island coast from Raccoon Island to Sandy Point (Reaches 37 to 50), average shoreline recession rates are approximately 10 ft/yr greater than those recorded for the entire Louisiana open-Gulf coast. For the 1880s to 1930s epoch, open-Gulf shoreline recession averaged 17.1 ft/yr. For the same period, shorelines along the central barrier island coast receded at 29.7 ft/yr, emphasizing the influence of the central barrier island coast on coast-wide erosion rates. The Chandeleur Islands region recorded similar recession rates for this period. Between the 1930s and 1950s, a period of reduced hurricane impacts, average shoreline change decreased to -10.5 ft/yr along the open-Gulf coast, and erosion rates along the central barrier island coast decreased as well. However, the magnitude of change for the central barrier island coast (-19.5 ft/yr) and the Chandeleur Islands region (-16.0 ft/yr) was greater than 1.5 times the open-Gulf shoreline change average. During the 1950s to 1998 epoch, shoreline recession increased along the central barrier island coast (26.7 ft/yr) and the Chandeleur Islands (33.9 ft/yr), contributing substantially to the coast-wide

average erosion rate of 17.6 ft/yr. However, between 1998 and 2015, when large-scale restoration of the central barrier island coast was active, shoreline recession decreased to 19.6 ft/yr compared with an open-Gulf mean shoreline change of -21.7 ft/yr. Conversely, the Chandeleur Islands region experienced a nearly three-fold increase in shoreline recession for the same period.

Overall, regional shoreline response is relatively predictable and driven by tropical cyclone magnitude and frequency; however, engineering activities (e.g., beach/island restoration and coastal structure placement) have measurable impacts on localized shoreline response. Where barrier island restoration efforts have been implemented, the coast has been made more resilient and sediment volume lost from eroding deltaic shorelines has been replenished, in part, with sand from sources outside the active sand transport system, thereby augmenting the existing littoral sediment budget. Barrier shoreline changes for the 1998 to 2015 (and 2004 to 2012) epoch(s) document the positive impact of beach and island restoration. As an example, East Grand Terre Island (Reach 48) illustrates increasing shoreline deterioration between the 1880s and 1998, but that trend was reversed after approximately 3 million cubic yards (MCY) of sand and 1.6 MCY of mixed sediment were used to restore the island in 2010. Between 1998 and 2015, shoreline recession rates were reduced to 21.9 ft/yr, and for the period 2004 to 2012, shoreline change was nearly stable at -0.5 ft/yr. Overall, beach restoration/protection projects during the 1998 to 2015 epoch along the Early Lafourche Delta, Late Lafourche Delta, and Modern Delta Regions resulted in net reduction in shoreline recession relative to that recorded during the 1950s to 1998 epoch.

Conversion Factors

U.S. Customary Units	International System of Units
1 foot (ft)	0.3048 meters (m)
1 inch (in)	25.4 millimeters (mm)
1 mile (mi)	1.609 kilometers (km)
1 cubic yard	0.7646 cubic meters

Abbreviations

BICM	Barrier Island Comprehensive Monitoring Program
BIMP	Barrier Island Maintenance Program
CIAP	Coastal Impact Assistance Program
CIMS	Coastal Information Management System
CPRA	Louisiana Coastal Protection and Restoration Authority
CRMS	Coast-wide Reference Monitoring System
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
DSAS	Digital Shoreline Analysis System
GoM	Gulf of Mexico
LCA	Louisiana Coastal Area
LDNR	Louisiana Department of Natural Resources
MCY	Million cubic yards
NAD83	North American Datum of 1983
NAIP	National Agriculture Imagery Program
NGS	National Geodetic Survey
NOAA	National Oceanic and Atmospheric Administration
RSS	Root of Sum of Squares
SSRT	(Louisiana) Shoreline Science Restoration Team
SWAMP	System-Wide Assessment and Monitoring Program
UNO	University of New Orleans
USACE	US Army Corps of Engineers
USC&GS	US Coast and Geodetic Survey
USGS	US Geological Survey

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1.0 Introduction

Shoreline position, defined as the land-water interface at high water, is one of the most important features to monitor in coastal settings. It is particularly important in coastal Louisiana where shoreline erosion is relentless. This dynamic feature marks private versus public ownership, is a tangible line of defense against storm waves for inland communities, is an important ecological habitat for fisheries, and is the primary boundary for numerically predicting coastal landscape changes under natural and engineered future conditions. Morgan and Larimore (1957) were the first to systematically map shoreline position and change in coastal Louisiana, and many other project-level (e.g., Edwards and Namikas, 2011) and regional-scale (e.g., McBride et al., 1992) efforts have aimed to improve on this initial effort. Martinez et al. (2009) completed the BICM-Phase 1 coast-wide shoreline mapping task, and the present report (BICM-Phase 2) updates and replaces the Martinez et al. (2009) data set.

Approximately a third of all Louisiana residents live in coastal zone parishes, the most populated of which are associated with the City of New Orleans. Terrebonne and Lafourche are the two most populated parishes south of New Orleans with extensive beach erosion and shoreline migration where the shoreline meets the Gulf of Mexico (GoM). As such, State resource agencies have allocated considerable resources to establish a comprehensive monitoring strategy, developing a systematic approach at managing risk associated with living within the coastal zone. Geologically, these areas reside on the most-recently abandoned deltaic deposits of the Mississippi River Delta; the Lafourche Delta complex (Frazier, 1967; Kulp et al., 2005; Blum and Roberts, 2012). Besides shoreline and wetland changes recorded on the Modern Birdfoot Delta (Britsch and Dunbar, 2006; Martinez et al., 2009), Gulf beaches associated with the Lafourche Delta Complex document greatest historical changes in south Louisiana (McBride et al., 1992).

West of the Mississippi River Delta Plain are the marginal deltaic deposits of the Chenier Plain (McBride et al., 2008). Shoreline erosion dominates the Gulf-facing coast east of the Mermentau River, whereas historical deposition for large segments of coast west to Sabine Pass has been documented (Byrnes et al., 1995). Although shoreline-change magnitude is less than that observed for the deltaic barrier island coast, sheltered shorelines of the Acadiana Bays and Pontchartrain Basin regions document lowest average change rates for the Louisiana coast (Martinez et al., 2009).

1.1 Barrier Island Comprehensive Monitoring Program (BICM)

Development of a comprehensive program to evaluate the State's barrier shoreline was initiated by a Louisiana Department of Natural Resources (LDNR) workgroup in 2002 (now Coastal Protection and Restoration Authority [CPRA]). This workgroup developed a monitoring framework to assess shoreline processes and resulting habitats, and the changes in these ecosystems over time. The initial plan was reviewed in 2004 by the Louisiana Shoreline Science Restoration Team (SSRT) working under the Louisiana Coastal Area (LCA) program. The LCA plan recommended establishment of a coordinated System-Wide Assessment and Monitoring Program (SWAMP) that would integrate the environmental monitoring of wetlands (Coast-wide Reference Monitoring System, or CRMS-Wetlands), rivers and inshore waters (CRMS-Waters), nearshore waters, and barrier islands (BICM).

The initiation of BICM in 2005 was conducted through CPRA and funded by the LCA Science and Technology (S&T) office through a partnership between the University of New Orleans (UNO) and the U.S. Geological Survey (USGS). Initial goals of the BICM program were to establish baseline conditions

for the State's barrier shoreline after hurricanes Katrina and Rita, as well as to refine methods and products for use in programs other than LCA (e.g., Coastal Wetlands Planning, Protection, and Restoration Act [CWPPRA]; Coastal Impact Assistance Program [CIAP]; Barrier Island Maintenance Program [BIMP]).

The advantage of BICM over project-specific monitoring is the ability to provide integrated long-term data on all Louisiana shorelines, instead of just those areas with constructed projects. As a result, large amounts of long-term data are available to evaluate constructed projects, facilitate planning and design of future barrier shoreline projects, support operations and maintenance activities, determine storm impacts, and provide coast-wide baseline conditions necessary for assessing system evolution. BICM encompasses a wide variety of datasets that include: 1) post-storm damage assessment photography, 2) coast-wide shoreline change and assessment, 3) topography, 4) bathymetry, 5) habitat composition with land/water changes, and 6) surficial sediment composition.

1.2 Initial BICM-Phases 1 and 2 Shoreline Analyses

Although coast-wide monitoring has been an important component of coastal restoration activities in south Louisiana since the 1990s, comprehensive shoreline assessments along the outer coast in support of shoreline restoration projects were not initiated until after the 2005 hurricane season. Severe storm impacts were encountered throughout most of coastal Louisiana during the passage of Hurricanes Katrina and Rita. Damages associated with these storms became a catalyst for increased attention on the need for a comprehensive monitoring effort to document shoreline and nearshore sediment transport processes on a consistent basis in support of Gulf shoreline restoration. As such, BICM was established in 2005 to provide long-term data on Louisiana barrier shoreline systems for planning, design, evaluation, and maintenance of restoration projects. The first phase of BICM was completed in 2012, culminating with a workshop on program achievements, the initial development process, and lessons learned from data collection and analysis (Kindinger et al., 2013). Initial shoreline compilation and change analyses were completed under BICM Phase 1 (Martinez et al., 2009) with shorelines from the 1880s, 1930s, 1998, 2004, and 2005 epochs. BICM Phase 2 shoreline compilation and change analyses (Byrnes et al., 2017) revised and updated Phase 1 efforts, and included three additional regional shorelines (1950s, 2008, and 2012). The present report is a continuation of BICM Phase 2, and specifically addresses assessment of historical and modern shoreline positions from the mid-1800s to 2015, as well as changes derived from temporal comparison of positions. Backbarrier shorelines also were developed for the period 1998 to 2015 for use with habitat delineation and change mapping.

1.3 Purpose

The primary goal of this BICM-Phase 2 effort was to revise and update existing BICM historical shoreline change data (Phase 2 - Byrnes et al., 2017) for coastal Louisiana from the mid-1800s to 2015. The principal addition to the existing data set was the 2015 regional shoreline derived from orthoimagery from the U.S. Department of Agriculture (National Agriculture Imagery Program [NAIP]). Backbarrier shorelines for the 1998, 2004, 2005, 2008, 2012, and 2015 periods also were digitized for establishing geomorphic polygons for habitat change analysis within the broader BICM program. Coastal structure locations were digitized for the 2015 epoch as well. As an update to existing Phase 2 shorelines, topographic maps for the 1930s were digitized and integrated with existing 1930s shorelines for more complete coverage in the Acadiana Bays and Pontchartrain Basin Regions. Finally, 1950s shoreline data previously interpreted from smaller-scale maps/photographs were re-interpreted from higher-resolution

imagery for portions of the Late Lafourche Delta, Modern Delta, and Chandeleur Islands regions for consistency with USC&GS shoreline positions mapped elsewhere. For this report, six periods were identified for documenting shoreline change and map production: 1) 1880s to 1930s; 2) 1930s to 1950s; 3) 1950s to 1998; 4) 1998 to 2015; 5) 2004 to 2012; and 6) 1880s to 2015.

2.0 Project Area

Shorelines along the Louisiana outer coast define the seaward geomorphic feature for protecting inland marsh habitat. Erosion, migration, and deterioration of this boundary pose a long-term impact to interior marsh extent and ecology, thereby potentially limiting the effectiveness of marshes as a buffer to storm energy. The 2012 and 2017 Louisiana Master Plans, as well as previous CWPPRA restoration efforts, recognize the importance of shoreline and barrier island restoration as a first line of defense for interior marshes. Project design depends on detailed analysis of historical shoreline position change under normal and storm processes. As such, shoreline positions for the outer coast of Louisiana were compiled to document historical changes since the mid-1800s from the most western portion of the Chenier Plain at Sabine Pass to the easternmost portion of the Delta Plain at the Chandeleur Islands. The only areas excluded from our analysis were the Modern Birdfoot Delta region and recent Wax Lake – Atchafalaya deltaic deposits where sedimentation processes resulted in shoreline changes inconsistent with those recorded along most other open-coast regions where waves and wave-generated currents dominate erosion and sedimentation patterns.

2.1 BICM Regions

Nine geomorphic regions were identified for which shoreline position and changes are documented between the mid-1800s and 2015 (Figure 1). Barrier beach shorelines are prominent along the Chenier Plain of southwestern Louisiana and the barrier island coast of the Mississippi River Delta Plain, whereas marsh shorelines primarily are associated with the Acadiana Bays and Pontchartrain Basin regions. Although shorelines for active deltaic areas of the Atchafalaya and Wax Lake Deltas and Mississippi River Delta are not included in our analyses, shorelines adjacent to these areas were compiled and evaluated for temporal changes.

2.2 Shoreline Change Reaches

Based on geomorphology and shoreline change characteristics, shoreline reaches were established for each geomorphic region (Figure 2). Eighty-three (83) reaches were delineated for documenting historical shoreline changes along the outer coast and within Lakes Maurepas, Pontchartrain, and Borgne in the Pontchartrain Basin (Table 1). Similar to geomorphic regions, shoreline extent is not constant for shoreline reaches; instead, reach boundaries are defined based on historical shoreline change trends and coastal features including bayou and inlet entrances and structures such as jetties. Overall, 15 of the 20 coastal zone parishes are included in this shoreline change assessment, the top five of which encompass about 60% of the Louisiana outer coast shoreline (Terrebonne [121.1 mi (195 km)], St. Bernard [113.2 mi (182 km)], Cameron [81.3 mi (131 km)], Iberia [79.2 mi (127 km)], and Vermilion [61.8 mi (100 km)]). The Mississippi River Delta Plain exterior shoreline encompasses about 66% of the outer coast (geomorphic regions east of Acadiana Bays), of which the barrier beach shorelines (Raccoon Island to Shell Island reaches and the Chandeleur Islands) extend approximately 142.8 mi (230 km; 30% of the deltaic plain exterior shoreline) and buffer interior marsh habitat against ocean waves from the GoM.

Louisiana Geomorphic Regions

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

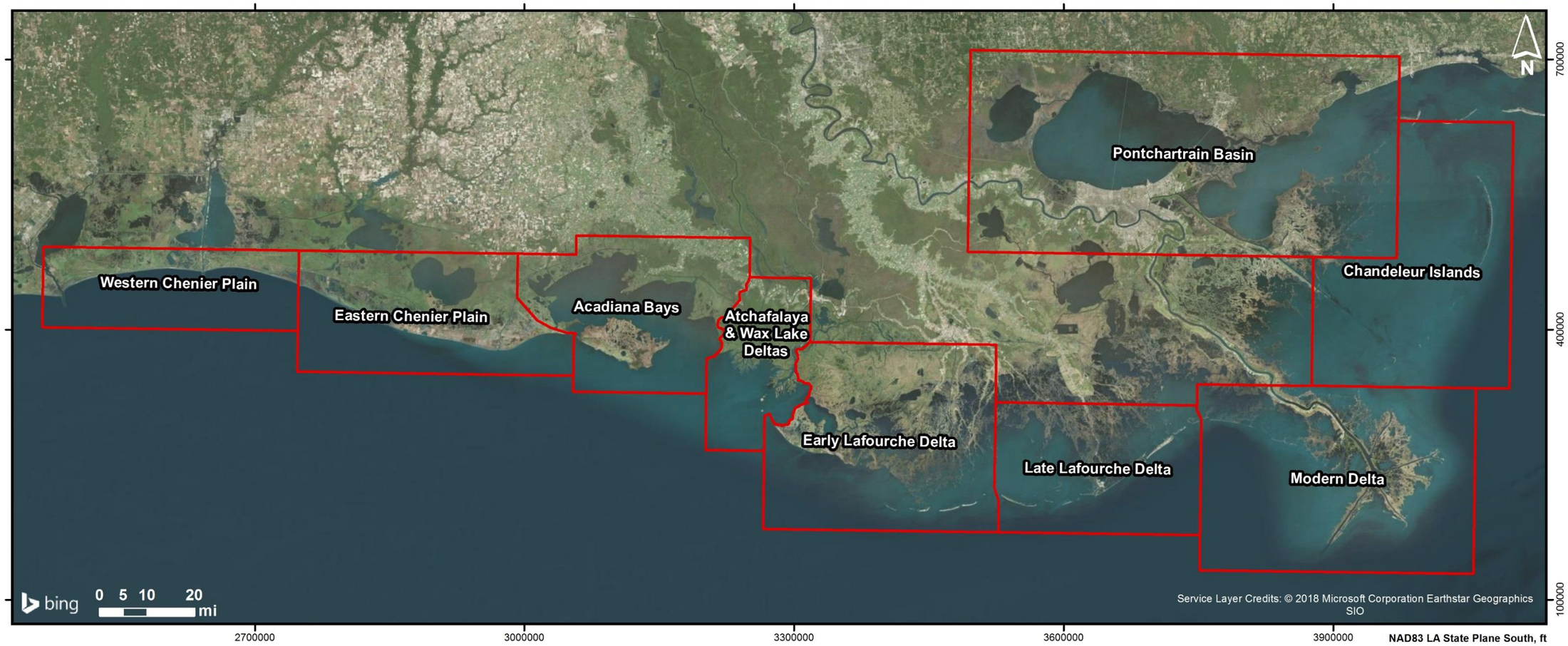
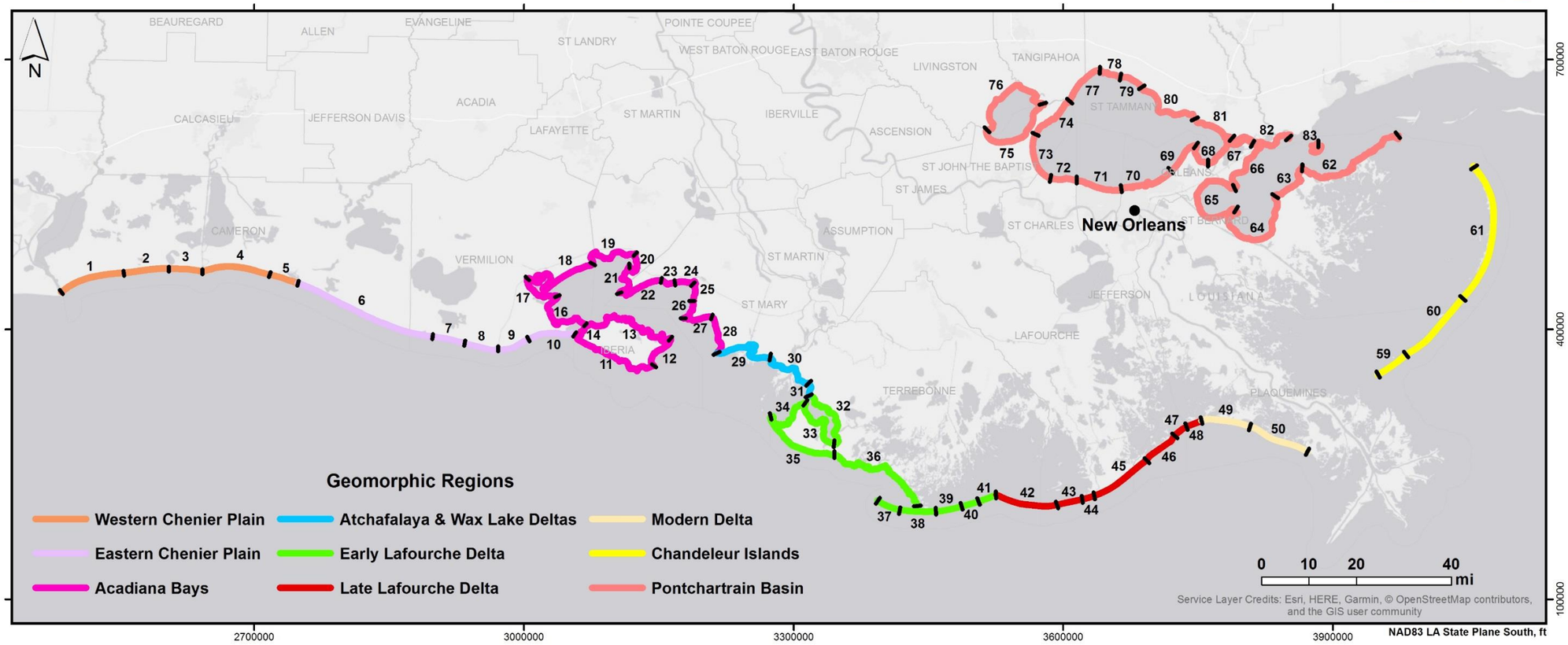


Figure 1. BICM geomorphic regions for coastal Louisiana.

Louisiana Geomorphic Regions and Reaches

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



No.	Reach Name	No.	Reach Name	No.	Reach Name	No.	Reach Name	No.	Reach Name	No.	Reach Name	No.	Reach Name
1	Johnson's Bayou	12	Marsh Island - South Point	24	The Jaws - West	35	Point Au Fer Island	46	Grand Isle	65	Bayou Bienvenue	76	Maurepas Northwest
2	Ocean View Beach	13	Marsh Island Bayside	25	The Jaws - East	36	Oyster Bayou to Caillou Boca	47	West Grand Terre	66	New Orleans Landbridge	77	Tangipahoa River
3	Holly Beach	14	SW Pass - Marsh Island	26	Point Marone	37	Raccoon Island	48	East Grand Terre	67	Lake Catherine	78	Madisonville
4	Hackberry Beach	16	Hell Hole Bayou	27	Point No Point	38	Whiskey Island	49	Chaland Headland	68	South Point	79	Mandeville
5	Mermentau River	17	Redfish Point	28	Bayou Sale	39	Trinity Island	50	Shell Island	69	Little Woods	80	Big Branch Marshes
6	Rockefeller Refuge	18	Vermilion Beach	29	Wax Lake Delta	40	East Island	59	Breton Island	70	New Orleans Lakefront	81	Slidell
7	Mulberry Island	19	Avery Island	30	Atchafalaya Delta	41	Wine Island	60	Grand Gosier and Curlew Islands	71	Jefferson Lakefront	82	Pearl River
8	Freshwater Bayou	20	Weeks Island	31	Plumb Bayou	42	Timbalier Island	61	North Chandeleur Islands	72	LaBranche Marshes	83	Grand Island Pass
9	Chenier Au Tigre	21	Cypremort Point - West	32	Four League Bay - East	43	East Timbalier Island	62	Isle Aux Pitre	73	Frenier Swamp		
10	Rainey Refuge	22	Cypremort Point - East	33	Four League Bay - West	44	West Belle Pass	63	Biloxi Marsh	74	Manchac Swamp		
11	Marsh Island	23	Cote Blanche Island	34	North Point	45	Caminada Headland	64	Shell Beach	75	Maurepas Southeast		

Figure 2. Shoreline reaches within BICM geomorphic regions for coastal Louisiana.

Table 1. Shoreline reaches, lengths, and Parishes.

Region	Reach No.	Reach Name	Length (mi)*	Parish
Western Chenier Plain	1	Johnson's Bayou	13.5	Cameron
	2	Ocean View Beach	9.6	
	3	Holly Beach	7.2	
	4	Hackberry Beach	14.1	
	5	Mermentau River	6.4	
Eastern Chenier Plain	6	Rockefeller Refuge	30.5	
	7	Mulberry Island	6.8	Vermilion
	8	Freshwater Bayou	7.2	
	9	Chenier Au Tigre	7.1	
	10	Rainey Refuge	10.0	
Acadiana Bays	11	Marsh Island	19.5	Iberia
	12	Marsh Island - South Point	7.9	
	13	Marsh Island Bayside	23.0	
	14	SW Pass - Marsh Island	1.2	
	16	Hell Hole Bayou	14.8	Vermilion
	17	Redfish Point	3.8	
	18	Vermilion Beach	12.1	
	19	Avery Island	12.7	Iberia
	20	Weeks Island	5.7	
	21	Cypremort Point - West	9.2	
	22	Cypremort Point - East	10.1	St. Mary
	23	Cote Blanche Island	3.1	
	24	The Jaws - West	4.1	
	25	The Jaws - East	3.8	
	26	Point Marone	4.5	
	27	Point No Point	6.6	
	28	Bayou Sale	8.8	
Atchafalaya & Wax Lake Deltas	29	Wax Lake Delta	12.9	
	30	Atchafalaya Delta	11.7	
	31	Plumb Bayou	3.1	Terrebonne
Early Lafourche Delta	32	Four League Bay - East	14.6	
	33	Four League Bay - West	14.2	
	34	North Point	11.2	
	35	Point Au Fer Island	17.4	
	36	Oyster Bayou to Caillou Boca	22.7	
	37	Raccoon Island	4.6	
	38	Whiskey Island	8.0	
	39	Trinity Island	5.6	
	40	East Island	3.5	
	41	Wine Island	2.5	

Table 1. Continued				
Region	**Reach No.**	**Reach Name**	**Length (mi)***	**Parish**
Late Lafourche Delta	42	Timbalier Island	13.7	Terrebonne
	43	East Timbalier Island	4.3	Lafourche
	44	West Belle Pass	2.9	
	45	Caminada Headland	13.7	
	46	Grand Isle	8.1	Jefferson
	47	West Grand Terre	3.4	
	48	East Grand Terre	3.3	Plaquemines
Modern Delta	49	Chaland Headland	10.0	
	50	Shell Island	13.5	
Chandeleur Islands	59	Breton Island	6.1	
	60	Grand Gosier and Curlew Islands	9.9	
	61	North Chandeleur Islands	29.7	St. Bernard
Pontchartrain Basin	62	Isle Aux Pitre	22.3	
	63	Biloxi Marsh	10.8	
	64	Shell Beach	21.6	
	65	Bayou Bienvenue	20.1	
	66	New Orleans Landbridge	13.0	Orleans
	67	Lake Catherine	7.3	
	68	South Point	5.1	
	69	Little Woods	8.2	
	70	New Orleans Lakefront	10.9	
	71	Jefferson Lakefront	9.7	Jefferson
	72	LaBranche Marshes	5.6	St. Charles
	73	Frenier Swamp	10.2	St. John the Baptist
	74	Manchac Swamp	9.8	
	75	Maurepas Southeast	16.7	
	76	Maurepas Northwest	21.0	Livingston
	77	Tangipahoa River	9.5	Tangipahoa
	78	Madisonville	4.4	St. Tammany
	79	Mandeville	5.0	
	80	Big Branch Marshes	15.8	
	81	Slidell	7.9	
	82	Pearl River	7.8	
	83	Grand Island Pass	8.7	St. Bernard
		Total	765.7	

* Approximate reach length analyzed for shoreline change based on transect number and spacing (1 mi = 1.6 km)

2.3 Shoreline Restoration/Protection Projects

Thirty-one (31) shoreline restoration/protection projects were constructed between 1994 and 2015 along the outer coast of Louisiana. Most projects have been constructed along the barrier island coastline, where shoreline recession rates exceed those recorded along the Chenier Plain coast, thereby signifying regions of greatest need (CPRA, 2016; Table 2). Projects include three along the Western Chenier Plain Region, two along the Eastern Chenier Plain Region, eight associated with the Early Lafourche Delta Region, nine along the Late Lafourche Delta Region, seven along the Modern Delta System, and two associated with the Chandeleur Islands Region (Table 2; Appendix A). Most of these projects have been monitored, and their performance has been assessed to improve design and performance of future shoreline restoration/protection efforts.

For the period 1998 to 2015, 23 projects were completed along the southeastern Louisiana Gulf shoreline. Approximately 67 million cubic yards (MCY) of sand and mixed sediment from borrow areas was placed to create barrier beach and dune habitat, and backbarrier marsh habitat (Appendix A). The projects have added substantial material to the coastal sediment budget, thereby providing resilience to the outer deltaic coast that constitutes the first line of defense to interior deltaic habitat from storm waves and water levels. The long-term benefit of this restoration approach is the addition of sediment to a littoral system that is otherwise sediment starved (Morang et al., 2013). Augmenting natural sediment delivery to the outer coast not only offers an immediate benefit in that created subaerial land protects interior habitat, but sediment added to the system replenishes adjacent environments through littoral sediment transport during the natural reworking process associated with barrier restoration.

Along the Chenier Plain coast, most projects involved the use of structures to protect shorelines against incident wave and current energy (Table 2). However, beach restoration and channel dredging placement were recorded between Sabine and Calcasieu Passes during the analysis period (CPRA, 2014). Approximately 1.75 MCY of sand from offshore borrow sites was added to the beaches landward of breakwater structures near the community of Ocean View Beach. Based on observations from aerial imagery and personal communications with Galveston District dredging engineers, approximately 4 MCY of sediment dredged from the Sabine navigation channel was pumped east of the Sabine Pass jetties at the coast between 2006 and 2010. Further, 2012 imagery illustrates sediment deposition immediately west of the Calcasieu jetties, presumably resulting from channel dredging, resulting in shoreline advance. Finally, approximately 2 million cubic yards of sand was placed along the shoreline between the western jetty at Calcasieu Pass and Holly Beach between August 2013 and February 2014. This restoration effort created a protective beach for nearly 6 miles west of Calcasieu Pass.

2.4 Historical Storms

Tropical cyclone wind, wave, and water level forces impart greatest changes to beach and wetland environments in coastal Louisiana. In fact, Stone et al. (1997) suggested that up to 90% of shoreline recession can be accounted for by hurricanes and tropical storms. Although daily variations in wave approach and intensity continually shape the boundary between land and sea, destructive energy associated with periodic events control shoreline evolution at all temporal scales. As such, observed historical shoreline changes were evaluated within the context of storm frequency and intensity for specific change periods and their proximity to shoreline survey end points. Research has noted the impact of tropical cyclones along the Louisiana coast and associated variations in storm magnitude and frequency

Table 2. Shoreline Restoration/Protection Projects (1994-2015) (from CPRA, 2016).	
	Construction Date
Western Chenier Plain (Johnson's Bayou to Mermentau River)	
Holly Beach Breakwaters (CSD-01)	1994
Holly Beach Sand Management (CS-31)	2003
Cameron Parish Shoreline Restoration (CS-33)	2013-2014
Eastern Chenier Plain (Rockefeller Refuge to Rainey Refuge)	
Cheniere au Tigre Shoreline Protection Project (TV-16)	2005
Rockefeller Refuge Gulf Shoreline Protection Demonstration Project (0018-EB)	2010
Early Lafourche Delta Region (Raccoon Island to Wine Island)	
Raccoon Island Repair and Restoration Project (TE-106)	1994
Raccoon Island Breakwaters Demonstration (TE-29)	1997
Whiskey Island Restoration (TE-27)	1998
Isles Dernieres Restoration East Island (TE-20)	1998
Isles Dernieres Restoration Trinity Island (TE-24)	1998
Raccoon Island Shoreline Protection/ Marsh Creation (TE-48)	2007, 2013
New Cut Dune and Marsh Restoration Project (TE-37)	2007
Whiskey Island Back Barrier Marsh Creation (TE-50)	2009
Late Lafourche Delta Region (Timbalier to East Grand Terre Island)	
Timbalier Island Planting Demonstration (TE-18)	1996
East Timbalier Island Sediment Restoration, Phase 1 (TE-25)	2000
East Timbalier Island Sediment Restoration, Phase 2 (TE -30)	2000
Vegetative Plantings of a Dredged Material Disposal Site on Grand Terre Island (BA-28)	2001
Timbalier Island Dune and Marsh Creation (TE-40)	2004
East Grand Terre Island Restoration (BA-30)	2010
West Belle Pass Barrier Headland Restoration (TE-52)	2012
Caminada Headland Beach and Dune Restoration (BA-45)	2013-2015
Modern Delta Region (East Grand Terre to Sandy Point)	
Pass La Mer to Chaland Pass Restoration (BA-38, part1)	2007
Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration (BA-35)	2009
Emergency Berms W8, W9, W10	2010-2011
Barataria Barrier Island Complex Project: Pelican Island and Pass (BA-38, part 2)	2012
Riverine Sand Mining/Scofield Island Restoration (BA-40)	2013
Shell Island East Berm (BA-110)	2013
Shell Island West Berm (BA-111)	2014
Chandeleur Islands Region	
Chandeleur Islands Marsh Restoration (PO-27)	2001
Eastern Berm Reach E4 (East of Mississippi River along Chandeleur Islands)	2010

(e.g., Stone et al., 1997; Mock, 2008). We focused on variations in tropical cyclones for the four analysis periods when shoreline changes were documented along the south Louisiana coast. Our analysis relies upon data present in the National Oceanic and Atmospheric Administration (NOAA) web site on historical hurricane tracks (NOAA, 2016). Tropical cyclone frequency and magnitude are summarized for two specific coastal segments; southwestern Louisiana between Sabine Pass and eastern Marsh Island, and southeastern Louisiana between eastern Marsh Island and the Chandeleur Islands. All direct hits within 125 miles of Lake Charles (southwestern Louisiana area) and 125 miles of New Orleans (southeastern Louisiana area) were recorded.

Tables 3 and 4 document the occurrence and magnitude of tropical cyclones impacting shoreline response in south Louisiana. For the initial shoreline change epoch (1880s to 1930s) in southwestern Louisiana, shoreline compilation for the 1880s encompassed the period 1855 to 1886, although the entire Chenier Plain outer coast was surveyed between 1883 and 1886 (see Appendix B). For the 1930s period, the western half of the Chenier Plain was surveyed in 1923 and 1924, whereas the eastern portion of the region was surveyed between 1933 and 1935. During this period, 20 tropical cyclones (2.5 per decade) crossed the coast, three (3) of which were Category 3 hurricanes (Figure 3A). The outer coast of southeastern Louisiana experienced 50 tropical cyclones (about 6 per decade) with greater intensity (two Category 4 and six Category 3 hurricanes) during the same period (Figure 3B).

The second shoreline change epoch (1930s to 1950s) recorded nine cyclones over a 20-year period for southwestern Louisiana, two of which were Category 2 hurricanes and six of which were tropical storms. Along the southeastern Louisiana outer coast, 14 cyclones impacted deltaic wetlands (about 5 per decade), but only one of the three hurricanes was a Category 2. This was a relatively calm period for south Louisiana (Figure 3B).

During the 1950s to 1998 epoch in southwestern Louisiana, hurricane frequency and intensity increased (eight hurricanes; one Category 4, one Category 3); however, the rate at which cyclones impacted this area was not substantially different than the previous period. Along the southeastern Louisiana coast, 12 tropical cyclones crossed the delta plain (11 hurricanes and 1 tropical storm). In the 1960s and early 1970s, one Category 5, two Category 4, and one Category 3 hurricane impacted the coast and interior wetlands, a trend similar to that experienced in southwestern Louisiana (Figure 3). Hurricanes had substantial impact on coastal change throughout south Louisiana during this period.

Between 1998 and 2015, the southwestern Louisiana coast experience five hurricanes and three tropical storms (Figure 3A). Hurricane Rita (category 3) had greatest impact on coastal changes; however, Hurricanes Gustav and Ike caused substantial beach changes in 2008 (Byrnes and McBride, 2009). For the 17-year period, cyclone frequency averaged about 5 per decade. Within this period, storm intensity and frequency were greatest between 2004 and 2012 (seven tropical cyclones). Four events were hurricanes and three were tropical storms. Because the period of record was 8 years, cyclone frequency was highest of any shoreline change epoch (about 9 per decade). Storm impacts resulted in greatest changes throughout the period of record, particularly those associated with Hurricanes Rita and Ike. The same trend was present in southeastern Louisiana, where 13 tropical cyclones resulted in large shoreline changes along the outer coast, especially those associated with Hurricanes Georges, Katrina, and Gustav (Table 4; Figure 3B).

Table 3. Historical tropical cyclones between Sabine Pass and eastern Marsh Island through 2015 (NOAA, 2016).			
Storm Name	**Year**	**Date**	**Category**
UNNAMED	1854	September 16-21, 1854	TS
UNNAMED	1856	August 9-12, 1856	H3
UNNAMED	1863	September 29 to Oct 01, 1863	TS
UNNAMED	1865	September 6-14, 1865	H2
UNNAMED	1867	September 25 to October 9, 1867	H1
UNNAMED	1879	August 19-24, 1879	H2
UNNAMED	1882	September 11-16, 1882	TS
UNNAMED	1886	June 13-15, 1886	H2
UNNAMED	1886	October 8-13, 1886	H3
UNNAMED	1889	August 8-9, 1889	TS
UNNAMED	1895	October 2-7, 1895	TS
UNNAMED	1897	September 10-13, 1897	H1
UNNAMED	1898	September 2-13, 1898	TS
UNNAMED	1898	September 12-22, 1898	TS
UNNAMED	1898	September 20-28, 1898	TS
UNNAMED	1905	September 24-30, 1905	TS
UNNAMED	1908	July 29 to August 3, 1908	TS
UNNAMED	1918	August 1-7, 1918	H3
UNNAMED	1932	September 18-21, 1932	TS
UNNAMED	1934	August 26 to September 1, 1934	H1
UNNAMED	1937	October 2-4, 1937	TS
UNNAMED	1938	August 10-15, 1938	H1
UNNAMED	1940	August 3-10, 1940	H2
UNNAMED	1940	September 18-25, 1940	TS
UNNAMED	1941	September 11-16, 1941	TS
UNNAMED	1943	July 25-30, 1943	H2
UNNAMED	1943	September 15-20, 1943	TS
UNNAMED	1946	June 13-16, 1946	TS
BARBARA	1954	July 27-30, 1954	TS
AUDREY	1957	June 25-29, 1957	H4
BERTHA	1957	August 8-11, 1957	TS
CINDY	1963	September 16-20, 1963	H1
FELICE	1970	September 12-17, 1970	TS
EDITH	1971	September 5-18, 1971	H2
CARMEN	1974	August 29 to September 10, 1974	H3
DEBRA	1978	August 26-29, 1978	TS
CLAUDETTE	1979	July 15-29, 1979	TS
DANIELLE	1980	September 4-7, 1980	TS
CHRIS	1982	September 9-12, 1982	TS
DANNY	1985	August 12-20, 1985	H1
JUAN	1985	October 26 to November 1, 1985	H1
BONNIE	1986	June 23-28, 1986	H1
UNNAMED	1987	August 9-17, 1987	TS
CHANTAL	1989	July 30 to August 3, 1989	H1
LILI	2002	September 21 to October 4, 2002	H1
IVAN	2004	September 2-24, 2004	TS
RITA	2005	September 18-26, 2005	H3
HUMBERTO	2007	September 12-14, 2007	H1
EDOUARD	2008	August 3-6, 2008	TS
GUSTAV	2008	August 25 to September 5, 2008	H2
IKE	2008	September 1-15, 2008	H2
LEE	2011	September 2-6, 2011	TS
Category refers to relative storm intensity (e.g., TS – tropical storm; H1 – Category 1 hurricane).			

Table 4. Historical tropical cyclones between eastern Marsh Island and the Chandeleur Islands through 2015 (NOAA, 2016).

Storm Name	Year	Date	Category
UNNAMED	1855	September 8-17, 1855	H3
UNNAMED	1855	August 3-7, 1855	TS
UNNAMED	1856	August 7-14, 1856	H4
UNNAMED	1857	June 22-25, 1857	TS
UNNAMED	1860	August 8-16, 1860	H3
UNNAMED	1860	September 7-16, 1860	H2
UNNAMED	1860	September 24 to October 3, 1860	H2
UNNAMED	1861	October 31 to November 3, 1861	TS
UNNAMED	1866	June 1-6, 1866	TS
UNNAMED	1867	September 25 to October 9, 1867	H2
UNNAMED	1867	September 15-17, 1867	TS
UNNAMED	1868	October 1-7, 1868	TS
UNNAMED	1869	September 4-6, 1869	H1
UNNAMED	1872	July 9-13, 1872	TS
UNNAMED	1875	September 2-19, 1875	TS
UNNAMED	1877	September 14-21, 1877	H1
UNNAMED	1879	August 29 to September 2, 1879	H3
UNNAMED	1879	October 3-7, 1879	TS
UNNAMED	1881	July 26 to August 3, 1881	TS
UNNAMED	1885	August 29-31, 1885	TS
UNNAMED	1885	September 17-23, 1885	TS
UNNAMED	1885	September 24 to October 2, 1885	TS
UNNAMED	1887	October 9-22, 1887	H1
UNNAMED	1887	June 11-14, 1887	TS
UNNAMED	1888	August 14-24, 1888	H2
UNNAMED	1888	June 25-28, 1888	TS
UNNAMED	1889	September 12-26, 1889	H1
UNNAMED	1890	August 18-28, 1890	TS
UNNAMED	1891	September 19-22, 1891	TS
UNNAMED	1892	September 8-17, 1892	TS
UNNAMED	1893	September 4-9, 1893	H2
UNNAMED	1893	September 27 to October 5, 1893	H4
UNNAMED	1895	August 14-17, 1895	TS
UNNAMED	1897	September 10-13, 1897	H1
UNNAMED	1900	September 11-15, 1900	TS
UNNAMED	1901	August 2-18, 1901	H1
UNNAMED	1905	October 5-11, 1905	TS
UNNAMED	1907	September 18-23, 1907	TS
UNNAMED	1909	September 13-22, 1909	H3
UNNAMED	1911	August 8-14, 1911	TS
UNNAMED	1912	June 7-17, 1912	TS
UNNAMED	1914	September 15-19, 1914	TS
UNNAMED	1915	September 21 to October 1, 1915	H3
UNNAMED	1920	September 16-23, 1920	H2
UNNAMED	1923	October 12-17, 1923	H1
UNNAMED	1923	June 22-29, 1923	TS
UNNAMED	1923	October 16-21, 1923	TS
UNNAMED	1926	August 20-27, 1926	H3
UNNAMED	1926	September 11-22, 1926	TS
UNNAMED	1931	July 11-17, 1931	TS
UNNAMED	1936	July 26-28, 1936	TS
UNNAMED	1937	September 16-21, 1937	TS
UNNAMED	1939	September 23-27, 1939	TS
UNNAMED	1944	September 9-11, 1944	TS
UNNAMED	1946	June 13-16, 1946	TS
UNNAMED	1947	August 18-27, 1947	TS

Table 4. Continued.			
Storm Name	**Year**	**Date**	**Category**
UNNAMED	1947	September 4-21, 1947	H2
UNNAMED	1948	September 1-6, 1948	H1
UNNAMED	1949	September 3-5, 1949	TS
BRENDA	1955	July 31 to August 3, 1955	TS
UNNAMED	1955	August 25-28, 1955	TS
UNNAMED	1956	June 12-15, 1956	TS
FLOSSY	1956	September 21-30, 1956	H1
ESTHER	1957	September 16-19, 1957	TS
ETHEL	1960	September 14-17, 1960	H1
HILDA	1964	September 28 to October 5, 1964	H3
BETSY	1965	August 27 to September 13, 1965	H4
CAMILLE	1969	August 14-22, 1969	H5
CARMEN	1974	August 29 to September 10, 1974	H4
BABE	1977	September 3-9, 1977	H1
BOB	1979	July 9-16, 1979	H1
ELENA	1985	August 28 to September 4, 1985	H3
JUAN	1985	October 26 to November 1, 1985	H1
FLORENCE	1988	September 7-11, 1988	H1
BERYL	1988	August 8-10, 1988	TS
DANNY	1997	July 16-27, 1997	H1
GEORGES	1998	September 15 to October 1, 1998	H2
HERMINE	1998	September 17-20, 1998	TS
ALLISON	2001	June 5-19, 2001	TS
BERTHA	2002	August 4-9, 2002	TS
HANNA	2002	September 12-15, 2002	TS
ISIDORE	2002	September 14-27, 2002	TS
BILL	2003	June 28 to July 03, 2003	TS
MATTHEW	2004	October 8-11, 2004	TS
CINDY	2005	July 3-11, 2005	H1
KATRINA	2005	August 23-31, 2005	H3
GUSTAV	2008	August 25 to September 5, 2008	H2
LEE	2011	September 2-6, 2011	TS
ISAAC	2012	August 20 to September 1, 2012	H1
Category refers to relative storm intensity (e.g., TS – tropical storm; H1 – Category 1 hurricane).			

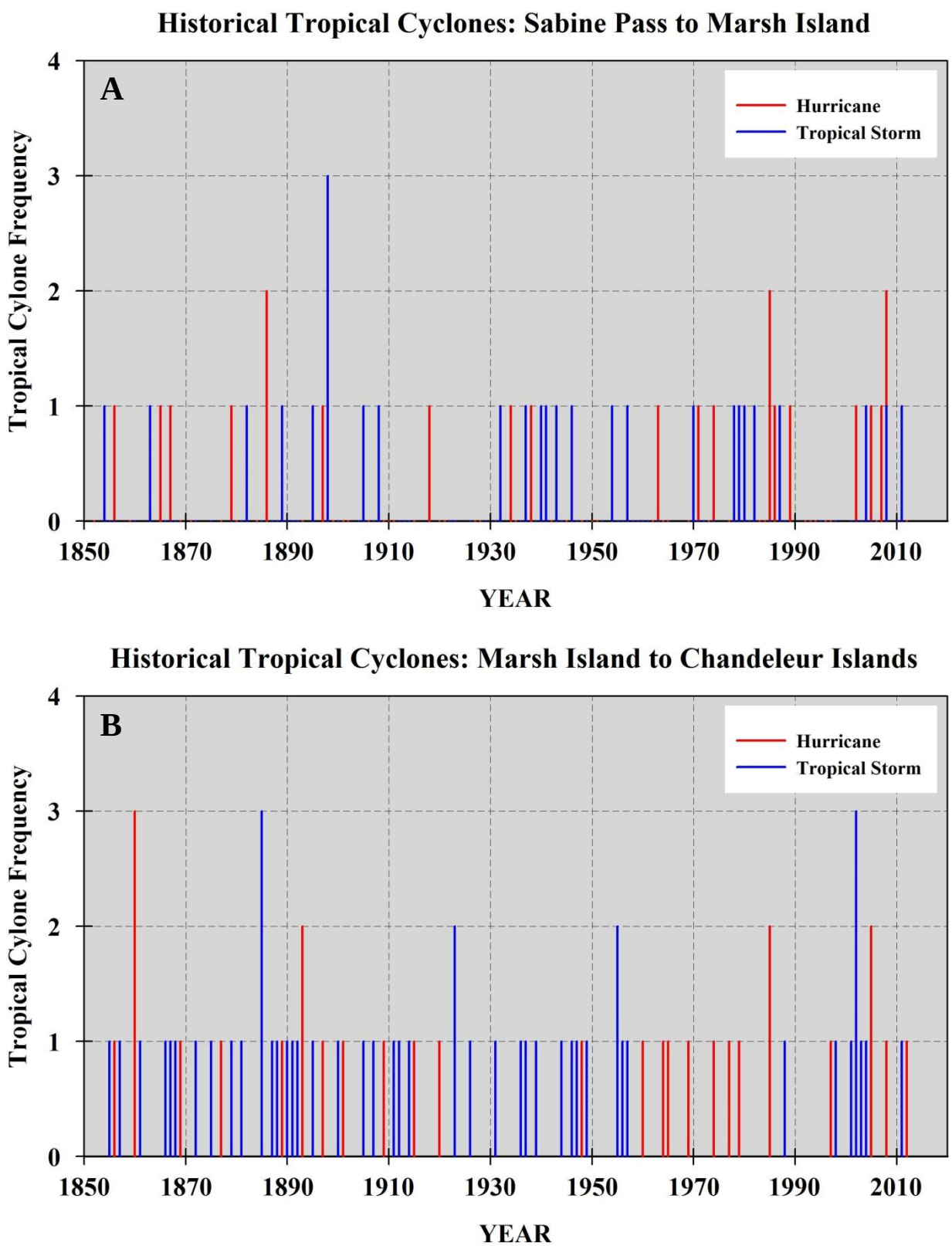


Figure 3. Tropical cyclone occurrence along the Louisiana coastal zone: A) Sabine Pass to eastern Marsh Island, B) eastern Marsh Island to the Chandeleur Islands.

3.0 Methods

Regional historical shoreline changes along the outer coast of Louisiana have been documented previously to determine the extent of Louisiana's jurisdiction over resource ownership in the offshore coastal zone (Morgan and Larimore, 1957), to document variations in shoreline recession and advance relative to dominant coastal processes and geological controls (Morgan and Morgan, 1983; McBride et al., 1992 [Louisiana Delta Plain]; Byrnes et al., 1995 [Louisiana Chenier Plain]), and to support coastal restoration requirements under the BICM program (Martinez et al., 2009; Byrnes et al., 2017). The present study updates Byrnes et al. (2017) to include a 2015 regional shoreline and backbarrier shorelines. Furthermore, shoreline position data for the 1930s were added for the Acadiana Bays and Pontchartrain Basin Regions, and some 1950s shoreline data previously interpreted from smaller-scale maps/photographs were re-interpreted from higher-resolution imagery for the Late Lafourche Delta, Modern Delta, and Chandeleur Islands Regions. When necessary, shoreline positions were re-analyzed to quantify change for the 1880s to 1930s, 1930s to 1950s, 1950s to 1998, 1998 to 2015, 2004 to 2012, and 1880s to 2015 epochs. Results presented in this report and accompanying data files supersede all existing BICM shoreline change data presented in Martinez et al. (2009) and Byrnes et al. (2017).

3.1 Shoreline Data Sources

US Coast & Geodetic Survey (USC&GS) topographic maps (T-sheets), US Geological Survey (USGS) topographic quadrangles, and orthorectified aerial imagery were used for compiling high-water shoreline position throughout the coastal zone of Louisiana. Nine shoreline periods were compiled during BICM Phase 2: 1) 1880s, 2) 1930s, 3) 1950s, 4) 1998, 5) 2004, 6) 2005, 7) 2008, 8) 2012, and 9) 2015. The 1880s, 1930s, and 1950s T-sheets encompassed multiple years (Appendix B). However, 1930s and 1950s USC&GS shorelines were limited in the Acadiana Bays and Pontchartrain Basin. As such, data gaps in the 1930s were filled with USGS topographic maps where appropriate, and gaps in the 1950s were filled using using aerial photography. The time range for orthorectified imagery between 1998 and 2015 was much narrower than map data and required no gaps to be filled with alternate sources. For all time periods, map dates for specific segments of coast were linked within each regional geodatabase, ensuring exact time comparisons for all shoreline position changes. Further, source data information presented in Appendix B is included with all digital data.

3.2 Shoreline and Structure Compilation

High-resolution scans of original USC&GS shoreline manuscripts (metric maps) were registered using graticule markings on the maps and projected to the 1983 North American Datum (NAD83) Louisiana South State Plane coordinate system using ArcGIS mapping software. National Geodetic Survey (NGS) control monuments were used as an independent check of map registration accuracy. Further, maps from the 1950s and 1930s were registered first because graticule, datum, and ellipsoid parameters for newer vintage maps are defined within ArcGIS, and these newer registered maps were used to bridge control to 1800s vintage maps for accurate co-registration. Finally, selected 1950s vintage maps were co-registered with orthorectified imagery to verify registration for the shoreline data set before temporal comparisons were made. This system of registration checks and balances produces internal consistency within the data set, producing most reliable shoreline changes.

High-water shorelines, as mapped by USC&GS (see Shalowitz, 1964), were compiled for temporal comparison using standard GIS mapping procedures, registration techniques aimed at highest accuracy

and internal data set consistency, and heads-up digitizing of high-resolution scans at a scale of 1:5,000. When initial BICM shoreline data from Martinez et al. (2009) met these compilation standards, data were incorporated within the present geodatabases. High-resolution orthorectified aerial imagery was used to interpret shoreline position for modern times (1998 through 2015). High-water shoreline position determined from orthoimagery represents the upper limit of average wave runup at high tide; relative to geomorphology, this position generally is recognized as the berm crest or an active scarp at the toe of a dune (Byrnes et al., 2012). It also is recognized as the wet/dry boundary on the beach at high water or a debris line marking the position of wave uprush (Leatherman, 2003). For south Louisiana, the wet/dry boundary on the beach at high tide was the primary shoreline marker. Where marsh/swamp shoreline type was dominant, shoreline position was mapped as the vegetation/water boundary, consistent with USC&GS historical shoreline mapping (Shalowitz, 1964). For sections of coast where high-water shoreline interpretation was complicated, and image acquisition date and time were available, measured water levels at nearby NOAA gauges were used to assist with interpretation (e.g., Sabine Pass, Calcasieu Pass, Port Fourchon, Grand Isle). For most images, acquisition was completed at or near the time of high-water. Interpretation from aerial imagery followed procedures consistent with that described by USC&GS for their shoreline position surveys, thereby resulting in consistent comparisons for the period of record.

In addition to shoreline compilation from maps and imagery, a coastal structures inventory was compiled for each period to assist with interpretation of shoreline change variations. Where shore-parallel structures represented the outer coast boundary along a shoreline (e.g., revetment), the outer structure boundary and shoreline boundary were concurrent, unless the structure became separated from the shoreline. Because structures generally do not change position between time periods (although they can be repaired or altered), most-recent structure positions were used to fix locations for all time periods where structures were present. This produced a consistent data set from which to make comparisons and interpretations.

3.3 Shoreline Position Measurement Uncertainty

All shoreline position measurements contain some degree of inherent uncertainty associated with data acquisition and compilation procedures. It is important to quantify limitations in survey measurements and document potential systematic errors that can be eliminated during quality control procedures (Anders and Byrnes, 1991; Crowell et al., 1991; Byrnes and Hiland, 1995; Fletcher et al., 2003; Baker and Byrnes, 2004). Substantial effort was made to ensure any systematic errors were eliminated prior to change analysis. Consequently, measurement uncertainties associated with present and past shoreline surveys are considered random.

Uncertainty estimates were determined to gauge confidence associated with shoreline change measurements for research/engineering applications and management decisions. Because individual uncertainties (those associated with map/image resolution and shoreline feature interpretation) are random and uncorrelated, a combined uncertainty measure was determined by summing in quadrature (root of sum of squares [RSS]) (Taylor, 1997; Fletcher et al., 2003; Genz et al., 2007; Hapke et al., 2010). Shoreline position interpretation from small-scale maps resulted in greatest uncertainty. RSS uncertainty for each shoreline can be calculated using the information in Table 5. Based on these estimates, total position uncertainty for each shoreline was determined as $U_t = \pm\sqrt{U_{fs}^2 + U_c^2 + U_{si}^2}$, where U_{fs} is the estimated uncertainty associated with field survey measurements, U_c is the estimated uncertainty for shorelines derived from cartographic sources, and U_{si} is the estimated uncertainty for shoreline interpre-

Table 5. Estimates of potential random uncertainty associated with shoreline surveys.			
Traditional Engineering Field Surveys (1880s)			
Location of rodded points	±3 ft		
Location of plane table	±7 to 10 ft		
Interpretation of high-water shoreline position at rodded points	±10 to 13 ft		
Error due to sketching between rodded points	up to ±15 ft		
Maximum Field Survey Uncertainty	±22.4 ft		
Cartographic Uncertainties (1880s, 1930s, 1950s)	Map Scale		
	1:10,000	1:20,000	1:30,000
Inaccurate location of control points on map relative to true field location	up to ±10 ft	up to ±20 ft	up to ±30 ft
Placement of shoreline on map	±15 ft	±30 ft	±45 ft
Line width for representing shoreline	±10 ft	±20 ft	±30 ft
Digitizer error	±3 ft	±6 ft	±9 ft
Operator error	±3 ft	±6 ft	±9 ft
Maximum Cartographic Uncertainty	±21.0 ft	±42.1 ft	±63.1 ft
Historical Aerial Surveys (1930s and 1950s)	Map Scale		
	1:10,000	1:20,000	1:30,000
Delineating high-water shoreline position	±15 ft	±30 ft	±45 ft
1998, 2004, 2005, 2008, 2012, 2015 Orthoimagery (delineating high-water shoreline position at 1-m pixel resolution)	±6 ft		
Sources: Shalowitz, 1964; Ellis, 1978; Anders and Byrnes, 1991; Crowell et al., 1991.			

Table 6. Maximum RSS uncertainty for BICM shoreline change data for the south Louisiana coast. Bold numbers identify uncertainty estimates for shoreline change epochs.

Year	1930s	1950s	1998	2004	2005	2008	2012	2015
1880s	**±84.6**[1]	±84.6	±67.2	±67.2	±67.2	±67.2	±67.2	**±67.2**
	(±1.7)[2]	(±1.2)	(±0.6)	(±0.6)	(±0.6)	(±0.6)	(±0.5)	**(±0.5)**
1930s		**±73.1**	±52.0	±52.0	±52.0	±52.0	±52.0	±52.0
		(±2.9)	(±0.8)	(±0.8)	(±0.8)	(±0.8)	(±0.7)	(±0.7)
1950s			**±52.0**	±52.0	±52.0	±52.0	±52.0	±52.0
			(±1.2)	(±1.1)	(±1.0)	(±1.0)	(±0.9)	(±0.8)
1998				±8.5	±8.5	±8.5	±8.5	**±8.5**
				(±1.4)	(±1.2)	(±0.9)	(±0.6)	**(±0.5)**
2004					±8.5	±8.5	**±8.5**	±8.5
					(±8.5)	(±2.1)	**(±1.1)**	(±0.8)
2005						±8.5	±8.5	±8.5
						(±2.8)	(±1.2)	(±0.9)
2008							±8.5	±8.5
							(±2.1)	(±1.2)
2012								±8.5
								(±2.8)

[1] Magnitude of potential uncertainty associated with high-water shoreline position change (ft); [2] Rate of potential uncertainty associated with high-water shoreline position change (ft/yr).

tation from aerial imagery. However, change analysis requires comparing two shorelines from the same geographic area, but different time periods, which means random errors associated with each shoreline must be summed in quadrature for comparison with change results. Table 6 presents a summary of potential RSS uncertainty (i.e., random errors) associated with change analyses computed for specific epochs. Most change estimates for the Louisiana coast document shoreline advance or recession greater than uncertainty estimates. Further, because random uncertainty is considered equally distributed (i.e., has no preferred direction), average uncertainty approaches zero as the number of observations (individual transect measurements) increases (Taylor, 1997). As such, uncertainty estimates are statistically minimized relative to average change calculations for coastal reaches containing many change measurements (i.e., ≈50 or more transect measurements).

3.4 Shoreline Change Analysis

Once shorelines were compiled and attributed, the Digital Shoreline Analysis System (DSAS version 4.3; Thieler et al., 2009) was used to quantify changes in shoreline position for six epochs along the coast: 1) 1880s to 1930s; 2) 1930s to 1950s; 3) 1950s to 1998; 4) 1998 to 2015; 5) 2004 to 2012; and 6) 1880s to 2015. Shoreline change analysis was completed for each of nine geomorphic regions and 83 shoreline reaches (see Figure 2) by establishing region-specific baselines and shore-perpendicular transects at 50-m (164-ft) longshore intervals. Rates of change were determined by subtracting shoreline positions from a common baseline for distinct time periods and dividing by the exact acquisition period for each shoreline location within the geodatabase used by DSAS for analysis. DSAS output tables were joined with transect files to analyze spatial changes. Detailed quality control procedures were employed on a transect-by-transect basis to ensure accurate shoreline comparisons for reach and region data summaries. All shoreline and change information was recorded within geodatabases established for each geomorphic region. For our analyses, we consider a mean calculated change rate to be insignificant if its magnitude is less than the uncertainty rate and the number of measurements used to determine the mean is less than about 50. As expected, all shoreline change rate averages exceed maximum RSS uncertainty estimates for the above criterion.

Shoreline change data are attributed by reach for every geomorphic region, and average changes are recorded for each reach and region by epoch. Further, maps illustrating changes at 50-m (164-ft) intervals document spatial and temporal variations within each geomorphic region (Appendix C). Because the duration of analysis epochs varies from 8 to 135 years, change rates for shorter intervals generally record greater variability than longer epochs. Shorter intervals do not have the benefit of time averaging of storm and normal coastal processes impacting change, and therefore are more susceptible to short-term event impacts. Unless one is interested in evaluating impacts associated with specific events, decade or longer epochs are most useful for comparing average shoreline changes between epochs. The data presented below offer a consistent framework from which to evaluate future shoreline changes along the coast, as well as for planning, design, evaluation, and maintenance of current and future barrier shoreline restoration projects. CPRA will make all shoreline and change data available through the Coastal Information Management System (CIMS).

4.0 Results

The challenge for regional shoreline change data sets is to develop an effective means to summarize and illustrate thousands of measurements throughout a project area (e.g., 16,000 to 21,000 measurements per epoch for south Louisiana) to document temporal and spatial trends, enabling users to understand

relationships between average changes by geomorphic region and reach and change measurements at individual transects. A series of digital and paper map products were developed for the BICM-Phase 2 shoreline change project to address these needs (see CIMS and Appendix C). All digital data were organized within geodatabases by geomorphic region and contain all change calculations. Shoreline change maps were produced for each epoch by geomorphic region, and individual change measurements at each transect were illustrated with average change by reach. These maps allow users to observe change variability within each reach relative to average change by region. In addition, coast-wide summary maps of average reach changes were created for each epoch.

4.1 Shoreline Changes

Six shoreline change epochs were evaluated to document variability in change trends relative to geographic location and engineering activities (i.e., beach restoration and coastal structure placement). The first three epochs (1880s to 1930s, 1930s to 1950s, and 1950s to 1998) illustrate shoreline changes prior to the advent of most shore protection measures along the Gulf shoreline, although navigation structures (jetties) and shore protection in Lake Pontchartrain were present. Since 1998, shore protection and coastal restoration have influenced shoreline response, primarily along the Ocean View Beach and Holly Beach Reaches of the Western Chenier Plain and barrier shoreline environments of the Early Lafourche Delta, Late Lafourche Delta, and Modern Delta Regions.

Table 7 illustrates average shoreline change by region for all of coastal Louisiana. Although shoreline change variability is large for all geomorphic regions, regional changes isolate areas of large and chronic loss that have been the primary focus of shoreline restoration. Mean shoreline position change for the entire coast of Louisiana varied between -9.5 and -13.5 ft/yr, a relatively consistent change rate regardless of temporal epoch. Most vulnerable geomorphic regions include the Eastern Chenier Plain, Early Lafourche Delta, Late Lafourche Delta, Modern Delta, and Chandeleur Islands. As expected, primarily protected shorelines of the Acadiana Bays, Atchafalaya and Wax Lake Deltas, and Pontchartrain Basin regions recorded relatively small mean shoreline recession rates (Table 7). Low mean shoreline recession rates to net shoreline advance for the open Gulf shoreline of the Western Chenier Plain is an anomaly compared with other open-Gulf shorelines in south Louisiana.

When shorelines with open-Gulf wave exposure are evaluated independent of semi-protected interior shorelines for the same temporal epochs, measurable differences in average shoreline change are illustrated. For open-Gulf shorelines, mean shoreline change varied between -10.5 and -21.7 ft/yr (Table 7). When shoreline position data are available for all regions, open-Gulf shorelines encompass about 40% of total shoreline length. These regions absorb the greatest impact from storms, thereby requiring greatest potential for shoreline restoration to provide protection to interior shorelines. For semi-protected coastal areas, a smaller range in mean shoreline recession between epochs was documented (5.8 to 8.6 ft/yr). Further, variability associated with shoreline change rates within epochs was much lower in semi-protected coastal areas away from the direct impact of open-Gulf waves and currents (Table 7).

4.1.1 1880s to 1930s Epoch. The only reaches of coast that illustrated net shoreline advance during this period were those associated with the Western and Easter Chenier Plain Regions and land built into Lake Pontchartrain for development (Figure 4). Reach 1 (Johnson's Bayou) recorded greatest net shoreline advance, although change variability was relatively large and not all segments of this reach showed accretion (Figure 5; Appendix C, Figure C1; Appendix D). Reach 4 (Hackberry Beach) illustrated a similar trend but the magnitude of net shoreline advance was lower (Figure 5).

Table 7. Shoreline change summary for coastal Louisiana. Detailed changes by reach are documented in Appendix D.

Region	1880s to 1930s Change (ft/yr)			1930s to 1950s Change (ft/yr)			1950s to 1998 Change (ft/yr)			1998 to 2015 Change (ft/yr)			2004 to 2012 Change (ft/yr)			1880s to 2015 Change (ft/yr)		
	Mean	**SD**	**n**[1]	**Mean**	**SD**	**n**	**Mean**	**SD**	**n**	**Mean**	**SD**	**n**	**Mean**	**SD**	**n**	**Mean**	**SD**	**n**
Western Chenier Plain	**5.1**	11.8	1595	**7.6**	15.7	1617	**-2.1**	12.6	1625	**1.7**	17.2	1621	**-2.2**	29.4	1619	**3.4**	9.9	1608
Eastern Chenier Plain	**-16.8**	15.5	1978	**-12.3**	26.5	1971	**-18.8**	21.9	1941	**-25.3**	19.7	1907	**-25.3**	19.5	1936	**-18.4**	18.6	1932
Acadiana Bays	**-8.7**	5.7	3015	**-7.5**	8.1	3312	**-8.8**	6.0	4377	**-7.9**	7.6	4187	**-8.2**	8.8	4237	**-8.2**	5.1	3893
Atchafalaya/Wax Lake Deltas	**-12.0**	5.1	632	**-17.9**	6.5	864	**-7.6**	10.0	788	**8.8**	30.6	776	**29.8**	68.5	769	**-8.5**	5.8	574
Early Lafourche Delta	**-19.4**	15.8	2150	**-12.4**	10.6	2981	**-16.5**	14.5	2665	**-16.7**	19.4	2470	**-15.9**	20.6	2472	**-19.6**	12.6	1724
Late Lafourche Delta	**-34.2**	45.2	1188	**-22.2**	35.2	1125	**-22.4**	28.8	1139	**-18.9**	31.6	1177	**-20.5**	37.9	1112	**-27.3**	28.1	1025
Modern Delta	**-15.7**	17.7	662	**-13.0**	18.8	680	**-24.8**	25.7	571	**-12.4**	24.8	530	**-21.1**	40.4	485	**-19.3**	15.6	554
Chandeleur Islands	**-28.4**	25.5	1073	**-16.0**	15.7	1051	**-33.9**	28.0	1002	**-94.0**	79.2	716	**-135.2**	108.9	346	**-31.3**	18.5	704
Pontchartrain Basin	**-4.4**	7.4	7922	**-5.7**	5.3	2734	**-8.6**	4.6	2467	**-6.2**	11.1	7312	**-8.2**	14.8	7290	**-5.5**	5.6	7459
Total	**-10.7**	18.7	20215	**-9.5**	17.8	16335	**-13.5**	17.7	16575	**-12.3**	28.0	20696	**-12.0**	33.4	20266	**-10.4**	14.4	19473
Open-Gulf Exposure	**-17.1**	26.0	8646	**-10.5**	22.4	9435	**-17.6**	22.6	8943	**-21.7**	39.1	8421	**-21.5**	43.1	7970	**-16.5**	20.7	7547
Semi-Protected Coast	**-5.9**	7.3	11569	**-8.1**	7.9	6910	**-8.6**	6.1	7632	**-5.9**	12.9	12275	**-5.8**	23.1	12296	**-6.5**	5.6	11926

[1]n = number of transect measurements for calculating mean; **SD** – standard deviation; **Open-Gulf Exposure** includes Western Chenier Plain, Eastern Chenier Plain, portions of the Early Lafourche Delta, Late Lafourche Delta, Modern Delta, and Chandeleur Islands Regions; **Semi-Protected Coast** includes Acadiana Bays, Atchafalaya/Wax Lake Deltas, and Pontchartrain Basin Regions.

