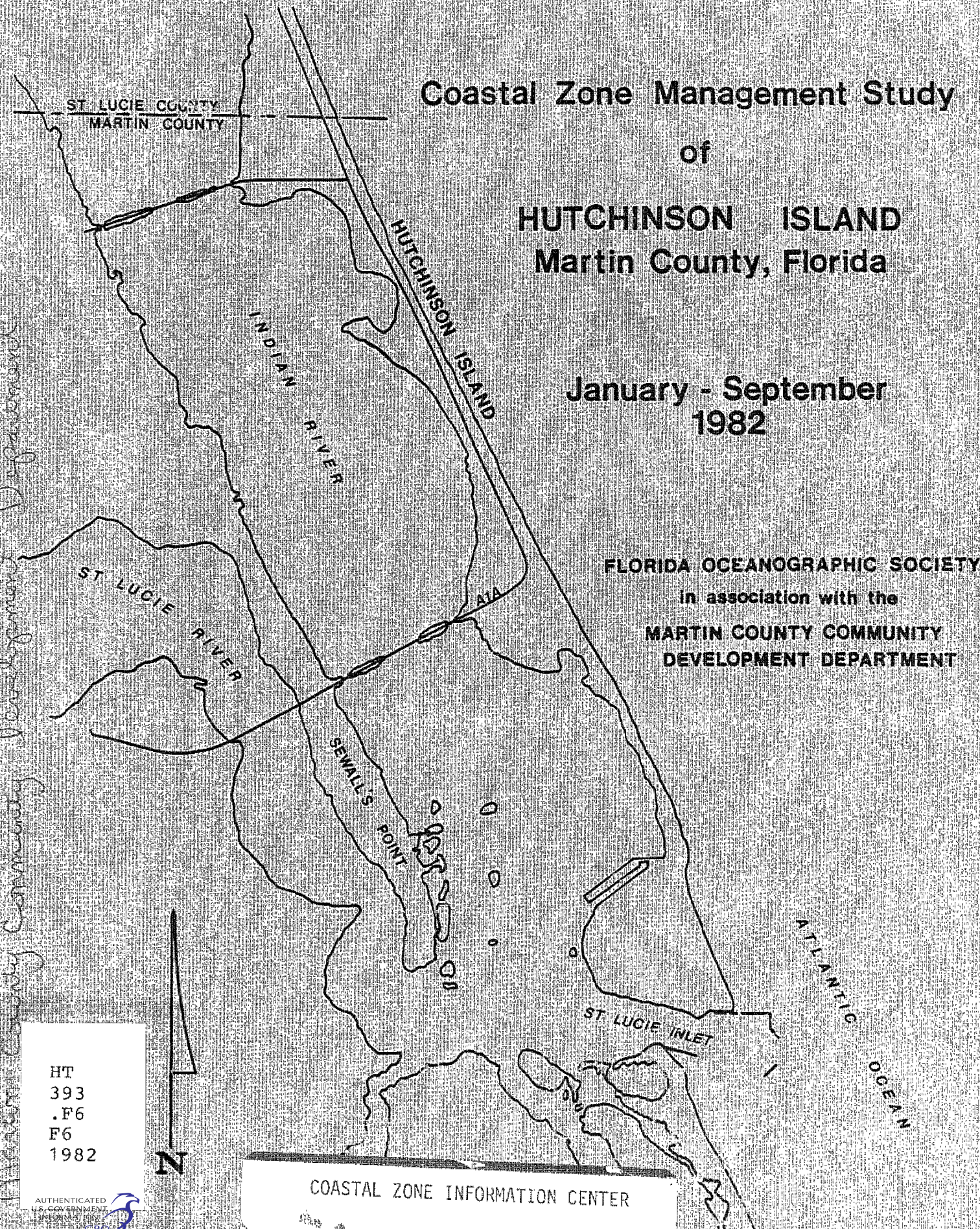
Coastal Zone Management Study of HUTCHINSON ISLAND Martin County, Florida

January - September 1982

FLORIDA OCEANOGRAPHIC SOCIETY
in association with the
MARTIN COUNTY COMMUNITY DEVELOPMENT DEPARTMENT



Florida Oceanographic
Society Inc.

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Letter of Transmittal

September 28, 1982

Mr. Robert H. Oldland
Martin County Administrator
P. O. Box 626
Stuart, Florida 33495

Dear Mr. Oldland:

Florida Oceanographic Society is pleased to submit our final report on the Coastal Zone Management Grant Project for Hutchinson Island, Martin County. The study was authorized by the Board of County Commissioners on January 26, 1982.

The study was undertaken for the purposes of gathering resource information and investigating the planning and management processes on Hutchinson Island in Martin County. The work, therefore, was carried out in association with the Planning Division of the Martin County Community Development Department and other County officials and departments which participated in various phases of the Study.

Florida Oceanographic Society has appreciated the opportunity to assist Martin County in this important planning and management study of Hutchinson Island and trust that we may continue to be of service in the future.

Respectfully yours,
FLORIDA OCEANOGRAPHIC SOCIETY

Mark Perry
Executive Secretary

MP:rae

COASTAL ZONE MANAGEMENT STUDY

of

HUTCHINSON ISLAND

MARTIN COUNTY, FLORIDA

January - September 1982

prepared for the

MARTIN COUNTY BOARD OF COMMISSIONERS

MARTIN COUNTY, FLORIDA

by

FLORIDA OCEANOGRAPHIC SOCIETY, INC.
1212 Riverside Drive
Stuart, Florida

In Association With
MARTIN COUNTY COMMUNITY DEVELOPMENT DEPT.
Martin County, Florida

This study was accomplished with financial assistance provided by the Florida Department of Environmental Regulation and by the Coastal Zone Management Act of 1972, as amended, administered by the Office of Coastal Zone Management, National Oceanic and Atmospheric Administration.

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Also a special thanks to: the Martin County Planning Staff, Mr. Joseph Banfi, Director, Don Cuozzo, Eileen Miller and especially Morris Crady for finalization of the Plates; Martin County Engineering Staff, Mr. Bob Peterson; the Martin County Administration, Mr. Robert Oldland, Administrator and Mr. Roger Nichols and the Martin County Board of County Commissioners John Holt, Chairman, Sherri King, Vice Chairman, Alex Haynes, Maggie Hurchalla and Thomas Higgins.

The members of the CZM Task Force as a part of this project also contributed a great deal to the gathering of information.

Appreciation especially to Barbara Langer and Ruth Ewing for the typing of this report.

PART I

INTRODUCTION

PART I, INTRODUCTION

BACKGROUND

Martin County applied for the Coastal Zone Management Study in the latter part of August 1981 to the Office of Coastal Zone Management, Florida Department of Environmental Regulation. Funding limitations required the application to be modified at a reduced funding amount, thus the study was started late in January 1982 instead of October 1981 as originally designated. Martin County subcontracted with the Florida Oceanographic Society to do the study work as outlined in the CZM project.

The five major tasks of the CZM study project were to: (1) provide support and technical assistance to the Martin County Beach Committees, which consist of the Beach Improvements Committee, the Beach Acquisition Committee and Beach Finance Committee (the latter two met together as one soon after the CZM project started); (2) collect and organize any available information about Hutchinson Island, and conduct field surveys and research to identify and locate significant resource features; (3) conduct field surveys and research on the "Bathtub Reef" located nearshore at the south end of Hutchinson Island; (4) collect and organize regulatory and management information for federal, state and local levels as they relate to Hutchinson Island; and (5) work with the County Planning, Engineering and Public Safety staff on long range plans for the public areas on Hutchinson Island in Martin County.

There were several studies taking place at the same time which assisted this CZM project. The Florida Department of Natural Resources is undertaking a restudy of the Martin County Coastal Construction Setback Line which may be completed by

spring or summer 1983. The Treasure Coast Regional Planning Council has two studies in progress, "Hutchinson Island; The Development of a Barrier Island" and the "Hurricane Evacuation Study", parts of which have been completed. Also The Army Corp of Engineers is completing a "Feasibility Report for Beach Erosion Control Martin County, Florida".

Also assisting the coastal zone management efforts of Martin County was the adoption of the Martin County Comprehensive Plan in April 1982. The recent efforts of the County toward beach acquisition on Hutchinson Island with the passage of a five million dollar bond on June 29, 1982, and the Save Our Coast Program application by the County have added to this active period of Coastal Zone Management.

Martin County's coastal zone, considered as the region east of the Florida Turnpike, is a practical place for studies of the CZM nature. With the various waterway influences of the St. Lucie River estuary, Indian River Lagoon and Atlantic Ocean; the barrier island and inlet; and the rapidly growing population, to name a few, Martin County's coastal zone contains the many problems and dynamics faced by similar areas throughout Florida.

STUDY AREA LOCATION AND DESCRIPTION

"Barrier islands serve as shock absorbers for the mainland against the force of the open ocean. They are both fragile and resilient. Their resilience stems in part from their ability to shift position, to alter their shapes in response to a change in their environment."

"Rising Sea, Shifting Shores"
Pilkey & Evans, 1981
Coast Alert - Scientist Speak Out
Jackson and Reische, ed. 1981

Hutchinson Island is part of a chain of barrier islands which comprise the Atlantic Coast of Florida and much of the United States. It is located roughly 260 miles south of Jacksonville, Florida and 100 miles north of Miami, Florida (see Figure 1). Hutchinson Island is 22 miles long extending from Ft. Pierce Inlet in St. Lucie County, south to the St. Lucie Inlet in Martin County. The island varies in width from 200 feet to about 1 mile. The study area is that portion of Hutchinson Island in Martin County which extends from the St. Lucie Inlet north 7.1 miles to the Martin/St. Lucie County line. The interior shoreline bordering the Indian River lagoon meanders in various degrees for a rough total of 10.3 miles of shoreline. The total acreage of Hutchinson Island in Martin County is approximately 1658 acres.

Typically the barrier islands of Florida are long, narrow land forms with beaches and dunes on the ocean side, tidal marshes on the landward side, and lagoons or estuaries separating them from the mainland. These island chains are interrupted by inlets which provide open connections between the ocean and the inner lagoons or estuaries. Hutchinson Island has all of these typical features, with dunes and beaches of various widths and elevations on the Atlantic Ocean side, the Indian River lagoon on the western side, and the St.

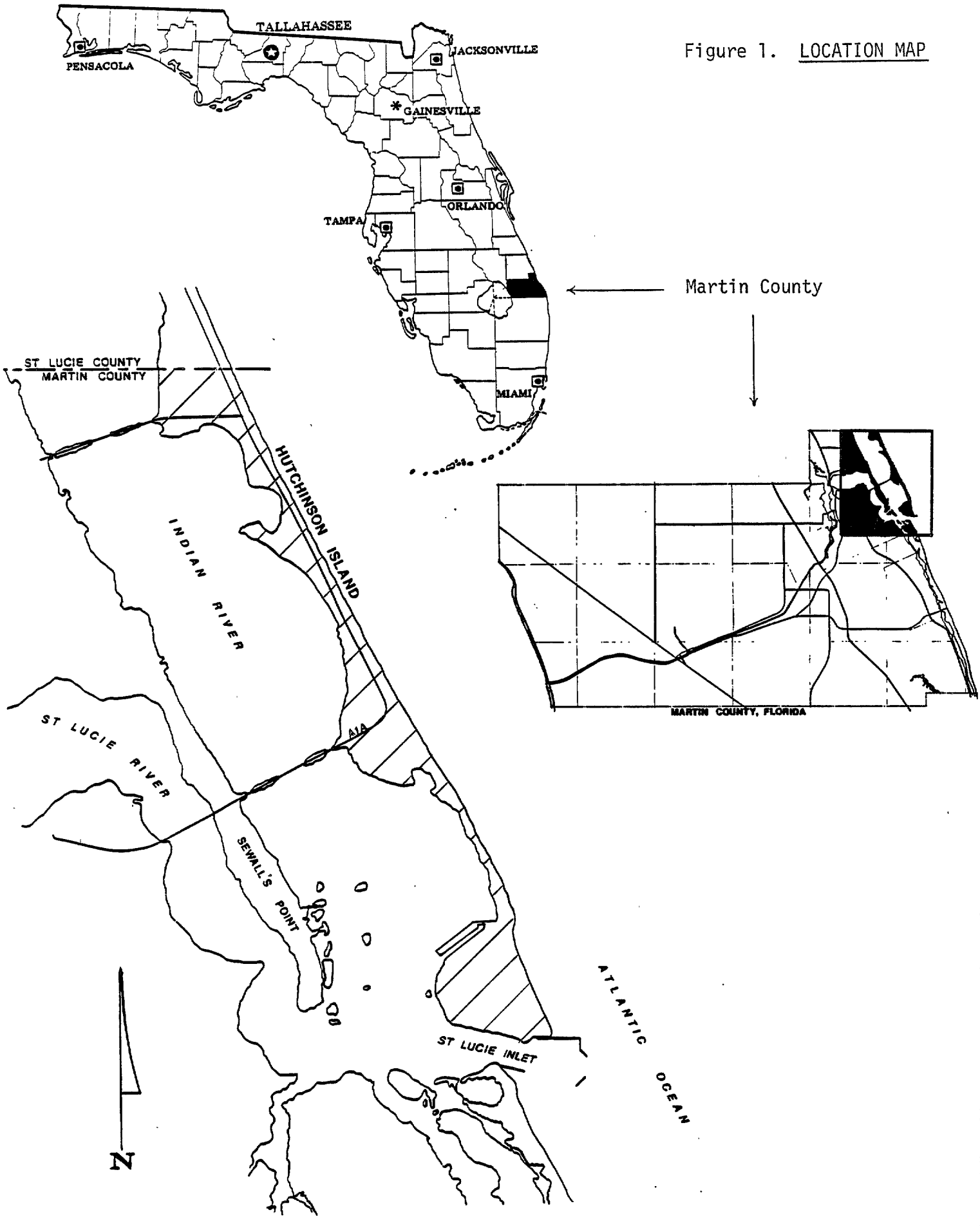

Figure 1. LOCATION MAP

Lucie Inlet providing tidal connection to the Atlantic Ocean.

Hutchinson Island is influenced by many factors. The St. Lucie River is both a natural river/estuarine system and man-made waterway connected by the St. Lucie Canal to Lake Okeechobee 22 miles to the west, forming the cross-state, Okeechobee Waterway. The St. Lucie River meets the Indian River lagoon, which is utilized for the Intracoastal Waterway, in the vicinity of the St. Lucie Inlet, an area locally known as "the Crossroads". Another more direct influence is the nearshore barrier reefs and rock outcroppings which parallel the Atlantic side of the Island. These reefs are composed of a substrate of various coquina limestones with polychaete worms forming a sand-tube "rock" on top of the substrate. One of these unique reef systems, known as the "Bathtub" reef, is located at the southern end of the island. Parts of this reef are exposed at low tide to form a "lagoon" or area of calm water between the reef and the shore.

Hutchinson Island is situated along the portion of the Florida east coast which is oriented on a line running north-north-west to south-south-east. The major axis of the Gulf Stream is about 21 miles offshore, with an average current to the north of 3.5 knots. This well-known ocean current is aligned almost due north - south in this area. Another ocean current, known as the littoral current, runs predominantly in the opposite direction of the Gulf Stream (north to south) and is situated in the surf zone adjacent to the shoreline between the Gulf Strean and Hutchinson Island. Other major

influences on Hutchinson Island are storms, which range from hurricanes to severe northeasters. These events can produce a rapid change to the various lands comprising the island.

Hutchinson Island is a unique and dynamic environment, continuously changing under the influences of both long term and short term events. The seashore and isolation offer appeal to both residential development and public recreation. This growing human influence requires more studies of this type in order to better understand the complex relationships.

PART II

HUTCHINSON ISLAND HISTORY

PART II. HUTCHINSON ISLAND HISTORY

NATURAL GEOLOGIC HISTORY

The formation of Hutchinson Island took place as part of the series of geological events which shaped the Florida peninsula. In the late Miocene and Pliocene epochs (see Table 1) nearly all of the Floridan Plateau was below sea level. The formation of the Florida peninsula began with sediment deposition in northern Florida from rivers draining the Appalachian Mountains. At the same time marine carbonates, shell fragments and microscopic marine animals, were being deposited as sediments throughout the shallow waters covering most all of Florida south of the panhandle. It was during this time that the older rock formations of Hawthorn, Tamiami Limestone and Caloosahatchee Marl were formed.

During the Pleistocene epoch four great Ice Ages caused alternate flooding and exposure of the peninsula. As the land became flooded, large deposits of limestone and sandstone formed on top of the plateau. These were formed under various climatic and environmental conditions and are thus different in their composition and thickness. The names of these rock formations beginning with the oldest are the Fort Thompson, Key Largo Limestone, Anastasia, Miami Limestone, and Pamlico Sand. Due to the porous nature of these sedimentary rocks, some of them form the major aquifer (water reservoirs) of south Florida. The Floridian (artesian) aquifer ranging from 600 to 1,500 feet below the surface and the shallow (non-artesian) aquifer ranging from 15 to 150 feet, are the two major aquifers in Martin County (Lichtler, USGS, 1960). The Anastasia

Formation forms the shallow aquifer and is also the base rock of Hutchinson and Jupiter Islands. The consolidated coquinoid limestones of the Anastasia formation are exposed as rock ourcroppings at Rocky Point, Sewall's Point, Jupiter Island and Hutchinson Island (eg. near the House of Refuge Museum).

Just before the most recent Ice Age, the Wisconsin, which lasted from 100,000 to 11,000 years before present, the sea level was approximately 25-35 feet above the present mean sea level. This was the time of glacial minimum known as the Pamlico period. (See Figure 2 and Table 2). At that time the sea was covering most of Martin County except for the Orlando Ridge, which was a narrow peninsula or series of islands and shoals, and the Green Ridge, which was an offshore bar with the crest at sea level, (see Physiographic Map of Martin County shown in Figure 3). The sea beating against the much smaller Florida coast formed, by erosion and deposition, a broad terrace of Pamlico sands. These sands were composed of mostly quartz, fossils and some carbon materials. The Atlantic Coastal Ridge is of pre-Pamlico origin and was altered by the advancing Pamlico sea. This is evident by the south and north boundaries of the Jensen Beach and Jonathan Dickinson Sandhills which have spit-like structures projecting westward, as shown in Figure 3. These tall sandhills together with Sewall's Point and Rocky Point form the backbone of the Atlantic Coastal Ridge. It is breached by the St. Lucie River between

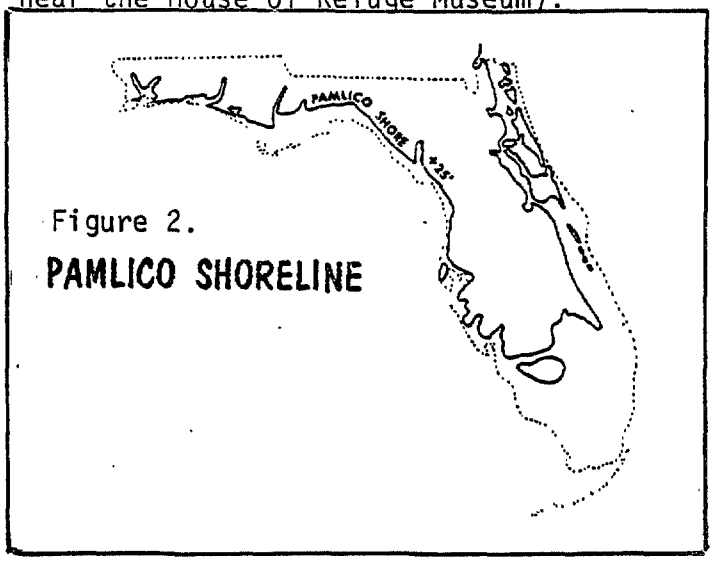

Figure 2.
PAMLICO SHORELINE

Table 1. GEOLOGIC TIME TABLE

Years B.P. (Before Present)	Epoch	Rock Formation
11,000	Recent	
1,000,000	Pleistocene	Pamlico Sand Anastasia Formation Ft. Thompson Formation
2,000,000	Pliocene	Caloosahatchee Marl Tamiami Limestone
6,000,000	Miocene	Hawthorn Formation

Table 2. SEA LEVEL CHANGES AND ICE AGE EVENTS
From Late Pleistocene to Early Recent Epochs

Years B.P. (Before Present)	Events	Sea Level Change - Below Present Meters	Feet	Source
1,700		- 0.5	- 1.6	1
3,500	Slow rise in Sea Level (0.06"/yr)	- 1.6	- 5.3	1
4,000		- 3.1	- 10.0	2
4,400		- 4.0	- 13.1	1
7,000	Glacial Minimum (interglacial period)	-21.3	- 70.0	2
8,000	Rapid Rise in Sea Level (0.2"/yr)	-21.3	- 70.0	2
11,000-12,000	Deglaciation	-30.5	-100.0	3
12,000		-45.7	-150.0	2
17,000		-30.5	-100.0	3
20,000	Wisconson Ice Age Glacial Maximum	-91.5	-300.0	3
100,000	Glacial Minimum (interglacial period)	+ 7.6	+ 25.0	4

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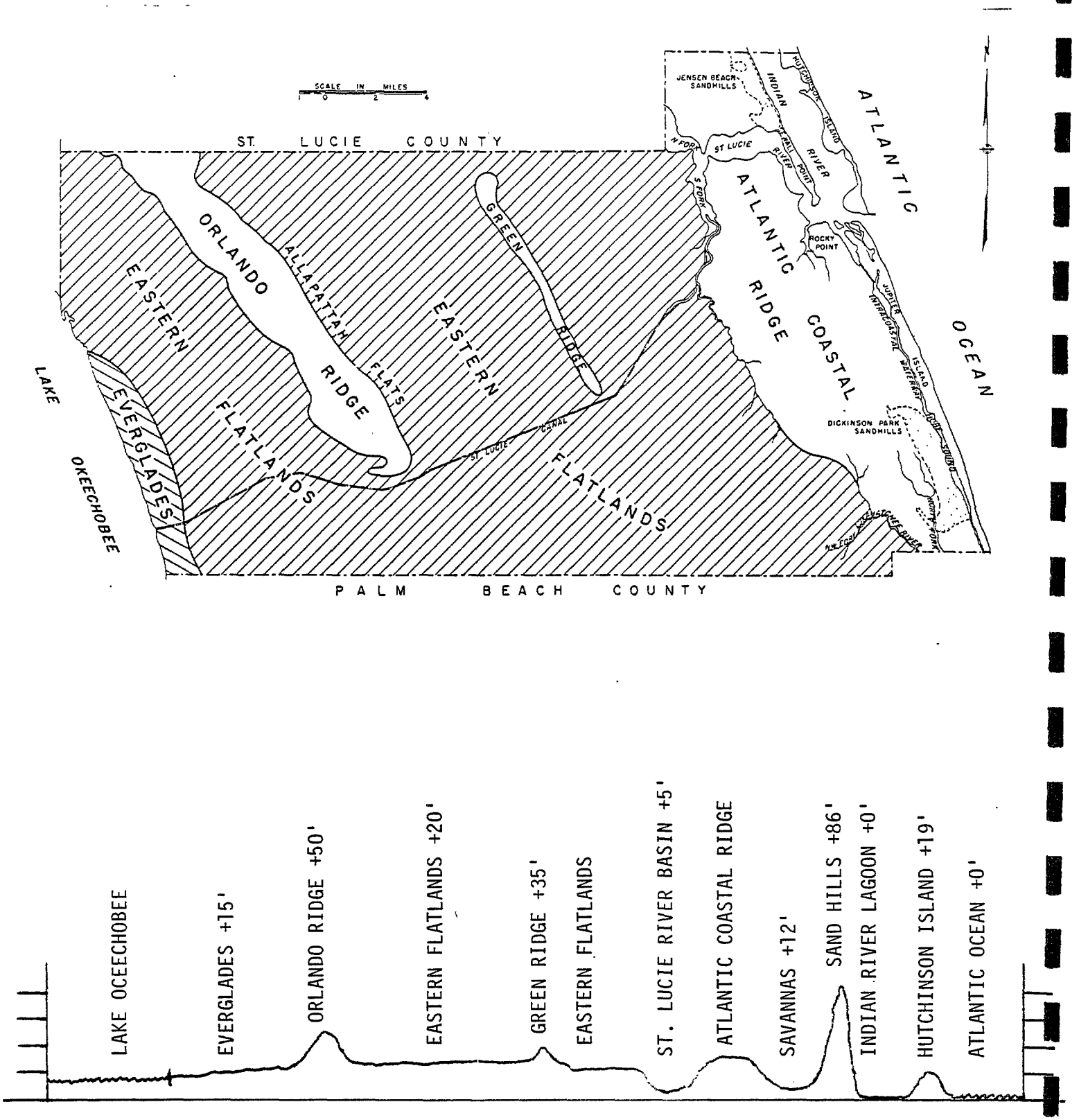


Figure 3. Physiographic Map of Martin County

Source: Lichtler, USGS 1960 Ground Water Resources of Martin County

Sewall's Point and Rocky Point. During the times of high sea level, the Pamlico Period, the drainage basins of the St. Lucie River and Loxahatchee River probably formed an ancient lagoon such as the Indian River does today, with the older sandhills of Jensen Beach and Jonathan Dickinson acting as the barrier islands and dunes of that time. It was also during this time when Hutchinson and Jupiter Islands began forming as offshore bars.

Another event took place either during or following one of the four Ice Ages of the Pleistocene epoch. It is believed that the entire Floridian Plateau tilted on its longitudinal axis elevating the east coast and partially submerging the west coast. This event assisted in elevating these offshore bars which eventually formed Hutchinson and Jupiter Islands, and created the wide shallow continental shelf off the west coast of Florida.

The Anastasia formation, composed of shelly quartz sand, silt, sandy limestone or sandstone, underlies the Atlantic Coastal Ridge in Martin County. As previously mentioned, the Anastasia rock can be seen exposed in outcroppings along the seaward edge of Hutchinson Island north and south of the House of Refuge Museum for about 2300 and 4200 feet respectively. These rock outcrops are elevated 10 to 12 feet above sea level. The Anastasia formation is about 140 feet thick at this eastern exposure, and thins out to the west in Martin County where it merges with the older Ft. Thompson formation.

The final Ice Age of the Pleistocene epoch, the Wisconsin Age, began after the high sea level of the Pamlico period approximately 100,000 years ago. As the glacial ice formed and grew, the sea level lowered until about 20,000 years ago, when the sea reached a low point some 300 feet below the present sea level (see Table 2). The shoreline at that time was about 9 to 12 miles east of the

present shoreline of Hutchinson Island.

Following this glacial maximum came the more rapid de-glaciation or melting of the ice. The sea level began to rise from about 17,000 years ago until it reached a level of 10 to 12 feet below the present level, some 4,400 years ago. From that time until now the sea level has continued to rise at a slightly slower rate.

During the time when sea level last retreated, Hutchinson Island began taking shape. Around 1700 years ago the sea level was still 1.6 feet below its present level. As we moved from the 19th to the 20th Century, we began to take a closer look at sea levels and established the standards by which we study this phenomena. Although the last great ice sheets melted away 11,000 years ago ending the Pleistocene epoch, the warm climate of the present time period, or Recent epoch, is similar to a continuing interglacial period. Worldwide climatologists are studying the trend of warming temperatures and their relationships to the atmosphere and oceans. Some agree that sea level is continuing to rise as a result of this warming trend. But regardless of the cause, the effect can be readily noticeable on our coastline. Sea level appears to be rising at an increasing rate over recent years (see "Rising Sea Level Section" in the Hutchinson Island Resource Inventory, Part III).

Hutchinson Island formed as a part of a chain of long, narrow and often low islands which comprise much of the coast of Florida and are known as "barrier islands". This term stems from the fact that they form the first line of defense for the mainland against the high energy of the sea during severe storms

and hurricanes. The islands also contribute to the lagoon and estuarine systems which allow mixing of the sea with fresh water from rivers and other drainage basins. These lagoons and estuaries on the mainland side of the Island are the desirable habitat for a wide diversity of aquatic life forms. In contrast to the relatively peaceful setting of the mainland side, we find the very dynamic and ever shifting sands of the beaches and dunes on the seaward side. In most cases the barrier island is less than a mile wide and elevations are generally less than 20 feet above mean sea level. Typically, during high seas and storms, the island is overwashed by the sea which spreads the sands into the lagoon forming a fan or delta shape. Also during storms, new inlets may break through the island while others may fill in and become closed.

From the time it became an exposed land form, Hutchinson Island has gone through these typical changes. The older overwash fans are seen as areas such as Indian River Plantation and Sailfish Point. Tidal deltas caused by ebb and flood currents through inlets, take shapes like Joe's Point. Inlets have opened and closed along the Island. Some early maps of Florida, dated 1856 and 1863, (see Figure 4.), give some evidence of an inlet occurring near what is now Joe's Point. Two natural inlets also occurred: the Indian River Inlet (in the vicinity of Jack Island, 2.5 miles north of the present Ft. Pierce Inlet) and Jupiter Inlet (near the same location as today). More detailed maps of this section of coastline show only the two natural inlets mentioned above and show Hutchinson and Jupiter

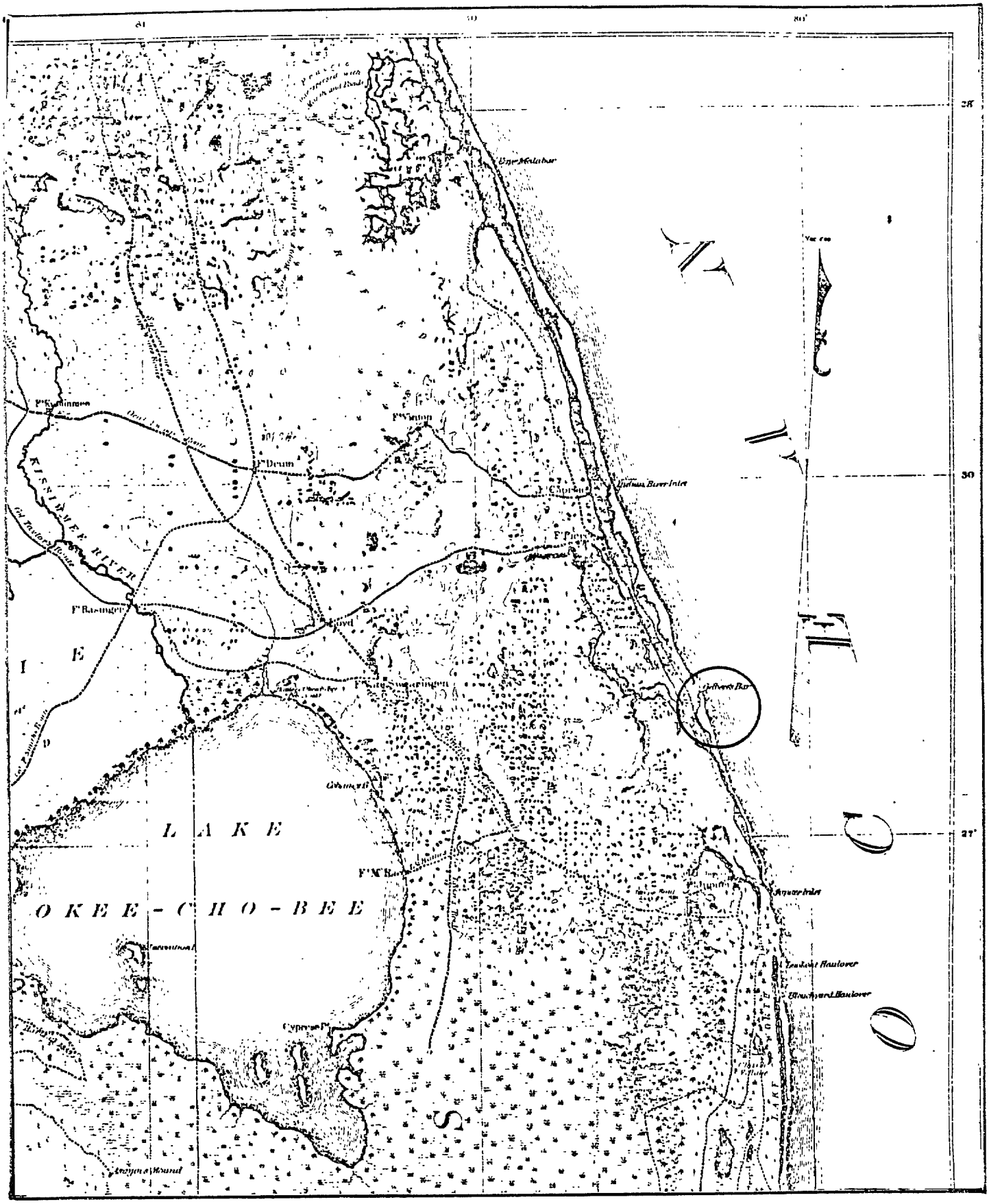


Figure 4. 1856 Jefferson Davis Map of the Southern District of Florida

Source of copy: Florida Dept. of State, Division of Archives

Islands as a continuous 40-mile long coastline for the time periods of 1883 and 1891 (see Plate II). There may have been several temporary, shallow inlets which opened and closed, such as was apparent in the 1856-1863 period.

As man began to inhabit the coastal areas there was an attempt to stabilize a navigable channel to the sea. Local interests cut an inlet 30 feet wide, 5 feet deep at the site of the present day St. Lucie Inlet in 1892. By 1898 the currents had widened the inlet to nearly 1500 feet and scoured it to a depth of 7 feet. The shoreline changed dramatically in the vicinity of the new St. Lucie Inlet and in 1908 the shore on the north and south sides was moved roughly 1200 feet to the west of the old shoreline. Between 1926 and 1929, a 3325 ft. stone jetty was constructed on the north side of the St. Lucie Inlet in an effort to keep the inlet from shoaling. (See also section on St. Lucie Inlet, Part III).

At the opening of the St. Lucie Inlet in the late 1800's, Hutchinson Island was defined as the barrier island between the St. Lucie Inlet and Indian River Inlet to the north, for a total lenght of about 24.5 miles. Between 1930 and 1938 a new inlet was constructed at Ft. Pierce, south of the old Indian River Inlet. This created the present boundaries of Hutchinson Island between the St. Lucie and Ft. Pierce Inlets.

In summary, the nature of Hutchinson Island seems to be typical of the many barrier islands in Florida and elsewhere. The rising sea level and the

continuous movement of the beach sands, both onshore-offshore and along the shore, are gradually accounting for a loss in the material of the dunes. Severe northeast storms and hurricanes continue to inflict the most dramatic changes in a short time period. Hutchinson Island is a continuously changing land form, responding to the effects of both man-made and natural forces.

CULTURAL HISTORY AND DEVELOPMENT

The earliest known inhabitants of Hutchinson Island and the adjacent mainland were Indians, who migrated from the west coast of Florida and were originally part of the Muskhogean tribe inhabiting lands west of the Mississippi River. Evidence was uncovered from the burial/midden mound used by these and later Indians, located near the present Elliot Museum, which dates the older inhabitants to some 3,000 years ago. The excavation was done under the direction of the Martin County Historical Society in 1971-72 and later by the Florida Department of State, Division of Archives. The artifacts can be seen at the Elliot Museum.

These early Indians, known as the Guacata or Santa Lucea, were a sub-tribe of the Ais (Ays) Indians who inhabited the area from the St. Lucie River north to Cape Canaveral. Another tribe, the Jeagas, who inhabited from Pompano north to the St. Lucie River may have also lived at times on parts of Hutchinson Island. The principal homes for the Indians were most likely on the mainland, and during the winter months they migrated to the island where fish and shellfish were abundant. These Indians were here long before the arrival of Spanish around 1492-1500, and the only description of them comes from contemporary Spanish and English observers who lived among them.

The first of these descriptions was from the Spaniard, Fontaneda, who at 13 and following a shipwreck, was captured by Ais Indians and lived as their slave until age 30. He returned to Spain and in 1575 wrote a Memoir which provides a remarkable firsthand description of these very primitive people and

their life on Hutchinson Island. Fontaneda's Memoir is a unique and accurate account of the life of the Indians who had, for reasons not fully understood, become extinct by 1760. It is speculated that they succumbed to diseases acquired from European explorers and colonists.

A second early account of the Hutchinson Island Ais Indians was written in 1696 by Jonathan Dickinson, a Philadelphia Quaker merchant, leader of a party which was shipwrecked north of Jupiter Inlet and worked it's way northward to St. Augustine. During this journey of several months, they were in almost constant contact with more or less hostile Indians and spent some time with the Ais Indians on Hutchinson Island. At the end of a long journey to Philadelphia, Dickinson wrote an account of the trip which was published as Dickinson's Journal. Jonathan Dickinson State Park in Martin County has been named in honor of him.

Following the voyage of Columbus in 1492 all of Florida was claimed by Spain, and Spanish sovereignty continued until 1763 when it was claimed by England. In 1783 Florida was returned to Spain from whom it was acquired by the United States in 1821. Prior to it's possession by the United States the area of Hutchinson Island had no residents except Indians. Several Spanish explorers and parts of fleets enroute to Spain may have stopped here. It is said that in 1513, Ponce DeLeon, returning from Cuba, entered the St. Lucie River where he dropped a stone cross into the water to claim the area for Spain.

In the early 1830's the Spanish pirate Don Pedro Gilbert brought his disabled ship through the St. Lucie Inlet to inside waters for repairs and posted

a sentry on the high ground possibly near where the House of Refuge now stands. When built in 1875 the House of Refuge was described as the home of the United States Life Saving Service at Gilbert's Bar. The pirate's name had been attached to a dangerous reef which was a short distance off-shore and was the site of many shipwrecks.

Probably the first actual non-Indian inhabitant of Hutchinson Island was a Cuban wanderer who settled near the present site of Stuart Public Beach about 1860. His last name is uncertain, but he was known variously as "Old Cuba", "Nigger Joe" and "Portugese Joe". Joe was visited by Dr. James Henshall in 1879 and described by him as "the only settler between Ft. Pierce and Jupiter Inlet". Joe's name survives through Joe's Point and Joe's Cove (or Negro Cove).

The first individual land owner of Hutchinson Island was James A. Hutchinson, who in 1803 was granted a 2,000 acre tract in the vicinity of Ankona by the Spanish governor at St. Augustine. Later this grant was transferred to the southern part of Jupiter Island and finally to what we now know as Hutchinson Island. James Hutchinson never lived on his property but his title was upheld by a United States Territorial court. In 1843 his grandson, John Hutchinson, came with the Armed Occupational Colony and established residence on the Island. In 1885 Edward B. Hutchinson and his wife built a house on the Island, across from the north end of Eden. They cleared approximately 5 acres and raised beans. These bean farms were made evident with rows of cabbage palms which marked the edge of the fields. Pineapples were the only other agricultural attempt on the Island but the soils were not dry enough.

The climate was a few degrees warmer on the Island than the mainland, which may have helped to sustain the bean farming. The Hutchinson Grant was confirmed as 2,000 acres in 1894 most of which, however, was north of the Martin County line.

About 1845 United States mail was delivered between St. Augustine and Fort Dallas on Biscayne Bay by a barefoot mailman who walked the firm sand of the beaches and swam or rafted the intervening rivers. The beach of Hutchinson Island was on his route which served a chain of coastal military posts established to support the Army's actions in the Seminole Indian War.

In 1875 the United States government completed and started operating a Life Saving Service at the site now occupied by the House of Refuge Museum. It was continued in operation and merged with the Coast Guard in 1915. In 1941 the House of Refuge was operated by the Navy as a World War II Patrol Station and in 1945 was entirely decommissioned and was sold to Martin County for preservation as a State and National Historical Monument. The Gilbert's Bar House of Refuge was restored in 1978 and has been operated as a museum by the Martin County Historical Society.

In 1925 a wooden bridge was constructed across the Indian River to connect Hutchinson Island with Jensen Beach. The center span was a swing section which allowed boats to pass through and required a bridge tender. This access was used by the early residents of the Island such as William Clark Shepard, the Cheeks, Gordon Brewer, Bill and Ben McCoy and Lou Hitchcock, to name a few.

A Coast Guard Station was located just north of the present Jensen Beach During World War II. The station included horse stables, the horses being used

to patrol the beaches. There were activities such as boat building, a shark processing plant and others that were short lived on Hutchinson Island. A small motel located between the House of Refuge and Sailfish Point was a first but was destroyed by a hurricane in the early 1950's.

Another bridge to Hutchinson Island from Sewall's Point to the site of Indian River Plantation was completed in 1957, together with the bridge crossing the St. Lucie River connecting Sewall's Point to the mainland. Tolls were charged at each bridge, 10¢ and 25¢ and even though the tolls were removed, people still refer to them as the 10¢ and 25¢ bridge. The old wooden bridge at Jensen was replaced in 1963 by the present causeway. More residents moved to the Island such as Les Combs, Ralph Evinrude and Mrs. Roscoe Turner. Hutchinson Island had some hermits as well during these early years, such as Capt. Louie, Pompano Chuck and Dirty Freddie.

The first multi-family residential units to be built on Hutchinson Island, Martin County were Little Ocean Club and Angler's Cove, in the early 1960's. The development of Seminole Shores, including the only ocean fishing pier, was started about this same time on the property which is now Sailfish Point.

The first public beaches acquired by Martin County on Hutchinson Island were the Stuart and Jensen Beach parks in 1960-1963. The Save Our Beaches Campaign of 1972 acquired an eventual total of eight 100-foot access strips along Hutchinson Island, (see Plate VII) for Martin County. This year in June 1982, Martin County passed a five million dollar bond and filed application under the State Save Our Coast Program for additional beach acquisition.

PART III

HUTCHINSON ISLAND RESOURCES INVENTORY

PART III. HUTCHINSON ISLAND RESOURCE INVENTORY

This portion of the CZM study presents an inventory of the significant features, resources, and impacts associated with Hutchinson Island in Martin County, Florida. Included are studies and analyses of the active ocean beach and dune system, the existing vegetation and wildlife communities, and the development on the barrier island.

ACTIVE BEACH AND DUNE ZONE

CLASSIFICATION AND DESCRIPTION

The coast of Martin County can be classified as an Amero-type trailing edge coast, being the trailing edge of the North American continental plate. It is also a secondary coast based on the genetic coastal classification, having been formed and influenced primarily by marine processes. The barrier island was formed by wave deposition, as discussed previously in the section on Natural History of Hutchinson Island.

The seven miles of ocean beaches of Hutchinson Island are barrier beaches, located on the frontside of the barrier island and separated from the mainland by the Indian River Lagoon. The north 4.3 miles of the study area, from the north Martin County line to a little over one-half mile south of the Stuart Public Beach, is a coastal plain beach, with a relatively straight shoreline. The next 1.3 miles are influenced by numberous rock outcroppings on the beach,

forming pocket beaches in between, but the overall shoreline remains fairly straight. The remaining south 1.4 miles of ocean beach, terminating at the St. Lucie Inlet, curves dramatically westward, lying inside the Bathtub Reef. This reef forms a natural southerly extension of the straight shoreline to the north. These areas are referred to as the coastal plain beach, pocket beaches, and Bathtub Reef segments, and are shown in Plate I.

The barrier island between the north Martin County line and St. Lucie Inlet is relatively narrow and low, ranging in width from 200 to 4,000 feet. The primary dune line immediately landward of the beach and shoreline comprises the highest elevations on Hutchinson Island, ranging from less than 10 feet to 22 feet MSL. West of the dune the land elevations decrease to the Indian River Lagoon.

The ocean beaches and dunes are composed of coarse to fine sand and shell fragments. Anastasia coquinoid limestone underlies the beach material, being exposed year-round in some locations, and exposed seasonally due to severe weather in other locations, most noticeably at the Stuart Public Beach.

NATURAL FORCES

Wind

The effects of the wind are twofold: (1) the indirect effect of wind generation or alteration of ocean waves and tide levels, discussed in the following sections, and (2) the direct effect of wind on sand transport. For

the study area, the primary direct influence of the wind is the landward transport of sand from the beach, resulting in a build-up of the primary dune. Wind data is shown in Figure 5.

Waves

Virtually all ocean waves are generated by wind blowing over the sea surface. The waves that occur in the study area consist of two types: (1) seas, which are locally generated wind waves, and (2) swells, which are waves generated from distant storms that enter the study area independent of the existing local wind conditions. These waves can cause sand movement on-shore, offshore, and parallel to the shore (longshore), depending on the wave height, wavelength or frequency, wave direction, and other governing factors. Wave data are shown in the swell diagram of Figure 6 and are summarized in Table 3 below:

Table 3. SUMMARY OF AVAILABLE WAVE DATA

Average Annual Wave Period[1]	7 seconds
Average Annual Wave Height[1]	2.1 feet
Average Significant Wave Height[2]	2.0 feet
Maximum Significant Wave Height[2]	12.5 feet

Notes: 1 Jacksonville District Corp of Engineers (1980)

2 Corson (1981)

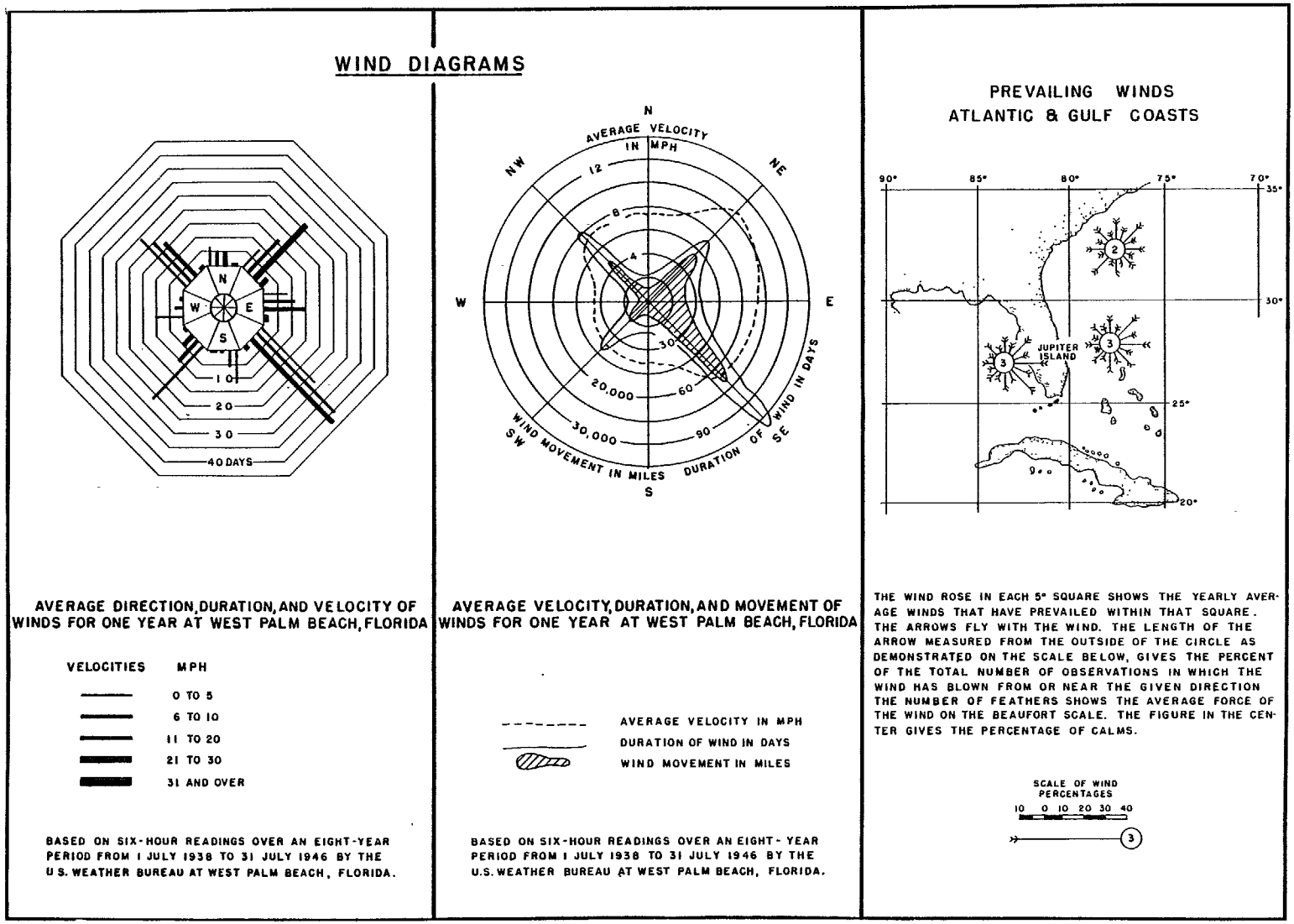


Figure 5. WIND DATA FOR MARTIN COUNTY STUDY AREA (Corp of Engineers)

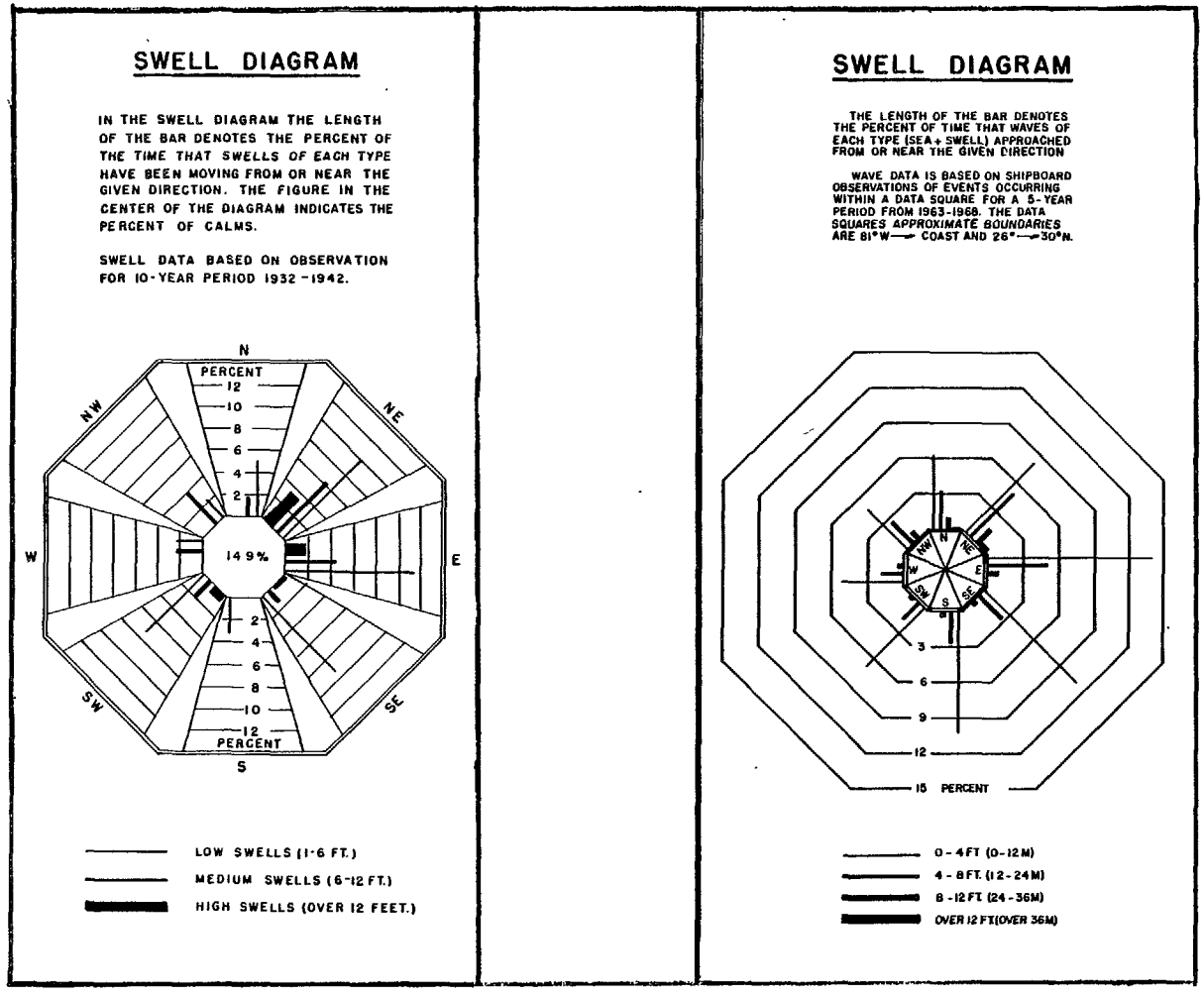


Figure 6. WAVE DATA - SWELL DIAGRAMS (Corp of Engineers)

Currents and Littoral Drift

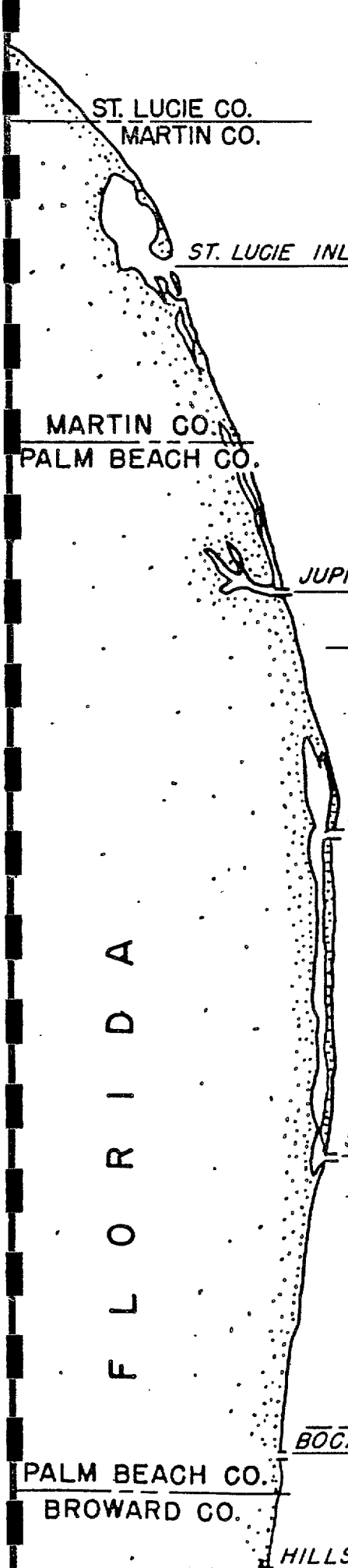
The Gulf Stream, the major ocean current that lies off the east coast of Florida, has a negligible direct effect on the beach and dune processes in the study area. It does, however, contribute to the warm water temperature hence tropical ecology of the area. The primary currents directly affecting the study area consist of (1) the longshore current, which runs parallel to the coast, (2) rip currents, which run perpendicular to the coast, and (3) tidal currents in the vicinity of the St. Lucie Inlet.

Waves striking the coast at an angle produce a longshore current. For example, waves which approach from the northeast during the fall and winter produce a longshore current that runs along the coast in a southerly direction. Waves approaching from the southeast, primarily during the summer, produce a longshore current travelling to the north. This current transports sand down the coast in what is referred to as the littoral drift. The net average annual amount of littoral drift for the study area is estimated to be about 230,000 cubic yards per year to the south (Corp of Engineers, 1968) as shown in Figure 7. Although the predominant littoral drift is southerly, there are seasonal reversals of wave direction which cause sand transport to the north.

Rip currents are produced by the seaward return flow of water from wave runup. These currents can transport sand offshore during large wave activity.

Tidal currents in the St. Lucie Inlet primarily affect the adjacent beaches. These currents are produced by the changes in tidal elevation between the ocean

Figure 7. LITTORAL DRIFT RATES (Corp of Engineers, 1968)



	COMPUTED ABOVE 18-FT. DEPTH		LITTORAL DRIFT RATE TO SOUTH CU. YDS/YR.	ESTIMATED QUANTITY DRIFT LOST AT INLETS CU. YDS./YR.
	EROSION CU. YDS./YR.	ACCRETION CU. YDS./YR.		
	114,000	48,000		
ST. LUCIE INLET			230,000	40,000
	528,000	168,000		
JUPITER INLET			230,000	47,000
	50,000			
		152,000		
LAKE WORTH INLET			230,000	40,000
	200,000			
SO. LAKE WORTH INLET				70,000
	99,000			
BOCA RATON INLET		57,000		40,000
	48,000			
HILLSBORO INLET			120,000	40,000

and interior bay area. The history and effects of the St. Lucie Inlet are discussed in detail in a subsequent section.

Tides

The tides in the Atlantic Ocean for the study area are principally semi-diurnal, with two high and low tides occurring daily. The mean tidal range is 2.6 feet and the spring range is 3.0 feet. These tide elevations are a result of the difference in gravitational attraction between the earth, moon, and sun, and are referred to as the astronomical tide. Highest tide elevations occur during the fall months, when the moon is in perigree (closest orbit to the earth).

The actual water level experienced at the coast is influenced by the local effects of wind, waves, and atmospheric pressure, whose combined effect is termed storm surge, and by wave runup. These create a complex total effect on the actual water level experienced. Storms and their effects are further discussed in the following section.

Storms and Hurricanes

The study area is subject to tropical storms of hurricane intensity during the summer and fall, and extra-tropical storms, called "northeasters", during the fall, winter and spring months. These storms can cause severe erosion and damage due to the combination of high winds, increased water levels, and large waves.

