FLORIDA
SEA GRANT COLLEGE

Sikes Cut
Glossary of Inlets Report No.7

by T. A. Zeh

Report Number 35

August 1980

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FOREWORD

The numerous inlets connecting Florida's inner waters to the Atlantic Ocean and the Gulf of Mexico are important from consideration of recreational and commercial vessel traffic and also because they provide small boats access to safe refuge during unexpected severe weather and waves. In addition, inlets act as flushing agents, providing renewal of bay waters by exchange with outer continental shelf waters. Unfortunately, inlets also contribute significantly to the serious beach erosion problem prevalent along most of Florida's shoreline. The complexities of the hydraulic and sediment transport mechanics in the vicinity of inlets present a formidable challenge to engineers and scientists. These factors, along with the interesting historical role that inlets have played in the early development of Florida have resulted in considerable documentation pertaining to the major inlets of of the State.

This report on Sikes Cut is one in a "Glossary of Inlets" series to be prepared under the State University System Sea Grant project, "Glossaries of Tidal Inlets in Florida." The purpose of this series is to provide for each inlet a summary of the more significant available information and to list known documentation. It is hoped that this series will yield an improved understanding of the overall effect of each inlet on the economics, recreation, water quality and shoreline stability of the surrounding area. The proper future management, use and control of Florida's inlets will require an appreciation of the evolution and past response of the inlets as well as considerable future study.

ACKNOWLEDGEMENT

The author wishes to acknowledge the guidance of Dr. A. J. Mehta, who was the principal investigator for the project. Sincere thanks are due to W.W. Burdin of the Corps of Engineers, Mobile District, for his assistance in obtaining surveys, dredging records and other pertinent information necessary for the completion of this report.

I. INTRODUCTION

Sike's Cut is a man-made inlet located in Franklin County, approximately five miles south of Apalachicola, Florida (see Figure 1.1), and its coordinates are as follows:

Latitude	Longitude
29 36' 50" N	84 57' 32" W

It is located on St. George Island, which is a barrier island separating the Gulf of Mexico from Apalachicola Bay, as shown in Figure 1.2. Figure 1.3 shows an aerial photo of Sikes Cut taken in October 1977 by the Florida Department of Transportation.

Apalachicola Bay is 25 miles long and an average of six miles wide and has five flow connections to the Gulf; Indian Pass, West Pass, Sikes Cut, St. George Sound and East Pass. Fresh water flows into the bay from the Apalachicola River (see Figure 1.2). Sikes Cut was originally dredged across the island in August 1954 by local interests according to U.S. Army Corps of Engineers, Mobile District, specifications. By 1956 the channel shoaled drastically and at times was navigable only by small boats. At that time the Corps of Engineers constructed two jetties on the Gulf side and redredged the channel to a depth of 10 feet below MLW. Periodic maintenance dredging has been performed since then to maintain the 10 foot depth in the channel and the adjacent bay and Gulf.

St. George Island is approximately 3,000 years old and consists mainly of quartz sand. It is presently increasing in length due to accretion occurring at both Cape St. George and on the eastern end at East Pass. The Gulf coastline of the island has experienced only minor recession due to erosion in the past 100 years. The major change has been the shoaling of "New Inlet" (see Figure 5.1) in 1900 after its breakthrough in 1837 by a hurricane.

St. George Island is connected with the mainland by a causeway and the Bryan Patton Toll Bridge built in 1965. The part of the island east of the causeway is slated to become a state park. At the present time camping is not permitted on the island. Fishermen regularly fish from the two jetties at the inlet. Environmentalists have been concerned over the development on the island and its effect on the bay's water quality.

Apalachicola Bay is biologically a highly productive region which produces approximately 90% of the commercial oyster harvest in the state of Florida. The area also has other commercial fishing interests that use Sikes Cut as a time saving route from Apalachicola to the Gulf of Mexico. Recently Apalachicola Bay has experienced an increase in salinity which has resulted in an increase in the population of the oyster's predators. Sikes Cut is believed to have some effect on this increase by directing freshwater flow through the inlet and introducing additional salt water from the Gulf. The affect which these changes had on the oyster reefs is disputed. Dr. E.T. LaRoe of the Bureau of Coastal Zone Management has estimated that a 15% reduction in the bay's oyster production has occurred (personal communication). However, R.M. Ingle of the Florida Board of Conservation, Division of Oyster Culture, states that the years 1977-1979 were the greatest oyster production years in the history of the bay (personal communication). Both agree that the reefs in the vicinity of the cut have been damaged and are no longer producing marketable oysters.

The main channel through the inlet is presently 15 feet below MLW and the inner and outer shoals are periodically dredged to maintain the minimum 10 foot channel depth. The inlet is safely navigable by both commercial and pleasure craft and has a maximum spring tide current of 4.6 fps. Erosion of the inlet shoreline north of the jetties has been prevalent since the installation

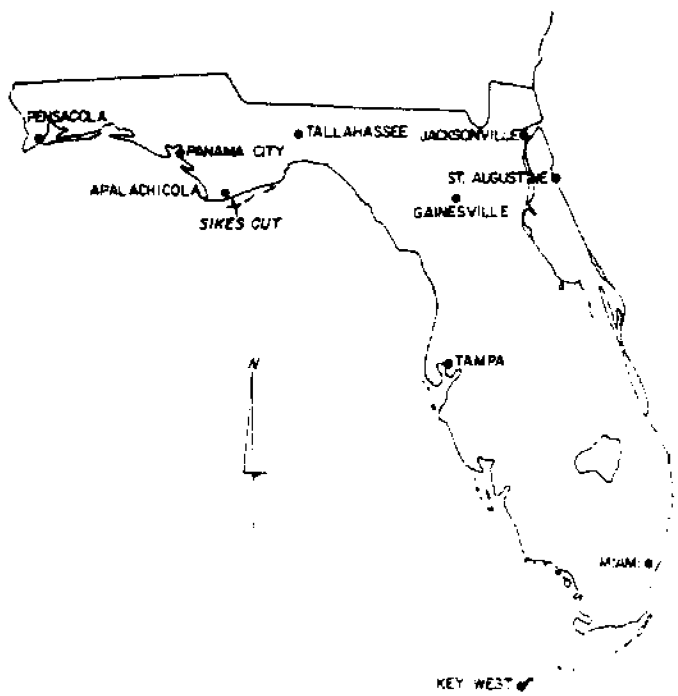


Figure 1.1 Location Map

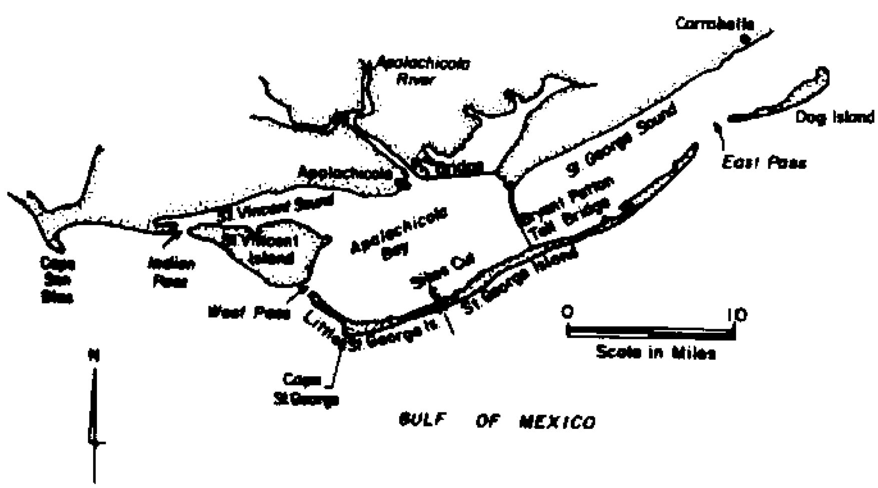


Figure 1.2 Location Map of Sikes Cut and Apalachicola Bay Area

of the jetties until recently when the shoreline has apparently stabilized.

The tides at Sikes Cut range from semi-diurnal at neap tide to diurnal at spring tide. The spring tide range measured at Sikes Cut in August 1970, was 1.77 feet on the bay side of the inlet. The U.S. Army Corps of Engineers, Mobile District and the National Oceanic and Atmospheric Administration (NOAA) monitor the tide in the Apalachicola River near Apalachicola.

Figure 1.3 Aerial Photo of Sikes Cut, October 17, 1977 from the Florida Department of Transportation

II. GEOLOGICAL SETTING

The Apalachicola Bay System lies along the coastal margins of the Gulf Coastal Plain. The underlying basement rocks consist of highly deformed and metamorphosed Pre-Cretaceous rocks. These rocks form a series of overlapping belts. They are overlain by strata consisting of marine, coastal and alluvial sediments. Figure 2.1 shows typical core borings from Schnable (1966).

The Apalachicola Bay floor consists of quartz sand covered with a thin layer of silt and clay. It has a thickness at the central bay of 40 to 50 feet. The sand is probably derived from wave erosion of older deltaic deposits during higher sea stands. Oyster reefs contribute calcareous debris to the flat. While upstream dams do experience sediment trapping, this is apparently offset by streambed degradation downstream and some sediment is transported to the bay via the Apalachicola River.

The shore system of the bay is built of older dune systems, probably dating 3,000 to 6,000 years before the present. The barrier islands are younger and are probably no older than 3,000 years. They consist of quartz sand resting on an eroded Pleistocene surface. St. George Island is characterized by quartz sand beaches, dune areas and back dune flats. Most of the high dunes have recently been stabilized by dune vegetation - sea oats, railroad vine, scrub oak and palmetto. The source of the sediment of which the islands and the offshore sandy shelf were comprised was the Southern Apalachian Piedmont in northern Georgia. It was transported to the area by the Apalachicola River. The sand was supplied to the barrier beaches during lower sea level stands.

For a detailed study of the local sediment and sieve analysis, see Section 6.6 in this report. Figure 2.2 shows the typical surface geology found in the study area.

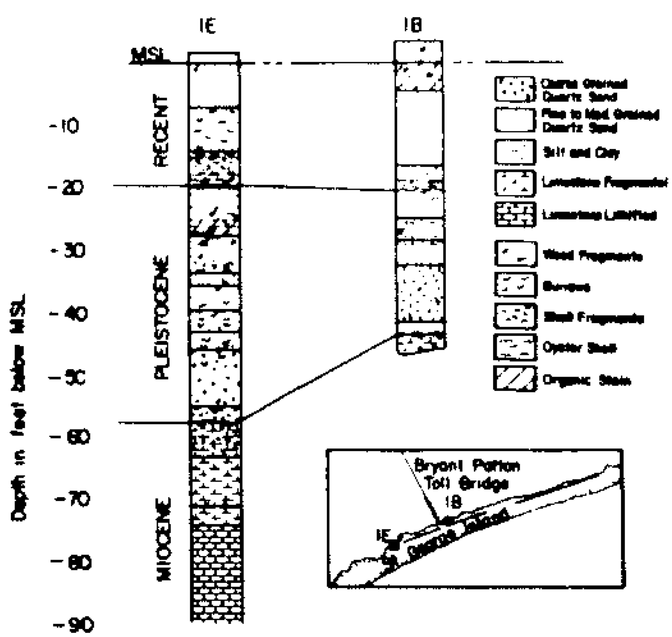


Figure 2.1 Core Borings, St. George Island (Schnable, 1966)

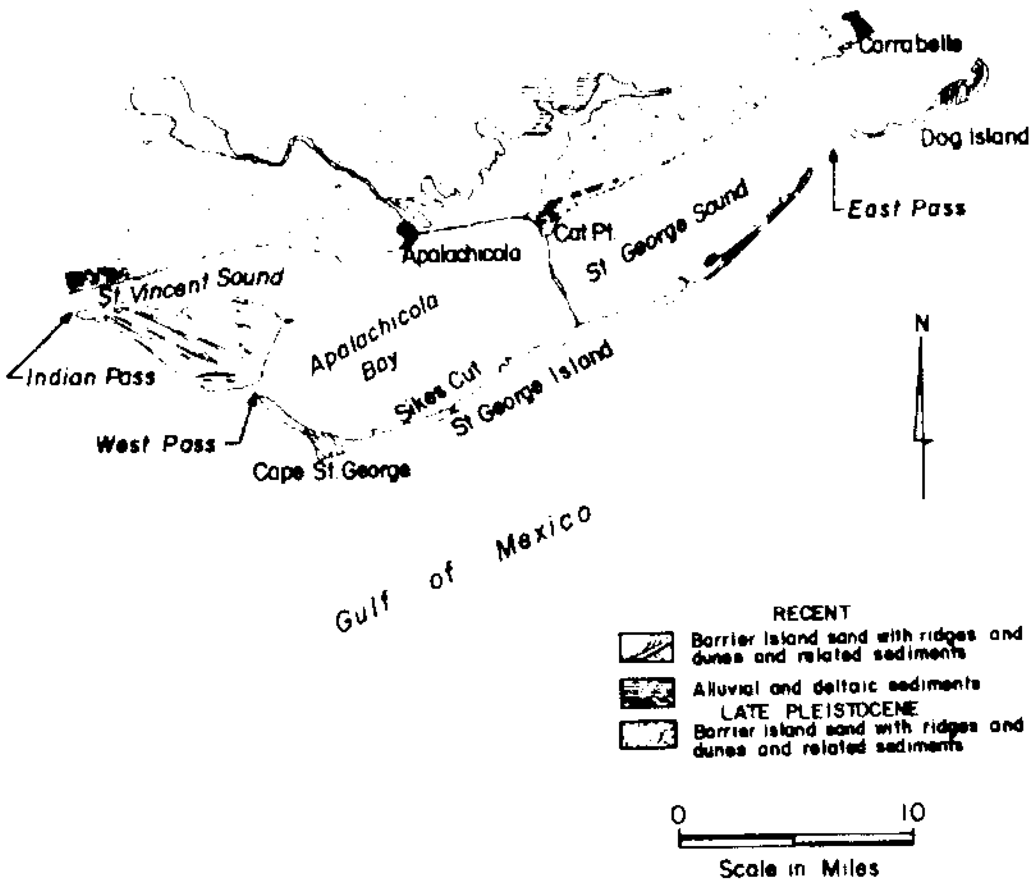


Figure 2.2 Sedimentology of Apalachicola Area
(Schnable, 1966)

III. CLIMATE AND STORM HISTORY

3.1 Climate

The climate of the Apalachicola, Franklin County, Florida area can be described as humid semi-tropical. Table 3.1 shows the monthly average temperatures and precipitation. Maximum rainfall occurs during the months of June through October in the form of squalls. The yearly average precipitation at the Apalachicola National Weather Service Station (Sta. #0211-01) from 1940 to 1970 was 56.2". The mean daily temperature for the same location was 68.8 F.