Net shoreline advance at Reaches 8 and 9 along the Eastern Chenier Plain coast were the only other reaches along the Louisiana coast to document natural net shoreline advance (Figure 4). Shoreline change variability relative to mean change was high (Figure 6), and change rates did not always record advance (Appendix C, Figure C7). Overall, the Western Chenier Plain region recorded net accretion for this period (5.1 ft/yr), whereas the Eastern Chenier Plain Region recorded net recession of 16.8 ft/yr (Table 7).

The Acadiana Bays Region recorded net shoreline recession of approximately 8.7 ft/yr (Table 7), although reach change averages varied from -14.0 ft/yr at Reach 12 (Marsh Island – South Point) to -1.8 ft/yr at Reach 20 (Weeks Island) (Figure 4; Appendix C, Figure C13). Eight reaches within the Acadiana Bays Region did not have USC&GS data available for the 1930s, although data for four of those reaches were able to be supplemented with USGS topographic map shorelines. Shoreline change variability was relatively low (Figure 7) as indicated by the low standard deviation associated with mean change (Table 7). Similar to the Acadiana Bays shorelines, the Atchafalaya and Wax Lake Deltas shorelines documented net recession prior to modern deltaic deposition, even though the magnitude of net change was slightly higher at about -12.0 ft/yr (Table 7). Again, shoreline change variability was relatively low (Figure 8; Appendix C, Figure C19); most transect measurements recorded shoreline recession during this period.

The Early Lafourche Delta Region contains two distinctly different coastal segments. Reaches 32 through 36 (Four League Bay – East to Caillou Boca) are primarily marsh and perched beach shorelines, whereas Reaches 37 to 41 (Raccoon Island to Wine Island) are barrier island shorelines of the Isles Dernieres (Appendix C, Figure C25). The sandy barrier shorelines respond much differently to storm and normal wave sediment transport processes than marsh shorelines to the northwest in this region. Net shoreline change within this region is -19.4 ft/yr (Table 7); however, net change along the Isles Dernieres reaches is -36.5 ft/yr (Figures 4 and 9). Shoreline change variability is quite high in this region (Appendix C, Figure C25) but all reaches record recession for this period, indicating long-term deterioration of this abandoned delta lobe (Figure 9).

Farther east, on the most-recently abandoned delta lobe of the Mississippi River (Late Lafourche), net shoreline recession rates exceed 100 ft/yr at Reaches 43 and 44 (East Timbalier Island and West Belle Pass) (Figure 4 and 10). However, variability in the magnitude of shoreline recession is large (-144.2 ft/yr to -0.6 ft/yr) (Appendix C, Figure C31), and the predominant direction of lateral island migration is east and west on either side of the Caminada Headland. Net shoreline recession for the region is 34.2 ft/yr, the highest erosion rate for any region along the Louisiana coast (Table 7).

The Modern Delta Region encompasses the easternmost islands of the barrier islands west of the Mississippi River (Figures 4 and 11). Mean shoreline recession for this region is 15.7 ft/yr, but variability relative to mean change is large (Appendix C, Figure C37; Appendix D).

East of the Mississippi River, two geomorphic regions encompass the remaining Louisiana shoreline. The Chandeleur Islands Region includes sandy barrier islands of the St. Bernard Delta. These are low-relief barrier islands that migrate landward and deteriorate in response to storm-induced sediment transport processes (Fearnley et al., 2009a,b). Average shoreline recession is 28.4 ft/yr (Table 7; Appendix D), but shoreline change variability is large (Figure 12; Appendix C, Figure C43). Conversely, shoreline changes within the more protected Pontchartrain Basin Region are lower and more consistent (Figures 4 and 13). Mean shoreline change is -4.4 ft/yr, with largest shoreline recession at Reaches 72 and 74 (LaBranche Marshes and Manchac Swamp; 9.7 ft/yr) and greatest shoreline advance of 15.6 ft/yr at Reach 70 (New Orleans Lakefront) where land was built into Lake Pontchartrain for development

Louisiana Shoreline Change: 1880s to 1930s

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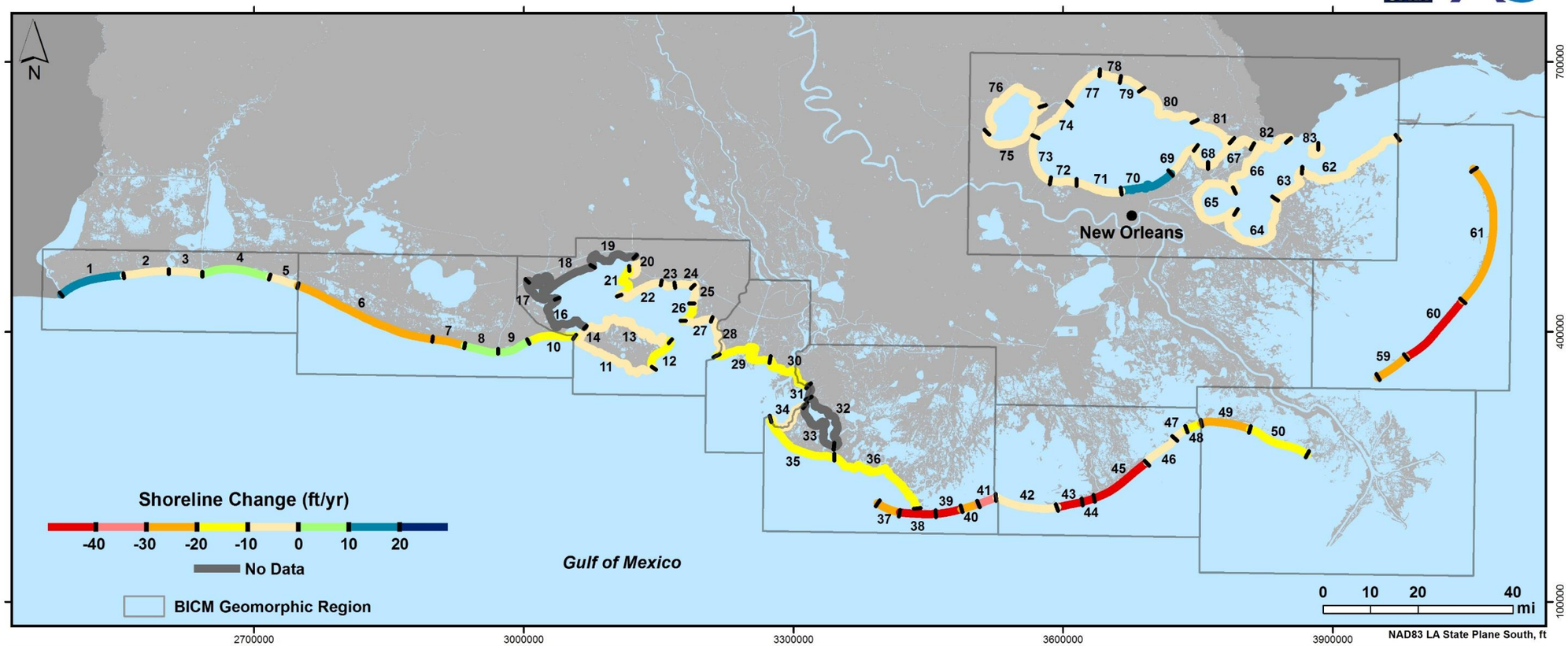

Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)
1	15.5	12	-14.0	24	-9.9	35	-17.7	46	-0.6	65	-5.4	76	-3.4
2	-4.0	13	-8.2	25	-6.8	36	-12.5	47	-5.8	66	-4.9	77	-5.7
3	-1.5	14	-6.4	26	-10.8	37	-23.6	48	-15.9	67	-4.8	78	-6.2
4	8.4	16	No Data	27	-9.2	38	-47.9	49	-21.8	68	-5.0	79	-0.9
5	-3.2	17	No Data	28	-5.4	39	-40.8	50	-11.3	69	-4.2	80	-4.1
6	-28.0	18	No Data	29	-10.2	40	-25.0	59	-20.1	70	15.6	81	-4.1
7	-24.4	19	No Data	30	-15.2	41	-39.5	60	-57.8	71	-3.7	82	-4.6
8	4.4	20	-1.8	31	No Data	42	-7.7	61	-27.9	72	-9.7	83	-5.3
9	8.7	21	-13.5	32	No Data	43	-144.2	62	-9.3	73	-5.5		
10	-10.6	22	-9.5	33	No Data	44	-132.7	63	-8.0	74	-9.7		
11	-8.6	23	-9.1	34	-5.6	45	-48.6	64	-5.7	75	-3.8		

Figure 4. Average shoreline change rates by reach for coastal Louisiana; 1880s to 1930s.

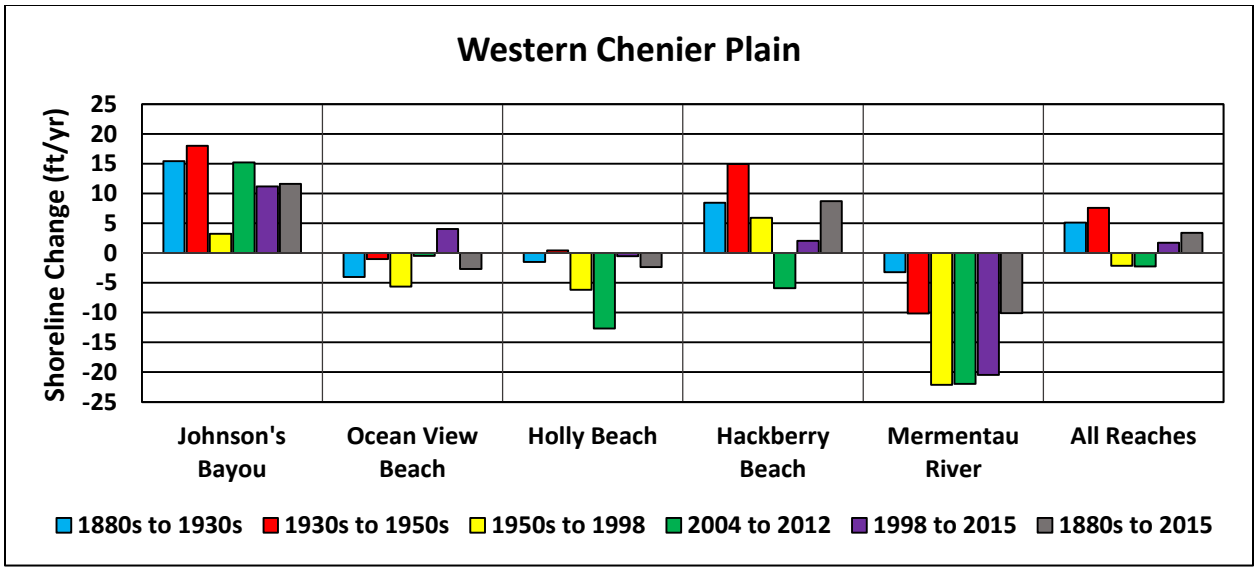

Figure 5. Shoreline change by reach for the Western Chenier Plain Region.

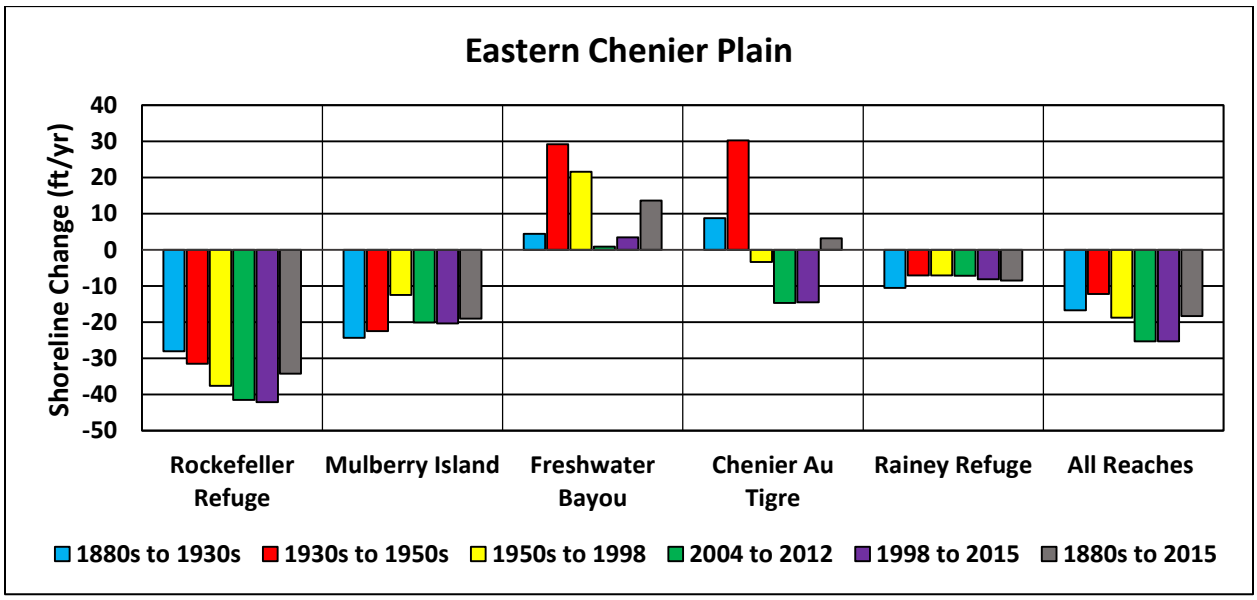

Figure 6. Shoreline change by reach for the Eastern Chenier Plain Region.

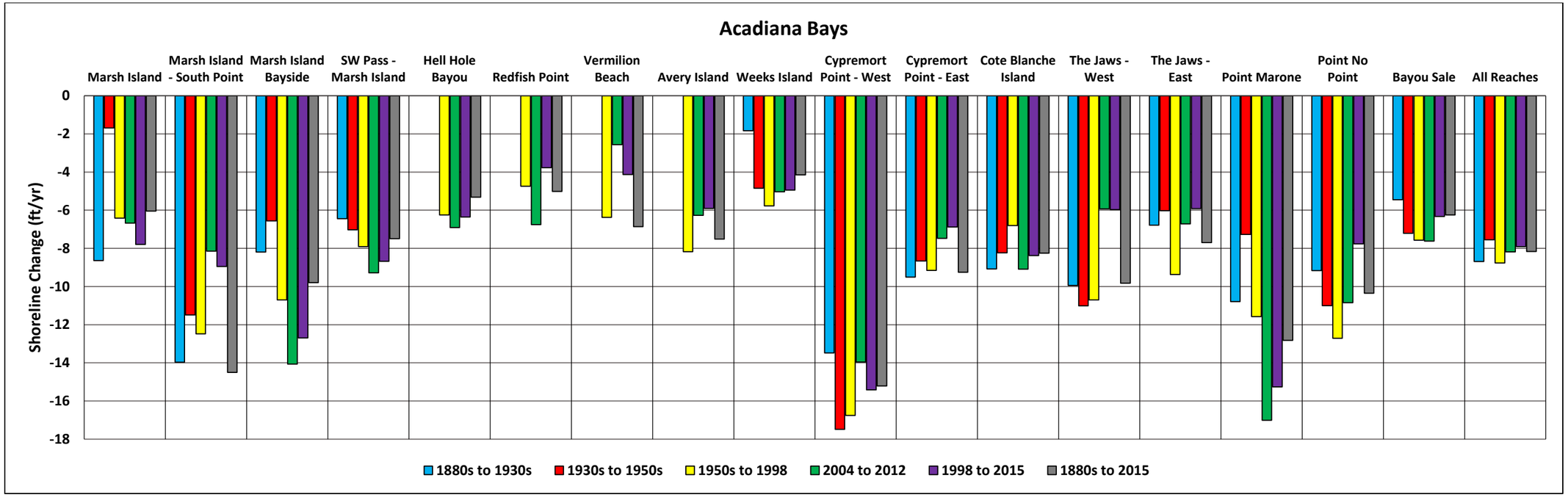

Figure 7. Shoreline change by reach for the Acadiana Bays Region.

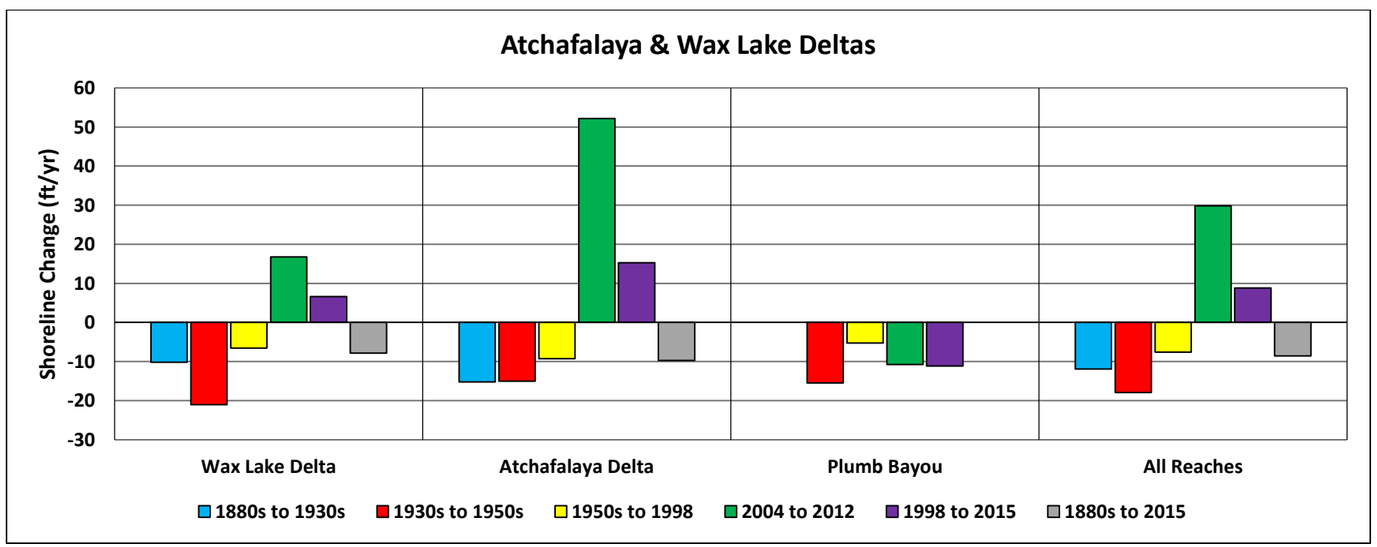

Figure 8. Shoreline change by reach for the Atchafalaya & Wax Lake Deltas Region.

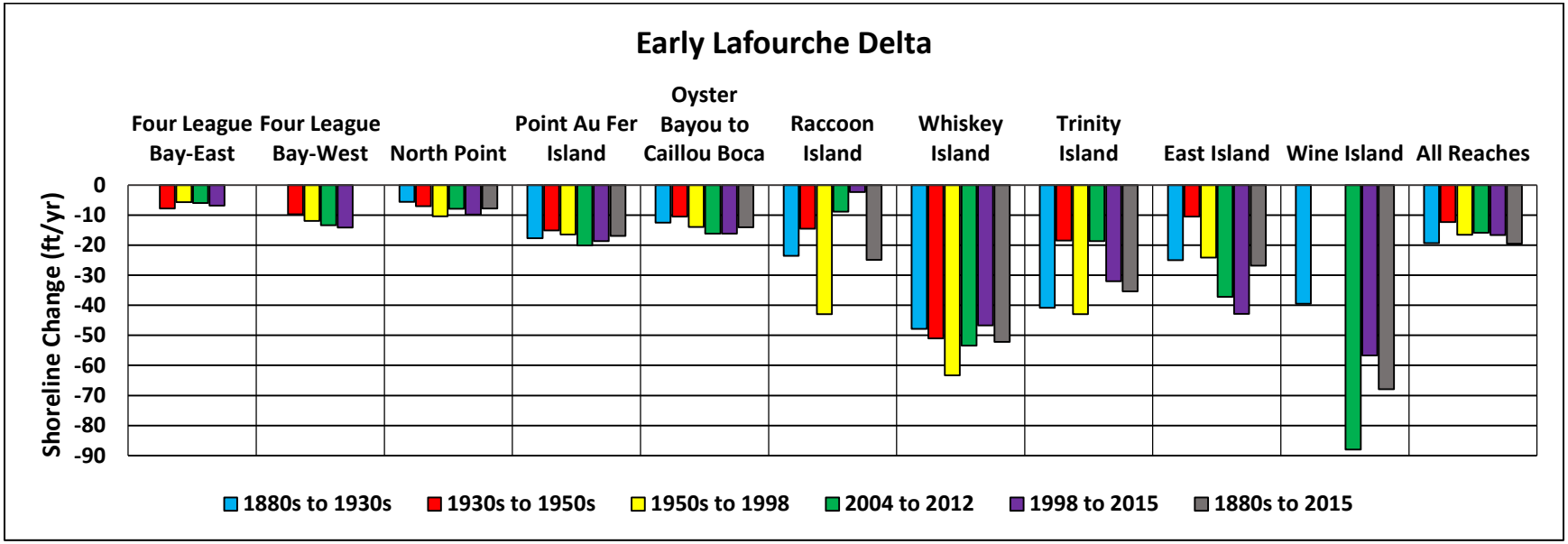

Figure 9. Shoreline change by reach for the Early Lafourche Delta Region.

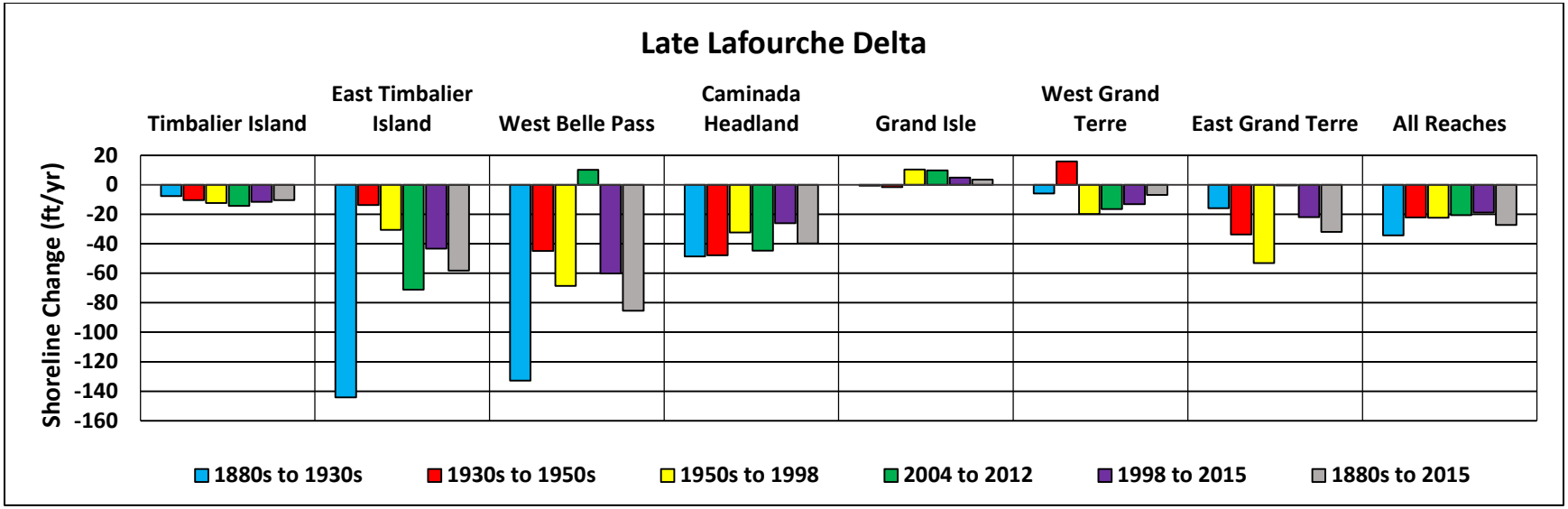

Figure 10. Shoreline change by reach for the Late Lafourche Delta Region.

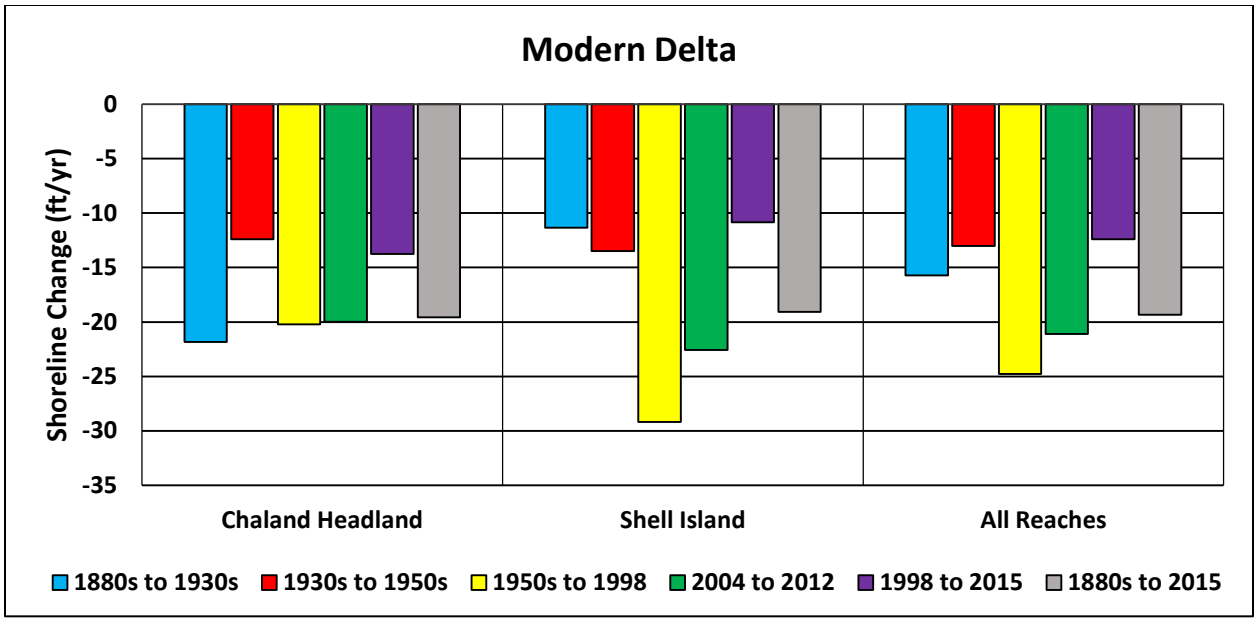

Figure 11. Shoreline change by reach for the Modern Delta Region.

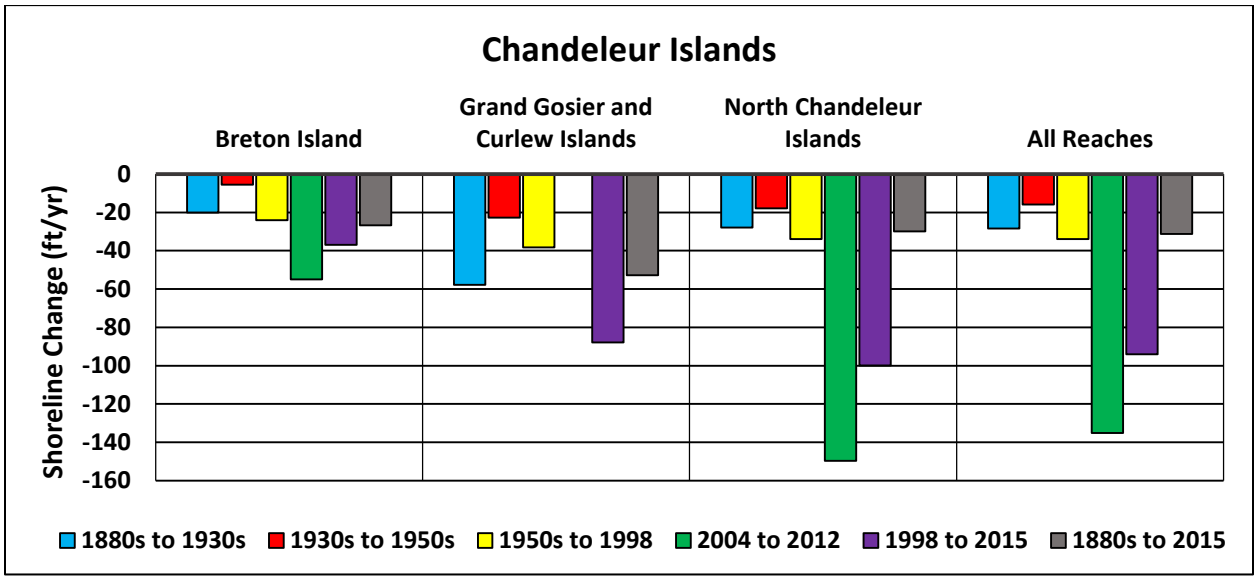

Figure 12. Shoreline change by reach for the Chandeleur Islands Region.

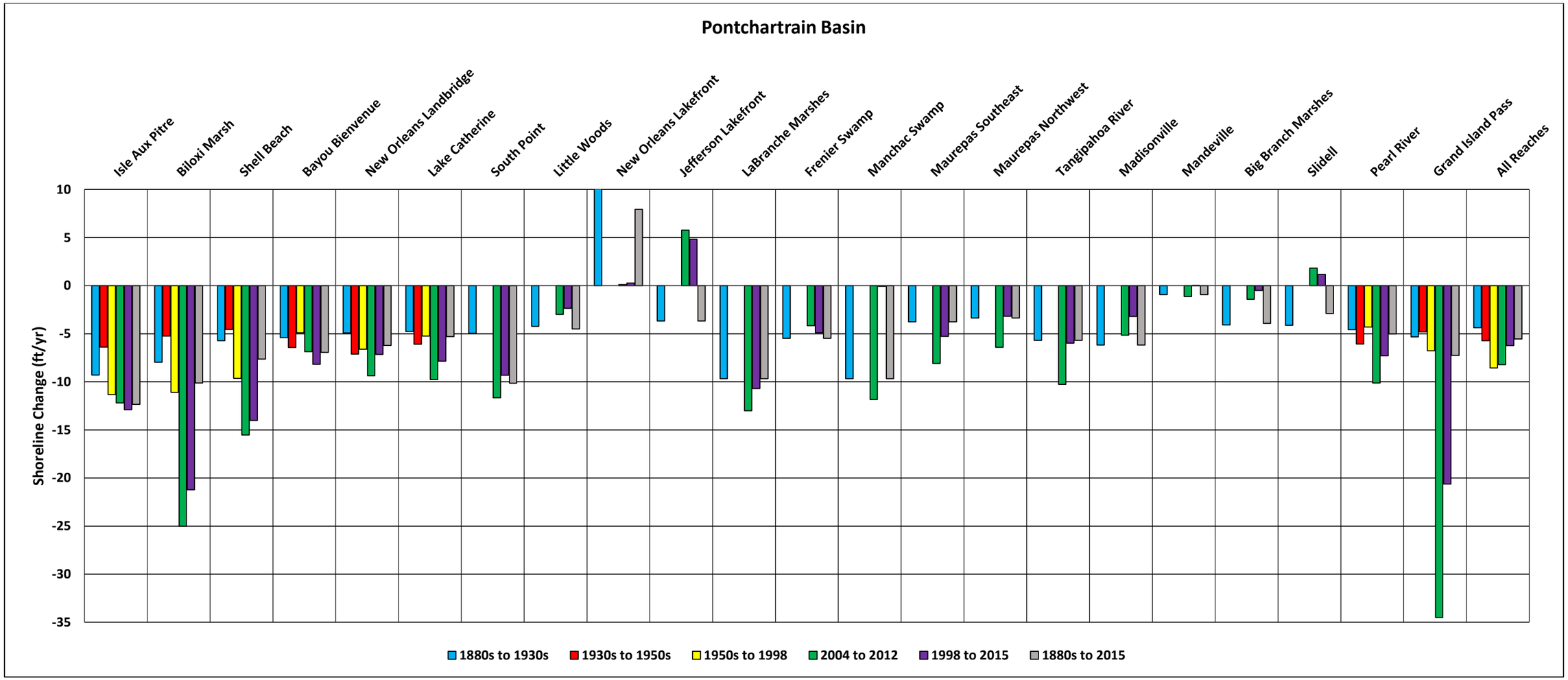

Figure 13. Shoreline change by reach for the Pontchartrain Basin Region.

(Appendix C, Figure C49; Appendix D). Shoreline change in this region represents nearly 40% of average change for the entire coast during this period.

When comparing open-Gulf shorelines with semi-protected shoreline regions, mean change rates differ by nearly 3 times. Mean open-Gulf shoreline recession was 17.1 ft/yr, whereas mean shoreline recession in semi-protected regions was 5.9 ft/yr (Table 7). Variability in shoreline change rates also is lower for semi-protected regions. This illustrates the impact of storm waves and currents on outer-coast shores and their importance for buffering storm impacts on interior shorelines.

4.1.2 1930s to 1950s Epoch. For most geomorphic regions, mean shoreline recession rates were smaller than those recorded for the 1880s to 1930s epoch. Although magnitudes of shoreline position change were smaller, change patterns were consistent (i.e., regions with largest average shoreline recession rates in the 1880s to 1930s epoch recorded largest recession rates in the 1930s to 1950s epoch) throughout coastal Louisiana (Figure 14; Table 7). Similar to the 1880s to 1930s epoch, shoreline advance (7.6 ft/yr) dominated the Western Chenier Plain Region (Figure 14; Table 7); however, Reach 2 (Ocean View Beach) recorded an average recession rate of 1.0 ft/yr and Reach 5 (Mermentau River) receded at about 10.1 ft/yr (Appendix C, Figure C2; Appendix D). Farther east, the Eastern Chenier Plain region illustrated large variability in average shoreline changes by reach (Appendix C, Figure C8). Reaches 6 and 7 (Rockefeller Refuge and Mulberry Island) had mean shoreline recession rates of approximately 30 and 20 ft/yr, whereas Reaches 8 and 9 (Freshwater Bayou and Chenier Au Tigre) recorded shoreline advance of about 30 ft/yr (Figure 14; Appendix D). Because Reaches 6 and 7 were longer than Reaches 8 and 9, mean shoreline recession for the region was dominant at 12.3 ft/yr, approximately 4 ft/yr less shoreline erosion than the 1880s to 1930s epoch.

Most shoreline reaches within the Acadiana Bays Region documented lower shoreline recession rates, resulting in an average of about 1 ft/yr less erosion compared with the 1880s to 1930s epoch (Table 7; Appendix D). 1930s USC&GS shoreline data were not available for Reaches 16 through 19 (Hell Hole Bayou to Avery Island) (Figure 14). Although Reaches 20 (Weeks Island), 21 (Cypremort Point-West), 24 (The Jaws-West), 27 (Point No Point), and 28 (Bayou Sale) indicated an increase in shoreline recession, lower shoreline erosion rates dominated throughout the region, particularly for the Marsh Island reaches (11 – 13) (Figure 14; Appendix C, Figure C14; Appendix D).

Shoreline reaches within the Atchafalaya and Wax Lake Deltas Region (prior to modern deltaic sedimentation) recorded an average increase in shoreline recession to 17.9 ft/yr (Table 7, Appendix D), only one of two regions to document this trend relative to the 1880s to 1930s epoch. Although shoreline change data for Reach 31 (Plumb Bayou) were included for this epoch, a two-fold increase in shoreline recession for Reach 29 (Wax Lake Delta) had greatest influence on average change (Appendix C, Figure C20 versus C19).

The Early Lafourche Delta Region illustrated substantial reduction in average shoreline recession; however, not all reaches recorded less shoreline erosion during this epoch. Shoreline change data for Four League Bay (Reaches 32 and 33) were available for this epoch, contributing to a reduction in average erosion for the region (Figure 14, Appendix D). These data were not available for the 1880s to 1930s epoch, and because shoreline recession rates for these reaches are below average change for the region, the average shoreline recession rate is biased toward higher recession rates associated with the Isles Dernieres barrier islands (Reaches 37 through 41; Appendix C, Figure C26 versus C25). However, average shoreline recession for the Isles Dernieres reaches is about 14 ft/yr lower than rates

Louisiana Shoreline Change: 1930s to 1950s

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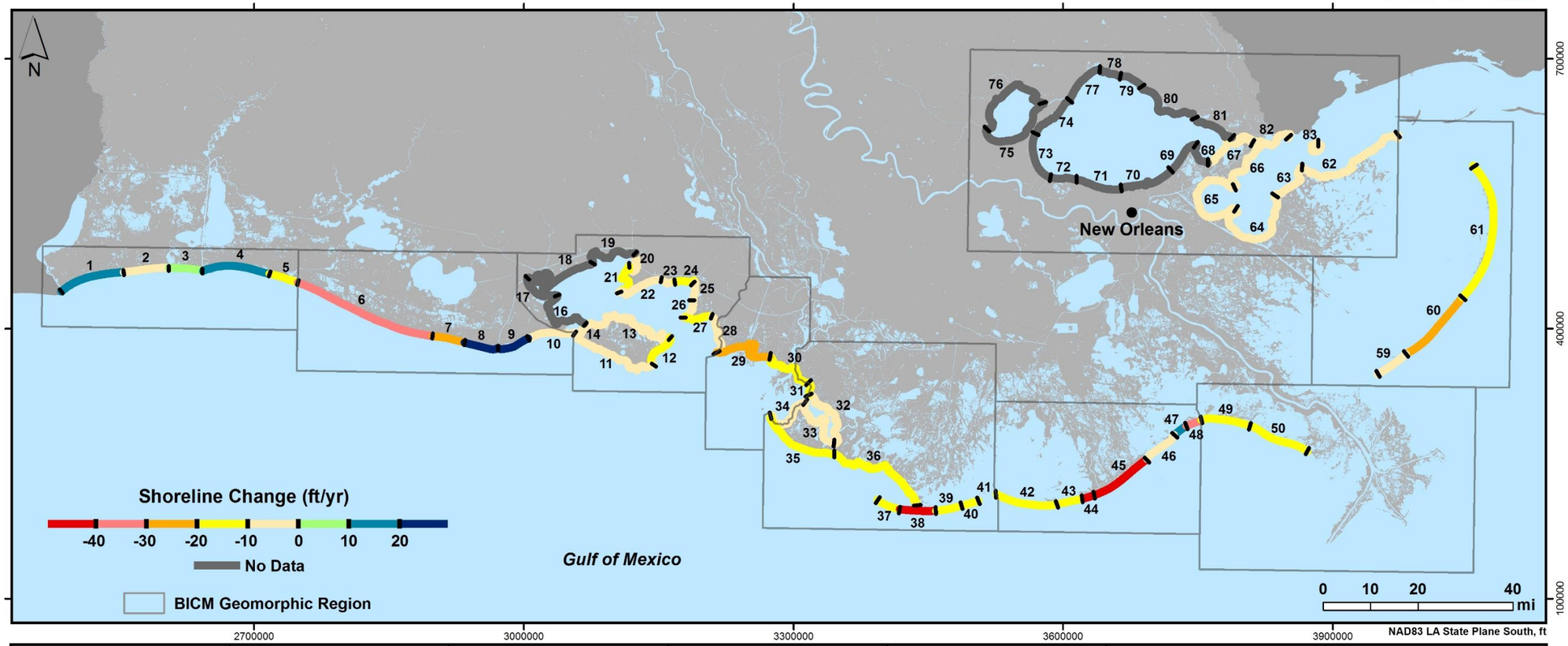

Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)
1	18.0	12	-11.5	24	-11.0	35	-15.1	46	-1.6	65	-6.4	76	No Data
2	-1.0	13	-6.6	25	-6.0	36	-10.5	47	15.9	66	-7.1	77	No Data
3	0.4	14	-7.0	26	-7.3	37	-14.5	48	-33.7	67	-6.1	78	No Data
4	14.9	16	No Data	27	-11.0	38	-51.0	49	-12.4	68	No Data	79	No Data
5	-10.1	17	No Data	28	-7.2	39	-18.5	50	-13.5	69	No Data	80	No Data
6	-31.5	18	No Data	29	-21.0	40	-10.5	59	-5.5	70	No Data	81	No Data
7	-22.5	19	No Data	30	-15.0	41	N/A	60	-22.7	71	No Data	82	-6.1
8	29.2	20	-4.8	31	-15.5	42	-10.4	61	-17.8	72	No Data	83	-4.8
9	30.2	21	-17.5	32	-7.8	43	-13.8	62	-6.4	73	No Data		
10	-7.1	22	-8.7	33	-9.7	44	-44.8	63	-5.2	74	No Data		
11	-1.7	23	-8.2	34	-7.1	45	-47.9	64	-4.6	75	No Data		

Figure 14. Average shoreline change rates by reach for coastal Louisiana; 1930s to 1950s.

recorded for the first change epoch (-36.5 ft/yr average for Reaches 37 to 41; Appendix D). Given this trend, the reduction in shoreline recession for this region appears consistent with most geomorphic regions and is not a function of data coverage.

The trend in reduced shoreline recession is duplicated for the Late Lafourche Delta barrier islands where average shoreline change for the region was -22.2 ft/yr, about 12 ft/yr less than average recession for the 1880s to 1930s epoch (Appendix C, Figure C32; Appendix D). Although Reach 48 (East Grand Terre) recorded a shoreline recession rate more than two times that of the previous epoch (-33.7 ft/yr versus -15.9 ft/yr), Reach 47 (West Grand Terre) illustrated average accretion (Figure 14; Appendix C; Figure C32 versus C31).

Average shoreline change for the Modern Delta barrier shoreline also was less than that recorded for the 1880s to 1930s epoch. However, it was not substantially different and was primarily influenced by a large decrease in shoreline recession at Reach 49 (Chaland Headland) (-12.4 ft/yr) relative to that recorded for the previous epoch (-21.8 ft/yr) (Appendix C; Figure C38; Appendix D). This was not the case for the Chandeleur Islands Region where all reaches recorded substantial reductions in shoreline recession rate, resulting in an average change rate almost half that identified during the 1880s to 1930s epoch (Figure 14; Appendix C, Figure C44 versus C43).

Although a majority of the Pontchartrain Basin shoreline did not have shoreline data for the 1950s (Figure 14), average change rates for the areas where data were available were relatively consistent (Appendix D). Average changes for individual reaches varied (Appendix C, Figure C50 versus C49), but mean change for the region was within 1.2 ft/yr of the 1880s to 1930s epoch. This difference likely is related to the absence of change data within Lake Pontchartrain for the 1930s to 1950s epoch.

After separating open-Gulf and semi-protected shoreline regions, mean change for Gulf-facing shorelines increased to -10.5 ft/yr and decreased for semi-protected shorelines to -8.1 ft/yr, relative to the coastwide average of -9.5 ft/yr (Table 7). Average open-Gulf shoreline change can be compared with the 1880s to 1930s rate because the number of transects is similar; however, comparison between the two epochs for semi-protected change rates is questionable because the number of change measurements for the 1930s to 1950s epoch is about 40% less than used for the 1880s to 1930s epoch. Mean change data from epochs where full shoreline coverage is available indicate that reduced coverage rates overestimate mean recession rates for semi-protected regions (Table 7).

4.1.3 1950s to 1998 Epoch. Average shoreline recession for the entire Louisiana coast peaked during this epoch at -13.5 ft/yr (Table 7). All regions were net erosional during this epoch (Figure 15), whereas the Western Chenier Plain coast recorded net shoreline advance between the 1880s and 1950s. Mean shoreline change ranged from -2.1 ft/yr to -33.9 ft/yr, and greatest shoreline recession was associated with barrier islands of the Early Lafourche Delta, Late Lafourche Delta, Modern Delta, and Chandeleur Islands Regions (Figure 15; Table 7; Appendix C, Figure C3).

The Western Chenier Plain shoreline was net erosional for this epoch (-2.1 ft/yr; Table 7). All shoreline reaches showed less accretion or greater erosion (Figure 15). Reach 5 (Mermentau River) recorded more than double the shoreline recession rate (-22.1 ft/yr) recorded for the previous period (-10.1 ft/yr) (Figure 5). A similar trend was observed for the Eastern Chenier Plain Region; however, the magnitude of change was not as great (Figure 6). Average shoreline recession increased to 18.8 ft/yr, but two reaches documented a decrease in shoreline recession (Figure 15; Appendix D) and shoreline change variability was large (Appendix C, Figure C9). The Chenier Au Tigre reach went from highly accretional for the 1930s to 1950s epoch (30.2 ft/yr) to net erosional during this 1950s to 1998 epoch (-3.3 ft/yr).

Louisiana Shoreline Change: 1950s to 1998

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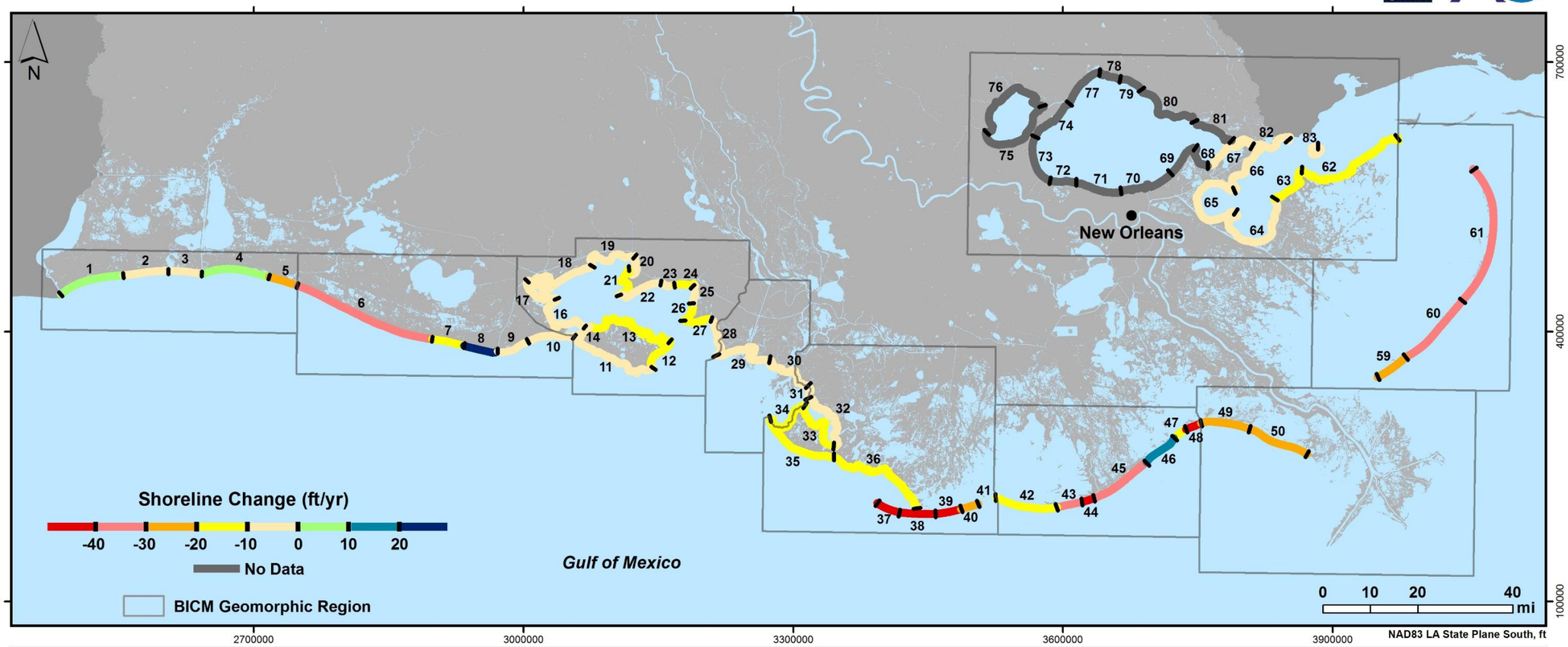

Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)
1	3.2	12	-12.5	24	-10.7	35	-16.4	46	10.4	65	-4.9	76	No Data
2	-5.6	13	-10.7	25	-9.4	36	-13.9	47	-19.7	66	-6.6	77	No Data
3	-6.2	14	-7.9	26	-11.6	37	-42.9	48	-53.1	67	-5.2	78	No Data
4	6.0	16	-6.3	27	-12.7	38	-63.4	49	-20.2	68	No Data	79	No Data
5	-22.1	17	-4.7	28	-7.6	39	-43.0	50	-29.2	69	No Data	80	No Data
6	-37.6	18	-6.4	29	-6.6	40	-24.2	59	-24.1	70	No Data	81	No Data
7	-12.5	19	-8.2	30	-9.3	41	N/A	60	-38.3	71	No Data	82	-4.3
8	21.6	20	-5.8	31	-5.3	42	-12.4	61	-33.9	72	No Data	83	-6.8
9	-3.3	21	-16.8	32	-5.7	43	-30.6	62	-11.3	73	No Data		
10	-7.1	22	-9.2	33	-12.0	44	-68.6	63	-11.1	74	No Data		
11	-6.4	23	-6.8	34	-10.4	45	-32.4	64	-9.6	75	No Data		

Figure 15. Average shoreline change rates by reach for coastal Louisiana; 1950s to 1998.

Average shoreline change for the Acadiana Bays Region was -8.8 ft/yr, consistent with that recorded for the 1880s to 1930s epoch, but 1.3 ft/yr greater than that recorded between the 1930s and 1950s (Table 7). Although shoreline change data were more complete for the 1950s to 1998 epoch, average change for reaches where data were not available in 1930 was about -7 ft/yr, slightly less than region averages for both epochs (Appendix D). This suggests that region averages were not substantially influenced by changes recorded in Reaches 14 through 22 (SW Pass-Marsh Island to Cypremort Point-East) (Figure 15; Appendix C, Figure C15).

Unlike other regions, the Atchafalaya and Wax Lake Deltas Region documented a large decrease in shoreline recession relative to earlier epochs (Figure 15; Table 7). All shoreline reaches recorded a decrease in erosion as sediment from the Atchafalaya River began depositing along the shorelines adjacent to the Atchafalaya and Wax Lake outlets to Atchafalaya Bay (Roberts et al., 1997) (Appendix C, Figure C21). Average shoreline recession for this region was less than half that recorded for the 1930s to 1950s epoch (Table 7, Appendix D).

Shoreline recession rates along the Early Lafourche Delta coast consistently increased relative to the 1930s to 1950s epoch, except for Reach 32 (Four League Bay – East Reach). In fact, shoreline recession along barrier island Reaches 37 through 40 (Raccoon Island to East Island) increased to 42.1 ft/yr, nearly double that recorded for the 1930s to 1950s epoch (Figure 9, Appendix D). However, average regional shoreline recession only increased by about 4 ft/yr because deterioration of the barrier islands resulted in smaller islands that contribute less to the regional average with time (i.e., 583 change measurements for Epoch 1, 482 change measurements for Epoch 2, 396 change measurements for Epoch 3) (Appendix C, Figure C27 compared with C26 and C25; Appendix D). Further, barrier islands reach transects represent only 15% of reaches in the Early Lafourche Delta region.

Although variability in average shoreline change rates was substantial for the Late Lafourche Delta Region (+10.4 to -68.6 ft/yr; Figures 10 and 15), average shoreline change for the region was nearly equal to the previous epoch (Table 7). No consistent change in shoreline recession is apparent for this rapidly migrating barrier island coast relative to earlier epochs (Appendix C, Figure C33; Appendix D). However, barrier shorelines along the Modern Delta Region document substantial increases in shoreline recession relative to earlier epochs (Appendix C, Figure C39). Shoreline recession averages about 10 ft/yr greater for this region (Table 7, Figure 11, Appendix D) as beaches erode and migrate landward in response to storms and rising relative sea level.

Shoreline recession rates along the Chandeleur Islands more than doubled relative to the 1930 to 1950s epoch (Table 7, Figure 15). Average shoreline change was the highest of any region along the Louisiana coast (-33.9 ft/yr). Although variability in shoreline recession was high (Figure 12; Appendix C, Figure C45), this trend is consistent for all epochs (Appendix D). As such, comparison of average change between epochs provides a reasonable estimate of barrier system response to storm versus normal coastal processes.

A majority of shoreline data within the Pontchartrain Basin again was absent for the 1950s, so shorelines within and adjacent to Lake Borgne were the only ones available for quantifying shoreline change (Figure 15), similar to the 1930s to 1950s epoch. As with most other regions, average shoreline recession increased, in this case by about 3 ft/yr to 8.6 ft/yr (Table 7). Average recession rates by reach did not change consistently relative to earlier epochs; however, reaches closer to Mississippi Sound and the Gulf of Mexico exhibited greater erosion rates (Figure 13; Appendix C, Figure C51) whereas more protected shorelines in Lake Borgne illustrated decreased rates compared with the 1930s to 1950s epoch.

4.1.4 1998 to 2015 Epoch. This epoch reflects a period of regional shoreline restoration along many of the barrier beach shorelines in south Louisiana, particularly those in the Early Lafourche Delta, Late Lafourche Delta, and Modern Delta Regions. It also encompasses a period of significant tropical cyclone frequency and magnitude. Coast-wide mean shoreline recession decreased slightly relative to the previous epoch (-12.3 ft/yr versus -13.5 ft/yr). However, when open-Gulf shorelines are evaluated independent of semi-protected coastal regions, mean shoreline change for this period (-21.7 ft/yr) is higher than any other analyzed epoch (Table 7). Tropical cyclones measurably impacted shoreline change along the open-Gulf shoreline during this period. For semi-protected coastal regions, mean shoreline change was about four times less (-5.9 ft/yr) than for the outer coast, illustrating the importance of open-Gulf shorelines for protecting interior shorelines. Additionally, restoration efforts along the central barrier island coast (Appendix A) reduced recession rates (see Table 7).

Mean shoreline change along the Western Chenier Plain Region illustrated net accretion (Figure 5), however, substantial variation in change rates was present (Figure 16; Appendix D). Partially restored Reaches 1 and 2 (Johnson's Bayou and Ocean View Beach) recorded mean accretion of 11.3 and 4.1 ft/yr (Figure 16), whereas Reach 5 (Mermentau River) illustrated mean beach erosion (20.4 ft/yr) consistent with that documented for the 1950s to 1998 epoch (Figure 5; Appendix C, Figures C3 and C4). In contrast, shoreline along the Eastern Chenier Plain Region was characterized as net erosional (-25.4 ft/yr; Table 7). Reach 8 (Freshwater Bayou) is the only shoreline in this region to document net accretion (Figure 6; Appendix D). Similar to all other epochs, Reach 6 (Rockefeller Refuge) documents largest mean shoreline recession and is the longest reach in the region (Figure 16), thereby dominating the mean erosion signal.

The semi-protected shoreline within the Acadiana Bays Region documented mean erosion for all reaches during this period (Figure 16). However, variation in the magnitude of erosion was large, resulting in a mean change of -7.9±7.6 ft/yr (Table 7; Appendix D). Greatest shoreline recession is illustrated at Reaches 21 and 26 (Cypremort Point – West and Point Marone; about 15 ft/yr) where coastline is exposed to erosive west and northwest winds (Appendix C, Figure C16). To the east in the Atchafalaya and Wax Lake Deltas Region very different shoreline response is documented due to sedimentation from the Atchafalaya River and Wax Lake Outlet channels. Mean shoreline change for the region is net accretional (8.8 ft/yr; Table 7). Only Reach 31 (Plumb Bayou) is net erosional as sediment from the Atchafalaya River system is deposited along the shorelines at Reaches 29 and 30 (Wax Lake Delta and Atchafalaya Delta) (Figure 8; Appendix C, Figure C22; Appendix D).

Moving east away from active sediment supply to the coast, shoreline recession dominates mean change for all reaches in the Early Lafourche Delta Region (Figures 9 and 16). Beach erosion encountered at Reaches 37 – 41 (Raccoon Island to Wine Island) results in greatest net shoreline recession in this region. However, the length of shoreline over which large recession rates occur only represents about 14% of total shoreline length for the region (Appendix C, Figure C28; Appendix D). As such, shoreline recession in these reaches has just minor influence on mean change for the region (-16.7 ft/yr). Variations in shoreline change within the Late Lafourche Delta Region are large, likely driven by island and beach restoration activities during this epoch (Appendix A). Although mean shoreline change is substantial (-18.9 ft/yr), this is the lowest change rate for any of the epochs (Figure 10; Appendix D), attesting to the importance of shoreline restoration in this region (Appendix C, Figure C34). This same trend is illustrated for the Modern Delta Region, where mean shoreline change (-12.4 ft/yr) was lowest of any epoch in this region (Figure 11; Table 7; Appendix D).

Louisiana Shoreline Change: 1998 to 2015

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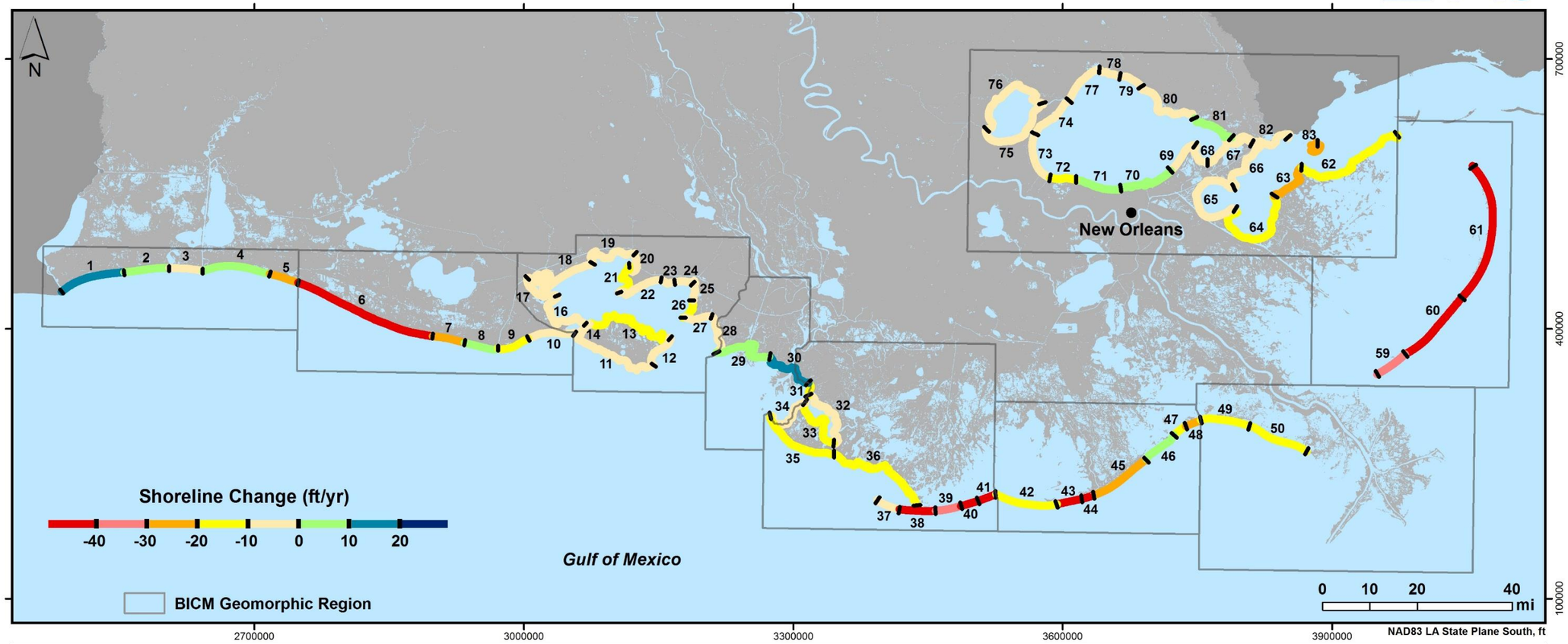

Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)
1	11.3	12	-9.0	24	-6.0	35	-18.7	46	4.9	65	-8.2	76	-3.2
2	4.1	13	-12.7	25	-5.9	36	-16.2	47	-13.2	66	-7.2	77	-6.0
3	-0.5	14	-8.7	26	-15.3	37	-2.3	48	-21.9	67	-7.9	78	-3.2
4	2.0	16	-6.4	27	-7.8	38	-46.8	49	-13.7	68	-9.3	79	0.0
5	-20.4	17	-3.8	28	-6.3	39	-32.0	50	-10.8	69	-2.4	80	-0.5
6	-42.2	18	-4.1	29	6.6	40	-42.8	59	-37.0	70	0.3	81	1.2
7	-20.4	19	-5.9	30	15.3	41	-56.7	60	-87.9	71	4.8	82	-7.3
8	3.4	20	-4.9	31	-11.2	42	-11.6	61	-99.8	72	-10.7	83	-20.6
9	-14.6	21	-15.4	32	-6.9	43	-43.4	62	-12.9	73	-4.9		
10	-8.2	22	-6.9	33	-14.1	44	-60.2	63	-21.2	74	-0.1		
11	-7.8	23	-8.4	34	-9.9	45	-26.2	64	-14.0	75	-5.3		

Figure 16. Average shoreline change rates by reach for coastal Louisiana; 1998 to 2015.

The Chandeleur Islands absorbed the greatest impact of Hurricane Katrina in coastal Louisiana, and it is reflected in extreme shoreline recession recorded for this epoch. Mean shoreline change was -94.0 ft/yr (Table 7, Figure 12), the majority of which can be related to Katrina. This magnitude of change is approximately three times greater than the previous epoch and the long-term mean recession rate (Figure 12; Appendix D). Just to the west and north of this region is the semi-protected Pontchartrain Basin Region. Although substantial impacts from Hurricane Katrina were experienced in this region as well, protection from open-Gulf waves significantly reduced the magnitude of change recorded for this region (Figure 16). In fact, the reaches with greatest exposure to Gulf-like conditions (Reaches 62-64, 83; Isle Aux Pitre to Shell Beach, and Grand Island Pass) recorded largest shoreline recession rates within the Basin (Figure 13; Appendix C, Figure C52; Appendix D). The majority of shorelines within Lake Pontchartrain experienced erosion far less extreme than that recorded for shorelines more directly impacted by open-Gulf conditions (Figure 16).

4.1.5 2004 to 2012 Epoch. This period is a component of the previous epoch that encompasses a time when regional shoreline restoration along many of the barrier beach shorelines in south Louisiana was very active, particularly associated with the Early Lafourche Delta, Late Lafourche Delta, and Modern Delta Regions. It also was a time of frequent hurricanes and tropical storms that had marked impact on shoreline change along the entire Louisiana coast (see Section 2.4). Average shoreline recession for all coastal regions decreased during this epoch to 12.0 ft/yr (Table 7). All but three regions illustrated lower shoreline recession rates compared with the 1950s to 1998 epoch, yet all were net erosional except for the Atchafalaya and Wax Lake Deltas, which exhibited average shoreline advance of about 30 ft/yr (Table 7). Three regions of increased average shoreline recession were along the Western and Eastern Chenier Plain, and the Chandeleur Islands, the regions most directly impacted by Hurricanes Rita and Katrina. Mean shoreline change ranged from 29.8 ft/yr to -135.2 ft/yr, and greatest shoreline recession was associated with the Chandeleur Islands Region (Figure 17) primarily due to the passage of Hurricane Katrina.

Average change along the Western Chenier Plain shoreline was -2.2 ft/yr during this epoch (Table 7; Figure 17). Variability was large from average shoreline advance at Reach 1 (Johnson's Bayou; 15.2 ft/yr) to increased shoreline recession at Reach 3 (Holly Beach; 12.7 ft/yr) to consistent erosion at Reach 5 (Mermentau River; 22.0 ft/yr) relative to the 1998 to 2015 epoch (Appendix C, Figure C5; Appendix D). Conversely, average shoreline recession along the Eastern Chenier Plain remained unchanged at 25.3 ft/yr (Table 7). Shoreline recession at Reach 10 was unchanged relative to the 1950s to 1998 epoch; however, Reach 5 (Freshwater Bayou) shoreline change recorded a decreased accretion rate (0.9 versus 21.6 ft/yr) (Appendix C, Figure C11; Appendix D).