Historical hurricane paths influencing the study area are shown in Figure 8., and detailed descriptions of storms of record and resulting damages are summarized in Appendix A. The Saffir/Simpson Hurricane Scale developed by the National

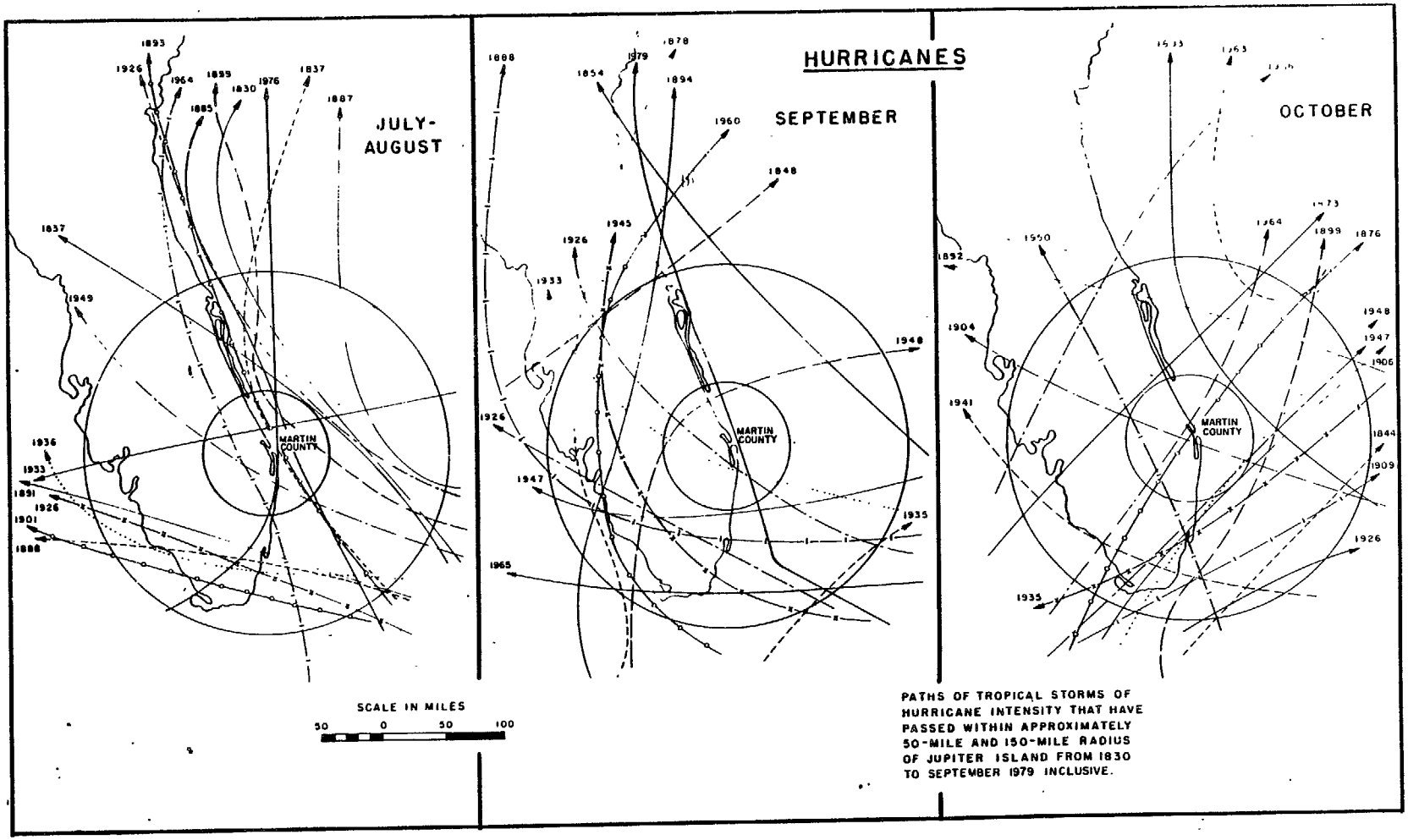


Figure 8. HURRICANE PATHS OF RECORD AFFECTING STUDY AREA (Corp of Engineers, 1968)

Weather Service (NWS) is also included in Appendix A, and lists wind velocities, storm surge, and damages associated with hurricanes of different intensities. The most recent hurricane that passed through the study area was "David" in September 1979. Although the eye of the storm passed over the study area, maximum winds were only 90 miles per hour, corresponding to a Category No. 1 hurricane. Damages were limited primarily to shrubbery, trees and power lines.

The Miami Hurricane Center lists 35 hurricanes where the eye passed within 100 nautical miles of Stuart between 1886 and 1982. There have been 17 hurricanes that caused damage and flooding problems. Some of the worst storms from a damage standpoint occurred in 1928, 1933, 1947, 1949 and 1964. From this data we can expect a hurricane to pass within 100 miles of Stuart about once every three years, and a damaging storm frequency of once every six years. A major hurricane with the eye passing inland near this immediate area can be expected once every fifteen years based on this relatively short period of record, bringing sustained wind velocities of 130 m.p.h.

There are no official tidal gage stations on the open shoreline of Martin County, so that the historical heights of storm surges, wave runup, and flooding must be interpolated from the few records available. The reported 1949 storm surge elevation at the railroad bridge at the U. S. Highway No. 1 crossing of the St. Lucie River was 8.5 feet MSL. This surge level occurred seven miles up river from the inlet mouth. Other studies and records indicate maximum hurricane storm surge elevations at Ft. Pierce Inlet and Palm Beach coasts

of 11 feet above MSL. The 1949 hurricane probably had a storm surge of 10 to 11 feet above normal sea levels at the Hutchinson Island beaches in Martin County. The frequency and elevations of storm surge, wave runup, and resulting dune recession predicted by available studies are summarized in Table 4.

The two most recent hurricane studies are the 1982 Treasure Coast Regional Planning Council (TCRPC) "Hurricane Evacuation Study" and the 1980 National Flood Insurance study for Martin County. The Flood Insurance Study reports a storm surge of 11.3 feet at Ft. Pierce during the 1949 hurricane, and predicts surges of nine feet plus wave runup for south Hutchinson Island. The TCRPC Hurricane Evacuation Study obtained data from the Miami Hurricane Center computer model. This 1982 prediction model estimates a "worst case" storm surge of 13.7 feet for the study area during a Category 4 hurricane. This "worst case" scenario assumes a hurricane whose eye comes ashore in the vicinity of Hobe Sound, moving from east to west.

Another detailed study of hurricane effects is included in the St. Lucie Nuclear Power Plant 1972 report, "Preliminary Safety Analysis". This study predicted a worst case storm surge of 11.8 feet. The same study also reports a maximum storm surge for this coastal vicinity of 11.5 feet above MSL at Palm Beach during the September 1928 hurricane. The engineering design criteria for the nuclear power plant required an elevation of 18 feet above MSL to prevent wave damage.

The review of both historical hurricane records and computer model studies shows a surprising degree of correlation considering the large number of

Table 4. FREQUENCIES AND ELEVATIONS OF STORM SURGE, WAVE RUNUP, AND DUNELINE RECESSION

Return Interval (years)	Annual % Freq. of Occurrence	U of F Still-water Elev.[1] (ft., MSL)	NOAA Still-water Elev.[2] (ft., MSL)	Water Level w/ Wave Runup[3] Elevation (ft., MSL)	Duneline Recession[4] (ft., horiz. dist.)
2	50%	4.0	N/A	N/A	N/A
5	20%	4.3	N/A	N/A	N/A
10	10%	4.8	3.7	8.0	20
20	5%	6.4	4.2	12.2	50
50	2%	9.0	5.2	13.0	90
100	1%	11.0	6.1	14.2	108
500	0.2%	N/A	8.0	N/A	125

NOTES:
1. Per Bruun, et al. (1962). University of Florida.
2. National Oceanic and Atmospheric Administration (NOAA).
3. Jacksonville District Corps of Engineers (1980), based on NOAA Still-water elevation.
4. Jacksonville District Corps of Engineers (1980), for undeveloped shoreline.

variables involved and the lack of official tidal gage station records. Maximum storm surge elevations on south Hutchinson Island of 12 feet above normal sea level could occur. The 100-year frequency storm surge elevation at the St. Lucie Inlet no doubt lies between 11.0 and 12.0 MSL. Large storm waves associated with the winds of hurricanes would be added to surge elevation to produce a dramatic and often devastating impact on the immediate coastline.

Northeast storms result from extratropical cyclones and associated cold fronts which enter Florida from the north during the colder months. Strong northerly winds blowing along the east coast of the United States can generate large waves which reach the study area as northeast swells. Locally, the northeast wind and waves cause elevated water levels and strong littoral drift, that result in erosion of the beach and dune.

The northeasters that occur in the fall, due to the higher astronomical tides experienced during that season, can produce extensive erosion, especially with the combination of spring tide, storm surge and large waves. This occurred in the study area most recently during October and November 1981, eroding large amounts of beach and dune sand and threatening upland structures. Sand is returned to the beach and dune system during calmer weather, but a net loss of dune material has occurred.

St. Lucie Inlet

Located at the southernmost end of Hutchinson Island, the St. Lucie Inlet connects the complex estuarine systems of the Indian River, St. Lucie River, and Intracoastal Waterway with the Atlantic Ocean, as shown on the Location Map of

Figure 1. Throughout its history, St. Lucie Inlet has been a dangerous inlet, in which many boats and human lives have been lost. Frequent dredging of the inlet has been required to keep it open for navigation.

Although various historical accounts mention the existence of an inlet near the present site of St. Lucie Inlet, no inlet existed prior to the cut through the narrow barrier island by local residents in 1892 (see also Natural History Section). Charts and maps prior to 1892 show a relatively straight shoreline in this vicinity, with occasional rock outcroppings (see Plate II). Following the initial cut, St. Lucie Inlet widened naturally due to strong currents, eroding the adjacent barrier islands and forming interior shoals. By 1898 the inlet had widened to nearly 1500 feet and scoured to a depth of 7 feet. In 1916, dredging of the inlet was attempted under a Federal project, but rapid shoaling of the dredged portion of the channel resulted in the abandonment of this project. Between 1926 and 1929, local interests constructed the 3,325-foot north jetty and dredged a channel from the ocean to the entrance of the Manatee Pocket. Seaward accretion north of the jetty resulted, but south of the inlet the shoreline has continued to erode (see also following section on Shoreline Changes). In 1945 the Federal project was modified to provide a channel 10 feet deep and 200 feet wide across the offshore bar and reef. This improvement was completed in 1948.

Since the 1930's the configuration of the St. Lucie Inlet has changed little. Frequent dredging of the inlet has been required to maintain a navigable channel. The spoil material from dredging operations was placed

in a disposal area immediately south of the navigation channel, creating a large shoal in the area that is now located between the south jetty and detached breakwater.

In 1962, a severe storm caused a breakthrough in the barrier island (Jupiter Island) at Peck Lake, about 3.7 miles south of St. Lucie Inlet (see also Storm Data in Appendix A). This new inlet became the preferred inlet during rough weather, due to the hazardous conditions in St. Lucie Inlet and the protection provided by the offshore reefs at the Peck Lake Inlet. The Peck Lake Inlet was closed by the Corp of Engineers in 1963 to remedy the shoaling and tidal currents in the Intracoastal Waterway resulting from the new inlet.

Emergency dredging of the St. Lucie Inlet entrance was performed by the Corp of Engineers in January 1965. The Federal project was further modified in 1966 to provide for Federal maintenance of a channel 6 feet deep and 100 feet wide from the authorized bar channel to the Intracoastal Waterway. Since this date, periodic maintenance dredging of the navigation channel, primarily in the bar and reef cut, has been performed, as summarized in Table 5.

The construction of the St. Lucie Inlet Improvement Project is presently being completed. The design incorporates the concept of a "weir-jetty", in which sand from the littoral drift passes over a weir section of the jetty and is trapped in an "impoundment basin". The trapped sand is then used to replenish the eroding down-drift beaches, thereby accomplishing sand bypassing of the inlet. Details of the inlet design are shown in Figure 9.

Table 5. ST. LUCIE INLET DREDGING RECORDS[1]

1965 to Present

Date	Type of Dredge	Total Quantity Removed (cu. yds.)
Jan 1965	Pipeline	8,300
Dec. 1966	Sidecasting	37,960
Mar/Apr 1967	Sidecasting	26,750
Mar 1968	Pipeline	100,102
Nov/Dec 1968	Pipeline	42,420
Dec 1968	Sidecasting	8,773
Nov 1969	Sidecasting	18,456
Nov/Dec 1971	Sidecasting	18,829
Nov/Dec 1972	Sidecasting	30,864
Sep/Oct 1973	Sidecasting	53,298
Sep/Oct 1974	Sidecasting	26,940
Sep 1974	Pipeline	77,369
Jul/Aug 1975	Sidecasting	40,201
Jun/Jul 1976	Sidecasting	36,684
Oct/Nov 1976	Sidecasting	41,118
May/Jun 1977	Sidecasting	55,414
Mar 1978	Pipeline	178,437
Nov/Dec 1978	Sidecasting	55,270
Aug/Sep 1979	Sidecasting	57,246
Dec 1980 to Nov 1981	Pipeline	560,000[2]

Notes: 1 Data from U. S. Army Corp of Engineers, Jacksonville District.

2 Dredging associated with the St. Lucie Inlet Improvement Project, which is not complete; additional dredging scheduled for completion by 1983.

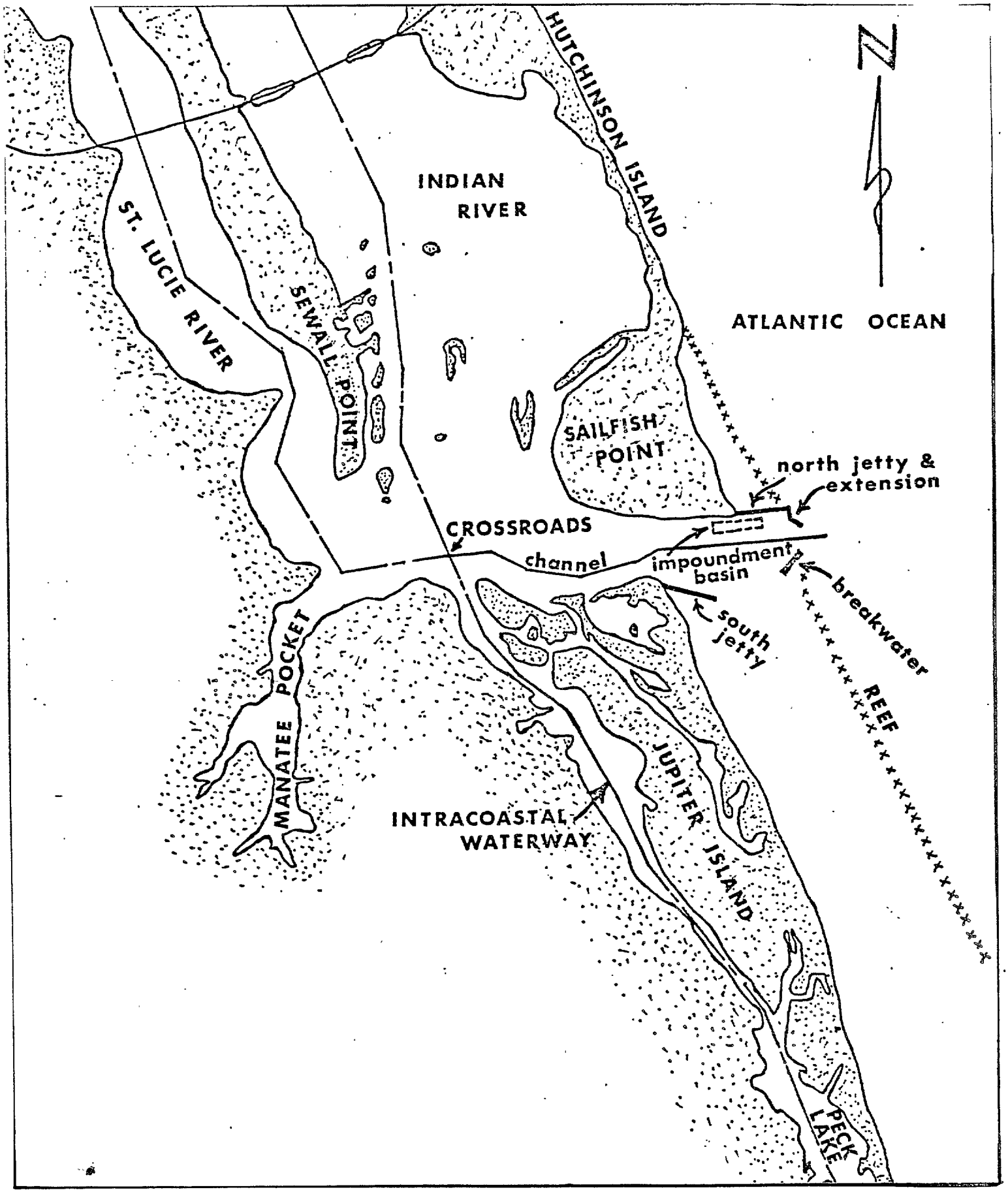


Figure 9. ST. LUCIE INLET IMPROVEMENT PROJECT

The St. Lucie Inlet design utilizes the 1927 north jetty as the weir section, allowing sand to pass over and through it, as it has over the past years. A north jetty extension and a detached breakwater have been added to reduce the wave action inside the inlet, both for enhancing the navigability of the inlet and to provide calm waters for periodic dredging operations of the impoundment basin. Sand dredged during the project construction and periodic maintenance dredging of the impoundment basin will be used to nourish the beaches south of the inlet.

Another feature of the improvement project is the construction of a south jetty which extends southeasterly from the north end of Jupiter Island. The jetty is designed to help stabilize the beaches to the south, preventing sand from entering the inlet during ebb flow or southeast wave activity. The south jetty has cut off a natural tidal current channel that ran south from the inlet inside the reef, diverting this flow in a more easterly direction.

Construction of the improvement project is nearly completed, with the structures in place and dredging operations scheduled for completion in summer 1982. Aerial photography flown during large wave activity shows that the north jetty extension, detached breakwater, and deepened channel have greatly reduced the wave energy inside the inlet.

The most direct effect of the improvement project on the tidal hydraulics is the blockage of the south channel by the construction of the south jetty. This tidal flow is now diverted easterly, increasing the flow in the navigation

channel. This increased flow could help to maintain the navigation channel, but at present a blockage of the channel at the inlet entrance by a shallow bar or rock creates dangerous conditions. A dredge began removing this blockage in August 1982.

Between the south jetty and the detached breakwater, a large shoal has continued to exist, having been the former disposal site of inlet maintenance dredging. Tidal flow through this area is therefore very limited. The dredging of a channel through this region has been considered to reduce the flow in the navigation channel, if the removal of the blockage does not. If a major current develops between the south jetty and detached breakwater, however, an extension of the south jetty could become necessary to redirect major tidal flow through the navigation channel.

Completion of the St. Lucie Inlet Improvement Project construction will be followed by a period of readjustment, with the natural forces of the tide, currents, and waves redistributing the sediments and establishing equilibrium inlet and shoreline configurations. Monitoring of the inlet during this period is essential, both to document the performance of the project, and to determine the project's effects on the surrounding waters and shorelines.

Rising Sea Level

The rise in sea level further compounds the beach and dune erosion problem. The mean level of the world's oceans has risen at varying rates since the last Ice Age, some 20,000 years ago (see Natural History section for a detailed

discussion). Recent rates of vertical sea level rise are difficult to determine, and range in value as indicated in Table 6.

The apparently increasing rate of vertical sea level rise has serious implications for low lying coastal areas. A continuous rise in sea level causes annual shore erosion (Bruun, 1962) in addition to the other factors previously mentioned. For the average beach slope in the study area, a projected vertical rise in sea level of one-half inch per year would result in a horizontal loss of over one foot per year. The rising sea level also contributes to the effects of storms, adding to the elevation at which they affect the coast. Therefore, this rise in sea level must be added to the predicted storm surge heights of Table 2. If the vertical rise in sea level continues, especially if the rate continues to accelerate, the threat to coastal development will also continue to increase.

ANALYSIS OF EXISTING CONDITIONS

Other Reports and Studies

Prior reports and studies concerning Hutchinson Island and St. Lucie Inlet in Martin County were thoroughly researched and assembled for this study. A complete listing of all the reports and data sources is contained in the bibliography section. Reports particularly documenting the active beach and dune zone are briefly described in the following paragraphs.

Numerous reports and studies have been performed by the U. S. Army Corp of Engineers. Detailed studies of the St. Lucie Inlet have resulted in the

Table 6. RECENT RATES OF SEA LEVEL RISE

(Data compiled by Florida Oceanographic Society)

SOURCE	TIME PERIOD	RATE OF VERTICAL RISE (Per Year)	
Emery, 1980 (WHOI)	1970-1975	14.0mm	0.55"
Emery, 1980 (WHOI)	1966-1975	7.0mm	0.28"
Collier, 1977 (DNR)-Florida	1964-1973	6.0mm	0.24"
NOAA Tide Records[1]-Florida,East Coast	1931-1980	3.0mm	0.12"
Etkins & Epstein,1982 (NOAA)	1940-1980	2.5mm	0.10"
Hicks, 1978 (NOAA)	1940-1975	2.3mm	0.09"
Emery, 1980 (WHOI)	1936-1975	3.0mm	0.12"
Pilkey & Evans, 1981	1935-1970	6.9mm[2]	0.27"[2]
Scholl & Stuiver, 1967-Florida	1940-1967	2.4mm	0.09"
Scholl & Stuiver, 1967 Southwest Coast	1900-1940	4.3mm[2]	0.17"[2]
NOS/NOAA TM #12, 1973	1893-1971	1.8mm	0.07"
Etkins & Epstein, 1982 (NOAA)	1890-1940	0.8mm	0.03"

Notes: 1. Values computed by F.O.S. from NOAA tide records for Miami Beach and Daytona Beach, Florida.
2. These values deviate substantially from the other values that establish a general trend of an accelerating rate of vertical sea level rise.

construction of the improvement project now being completed (see previous section on St. Lucie Inlet). A beach erosion control study for Martin County was completed by the Corp in 1968, which concluded that insufficient public benefits would result from the project, thereby prohibiting further Federal participation at that time. The study recommended beach nourishment to form a protective and recreational beach for 1,500 feet of shoreline at the Jensen Public Beach and 1,150 feet at the Stuart Public Beach. A system of four groins at Jensen Beach and three groins at Stuart Beach were included to retain the beach fill material, with periodic renourishment also needed. This recommended plan is shown in Figure 10.

Estimated initial costs in 1968 were $375,000 and $296,000 for Jensen Beach and Stuart Beach respectively, with annual costs of $17,200 and $16,200. Benefit-to-cost ratios were 0.5 to 1 at Jensen Beach and 0.8 to 1 at Stuart Beach, making this project economically unjustifiable.

The Jacksonville District of the U. S. Army Corp of Engineers is presently completing a beach erosion control study for Martin County (U. S. Army Corp of Engineers, 1980), updating the previous study by the Corp completed in 1968. The new study states that "The existing condition of the shorefront on Hutchinson Island is one of reduced capacity for protection of upland development and recreation needs due to long-term recession."

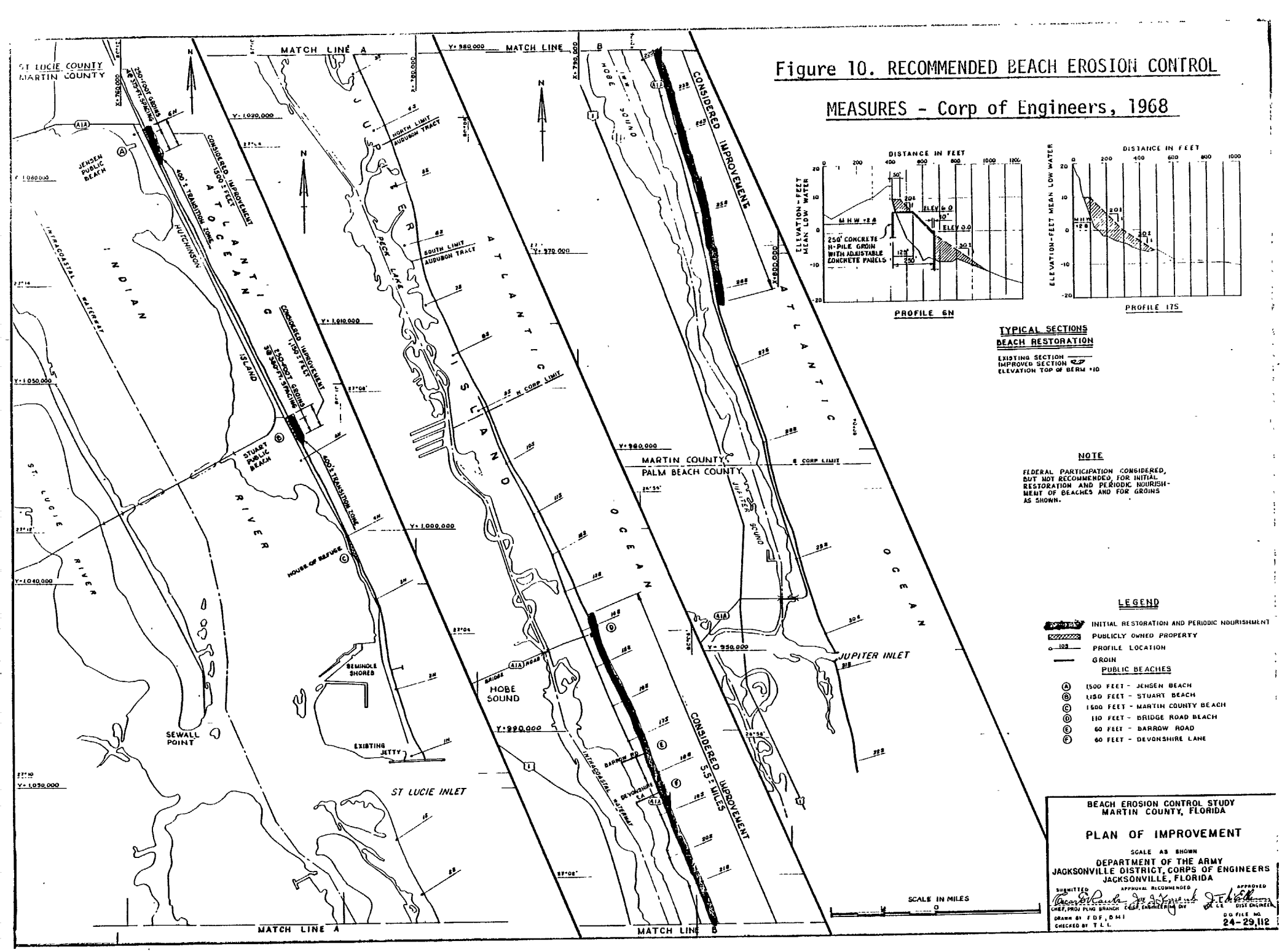
The Corp of Engineers' study found that Federal participation in the construction of beach erosion control works at the Jensen and Stuart Public

Beaches is warranted. The preliminary recommended plan is for beach nourishment with offshore breakwaters and periodic renourishment. The beach fill design incorporates a 55-foot wide berm at elevation + 9.0 feet above MLW, thence a seaward slope of 1 vertical to 20 horizontal to elevation 0.0 MLW, thence 1 vertical to 30 horizontal to the existing bottom. The proposed plan details are shown on Figure 11.

The total initial cost of the plan (1980 price levels) is estimated to be $6,082,000, with annual maintenance costs of $84,000. Martin County's share of these costs are estimated to be $2,414,400 for initial construction and $48,400 for annual maintenance. The benefit-to-cost ratio for this proposed plan is estimated as 1.53 to 1 based on recreational benefits and prevention of damages to erosion, making the plan economically justifiable.

The Florida Department of Natural Resources (DNR), Bureau of Beaches and shores is also presently conducting a study of Martin County's beaches, to re-evaluate the Coastal Construction Setback Line (CCSBL). Recent and historical beach profile surveys at approximately 900-foot intervals are being analyzed, and these data are included in Appendix B of this report. Storm surge and wave run-up analyses will also be performed as a part of the DNR study and the location of the CCSBL re-evaluated. Completion of the DNR report is scheduled for December 1982. Additional details of the CCSBL are discussed under the sections on coastal structures and regulatory

Figure 10. RECOMMENDED BEACH EROSION CONTROL MEASURES - Corp of Engineers, 1968



PROFILE 6N

PROFILE 17S

TYPICAL SECTIONS
BEACH RESTORATION

EXISTING SECTION
IMPROVED SECTION
ELEVATION TOP OF BERM +10

NOTE

FEDERAL PARTICIPATION CONSIDERED, BUT NOT RECOMMENDED, FOR INITIAL RESTORATION AND PERIODIC NOURISHMENT OF BEACHES AND FOR GROINS AS SHOWN.

LEGEND

- INITIAL RESTORATION AND PERIODIC NOURISHMENT
- PUBLICLY OWNED PROPERTY
- PROFILE LOCATION
- GROIN

PUBLIC BEACHES

- (A) 1500 FEET - JENSEN BEACH
- (B) 1150 FEET - STUART BEACH
- (C) 1500 FEET - MARTIN COUNTY BEACH
- (D) 110 FEET - BRIDGE ROAD BEACH
- (E) 60 FEET - BARROW ROAD
- (F) 60 FEET - DEVONSHIRE LANE

BEACH EROSION CONTROL STUDY
MARTIN COUNTY, FLORIDA

PLAN OF IMPROVEMENT

SCALE AS SHOWN

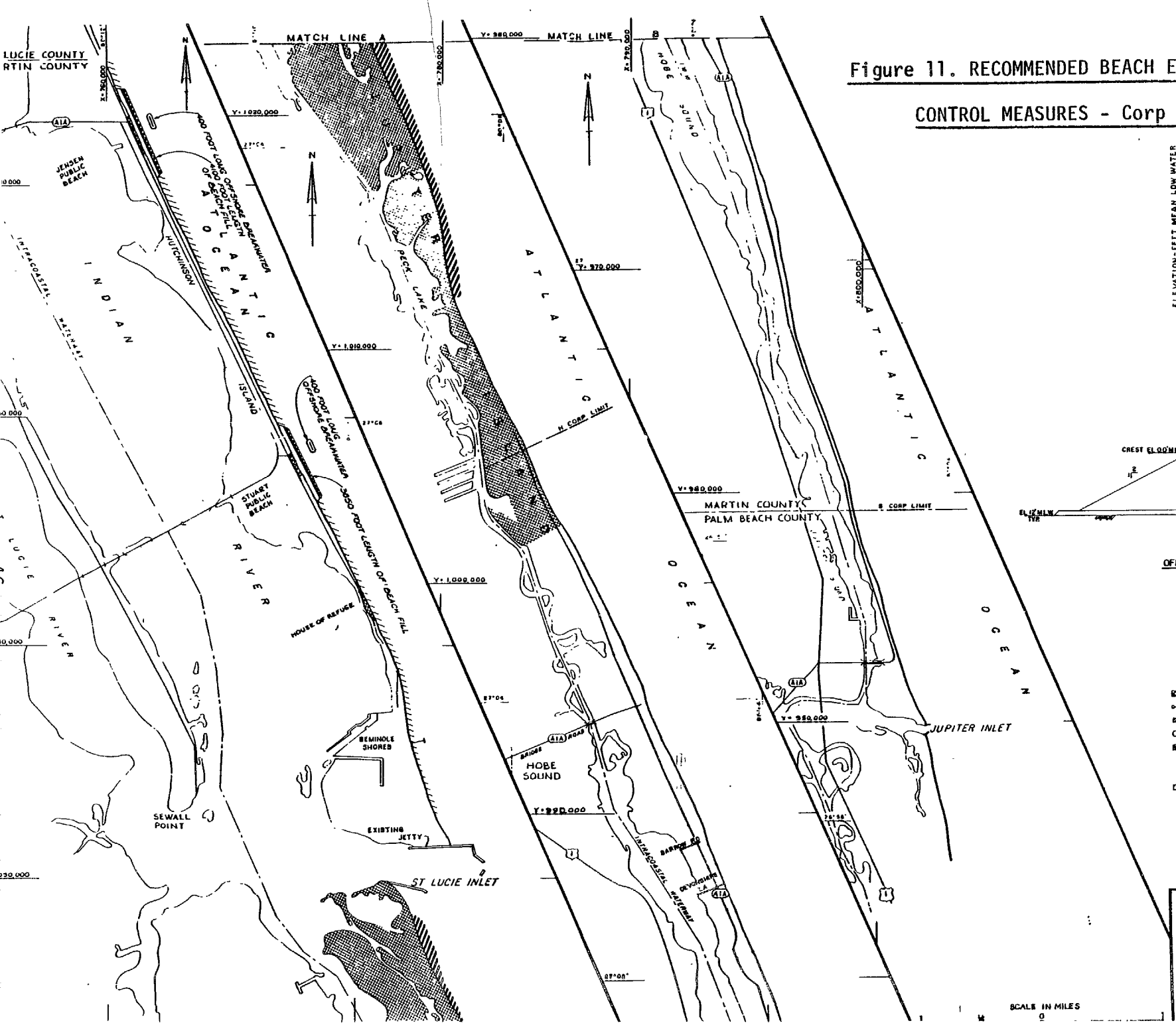
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

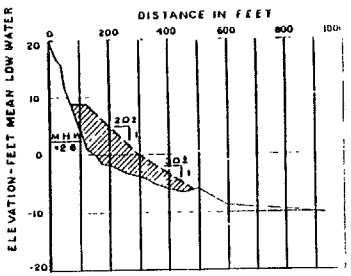
SUBMITTED — APPROVAL RECOMMENDED — APPROVED
CHIEF, PROJ PLNG BRANCH — CHIEF, ENGINEERING DIV — DIST ENGINEER

DRAWN BY F.D.F., D.M.I.
CHECKED BY T.L.L.

DG FILE NO. 24-29.112

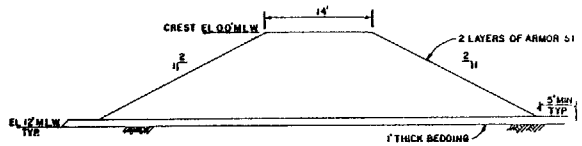
Figure 11. RECOMMENDED BEACH EROSION CONTROL MEASURES - Corp of Engineers, 1980





TYPICAL SECTION
BEACH RESTORATION

EXISTING SECTION
IMPROVED SECTION
ELEVATION TOP OF BERM +9



TYPICAL SECTION
OFFSHORE BREAKWATER

LEGEND

- PUBLICLY OWNED PROPERTY
- PROFILE LOCATION
- BEACH FILL AND PERIODIC NOURISHMENT
- BREAKWATER
- BEACH FILL AND PERIODIC NOURISHMENT INITIAL CONSTRUCTION AND PERIODIC MAINTENANCE OF (1980) NAVIGATION IMPROVEMENTS TO ST LUCIE INLET
- PERIODIC NOURISHMENT AS NEEDED AND JUSTIFIED

BEACH EROSION CONTROL STUDY
MARTIN COUNTY, FLORIDA

SELECTED PLAN
HUTCHINSON ISLAND

SCALE AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGI
JACKSONVILLE, FLORIDA

and management authorities, and setback line criteria are included in Appendix C.

Historical Shoreline and Volumetric Changes

Historical surveys, navigation charts, and recent beach profile survey data were analyzed to establish shoreline and offshore changes. U. S. Coast and Geodetic Surveys of 1863, 1882, 1883, 1891, 1908 and 1928-30 provided baseline data for determining long-term changes. The overall shoreline change from 1883 to 1972 is shown in Plate II. The most dramatic shoreline changes have occurred in the vicinity of St. Lucie Inlet, following its initial opening in 1892 (see also the section on St. Lucie Inlet). By 1908 the shoreline on both the north and south sides of the inlet had receded 1200 feet, due to the natural widening of the inlet by tidal currents. Between 1926 and 1929 the 3,325-foot north jetty was constructed to stabilize the inlet and shoreline. Accretion north of the jetty followed, and the shoreline has advanced approximately 200 feet seaward of its pre-inlet position. South of the inlet, the shoreline of Jupiter Island has continued to erode, with an overall recession of about 2600 feet west of its pre-inlet position. From 1882-1976 the Corps of Engineers' recent Beach Erosion Control Study for Martin County states that the shorelines at the Jensen Beach and Stuart Beach Public Parks have receded 175 and 200 feet respectively, for a long-term average rate of about 2 feet of recession per year.

Beach Profile Line surveys were performed by the Corps of Engineers in 1946 and 1964, and by the Florida D.N.R., Bureau of Beaches and Shores in

1971, 1976 and 1982. The location of the beach profile lines used in these surveys are shown on Plate I. The profile lines surveyed by the Corps of Engineers are labeled as 1-N through 6-N and are widely and unevenly spaced. The D.N.R. profile lines are much more closely and evenly spaced, with each profile line located about 900 feet apart. The D.N.R. profile lines, given a letter "R" designation followed by sequential numbers from north to south, are resurveyed on a request and availability basis to periodically re-evaluate the State's Coastal Construction Setback Line. Shoreline and volumetric changes have been determined by the Corps of Engineers from this data (with the exception of the newest 1982 D.N.R. data), and are summarized in Table 7.

Detailed analyses of shoreline and volumetric changes based on the D.N.R. data for each profile line (R-1 through R-42) on Hutchinson Island for the years 1971, 1976 and 1982 were performed as part of this study. Plotted profile line data are included in Appexdix B. The changes in the position of the MHW line (at an elevation of + 1.3 feet MSL) are shown in Table 8. Since shoreline position varies seasonally and with changing beach slope, sand volumetric changes produce the best quantitative analysis. Tables 9, 10 and 11 summarize the sand volume changes in the beach profiles computed for the zone extending 200 feet seaward of the survey monuments. It is important to note that the overall net change is far less than the total individual volumes eroded and accreted. The shoreline and volumetric changes plotted at their locations are presented in Plate III.

The analysis of shoreline and volumetric changes over the past eleven years clearly indicates the differences between the three major beach types

Table 7. VOLUMETRIC ACCRETION AND EROSION, 1971-1976

(U. S. Army Corps of Engineers' Beach Erosion Control Study, 1980)

Corps of Engineers Profile Line Designation	DNR Beach Profile Line Designation	Distance (ft)	Volumetric Change[1] (cu. yds)	Annual Erosion Rate[1] (cu.yds/ft.yr)
1 - N	R-1 to R-2	1,350	- 1,300	- 1.0
2 - N	R-3 to R-7	4,350	- 6,800	- 1.6
3 - N	R-8 to R-20	11,500	- 13,000	- 1.1
4 - N	R-21 to R-24	3,400	+ 7,900	+ 2.3[2]
5 - N	R-25 to R-37	14,850	- 17,600	- 1.2
6 - N	R-38 to R-42	4,450	+ 17,800	+ 4.0
	Totals:	39,900	- 13,000	

Notes:

1. Positive values indicate accretion, and negative values indicate erosion.
2. Accretion along nearshore bottom. The backshore and foreshore slope show erosion.

Table 8. MEAN HIGH WATER SHORELINE CHANGES

Profile Line Number	Shoreline Advance and Recession[1] (in feet) 1971 - 1976	1976 - 1982	1971 - 1982
R-1	+ 9.4	+ 1.0	+ 10.4
R-2	+ 13.4	- 14.6	- 1.3
R-3	- 22.9	+ 28.8	+ 5.9
R-4	- 3.9	+ 11.7	+ 7.8
R-5	+ 2.2	+ 6.1	+ 8.3
R-6	- 7.3	+ 13.5	+ 6.2
R-7	+ 37.3	- 29.2	+ 8.0
R-8	+ 3.3	+ 11.8	+ 15.1
R-9	- 6.1	+ 11.0	+ 4.9
R-10	+ 21.8	- 19.4	+ 2.4
R-11	- .3	+ 6.7	+ 6.4
R-12	- .1	+ 7.8	+ 7.7
R-13	- 14.5	+ 14.9	+ .3
R-14	- 8.7	+ 10.1	+ 1.4
R-15	- 6.8	+ 2.2	- 4.6
R-16	- 22.2	+ 10.3	- 11.9
R-17	+ 6.3	- 5.0	+ 1.3
R-18	+ 2.1	+ 3.0	+ 5.1
R-19	- 9.5	- 8.3	- 17.8
R-20	- 15.6	- .7	- 16.4
R-21	+ 7.5	- 1.2	+ 6.3
R-22	+ 4.1	- 12.2	- 8.1
R-23	+ 7.3	- 19.5	- 12.2
R-24	- 2.1	- 7.0	- 9.1
R-25	- 21.4	+ 33.9	+ 12.5
R-26	- 25.1	+ 14.4	- 10.7
R-27	- 5.6	+ 5.2	- 0.4
R-28	+ 54.2	+ 6.1	+ 60.3
R-29	+ 9.2	+ 4.6	+ 13.8
R-30	- .5	+ 11.3	+ 10.8
R-31	- .9	+ 9.8	+ 8.9
R-32	+ 6.1	+ 45.1	+ 51.2
R-33	- 2.4	+ 18.9	+ 16.5
R-34	+ 20.0	+ 10.6	+ 30.6
R-35	- 37.0	- 6.1	- 43.1
R-36	- 87.6	- 98.9	-186.6
R-37	-106.1	- 64.2	-170.3
R-38	+ 11.8	- 31.2	- 19.4
R-39	+ 55.4	- 4.3	+ 51.1
R-40	+ 46.7	+ 37.8	+ 84.6
R-41	+ 26.7	+ 72.1	+ 98.7
R-42	+ 44.5	+ 78.9	+123.4

Notes: [1] Positive values indicate shoreline advance and negative values indicate shoreline recession

Table 9. SAND VOLUME CHANGES, 1971 -1976

Profile Line Number	Distance[1] (in feet)	Volume Change[2] Per Foot of Shoreline	(in cubic yards) Total Change
R-1	450.18	- 9.76	- 4394.02
R-2	899.97	6.69	6020.75
R-3	899.76	- 40.40	- 36354.10
R-4	899.87	- 11.39	- 10249.52
R-5	804.80	- 3.23	- 2598.55
R-6	899.08	- 19.38	- 17425.20
R-7	994.00	22.98	22842.70
R-8	899.73	- 22.95	- 20645.30
R-9	899.76	- 26.57	- 23902.70
R-10	899.67	- 0.12	- 106.94
R-11	899.95	- 12.13	- 10916.40
R-12	1005.03	- 14.26	- 14334.50
R-13	958.44	- 13.64	- 13070.40
R-14	853.46	- 9.42	- 8043.33
R-15	899.82	5.53	4976.97
R-16	869.94	- 34.58	- 30086.90
R-17	900.06	- 3.20	- 2881.69
R-18	920.00	- 5.16	- 4746.16
R-19	900.08	- 12.87	- 11583.60
R-20	910.33	- 35.33	- 32163.50
R-21	899.98	7.29	6557.37
R-22	900.20	- 3.36	- 3025.70
R-23	899.85	5.63	5065.17
R-24	899.81	- 14.33	- 12897.80
R-25	900.09	- 33.97	- 30573.10
R-26	900.25	- 25.28	- 22754.30
R-27	900.22	3.30	2972.69
R-28	899.69	67.51	60736.70
R-29	898.93	15.70	14115.70
R-30	900.95	13.54	12195.40
R-31	901.59	1.35	1220.65
R-32	872.17	14.38	12541.90
R-33	908.33	- 2.66	- 2416.13
R-34	903.69	47.22	42671.70
R-35	887.08	0.82	727.95
R-36	918.81	7.06	6488.20
R-37	1000.90	- 20.74	- 20759.70
R-38	924.02	39.83	36802.10
R-39	798.79	80.97	64678.50
R-40	876.44	67.48	59142.70
R-41	900.25	46.36	41731.60
R-42	450.03	48.52	21835.40
Totals:	37,006.00		+ 87394.61

Total sand volume eroded = -335,929.54 cubic yards
Total sand volume gained = +423,324.15 cubic yards
Total Net Sand Volume Change = + 87,394.61 cubic yards

Notes: [1]Distance refers to the distance over which the survey data for each profile line represents (values are computed as the sum of the distance from the stated profile line to points halfway to each adjacent profile line).
[2]Positive values indicate sand volume accretion, and negative values indicate sand volume erosion. Volumes are computed for the zone extending 200 feet seaward from the DNR survey monuments.

Table 10. SAND VOLUME CHANGES, 1976 - 1982

Profile Line Number	Distance[1] (in feet)	Volume Change[2] (in cubic yards) Per Foot of Shoreline	Total Change
R-1	450.18	6.76	3043.76
R-2	899.97	- 15.29	- 13761.60
R-3	899.76	35.09	31571.70
R-4	899.87	19.83	17844.42
R-5	804.80	13.79	11097.30
R-6	899.08	19.56	17586.50
R-7	994.00	- 23.54	- 23394.90
R-8	899.73	24.96	22455.20
R-9	899.76	24.39	21944.20
R-10	899.67	- 29.63	- 26653.20
R-11	899.95	10.69	9623.98
R-12	1005.03	8.57	8614.80
R-13	958.44	6.78	6496.09
R-14	853.46	- 3.86	- 3294.34
R-15	899.92	- 16.16	- 14544.60
R-16	869.94	5.25	4567.64
R-17	900.06	- 2.92	- 2628.71
R-18	920.00	- 7.11	- 6541.69
R-19	900.08	- 27.53	- 24780.20
R-20	910.33	- 29.55	- 26903.30
R-21	899.98	6.60	5940.83
R-22	900.20	- 25.26	- 22735.80
R-23	899.85	- 26.81	- 24121.00
R-24	899.81	3.75	3374.78
R-25	900.09	35.07	31565.20
R-26	900.25	- 5.24	- 4717.85
R-27	900.22	- 0.02	- 16.92
R-28	899.69	6.39	5746.95
R-29	898.93	0.15	132.37
R-30	900.95	- 12.83	- 11559.80
R-31	901.59	5.57	5017.85
R-32	872.17	69.69	60778.60
R-33	908.33	26.62	24177.20
R-34	903.69	8.92	8065.42
R-35	887.08	- 60.33	- 53515.10
R-36	918.81	- 74.56	- 68503.20
R-37	1000.90	- 71.59	- 71650.60
R-38	924.02	- 30.95	- 28598.90
R-39	798.79	14.03	11210.10
R-40	876.44	42.16	36954.10
R-41	900.25	60.49	54453.10
R-42	450.03	40.69	18311.00
Totals	37,006.00		- 7348.62

Total sand volume eroded = -427,921.71 cubic yards
Total sand volume gained = +420,573.09 cubic yards
Total Net Sand Volume Change= - 7,348.62 cubic yards

Notes: 1 Distance refers to the distance over which the survey data for each profile line represents (values are computed as the sum of the distance from the stated profile line to points halfway to each adjacent profile line.

2 Positive values indicate sand volume accretion, and negative values indicate sand volume erosion. Volumes are computed for the zone extending 200 feet seaward from the DNR survey monuments.

Table 11. SAND VOLUME CHANGES, 1971 - 1982

Profile Line Number	Distance[1] (in feet)	Volume Change[2] (in cubic yards) Per Foot of Shoreline	Total Change
R-1	450.18	- 3.00	- 1350.27
R-2	899.97	- 8.60	- 7740.82
R-3	899.76	- 5.32	- 4782.39
R-4	899.87	8.44	7594.90
R-5	804.80	10.56	8498.78
R-6	899.08	0.18	161.28
R-7	994.00	- 0.56	- 552.15
R-8	899.73	2.01	1809.89
R-9	899.76	- 2.18	- 1958.50
R-10	899.67	- 29.74	- 26760.10
R-11	899.95	- 1.44	- 1292.41
R-12	1005.03	- 5.69	- 5719.73
R-13	958.44	- 6.86	- 6574.36
R-14	853.46	- 13.28	- 11337.70
R-15	899.82	- 10.63	- 9567.62
R-16	869.94	- 29.33	- 25519.20
R-17	900.06	- 6.12	- 5510.40
R-18	920.00	- 12.27	- 11287.90
R-19	900.08	- 40.40	- 36363.80
R-20	910.33	- 64.89	- 59066.80
R-21	899.98	13.89	12498.20
R-22	900.20	- 28.62	- 25761.50
R-23	899.85	- 21.18	- 19055.80
R-24	899.81	- 10.58	- 9523.03
R-25	900.09	1.10	992.11
R-26	900.25	- 30.52	- 27472.10
R-27	900.22	3.28	2955.77
R-28	899.69	73.90	66483.60
R-29	898.93	15.85	14248.10
R-30	900.95	0.71	635.63
R-31	901.59	6.92	6238.49
R-32	872.17	84.07	73320.40
R-33	908.33	23.96	21761.10
R-34	903.69	56.14	50373.10
R-35	887.08	- 59.51	- 52787.20
R-36	918.81	- 67.49	- 62015.00
R-37	1000.90	- 92.33	- 92410.30
R-38	924.02	8.88	8203.16
R-39	798.79	95.00	75888.60
R-40	876.44	109.64	96096.80
R-41	900.25	106.84	96184.70
R-42	450.03	89.21	40146.40
Totals:	37,006.00		80045.99

Total sand volume eroded = -504,409.08 cubic yards
Total sand volume gained = +584,455.01 cubic yards
Total Net Sand Volume Change = + 80,045.99 cubic yards

Notes: 1 Distance refers to the distance over which the survey data for each profile line represents (values are computed as the sum of the distance from the stated profile line to points halfway to each adjacent profile line).

2 Positive values indicate sand volume accretion, and negative values indicate sand volume erosion. Volumes are computed for the zone extending 200 feet seaward from the DNR survey monuments.

on Hutchinson Island, namely the coastal plain beach, pocket beaches and Bathtub (Barrier) Reef beach. The most dramatic changes occurred in the beaches of the Bathtub Reef Area, due to the effects of the adjacent St. Lucie Inlet and offshore barrier reef. Accretion immediately north of the north jetty occurred, with erosion farther north near the Sailfish Point access strip. This eroded area caused a structural threat this past fall, but has accreted seaward dramatically (up to 150 feet) during summer of 1982. The area classified as pocket beaches shows alternately accreting and unchanged shoreline, due to the irregularly spaced rock outcroppings in this area. The northernmost reach, being a coastal plain beach, shows the least change during this eleven-year period. High erosion rates do occur, however, in the area north of the Stuart Public Beach, where rock revetments have been constructed (Near R-19 and R-20).

It must be emphasized that these results are based on three surveys performed during summer 1971, winter 1976, and winter 1982; thereby giving indications of net changes from one time period to the next. Short term changes, especially erosion during severe storms, can occur at much greater rates. These analyses do indicate overall changes which need to be considered for Coastal Zone Management.

Dune Stability and Vegetation

The dune system exists in a delicate balance of shifting sands, adaptive plants and volatile seas. It is our natural barrier between the sea and man's development. The stabilized dune affords protection against high water levels

and storm wave runup, as well as supplying sand for offshore bars during large wave activity.

Wind transport of sand particles creates an accumulation of sand when an obstacle is found in its path. For the dune, plants are a primary means of capturing and retaining such sand. Dune plants must be hardy to survive drought, wind, heat and high salinity levels in both air and soil. Some adaptive measures include thick, waxy cuticles, epidermal hairs, or trichomes to limit salt penetration. Other plants can detoxify or excrete absorbed salt ions. Extensive root systems help to stabilize these plants and increase their ability to obtain water.

The dune vegetation zone is known as the coastal strand. This zone is divided into three phases that help to visualize the relationships between the plants and their environment: (1) the pioneer zone, (2) scrub zone and (3) forest zone. Detailed discussion of the native vegetation is also included in a later section on plant communities.

Existing in the pioneer zone, located just landward of most wave action, are the hardiest of plants. They must survive in sandy, alkaline soil high in excess soluble salts, and having minimal nutrients or water. Pioneer zone vegetation has adapted to repeated burial by accumulating sand, by its ability to grow through it and to spread laterally, creating an extensive layered root system. Primarily consisting of grasses and vines, the pioneer zone plants serve to catch and consolidate sand, and eventually return sufficient nutrients to this poor soil to support the slightly less hardy plants of the scrub zone.

Tenants of the scrub zone are generally wood shrubs extending from the front side of the dune to landward of the dune crest. These continue the

process of sand entrapment and nutrient enrichment, giving rise to the more substantial trees of the forest zone.

The forest zone is located immediately landward of the scrub zone. Many woody shrubs found in the scrub zone appear in tree form in the forest zone, as the separation between these two areas is often indistinct. The forest zone may also occur in troughs between dune lines where fresh water and nutrients are more readily available.

Typical pioneer zone plants found on Hutchinson Island in Martin County are sea oats, saltgrass, spurge, beach croton, railroad vine, beach morning glory, beach sunflower, beach star, sand spurs, bay bean, beach iva, sea rockets and purslane. Where this type of vegetation can be seen growing seaward during spring and summer months, it is frequently washed away by harsh winter waves in the study area. The net effect leaves much of this island with a narrow or non-existant pioneer zone.

Scrub zone vegetation immediately landward of the hardy pioneer plants are comprised mainly of sea grapes, inkberry, Spanish bayonet, coral bean, necklace pod, Brazilian pepper, saw palmetto, sea lavendar, prickly pear, bay cedar and seacoast marsh elder in the study area. Where the pioneer zone is scanty, a combination of pioneer and scrub plants - such as sea oats, sea grapes, and Spanish bayonets - predominate.

Australian pines form the majority of vegetation in disturbed areas of Hutchinson Island's forest zone. In undisturbed areas tropical hammocks or pine/palmetto woodlands predominate.

In reviewing the status of vegetation and dunes along the Martin County section of Hutchinson Island, descriptions have been referenced to DNR marker locations, as depicted in Plate I. Beach profiles are also included in the Appendix. At the northernmost end of Martin County, there are high, steep scarps where the dune has been eroded back to the scrub zone. At markers R-1 and R-2 the pioneer plants have started to grow back on the face of the scarp. In contrast, at Marker R-3, the roots of an Australian pine (forest zone) are badly eroding away. Markers R-4, R-5 and R-6 show a marked decrease in the height of the scarp and amount of erosion, until at markers R-7 through R-11 most signs of erosion are gone. At this point the beach is actually building. The dune here shows typical characteristics of pioneer, scrub and forest zones. R-12 is again starting to show major erosion where the dune has been cut back to the saw palmettos and Spanish bayonets of the scrub zone. The dune at R-14 was badly eroded, but pioneer plants are starting to creep forward again. At R-17 and R-18 there is considerable root exposure, with Spanish bayonets growing on the face of a steep scarp. Close to R-18 exists a beach walkover that has been extended by approximately six feet due to severe erosion of the beach. In the vicinity of R-19 and R-20 two rock revetments and a wooden bulkhead have been erected to attempt to control the severe dune erosion. In this area, pioneer vegetation is scanty or absent. R-22 shows

an example of serious erosion that has killed the sea grape and Australian pine on the dune edge.

With the exception of R-24, which seems to show a building beach, from R-23 to R-29 (Stuart beach to the House of Refuge) erosion is prevalent with steep escarpments and root exposures. Stuart beach has some badly eroded beach accesses. In the vicinity of the House of Refuge where rock outcroppings exist, the adjacent beaches are building and pioneer plants are moving seaward. From marker R-30 to R-36, a typical beach and dune system exists, slightly eroded, but on a building trend evidenced by advancing pioneer zone plants. In the Sailfish Point region, markers R-37 to R-42, vegetation is sparse over a wider, lowered dune profile. Erosion is not severe in this area, and whatever destruction has occurred to the dune, replanting and the offshore reef system are helping to restore this area.

A substantial dune system offers natures best protection for absorbing the shock of storm waves and high tides. In many areas of Martin County's beaches, the dune has been reduced to a minimally effective or non-existant barrier. Several factors contribute to this destructive trend. In discussing the dune processes, two specific points should be mentioned;

(1) High still-water levels are the primary contributors to dune erosion. The higher the water level, the higher the elevation at which waves can attack. Higher water levels also provide deeper depths seaward of the coast, allowing larger waves to reach the dune. For these reasons, maximum erosion typically occurs during the recurring fall and winter northeast storms, when the

highest water levels and sufficient wave energy occur. A major hurricane can also produce these extreme conditions.

The rise in sea levels since the establishment of the MSL datum in 1929 is significant to the consideration of the still-water level. A rise of over one foot has occurred in the study area since 1929. This means that all elevations referenced to the 1929 MSL datum are actually one foot lower than indicated, relative to the present sea level. The elevation of the top of the highest dune, for example, is 22 feet above the 1929 MSL datum, but only 21 feet above the present average water elevation.

(2) If dune vegetation is the primary sand building and retaining factor, then its' devastation would also be of concern in dune depletion. Human foot traffic and vehicular travel on and near dune vegetation is directly responsible for contributing to erosion. Vegetation is also lost through the effects of the aforementioned elevated still-water level.

In the following section, a more detailed discussion of the effects of man-made structures on the dune system will be explored. The factors controlling dune growth or recession are numerous and complexly interrelated. At any given time and point on the shoreline, a unique combination of forces work to create the existing conditions.

Existing Coastal Protective Structures

The existing coastal protective and beach erosion control structures affecting the coastal processes include the north jetty of the St. Lucie

Inlet (near R-42), a concrete groin at Sailfish Point (near R-36), a wooden bulkhead at a private residence (near R-20), two rock revetments at Islander 12 Condominium (near R-20) and Little Ocean Club and Place (near R-19), and the concrete seawall at the Jensen Beach Public Beach (between R-4 and R-5).

These structures produce an effect referred to as "hardening of the shoreline," and produce undesireable effects on the natural beach system. (Walton and Sensabaugh, 1979). Hardening of the shoreline occurs when the softer, more mobile beach sand is replaced by a harder more permanent structure. During increased wave activity, this causes the remaining available sand to be transported offshore, leaving a lowered beach profile in front of and around the existing man-made structure.

Wave heights, water levels, and current velocities are greater in front of a hardened shoreline. There is not enough sand available to move offshore and form bars, thereby inhibiting wave dissipation. The sand that does move creates a trough in front of the structures, allowing increased water depths and wave heights closer to the endangered upland structures. The beaches are thus narrowed in these areas. Narrowing of the beach width allows less area over which the longshore current can flow. The current velocity will then increase due to this constriction, and erosion is again increasingly aggravated. The hardened shoreline removes the normally more gentle beach slope that allows wave energy to dissipate over a larger area. Instead, breaking waves find themselves faced with hard resistance, and wave energy is increased by reflection back toward the sea. Once again, the increased wave activity leads to further erosion and aggravation of the existing conditions.

MAJOR VEGETATION AND WILDLIFE

SOIL TYPES

Soils Inventory & Description

An inventory of soils occurring on Hutchinson Island in Martin County are indicated on Plate IV. These soils were inventoried with the help of the Martin County Soil and Water Conservation District and are a part of the larger Soil Survey of Martin County Area, Florida issued April 1981. This valuable reference was a joint effort of the Soil Conservation Service, U.S.Dept. of Agriculture, University of Florida and others. The field work for the Survey was done during the period 1974-1978 and mapped on aerial imagery (1972) which is included in the Survey.

On Hutchinson Island, 11 different soils are found. The soils are listed by number corresponding to the mapped area. The following is a brief description of the soil characteristics and the natural vegetation that will occur on the soil:

8 - Palm Beach sand: Nearly level to sloping soil, well drained to excessively drained. It is found on dunelike ridges which run parallel to the coastline. Depth to the water table is more than 120 inches. Natural vegetation consists of saw palmetto, seagrape, sea oats and scattered cabbage palm.

23 - Urban sand: This miscellaneous area is more than 70 percent covered by shopping centers, parking lots, large buildings, houses, streets, sidewalks, airports and other residential and commercial related facilities. Generally the soil has been altered by grading and shaping or it has been covered with 5-12 inches of sandy fill material.

25 - Beaches: Nearly level to sloping narrow strips of tide washed sand and shell fragments. Found along the Atlantic Ocean shoreline. Beaches range from less than 100 feet to more than 500 feet in width. As much as half of the area may be flooded daily during high tides. Water table depth is highly variable depending on distance from the shore, elevation of the beach and tidal condition. Commonly the water table can range from 0-72 inches depending on time and place.

27 - Arents, organic substratum: Nearly level, poorly drained. It consists of fill material that has been excavated and spread over organic soils, then shaped or smoothed to suit the desired use. The material was spread over the surface of the organic soil to a depth of 20-50 inches. The water table is at a depth of 20-40 inches during most of the year. Most areas are used for urban development.

28 - Canaveral sand: Nearly level to gently sloping, somewhat poorly drained to moderately well drained. Associated on low dune-like ridges and side slopes bordering sloughs and mangrove swamps. The water table is at a depth of 10-40 inches for 2-6 months of the year; below this level during the dry season. Native vegetation consists of cabbage palm, scattered saw palmetto, magnolia and bay trees. Many areas have Australian pine and cabbage palm, and a sparse ground cover of grasses and sedges.

29 - Paola sand: Nearly level to sloping soil is excessively drained. Associated with coastal ridges and isolated knolls in coastal areas. Water table is below a depth of 72 inches throughout the year. Natural vegetation consists of sand pine, scrub oak, rosemary, sawpalmetto, running oak, cacti, mosses and lichens. Slash pine and scrub hickory are in some areas.