Table 3.2 gives the wind speed and direction frequencies for the northeastern Gulf of Mexico. This data is the result of 7273 observations from 1881 through 1968 and may be found in the "Summary of Synoptic Meteorological Observation" Volume V (U.S. Naval Weather Service Command, 1970). The most frequent winds are out of the east on an average of 11.2 knots; however, the highest intensity winds are out of the northwest (average wind speed of 13.3 knots).

3.2 Storms

The majority of damaging storms that strike the Apalachicola shoreline are tropical storms and hurricanes that have formed in the southern Gulf of Mexico and Caribbean Sea. Summer squalls and cold fronts during the winter months cause little damage to the shoreline since the accompanying winds are generally from the north and direct the waves offshore.

Between the years 1837 and 1977 there were 15 tropical storms of hurricane intensity that passed within 50 miles of Sikes Cut - an average of approximately 1 every 10 years. Between those same years 26 tropical storms of hurricane intensity passed within 150 miles of Apalachicola, an average of approximately 1 every 5 years. Figure 3.1 shows the paths of some of these storms. A description of some of the more damaging storms follows:

Aug. 31 - Sept. 2, 1837 — This hurricane was known as the "Western Florida Hurricane"; 10 to 15 foot tides were reported at St. George Island. Also "New Inlet" was breached across St. George Island 2 miles west of Sikes Cut. The inlet was 10 feet wide and 21 feet deep, then shoaled and closed by the year 1900. The hurricane caused $50,000 damage to Apalachicola (Apalachicola Gazette), and according to a Tallahassee Floridian correspondent: "The storm was considered the most severe gale ever felt in that section of the coast since the settlement of Florida by the Americans."

Sept. 30 - Oct. 6, 1842 — This hurricane's eye hit land near St. Marks after originating west of the Yucatan Peninsula. From the skipper of the Brig Sampson we have the following account. "At Apalachicola the wind blew a 'perfect hurricane' and was thought to be one of the severest gales on record." The upper 20 to 30 feet of the lighthouse at East Pass was blown down. The water is stated to have risen twenty feet above the low water mark east of Apalachicola.

TABLE 3.1

AVERAGE MONTHLY APALACHICOLA PRECIPITATION AND TEMPERATURE (1940 - 1970)
(NOAA, 1970)

MONTH	PRECIPITATION (inches)	TEMPERATURE (°F)
January	3.14	55.1
February	3.91	56.8
March	4.52	61.0
April	4.30	67.5
May	2.88	74.8
June	5.30	80.2
July	7.93	81.5
August	7.74	81.5
September	8.53	78.9
October	2.44	71.2
November	2.58	61.3
December	2.96	55.8

TABLE 3.2

WIND SPEED AND DIRECTION IN NORTHEASTERN GULF OF MEXICO

Wind Direction	Total Observations	Percent Frequency	Mean Speed (knots)
N	849	11.7	12.2
NE	1130	15.5	11.8
E	1488	20.5	11.2
SE	1083	14.9	11.0
S	657	9.0	10.2
SW	467	6.4	10.0
W	617	8.5	11.5
NW	708	9.7	13.3
Variable	2	-	1.5
Calm	272	3.7	0.0

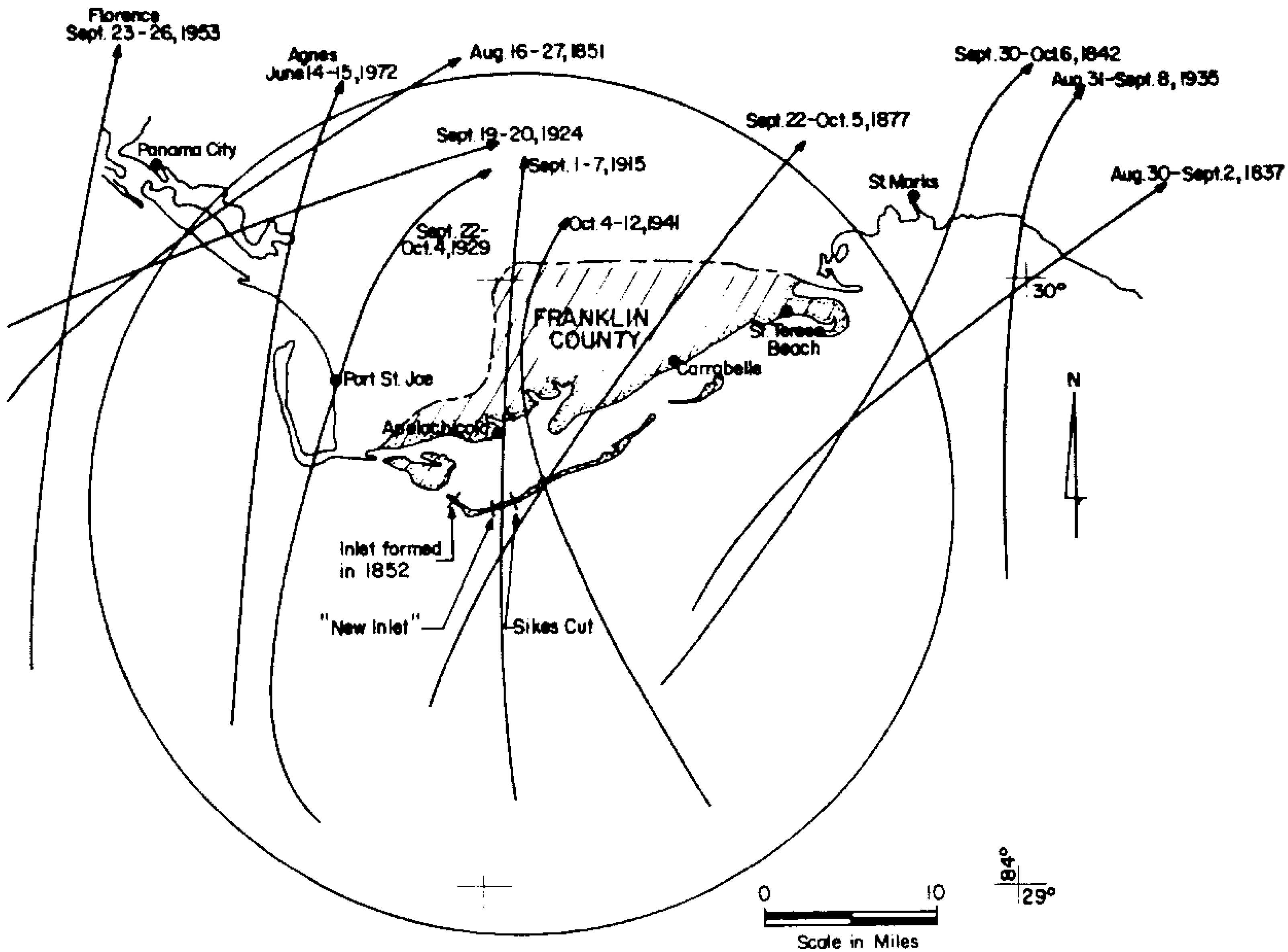


Figure 3.1 Storm Tracks Within 50 Miles of Sikes Cut (NOAA, and Corps of Engineers)

Aug. 16 - Aug. 27, 1851	Known as the "Apalachicola Storm", this storm is described as the worst in the Apalachicola Bay area's history. The entire town of St. Teresa was destroyed and Apalachicola was flooded.
Oct. 9, 1852	Little is known about this hurricane except that it breached a gap on St. George Island two miles east of West Pass. The inlet was narrow and shallow, and shoaled by 1917 (see Figure 3.1).
Sept. 1 - Sept. 7, 1915	This hurricane caused unprecedented tides at several eastern Gulf stations. Seven foot tides were reported at Carrabelle. The highest wind speeds at Apalachicola were 70 mph with a barometric pressure of 29.32 inches.
Sept. 13 - Sept. 20, 1924	This hurricane had wind speeds of 68 mph at Apalachicola with a barometric pressure of 29.12 inches, though little damage was done.
Oct. 3 - Oct. 14, 1941	This hurricane recorded winds of 75 mph and high tides of 6.4 ft above msl at Carrabelle.
June 14 - June 23, 1972	This storm known as "Agnes" had a maximum wind speed of 86 mph. A storm surge of 7 to 8 feet was observed on St. George Island. Eight miles of road on the island were destroyed.

3.3 Flooding

Figure 3.2 shows the return period in years of the superelevation of the water surface above msl for both Carrabelle and Apalachicola as calculated by Ho and Tracey (1975). The curve for Apalachicola refers to the Gulf shore of St. George Island west of Sikes Cut while the Carrabelle curve refers to the extreme eastern end of St. George Island. The average dune height on the Gulf shore of the island ranges from 10 to 15 feet near Sikes Cut (see Figure 5.6 for typical beach profiles). It is evident from Figure 3.2 that a 100 year storm (superelevation 12.4 feet) would cause flood damage to the island as Hurricane "Agnes" did in 1972 (Section 3.2).

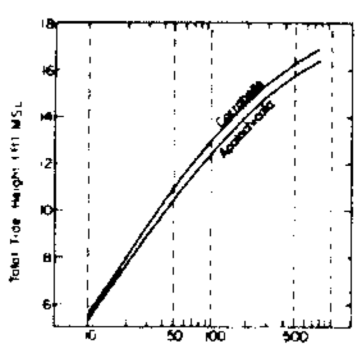


Figure 3.2 Tide Height Frequency Curve (NOAA, 1975)

IV. HISTORY OF THE INLET

Sikes Cut has historically been a concern of two separate fishing industries. First, the shrimp, scallop and other commercial fishermen with small vessels consider the cut essential to their financial stability. It often reduces their travel time to and from their fishing grounds in the Gulf of Mexico by two to three hours. This time saving can substantially increase their profits due to increased fishing time. The oystermen, on the other hand, have no need to leave Apalachicola Bay to reach the oyster beds. Consequently, Sikes Cut was of no concern to them until recently. Due to a deterioration of the Bay's oyster beds, the oyster interest groups have hypothesized that Sikes Cut has caused the salinity increase noted in the bay, which is detrimental to the beds.

With this background, the history of the inlet is summarized by the following chronology of events:

1856 - St. George Island was surveyed by the United States Land Office.

1937 - At a public hearing held in Apalachicola, local interests of the shrimp and fishing industries requested a channel 15 feet deep and 100 feet wide be dredged. It was to run from Apalachicola Bay to the Gulf of Mexico through a former opening in St. George Island called "New Inlet". This request was rejected by the Corps of Engineers.

1939 - At a second public hearing in Apalachicola, The Junior Chamber of Commerce requested a 10 foot by 100 foot channel be dredged through "New Inlet". Subsequent to the hearing, the location of the proposed channel was relocated 2.5 miles east of "New Inlet". The Corps of Engineers, Mobile District, supported the new proposal.

1942 - Between this year and 1950 the Corps of Engineers surveyed the area for the new channel and designed the channel and jetties which would be required.

1945 - The United States Coast and Geodetic Survey in cooperation with the Corps of Engineers, surveyed all of St. George Island. They also coordinated all previous surveys on the Island into a shoreline change map (U.S. Army Corps of Engineers, 1950).

1952 - The 82nd Congress, 2nd Session, in House Document 557, authorized the dredging of a channel across St. George Island, 2.5 miles east of "New Inlet".

1954 - After many delays in project approval, local interests proceded with the dredging of the channel according to Corps specifications. The work was completed by a McCollough dredge on August 11.

1955 - The new channel was named Bob Sikes Cut on May 10 by the Florida Senate after U.S. Congressman Bob Sikes. He was responsible for getting congressional approval for the channel.

1956 - Due to a shifting of the channel's mouth, the Corps of Engineers proposed and constructed two 740 foot jetties (see Figure 4.1) into the Gulf of Mexico. The work was authorized by the River and Harbor Act of 1954. The actual size of the jetties changed at construction to one of 850 ft on the east side of the inlet and one of 1000 ft on the west, with both running 500 ft into the Gulf from the beach.