Shoreline change for the Acadiana Bays Region showed a minor increase in shoreline recession relative to the 1998 to 2015 epoch, but overall, average changes for all but the 1930s to 1950s epoch were consistent at approximately -8 to -8.5 ft/yr (Table 7). A very different trend emerged for the Atchafalaya and Wax Lake Deltas Region where sediment accretion within the Atchafalaya Delta and Wax Lake Delta reaches resulted in average shoreline advance of 29.8 ft/yr (Appendix C, Figure C23; Appendix D). However, the Reach 31 (Plumb Bayou) shoreline recorded consistent shoreline recession relative to the 1998 to 2015 epoch.

Louisiana Shoreline Change: 2004 to 2012

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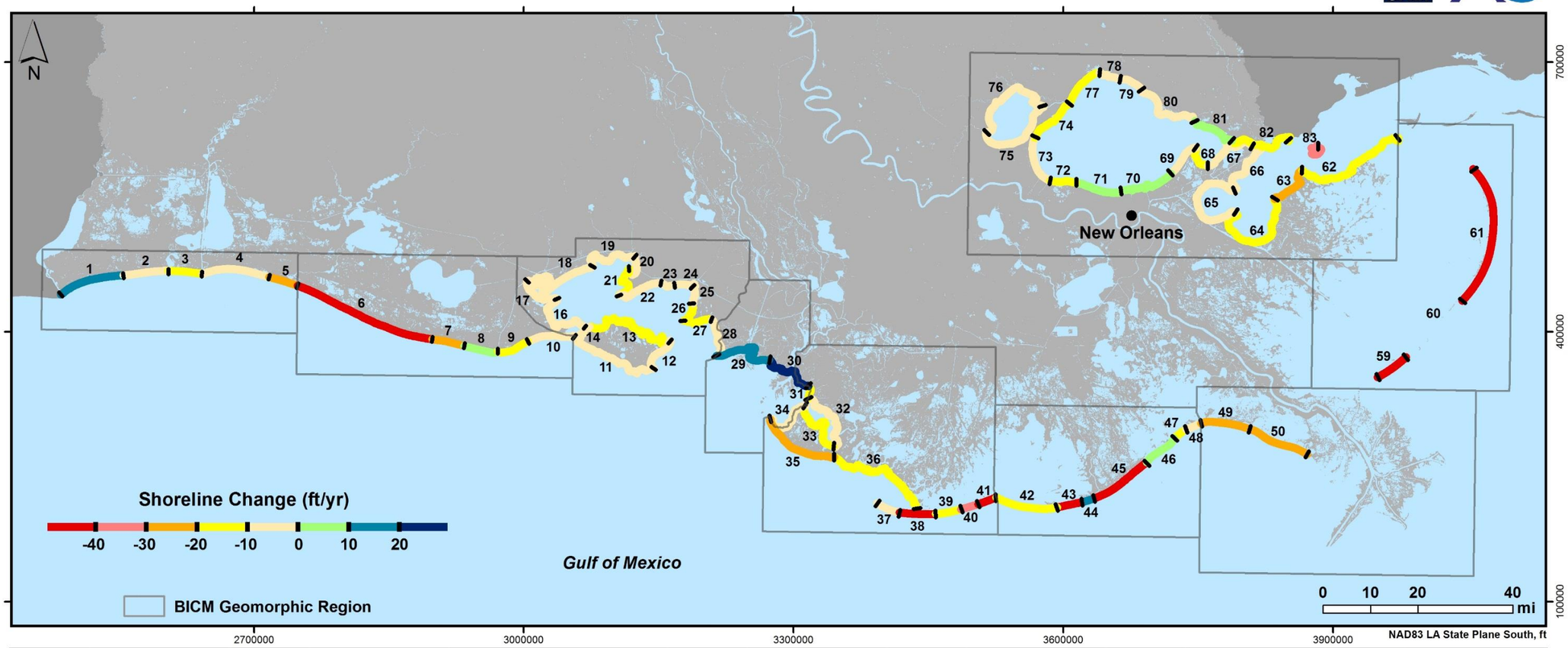

Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)
1	15.2	12	-8.1	24	-5.9	35	-20.1	46	9.7	65	-6.9	76	-6.4
2	-0.5	13	-14.1	25	-6.7	36	-16.2	47	-16.4	66	-9.4	77	-10.3
3	-12.7	14	-9.3	26	-17.0	37	-8.8	48	-0.5	67	-9.8	78	-5.1
4	-5.9	16	-6.9	27	-10.8	38	-53.4	49	-20.0	68	-11.6	79	-1.1
5	-22.0	17	-6.8	28	-7.6	39	-18.7	50	-22.6	69	-3.0	80	-1.4
6	-41.5	18	-2.6	29	16.8	40	-37.2	59	-54.9	70	0.1	81	1.8
7	-20.1	19	-6.3	30	52.2	41	-88.0	60	N/A	71	5.8	82	-10.1
8	0.9	20	-5.0	31	-10.8	42	-14.4	61	-149.7	72	-13.0	83	-34.5
9	-14.7	21	-14.0	32	-6.0	43	-71.0	62	-12.2	73	-4.2		
10	-7.1	22	-7.5	33	-13.3	44	10.2	63	-25.0	74	-11.8		
11	-6.7	23	-9.1	34	-7.9	45	-44.7	64	-15.5	75	-8.1		

Figure 17. Average shoreline change rates by reach for coastal Louisiana; 2004 to 2012.

On average, the Early Lafourche Delta Region experienced a decrease in shoreline recession relative to the 1950s to 1998 epoch, possibly resulting from reduced shoreline recession rates along the barrier islands associated with shoreline protection/restoration measures (Figure 17). Average shoreline change for Reaches 37 through 41 (Raccoon Island to Wine Island) was -30.6 ft/yr during this epoch, whereas the change rate for the 1950s to 1998 epoch was -42.1 ft/yr (Appendix D). An increase in shoreline recession along the remaining shoreline of the Early Lafourche Delta Region (-13.5 vs -12.1 ft/yr [1950s to 1998]) resulted in a slightly lower average recession rate for the region (Figure 9; Appendix C, Figure C29), suggesting that island restoration was partially responsible for reduced mean erosion rates for the region.

Barrier beach shorelines of the Late Lafourche Delta and Modern Delta Regions illustrated reduced average shoreline recession rates relative to the 1950s to 1998 epoch (Table 7). Reaches illustrating average accretion and reduced erosion were associated with beach/island restoration. Average shoreline recession for both regions remains substantial (20.5 and 21.1 ft/yr, respectively) (Appendix D), but restoration and shore protection measures appear to be having a positive impact on shoreline response (Figure 10 and 11; Appendix C, Figures C35 and C41).

Similar to the 1998 to 2015 epoch, the Chandeleur Islands Region experienced a substantial increase in shoreline recession, primarily attributable to Hurricane Katrina. Average shoreline recession for the North Chandeleur Island Reach was 149.7 ft/yr (Figure 17; Appendix D). Shoreline change variability was large, but it was all in the same direction (recession; Figure 12; Appendix C, Figure C47). Much of the island remained submerged as shallow shoals in 2012.

Overall, the Pontchartrain Basin shoreline experienced an increase in average shoreline recession relative to the 1998 to 2015 epoch (Table 7). Comparisons relative to the 1950s to 1998 epoch were not feasible because shoreline data were not available for a significant portion of the Lake Pontchartrain shoreline in the 1950s (Figures 15 versus 17; Appendix C, Figure C51 versus C53). Average shoreline change for the region was -8.2 ft/yr, and variability in shoreline change rates at each reach was large (Figure 13; Appendix D). Shoreline change ranged from 5.8 to -34.5 ft/yr, but reaches illustrating net accretion were the result of shoreline restoration and protection measures after Hurricane Katrina.

4.1.6 1880s to 2015 Epoch. With the addition of a 2015 shoreline, this epoch documents shoreline change for the entire analysis period. A coastwide average change of -10.4 ft/yr occurred, making the 1880s to 1930s and 1998 to 2015 epochs most representative of the historical average (Table 7). Geomorphic Regions with open-Gulf exposure had an average change of -16.5 ft/yr, while those with semi-protected coasts changed at -6.5 ft/yr. The Chandeleur Islands Region has the highest erosion rate, while the Western Chenier Plain is net accretional (Figure 18; Appendix C, Figure C6). Due to the 135-year record, event-driven changes (e.g. storms, restoration) have been time-averaged and variability between regions is lower than other epochs (appendix D). Additionally, because of the dynamic nature of the Louisiana coast, long-term averages for individual geomorphic regions and shoreline reaches may not be representative of changes presently occurring, particularly for barrier islands.

The Western Chenier Plain was the only region to record net accretion, with an average shoreline change rate of 3.4 ft/yr (Table 7). Reaches 1 and 4 (Johnson's Bayou and Hackberry Beach) advanced along its entire length at 11.6 and 8.7 ft/yr, respectively. Reach 2 (Ocean View Beach, -2.7 ft/yr) and Reach 3 (Holly Beach, -2.3 ft/yr) recorded relatively low erosion rates likely influenced by more recent shore-protection structures and beach fills. Reach 5 (Mermentau River) eroded an average of 10.1 ft/yr from 1884 to 2015, with the eastern third immediately downdrift of the Mermentau jetties eroding at double the mean rate (Figure 18; Appendix C, Figure C6).

Louisiana Shoreline Change: 1880s to 2015

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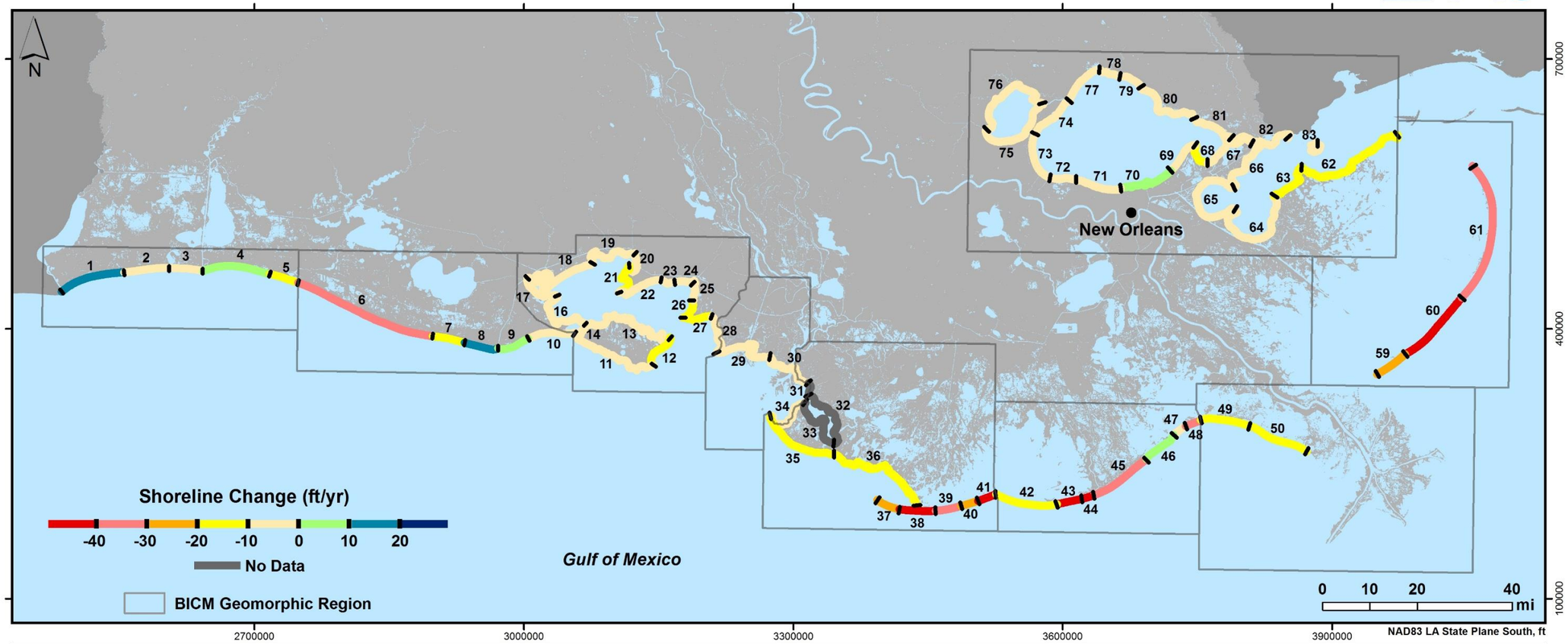

Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)	Reach #	Average (ft/yr)
1	11.6	12	-14.5	24	-9.8	35	-16.9	46	3.5	65	-6.9	76	-3.4
2	-2.7	13	-9.8	25	-7.7	36	-14.1	47	-6.9	66	-6.2	77	-5.7
3	-2.3	14	-7.5	26	-12.8	37	-24.9	48	-31.9	67	-5.3	78	-6.2
4	8.7	16	-5.3	27	-10.3	38	-52.2	49	-19.6	68	-10.1	79	-0.9
5	-10.1	17	-5.0	28	-6.2	39	-35.4	50	-19.1	69	-4.5	80	-3.9
6	-34.3	18	-6.9	29	-7.9	40	-26.8	59	-26.8	70	7.9	81	-2.9
7	-19.1	19	-7.5	30	-9.7	41	-68.0	60	-52.8	71	-3.7	82	-5.0
8	13.6	20	-4.1	31	No Data	42	-10.4	61	-30.0	72	-9.7	83	-7.3
9	3.2	21	-15.2	32	No Data	43	-58.1	62	-12.3	73	-5.5		
10	-8.5	22	-9.3	33	No Data	44	-85.5	63	-10.1	74	-9.7		
11	-6.0	23	-8.3	34	-7.8	45	-39.7	64	-7.6	75	-3.8		

Figure 18. Average shoreline change rates by reach for coastal Louisiana; 1880s to 2015.

The Eastern Chenier Plain Region had a mean erosion rate of 18.4 ft/yr (Table 7). Rockefeller Refuge (Reach 6) is an area of long-term chronic erosion (-34.3 ft/yr) that has increased with time (Appendix D). Mulberry Island (Reach 7) receded at 19.1 ft/yr, with higher erosion rates in the western third, adjacent to Rockefeller Refuge. Reach 10 (Rainey Refuge), the easternmost portion of the Chenier Plain, eroded at an average rate of 8.5 ft/yr. Between Reaches 7 and 10, there is a strong trend-reversal at Freshwater Bayou (Reach 8, +13.6 ft/yr), a vegetated shoreline downdrift of the Freshwater Bayou entrance to the GoM, and Reach 9 (Chenier Au Tigre, +3.2 ft/yr) to the east (Figures 6 and 18; Appendix C, Figure C12; Appendix D).

The Acadiana Bays Region had an average shoreline change rate of -8.2 ft/yr, which was within 1 ft/yr of all other epochs. Reach 21 (Cypremort Point-West) had the largest average long-term erosion rate of 15.2 ft/yr, with between -30 and -40 ft/yr of change occurring on the northwest coast of Shark Island. Although Avery Island (Reach 19) had an average change rate of -7.5 ft/yr, the central portion that faces directly south to Vermilion Bay eroded as much as 30 ft/yr (Figure 18). Most reaches in the western half of Acadiana Bays experienced lower erosion (around 5 to 7 ft/yr), while the western half (closer to the Gulf) had higher erosion rates (Figure 7; Appendix C, Figure C18; Appendix D).

The Atchafalaya and Wax Lake Deltas Region illustrated mean shoreline erosion of 8.5 ft/yr, even though the Atchafalaya River has supplied this area with sediment for over five decades. A reduction in shoreline erosion to mean accretion in this region since the 1950s has not been sufficient to produce net shoreline advance since 1855 (Table 7), thereby leading to net erosional coasts for the full analysis period for Reach 29 (Wax Lake Delta, 7.9 ft/yr) and Reach 30 (Atchafalaya Delta, 9.7 ft/yr) (Appendix D). An 1880s epoch shoreline was not available for Plumb Bayou (Reach 31); however, this reach was erosional for all other epochs and would have likely contributed to a higher average erosion rate for the region (Figure 7; Appendix C, Figure C24).

Early Lafourche Delta reaches eroded an average of 19.6 ft/yr for the full record (Table 7). Reach 34 (North Point) faces west into Atchafalaya Bay and had the lowest rate of shoreline recession (7.8 ft/yr). The coast from Point Au Fer Island to Caillou Boca (including Reaches 35 and 36) eroded around 14 to 17 ft/yr, although a 4-mi (6.5-km) segment of central Point Au Fer shoreline eroded at 22 ft/yr from the 1880s to 2015. Along the Isles Dernieres barrier island chain (Reaches 37 to 41), which was one continuous island in the 1880s (minus Wine Island), the shoreline receded at a much higher rate (38 ft/yr). Raccoon Island (Reach 37) was the least erosional (24.9 ft/yr), whereas Whiskey Island (Reach 38) receded at 52.2 ft/yr (Figure 18; Appendix D). In fact, all analysis epochs for Whiskey Island document over 45 ft/yr of erosion. The shorelines of Trinity and East Islands (Reaches 39 and 40), which were one continuous island in the mid-twentieth century, underwent erosion and landward migration of 35.4 and 26.8 ft/yr, respectively. Wine Island (Reach 41) deteriorated and migrated landward over 60 ft/yr from 1887 to 2015, with island size so small by 2015 that only three transects were available to document change (Appendix C, Figure C30).

Average shoreline recession for the Late Lafourche Delta Region was the largest for all barrier island regions west of the Birdfoot Delta (27.3 ft/yr; Table 7). Erosional hotspots were associated with East Timbalier Island (Reach 43, 58.1 ft/yr), West Belle Pass (Reach 44, 85.5 ft/yr), and the western half of Caminada Headland (part of Reach 45, around 50 ft/yr) (Figure 10; Appendix D). Grand Isle is the only net accretional island (Reach 46, 3.5 ft/yr) within this region. Although stable to slightly erosional between the 1880s and 1950s before widespread development on the island, protection and restoration activities since the 1950s have resulted in enough shoreline advance to make the long-term shoreline

change trend positive. Timbalier Island (Reach 42) is laterally migrating to the west, making analysis of cross-shore changes over a 128-year period difficult since limited transects intersect the coast in both time periods (Appendix C, Figure C36).

The Modern Delta Region (east to Sandy Point) eroded an average of 19.3 ft/yr (Table 7). Reaches 49 (Chaland Headland) and 50 (Shell Island) recorded similar mean change of around -19 ft/yr (Figure 11). For the Chaland Headland Reach, there was an increased erosion trend from east to west. Shorelines of the Shell Island Reach were stable to accreting in the central portion (Pelican Island) and erosional on either side, especially in the western part at Shell Island downdrift of the Empire jetties (Appendix C, Figure C42; Appendix D).

Average erosion in the Chandeleur Islands Region occurred at 31.3 ft/yr for the period of record, highest of all geomorphic regions (Table 7). All shorelines in this region have open-Gulf exposure, making this barrier coast highly vulnerable to storm impacts. Reach 61 (North Chandeleur Islands) documented a change rate of -30 ft/yr, although the southern half of this reach experienced higher rates of recession (around 45 ft/yr). Grand Gosier and Curlew Islands (Reach 60) eroded and migrated landward at 52.8 ft/yr, while Breton Island (Reach 59) receded an average of 26.8 ft/yr (Figure 18; Appendix C, Figure C48; Appendix D).

The semi-protected coast of the Pontchartrain Basin Region illustrated an average shoreline change rate of -5.5 ft/yr (Appendix D). Shorelines in this region showed fairly consistent changes (0 to -10 ft/yr) (Figure 13). Reaches with higher recession rates include the northern half of Manchac Swamp (Reach 74), the eastern half of LaBranche Marshes (Reach 72), and the eastern half of Isle Aux Pitre (Reach 62) (Figure 18). New Orleans Lakefront (Reach 70) had an average shoreline advance of 7.9 ft/yr, due to development that occurred along Lake Pontchartrain, as well as structures spanning the entire reach (Appendix C, Figure C54).

5.0 Discussion

Six epochs were identified for documenting historical shoreline changes in nine geomorphic regions comprising 83 shoreline reaches in coastal Louisiana. Incremental epochs encompass distinct cultural characteristics from growth of commercial navigation and levees (1880s to 1930s) to flood control and industrial expansion in wetlands (1930s to 1950s) to major economic development and population expansion (1950s to 1998) to regional barrier shoreline restoration (1998 to 2015). However, dominant natural processes that drive shoreline change for all epochs include tropical cyclones, relative sea-level rise (up to 80% of which is controlled by subsidence [Penland and Ramsey, 1990]), and sediment supply from the Mississippi River and Atchafalaya River where active sedimentation is occurring. Arguably, the primary driver for shoreline change along the outer coast of Louisiana is tropical cyclones; secondary factors include winter storms and relative sea-level rise. Erosive wave processes associated with storm events mobilize sediment at land-water boundaries and redistribute sediment alongshore and cross-shore. Eroding boundaries (shoreline recession) in Louisiana are associated with deltaic (Delta Plain) or marginal deltaic (Chenier Plain) deposits that contain mixtures of fine- (silt and clay) and coarse-grained (sand) material that erode, move, and settle based on distinct geotechnical properties (e.g., sediment bulk density and shear strength; particle size, shape, and density).

Along a mixed sediment coast, particle transport generally is concentrated within a narrow zone of active sand movement referred to as the littoral zone. Sand moves alongshore and cross-shore in relatively

predictable ways depending on incident wave climate. Along low-lying deltaic and marginal deltaic coasts, eroding shoreline deposits encompass a mixture of fine particles and sand-sized sediment, often with a greater proportion of fines. Once eroded, fine particles generally are transported outside the active sand transport zone to deeper shelf environments or through inlets to backbarrier bay and marsh environments. Unlike eroded sandy beach deposits, eroded fine-grained sediment from deltaic shorelines is permanently lost from the active beach sand transport system, thereby exacerbating shoreline recession in these areas. In deltaic environments like south Louisiana, where riverine sediment is not contributing appreciably to maintenance or growth of coastal environments, chronic erosion at shoreline boundaries is the only outcome. A countermeasure for maintaining shoreline stability is to augment the coastal sediment budget with beach and backbarrier sediment restoration, which Louisiana has been very successful at implementing (see Appendix A). Further, beach and barrier island restoration involves placement of predominantly sand where a mixture of sand and mud once existed, creating a more resilient feature that provides greater amounts of sand to sand-starved deltaic barriers.

Shoreline change throughout coastal Louisiana varies widely (see Appendix C), but average recession rates for each epoch are relatively consistent at 9.5 to 13.5 ft/yr. These coast-wide erosion rates encompass all shoreline changes, regardless of whether coastal settings have primary exposure to open-Gulf waves and currents or are located in semi-protected lakes and bays with limited exposure to open-Gulf processes. When geomorphic regions with clear differences in exposure to open-Gulf processes are evaluated separately, a distinct difference in the magnitude of shoreline recession emerges. Shorelines with predominantly open-Gulf exposure illustrate a two- to three-fold increase in erosion relative to semi-protected coastal regions (Table 7). Shoreline change along predominantly Gulf-facing regions ranges from -10.5 to -21.7 ft/yr whereas semi-protected regions that contain near-complete shoreline data coverage average -5.8 to -6.5 ft/yr. Not only is the magnitude of change greater for Gulf-facing shorelines but the variability in mean change rates is larger. This contrast in shoreline response emphasizes the importance of outer-coast barrier beaches for modulating the impact of waves on shoreline erosion at areas inland of the coast.

Smallest average shoreline changes for open-Gulf regions occurred during the flood control and industrial expansion epoch of the 1930s to 1950s (-10.5 ft/yr). However, this was a period when hurricane occurrence and intensity were low. In fact, only one Category 2 and two Category 1 hurricanes made landfall in south Louisiana during this entire epoch. Conversely, the epoch with greatest average shoreline changes (1998 to 2015; -21.7 ft/yr) recorded 10 hurricanes impacting the coast (Table 8), including two Category 3 (Hurricanes Katrina and Rita) and four Category 2 events (~5.9 per decade). As a subset of this epoch, the 2004 to 2012 epoch recorded the most frequent occurrence of hurricanes (~8.8 per decade) and open-Gulf shoreline change was nearly equal to that recorded for the 1998 to 2015 epoch. Although the 1880s to 1930s epoch contained a large number of Category 3 and 2 storms, the frequency of hurricane impact was lower (~3.4 hurricanes per decade) resulting in an average shoreline change of -17.1 ft/yr for the open-Gulf coast. The 1950s to 1998 epoch experienced the greatest number of hurricane impacts; however, the frequency of occurrence was similar to that for the 1880s to 1930s epoch (~3.5 per decade), as was mean shoreline change (-17.6 ft/yr).

Although the 1998 to 2015 epoch incurred significant storm impacts over a relatively short period, this epoch also was a time of increased shoreline and barrier island restoration (see Table 2), which increased the resilience of restored shorelines. Coastal Louisiana shoreline response is driven primarily by tropical cyclone impacts; however, the magnitude of change varies substantially depending on shoreline exposure, orientation, and tropical cyclone characteristics.

Table 8. Summary of tropical cyclones impacting south Louisiana.							
	Hurricane Frequency by Category					Tropical Storms	Tropical Cyclones
Epoch	5	4	3	2	1		
1880s to 1930s		2	8	9	8	40	67
1930s to 1950s				3	3	16	22
1950s to 1998	1	3	2	1	10	8	25
1998 to 2015			2	4	4	11	21
2004 to 2012			2	2	3	4	11

Coast-wide variations in shoreline response were driven by regional changes in erosion along the most vulnerable coastal reaches, particularly those associated with the barrier shorelines of the Early and Late Lafourche Deltas, Modern Delta, and Chandeleur Islands. These beaches bear the brunt of direct storm wave impacts from the GoM, resulting in chronic erosion, barrier beach overtopping, and island migration and deterioration (see Appendix C). The Rockefeller Refuge and Mulberry Island coastal reaches of the Eastern Chenier Plain geomorphic region experience similar high rates of shoreline recession (20 to 40 ft/yr) as barrier beaches of the delta plain. However, dominant westward sediment transport to downdrift shorelines tempers the magnitude and direction of shoreline change along the east-west oriented Western Chenier Plain coast. The remaining coastal regions are protected to varying degrees from open-Gulf wave processes, although most experience net shoreline erosion (5.8 to 6.5 ft/yr; Table 7) in response to locally-generated storm waves (i.e., those generated within coastal lakes and bays) and relative sea-level rise.

When one isolates shoreline changes by epoch for the central barrier island coast from Raccoon Island to Sandy Point (Reaches 37 to 50), average shoreline recession rates are approximately 10 ft/yr greater than those recorded for the entire Louisiana open-Gulf coast. For the 1880s to 1930s epoch, open-Gulf shoreline recession averaged 17.1 ft/yr. For the same period, shorelines along the central barrier island coast eroded and migrated at 29.7 ft/yr, emphasizing the influence of barrier shoreline recession on coast-wide erosion rates. The Chandeleur Islands region recorded similar recession rates for this period. Between the 1930s and 1950s, a period of reduced hurricane impacts, average shoreline change decreased to -10.5 ft/yr along the open-Gulf coast (Table 7), and erosion rates along the central barrier island coast decreased as well. However, the magnitude of change for the central barrier islands (-19.5 ft/yr) and the Chandeleur Islands region (-16.0 ft/yr) was greater than 1.5 times the open-Gulf shoreline change average. During the 1950s to 1998 epoch, shoreline recession increased along the central barrier island coast (26.7 ft/yr) and the Chandeleur Islands (33.9 ft/yr), contributing substantially to the coast-wide average erosion rate of 17.6 ft/yr. However, between 1998 and 2015, when large-scale restoration of the central barrier island coast was active, shoreline recession decreased to 19.6 ft/yr compared with an open-Gulf mean shoreline change of -21.7 ft/yr. Conversely, the Chandeleur Islands region experienced a nearly three-fold increase in shoreline recession for the same period.

Overall, regional shoreline response is relatively predictable and driven by tropical cyclone magnitude and frequency; however, engineering activities (e.g., beach/island restoration and coastal structure placement) have measurable impacts on localized shoreline response. Where barrier island restoration efforts have been implemented, the coast has been made more resilient and sediment volume lost from eroding deltaic shorelines has been replenished, in part, with sand from sources outside the active sand transport system, thereby augmenting the existing littoral sediment budget. Barrier shoreline

changes for the 1998 to 2015 (and 2004 to 2012) epoch(s) document the positive impact of beach and island restoration. As an example, East Grand Terre Island (Reach 48) illustrates increasing shoreline deterioration between the 1880s and 1998, but that trend was reversed after approximately 3 million cubic yards (MCY) of sand and 1.6 MCY of mixed sediment were used to restore the island in 2010. Between 1998 and 2015, shoreline recession rates were reduced to 21.9 ft/yr, and for the period 2004 to 2012, shoreline change was nearly stable at -0.5 ft/yr. Overall, beach restoration/protection projects during the 1998 to 2015 epoch along the Early Lafourche Delta, Late Lafourche Delta, and Modern Delta Regions resulted in net reduction in shoreline recession relative to that recorded during the 1950s to 1998 epoch.

6.0 Recommendations

The intent of the BICM regional shoreline change analyses is to provide a quantitative understanding of regional variations in shoreline position relative to natural and human influences. During the era of modern shoreline surveying techniques (1930s to present), our goal is to develop a time series of measurements with incremental time gaps no greater than approximately 20 years. The purpose for this approach is to capture changes along a rapidly evolving coast during the period of rapid industrial development and population growth in coastal Louisiana. For the BICM program to complete the shoreline data set, a 1970s shoreline should be developed for all coastal reaches. Once complete, nine accurate shorelines will be available for documenting regional variations in change rates between the 1930s and 2015.

Based on evaluation of shoreline-change trends for the entire data set, one may be able to limit the frequency of data collection/analysis relative to consistency of change rates. For instance, quantitative data indicate that semi-protected coastal regions exhibit relatively consistent change trends throughout the period of record. This suggests that future regional shoreline change data may not add significant new information for these regions to better understand shoreline response.

Conversely, active growth (and deterioration) at the Birdfoot, Atchafalaya, and Wax Lake deltas were not mapped as part of this effort because the processes impacting shoreline change in these areas is very different than those recorded elsewhere in coastal Louisiana. Shorelines could be compiled for these areas of active deposition to document rate of growth to better understand deltaic sedimentation as it may relate to marsh growth associated with installation of sediment diversions.

Although BICM shoreline change efforts are regional in context, shoreline information compiled can be used for more detailed analyses of barrier shoreline response to beach restoration projects. Project-level analyses of shoreline position changes between 1998 and 2015 (refined baseline orientation and transect spacing) for the central barrier island coast would provide a more complete understanding of beach restoration efforts and their value for creating a more resilient coastline. Barrier island erosion is expected to continue, but addition of sand to an otherwise sand-starved system results in a more resilient coastline. A more comprehensive analysis of change in and adjacent to restoration projects should provide this information. The final BICM program report is expected to better assess restoration impacts by integrating multiple BICM program data sets.

As a final note, data compiled and analyzed as part of this report (and accompanying digital files) represent the most complete and reliable shoreline position and change information for coastal Louisiana. However, the data set should always be viewed as dynamic, and continual updating is required.

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Appendix A: Barrier Shoreline Restoration/Protection Projects, 1994 to 2015

(from CPRA, 2014, 2016; Penland et al., 2003)

Western Chenier Plain (Johnson's Bayou to Hackberry Beach)

1) **Holly Beach Breakwaters (CS-01, 1994)**

The State of Louisiana constructed 85 shore-parallel segmented breakwaters for shoreline protection in four phases from 1991 to 1994 along 12 km of shoreline in Cameron Parish, Louisiana. The project completion date was 1994.

2) **Holly Beach Sand Management (CS-31, 2003)**

The Holly Beach Sand Management (CS-31) project area is located between the communities of Holly Beach and Constance Beach on the Gulf shoreline, west of Calcasieu Pass. The project modified the design of 18 existing breakwaters on the west end of the breakwater field and removed 6 experimental breakwaters located landward of existing breakwaters 35 through 40. The breakwater modification was completed on June 19, 2002. The removal of the experimental breakwaters occurred on September 5, 2002. Approximately 1,750,000 cubic yards of coarse grained sand were pumped from a distance of 5 miles offshore between Holly Beach and Ocean View Beach. Construction of the sand-pumping portion of the project was initiated in July 2002, inclement weather and equipment problems delayed completion until March 2003.

3) **Cameron Parish Shoreline Restoration (CS-33, 2013-2014)**

The Cameron Parish Shoreline Restoration project restored the protective beach for nearly 6 miles west of Calcasieu Pass, between the western jetty and Holly Beach. From August 2013 until February 2014, approximately 2 million cubic yards of sand sourced from Sabine Shoal in the Gulf of Mexico were placed in the project site at an average elevation of five feet, restoring the coast, as well as providing protection for State Highway 82/27, a main evacuation route.

Eastern Chenier Plain (Rainey Refuge to Mermentau Beach)

1) **Cheniere Au Tigre Shoreline Protection Project (TV-16, 2005)**

The project area is located along the shoreline of the Gulf, approximately 15 mi south of Intracoastal City, in Vermilion Parish. The project involved construction of 13 rip-rap breakwater segments, each 200 ft long, with a 120 ft gap between segments to protect the beaches and interior brackish marshes of Cheniere au Tigre. Breakwater segments were constructed parallel to the shoreline at a distance of 200 ft from the shoreline. Six breakwaters were initially constructed in October 2001, with an additional seven completed by December 2005.

2) **Rockefeller Refuge Gulf Shoreline Protection Demonstration Project (0018-EB, 2010)**

The project is located along 2.5 miles of Gulf shoreline on the west end of Rockefeller Wildlife Refuge in Cameron Parish. The goal of this demonstration project was to evaluate three construction designs as a cost effective means for protecting shoreline areas with poor load bearing capacities. Breakwater test sections were established along the western shore of Joseph Harbor Canal. There were two types of demonstration breakwaters. The first was made of lightweight aggregate (LWA) composed of a neutrally buoyant clay and shale; the second was composed of rocks typically used with breakwater installation. Project completion was January 2010.

Early Lafourche Region (Raccoon Island to Wine Island)

1) **Raccoon Island Repair and Restoration Project (TE-106, 1994)**

Project goal was to close breaches formed by Hurricane Andrew and restore the sand beach also removed during the storm. This was accomplished through the closure of 5 breaches, restoration and elevation of the beach, and construction of backbarrier nodes (small sand islands) to provide additional habitat. Construction placed 1.5 million cubic yards (MCY) of fine sand dredged from back barrier borrow sites. Vegetation was installed to hold sediments and create appropriate habitats.

2) **Raccoon Island Breakwaters Demonstration (TE-29, 1997)**

Project goal was to reduce shoreline erosion and increase subaerial land area. Eight segmented breakwaters were constructed along the eastern end of the island to reduce the rate of shoreline recession, promote sediment accretion along the beach, and protect seabird habitat.

3) **Whiskey Island Restoration (TE-27, 1998)**

Project goal was to create and restore beaches and back barrier marsh platform on Whiskey Island. Approximately 4.6 miles of Gulfside shoreline with beach/dune component of variable width (700 to 800 feet) were restored using about 2.9 MCY of sand. The dune height was 4 feet with crest width varying between 300 and 500 feet. The project created 168 acres of new land, including filling the breach at Coupe Nouvelle. Initial vegetation planting of smooth cordgrass (*Spartina alterniflora*) on the bayside shore was completed in July 1998, and additional vegetation seeding and planting were carried out in spring 2000.

4) **Isles Dernieres Restoration East Island (TE-20, 1998)**

Project goal was to restore coastal dunes and wetlands of Eastern Isles Dernieres. Approximately 3.9 MCY of sand were dredged from Lake Pelto to build about 187 acres of beach and dune with target elevations of 2 feet and 8 feet, respectively. Dune crest width ranged from 300 to 500 feet. By the following summer, sand fences were installed and vegetation planted to stabilize the sand and minimize aeolian transport.

5) **Isles Dernieres Restoration Trinity Island (TE-24, 1998)**

Project goal was to restore the dunes and back-barrier marshes of Trinity Island. Approximately 4.85 MCY of sand/sediment were dredged from a borrow area in Lake Pelto to build approximately 4.3 miles of 8-ft high dune with crest width of about 300 feet, along with an elevated marsh platform at the bay side of the island. A total of about 93 acres of mostly supratidal habitat were created. By the following summer, about 22,500 feet of sand fences were installed with vegetative planting to stabilize the sand and minimize wind-driven transport.

6) **Raccoon Island Shoreline Protection/ Marsh Creation (TE-48, 2007, 2013)**

Project goal was to protect the Raccoon Island rookery and seabird colonies from an erosional shoreline, by reducing the rate of erosion along the western end of the island and creating more land along the northern shoreline. Construction included eight additional breakwaters west of the existing (TE-29) breakwaters and a terminal groin along the eastern side of the island (Phase A). In addition, approximately 0.74 MCY of mixed sediment (NRCS, 2014) from an offshore borrow area in federal waters was dredged to create 60 acres of back barrier marsh platform with an average elevation of 3.5 feet (Phase B). The shoreline protection (Phase A) component of this project

was constructed in 2007; construction of the back barrier marsh platform component (Phase B) was completed in April 2013.

7) **New Cut Dune and Marsh Restoration Project (TE-37, 2007)**

Project goal was to close the breach between Trinity and East Islands through the creation of beach, dune, and marsh habitats to increase the structural integrity of eastern Isles Dernieres. New Cut was closed through construction of about 8,000 feet of dune platform (by placing approximately 0.85 MCY of sand dredged from an offshore borrow area) matching the dune elevations on the east and west. Native barrier island vegetation was planted along with approximately 17,000 linear feet of sand fence.

8) **Whiskey Island Back Barrier Marsh Creation (TE-50, 2009)**

Project goal was to increase the longevity of the previously restored island by increasing island width. Approximately 316 acres of back barrier intertidal marsh habitat, 5,800 linear feet of tidal creeks, three one-acre tidal ponds, and 13,000 linear feet of protective sand dune were created by semi-confined disposal and placement of dredged material. About 2.76 MCY of mixed sediment was dredged from an offshore borrow area in the Gulf. After removal of the mixed sediment overburden, about 0.36 MCY of underlying sand was used to create the dune fronting the marsh platform. Native marsh vegetation was planted to colonize and protect the placed marsh soil.

Late Lafourche Region (Timbalier to East Grand Terre Island)

1) **Timbalier Island Planting Demonstration (TE-18, 1996)**
Sand fences were installed and vegetation suited to the salinity and habitat type of Timbalier Island was planted in several areas on the island to trap sand and buffer wind and wave energy.

2) **East Timbalier Island Sediment Restoration, Phase 1 (TE-25, 2000)**

Project goal included placement of dredged sediment in three embayments along the landward shoreline of East Timbalier Island, including aerial seeding of the dune platform, installation of about 13,000 linear feet of sand fencing, and dune vegetation plantings. About 2.8 MCY of sediment was dredged from an offshore borrow area creating approximately 217 acres of supratidal and intertidal habitats, including a 5-ft high dune with a crest width of about 200 feet and a 2-ft high and 500-ft wide marsh platform.

3) **East Timbalier Island Sediment Restoration, Phase 2 (TE-30, 2000)**

Project goals and objectives were the same as that of Phase 1. Project funds were used to construct 7,000 feet of rubble mound revetment.

4) **Vegetative Plantings of a Dredged Material Disposal Site on Grand Terre Island (BA-28, 2001)**

Project goal was to stabilize dredged material sites on West Grand Terre Island through vegetation plantings.

5) **Timbalier Island Dune and Marsh Creation (TE-40, 2004)**

Project goal was to restore the eastern end of Timbalier Island by restoring beach, dunes, and marsh. An 8-ft high dune with average crest width of about 400 feet was built using about 4.6 MCY of

sand/sediment dredged from an offshore borrow area which created a total fill area of about 273 acres, including about 196 acres of marsh platform

6) **East Grand Terre Island Restoration (BA-30, 2010)**

Approximately 621 acres of land were created by restoring 2.8 miles of barrier shoreline through construction of a 6-ft high dune, 165 acres of beach habitat, and about 456 acres of marsh platform using roughly 3 MCY of sand and 1.6 MCY of mixed sediment from two offshore borrow areas.

7) **West Belle Pass Barrier Headland Restoration (TE-52, 2012)**

Project goal was to re-established the eroded West Belle Pass headland via dune and marsh creation. The project created a continuous headland approximately 10,660 feet in length, creating about 93acres of dune habitat using nearly 1.74 MCY of dredged sand, and about 227 acres of marsh habitat using 3.05 MCY of dredged mixed sediment.

8) **Caminada Headland Beach and Dune Restoration (BA-45, 2013-2015)**

Caminada Headland Beach and Dune Restoration project has restored and maintained the headland through the creation of dunes and beach habitat and will protect unique coastal habitats, re-established littoral sand transport to Grand Isle, and protect Port Fourchon and the only hurricane evacuation route available to the region. This reach of the Barataria shoreline also supports the only land-based access to the barrier shoreline in the Deltaic Plain. Construction of portions of the Caminada Headland component of the LCA-BBBS Restoration Project template began in early 2013 using CIAP 2007 and Surplus 2008 funds. Approximately 3.3 MCY of sand from South Pelto Blocks 12 and 13 borrow area (eastern portion of Ship Shoal Complex) were placed to restore approximately 6 miles of shoreline by constructing a 7-foot high and about 290-foot wide dune and a 4.5-foot high and 65-foot wide beach over a surface area of about 303 acres. This restoration project is unique in that it is the first time that sand from the Ship Shoal complex was dredged for coastal restoration purposes and was transported a distance of almost 22 miles.

Modern Delta Region (East Grand Terre to Sandy Point)

1) **Pass La Mer to Chaland Pass Restoration (BA-38, Part 1, 2007)**

Project goal was to construct approximately 254 acres of back-barrier marsh platform with an average elevation of 2.5 ft. Back-barrier marsh platform was constructed using about 1.0 MCY of overburden mixed sediment from an offshore borrow area. About 2.4 MCY of sand created 230 acres of beach-dune habitat with a dune height of 6 ft and crest width of 400 ft over a project length of 2.7 miles.

2) **Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration (BA-35, 2009)**

Project constructed roughly 350 acres of total fill area, including a marsh platform approximately 1,000 feet wide contiguous with the northern side of the gulf shoreline of Bay Joe Wise. The dune was built to an elevation of 6 feet with a dune crest width of about 110 feet. Approximately 3 MCY of sediment were dredged from the Pas la Mer, Pass Chaland, and Grand Pass ebb delta. Construction of approximately 10,000 feet of 4-ft wide, 2-ft deep water exchange channels was completed to enhance surface hydrology. In addition, immediate post-construction aerial seeding was conducted for various plant cover.

3) **Emergency Berms (W8,W9,W10, 2010-2011)**

In response to the Deepwater Horizon oil spill, which began on April 20, 2010, the State of Louisiana constructed approximately 16 miles of sand berms along several sections of the barrier island shoreline east and west of the Mississippi River. The objective was to provide a barrier to oil and minimize the potential impact of the oil spill to thousands of acres of fragile barrier islands and wetland ecosystems in coastal Louisiana.

Berm Reach W8 (Shell Island): Located within the footprint of the Shell Island restoration project. The construction template was identical to the templates used on the other berm reaches: a 20-ft crest width, 5-ft crest elevation, 1:25 side slopes above -2.0 ft NAVD88, and 1:50 below -2.0 ft, NAVD88. Construction of approximately 9,000 linear feet of berm on Shell Island started on October 9, 2010 and was completed by November 23, 2010. Approximately 777,000 cubic yards of sand was placed along the island.

Berm Reach W9 (Pelican Island): Construction along Pelican Island started on July 18, 2010 and was completed by October 2, 2010. The template was superimposed on the existing island and within the footprint of the proposed CWPPRA Pelican Island Restoration Project (BA-38-1). A total length of 12,700 feet of berm was constructed and approximately 1,294,000 cubic yards of sand was placed within the berm along Pelican Island.

Berm Reach W10 (Scofield Island): Construction started on September 13, 2010. Approximately 935,000 cubic yards of sand was placed between September 13 and November 23, 2010 for constructing approximately 14,755 feet of berm. The construction template was identical to the other berm reaches. The berm was constructed within the footprint of the proposed CWPPRA Scofield Island Restoration Project (BA-40).

4) **Barataria Barrier Island Complex Project: Pelican Island and Pass (BA-38, Part 2, 2012)**

Pelican Island was restored using about 6.4 MCY of mixed sediment and sand from four different borrow areas in state and federal waters. Approximately 2.1 MCY (in-place volume) of sand were utilized to create 192 acres of beach-dune habitat. Approximately 398 acres of marsh platform, with an average elevation of about 2.6 feet, were constructed using 1.6 MCY of sediment. Average dune elevation was 7.5 feet, extending a length of 2.5 miles. The emergency Berm W9 was built in front of this island using about 1.24 MCY of sand.

5) **Riverine Sand Mining/Scofield Island Restoration (BA-40; Berm Funds; 2013)**

The goals of this project were to mitigate breaches and tidal inlets in the shoreline, reinforce the existing shoreline with sand, increase the width of the island with back barrier marsh to increase island longevity, and to re-establish a sandy dune along the length of the shoreline to protect the back barrier marsh platform from sea level rise and storm damage. The beach-dune habitats were constructed by the sand dredged from a borrow area in the Lower Mississippi River via a 22-mile long pipeline and the marsh platform was constructed from an offshore borrow source of mixed sediment. Although this project was designed under CWPPRA, construction began in December 2012 using Berm Funds. This created approximately 2.16 miles of beach and dune fill to close the breach areas and restore/protect the eroding beach. The dune component included a 50-foot wide crest width at +6 feet NAVD88. The beach fill template included a 100-foot wide construction berm at +4 feet NAVD88. The surface area of the beach platform was approximately 223 acres measured at +4 feet NAVD88. The required fill volume was approximately 2.03 MCY (required excavation (cut) volume was approximately 2.64 MCY). An

approximately 2.23-mile long back barrier marsh platform on the bay side of Scofield Island was constructed. The surface area of the proposed marsh platform is approximately 375 acres with target marsh platform elevation of +3.0 feet NAVD88. The required fill volume was approximately 1.74 MCY (the required excavation (cut) volume is approximately 2.79 MCY). It may be noted that Emergency Berm W-10 was built in front of this island using about 0.964 MCY of sand.

6) <u>Shell Island East Berm (BA-110; 2013)</u>

Shell Island East Berm was constructed between April 2013 and August 2013. About 2.29 MCY of sand from a Lower Mississippi River Borrow Area (the same borrow area used for the Scofield Restoration Project [BA-40]) were utilized to construct an 8-foot NAVD 88 dune with a crest width of 340 feet between station 76+79 and station 144+00 creating a dune area of about 87 acres as well as a beach area of approximately 54 acres. About 136 acres of marsh platform were constructed using about 0.286 MCY from the same borrow area as the dune sediment.

7) <u>Shell Island West Berm (BA-111; 2014)</u>

The template of this project includes 16,100 feet of shoreline with an 8-foot high and 340-foot wide dune on the western portion of the east island, and a 380-foot wide dune on the western island, creating an area of about 231 acres with 4.8 MCY of sand. The project involves the construction of approximately 285 acres of barrier marsh platform with about 1.1 MCY of mixed sediment from an offshore borrow area. This project is funded through the Louisiana Outer Coast Restoration project using NRDA Early Restoration Funds.

Chandeleur Islands Region

1) <u>Chandeleur Islands Marsh Restoration (PO-27, 2001)</u>

Project was intended to accelerate the recovery period of barrier island areas overwashed by Hurricane Georges in 1998 through vegetation plantings. Washover areas, which encompass 364 acres and are located at 22 sites along the Sound side of the island, were planted with smooth cordgrass (*Spartina alterniflora*).

2) <u>Eastern Berm Reach E4 (East of Mississippi River along Chandeleur Islands, 2010)</u>

Project was constructed in response to the Deepwater Horizon oil spill to provide a barrier to oil and minimize the potential impact of the oil spill. Approximately 47,000 feet (8.9 miles) of berm were constructed along the Chandeleur Islands with approximately 5.85 MCY of sand dredged from Hewes Point in the north.

Appendix B:

Shoreline Data Coverage and Source Characteristics

Louisiana Shoreline Data Coverage: 1880s Epoch

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

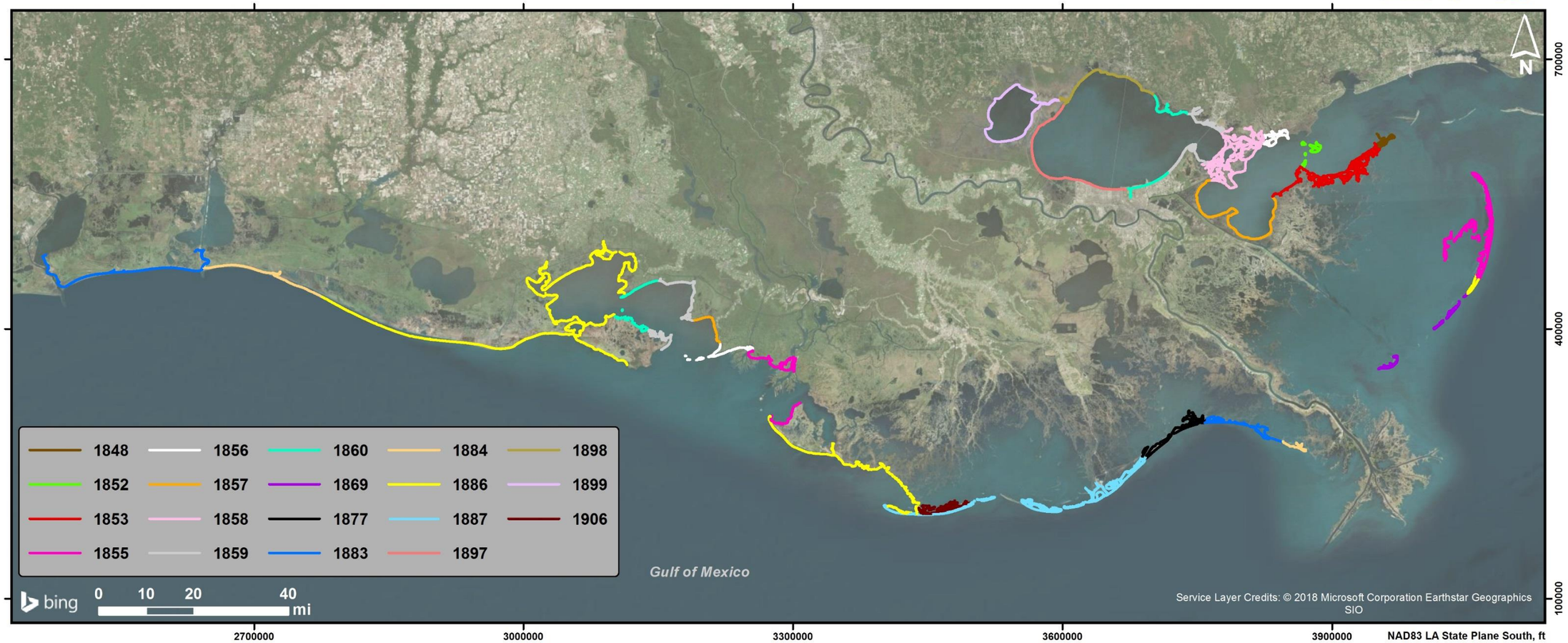


Figure B1. Shoreline data coverage for the 1880s epoch.

Table B1. 1880s Epoch Shoreline Source Data					
Source	**Description**	**Date**	**Source Type**	**Scale**	**Region**
T01643	East of Sabine Pass	1883	USC&GS T-Sheet	1:20,000	WC
T01644	East of Sabine Pass	1883	USC&GS T-Sheet	1:20,000	WC
T01642	East of Sabine Pass, Long. 93 31 to Calcasieu Pass	1883	USC&GS T-Sheet	1:20,000	WC
T01654	From Calcasieu Pass Eastward	1884	USC&GS T-Sheet	1:20,000	WC
T01655	From Mermentau R. to the Eastward	1884	USC&GS T-Sheet	1:20,000	WC/EC
T01689	From Big Constance Bayou to the Westward	1886	USC&GS T-Sheet	1:30,000	EC
T01688	Freshwater Bayou to Big Constance and Pecan Isl.	1886	USC&GS T-Sheet	1:30,000	EC
T01686	Chenier Le Tigre and Vicinity	1886	USC&GS T-Sheet	1:30,000	EC
T01684	South West Pass and Entrance to Vermilion Bay	1886	USC&GS T-Sheet	1:20,000	EC/AB
T01680A	Marsh Island	1886	USC&GS T-Sheet	1:20,000	AB
T00793	West Cote Blanche	Feb.-Mar. 1860	USC&GS T-Sheet	1:20,000	AB
T00764	West Cote Blanche Bay	April-May 1859	USC&GS T-Sheet	1:20,000	AB
T01685	Entrance from Vermilion Bay to Vermilion River	1886	USC&GS T-Sheet	1:20,000	AB
T01693	North West Shore of Vermilion Bay	1886	USC&GS T-Sheet	1:20,000	AB
T01687	Weeks Bay and East Shore of Vermilion Bay	1886	USC&GS T-Sheet	1:20,000	AB
T00631	Eastern part of Cote Blanche Bay	1857	USC&GS T-Sheet	1:20,000	AB
T00632	Atchafalaya Bay, the North West part	1856	USC&GS T-Sheet	1:20,000	AB/AW
T00639	Atchafalaya Bay and River	1855	USC&GS T-Sheet	1:9,660	AW
T00637	Atchafalaya Bay	1855	USC&GS T-Sheet	1:9,660	ELD
T01690	From Point Au Fer to near Oyster Bayou	1886	USC&GS T-Sheet	1:20,000	ELD
T01692	Shore Line from Oyster Bayou to Caillou Boca	1886	USC&GS T-Sheet	1:20,000	ELD
T01691	Shore Line of Caillou Boca	1886	USC&GS T-Sheet	1:20,000	ELD
T01762	Western Part of Isle Derniere	1887	USC&GS T-Sheet	1:20,000	ELD
T01763	Vine Island and Eastern Part of Isle Derniere	1887	USC&GS T-Sheet	1:20,000	ELD
T02752	Lake Pelto	1906	USC&GS T-Sheet	1:20,000	ELD
T01764	Timbalier and Caillou Islands	1887	USC&GS T-Sheet	1:20,000	LLD
T01765	From Grand Pass Timbaliere to Bayou Moreau	1887	USC&GS T-Sheet	1:20,000	LLD
T01766	From Bayou Moreau to Caminada Bay	1887	USC&GS T-Sheet	1:20,000	LLD
T01468A	Lower Part of Barataria Bay and Vicinity	1887	USC&GS T-Sheet	1:20,000	LLD/MD
T01648	Ronquille Bay to Bayou Schofield	Mar.-April 1883	USC&GS T-Sheet	1:30,000	MD
T01658	Grand Pass	Jan-April 1884	USC&GS T-Sheet	1:30,000	MD
T01097	Isle Au Breton	Feb. 1869	USC&GS T-Sheet	1:20,000	CI
T01092	Errol Islands	Mar. 1869	USC&GS T-Sheet	1:20,000	CI
H01654	Chandeleur Islands	Feb. 1886	USC&GS H-Sheet	1:80,000	CI
T00549	Chandeleur Islands	1855	USC&GS T-Sheet	1:20,000	CI
T00548	Chandeleur Islands	1855	USC&GS T-Sheet	1:20,000	CI
T00242	Cat Island and Isle Aux Pied	1848	USC&GS T-Sheet	1:20,000	PB
T00404	South Shore of Mississippi Sound	Dec. 1852-Jan. 1853	USC&GS T-Sheet	1:20,000	PB
T00405	Eastern Shore of Lake Borgne	Mar. 1853	USC&GS T-Sheet	1:20,000	PB
T00628	Point Aux Marcherra to Proctorville	1857	USC&GS T-Sheet	1:20,000	PB
T00629	Shores of Lake Borgne	1857	USC&GS T-Sheet	1:20,000	PB
T00773	Lakes Borgne and Pontchartrain	Jan.-Apr. 1858	USC&GS T-Sheet	1:20,000	PB

Table B1. Continued.					
Source	**Source**	**Source**	**Source**	**Source**	**Source**
T00786	Point Aux Herbes	Feb.-May 1859	USC&GS T-Sheet	1:20,000	PB
T00799	Lake Pontchartrain	1860	USC&GS T-Sheet	1:20,000	PB
T02254	Lake Pontchartrain	Jan. 1897	USC&GS T-Sheet	1:10,000	PB
T02255	Lake Pontchartrain	Jan.-Feb. 1897	USC&GS T-Sheet	1:20,000	PB
T02256	Lake Pontchartain	Jan.-Feb. 1897	USC&GS T-Sheet	1:20,000	PB
T02257	Lake Pontchartrain	Jan. 1897	USC&GS T-Sheet	1:20,000	PB
T02361	North Half Lake Maurepas and Pass Manchac	Mar.-Apr. 1899	USC&GS T-Sheet	1:20,000	PB
T02362	South Half Lake Maurepas	Mar. 1899	USC&GS T-Sheet	1:20,000	PB
T02307	Chefuncte River to Pass Manchac	Mar. 1898	USC&GS T-Sheet	1:20,000	PB
T02306	Ragged Point to Chefuncte River	Feb.-Mar. 1898	USC&GS T-Sheet	1:20,000	PB
T00796	Bayou Bonfouca to Ragged Point	1860	USC&GS T-Sheet	1:20,000	PB
T00774	Salt Bayou to Bonfouca Bayou	Jan.-May 1859	USC&GS T-Sheet	1:20,000	PB
T00633	Pearl River Island and Vicinity	Mar.1856	USC&GS T-Sheet	1:20,000	PB
T00371	Point Clear to Pearl River	May 1852	USC&GS T-Sheet	1:20,000	PB

Louisiana Shoreline Data Coverage: 1930s Epoch

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

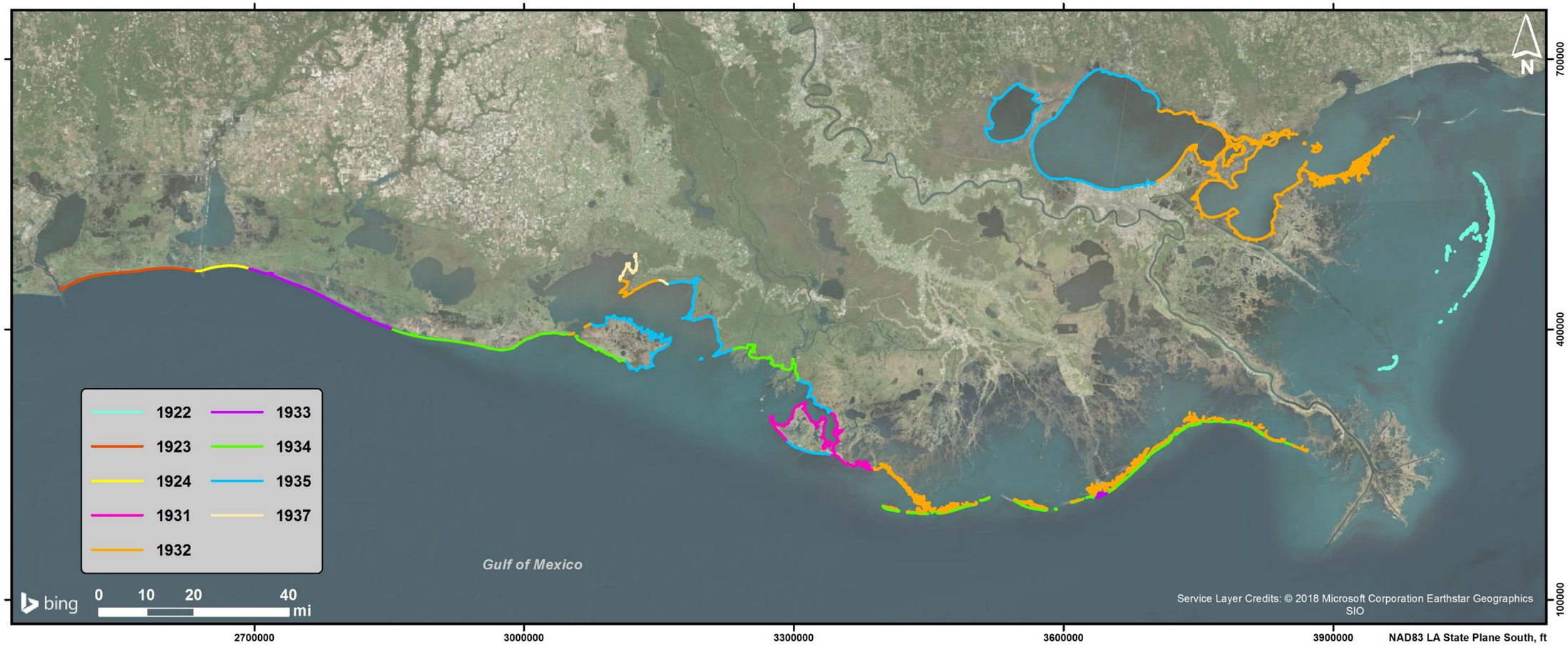


Figure B2. Shoreline data coverage for the 1930s epoch.

Table B2. 1930s Epoch Shoreline Source Data

Source	Description	Date	Source Type	Scale	Region
T04057	Sabine Pass	Mar.-June 1923	USC&GS T-Sheet	1:20,000	WC
T04061	Calcasieu Pass, Westward	Dec. 1923	USC&GS T-Sheet	1:20,000	WC
T04060	Calcasieu Pass	Apr. 1924	USC&GS T-Sheet	1:20,000	WC
T04791	Mouth of Mermentau River	Jan.-March 1933	USC&GS T-Sheet	1:20,000	EC/WC
T04795	Little Constance Bayou to Hog Bayou	Aug. 1933	USC&GS T-Sheet	1:20,000	EC
T04922	Vicinity of Big Constance Bayou	Aug. 1933-Mar. 1934	USC&GS T-Sheet	1:20,000	EC
T04923	Chenier Le Tigre to Mulberry Island	June 1934	USC&GS T-Sheet	1:20,000	EC
T04924	Vicinity of Southwest Pass	May 1934	USC&GS T-Sheet	1:20,000	AB
Topo	Redfish Point SE, LA	June 1932	USGS Topo	1:31,680	EC/AB
T04926	Shell Keys and Vicinity	June 1934	USC&GS T-Sheet	1:20,000	AB
T06325B	Point Chevreuil and E. End Marsh Island	Feb.-June 1935	USC&GS T-Sheet	1:20,000	AB
T06347A2	N. Shore of Marsh Island and Marone Pt. and Vicinity	June-July 1935	USC&GS T-Sheet	1:20,000	AB
T06347A1	N. Shore of Marsh Island and Marone Pt. and Vicinity	June-July 1935	USC&GS T-Sheet	1:20,000	AB
Topo	Derouen, LA	June 1937	USGS Topo	1:62,500	AB
Topo	Cypremort Point, LA	June 1932	USGS Topo	1:31,680	AB
Topo	Bayou Sale, LA	June 1937	USGS Topo	1:62,500	AB
T06347B2	N. Shore of Marsh Island and Marone Pt. and Vicinity	June-July 1935	USC&GS T-Sheet	1:20,000	AB
T06347B1	N. Shore of Marsh Island and Marone Pt. and Vicinity	June-July 1935	USC&GS T-Sheet	1:20,000	AB
T06347B3	N. Shore of Marsh Island and Marone Pt. and Vicinity	June-July 1935	USC&GS T-Sheet	1:20,000	AB
T06347B4	N. Shore of Marsh Island and Marone Pt. and Vicinity	June-July 1935	USC&GS T-Sheet	1:20,000	AB
T06347B5	N. Shore of Marsh Island and Marone Pt. and Vicinity	June-July 1935	USC&GS T-Sheet	1:20,000	AB
T06325-A	Point Chevreuil and E. End Marsh Island	Feb.-June 1935	USC&GS T-Sheet	1:20,000	AB/AW
T06300	Wax Lake and Vicinity	Nov. 1934	USC&GS T-Sheet	1:20,000	AW
T06299B	Morgan City to Atchafalaya Bay	Sept.-Dec. 1934	USC&GS T-Sheet	1:20,000	AW
T06323-B	Fourleague Bay to Point Au Fer	Jan.-May 1935	USC&GS T-Sheet	1:20,000	AW/ELD
T06324B1	North Shore of Fourleague Bay	Feb. & May 1935	USC&GS T-Sheet	1:20,000	ELD
T06322-2	Jack Stout Bayou to Big Carrion Crow Bayou	Feb.-Apr. 1935	USC&GS T-Sheet	1:20,000	ELD
T05662	Fourleague Bay	Feb. 18-Mar. 23, 1931	USC&GS T-Sheet	1:20,000	ELD
T05389	Atchafalaya Bay, Point Au Fer Island	Feb. 17-Mar. 4, 1931	USC&GS T-Sheet	1:20,000	ELD
T05389i	Point Au Fer Island (Inset-Northern tip)	Feb. 17-Mar. 4, 1931	USC&GS T-Sheet	1:20,000	ELD
T06324B	Atchafalaya Bay, Fourleague Bay to Point Au Fer	Jan.-May 1935	USC&GS T-Sheet	1:20,000	ELD
T06324A	Oyster Bayou & Vicinity, North Shore of Fourleague Bay	Feb.-May 1935	USC&GS T-Sheet	1:10,000	ELD
T05290	Caillou Bay, Bayou Grand Caillou	Nov. 30, 1932	USC&GS T-Sheet	1:20,000	ELD
T05291	Caillou Bay, Isles Dernieres	Nov. 30, 1932-June 30, 1934	USC&GS T-Sheet	1:20,000	ELD

Table B2. Continued.