30 - Bessie muck: Nearly level, very poorly drained organic soil. Associated with mangrove swamps along coastal areas, especially the intracoastal waterway. The water table is dependent upon tidal action. It is at or above the soil surface during high tides and storm periods and is within a depth of 10 inches at all other times. The natural vegetation is a dense growth of red, black, and white mangrove trees and bushy sea-oxeye, sea purslane, leather fern and glasswort in more open areas.

31 - Cocoa variant sand: Nearly level, moderately well drained soil. Associated with low ridges on Hutchinson Island. The water table is at a depth of 30-40 inches for brief periods during the wet season, 40-60 inches for the remainder of the year. The natural vegetation consists of cabbage palm, saw palmetto, Australian pine, seagrape and other shrubs and grasses.

36 - Arents: Nearly level soil, somewhat poorly drained to moderately well drained. Consists of fill material that was excavated and spread over the surface of wet mineral soils. Mixed fill material spread to a depth of about 20-50 inches. The water table is below a depth of 30 inches during most of the year.

50 - Okeelanta variant muck: Nearly level soil, very poorly drained. Associated with tidal mangrove swamps along the intracoastal waterway. The soil is flooded by high tides and during storm periods. The water table is within 10 inches at all other times. Natural vegetation consists of red, black and white mangrove trees. Open areas are vegetated with glasswort, bushy sea-oxeye and other salt tolerant plants.

67 - Aquents: Nearly level, very poorly drained. Consists of stratified deposits of marine sediment. It is in small to large mangrove swamps in coastal areas. The soil is flooded by salt or brackish water during seasonal or storm tides. Native vegetation consists of mangrove and salt tolerant plants. The soil is best used in its native condition as a nesting and breeding grounds for fish and wildlife.

Management Concerns

The Soil Survey of Martin County Area, Florida has descriptions of the suitability of soils for Recreational Development, Wildlife Habitat, Building Site Development, Sanitary Facilities and Water Management as well as others, however these are the most pertinent to coastal management concerns for Hutchinson Island, Martin County. These tables are condensed in Tables 12 thru 16 for only those 11 soils occurring in the study area. In summary, Recreational Development describes all soils in the study area as "severely" restrictive with one exception of "moderate" under the catagory of golf fairways for #31 - Cocoa variant. For Wildlife Habitat, one soil, #51 - Okeelanta variant muck, was rated "good" for potential habitat elements of wetland plants and shallow water areas providing good habitat for wetland wildlife. Canaveral sand #28 and Paola sand #29 had "fair" potential for wild herbaceous plants as habitat elements. All other soils were rated "poor" or "very poor" for all catagories of wildlife habitat. It is noted however that #67 - Aquents is best used in its natural condition for nesting and wildlife.

For Building Site Development, two soils #8 - Palm Beach and #29 - Paola have the least restrictive features for dwellings with and without basements, local roads and streets and moderate restrictions for small commercial buildings. Cocoa variant #31 is perhaps the least restrictive soil showing only "slight" restrictions for dwellings without basements, small commercial buildings and local roads and streets. It also shows only "moderate" restrictions for dwellings with basements and lawns and landscaping. Canaveral #28 has "moderate" restrictions in local roads and streets. All other soils in all Building Site catagories show severe restrictions. For Sanitary Facilities two soils #8 - Palm Beach and #29 - Paola Sand show the least restrictive for septic tank absorption fields. All other soils for catagories sewage lagoon areas, trench sanitary landfill, area sanitary landfill and daily cover for landfill show "severe" restrictions.

All soils on Hutchinson Island, Martin County show "severe" limitations for embankments, dikes and levees and aquifer-fed excavated ponds under Water Management criteria. Only #30 - Bessie muck has "mode rate" limitations for pond reservoir areas while all other soils show "severe" limitations under this catagory. All the soils on the Island have undesirable features for drainage, irrigation and grassed waterways, except for #8 - Palm Beach and #29 - Paola Sands which show deep to water or "moderately" good drainage.

Soil Types Related To:*

Table 12. RECREATIONAL DEVELOPMENT

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
8-Palm Beach	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: droughty
23-Urban land					
25-Beaches					
27-Arents					
28-Canaveral Sand	Severe: wetness too sandy	Severe: too sandy	Severe: too sandy wetness	Severe: too sandy	Severe: droughty
29-Paola Sand	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: droughty
30-Bessie	Severe: floods, wetness percs slowly	Severe: wetness excess humus excess salt	Severe: excess humus wetness floods	Severe: wetness excess humus	Severe: excess salt wetness floods
31-Cocoa Variant	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy	Moderate: droughty too sandy
36-Arents					
50-Okeelanta Variant	Severe: floods wetness excess humus	Severe: floods wetness excess humus	Severe: excess humus wetness floods	Severe: wetness excess humus floods	Severe: excess salt wetness floods
67-Aquents					

*Source: Soil Survey of Martin County Area, Florida, 1981

Soil Types Related To:

Table 13. WILDLIFE HABITAT*

Map symbol and soil name	Grain and seed crops	Grasses and Legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland Wildlife	Woodland Wildlife	Wetland Wildlife
8-Palm Beach	Poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor	---	Very poor
23-Urban land										
25-Beaches										
27-Arents										
28-Canaveral Sand	Poor	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor
29-Paola Sand	Poor	Poor	Fair	Very poor	Poor	Very poor	Very poor	Poor	Poor	Very poor
30-Bessie	Very poor	Very poor	Very poor	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Poor
31-Cocoa Variant	Poor	Poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor
36-Arents										
50-Okeelanta Variant	Very poor	Very poor	Very poor	Very poor	Very poor	Good	Good	Very poor	Very poor	Good
67-Aquents										

* Source: Soil Survey of Martin County Area, Florida, 1981

Soil Types Related To: *

Table 14. BUILDING SITE DEVELOPMENT

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
8-Palm Beach	Severe: cutbanks cave	Slight	Slight	Moderate: slope	Slight	Severe: droughty
23-Urban Land						
25-Beaches						
27-Arents						
28-Canaveral Sand	Severe: cutbanks cave, wetness	Severe: wetness	Severe: wetness	Severe: wetness	Moderate: wetness	Severe: droughty
29-Paola Sand	Severe: cutbanks cave	Slight	Slight:	Moderate: slope	Slight:	Severe: droughty
30-Bessie	Severe: cutbanks cave wetness	Severe: floods wetness shrink-swell	Severe: floods wetness shrink-swell	Severe: floods wetness shrink-swell	Severe: low strength wetness floods	Severe: excess salt wetness floods
31-Cocoa Variant	Severe: cutbanks cave	Slight:	Moderate: wetness depth to rock	Slight:	Slight:	Moderate: droughty too sandy
36-Arents						
50-Okeelanta Variant	Severe: cutbanks cave wetness floods	Severe: floods wetness	Severe: floods wetness	Severe: floods wetness	Severe: wetness floods	Severe: excess salt wetness floods
67-Aquents						

* Source: Soil Survey of Martin County Area, Florida, 1981

Soil Types Related To:

Table 15. SANITARY FACILITIES*

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
8-Palm Beach	Slight	Severe: seepage	Severe: too sandy	Severe: seepage	Poor: seepage too sandy
23-Urban land					
25-Beaches					
27-Arents					
28-Canaveral Sand	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage wetness too sandy	Severe: seepage wetness	Poor: seepage too sandy wetness
29-Paola Sand	Slight:	Severe: seepage	Severe: seepage too sandy	Severe: seepage	Poor: seepage too sandy
30-Bessie	Severe: floods wetness percs.slowly	Severe: seepage floods excess humus	Severe: floods seepage wetness	Severe: floods seepage wetness	Poor: too clayey hard to pack wetness
31-Cocoa Variant	Severe: depth to rock wetness poor filter	Severe: seepage depth to rock wetness	Severe: depth to rock seepage wetness	Severe: depth to rock seepage wetness	Poor: area reclaim seepage too sandy
36-Arents					
50-Okeelanta Variant	Severe: floods wetness	Severe: seepage floods wetness	Severe: floods seepage wetness	Severe: floods seepage wetness	Poor: seepage too sandy wetness
67-Aquents					

*Source: Soil Survey of Martin County, Florida, 1981

Soil Types Related To:

Table 16. WATER MANAGEMENT*

Map symbol and soil name	Pond reservoir areas	Embankments dikes and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
8-Palm Beach	Severe: seepage	Severe: seepage piping	Severe: no water	Deep to water	Droughty fast intake soil blowing	Droughty
23-Urban land						
25-Beaches						
27-Arents						
28-Canaveral Sand	Severe: seepage	Severe: seepage piping wetness	Severe: cutbanks cave	Cutbanks cave	Wetness droughty fast intake	Wetness droughty
29-Paola Sand	Severe: seepage	Severe: seepage piping	Severe: no water	Deep to water	Droughty fast intake soil blowing	Droughty
30-Bessie	Moderate: seepage	Severe: hard to pack wetness excess salt	Severe: slow refill salty water cutbanks cave	Percs slowly floods	Wetness percs slowly floods	Wetness excess salt erodes easily
31-Cocoa Variant	Severe: seepage	Severe: seepage piping	Severe: depth to rock cutbanks cave	Depth to rock cutbanks cave	Wetness droughty fast intake	Droughty depth to rock
36-Arents						
50-Okeelanta Variant	Severe: seepage	Severe: seepage wetness excess salt	Severe: salty water	Floods subsides excess salt	Wetness floods excess salt	Wetness excess salt
67-Aquents						

* Source: Soil Survey of Martin County, Florida, 1981

PLANT COMMUNITIES AND WETLANDS

Community Descriptions

The major vascular plant communities and other features were mapped using stereographic aerial imagery of Hutchinson Island, Martin County. It was by fortunate circumstance that this study took place near the same time of the aerial photography. The photo imagery was done by the Florida Department of Transportation for the Florida Department of Natural Resources in a re-study of the Martin County Coastal Construction Setback line. The date of the photography is March 6, 1982 and was flown at a scale of 1 inch = 500 feet (1:6000).

Sterographic film positives and prints were obtained and used with the simple parallax stereoscope to map plant communities. Field surveys were undertaken to verify specific community areas as well as understory vegetation.

The results of the mapping and surveys are the following description of major plant community types with the mapping unit designations which are plotted on Plate V. Table 17, at the end of this section gives a listing of the predominantly naturally occurring vascular plants on Hutchinson Island, Martin County.

Unvegetated

Bare Soil (BS). This mapping unit is made up of predominately sandy soils where plant cover is less than 5% locally. It indicates non-beach disturbed areas.

Beach (B). This mapping unit covers bare sand influenced by tidal action and occurs on the ocean and bay fringes of Hutchinson Island.

Vegetated

Dune Grassland (DG). This mapping unit occurs primarily on sloping

undulating or level sandy soil. Its best development occurs in fore-dune areas and to a much lesser extent in level areas behind the dune crests of Hutchinson Island. The dominant species include Uniola paniculata (Sea Oats), Iva imbricata (Marsh Elder) and Helianthus debilis (Beach Sunflower). Subdominant species include Philoxerus vermicularis (Saltweed), Euphorbia ipecacuanhea (Wild Ipecac), Ipomoea pes-caprae (Railroad Vine), Canavalia maritima (Bay Bean), Croton punctatus (Beach Croton), Cakile lanceolata (Sea Rocket), Helianthus debilis (Beach Sunflower), Borrichia frutescens (Sea Daisy) and Sesuvium portulacastrum (Sea Purslane).

Dune Thicket (DT). This mapping unit characteristically covers fore-dune crest and rear-dune slopes and level areas along the eastern edge of Route AIA on Hutchinson Island immediately behind the Dune Grassland. Dominant species include Coccoloba uvifera (Sea grape), Serenoa repens (Saw palmetto), Dalbergia escatophyllum (Fish poison), and Yucca aloifolia (Spanish bayonet). Subdominant species include Dalbergia ecastophyllum (Fish poison), Scaevola plumieri (Beach berry), Rhus copallina (Southern sumac), Schinus terebinthifolius (Brazilian Pepper tree), Randia aculeata (White indigo berry) and Tournefortia gnaphalodes (Sea lavender).

Scrub Thicket (ST). This community type is composed of tall shrubs or small trees usually less than twenty feet tall. Taller shrubs and trees include Quercus virginia (Live oak), Quercus virginiana var. geminata (Sand live oak), Persea borbonia (Red ray), Myrica cerifera (Wax myrtle), Schinus terebinthifolius (Brazilian pepper), Erythrina herbacea (Coral bean) and Rhus copallina (Southern sumac). The soil is moderately well drained and mangroves occur sparingly in varying proportions in the less well drained sites. Serenoa repens (Saw palmetto) forms a relatively continuous and extensive lower shrub layer beneath the aforementioned small trees. A good example of this community is found west of Route AIA opposite the Elliott Museum.

Woodland (W). This mapping unit includes woody plants over twenty feet tall with local coverage greater than 80%. With few exceptions this vegetation type is composed of floristically monodominant stands of Casuarina equisetifolia (Australian pine) with few understory species such as Vinca rosea (Madagascar periwinkle), Solanum spp (Nightshade) and Yucca aloifolia (Spanish bayonet). It occurs primarily along roadsides, at public beaches, along canals and along spoil banks in ditched mangrove communities. Australian pine is fast growing and occurs often on lands which have been changed or modified and of natural vegetation.

Submerged Mangrove (SM). This mapping unit includes at least partially submerged mangrove communities where water level is

influenced by tidal ebb and flow. Rhizophora mangle (Red mangrove) is the dominant if not exclusive species. Avicennia germinans (Black mangrove), Laguncularia racemosa (White mangrove) and Spartina alterniflora (Smooth cordgrass) occur in varying numbers as subdominant species. This community is found predominantly on the western edges of Hutchinson Island bordering the Indian River.

Mixed Mangrove (MM). This mapping unit includes the three mangrove species Rhizophora mangle (Red mangrove), Avicennia germinans (Black mangrove) and Laguncularia racemosa (White mangrove). The topography of these sites is mildly undulating and the proportions of these species varies with local drainage conditions. Raised areas of unimpeded drainage are dominated by Black mangrove and White mangrove in varying proportions. Depressed areas of congested drainage are dominated by Red mangrove. This community is found on the western side of Route AIA and is an intermediate community type between Submerged Mangrove and Emergent Mangrove. Many mixed Mangrove and Emergent Mangrove areas have been influenced by man-made mosquito impoundments.

Emergent Mangrove (EM). This mapping unit also includes three mangrove species as the dominant plants Rhizophora mangle, Avicennia germinans and Laguncularia racemosa. However, because of moist but well-drained soil conditions, A. germinans and L. racemosa are the dominant species with R. mangle being restricted to ditches and depressed areas of poorer drainage. Herbaceous plants such as Batis maritima (Batis), Salicornia virginica (Perennial Glasswort), Borrichia frutescens (Sea daisy) and Acrostichum aureum (Leather fern) occur as a low shrub area in well drained sites beneath A. germinans and L. racemosa.

Mangrove Slouth (MS). This mapping unit is a small one and comprises interrupted sloughs that occur periodically along the eastern edge of Route AIA. R. mangle is the dominant species. Australian pine established on the slough banks, forms a canopy above this community.

Mixed Grassland (MG). This community type differs from Dune Grassland by having a more varied and inconsistent composition including numerous "weed" species. This community is usually an early stage of secondary succession, where the primary community (largely woody species) has been removed and the soil disturbed. Common species include Bidens pilosa (Beggar ticks), Heterotheca subaxillaris (Golden Aster), Cenchrus spp (Sandbur), Paspalum vaginatum (Salt joint grass), Cassia fasiculata (Patridge pea), Tribulus cistoides (Puncture vine), Cnidoscolus stimulosus (Tread softly or Stinging nettle), Opuntia stricta (Prickly pear), Vinca rosea (Madagascar periwinkle) and Paspalum vaginatum (Salt joint grass). Shrubs such as Baccharis halimifolia (Groundsel tree) and Schinus terebinthifolius (Brazilian pepper tree) and small

trees of Australian pine and Brazilian pepper are sparsely scattered within this community.

Man-Made

Pond (P). This mapping unit occurs in both developed and undeveloped areas. All ponds are apparently man-made or occur in depressed areas formed by soil-moving activities.

Road (R). This mapping unit pertains to major paved roadways.

Developed (D). This mapping unit includes all dwellings, buildings, recreational facilities and related structures or areas where the natural vegetation has been significantly modified or controlled by man.

Vegetation Zones

Hutchinson Island can be divided into four vegetation zones (See Figure 12). The Pioneer Zone is primarily the fore-dune area where vegetation is subject to severe conditions. It includes the Dune Grassland (DG) and some of the Dune Thicket (DT) as mapped on Plate V . The next zone to the west from the Pioneer is the Scrub Zone. This area is just behind the dune and the soils are somewhat stable and slightly more organic than the beach sands of the Pioneer. The vegetation is low in profile as it is subjected to sea wind and salt spray. The Scrub Zone includes primarily Dune Thicket (DT) but also contains some Scrub Thicket (ST) areas and smaller areas of Woodland (W) vegetation. State Road AIA runs the length of Hutchinson Island from Stuart Public Beach north to Martin County line west of the top of the dune line an average of 200-300 feet. The road covers the area where the Scrub Zone mixes with the Forest Zone.

The Forest Zone is a stable soil with suitable organic content and slightly lower salinity. Larger trees are established such as pines and Cabbage Palm and includes the tropical hardwood hammock trees of Live Oak and Gumbo Limbo.

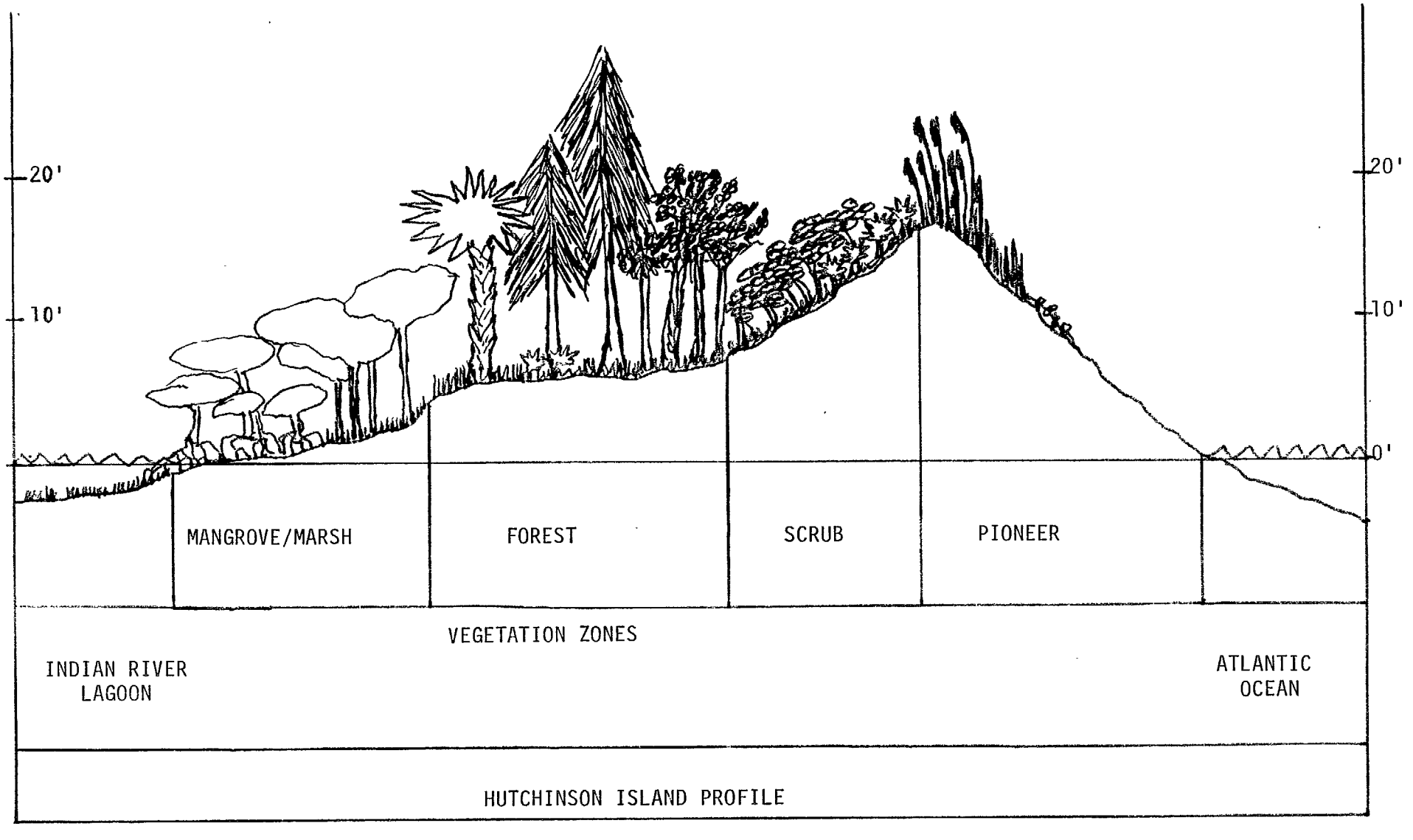


Figure 12. VEGETATION ZONES CROSS-SECTION OF HUTCHINSON ISLAND

On Hutchinson Island, this zone is mixed but contains primarily Woodland (W) and Scrub Thicket(ST) with Mixed Grassland (MG) and Mangrove Slough (MS) showing a stage of secondary succession to the original Woodland and Scrub communities. West of the Forest Zone on the Indian River Lagoon side of Hutchinson Island is the Mangrove/Marsh Zone. This is occupied predominantly by the productive Submerged Mangrove (SM) community but also contains the larger areas of Mixed Mangrove (MM) and Emergent Mangrove (EM). The latter two areas are mixtures of the mangrove communities which could be considered more wetland areas of poor drainage influenced by extreme tides or man-made canals and impoundments (see Plate V). The Submerged Mangrove community occupies roughly 71% of the approximate 53,000 feet of the Island's western shoreline and ranges from 100 feet in width to large areas depending on elevations and drainage of the lands.

Wetlands on Hutchinson Island are identified by their low elevations, moist or wet soil characteristics and wetland vegetation. Often the salt-water wetlands are associated with the Mangrove/Marsh Zone of vegetation.

Plate V identifies man-made mosquito impoundment ditches by dashed lines. These impoundment systems were constructed during the late 1950's and early 1960's to control the water regime in these often low, wet areas. The purpose of these systems is to manage the water level of the wetland for control of the saltmarsh mosquitoes and sandflies during their breeding cycles. The series of ditches were dug to connect the pockets of low areas (shallow ponds). Flooding of the area was done by pumping stations or flood gates

connected to an outside source (Indian River). Flooding the area at breeding times allowed less damp soil or shorelines within the wetland on which the mosquitoes lay their eggs and also allows natural predation of the larvae by small mosquitofish to occur throughout the area.

Most mosquito control on Hutchinson Island is now done by airplane spraying, however some areas have been opened and allow natural flooding by higher tides which also aids in control.

These wetland areas are discussed further in the following section of Fish and Wildlife.

This zonation of vegetation as shown in Figure 12, is idealistic of a typical barrier island. When comparing the map of vegetation communities, we observe a mixture or variability of the zones between the Pioneer/Scrub of the eastside dunes and the Mangrove/Marsh of the westside shoreline. This mixing is caused by several geologic processes and historical development influence.

Suggested Exemplary Areas

Four areas could be noted as possible exemplary plant community sites on Hutchinson Island in Martin County. These relatively undisturbed areas show the greatest amount of species diversity, and also show the occurrence of natural succession on a barrier island. In addition, the areas are representative of some of the plant communities delineated on the vegetative map of the island.

The locations of the areas are as follows: (1) On the west side of AIA, just north of the Park and Fish which is located south of the Jensen

Bathing Beach, is an area of Emergent Mangrove (EM). This area can be seen on the map south of a fairly large canal which is lined with Casuarina equisetifolia - (Australian Pine). (2) A second area of Mixed Mangrove (MM) is located on the west side of AIA also, north of Joe's Point. (3) The third area is on the east and west side of AIA, located approximately 1500 feet north of the Elliott Museum. The area consists of a trumcated Dune Grassland (DG) and a well drained Dune Thicket (DT) and extensive Scrub Thicket (ST). The site comes closer to approaching a coastal hardwood hammock than any other site on the island in Martin County. (4) The fourth site is representative of the Dune Grassland (DG) and Dune Thicket (DT) communities, and is located on the east side of AIA, south of the earlier mentioned Park and Fish which was south of the Jensen Bathing Beach.

The value of preserving these sites lies primarily in their use as teaching instruments. With these areas protected, people can view the steps involved in natural succession of a barrier island, as well as view the condition of natural areas on Hutchinson Island.

FISH AND WILDLIFE

The number of aquatic and terrestrial organisms considered associated with Hutchinson Island, Martin County is tremendous. A catagorized listing of the various animals from several inventories, surveys and observations is provided in Appendix D but by no means is this listing complete. The relationship these animals have with Hutchinson Island vary from a stop-

over place during migration to providing nesting areas and primary sources of food. The diversity of life ranges from the simplist plankton and insects to the complex mammals and birds.

It is perhaps interesting to note some historical changes of certain species. During the early 1900's early settlers would hunt on the Island, eat hearts of cabbage palm and prowl for turtle eggs. It was reported that in 1933 or 1936 the last Black Bear was killed on the Island and some hunting of rabbit and racoon was also done. There have been occasional sightings of Bobcat, Florida Panther and other somewhat rare species. Development of Hutchinson Island has altered much of the habitat areas and animals have either adapted to these new environments, migrated to remaining undeveloped areas or have perished because they were unable to do either. Changes in species and populations may not have necessarily been caused by development or other influences of man, but perhaps by behavioral characteristics, ecological evolutions or other events and cycles not fully understood.

Hutchinson Island can be divided into four habitat areas: (1) Open Ocean and Seashore, (2) Scrub and Forest Areas, (3) Ponds, Lakes and Developed Areas and (4) Mangrove Marsh/Wetland Areas. Appendix D shows the occurrence of species in each habitat area. Plate V. "Major Plant Communities, Fish and Wildlife" associates the plant communities with these four habitat areas.

Open Ocean and Seashore

The dunes and beaches along the Atlantic coast of Hutchinson Island (some 37,500 feet of shoreline) provide food sources and habitat for a full

range of animals. The smallest critters of mainly microscopic plankton (both animals and plants) occur in the coastal waters because of several environmental factors. The proximity of the gulf stream, the shallow continental shelf waters and the freshwater mixing from the estuary are a few of these factors. The geographic location and resulting climate also contribute to produce a preferred environment to the smallest primary producers. Proceeding up the food chain are animals which make their homes on the seashore and feed on the small plankton. The phyla (or groups) commonly represented are the sponges (Phylum Porifera) and polyps (Coelentera), the segmented worms (Annelida), the crustaceans including the crabs and shrimp (Arthopoda), the mollusks or shellfish (Mollusca) and the starfish, sea urchins and sand-dollars (Echinodermata).

A good example of the seashore relationship is given by the mole crab or sand flea (Hippa talpoida), a common small crustacea living just beneath the sand at the waters edge. As the waves wash up on the beach they bring food (plankton) which the crab filters from the water. Coastal fish and birds such as the Pompano (Trachinotus carolinus) and Herring Gull (Larus argentatus) in turn consume the sand flea and are thus attracted to the seashore.

The listing in Appendix D only gives some of the common animals inventoried in this area as it would be a major undertaking to identify all animals living here. Some of the common shore birds such as Least tern (Sterna alloifrons) use the sand for nesting as well as crabs such as the Ghost crab (Ocypode Abicans) whose holes can be seen on the beach. Perhaps

the most significant nesting along the seashore is done by sea turtles during mid and late summer. The loggerhead (Caretta caretta) and green turtle (Chelonia mydas) come ashore at night, dig their nest in the sand and lay their eggs. Once the eggs hatch, the small turtles make their way to the ocean. Although these sea turtles are protected by Federal law, they are very vulnerable to natural predation.

Scrub and Forest Areas

These areas comprise the typical upland vegetation of the barrier island. Plant communities would include Dune and Scrub Thickets as well as Woodlands and Mixed Grassland. The vegetation inventory of this report indicates as of 1982 there is roughly 287 acres of this habitat on Hutchinson Island, Martin County.

The animals observed in this habitat include the two major classes of Phylum Arthropoda, namely Arachnida (spiders, etc) and Insecta (insects) as well as the various classes of vertebrates, namely amphibians, reptiles, birds and mammals. Some of the more common of these animals would include those which make their homes in burrows beneath the thicket/scrub vegetation or nest in trees. Examples of these are the Marsh Rabbit (Sylvilagus palustris), Raccoon (Procyon lotor), Opossum (Didelphis marsupialis) and Armadillo (Dasypus novemcinctus). Various snakes, turtles and some birds such as Mourning Doves (Zenaida macroupa) also inhabit these areas. Some larger birds such as the Osprey (Pandion haliaetus) and Marsh Hawk (Circus

syaneus) may be seen nesting in the higher trees of the Woodlands but perhaps more often in the isolation of Mangrove Marsh and Wetland Areas.

Ponds, Lakes and Developed Areas

Present inventory of developed or under construction and excavated lands for 1982 (Plate VI) shows these areas totalling approximately 1132.6 acres. Excavated land (ponds and lakes) include 165.5 acres and a majority of the developing lands are landscaped open spaces comprising mainly large golf courses such as Indian River Plantation and Sailfish Point. Although these lands have been altered from their original state, efforts to retain desirable vegetation such as gumbo limbo, sea grape, cabbage palm, etc. and revegetating with natural species such as Smooth cordgrass (Spartina alterniflora) and Red Mangrove (Rhizophora mangle) have created habitats for numerous animal species.

Aquatic animals inhabiting these ponds and lakes range from marine to freshwater species. They may contain various invertebrates such as crabs, shrimp and prawns as well as the vertebrates such as snappers, snooks and killifishes to name only a few. Populations of these ponds and lakes also support several species of coastal birds such as the herons, egrets, ibises and isolated occurrences of Roseate Spoonbills (Ajaia ajaia) and Wood storks (Mycteria americana). Buildings, docks and other man-made facilities are sometimes used by shore birds for rest stops or small bird nesting places and would include Brown pelicans (Pelecanus occidentalis), Seagulls and Terns.

Mangrove Marsh/Wetland Areas

From the inventory of Plant Communities (Plate V) there are roughly 35,100 linear feet of Submerged Mangrove (SM) shoreline of the 54,300 feet

total west shoreline of Hutchinson Island, Martin County. In addition there are nine Mangrove Marsh or Wetland areas presently on the Island totalling roughly 379.5 acres. Some of the marsh/wetland areas have been impounded by dykes and ditch systems to control mosquito breeding. Tidal exchange of detrital material from the vegetation in the impounded areas to the lagoon has been reduced, however the shoreline areas of Submerged Mangrove contribute significantly to the primary productivity of the Indian River Lagoon.

Besides providing food sources for the wide variety of aquatic vertebrates and invertebrates, the Submerged Mangrove shoreline is a significant habitat for many of these animals. There appear to be both residents and the larvae or juveniles of others which establish themselves or seek refuge among the prop root system of Red Mangrove (Rhizophora mangle).

The Wetlands on Hutchinson Island, Martin County are basically areas remote or isolated from human activity. These areas are suitable nesting sights for the many coastal birds of the Island. Ospreys, Herons, Egrets, hawks, falcons, kingfishers and others can be found here. Because the soils of these wetlands are hydric, they are not well suited for mammals and similar animals preferring dryer conditions. The wetlands do support large populations of insects, particularly two species of salt marsh mosquitoes (Aedes teaniorhynchus and A. sollicitans) and sand fly species (Culicoidies furens) and (C.Mellius) accounting for the impoundment control of these lands. Aquatic species include the Mosquitofish (Gambusia affinis) and Sailfin Molly (Poecilia latipinna).

Overall the Fish and Wildlife associated with Hutchinson Island, Martin County includes a wide diversity of animals with the unique combinations and

mixing of subtropical and temperate species. Hutchinson Island provides these animals with significant habitat and supporting food sources that must be considered in decisions of coastal land and resource management.

Table 17. VASCULAR PLANTS OF HUTCHINSON ISLAND

Compiled by: Joseph T. Bridges, Ph.D., Faith Aubin, Linda Leonard
June, 1982

Abrus precatorius - (Crab's Eye)- Agavacea
Acrostichum aureum - (Leather Fern)- Pteridaceae
Aloe barbadensis - (Aloe)- Liliaceae
Amaranthus cannabinus - (Waterhemp) - Amaranthaceae
Ambrosia artemisiifolia - (Common Ragweed) - Asteraceae
Ambrosia hispida -(Coastal Ragweed)- Asteraceae
Antigonon leptopus -(Coral Vine) - Polygonaceae
Aralia spinosa - (Devil's Walking Stick) - Araliacea
Artemisia vulgaris -(Sagebrush) - Asteraceae
Avicennia germinans - (Black Mangrove) - Verbenaceae
Baccharis angustifolia - (False willow) - Asteraceae
Baccharis halimifolia - (Groundsel Tree) - Asteraceae
Bacopa monnieri - (Water Hyssop) - Scrophulariaceae
Batis maritima - (Batis) - Bataceae
Bidens pilosa - (Beggar Ticks) - Asteraceae
Borrichia frutescens - (Sea Daisy) - Asteraceae
Bursera simaruba - (Gumbo Limbo)- Burseraceae
Caesalpinia crista - (Nickerbean) - Fabaceae
Cakile lanceolata - (Sea Rocket) - Brassicaceae
Canavalia maritima - (Bay Bean) - Fabaceae
Cassia fasciculata - (Partridge Pea) - Fabaceae
Casuarina equisetifolia - (Australian Pine) - Casuarinaceae
Cenchrus spp - (Sandbur)- Poaceae
Cereus undatus - (Night-blooming Cereus)- Cactaceae
Chenopodium album -(Pigweed) - Chenopodiaceae
Chenopodium ambrosioides - (Mexican Tea)- Chenopodiaceae
Chrysobalanus icaco - (Coco Plum) - Chrysobalanaceae
Cnidoscolus stimulosus - (Stinging Nettle) - Euphorbiaceae
Coccoloba uvifera - (Sea Grape) - Polygonaceae
Cocos nucifera - (Coconut Palm) - Arecaceae
Colubrina arborescens - (Wild Coffee) - Rhamnaceae
Conocarpus erectus - (Buttonwood) - Combretaceae
Crotalaria incana - (Rattlebox) - Fabaceae
Croton punctatus - (Beach Croton) - Euphorbiaceae
Cuscuta americana - (Dodder) - Combretaceae
Dalbergia ecastophyllum - (Fish Poison) - Fabaceae
Dichondra caroliniensis - (False Pennwort)- Convolvulaceae
Distichlis spicata - (Salt Grass) - Poaceae
Erigeron strigosus - (Daisy Fleabane) - Asteraceae
Erythrina herbacea - (Coral Bean)- Fabaceae
Eupatorium aromaticum - (
Euphorbia heterophylla - (Wild Poinsettia) - Euphorbiaceae
Euphorbia ipecacuanhae - (Wild Ipecac) - Euphorobiaceae
Fiscus aurea - (Strangler Fig) - Moraceae
Helianthus debilis -(Beach Sunflower)- Asteraceae
Heliotropium angiospermum - (Heliotrope) - Boraginaceae

Heliotropium curassavicum - (Seaside Heliotrope)- Boraginaceae
Heterotheca floridana - (Golden Aster) - Asteraceae
Heterotheca subaxillaris - (Golden Aster) - Asteraceae
Hibiscus tiliaceus - (Mahoe)- Malvaceae
Hydrocotyle umbellata - (Water Pennywort)- Apiaceae
Hyptis alata - (Musky Mint)- Lamiaceae
Ilex vomitoria - (Yaupon) - Aquifoliaceae
Ipomoea alba - (Moon Flowers) - Convolvulaceae
Ipomoea pes-caprae - (Railroad Vine) - Convolvulaceae
Iva imbricata - (Marsh Elder) - Asteraceae
Juncus roemerianus - (Black Rush)- Juncaceae
Laguncularia racemosa - (White Mangrove) - Combretaceae
Lantana camara - (Lantana) - Verbenaceae
Lantana montevidensis - (Weeping Lantana) - Verbenaceae
Lemna minor - (Duckweed) - Lemnaceae
Lepidium virginicum - (Pepper Grass)- Brassicaceae
Lippia geminata - (Capeweed) - Verbenaceae
Lippia nodiflora - (Capeweed)- Verbenaceae
Lupinus Nuttallii - (Lupine) - Fabaceae
Lycium carolinianum - (Christmas Berry)- Solanaceae
Melothria pendula - (Creeping Cucumber)- Cucurbitaceae
Mentzelia floridana - (Poor-man's Patches)- Loasaceae
Mikania scandens - (Climbing Hempweed) - Asteraceae
Momordica charantia - (Wild Balsam Apple) - Cucurbitaceae
Monarda punctata - (Horse-mint)- Lamiaceae
Myrica cerifera - (Wax Myrtle) - Myricaceae
Oenothera humifusa - (Seaside Evening Primrose)- Onagraceae
Okenia hypogaea - (Beach Peanut) - Nyctaginaceae
Opuntia stricta var. dillenii - (Prickly Pear)- Cactaceae
Oxalis stricta - (Sour Grass) - Oxalidaceae
Panicum amarulum - (Beach Grass) - Poaceae
Parthenocissus quinquefolia - (Virginia Creeper) - Vitaceae
Paspalum vaginatum - (Salt Joint Grass) - Poaceae
Persea borbonia - (Red Bay) - Lauraceae
Philoxerus vermicularis - (Saltweed) - Amaranthaceae
Physalis angulata - (Ground Cherry) - Solanaceae
Phytolacca americana - (Pokeweed) - Phytolaccaceae
Pluchea camphorata - (Camphor Weed) - Asteraceae
Pluchea purpurascens - (Marsh Fleabane)- Asteraceae
Portulaca pilosa - (Rose Purslane) - Portulacaceae
Quercus virginiana - (Live Oak) - Fagaceae
Quercus virginiana var geminata - (Sand Live Oak) - Fagaceae
Randia aculeata - (White Indigo Berry) - Rubiaceae
Remirea maritima - (Beach Star)- Cyperaceae
Rhabdadenia biflora - (Rubber Vine) - Apocynaceae
Rhizophora mangle - (Red Mangrove)- Rhizophoraceae
Rhus copallina - (Southern Sumac) - Anacardiaceae
Richardia scabra - (Mexican Clover) - Rubiaceae
Ricinus communis - (Castor Bean) - Euphorbiaceae
Rivina humilis - (Rouge Plant)- Phytomlaccaceae

Sabal palmetto - (Cabbage Palm) - Arecaeae
Salicornia virginica -(Perennial Glasswort) - Chenopodiaceae
Salix caroliniana - (Coastal-plain Willow) - Salicaceae
Salsola kali - (Saltwort) - Chenopodiaceae
Sansevieria thyrsiflora -(Bowstring Hemp) - Agavacea
Scaevola plumieri - (Beach Berry) - Goodeniaceae
Schinus terebinthifolius - (Brazilian Pepper Tree) -Anacardiaceae
Serenoa repens - (Saw Palmetto) -Arecaceae
Sesuvium portulacastrum - (Sea Purslane) - Aizoaceae
Sida acuta -
Smilax Auriculata - (Greenbriar) - Smilacaceae
Solanum americanum - (Common Nightshade) - Solanaceae
Solanum erianthum - (Potato Tree) - Solanaceae
Solanum verbascifolium - (Nightshade) - Solanaceae
Sonchus oleraceus - (Common sow thistle) - Asteraceae
Spartina alterniflora - (Smooth Cordgrass) - Poaceae
Suriana maritima - (Bay Cedar)- Surianaceae
Tephrosia spp - (Hoary Pea) - Fabaceae
Tournefortia gnaphalodes - (Sea Lavender) - Boraginaceae
Toxicodendron radicans - (Poison Ivy) - Anacardiaceae
Tribulus cistodes - (Puncture Vine) - Zygophyllaceae
Trichostema dichotomum - (Blue Curls) - Lamiaceae
Trichostema suffrutescens - (Blue Curls) - Lamiaceae
Tridax procumbens - (Tridax) - Asteraceae
Typha latifolia - (Common Cattail)--Typhaceae
Uniola paniculata - (Sea Oats) -Poaceae
Verbena maritima - (Vervain) - Verbenaceae
Verbena tenuisecta - (Vervain) - Verbenaceae
Verbesina laciniata - (Crowbeard) - Asteraceae
Vinca rosea - (Madagascar Periwinkle) - Apocynaceae
Vitis rotundifolia - (Muscadine Grape) - Vitaceae
Vitis shuttleworthii - (Calusa Grape) - Vitaceae
Wedelia trilobata - (Wedelia) - Asteraceae
Yucca aloifolia - (Spanish Bayonet) - Agavacea

LAND USE INVENTORY

DEVELOPMENT AND LAND USE

The development of Hutchinson Island in Martin County has been significant over the past ten years. Plate VI "Development Changes 1971-1982" shows the changes from vacant land to developed or under construction, public lands developed and excavated. With an approximate total acreage of 1658 acres, and the acreage estimates given for the two years, some comparisons and observations can be made.

In 1971 approximately 92% of the land was vacant, 5% was developed or under construction, less than 2% was developed as public lands and only 1% was excavated. In 1982 we find only 32% of the land still vacant, while 50% has been developed or is under construction, 8% is developed as public lands and excavated represents approximately 10%.

The growth or notable increase has clearly been in residential developments but while representing one half of the lands, the large developments, such as Indian River Plantation and Sailfish Point provide extensive open space. The public lands increase from 2% to 8% has not kept pace with the population growth of Hutchinson Island and Martin County. To change this, the County this year has made efforts to expand the public lands through local and state acquisition programs. This expansion would increase the public land use to 14% or greater. It should be noted here that large portions of vacant land, at Stuart and Jensen Beaches are at present under public ownership but have not been

developed. These are primarily on the west side of AIA and the acreage at Jensen Beach is mostly wetlands not suitable for development.

Another change to be noted is that of excavated lands 1% in 1971 to 10% in 1982 which is significant. Most of these areas are incorporated in golf courses and open space as ponds and lakes. Some are canals and canal like systems open to the Indian River lagoon. Most of these lands were used as fill to increase the elevation of the existing lands. The changes these excavated areas have on drainage, ground water and other water management concerns may become a significant consideration over long time periods. There may also be some benefits to these areas for various fish and wildlife.

Plate VII "Land Use Inventory 1982" together with Tables 18 and 19 provide detailed specifics as to the land use of Hutchinson Island, Martin County. This information should be helpful not only as inventory but in long range coastal management considerations.

PARKS AND RECREATION

The existing beachfront parks for Martin County are listed on Table 20 "Existing Beachfront Parks and Access Strips" with the first 13 listings covering Hutchinson Island. These are listed in order from the north county line south to Sailfish Point and can be located on Plate VII "Land Use Inventory 1982".

The main beach park areas of Stuart Beach and Jensen Beach were established in the early 1960's. A major public campaign in 1972, "Save Our

Table 18 LAND USE 1982

RESIDENTIAL DEVELOPMENT

NAME	# UNITS	DEV. STAGE	GROSS ACREAGE
Anglers' Cove	64	D	7.13
The Beach House	66	UC	9.5
Beach Walk - PUD	32	UC	11.6
Beachwood Villas	80	D	7.08
The Dune	31	UC	4.55
Dunes Club	30	D	1.72
Fairwinds Cove	288	UC	22.07
Green Turtle Cove	80	D	5.45
Hutchinson House East	42	D	3.01
Hutchinson House West - PUD	69	D	8.04
Indian River Plantation - PUD	1200	UC	200.
Indian River Point - PUD	72	D	11.5
Islander 12	12	D	1.24
Joe's Point (Subdivision)- PUD	49	UC	13.8
Little Ocean Club	48	D	1.73
Little Ocean Place	24	D	1.0
Maritimes East - PUD	28	D	4.52
Maritimes West	27	UC	
Middleton Gardens - PUD	212	UC	38.0
Ocean Cove (Subdivision)	5	UC	3.5
Ocean View - PUD	98	D	13.8
Pelican's Landing - PUD	60	UC	8.1
Sailfish Point - PUD	765	UC	532.
Sandpebble Beach Club - PUD	242	UC	37.07
Spyglass - PUD	32	P	2.72
Suntide	80	D	5.4
Surf Club Oceanside - PUD	32	P	4.92
Buttonwood	21	UC	7.28
Santa Lucea - PUD	92	UC	10.4
Seaside of Stuart	20	D	1.43
Shore Village (Subdivision)	12	UC	4.05
Rose Walk (Subdivision)	10	P	9.55

Totals		
	32 Developments	3923 Units
	15 D (Developed)	778 D (Developed)
	14 UC (Under construction)	3071 UC (Under construction)
	3 P (Pending approval)	74 P (Pending approval)

Average densities	992.16 Gross Acreage
10.0 UPA (Developed)	77.6 D (Developed)
3.4 UPA (Under construction)	897.37 UC(Under construction)
4.3 UPA (Pending approval)	17.19 P (Pending approval)

PUD - 2983 Units

Table 19. LAND USE 1982
NON-RESIDENTIAL DEVELOPMENT

DOT*	
140	Commercial
1455	Cat Cove Marine Rental (boat rental)
	Indian River Plantation Pantry
1412	Service station
1414	Convenience store
143	Professional offices
	Indian River Plantation
1413	Banking facilities (Florida National)
143	Professional offices
1415	Restaurants
1452	Holiday Inn Oceanside
1413	First Federal of Martin County (under construction)
147	Mixed commercial services (corner of SR707A and AIA)(under construction)
144	Cultural and Entertainment
1442/6	Elliott Museum
1442	House of Refuge Museum
170	Institutional
1754	Hutchinson Island Fire Dept.
180	Recreational
181	Swimming Beaches
	Stuart Beach Park
	Jensen Beach Park
	8 Beach access strips
182	Golf Courses
	Indian River Plantation
	Sailfish Point
188	Historical Sites
1881	Indian mounds - Prehistoric
1882	House of Refuge - Historic
800	Transportation
8113	Airports (Private)
	Sailfish Point
8143	Two-lane highway (State)
	A-1-A
820	Communications
8212	Radio/TV Tower - Jensen Beach Park

834 Sewage Treatment
8341 Treatment Plants
- Sailfish Point (under construction)
- Dunes Club
- Indian River Plantation
- Anglers' Cove
- The Beach House (under construction)
- Beach Walk (under construction)
- The Dune (under construction)
- Fairwinds Cove (under construction)
- Green Turtle Cove
- Hutchinson House East
- Hutchinson House West
- Indian River Point
- Islander 12
- Joe's Point
- Middleton Gardens (under construction)
- Ocean View
- Pelican's Landing (under construction)
- Sandpebble Beach Club (under construction)
- Spyglass (undeveloped)
- Suntide
- Surf Club (pending approval)
- Buttonwood (under construction)
- Seaside of Stuart

833 Water Supply Plants
- Sailfish Point (under construction)
- Dunes Club
- Indian River Plantation
- The Beach House (under construction)
- Beach Walk (under construction)
- The Dune (under construction)
- Fairwinds Cove
- Indian River Point
- Islander 12
- Joe's Point
- Middleton Gardens
- Ocean View
- Pelican's Landing (under construction)

* Land Use Cover and Forms Classification System
May 1981, Florida Department of Transportation

Table 20. Existing Beachfront Parks and Access Strips

	Beach Front Ft.	Acreage	Ocean Front Only	Ocean To River	Parking Spaces	Bathroom Or Shower Facilities
1. Access Strip #1	110	0.82	X		33	
2. Jensen Beach Park	1480	50.0		X	240	X
3. Martin County Park & Fish	100	1.0		X	32	
4. Bryn Mawr Strip #2	100	0.62	X		23	
5. Forrest Strip #3	100	0.74	X		22	
6. Tiger Shores Strip #4	100	0.80	X		26	
7. Stuart Beach Park	1160	68.36		X	145	X
8. Fletcher Strip #5	100	0.80		X	12	
9. House of Refuge	2100	10.46		X	32	
10. Chastain Strip #6	80	1.26		X	30	X
11. County Strip	30	0.6		X	-	
12. City Strip #7	50	1.5		X	-	
13. Sailfish Point Strip #8	130	0.77	X		54	X
Total for Hutchinson Island	5650	137.73	5	8	649	
14. Hobe Sound Beach	450	2.0	X		75	X

Ocean Front in Martin County

Hutchinson Island - 37,500 feet
Jupiter Island - 76,032 feet

Other Parks on Jupiter Island

-St. Lucie Inlet State Park (State) 14,256' (Proposed access)

-Hobe Sound Wildlife Refuge (Federal) 18,480' (345' access, 88 car parking (4 handicap and 2 bus), no bathroom facilities)

-Blowing Rocks Beach (Nature Conservancy) 4,488' (overwalk access, 18 car parking, no bathroom facilities)

Beaches", raised money which was matched by the County for the purchase of eight access strips. Some of the strips were acquired through donations and are designated by the names of the donor. Plans for future expansion of the beach parks are proposed and are discussed in later sections of this report.

The Coastal Zone of Martin County has a variety of attractive recreational resources. The waterways range from freshwater estuaries to lagoons and nearshore as well as offshore Atlantic waters. Fishing, boating, swimming, surfing and picnicing are a few of the recreational activities which take place on Hutchinson Island. Others perhaps less active, but equally important are sunbathing and shelling or just watching the ocean come to shore in its ever changing moods. The seashore is a unique place, naturally relaxing to the human spirit.

The existing beachfront parks and access strips of Hutchinson Island, Martin County, are oriented for various recreational activities. Only two strips, the County Strip and City Strip are not developed for direct access. Jensen Beach and Stuart Beach are the oldest and largest providing the most parking as well as lifeguard protection, bathroom/shower facilities and picnic areas. They are referred to as beachfront parks. The access strips, with the exception of the Chastain Strip #6 and Sailfish Point Strip #8, only provide limited parking (20-30 cars) and one dune overwalk for access to the beach. These access strips do not have lifeguard protection but were provided for public access to various points along the barrier island.

Fishing - Most all public beach areas provide good surf fishing

although you may find most fisherman either north or south of the actual access to the beach. North of Jensen Beach to Strip #1 has been well known for catching whiting, pompano, etc. The Park and Fish strip was named to also indicate a popular spot. Each access area has it's own set of nearshore bottom conditions such as sand bars, troughs, etc which continuously change their shapes and sizes with the seasons. South of the Stuart Beach is also a good area for fishing. The Fletcher Strip, House of Refuge and Chastain Strip are areas of the Anastasia rock outcrops and pocket beaches where fishermen must manuver the nearshore rocky bottoms. The Sailfish Point Strip #8 is used by fisherman as an access to walk the 1.2 miles of beach to the north St. Lucie Inlet jetty.

Swimming - The three popular swimming beaches are Jensen Beach, Stuart Beach and the Bathtub Beach of Sailfish Point Strip #8. At Jensen and Stuart, lifeguards are provided through the County Public Safety Department. The Bathtub area is popular for the protective reef which, exposed at low tides, creates a "bathtub" like affect. This area is used by families with young children and others. All of the beaches are excellent for swimming except perhaps for some of the rocky shores between The Chastain Strip and Fletcher Strip #5.

Surfing - This popular activity has been in the area for many years. Some of the popular surfing areas include Jensen Beach, Tiger Shores Strip #4, Stuart Beach and the Chastain Strip known as "The Rocks". Generally surfers will look at several places to find the best "break" of the waves

and the areas where there are less activities of fishing or swimming. At the Stuart and Jensen Beaches, lifeguards generally designate the surfing areas away from swimming, however when large ocean swells are crashing the shores of Hutchinson Island, it is unsafe for swimming and popular for surfing.

In summary, there are many recreational opportunities at the beach parks and access strips of Hutchinson Island. Each person can generally find a place and time for their particular activity. The need for more public areas on Hutchinson Island certainly presents itself with the increasing population of the County. Along with the new acquisitions must be sound development and management of the areas with consideration for significant environmental features and natural surroundings as well as diversity in recreational opportunities.

CULTURAL AND HISTORICAL FEATURES

There are some significant cultural and historical features existing on Hutchinson Island, Martin County. Their cultural descriptions range from prehistoric, historic to museums and contribution to the arts and education.

The prehistoric and historic sites are listed as Table 21 and are from the record of the Florida Master Site File, Florida Department of State, Division of Archives, History and Records Management. The locations of these can be found as numbers 30 and 34 on Plate VII "Land Use Inventory 1982".

Table 21. RECORDED HISTORICAL SITES

(Florida Dept. of State)

Site No.	Site Name	Location	Cultural Classification	Functional Classification
8Mt2	Jensen Beach	S24,T37S-R41E	Prehistoric	Shell Midden
8Mt3	St. Lucie Beach	S08,T38S-R42E	Prehistoric	Burial Mound
8Mt27	Gilbert's Bar House of Refuge	S05,T38S-R42E	Historic (Late 19th century American)	Building; National Register
8Mt37	Hutchinson Island	S32,T37S-R42E	Prehistoric (Glades)	Burial Mound
8Mt45	Joe's Point	S24,T37S-R41E	Prehistoric (St. Johns)	Shell Midden

The historic site of Gilbert's Bar House of Refuge is well known and discussed in Part I of this report. It functioned as one of ten such installations constructed by order of Congress in 1874 to provide aid to shipwreck victims along the east coast. The facility operated as a submarine patrol base during World War II and today is an historical museum operated by the Martin County Historical Society with assistance from Martin County Commission.

The prehistoric sites are two indian burial mounds and two shell middens, which were used to deposit oyster shells and other refuse of indian life.

These are the only recorded sites of the Island but it should be noted that other sites may exist and are as yet unrecorded. There is a moderate probability of sites occurring in areas of slight rises near mangrove swamps and in areas where the coastal strand meets the Indian River. Sites may also be expected to occur in tropical hardwood hammocks within mangrove swamp areas. This information and inventory should be considered in management of the coastal zone. No person should seek out these sites for their own advantage as they are significant to the archeological history of the State of Florida and would not contain valuable wealth or treasure. The County should require preliminary surveys prior to the development of any future lands on Hutchinson Island to determine the occurrence of any unrecorded sites. Then only professional archeologists under State of Florida supervision should be allowed to disturb the site.

Another more recent cultural feature of Hutchinson Island is the Elliott Museum built by Harmon Parlver Elliott in 1961 in memory of his father Sterling. Both were inventors of their time and the elder Mr. Elliott can best be remembered for the inventions of the kin pin (used in steering automobiles to this day) and the address machine. The Elliotts were collectors of antique cars and the main facility houses their collection. The museum is operated by the Martin County Historical Society established since 1955. It also has on display the best collection for the history of Martin County. The Elliott Museum also has a room for changing art exhibits and performing arts at various occasions.

Both the Elliott and House of Refuge Museums play an important role in education. Of significance also to education are the various environmental

features of Hutchinson Island. Field trips by Martin County and other schools are conducted by the Martin County Environmental Studies Center. Students learn about a variety of coastal environments as provided by areas such as the Bathtub Reef, dunes and beaches, tropical hammocks, mangroves and nearshore lagoon grass beds. These field trips in nature study are of significant value to our cultural heritage.

PART IV

BATHTUB REEF STUDY

PART IV. BATHTUB REEF STUDY

This part provides information on a sabellariid worm reef system offshore of Hutchinson Island, Martin County, Florida. The area of study is located at approximately 27°11'30"N. latitude and 80°9'15"W. longitude and extends from the St. Lucie Inlet in a N.W. direction for approximately one and one-half miles. The area is locally referred to as the "Bathtub Reef".

Included is a brief description of the marine worm, Phragmatapoma lapidosa Kinberg, its tube and reef building abilities, and geographical distribution. The study also includes a mapping of the Bathtub Reef, documentation of the physical features of the reef system relative to mean sea level, a description of observed flora and fauna within the reef system with emphasis on zonation patterns and a description of recreational uses of the reef area and associated beaches. Conclusions and recommendations derived from this study are provided along with maps, figures, listing of identified species and bibliography.

BIOLOGICAL, PHYSICAL AND GEOGRAPHICAL FACTORS

The nearshore reefs of Hutchinson Island, Florida are built by tiny tube building worms. These small, polychaete worms belong to the family, Sabellariidae and are known by the name, Phragmatopoma lapidosa Kinberg. They generally measure no more than one or two millimeters in diameter and seldom more than eight to ten centimeters in length, about the size of a common wooden matchstick.

The life cycle of P. lapidosa begins with the release of sperm and eggs into the surrounding water where fertilization takes place. After fertilization, a free swimming larva is formed which may spend from three weeks to six months in a planktonic form before it settles on a suitable substrate and begins to construct a tube. The triggering mechanism for the settling behavior is not fully known. The substrate must be stable, for once the worm settles and begins to build its tube it must spend the rest of its life on that spot. It does not have the option to move to a more suitable location. Rock outcroppings, pilings, jetties and ship wrecks are used as substrates.

After settling, P. lapidosa begins to build its home. Sand grains and shell fragments are captured from the surrounding water and selected for building material. There seems to be a definite process of selection as to size and type of particle. After the particle is chosen it is then coated with a protein-based cement and glued to other particles to form the tublar home of the worm. The tube itself is lined with a mucuous material, and each tube has a protected hood of cemented particles over the opening. (Figure 13.)