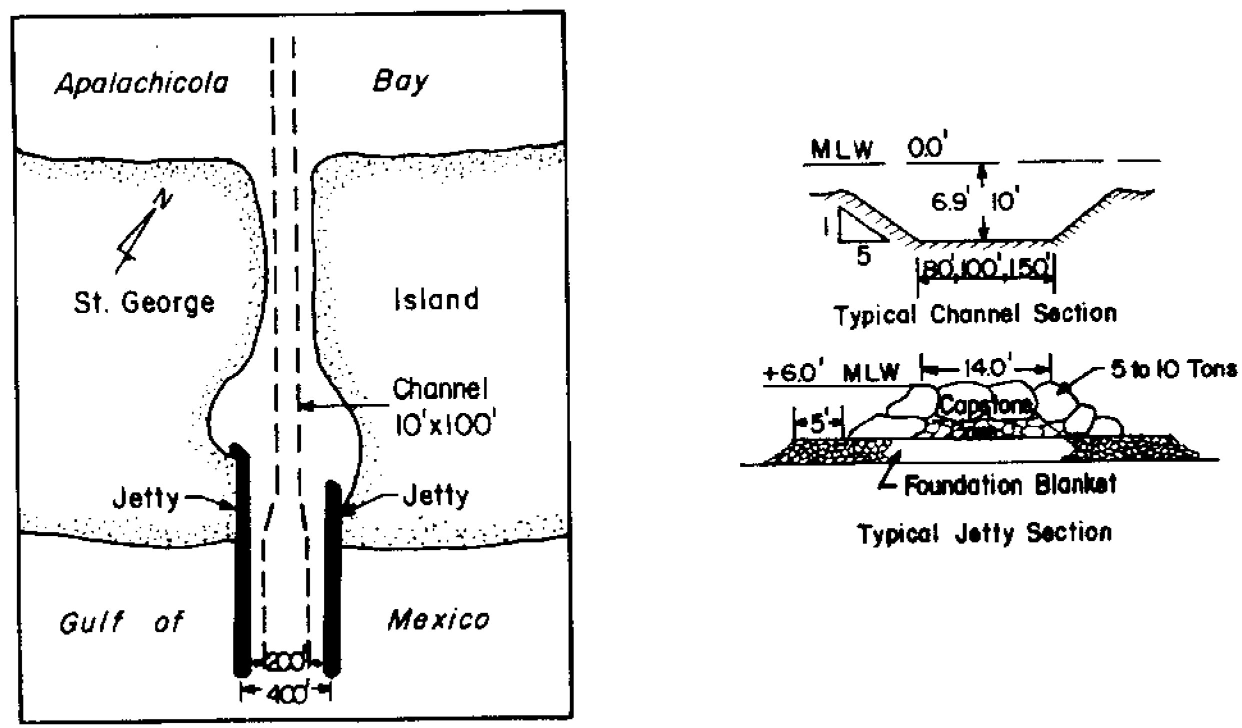


Figure 4.1 Sikes Cut Channel Specifications and Jetty Section (U.S. Army Corps of Engineers, 1950)

1956 - R. W. Menzel, N. C. Hulings and R. R. Hathaway of the Oceanographic Institute of Florida State University performed a complete salinity study of Apalachicola Bay to investigate salinity effects on oyster production. They published a paper "Oyster Abundance in Apalachicola Bay, Florida in Relation to Biotic Associations Influenced by Salinity and Other Factors". They concluded that increased bay salinity was the major factor attributing to decreased oyster production.

1958 - The Corps of Engineers has performed maintenance dredging 20 times since May 5, 1958 (see Table 4.1), as authorized by the River and Harbor Act of 1958. Channel surveys were performed before and after most of these dredging operations. Dredge spoils were placed as per Figure 4.2.

1965 - The bridge to St. George Island was opened December 17. It was named the Bryant Patton Toll Bridge (see Figure 1.2).

1970 - The University of Florida Coastal and Oceanographic Engineering Laboratory submitted a report ("Coastal Engineering Investigation of St. George Island Channel") to the U.S. Army Corps of Engineers, Mobile District. They proposed extending the jetty system back through the channel to alleviate erosion along the channel banks. The Corps rejected the proposal. Subsequently the channel bank erosion has stabilized.

1973 - The state cabinet approved a 1,500 acre state park to be built on the eastern part of St. George Island. Completion date was set for 1979.

1974 - A Construction Setback Line (COEL, 1973) was established by the Florida Department of Natural Resources (DNR) for the Gulf shore of St. George Island in a state cabinet hearing on August 6. The name of the line was changed to the Construction Control Line in 1978 by the Florida Legislature.

1975 - W. R. Boynton wrote a Ph.D. dissertation on "Energy Basis of a Coastal Region: Franklin County and Apalachicola Bay, Florida". He showed that there often was a salinity stratification in the bay and that periods of low Apalachicola River flow were directly related to decreased oyster production.

The Board of Commissioners of Franklin County requested a federal study to determine the feasibility of the following:

1) Redredging Sikes Cut to a depth of 12 feet,
2) Redredging the existing channel on the Gulf side of Sikes Cut to a depth of 14 feet,
3) Dredging a new 12 foot by 100 foot channel from the existing Intracoastal Waterway channel in the bay to Sikes Cut.

These proposals were to allow access to the Gulf via Sikes Cut to larger shrimp and scallop trawlers.

1977 - The redredging proposal of Sikes Cut was rejected after a feasibility study by the Corps of Engineers determined the additional cross-section of the channel could be detrimental to the oyster population of the bay.

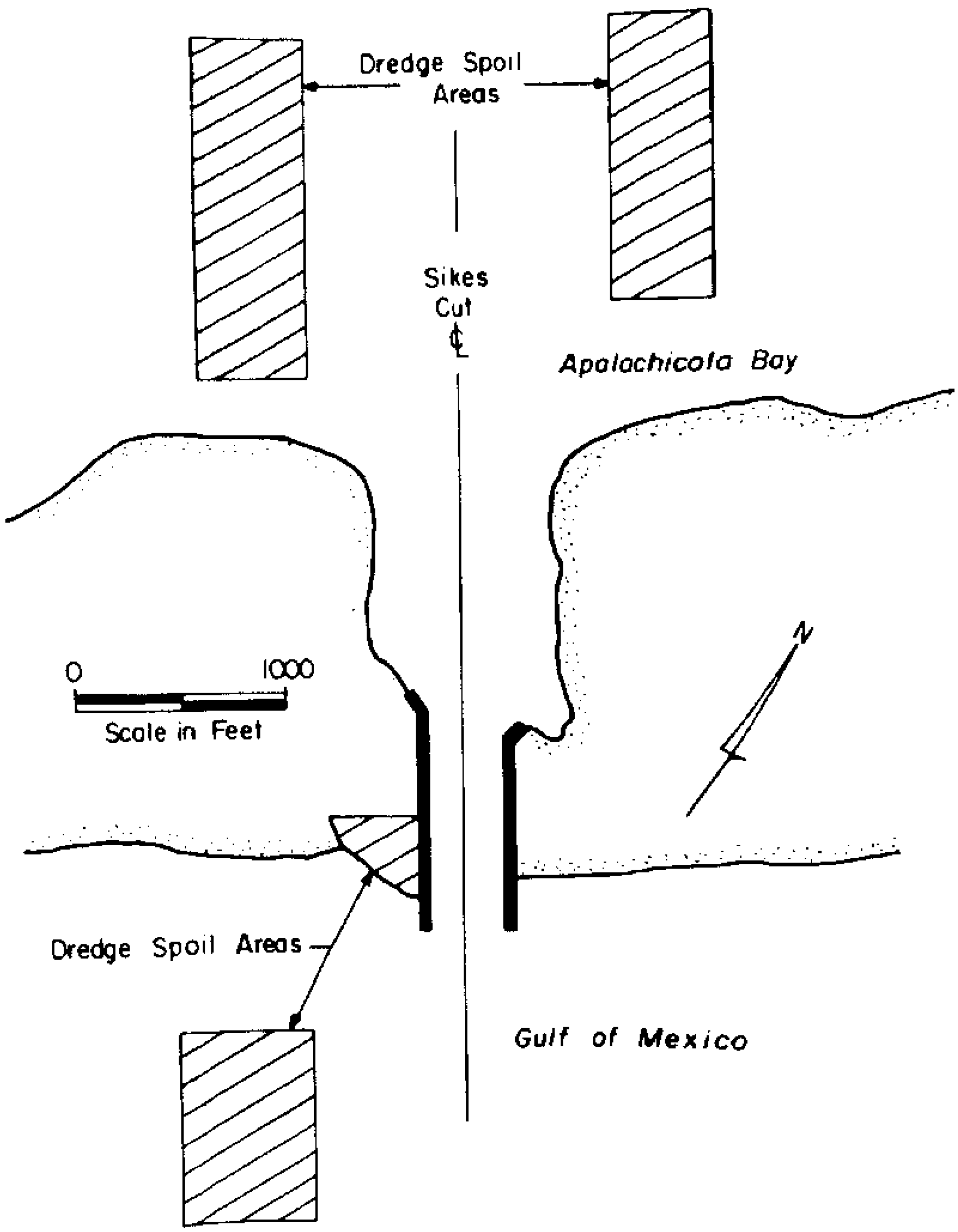


Figure 4.2 Approximate Location of U.S. Army Corps of Engineers Dredging Spoils Sites (1956 to 1977)

1978 - University of Florida Coastal and Oceanographic Engineering Department field study performed during August to obtain salinity, tide and current data both in Sikes Cut and the adjacent bay. The turbulent jet issuing into the bay on August 9 was also measured (Zeh, 1979; Mehta and Zeh, 1979).

The Apalachicola Symposium and Workshops were organized in October by the Conservation Foundation to review goals for conservation of the Apalachicola drainage system. A proposal was introduced to make Apalachicola Bay an Estuarine Sanctuary.

1979 - U.S. Office of Coastal Zone Management and the Florida Department of Environmental Regulation published a draft Environmental Impact Statement to propose making Apalachicola Bay an Estuarine Sanctuary.

TABLE 4.1

RECORD OF MAINTENANCE DREDGING

DREDGING DATES		QUANTITY REMOVED (cu. yds.)
May 5 - 25, 1958		35,897
Sept. 10 - 12, 1958		24,291
Jan. 27 - 30 and June 6 - 8, 1959		29,435
Jan. 10 - Feb. 3, 1960		25,998
Jan. 23 - Feb. 20, 1961		35,312
Feb. 1 - 6, 1962		24,321
April 11 - 15, 1963		32,973
Jan. 29 - Feb. 3 and June 12 - 15, 1964		89,164
Jan. 18 - 26, 1965		58,754
March 3 - 11 and May 24 - 27, 1966		115,181
March 11 - 20, 1967		10,592
August 6 - 11, 1968		38,544
March 1969		21,735
May - June 1971		71,619
Feb. 1974		23,129
July 1975		54,995
	TOTAL	691,940
	AVERAGE	40,000/yr.

NOTE: Data for the years 1976-79 were not available at the time of completion of this report.

V. MORPHOLOGICAL CHANGES

5.1 Maps, Surveys and Photographs

Sikes Cut appears in NOAA National Ocean Survey Coast Nautical Chart Numbers 11404 (formerly 865-SC), 11402 (formerly 865-SG) and 1262. The inlet also appears in the U.S. Geological Survey, Apalachicola Quadrangle, 1957 (revised 1975). The USGS New Inlet, Topographic Quadrangle, 1950, shows St. George Island. These charts show no channel depths.

Gulf of Mexico and Apalachicola Bay depths in the vicinity of the inlet are shown in U.S. Coast and Geodetic Survey Boat Sheet Numbers H-1184 and H-6788. The only maps that detail the inlet depths are the U.S. Army Corps of Engineers, Mobile District, channel survey maps performed for the maintenance dredging as stated in Section 4.1.

Before the dredging in the inlet, the U.S. Army Corps of Engineers, Mobile District, surveyed St. George Island. The survey and all the aforementioned charts are available in the Coastal and Oceanographic Engineering Archives, University of Florida. Figure 5.1 shows the shoreline changes from 1856 to 1973 and is a composite of the mhw (based on the 1929 datum) shoreline from all the surveys available.

Seven photographs showing the inlet (the earliest taken in September 1954) are available in the COE Archives. Most were taken by the Florida Department of Transportation, though one is a satellite imagery obtained from the Environmental Protection Agency Lab in Las Vegas, Nevada.

5.2 Outercoast Shoreline

Figure 5.1 shows the mhw shoreline of St. George Island adjacent to Sikes Cut for the years 1856, 1934, 1945, 1959 and 1973. The major change in the Gulf shoreline since 1856 has been the shoaling of New Inlet in the year 1900. The beach west of Sikes Cut receded approximately 300 feet between 1856 and 1934, but since then has shown no major variation. The beach east of Sikes Cut has remained within 50 feet of its position in 1856. The bay shoreline in Figure 5.1 shows major changes in some areas, however this is probably attributable to inaccuracies in the older surveys and a rise in sea level of approximately one foot between 1856 and 1973 (see Figure 5.2).

Figure 5.2 shows the variation in sea level as computed by the U.S. Army Corps of Engineers, Mobile District for both Biloxi, Mississippi from 1900 to the present and Panama City, Florida from 1935 to the present. The graphs show both the annual mean sea level computed from tide records and the five year moving average computed from five consecutive annual mean sea levels. The Panama City sea level variation is shown to coincide well with the Biloxi sea level, indicating the northern Gulf coast sea level changes are uniform. Therefore, Figure 5.2 may be applied to the Gulf Coast of St. George Island. The sea level has risen approximately 0.7 feet since 1900.

Figure 5.3 shows photographs of the Sikes Cut inlet in 1954, 1955 and 1960. Notice the shoaling which occurred in the inlet without jetties in just a year from 1954 to 1955. Figure 5.4 shows the change in the inlet shoreline from 1954 to 1977. Until 1969, the shoreline north of the jetties was rapidly receding, but since then has stabilized.

Figure 5.5 shows the locations of the construction control line profiles for the area near Sikes Cut (COEL, 1973). In Figure 5.6 are some typical beach profiles from the DNR survey for the setback line.