Source	Description	Date	Source Type	Scale	Region
T05295	Lake Pelto, Wine Island	Nov. 30, 1932-June 30, 1934	USC&GS T-Sheet	1:20,000	ELD/LLD
T05299	Timbalier Bay, Grand Pass Timbalier	Dec. 1, 1932-July 10, 1934	USC&GS T-Sheet	1:20,000	LLD
T05303	Timbalier Bay, Raccoon Pass	Dec. 1, 1932-Mar. 31, 1934	USC&GS T-Sheet	1:20,000	LLD
Topo	Belle Pass, LA	Jan. 1, 1933	USGS Topo	1:31,680	LLD
T05302	Caminada Bay, Hackberry Bay to Grand Isle	Dec. 1, 1932-Feb. 28, 1934	USC&GS T-Sheet	1:20,000	LLD
T05311	Barataria Bay, Grand Isle to Robinson Bayou	Dec. 21, 1932-April 30, 1934	USC&GS T-Sheet	1:20,000	LLD/MD
T05432	Bastian Bay	Dec. 21, 1932-May 31, 1934	USC&GS T-Sheet	1:20,000	MD
T05433	Scofield Bayou	Dec. 21, 1932-May 31, 1934	USC&GS T-Sheet	1:20,000	MD
T05402	Mississippi River Delta, Sandy Point to Main Pass	Dec. 2, 1932	USC&GS T-Sheet	1:20,000	MD
T03920	Breton Island	Mar. 1922	USC&GS T-Sheet	1:20,000	CI
T03918	Chandeleur Islands	Feb. 1922	USC&GS T-Sheet	1:20,000	CI
T03985	North, New Harbor, Freemason, Old Harbor Islands	Sept. 1922	USC&GS T-Sheet	1:20,000	CI
T03917	Chandeleur Islands	Feb.-Mar. 1922	USC&GS T-Sheet	1:20,000	CI
T05325	Mississippi Sound, Cat Island	Nov. 28, 1932	USC&GS T-Sheet	1:20,000	PB
T05326	NW Jack Williams Bay to Door Point	Nov. 28, 1932	USC&GS T-Sheet	1:20,000	PB
T05321	Malheureuz Pt. to Greque Bayou	Nov. 2-28, 1932	USC&GS T-Sheet	1:20,000	PB
T05313	Lake Borgne, Alligator Point	Nov. 28, 1932	USC&GS T-Sheet	1:20,000	PB
T05314	Proctor Point to East Branch Bayou St. Malo	Dec. 1-2, 1932	USC&GS T-Sheet	1:20,000	PB
T05315	Bayou Terre Aux Boeufs to Lagoon Jireaux	Dec. 1-2, 1932	USC&GS T-Sheet	1:20,000	PB
T05306	Chalmette to Lake Borgne	Nov. 28-29, 1932	USC&GS T-Sheet	1:20,000	PB
T05305	Chef Menteur Pass	Nov. 28, 1932	USC&GS T-Sheet	1:20,000	PB
T05312	Lake Borgne, Pearl River	Nov. 28, 1932	USC&GS T-Sheet	1:20,000	PB
T05304	Point Aux Herbes	Nov. 28, 1932	USC&GS T-Sheet	1:20,000	PB
Topo	Spanish Fort, LA	June 1935	USGS Topo	1:31,680	PB
Topo	Indian Beach, LA	June 1935	USGS Topo	1:31,680	PB
Topo	LaBranche, LA	June 1935	USGS Topo	1:31,680	PB
Topo	Laplace, LA	June 1935	USGS Topo	1:31,680	PB
Topo	Ruddock, LA	June 1935	USGS Topo	1:31,680	PB
Topo	Ponchatoula, LA	June 1935	USGS Topo	1:62,500	PB
Topo	North of Garyville, LA	June 1935	USGS Topo	1:31,680	PB
Topo	Springfield, LA	June 1935	USGS Topo	1:62,500	PB
Topo	Covington, LA	June 1935	USGS Topo	1:62,500	PB
Topo	Slidell, LA	June 1935	USGS Topo	1:62,500	PB
T05320	Grand I. to Lower Point Clear	Nov. 28, 1932	USC&GS T-Sheet	1:20,000	PB

Louisiana Shoreline Data Coverage: 1950s Epoch

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

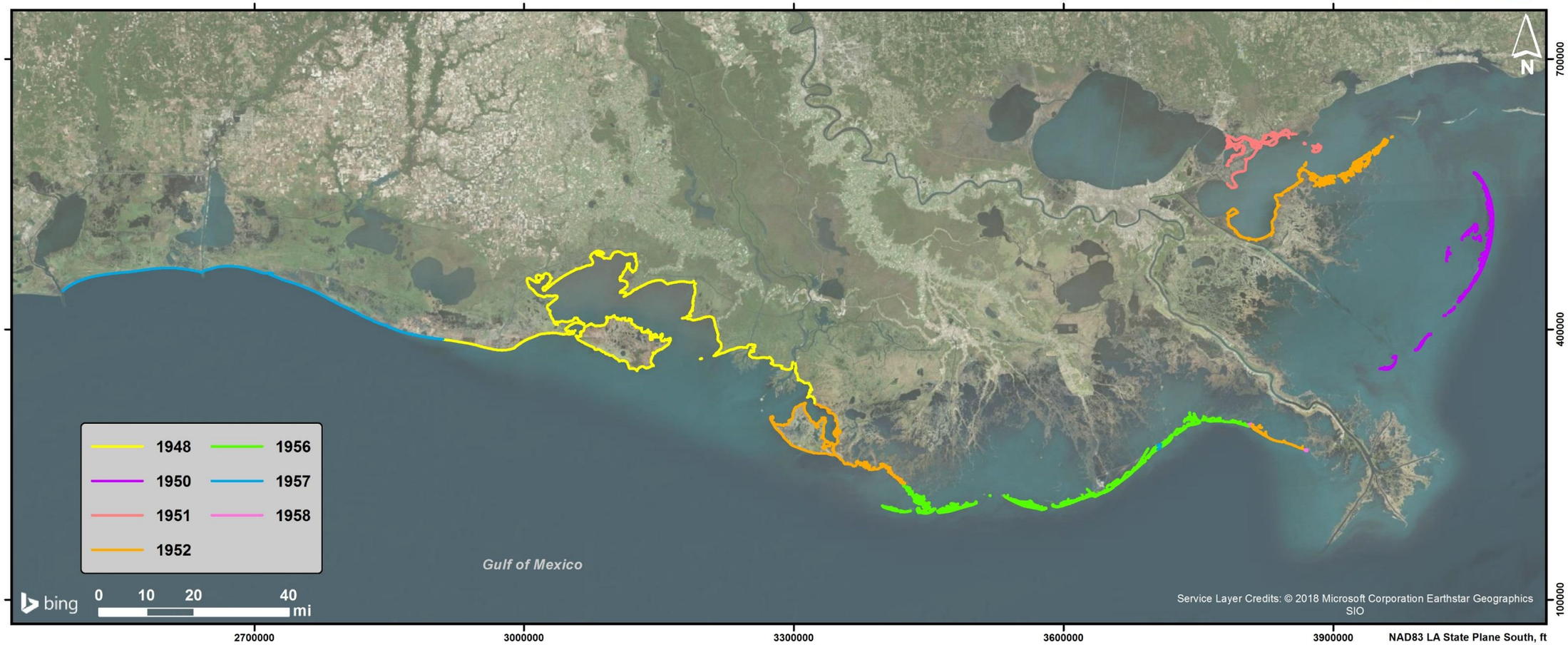


Figure B3. Shoreline data coverage for the 1950s epoch.

Table B3. 1950s Epoch Shoreline Source Data

Source	Description	Date	Source Type	Scale	Region
T10635	Sabine Pass	Apr. 6, 1957	USC&GS T-Sheet	1:20,000	WC
T10629	Smith Bayou	Apr. 6, 1957	USC&GS T-Sheet	1:20,000	WC
T10630	Peveto Beach	Apr. 6, 1957	USC&GS T-Sheet	1:20,000	WC
T10631	Holly Beach	Apr. 6, 1957	USC&GS T-Sheet	1:20,000	WC
T10632	Calcasieu Pass	Apr. 6, 1957	USC&GS T-Sheet	1:20,000	WC
T10633	Mesquite Ridge	Apr. 6, 1957	USC&GS T-Sheet	1:20,000	WC
T10634	Mermentau River	Apr. 6, 1957	USC&GS T-Sheet	1:20,000	WC
T10636	Hackberry Beach	Apr. 6, 1957	USC&GS T-Sheet	1:20,000	WC/EC
T10637	Hog Bayou	Apr. 6, 1957	USC&GS T-Sheet	1:20,000	EC
T10638	Tolan Lake	Apr. 6, 1957	USC&GS T-Sheet	1:20,000	EC
T10639	Big Constance Lake	Apr. 6, 1957	USC&GS T-Sheet	1:20,000	EC
T10640	Flat Lake	Apr. 6, 1957	USC&GS T-Sheet	1:20,000	EC
T09110	South of Pecan Island	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	EC
T09111	South of Pecan Island	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	EC
T09112	Chenier Au Tigre	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	EC
T09113	Southwest Pass	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	EC/AB
T09114	Vermilion Bay, Marsh Island	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09115	W. Cote Blanche Bay, Marsh Island	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09117	Gulf Coast, Marsh Island	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09116	E. Cote Blanche Bay, Marsh Island	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09563	Cypremort Point-Blue Point	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09109	Redfish Point	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09108	Belle Isle	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09104	Intracoastal City	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09105	Boston Bayou	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09012	Bayou Petite Anse	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09013	Weeks Island	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09017	Cote Blanche Island S. to Point Marone	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09018	W.-E. Cote Blanche Bays	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB
T09023	East Cote Blanche Bay	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AB/AW
T09024	Belle Isle	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AW
T09025	Lake Salve	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AW
T09031	Lower Atchafalaya River	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AW
T09032	Fourleague Bay and Vicinity	Mar. 13, 1948	USC&GS T-Sheet	1:20,000	AW/ELD
T09807	Bay Castagnier to S. Point	Sept. 29, 1952	USC&GS T-Sheet	1:20,000	ELD
T09859	Lost Lake	Sept. 29, 1952	USC&GS T-Sheet	1:20,000	ELD
T09868	Oyster Bayou	Sept. 29, 1952	USC&GS T-Sheet	1:20,000	ELD
T09806	Locust Bayou to Eugene Island	Sept. 29, 1952	USC&GS T-Sheet	1:20,000	ELD
T09971	Point Au Fer Island, Burkes Bayou	Sept. 29, 1952	USC&GS T-Sheet	1:20,000	ELD
T09869	Pecan Island	Sept. 29, 1952	USC&GS T-Sheet	1:20,000	ELD
T09870	Grand Bayou Du Large	Sept. 29, 1952	USC&GS T-Sheet	1:20,000	ELD

Table B3. Continued

Source	Description	Date	Source Type	Scale	Region
T09868	Oyster Bayou	Sept. 29, 1952	USC&GS T-Sheet	1:20,000	ELD
T09806	Locust Bayou to Eugene Island	Sept. 29, 1952	USC&GS T-Sheet	1:20,000	ELD
T09971	Point Au Fer Island, Burkes Bayou	Sept. 29, 1952	USC&GS T-Sheet	1:20,000	ELD
T09869	Pecan Island	Sept. 29, 1952	USC&GS T-Sheet	1:20,000	ELD
T09870	Grand Bayou Du Large	Sept. 29, 1952	USC&GS T-Sheet	1:20,000	ELD
T09878	West Derniere	Oct. 24, 1956	USC&GS T-Sheet	1:20,000	ELD
T09879	Derniere	Oct. 24, 1956	USC&GS T-Sheet	1:20,000	ELD
T09880	East Derniere	Oct. 24, 1956	USC&GS T-Sheet	1:20,000	ELD
T09881	Cat Island Pass	Oct. 24, 1956	USC&GS T-Sheet	1:20,000	ELD/LLD
T09882	Timbalier Island	Oct. 24, 1956	USC&GS T-Sheet	1:20,000	LLD
T09883	Calumet Island	Oct. 24, 1956	USC&GS T-Sheet	1:20,000	LLD
T09884	Belle Pass	Oct. 24, 1956	USC&GS T-Sheet	1:20,000	LLD
T09876	Leeville	Oct. 24, 1956	USC&GS T-Sheet	1:20,000	LLD
T09877	Caminada Pass	Oct. 24, 1956	USC&GS T-Sheet	1:20,000	LLD
CPV-1T-74	Grand Isle	Mar. 22, 1957	USDA Aerial Image	1:20,000; 1.5-ft pix.	LLD
ARA550250 010026	Grand Isle	Feb. 22, 1956	USGS Aerial Image	1:30,000; 7-ft pixel	LLD
ARA550250 010028	Grand Isle	Feb. 22, 1956	USGS Aerial Image	1:30,000; 7-ft pixel	LLD
ARA550250 010070	West Grand Terre Island	Feb. 22, 1956	USGS Aerial Image	1:30,000; 7-ft pixel	LLD
ARA550250 010069	East Grand Terre Island	Feb. 22, 1956	USGS Aerial Image	1:30,000; 7-ft pixel	LLD
ARA550250 010075	East Grand Terre Island	Feb. 22, 1956	USGS Aerial Image	1:30,000; 7-ft pixel	LLD/MD
ARA550250 030141	Cheniere Ronquille	Feb. 22, 1956	USGS Aerial Image	1:30,000; 7-ft pixel	MD
ARA550250 010097	Bayou Cheniere Ronquille-Bayou Chaland	Feb. 22, 1956	USGS Aerial Image	1:30,000; 7-ft pixel	MD
ARA550250 020138	Bay Joe Wise	Feb. 22, 1956	USGS Aerial Image	1:30,000; 7-ft pixel	MD
Bastian Bay Quad	Bastian Bay	Oct. 1, 1958	Tobin Aerial Image	4-ft pixel	MD
V24-015	Shell Island	Mar. 8, 1952	US Navy Aerial Image	1:20,000; 2.7-ft pix.	MD
V31-053	Pelican Island	Mar. 29, 1952	US Navy Aerial Image	1:20,000; 2.7-ft pix.	MD
V31-051	East of Schofield Bayou	Mar. 29, 1952	US Navy Aerial Image	1:20,000; 2.7-ft pix.	MD
T10949	Sandy Point	Oct. 11, 1958	USC&GS T-Sheet	1:20,000	MD
T09393	Breton Island	May 9, 1950	USC&GS T-Sheet	1:20,000	CI
T09392	Grand Gosier Island	May 9, 1950	USC&GS T-Sheet	1:20,000	CI

Table B3. Continued					
Source	**Description**	**Date**	**Source Type**	**Scale**	**Region**
T10949	Sandy Point	Oct. 11, 1958	USC&GS T-Sheet	1:20,000	MD
T09393	Breton Island	May 9, 1950	USC&GS T-Sheet	1:20,000	CI
T09392	Grand Gosier Island	May 9, 1950	USC&GS T-Sheet	1:20,000	CI
Topo	Stake Islands, LA	May 9, 1950	USGS Topo	1:24,000	CI
T09391	Boot Island	May 9, 1950	USC&GS T-Sheet	1:20,000	CI
T09389	New Harbor Islands	May 16, 1950	USC&GS T-Sheet	1:20,000	CI
T09387	North Islands	May 9, 1950	USC&GS T-Sheet	1:20,000	CI
T09386	Chandeleur Islands	May 9, 1950	USC&GS T-Sheet	1:20,000	CI
T09388	Freemason Island	May 16, 1950	USC&GS T-Sheet	1:20,000	CI
T09655	Isle Au Pitre	Feb. 27, 1952	USC&GS T-Sheet	1:20,000	PB
T09659	Door Point	Feb. 27, 1952	USC&GS T-Sheet	1:20,000	PB
T09658	Three Mile Bay	Feb. 27, 1952	USC&GS T-Sheet	1:20,000	PB
T09657	Malheureux Point	Feb. 27, 1952	USC&GS T-Sheet	1:20,000	PB
T09656	False Mouth Bayou	Feb. 27, 1952	USC&GS T-Sheet	1:20,000	PB
T09661	Lake Borgne	Feb. 27, 1952	USC&GS T-Sheet	1:20,000	PB
T09666	Len Lagoon	Feb. 27, 1952	USC&GS T-Sheet	1:20,000	PB
T09665	Shell Beach	Feb. 27, 1952	USC&GS T-Sheet	1:20,000	PB
T09660	Proctor Point	Feb. 27, 1952	USC&GS T-Sheet	1:20,000	PB
T09792	Alligator Point	Apr. 24, 1951	USC&GS T-Sheet	1:20,000	PB
T09789	Rigolets	Apr. 24, 1951	USC&GS T-Sheet	1:20,000	PB
T09790	Pearl River Island	Apr. 24, 1951	USC&GS T-Sheet	1:20,000	PB
T09791	Grand Island Pass	Apr. 24, 1951	USC&GS T-Sheet	1:20,000	PB

Louisiana Shoreline Data Coverage: 1998

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

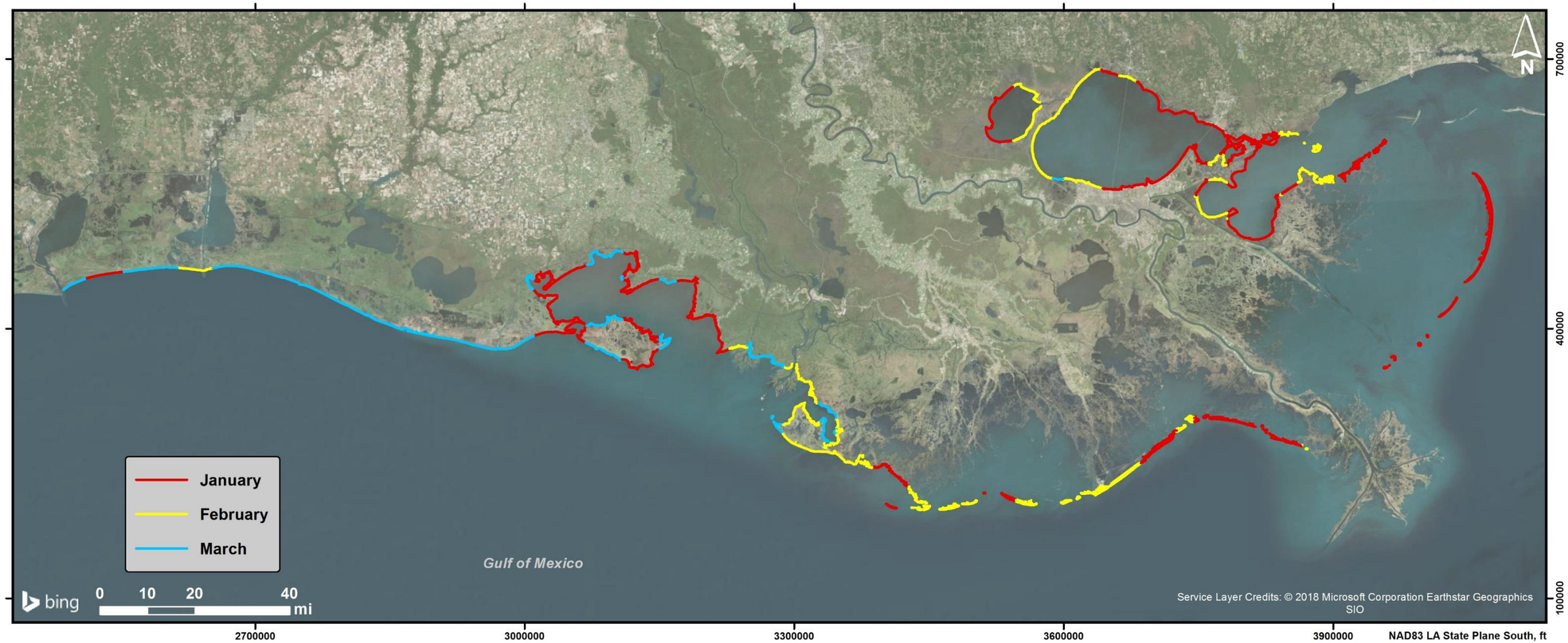


Figure B4. Shoreline data coverage for 1998.

Louisiana Shoreline Data Coverage: 2004

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

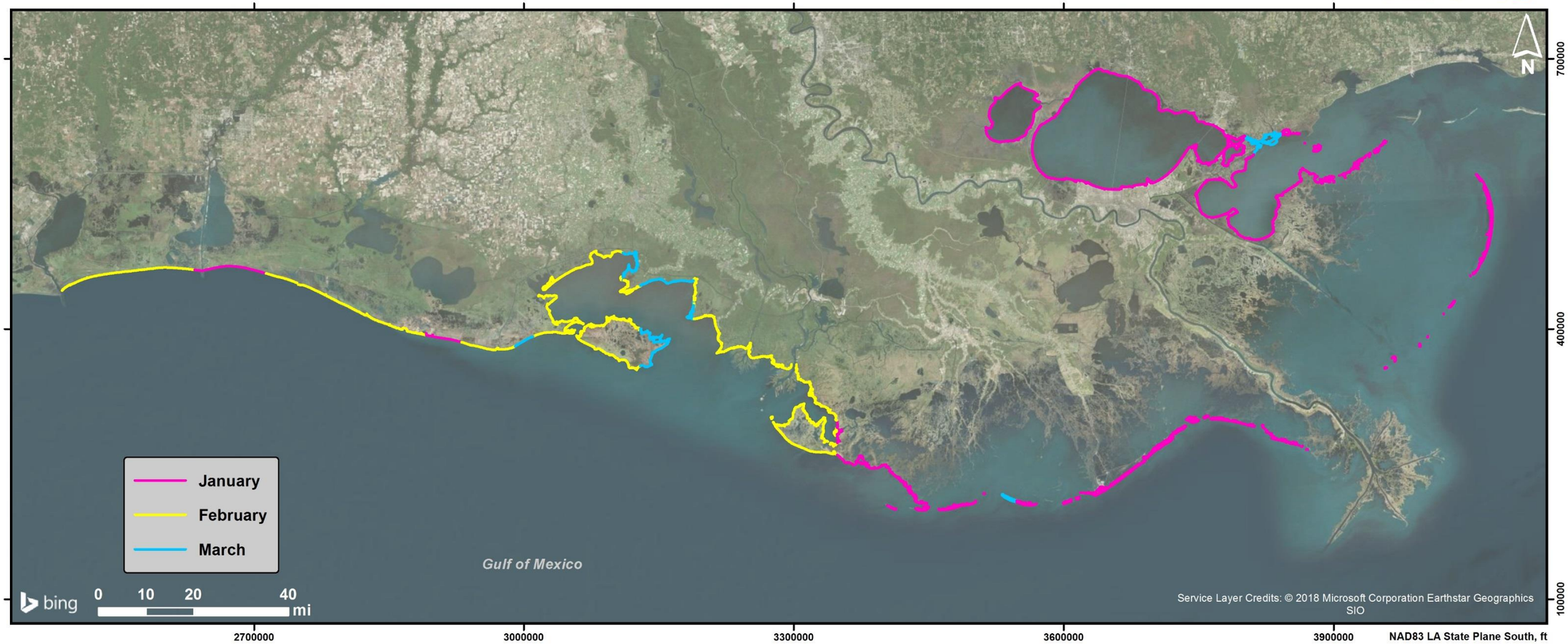


Figure B5. Shoreline data coverage for 2004.

Louisiana Shoreline Data Coverage: 2005

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

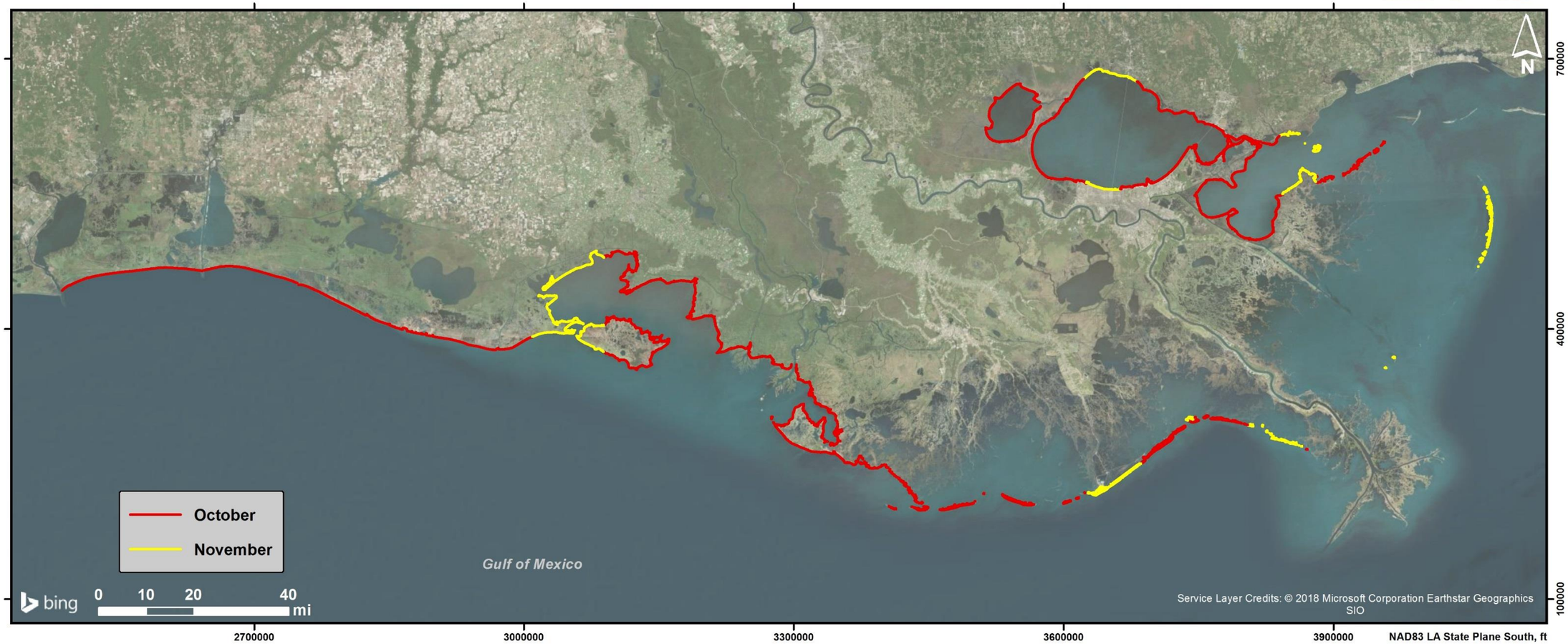


Figure B6. Shoreline data coverage for 2005.

Louisiana Shoreline Data Coverage: 2008

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

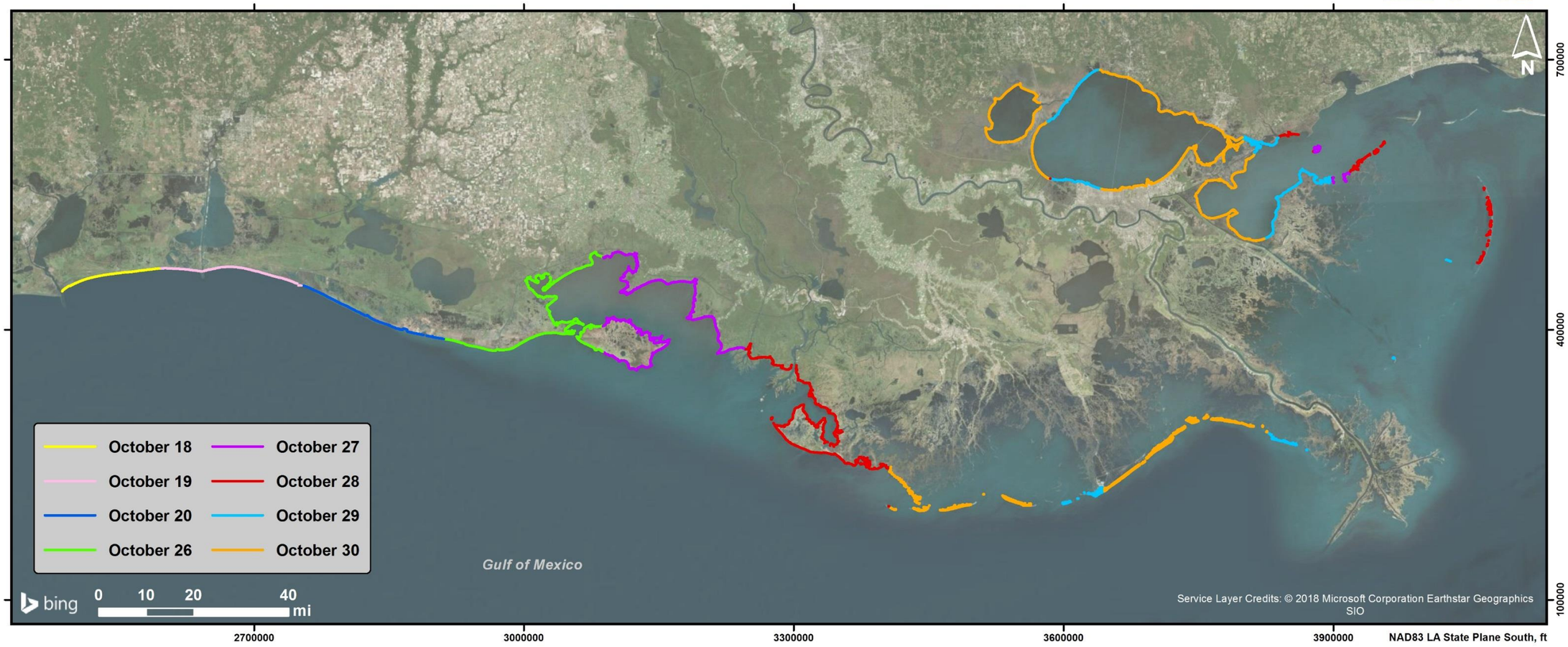


Figure B7. Shoreline data coverage for 2008.

Louisiana Shoreline Data Coverage: 2012

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

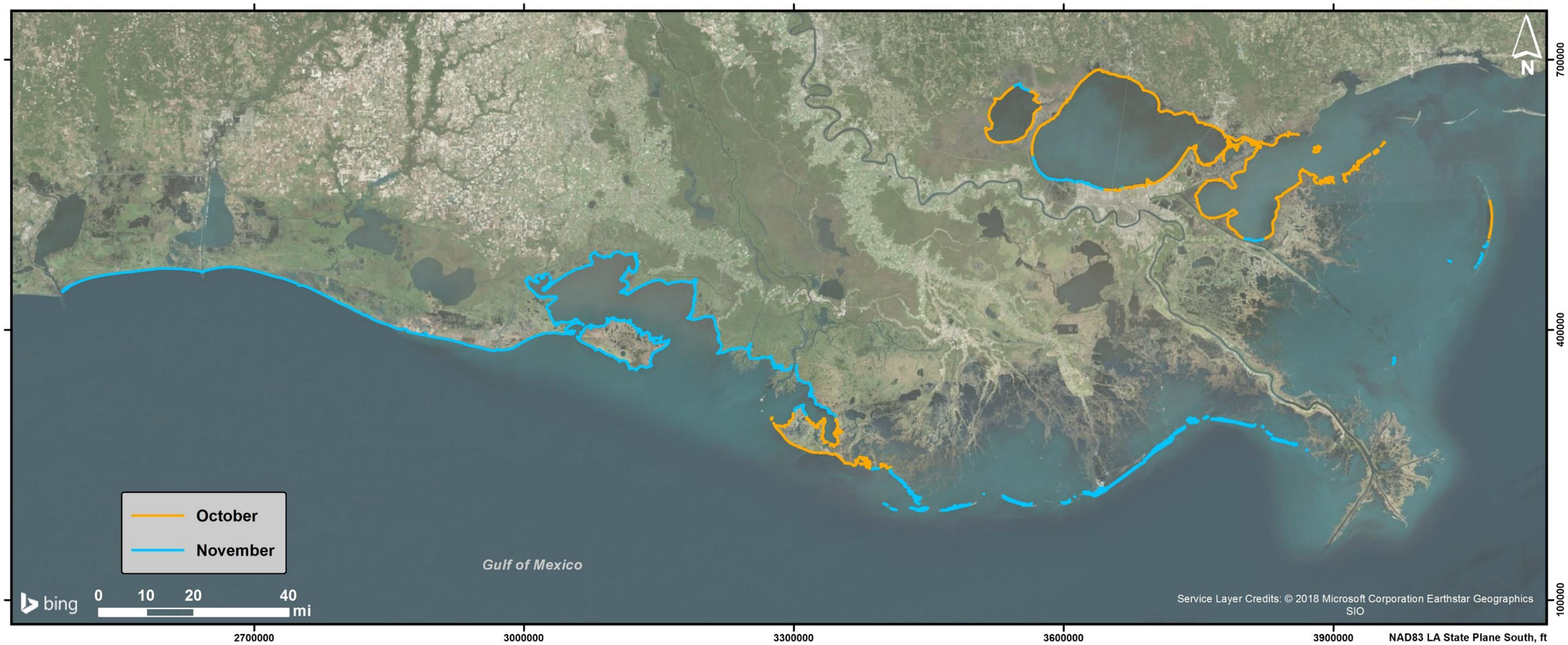


Figure B8. Shoreline data coverage for 2012.

Louisiana Shoreline Data Coverage: 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

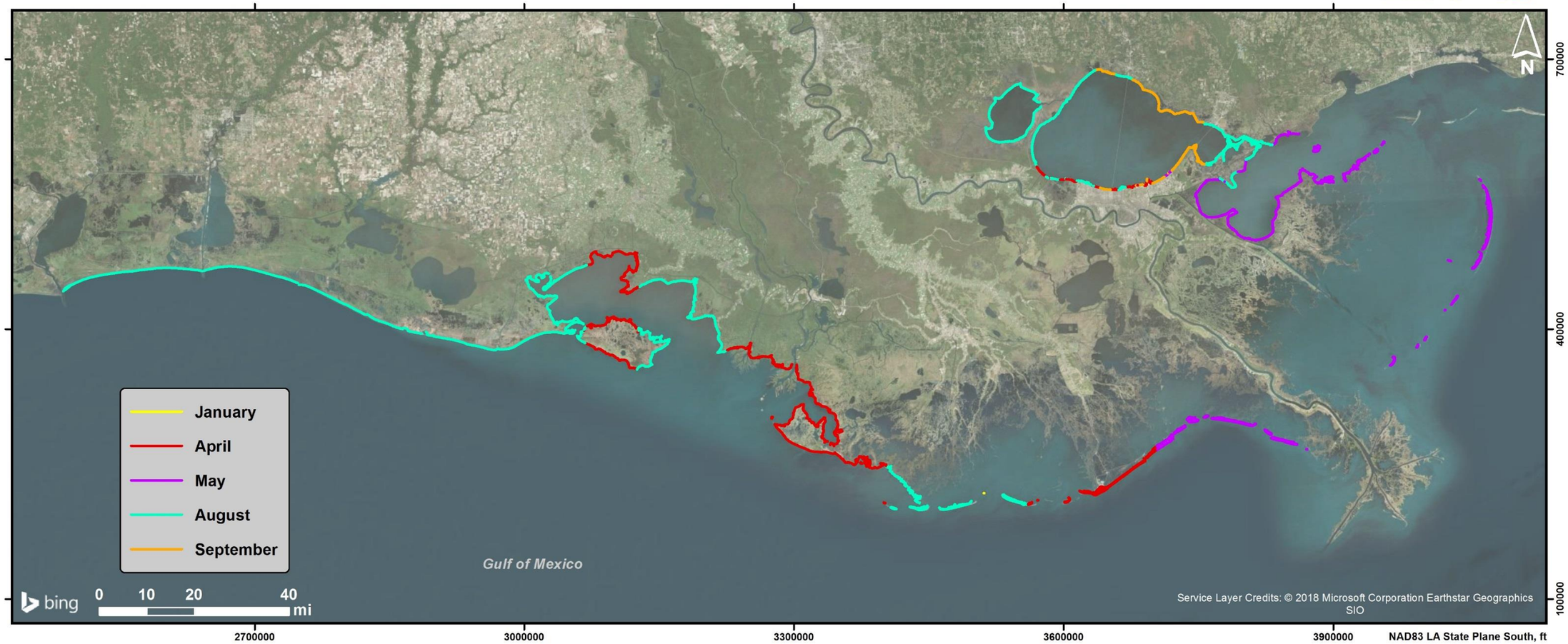


Figure B9. National Agriculture Imagery Program (NAIP) shoreline data coverage for 2015.

Table B4. Orthoimagery Source Data Characteristics

Source	Description (USGS DOQQ)	1998	2004	2005	2008	2012*	2015**	Region
c2909318.nws	TEXAS POINT NW	03/01	02/16	10/21	10/18	11/06	08/02	WC
c2909318.nes	TEXAS POINT NE	03/01	02/16	10/21	10/18	11/06	08/02	WC
c2909319.nws	SMITH BAYOU NW	01/16	02/07	10/21	10/18	11/06	08/02-10	WC
c2909319.nes	SMITH BAYOU NE	01/16	02/07	10/21	10/18	11/06	08/02	WC
c2909311.ses	JOHNSONS BAYOU SE	01/16	02/07	10/21	10/18	11/06	08/02	WC
c2909312.sws	PEVETO BEACH SW	03/01	02/16	10/21	10/18	11/06	08/02	WC
c2909312.ses	PEVETO BEACH SE	03/02	02/27	10/21	10/18	11/06	08/02	WC
c2909313.sws	HOLLY BEACH SW	03/02	02/18	10/21	10/19	11/06	08/02	WC
c2909313.ses	HOLLY BEACH SE	02/08	02/18	10/21	10/19	11/06	08/02	WC
c2909314.sws	CAMERON SW	02/08	01/07	10/21	10/19	11/06	08/02	WC
c2909314.ses	CAMERON SE	03/01	01/27	10/21	10/19	11/08	08/02	WC
c2909315.sws	GRAND BAYOU SW	03/02	01/27	10/22	10/19	11/08	08/02	WC
c2909315.ses	GRAND BAYOU SE	03/02	01/27	10/22	10/19	11/08	08/02	WC
c2909316.sws	CREOLE SW	03/02	02/18	10/22	10/19	11/08	08/02	WC
c2909324.nws	HACKBERRY BEACH NW	03/02	02/18	10/22	10/19	11/08	08/02	WC
c2909324.nes	HACKBERRY BEACH NE	03/02	02/21	10/22	10/19	11/08	08/02	WC/EC
c2909217.nws	HOG BAYOU NW	03/02	02/21	10/22	10/20	11/08	08/02	EC
c2909217.nes	HOG BAYOU NE	03/02	02/21	10/22	10/20	11/08	08/02-10	EC
c2909217.ses	HOG BAYOU SE	03/02	02/21	10/22	10/20	11/08	08/10	EC
c2909218.sws	COW ISLAND SW	03/02	02/07	10/22	10/20	11/08	08/02	EC
c2909218.ses	COW ISLAND SE	03/02	02/07	10/22	10/20	11/08	08/14	EC
c2909219.sws	DEEP LAKE SW	N/A	02/07	10/22	10/20	11/08	08/14	EC
c2909227.nws	BIG CONSTANCE LAKE NW	03/02	02/07	10/22	10/20	11/08	08/14	EC
c2909227.nes	BIG CONSTANCE LAKE NE	03/02	02/07	10/22	10/20	11/08	08/14	EC
c2909228.nws	ROLLOVER LAKE NW	03/02	02/16	10/23	10/20	11/08	08/02	EC
c2909228.nes	ROLLOVER LAKE NE	03/02	01/28	10/23	10/20	11/08	08/02	EC
c2909229.nws	MULBERRY ISLAND WEST NW	03/02	01/28	10/23	10/20	11/08	08/02	EC
c2909229.sws	MULBERRY ISLAND WEST SW	03/02	01/28	10/23	10/26	11/08	08/02	EC
c2909229.ses	MULBERRY ISLAND WEST SE	03/02	02/16	10/23	10/26	11/08	08/02	EC
c2909230.sws	MULBERRY ISLAND EAST SW	03/01	02/16	10/23	10/26	11/08	08/10	EC
c2909230.ses	MULBERRY ISLAND EAST SE	03/01	02/16	10/23	10/26	11/08	08/02	EC
c2909231.sws	CHENIERE AU TIGRE SW	03/01	03/06	10/23	10/26	11/08	08/10	EC
c2909231.nws	CHENIERE AU TIGRE NW	03/01	03/06	10/23	10/26	11/08	08/10	EC
c2909231.nes	CHENIERE AU TIGRE NE	01/10	02/18	11/02	10/26	11/08	08/10	EC
c2909232.nws	HELL HOLE BAYOU NW	01/10	02/18	11/02	10/26	11/8-9	08/10	EC/AB
c2909232.nes	HELL HOLE BAYOU NE	01/10	02/18	11/02	10/26	11/8-9	08/10	EC/AB

Table B4. Continued.

Source	Description (USGS DOQQ)	1998	2004	2005	2008	2012*	2015**	Region
c2909232.ses	HELL HOLE BAYOU SE	01/10	02/18	11/02	10/26	11/08	08/10	AB
c2909125.sws	BAYOU LUCIEN SW	03/01	02/16	11/02	10/27	11/08	04/30	AB
c2909125.ses	BAYOU LUCIEN SE	03/02	02/27	10/15	10/27	11/08	04/30	AB
c2909126.sws	BAYOU BLANC SW	01/10	02/27	10/15	10/27	11/09	04/30	AB
c2909134.nws	MOUND POINT NW	01/10	02/27	10/15	10/27	11/09	04/30	AB
c2909134.nes	MOUND POINT NE	01/10	03/09	10/15	10/27	11/09	08/27	AB
c2909126.ses	BAYOU BLANC SE	01/10	03/09	10/15	10/27	11/09	08/27	AB
c2909127.sws	LAKE POINT SW	03/02	03/09	10/16	10/27	11/08	08/26	AB
c2909127.nws	LAKE POINT NW	03/02	03/09	10/16	10/27	11/08	08/26	AB
c2909126.nes	BAYOU BLANC NE	01/10	03/09	10/15	10/27	11/8-9	08/27	AB
c2909126.nws	BAYOU BLANC NW	01/10	02/27	10/15	10/27	11/09	04/30	AB
c2909118.sws	HAMMOCK LAKE SW	01/10	02/27	10/15	10/27	11/09	04/30	AB
c2909117.ses	CYPREMORT POINT SE	03/02	02/27	10/15	10/27	11/09	04/30	AB
c2909125.nes	BAYOU LUCIEN NE	03/02	02/27	10/15	10/27	11/09	04/30	AB
c2909125.nws	BAYOU LUCIEN NW	03/01	02/16	11/02	10/26	11/09	04/30	AB
c2909224.ses	REDFISH POINT SE	01/10	02/18	11/02	10/26	11/09	08/10	AB
c2909224.sws	REDFISH POINT SW	01/10	02/18	11/02	10/26	11/8-9	08/10	AB
c2909223.ses	FEARMAN LAKE SE	01/10	02/18	11/02	10/26	11/8-9	08/10	AB
c2909224.nws	REDFISH POINT NW	01/10	02/18	11/02	10/26	11/08	08/10	AB
c2909223.nes	FEARMAN LAKE NE	01/10	02/18	11/02	10/26	11/08	08/10	AB
c2909223.nws	FEARMAN LAKE NW	03/01	No Shoreline	No Shoreline	10/26	11/08	08/10	AB
c2909215.sws	INTRACOASTAL CITY SW	03/01	No Shoreline	No Shoreline	10/26	11/08	08/10	AB
c2909215.ses	INTRACOASTAL CITY SE	01/10	02/18	11/02	10/26	11/08	08/10	AB
c2909216.sws	HEBERT LAKE SW	01/10	02/18	11/02	10/26	11/8,14	08/10	AB
c2909216.ses	HEBERT LAKE SE	01/10	02/18	11/02	10/26	11/8,15	08/10	AB
c2909109.sws	TIGRE LAGOON SW	03/01	02/16	11/02	10/26	11/15	04/30	AB
c2909109.nws	TIGRE LAGOON NW	03/01	02/16	11/02	10/26	11/15	04/30	AB
c2909109.nes	TIGRE LAGOON NE	03/02	03/09	10/15	10/27	11/15	04/30	AB
c2909110.nws	WEEKS NW	01/10	03/09	10/15	10/27	11/15	04/30	AB
c2909110.sws	WEEKS SW	01/10	03/09	10/15	10/27	11/14-15	04/30	AB
c2909109.ses	TIGRE LAGOON SE	03/02	03/09	10/15	10/27	11/14	04/30	AB
c2909117.nes	CYPREMORT POINT NE	01/10	02/27	10/15	10/27	11/14-15	04/30	AB
c2909118.nws	HAMMOCK LAKE NW	01/10	02/27	10/15	10/27	11/15	04/30	AB
c2909118.nes	HAMMOCK LAKE NE	01/10	03/09	10/15	10/27	11/14-15	08/27	AB
c2909111.sws	KEMPER SW	03/02	03/09	10/16	10/27	11/14	08/26	AB
c2909119.nws	MARONE POINT NW	03/02	03/06	10/16	10/27	11/14-15	08/26	AB
c2909119.nes	MARONE POINT NE	01/10	03/09	10/16	10/27	11/14	08/26	AB
c2909112.sws	FRANKLIN SW	01/10	02/19	10/16	10/27	11/14	08/26	AB
c2909120.nws	ELLERSLIE NW	01/10	02/19	10/16	10/27	11/14-15	08/26	AB

Table B4. Continued.

Source	Description (USGS DOQQ)	1998	2004	2005	2008	2012*	2015**	Region
c2909119.ses	MARONE POINT SE	01/10	03/09	10/16	10/27	11/15	08/26	AB
c2909120.sws	ELLERSLIE SW	01/10	03/09	10/16	10/27	11/15	08/26	AB
c2909120.ses	ELLERSLIE SE	01/10	02/18	10/16	10/27	11/15	08/26	AB
c2909128.nes	POINT CHEVREUIL NE	01/10	02/18	10/16	10/27	11/8-9	08/26	AB
c2909128.ses	POINT CHEVREUIL SE	01/10	02/18	10/16	10/27	11/09	08/26	AB/AW
c2909129.sws	BELLE ISLE SW	02/21	02/18	10/16	10/27	11/09	04/30	AW
c2909129.ses	BELLE ISLE SE	03/02	02/18	10/16	10/28	11/09	04/30	AW
c2909130.sws	LAKE SALVE SW	03/03	02/19	10/16	10/28	11/09	04/30	AW
c2909138.nws	POINT AU FER NE NW	03/03	02/19	10/16	10/28	11/09	04/30	AW
c2909138.nes	POINT AU FER NE NE	02/04	02/07	10/15	10/28	11/8-9	04/30	AW
c2909139.nws	PLUMB BAYOU NW	02/23	02/07	10/15	10/28	11/08	04/30	AW
c2909139.sws	PLUMB BAYOU SW	02/23	02/07	10/15	10/28	11/08	04/30	AW/ELD
c2909147.nes	FOURLEAGUE BAY NE	03/10	02/07	10/15	10/28	11/8,28	04/30	ELD
c2909148.nws	LOST LAKE NW	02/04	01/27	10/16	10/28	10/28	04/30	ELD
c2909148.sws	LOST LAKE SW	02/04	01/27	10/16	10/28	10/28	04/30	ELD
c2909147.ses	FOURLEAGUE BAY SE	03/10	02/07	10/15	10/28	10/28	04/30	ELD
c2909147.sws	FOURLEAGUE BAY SW	02/23	02/07	10/15	10/28	10/28	04/30	ELD
c2909147.nws	FOURLEAGUE BAY NW	02/23	02/07	10/15	10/28	10/28, 11/8	04/30	ELD
c2909146.nes	POINT AU FER NE	02/04	02/07	10/15	10/28	10/28, 11/8	04/30	ELD
c2909146.nws	POINT AU FER NW	03/03	02/19	10/15	10/28	10/28	04/30	ELD
c2909146.sws	POINT AU FER SW	03/03	02/19	10/15	10/28	10/28	04/30	ELD
c2909146.ses	POINT AU FER SE	02/04	02/07	10/15	10/28	10/28	04/30	ELD
c2909154.nes	POINT AU FER NE	02/04	02/07	10/15	10/28	10/28	04/30	ELD
c2909155.nws	OYSTER BAYOU NW	02/23	02/07	10/15	10/28	10/28	04/30	ELD
c2909155.nes	OYSTER BAYOU NE	02/23	02/07	10/16	10/28	10/28	04/30	ELD
c2909156.nws	EAST BAY JUNOP NW	02/04	01/27	10/16	10/28	10/28	04/30	ELD
c2909156.sws	EAST BAY JUNOP SW	02/04	01/27	10/16	10/28	10/28	04/30	ELD
c2909156.ses	EAST BAY JUNOP SE	02/04	01/27	10/16	10/28	10/28	04/30	ELD
c2909156.nes	EAST BAY JUNOP NE	02/04	01/27	10/16	10/28	10/28	04/30	ELD
c2909049.sws	GRAND BAYOU DU LARGE SW	01/31	01/27	10/16	10/28	10/28, 11/7	04/30	ELD
c2909049.ses	GRAND BAYOU DU LARGE SE	01/31	01/19	10/16	10/30	11/07	08/26	ELD
c2909057.nes	WESTERN ISLES DERNIERES NE	01/31	01/19	10/16	10/30	11/07	08/26	ELD
c2909058.nws	CENTRAL ISLES DERNIERES NW	02/23	01/19	10/16	10/30	11/07	08/26	ELD
c2909058.nes	CENTRAL ISLES DERNIERES NE	02/23	01/19	No Shoreline	No Shoreline	No Shoreline	No Shoreline	ELD
c2909057.nws	WESTERN ISLES DERNIERES NW	No Shoreline	No Shoreline	No Shoreline	No Shoreline	11/07	04/30	ELD

Table B4. Continued.

Source	Description (USGS DOQQ)	1998	2004	2005	2008	2012*	2015**	Region
c2909057.sws	WESTERN ISLES DERNIERES SW	01/31	01/27	10/16	10/28	11/07	No Shoreline	ELD
c2909057.ses	WESTERN ISLES DERNIERES SE	01/31	01/19	10/16	10/30	11/07	08/26	ELD
c2909058.sws	CENTRAL ISLES DERNIERES SW	02/23	01/19	10/16	10/30	11/07	08/26	ELD
c2909058.ses	CENTRAL ISLES DERNIERES SE	02/23	01/19	10/16	10/30	11/07	08/26	ELD
c2909059.sws	EASTERN ISLES DERNIERES SW	02/04	01/19	10/28	10/30	11/07	08/26	ELD
c2909059.ses	EASTERN ISLES DERNIERES SE	02/04	01/19	10/28	10/30	11/07	08/26	ELD
c2909059.nes	EASTERN ISLES DERNIERES NE	02/04	01/19	10/28	10/30	11/07	08/26	ELD
c2909060.nws	CAT ISLAND PASS NW	01/28	01/19	10/28	10/30	11/07	01/25	ELD
c2909060.nes	CAT ISLAND PASS NE	01/28	03/06	10/28	10/30	11/07	08/26	LLD
c2909061.nws	TIMBALIER ISLAND NW	02/04	01/27	10/28	10/30	11/07	08/26	LLD
c2909061.sws	TIMBALIER ISLAND SW	02/04	01/27	10/28	10/30	11/07	08/26	LLD
c2909061.ses	TIMBALIER ISLAND SE	02/04	01/27	10/27	No Shoreline	No Shoreline	No Shoreline	LLD
c2909062.nws	CALUMET ISLAND NW	02/04	01/27	10/27	10/29	11/07	04/30	LLD
c2909062.nes	CALUMET ISLAND NE	02/04	01/22	10/27	10/29	11/07	04/30	LLD
c2909063.nws	BELLE PASS NW	02/04	01/22	11/18	10/29	11/07	04/30	LLD
c2909063.nes	BELLE PASS NE	02/04	01/22	11/18	10/30	11/07	04/30	LLD
c2909055.ses	LEEVILLE SE	02/04	01/22	11/18	10/30	11/13	04/30	LLD
c2909056.sws	CAMINADA PASS SW	02/04	01/22	11/18	10/30	11/13	04/30	LLD
c2909056.ses	CAMINADA PASS SE	01/24	01/22	10/19	10/30	11/13	04/30	LLD
c2909056.nes	CAMINADA PASS NE	01/24	01/22	10/19	10/30	11/13	04/30	LLD
c2908949.nws	GRAND ISLE NW	01/24	01/22	10/19	10/30	11/29	05/03	LLD
c2908941.sws	BARATARIA PASS SW	01/24	01/22	10/19	10/30	11/9,29	05/03	LLD
c2908941.ses	BARATARIA PASS SE	02/23	01/21	10/27	10/30	11/01	05/03	LLD
c2908941.nes	BARATARIA PASS NE	02/23	01/21	11/02	10/30	11/01	05/03	LLD
c2908942.sws	BAY RONQUILLE SW	01/24	01/21	10/27	10/30	11/01	05/03	LLD
c2908942.nws	BAY RONQUILLE NW	01/24	01/21	10/27	10/30	11/1,9	05/03	LLD /MD
c2908942.nes	BAY RONQUILLE NE	01/24	01/21	10/27	10/30	11/09	05/03	MD
c2908942.ses	BAY RONQUILLE SE	01/24	01/21	10/27	10/30	11/01	05/03	MD
c2908943.sws	BASTIAN BAY SW	01/24	01/21	10/28	10/30	11/01	05/03	MD
c2908943.ses	BASTIAN BAY SE	01/24	01/21	11/02	10/30	11/01	05/02	MD
c2908944.sws	BURAS SW	01/24	01/21	11/02	10/30	11/1,9	05/02	MD
c2908952.nws	BAY COQUETTE NW	01/24	01/21	11/02	10/29	11/09	05/02	MD
c2908952.nes	BAY COQUETTE NE	01/25	01/21	10/28	10/29	11/09	05/02	MD
c2908953.nws	PASS TANTE PHINE NW	02/04	01/21	10/28	10/29	11/13	05/02	MD

Table B4. Continued.

Source	Description (USGS DOQQ)	1998	2004	2005	2008	2012*	2015**	Region
c2908939.nws	BRETON ISLANDS NW	01/24	01/20	11/17	No Shoreline	No Shoreline	05/02	CI
c2908939.nes	BRETON ISLANDS NE	01/24	01/20	11/17	10/29	11/01	05/02	CI
c2908932.sws	GRAND GOSIER ISLANDS SW	01/24	01/20	No Shoreline	No Shoreline	No Shoreline	05/02	CI
c2908932.ses	GRAND GOSIER ISLANDS SE	01/24	01/20	No Shoreline	No Shoreline	No Shoreline	05/02	CI
c2908932.nes	GRAND GOSIER ISLANDS NE	01/24	No Shoreline	No Shoreline	No Shoreline	No Shoreline	No Shoreline	CI
c2908825.nws	GRAND GOSIER ISLANDS OE E NW	01/24	No Shoreline	No Shoreline	No Shoreline	No Shoreline	No Shoreline	CI
c2908817.sws	CURLEW ISLANDS SW	01/24	01/20	No Shoreline	No Shoreline	No Shoreline	05/02	CI
c2908817.nes	CURLEW ISLANDS NE	01/24	01/20	No Shoreline	No Shoreline	No Shoreline	No Shoreline	CI
c2908809.ses	FREEMASON ISLAND SE	01/24	01/20	No Shoreline	10/28	No Shoreline	05/02	CI
c2908810.sws	NEW HARBOR ISLANDS SW	01/24	01/20	11/17	10/28	11/14	05/02	CI
c2908810.nws	NEW HARBOR ISLANDS NW	01/24	01/20	11/17	10/28	10/30,11/14	05/02	CI
c2908802.sws	NORTH ISLANDS SW	01/24	01/20	11/17	10/28	10/30	05/02	CI
c2908802.nws	NORTH ISLANDS NW	01/24	01/20	11/17	10/28	10/30	05/02	CI
c3008858.sws	CHANDELEUR LIGHT SW	01/24	01/20	11/17	10/28	No Shoreline	05/02	CI
c3008857.ses	CHANDELEUR LIGHT OE W SE	01/24	01/20	No Shoreline	No Shoreline	No Shoreline	No Shoreline	CI
c3008955.ses	ISLE AU PITRE SE	01/24	No Shoreline	No Shoreline	No Shoreline	No Shoreline	No Shoreline	PB
c3008955.sws	ISLE AU PITRE SW	01/24	01/20	10/29	10/28	10/28	05/02	PB
c3008963.nws	DOOR POINT NW	01/24	01/20	10/29	10/28	10/28	05/02	PB
c3008962.nes	THREE MILE BAY NE	01/24	01/20	10/29	10/28	10/28,30	05/02	PB
c3008962.nws	THREE MILE BAY NW	01/25	01/21	10/29	10/27	10/30	05/02	PB
c3008962.sws	THREE MILE BAY SW	01/25	01/21	10/29	10/27	10/30	05/02	PB
c3008961.ses	MALHEUREUX POINT SE	02/04	01/21	10/29	10/29	10/30	05/02	PB
c3008961.sws	MALHEUREUX POINT SW	02/04	01/21	11/02	10/29	10/30	05/02	PB
c3008961.nws	MALHEUREUX POINT NW	02/04	01/21	11/02	10/29	10/30	05/02	PB
c3008960.ses	FALSE MOUTH BAYOU SE	01/24	01/21	11/02	10/29	10/30	05/02	PB
c2908904.nes	POINTE AUX MARCHETTES NE	02/04	01/21	10/28	10/29	10/30	05/02	PB
c2908904.nws	POINTE AUX MARCHETTES NW	01/24	01/21	10/28	10/29	10/30	05/02	PB
c2908904.sws	POINTE AUX MARCHETTES SW	01/24	01/21	10/28	10/29	10/30	05/02,03	PB
c2908912.nws	LENA LAGOON NW	01/24	01/21	10/28	10/29	10/30	05/03	PB
c2908911.nes	YSCLOSKEY NE	01/24	01/21	10/28	10/30	11/14	05/03	PB

Table B4. Continued.

Source	Description (USGS DOQQ)	1998	2004	2005	2008	2012*	2015**	Region
c2908911.nws	YSCLOSKEY NW	01/24	01/21	10/28	10/30	10/30	05/03	PB
c2908903.sws	PROCTOR POINT SW	01/24	01/21	10/28	10/30	10/30	05/03	PB
c2908903.nws	PROCTOR POINT NW	01/24	01/21	10/28	10/30	10/30	05/03	PB
c2908902.nes	MARTELLO CASTLE NE	02/23	01/21	10/27	10/30	10/30	05/03	PB
c2908902.ses	MARTELLO CASTLE SE	02/23	01/21	10/27	10/30	10/30	05/03	PB
c2908902.sws	MARTELLO CASTLE SW	02/23	01/21	10/27	10/30	10/30	05/03	PB
c2908902.nws	MARTELLO CASTLE NW	02/23	01/21	10/27	10/30	10/30	05/03	PB
c3008958.sws	CHEF MENTEUR SW	01/24	01/21	10/27	10/30	10/30	05/03	PB
c3008958.ses	CHEF MENTEUR SE	02/23	01/21	10/27	10/30	10/30	5/3, 8/31	PB
c3008959.sws	ALLIGATOR POINT SW	01/24	01/21	10/28	10/30	10/30	8/31	PB
c3008959.nws	ALLIGATOR POINT NW	01/24	01/21	10/28	10/30	10/30	5/2, 8/31	PB
c3008959.nes	ALLIGATOR POINT NE	01/24	01/21	10/28	10/30	10/28,30	5/2, 8/31	PB
c3008951.ses	RIGOLETS SE	01/24	01/21	10/28	10/29	10/28	08/31	PB
c3008951.sws	RIGOLETS SW	01/24	01/21	10/28	10/30	10/28	08/31	PB
c3008950.ses	NORTH SHORE SE	01/24	01/21	10/27	10/30	10/28	08/31	PB
c3008958.nes	CHEF MENTEUR NE	02/23	01/21	10/27	10/30	10/28,30	08/31	PB
c3008958.nws	CHEF MENTEUR NW	01/24	01/21	10/27	10/30	10/28,30	8/31, 9/13	PB
c3008950.sws	NORTH SHORE SW	01/24	01/21	10/27	10/30	10/28	09/13	PB
c3008949.ses	SOUTH POINT SE	01/24	01/21	10/27	10/30	10/28	09/13	PB
c3008957.nes	LITTLE WOODS NE	01/24	01/21	10/27	10/30	10/30	09/13	PB
c3008957.nws	LITTLE WOODS NW	01/24	01/22	10/19	10/30	10/30	05/03	PB
c3008957.sws	LITTLE WOODS SW	01/24	01/22	10/19	10/30	10/30	09/13	PB
c3009064.ses	SPANISH FORT SE	01/24	01/22	10/19	10/30	10/30	4/30, 9/13	PB
c3009064.sws	SPANISH FORT SW	01/24	01/22	10/19	10/30	10/30,11/9	4/30, 8/28	PB
c3009063.ses	INDIAN BEACH SE	01/24	01/22	11/18	10/30	10/30,11/9	4/30, 9/13	PB
c3009063.sws	INDIAN BEACH SW	02/04	01/22	10/27	10/29	11/09	4/30, 8/28	PB
c3009062.ses	LA BRANCHE SE	02/04	01/22	10/27	10/29	11/09	4/30, 8/28	PB
c3009062.sws	LA BRANCHE SW	02/04	01/27	10/27	10/29	11/09	4/30, 8/15	PB
c3009061.ses	LAPLACE SE	02/04	01/27	10/27	10/30	11/09	4/30, 8/15	PB
c3009061.nes	LAPLACE NE	02/04	01/27	10/27	10/30	11/8-9	4/30, 8/27	PB
c3009053.ses	RUDDOCK SE	02/04	01/27	10/27	10/30	10/28	8/27	PB
c3009053.nes	RUDDOCK NE	02/04	01/27	10/27	10/30	10/28	8/15, 27	PB
c3009054.nws	BONNET CARRE NE NW	02/04	01/27	10/27	10/29	10/28	08/15	PB
c3009046.sws	PONCHATOULA SE SW	02/04	01/27	10/27	10/29	10/28	08/15	PB

Table B4. Continued.