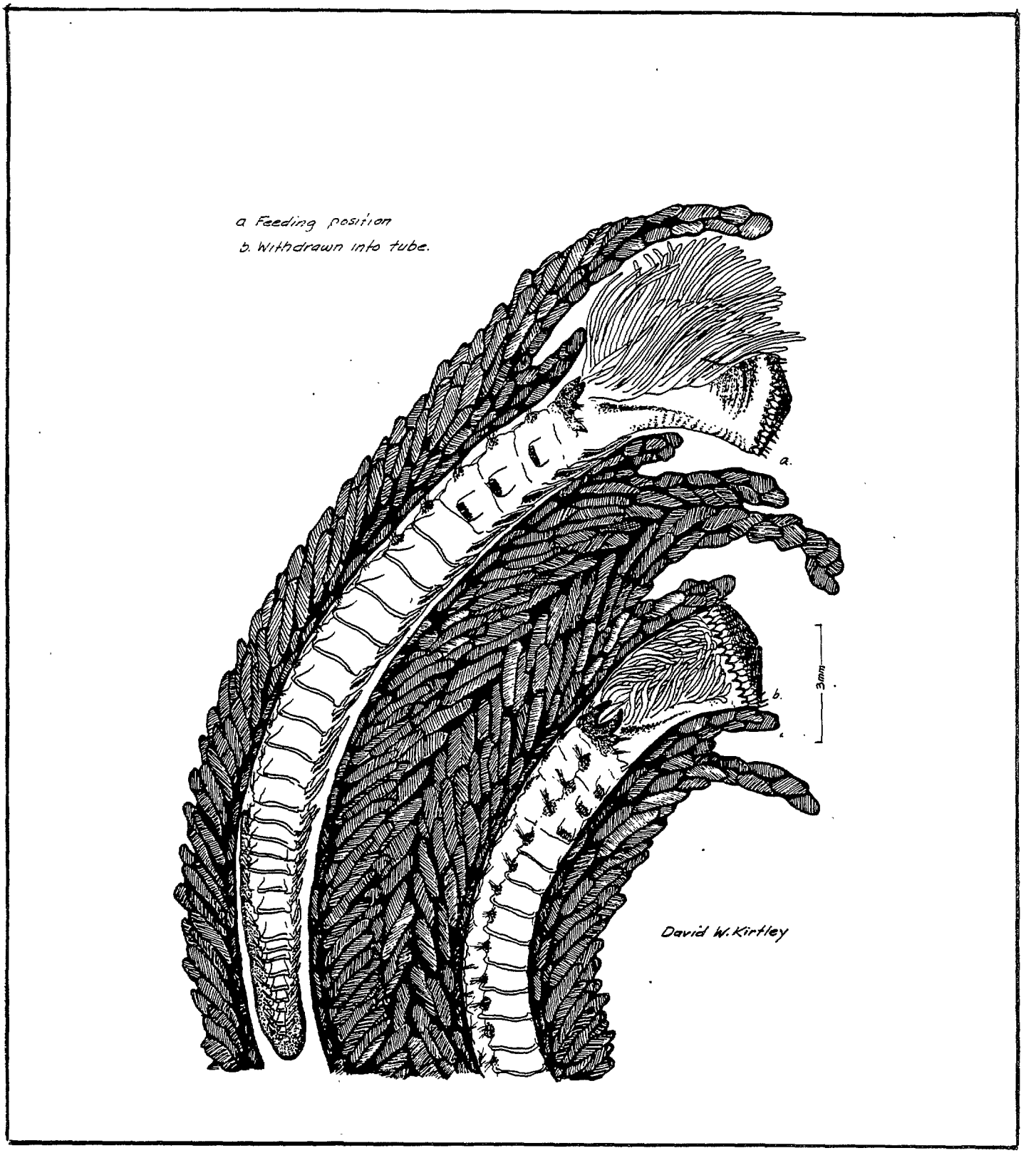


Figure 13. DIAGRAM OF PHRAGMATOPOMA LAPIDOSA KINBERG

As the worms crowd together on a common base the tubes of adjacent worms are cemented to each other. This cementing together of thousands upon thousands of these tubes lays the base for the formation of an extensive reef. Newly arriving larvae may build on vacant spaces on the substrate or use the compacted homes of older worms for their base. The constant competition for space and new building makes the reef an ever changing and growing community. Heavy wave action, predators, and other factors may serve to tear down worm tubes and return the sand and shell particles back to the ocean floor while at the same time new larvae settle and begin the process of building over again.

Since P. Lapidosa cannot leave its tube in search of food and building materials it must depend on the surrounding water to supply them. Therefore the water must maintain a relatively high degree of turbulance to suspend the sand grains and shell fragments which are used in the tube building. Consequently, the most active growth of P. lapidosa reefs is near shore and perpendicular to the dominant wave vector for the area.

Once established, the worm base can serve as a home for many attached and free moving forms of marine life. Cracks and crevices in the reef provide habitats for numerous crustaceans and other crawling marine organisms. Local and migratory fish find the reef a suitable location for food and protection. The rock substrate and the living worm reef thus become the base for an entire community of plants and animals.

The distribution of sabellariid worm reefs is world-wide in nearshore ocean waters. P. lapidosa reefs are reported from Florida to Brazil

in western Atlantic waters. The distribution of P. lapidosa in Florida is along the Atlantic coast from Cape Canaveral to Miami. (Figure 14.)

There are numerous reef outcroppings in the Martin-St. Lucie County area. However, the nearshore reef off Hutchinson Island, locally referred to as the "Bathtub Reef", is unique in the extent to which it forms a continuous reef system, its accessibility to shore and the amount of reef which is exposed at low tide.

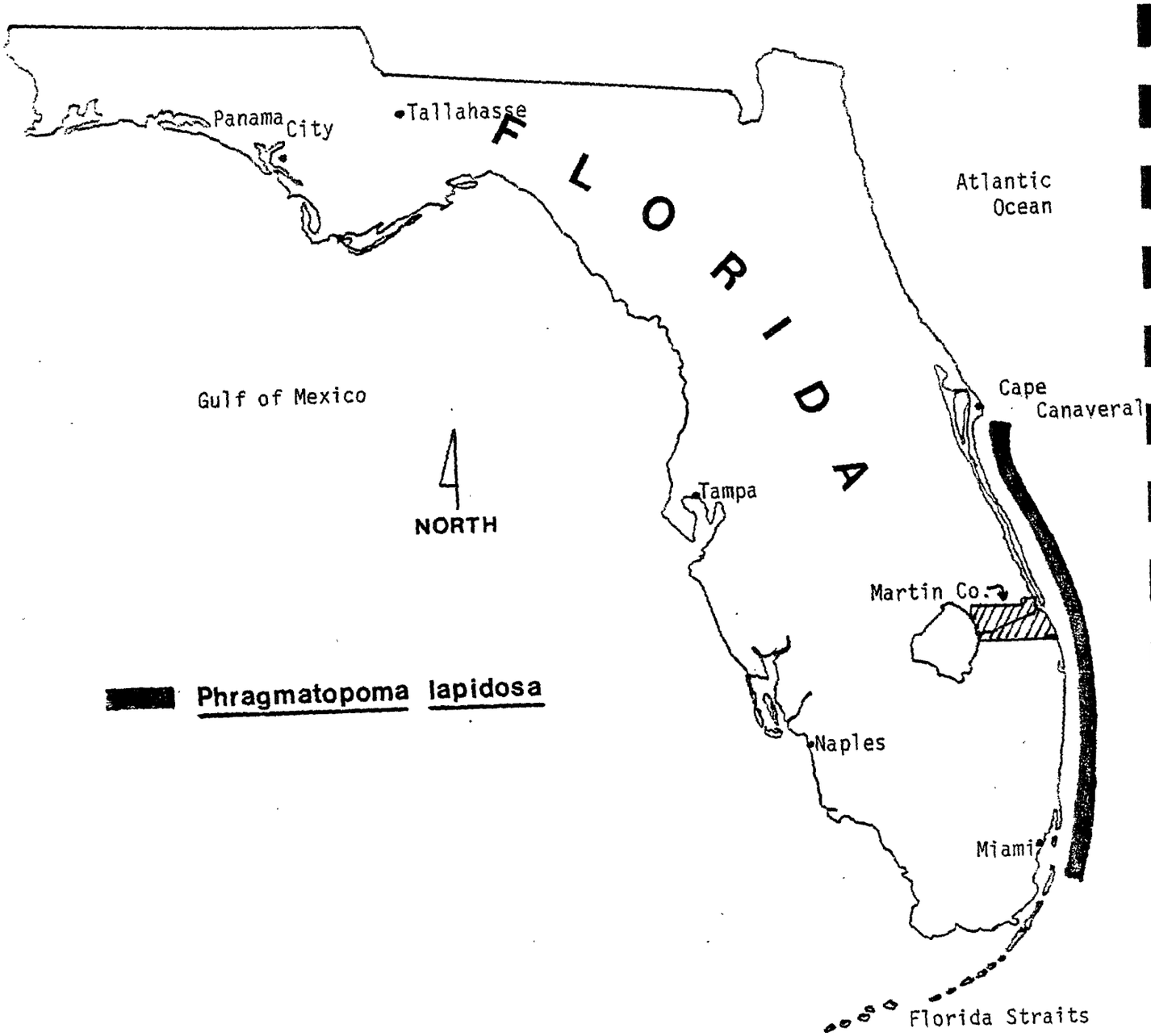


Figure 14. DISTRIBUTION OF SABELLARIID WORM REEFS ALONG FLORIDA'S COAST.
After Kirtley and Tanner.

MATERIALS AND METHODS

RESOURCES USED

The mapping of the Bathtub Reef system was accomplished through the use of aerial photographs taken by the Florida Department of Transportation in March 1982 and on site verification. The photographs provided sufficient vertical imagery of the reef system on a scale of 1":100' to allow an accurate outline of the reef. In areas of very deep water or where the photos glared, the outline is approximate.

A review was made of past beach surveys made by the Florida Department of Natural Resources (DNR) in the Bathtub Reef area. A compilation of those surveys is included in the "Barrier Island Resource Inventory" section of this report.

The DNR beach surveys are taken along a bearing of N69^{o}E from bench markers, known as R-markers, located 900 feet apart along the dune line the entire length of Hutchinson Island. They were installed and are maintained by the Department of Natural Resources. Profile data of the reef was taken along the same bearing, N69^{o}E, from each R-marker using standard surveying equipment-transit, stadia, measuring tape and hand-held magnetic compass. Biological surveys were conducted at the same time and along the same transect lines. Materials included field notebook, snorkeling gear and metric tapes. Field guides were used for identification of the more common species of plants and animals. Further biological surveys were taken by walking and snorkeling the reef system along its axis.

MAPPING

Aerial photographs on a scale of 1":100' were placed in sequence and fitted together by matching landmarks. Mylar drafting paper was placed over the photos and taped down. All significant, distinct features of the first

and second reef lines were copied. R-markers were located by sighting targets placed on each marker when the photographs were taken.

Verification of the mapping was performed by on-site inspection and comparison of distances determined by the use of stadia in doing the transects.

PHYSICAL FEATURES - TRANSECTS

Starting at the northern most R-marker, R-34, transect lines were set up at a bearing of N69^{o}E using a handheld compass. The line was marked from the dune to the waterline by a series of stakes. The transit was then set up at the top of the dune and a backsight reading taken to the R-marker. Foresight readings and stadia were taken from the stake sights set along the beach face. This procedure was repeated as often as necessary in order to set the transit at the waterline. The number of turning points was determined by the slope of the beach face. Once the transit was situated at the waterline, foresight and stadia readings were taken at various points along the reef itself. The stadia factor for the particular transit used was determined by measuring a distance of 100 ft. with a tape, sighting on it with the transit and noting the measurements at the top and bottom of the transit. The distances determined by the use of stadia were later used to verify the mapping done with aerials.

Readings were taken at the back reef (shoreward), midreef and forereef (seaward) locations along each transect. Starting at the shoreward side of the reef, at the line separating sand from worm rock or coquina rock, an elevation was taken. The stadia was then moved to a midreef location. Midreef readings were made at what appeared to be

the highest elevation of the reef at a point as near to the center of the reef as possible. Forereef elevations were taken on the seaward side where coquina or worm rock ended and sand began.

BIOLOGICAL SURVEY

By sighting back to the R-markers with the stakes as a guide, a fiberglass, 20m tape was laid out and weighted down at intervals in the shallower portion of the reef. Beginning at the shoreward side of the reef, the tape was either walked or swam. Living sections of worm rock and major sessile communities were noted as to their location along the tape, and an estimate was made of the percentage of cover over an area within one-half meter on either side of the tape. Vertebrate and invertebrate organisms seen within the area of the transect line were also noted. In deeper areas of the reef, the transect was swam with mask and snorkel, and notes were made of exposed rock, general coverage by sessile organisms and living worm rock. Fish observed while snorkeling or caught by fishermen in the area were noted for the species listing. (See Table 22 at end of this part).

RECREATIONAL SURVEY

Recreation surveys were made each time physical or biological surveys were done. Notes were kept on general usage of the reef, lagoon and associated beach areas. A quantative study was not attempted.

RESULTS AND DISCUSSION

MAPPING

The Bathtub Reef system off south Hutchinson Island runs almost parallel to the shoreline and extends from the shoreline off R-34 at a bearing of N 135^{o}E to the north jetty of the St. Lucie Inlet, a distance of approximately 1.5 miles. The reef system extends south of the inlet for a distance of approximately 4.5 miles along the same bearing. Presently exposed coquinoid rock and living worm reef covers an area of approximately 85+ acres. This area varies seasonally and yearly depending on the shifting of sand carried by longshore currents, direction of wave action and magnitude of waves.

Depending upon the amount of rock exposed, the reef system is comprised of two parallel outcroppings which connect at various points. Emphasis in this study was on the nearshore system. Plate VIII, indicates the extent of this system with a general outline of the second reef. The inner reef varies in widths from 10 feet inshore at R-34 to 200+ feet off R-41 and R-42. It should be notes that as this study was being done the reef outline was changing. Sand was accreting along the shore between R-34 and R-35. The exposed coquinoid rock between R-35 and R-36 was also being covered by sand on the landward side.

SURVEY TRANSECTS

Survey transects show cross sections of the reef beginning at R-34 and extending south to R-42. Mean elevations ranged from -0.9 ft at R-34 to -8.3 ft at R-42 indicating a gradual downward slope from north to south. (See Table 23)

Individual transects are varied depending on the mean depth and amount of living worm rock. The northern portion of the reef is a relatively flat

Table 23. ELEVATIONS OF BATHTUB REEF SYSTEM ALONG TRANSECTS

All figures in feet relative to Mean Sea Level.

Reef Survey Transect #	Backreef	Midreef	Forereef	Mean	Width
R-34	- .873	- .863	- .853	- .863	10
R-35	- .49	+0.66	-3.28	-1.04	42
R-36	- 3.28	-1.64	-4.59	-3.17	71
R-37	- 6.95	-6.30	-8.26	-7.17	117
R-38	- 4.75	+0.10	-6.07	-3.57	200
R-39	- 8.89	-3.31	-9.87	-7.36	114
R-40	- 5.35	-1.08	-6.66	-4.36	128
R-41	-10.00	-5.00	-7.50	-7.50	200
R-42	- 9.0	-7.0	-9.0	-8.33	200

coquinoid limestone base with small patches of living worm mounds. This area receives the greatest wave action and undergoes constant change in being covered by sand part of the time and exposed at other times. The southern portions of the reef, R-41 and R-42, also have a flat coquinoid base, but the midreef area is covered with large masses of living worm rock. Wave action in these areas is moderate with the greatest amount over the elevated, living worm mounds. This area does not appear to have as much change in sand coverage as the northern portion.

The seaward, forereef has spur and groove buttresses along the entire length of the reef. These do not show up in the mapping or the transect measurement.

BIOLOGICAL COMMUNITIES

A comprehensive species listing of organisms found on the Bathtub Reef is beyond the scope of this survey. Common and readily identifiable organisms were used to indicate zonation patterns and habitat areas. Species identified are listed in Table 23. A more comprehensive listing of species identified in other studies is found in Appendix D.

The communities or organisms associated with the Bathtub Reef system are largely determined by the tides and the elevation of the reef base relative to mean sea level. Due to the sloping of the reef along a line of 135^{o}, approximately parallel to the shoreline, the system can be divided into distinct zones. The backreef and midreef in the northern third of the system are predominantly littoral or intertidal, covered with water at high tide and exposed to the air at low tide. The southern two-thirds of the entire reef and the northern forereef are sublittoral, always covered with water. (See Plate VIII).

From R-34 southward for approximately 250 ft there are extended portions of exposed beach rock along the shoreline. This area is predominantly a

splash zone characterized by periwinkle snails, barnacles and chitons, During fall high tides and northeasterly storms this area may be completely covered with water. In front of the rock outcropping is a broad, flat area of rock extending seaward. This flat pavement rock is covered by sand throughout most of the year. The area itself is intertidal being covered with water at high tide and exposed to the air at low tide. No living worm rock is found on the flat, seaward extension, but small growths occur in lower, protected area of the rock outcroppings.

Further south from the rock outcropping and extending to a midpoint between R-36 and R-37 the midreef and backreef are intertidal in nature. In the northern portion of this area there are numberous tide pools containing limpets, barnacles, and mixed algal growths. The tide pools also have an abundance of small fish. Sergeant majors, beaugregories, blennies and gobies are common in the deeper tide pools. Living worm reef in this area is patchy with most worm colonies located midreef. Living worm patches are generally no larger than one square meter in size. On the shoreward side of the mapped intertidal reef there are expanses of base rock covered with sand. Depending on longshore transport of sand and seasonal storms this entire area may be covered with sand, or completely exposed. When more rock is exposed algae and other encrusting organisms quickly move into this area. One year ago this area was almost completely covered with living worm mounds. Now the area seems to be in a process of being covered with sand.

In the southern portion of the intertidal zone the reef system is covered with water most of the time. This area is only exposed for one to two hours at low tide. In this area the coquina rock foundation is always covered with

water but larger worm mounds are frequently exposed to the air. This area is most subject to breaking wave action because of its shallow depth and being covered by water most of the time. Both small and large wave forms tend to keep this an area of continuous breakers except at the very lowest tides.

This area also exhibits zonation from seaward to landward. The midreef is covered with large growths of living worms except in surge channels. The backreef is mostly flat coquinoid limestone covered with various algal growths. The backreef area varies greatly in size due to shifting sand, and at times sand may cover the entire backreef area leaving only the midreef exposed. At other times the backreef may be completely free of sand and extend shoreward 50 to 100 feet or more. When free from sand the backreef supports a large variety of algae and other sessile benthic organisms. Patches of living worm rock will grow in this area but seldom become very large before they are covered with sand.

The living worm rock on the midreef is virtually free of macroscopic algae. Either these areas are kept clean by the living worms or the heavy wave action tends to scour this area and keep down algal growth. The surge channels of the midreef and the flat base rock of the backreef are covered with growths of encrusting algae, bryzoans and sponges. Large areas, more than 1m x 1m, are covered with growths of a red, boring sponge.

From R-34 to R-36 the forereef is sublittoral. It is primarily an area of spur and groove buttresses with occasional living worm mounds rising to the

surface of the water. This area supports numerous schools of small fish. Algal growths in this area are generally low and encrusting.

From R-36 southward to the St. Lucie Inlet the reef system is always covered with water. Massive living worm colonies cover most of the top, midreef area interrupted only periodically by surge channels. The living worm mounds are generally free from other attached organisms living on them, but the cracks and crevasses between the mounds of worms support large numbers of algae, sponges, colonial tunicates and other encrusting or sessile organisms.

The backreef is generally flat and one to three feet lower than the midreef section. Smaller patches of living worm rock are found on the backreef, but the rock base is generally covered with sponges and algae growth.

The forereef in this area is difficult to define. It is mostly composed of pieces of reef rubble covered with living worm colonies dispersed over large sand flats. In some places the rubble forms continuous reef lines running 50 to 100 feet along the same direction as the main reef. In other areas there are simply mounds of rubble sitting in the middle of extensive sand flats. As one moves further seaward the living worm areas form a lower profile. Instead of forming one to two meter high mounds the worms encrust the base rock in thickness of only 10 to 20 cm.

RECREATIONAL USES

The Bathtub Reef system and associated land area is used extensively as a recreational area. Activities are more concentrated at the public

access #8, just north of the private development of Sailfish Point. The majority of activities include picnicking, swimming, fishing, specimen collecting, snorkeling and scuba diving.

This area is particularly suitable for small children due to decreased wave action and lack of associated currents. The sabellariid worm reef acts as a barrier to the waves rendering the associated lagoon a virtual "bathtub" of calm water. Surf fishing is popular along the beach south of the public access area.

Specimen collection occurs in all areas of the reef, activities being dependent upon water depth and tides. In shallow water, especially at low tides, people walk out on the reef collecting small fish and sessile organisms found there. In deeper water where snorkeling and diving gear are needed, collection of specimens is also possible but has a more limited access due to this activity's dependence upon water conditions. The worm rock itself is rarely taken in collection.

Recreational diving is becoming more and more popular on the Bathtub Reef system. Snorkeling is most popular due to the shallow nature of the reef, but occasionally scuba divers are seen in the deeper areas. In the 1950's and 60's diving for spiny lobsters was popular on this reef system; however, the population has dwindled and this area is no longer as popular for this sport. Although not common, some spear fishing is done on the Bathtub Reef system. During the surveys for this report two jewfish were seen taken by divers using spear guns. Each fish weighed 20-30 pounds.

The beach associated with the Bathtub Reef system is also a popular area to look for large sea turtles laying their eggs. At night, during

the months of May through August, female loggerhead (Caretta caretta) and green (Chelonia mydas) sea turtles come ashore to lay their eggs on or near the dune line. Also during these months sea turtles can be found swimming around the reef or hiding and resting under ledges along the reef.

Educational uses of the Bathtub Reef are increasing. Students from Florida Institute of Technology, located in Jensen Beach, Florida, use the reef for a variety of studies. The Martin County Schools Environmental Studies Center use the reef and associated beaches as an outdoor classroom for students in their studies of ecology, hydrology and beach dynamics.

CONCLUSIONS AND RECOMMENDATIONS

The sabellariid worm reef located nearshore off southern Hutchinson Island Florida is a dynamic, living system. It provides more than 85 acres of habitat for numerous plants and animals as well as recreational advantages for man.

The success of this system depends on a tiny, tube-building polychaete worm, Phragmatopoma lapidosa. These worms grow together forming large mounds on a coquinoid limestone base lying just off the shoreline. The mounds form a barrier to wave action and may serve to protect the beach from erosion.

The lagoon formed by this reef system has made this area a popular recreational location for residents and tourists. The name, Bathtub Reef, has been used for over 40 years by local residents who used this area for recreational activities long before roads were built to provide public access.

The Bathtub Reef System is unique in several ways. The geographical distribution of Phragmatopoma lapidosa reefs is mostly limited to southern Florida and Brazil. Also, this reef, along with the extension of the same reef system of Jupiter Island, provides one of the longest stretches of nearshore worm reefs in Florida. It is generally an unstudied reef and provides an opportunity for students in the Marine Sciences a new area for investigation. Therefore, the Bathtub Reef system not only functions as a unique biological community, but also provides an excellent location for recreational, educational and research activities.

It is recommended that the reef be preserved in its natural state, and that designation as a local or national marine sanctuary be considered. Restrictions on the recreational use of the reef are not recommended, but the possibility of damage to the system by over-usage or careless usage does exist. A through base-line study of the reef should be done with provisions made for periodic monitoring of the system. Sound management of the area should allow a wide variety of recreational use without endangering the balance of the system.

Table 22. COMMON ALGAE, INVERTEBRATES AND FISH OBSERVED DURING THE BATHTUB REEF STUDY

Phylum Chlorphyta - Green Algae

- *Acetabularia crenulata*
- *Caulerpa spp.*
- *Codium spp.*
- *Enteromorpha spp.*
- *Halimeda discoidea*
- *Ulva lactuca*
- *Valonia ventricosa*

Phylum Phaeophyta - Brown Algae

- *Dictyota sp.*
- *Padina sp.*
- *Sargassum spp.* (floating, none attached)

Phylum Rhodophyta - Red Algae

- *Bryothamnion sp.*
- *Ceramium sp.*
- *Dasya sp.*
- *Galaxura sp.*

Phylum Porifera - Sponges

Cliona sp. - (Red boring sponge)

Phylum Coelenterata - Anemones, Corals and Jellyfish

- *Zoanthus sp.* - (Mat anemone)
- *Siderastrea radians* - (Star coral)
- *Physalia pelagica* - (Portuguese man-of-war)
- *Velella velella* - (By-the-wind-sailor)
- *Porpita umbella* - (Blue buttons)
- *Chrysaora Quinquicirrha* - (Sea nettle)

Phylum Annelida - Worms

Class Polychaeta - (Marine worms)

- *Phragmatopoma lapidosa* - (Reef-building worm)
- *Loimia medusa* - (Medusa worm)
- *Eurythoe complanata* - (Orange bristle worm)

Table 22. COMMON ALGAE, INVERTEBRATES AND FISH OBSERVED DURING THE BATHTUB REEF STUDY (Cont.)

Phylum Arthropoda
  Class Crustacea - Crabs, Lobsters and relatives
    Balanus sp. - (Barnacle)
    Pseudosquilla ciliata - (False mantis shrimp)
    Alpheus sp. - (Snapping shrimp)
    Synalpheus sp. - (Snapping shrimp)
    Panulirus argus - (Spiny lobster)
    Stenorhynchus seticornis - (Arrow crab)
    Callinectes sapidus - (Blue crab)
    Arenaeus cribrarius - (Speckled crab)
    Menippe mercenaria - (Stone crab)
    Mithrax sp. - (Spider crab)
    Pachygrapsus sp. - (Grapsoid crab)
    Petrochirus diogenes - (Hermit crab)
    Plagusia depressa - (Grapsoid crab)

Phylum Mollusca - Soft bodied animal

    Thais floridana - (Florida dye shell)
    Littorina sp. - (Periwinkle
    Cypraea spp. (Deer and measled cowrie)
    Aplysia dactylomela - (Spotted sea hare)
    Octopus vulgarus - (Common atlantic octopus)

Phylum Echinodermata - Spiny skinned animals

    Diadema antillarum - (Long-spined urchin)
    Arbacia punctulata - (Common arbacia urchin)
    Lytechinus variegatus - (Variegated urchin)
    Eucidaris tribuloides - (Pencil urchin)
    Isostichopus sp. - (Sea cucumber)
    Holothuria sp. - (Florida Sea cucumber)
    Actinopyga agassizii - (Agassiz' sea cucumber)
    Ophionereis reticulata - (Brittle star)
    Asteropectin duplicatus - (Sea star)

Phylum Vertebrata
  Class Chondrichthyes
    Family Orectolobidae - (Nurse shark)
      Ginglymostoma cirratum - (Nurse shark)

    Family Dasyatidae - Stingray
      Dasyatis americana - (Southern stingray)

    Family Torpedinidae - Torpedorays
      Narcine brasiliensis - (Electric ray)

Table 22. COMMON ALGAE, INVERTEBRATES AND FISH OBSERVED DURING THE BATHTUB REEF STUDY (Cont.)

Class Osteichthyes
- Family Elopidae
  - Megalops atlantica - (Tarpon)
- Family Muraenidae - Morays
  - Gymnothorax funebris - (Green moray)
  - G. moringa - (Spotted moray)
- Family Centropomidae
  - Centropomus undecimalis - (Snook)
- Family Serranidae - Sea basses
  - Epinephelus itajara - (Jewfish)
- Family Carangidae - Jacks
  - Caranx hippos - (Common jack)
  - C. fusus - (Blue runner)
  - C. latus - (Horse-eye-jack)
  - Trachinotus carolinus - (Pompano)
- Family Lutjanidae - Snappers
  - Lutjanus apodus - (Schoolmaster)
  - L. griseus - (Gray snapper)
- Family Pomadasyidae - Grunts
  - Anisotremus virginicus - (Porkfish)
  - Haemulon parrai - (Sailor's choice)
- Family Sparidae - Porgies
  - Diplodus argenteus - (Silver porgy)
- Family Sciaenidae - Drums
  - Equetus acuminatus - (High-hat)
- Family Ephippidae - Spadefish
  - Chaetodipterus faber - (Atlantic spadefish)
- Family Pomacentridae - Damselfishes
  - Abudefduf saxatilis - (Sargeant major)
  - Eupomacentrus partitus - (Beaugregory)

Table 22, COMMON ALGAE, INVERTEBRATES AND FISH OBSERVED DURING THE BATHTUB REEF STUDY (Cont.)

Family Sphyraenidae - Barracudas
Sphyraena barracuda - (Great barracuda)

Family Blennidae - Combtooth blennies
Blennius cristatus - (Molly miller)
B. Marmoreus - (Seaweed blenny)

Family Acanthuridae - Surgeonfishes
Acanthurus coeruleus - (Blue tang)
A. chirurgus - (Doctorfish)

Family Uranoscopidae - Stargazers
Astroscopus y-graecum - (Southern stargazer)

Family Ogcocephalidae - Batfishes
Ogcocephalus vespertilio - (Longnose batfish)

PART V

MANAGEMENT AND PLANNING

PART V. MANAGEMENT AND PLANNING

REGULATORY AND MANAGEMENT AUTHORITIES

There are several interactions among agencies of the various levels of government which influence Hutchinson Island, Martin County. For the purpose of this study and simplicity the regulation and management is presented in outline, matrix form. This will provide for quick reference to particular issues and thus use more as a management tool. Further information on particular programs can be researched through the indicated references.

FEDERAL AND STATE PROGRAMS

The Treasure Coast Regional Planning Council prepared the following outlines of Federal and State Programs affecting barrier island management. They provide the name of the program, management authority or law, administering agency, program objectives, program eligibility requirements, management issue, value for future management and the agency contact.

The TCRPC is established in the regional level to provide project review and coordination among the four counties; Palm Beach, Martin, St. Lucie and Indian River. The Council is comprised of city and county officials of the four counties and meets monthly to review and take action on regional issues.

The regulation and management of Hutchinson Island is a primary regional issue because it transcends the Martin/St. Lucie County boundary. The dramatically different approaches to development of Hutchinson Island has created a concern by the Treasure Coast Council. The TCRPC has recently requested the State to consider designating Hutchinson Island as an area of critical state concern. This would assist local governments in providing for adequate protection of regional and state resources.

The impacts on Hutchinson Island in Martin County caused by the development of southern Hutchinson Island in St. Lucie County are of concern to coastal

management. The impacts include those of resources such as water and waste water management, environmental quality, etc. and those of social importance such as evacuation, disaster preparedness, traffic control and use of public beach facilities.

The following Federal and State programs outline is presented as a planning and management tool for the County and should be updated periodically, and expanded to include other programs, as necessary.

FEDERAL PROGRAMS AFFECTING BARRIER ISLAND MANAGEMENT

PROGRAM	MANAGEMENT AUTHORITY	ADMINISTERING AGENCY	PROGRAM OBJECTIVES	PROGRAM ELIGIBILITY REQUIREMENTS	MANAGEMENT ISSUE	VALUE FOR FUTURE MANAGEMENT	AGENCY CONTACT
Beach Erosion Control	Rivers and Harbors Act of 1962, as amended, Sec. 103, P.L. 87-874.	U.S. Army Corps of Engineers	Design and construct structures and undertake efforts(e.g. beach nourishment) to provide for the protection of public shoreline.	Requires participation of local sponsor in defraying project construction and maintenance costs.	Shoreline Protection	To provide for the stabilization of public shoreline.	U.S. Army Corps of Engineers, Jacksonville District Office, P.O. Box 4970, Jacksonville, FL 32232 (904)791-2241
Coastal Zone Management Program	Coastal Zone Mgmt. Act of 1972, P.L. 92-583, CZM Act Amendments 1976 and 1980, P.L. 94-37 and P.L. 96-464.	Dept. of Commerce, National Oceanic and Atmospheric Administration	Program Implementation Provide for the implementation of the State's coastal management program. Estuarine Sanctuaries Assist State in requiring and operating sanctuaries in the estuaries of its coastal zone. Coastal Energy Impact Assist States and local governments in planning for coastal energy impacts.	Projects have to be in accordance with approved State Coastal Management Programs.	Program Implementation Coastal Resource Mgmt. Estuarine Sanctuaries Special Area Management Coastal Energy Impact On-shore consequences of coastal energy facility siting.	Program Implementation To obtain financial assistance in conducting coastal planning and management efforts. Estuarine Sanctuaries To provide for added protection of exceptional estuarine areas. Coastal Energy Impact To prepare for impacts of offshore energy facilities.	Program Implementation Coastal Zone Management Programs Office, Wahsington, DC (202)634-1672 Florida Office of Coastal Mgmt., 2600 Blair Stone Rd., Tallahassee, FL 32301 (904) 488-8614 Estuarine Sanctuaries Sanctuary Programs Office, Office of Coastal Zone Mgmt., Washington, DC (202) 634-4236 Florida Bureau of Environmental Land Mgmt., 3900 Commonwealth Blvd., Tallahassee, FL 32303 (904) 488-6242 Coastal Energy Impact Coastal Energy Impact Program Office, Washington, DC (202) 254-8000 Department of Community Affairs, Office of Federal Coastal Programs, 2571 Executive Center Circle, East, Tallahassee, FL 32301 (904) 488-9210

FEDERAL PROGRAMS AFFECTING BARRIER ISLAND MANAGEMENT

PROGRAM	MANAGEMENT AUTHORITY	ADMINISTERING AGENCY	PROGRAM OBJECTIVES	PROGRAM ELIGIBILITY REQUIREMENTS	MANAGEMENT ISSUE	VALUE FOR FUTURE MANAGEMENT	AGENCY CONTACT
Community Development Block Grants	Title 1 of the Housing and Community Development Act of 1974, P.L. 93-383, as amended.	Dept. of Housing and Urban Development, Community Planning and Development.	Provide project grants to benefit low and moderate income persons in small cities.	States and units of local government, including counties.	Public facility improvement (e.g. water and sewer facilities)	(Note: program does not appear appropriate for barrier island development here.)	Small Cities Division, Office of Block Grant Assistance, Washington, DC (202) 755-6587
Dredging and Filling (Regulatory Functions)	Rivers and Harbors Act of 1899; Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500; National Environmental Policy Act of 1969 (NEPA); Endangered Species Act of 1973, P.L. 93-205; Fish and Wildlife Coordination Act of 1956, P.L. 85-624.	U.S. Army Corps of Engineers	Regulate activities in navigable waters and their tributaries, isolated wetlands and other waters deemed necessary for the protection of water quality.	Requires Corps to consider navigation issues as well as other factors (e.g. affect on fish and wildlife) in deciding permit cases modifying navigable waters. Local government input is solicited through public notice process.	Wetland Management	To provide for navigational needs and the protection of wetlands and fish and wildlife resources.	U.S. Army Corps of Engineers, Jacksonville District Office, P.O. Box 4970, Jacksonville, FL 32232 (904) 791-2251 U.S. Army Corps of Engineers, Stuart Regulatory Field Office, 300 Osceola Avenue, Stuart, FL 33494 (305) 286-0509
Economic Development	Public Works & Economic Development Act of 1956; Public Law 89-136, as amended.	Department of Commerce, Economic Development Admin.	Provide project grants for public works and development facilities.	Political subdivisions in designated economic development centers.	Public Works Development	(Note: Program is now being dismantled. There are no plans for additional grant monies).	Economic Development Admininstration, Washington, DC (202) 377-3081 Economic Development Administration, 1365 Peachtree Street, Atlanta, GA 30309 (404) 881-7401

FEDERAL PROGRAMS AFFECTING BARRIER ISLAND MANAGEMENT

PROGRAM	MANAGEMENT AUTHORITY	ADMINISTERING AGENCY	PROGRAM OBJECTIVES	PROGRAM ELIGIBILITY REQUIREMENTS	MANAGEMENT ISSUE	VALUE FOR FUTURE MANAGEMENT	AGENCY CONTACT
Outdoor Recreation--Acquisition, Development and Planning	Land and Water Conservation Fund Act of 1965, P.L. 88-578; as amended	Department of Interior, National Park Service	Provide funding assistance to States and their subdivisions for outdoor recreation.	Meets high priority recreation need as defined by State plan.	Management of Natural areas for recreational purpose.	To acquire, plan, and develop recreation areas.	Division of State, Local and Urban Programs, National Park Service, Washington, DC (202) 272-3660 Division of Recreation and Parks, Department of Natural Resources, 3900 Commonwealth Blvd., Tallahassee, FL 32303 (904) 488-6321
Water and Waste Disposal Systems for Rural Communities	Consolidated Farm and Rural Development Act, as amended, Section 306; P.L. 92-419	Department of Agriculture, Farmers Home Administration	Provide guaranteed/insured loans for the construction or improvement of a rural community facilities.	Political subdivisions of the State. Incorporated areas must be under 20,000 population.	Development of community facilities	To construct or improve community facilities for public use.	Farmers Home Admin., Washington, DC (202) 447-7967 (202) 382-9583 Area District Office 701 Clemantis Street West Palm Beach, FL (305) 832-5615
(National) Flood Insurance Program/ Flood Plain Management.	Flood Disaster Act of 1973; P.L. 93-234, as amended and National Flood Insurance Act of 1968; P.L. 90-448, as amended	Federal Emergency Management Agency, Federal Insurance Administration.	Improve management of flood prone areas and reduce flood risks.	Communities with flood hazard areas.	Flood Prone Area Management	To provide for adequate building requirements in flood prone areas.	Federal Insurance Administration, Washington, DC (202)755-7984 Florida Department of Community Affairs, Local Resource Mgmt. Office, 2571 Executive Center, Tallahassee, FL 32301 (904) 488-9210

STATE PROGRAMS AFFECTING BARRIER ISLAND MANAGEMENT

PROGRAM	MANAGEMENT AUTHORITY	ADMINISTERING AGENCY	PROGRAM OBJECTIVES	PROGRAM ELIGIBILITY REQUIREMENTS	MANAGEMENT ISSUE	VALUE FOR FUTURE MANAGEMENT	AGENCY CONTACT
Areas of Critical State Concern	The Florida Environmental Land and Water Management Act of 1972 SS 380.012 - 380.12 Florida Statutes; Chapters 27F-3, 27F-5-13, Florida Administrative Code	Department of Community Affairs, Division of Local Resource Management, Bureau of Land and Water Management	To prevent resources of regional and statewide significance from unsuitable land development.	Includes areas having a significant impact on environmental and historical/archaeological resources and major public facilities.	Protection of resources of statewide significance	To assist local jurisdictions in providing for adequate protection of regional and state resources.	Department of Community Affairs, Division of Local Resource Management Bureau of Land and Water Management 2571 Executive Center Circle, East Tallahassee, FL 32301 1-(800) 342-9276 (904) 488-4925 Treasure Coast Regional Planning Council P. O. Box 396 Stuart, FL 33495 (305) 286-3313
Coastal Construction Control Line (Permits)	Beach and Shore Preservation Act (Chapter 161, Florida Statutes, Parts I and II); Chapters 16B-23, 24, 25, 26, 33, Florida Administrative Code.	Department of Natural Resources, Division of Beaches and Shores	To preserve and protect the State's beaches from imprudent construction.	Counties with sandy beaches and shores fronting on the Atlantic Ocean or the Gulf of Mexico.	Adequate regulation of development along sandy beaches and shores.	To establish the basis for adequate local coastal development controls.	Department of Natural Resources, Division of Beaches & Shores 3900 Commonwealth Boulevard Tallahassee, FL 32301 (904) 488-3180

STATE PROGRAMS AFFECTING BARRIER ISLAND MANAGEMENT

PROGRAM	MANAGEMENT AUTHORITY	ADMINISTERING AGENCY	PROGRAM OBJECTIVES	PROGRAM ELIGIBILITY REQUIREMENTS	MANAGEMENT ISSUE	VALUE FOR FUTURE MANAGEMENT	AGENCY CONTACT
velopments of Regional Impact	The Florida Environmental Land and Water Management Act of 1972: ss. 380.012 - 380.12, Florida Statutes. Chapters 9B-16, 27F-1 and 2, Florida Administrative Code	Department of Community Affairs, Division of Local Resource Management, Bureau of Land and Water Management.	To facilitate orderly and well planned development.	Developments with substantial impacts on more than one county.	Regulation of development which have impacts of greater than local concern.	To provide local decision makers with adequate information to assess the impacts of major developments.	Department of Community Affairs, Division of Local Resource Management Bureau of Land and Water Management 2571 Executive Center Circle, East Tallahassee, FL 32301 1-(800) 342-9276 (904) 488-4925
ironmental rmitting	(Environmental Control) Chapter 403, Florida Statutes; (State Lands), Chapter 253, Florida Statutes; Florida Water Resource Act of 1972 Chapter 373, F.S. General Rules: Chapters 17-1 and 17-4, Florida Administrative Code. Dredge and Fill: Chapters 17-3 and 17-4, FAC. Water Pollution: Chapters 17-3, 4, 6, 15, 16, 19, and 28, FAC. Public Drinking Water Supply Systems/Water Wells: Chapters 17-16 20 to 23. FAC. Electrical Power Plant Siting: Chapters 17-17, FAC.	Department of Environmental Regulation Department of Health and Rehabilitative Services	Dredge and Fill: Control dredging and filling of submerged lands. Water Pollution: Prevent and abate water pollution. Public Drinking Water Supply Systems/Water Wells: Provide Provide safe drinking water at all times. Electrical Power Plant Siting: Regulate effects of locating and operating electrical generating facilities.	Dredge and Fill: Dredging and filling activities conducted in navigable waters or Waters of the State. Water Pollution: Waters that are required to meet specific water quality standards Public Drinking Water Supply Systems/Water Wells: Development of public drinking water supply systems. Electrical Power Plant Siting: Locating and operating electrical generating facilities and associated facilities	Dredge and Fill: Regulation of the use of wetlands, navigable waters, and Waters of the State. Water Pollution: Maintenance of water quality standards. Public Drinking Water Supply Systems/Water Wells: Maintenance of water quality and quantities of public drinking water systems. Electrical Power Plant Siting: Power plant location and operation.	Dredge and Fill: To provide for the protection of submerged lands, and water quality and those resources which affect them. Water Pollution: To monitor and control activities which affect water quality. Public Drinking Water Supply Systems/Water Wells: To regulate the quantity and quality of water used for public drinking supplies. Electrical Power Plant Siting: To minimize adverse impacts from power plants by coordinating local, regional and state requirements.	Dredge and Fill: DER Southeast FL District Branch Office 2745 SE Morningside Boulevard Port St. Lucie, FL 33452 (305) 878-3890 Water Pollution: Department of Environmental Regulation Southeast FL District Branch Office 2745 SE Morningside Boulevard Port St. Lucie, FL 33452 (305) 878-3890 South Florida Water Management District P. O. Box V West Palm Beach, FL 33406 1-(800) 432-2045 (305) 686-8800 Public Drinking Water Sypply Systems/Water Wells: Department of Environmental Regulation Southeast FL District Branch Office 2745 SE Morningside Boulevard Port St. Lucie, FL 33452 (305) 878-3890

STATE PROGRAMS AFFECTING BARRIER ISLAND MANAGEMENT

PROGRAM	MANAGEMENT AUTHORITY	ADMINISTERING AGENCY	PROGRAM OBJECTIVES	PROGRAM ELIGIBILITY REQUIREMENTS	MANAGEMENT ISSUE	VALUE FOR FUTURE MANAGEMENT	AGENCY CONTACT
							(continued) Department of Health and Rehabilitative Services 131 E. 7th Street Stuart, FL 33495 1-(305) 287-2777 Electrical Power Plant Siting: Department of Environmental Regulation Southwest Florida District 3301 Gun Club Road West Palm Beach, FL 33402 (305) 689-5800 Department of Community Affairs Division of Local Resource Management 2571 Executive Circle, East Tallahassee, FL 32301 1-(800) 342-9276 (904) 488-2356
Hazard Mitigation	State Disaster Preparedness Act of 1974 Chapt. 252, Florida Statutes; Chapters 9G-2, 5, 6, 7, 11, Florida Administrative Code.	Department of Community Affairs, Division of Public Safety, Planning and Assistance	To provide a means to assist in the prevention of disasters.	Local governments must provide adequate hazard protection through land development controls and planning.	Protection from hazards.	To assist local governments in reducing the impact on people and property from hazards.	Department of Community Affairs Division of Public Safety Planning and Assistance 2571 Executive Center Circle, East Tallahassee, FL 32301 1-(800) 342-9276 (904) 488-6001

STATE PROGRAMS AFFECTING BARRIER ISLAND MANAGEMENT

PROGRAM	MANAGEMENT AUTHORITY	ADMINISTERING AGENCY	PROGRAM OBJECTIVES	PROGRAM ELIGIBILITY REQUIREMENTS	MANAGEMENT ISSUE	VALUE FOR FUTURE MANAGEMENT	AGENCY CONTACT
ocal Government Comprehensive Planning	Local Government Comprehensive Planning Act of 1975, s.s. 163.3161-163.3211, Florida Statutes, Chapter 9B-5, Florida Administrative Code.	Department of Community Affairs	To utilize and strengthen the existing role, processes and powers of local governments so that they can encourage the most appropriate use of land, and water resources; consistent with the public interest, when adopting and implementing a comprehensive plan to guide and control future development.	Every county municipality and special district government in the State of Florida.	Orderly growth and development	To provide the framework to maintain the character and stability of an area through proper planning.	Department of Community Affairs Division of Local Resource and Management 2571 Executive Center Circle, East Tallahassee, FL 32301 1-(800) 342-9276 (904) 488-7956
ewage Treatment Construction Grants (The Construction Grants Program)	Florida Air and Water Pollution Control Act (Chapt. 403, Florida Stat). Chapter 17-15, FL Administrative Code	Department of Environmental Regulation Bureau of Wastewater Management and Grants.	To administer planning, design and construction activities of the Construction Grants Program for sewage treatment facilities.	Local governments which need financial assistance for sewage treatment plant construction.	Maintenance and improvement of water quality	To provide both financial and technical assistance in constructing sewage treatment facilities.	Department of Environmental Regulation Southeast Florida District Office 3301 Gun Club Road West Palm Beach, FL 33402 (305) 689-5800
State Highway Construction and Maintenance	Florida Transportation Code, Chapters 334 and 335, Florida Statutes Chapter 14-6, F.A.C.	Department of Transportation (DOT)	Construct, maintain and operate a balanced and efficient transportation system.	Any DOT designated state roads in the State highway system.	Meet current and future transportation needs.	To provide for the coordinating of transportation planning efforts.	Department of Transportation District Office 780 SW 24th Street Ft. Lauderdale, FL 33315 (305) 524-8621

LOCAL REGULATION AND MANAGEMENT

The two main areas of regulation and management at the County level are the recently adopted Martin County Comprehensive Plan, April 1, 1982 and the existing Martin County Code of Laws and Ordinances.

Each Article or Element of the Martin County Comprehensive Plan can be related to Hutchinson Island in various degrees. Some elements have broad policies which affect Hutchinson Island while others are specific to the barrier island. The Comprehensive Plan is perhaps the best management guideline for the entire County including Hutchinson Island.

The Articles or Elements of the Martin County Comprehensive Plan containing direct reference to the coastal zone management of Hutchinson Island are as follows;

Article VII "Parks, Recreation and Open Space Element"
- Section 7-1 Objectives
  - A (2) Places beach acquisition at top recreation priority
  - B (2) Maintenance and control of beach access
    (6) Preserve historical, archeological and cultural sites
    (7) Identify above resources
    (8) Encourage protection of above resources
- Section 7-3 Implementation
  - A (1) Create county wide parks and recreation department
    (3) Acquire additional ocenfront property

Article VIII "Conservation and Coastal Management Element"
- Section 8-1 Objectives
  - A Ocean/Beach objectives - preserve and enhance beach/dune system, nearshore reefs and inlets, native dune vegetation, combat beach erosion, regulate shoreline structures.
  - B Estuary System - Protect tidal marsh water quality and marine grass beds, preserve shoreline.
  - C Flood Plain Hurricane Flood Zone Objectives. Emergency preparedness plans.
  - D Land, Air & Water Quality Objectives - Conservation of natural characteristics, open space, protect and conserve ground-water recharge, wetlands, hammocks, etc.
  - E Fish, Wildlife & Vegetation Conservation. Promote population diversity and native species, protect unique and endangered species.
- Section 8-2 Implementation
  - A Ocean System Programs
    (1) Requirements for barrier island construction.

(2) Coastal construction control line.
(3) Combat beach erosion and stabilize dune system.
(4) Acquire undeveloped property on Hutchinson Island

B- Estuary System Programs
(1) Enforce shoreline protection
(2) Manage location of construction near shoreline.

C- Flood Plain & Hurricane Flood Zone Programs
(1) Flood damage prevention ordinance
(3) Maintain emergency preparedness in response to public safety regarding hurricanes and floods.
(4) Enforce land use controls on barrier islands to promote development harmonious to natural systems.

D- Land, Air & Water Quality Programs
(1) Enforce conservation of environmentally sensitive ecosystems, preserve natural habitats.
(2) Manage soil erosion and sedimentation.
(3) Water management to protect water quality.

E- Fish & Wildlife Preservation Programs.
(1) Review site plans for impacts.

Other articles of the Comprehensive Plan address issues which are more broadly related such as transportation or electric utility. Since the adoption of the Plan, implementation of the objectives outlined have begun. Perhaps the major reference or influence to the regulation and management of public lands on Hutchinson Island, would be the establishment of a County Parks and Recreation Department outlined in Article VII.

The Codes & Laws of Martin County as pertain to Hutchinson Island are summarized as follows:

Chapter 5 - Beaches, Parks and Recreation

Sec. 5-1 thru 5-6 General Authority of Board to operate and manage parks.

Sec. 5-7 Prohibits motor vehicle traffic on public beaches defined as all shore from vegetation line to waters of Atlantic.

Sec. 5-9 Rules and regulations for parks - now ordinance No. 156.

Paragraph A. Rules and Regulations for all County Parks (includes beaches and beach access strips)

1. Restricts vehicles to designated areas for both parking and traffic.
   Restricts use of fires to designated fixtures and prohibits use of fireworks and possession of firearms.
2. Defines limits of mobile vendors.
   (Note paragraph b is often violated at Jensen Beach, Bathtub access and other places)
3. F.S. 856.011

Paragraph G. Additional Rules and Regulations for all beach parks, access strips and causeways.

1. No glass containers
2. No alcoholic beverages consumed or possessed between 7 pm 6 am.
3. Campfires permitted outside designated fixtures, no chopping of trees. (Note, this seems conflicting especially since no camping areas or overnight parking is allowed. Recommend review of this permission/restriction to better reflect the intent of the law).
4. No dogs or other pets allowed in designated swimming areas of Jensen Beach and Stuart Beach. (Also Hobe Sound).

Article II - Leases of County owned land for civic and recreational purposes. Authority and Term limit (not to exceed 10 years).

Chapter 12 Environmental Control

Article I - III General control of pollution of water and air. Although not directly or specifically related to Hutchinson Island, the Board should monitor any specific actions that would pollute natural environments occurring on the Island and in particularly the public areas.

Article IV - Beach Erosion - Authority to prevent beach erosion and to acquire and construct roads, bridges, rights-of-way, and acquire, construct, repair, equip and remodel any county building or public facility in connection with and pursuant to beach erosion.

Chapter 14 - Flood Damage Prevention - to minimize public and private losses due to flood conditions. (Amended by Ordinance 175, June 1981)

Section 14-13 Definitions

(2) "Area of special flood hazard". Zones A1-A30 AH and VI-V30 on FIRM is covered by this definition.

(5) "Coastal high hazard area". Zones V 1 -V30. Includes of Hutchinson Island, Martin County.

Section 14-18 County Engineer designated Administrator of article provisions.

Section 14-20 General Standards - All apply to Hutchinson Island particularly in relation to tie-downs and pilings, materials, alteration of mangrove stands and water-course.

Section 14-20 Specific Standards

(1) Plans must show elevation of lowest floor of structure in relation to mean sea level.

(2) Coastal high hazard areas - requirements here apply to areas within 200 feet of coastal construction setback line or within V1-V30 zones.

(3) Floodways - areas of special flood hazard. To prevent debris, erosion etc due to high velocity floodwaters, no mobile homes.

Chapter 16 - Fish and Wildlife

Section 16-1 Protection of bald eagles.

Section 16-2 Protection of sea turtles and their eggs.

Section 16-3 Alligator protection

Article II - Fishing

Section 16-15 Use of spearfishing equipment. Restricted within 500 yards of any pier, wharf, dock, bridge or jetty in Martin County.

Section 16-19 Fishing on ocean beaches with more than two poles prohibited.

Section 16-25 Netting prohibited within one-mile diameter circle, the center located in middle of St. Lucie Inlet. (This affects portions of Sailfish Point shoreline).

Section 16-26 Netting prohibited within one-fourth mile of bridges, Jensen Beach, Causeway Bridge, Stuart Causeway Bridge. (This affects the shorelines north and south of these bridges on Hutchinson Island.

Chapter 23

Article VI - Specific Area Plan for Hutchinson Island.

Section 23-121 - Specific Area Plan includes the "Hutchinson Island Planning Study: The Impact and Management of Growth" by Peat, Marwick, Mitchell & Co. and the Supplementary provisions, Sec. 23-122. The "Hutchinson Island Planning Study" transmitted December 1973, presents an excellent base of sound planning goals, objectives and recommendations for Hutchinson Island and addresses important issues of traffic, utilities, zoning regulations, land use and development. Any Coastal Zone Management of Hutchinson Island in Martin County should include this and other similar studies or reports.

Section 23-122 Supplementary provisions. Defines the elements of Planned Unit Development (PUD) for Hutchinson Island.

(4) Defines standards for open space and construction setbacks. Four stories or forty feet height limitation, 25 feet west

of coastal construction setback line, 50 feet from mean high water and 65 feet from center line of road are a few.

(5) PUD Guidelines for the Island, density may not exceed 12 units per acre.

(6) "Buildable Acre" includes lands which are or will be brought to an elevation of six feet above mean sea level.

(8) Establishes total number of PUD units not to exceed 3,000. (It should be noted that at present land use, the number of units under PUD totals 2983. The number allowed may increase with unit transfer as outlined by Ordinance 188 adopted 1/12/82.)

Chapter 27 - Public Lands

Outlines the specific requirements for the sale and dedication of Public Lands.

Chapter 33 - Zoning

Section 33-63 - Waterfront

(b) No structures shall be permitted on ocean frontage that will in any way endanger the protective sand dune. No vegetation shall be removed or destroyed for 15 feet landward of the high point of the dune seaward without unanimous consent of the Board of County Commissioners and compliance with state statutes. No structures shall be permitted within 25 feet of the high point of the dune.

(c) No removal or displacement of any beach materials along the ocean-front or waterway without approval in writing from the county engineer and concurrence of the Board of County Commissioners. (These are perhaps the most specific parts, of the code which apply to the preservation of the Dune/Beach systems together with Sec. 33-72.)

Section 33- 72 Special requirements for Barrier Islands (Hutchinson Island)

(3) Density of residential development. Maximum density of 7.5 units per acre, except PUD. (This has been superceeded by the Comprehensive Plan, Future Land Use which indicates up to 15 units per acre for parts of Hutchinson Island.)

(4) Setback requirements (minimum). 25 feet westerly of coastal construction setback line 50 feet from mean high water, 65 feet from centerline of non-state road and 100 feet from centerline of state road. (These setback requirements may somewhat limit development on the narrow portions of Hutchinson Island between Indian River Plantation and Sailfish Point).

(5) Minimum elevations.

(a) Minimum living floor elevation; 15 feet above mean sea level at westerly setback from CCSL, declining 1 foot elevation

for each 20 feet westerly of setback to a distance of 140 feet, at all other points westerly, not less than 8 feet above mean sea level.

(b) No septic tank below 7 feet above mean sea level.

(c) Minimum road and driveway elevation not less than 6 feet above mean sea level.

(6) Dune protection

(a) No heavy equipment shall be used for land clearing or construction activities within 5 feet of the state coastal construction setback line.

(b) All dune crossings shall be by elevated boardwalks or ramps which meet the standards of Florida's Department of Natural Resources.

(7) Parking. Each residential dwelling unit requires two off-street parking spaces.

(8) Bulkhead - No bulkheads or similar structures shall be built with an elevation lower than 5 feet above mean sea level.

See also the following Ordinances

156	Park Rules and Regulations	3-24-81
188	Transfer of Development	1-12-82
175	Flood Damage Prevention	6-8- 81
192	Flood Damage Prevention	4-13-82

MARTIN COUNTY BEACH COMMITTEES

Committees can play an important role in the management and planning process. The broad purpose of the Beach Committees of Martin County is to focus on the special issues and problems of the County's public beaches, explore alternative solutions to the problems and make recommendations to the Board of County Commissioners. Members of the Committees are listed at the end of this section.

BEACH IMPROVEMENT COMMITTEE

Near the later part of spring 1981, Commissioner Alex Haynes recognized the need for improvements at the County's public beaches on Hutchinson Island. May 20, 1981 was the first meeting of the group to discuss such problems as the intersection at Jensen Causeway (707A) and AIA, the parking problems, lack of facilities, and potential funding. Several on-site surveys were made and meetings were held once every other week or more frequently if needed. A list of Proposed Beach Improvements and cost estimates was prepared by Mr. Bob Peterson, County Engineering and presented to the Committee July 2, 1981. Priorities were set on items which needed immediate attention and these were labeled as Phase I improvements with Phase II to be done under a possible DNR improvements grant.

In late September, the County was considering bids for the new entrance at Jensen Beach as the old intersection was getting worse. This would become a part of the Phase I improvements. October 13, 1981 the County Commission officially applied for a $100,000 grant under the Florida Recreation Development Assistance Program administered by the Department of Natural Resources. The

County set aside the $50,000 needed for matching funds to make the combined amount of $150,000 for the Phase II Beach improvements.

By the end of January 1982, work had started on the new entrance at Jensen Beach and many of the Phase I improvements were underway. The Committee continued to meet on a regular bases, twice a month, to keep up to date on Phase I and Phase II improvements and explore possible forms of revenue for improvements such as, special districts or parking fees. Trips were made to Boca Raton and other areas to observe similar beach park operations and facilities. Also a visit from Mr. Mike Murphy of the Hobe Sound National Wildlife Refuge gave the committee insite on facilities at the beach access located in the Refuge roughly three miles south of the St. Lucie Inlet on Jupiter Island.

On the meeting of April 15th, word of approval of the Phase II, DNR Grant was received. Official approval was received May 4th from DNR. Plans to implement Phase II improvements on Jensen Beach were being completed by Bob Peterson and the Engineering staff. Official agreement was received from DNR by June 24th which outlined procedures for review of construction plans. August 5th the Jensen Beach Phase II improvements were approved by DNR and the bid package was quickly assembled by Engineering and went out for bid by September 2nd. Phase II plans for Stuart Beach are now being drawn up.

Phase I improvements completed have included stucco of the older bathhouses at both Stuart and Jensen Beaches, new showers installed, and four new signs for the rules and information installed at the two beach parks, Stuart and Jensen. The major renovation of the entrance to Jensen Beach was completed by May 27th which made a substantial improvement of the traffic flow.

The Beach Improvements Committee is continuing to explore future need and funding for improvement and development of the public beaches and lands of

Hutchinson Island. An application for funding under the DNR Erosion Control Program for FY 83-84 and 84-85 was prepared by Mr. Peterson, Engineering and the County Commission on August 24th approved the matching of $80,000 total for the two future years. All of the efforts, both volunteer and official, show the strong commitment of Martin County toward improvement of a major asset, the public beaches.

BEACH ACQUISITION AND FINANCE COMMITTEE

The Beach Acquisition Committee began meeting on a regular basis from the middle of August 1981. The purpose of the Committee was to explore acquisition by the County of more beachfront property on Hutchinson Island for public use. The Beach Finance Committee was formed in early October 1981 to explore the alternatives for financing County acquisition of beachfront property. The two committees began to meet as one committee starting in January 1982 on a regular monthly or twice monthly basis. The purposes of both committees were then mutual.

A study team of the Acquisition Committee reviewed all available properties on Hutchinson Island for potential acquisition and presented the results to the Committee on September 11, 1981. The Acquisition Committee then forwarded it's recommendations to the Martin County Board of Commissioners where they were approved September 22, 1981. (See Appendix "Beach Acquisition Committee Recommendations"). Three basic areas of acquisition included additions north to Jensen Beach (1613 ft), Stuart Beach (1538 ft) and enlarging the Bathtub Beach area by additions north of the Sailfish Point access strip #8 (1088 ft) and south of the Chastain strip #6 (325 ft) to make larger contiguous areas for improving management, maintenance and operation.

In November action was taken by the Finance Committee to apply to the upcoming Save Our Coast (SOC) Program announced by Governor Graham. The

Acquisition and Finance Committees worked to prepare the Save Our Coast application which included 21 areas of 72 different properties with a total oceanfront footage of 14,633 feet on Hutchinson Island, Martin County. The application was submitted to the State DNR December 15,1981.

Since the Save Our Coast Program had to still go before Florida legislature, the Acquisition/Finance Committee continued to explore alternatives for funding acquisition. An important step was the development of a transfer of development rights (TDR) program for Hutchinson Island. This allows for a property owner to transfer the density from Island oceanfront to other parts of the Island in return for dedication of the oceanfront to Martin County. The Board of County Commissioners reviewed the recommendation and in December 1981 enacted an addition of Article VII, Chapter 23 of the Codes (Ordinance 188) to allow for this transfer option.