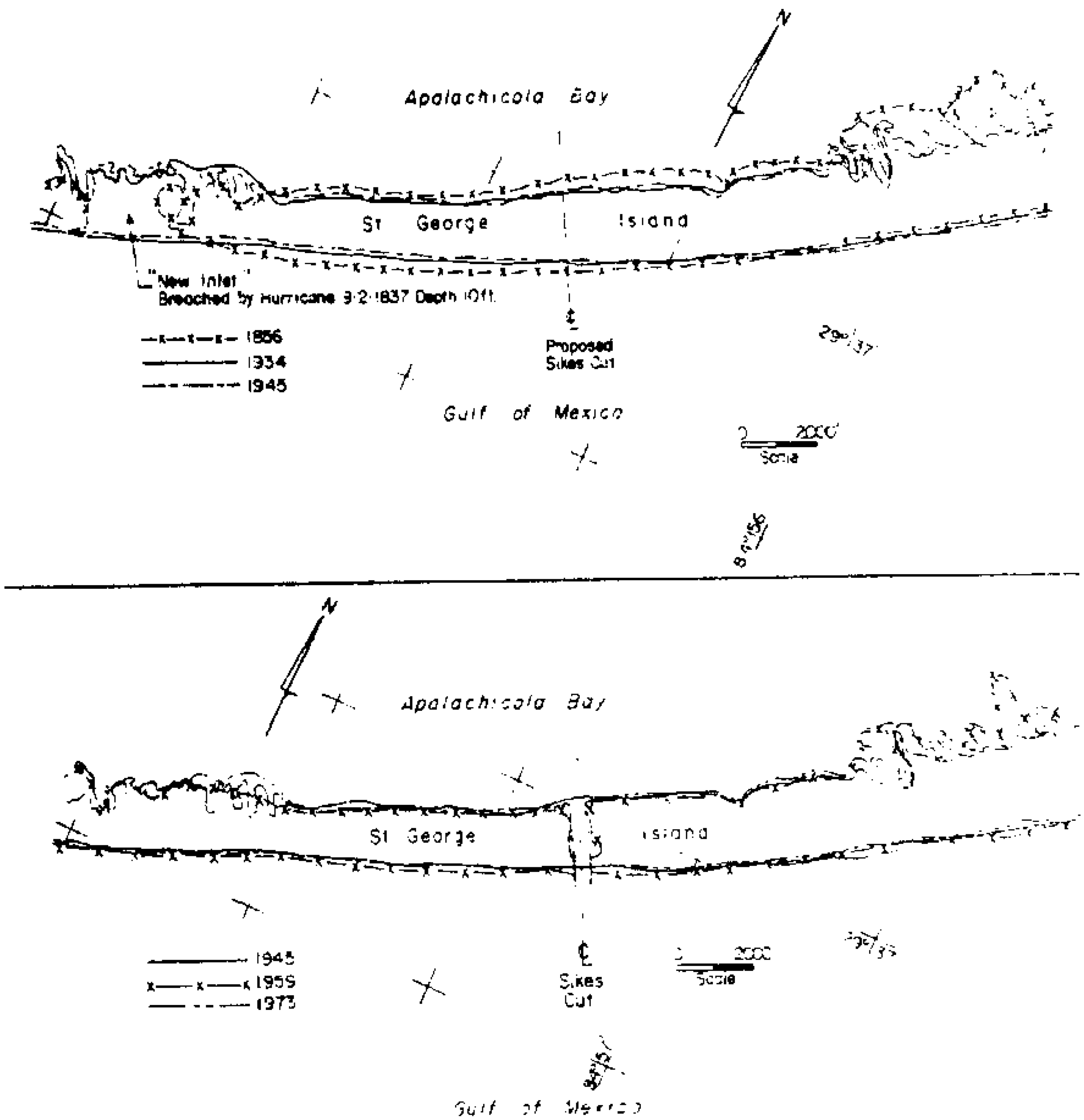


Figure 5.1 Shoreline Change Map of St. George Island
(Corps of Engineers, 1950 and U.S.G.S.)

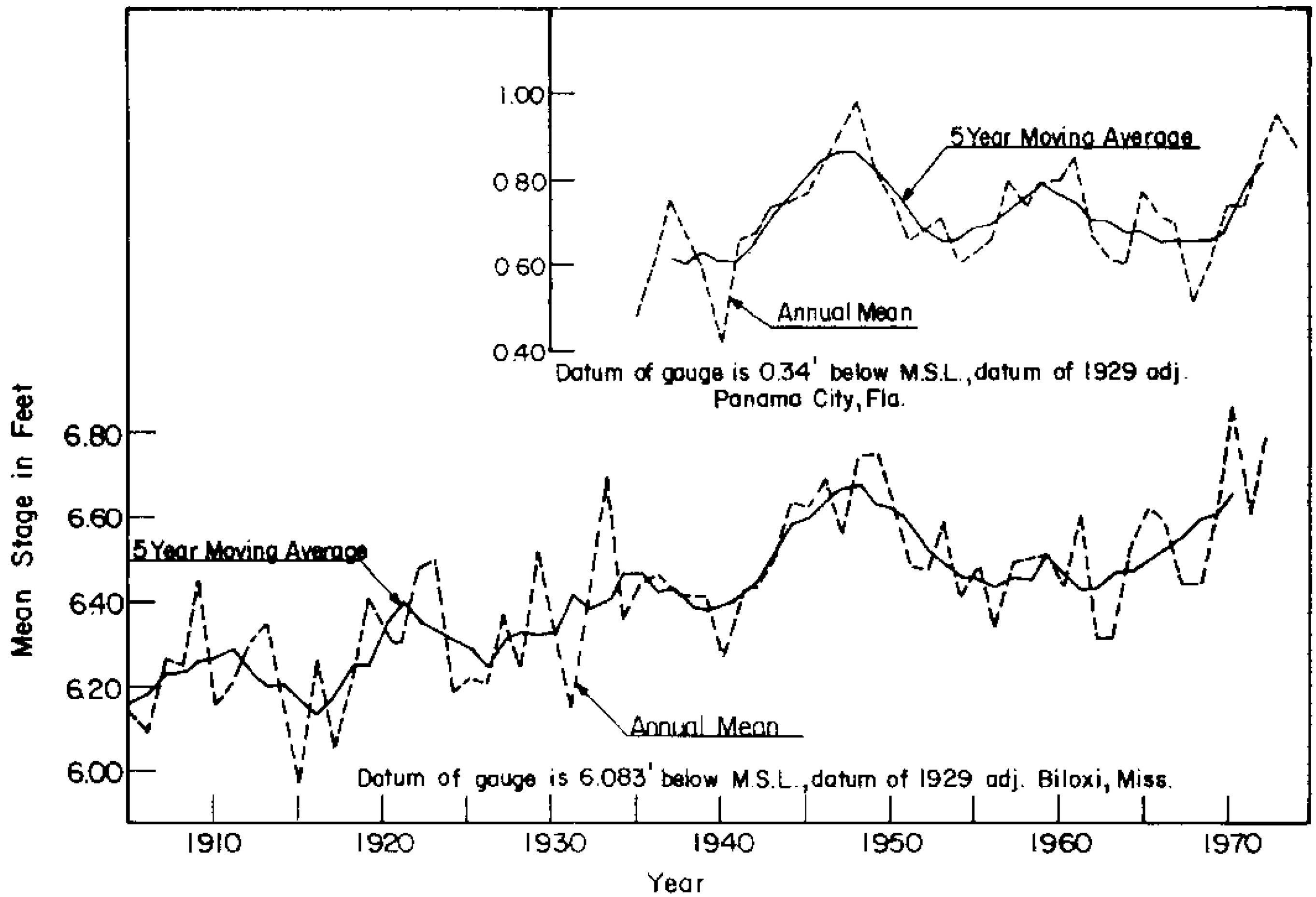
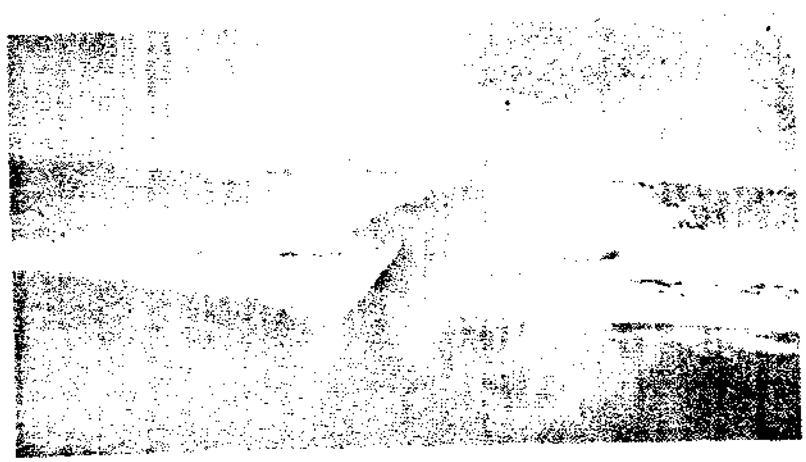


Figure 5.2 Annual Mean and Five Year Moving Average Sea Level Changes for Biloxi, Mississippi and Panama City, Florida (from Corps of Engineers, Mobile District)

a) 1954

b) 1955



c) 1960

Figure 5.3 Aerial Photographs of Sikes Cut, U.S. Army Corps of Engineers

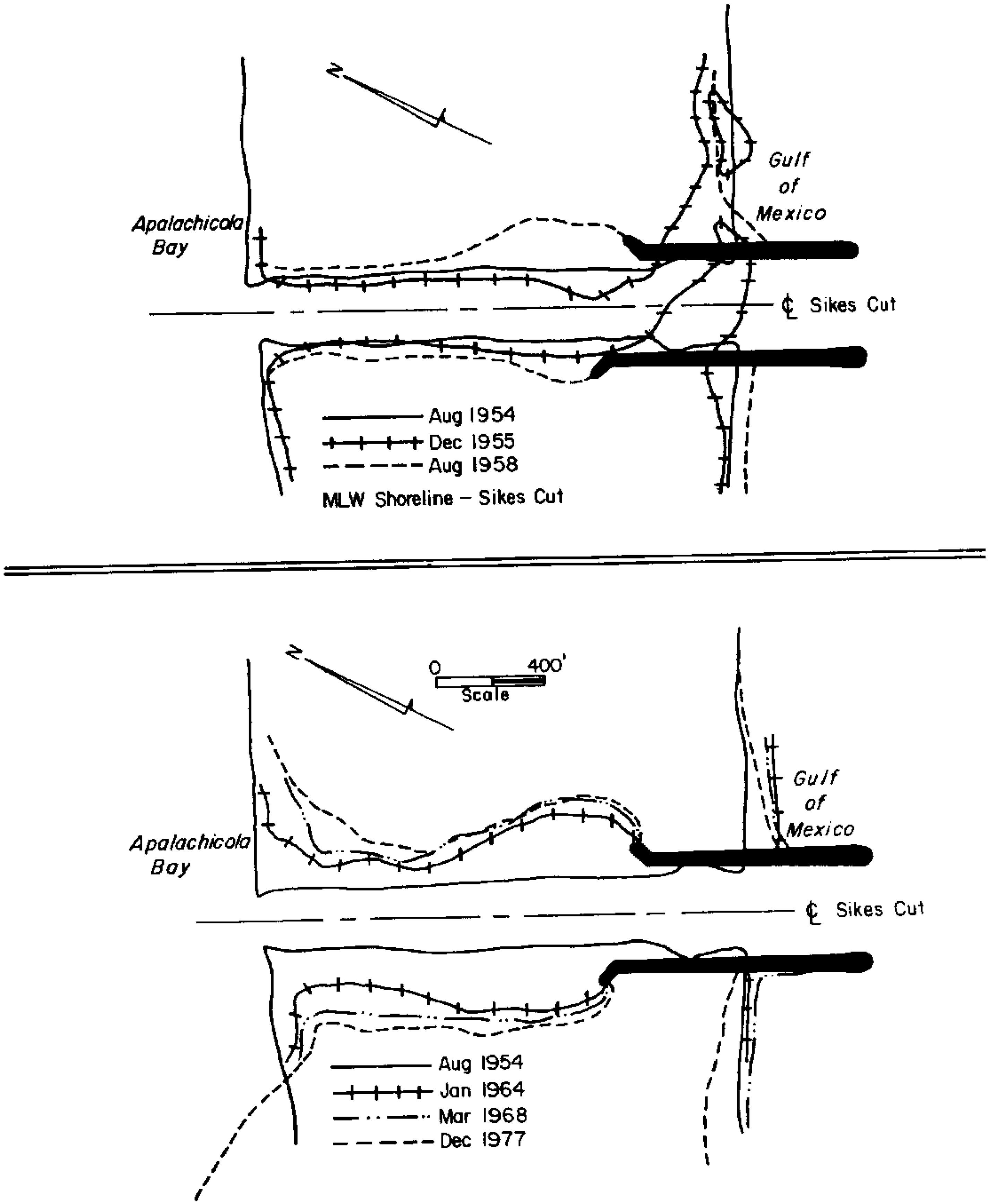


Figure 5.4 Inlet Shoreline Change at Sikes Cut

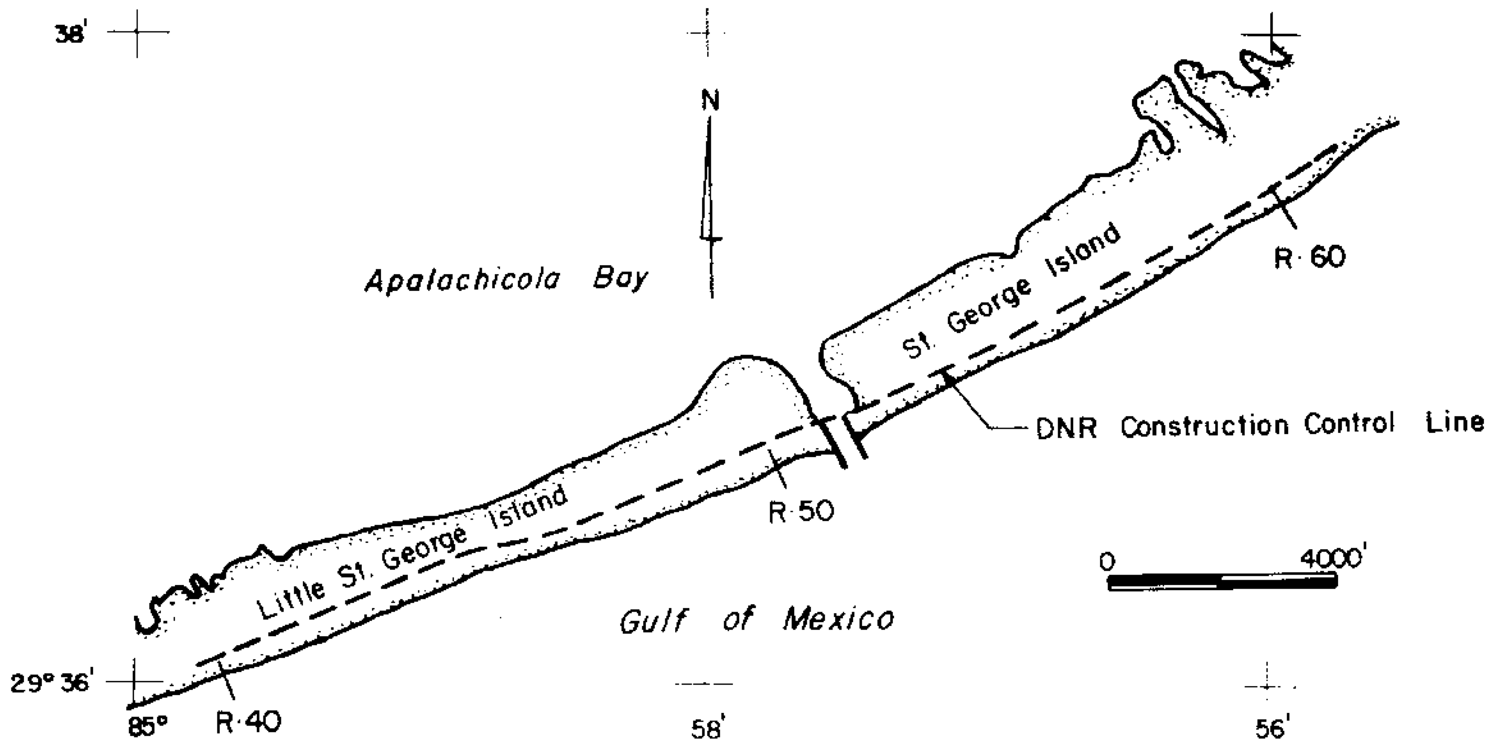


Figure 5.5 Location of Construction Control Line in the Vicinity of Sikes Cut (COEL, 1973)