Source	Description (USGS DOQQ)	1998	2004	2005	2008	2012*	2015**	Region
c3009046.ses	PONCHATOULA SE SE	02/04	01/27	10/27	10/29	10/29	08/15	PB
c3009045.ses	MANCHAC SE	02/04	01/27	10/27	10/30	10/28-29	08/27	PB
c3009053.nws	RUDDOCK NW	02/04	01/27	10/28	10/30	10/28	08/27	PB
c3009053.sws	RUDDOCK SW	02/04	01/27	10/28	10/30	10/28	08/27	PB
c3009052.ses	MOUNT AIRY NE SE	01/28	01/27	10/28	10/30	10/28	08/27	PB
c3009052.nws	MOUNT AIRY NE NW	01/28	01/27	10/28	10/30	10/28	08/27	PB
c3009044.sws	KILLIAN SW	01/28	01/27	10/28	10/30	10/28	08/27	PB
c3009044.ses	KILLIAN SE	01/28	01/27	10/28	10/30	10/29	08/27	PB
c3009044.nes	KILLIAN NE	01/28	01/27	10/28	10/30	10/29	08/27	PB
c3009045.nws	MANCHAC NW	02/04	01/27	10/28	10/30	11/09	08/27	PB
c3009045.nes	MANCHAC NE	02/04	01/27	10/27	10/30	10/29	08/27	PB
c3009046.nes	PONCHATOULA SE NE	02/04	01/22	10/27	10/29	10/22	08/15,28	PB
c3009047.nws	COVINGTON SW NW	02/04	01/22	11/18	10/29	10/22	08/28	PB
c3009039.sws	MADISONVILLE SW	02/04	01/22	11/18	10/29	10/22	8/28, 9/13	PB
c3009048.ses	MANDEVILLE SE	01/24	01/22	10/19	10/30	10/22	09/13	PB
c3009047.nes	COVINGTON SW NE	01/24	01/22	11/18	10/30	10/22	08/28, 09/13	PB
c3009048.nws	MANDEVILLE NW	02/21	01/22	11/18	10/30	10/22,29	08/28, 09/13	PB
c3009048.nes	MANDEVILLE NE	01/24	01/22	10/19	10/30	10/29	09/13	PB
c3009039.ses	MADISONVILLE SE	01/20	01/22	11/18	10/30	10/29	09/13	PB
c3008941.sws	LACOMBE SW	01/24	01/22	10/19	10/30	10/28-29	09/13	PB
c3008941.ses	LACOMBE SE	01/24	01/22	10/27	10/30	10/28	09/13	PB
c3008949.nes	SOUTH POINT NE	01/24	No Shoreline	No Shoreline	10/30	10/28	09/13	PB
c3008942.sws	SLIDELL SW	01/24	01/21	10/27	10/30	10/28	09/13	PB
c3008950.nws	NORTH SHORE NW	01/24	01/21	10/27	10/30	10/28	08/31, 09/13	PB
c3008950.nes	NORTH SHORE NE	01/24	01/21	10/27	10/30	10/28	08/31	PB
c3008952.sws	ENGLISH LOOKOUT SW	01/24	03/06	10/28	10/29	10/28	05/02, 08/31	PB
c3008952.nws	ENGLISH LOOKOUT NW	01/24	03/06	No Shoreline	No Shoreline	No Shoreline	No Shoreline	PB
c3008952.ses	ENGLISH LOOKOUT SE	02/23	01/21	11/02	10/28	10/28	05/02	PB
c3008952.nes	ENGLISH LOOKOUT NE	02/23	01/21	11/02	10/28	10/28	05/02	PB
c3008953.sws	SAINT JOE PASS SW	02/04	01/21	11/02	10/28	10/28	05/02	PB
c3008953.ses	SAINT JOE PASS SE	02/04	01/21	11/02	10/27	10/28	05/02	PB

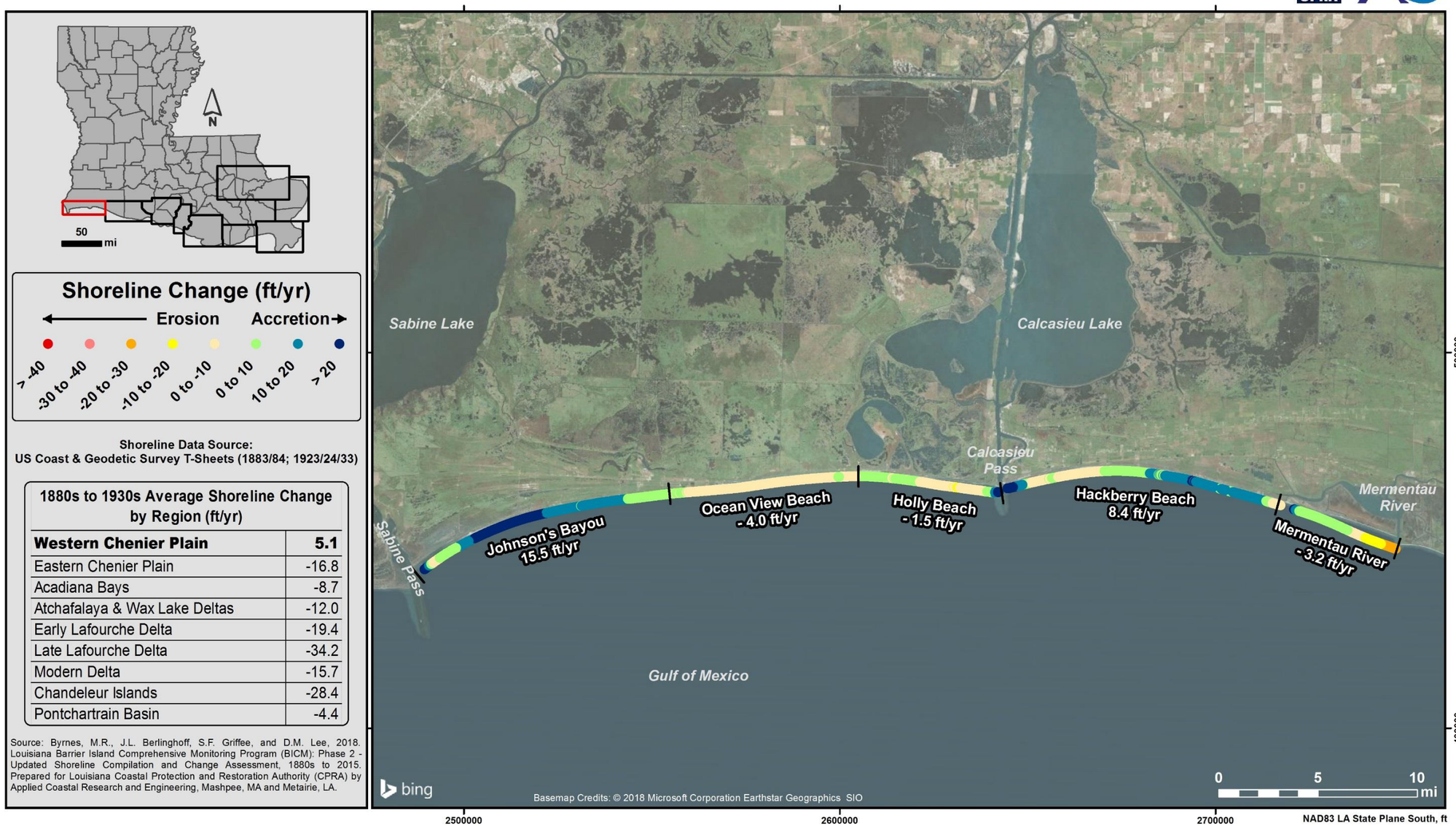
*2012 image numbers start with "f" instead of "c" and drop the last letter (e.g., c3008953.ses for 1998, 2004, 2005, and 2008 is f3008953.se for 2012).

**2015 image numbers start with "M" instead of "c" and drop the last letter (e.g., c3008953.ses for 1998, 2004, 2005, and 2008 is M3008953SE for 2015).

Appendix C:
Shoreline Change by Region

Louisiana Shoreline Change: Western Chenier Plain Region, 1880s to 1930s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

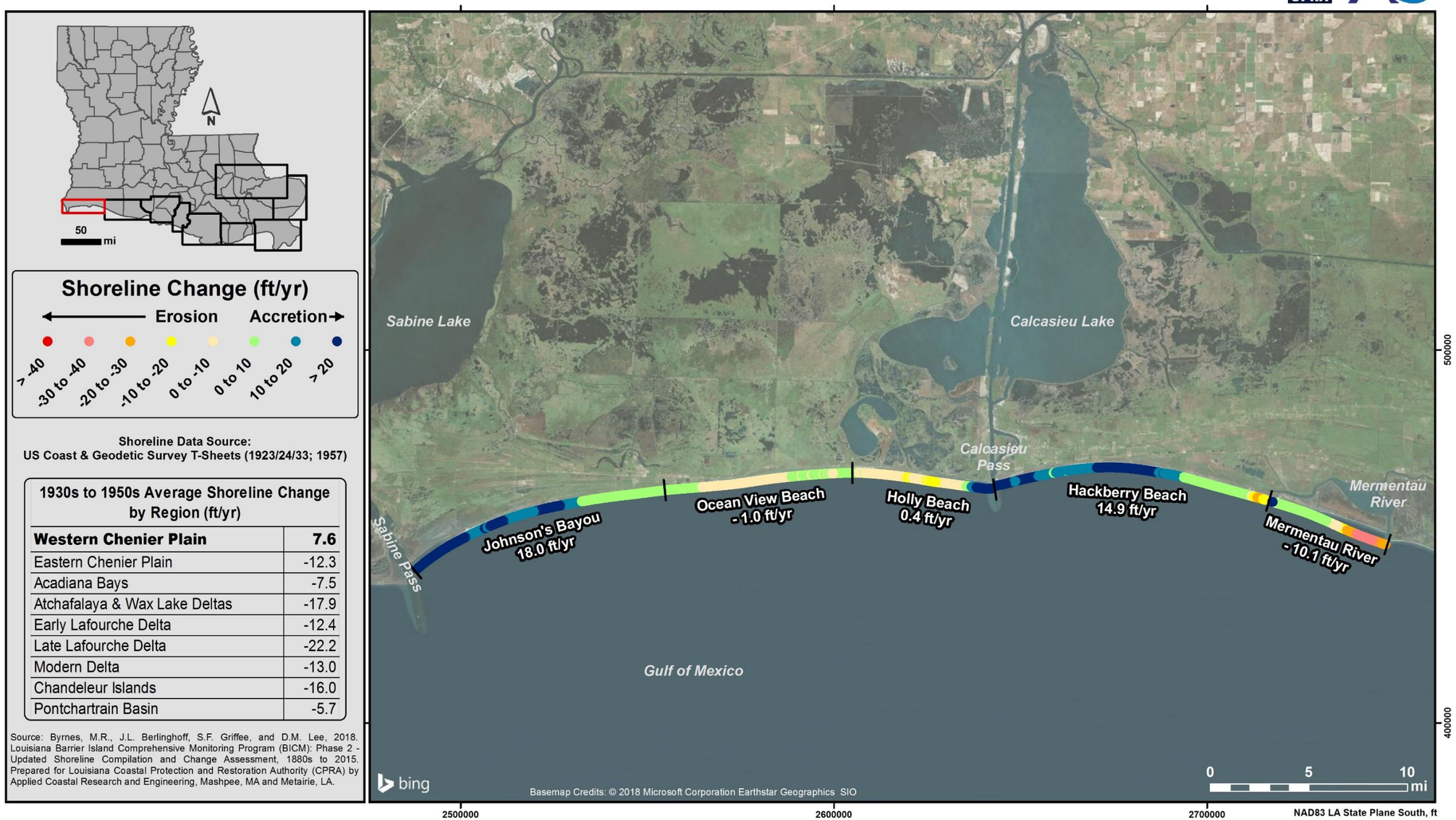


1880s to 1930s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	**5.1**
Eastern Chenier Plain	-16.8
Acadiana Bays	-8.7
Atchafalaya & Wax Lake Deltas	-12.0
Early Lafourche Delta	-19.4
Late Lafourche Delta	-34.2
Modern Delta	-15.7
Chandeleur Islands	-28.4
Pontchartrain Basin	-4.4

Figure C1. Shoreline change for the Western Chenier Plain Region, 1880s to 1930s.

Louisiana Shoreline Change: Western Chenier Plain Region, 1930s to 1950s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

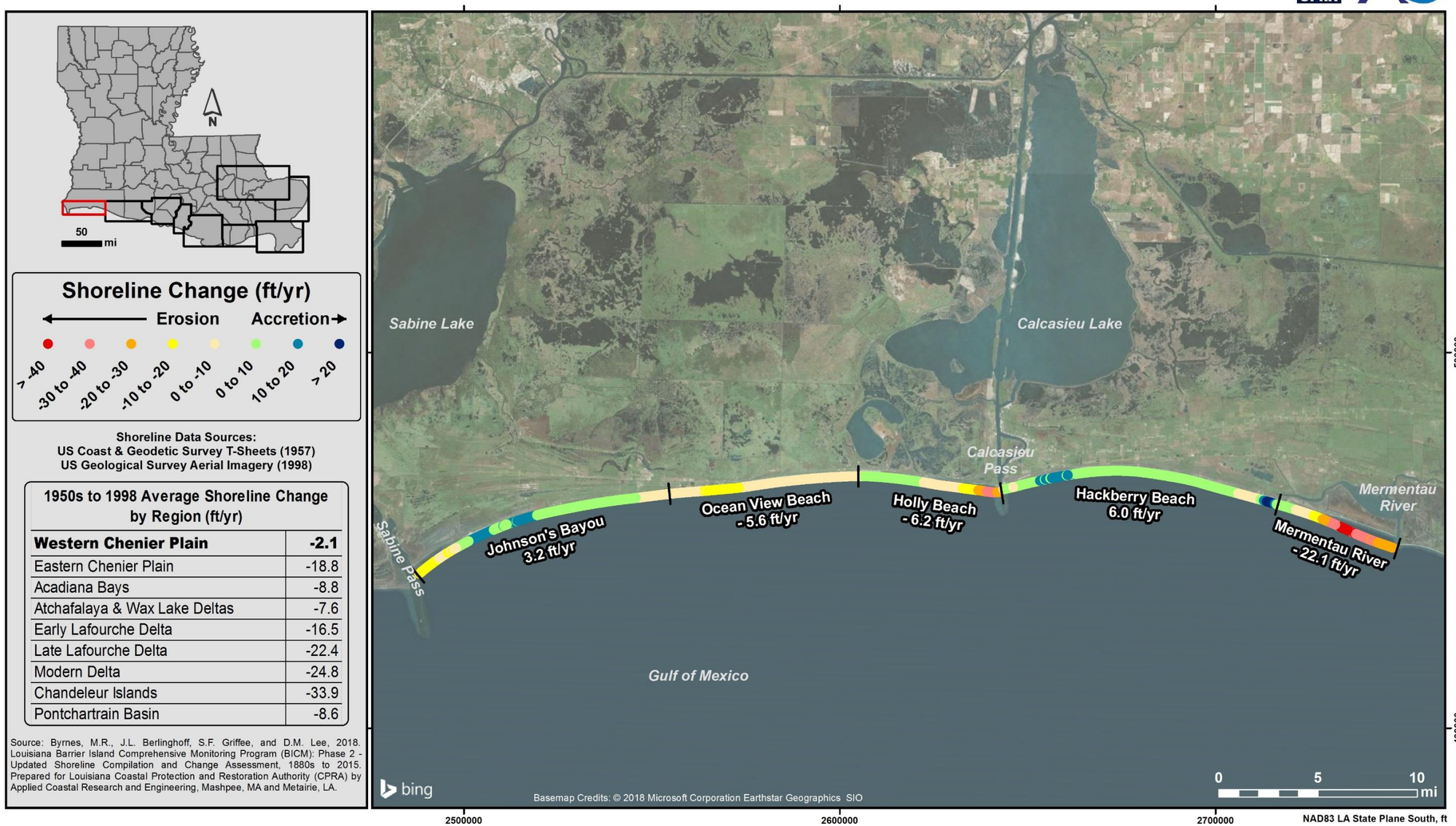


1930s to 1950s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	**7.6**
Eastern Chenier Plain	-12.3
Acadiana Bays	-7.5
Atchafalaya & Wax Lake Deltas	-17.9
Early Lafourche Delta	-12.4
Late Lafourche Delta	-22.2
Modern Delta	-13.0
Chandeleur Islands	-16.0
Pontchartrain Basin	-5.7

Figure C2. Shoreline change for the Western Chenier Plain Region, 1930s to 1950s.

Louisiana Shoreline Change: Western Chenier Plain Region, 1950s to 1998

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



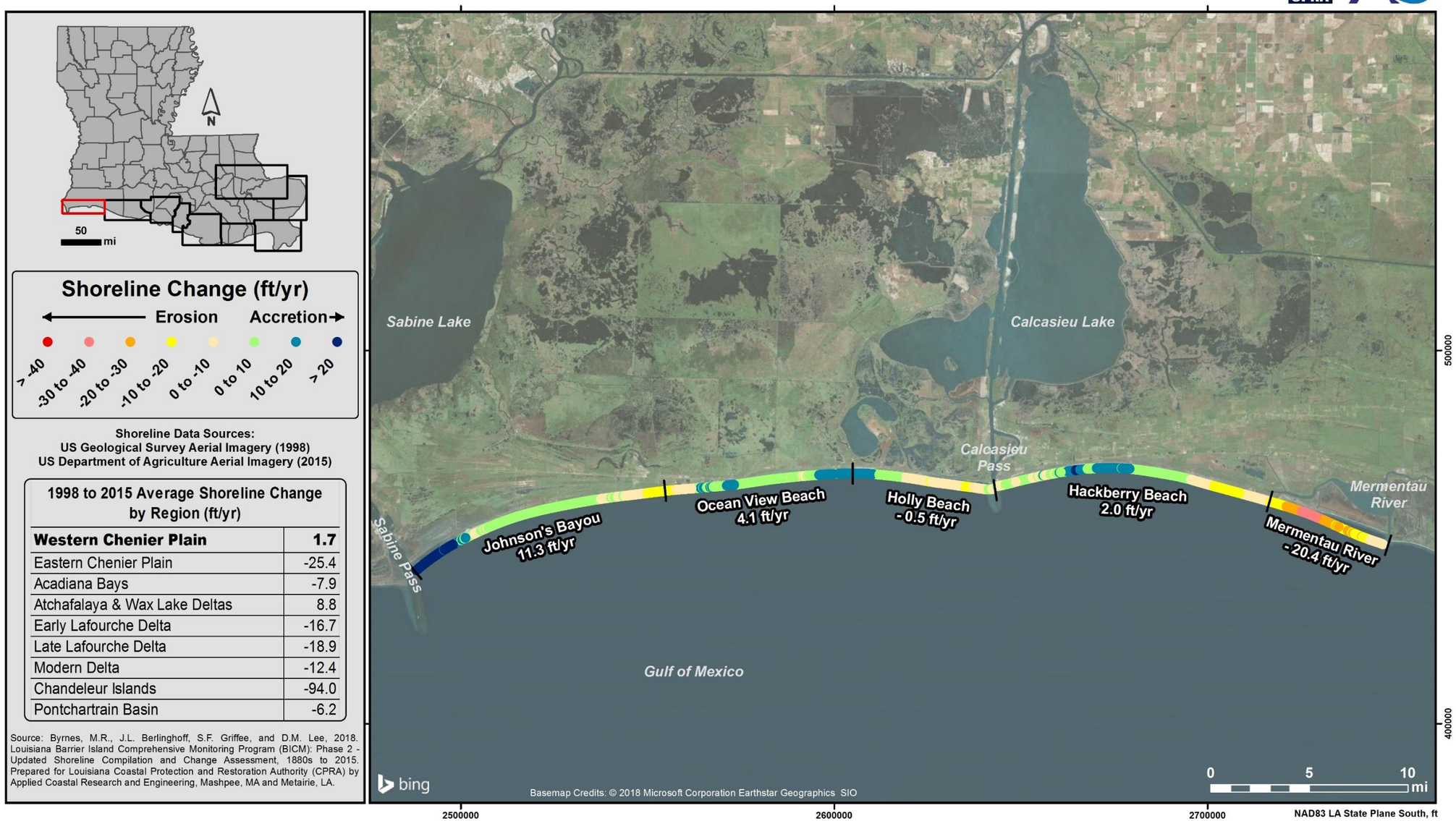
1950s to 1998 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	**-2.1**
Eastern Chenier Plain	-18.8
Acadiana Bays	-8.8
Atchafalaya & Wax Lake Deltas	-7.6
Early Lafourche Delta	-16.5
Late Lafourche Delta	-22.4
Modern Delta	-24.8
Chandeleur Islands	-33.9
Pontchartrain Basin	-8.6

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C3. Shoreline change for the Western Chenier Plain Region, 1950s to 1998.

Louisiana Shoreline Change: Western Chenier Plain Region, 1998 to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



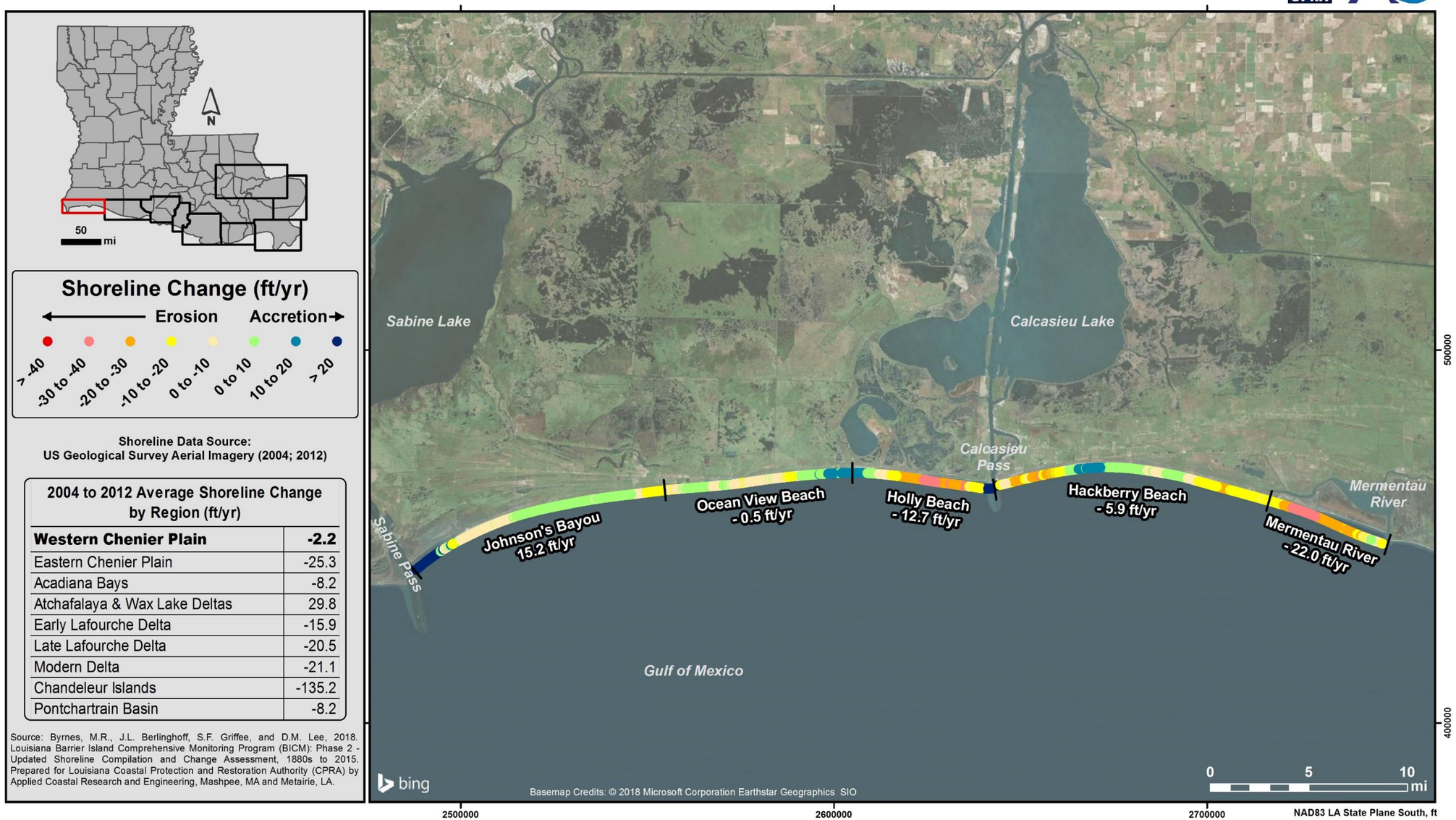
1998 to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	**1.7**
Eastern Chenier Plain	-25.4
Acadiana Bays	-7.9
Atchafalaya & Wax Lake Deltas	8.8
Early Lafourche Delta	-16.7
Late Lafourche Delta	-18.9
Modern Delta	-12.4
Chandeleur Islands	-94.0
Pontchartrain Basin	-6.2

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C4. Shoreline change for the Western Chenier Plain Region, 1998 to 2015.

Louisiana Shoreline Change: Western Chenier Plain Region, 2004 to 2012

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



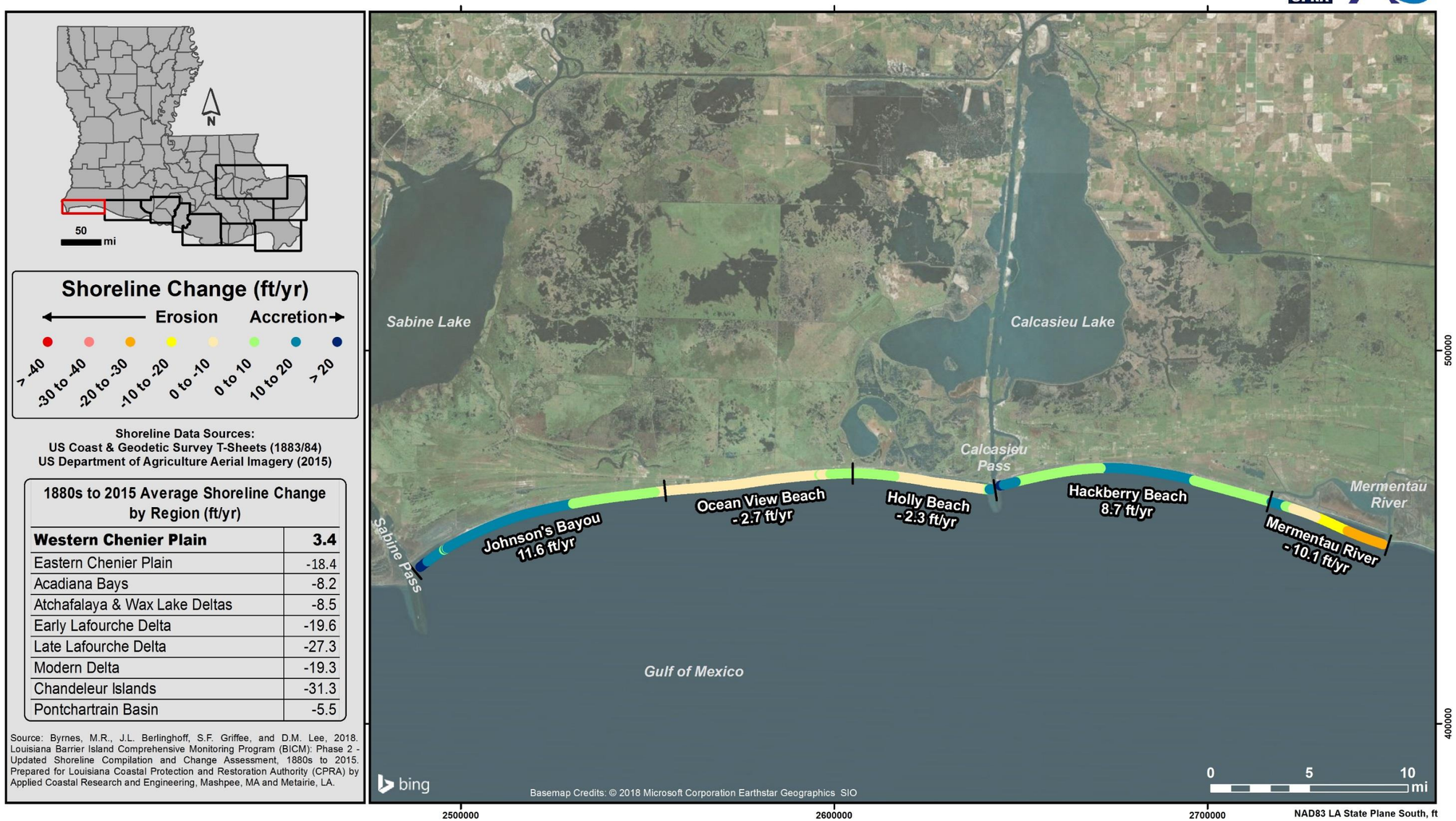
2004 to 2012 Average Shoreline Change by Region (ft/yr)

Western Chenier Plain	**-2.2**
Eastern Chenier Plain	-25.3
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	29.8
Early Lafourche Delta	-15.9
Late Lafourche Delta	-20.5
Modern Delta	-21.1
Chandeleur Islands	-135.2
Pontchartrain Basin	-8.2

Figure C5. Shoreline change for the Western Chenier Plain Region, 2004 to 2012.

Louisiana Shoreline Change: Western Chenier Plain Region, 1880s to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

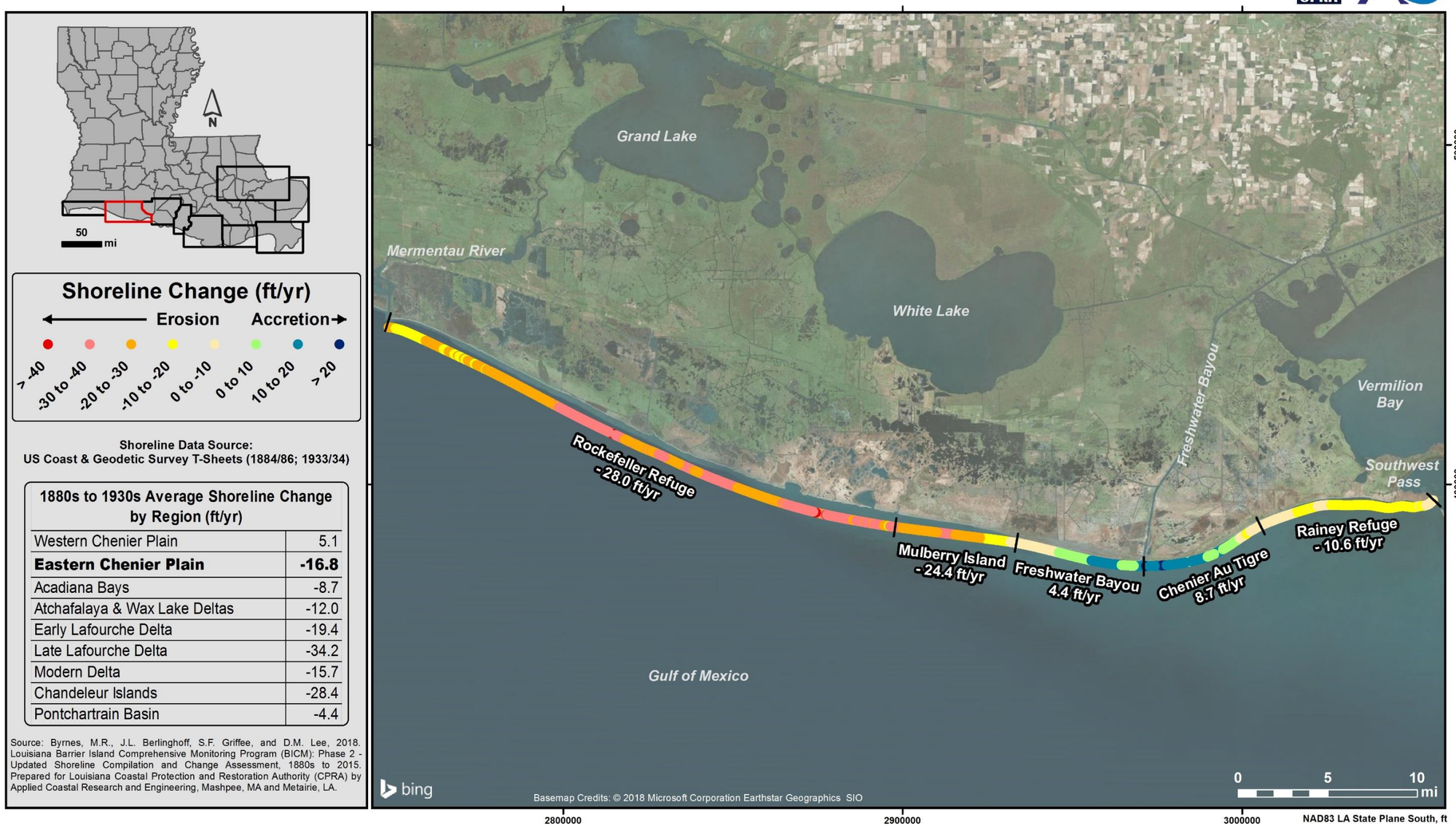


1880s to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	**3.4**
Eastern Chenier Plain	-18.4
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	-8.5
Early Lafourche Delta	-19.6
Late Lafourche Delta	-27.3
Modern Delta	-19.3
Chandeleur Islands	-31.3
Pontchartrain Basin	-5.5

Figure C6. Shoreline change for the Western Chenier Plain Region, 1880s to 2015.

Louisiana Shoreline Change: Eastern Chenier Plain Region, 1880s to 1930s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

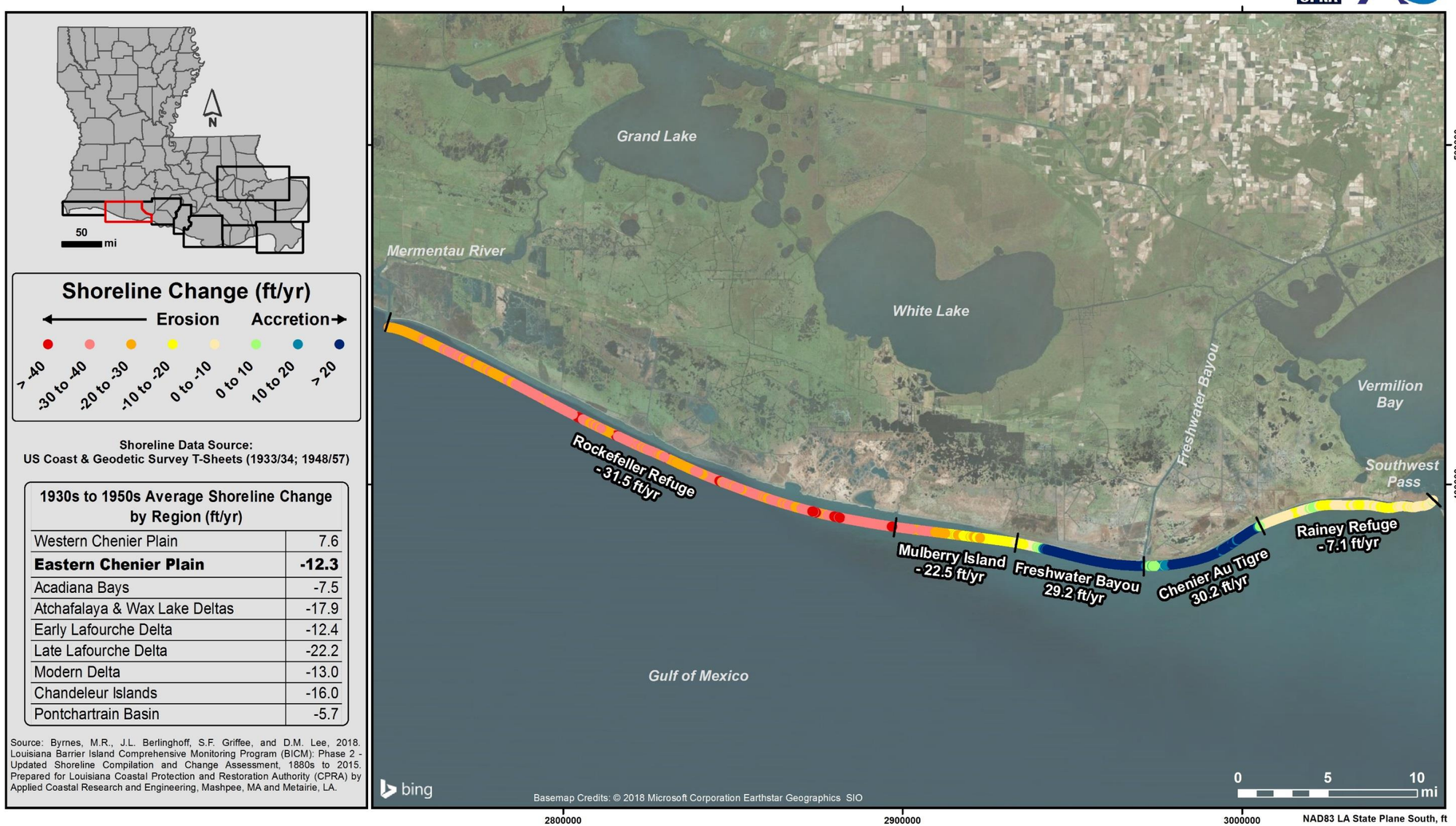


1880s to 1930s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	5.1
Eastern Chenier Plain	**-16.8**
Acadiana Bays	-8.7
Atchafalaya & Wax Lake Deltas	-12.0
Early Lafourche Delta	-19.4
Late Lafourche Delta	-34.2
Modern Delta	-15.7
Chandeleur Islands	-28.4
Pontchartrain Basin	-4.4

Figure C7. Shoreline change for the Eastern Chenier Plain Region, 1880s to 1930s.

Louisiana Shoreline Change: Eastern Chenier Plain Region, 1930s to 1950s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

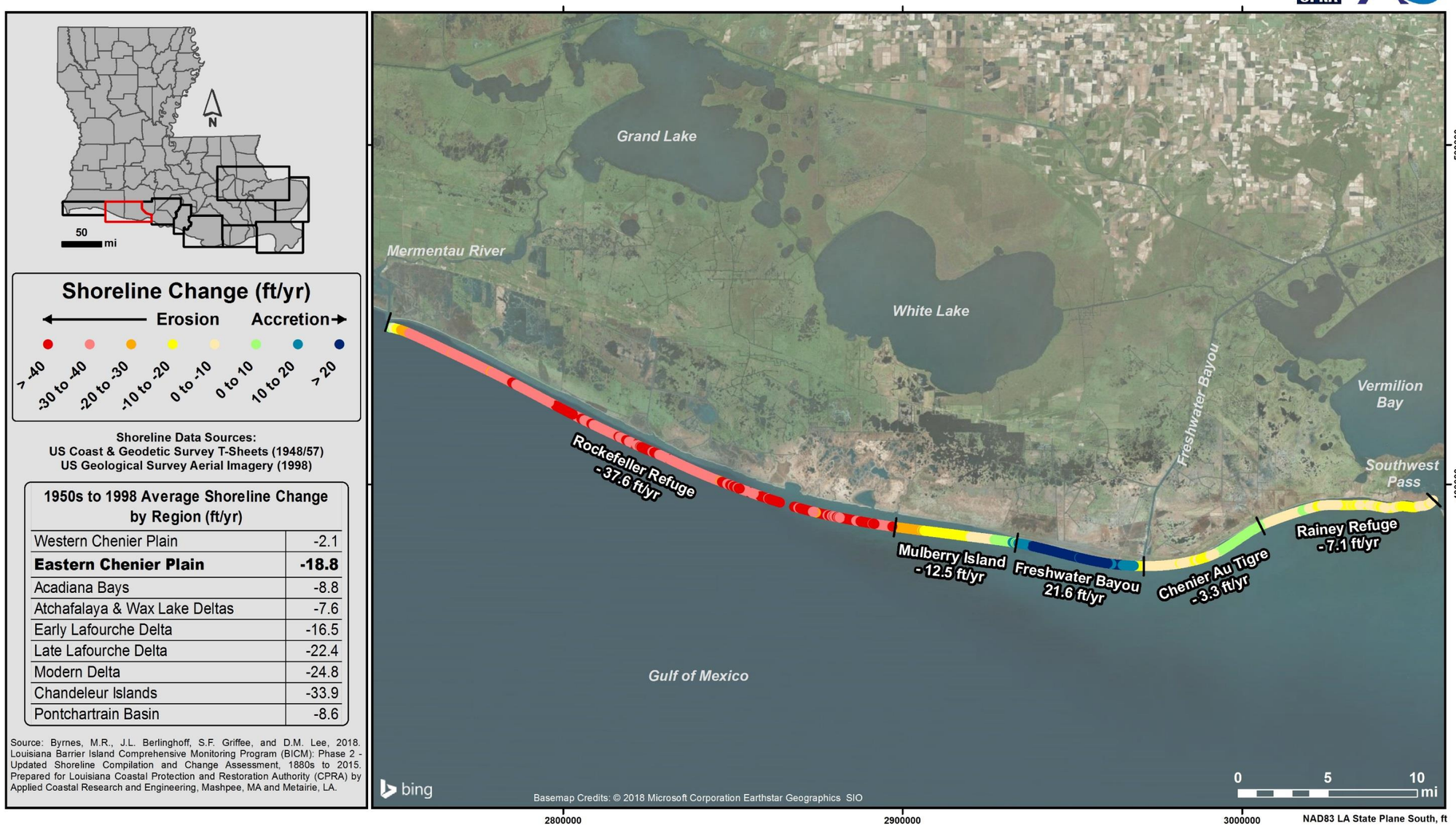


1930s to 1950s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	7.6
Eastern Chenier Plain	**-12.3**
Acadiana Bays	-7.5
Atchafalaya & Wax Lake Deltas	-17.9
Early Lafourche Delta	-12.4
Late Lafourche Delta	-22.2
Modern Delta	-13.0
Chandeleur Islands	-16.0
Pontchartrain Basin	-5.7

Figure C8. Shoreline change for the Eastern Chenier Plain Region, 1930s to 1950s.

Louisiana Shoreline Change: Eastern Chenier Plain Region, 1950s to 1998

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

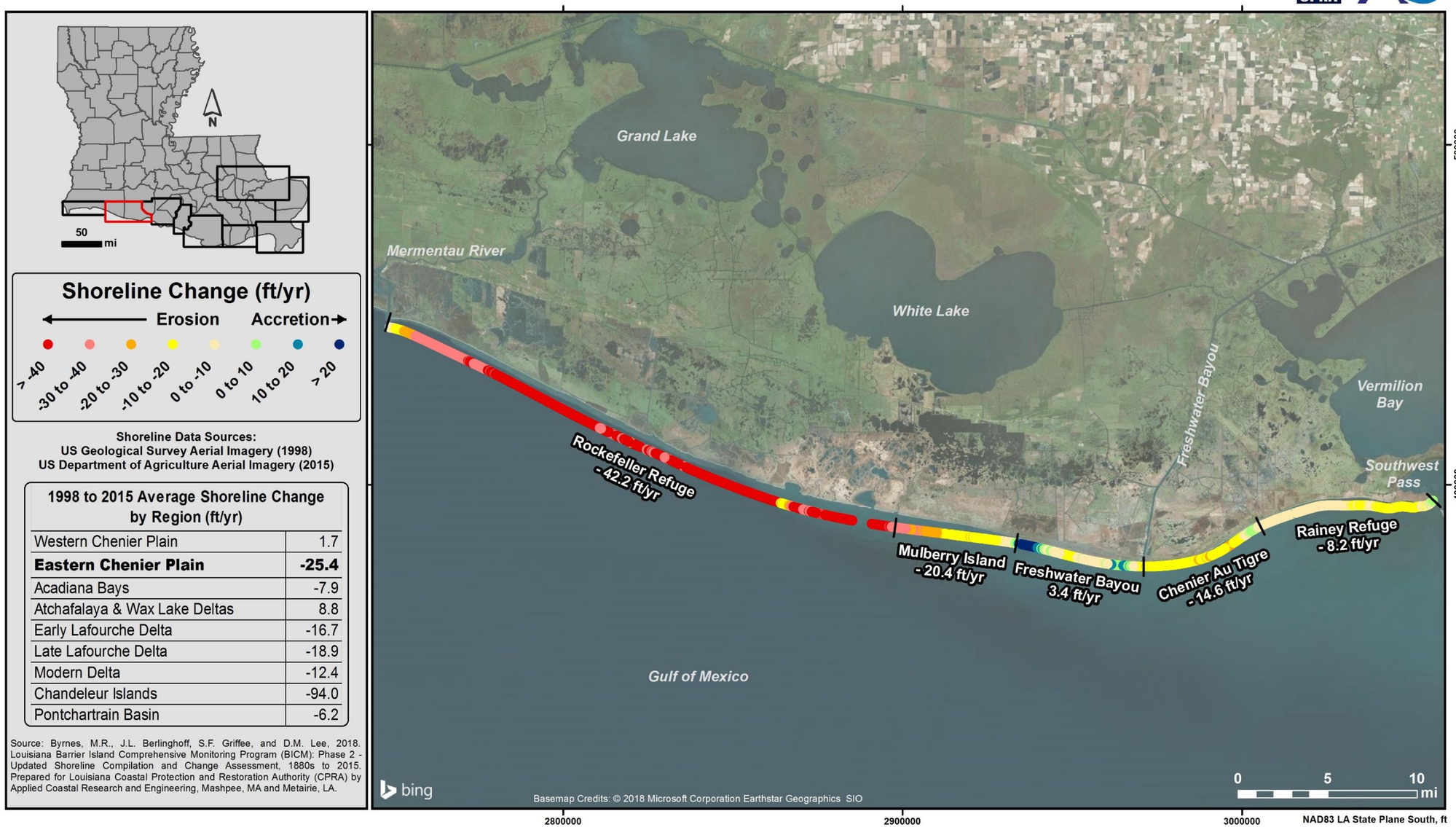


1950s to 1998 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.1
Eastern Chenier Plain	**-18.8**
Acadiana Bays	-8.8
Atchafalaya & Wax Lake Deltas	-7.6
Early Lafourche Delta	-16.5
Late Lafourche Delta	-22.4
Modern Delta	-24.8
Chandeleur Islands	-33.9
Pontchartrain Basin	-8.6

Figure C9. Shoreline change for the Eastern Chenier Plain Region, 1950s to 1998.

Louisiana Shoreline Change: Eastern Chenier Plain Region, 1998 to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

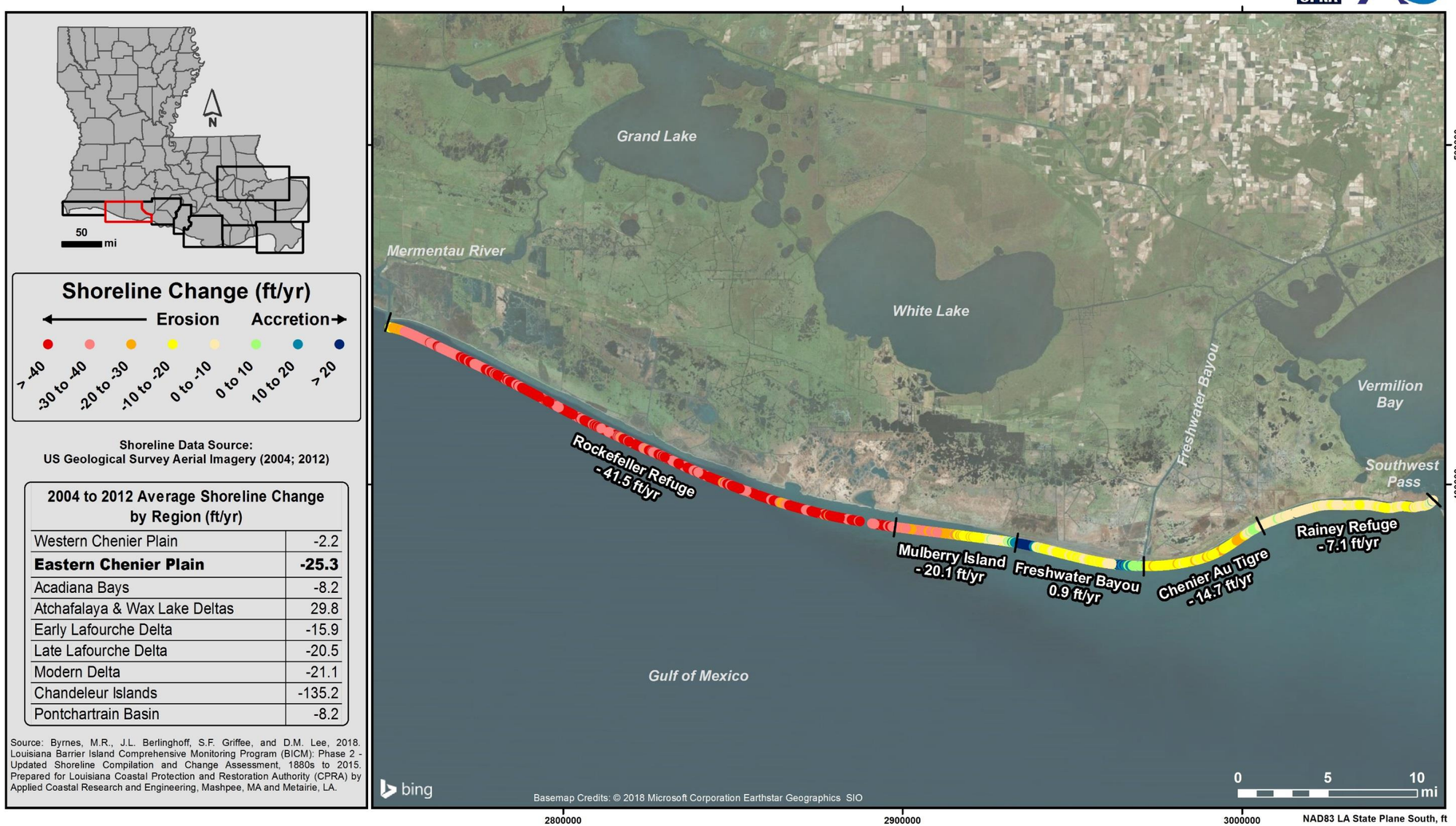


1998 to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	1.7
Eastern Chenier Plain	**-25.4**
Acadiana Bays	-7.9
Atchafalaya & Wax Lake Deltas	8.8
Early Lafourche Delta	-16.7
Late Lafourche Delta	-18.9
Modern Delta	-12.4
Chandeleur Islands	-94.0
Pontchartrain Basin	-6.2

Figure C10. Shoreline change for the Eastern Chenier Plain Region, 1998 to 2015.

Louisiana Shoreline Change: Eastern Chenier Plain Region, 2004 to 2012

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

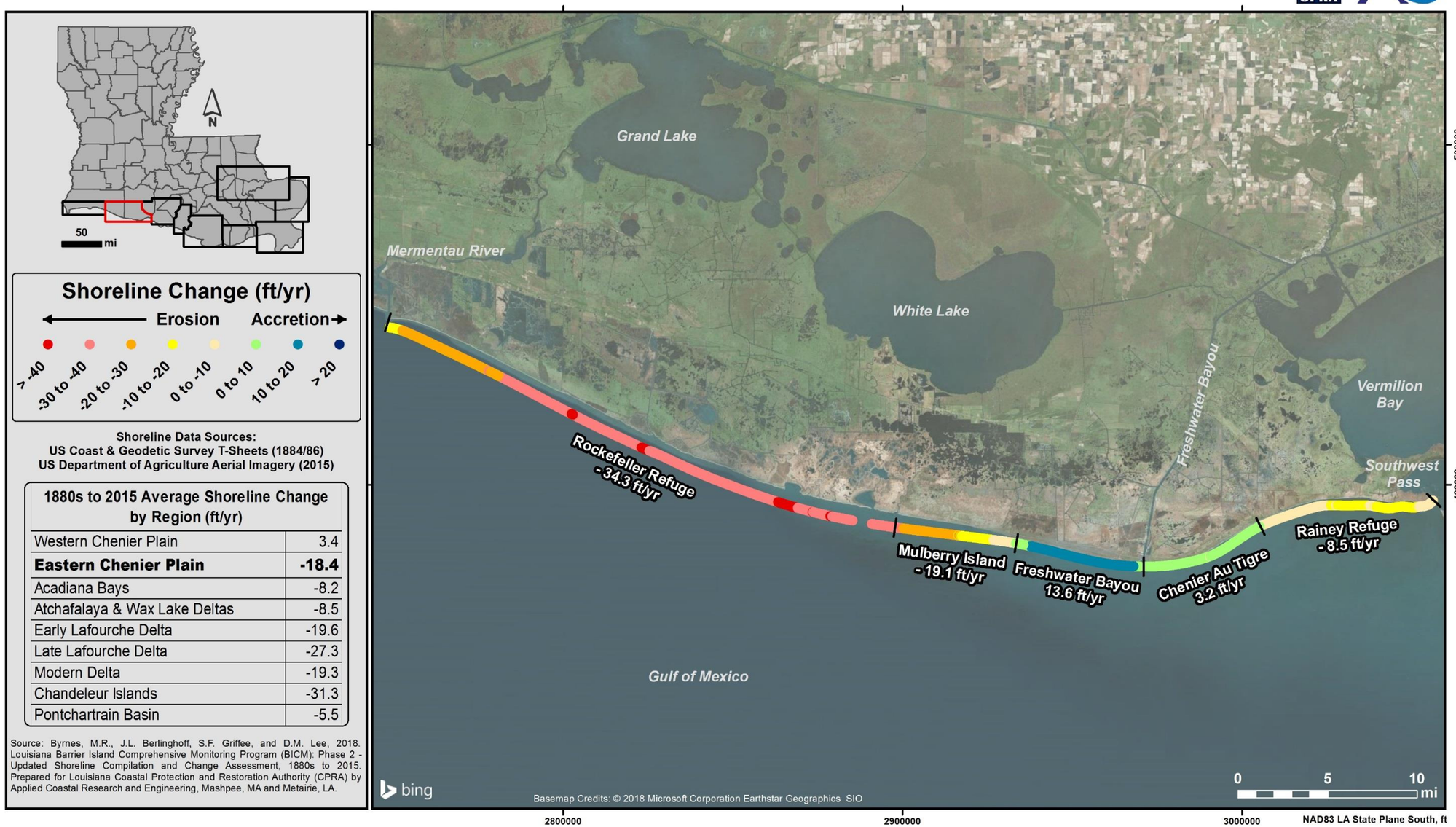


2004 to 2012 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.2
Eastern Chenier Plain	**-25.3**
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	29.8
Early Lafourche Delta	-15.9
Late Lafourche Delta	-20.5
Modern Delta	-21.1
Chandeleur Islands	-135.2
Pontchartrain Basin	-8.2

Figure C11. Shoreline change for the Eastern Chenier Plain Region, 2004 to 2012.

Louisiana Shoreline Change: Eastern Chenier Plain Region, 1880s to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

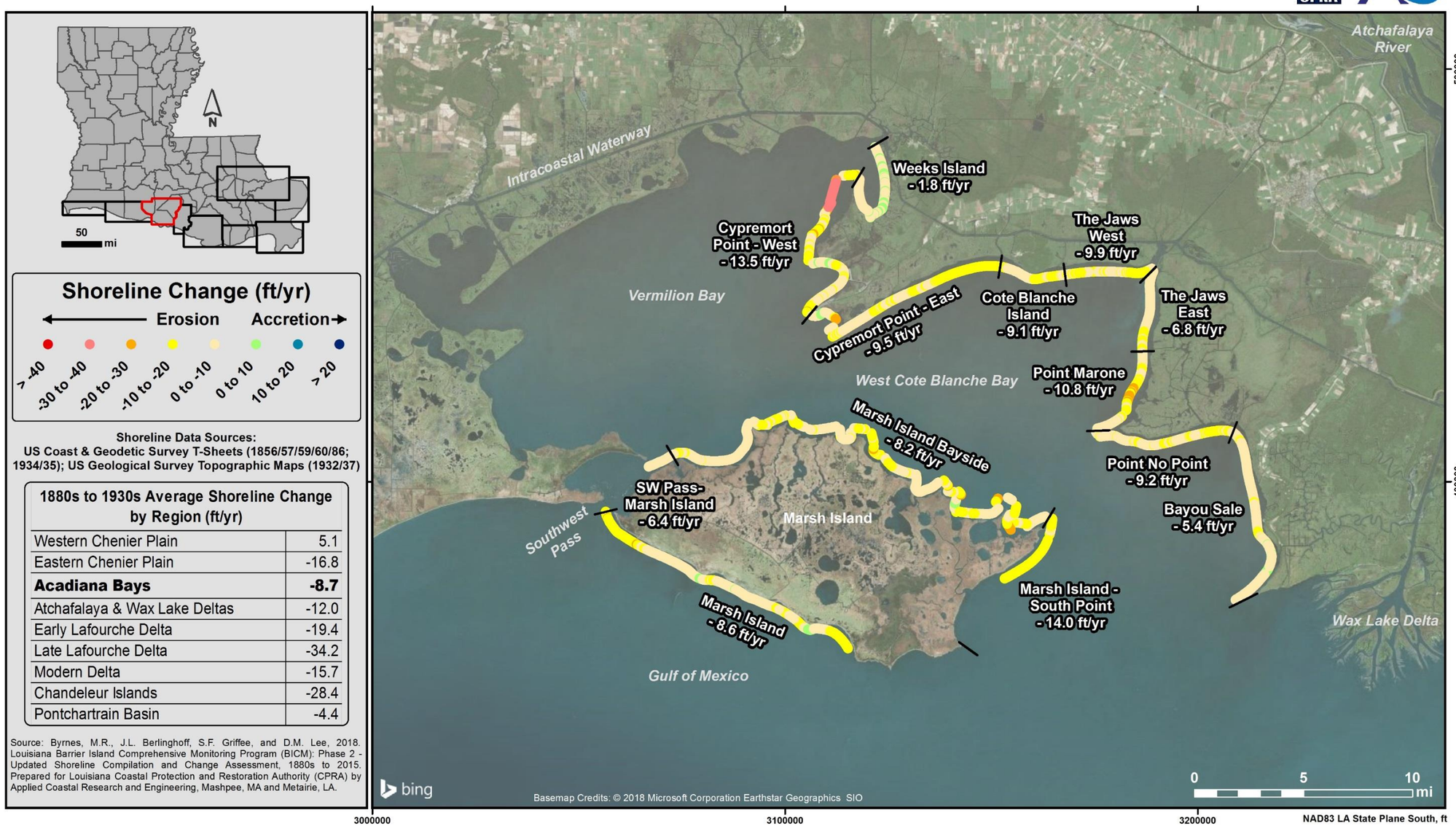


1880s to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	3.4
Eastern Chenier Plain	**-18.4**
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	-8.5
Early Lafourche Delta	-19.6
Late Lafourche Delta	-27.3
Modern Delta	-19.3
Chandeleur Islands	-31.3
Pontchartrain Basin	-5.5

Figure C12. Shoreline change for the Eastern Chenier Plain Region, 1880s to 2015.

Louisiana Shoreline Change: Acadiana Bays Region, 1880s to 1930s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

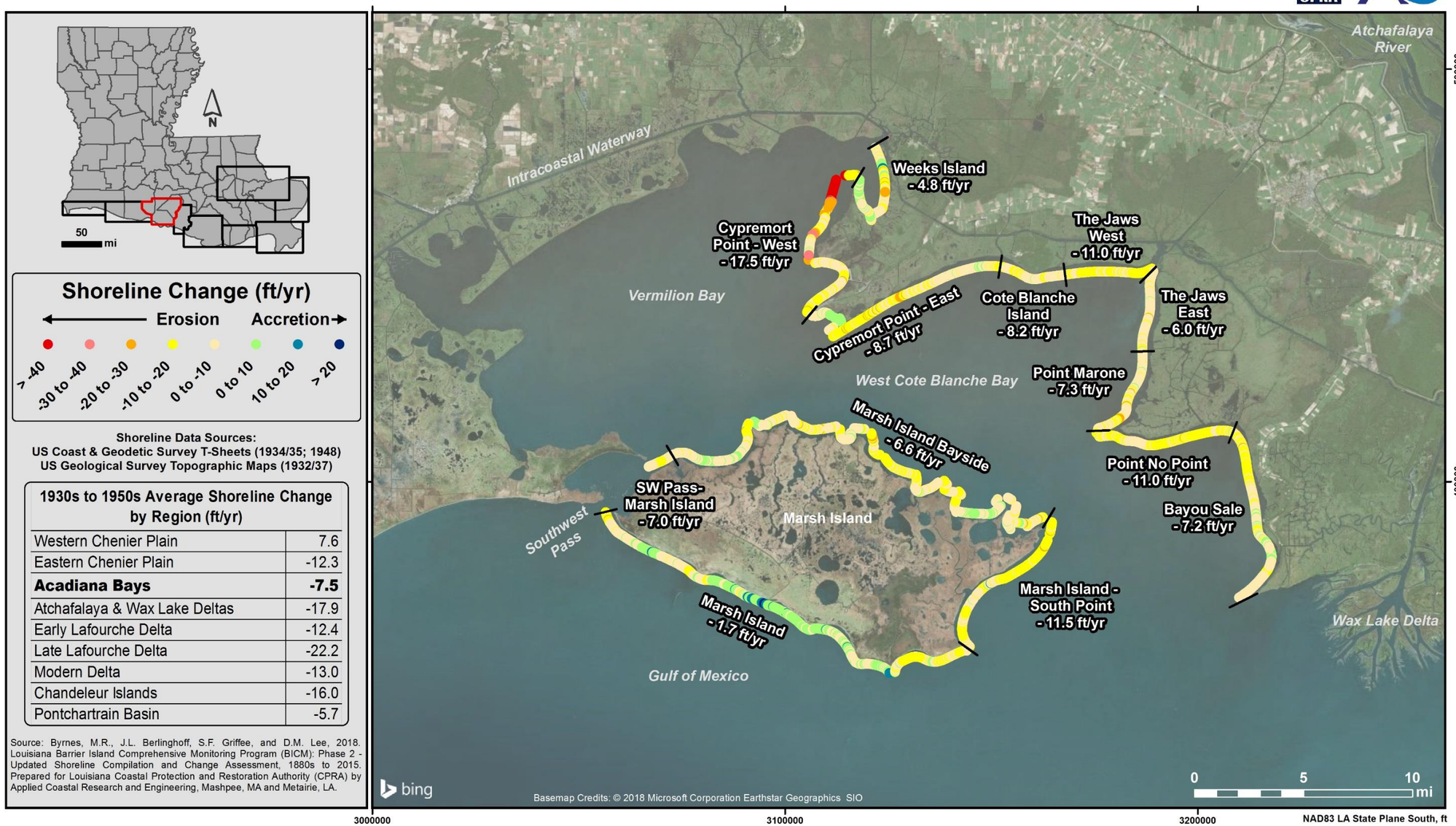


1880s to 1930s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	5.1
Eastern Chenier Plain	-16.8
Acadiana Bays	**-8.7**
Atchafalaya & Wax Lake Deltas	-12.0
Early Lafourche Delta	-19.4
Late Lafourche Delta	-34.2
Modern Delta	-15.7
Chandeleur Islands	-28.4
Pontchartrain Basin	-4.4

Figure C13. Shoreline change for the Acadiana Bays Region, 1880s to 1930s.

Louisiana Shoreline Change: Acadiana Bays Region, 1930s to 1950s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

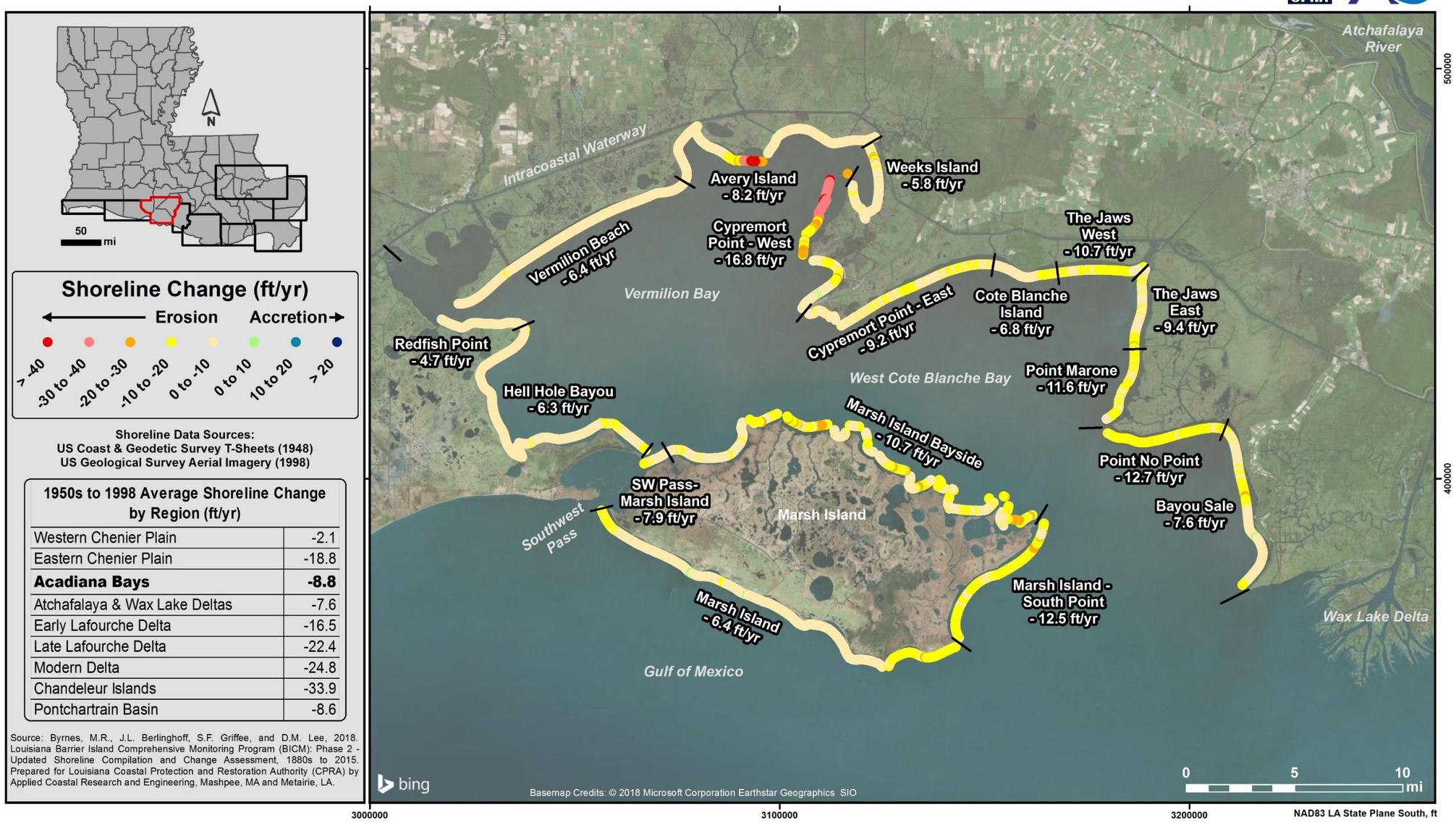


1930s to 1950s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	7.6
Eastern Chenier Plain	-12.3
Acadiana Bays	**-7.5**
Atchafalaya & Wax Lake Deltas	-17.9
Early Lafourche Delta	-12.4
Late Lafourche Delta	-22.2
Modern Delta	-13.0
Chandeleur Islands	-16.0
Pontchartrain Basin	-5.7

Figure C14. Shoreline change for the Acadiana Bays Region, 1930s to 1950s.