Other potentials for financing were considered and the following outline shows the variety of possibilities:

Direct Purchase
1. Surplus fund
2. Bond
3. Mortgage
4. State, Federal, Local sharing

Indirect Purchase
1. Lease/Purchase (under 2 yrs. no reforendum)
2. Repurchase from Trust for Public Lands 5- 10 years
3. Subscriptions

State
1. Save our Coast CARL Program
2. Impact Fee
3. Stamp Tax 2% RE Transfer tax
4. Parking fees.

Transfer Development Rights
1. Onsite
2. Offsite - unit transfer
3. Direct Trades - Beach front to river

Donation
1. Tax Incentive
2. Fund Raising

At the Committee meeting of March 18, 1982 it was passed unanimously to approve ad valorem bonds of five million dollars for purchase of beaches to be put on the ballot for vote as a bond referendum. This was a positive step toward a locally sponsored acquisition program. The Committee began to work on the requirements of a Bond referendum and the many details involved. The Beach Acquisition/ Finance Committee began to meet every week in order to prepare for the referendum. A public hearing was held April 21, 1982 and the public expressed concerns about the bond program. The date was set for Tuesday, June 29, 1982 to hold the County wide special election for the Beach Bond Acquisition Referendum. There were several debates, articles and discussions during the period before the election. The vote on June 29th resulted in a roughly two to one margin in favor of the Beach Acquisition Bonds.

The Committee worked to coordinate all the processes involved with the implementation of the five million dollar bond acquisition program. Careful coordination with the State Save Our Coast Program was achieved through several meetings and discussions with DNR. The Cabinet meeting of August 3, 1982 resulted in the approval of Martin County's SOC proposal in catagory "A" which gives DNR the go ahead for appraisals, surveys and title searches on the Martin County parcels. The State DNR had reduced the originally proposed 21 parcels on Hutchinson Island to 6 which include SOC # 3, 5, 6, 9, 11 and 21, roughly 9572 feet of ocean frontage. (See Table 24). On July 27th the County Commission approved the proposed acquisition and ranking priority for eight acquisition parcels, see Table 26. The listing is the resultant of the Beach Acquisition/Finance Committee's recommendations and the Save Our Coast Program.

Table 24. Save Our Coast Program Proposal - Summary

Priorities 9/81	Ocean Front Ft.	Acres	Just Values (Tax Rolls '81)	# of Properties in Parcel
1.	110	0.7	$ 95,000	1
2.	225	1.4	182,200	1
IC — X (3)	1613	14.8	922,800	3
(4)	1088	8.0	1,087,987	4
X (5)	1500	11.8	1,593,850	5
X (6)	2588	18.7	3,070,212	14
7.	263	2.1	305,338	1
8.	112	0.8	120,000	1
(9)	1245	11.2	1,174,880	4
10.	300	2.8	357,700	1
IB — (11)	1538	14.8	2,082,200	6 — not purchased
12.	188	2.0	210,700	1
(13)	1500	4.8	1,054,100	5
14.	200	1.1	317,359	4
15.	325	1.6	450,462	2
16.	75	0.2	111,332	1
17.	100	0.5	259,958	1
18.	150	0.8	236,407	2
19.	100	0.7	90,787	1
20.	325	2.2	355,500	2
IA — (21)	1088	8.8	1,355,065	12 ← bought to.
	14,633		$15,433,837	

○ — Indicates Save Our Coast State selections - April 1982

Table 25. SOC Proposed Acquisition Ranking of Priority Areas
7/27/82

Ranking	S.O.C. Application Parcel Numbers	PROPOSED PARCELS
1	#21	Bathtub(Tracts #64 thru 82) 950 lin. ft. beachfront
2	#3	Jensen Beach North (Tract #12) 1100 lin. ft. (Partial)
3	#11	Stuart Beach North 1538 lin. ft. beachfront
4	#20	Chastain South Bathtub (Tract#53 thru 63) 460 lin. ft.
5	#3	Remainder Jensen Beach North 480 lin. ft.
6	#5 & #6	Park and Fish North and South 4088 lin.ft.
7	#4	Holiday Inn South 1088 lin ft.
8	#9	Century, et al. , 1245 lin. ft.

In summary, the work of both Beach Improvements and Beach Acquisition/ Finance Committees continues. The coordination efforts provided by the Acquisition/ Finance Committee resulted in the sequence of events which will undoubtably lead to State participation through the Save Our Coast Program. The Beach Improvements Committee continues to coordinate the efforts toward State assistance on beach improvements through grant applications and implementation. The work of these Committees has provided the County with the necessary assistance which would have been otherwise difficult under the existing County staff conditions.

Technical assistance and support to the Beach Committees has been provided by this CZM Study. This support includes research of property information on Hutchinson Island from County records, obtaining and assembling maps showing proposed acquisition, surveys of existing conditions and preliminary site planning and management considerations for existing and proposed public lands on Hutchinson Island.

MARTIN COUNTY BEACH COMMITTEES - COMMITTEE MEMBERS

BEACH IMPROVEMENTS COMMITTEE

Commissioner Alex L. Haynes (Chairman)
Allan S. Connel
Hugh Furman
John Heyburn
Walter Stokes, M. D.
Mark Perry
Bob Peterson
Wayne Blythe
Felix Williams
Richard Noyes

BEACH ACQUISITION COMMITTEE

Commissioner Alex L. Haynes (Chairman)
H. Van Dyke
Tom Kenny
Walter Stokes, M.D.
Mark Perry
Diane Salz
Robert Hemberger
Ken Ferrari

BEACH FINANCE COMMITTEE

Dagney Jochem (Chairman)
Commissioner Alex L. Haynes
John Fix
Dennis Hudson, III
Doug Sands
Tom Kenny
Mary Dawson

LONG RANGE PLANNING AND MANAGEMENT

Long range plans for the public areas on Hutchinson Island in Martin County just began during the period of this study and should continue after this date. Several factors have influenced planning and management of the public areas:

1. The County received a beach park improvements grant from Florida Department of Natural Resources for major improvements to Jensen and Stuart Beaches.
2. The County has passed a five million dollar bond for the acquisition of beachfront property on Hutchinson Island.
3. The County has application to the State under the Save Our Coast Program for major land acquisitions on Hutchinson Island and will be required to develop and manage these lands.
4. The County has committed to participate in the DNR Beach Erosion Control Program for FY84 and FY 85.

These and similar positive measures by the County toward expanding their interest in public beachfront areas on Hutchinson Island, almost demands long range planning.

Although the County's financial resources may only allow small amounts of acquisition or development, it is essential to have the long range plans for areas so that as the phases are completed, the end result is comprehensive and manageable. Long range planning is a necessary initial process and should continue through the implementation with a review and elevation of the plans. This allows for the changing needs of the population and the changes of a dynamic natural environment such as Hutchinson Island.

As of the end of this study, site plans for Stuart Beach, Jensen Beach and the proposed acquisition of the Bathtub Beach area had been completed by Planning

Division on scales of 1"=100', 1"=50' and 1"=30'. Engineering has completed the improvements drawings for Jensen Beach and is working on Stuart Beach according to the DNR improvements grant. Planning Division has also been gathering standards on beach park facilities and other information from State and various other sources. The Division of Marine Safety has been recording the Bathing Area Useage for Jensen, Stuart and Hobe Sound Beaches and is presented in Table 26 . This information can be used with the technical standards to determine how many parking spaces are needed, bathroom facilities, dune overwalks, etc.

The existing facilities or approved planned improvement being done by Engineering can be used as a starting point for long range plans. Any statistics gathered on useage, parking, traffic, etc. will also aid in future plans and should be continued.

Management of the existing and future public areas on Hutchinson Island will be of increasing concern as the acquisition of more areas takes place. Consideration of a Parks and Recreation Department will play a key roll in the management of these areas. Responsibilities among the existing and future organization of the County will need to be defined to determine efficient management. Financial considerations will also have to be determined as there will be considerable increase for long range management.

Rich Noise 407 225-2290.

Table 26. BATHING AREA USAGE

estimates based on lifeguard estimates.

	Monthly Totals (Daily Av.) (Days Reported)		
1981	Jensen	Stuart	Hobe Sound
December	17,965 (580) (31)	9,825 (317) (31)	4,148 (134) (31)
1982			
January	23,520 (759) (31)		4,010 (251) (16)
February	28,800 (1029) (28)		15,010 (715) (21)
March	36,460 (1176) (31)	17,482 (874) (20)	9,995 (400) (25)
April	36,660 (1410) (26)	36,750 (1670) (22)	8,455 (352) (24)
May	29,950 (998) (30)	23,675 (1029) (23)	8,800 (383) (23)
June	49,250 (1642) (30)	13,305 (1331) (10)	12,530 (1044) (22)
July	53,525 (1784) (30)	26,050 (1240) (21)	10,275 (604) (17)
August	41,850 (1350) (31)	35,700 (1373) (26)	9,154 (436) (21)

Source: Martin County Dept. of Public Safety
Division of Marine Safety

PART VI

CONCLUSIONS AND RECOMMENDATIONS

PART VI. CONCLUSIONS AND RECOMMENDATIONS

Hutchinson Island is by far one of the most unique areas of Martin County. The County has taken steps in recent years toward comprehensive planning for all of Martin County including Hutchinson Island. The Martin County Comprehensive Plan forms the guidelines for future development and land use.

The recent efforts by Martin County toward acquisition of lands on Hutchinson Island for public use seems to be proceeding well, and will increase the publicly owned areas on the island dramatically. Once the acquisition is completed, it will be the responsibility of the County to plan, develop and manage these areas for public use. The development of these areas will require assurances for maintaining and enhancing the natural ecological systems and still provide for adequate recreational use by the public.

Some issues which face the future management of Hutchinson Island include: providing adequate water and sewage facilities, traffic, public safety services such as police and lifeguard protection, consideration of user fees and fiscal responsibility to provide services.

In this research effort available information and resource data have been coordinated and assembled to provide a baseline for the planning and management processes involved with Hutchinson Island. The County should make efforts to be in communication with the various agencies both on major issues and during these planning processes. Long range plans for public areas were

started during the period of this study. It would be in the interest of the County to continue these efforts through the Planning Division and Engineering Division and through the Public Safety Department. For continued management however, it would be in the best interest of the County to implement the planned Parks and Recreation Department who would take up, organize and coordinate these efforts.

The Bathtub Reef is a well known unique resource. During the period of this study it has been nominated for a National Marine Sanctuary. In discussions with Florida's Parks and Recreation Department, it was indicated that the Bathtub Reef may not make the National Program designation this year. Proper management of the reef must be achieved, however, especially in light of the potential acquisition of additional public beach areas increasing the use of the Bathtub Reef. This may be achieved with assistance from the State, and the County should continue to coordinate with the Florida Department of Natural Resources concerning the reef.

The following is a summary of major conclusions derived from this Study, each of which has a recommendation to be considered by Martin County in relation to improving coastal zone management on Hutchinson Island;

1. A substantial dune system offers the best protection for absorbing the shock of storms and high tides on Hutchinson Island.

   Martin County should continue efforts to protect the beach/dune system through the review of Codes and Laws, review of site plans and particularly continuing review of the Coastal Construction Setback line. The County should encourage re-vegetation of dune areas and prohibit dune transgress while providing dune overwalk structures for beach access.

2. Hardening of the shoreline by coastal protective structures produces undesirable effects on the natural beach/dune system.

   Review of all site plans for any shore stabilization structures should be done by the County. Any structural methods to prevent coastal erosion should be discouraged as impacts on the beach/dune system as a whole should be considered.

3. There are four exemplary areas of vegetation on Hutchinson Island, relatively undisturbed, showing natural succession on a barrier island. (See Part III, Plant Communities and Wetlands)

   These sites should be considered whenever possible by Martin County as nature areas for teaching and places where people can view the natural succession of Hutchinson Island, a barrier island.

4. Land use inventory indicates a need for increasing public areas on Hutchinson Island.

   The recent efforts of Martin County toward beach acquisition should be carried out and planning for development and management of the existing and proposed public areas should follow.

5. There are five sites of archeological and historical significance as indicated by the land use inventory, 1982. Many more sites probably exist but are not of record with Florida Department of State, Division of Archives, History and Records Management.

   The existing prehistoric and historic sites should be preserved and maintained as significant features of Hutchinson Island. Martin County should review the site plans for any proposed development to determine if any prehistoric or historic sites exist on the lands to be developed. The County should encourage the preservation of any new sites found and communicate their location to the Florida Department of State, Division of Archives, History and Records Management.

6. The Bathtub Reef is a unique and valuable resource of Hutchinson Island in Martin County.

   The reef should be managed to prevent any destructive impacts by direct or indirect influences. Coordination with National Marine Sanctuary and State of Florida guidelines and participation should be pursued. Local development and management guidelines should be developed to encourage recreational, educational and research activities for this unique resource. Detailed studies of the impacts on the reef system should be undertaken.

7. There are many Federal and State programs affecting Hutchinson Island and major issues of coastal management transcend the boundary of Martin and St. Lucie Counties.

   Review of federal and state programs should be continued to determine specific relationships between the County and these programs. Efforts should be made to address the issues of regional concern between Martin and St. Lucie Counties with intervention by the State if necessary. Disaster Preparedness and Evacuation plans should be addressed as major issues of Hutchinson Island, along with general traffic issues related to Stuart and Jensen causeways.

8. The Martin County Comprehensive Plan provides good management guidelines for Hutchinson Island and there are many Codes, Laws and Ordinances which affect local regualation and management of the study area.

   A review of the existing Codes and Laws should be made in comparison to the Comprehensive Plan and efforts should be made to implement the guidelines set forth in the Comprehensive Plan into the Codes and Laws of Martin County. A countywide Parks and Recreation Department should be implemented to provide organized planning and management of the public areas on Hutchinson Island.

9. Beach Committees have had a significant role in the organization and effort of planning and management on Hutchinson Island.

   The Beach Commitees' efforts should continue but often issues overlap different committees. To concentrate these efforts, one Beach Advisory Committee could be formed to address issues of acquisition, finance, planning, development and management of the county's public beach areas on Hutchinson Island.

10. Long range planning is important to the comprehensive development and efficient management of the public areas on Hutchinson Island, both existing and proposed.

    Continue to organize and develop planning standards and criteria for developing and managing public areas on Hutchinson Island. Coordination should be maintained between Planning Division, Engineering Division, Public Safety Department, Parks and Recreation Division and other existing sections as well as any Beach Advisory Committee (s) on long range plans. A new Parks and Recreation Department should be implemented to provide a focal point and organizational structure for these efforts.

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Plate 3

Shoreline & 6-18-30 Offshore Depth Changes
December 1965

Shoreline & 12-24 Offshore Depth Changes

High-Water Shoreline Changes
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AVAILABLE AERIAL PHOTOGRAPHY FOR
HUTCHINSON ISLAND, MARTIN COUNTY, FLORIDA

DATE	SCALE	DESIGNATION	SOURCE
1/8/58		EEP-IV- 52-56 & 91-96	COE
8/21/59	1"=1667'	C&GS Flight #4	DOT
1/31/66	1"=2000'	PD-373 Flight 7,8,9 & 10	DOT
11/11/69	1"=2000'	PD-690 Flight 13 (partial)	DOT
5/9/74		PR-306 to 320	COE
8/31/76	1"=200'	PD-1933 Flight 15,16,17	DOT
9/5/79	1"=333' & 1"=450'	PD-2533 (partial post hurricane)	DOT
4/16/80	1"=400'	PD-2638 Flight 14,15,16	DOT
1980	1"=2000'	Quad Sheet Name	COE
11/15/81	1"=2000'	RB-1137 to 1139 & 6812 to 6815	COE
3/6/82	1"-500'	PD-2862-2 1 to 45	DOT

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1. Florida Department of Transportation (DOT) (904) 488-2250
   Haydon Burnes Bldg. 605 Suwannee St. Tallahassee, Florida 32301
2. Florida Department of Natural Resources (DNR) (904) 488-3180
   3900 Commonwealth Blvd. Tallahassee, Florida 32303
3. U.S. Army Corps of Engineers (COE) (904) 791-2273
   P.O. Box 4970 Jacksonville, Florida 32202
4. U.S. Coast & Geodetic Survey (C &GS)
   325 John Knox Rd. Tallahassee, Florida 32301

Other Sources:

1. Enoch A. Knight, Contracting Officer Aerial Photography Field Office
   U.S. Dept. of Agriculture P.O. Box 30010 Salt Lake City, Utah 84125
   (801) 524-4262
2. Fairchild National Services, Inc. (800) 528-7250
   14437 N. 73rd Street Scottsdale, Arizona 85260
3. Bob Brown, Remote Sensing Bureau
   South Florida Water Management District (SFWMD) (305) 686-8800
   3301 Gun Club Road West Palm Beach, Florida 33402
4. Martin County Soil and Water Conservation District - Martin County
   Administrative Center, Stuart, FL, 287-3313

   1:20,000 and 1:40,000
   For all Martin County
   1952, 1958, 1970, 1972

APPENDICES

APPENDIX A

STORM DATA

The study area is in a zone subjected to tropical storms of hurricane intensity. The study area is also subjected to relatively frequent coastal storms from the northeast (extra-tropical). Specific hurricanes and northeast storms that affected the beaches of Martin County are listed in this appendix, as well as the Saffir/Simpson Hurricane Scale. More information can be obtained from the recently study by the Teasure Coast Regional Planning Council.

The problem along the study area is one of erosion and lowering of the beach profile, and recession of the shoreline and dunes. Hurricanes and severe northeast storms have caused considerable erosion and damage. Along parts of the shore within the study area erosion of the beach and dune has placed seawalls, buildings, and other structures in a position vulnerable to severe damage during storms.

HURRICANES

August 23, 1885
October 10-13, 1904
July-August 1926
September 6-22, 1926
September 6-22, 1928
August 31-September 7, 1933
August 24-29, 1944
August 23-31, 1949
October 15-19, 1950
October 16-30, 1963
August 17-29, 1964
October 7-14, 1964
August 27- September 10, 1965
September 4, 1979

NORTHEAST STORMS

November 1956
December 1957
March 1962
November-December 1962
December 1963
January 1964
Fall 1976
Fall 1979
Fall 1981

HURRICANES

The study area has experienced, within a 150-mile radius, 52 storms of hurricane intensity between 1830 and 1965, inclusive, or an average of one hurricane every 2.6 years. However, only 15 hurricanes passed within 50-mile radius in that period, or a average of one hurricane in nine years. The effect of hurricanes on the beaches of Martin and North Palm Beach Counties has not been as severe as that of many northeast storms. The short duration of hurricane-force winds and waves in the area has usually limited the severity of erosion damage. The approximate paths of hurricanes of record that have

passed through or near the study area are shown in Figure 8 of the main report. Specific hurricanes and their effects on the shores of Jupiter Island and adjacent Martin County shores, to the extent of available data, are discussed in the following paragraphs.

August 23, 1885 The hurricane approached from the southeast and skirted the Atlantic coast of Florida. It passed about 15 miles east of Jupiter Island with full hurricane force. Winds of 40 miles per hour were recorded in Jacksonville as the storm passed 40 miles to the east. Details on storm damage at Jupiter Island and the remainder of Martin County are not available.

October 10-13, 1904 This storm approached Florida from the southeast and passed over Jupiter Island. Its intensity decreased rapidly to less than hurricane force after moving inland. Peak winds of 88 miles per hour were reported at Jupiter Island on October 17 in the second phase of the storm. The extent of storm damages is unrecorded.

July-August 1926 Moving in a northerly direction and parallel to the Atlantic coastline, the hurricane passed by a short distance offshore. The storm caused an estimated $3 million property damages to the east coast of Florida.

September 6-22, 1926 This hurricane was one of the most severe of the present century. A minimum barometric pressure of 27.61 inches, recorded at the Miami Weather Bureau Station, was at that time the lowest corrected reading ever recorded by a regular Weather Bureau Station. A maximum 2 minuite wind velocity of 132 miles an hour was recorded. Over 350 persons lost their lives, according to Red Cross reports. Tidal flooding extended northward to Fort Pierce. Damages caused by the storm in south Florida were evaluated to be from $50 to $165 million.

September 60-20, 1928 This storm is also considered one of the most violent of the present century to strike Florida. The minimum barometric pressure at West Palm Beach was 27.43 inches, one of the lowest of record in the United States at that time. The storm entered Florida at West Palm Beach, causing $11.5 million damage in the Palm Beach-Lake Worth area. West Palm Beach recorded a wind velocity from the northeast of over 100 miles per hour. Moderately heavy damages were reported by areas north of West Palm Beach. Beach highways from Jupiter to Delray Beach were undermined by tide and wave action. High tides were reported along the entire east coast. At Jupiter Island, strongest winds were from the northeast and east. Waves from that storm caused considerable erosion on Jupiter Island, the principal areas affected being in the vicinity of Blowing Rocks. A short distance south of Blowing Rocks, the bluff was cut back to the edge of the road. Beginning just north of Blowing Rocks, erosion occurred over

approximately 1 mile, the greatest shore recession being about 170 feet.

August 31-September 7, 1933 A small severe storm that moved northwesterly from the Virgin Islands and entered the Florida coast at Jupiter Inlet occured at this time. The minimum barometric pressure recorded at Jupiter Inlet was 27.98 inches. A wind velocity of 110 miles an hour was recorded at Jupiter Inlet. Storm damages were moderately severe, with the largest percentage of the damages occurring between Jupiter Island and Fort Pierce. Bridges, docks and numerous seawalls were damaged.

August 24-29, 1944 Passing inland over the West Palm Beach-Delray Beach area, this hurricane caused total losses in the State of $45 million, including $20 million crop damage and $18 million property damage. The strongest winds and heaviest wind damage were in the vicinity of Stuart and Jupiter. Jupiter had wind gusts of 153 miles per hour. A total of 265 dwellings were destroyed and 24,000 others reported damaged. Stuart, immediately west of the study area, suffered severe damage, the worst in the history of the area, with over 500 persons homeless. A high-water mark of 8.5 feet was observed in the St. Lucie River on the railraod bridge near Stuart. Sections of waterfront streets were swept by high seas and were badly eroded.

August 23-31, 1949 "The Great Hurricane of 49" has been described as one of the worst hurricanes to strike this coast. Damage was extensive with Martin County receiving the most. Two persons died and 133 were injured. The storm formed in the northern Leeward Islands, moved northwest and came ashore near Jupiter where winds were recorded to 153 mph before instrumentation failed. The old Jensen Beach Bridge was destroyed and tides in the North Fork of the St. Lucie River rose to 12.5 feet.

October 15-19, 1950 This was a small but violent storm. Wind gusts of 122 to 150 miles an hour were reported at Miami. Storm damages were severe along the lower east coast of Florida.

October 16-30, 1963 Hurricane Ginny was an unusual storm. It developed from an extratropical depression in the Bahamas; intensification of hurricane force occurred on the 20th when it was centered near Cape Hatteras. The center was then slowly forced southward parallel to the coast, less than 100 miles off-shore, by a high pressure area until it reached the latitude of Daytona Beach. The high pressure area then weakened and the hurricane center reversed its path. Ginny was a minor hurricane and its damaging effects were moderate. Winds along the northeast Florida coast ranged from 35 to 45 miles an hour. Tides at Daytona Beach were reported 2 to 3 feet above normal. Beach erosion

was reported in some places, but was of a minor nature in Florida. Total damages in Florida were estimated at $50,000.

August 17-29, 1964 Hurricane Cleo was the first full hurricane to strike directly into the metropolitan complex of southeastern Florida since the storm of October 17, 1950. It first reached hurricane force about 1,000 miles east of the Lesser Antilles on August 21. After crossing Cuba, the storm followed a track which brought the center over Miami at 2 A.M. on August 27. The storm center then followed a path some 10 to 20 miles inland, closely parallelling the coast until it passed over the ocean near Jacksonville Beach on the 28th. Maximum winds along the lower east coast were estimated at 100 to 110 miles per hour with gusts to 135. The storm center was small (10 to 16 miles in diameter) and damage was restricted to a strip 20 to 35 miles wide between Miami and Melbourne. Peak tides along the lower east coast were 5 feet above normal; some minor beach erosion was reported there. Highest tides elsewhere along the coast were equivalent to spring tides. Overall direct and indirect damages in Florida have been estimated at $125 million. Losses were caused primarily by the wind and include minor structural damages, crop damage, uprooted trees, disrupted communication, and power failures.

October 7-14, 1964 Developing from a tropical depression in the western Carribbean on October 7-Hurricane Isabell reached hurricane intensity as it neared western Cuba on the 13th. From there it took a northwesterly course, reaching the lower coast of Florida at Everglades at 4 P.M. on the 14th. It then pursued a rapid northeastward course across the State, making its exit from Florida near Jupiter. Property damage in the State was estimated at about $5 million. A sizable portion of this was caused by tornadoes. Two persons were killed and 50 people injured. Highest winds reached in Florida were nearly 90 miles per hour along the coasts. Isabell was a small storm and damage was limited to a narrow strip across the State. Vegetable crops in the Everglades were damaged by winds and rain. Tidal damages were of a minor nature, being generally limited to smaller piers and boats.

August 27-September 10, 1965 Hurricane Betsy was an unusual storm. It developed from a tropical depression in the southwest Atlantic Ocean. Intensification to hurricane force occured on the 29th when it was centered about 200 miles northeast of Puerto Rico, after which it followed an erractic track for the next 2 days. On September 1, a more definite west-northwestward movement began. Development of a high pressure area off the Carolina coast affected Betsy's movement at that time, forcing the storm toward the southwest. The hurricane center moved slowly southward through the northern Bahamas for the next 2 days. On September 8 the

center, 40 miles in diameter, passed over extreme south Florida. The storm center then followed a path west to northwest through the Gulf of Mexico, crossed inland just west of New Orleans, and passed northward through Louisiana and into eastern Arkansas. The greatest damages in Florida occurred in the southern end of the State, where about 15,000 acres of agricultureal lands and sections of Miami were inundated by rising tides in Biscayne Bay. The President of the United States declared 10 south Florida counties a disaster area because of the extent of damages resulting from the hurricane. Estimated damages in the State of Florida as a result of the hurricane were about $140 million damages to public facilities, and $7.5 million damages to the agricultural industry. Waves, currents, and tides accompanying this hurricane caused a major loss of fill along the beaches of the lower east coast of Florida where beaches had been wide and stable for many years. There was an appreciable loss of sand from the beaches throughout Martin County. The recreational beaches at Stuart and Jensen Beach were essentially completely eroded. Vertical seawalls were flanked and other development features were undermined and threatened.

September 4, 1979 The eye of Hurricane David passed over Hutchinson Island on Labor Day, causing cancellation of the planned St. Lucie Inlet Festival. This storm was very strong and caused considerable damages to the Carribean Islands, but had weakened to a Category 1 hurricane with highest wind speeds of 90 m.p.h. before striking the Martin County Coast. Damages were most severe along Hutchinson Island, with downed trees and power lines making highway A1A impassable. No real storm surge accompaned the hurricane, so that erosion at the beaches was minimal.

NORTHEAST STORMS

These seemingly periodic storms attack the Florida east coast during the fall and winter months. It is reported that northeasters cause more erosion to the beaches in 2 or 3 months than is caused by winds and swells from other directions during the rest of the year. If the northeasters occur when the moon is in perigee, they are accompanied by abnormally high tides. The combination of large waves from the northeast and high tides for several days appear to cause more sand movement than the average hurricane, probably due to the short duration of hurricanes. Detailed information on damages caused by northeast storms is generally scarce. However, loss of valuable land and recreational areas, damage to protective structures and development, and damage to shorefront highways and streets are reported annually. Specific recent northeasters and their effects on the study area, to the extent of available information, are presented in the following paragraphs.

November 1956 The damage during the November 2-5, 1956 northeast storm was caused chiefly by wave action on top of high tides generated by winds from a storm center which later developed into Hurricane Greta. The winds blew generally from the northeast at sustained velocities of 20 to 30 miles an hour for 4 days. The winds generated tides as much as 4 feet above normal, with fairly heavy seas. Heavy erosion on the beach ridge and lowering of the beach profile was observed along Jupiter Island. Erosion was particularly evident along the southerly 2 miles of the island. At Jensen Beach it was reported that the beach road leading south was damaged at several points by erosion into the edge of the roadway and that the recreational beach was essentially lost.

December 1957 That storm caused severe and lasting erosion in Palm Beach and Martin Counties. The outer end of the steel-sheet-pile jetty on the north side of Jupiter Inlet was badly deformed and bent out of line. The shore to the south of Jupiter Inlet experienced severe recession.

March 1962 The storm, a vast low pressure system centered off the middle Atlantic coast, battered installations along the coast from Florida to New England between March 5 and 9. Huge swells, building up to about 20 feet near the shore on top of abnormally high tides, caused considerable flooding and erosion. The narrow sand barrier near the north end of Jupiter Island was breached, opening an inlet from the Atlantic Ocean into Peck Lake. Peck Lake, located about 3.5 miles south of St. Lucie Inlet, is a shallow sound about 1 mile long and 1/3 mile wide, which is traversed by the Intracoastal Waterway. Before the breakthrough, the beach barrier was about 400 feet wide from the ocean to Peck Lake. The initial breach was about 350 feet wide and 5 feet deep. The inlet widened to about 700 feet and reopened to about 12 feet in 1 year. Peck Lake Inlet was closed by the Corps of Engineers to protect traffic on the Intracoastal Waterway. Closure was by a dredged barrier beach and was completed in August 1963.

November-December 1962 A severe coastal storm with winds 60 to 70 miles an hour within 100 miles of the center remained within 300 to 500 miles of the beaches in the study area for several days. Sustained northeast winds over a stretch of several hundred miles generated large waves that pounded the shore for several days. Although erosion was extensive in Martin County, it was not as severe as in north Florida. On Jupiter Island the steep beach ridge in areas unprotected by seawalls was severely eroded. The beach in fromt of the vertical seawalls was eroded and lowered considerably. It was reported that wave action and the loss of sand endangered the stability of about 2,000 feet of seawall and caused the failure of several hundred feet of wall.

December 1963 That storm caused severe and lasting erosion at Hutchinson and

and Jupiter Islands. Heavy erosion of the beach ridge and lowering of the beach profile was observed along the two islands. Erosion was particularly evident at Jensen Beach because the beach dropped about 5 feet in elevation, endangering a public pavilion and other development features. The storm was accompaned by unusually high tides and large waves.

January 1964 That northeast storm caused severe erosion and destroyed the sea-wall and a section of the parking area at the public beach of Jensen Beach. Erosion was particularly evident just south of the Jensen Beach pavilion. Huge swells, building up to about 15 feet near the shore, on top of high tides, caused considerable flooding and erosion throughout the Martin County ocean frontage. The beach dropped about 3 feet in elevation and many of the oceanfront structures were damaged during this northeaster.

Other Recent Northeast Storms Many northeast storms of lesser intensity and causing less severe and widespread damage than those described above have affected the study area shores in the last few years. In the fall of 1976, 1979, and 1981 in particular, the study area beaches were exposed to northeasters that caused considerable erosion as in 1963. Recurrent northeast storms accompanied by large waves and high water levels affected the study area one after another, so that the beaches and dunes had not recovered from the previous storm. Many structures have been threatened, promoting the construction of protective coastal structures. Nearly every winter, in addition to seasonable winds and waves from the north-northeast, periods of intense storm wave activity occur, causing considerable erosion and damage.

Summary

Much damage has been done periodically to the beaches in the study area by tropical and extratropical storms. Since only portions of the shore are highly developed in this area, and some development has been relatively recent, losses have not always been readily apparent and at times were unrecorded. Period of record storms have frequently caused several million dollar's damage to highly developed beaches nearby. Considerable damage from these storms can generally be expected to have extended to the shores of the study area. The impact of rising sea level and increasing barrier island development is to increase the future damage potential of naturally occurring storms.

THE SAFFIR/SIMPSON HURRICANE SCALE

The Saffir/Simpson Hurricane Scale is used by the National Weather Service to give public safety officials a continuing assessment of the potential for wind and storm surge damage from a hurricane in progress. Scale numbers are made available to public-safety officials when a hurricane is within 72 hours of landfall. Scale assessments are revised regularly as new observations are made, and public-safety organizations are kept informed of new estimates of the hurricane's disaster potential.

Scale numbers range from 1 to 5. Scale No. 1 begins with hurricanes in which the maximum sustained winds are at least 74 miles per hour, while Scale No. 5 applies to those in which the maximum sustained winds are 155 miles per hour or more.

The scale was developed by Herbert Saffir, Dade County, Florida, consulting engineer, and Dr. Robert H. Simpson, former National Hurricane Center director, and projects scale assessment categories as follows:

Category No. 1 Winds of 74 to 95 miles per hour. Damage primarily to shrubbery, trees, foliage, and unanchored mobile homes. No real damage to other structures. Some damage to poorly-constructed signs. Low-lying coastal roads inundated, minor pier damage, some small craft in exposed anchorage torn from moorings.

Category No. 2 - Winds of 96 to 110 miles per hour. Considerable damage to shrubbery and tree foliage; some trees blown down. Major damage to exposed mobile homes. Extensive damage to poorly constructed signs. Some damage to roofing materials of buildings; some window and door damage. No major damage to Buildings. Coastal raods and low-lying escape routes inland cut by rising water two to four hours before arrival of hurricane center. Considerable damage to piers. Marinas flooded. Small craft in unprotected anchorages torn from moorings.

Category No. 3 - Winds of 111 to 130 miles per hour. Foliage torn from trees; large trees blown down. Practically all poorly constructed signs blown down. Some damage to roofing materials of buildings; some window and door damage. Some structural damage to small buildings. Mobile homes destroyed; serious flooding at coast and many smaller structures near coast destroyed; large structures near coast damaged by battering waves and floating debris. Low-lying escape routes inland cut by rising water three to five hours before hurricane center arrives.

Category No. 4 - Winds of 131 to 155 miles per hour. Shrubs and trees blown down; all signs down. Extensive damage to roofing materials, windows and doors. Complete failure of roofs on many small residences. Complete destruct ion of mobile homes. Major damage to lower floors of structures near shore due to flooding and battering by waves and floating debris. Low-lying escape routes inland cut by rising water three to five hours before hurricane center arrives. Major erosion of beaches.

Category No. 5 - Winds greater than 155 miles per hour. Shrubs and trees blown down; considerable damage to roofs of buildings; all signs down. Very severe and extensive damage to windows and doors. Complete failure of roofs on many residences and industrial buildings. Extensive shattering of glass in windows and doors. Some complete building failures. Small buildings overturned or blown away. Complete destruction of mobile homes. Major damage to lower floors of all structures less than 15 feet above sea level within 500 yards of shore. Low-lying escape routes inland cut by rising water three to five hours before hurricane center arrives.

Dr. Neil Frank, present National Hurricane Center Driector, has adapted atmospheric pressure ranges to the Saffir/Simpson Scale. These pressure ranges, along with a numerical break-down of wind and average storm surge ranges, are listed below:

SCALE NUMBER	CENTRAL PRESSURE		WINDS (MPH)	SURGE (FT.)	DAMAGE
	MILLIBARS	INCHES			
1	980	28.94	74-95	4-5	Minimal
2	965-979	28.5-28.91	96-110	6-8	Moderate
3	945-964	27.91-28.47	111-130	9-12	Extensive
4	920-944	27.17-27.88	131-155	13-18	Extreme
5	920	27.17	155+	18+	Catastrophic

APPENDIX B

BEACH PROFILE LINE DATA

Data Source: Florida Department of Natural Resources
Division of Beaches and Shores
Tallahassee, Florida

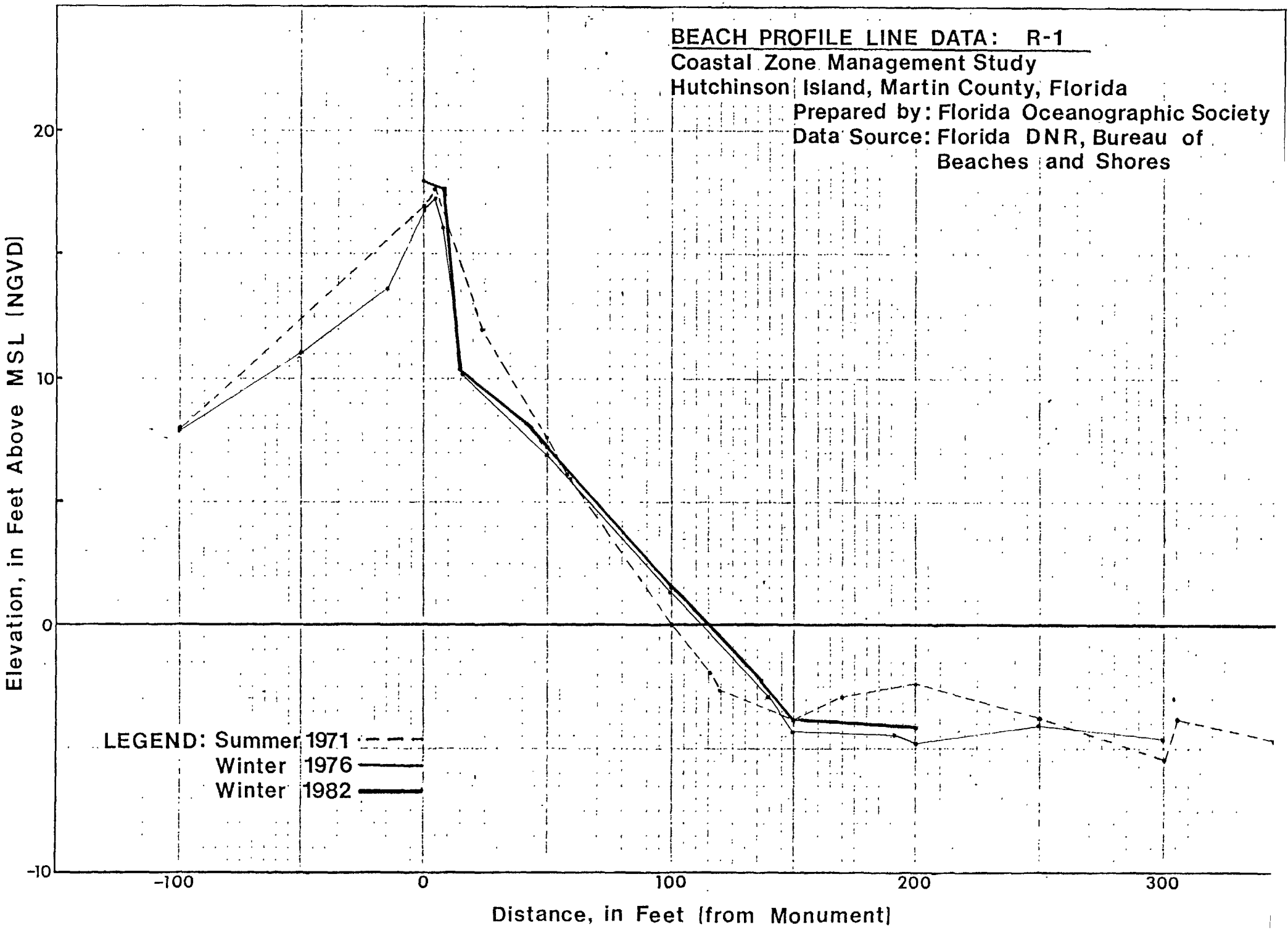
RANGE MONUMENTS AND ELEVATIONS 1982

MARTIN COUNTY COASTAL ZONE MANAGEMENT STUDY

Range	Northing	Easting	Elevation
1	1065431.47	759819.26	17.74
2	1064598.19	760160.27	16.35
3	1063765.70	760501.15	12.97
4	1062933.27	760843.16	10.67
5-U (1979)	1062122.23	761197.43	10.76
6 (1975)	1061467.66	761509.30	12.47
7	1060487.06	761981.43	9.86
8	1059680.53	762380.08	10.77
9 (1982)	1058873.06	762777.13	10.47
10-U (1979)	1058078.56	763197.16	13.06
11 (1982)	1057259.30	763572.99	15.95
12-U (1979)	1056451.22	763971.45	12.21
13 (1982)	1055645.07	764369.31	14.72
14	1054837.23	764767.89	18.63
15	1054029.92	765165.37	15.53
16	1053223.09	765563.69	12.39
17 (1975)	1052477.58	765950.95	9.69
18	1051608.67	766359.15	13.92
19 (1982)	1050819.55	766748.57	13.73
20	1049993.61	767154.22	14.85
21	1049186.22	767551.60	16.11
22	1048378.89	767949.54	15.61
23 (1975)			15.62
24	1046802.66	768818.10	17.50
25	1046015.02	769254.06	20.68
26	1045227.25	769689.15	17.87
27 (1982)	1044439.15	770124.96	10.34
28	1043651.95	770560.93	14.46
29	1042865.45	770997.46	13.94
30-A (1975)	1042032.72	771334.47	16.24
31 (1982)	1041216.37	771719.80	16.62
32 (1982)	1040398.27	772093.44	22.43
33 (1982)	1039638.69	772464.56	16.15
34 (1975)	1038742.46	772840.61	17.57
35 (1982)	1037889.34	772835.25	9.24
36 (1982)	1036989.28	773041.18	12.68
37	1036108.42	773295.51	13.14
38 (1975)	1035062.70	773646.01	12.79
39 (1975)	1034363.90	773904.74	12.37
40	1033576.66	774231.66	10.99
41	1032732.02	774543.70	11.80
42	1031887.68	774855.48	12.20