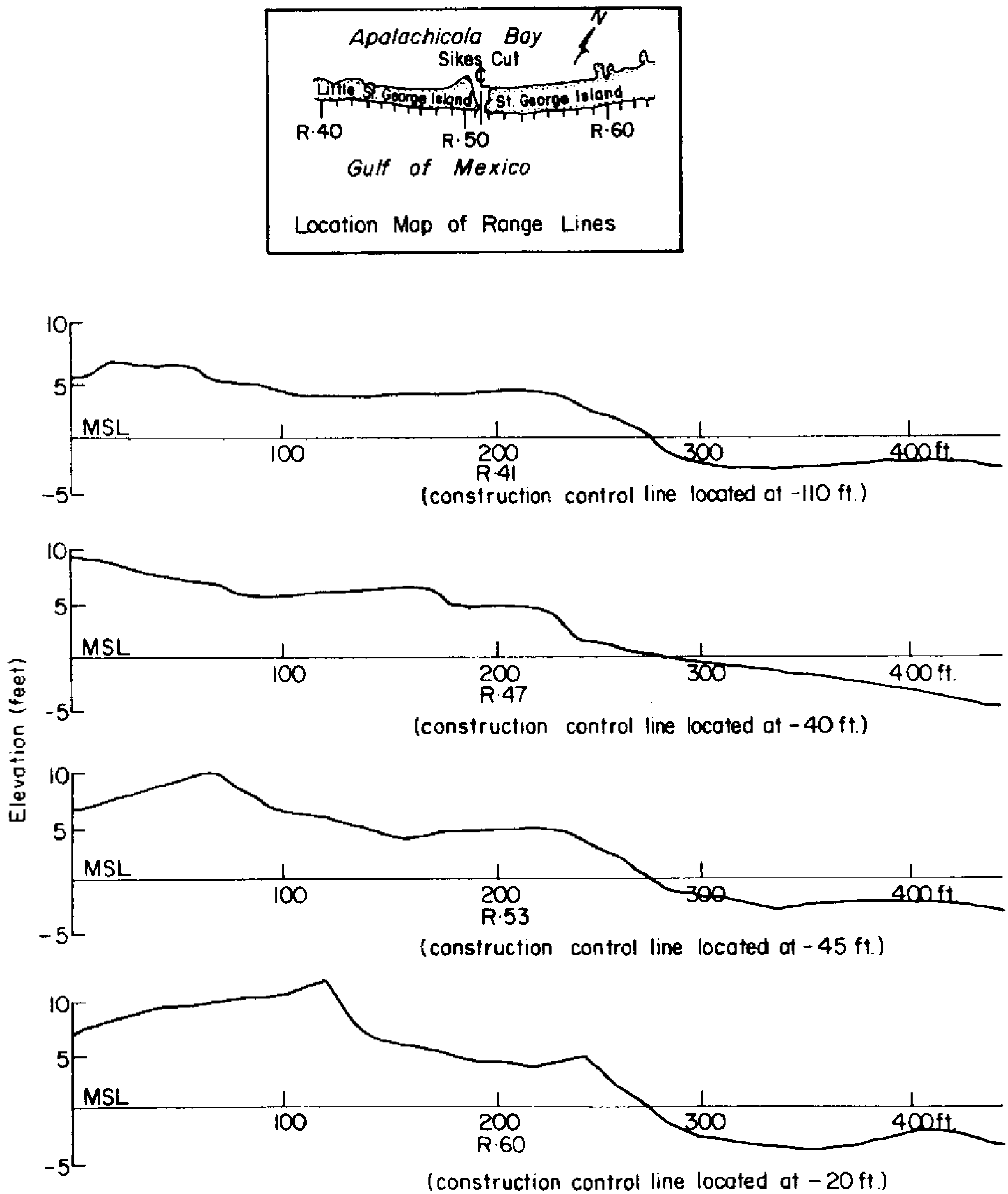


Figure 5.6 Beach Profiles Along St. George Island Gulf Shoreline (COEL, 1973)

VI. HYDRAULICS

6.1 Tides

The National Oceanic and Atmospheric Adminstration (NOAA) and the U.S. Army Corps of Engineers, Mobile District, maintain tide gage stations at Apalachicola on the Apalachicola River at the locations shown in Figure 6.1. During August 1978, the Department of Coastal and Oceanographic Engineering, University of Florida, monitored the tide on both the Gulf and bay sides of Sikes Cut at the locations shown in Figure 6.2. The neap and spring tide curves from these gages for August 9 and August 18,1978 are shown in Fig. 6.3a and 6.3b respectively. The Corps of Engineers also monitored the Gulf and bay tides during November 1949, at a location two miles west of the then proposed Sikes Cut as shown in Figure 6.1. Figure 6.3c and 6.3d show typical neap and spring tides from these gages.

Figures 6.3c and 6.3d are typical tide curves from a 1949 Corps of Engineers field study to determine the hydraulics of Sikes Cut before the inlet was dredged. The Corps found the bay to be superelevated over the Gulf 80% of the time due to the freshwater outflow of the Apalachicola River. The bay is superelevated an average of 0.5 feet as shown in Figure 6.3c. Figures 6.3a and 6.3b show the bay, Gulf and Apalachicola River tide after construction of the inlet. The Apalachicola River gage is superelevated as compared to both the Gulf and bay tides at Sikes Cut, indicating the Gulf tide influence reduces the superelevation of the bay in the immediate vicinity of Sikes Cut as could be expected.

The 1978 National Ocean Survey (NOS) Tide Tables give the diurnal range at West Pass as 1.4 feet and at Apalachicola as 1.7 feet. The measured range during the spring tide on August 17 and 18, 1978 was 1.77 feet at the bay tide gage station. The spring tide is mixed while the neap tide in the vicinity of Sikes Cut is semi-diurnal.

6.2 Salinity

Salinity profiles obtained at stations 1a, 2 and 5 (see Figure 6.2) during neap tide on August 9 and spring tide on August 18, 1978 are shown in Figure 6.4. The salinity is normalized by S_0 = 34.55 ppt, the average Gulf salinity for August as given in the 1975 NOAA Temperature, Salinity, Oxygen and Phosphate Tables for the Gulf of Mexico. Figure 6.4a and 6.4b show the salinity profile to be well mixed for neap tidal conditions with wave heights of 1 and 2 feet and winds out of the southeast at 15 to 20 mph. Figures 6.4c and 6.4d show partially mixed salinity profiles for spring tidal conditions with bay wave heights of 0.5 feet and 10 mph southerly winds.

The salinity structure variation from well mixed to partially mixed is a function of the freshwater flow, tidal currents, winds and waves. The Apalachicola River provides the main freshwater flow into the Bay. Estimates of the magnitude of freshwater discharge vary from author to author. Gorsline (1963) estimated the average flow rate as 60,000 cfs, varying from 120,000 cfs in the spring to 20,000 cfs in the fall. His estimates are based on river stage elevations at Chattahoochee, Florida, 80 miles upstream. Discharge rates from the Jim Woodruff Dam, just upriver from Chattahoochee, indicate an average flow rate of 21,300 cfs ranging from 40,300 cfs in the spring to 12,000 cfs in the fall (Corps of Engineers, 1973). Dr. G.M. Powell of Environmental Science and Engineering, Gainesville, FL, has estimated the average flow rate at the mouth of the river as 27,500 cfs, varying from 82,500 cfs as a maximum in the spring to 8,600 as a minimum in the fall. His estimates are based on measured and estimated flow rates of the river and its tributaries near the mouth as published by the USGS for the period 1966-1977. The Corps of Engineers (1950) indicated that a maximum river discharge would induce approximately a 1.0 foot

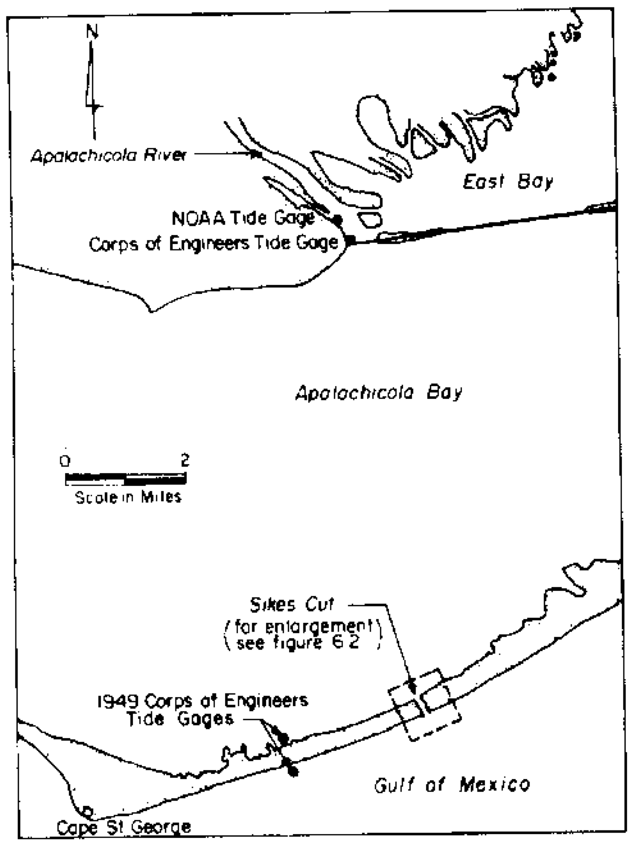


Fig. 6.1 Location Map of Sikes Cut and Apalachicola Tide Gages

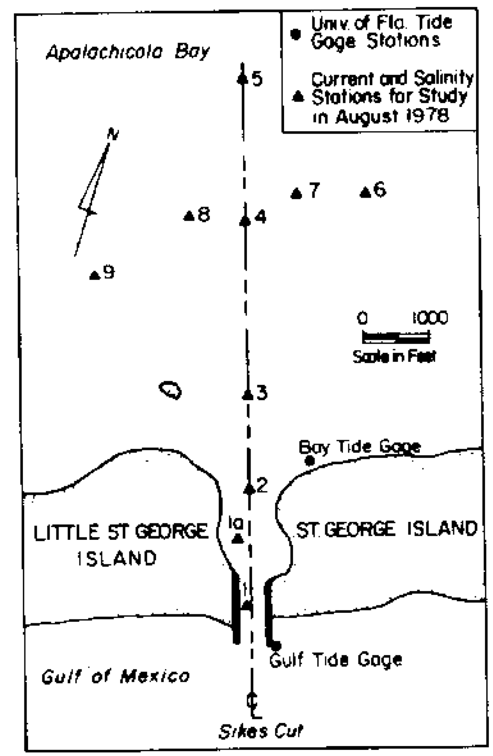
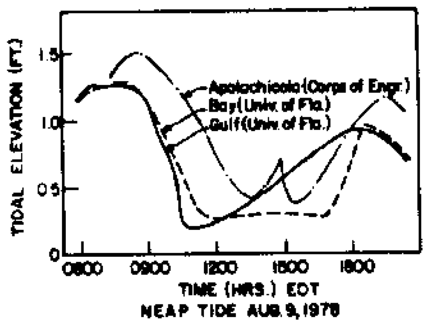
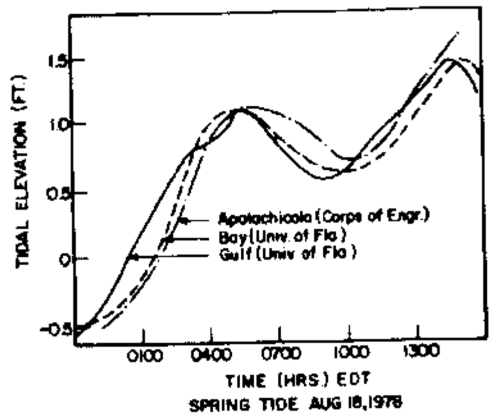


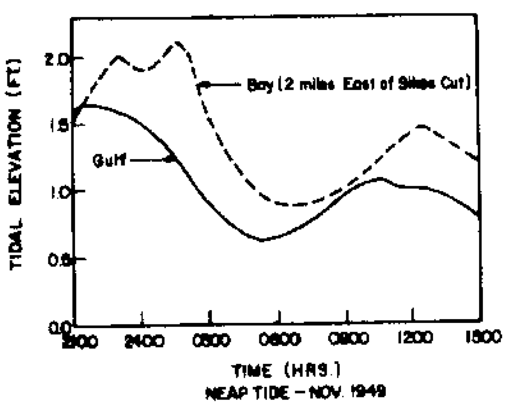
Fig. 6.2 Location of Tide Gage and Monitoring Stations for Sikes Cut (August 1978), University of Florida