Louisiana Shoreline Change: Acadiana Bays Region, 1950s to 1998

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

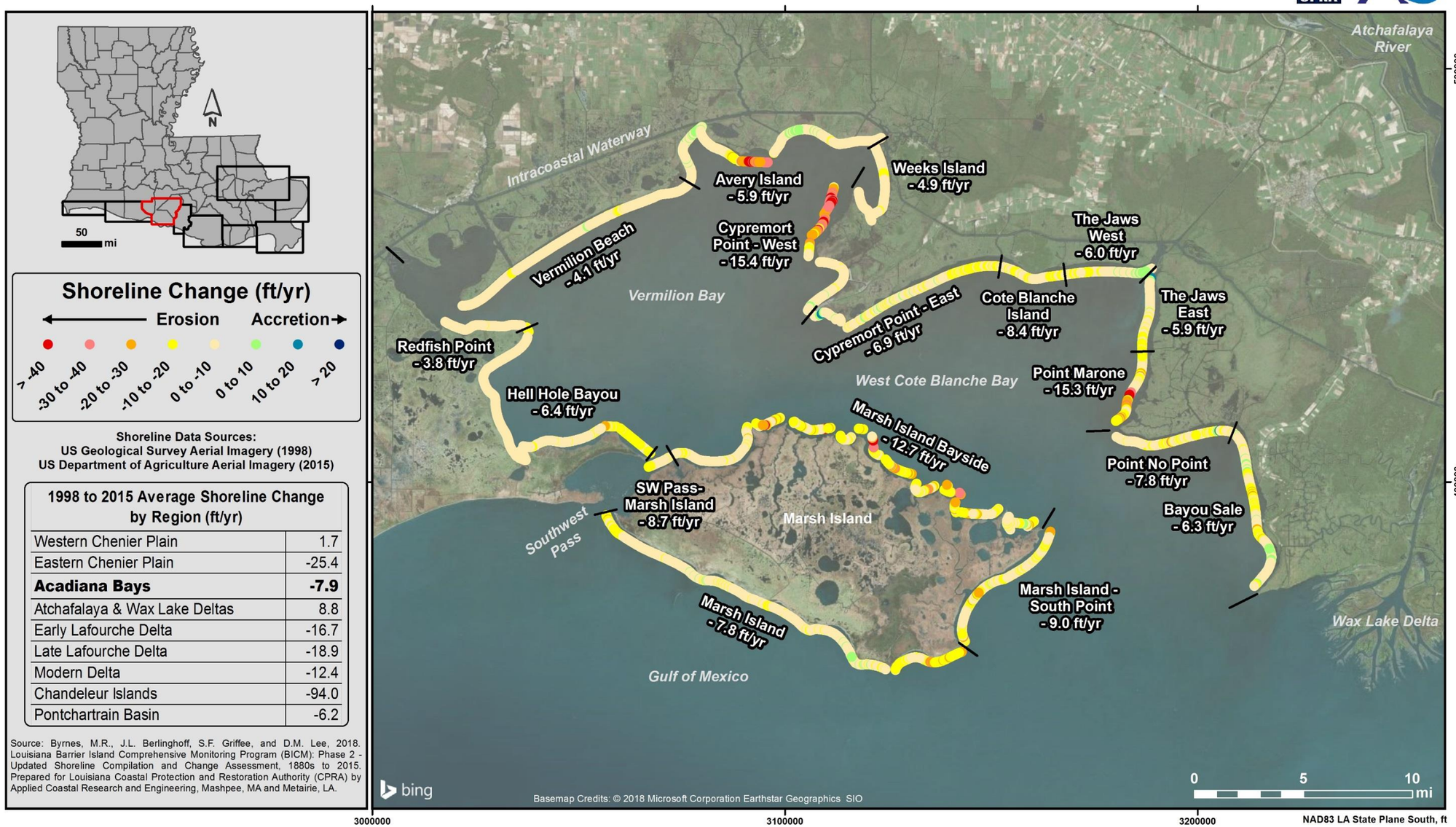


1950s to 1998 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.1
Eastern Chenier Plain	-18.8
Acadiana Bays	**-8.8**
Atchafalaya & Wax Lake Deltas	-7.6
Early Lafourche Delta	-16.5
Late Lafourche Delta	-22.4
Modern Delta	-24.8
Chandeleur Islands	-33.9
Pontchartrain Basin	-8.6

Figure C15. Shoreline change for the Acadiana Bays Region, 1950s to 1998.

Louisiana Shoreline Change: Acadiana Bays Region, 1998 to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

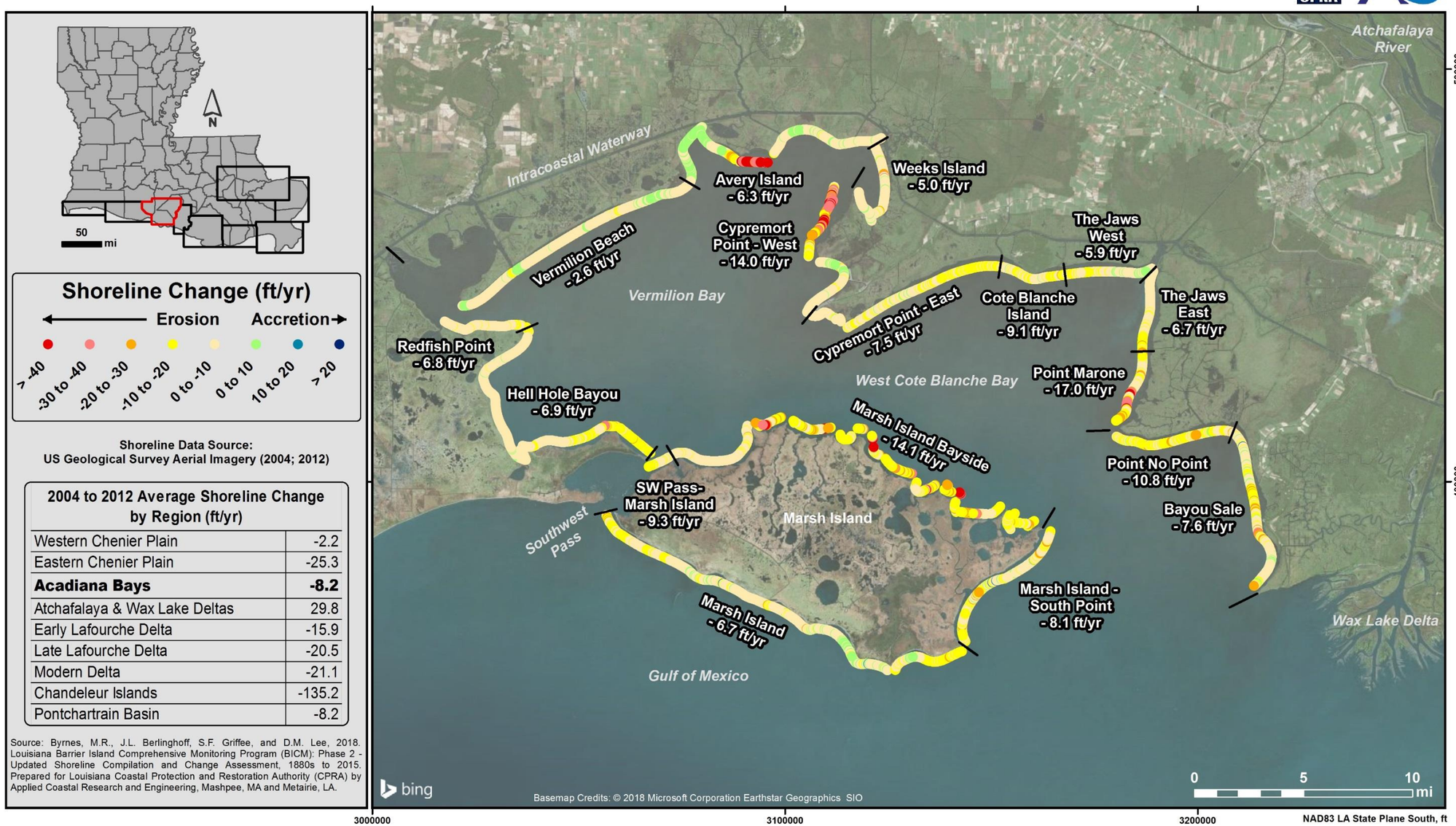


1998 to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	1.7
Eastern Chenier Plain	-25.4
Acadiana Bays	**-7.9**
Atchafalaya & Wax Lake Deltas	8.8
Early Lafourche Delta	-16.7
Late Lafourche Delta	-18.9
Modern Delta	-12.4
Chandeleur Islands	-94.0
Pontchartrain Basin	-6.2

Figure C16. Shoreline change for the Acadiana Bays Region, 1998 to 2015.

Louisiana Shoreline Change: Acadiana Bays Region, 2004 to 2012

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

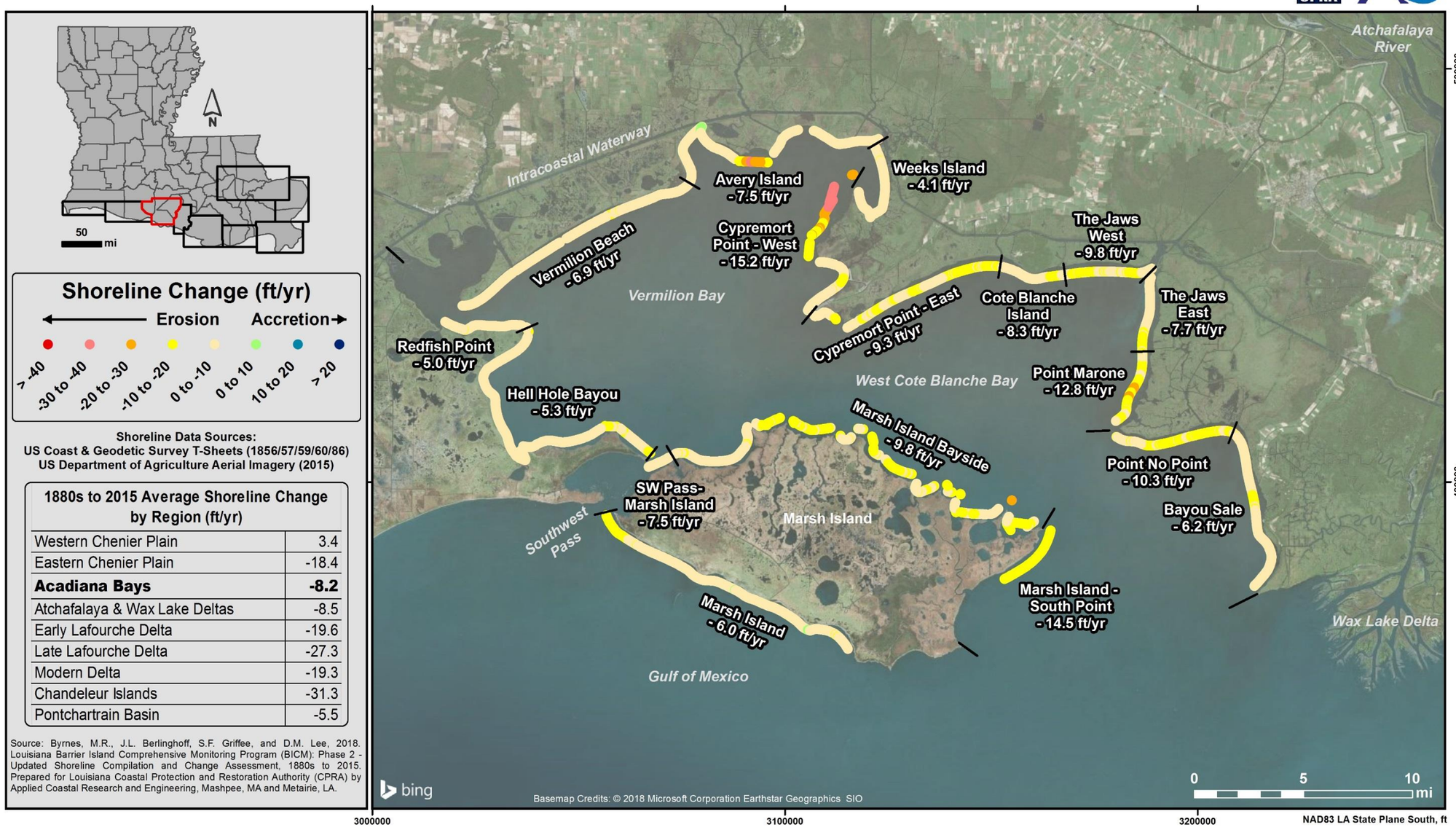


2004 to 2012 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.2
Eastern Chenier Plain	-25.3
Acadiana Bays	**-8.2**
Atchafalaya & Wax Lake Deltas	29.8
Early Lafourche Delta	-15.9
Late Lafourche Delta	-20.5
Modern Delta	-21.1
Chandeleur Islands	-135.2
Pontchartrain Basin	-8.2

Figure C17. Shoreline change for the Acadiana Bays Region, 2004 to 2012.

Louisiana Shoreline Change: Acadiana Bays Region, 1880s to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

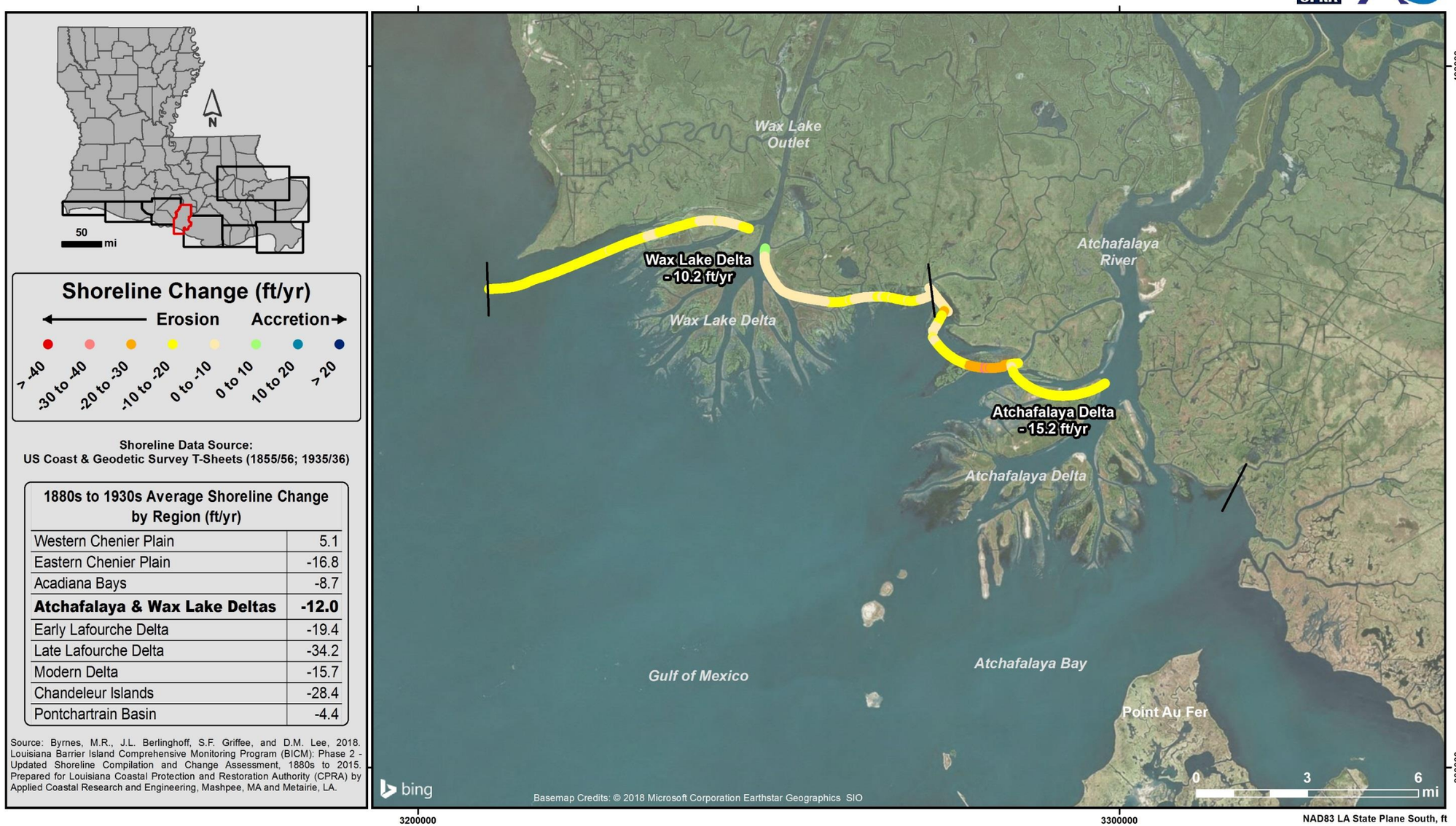


1880s to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	3.4
Eastern Chenier Plain	-18.4
Acadiana Bays	**-8.2**
Atchafalaya & Wax Lake Deltas	-8.5
Early Lafourche Delta	-19.6
Late Lafourche Delta	-27.3
Modern Delta	-19.3
Chandeleur Islands	-31.3
Pontchartrain Basin	-5.5

Figure C18. Shoreline change for the Acadiana Bays Region, 1880s to 2015.

Louisiana Shoreline Change: Atchafalaya & Wax Lake Deltas Region, 1880s to 1930s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

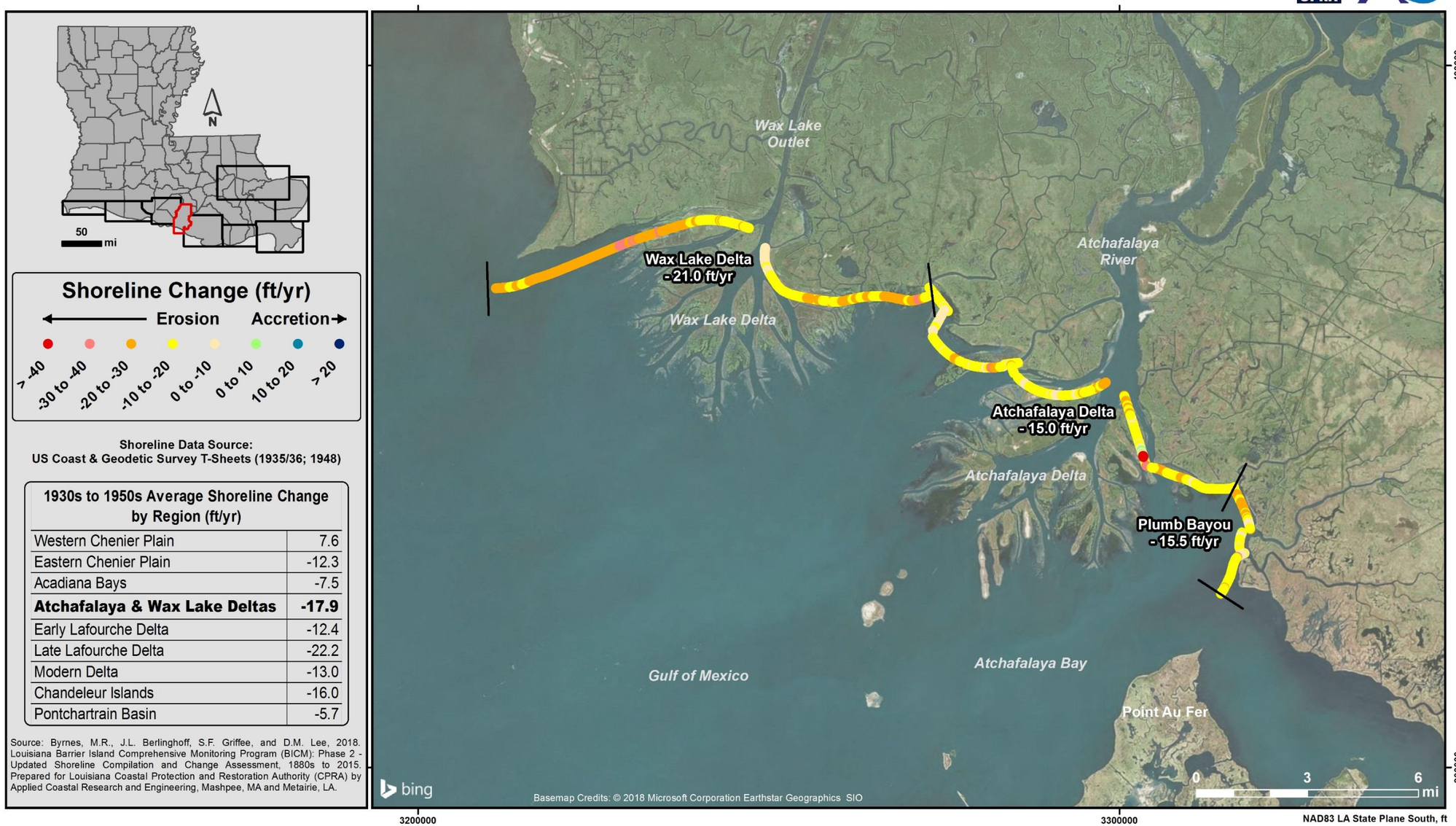


1880s to 1930s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	5.1
Eastern Chenier Plain	-16.8
Acadiana Bays	-8.7
Atchafalaya & Wax Lake Deltas	**-12.0**
Early Lafourche Delta	-19.4
Late Lafourche Delta	-34.2
Modern Delta	-15.7
Chandeleur Islands	-28.4
Pontchartrain Basin	-4.4

Figure C19. Shoreline change for the Atchafalaya and Wax Lake Deltas Region, 1880s to 1930s.

Louisiana Shoreline Change: Atchafalaya & Wax Lake Deltas Region, 1930s to 1950s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

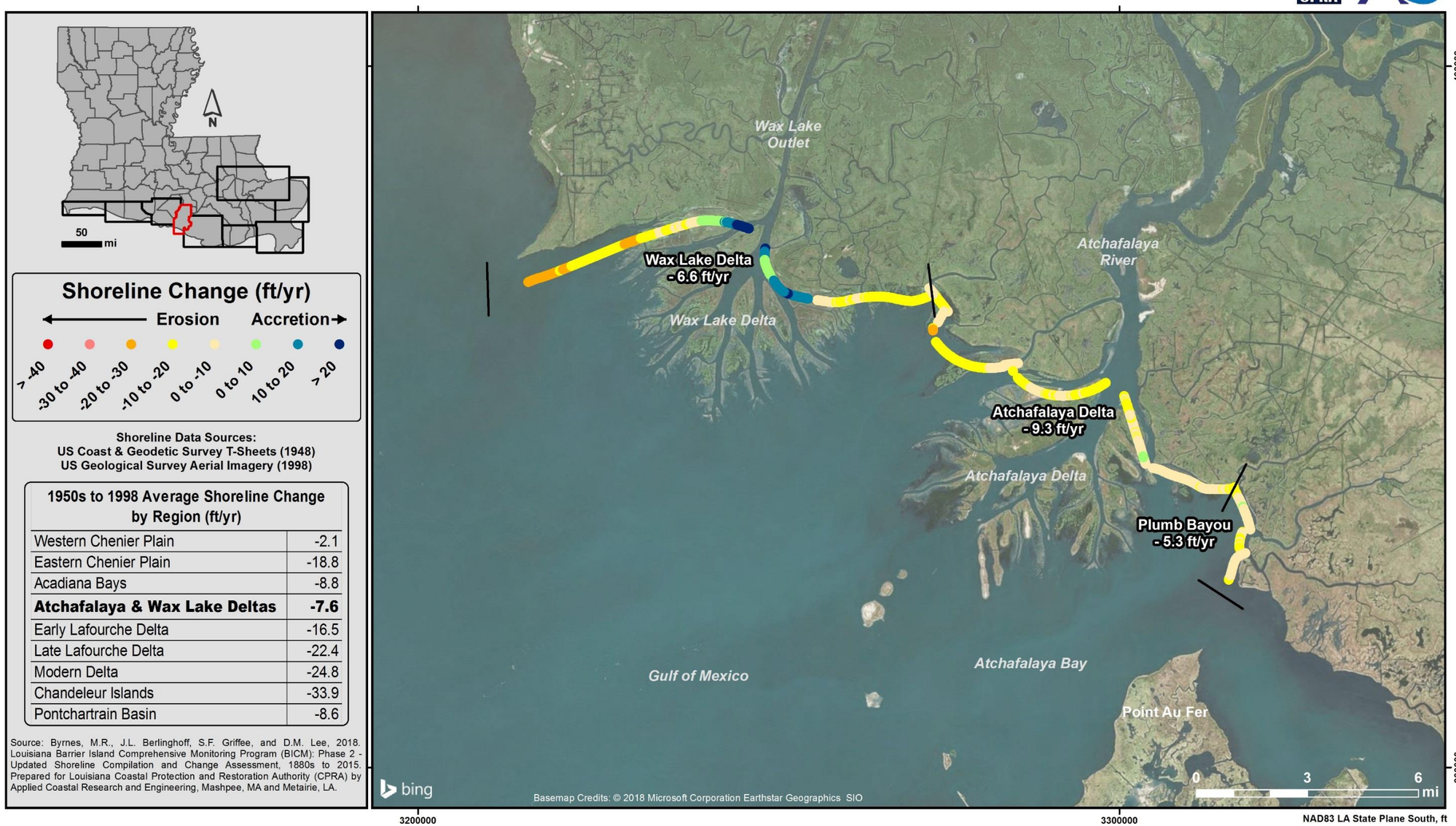


1930s to 1950s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	7.6
Eastern Chenier Plain	-12.3
Acadiana Bays	-7.5
Atchafalaya & Wax Lake Deltas	**-17.9**
Early Lafourche Delta	-12.4
Late Lafourche Delta	-22.2
Modern Delta	-13.0
Chandeleur Islands	-16.0
Pontchartrain Basin	-5.7

Figure C20. Shoreline change for the Atchafalaya and Wax Lake Deltas Region, 1930s to 1950s.

Louisiana Shoreline Change: Atchafalaya & Wax Lake Deltas Region, 1950s to 1998

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

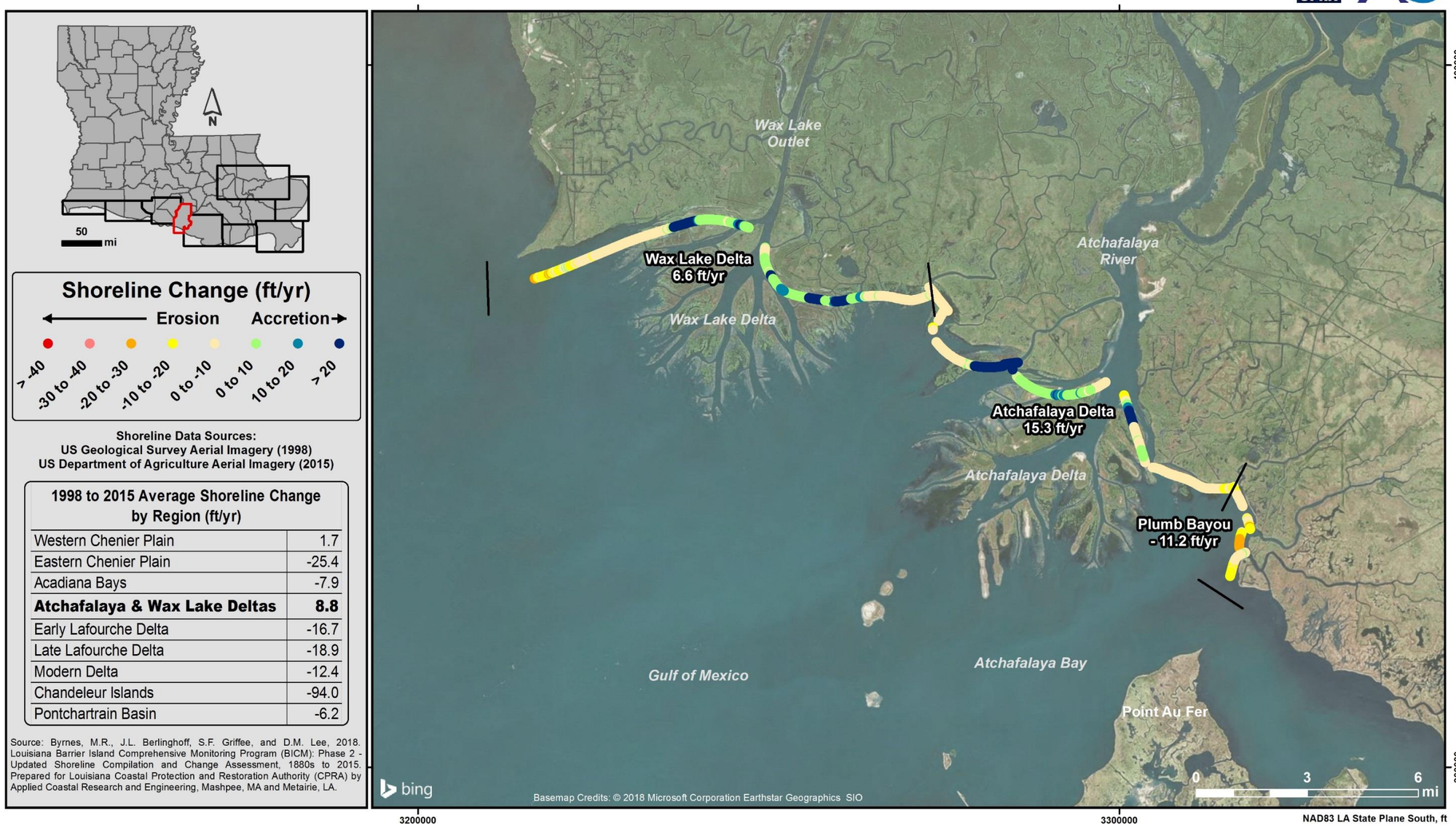


1950s to 1998 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.1
Eastern Chenier Plain	-18.8
Acadiana Bays	-8.8
Atchafalaya & Wax Lake Deltas	**-7.6**
Early Lafourche Delta	-16.5
Late Lafourche Delta	-22.4
Modern Delta	-24.8
Chandeleur Islands	-33.9
Pontchartrain Basin	-8.6

Figure C21. Shoreline change for the Atchafalaya and Wax Lake Deltas Region, 1950s to 1998.

Louisiana Shoreline Change: Atchafalaya & Wax Lake Deltas Region, 1998 to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

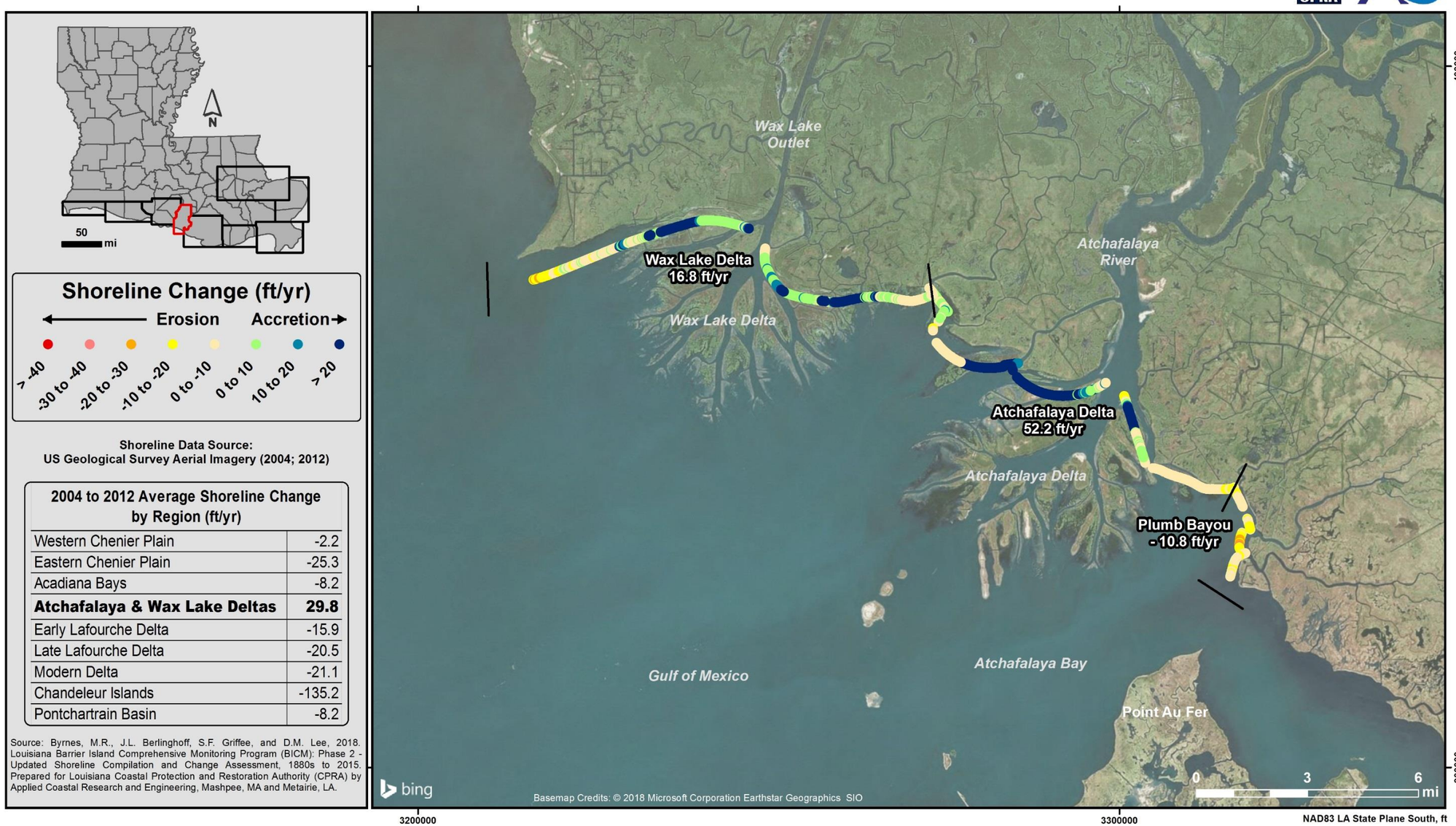


1998 to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	1.7
Eastern Chenier Plain	-25.4
Acadiana Bays	-7.9
Atchafalaya & Wax Lake Deltas	**8.8**
Early Lafourche Delta	-16.7
Late Lafourche Delta	-18.9
Modern Delta	-12.4
Chandeleur Islands	-94.0
Pontchartrain Basin	-6.2

Figure C22. Shoreline change for the Atchafalaya and Wax Lake Deltas Region, 1998 to 2015.

Louisiana Shoreline Change: Atchafalaya & Wax Lake Deltas Region, 2004 to 2012

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

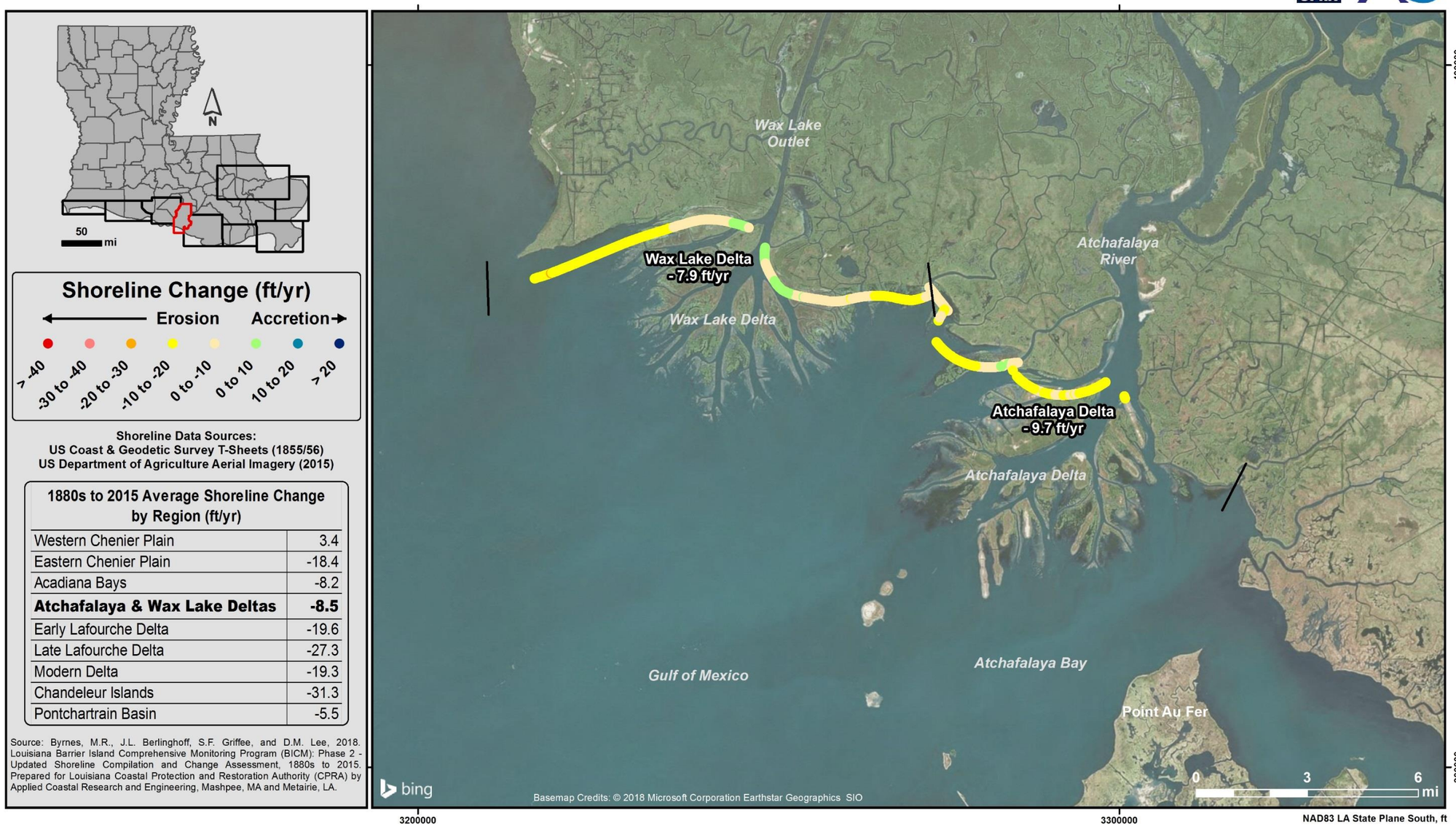


2004 to 2012 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.2
Eastern Chenier Plain	-25.3
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	**29.8**
Early Lafourche Delta	-15.9
Late Lafourche Delta	-20.5
Modern Delta	-21.1
Chandeleur Islands	-135.2
Pontchartrain Basin	-8.2

Figure C23. Shoreline change for the Atchafalaya and Wax Lake Deltas Region, 2004 to 2012.

Louisiana Shoreline Change: Atchafalaya & Wax Lake Deltas Region, 1880s to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

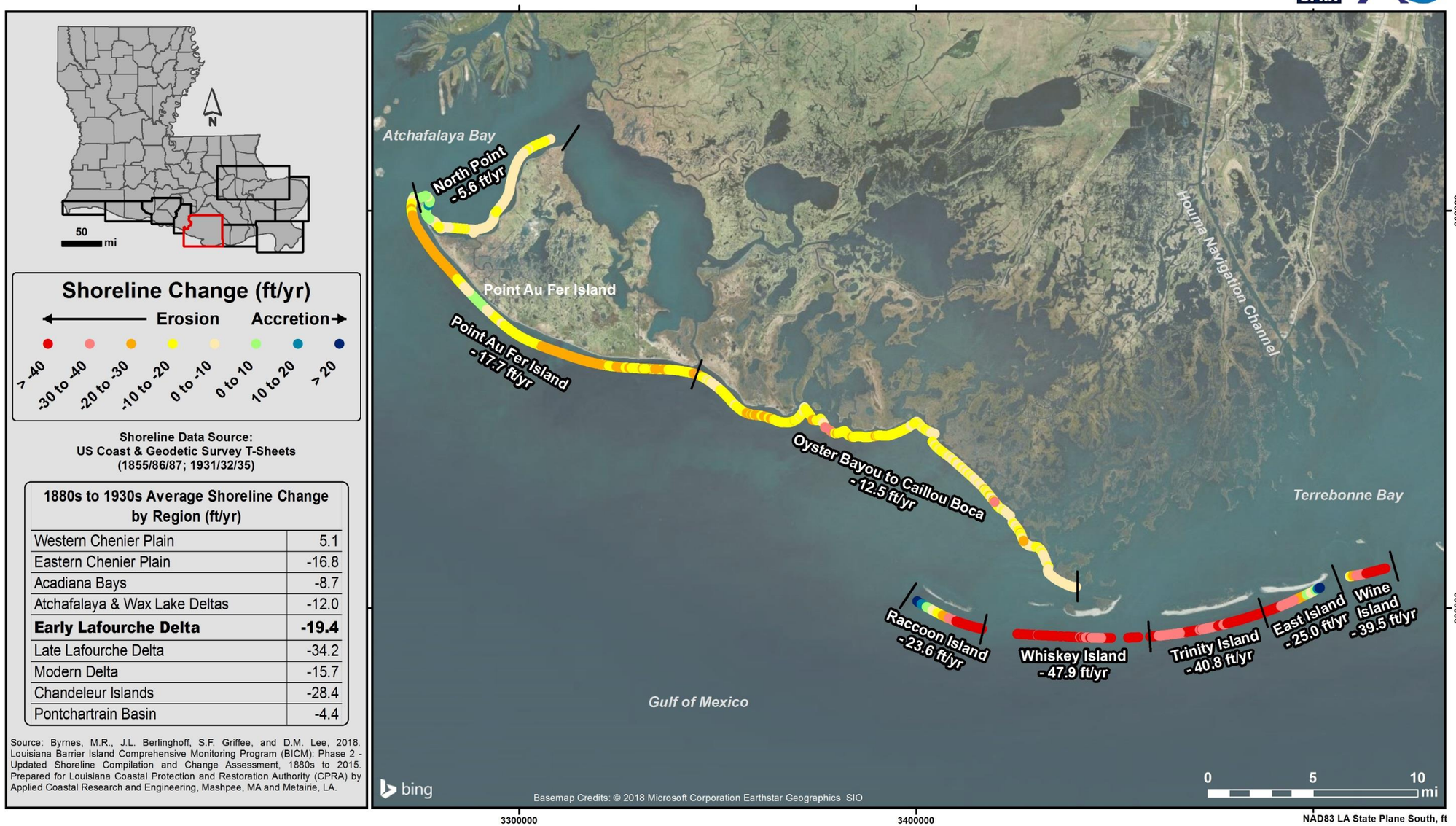


1880s to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	3.4
Eastern Chenier Plain	-18.4
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	**-8.5**
Early Lafourche Delta	-19.6
Late Lafourche Delta	-27.3
Modern Delta	-19.3
Chandeleur Islands	-31.3
Pontchartrain Basin	-5.5

Figure C24. Shoreline change for the Atchafalaya and Wax Lake Deltas Region, 1880s to 2015.

Louisiana Shoreline Change: Early Lafourche Delta Region, 1880s to 1930s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

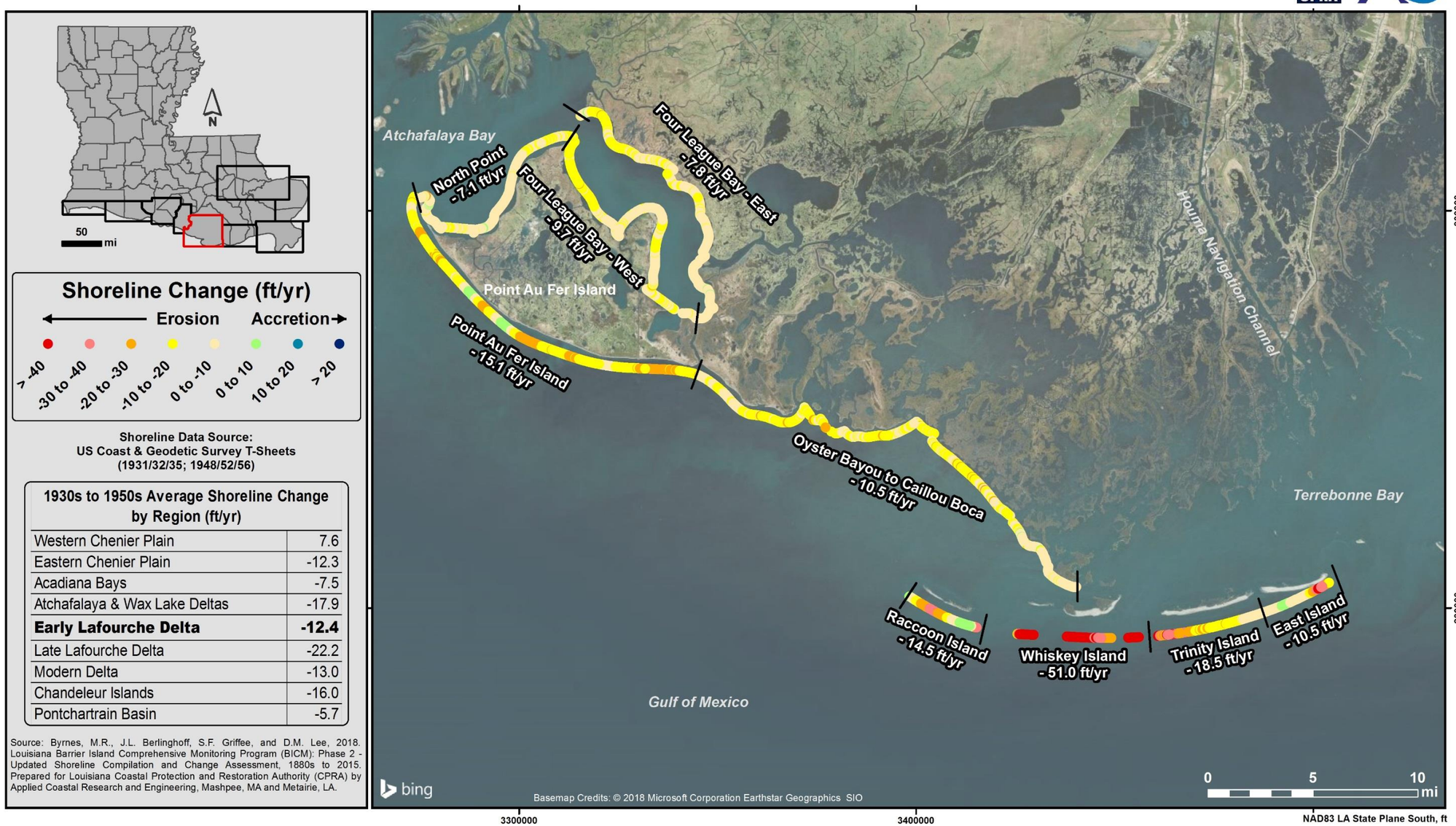


1880s to 1930s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	5.1
Eastern Chenier Plain	-16.8
Acadiana Bays	-8.7
Atchafalaya & Wax Lake Deltas	-12.0
Early Lafourche Delta	**-19.4**
Late Lafourche Delta	-34.2
Modern Delta	-15.7
Chandeleur Islands	-28.4
Pontchartrain Basin	-4.4

Figure C25. Shoreline change for the Early Lafourche Delta Region, 1880s to 1930s.

Louisiana Shoreline Change: Early Lafourche Delta Region, 1930s to 1950s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

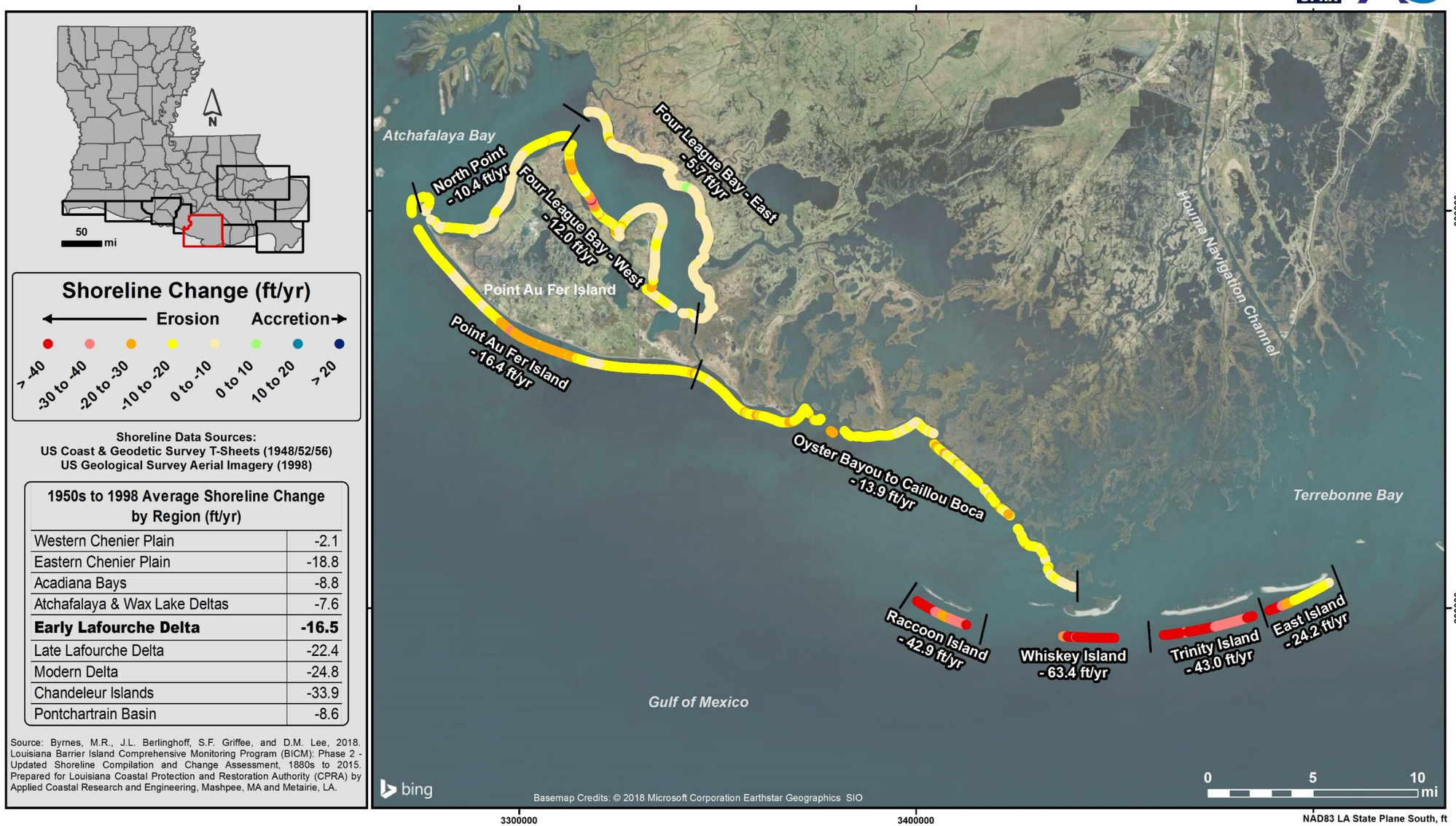


1930s to 1950s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	7.6
Eastern Chenier Plain	-12.3
Acadiana Bays	-7.5
Atchafalaya & Wax Lake Deltas	-17.9
Early Lafourche Delta	**-12.4**
Late Lafourche Delta	-22.2
Modern Delta	-13.0
Chandeleur Islands	-16.0
Pontchartrain Basin	-5.7

Figure C26. Shoreline change for the Early Lafourche Delta Region, 1930s to 1950s.

Louisiana Shoreline Change: Early Lafourche Delta Region, 1950s to 1998

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



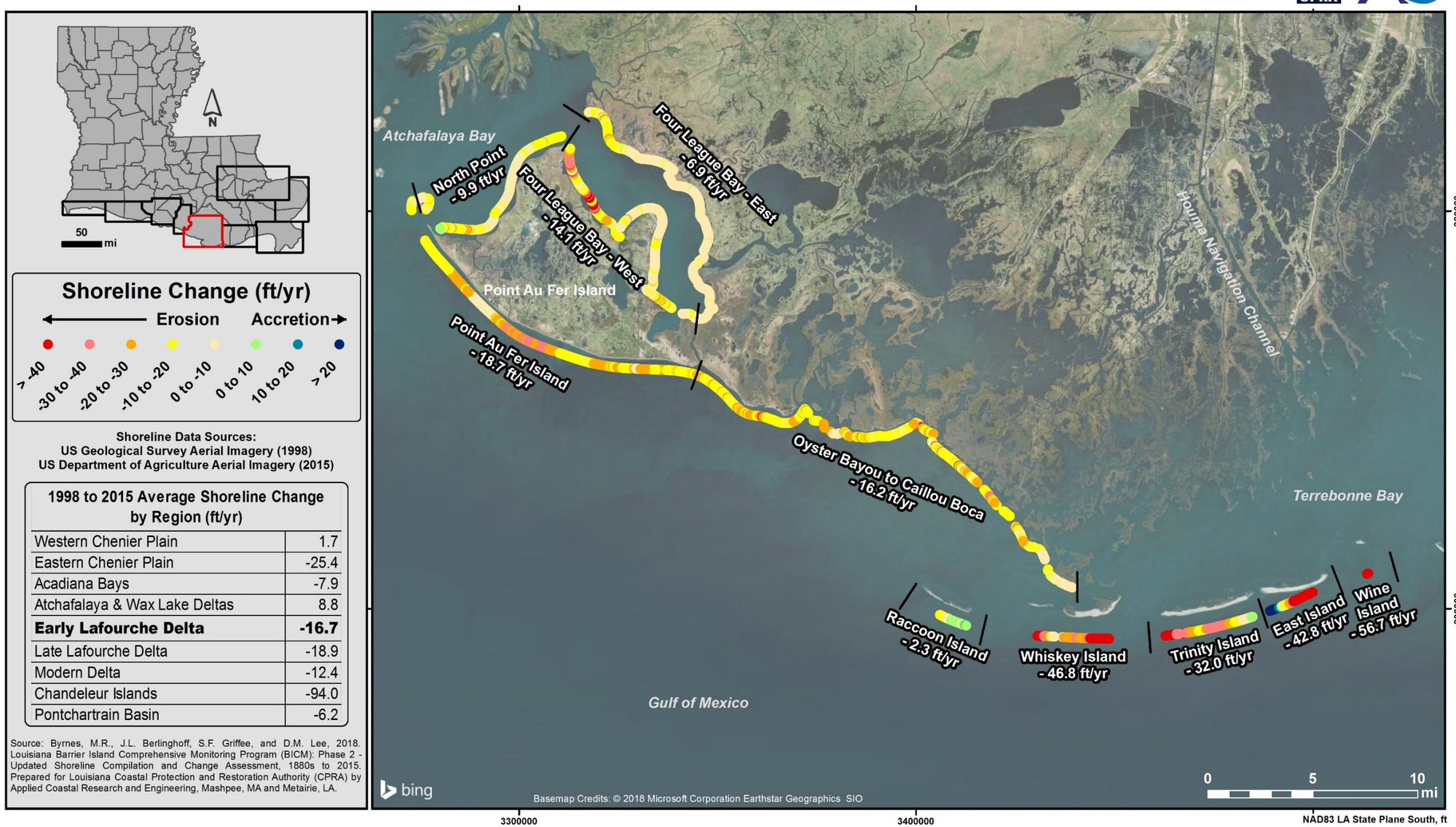
1950s to 1998 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.1
Eastern Chenier Plain	-18.8
Acadiana Bays	-8.8
Atchafalaya & Wax Lake Deltas	-7.6
Early Lafourche Delta	**-16.5**
Late Lafourche Delta	-22.4
Modern Delta	-24.8
Chandeleur Islands	-33.9
Pontchartrain Basin	-8.6

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C27. Shoreline change for the Early Lafourche Delta Region, 1950s to 1998.

Louisiana Shoreline Change: Early Lafourche Delta Region, 1998 to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



1998 to 2015 Average Shoreline Change by Region (ft/yr)

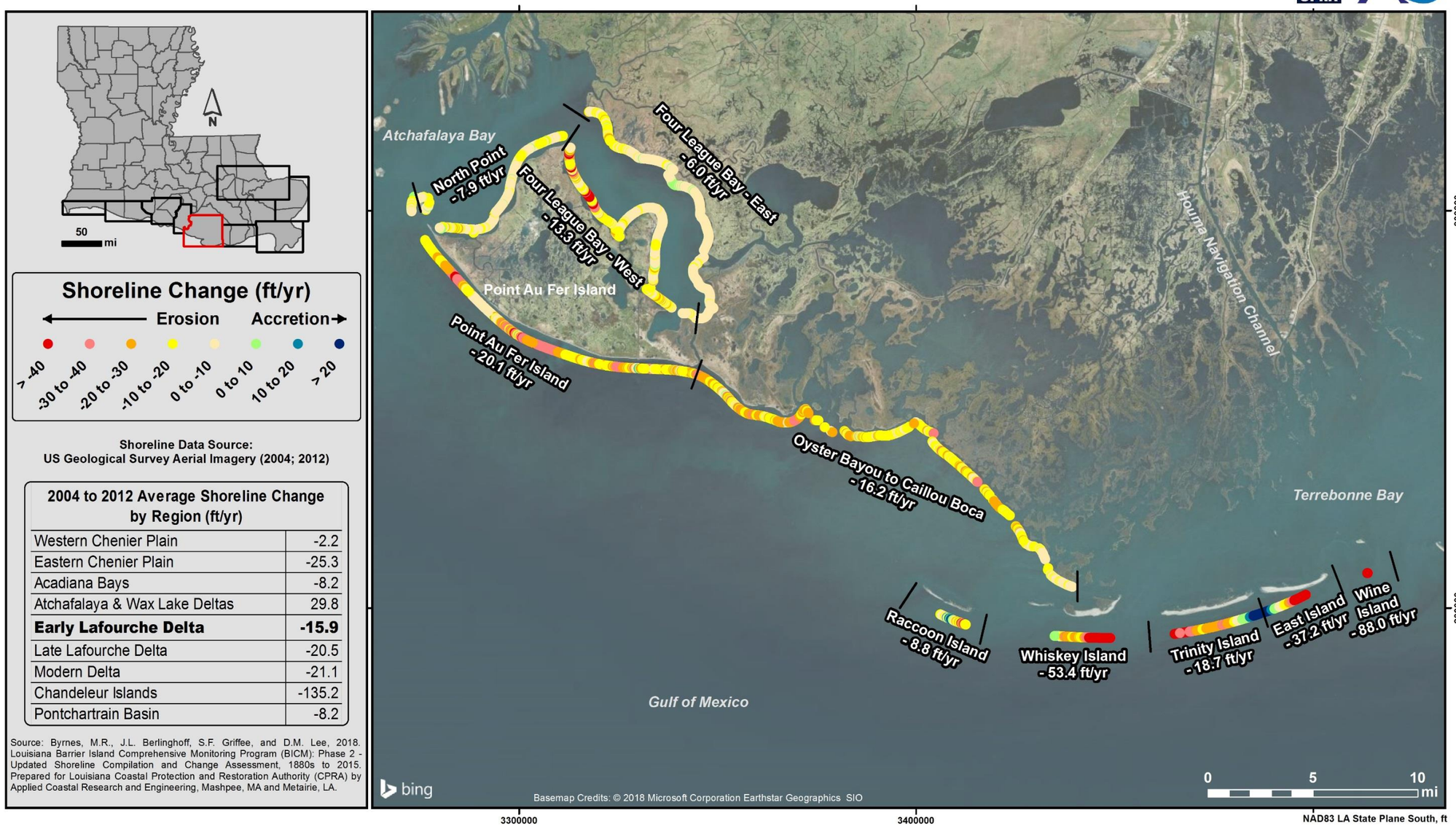
Western Chenier Plain	1.7
Eastern Chenier Plain	-25.4
Acadiana Bays	-7.9
Atchafalaya & Wax Lake Deltas	8.8
Early Lafourche Delta	**-16.7**
Late Lafourche Delta	-18.9
Modern Delta	-12.4
Chandeleur Islands	-94.0
Pontchartrain Basin	-6.2

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C28. Shoreline change for the Early Lafourche Delta Region, 1998 to 2015.

Louisiana Shoreline Change: Early Lafourche Delta Region, 2004 to 2012

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



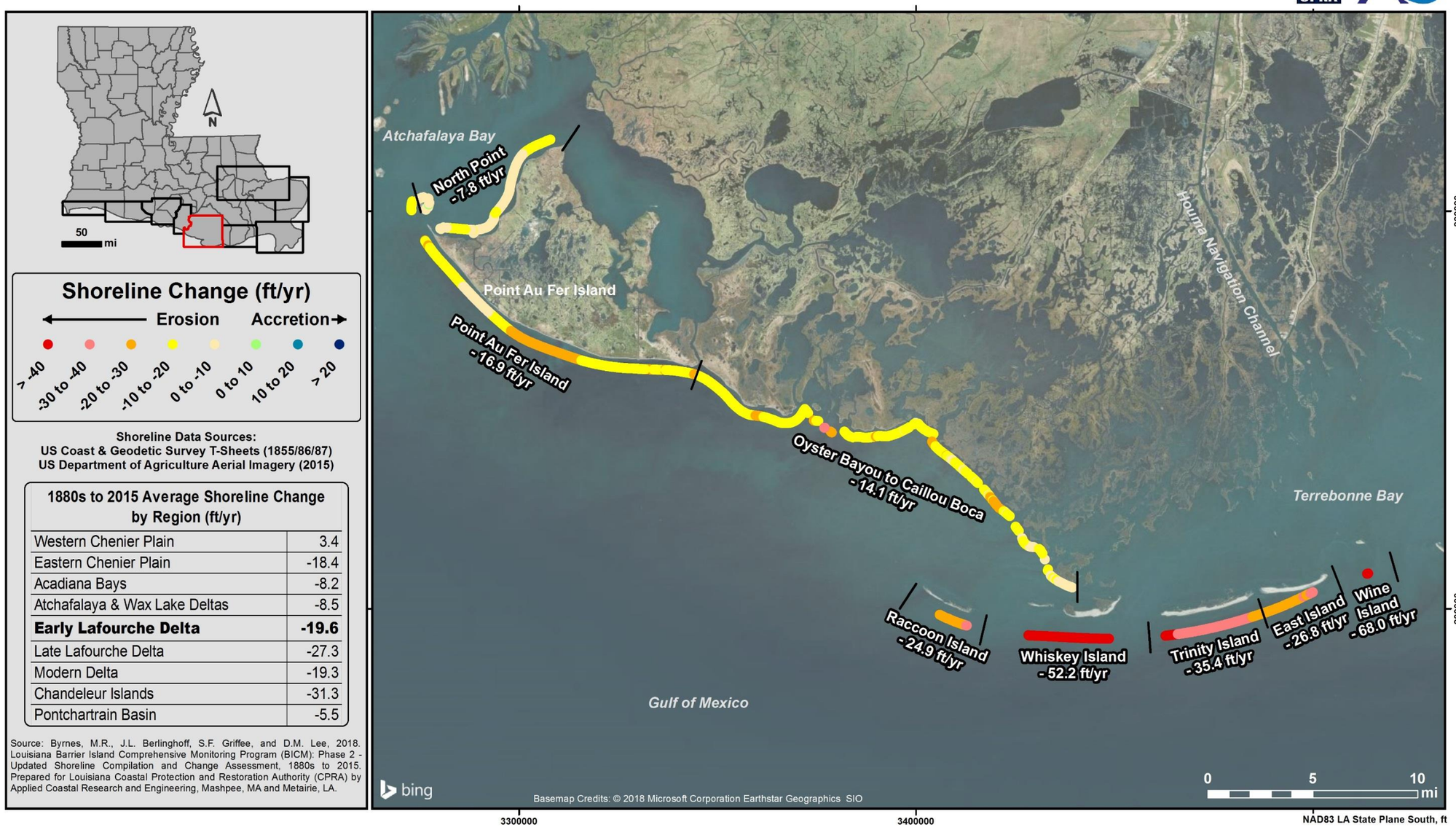
2004 to 2012 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.2
Eastern Chenier Plain	-25.3
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	29.8
Early Lafourche Delta	**-15.9**
Late Lafourche Delta	-20.5
Modern Delta	-21.1
Chandeleur Islands	-135.2
Pontchartrain Basin	-8.2

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C29. Shoreline change for the Early Lafourche Delta Region, 2004 to 2012.