Source: Florida Department of Natural Resources, Division of Beaches & Shores

Note: Monuments are from original survey in 1971 unless otherwise noted by parenthesis.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Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
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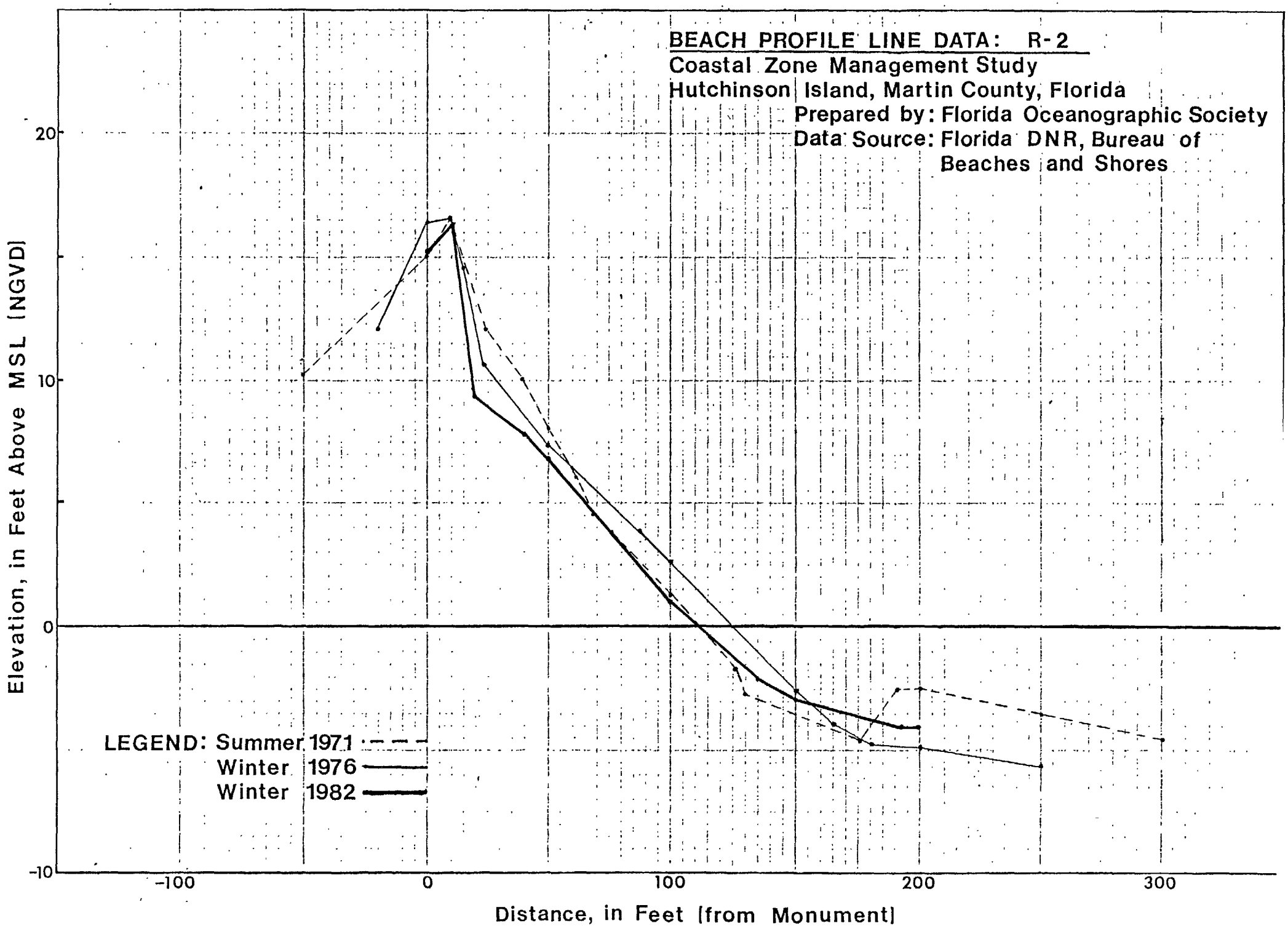
10
0
-10
-100
0
100
200
300
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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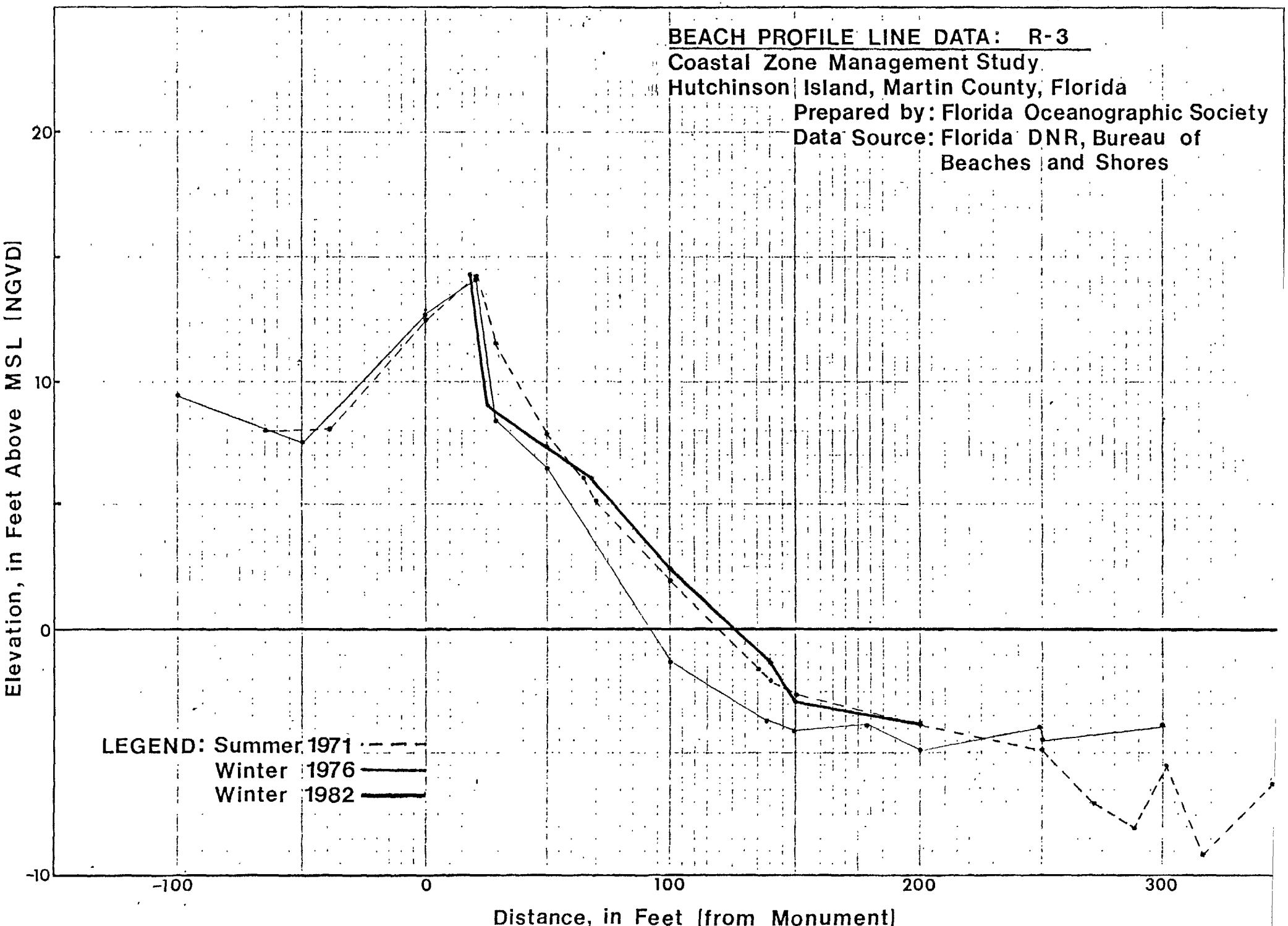
20
10
0
-10
-100
0
100
200
300
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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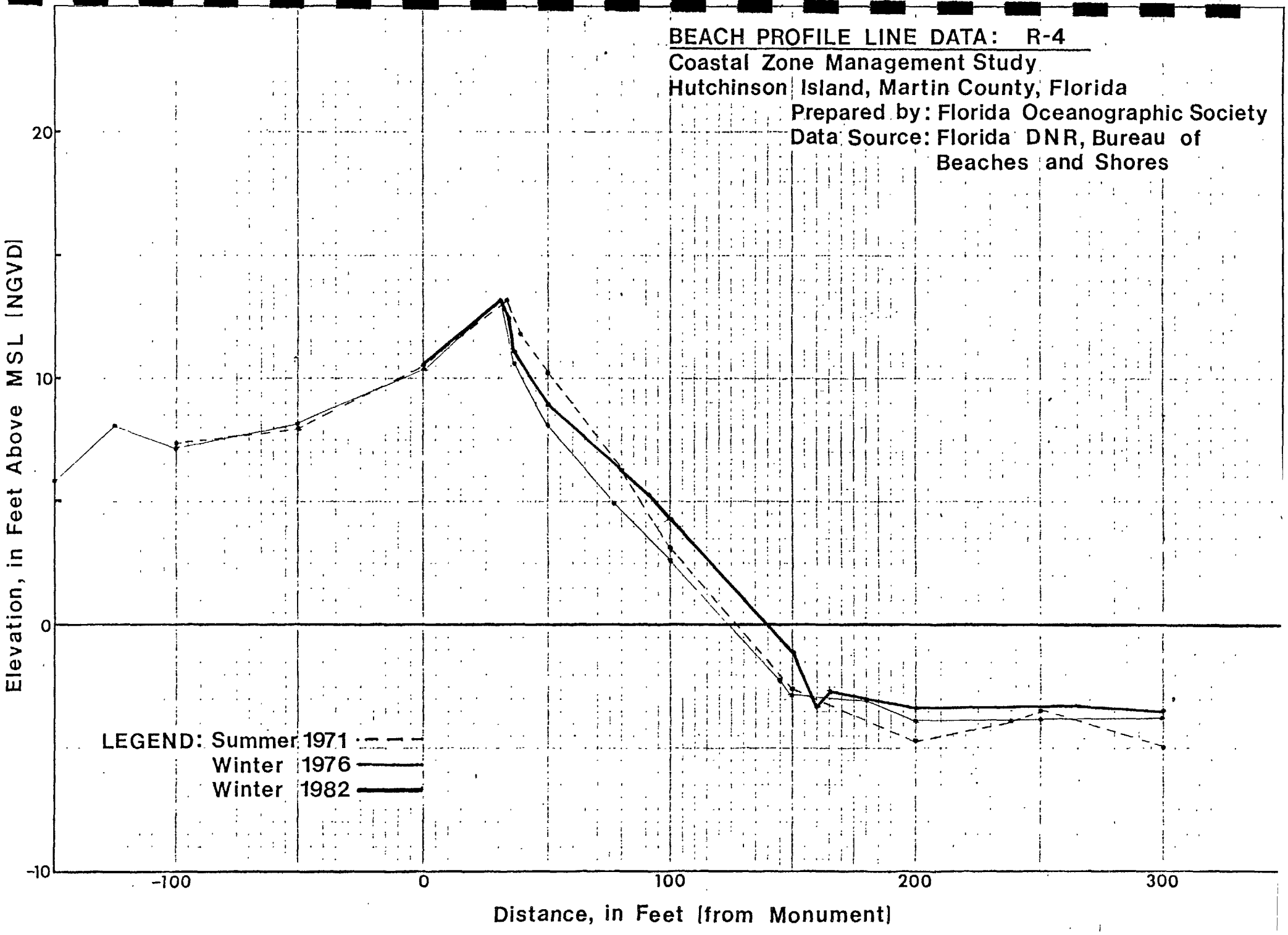
10
0
-10
-100
0
100
200
300
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
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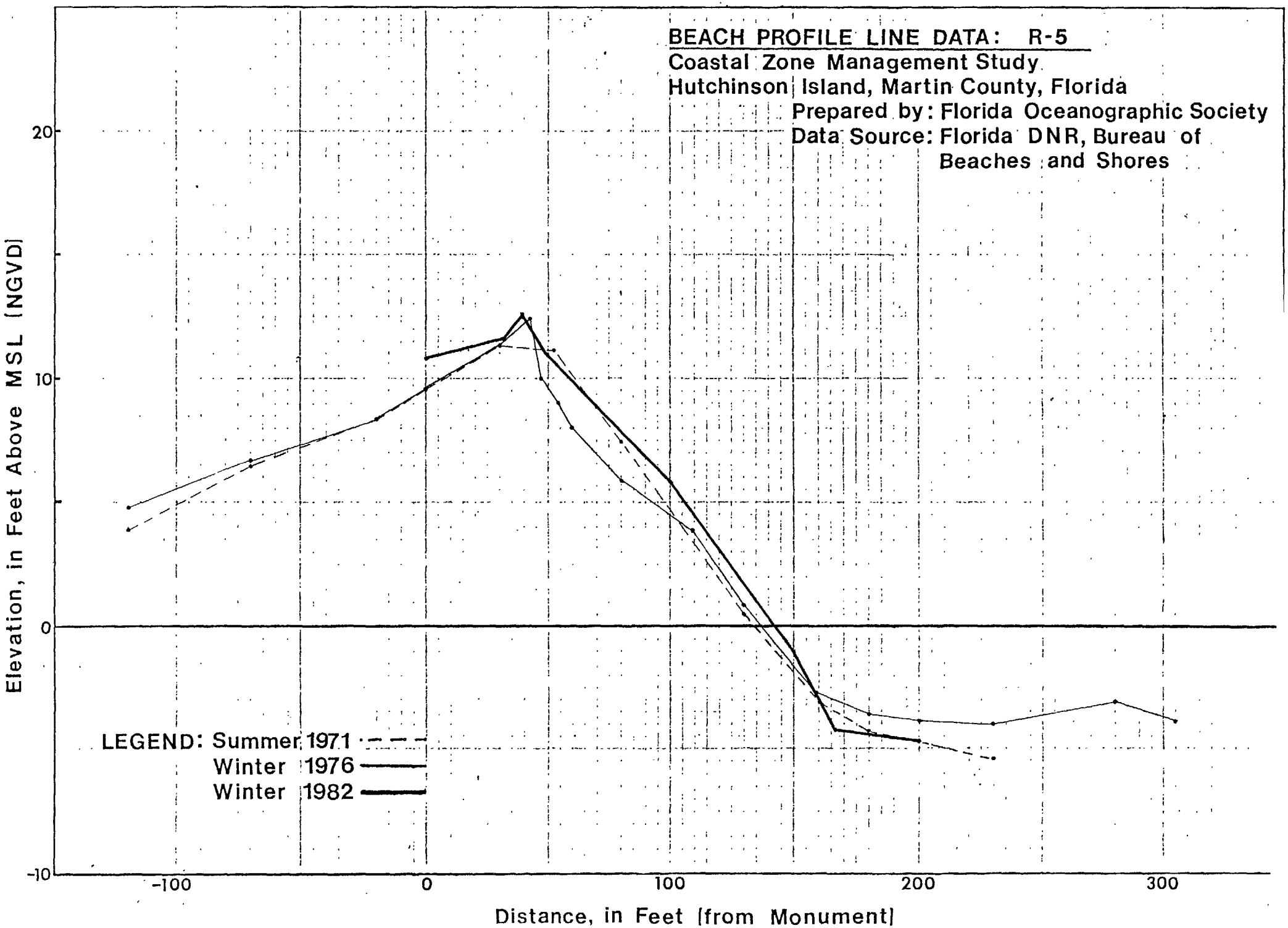
20
10
0
-10
-100
0
100
200
300
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Prepared by: Florida Oceanographic Society
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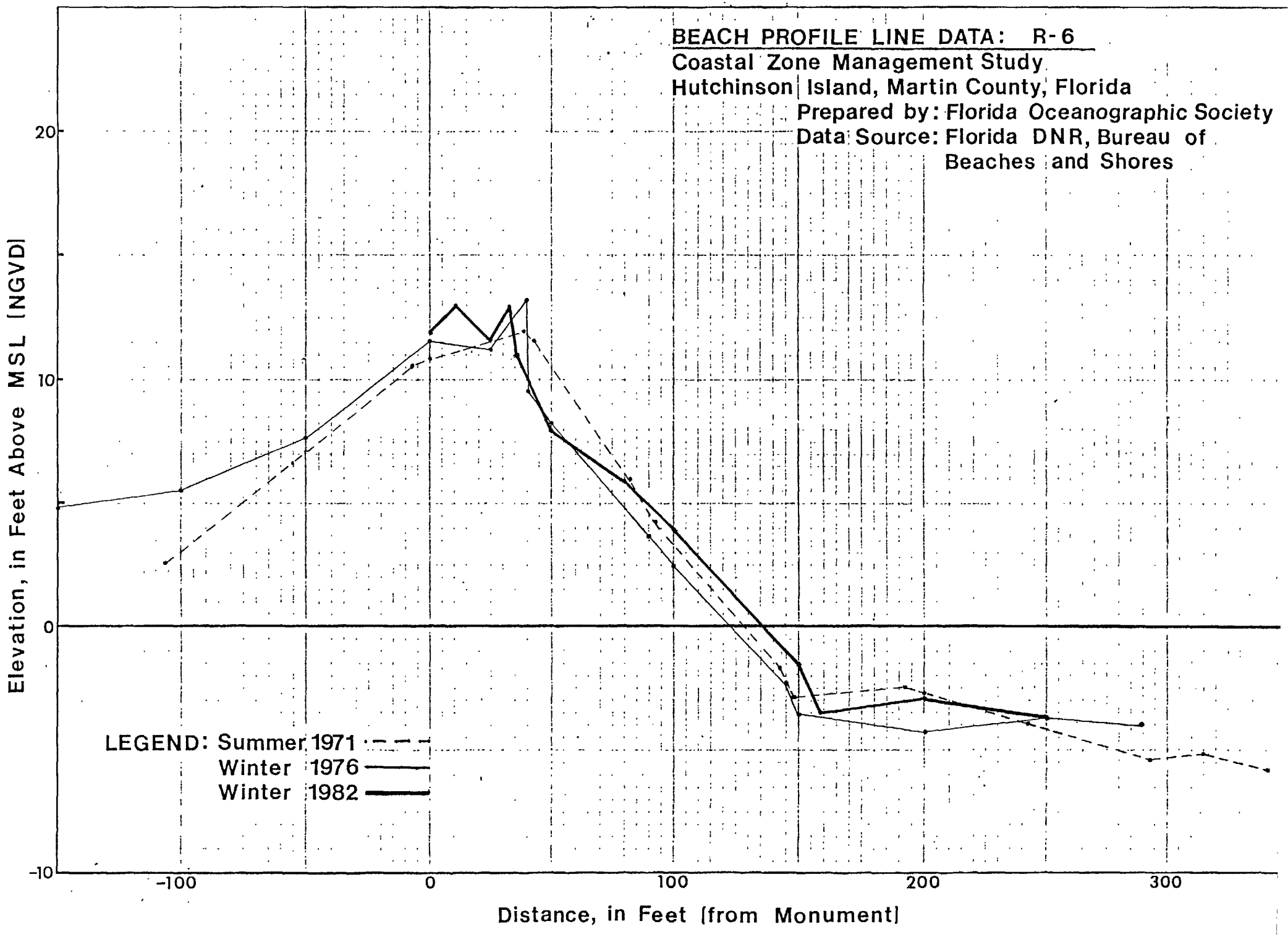
10
0
-10
-100
0
100
200
300
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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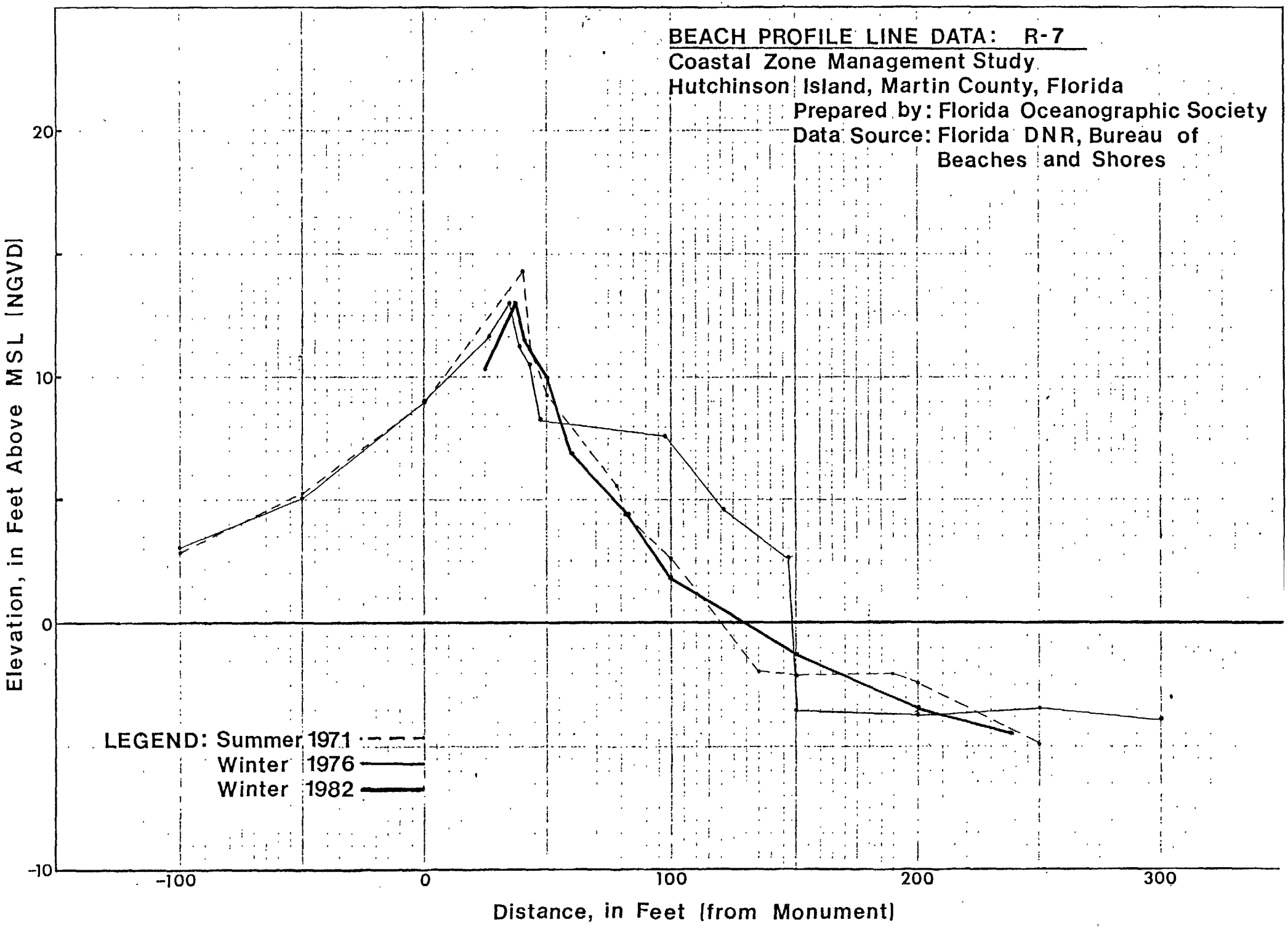
10
0
-10
-100
0
100
200
300
Distance, in Feet [from Monument]
LEGEND: Summer 1971
Winter 1976
Winter 1982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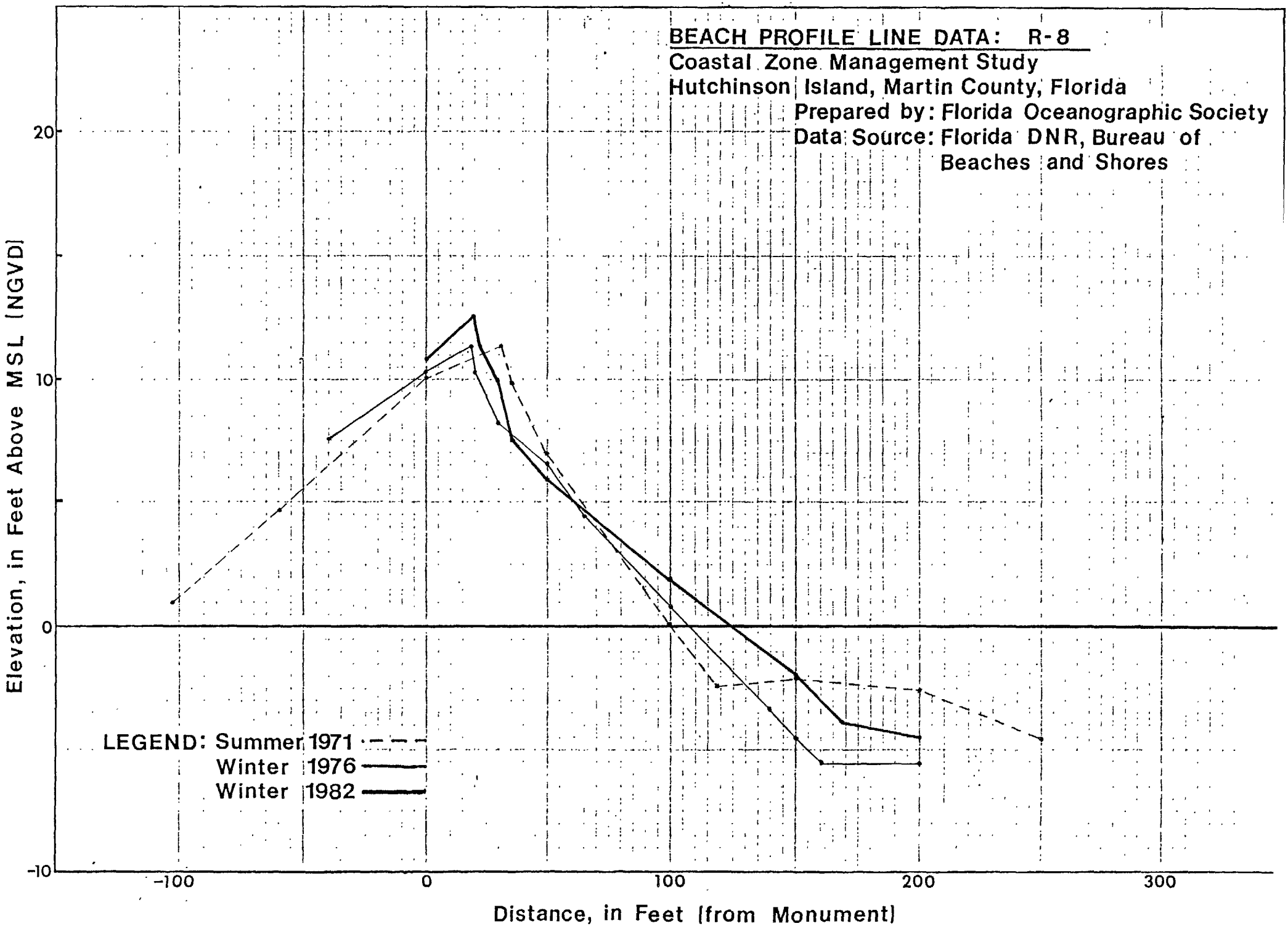
10
0
-10
-100
0
100
200
300
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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10
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-10
-100
0
100
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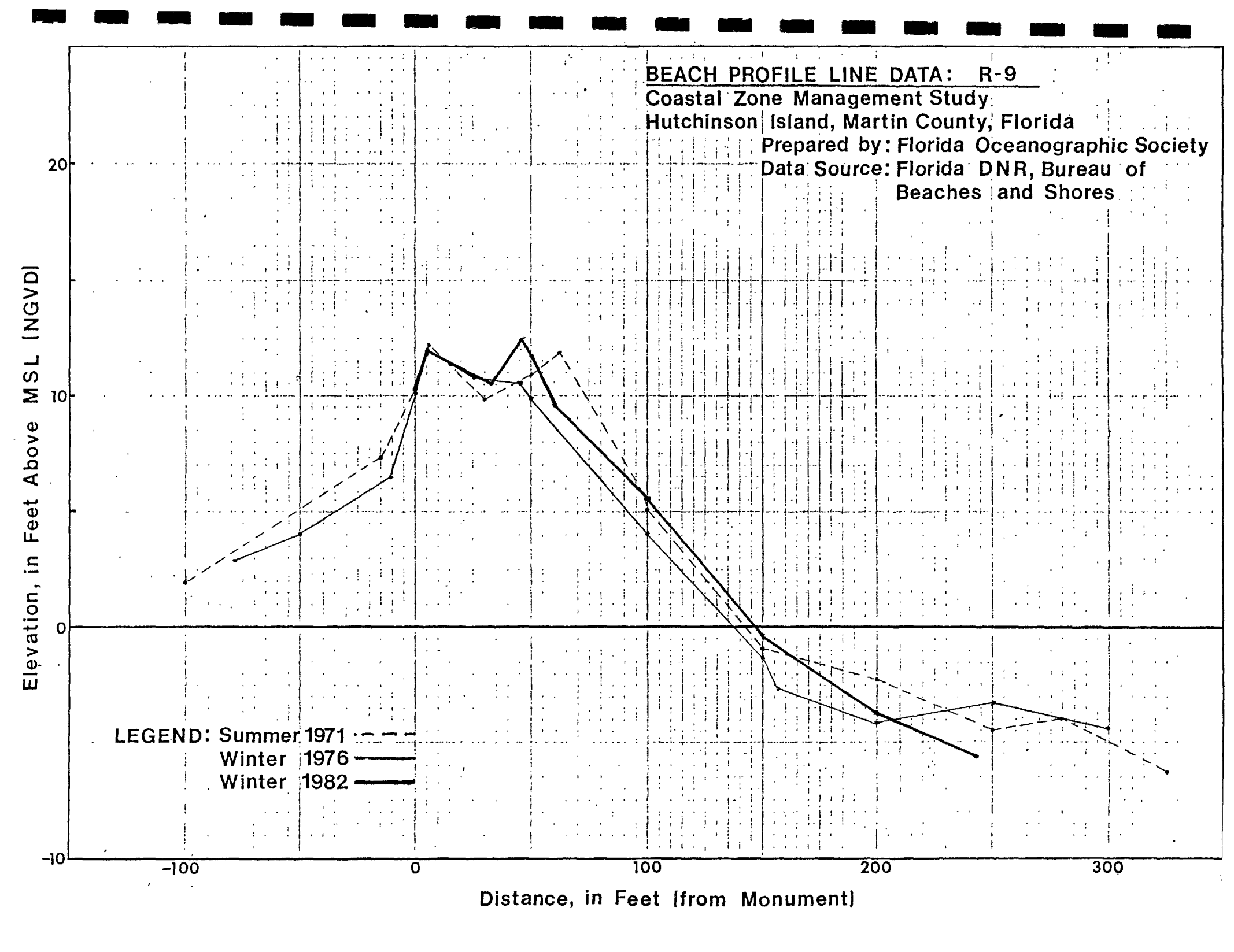
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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10
0
-10
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100
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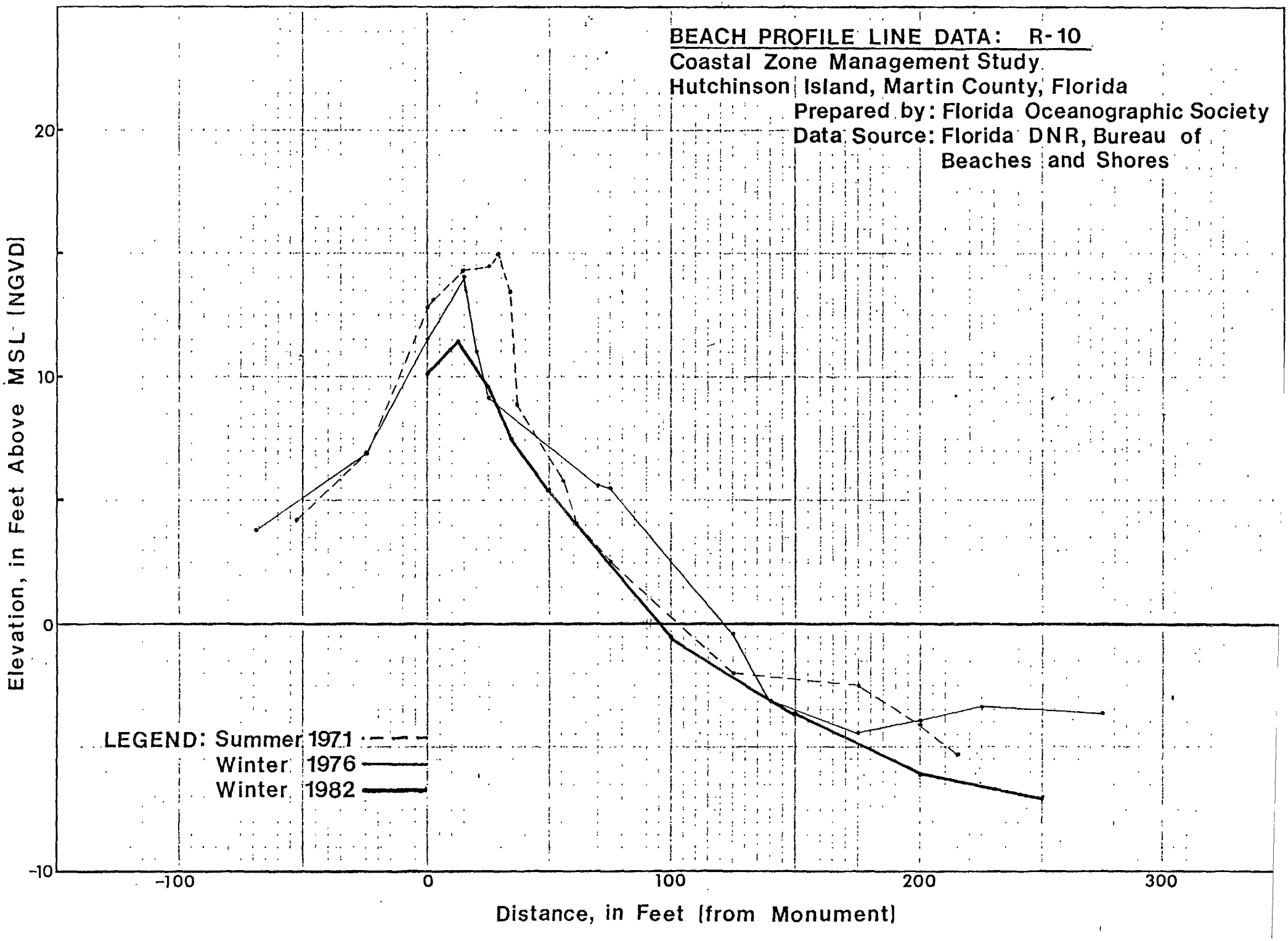
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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10
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-100
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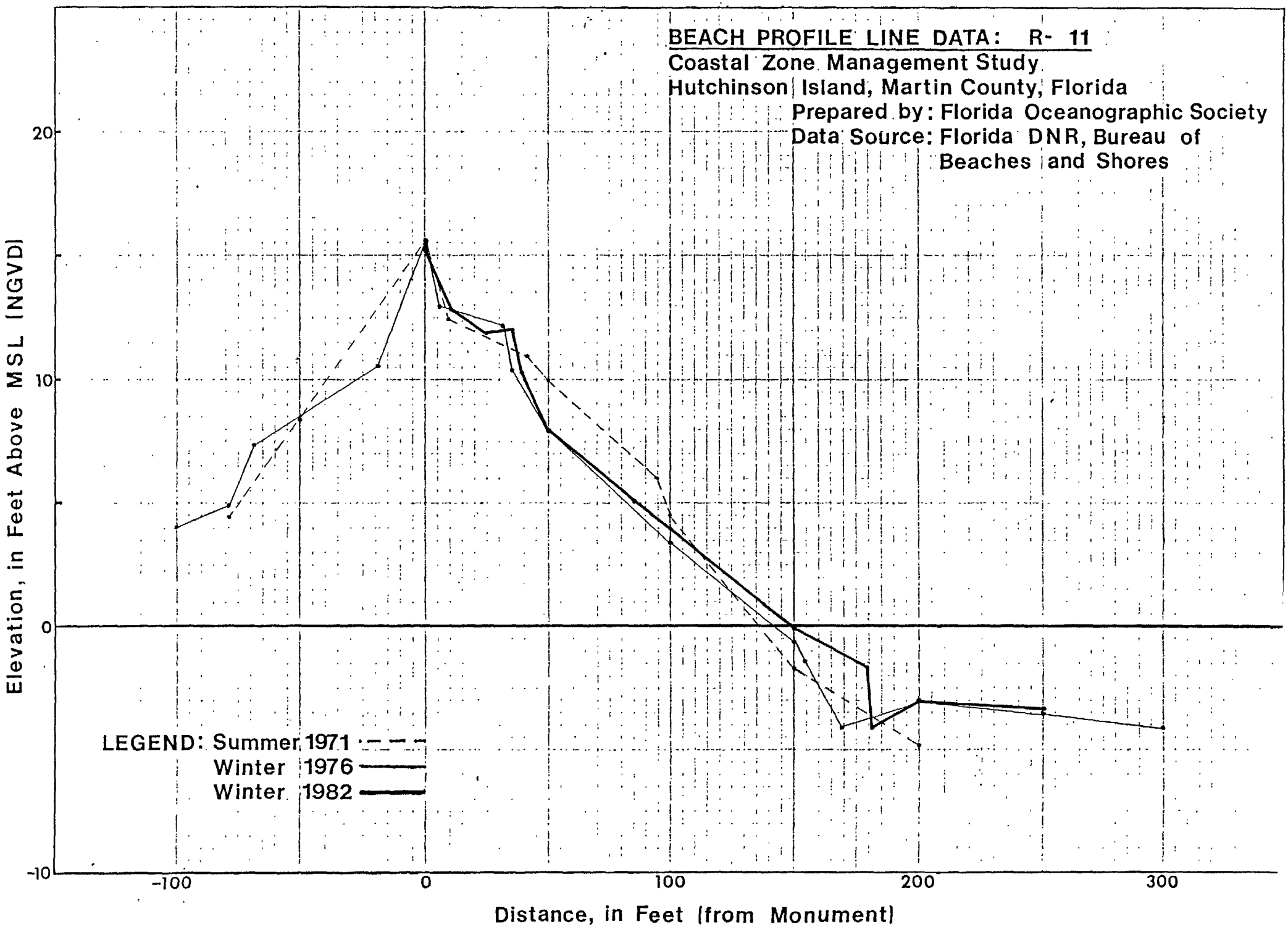
100
200
300
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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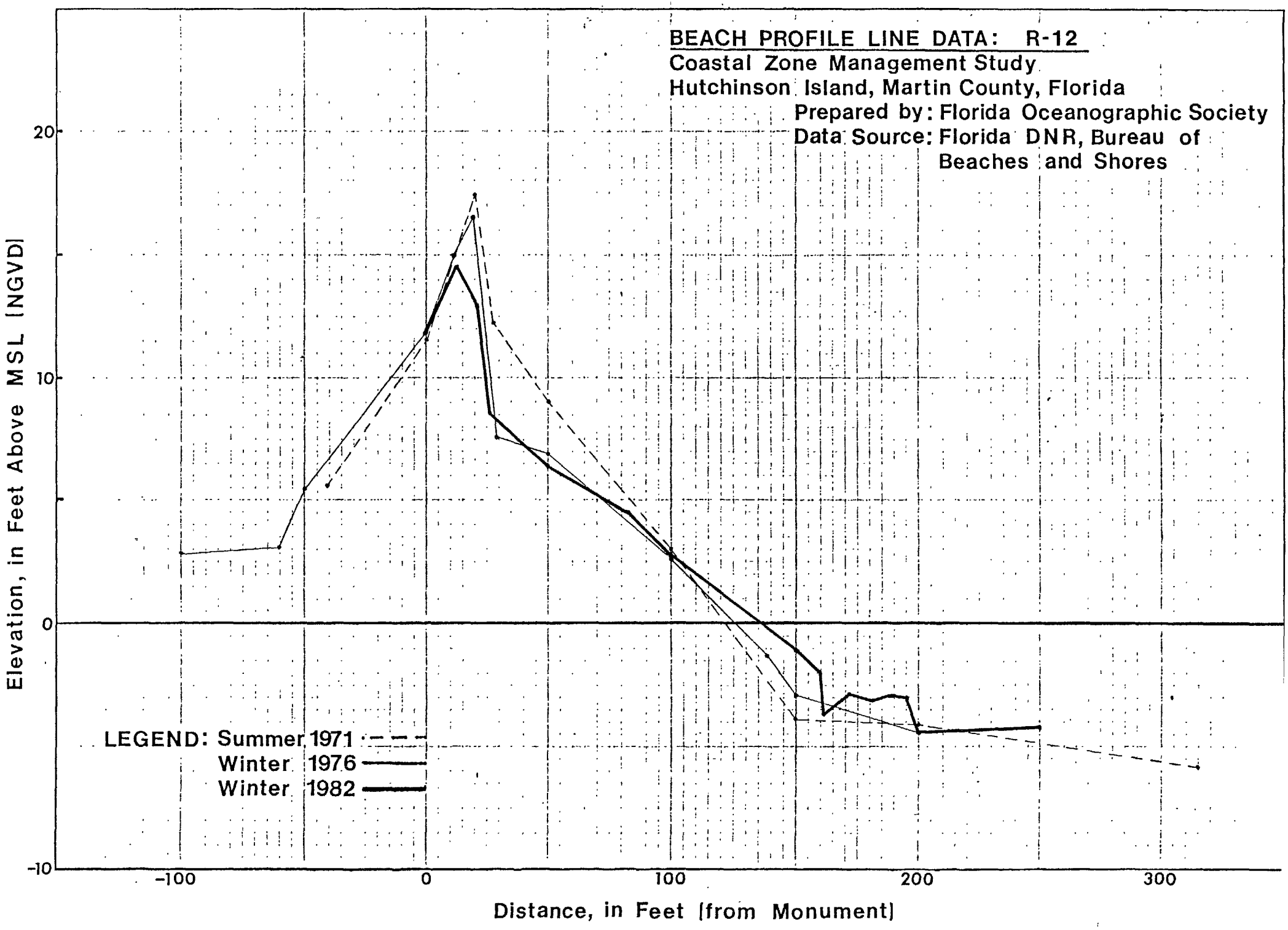
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
20
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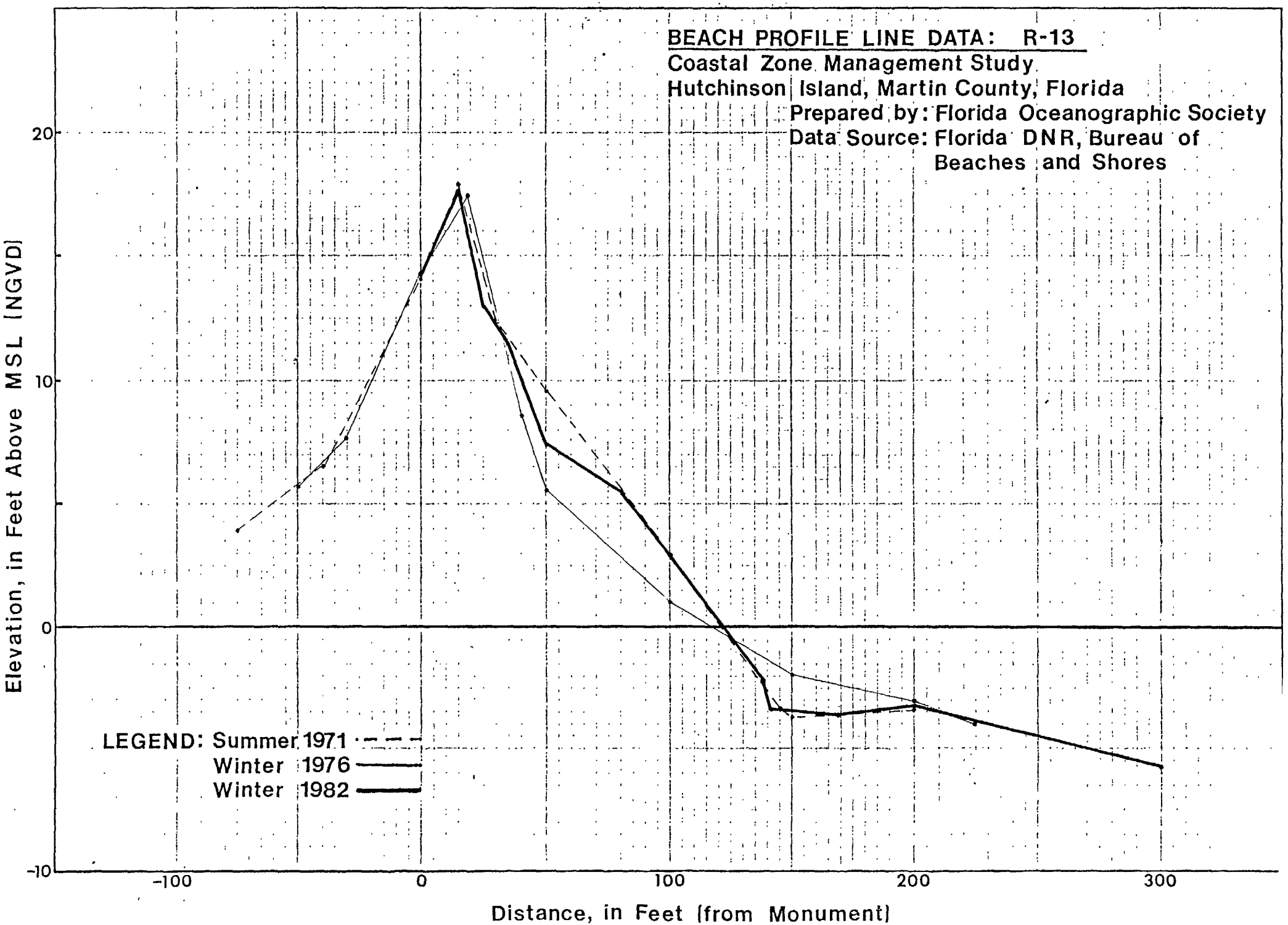
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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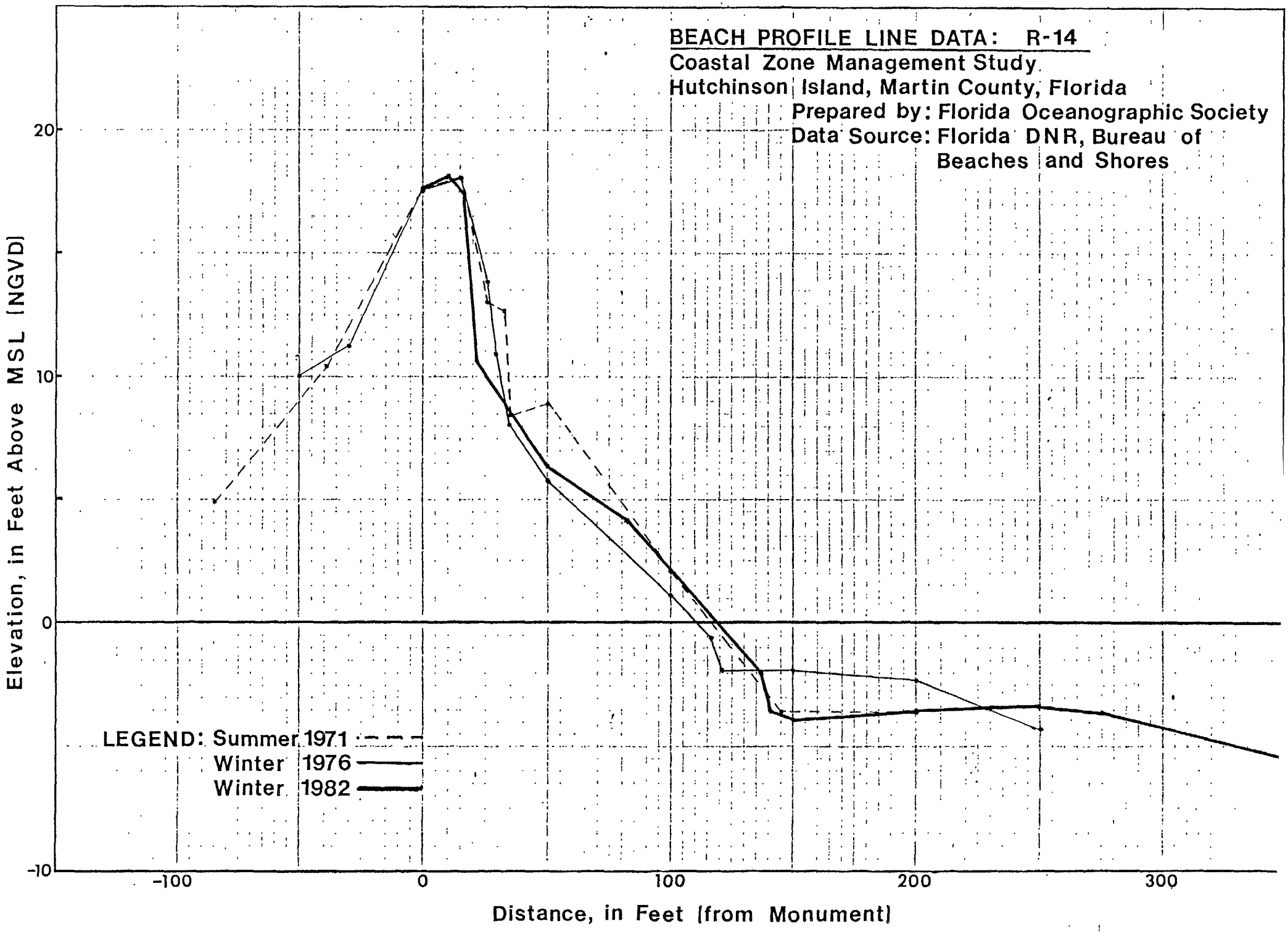
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
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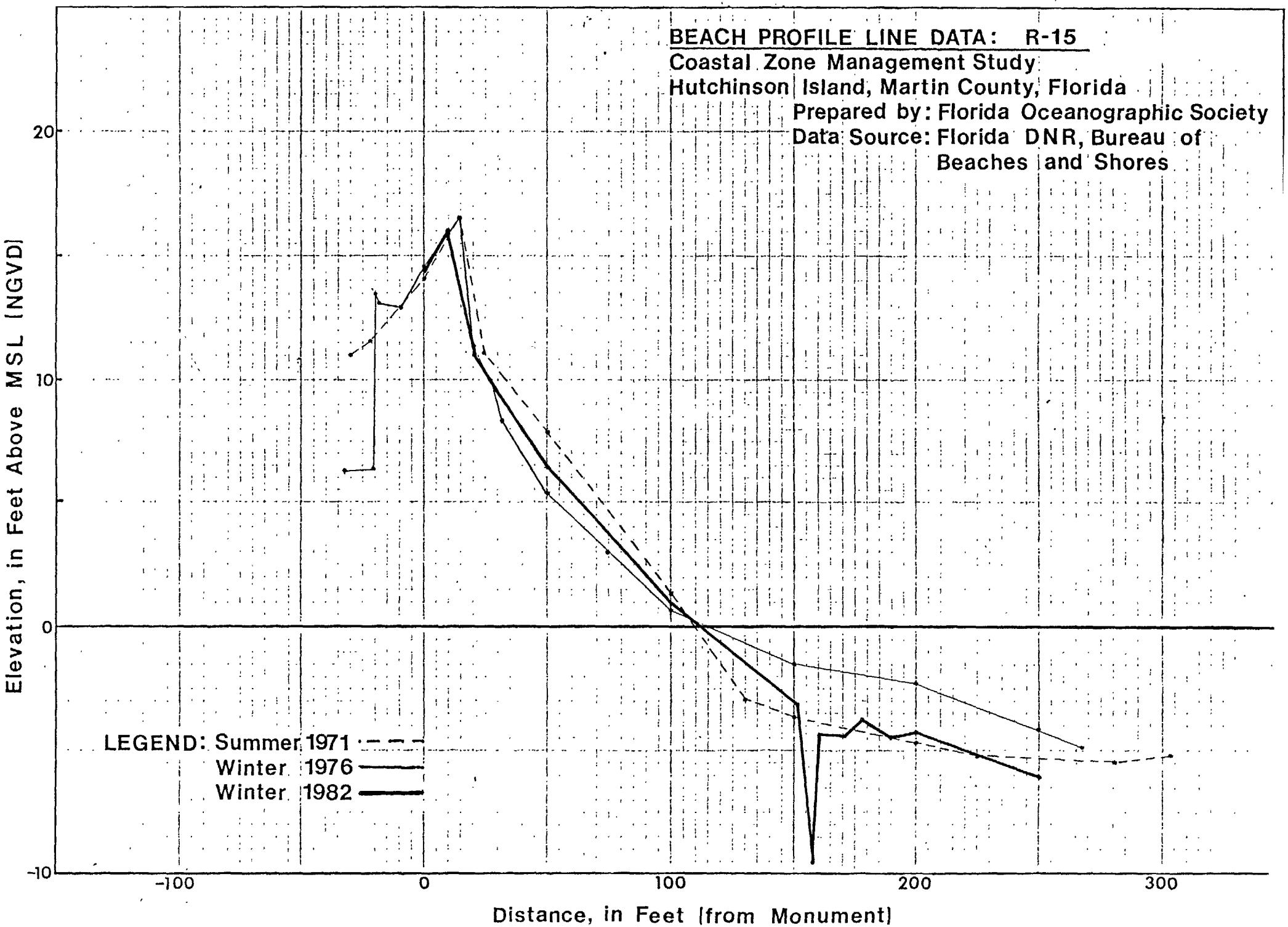
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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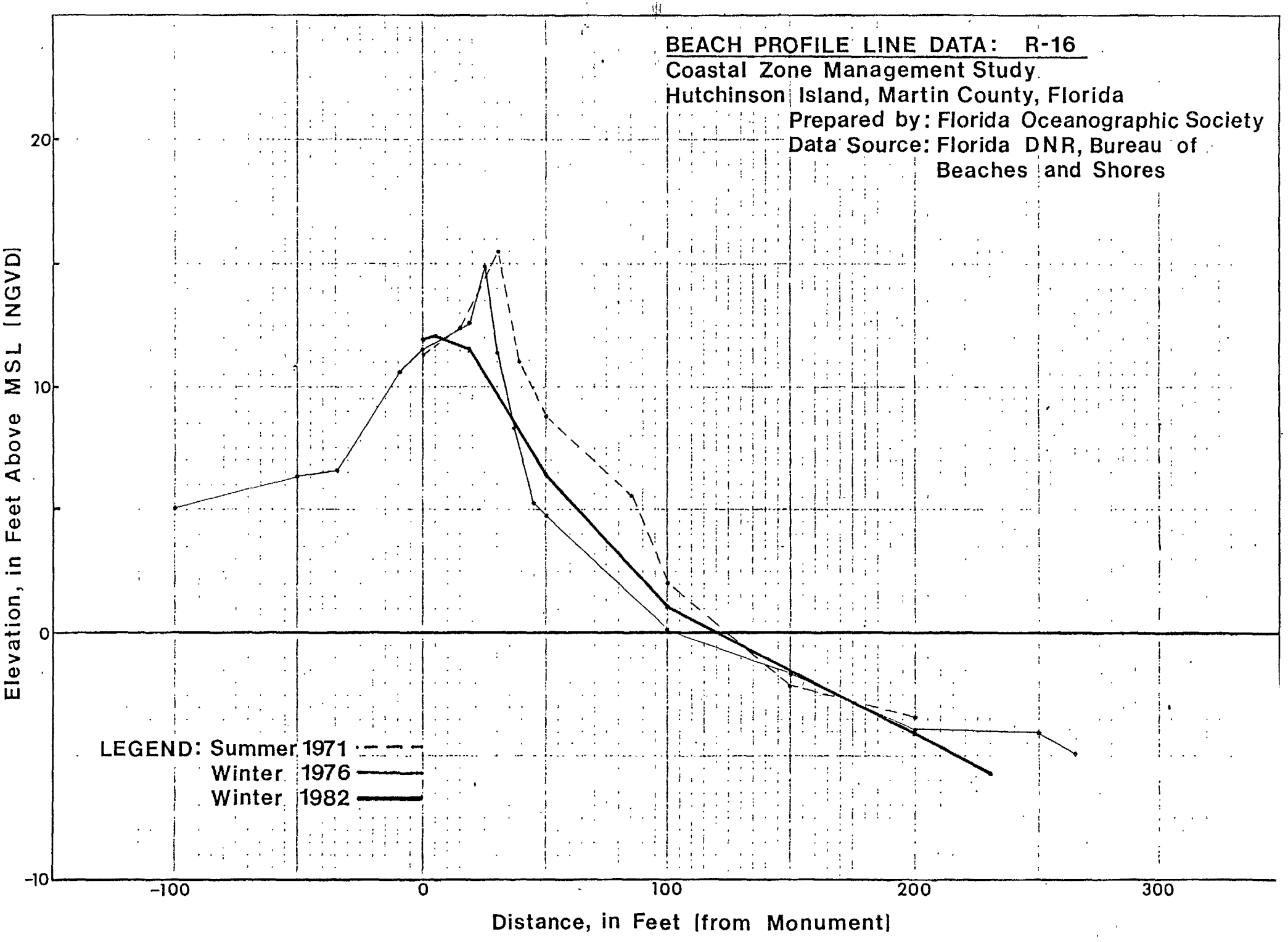
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL [NGVD]
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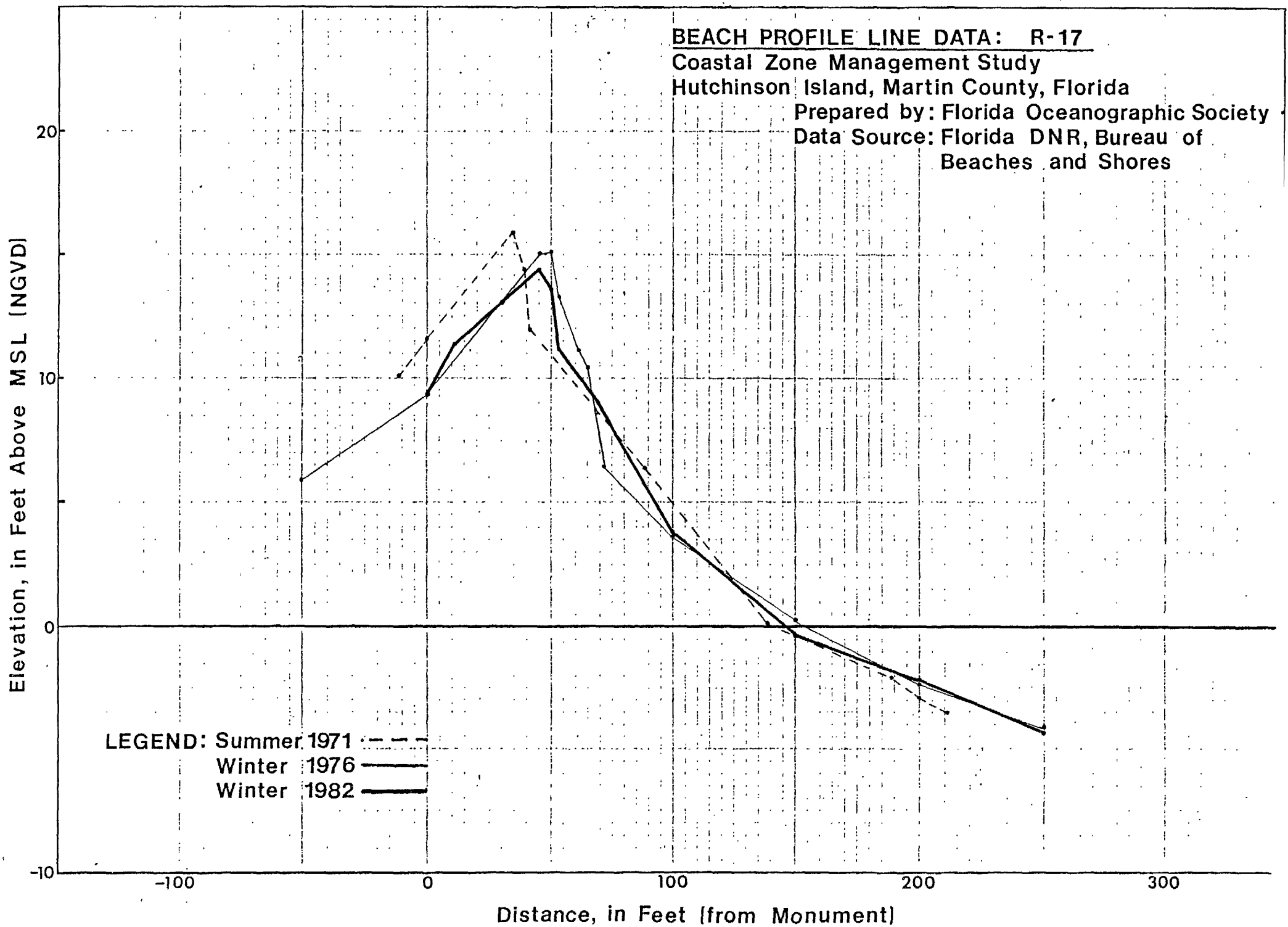
Distance, in Feet [from Monument]
LEGEND: Summer 1971
Winter 1976
Winter 1982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Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
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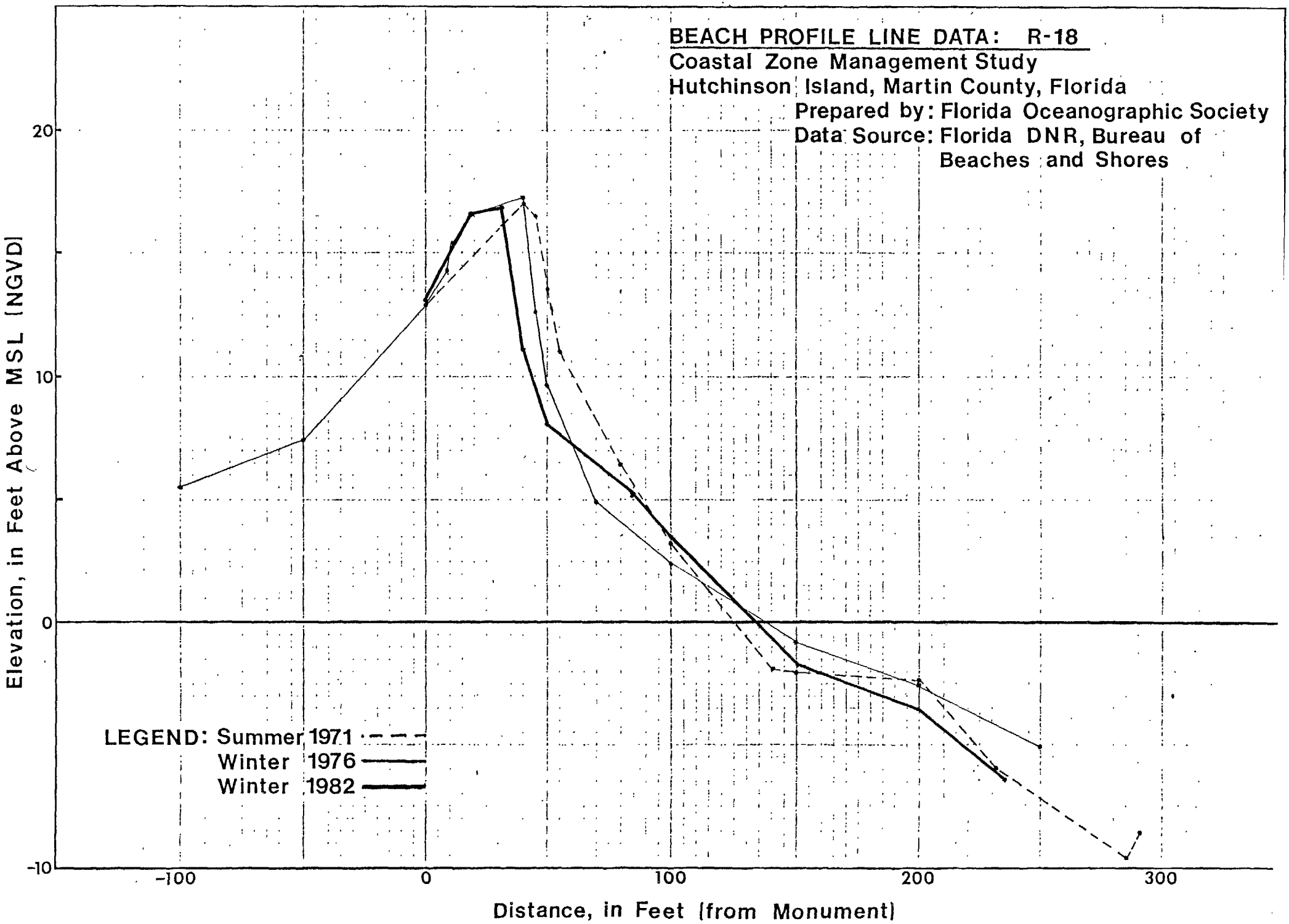
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
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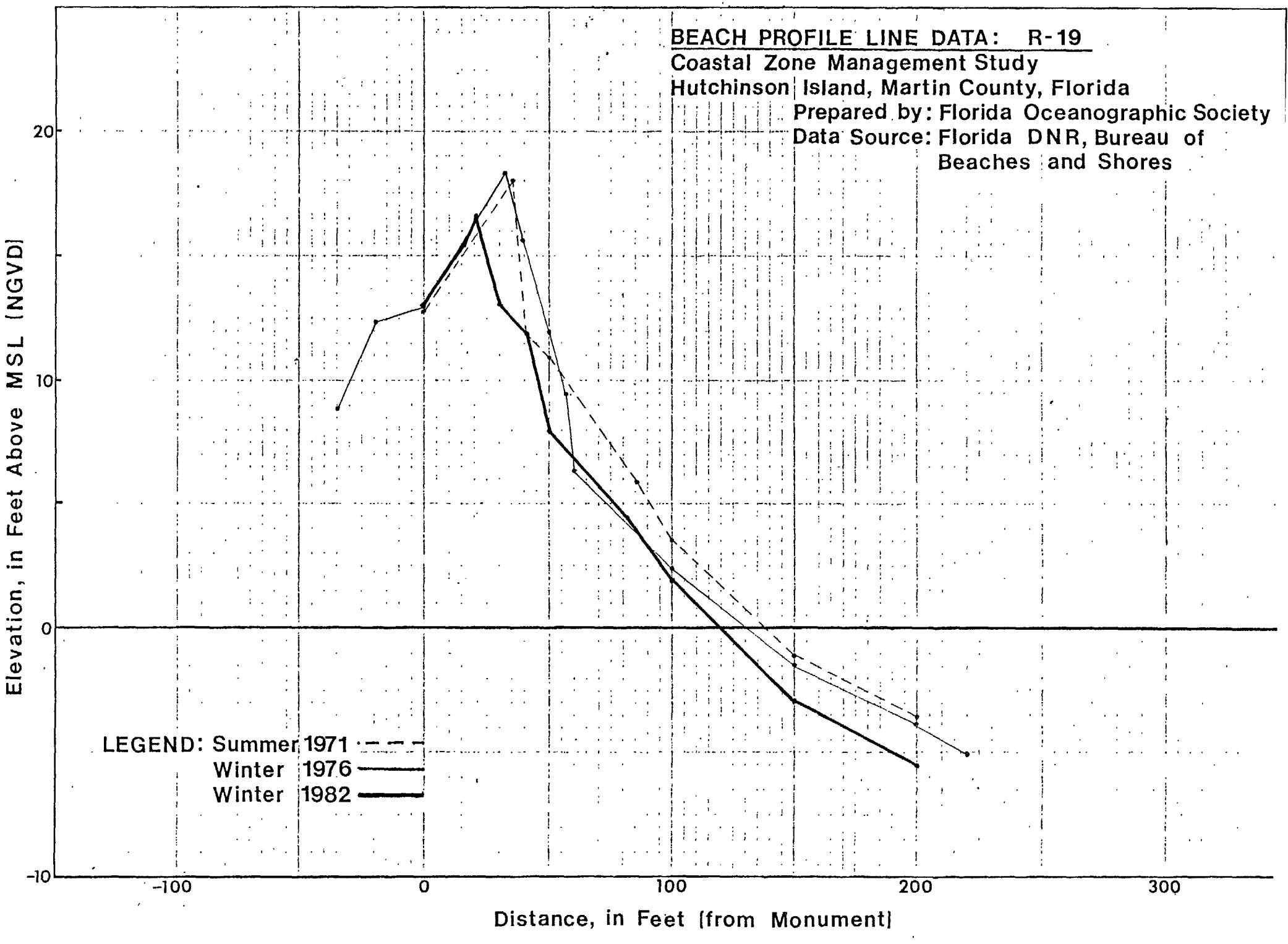
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
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Winter 1976
Winter 1982
Elevation, in Feet Above MSL (NGVD)
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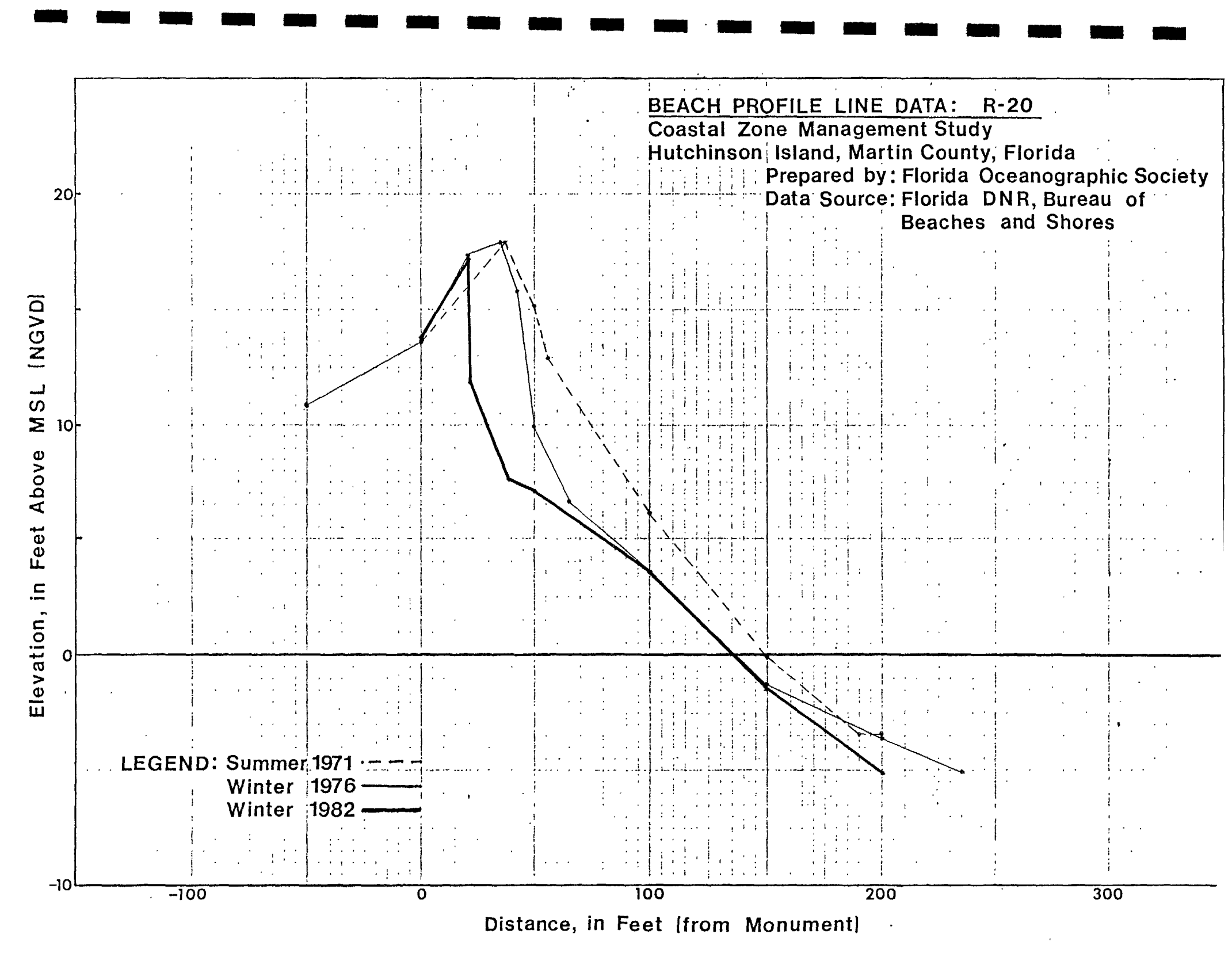
Distance, in Feet (from Monument)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Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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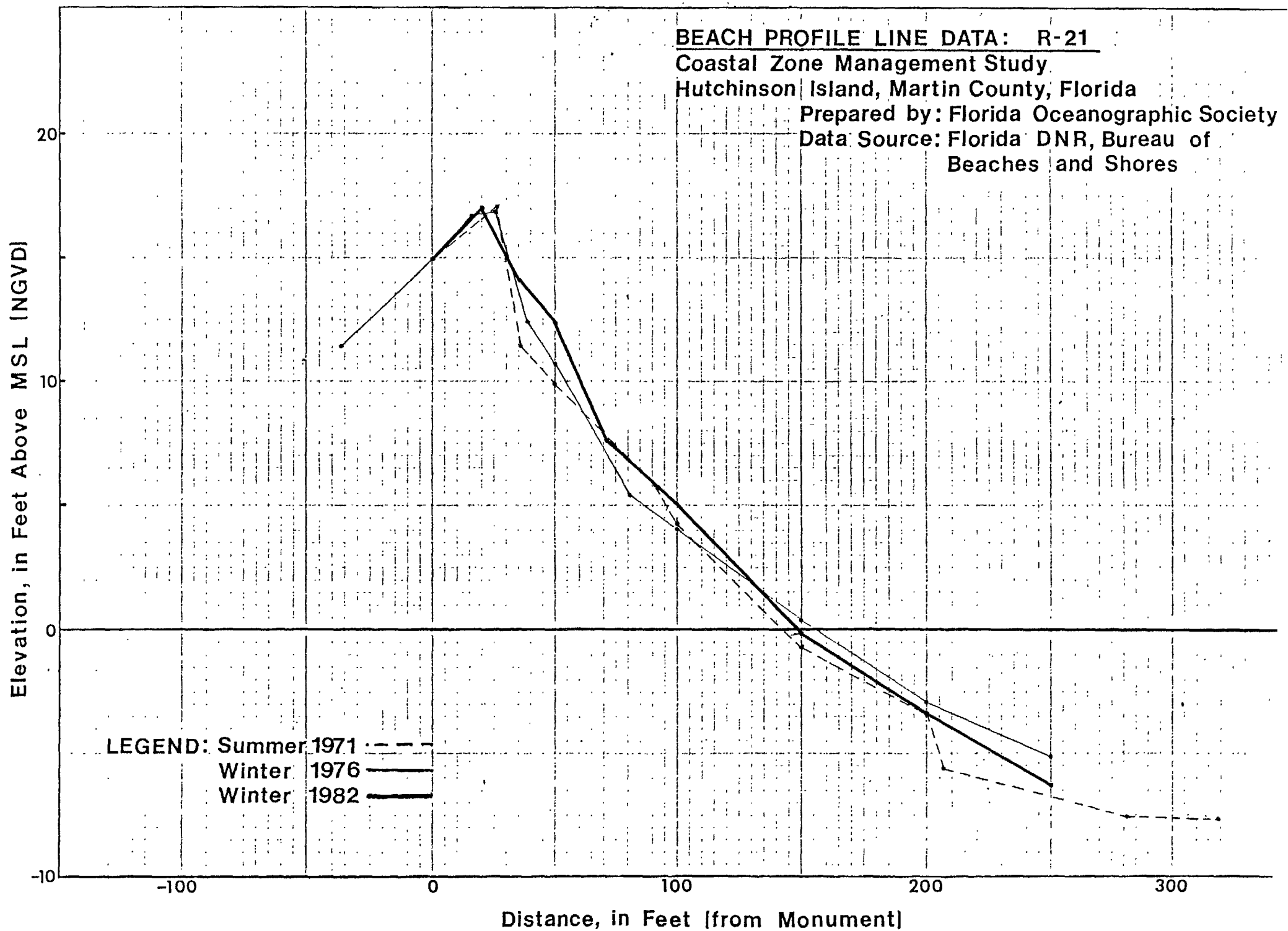