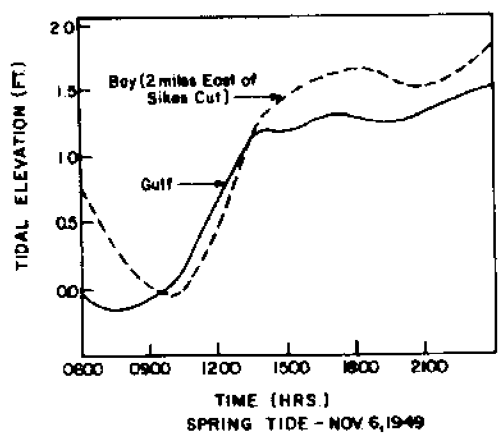
(a)



(b)



(c) (U.S. Army Corps of Engr., 1950)



(d) (U.S. Army Corps of Engr., 1950)

Figure 6.3 Tide Data for Sikes Cut and Apalachicola Bay

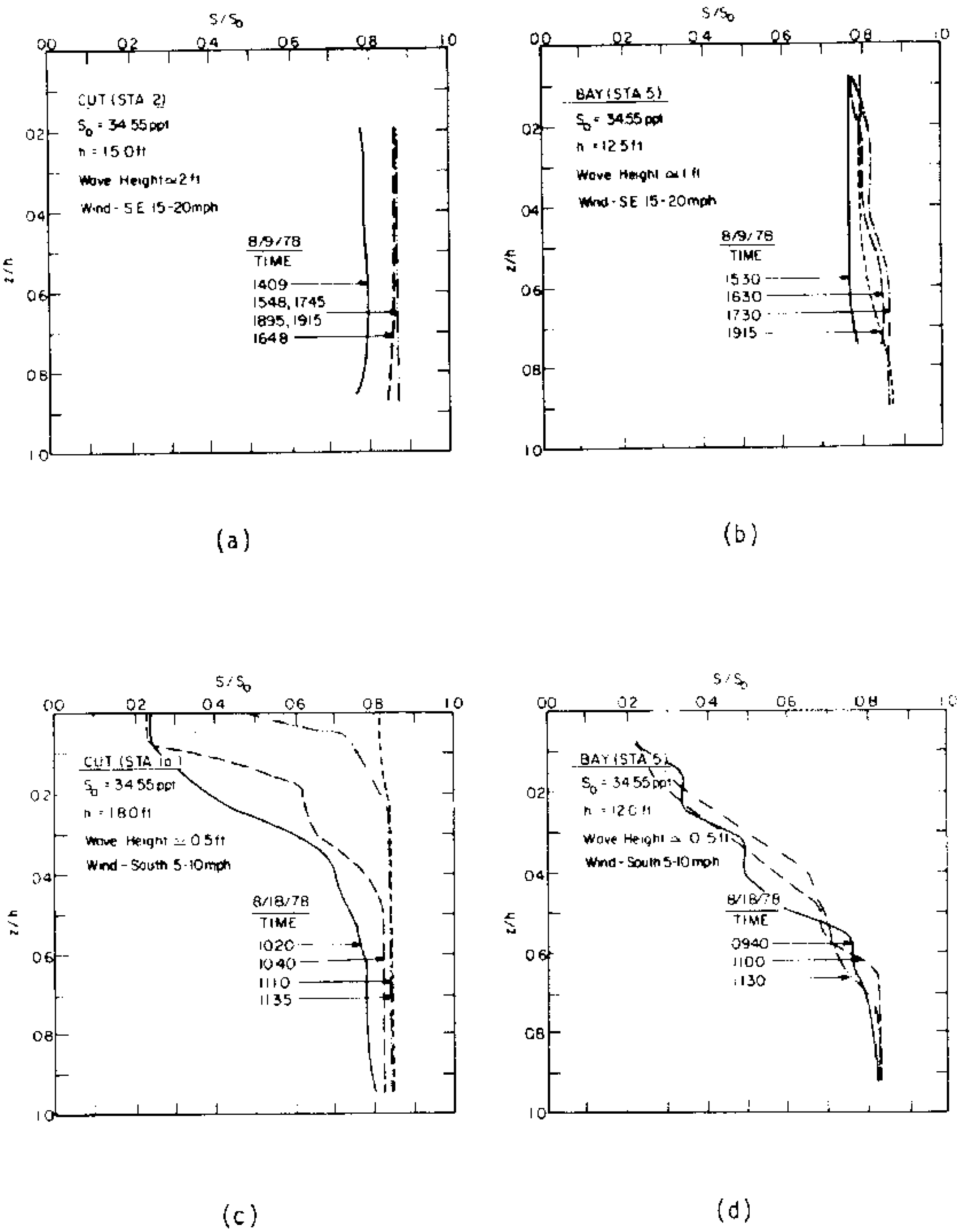


Figure 6.4 Salinity Profiles of Sikes Cut and Apalachicola Bay, University of Florida

superelevation of the Apalachicola tide above the Gulf tide. As shown in Figure 6.3a, the neap tide on August 9, 1978 at Apalachicola is an average of 0.4 over that in the Gulf. In Figure 6.3b the spring tide on August 18 at Apalachicola is seen to be approximately equal to that in the Gulf. Based on these tidal elevation differences between Apalachicola and the Gulf, the flow rate in the Apalachicola River can be postulated to have been moderate during the neap tide and low during the spring tide. In addition, the neap tidal currents, as expected, were less than the spring currents. These characteristics (i.e. moderate freshwater discharge and neap tide) are usually conducive to the formation of a stratified salinity structure. However, a well mixed salinity profile was found in the bay during the neap tide on August 9. The probable contributing factor to this mixed salinity structure was the 1 to 2 foot waves in the shallow water of Apalachicola Bay.

6.3 Hydraulic Parameters

a. Tidal Prism

The tidal prism is defined as the volume of water that enters an inlet during flood flow and exits during ebb flow, though flood and ebb prisms are not always equal. The reason for this inequality can be due to a circulation within a multi-bay inlet or a freshwater discharge into the bay. At Sikes Cut the ebb prism was larger than the flood prism on August 9, 1978 as shown by the discharge curve (Figure 6.5) computed by the Point Discharge Method (Mehta, et al., 1977; Hayter, 1979) using current data collected at station 1 (see Figure 6.2). The main reason for this difference is that the ebb flow includes some of the Apalachicola River discharge. The spring tidal prism at Sikes Cut has been estimated to be 2.15×10^8 ft^3 (Zeh, 1979).

b. Maximum Currents

Figure 6.6 shows cross-sectional average inlet velocities on August 9, 1978 neap tide. The maximum ebb and flood velocities are shown to be 3.07 fps. Inlet velocities were also obtained on August 18 and August 23, 1978 with the largest measured velocity being 4.67 fps which was recorded at station 1 one foot below the surface on August 23.

c. Slack Water Lag

The lag of slack water after high and low tide in the Gulf can be obtained for the neap tide at Sikes Cut on August 9, 1978 as shown in Figure 6.6 The average lag of slack water after high tide was 25 minutes while the average lag of slack water after low tide was 170 minutes. This value of 170 minutes appears to be unreasonably high, and could be due to a combination of the Apalachicola River discharge and the northwesterly wind on August 9, both of which would serve to extend the ebb flow out of Apalachicola Bay. Also, the flow direction was determined visually at the surface only; therefore, the denser bottom water could conceivably have begun flooding earlier in the cycle.

Spring Bay Tide Range = 1.77 feet
Spring Maximum Cross-Sectional Average Velocity (flood) = 3.07 ft/sec
Spring Maximum Cross-Sectional Average Velocity (ebb) = 3.06 ft.sec
Spring Tidal Prism = 2.15×10^8 ft^3
Inlet Throat Cross-Sectional Area (below mlw) = 5,500 ft^2
Inlet Throat Surface Width = 350 ft
Inlet Throat Hydraulic Radius (mean depth) = 15.5 ft
Lag of Slack Water After High Water = 25 minutes

6.4 Waves

No information is available specifically on the wave climate of the Gulf coast of St. George Island. Using the synoptic deep water wave height and period information based on ship observation, Walton (1973) has prepared wave period and height roses (Figs. 6.7 and 6.8) which pertain to the northeastern Gulf of Mexico. They are frequency distributions including directional dependence on an annual basis. Noting the geographical alignment of St. George Island, the frequency of approach of the waves is greater from the east and southeast (100-140). This would explain the predominate southwestern littoral drift on the western end

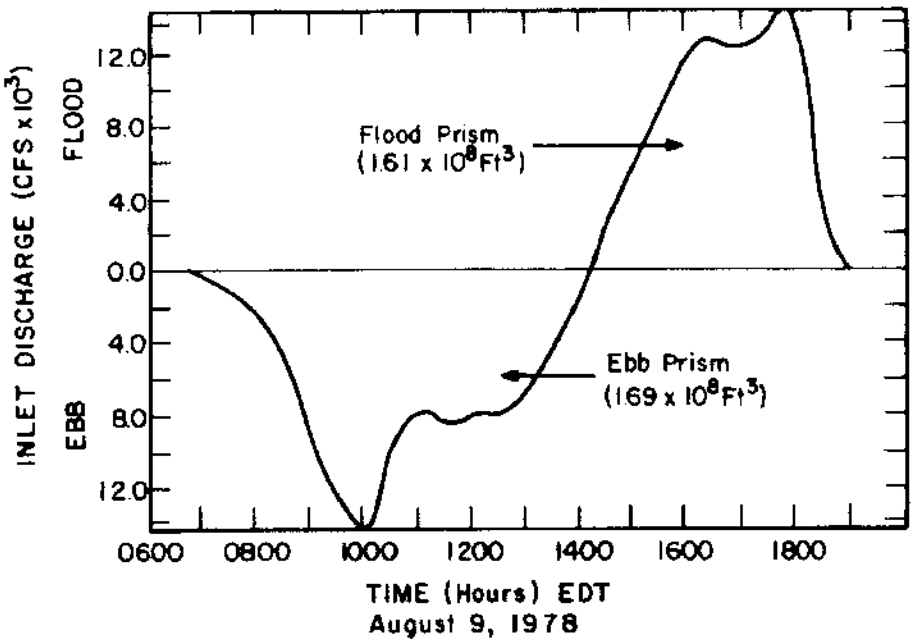


Figure 6.5 Discharge for Sikes Cut

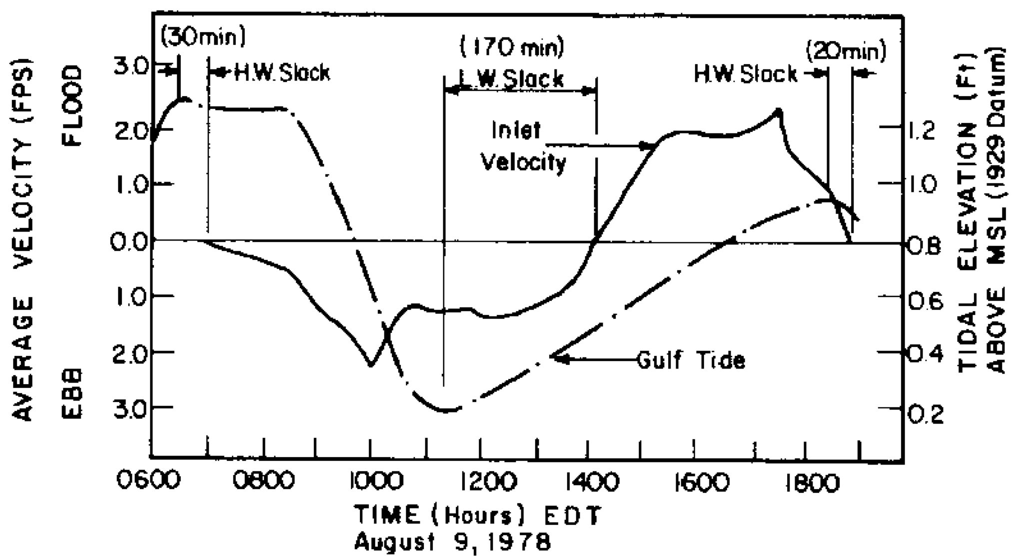


Figure 6.6 Cross-Sectional Average Inlet Velocity for Sikes Cut Station 1 (Computed by Pt. Discharge Method) and Gulf Tide

of St. George Island. Note that these are deep water waves and therefore must be used with caution when applied to the shoreline. They give a reasonable description of the deep water climate for relatively long segments of the shoreline, but where details are involved, the roses tend to assume a more qualitative role.