Louisiana Shoreline Change: Early Lafourche Delta Region, 1880s to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



1880s to 2015 Average Shoreline Change by Region (ft/yr)

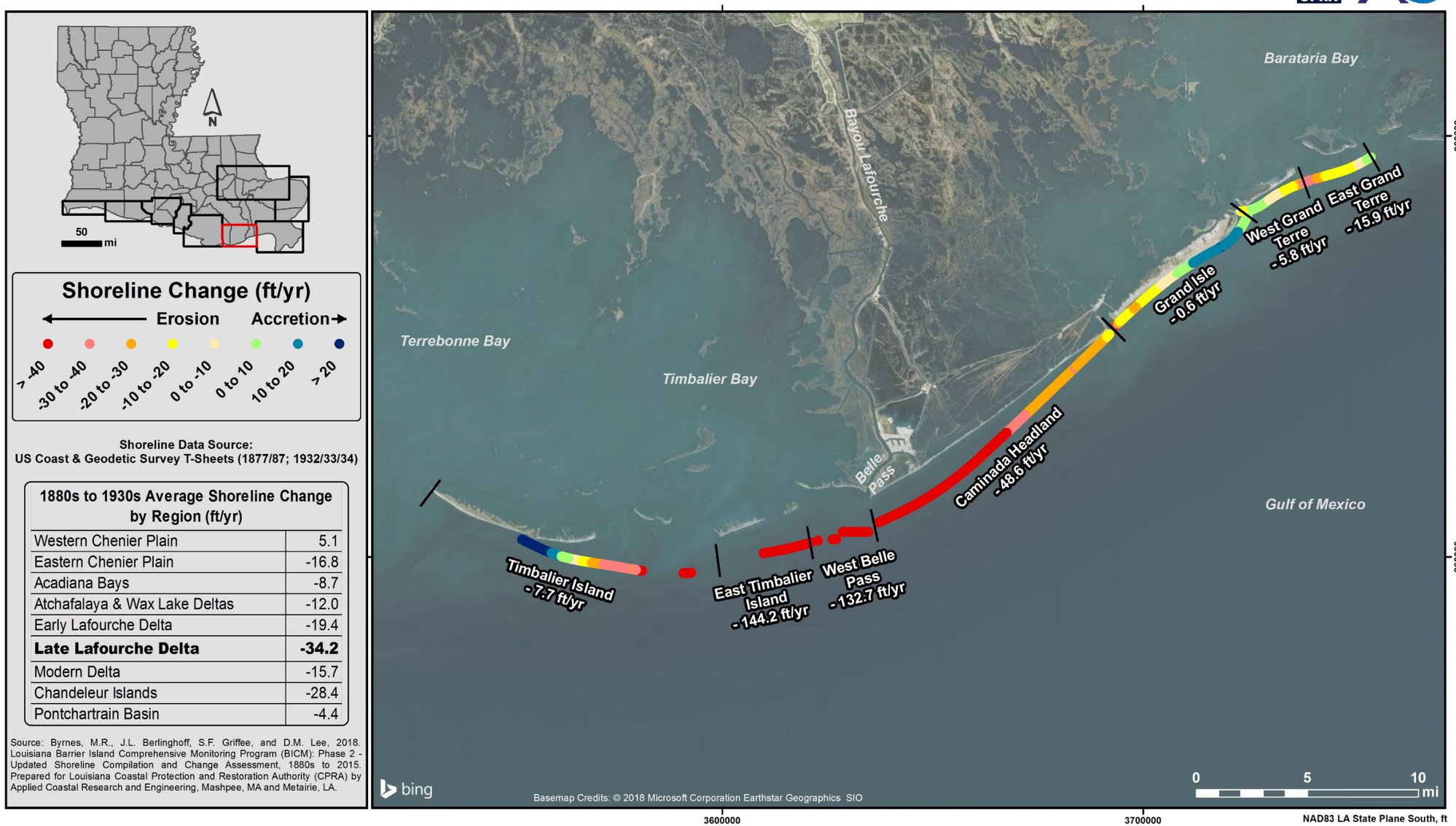
Western Chenier Plain	3.4
Eastern Chenier Plain	-18.4
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	-8.5
Early Lafourche Delta	**-19.6**
Late Lafourche Delta	-27.3
Modern Delta	-19.3
Chandeleur Islands	-31.3
Pontchartrain Basin	-5.5

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C30. Shoreline change for the Early Lafourche Delta Region, 1880s to 2015.

Louisiana Shoreline Change: Late Lafourche Delta Region, 1880s to 1930s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

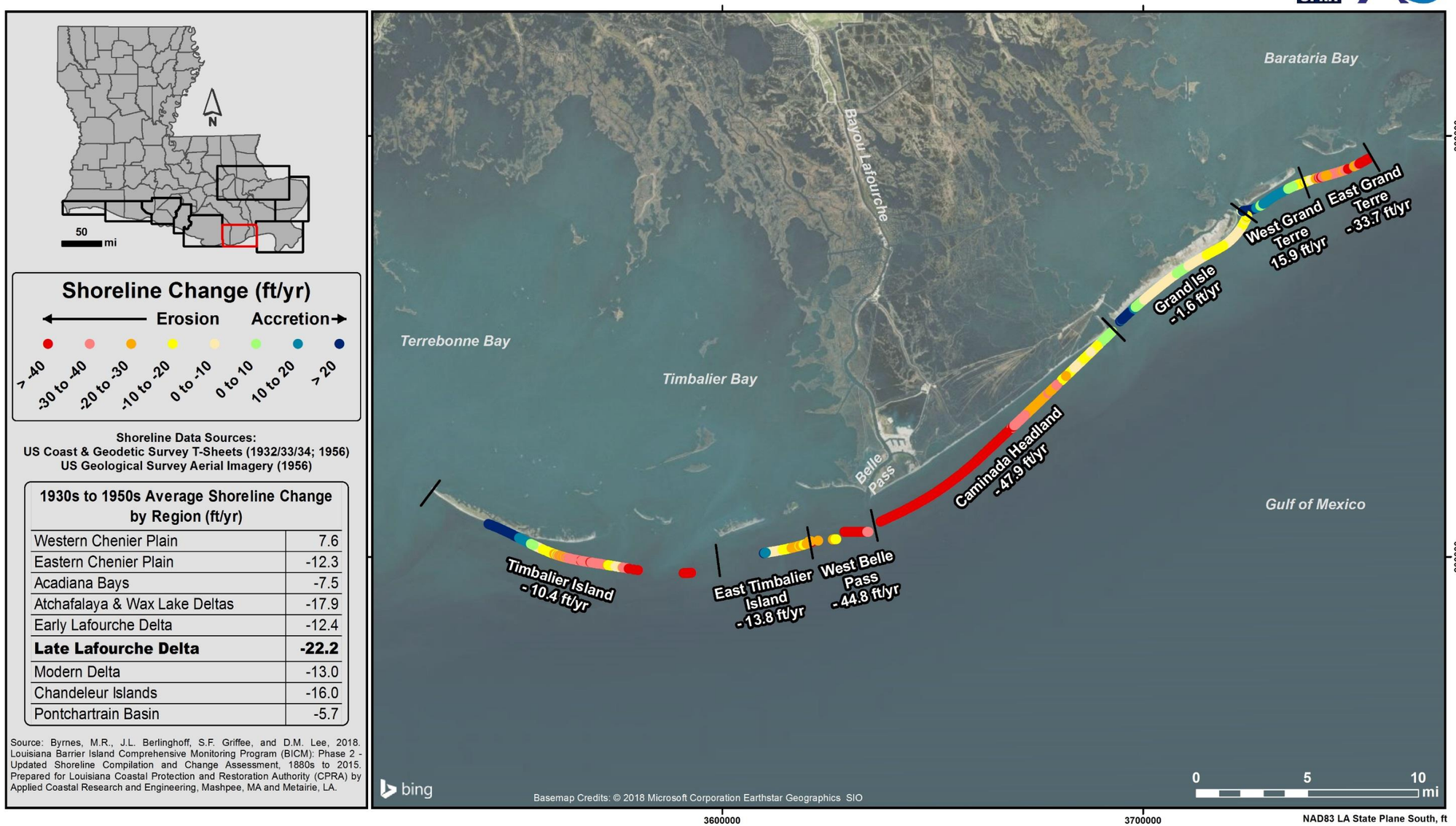


1880s to 1930s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	5.1
Eastern Chenier Plain	-16.8
Acadiana Bays	-8.7
Atchafalaya & Wax Lake Deltas	-12.0
Early Lafourche Delta	-19.4
Late Lafourche Delta	**-34.2**
Modern Delta	-15.7
Chandeleur Islands	-28.4
Pontchartrain Basin	-4.4

Figure C31. Shoreline change for the Late Lafourche Delta Region, 1880s to 1930s.

Louisiana Shoreline Change: Late Lafourche Delta Region, 1930s to 1950s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



1930s to 1950s Average Shoreline Change by Region (ft/yr)

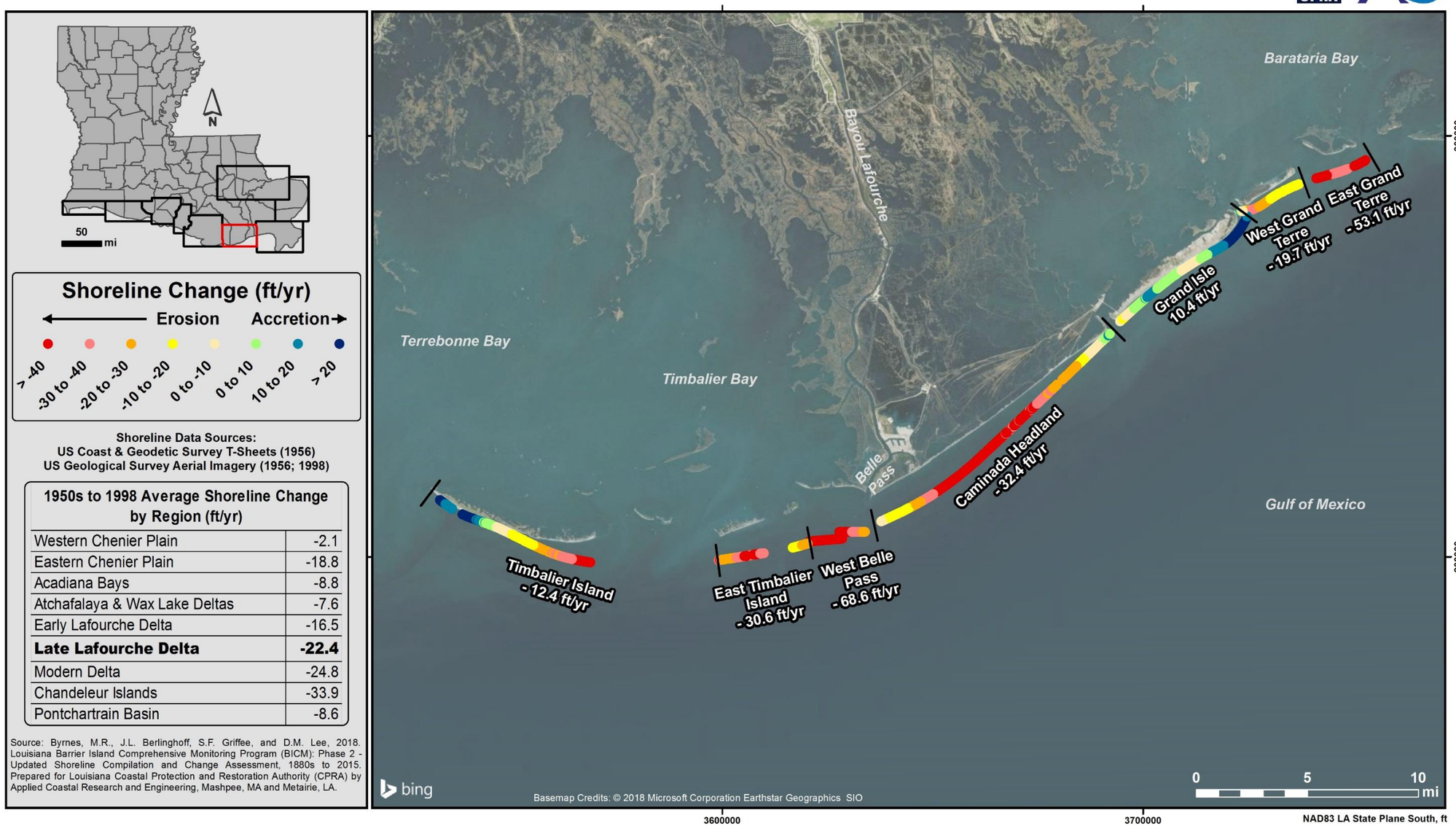
Western Chenier Plain	7.6
Eastern Chenier Plain	-12.3
Acadiana Bays	-7.5
Atchafalaya & Wax Lake Deltas	-17.9
Early Lafourche Delta	-12.4
Late Lafourche Delta	**-22.2**
Modern Delta	-13.0
Chandeleur Islands	-16.0
Pontchartrain Basin	-5.7

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C32. Shoreline change for the Late Lafourche Delta Region, 1930s to 1950s.

Louisiana Shoreline Change: Late Lafourche Delta Region, 1950s to 1998

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

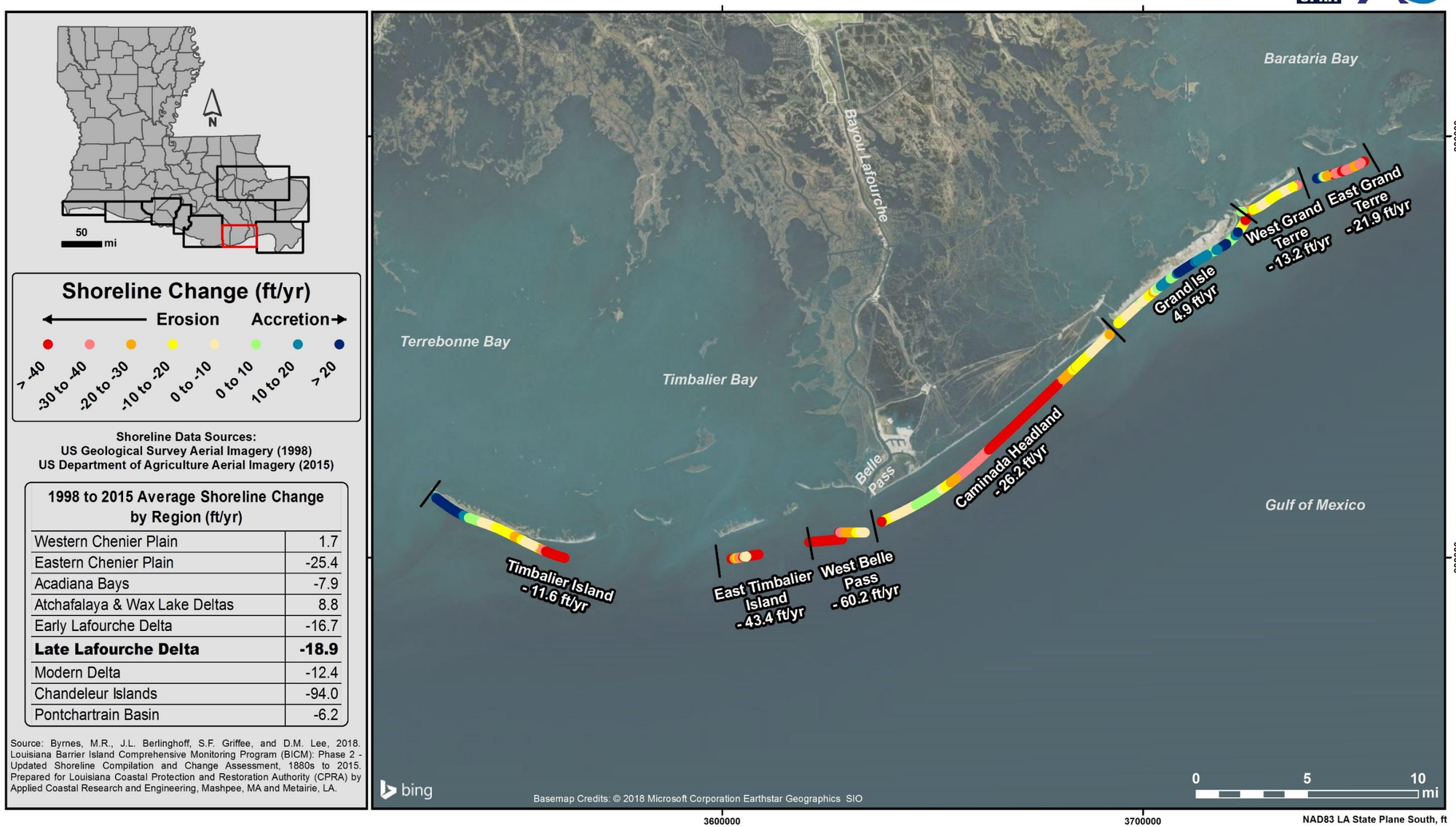


1950s to 1998 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.1
Eastern Chenier Plain	-18.8
Acadiana Bays	-8.8
Atchafalaya & Wax Lake Deltas	-7.6
Early Lafourche Delta	-16.5
Late Lafourche Delta	**-22.4**
Modern Delta	-24.8
Chandeleur Islands	-33.9
Pontchartrain Basin	-8.6

Figure C33. Shoreline change for the Late Lafourche Delta Region, 1950s to 1998.

Louisiana Shoreline Change: Late Lafourche Delta Region, 1998 to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

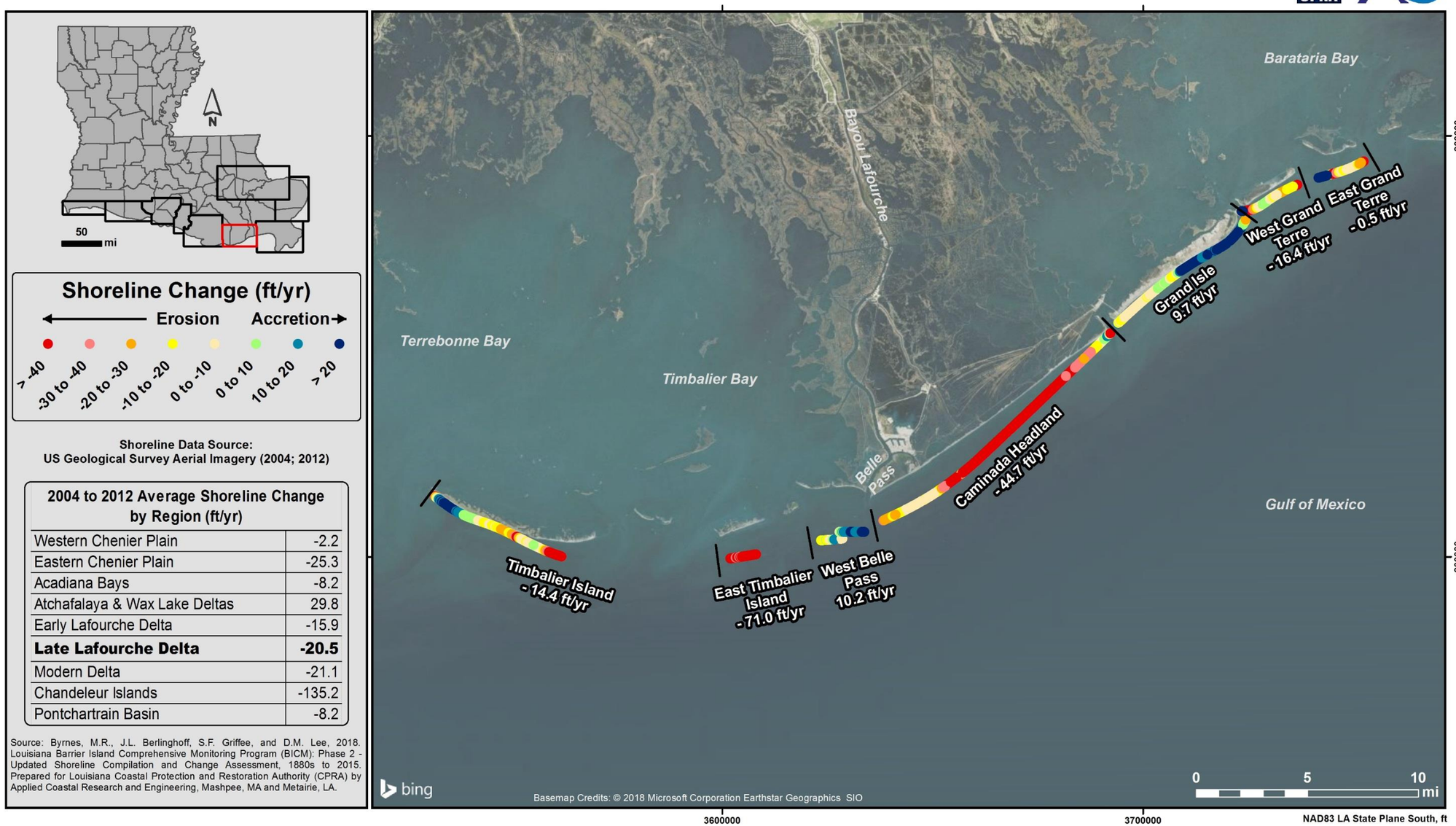


1998 to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	1.7
Eastern Chenier Plain	-25.4
Acadiana Bays	-7.9
Atchafalaya & Wax Lake Deltas	8.8
Early Lafourche Delta	-16.7
Late Lafourche Delta	**-18.9**
Modern Delta	-12.4
Chandeleur Islands	-94.0
Pontchartrain Basin	-6.2

Figure C34. Shoreline change for the Late Lafourche Delta Region, 1998 to 2015.

Louisiana Shoreline Change: Late Lafourche Delta Region, 2004 to 2012

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

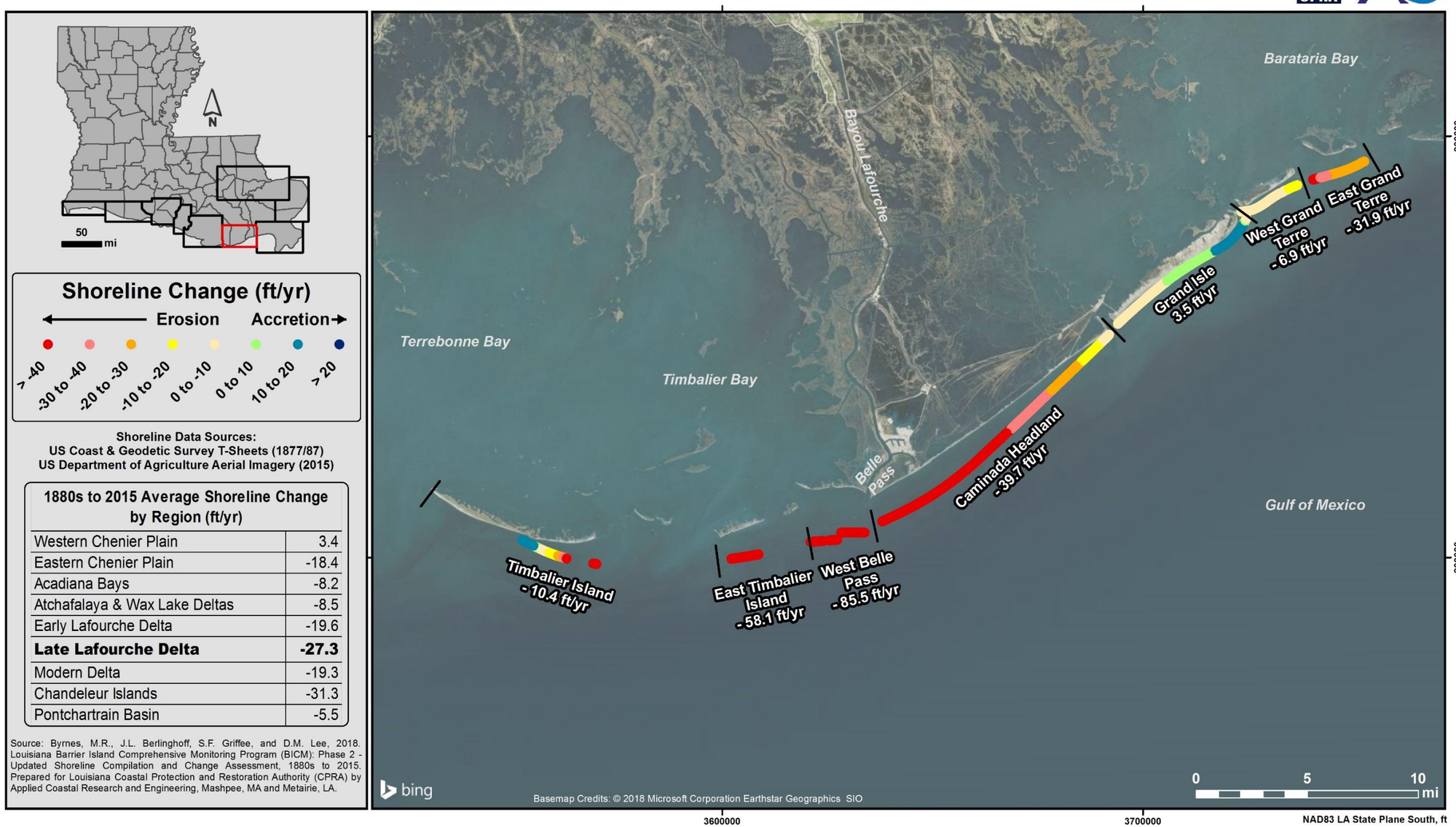


2004 to 2012 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.2
Eastern Chenier Plain	-25.3
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	29.8
Early Lafourche Delta	-15.9
Late Lafourche Delta	**-20.5**
Modern Delta	-21.1
Chandeleur Islands	-135.2
Pontchartrain Basin	-8.2

Figure C35. Shoreline change for the Late Lafourche Delta Region, 2004 to 2012.

Louisiana Shoreline Change: Late Lafourche Delta Region, 1880s to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

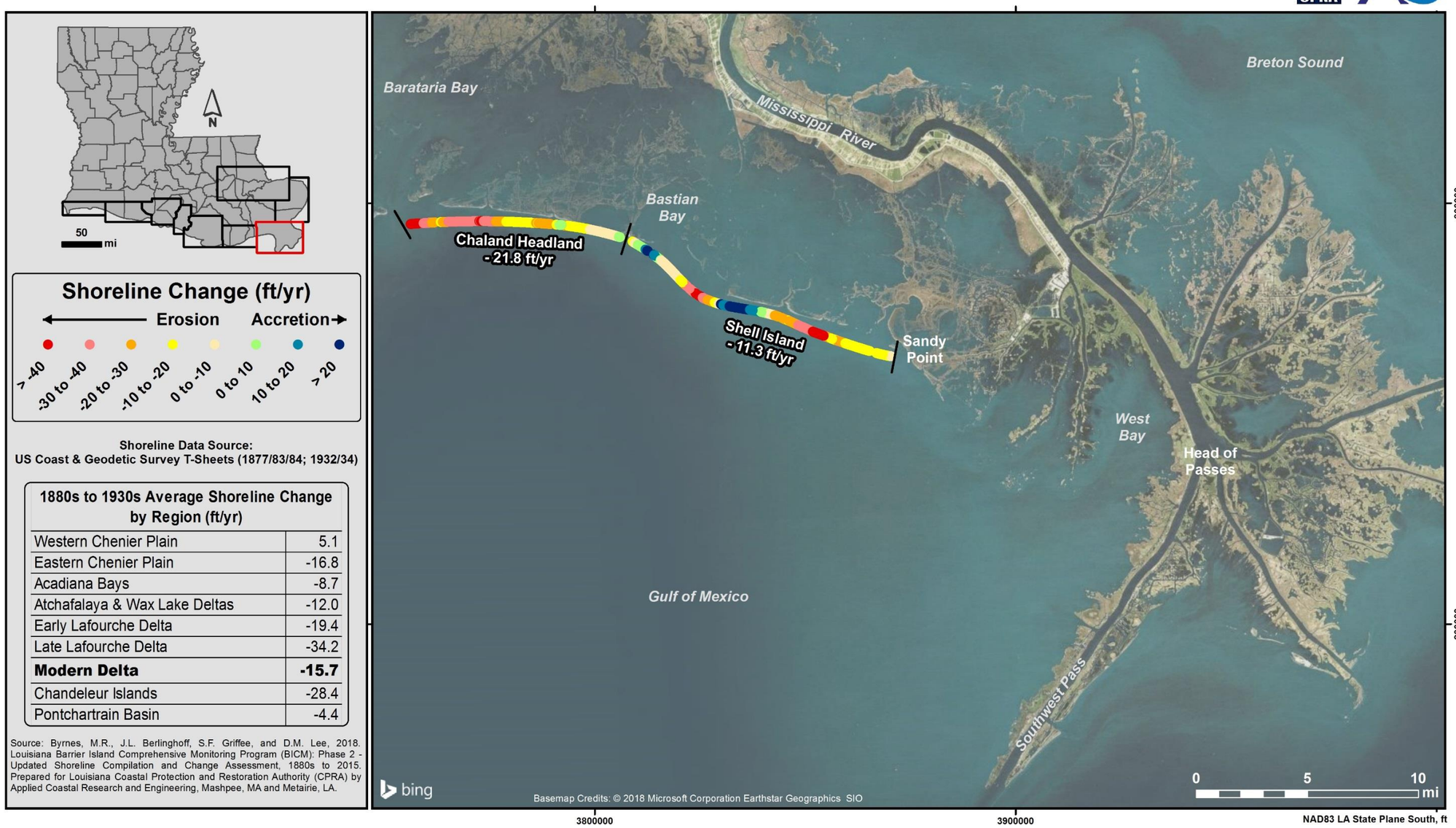


1880s to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	3.4
Eastern Chenier Plain	-18.4
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	-8.5
Early Lafourche Delta	-19.6
Late Lafourche Delta	**-27.3**
Modern Delta	-19.3
Chandeleur Islands	-31.3
Pontchartrain Basin	-5.5

Figure C36. Shoreline change for the Late Lafourche Delta Region, 1880s to 2015.

Louisiana Shoreline Change: Modern Delta Region, 1880s to 1930s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

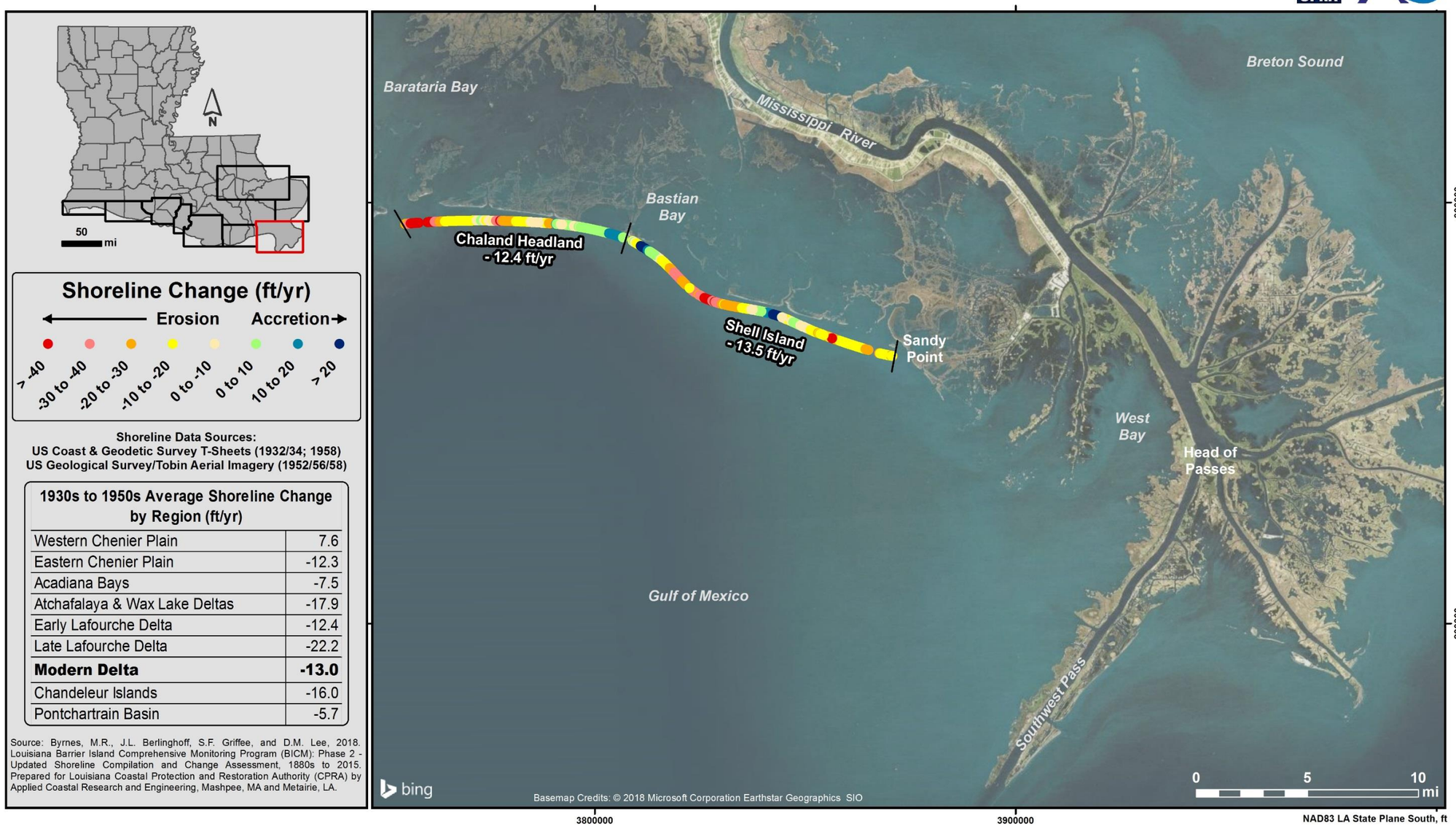


1880s to 1930s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	5.1
Eastern Chenier Plain	-16.8
Acadiana Bays	-8.7
Atchafalaya & Wax Lake Deltas	-12.0
Early Lafourche Delta	-19.4
Late Lafourche Delta	-34.2
Modern Delta	**-15.7**
Chandeleur Islands	-28.4
Pontchartrain Basin	-4.4

Figure C37. Shoreline change for the Modern Delta Region, 1880s to 1930s.

Louisiana Shoreline Change: Modern Delta Region, 1930s to 1950s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

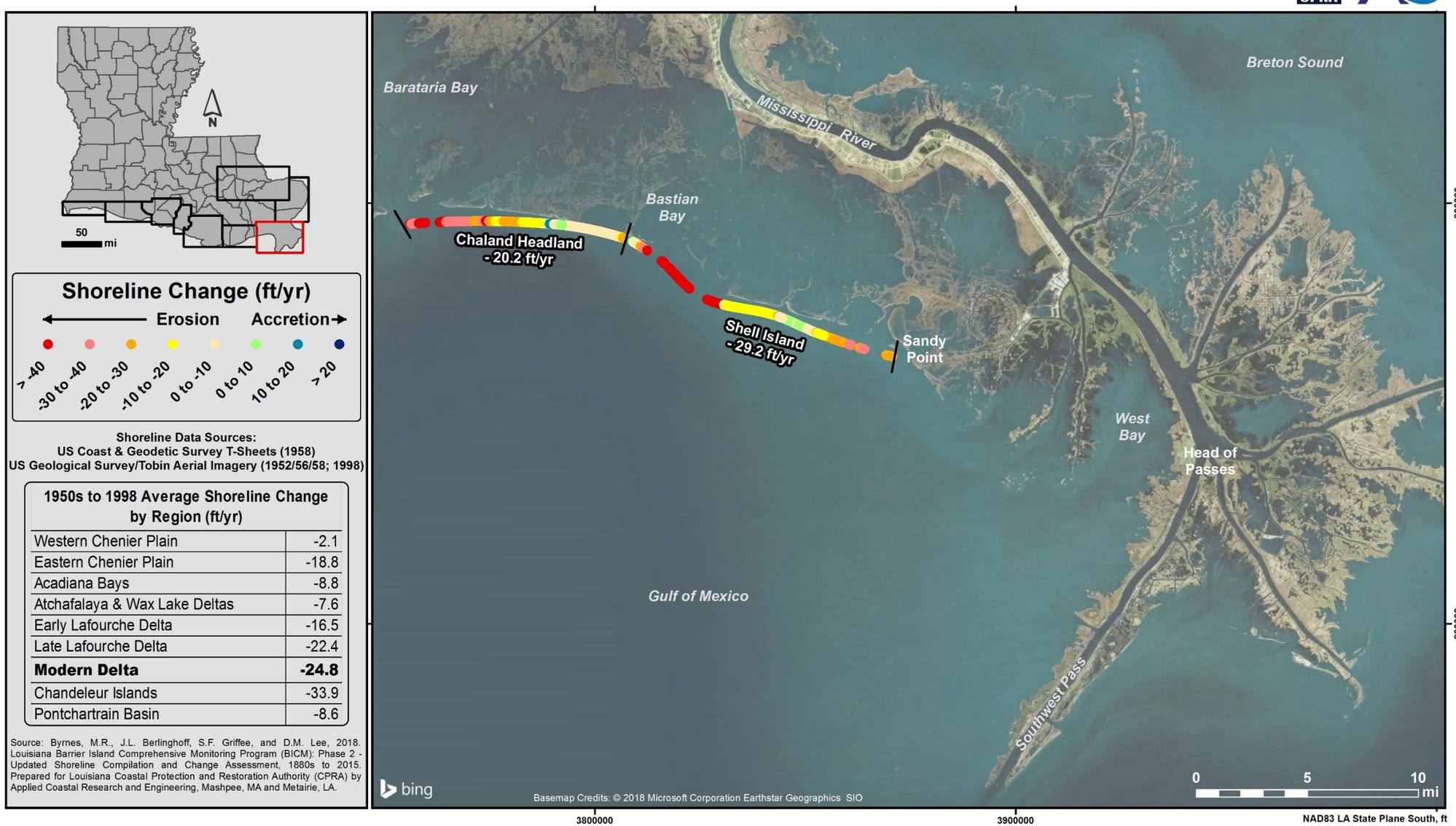


1930s to 1950s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	7.6
Eastern Chenier Plain	-12.3
Acadiana Bays	-7.5
Atchafalaya & Wax Lake Deltas	-17.9
Early Lafourche Delta	-12.4
Late Lafourche Delta	-22.2
Modern Delta	**-13.0**
Chandeleur Islands	-16.0
Pontchartrain Basin	-5.7

Figure C38. Shoreline change for the Modern Delta Region, 1930s to 1950s.

Louisiana Shoreline Change: Modern Delta Region, 1950s to 1998

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

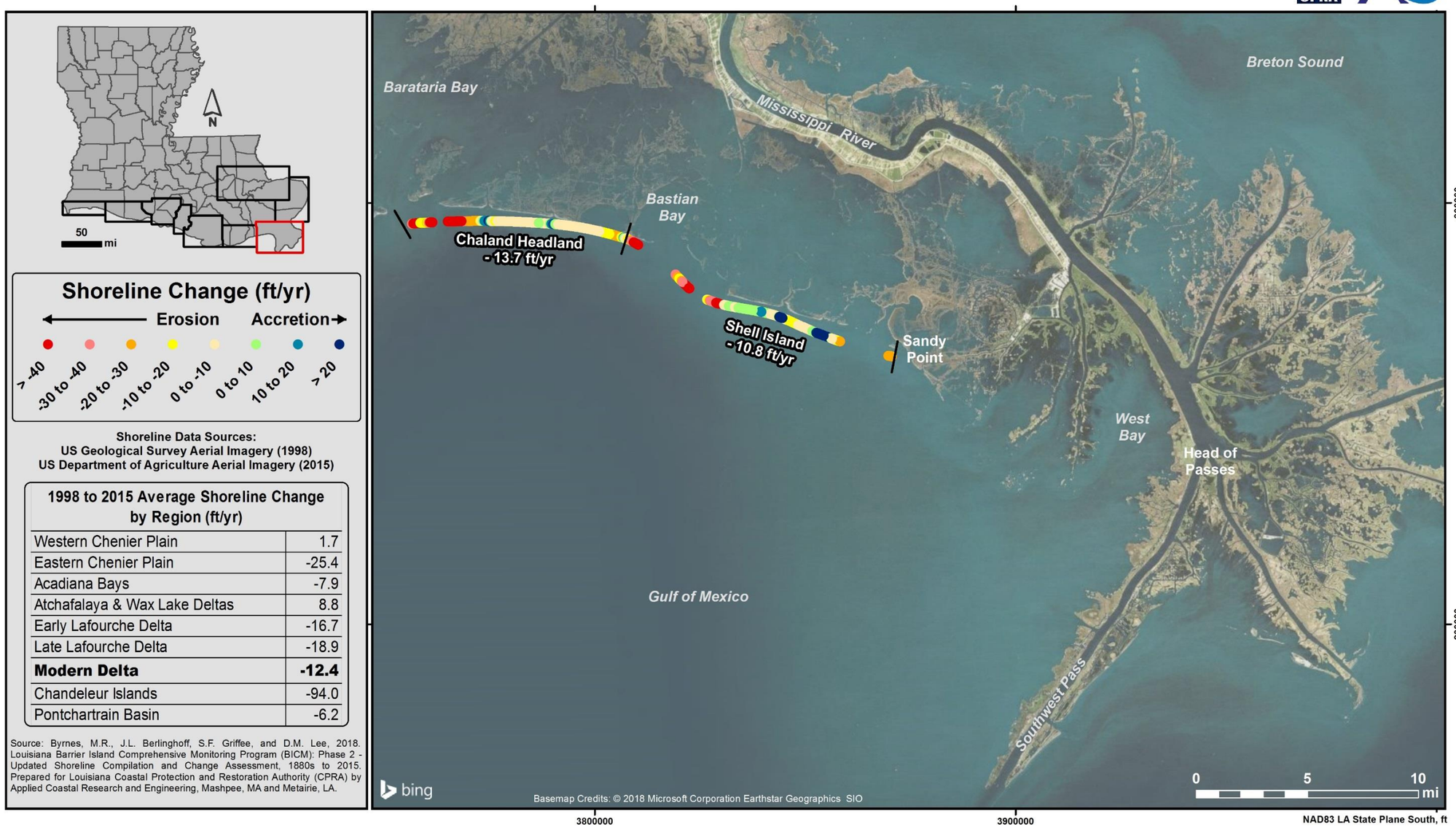


1950s to 1998 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.1
Eastern Chenier Plain	-18.8
Acadiana Bays	-8.8
Atchafalaya & Wax Lake Deltas	-7.6
Early Lafourche Delta	-16.5
Late Lafourche Delta	-22.4
Modern Delta	**-24.8**
Chandeleur Islands	-33.9
Pontchartrain Basin	-8.6

Figure C39. Shoreline change for the Modern Delta Region, 1950s to 1998.

Louisiana Shoreline Change: Modern Delta Region, 1998 to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

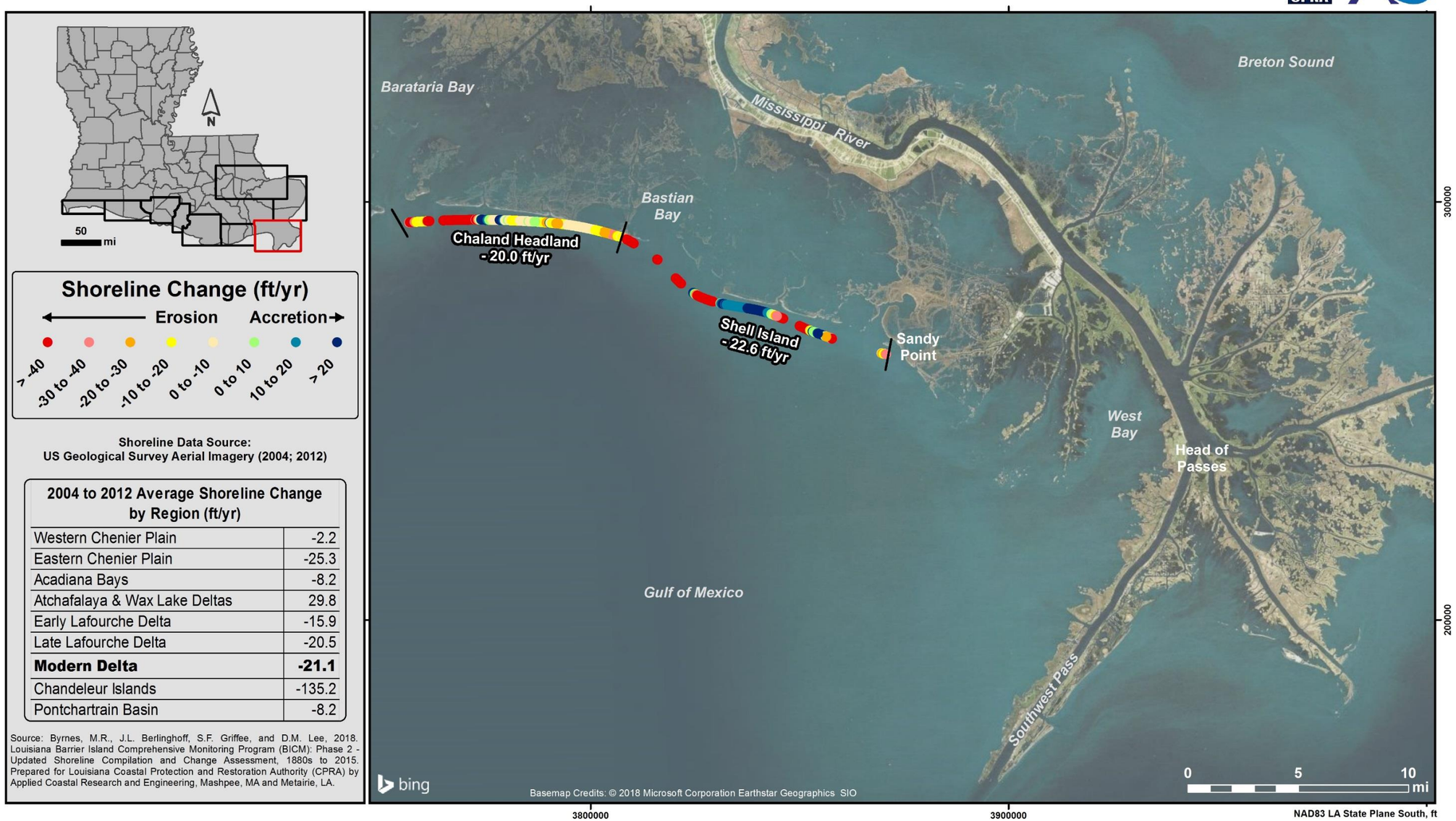


1998 to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	1.7
Eastern Chenier Plain	-25.4
Acadiana Bays	-7.9
Atchafalaya & Wax Lake Deltas	8.8
Early Lafourche Delta	-16.7
Late Lafourche Delta	-18.9
Modern Delta	**-12.4**
Chandeleur Islands	-94.0
Pontchartrain Basin	-6.2

Figure C40. Shoreline change for the Modern Delta Region, 1998 to 2015.

Louisiana Shoreline Change: Modern Delta Region, 2004 to 2012

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

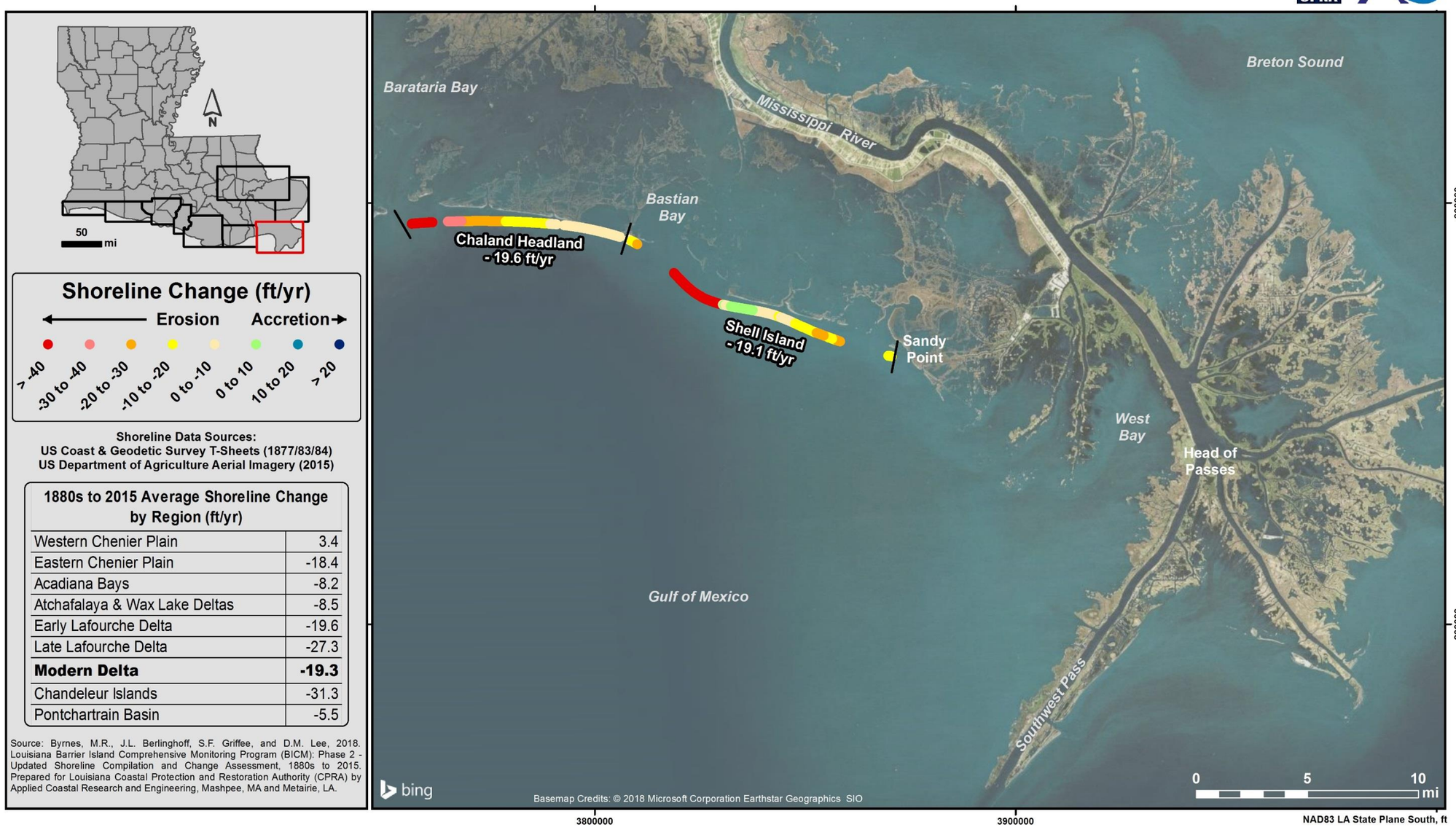


2004 to 2012 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.2
Eastern Chenier Plain	-25.3
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	29.8
Early Lafourche Delta	-15.9
Late Lafourche Delta	-20.5
Modern Delta	**-21.1**
Chandeleur Islands	-135.2
Pontchartrain Basin	-8.2

Figure C41. Shoreline change for the Modern Delta Region, 2004 to 2012.

Louisiana Shoreline Change: Modern Delta Region, 1880s to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

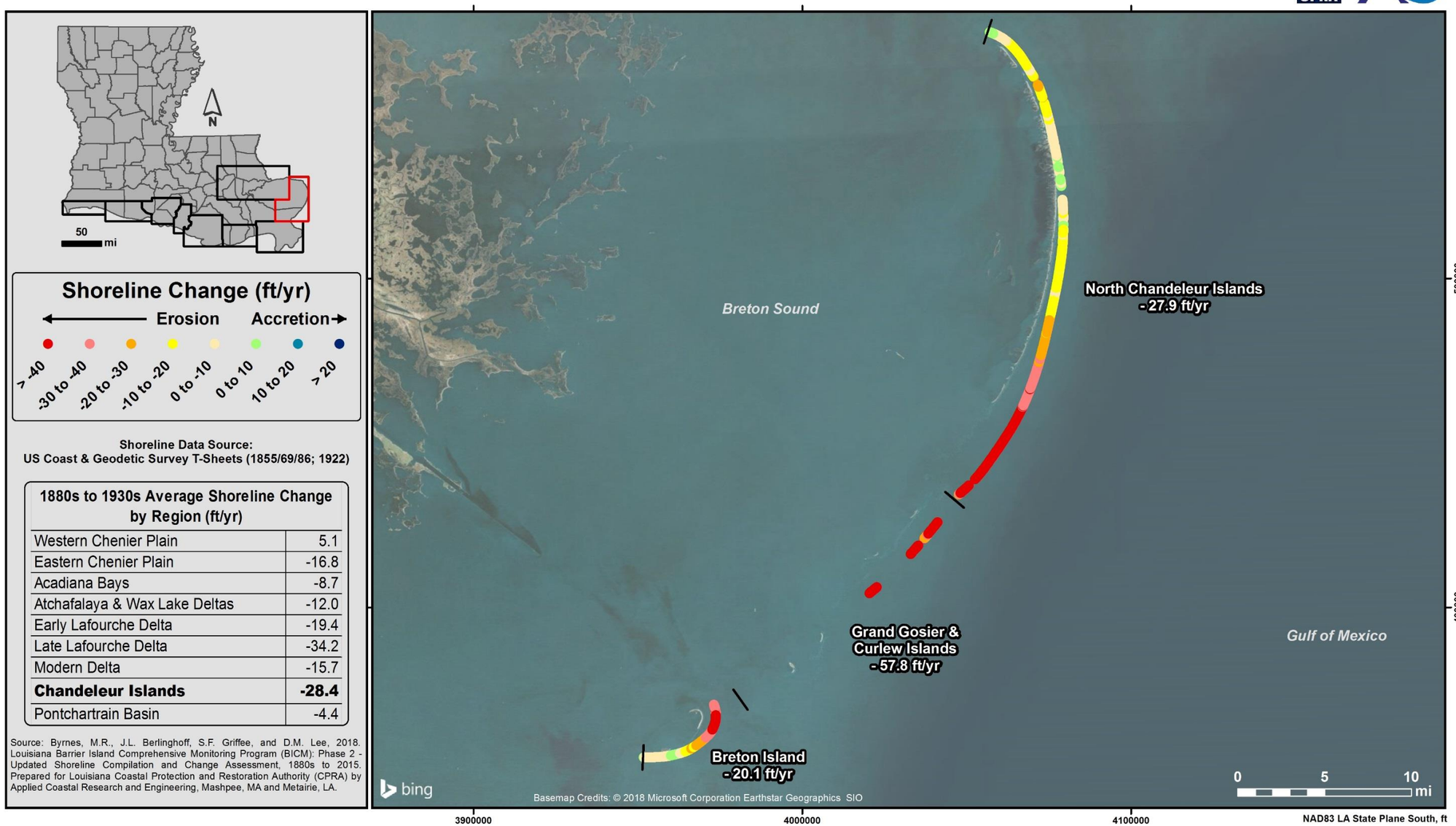


1880s to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	3.4
Eastern Chenier Plain	-18.4
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	-8.5
Early Lafourche Delta	-19.6
Late Lafourche Delta	-27.3
Modern Delta	**-19.3**
Chandeleur Islands	-31.3
Pontchartrain Basin	-5.5

Figure C42. Shoreline change for the Modern Delta Region, 1880s to 2015.

Louisiana Shoreline Change: Chandeleur Islands Region, 1880s to 1930s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



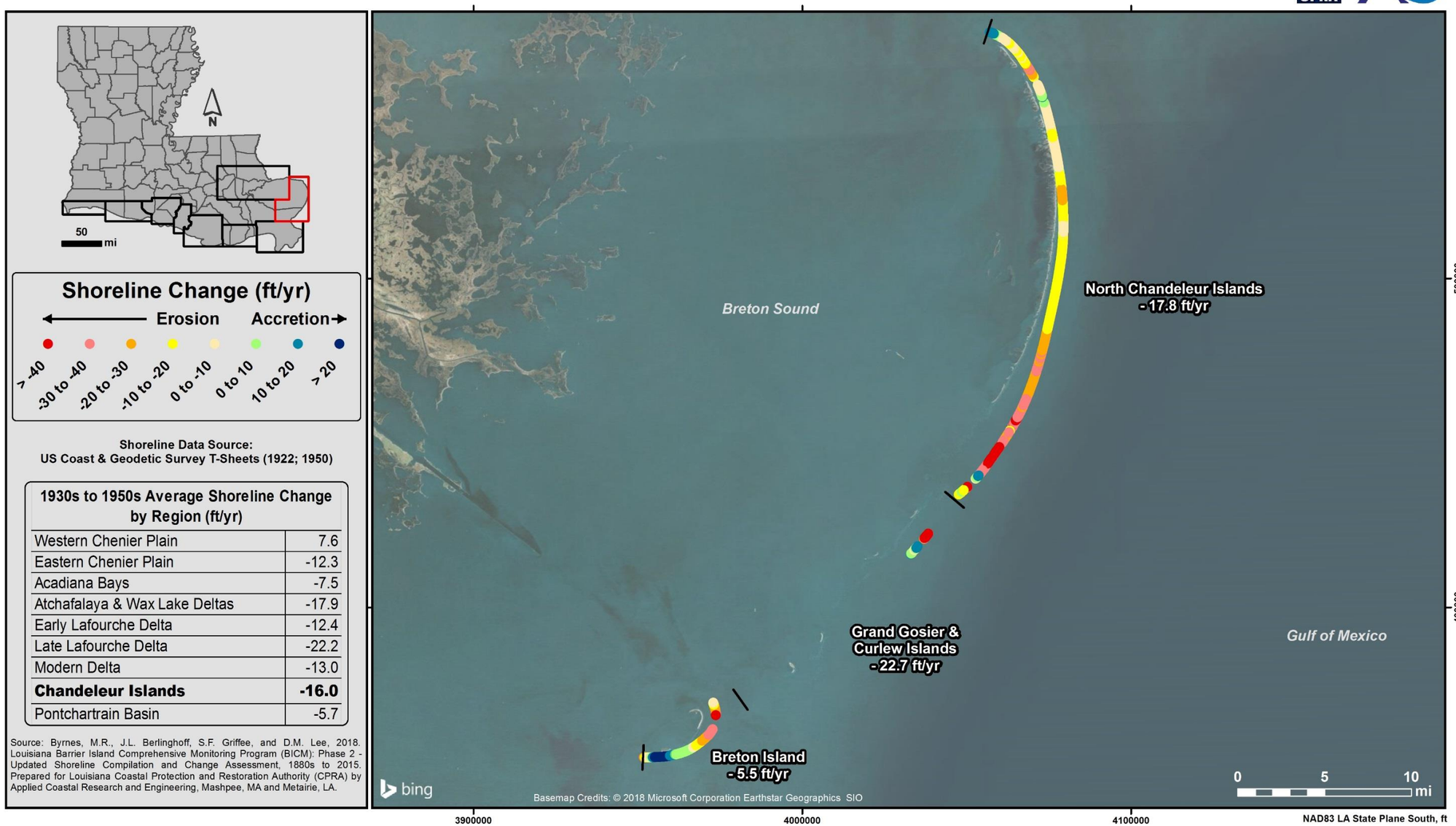
1880s to 1930s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	5.1
Eastern Chenier Plain	-16.8
Acadiana Bays	-8.7
Atchafalaya & Wax Lake Deltas	-12.0
Early Lafourche Delta	-19.4
Late Lafourche Delta	-34.2
Modern Delta	-15.7
Chandeleur Islands	**-28.4**
Pontchartrain Basin	-4.4

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C43. Shoreline change for the Chandeleur Islands Region, 1880s to 1930s.

Louisiana Shoreline Change: Chandeleur Islands Region, 1930s to 1950s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



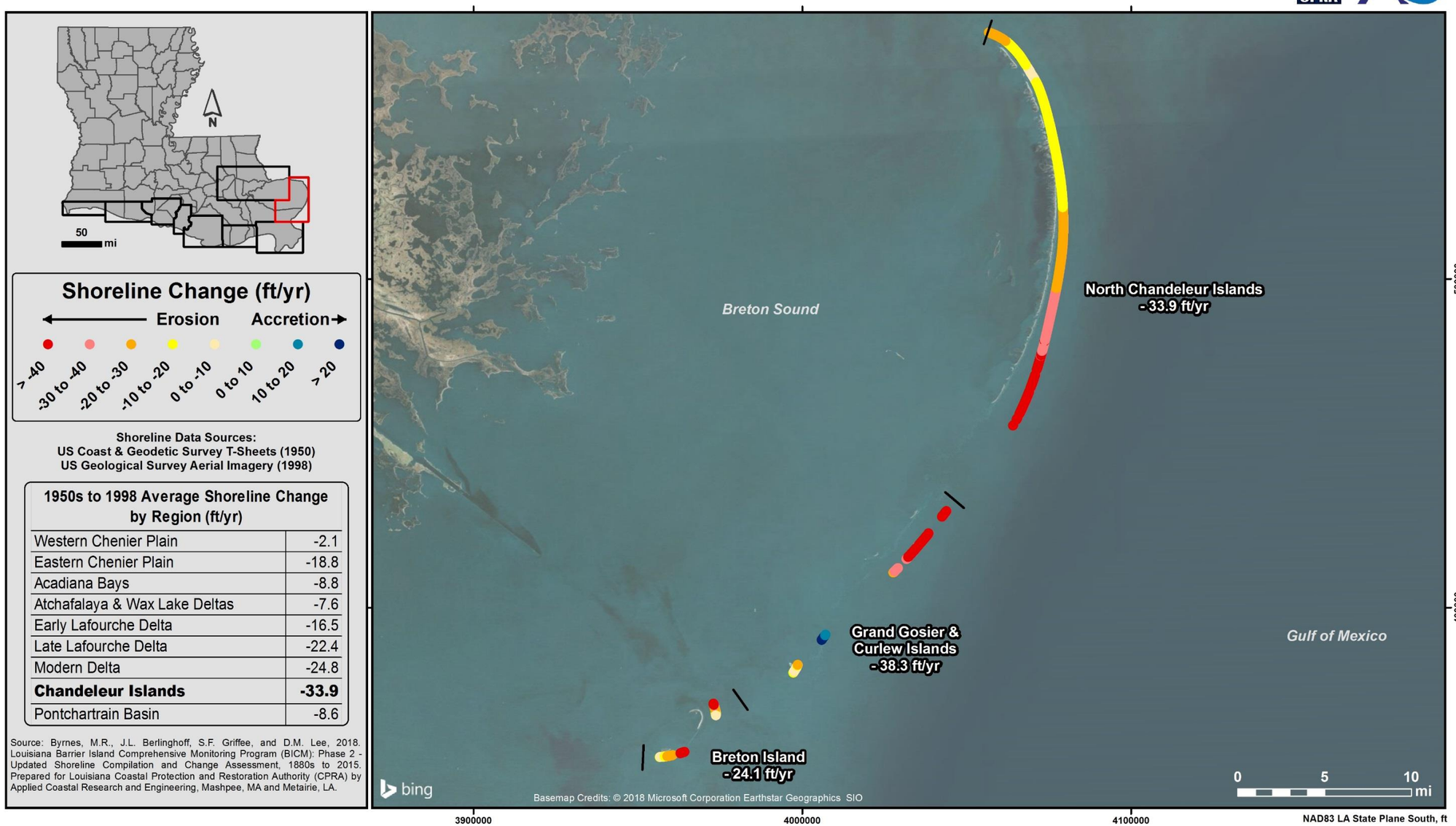
1930s to 1950s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	7.6
Eastern Chenier Plain	-12.3
Acadiana Bays	-7.5
Atchafalaya & Wax Lake Deltas	-17.9
Early Lafourche Delta	-12.4
Late Lafourche Delta	-22.2
Modern Delta	-13.0
Chandeleur Islands	**-16.0**
Pontchartrain Basin	-5.7

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C44. Shoreline change for the Chandeleur Islands Region, 1930s to 1950s.

Louisiana Shoreline Change: Chandeleur Islands Region, 1950s to 1998

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



Shoreline Data Sources:
US Coast & Geodetic Survey T-Sheets (1950)
US Geological Survey Aerial Imagery (1998)

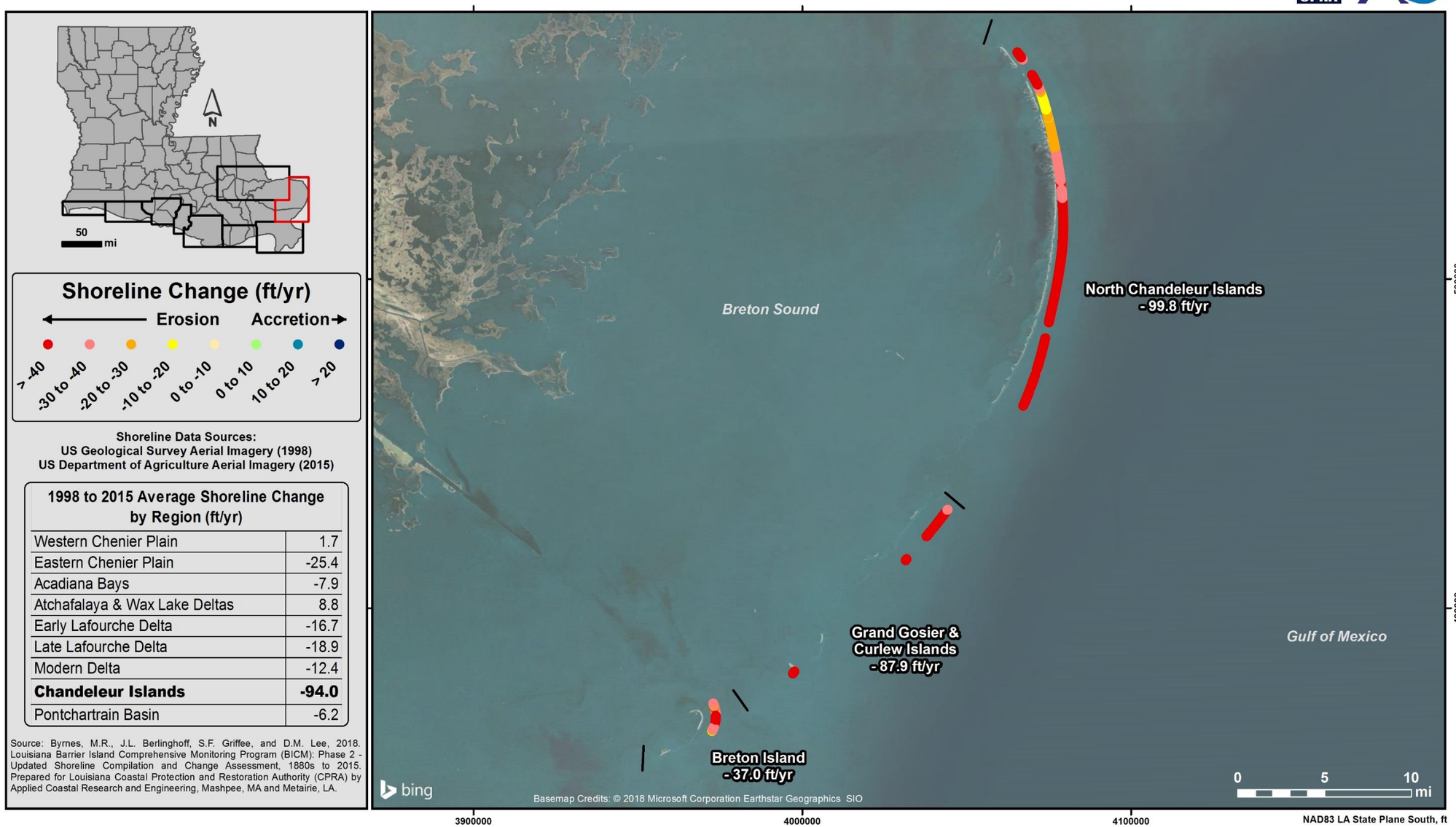
1950s to 1998 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.1
Eastern Chenier Plain	-18.8
Acadiana Bays	-8.8
Atchafalaya & Wax Lake Deltas	-7.6
Early Lafourche Delta	-16.5
Late Lafourche Delta	-22.4
Modern Delta	-24.8
Chandeleur Islands	**-33.9**
Pontchartrain Basin	-8.6

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C45. Shoreline change for the Chandeleur Islands Region, 1950s to 1998.