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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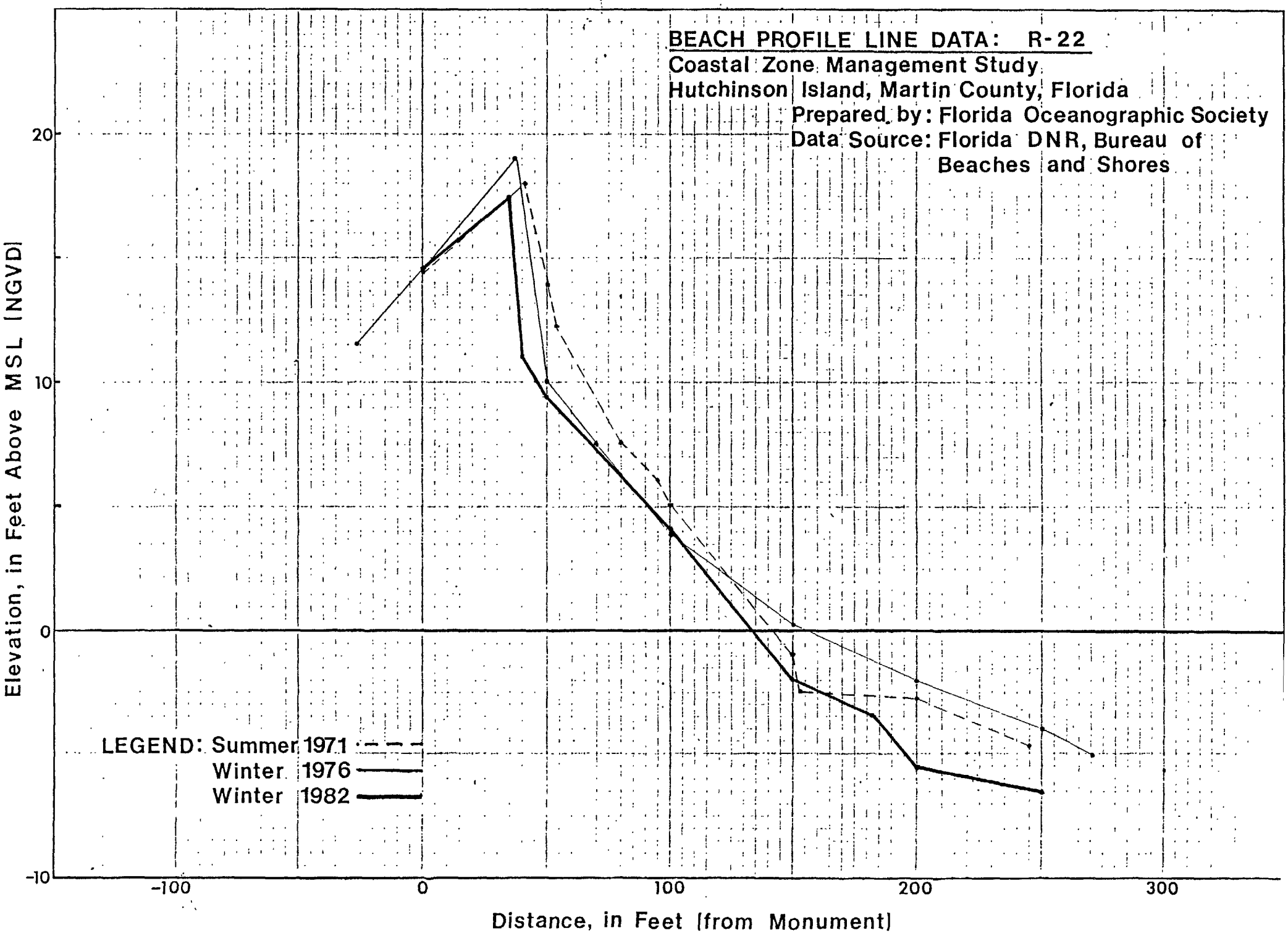
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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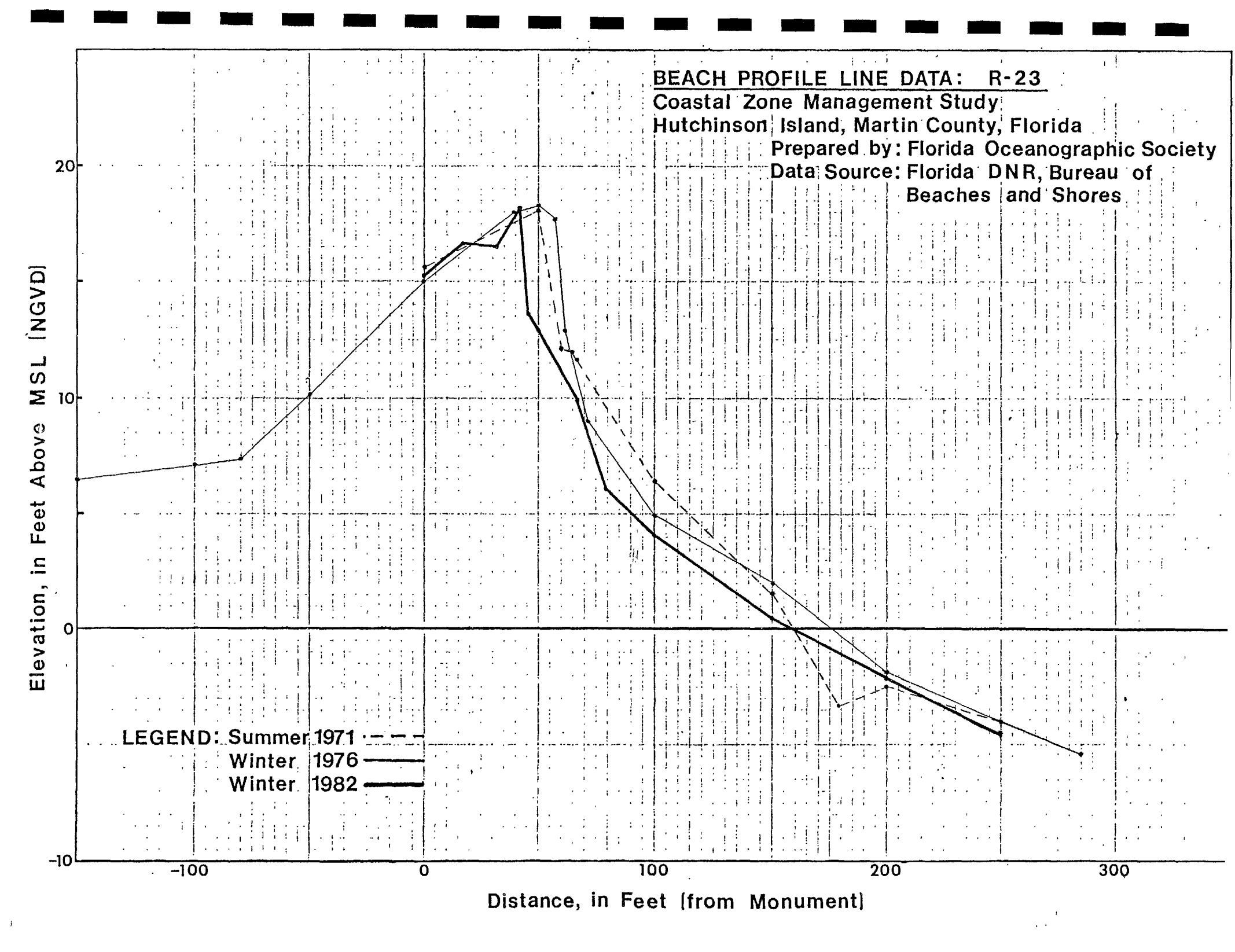
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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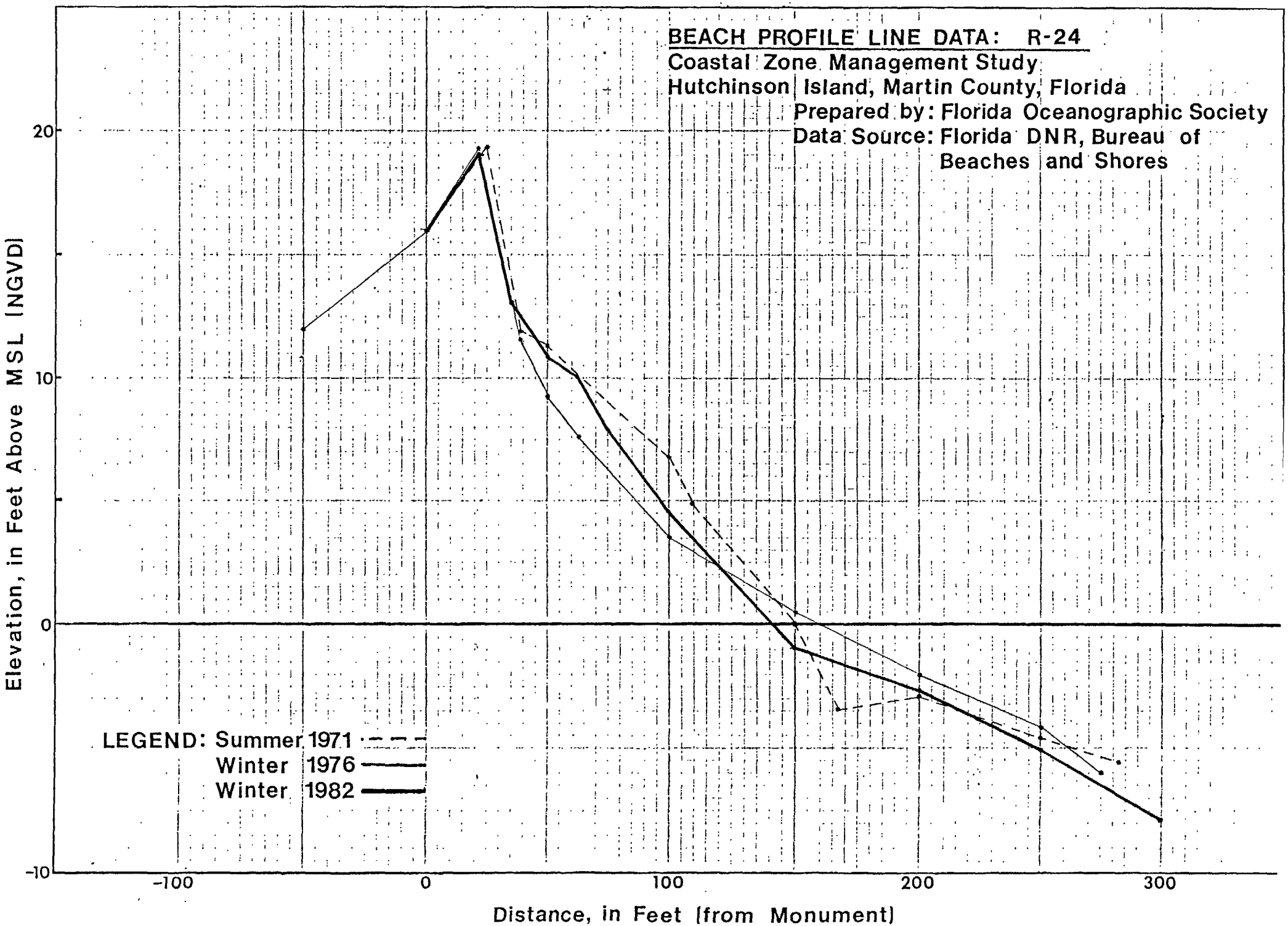
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
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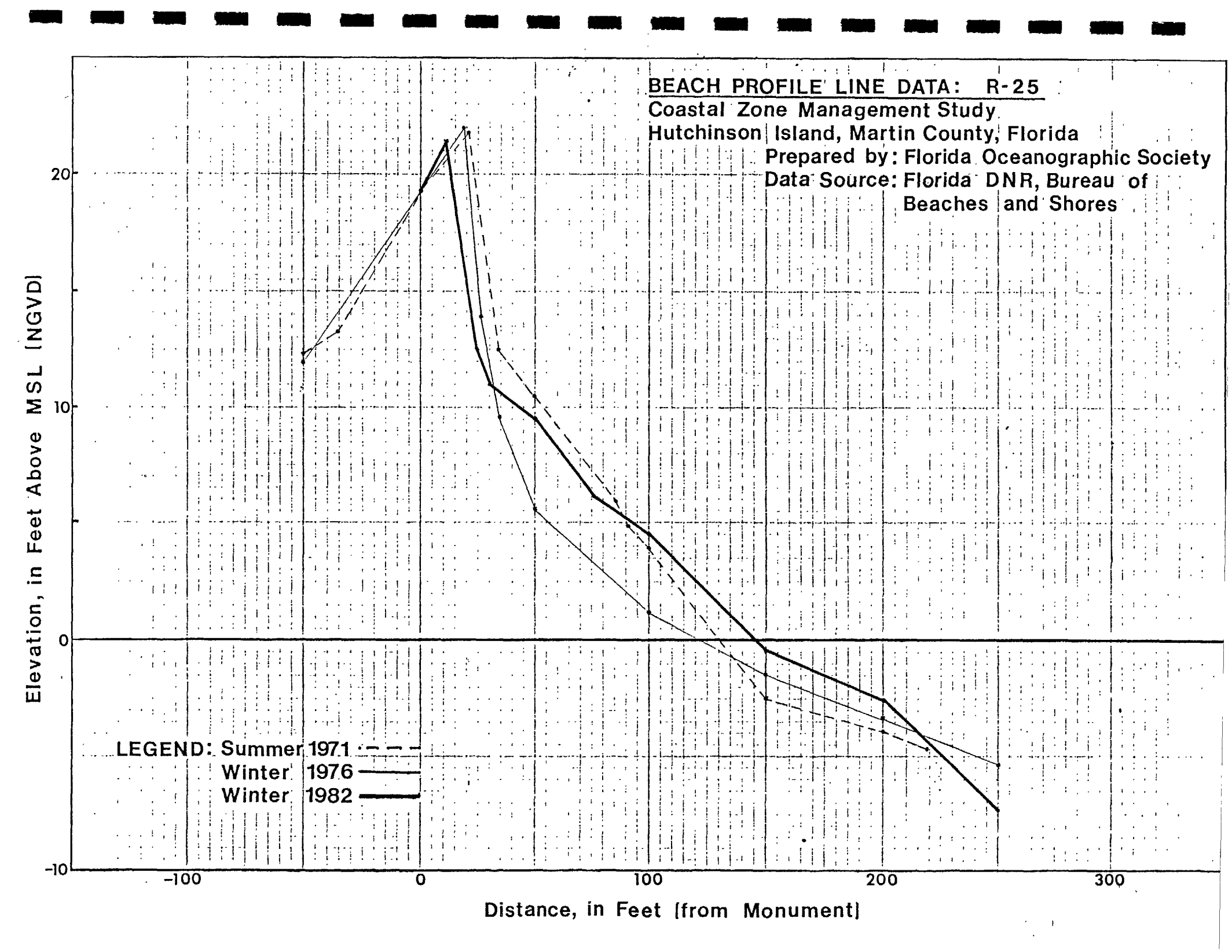
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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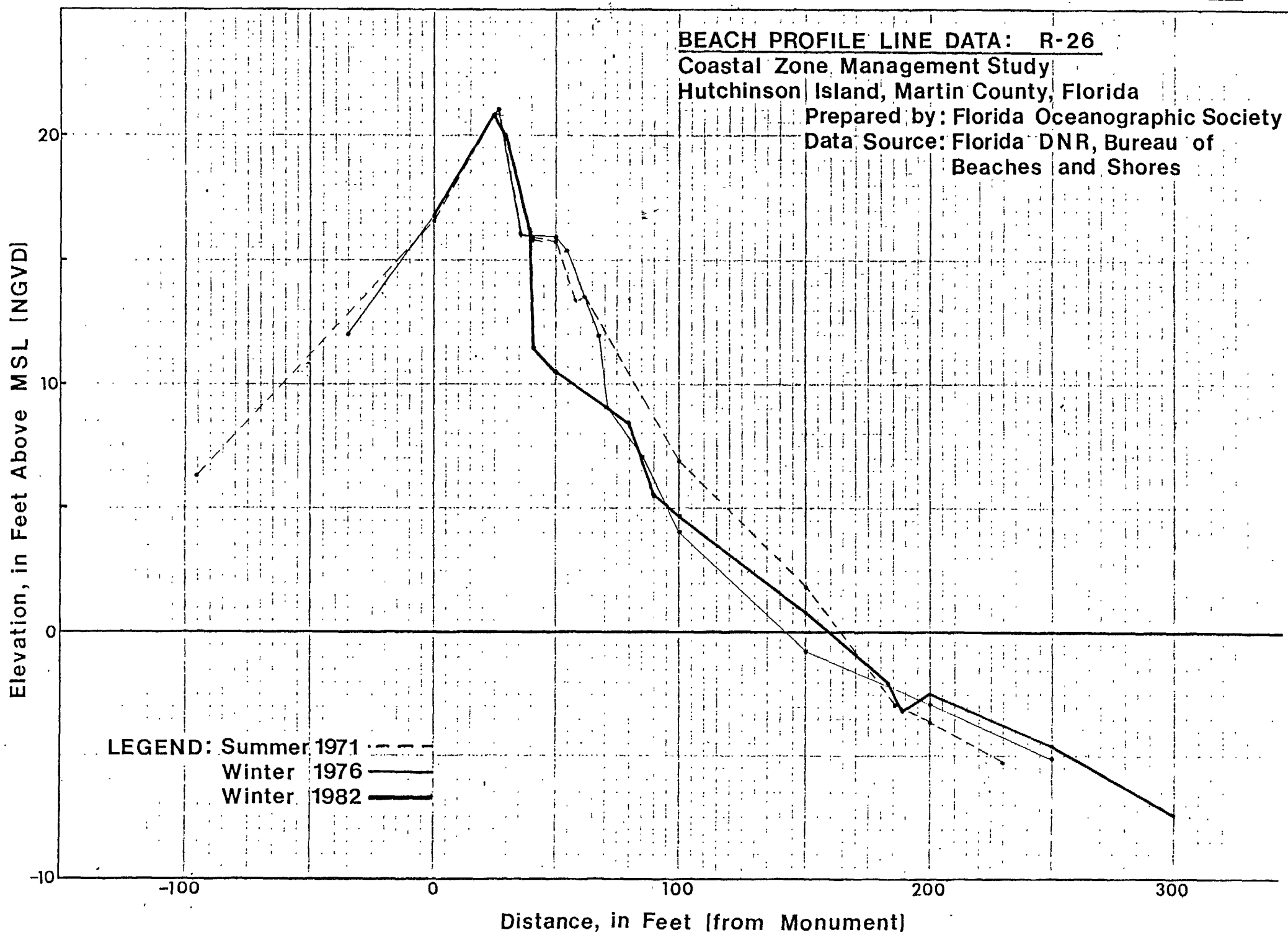
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL [NGVD]
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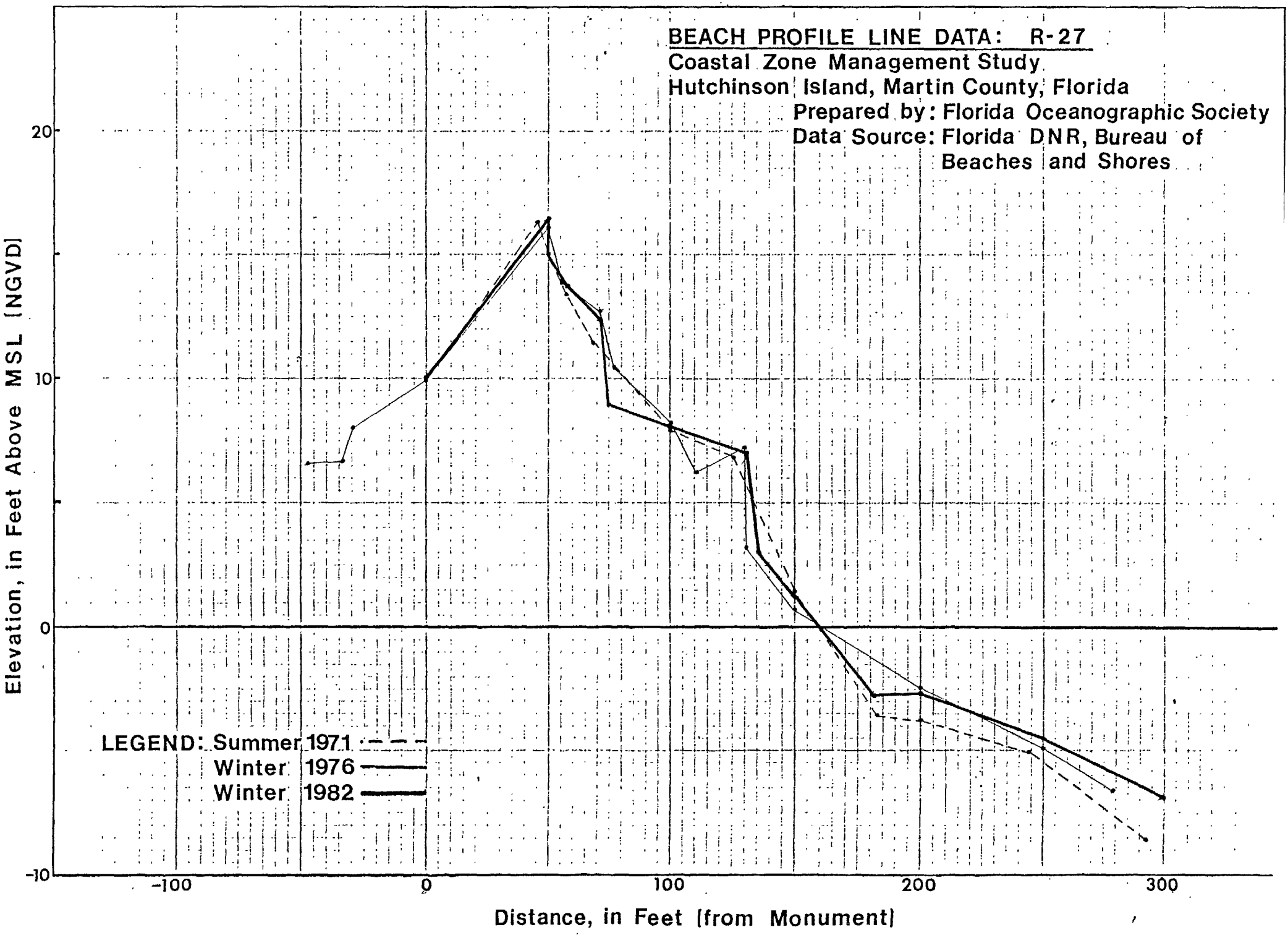
Distance, in Feet [from Monument]
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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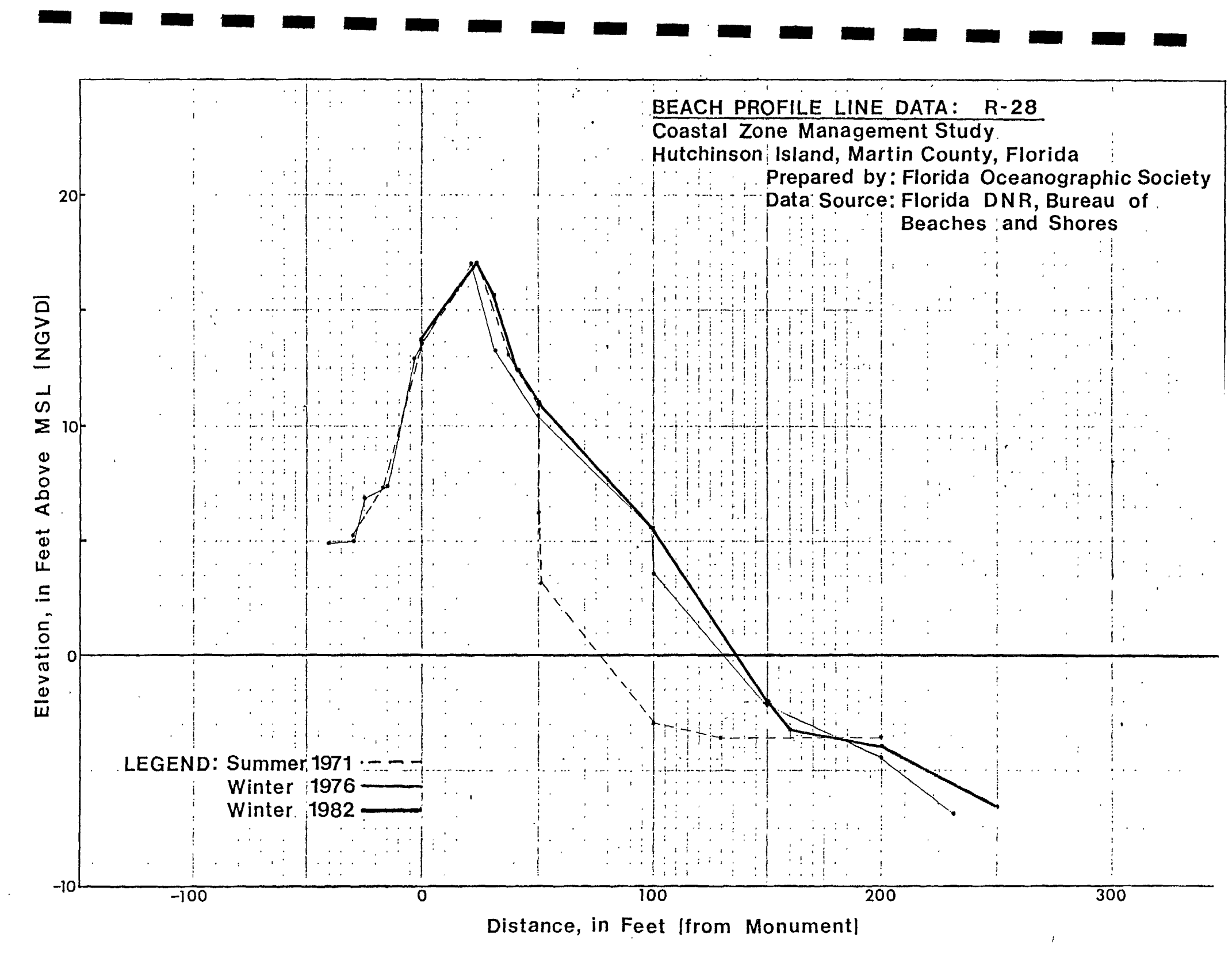
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL [NGVD]
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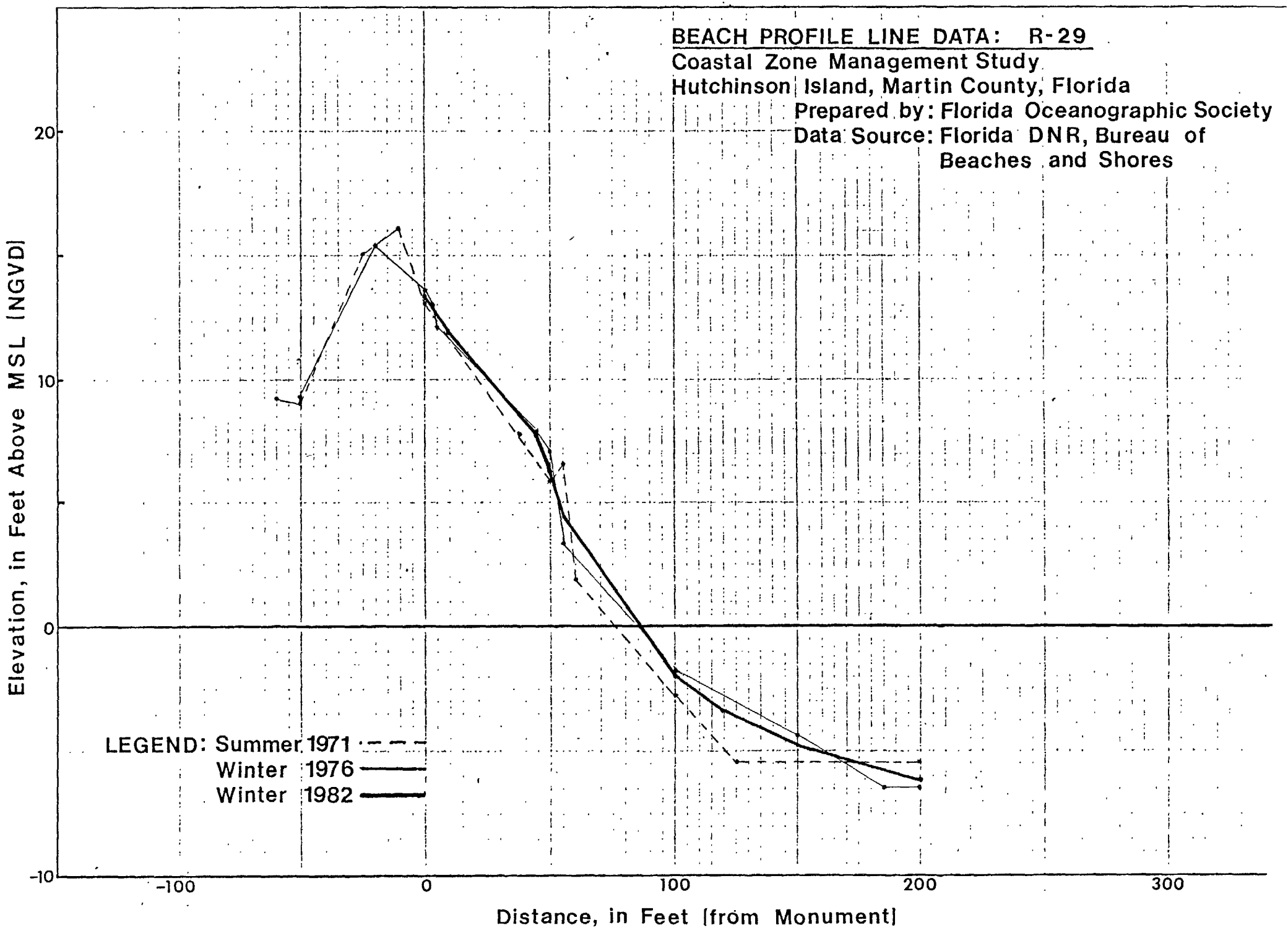
Distance, in Feet [from Monument]
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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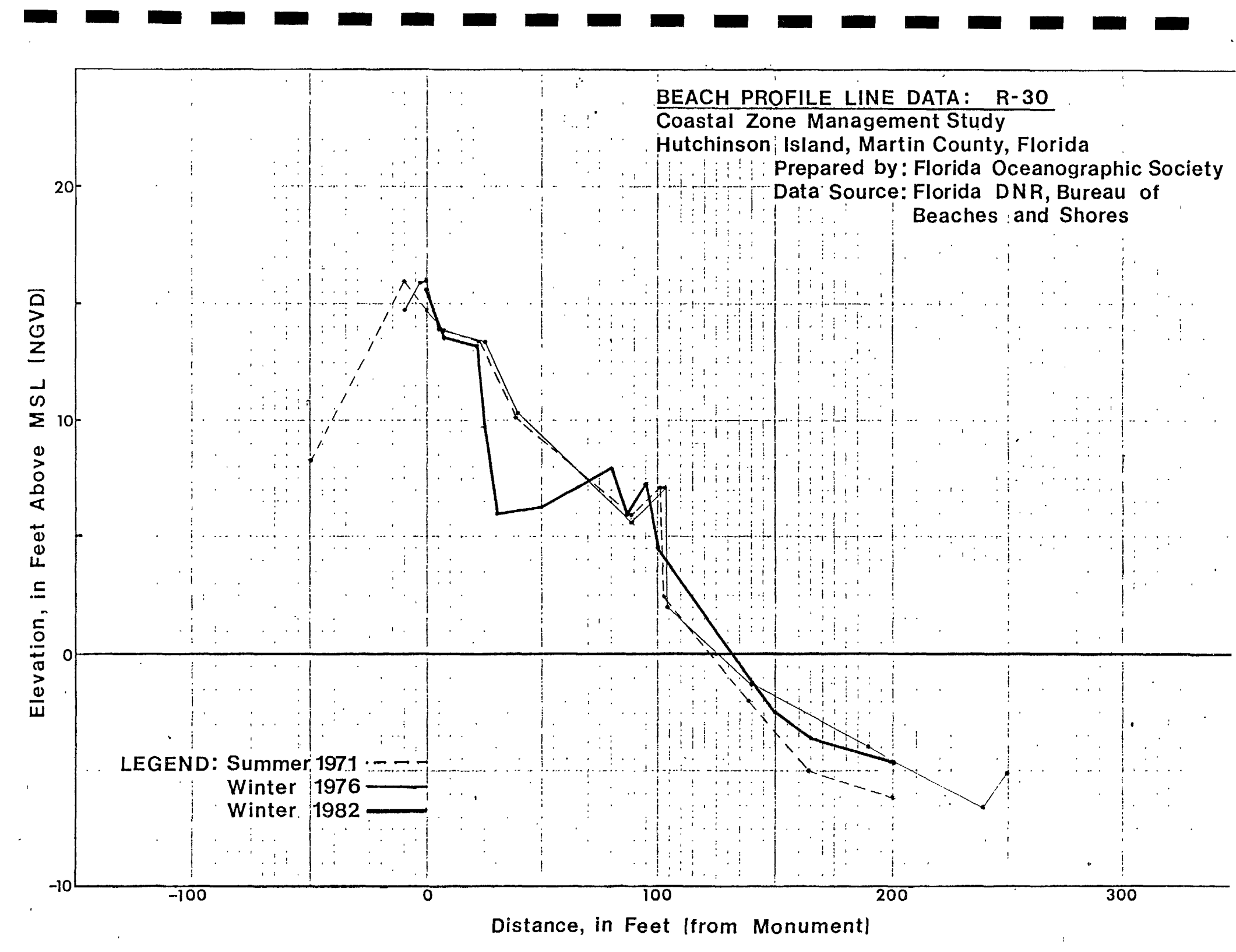
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
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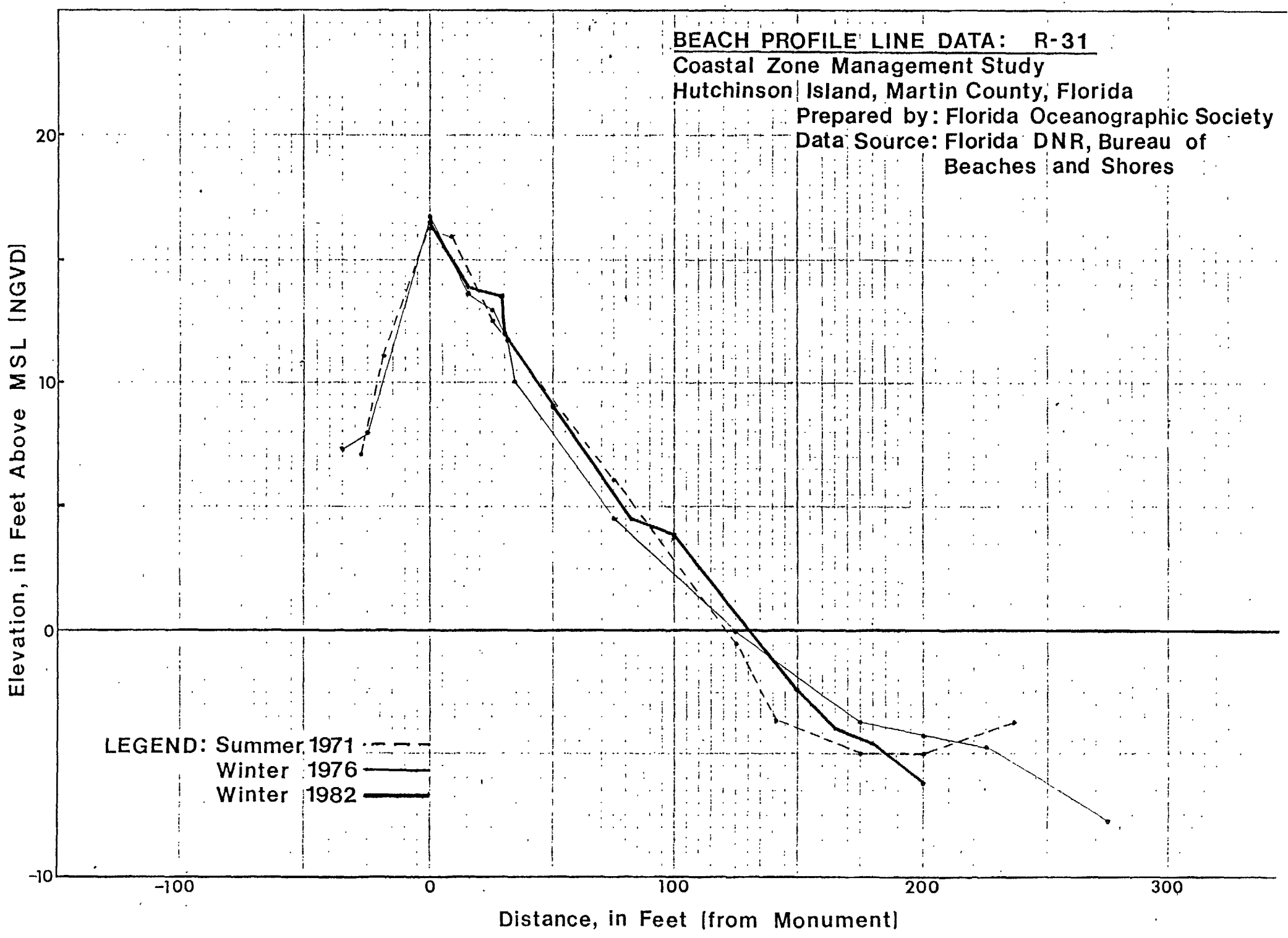
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL [NGVD]
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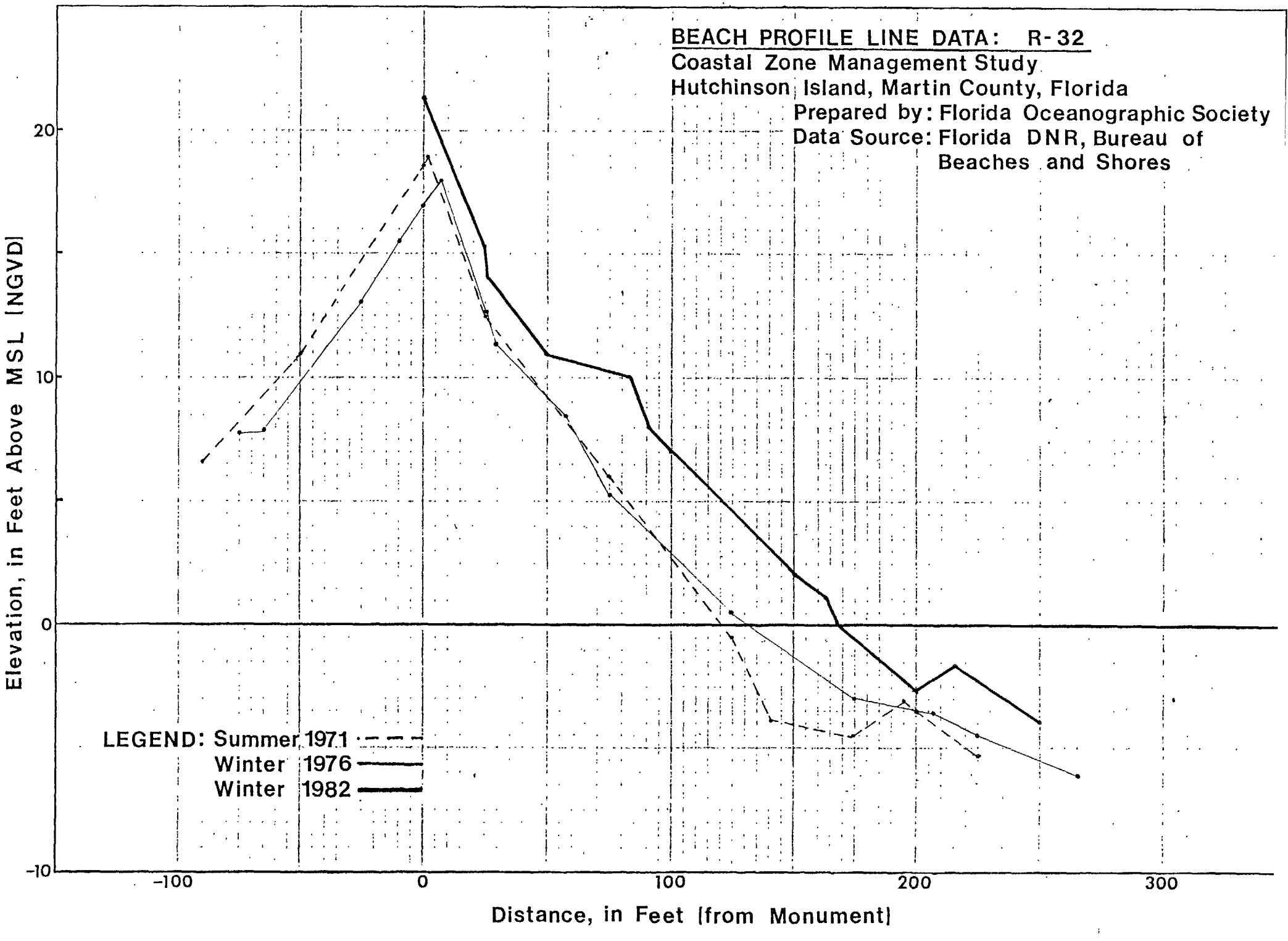
Distance, in Feet [from Monument]
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL [NGVD]
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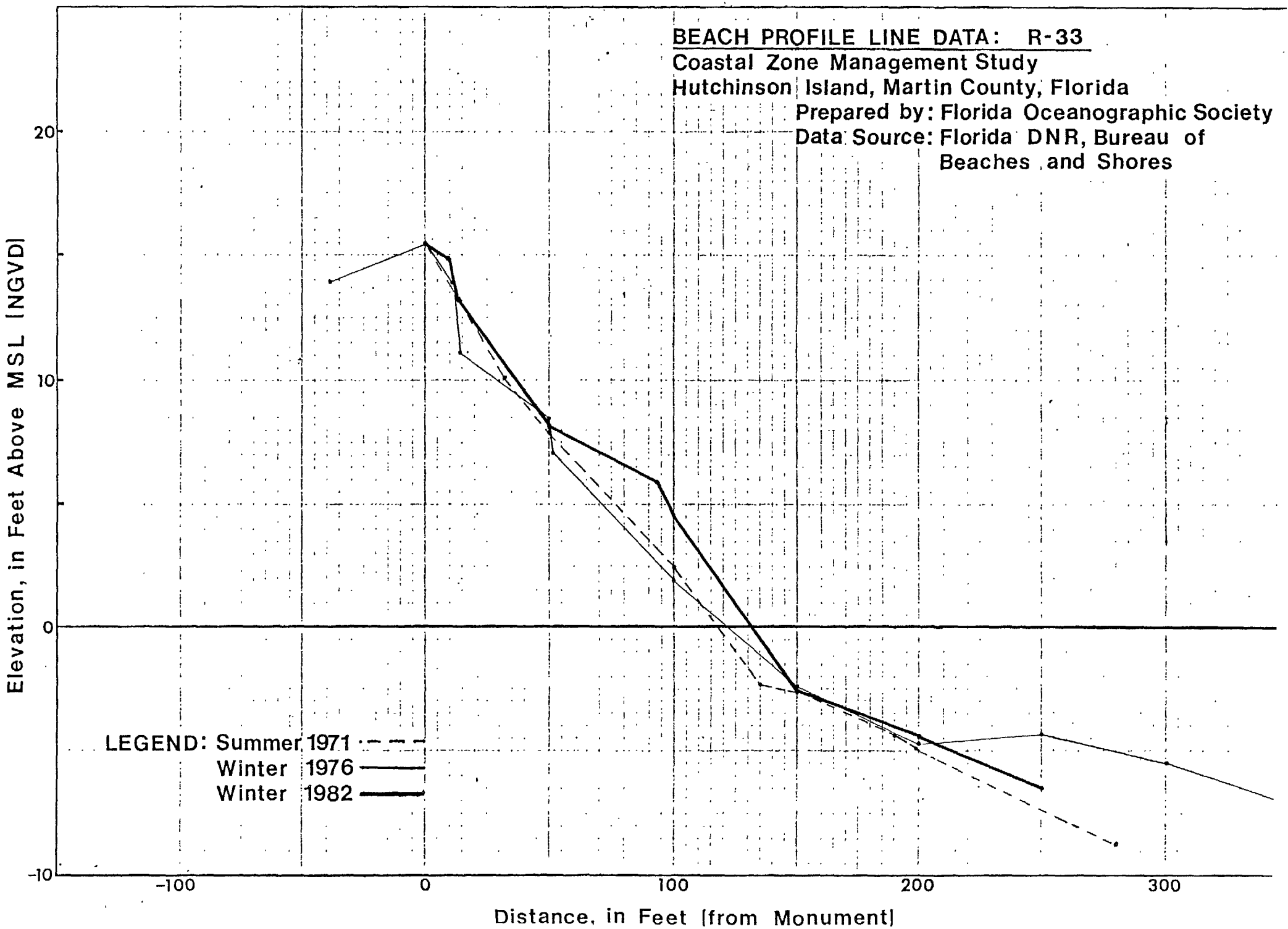
Distance, in Feet [from Monument]
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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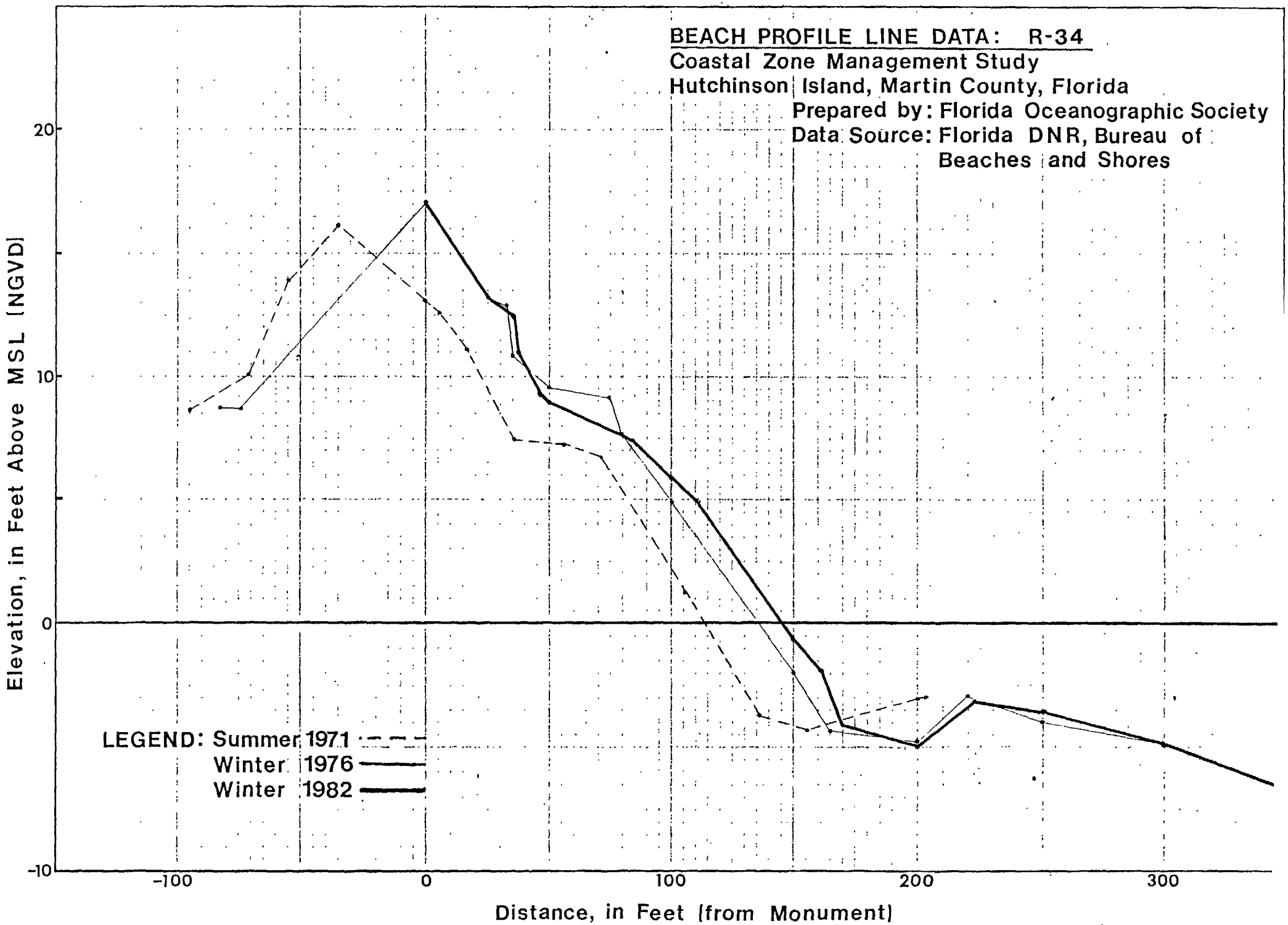
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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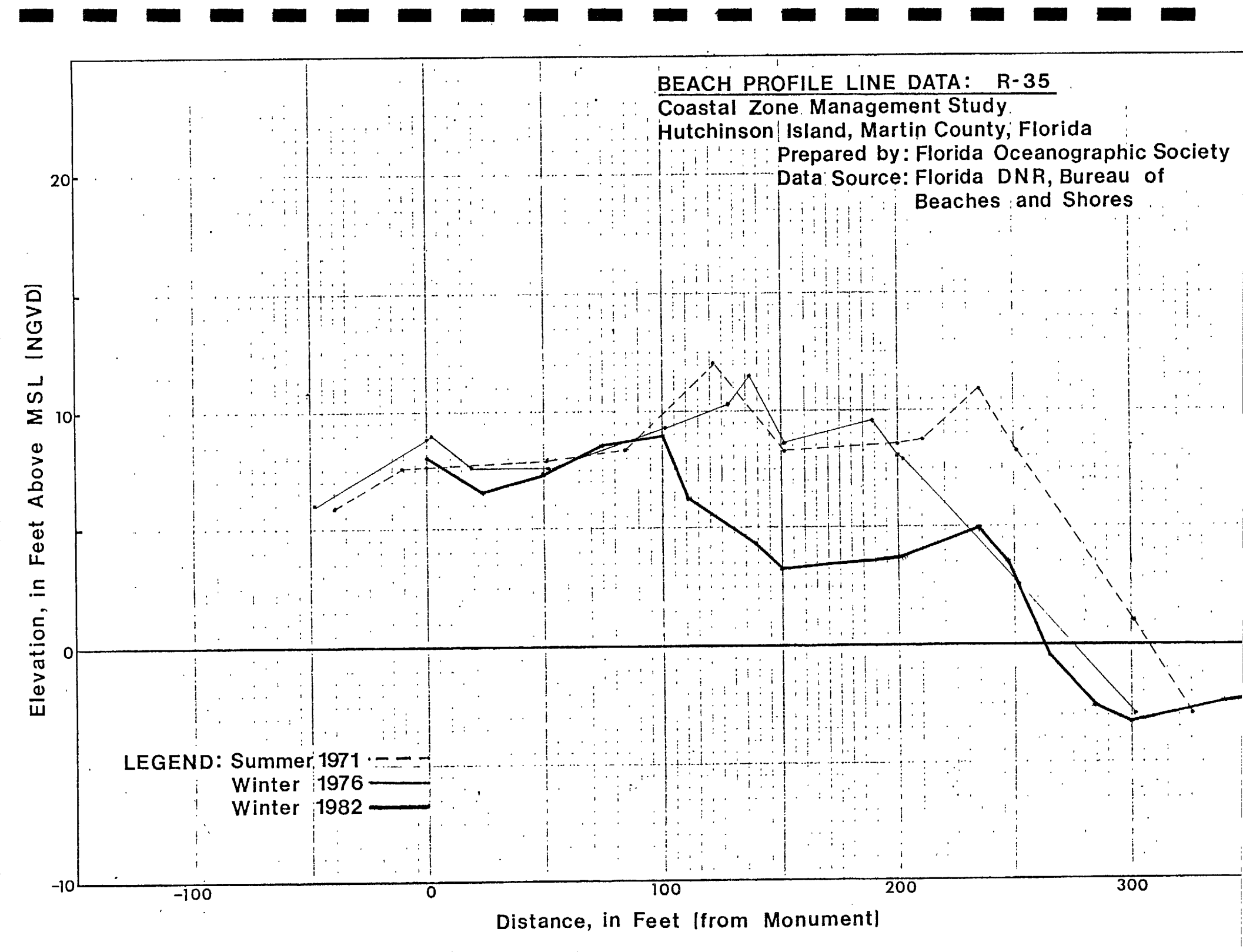
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL [NGVD]
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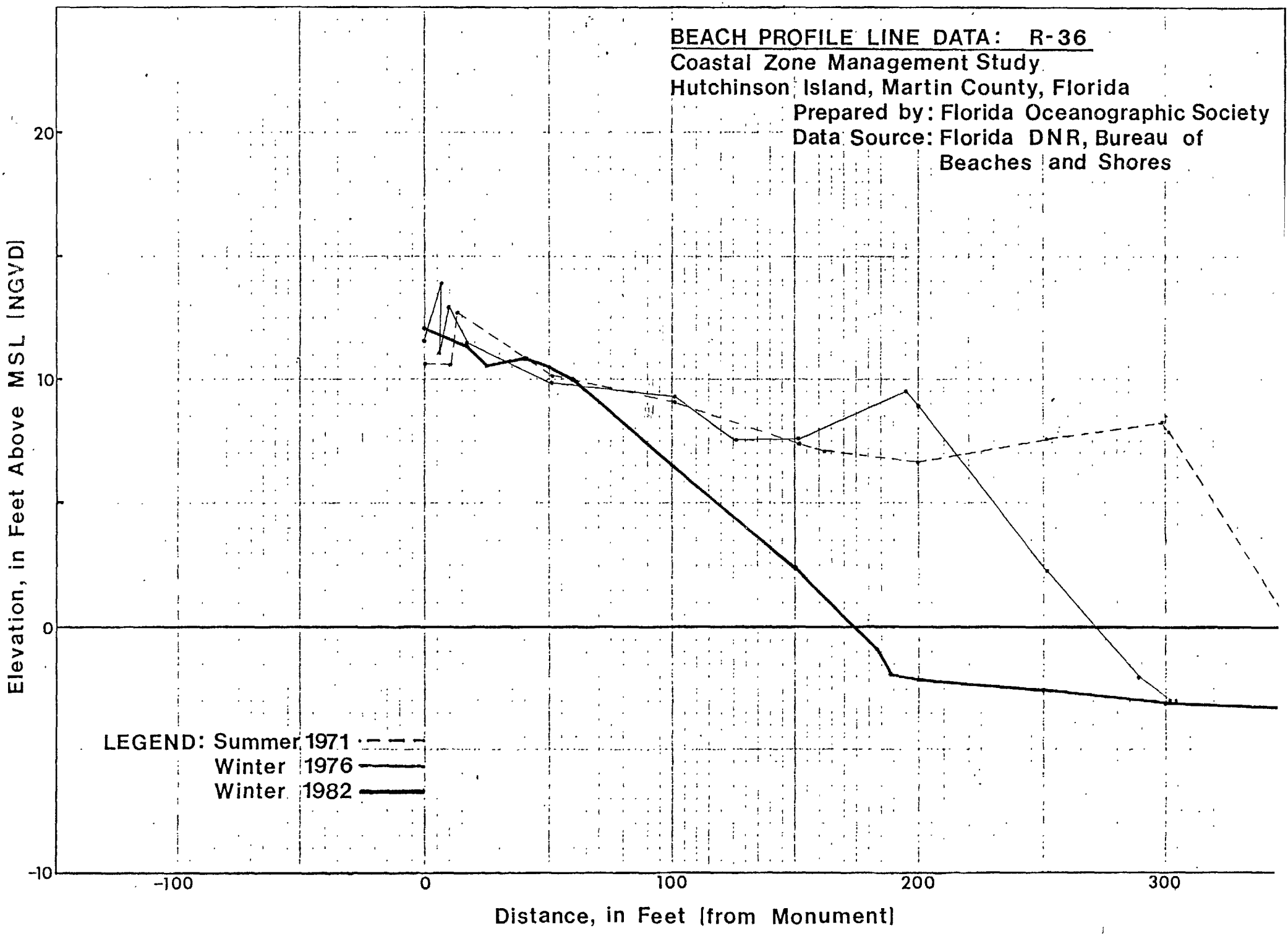
Distance, in Feet [from Monument]
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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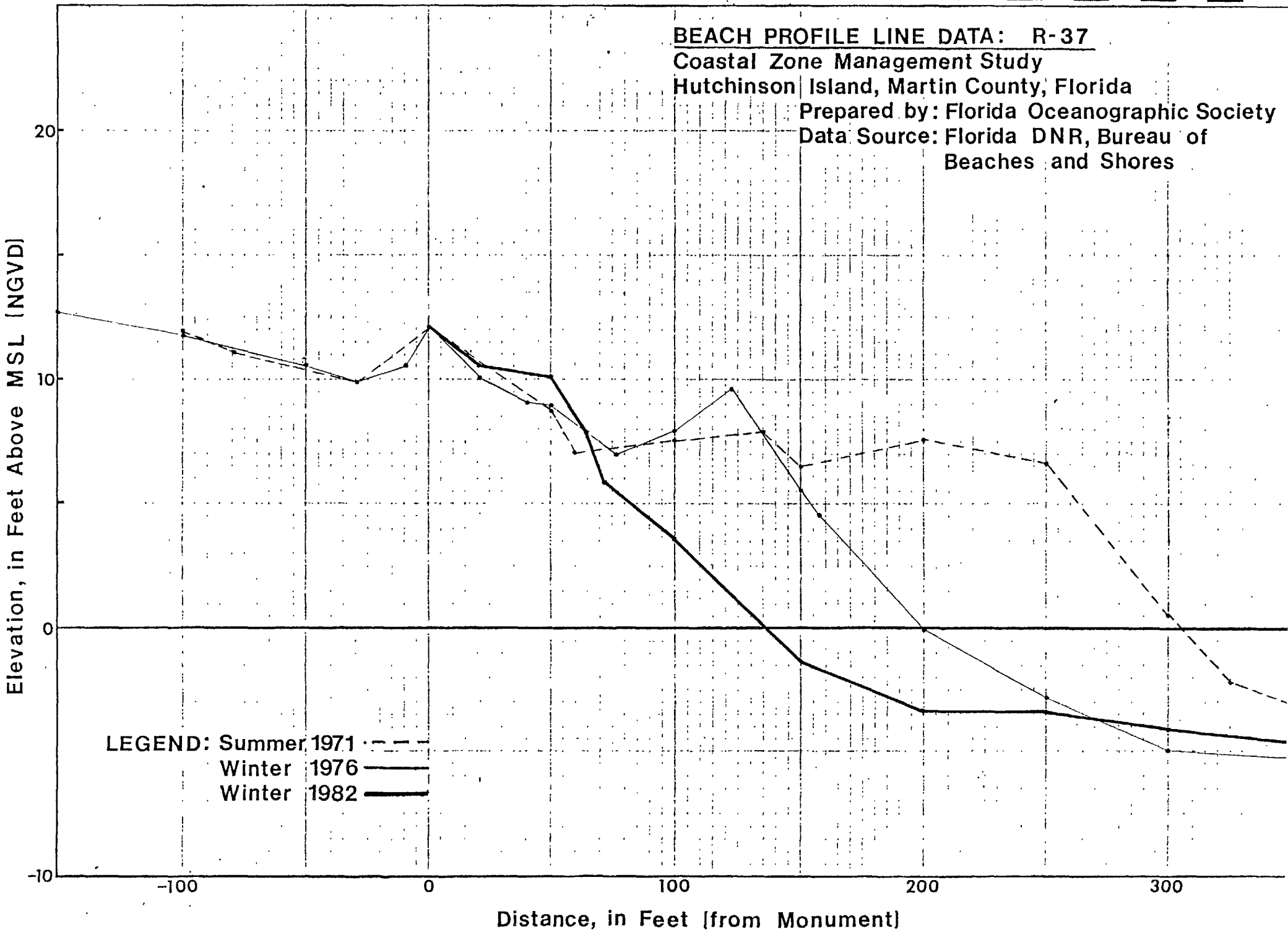
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
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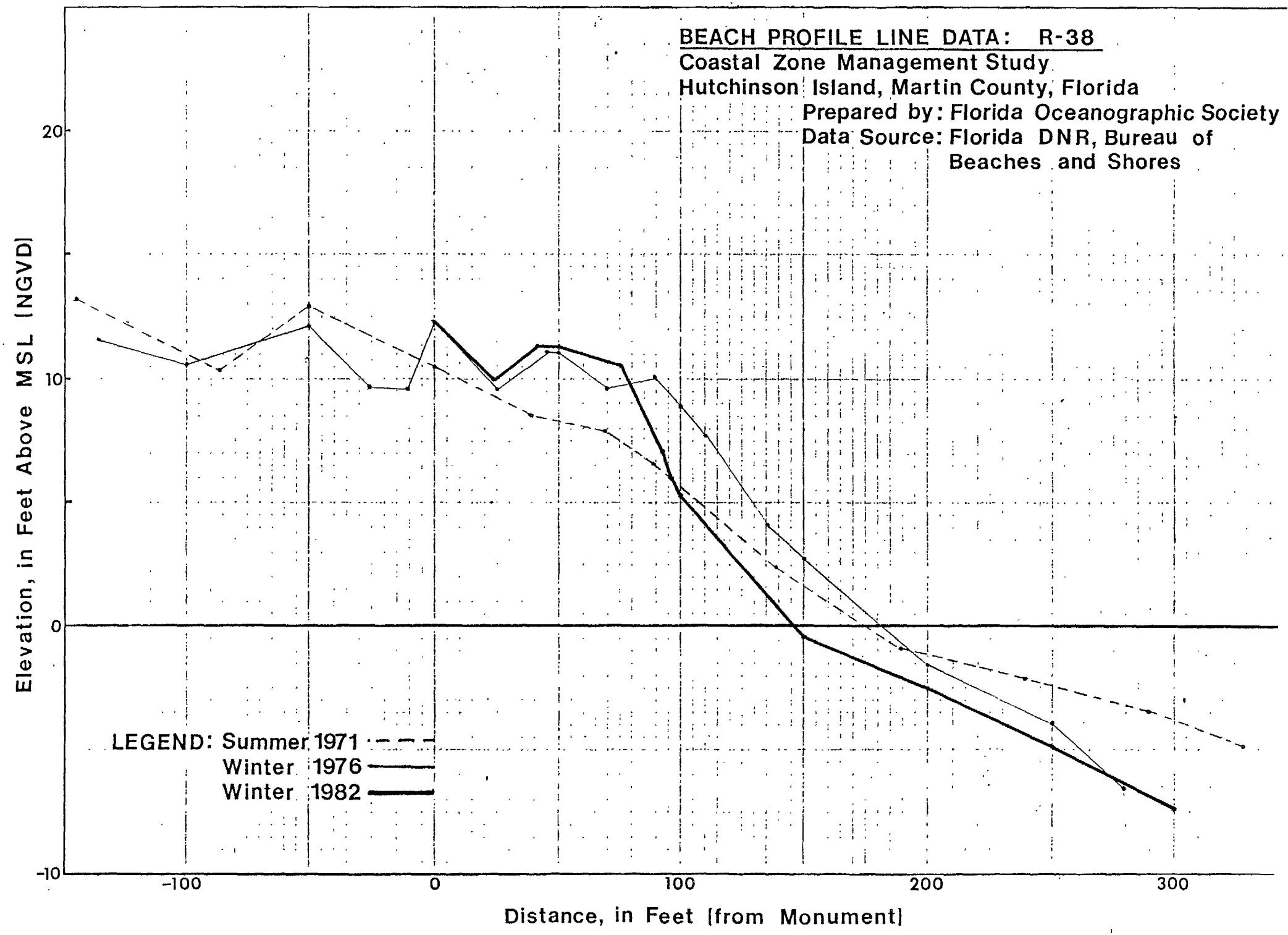
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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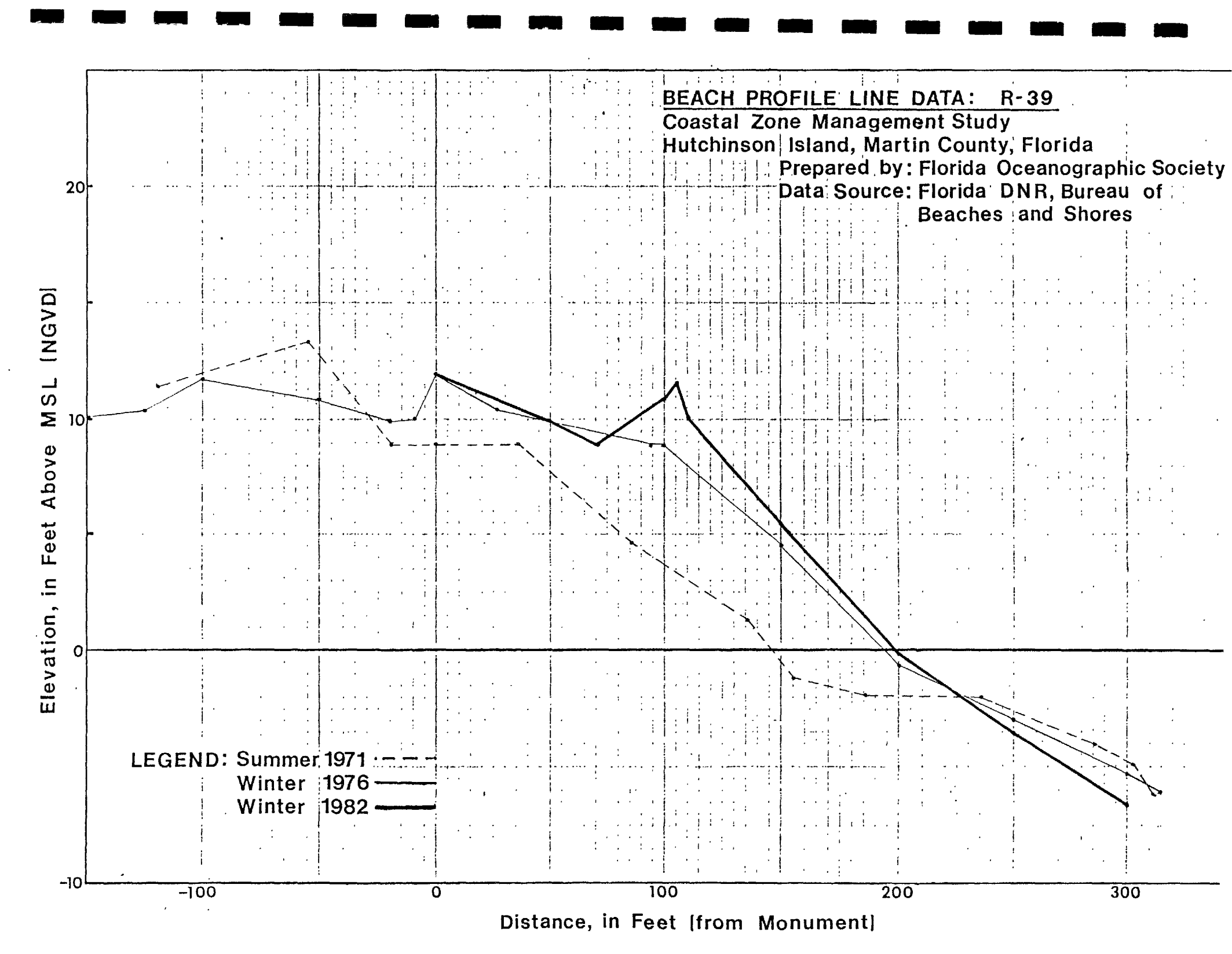
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL [NGVD]
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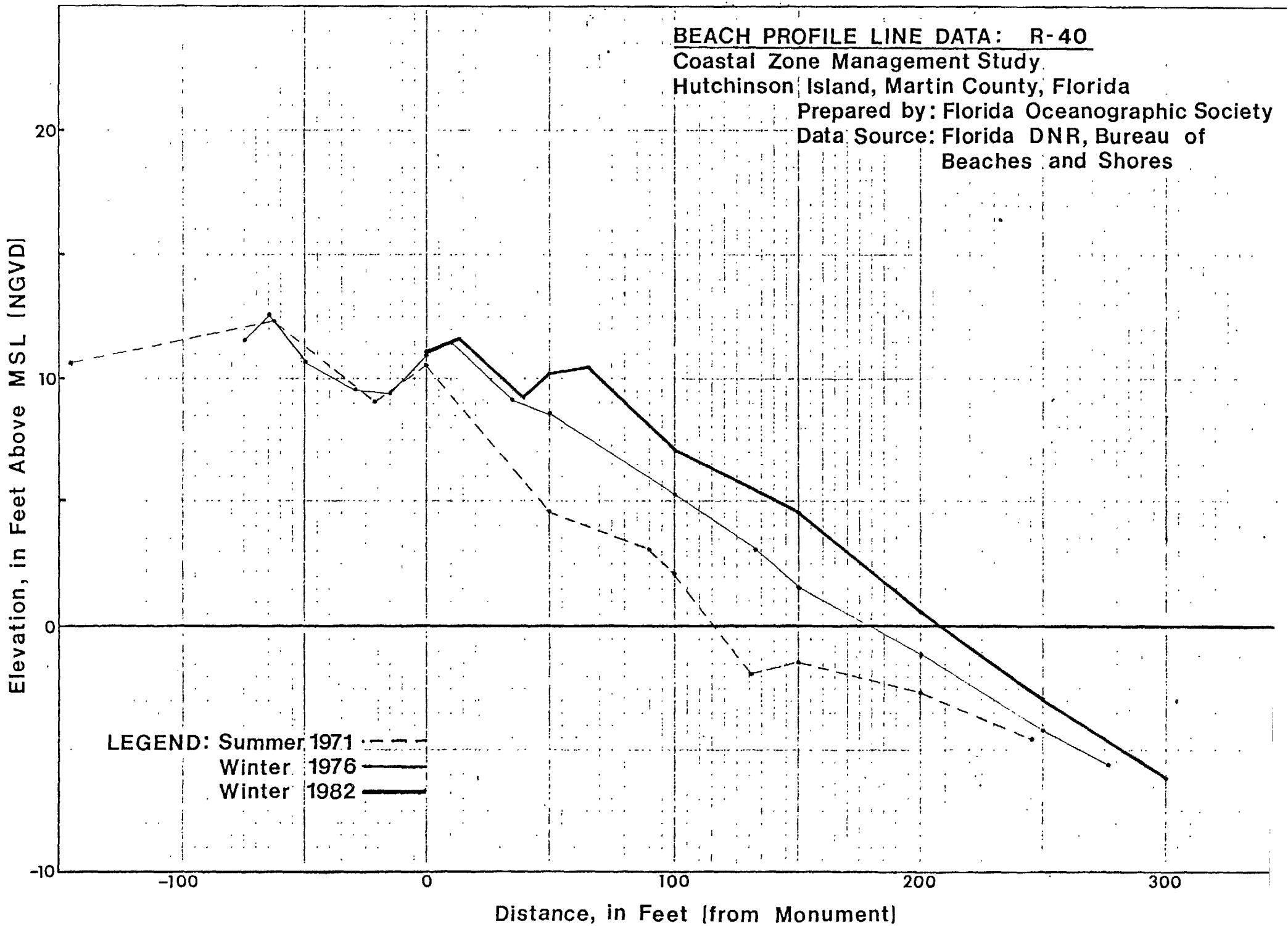
Distance, in Feet [from Monument]
LEGEND: Summer 1971
Winter 1976
Winter 1982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Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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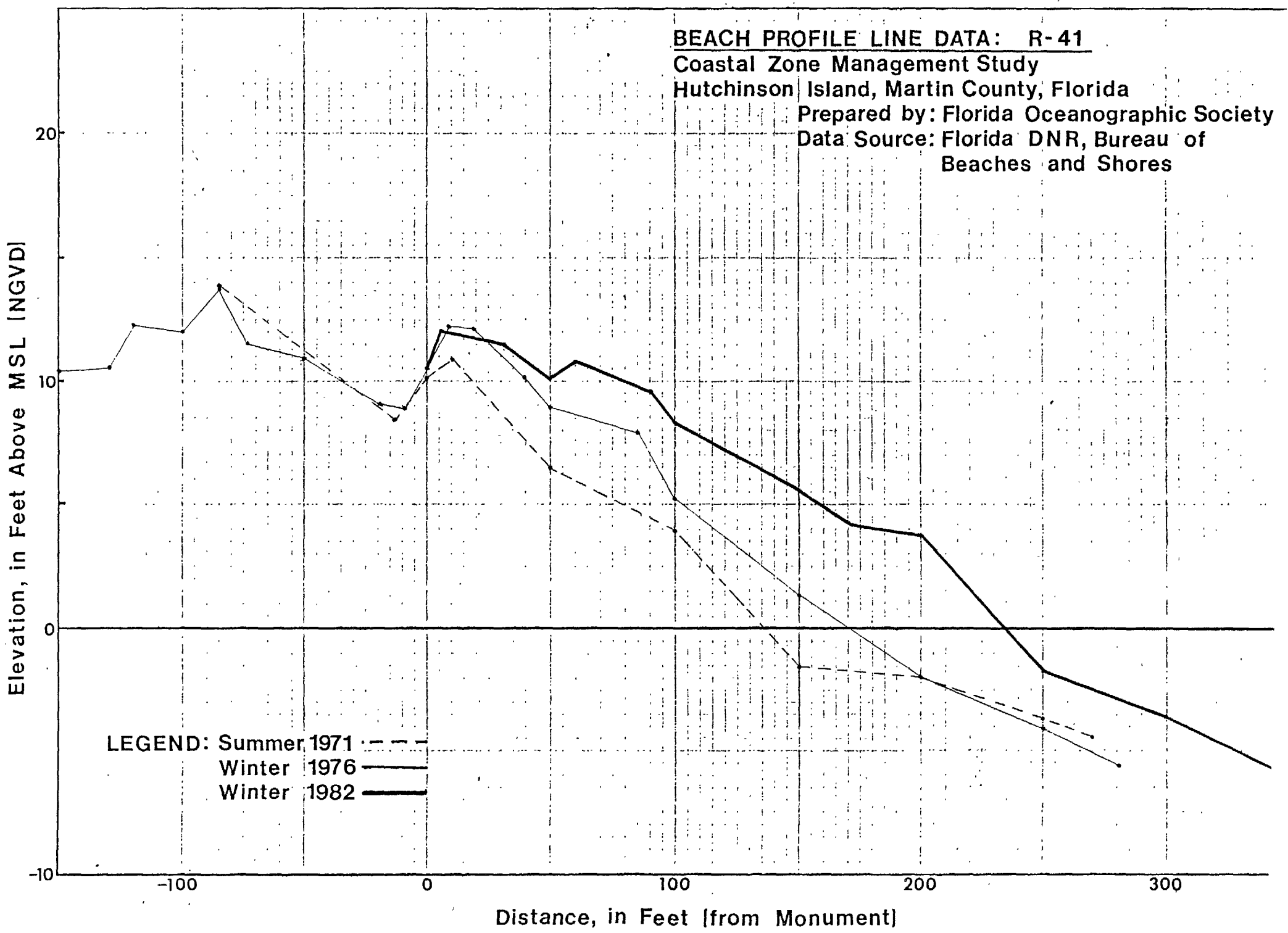
Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL [NGVD]
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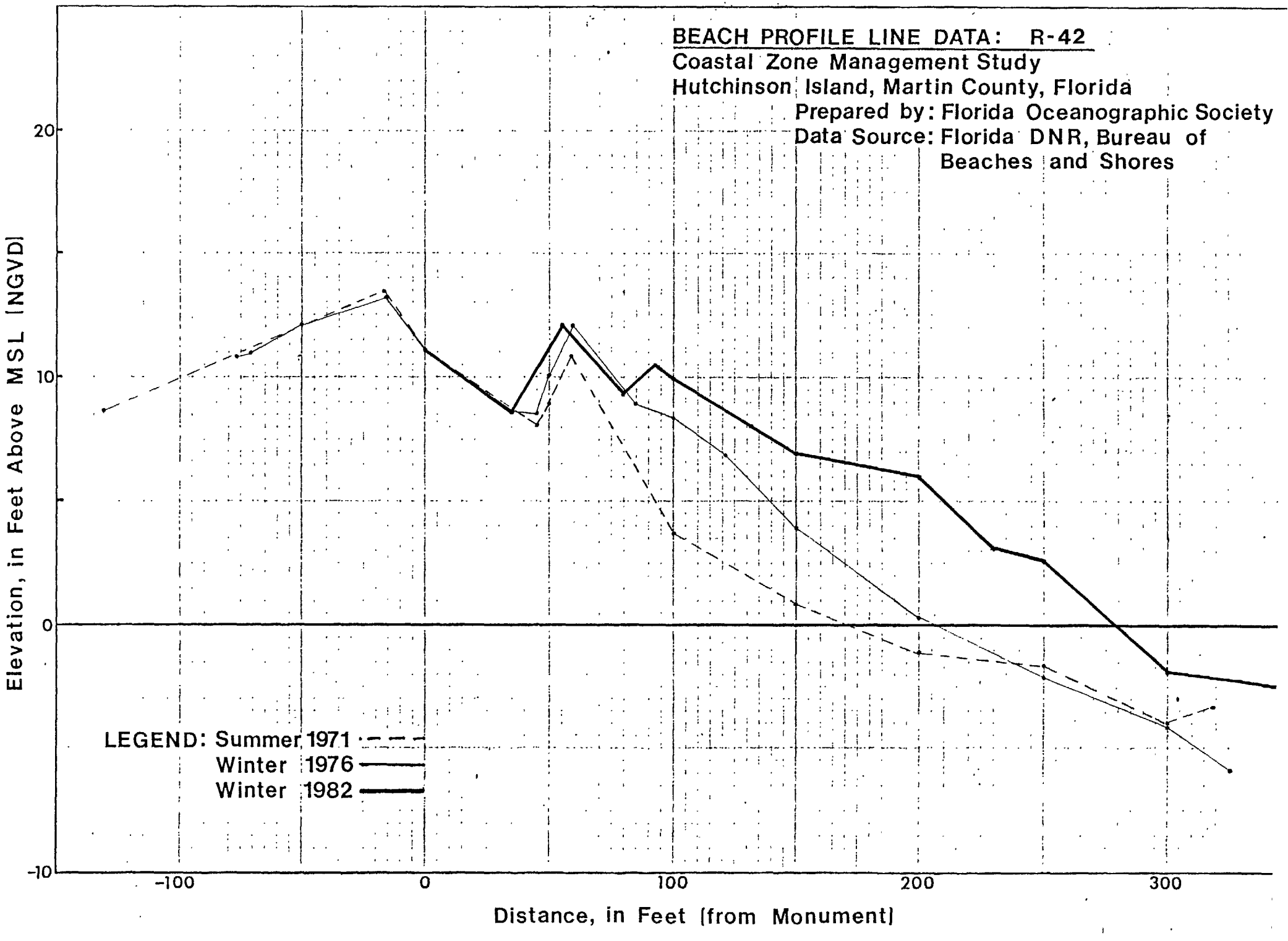
Distance, in Feet [from Monument]
LEGEND: Summer 1971
Winter 1976
Winter 1982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Coastal Zone Management Study
Hutchinson Island, Martin County, Florida
Prepared by: Florida Oceanographic Society
Data Source: Florida DNR, Bureau of Beaches and Shores
Elevation, in Feet Above MSL (NGVD)
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Distance, in Feet (from Monument)
LEGEND: Summer 1971
Winter 1976
Winter 1982