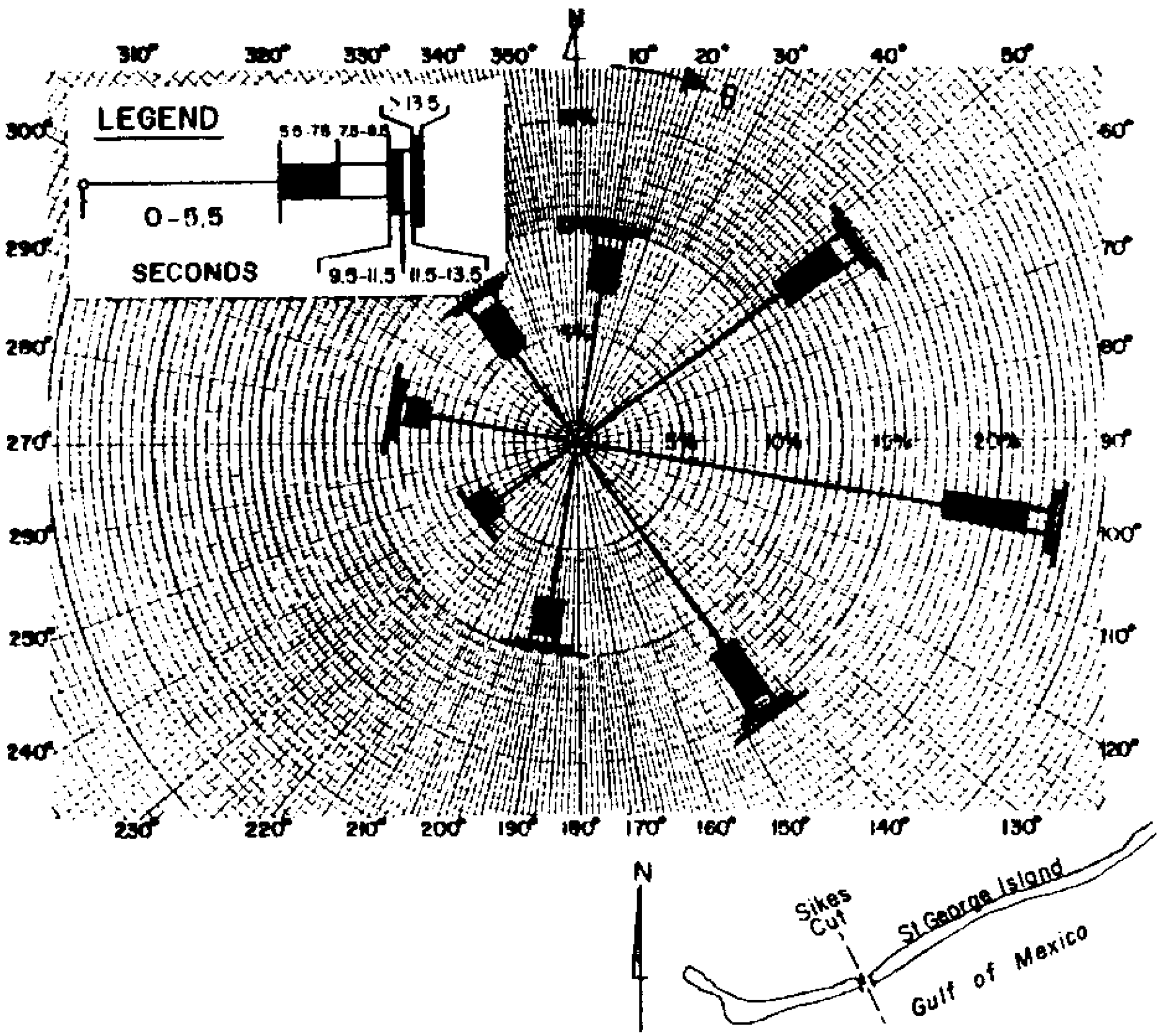


Figure 6.7 Wave Period Rose for Offshore Wave Climate for Northeastern Gulf of Mexico (Walton, 1973)

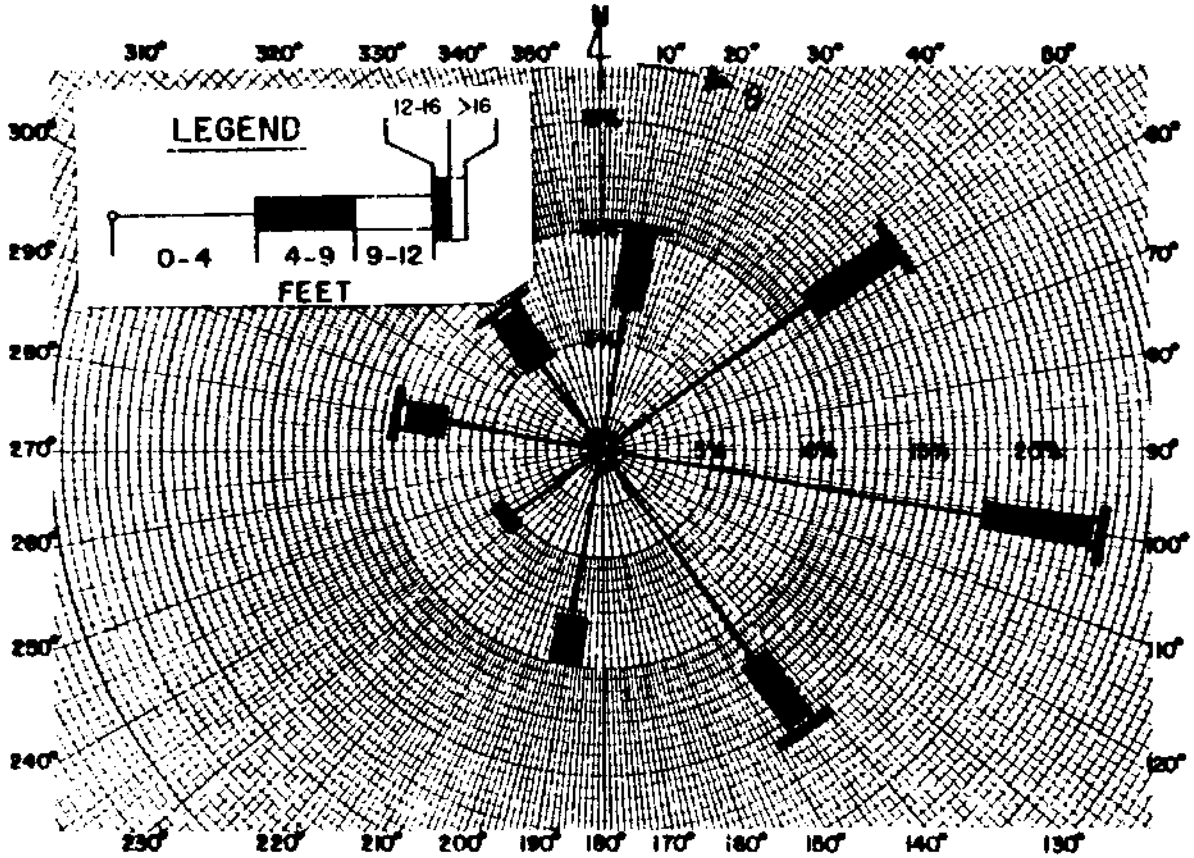


Figure 6.8 Wave Height Rose for Offshore Wave Climate for Northeastern Gulf of Mexico (Walton, 1973)

VII. SEDIMENTARY PROCESSES

7.1 Sedimentary Characteristics

The Coastal and Oceanographic Engineering Department, University of Florida, obtained surface samples on the Gulf of Mexico and Apalachicola Bay beaches near Sikes Cut on July 2, 1977. Grain size distribution curves of the samples are shown in Figure 7.1. In all locations the sand size was generally between 0.2 and 0.4 mm with a mean grain size of 0.25 mm. The shell content of each sample was less than 2%. This confirms the core borings in Figure 2.1, which show sand is prevalent in the first 5 to 10 feet below MSL, while the next 10 to 20 feet of sediment are comprised mainly of sand and shell fragments, mostly oyster shells.

7.2 Outer Bar Volume

Table 7.1 shows the outer bar volumes for West Pass, East Pass and Indian Pass (see Figure 1.1) as well as the outer bar volume of Sikes Cut. The throat cross-sectional area of the inlets are also given. Walton and Adams (1976) have shown that an empirical relationship exists that relates the outer bar volume to the spring tidal prism for highly exposed, moderately exposed and mildly exposed coasts. The Florida Panhandle Gulf coast is considered moderately exposed with the empirical relationship expressed as $\forall = 10.5 \times 10^{-5}\ P_S\ 1.23$ where $\forall$ = outer bar volume in cubic yards and P_S = spring tidal prism in cubic feet.

The spring tidal prism for Sikes Cut as determined in Chapter VI was 2.15 x 10 ft thus, the outer bar volume $\forall$ is $1.86 \times 10^6\ yd^3$ which is more than three times the actual volume in Table 7.1. The reason that the bar is less than what the empirical relationship predicts could be due to the fact that the outer bar is periodically dredged in conjunction with channel dredging, which decreases its volume. If the channel alone were dredged, the increase in channel cross-section could be expected to result in a corresponding increase in bar volume.

TABLE 7.1

VOLUME OF MATERIAL DEPOSITED IN OUTER INLET BAR

Inlet	Calculated Vol. (ft^3)	Throat Cross Section (ft^2)	Survey Year
East Pass	17.78×10^6 *	145,000	1935
West Pass	54.4×10^6 *	79,200	1935
	32.77×10^6 *	79,400	1874
Sikes Cut	0.5×10^6	4,900	1968
Indian Pass	2.4×10^6 **	--	1943

** from Walton and Dean (1976)

* from Dean and Walton (1973)

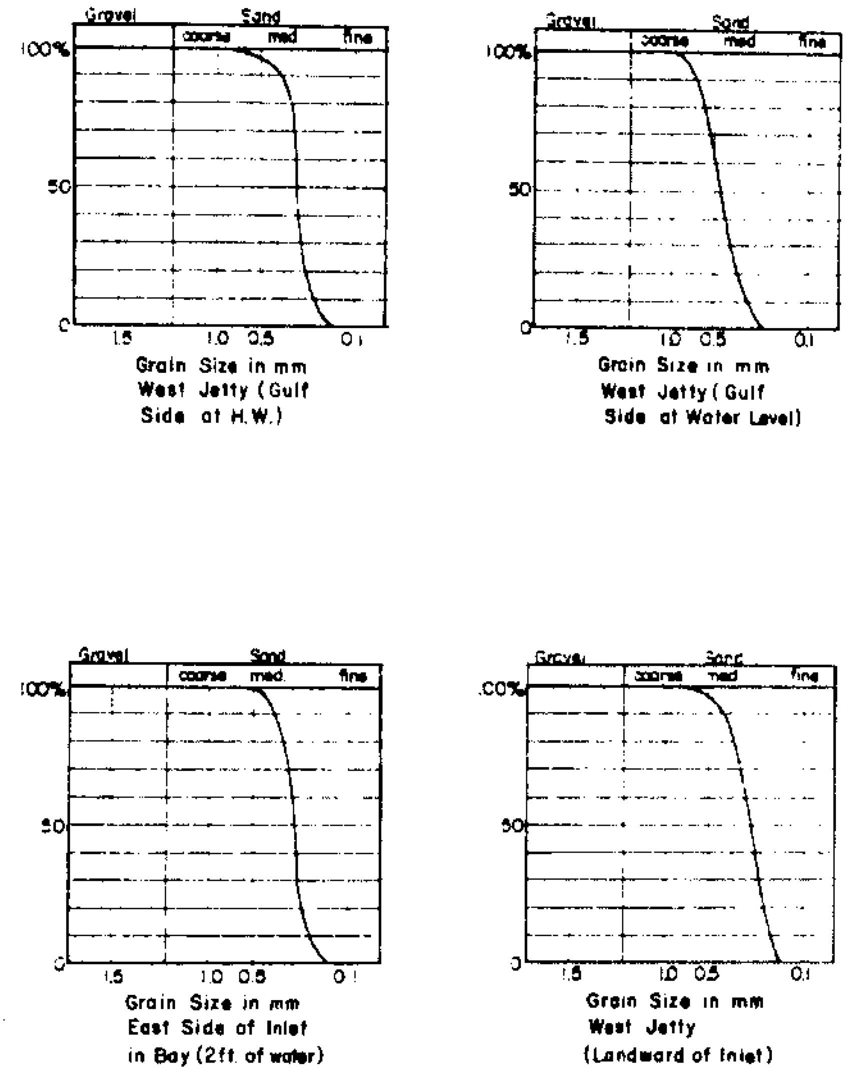


Figure 7.1 Grain Size Distributions from Beaches of St. George Island near Sikes Cut (July 1977)

7.3 Littoral Material Balance

Figure 7.2 shows a control volume for sedimentary budget for the Gulf shoreline region of St. George Island. The northern boundary passes through the throat section of Sikes Cut and parallels the shoreline while the southern control volume boundary parallels the shoreline approximately 3 miles offshore. The 30 foot contour is approximately 3 miles offshore, thus the southern boundary is at a location where there would be a negligible littoral exchange. The east and west boundaries are normal to the beach as shown. The west boundary is at an angle $\Theta_n = 150^\circ$ and the east boundary is at an angle $\Theta_n = 160^\circ$ as shown.

With reference to Figure 7.2 the material balance for the control volume is as follows:

$$\frac{\Delta V}{\Delta t} = Q_1 + Q_4 + Q_6 + Q_7 - Q_2 - Q_3 - Q_5 - Q_8$$

where ΔV is the change in the volume of littoral material within the control volume over a time Δt. The subscripted Q designates the volumetric rate of littoral transport across the boundaries.

Estimates of the littoral drift along St. George Island are available from Walton (1973) and Stapor (1973). Figure 7.3 shows an estimate of the net littoral drift for the shoreline from Cape St. George west to Cape San Blas (see Figure 1.2) by Walton. This estimate is assumed to be applicable to St. George Island as well.