Louisiana Shoreline Change: Chandeleur Islands Region, 1998 to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



Shoreline Data Sources:
US Geological Survey Aerial Imagery (1998)
US Department of Agriculture Aerial Imagery (2015)

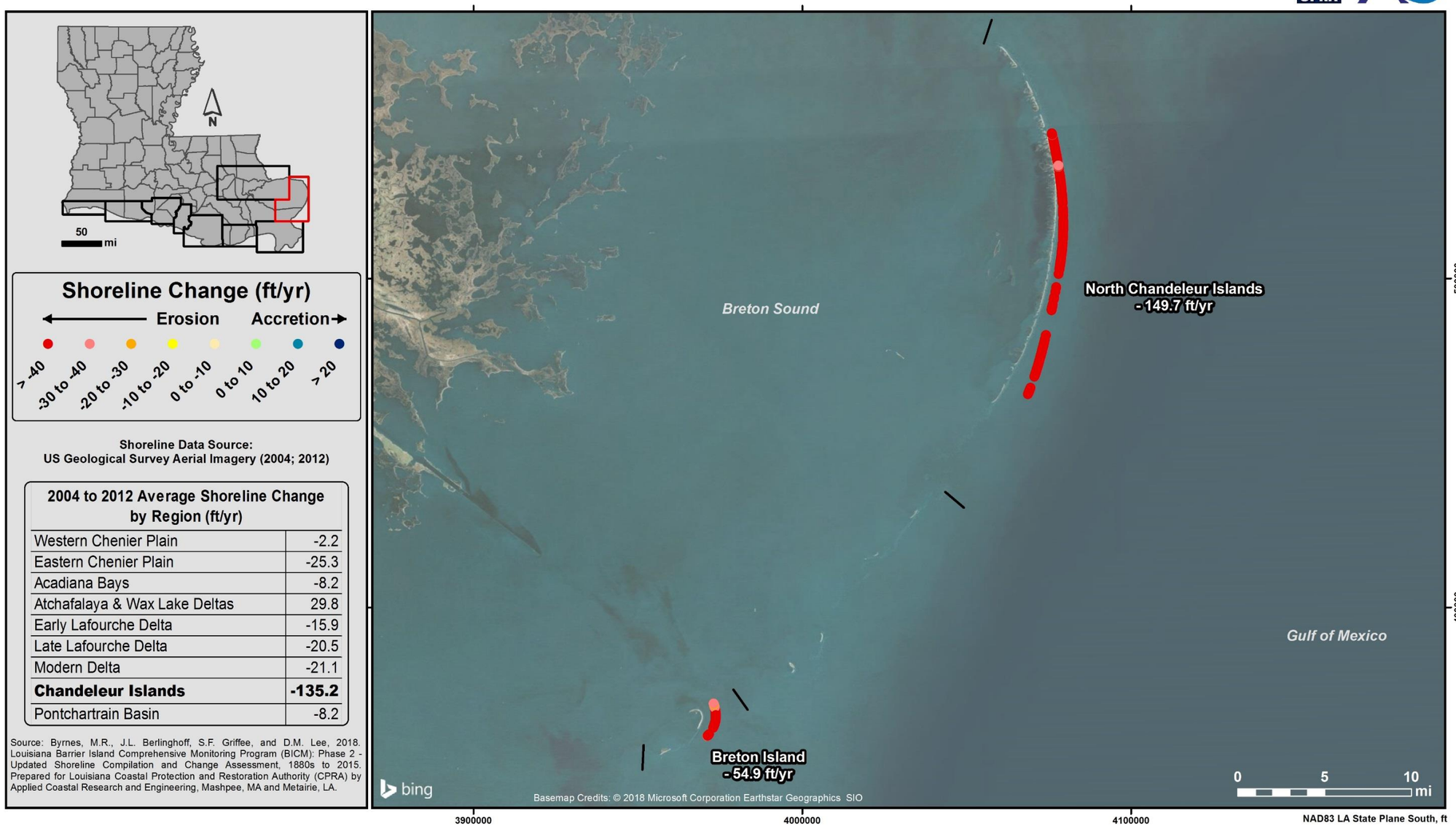
1998 to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	1.7
Eastern Chenier Plain	-25.4
Acadiana Bays	-7.9
Atchafalaya & Wax Lake Deltas	8.8
Early Lafourche Delta	-16.7
Late Lafourche Delta	-18.9
Modern Delta	-12.4
Chandeleur Islands	**-94.0**
Pontchartrain Basin	-6.2

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C46. Shoreline change for the Chandeleur Islands Region, 1998 to 2015.

Louisiana Shoreline Change: Chandeleur Islands Region, 2004 to 2012

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



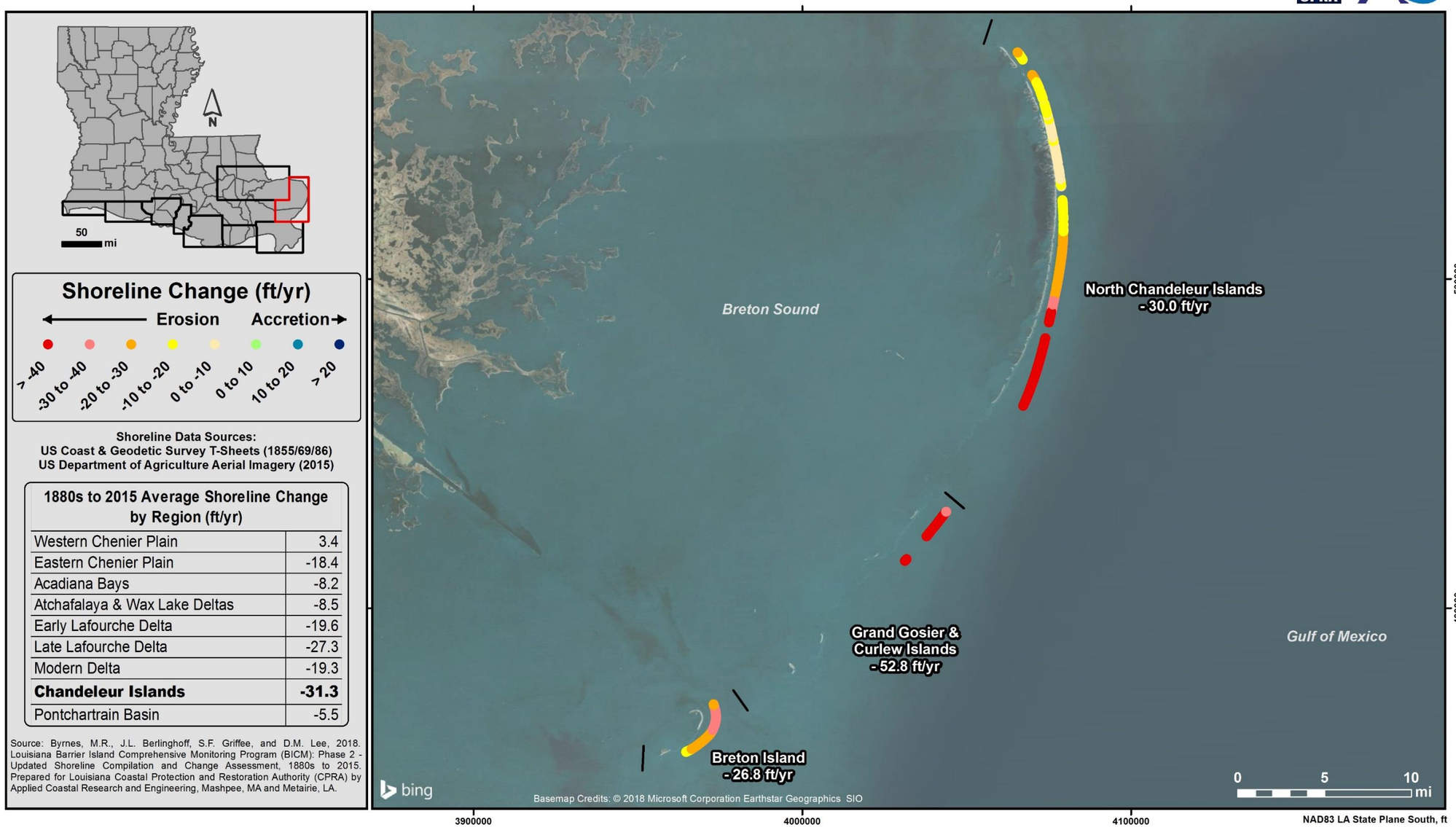
2004 to 2012 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.2
Eastern Chenier Plain	-25.3
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	29.8
Early Lafourche Delta	-15.9
Late Lafourche Delta	-20.5
Modern Delta	-21.1
Chandeleur Islands	**-135.2**
Pontchartrain Basin	-8.2

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C47. Shoreline change for the Chandeleur Islands Region, 2004 to 2012.

Louisiana Shoreline Change: Chandeleur Islands Region, 1880s to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



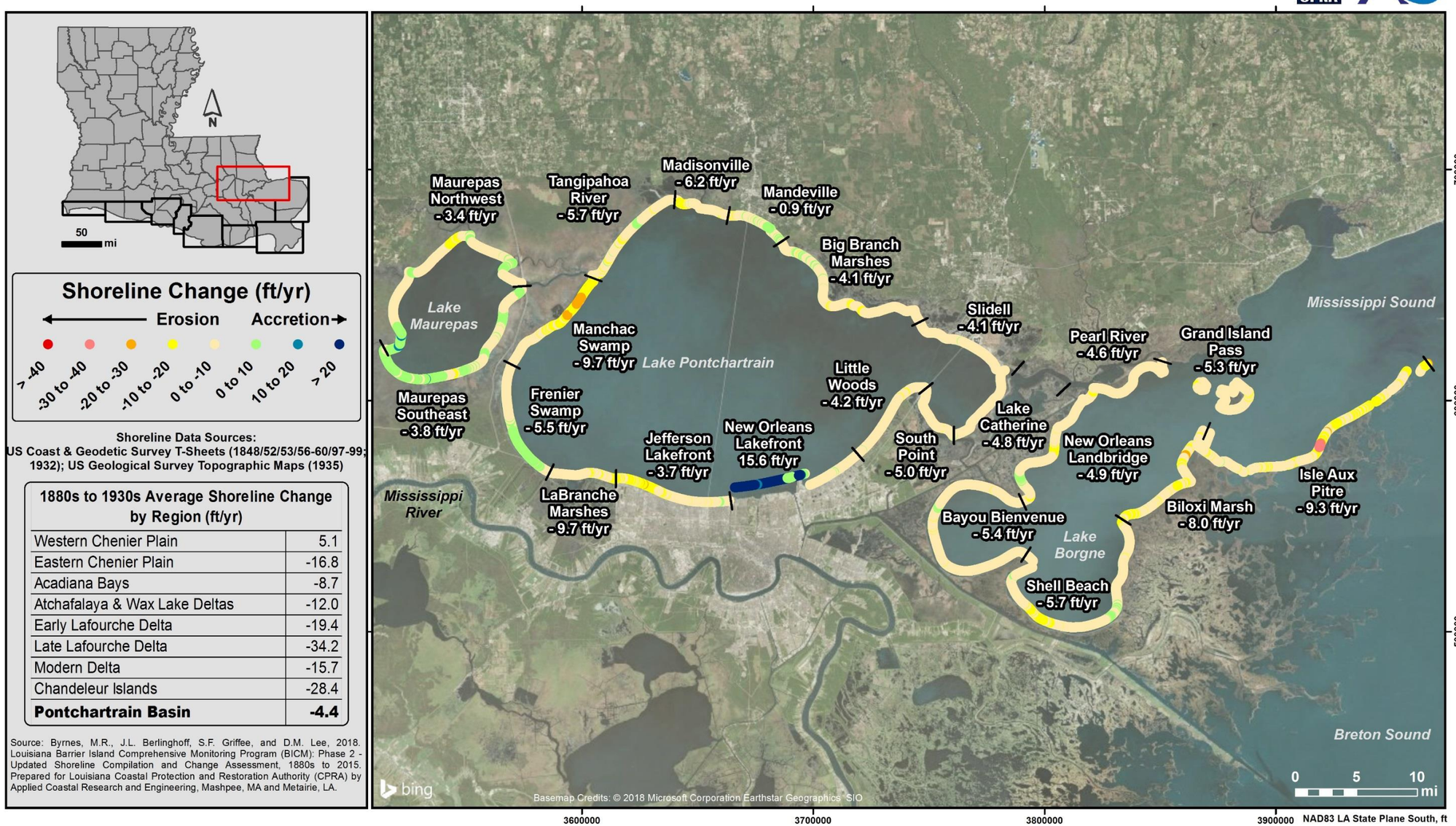
1880s to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	3.4
Eastern Chenier Plain	-18.4
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	-8.5
Early Lafourche Delta	-19.6
Late Lafourche Delta	-27.3
Modern Delta	-19.3
Chandeleur Islands	**-31.3**
Pontchartrain Basin	-5.5

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C48. Shoreline change for the Chandeleur Islands Region, 1880s to 2015.

Louisiana Shoreline Change: Pontchartrain Basin Region, 1880s to 1930s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

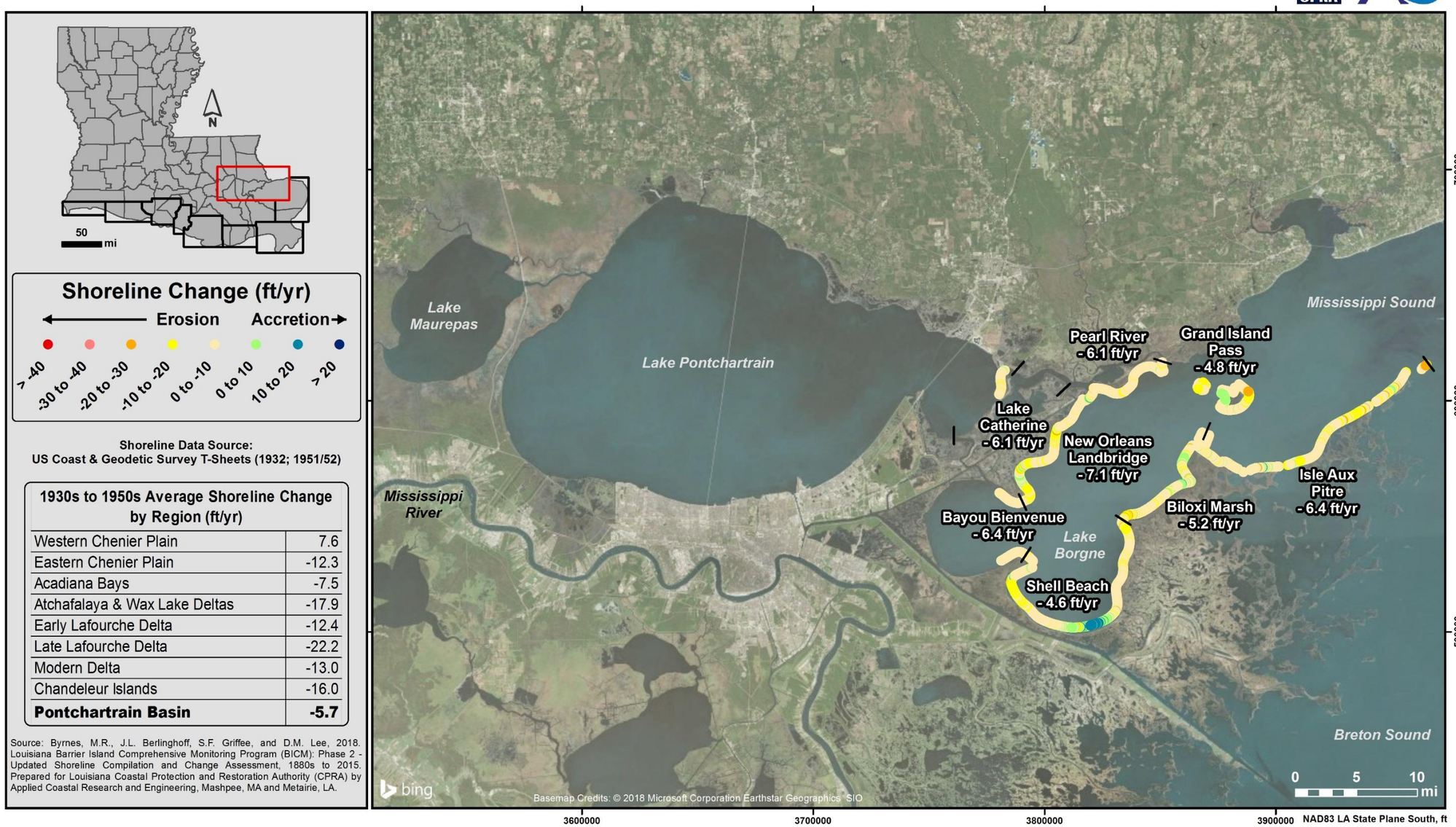


1880s to 1930s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	5.1
Eastern Chenier Plain	-16.8
Acadiana Bays	-8.7
Atchafalaya & Wax Lake Deltas	-12.0
Early Lafourche Delta	-19.4
Late Lafourche Delta	-34.2
Modern Delta	-15.7
Chandeleur Islands	-28.4
Pontchartrain Basin	**-4.4**

Figure C49. Shoreline change for the Pontchartrain Basin Region, 1880s to 1930s.

Louisiana Shoreline Change: Pontchartrain Basin Region, 1930s to 1950s

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

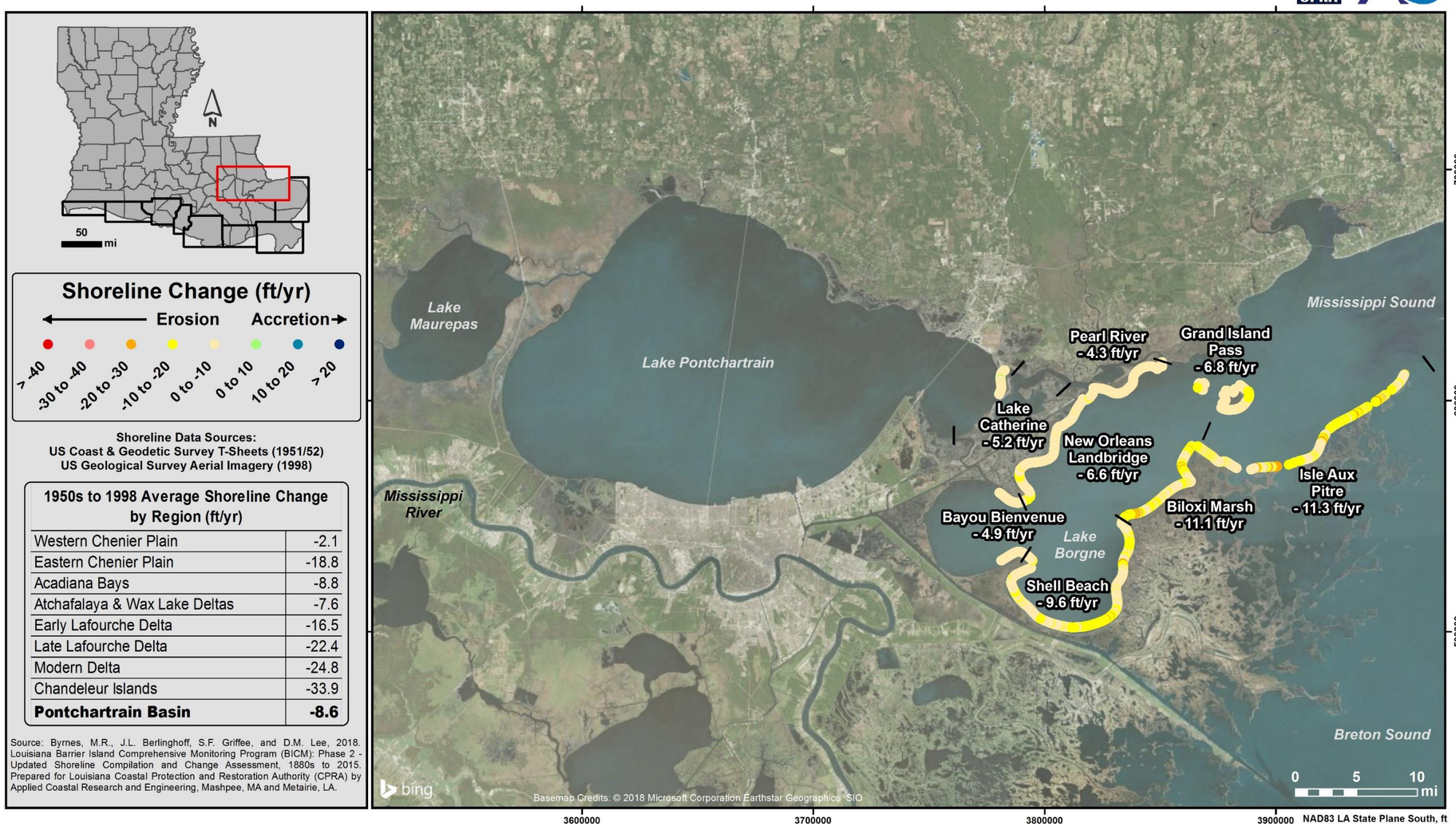


1930s to 1950s Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	7.6
Eastern Chenier Plain	-12.3
Acadiana Bays	-7.5
Atchafalaya & Wax Lake Deltas	-17.9
Early Lafourche Delta	-12.4
Late Lafourche Delta	-22.2
Modern Delta	-13.0
Chandeleur Islands	-16.0
Pontchartrain Basin	**-5.7**

Figure C50. Shoreline change for the Pontchartrain Basin Region, 1930s to 1950s.

Louisiana Shoreline Change: Pontchartrain Basin Region, 1950s to 1998

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

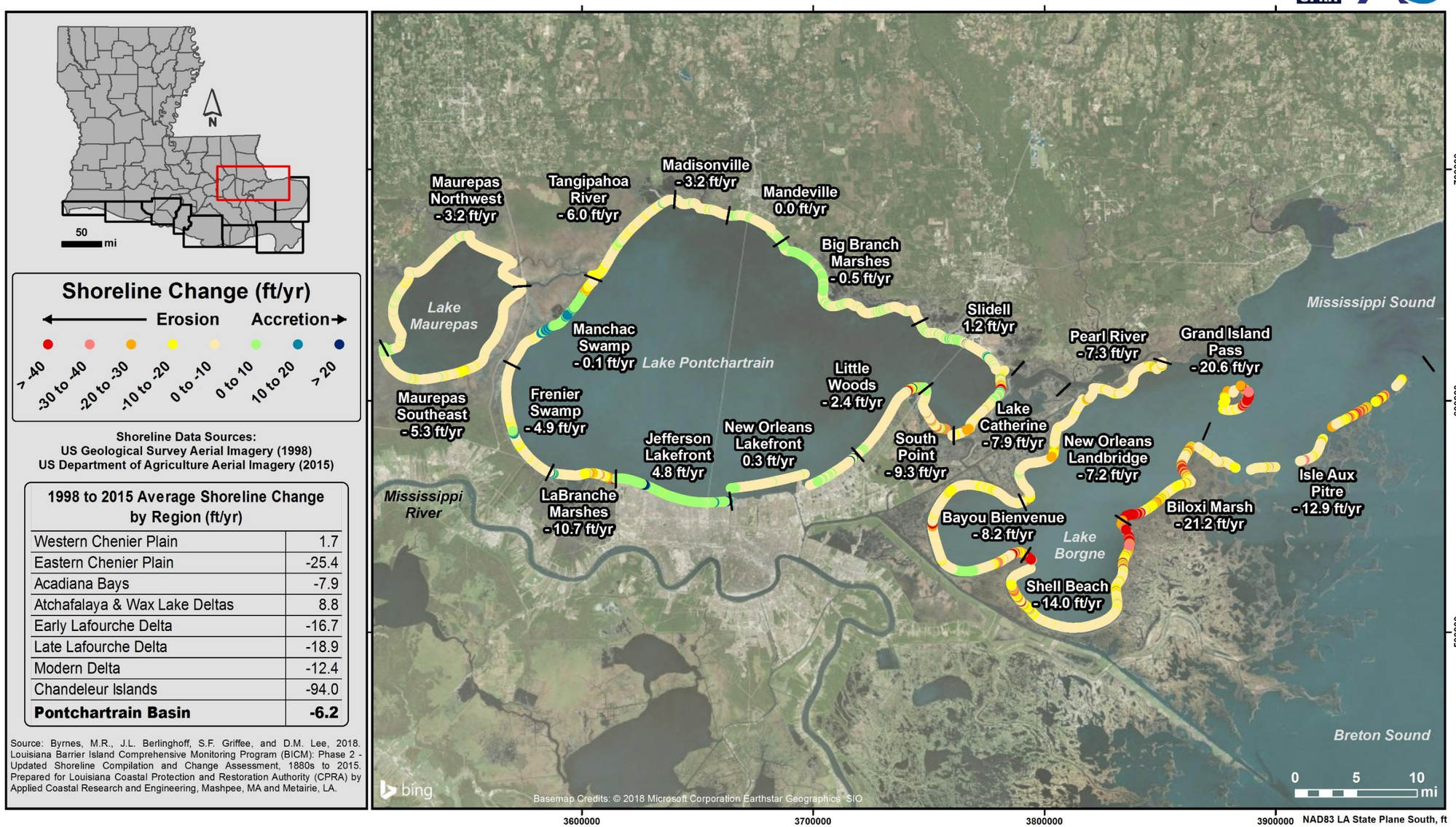


1950s to 1998 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.1
Eastern Chenier Plain	-18.8
Acadiana Bays	-8.8
Atchafalaya & Wax Lake Deltas	-7.6
Early Lafourche Delta	-16.5
Late Lafourche Delta	-22.4
Modern Delta	-24.8
Chandeleur Islands	-33.9
Pontchartrain Basin	**-8.6**

Figure C51. Shoreline change for the Pontchartrain Basin Region, 1950s to 1998.

Louisiana Shoreline Change: Pontchartrain Basin Region, 1998 to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



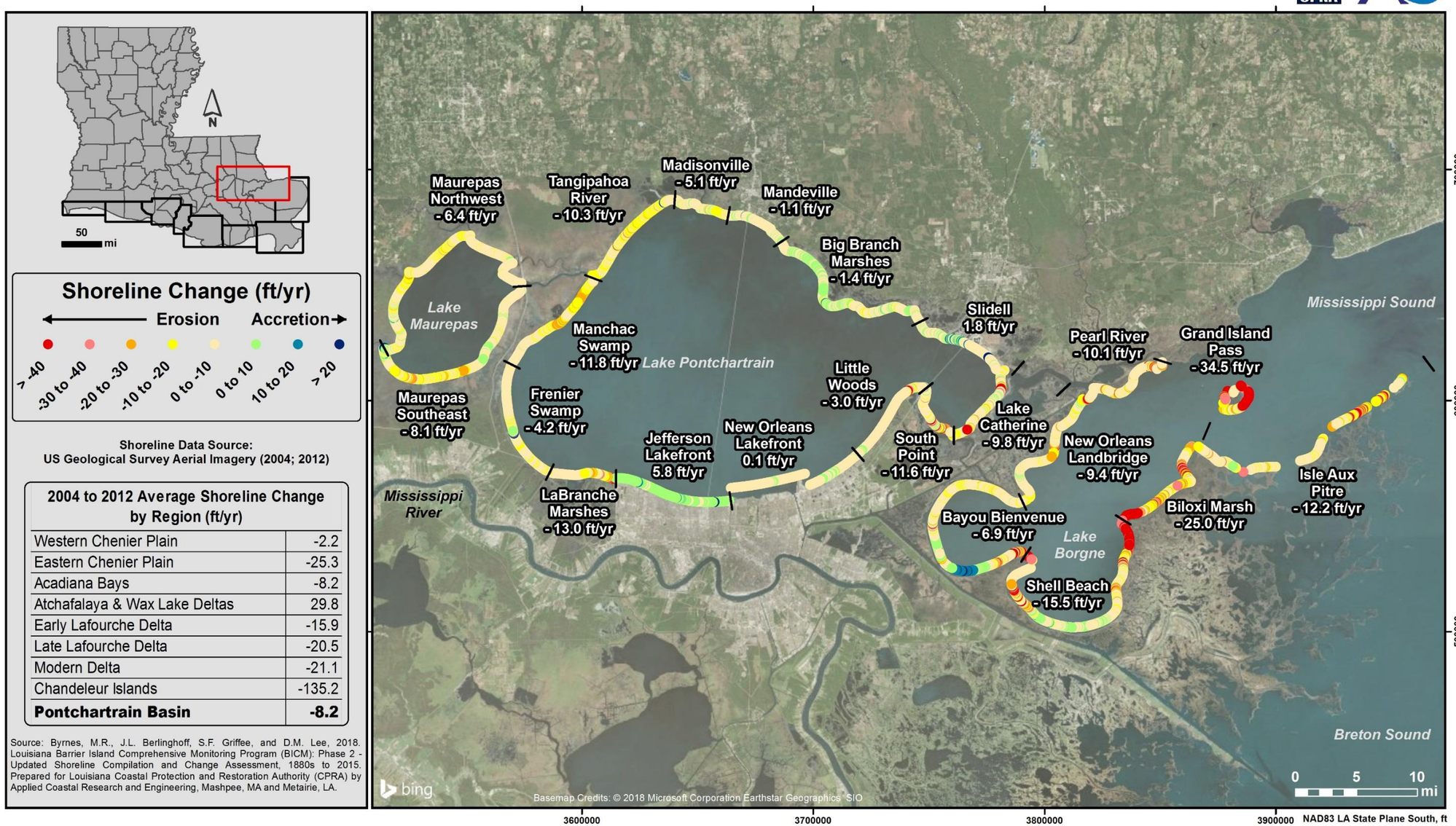
1998 to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	1.7
Eastern Chenier Plain	-25.4
Acadiana Bays	-7.9
Atchafalaya & Wax Lake Deltas	8.8
Early Lafourche Delta	-16.7
Late Lafourche Delta	-18.9
Modern Delta	-12.4
Chandeleur Islands	-94.0
Pontchartrain Basin	**-6.2**

Source: Byrnes, M.R., J.L. Berlinghoff, S.F. Griffee, and D.M. Lee, 2018. Louisiana Barrier Island Comprehensive Monitoring Program (BICM): Phase 2 - Updated Shoreline Compilation and Change Assessment, 1880s to 2015. Prepared for Louisiana Coastal Protection and Restoration Authority (CPRA) by Applied Coastal Research and Engineering, Mashpee, MA and Metairie, LA.

Figure C52. Shoreline change for the Pontchartrain Basin Region, 1998 to 2015.

Louisiana Shoreline Change: Pontchartrain Basin Region, 2004 to 2012

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2

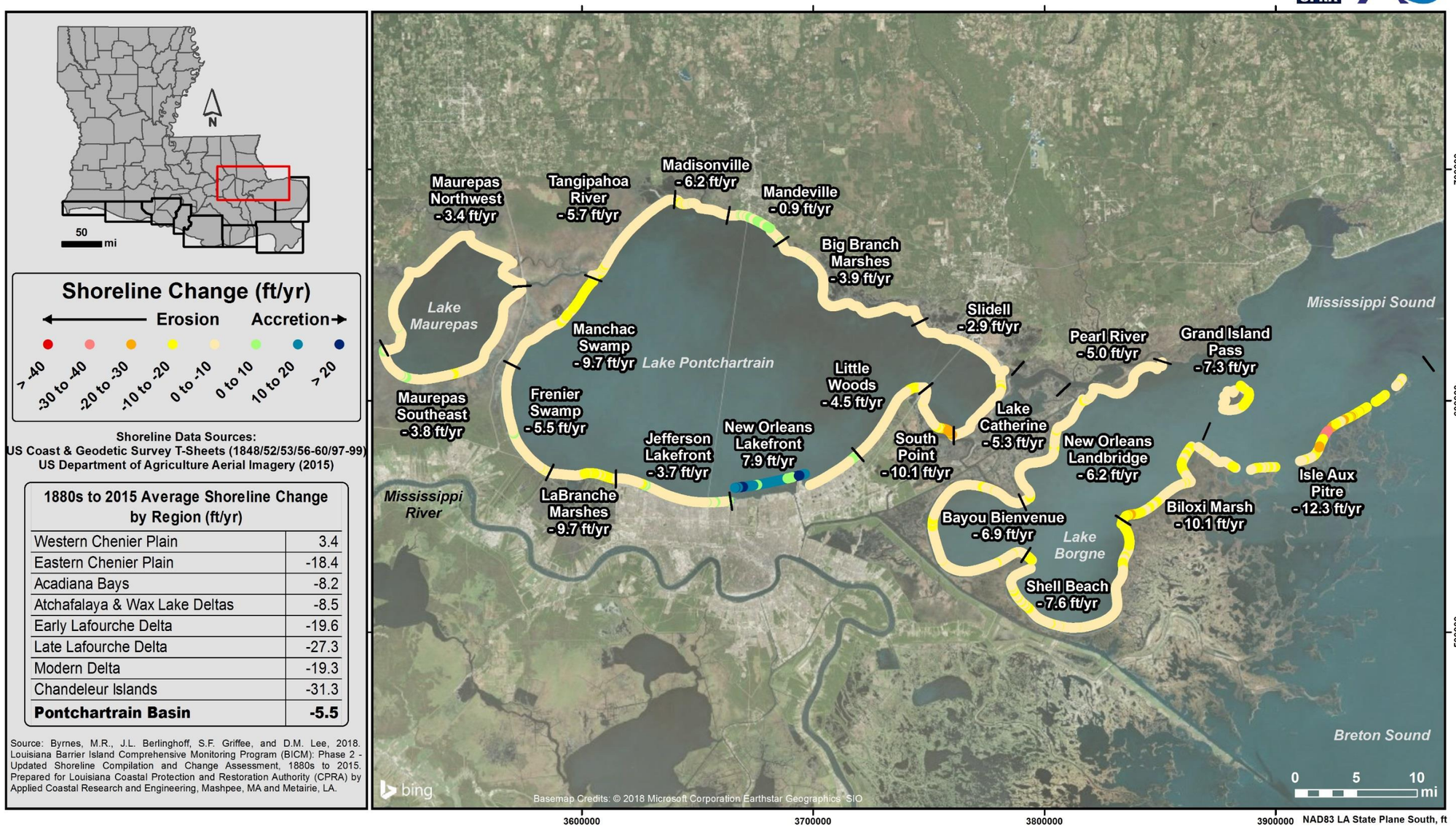


2004 to 2012 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	-2.2
Eastern Chenier Plain	-25.3
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	29.8
Early Lafourche Delta	-15.9
Late Lafourche Delta	-20.5
Modern Delta	-21.1
Chandeleur Islands	-135.2
Pontchartrain Basin	**-8.2**

Figure C53. Shoreline change for the Pontchartrain Basin Region, 2004 to 2012.

Louisiana Shoreline Change: Pontchartrain Basin Region, 1880s to 2015

Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2



1880s to 2015 Average Shoreline Change by Region (ft/yr)	
Western Chenier Plain	3.4
Eastern Chenier Plain	-18.4
Acadiana Bays	-8.2
Atchafalaya & Wax Lake Deltas	-8.5
Early Lafourche Delta	-19.6
Late Lafourche Delta	-27.3
Modern Delta	-19.3
Chandeleur Islands	-31.3
Pontchartrain Basin	**-5.5**

Figure C54. Shoreline change for the Pontchartrain Basin Region, 1880s to 2015.

Appendix D:
Shoreline Change Details by Reach and Region

Table D1. Shoreline change by reach and region for the Chenier Plain and Acadiana Bays.

Region	Reach # - Name	1880s to 1930s Change (ft/yr)					1930s to 1950s Change (ft/yr)					1950s to 1998 Change (ft/yr)					1998 to 2015 Change (ft/yr)					2004 to 2012 Change (ft/yr)					1880s to 2015 Change (ft/yr)				
		Mean	SD	Min	Max	n [1]	Mean	SD	Min	Max	n	Mean	SD	Min	Max	n	Mean	SD	Min	Max	n	Mean	SD	Min	Max	n	Mean	SD	Min	Max	n
Western Chenier Plain	1 - Johnson's Bayou	**15.5**	10.6	-3.5	91.7	425	**18.0**	11.2	3.0	54.1	431	**3.2**	8.0	-21.0	15.4	432	**11.3**	24.5	-17.7	83.0	427	**15.2**	46.9	-17.1	168.6	426	**11.6**	6.2	-1.4	44.6	422
	2 - Ocean View Beach	**-4.0**	2.9	-9.7	1.2	308	**-1.0**	2.7	-5.4	4.5	308	**-5.6**	3.4	-13.7	-0.6	308	**4.1**	7.3	-15.4	16.0	307	**-0.5**	7.6	-14.3	18.9	308	**-2.7**	1.9	-6.2	1.8	307
	3 - Holly Beach	**-1.5**	5.7	-10.4	22.4	230	**0.4**	17.5	-11.3	63.8	230	**-6.2**	10.9	-36.8	4.1	230	**-0.5**	8.3	-11.4	15.7	230	**-12.7**	21.2	-38.6	53.8	231	**-2.3**	4.8	-8.8	13.7	230
	4 - Hackberry Beach	**8.4**	10.0	-5.9	75.3	449	**14.9**	11.2	-24.0	36.1	449	**6.0**	6.5	-8.3	37.8	454	**2.0**	9.0	-14.2	20.7	454	**-5.9**	13.3	-33.8	56.1	454	**8.7**	3.4	2.4	29.4	449
	5 - Mermentau River	**-3.2**	11.2	-22.9	28.0	183	**-10.1**	15.4	-34.5	30.0	199	**-22.1**	15.8	-42.1	7.1	200	**-20.4**	8.6	-34.7	-5.8	199	**-22.0**	10.5	-39.7	2.6	199	**-10.1**	12.7	-23.8	19.8	199
	All Reaches	**5.1**	11.8	-22.9	91.7	1595	**7.6**	15.7	-34.5	63.8	1617	**-2.1**	12.6	-42.1	37.8	1624	**1.7**	17.2	-34.7	83.0	1617	**-2.2**	29.4	-39.7	168.6	1619	**3.4**	9.9	-23.8	44.6	1607
Eastern Chenier Plain	6 - Rockefeller Refuge	**-28.0**	5.7	-42.9	-15.7	977	**-31.5**	4.6	-58.0	-20.0	971	**-37.6**	7.1	-70.5	10.6	949	**-42.2**	9.9	-74.0	-2.3	919	**-41.5**	8.8	-96.8	-14.5	947	**-34.3**	6.2	-53.3	-10.6	944
	7 - Mulberry Island	**-24.4**	7.0	-30.9	-6.5	220	**-22.5**	7.5	-33.8	-9.5	220	**-12.5**	11.4	-54.8	12.1	220	**-20.4**	10.2	-42.1	2.2	218	**-20.1**	13.8	-44.4	13.6	218	**-19.1**	8.7	-33.0	0.1	218
	8 - Freshwater Bayou	**4.4**	6.9	-7.5	15.6	233	**29.2**	20.9	-13.5	75.2	233	**21.6**	8.9	-18.1	32.5	228	**3.4**	13.2	-14.3	38.9	226	**0.9**	16.9	-19.1	52.0	228	**13.6**	4.3	0.5	18.2	227
	9 - Chenier Au Tigre	**8.7**	8.9	-11.6	25.0	227	**30.2**	13.2	5.7	65.8	227	**-3.3**	7.5	-16.1	8.8	224	**-14.7**	6.1	-22.9	1.9	221	**-14.7**	7.2	-30.3	3.8	222	**3.2**	1.0	0.0	5.5	222
	10 - Rainey Refuge	**-10.6**	3.4	-16.9	-3.2	321	**-7.1**	4.8	-22.4	6.1	320	**-7.1**	4.4	-16.2	3.5	320	**-8.2**	4.4	-19.5	10.5	320	**-7.1**	4.3	-21.9	22.7	321	**-8.5**	3.3	-15.0	-0.1	321
	All Reaches	**-16.8**	15.5	-42.9	25.0	1978	**-12.3**	26.5	-58.0	75.2	1971	**-18.8**	21.9	-70.5	32.5	1941	**-25.3**	19.7	-74.0	38.9	1904	**-25.3**	19.5	-96.8	52.0	1936	**-18.4**	18.6	-53.3	18.2	1932
Acadiana Bays	11 - Marsh Island	**-8.6**	5.5	-21.0	4.8	427	**-1.7**	7.1	-23.6	23.7	625	**-6.4**	4.0	-21.5	1.5	612	**-7.8**	4.9	-31.7	8.9	602	**-6.7**	5.3	-29.2	11.5	601	**-6.0**	3.3	-15.6	0.8	422
	12 - Marsh Island - South Point	**-14.0**	2.0	-17.1	-8.3	114	**-11.5**	5.2	-23.2	14.5	236	**-12.5**	3.9	-31.6	-2.8	226	**-9.0**	4.6	-24.4	3.7	220	**-8.1**	6.2	-28.8	13.2	222	**-14.5**	2.1	-20.1	-11.5	104
	13 - Marsh Island Bayside	**-8.2**	4.7	-27.1	2.5	693	**-6.6**	5.3	-26.3	6.6	693	**-10.7**	4.4	-28.0	-3.9	598	**-12.7**	8.9	-65.4	3.5	516	**-14.1**	10.9	-81.7	0.0	528	**-9.8**	3.4	-20.7	-3.8	519
	14 - SW Pass - Marsh Island	**-6.4**	1.3	-9.8	-4.8	39	**-7.0**	2.8	-14.5	-0.5	39	**-7.9**	2.0	-12.6	-5.0	36	**-8.7**	2.0	-15.4	-5.2	33	**-9.3**	2.3	-13.0	-4.2	34	**-7.5**	1.0	-9.4	-5.5	33
	16 - Hell Hole Bayou	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-6.3**	2.6	-19.3	-1.0	464	**-6.4**	3.5	-23.5	0.0	455	**-6.9**	4.5	-33.3	4.0	457	**-5.3**	2.6	-13.2	-0.6	456
	17 - Redfish Point	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-4.7**	1.4	-9.7	-2.1	120	**-3.8**	2.0	-11.9	0.0	119	**-6.8**	2.6	-12.3	-0.7	120	**-5.0**	1.4	-10.5	-3.0	119
	18 - Vermilion Beach	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-6.4**	1.6	-12.0	-1.7	384	**-4.1**	2.3	-18.1	4.4	381	**-2.6**	2.9	-16.2	6.8	379	**-6.9**	1.6	-10.4	-1.9	371
	19 - Avery Island	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-8.2**	9.3	-49.3	-0.3	395	**-5.9**	10.0	-61.0	6.4	389	**-6.3**	13.3	-75.3	8.5	392	**-7.5**	6.7	-30.8	2.1	366
	20 - Weeks Island	**-1.8**	2.0	-5.9	2.3	172	**-4.8**	7.0	-24.0	16.5	171	**-5.8**	4.2	-24.7	2.0	154	**-4.9**	3.5	-18.6	-0.5	148	**-5.0**	5.3	-33.2	7.2	153	**-4.1**	2.0	-10.5	-1.0	149
	21 - Cypremort Point – West	**-13.5**	10.4	-36.0	1.5	281	**-17.5**	15.2	-62.0	3.8	265	**-16.8**	13.3	-42.5	1.3	229	**-15.4**	15.7	-55.0	4.2	214	**-14.0**	15.7	-64.2	4.9	221	**-15.2**	11.4	-36.7	-2.5	219
	22 - Cypremort Point – East	**-9.5**	3.8	-24.3	2.4	318	**-8.7**	6.4	-27.7	5.8	323	**-9.2**	2.6	-18.2	-3.1	281	**-6.9**	4.9	-16.8	18.6	267	**-7.5**	4.8	-19.2	6.4	273	**-9.3**	2.3	-12.8	-0.9	270
	23 - Cote Blanche Island	**-9.1**	2.3	-13.4	-3.1	100	**-8.2**	3.9	-16.4	1.7	100	**-6.8**	3.3	-15.6	-0.6	100	**-8.4**	3.8	-16.1	-0.9	97	**-9.1**	4.6	-22.8	3.8	97	**-8.3**	1.8	-12.2	-5.2	100
	24 - The Jaws - West	**-9.9**	1.2	-12.7	-6.7	131	**-11.0**	3.5	-18.9	-3.7	131	**-10.7**	1.4	-14.4	-7.6	131	**-6.0**	4.3	-13.7	3.5	131	**-5.9**	4.4	-17.0	1.0	131	**-9.8**	0.5	-10.7	-8.3	131
	25 - The Jaws - East	**-6.8**	3.3	-16.3	-1.1	120	**-6.0**	3.4	-20.8	0.5	120	**-9.4**	2.8	-20.7	-2.0	117	**-5.9**	6.0	-18.1	12.6	106	**-6.7**	4.9	-23.8	-0.8	117	**-7.7**	2.6	-15.6	-3.8	108
	26 - Point Marone	**-10.8**	7.5	-28.8	1.6	131	**-7.3**	4.7	-29.9	5.3	134	**-11.6**	3.3	-19.6	-4.8	102	**-15.3**	9.4	-40.2	-0.5	98	**-17.0**	11.3	-47.6	-1.8	102	**-12.8**	5.0	-27.6	-1.4	108
	27 - Point No Point	**-9.2**	1.6	-15.3	-3.6	206	**-11.0**	3.7	-21.2	-1.0	203	**-12.7**	2.9	-18.8	-1.5	176	**-7.8**	5.0	-34.0	25.9	167	**-10.8**	5.0	-27.7	3.4	168	**-10.3**	1.2	-13.7	-7.3	170
	28 - Bayou Sale	**-5.4**	3.0	-13.1	4.8	284	**-7.2**	5.4	-20.4	8.5	272	**-7.6**	4.5	-23.0	1.9	252	**-6.3**	6.2	-25.3	3.1	244	**-7.6**	7.6	-37.9	10.4	243	**-6.2**	2.9	-12.9	-0.4	248
	All Reaches	**-8.7**	5.7	-36.0	4.8	3016	**-7.5**	8.1	-62.0	23.7	3312	**-8.8**	6.0	-49.3	2.0	4377	**-7.9**	7.6	-65.4	25.9	4187	**-8.2**	8.8	-81.7	13.2	4238	**-8.2**	5.1	-36.7	2.1	3893

[1] n = number of transect measurements for calculating Mean; ND = No Data

Table D2. Shoreline change by reach and region for the Atchafalaya and Wax Lake Deltas, Late and Early Lafourche Delta, and Modern Delta.

Region	Reach # - Name	1880s to 1930s Change (ft/yr)					1930s to 1950s Change (ft/yr)					1950s to 1998 Change (ft/yr)					1998 to 2015 Change (ft/yr)					2004 to 2012 Change (ft/yr)					1880s to 2015 Change (ft/yr)				
		Mean	SD	Min	Max	n [1]	Mean	SD	Min	Max	n	Mean	SD	Min	Max	n	Mean	SD	Min	Max	n	Mean	SD	Min	Max	n	Mean	SD	Min	Max	n
Atchafalaya and Wax Lake Deltas	29 - Wax Lake Delta	**-10.2**	3.3	-16.7	1.2	410	**-21.0**	5.6	-34.0	-5.8	406	**-6.6**	14.0	-29.2	28.7	360	**6.6**	20.2	-28.0	94.4	363	**16.8**	37.5	-24.4	157.4	362	**-7.9**	6.5	-21.0	6.5	366
	30 - Atchafalaya Delta	**-15.2**	6.1	-30.5	-2.6	222	**-15.0**	6.0	-45.3	4.1	361	**-9.3**	3.8	-29.8	5.4	346	**15.3**	39.5	-18.9	149.4	342	**52.2**	90.4	-17.0	370.1	337	**-9.7**	4.2	-19.0	0.9	208
	31 - Plumb Bayou	**ND**	ND	ND	ND	ND	**-15.5**	5.5	-33.8	-3.2	97	**-5.3**	4.5	-16.1	0.1	82	**-11.2**	6.3	-26.5	1.1	71	**-10.8**	6.1	-30.5	-0.6	70	**ND**	ND	ND	ND	ND
	All Reaches	**-12.0**	5.1	-30.5	1.2	632	**-17.9**	6.5	-45.3	4.1	864	**-7.6**	10.0	-29.8	28.7	788	**8.8**	30.6	-28.0	149.4	776	**29.8**	68.5	-30.5	370.1	769	**-8.5**	5.8	-21.0	6.5	574
Early Lafourche Delta	32 - Four League Bay - East	**ND**	ND	ND	ND	ND	**-7.8**	3.9	-22.5	8.7	466	**-5.7**	3.0	-20.3	0.5	443	**-6.9**	4.5	-34.8	4.6	425	**-6.0**	4.4	-26.1	3.0	423	**ND**	ND	ND	ND	ND
	33 - Four League Bay - West	**ND**	ND	ND	ND	ND	**-9.7**	4.0	-28.4	-0.3	453	**-12.0**	7.2	-46.1	-1.7	422	**-14.1**	11.8	-59.4	0.0	390	**-13.3**	12.8	-68.3	0.8	393	**ND**	ND	ND	ND	ND
	34 - North Point	**-5.6**	5.5	-19.0	12.8	312	**-7.1**	3.8	-26.4	4.4	351	**-10.4**	3.5	-21.1	-2.1	313	**-9.9**	4.9	-30.9	5.4	262	**-7.9**	4.8	-29.7	7.0	271	**-7.8**	3.5	-17.6	1.2	260
	35 - Point Au Fer Island	**-17.7**	8.1	-29.2	9.1	556	**-15.1**	7.7	-31.7	6.9	559	**-16.4**	5.7	-33.2	-3.6	527	**-18.7**	7.9	-38.0	0.0	503	**-20.1**	11.4	-44.5	11.0	505	**-16.9**	4.7	-22.8	-2.8	498
	36 - Oyster Bayou to Caillou Boca	**-12.5**	5.5	-34.4	-1.3	699	**-10.5**	4.7	-30.9	3.3	670	**-13.9**	4.4	-30.0	-2.2	564	**-16.2**	6.4	-50.7	0.0	542	**-16.2**	7.6	-40.0	4.9	539	**-14.1**	4.3	-38.4	-4.4	559
	37 - Raccoon Island	**-23.6**	26.8	-65.5	31.3	110	**-14.5**	12.9	-35.1	8.6	115	**-42.9**	16.7	-79.2	-28.2	85	**-2.3**	9.1	-28.4	15.3	45	**-8.8**	16.3	-46.2	25.2	43	**-24.9**	1.9	-31.3	-22.9	46
	38 - Whiskey Island	**-47.9**	11.8	-88.8	-35.6	142	**-51.0**	14.2	-90.3	-19.3	100	**-63.4**	23.1	-141.4	-25.9	77	**-46.8**	32.0	-130.7	6.7	92	**-53.4**	49.2	-140.6	7.6	87	**-52.2**	7.1	-67.9	-42.1	124
	39 - Trinity Island	**-40.8**	5.9	-81.3	-32.3	177	**-18.5**	11.1	-51.4	-1.7	155	**-43.0**	6.0	-56.5	-32.1	132	**-32.0**	25.0	-144.8	6.0	138	**-18.7**	25.7	-102.0	47.9	137	**-35.4**	5.4	-56.2	-28.5	154
	40 - East Island	**-25.0**	20.1	-43.2	41.9	97	**-10.5**	14.5	-44.0	2.1	112	**-24.2**	16.5	-69.4	-9.2	102	**-42.8**	74.6	-195.5	73.8	70	**-37.2**	67.9	-225.1	44.2	72	**-26.8**	2.6	-35.2	-22.7	80
	41 - Wine Island	**-39.5**	13.3	-62.6	-3.7	57	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-56.7**	3.9	-61.2	-54.4	3	**-88.0**	2.7	-89.9	-86.1	2	**-68.0**	0.6	-68.7	-67.5	3
	All Reaches	**-19.4**	15.8	-88.8	41.9	2150	**-12.4**	10.6	-90.3	8.7	2981	**-16.5**	14.5	-141.4	0.5	2665	**-16.7**	19.4	-195.5	73.8	2470	**-15.9**	20.6	-225.1	47.9	2472	**-19.6**	12.6	-68.7	1.2	1724
Late Lafourche Delta	42 - Timbalier Island	**-7.7**	34.5	-85.9	63.6	194	**-10.4**	44.3	-134.6	103.9	205	**-12.4**	25.7	-86.0	41.4	202	**-11.6**	40.8	-194.5	36.8	211	**-14.4**	41.0	-221.3	32.9	204	**-10.4**	26.4	-84.7	18.9	77
	43 - East Timbalier Island	**-144.2**	5.1	-150.5	-134.4	69	**-13.8**	14.1	-55.5	29.3	72	**-30.6**	9.9	-48.7	-10.4	89	**-43.4**	29.3	-129.5	2.3	40	**-71.0**	37.4	-202.1	-30.8	40	**-58.1**	6.9	-75.7	-49.0	40
	44 - West Belle Pass	**-132.7**	10.9	-152.8	-111.6	46	**-44.8**	15.3	-73.9	-16.2	46	**-68.6**	28.0	-133.8	-25.0	80	**-60.2**	41.7	-132.7	-0.7	86	**10.2**	14.1	-19.9	35.0	54	**-85.5**	15.4	-116.5	-59.7	67
	45 - Caminada Headland	**-48.6**	22.1	-118.9	-10.3	428	**-47.9**	30.3	-153.1	7.9	377	**-32.4**	16.8	-60.9	10.8	365	**-26.2**	19.4	-137.3	5.7	430	**-44.7**	28.0	-93.8	13.0	411	**-39.7**	14.8	-57.0	-1.8	424
	46 - Grand Isle	**-0.6**	15.0	-49.1	20.7	252	**-1.6**	11.5	-20.9	31.4	243	**10.4**	13.2	-12.1	40.4	241	**4.9**	16.3	-73.1	31.9	244	**9.7**	17.5	-27.8	42.1	242	**3.5**	7.9	-6.9	18.5	245
	47 - West Grand Terre	**-5.8**	9.3	-32.7	9.6	100	**15.9**	13.6	-17.3	57.9	96	**-19.7**	7.7	-35.5	10.2	95	**-13.2**	8.9	-34.0	8.7	92	**-16.4**	19.4	-75.8	27.6	93	**-6.9**	3.1	-17.0	0.0	92
	48 - East Grand Terre	**-15.9**	10.9	-39.9	3.6	99	**-33.7**	11.1	-59.4	-2.4	86	**-53.1**	22.9	-126.7	-35.8	67	**-21.9**	29.2	-55.5	56.1	74	**-0.5**	39.7	-72.1	87.0	68	**-31.9**	8.4	-67.5	25.9	80
	All Reaches	**-34.2**	45.2	-152.8	63.6	1188	**-22.2**	35.2	-153.1	103.9	1125	**-22.4**	28.8	-133.8	41.4	1139	**-18.9**	31.6	-194.5	56.1	1177	**-20.5**	37.9	-221.3	87.0	1112	**-27.3**	28.1	-116.5	18.9	1025
Modern Delta	49 - Chaland Headland	**-21.8**	11.6	-44.0	3.2	277	**-12.4**	19.1	-76.0	16.7	292	**-20.2**	15.0	-63.9	10.4	282	**-13.7**	19.2	-70.1	45.3	284	**-20.0**	27.7	-100.3	58.4	277	**-19.6**	14.0	-59.4	-2.9	273
	50 - Shell Island	**-11.3**	19.9	-54.5	31.1	385	**-13.5**	18.6	-45.6	62.3	388	**-29.2**	32.4	-137.5	14.9	289	**-10.8**	30.0	-138.3	57.6	246	**-22.6**	52.7	-205.0	49.5	208	**-19.1**	17.0	-46.9	2.4	281
	All Reaches	**-15.7**	17.7	-54.5	31.1	662	**-13.0**	18.8	-76.0	62.3	680	**-24.8**	25.7	-137.5	14.9	571	**-12.4**	24.8	-138.3	57.6	530	**-21.1**	40.4	-205.0	58.4	485	**-19.3**	15.6	-59.4	2.4	554

[1] n = number of transect measurements for calculating Mean; ND = No Data

Table D3. Shoreline change by reach and region for the Chandeleur Islands and Pontchartrain Basin.

Region	Reach # - Name	1880s to 1930s Change (ft/yr)					1930s to 1950s Change (ft/yr)					1950s to 1998 Change (ft/yr)					1998 to 2015 Change (ft/yr)					2004 to 2012 Change (ft/yr)					1880s to 2015 Change (ft/yr)				
		Mean	SD	Min	Max	Max	Max	SD	Min	Max	n	Mean	SD	Min	Max	n	Mean	SD	Min	Max	n	Mean	SD	Min	Max	n	Mean	SD	Min	Max	n
Chandeleur Islands	59 - Breton Island	**-20.1**	16.6	-45.5	5.5	191	**-5.5**	20.6	-42.9	25.4	169	**-24.1**	15.3	-54.7	-0.8	57	**-37.0**	5.9	-43.4	-17.1	54	**-54.9**	14.6	-76.3	-26.5	53	**-26.8**	4.5	-32.2	-18.9	115
	60 - Grand Gosier and Curlew Islands	**-57.8**	16.5	-90.8	-24.5	66	**-22.7**	30.0	-58.9	22.3	27	**-38.3**	30.6	-83.6	34.9	121	**-87.9**	32.5	-173.9	-36.5	65	**ND**	ND	ND	ND	ND	**-52.8**	5.0	-63.7	-39.3	56
	61 - North Chandeleur Islands	**-27.9**	26.1	-112.5	10.0	816	**-17.8**	12.9	-77.7	17.7	855	**-33.9**	28.2	-166.2	-4.3	824	**-99.8**	84.1	-360.1	-12.5	597	**-149.7**	112.2	-491.5	-30.8	293	**-30.0**	19.8	-81.9	-2.2	533
	All Reaches	**-28.4**	25.5	-112.5	10.0	1073	**-16.0**	15.7	-77.7	25.4	1051	**-33.9**	28.0	-166.2	34.9	1002	**-94.0**	79.2	-360.1	-12.5	716	**-135.2**	108.9	-491.5	-26.5	346	**-31.3**	18.5	-81.9	-2.2	704
Pontchartrain Basin	62 - Isle Aux Pitre	**-9.3**	5.2	-40.1	3.3	648	**-6.4**	5.1	-27.2	11.9	614	**-11.3**	5.0	-29.2	-1.9	477	**-12.9**	11.2	-76.5	-1.2	393	**-12.2**	12.8	-77.9	2.6	413	**-12.3**	6.8	-36.2	-1.4	459
	63 - Biloxi Marsh	**-8.0**	3.2	-26.5	-1.1	338	**-5.2**	5.7	-25.0	12.3	334	**-11.1**	5.3	-28.5	-3.1	298	**-21.2**	18.1	-89.2	-1.7	295	**-25.0**	24.4	-130.9	-3.1	279	**-10.1**	4.4	-22.0	-2.4	296
	64 - Shell Beach	**-5.7**	3.2	-16.5	4.2	679	**-4.6**	6.5	-29.8	16.1	679	**-9.6**	4.2	-22.0	-1.0	668	**-14.0**	14.6	-83.9	1.1	652	**-15.5**	22.2	-113.8	12.0	644	**-7.6**	2.8	-15.7	-0.9	656
	65 - Bayou Bienvenue	**-5.4**	2.2	-19.2	1.8	635	**-6.4**	2.0	-12.8	-3.0	142	**-4.9**	1.4	-9.4	-2.2	142	**-8.2**	11.0	-81.2	8.4	611	**-6.9**	15.6	-116.3	24.0	606	**-6.9**	2.4	-17.6	-2.8	620
	66 - New Orleans Landbridge	**-4.9**	3.3	-13.0	6.2	416	**-7.1**	4.8	-22.1	10.9	413	**-6.6**	2.6	-16.1	-2.2	394	**-7.2**	6.4	-39.9	1.7	392	**-9.4**	10.5	-74.4	4.6	385	**-6.2**	2.8	-15.0	-1.1	405
	67 - Lake Catherine	**-4.8**	1.6	-9.7	-0.9	232	**-6.1**	3.4	-11.9	3.1	69	**-5.2**	2.4	-11.5	1.4	70	**-7.9**	12.3	-69.5	14.4	220	**-9.8**	17.9	-132.3	7.2	212	**-5.3**	1.9	-13.1	-1.7	227
	68 - South Point	**-5.0**	2.0	-10.6	0.1	163	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-9.3**	11.3	-50.3	10.3	135	**-11.6**	14.8	-71.3	5.9	135	**-10.1**	7.6	-24.1	-0.9	159
	69 - Little Woods	**-4.2**	2.5	-12.0	0.1	264	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-2.4**	8.2	-57.2	15.7	256	**-3.0**	12.2	-106.3	24.3	258	**-4.5**	4.4	-18.3	-0.2	260
	70 - New Orleans Lakefront	**15.6**	21.2	-5.9	68.2	335	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**0.3**	3.0	-13.9	28.6	344	**0.1**	1.2	-10.0	7.8	338	**7.9**	10.9	-3.6	44.0	334
	71 - Jefferson Lakefront	**-3.7**	3.6	-12.2	9.9	306	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**4.8**	8.3	-11.1	67.8	302	**5.8**	3.4	0.0	21.6	304	**-3.7**	3.6	-12.2	9.9	306
	72 - LaBranche Marshes	**-9.7**	4.4	-20.8	-1.6	175	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-10.7**	16.6	-73.7	17.2	176	**-13.0**	21.9	-130.2	1.9	174	**-9.7**	4.4	-20.8	-1.6	175
	73 - Frenier Swamp	**-5.5**	2.5	-11.5	1.2	323	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-4.9**	5.0	-19.4	21.1	319	**-4.2**	6.4	-22.6	32.2	319	**-5.5**	2.5	-11.5	1.2	323
	74 - Manchac Swamp	**-9.7**	4.0	-19.3	-3.7	316	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-0.1**	9.5	-26.0	18.7	315	**-11.8**	7.5	-34.0	0.5	316	**-9.7**	4.0	-19.3	-3.7	316
	75 - Maurepas Southeast	**-3.8**	2.5	-12.0	1.3	530	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-5.3**	4.1	-29.6	9.4	533	**-8.1**	7.0	-35.2	31.1	535	**-3.8**	2.5	-12.0	1.3	530
	76 - Maurepas Northwest	**-3.4**	1.3	-8.7	0.1	668	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-3.2**	2.8	-13.3	5.3	673	**-6.4**	6.0	-29.7	40.5	674	**-3.4**	1.3	-8.7	0.1	668
	77 - Tangipahoa River	**-5.7**	2.3	-12.5	-1.7	301	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-6.0**	4.7	-18.8	11.9	297	**-10.3**	5.9	-40.3	21.3	298	**-5.7**	2.3	-12.5	-1.7	301
	78 - Madisonville	**-6.2**	2.3	-11.2	0.3	142	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-3.2**	2.7	-10.8	5.2	137	**-5.1**	4.2	-20.3	3.8	135	**-6.2**	2.3	-11.2	0.3	142
	79 - Mandeville	**-0.9**	2.0	-8.2	5.6	161	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**0.0**	2.3	-7.0	9.1	159	**-1.1**	3.3	-11.1	13.3	159	**-0.9**	2.0	-8.2	5.6	161
	80 - Big Branch Marshes	**-4.1**	3.1	-13.0	3.3	508	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**-0.5**	3.5	-15.2	9.6	494	**-1.4**	4.0	-19.6	13.9	496	**-3.9**	1.9	-9.8	0.4	504
	81 - Slidell	**-4.1**	1.7	-9.3	0.6	248	**ND**	ND	ND	ND	ND	**ND**	ND	ND	ND	ND	**1.2**	3.6	-6.4	31.2	244	**1.8**	5.7	-8.8	37.9	243	**-2.9**	1.3	-8.0	-0.2	243
	82 - Pearl River	**-4.6**	1.8	-9.4	-1.0	249	**-6.1**	2.9	-22.0	1.8	235	**-4.3**	1.7	-8.8	-0.5	220	**-7.3**	5.8	-25.1	0.6	218	**-10.1**	10.1	-47.6	1.0	219	**-5.0**	1.5	-7.6	-1.0	219
	83 - Grand Island Pass	**-5.3**	2.5	-13.0	-1.1	274	**-4.8**	4.9	-25.7	4.9	248	**-6.8**	2.8	-13.6	-1.2	198	**-20.6**	14.8	-53.5	-2.4	147	**-34.5**	26.9	-96.8	-2.6	148	**-7.3**	3.9	-15.1	-2.0	155
	All Reaches	**-4.4**	7.4	-40.1	68.2	7922	**-5.7**	5.3	-29.8	16.1	2734	**-8.6**	4.6	-29.2	1.4	2467	**-6.2**	11.1	-89.2	67.8	7312	**-8.2**	14.8	-132.3	40.5	7290	**-5.5**	5.6	-36.2	44.0	7459

[1] n = number of transect measurements for calculating Mean; ND = No Data