The angle Θ_n represents the angle between the normal to the shoreline and north, while the littoral drift estimate was calculated from ship wave observations applied to the shore orientation Θ_n. In addition, Stapor (1973) estimated minimum littoral drift rates for St. George Island calculated from shoreline changes on the island since 1856. Table 7.2 relates these littoral estimates to the subscripted Q values in Figure 7.2

TABLE 7.2

VOLUMETRIC TRANSPORT RATE ESTIMATES

Quantity	Amount (cu. yds./yr.)	
	Walton (1973)	Stapor (1973)
$Q_1 - Q_2$	170,450	-78,500
$Q_6 - Q_5$	-182,450	-99,400
$Q_4 - Q_3$	-40,700 (from Table 4.1)	
Q_7	0 (assumed)	
Q_8	0 (assumed)	

The net transport at Sikes Cut ($Q_4 - Q_3$) is considered to be equal to the average volume dredged per year (see Table 4.1), i.e. -40,000 cu. yds./yr. The material balance for the control volume using the littoral drift rates of Walton (1973) is as follows:

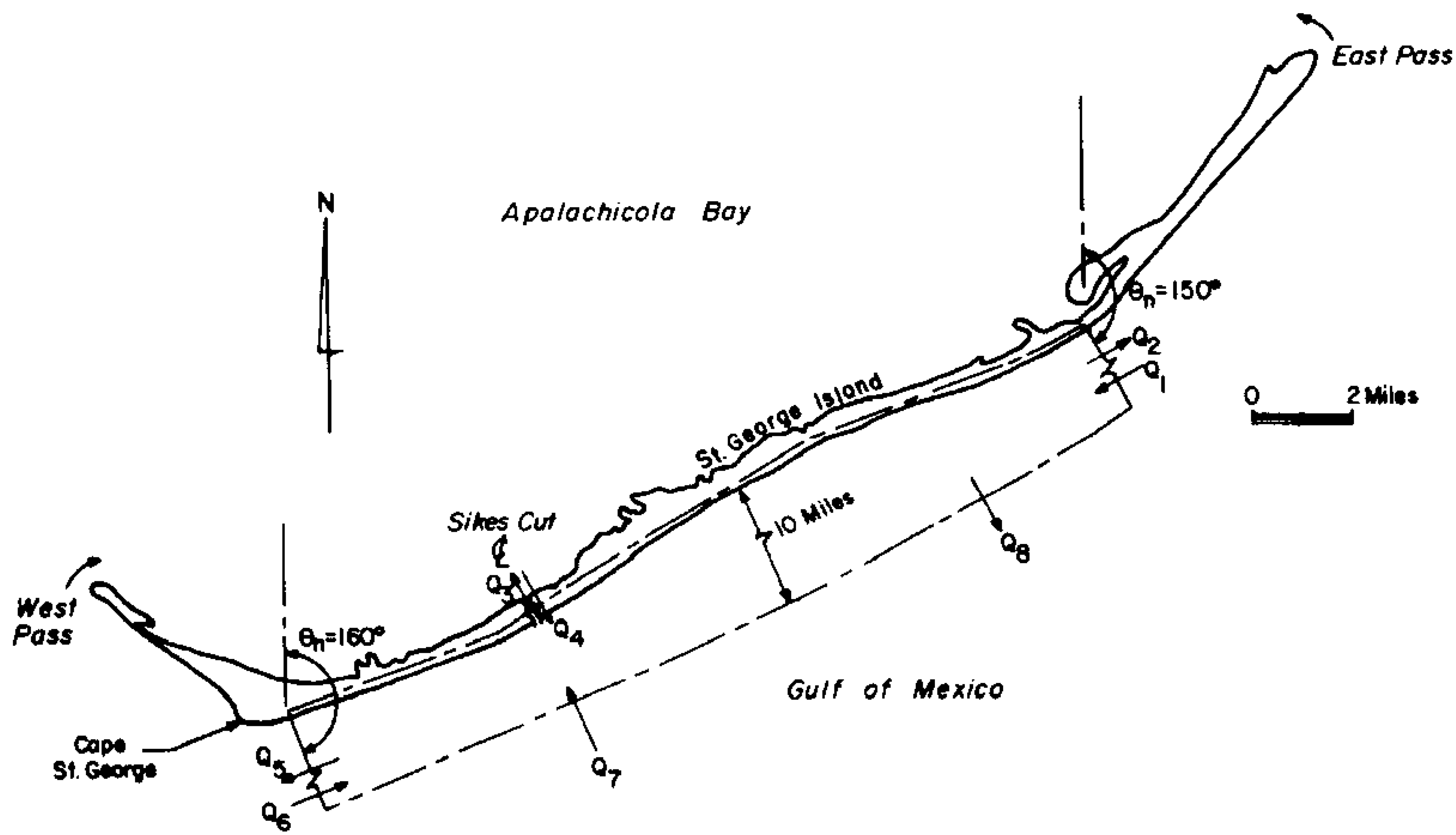


Figure 7.2 Control Volume for Material Balance Computations

$$\frac{\Delta V}{\Delta t} = 170{,}450 - 40{,}700 - 182{,}450 = -52{,}700 \text{ cu. yds./yr.}$$

This indicates that 52,700 cubic yards leave the system annually.

The resulting material balance using estimates of Stapor (1973) is as follows:

$$\frac{\Delta V}{\Delta t} = -78{,}500 - 99{,}400 - 40{,}700 = -218{,}600 \text{ cu. yds./yr.}$$

This implies that 218,600 cubic yards leave the system annually, with 78,500 and 99,400 cubic yards being transported across the eastern and western boundary respectively. This implies the existence of two littoral drift cells, one from the center of the island westward and the other from the center eastward.

Since the volumetric transport rates obtained from the work of Walton (1973) were extrapolated to include St. George Island, and Stapor's values were obtained from direct measurement of the beach erosion on St. George Island, the rates given by Stapor are probably more accurate. Additionally, Stapor (1973) calculated the deposition rates for the eastern and western ends of St. George Island based on the shoreline changes shown in Figure 7.4. Cape St. George was found to have increased at a rate of 127,000 cu. yds./yr. while the eastern tip of the island increased at a rate of 99,000 cu. yds./yr. These deposition rates indicate that Stapor's estimate of separate eastern and western littoral drift cells on the island to be at least qualitatively correct with accretion occuring at both ends of the island and erosion along the central portions.

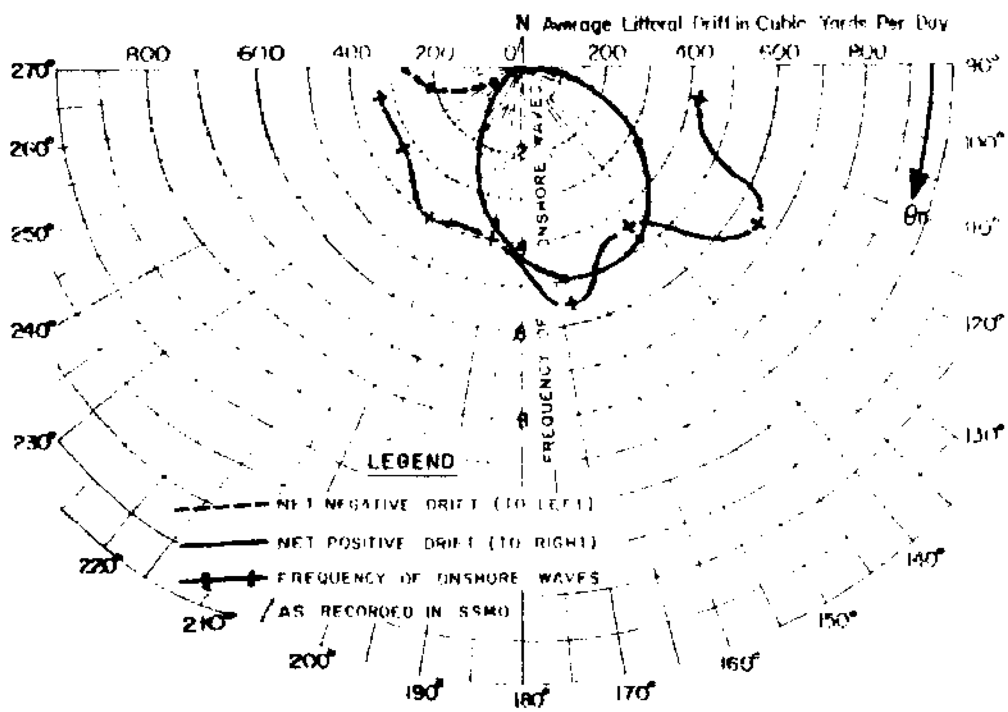


Figure 7.3 Variation of Average Annual Net Littoral Drift with Beach Orientation - Cape San Blas to Cape St. George, Florida (Walton, 1973)

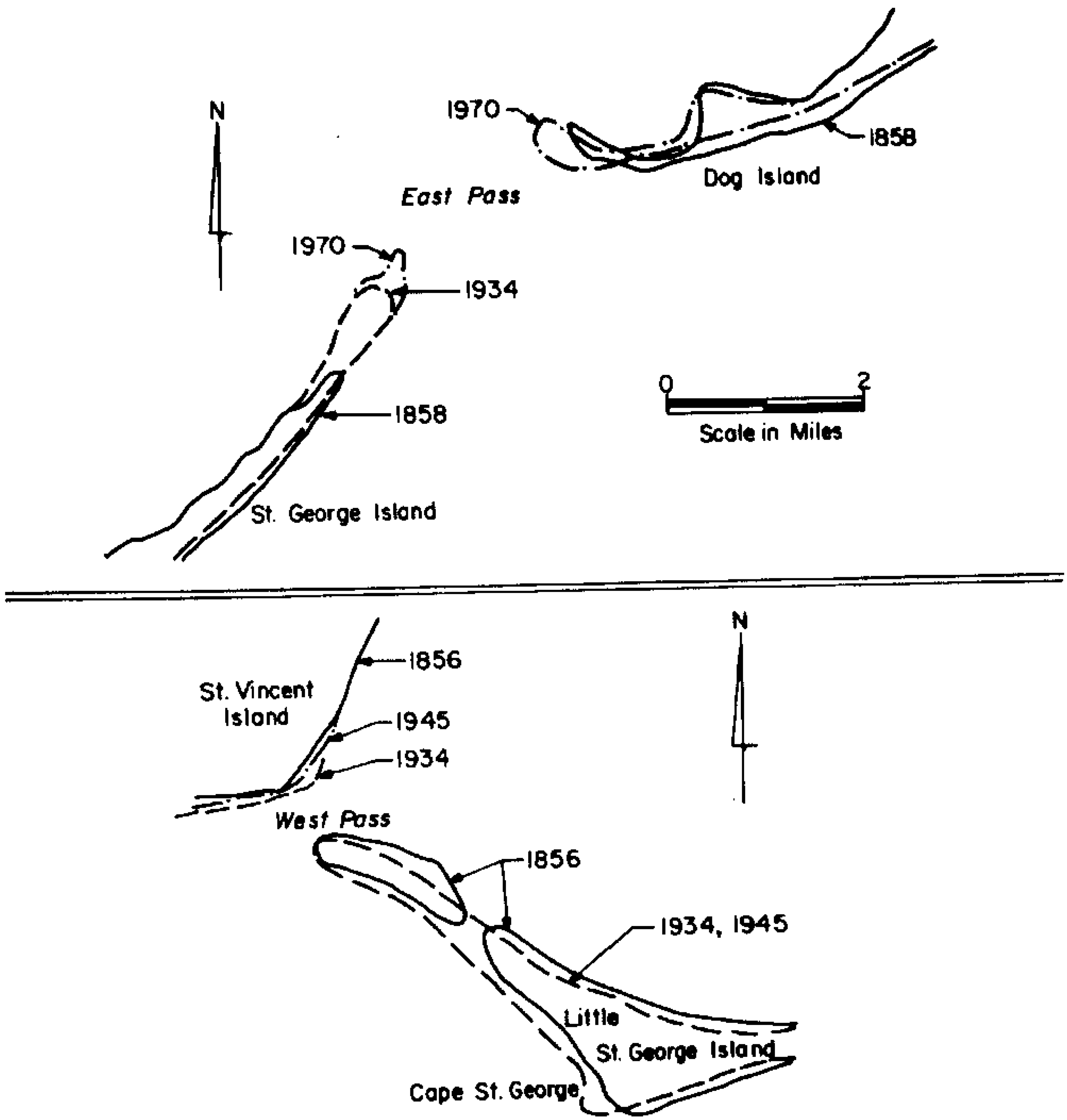


Figure 7.4 Shoreline Changes, for Eastern Tip of St. George Island, Dog Island, Western Tip of St. George Island and part of St. Vincent Island, 1856 - 1970.

VIII. SUMMARY

Sikes Cut is a man-made inlet on St. George Island which separates the Gulf of Mexico from Apalachicola Bay. The inlet is located five miles south across the bay from Apalachicola, on Florida's panhandle. Collected information and computed data in this report are summarized as follows.

1. The inlet has two Gulf jetties built in 1956, which have successfully stabilized the inlet cross-section, though dredging of the inner and outer shoals is required.

2. The cut spans a barrier island consisting of 3,000 year old quartz sand resting on an eroded Pleistocene surface.

3. The climate of the Apalachicola Bay area is humid semi-tropical with humid summers and mild winters. Much of the 56 inch annual rainfall occurs during the summer months. The mean temperature is 68.8°F.

4. The storms that have had major effects on the inlet have been tropical storms or hurricanes. They have passed within 50 miles of the inlet at a frequency of once every 10 years since 1837. The 1837 hurricane and hurricane "Agnes" in 1972 caused the greatest damage to the Apalachicola area.

5. The inlet is maintained under the River and Harbor Act of 1958. The shoals are dredged periodically by the U. S. Army Corps of Engineers, Mobile District.

6. The history of the inlet begins with its original dredging by local interests in 1954. After the main channel shoaled, the Corps of Engineers installed two jetties and redredged the inlet in 1956. The present throat cross-sectional area (minimum flow area) is 5,500 ft^2 below MLW.

7. The spring tidal prism has been estimated to be 2.15 x 10^8 ft^3.

8. The maximum current measured in the inlet was 4.67 fps. The inlet is easily navigable and readily used by shrimp boats and pleasure craft.

9. The salinity structure at the cut ranges from well mixed to partially mixed depending on fresh water flow rates and wind and wave conditions in the bay.

10. Tidal measurements at Sikes Cut in August 1978 showed the spring range on the bay end of the cut to equal 1.77 feet. The spring tide is diurnal while the neap tide is semi-diurnal.

11. The littoral drift on St. George Island has been estimated from two sources, Walton (1973) and Stapor (1973). Walton's estimates extrapolated from graphs pertaining to an area west of St. George Island, predicted a westerly drift of approximately 175,000 cu. yds./yr. with a net volumetric rate of 52,000 cu. yds./yr. leaving the system and depositing on Cape St. George. Stapor's results indicate two drift cells exists. A westerly cell originating at the center of the island deposits approximately 127,000 cu. yds./yr. on Cape St. George while the easterly cell deposits an estimated 99,000 cu. yds./yr. on the eastern end of St. George Island. In the vicinity of Sikes Cut the net westerly drift is given by both sources. Since Stapor's results were obtained directly from St. George Island shoreline changes, they are probably more accurate.

12. The outercoast shoreline of St. George Island has been relatively stable over the last 100 years with some erosion occurring southwest of the inlet.

13. The outer bar sand volume has been estimated to be 500,000 cu. yds. This volume is significantly less than the amount stored in the outer bars of other inlets on sandy shores of similar size, and is probably due to the fact the outer bar is periodically dredged.

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OTHER INLET STUDIES

Report No. 2	St. Lucie Inlet - Sea Grant Glossary of Inlets Report #1
No. 3	Fort Pierce Inlet - Sea Grant Glossary of Inlets Report #2
No. 14	Sebastian Inlet - Sea Grant Glossary of Inlets Report #3 (Out-of-Print)
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