APPENDIX C

COASTAL CONSTRUCTION SETBACK LINE CRITERIA

Florida D.N.R. - February 1972

In making the analysis for the setback line the objectives are to prevent beach encroachment that would further endanger existing structures and to prevent structures from being unreasonable subjected to great or irreparable damage.

In the analysis, the following criteria were all taken into consideration in determing the setback line position:

1. The 20-year frequency storm surge of 4.2 feet (MSL), 2.0 feet wave setup, and 1.8 feet (MSL) spring tide were used in the determination of a still water level of 8.0 feet. (MSL) under storm conditions.

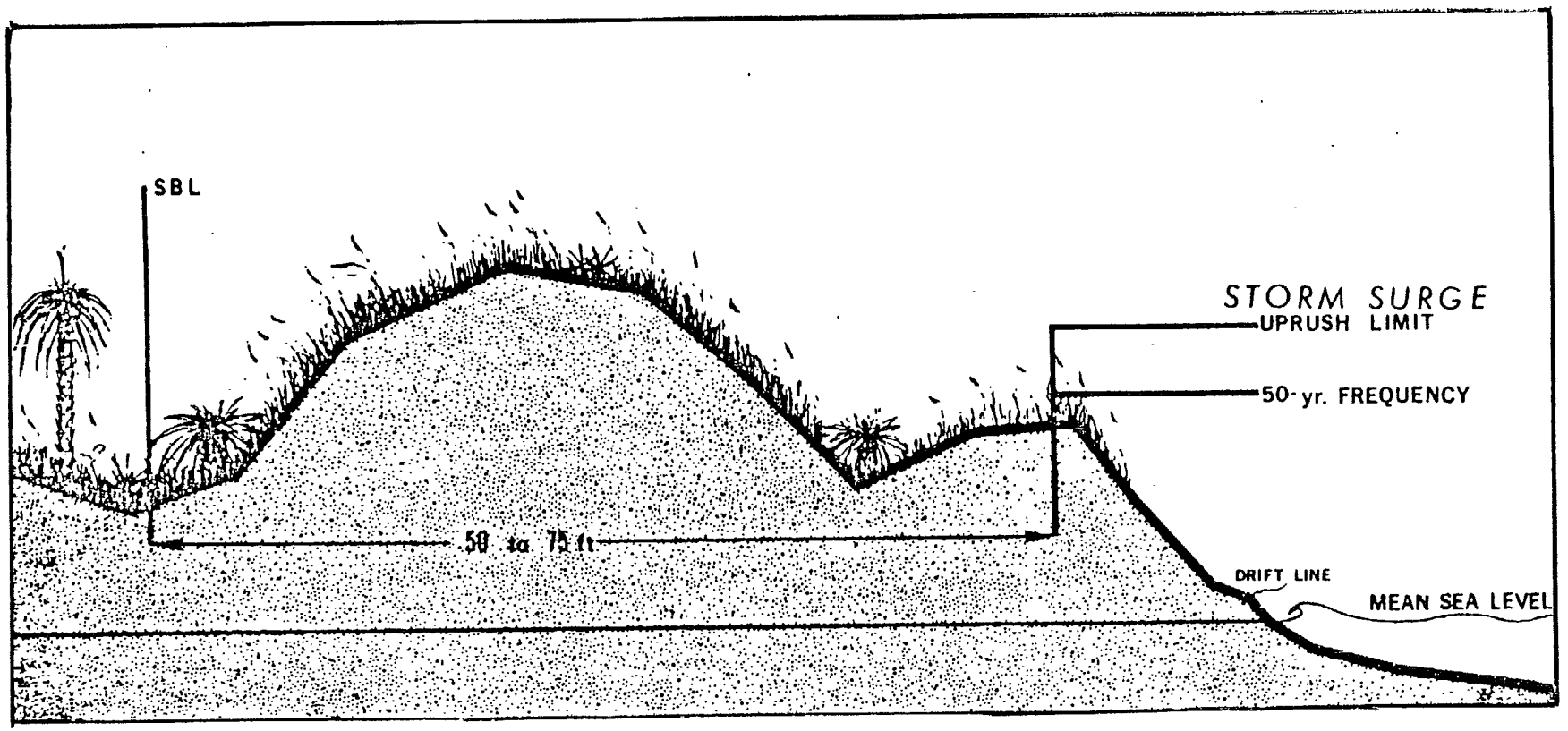
2. A wind wave of 6.5 feet in height and 8.0 second in period was chosen for computing the uprush by composite slope method[1] under the storm condition on each of the profiles. This yields the information about how far landward the uprush will reach.

3. Historial data (including erosion rates), and information gathered from field inspections are utilized to adjust the computed distances to a final suitable SBL.

In short, the SBL analysis considers two groups of factors: the topographic factors which include dune elevation, foreshore slope, offshore slope, beach width, adjacent profiles, and vegetation bluff line; and the dynamic factors which include storm surge elevation, erosion rates, wave uprush, tides, and short term fluctuations of the beach profiles.

1 "Wave Run-up on Composite Slopes", by T. Saville, Jr., Proc of the 6th Conference on Coastal Engineering, Council of Wave Research, Univ. of Calif. 1958.

Beach profile indicating acceptable position of construction setback line.



SBL-The setback line suggested should be in the swale behind the high second dune ridge, which would not be topped by storm surge.

The for dune profile shows the calculated height of storm surge in a northeastern coastal area.

The front Pioneer dune would be topped and destroyed probably within a 50-year period.

(Collier et.al., Feb. 1977)

APPENDIX D

FISH AND WILDLIFE ASSOCIATED WITH HUTCHINSON ISLAND

A comprehensive and complete inventory of all animals associated with Hutchinson Island would be a nearly impossible task and is not the effort of this table or section.

Listings presented for some groups of inver-ebrates are not representative of actual inventory as there are numerous species within these groups that were not able to be keyed out due to time constraints. Species listed for Fish, Reptiles, Birds and Mammals were either observed or keyed from recent surveys, inventories or listings. (See references for this table).

Designations preceeding some species indicates Threatened or Endangered Species - Federally listed (F) or State listed (S).

Four habitat areas of Hutchinson Island are used to indicate where animals were observed or most likely inhabit during a portion of their life cycle:

Open Ocean and Seashore (OS)
Scrub and Forest Areas (SF)
Ponds, Lakes and Developed Areas (PD)
Mangrove Marsh/Wetlands and Lagoon (ML)

(See Plate V "Major Plant Communities, Fish and Wildlife")

	OS	SF	PD	ML
Invertebrates				
Phylum Protozoa- (Microscopic, one-celled animals, plankton, amoebas, etc.)	X		X	X
Phylum Porifera (Sponges)	X			X
Phylum Coelentera (Hydroids, jellyfish, sea anemones)	X			X
Phylum Ctenophora (Comb-jellies)	X			X
Phylums Platyhelmia (Flatworms) Nemertea (Roundworms, Threadworms) Trechelmia (Rotifers) and Annulata (segmented or ringedworms)	X			X
Phylum Arthopoda				
Crustaceans				
Barnacles-(Balanus spp.)	X			X
Sandflea-(Emerita talpoida)	X			X
Shrimp-(Penaeus spp.)	X			X
Spiny lobster-(Panulirus argus)	X			X
Blue Crab-(Callinectes sapidus)	X			X
Hermit Crab-(Pagurus spp.)	X			X
Arachnids (spiders)		X	X	
(horseshoe crab)	X			X
Insects	X	X	X	X

	OS	SF	PD	ML
Phylum Mollusca (snails, bivalves, octopuses, squid, etc.)	X			X
Phylum Echinoderma (seastars, sea urchins, starfish, sea-cucumber)	X			X
Vertebrates				
Phylus Chordata				
Fishes				
Nurse shark - (Ginglymostoma cirratum)	X			
Sand tiger - (Odontaspis taurus)	X			
Finetooth shark - (Carcharhinus isodon)	X			
Blacknose shark - (C. acronotus)	X			
Spinner shark - (C. brevipinna	X			
Bull shark - (C. leucas)	X			X
Blacktip shark -(C. limbatus)	X			
Dusky shark - (C. obscurus)	X			
Sandbar shark - (C. plumbeus)	X			
Tiger shark - (Galeocerdo curvieri)	X			
Smooth dogfish-(Mustelus canis)	X			
Lemon shark -(Negaprion brevirostris)	X			X
Atlantic sharpnose shark -(Rhizopriondon terraenovae)	X			
Scalloped hammerhead-(Sphyran lewini)	X			
Great hammerhead-(S. mokarran)	X			
Bonnethead -(S. tiburo)	X			X
Spiny dogfish- (Squalis acanthias)	X			
Lesser electric ray - (Narcine brasiliensis)	X			
Clearnose skate - (Raja eglanteria)	X			
Atlantic stingray - (Dasyatidae sabina)				X
Roughtail stingray - (D. centroura)	X			
Spotted eagle ray -(Aetobatus narinari)				X
Bullnose ray - (Myliobatis freminvillei)	X			
Atlantic manta - (Manta birostris)	X			
Devil ray - (Mobula hypostoma)	X			
Atlantic sturgeon -(Acipenser oxyrhynchus)	X			
Longnose gar -(Lepisosteus osseus)				X
Ladyfish -(Elops saurus)	X			X
Tarpon - (Tarpon atlanticus)	X			X
Bonefish - (Albula vulpes)				X
Green moray -(Lycodontis funebris)	X			
Spotted moray -(L. moringa)	X			
Speckled worm eel-(Myrophis punctatus)				X
Yellowfin menhaden, bunker,pogy -(Brevoortia smithi)				X
Atlantic menhaden,bunker,pogy-(B.tyrannus)				X
Bunker, pogy-(B.smithi x B.tyrannus)				X
Gizzard shad - (Dorosoma cepedianum)				X
Scaled sardine-(Harengula jaguana)	X			X
Atlantic thread herring-(Opisthonema oglinum)	X			X
Spanish sardine-(Sardinella aurita)	X			X

	OS	SF	PD	ML
Cuban anchovy - (Anchoa cubana)	X			X
Striped anchovy- (A. hepsetus)	X			X
Bigeye anchovy - (A. lamprotaenia)	X			X
Dusky anchovy - (A. lyolepis)	X			X
Bay anchovy - (A. mitchilli)	X			X
Silver anchovy - (Engraulidae eurystole)	X			
Inshore lizardfish-(Synodus foetens)	X			X
Snakefish-(Trachinocephalus myops)	X			
Sea catfish - (Ariopsis felis)	X			X
Gafftopsail catfish -(Bagre marinus)	X			X
Oyster toadfish - (Opsanus tau)				X
Skilletfish-(Gobiesox strumosus)	X			X
Sargassumfish - (Histrio histrio)				X
Splitlure frogfish-(Phrynelox scaber)				X
Key brotula - (Ogilbia cayorum)				X
Atlantic flyingfish-(Cypselurus heterurus)				X
Halfbeak - (Hyporhamphus unifasciatus)	X			X
Halfbeak - (Hyporhamphus sp.)	X			X
Bob's halfbeak- (H. roberti)				X
Redfin needlefish - (Strongylura notata)				X
Timucu - (S. timucu)				X
Agujon - (Tylosurus acus)				X
Houndfish - (Tylosurus crocodilus)				X
Sheepshead minnow-(Cyprinodon variegatus)				X
Goldspotted killifish-(Floridichthys carpio)				X
Marsh killifish - (Fundulus confluentus)				X
Gulf killifish - (F. grandis)				X
Longnose killifish - (F. similis)	X			X
Rainwater killifish-(Lucania parva)				X
Mosquitofish -(Gambusia affinis)				X
Sailfin molly - (Poecilia latipinna)				X
Rough silverside-(Membras martinica)	X			X
Tidewater silverside-(Menidia beryllina)				X
Penninsula silverside-(M. peninsulae)	X			X
Lined seahorse-(Hippocampus erectus)				X
Dwarf seahorse - (H. zosterae)				X
Opossum pipefish -(Oostethus brachyurus)				X
Dusky pipefish - (Syngnathus floridae)				X
Chain pipefish- (S. louisianae)				X
Gulf pipefish - (S. scovelli)	X			X
Barbfish -(Scorpaena brasiliensis)				X
Plumed scorpionfish-(S.grandicornis)				X
Spotted scorpionfish-(S. plumieri)	X			X
Tarpon snook - (Centropomus pectinatus)				X
Snook - (C. undecimalis)				X
Rock sea bass-(Centropristis philadelphica)				X
Black sea bass- (C. striata)	X			X
Sand perch -(Diplectrum formosum)				X

	OS	SF	PD	ML
Jewfish - (Epinephelus itajara)	X			X
Red grouper- (E. morio)	X			X
Warsaw grouper -(E. nigritus)				X
Nassau grouper- (E. striatus)				X
Butter hamlet - (Hypoplectrus unicolor)				X
Black grouper - (Mycteroperca bonaci)				X
Grey grouper - (M. microlepis)	X			X
Scamp - (M. phenax)				X
Belted sandfish -(Serranus subligarius)	X			X
Whitespotted soapfish-(Rypticus maculatus)	X			X
Bluegill - (Lepomis macrochirus)				X
Largemouth bass-(Micropterus salmoides)				X
Barred cardinalfish-(Apogon binotatus)	X			
Flamefish- (A. maculatus)	X			
Twospot cardinalfish-(A. pseudomaculatus)	X			
Blackfin cardinalfish -(A.puncticulatus)				X
Conchfish - (A. stellatus)				X
Freckled cardinalfish-(Phacoptyx conklini)				X
Bluefish - (Pomatomus saltator)	X			X
Yellow jack-(Caranx bartholomaei)	X			
Blue runner - (C. crysos)	X			
Crevalle jack - (C. hippos)	X			X
Horsey-eye jack-(C. latus)	X			X
Bar jack - (S. ruber)	X			
Atlantic bumper-(Chloroscombrus chrysurus)	X			X
Round scad - (Decapterus punctatus)	X			
Leatherjacket -(Oligoplites saurus)	X			X
Atlantic moonfish-(Selene setapinnis)	X			X
Lookdown - (S. vomer)	X			X
Greater amberjack-(Seriola dumerili)	X			
Florida pompano -(Trachinotus carolinus)	X			X
Permit - (T. falcatus)	X			X
Palometa - (T. goodei)	X			
Dolphin - (Coryphaena hippurus)	X			
Mutton snapper-(Lutjanus analis)	X			X
Schoolmaster - (L. apodus)	X			X
Cubera snapper - (L. cyanopterus)				X
Gray snapper - (L. griseus)	X			X
Dog snapper - (L. jocu)	X			X
Mahogany snapper - (L. mahogoni)	X			
Lane snapper - (L. synagris)	X			X
Yellowtail snapper- (Ocyurus chrysurus)	X			X
Tripletale - (Lobotes surinamensis)				X
Irish pompano,sand perch - (Diapterus auratus)				X
Striped mojarra, goatfish-(Eugerres plumieri)				X
Spotfin mojarra-(Eucinostomus argenteus)	X			X
Silver jenny - (E. gula)	X			X
Flagfin mojarra -(E. melanopterus)				X

	OS	SF	PD	ML
Yellowfin mojarra-(Gerres cinereus)	X			X
Black margate -(Anisotremus surinamensis)	X			
Porkfish - (A. virginicus)	X			X
Tomtate - (Haemulon aurolineatum)	X			X
Caesar Grunt - (H. carbonarium)	X			
Smallmouth grunt -(H. chrysargyreum)	X			
French grunt - (H. flavolineatum)	X			
Sailor's choice - (H. parrai)	X			X
White grunt - (H. plumieri)	X			X
Bluestriped grunt- (H. sciurus)				X
Pigfish -(Orthopristis chrysoptera)				X
Sheepshead -(Archosargus probatocephalus)	X			X
Sea bream -(A. rhomboidalis)				X
Grass porgy - (Calamus arctifrons)				X
Jolthead porgy - (C. bajonado)	X			
Silver porgy - (Diplodus argenteus)	X			
Spottail pinfish - (D. holbrooki)	X			X
Pinfish,sailors choice-(Lagodon rhomboides)				X
Scup - (Stenotomus chrysops)				X
Silver perch,yellowtail-(Bairdiella chrysoura)				X
Spotted seatrout-(Cynoscion nebulosus)				X
Silver seatrout-(C. nothus)				X
Weakfish, yellowmouth -(C. regalis)	X			
Spot - (Leiostomus xanthurus)				X
Southern kingfish-(Menticirrhus americanus)	X			
Gulf kingfish - (M. littoralis)	X			
Northern kingfish - (M. saxatilis)	X			
Atlantic croaker -(Micropogonias undulatus)	X			
Reef croaker - (Odontoscion dentex)	X			
High hat - (Pareques acuminatus)	X			
Cubbyu - (P. umbrosus)	X			
Black drum - (Pogonias cromis)				X
Red drum, channel bass, redfish-(Sciaenops ocellata)	X			X
Sand drum - (Umbrina coroides)	X			
Spotted goatfish -(Pseudupeneus maculatus)	X			X
Glassy sweeper -(Pempheris schomburgki)	X			
Yellow chub -(Kyphosus incisor)	X			
Bermuda chub - (K. sectatrix)	X			
Atlantic spadefish-(Chaetodipterus faber)	X			X
Blue angelfish-(Holacanthus isabelita)	X			
Gray angelfish- (Pomacanthus arcautus)	X			
Sergeant major - (Abudefduf saxatilis)	X			
Night sergeant - (A. taurus)	X			
Dusky damselfish - (Pomacentrus dorsopunicans)	X			
Cocoa damselfish - (P. variabilis)	X			
Dwarf wrasse -(Doratonotus megalepis)	X			X

	OS	SF	PD	ML
Slippery dick -(Halichoeres bivittata)	X			X
Clown wrasse - (H. maculipinna)	X			X
Blackear wrasse - (H. poeyi)	X			
Puddingwife - (H. radiatus)	X			
Hogfish, hog snapper - (Lachnolaimus maximus)				X
Bluehead - (Thalassoma bifasciatum)	X			
Bluelip parrotfish-(Cryptotomus roseus)				X
Emerald parrotfish-(Nicholsina usta)				X
Midnight parrotfish-(Scarus coelestinus)	X			
Rainbow parrotfish-(S. guacamaia)	X			
Redtail parrotfish -(Sparisoma chrysopterum)	X			X
Redfin parrotfish- (S. rubripinne)	X			X
Striped mullet, black mullet-(Mugil cephalus)	X			X
White mullet- (M. curema)	X			X
Great barracuda-(Sphyraena barracuda)	X			X
Northern sennet - (S. borealis)				X
Guaguanche - (S. guachancho)	X			
Bigeye stargazer-(Dactyloscopus crossotus)	X			
Southern stargazer-(Astroscopus y-graecum)	X			
Palehead blenny - (Labrisomus gobio)	X			
Hairy blenny - (L. nuchipinnis)	X			
Rosy blenny- (Malacoctenus macropus)	X			
Saddle blenny -(M. triangulatus)	X			X
Checkered blenny-(Starksia ocellata)	X			
Striped blenny-(Chasmodes bosquianus)				X
Florida blenny - (C. saburrae)				X
Oyster blenny - (Hypleurochilus aequipinnis)				X
Highfin blenny-(Lupinoblennius nicholsi)				X
Seaweed blenny-(Parablennius marmoreus)				X
Molly miller - (Scartella cristata)	X			
Spinycheek sleeper-(Eleotris pisonis)				X
Emerald sleeper-(Erotelis smaragdus)	X			X
Notchtongue goby-(Bathgobius curacao)				X
Frillfin goby - (B. soporator)				X
Bridled goby -(Coryphopterus glaucofraenum)				X
Darter goby- (Gobionellus boleosoma)				X
Highfin goby-(Gobionellus oceanicus)				X
Emerald goby- (G. smaragdus)				X
Spotfin goby - (G. stigmaturus)				X
Code goby - (G. robustum)				X
Crested goby -(Lophogobius cyprinoides)				X
Clown goby - (Microgobius gulosus)				X
Green goby -(M. thalassinus)				X
Ocean surgeon-(Acanthurus bahianus)	X			X
Doctorfish - (A. chirurgus)	X			X
Blue tang - (A. coeruleus)	X			

		OS	SF	PD	ML
	Atlantic cutlassfish-(Trichiurus lepturus)	X			X
	Little tunny, bonito - (Euthynnus alletteratus)	X			
	King mackerel-(Scomberomorus cavalla)	X			
	Spanish mackerel - (S. maculatus)	X			X
	Spotted whiff - (Citharichthys macrops)				X
	Bay whiff - (C. spilopterus)				X
	Gulf flounder-(Paralichthys albigutta)	X			
	Summer flounder-(P. dentatus)	X			
	Southern flounder-(P. lethostigma)	X			
	Broad flounder-(P. aquamilentus)	X			
	Lined sole - (Achirus lineatus)				X
	Hogchoker -(Trinectes maculatus)				X
	Fringed filefish-(Monacanthus ciliatus)				X
	Planehead filefish-(Stephanolepis hispidus)	X			X
	Buffalo trunkfish - (Lactophrys trigonus)				X
	Smooth trunkfish -(Rhinesomus triqueter)	X			X
	Southern puffer-(Sphoeroides nephelus)				X
	Bandtail puffer - (S. spengleri)				X
	Checkered puffer -(S. testudineus)				X
	Striped burrfish-(Chilomycterus schoepfi)				X
	Amphibian and Reptiles				
(F)	Green sea turtle -(Chelonia mydas)	X			
(F)	Loggerhead sea turtle-(Caretta caretta)	X			
(F)	Hawksbill turtle-(Eretmockelys imbricata)	X			
(F)	Leatherback turtle-(Dermochelys coriacea)	X			
(F)	Eastern indigo snake-(Drymarchon corais)		X		
(F)	American alligator- (Alligator Mississippiensis)			X	X
	Gopher tortoise-(Gopherus polyphemus)		X	X	X
	Five-lined skink-(Eumeces fasciatus)		X	X	X
(S)	Corn snake -(Elaphe guttata)		X	X	X
	Mammals				
(F)	Florida manatee -(Trichechus manatus)				X
	Opossum -(Didelphis marsupialis)		X	X	
	Marsh rabbitt-(Sylvilagus palustris)		X	X	
	Racoon - (Procyon lotor)		X	X	X
	Eastern gray squirrel-(Sciurus carolinensis)		X	X	
	Eastern cottontail-(Sylvilagus floridanus)		X	X	
	Striped skunk - (Mephitis mephitis)		X	X	
	Birds				
	Double-crested comorant-(Phalacrocorax auritus)				X
	Anhinga - (Anhinga anhinga)				X
	Mallard -(Anas platyrhynchos)	X			X

		OS	SF	PD	ML
	Whistling swan -(Olor columbianus)	X			X
	White pelican-(Pelecanus erythrorhynchos)	X			X
(F)	Brown pelican-(Pelecanus occidentalis)	X			X
	Pied-billed grebe-(Podilymbus podiceps)	X			X
	Great egret-(Casmerodius albus)	X		X	X
	Cattle egret-(Bubulcus ibis)	X		X	X
	Wood stork-(Mycteria americana)	X		X	X
	Great white heron-(Ardea herodias occidentalis)	X		X	X
(S)	Roseate Spoonbill-(Ajaia ajaja)	X		X	X
(S)	Louisiana heron -(Egretta tricolor)	X		X	X
(S)	Great blue heron-(Ardea herodias)	X		X	X
(S)	Little blue heron-(Egretta caerulea)	X		X	X
	Green heron- (Butorides striatus)	X		X	X
	White ibis-(Eudocimus albus)	X		X	X
	Glaucous gull-(Larus hyperboreus)	X			
	Herring gull- (Larus argentatus)	X			
	Black-headed gull-(Larus ridibundus)	X			
	Laughing gull-(Larus atricilla)	X			
	Common tern -(Sterna hirundo)	X			
(S)	Least tern-(Sterna albifrons)	X			
(S)	Black skimmer-(Rynchops niger)	X			
	Greater shearwater-(Puffinus gravis)	X			
	Sooty shearwater- (Puffinus griseus)	X			
	Magnificent frigatebird-(Fregata magnificens)	X			
	Dunlin - (Calidris alpina)	X			
	Sanderling - (Calidris alba)	X			
	Black-bellied plover-(Pluvialis squatarola)	X			
	Ruddy turnstone-(Arenaria interpres)	X			
	Least sandpiper - (Calidris minutilla)	X			
	Stilt sandpiper-(Micropalama himantopus)	X			
	Short-billed dowitcher-(Limnodromus griseus)	X			
	Curlew sandpiper-(Calidris ferruginea)	X			
	Snowy plover- (Charadrius alexandrionus)	X			
(S)	American oystercatcher- (Haematopus palliatus)	X			
	King rail -(Rallus elegans)	X			
	Red-shouldered hawk-(Buteo lineatus)	X	X		X
(S)	Osprey-(Pandion haliaetus)	X	X		X
(F)	Peregrine falcon-(Falco peregrinus)	X	X		X
	Doves, quail,swallows,woodpecker	X	X		X
	Turkey vulture-(Cathartes aura)	X	X		X
	Belted kingfisher-(Megacerylea alcyon)		X		X
	Fish crow- (Corvus ossifragus)		X		X

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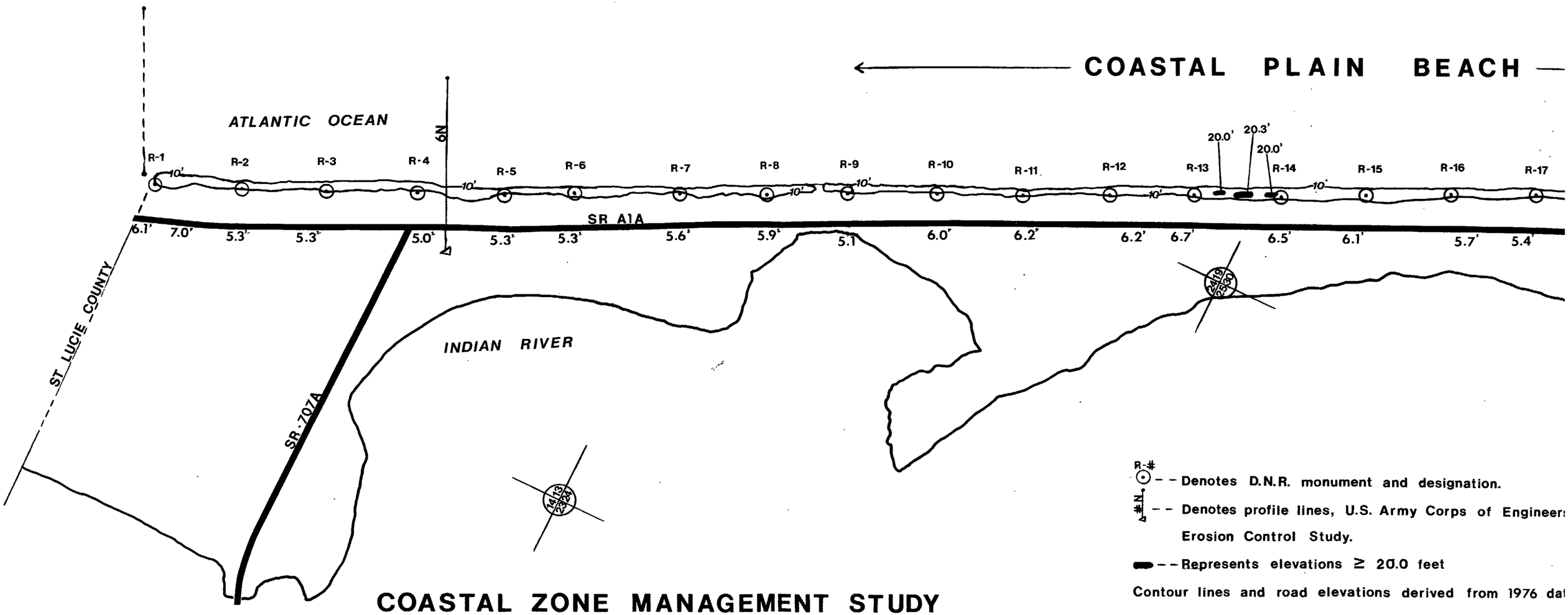
U.S.Dept. of Interior,Fish and Wildlife Service 1980 Atlantic Coast Ecological Inventory - Users Guide-Ft. Pierce Base map.

U. S.Dept. of Interior, Fish and Wildlife Service 1981 Significant Wildlife Resource

PLATES



R-# – – Denotes D.N.R. monument and designation.

4#N – – Denotes profile lines, U.S. Army Corps of Engineers Erosion Control Study.

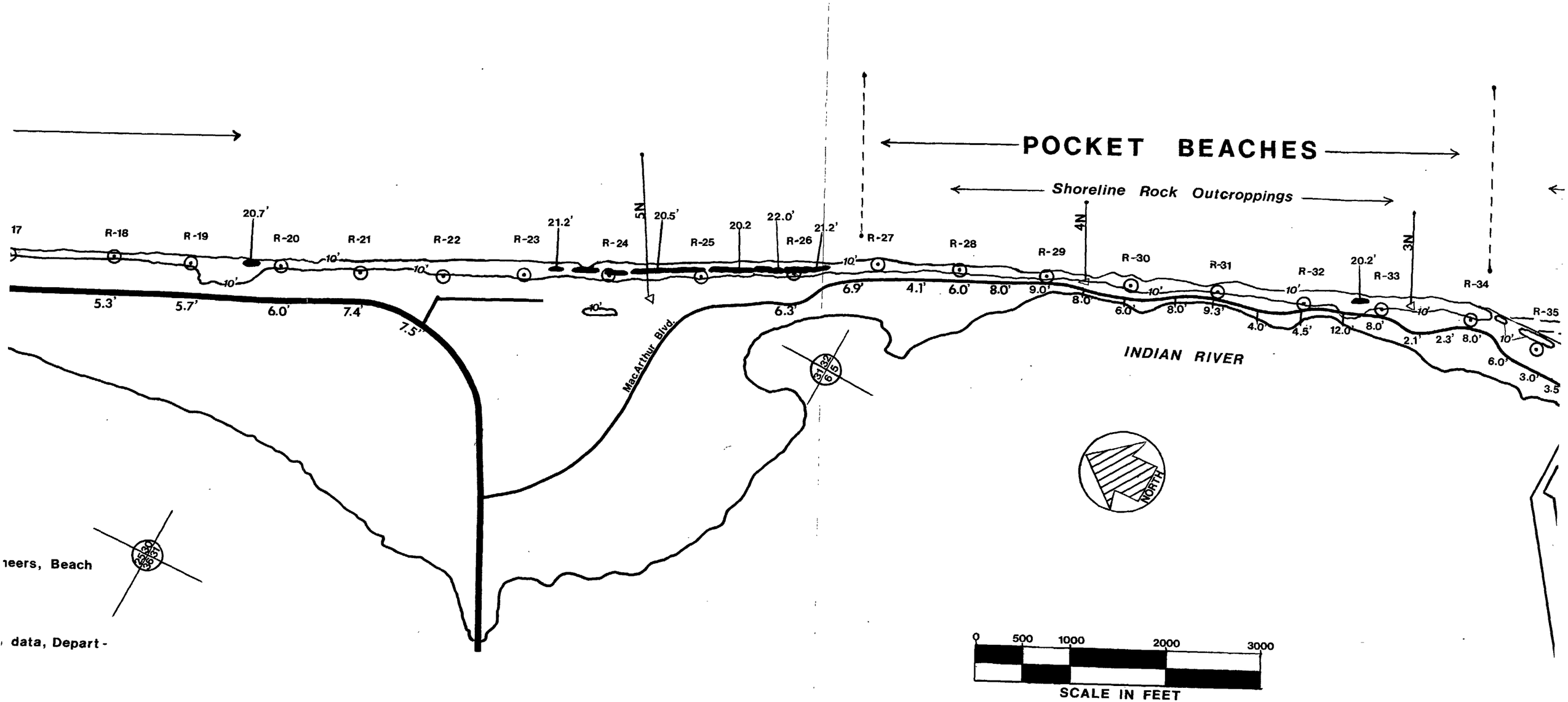
– – Represents elevations ≥ 20.0 feet

Contour lines and road elevations derived from 1976 dat ment of Natural Resources.

COASTAL ZONE MANAGEMENT STUDY

January - September 1982

HUTCHIN



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INSON ISLAND - Martin County, Florida

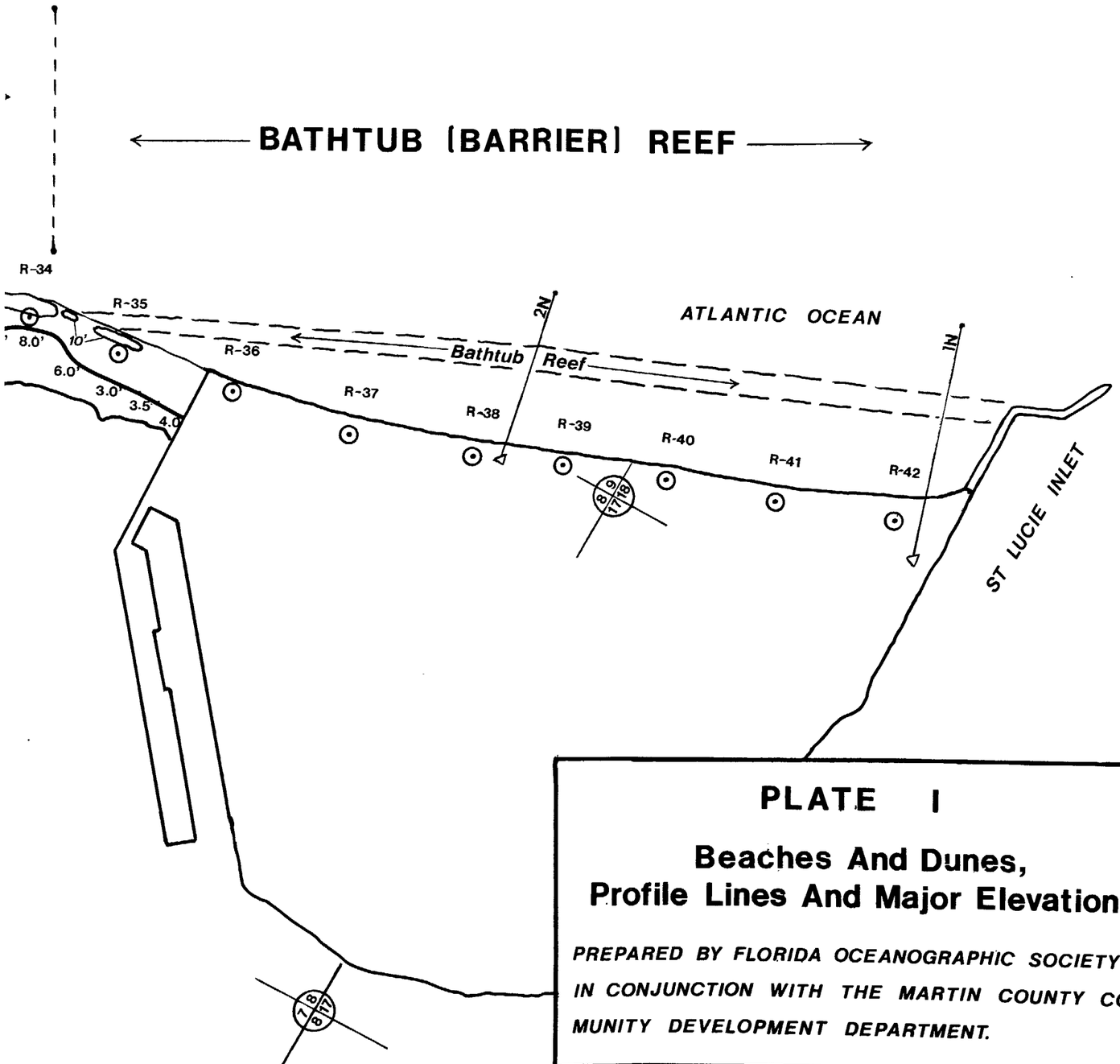
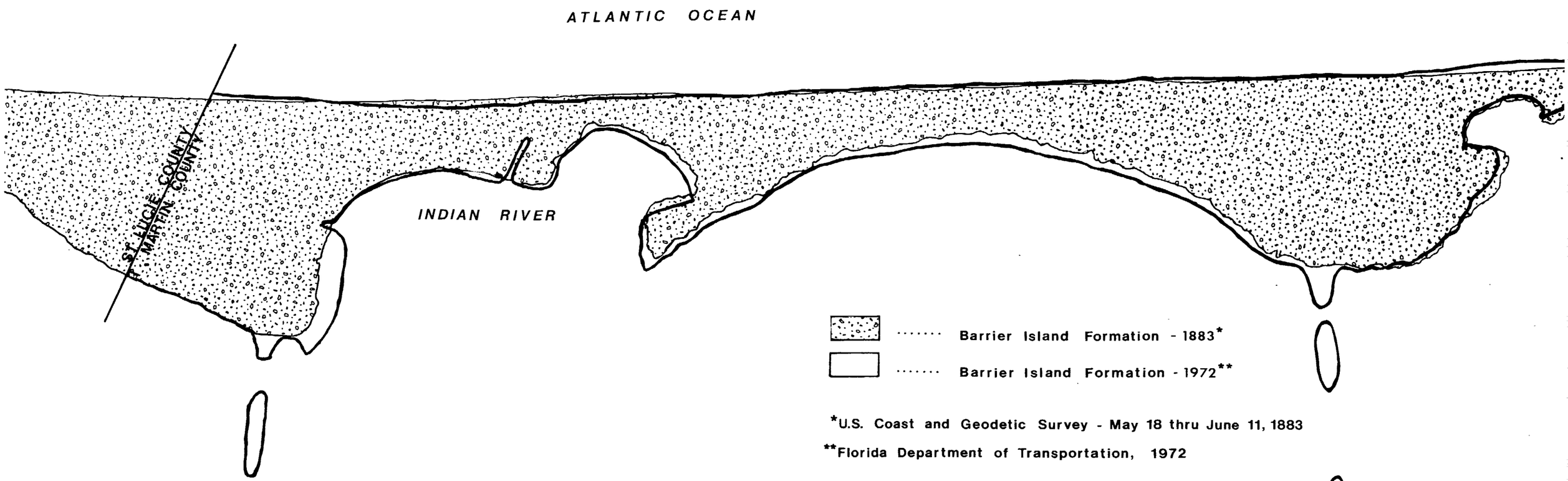


PLATE I

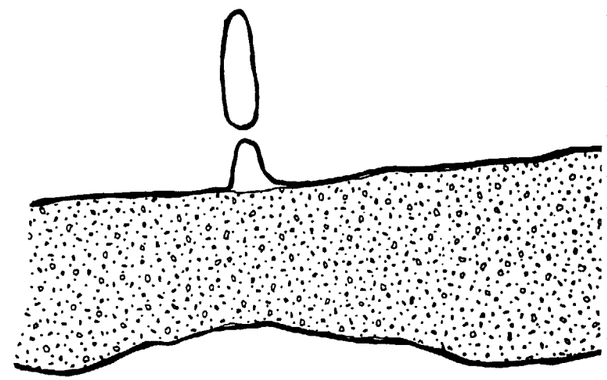
Beaches And Dunes, Profile Lines And Major Elevations

PREPARED BY FLORIDA OCEANOGRAPHIC SOCIETY IN CONJUNCTION WITH THE MARTIN COUNTY COMMUNITY DEVELOPMENT DEPARTMENT.

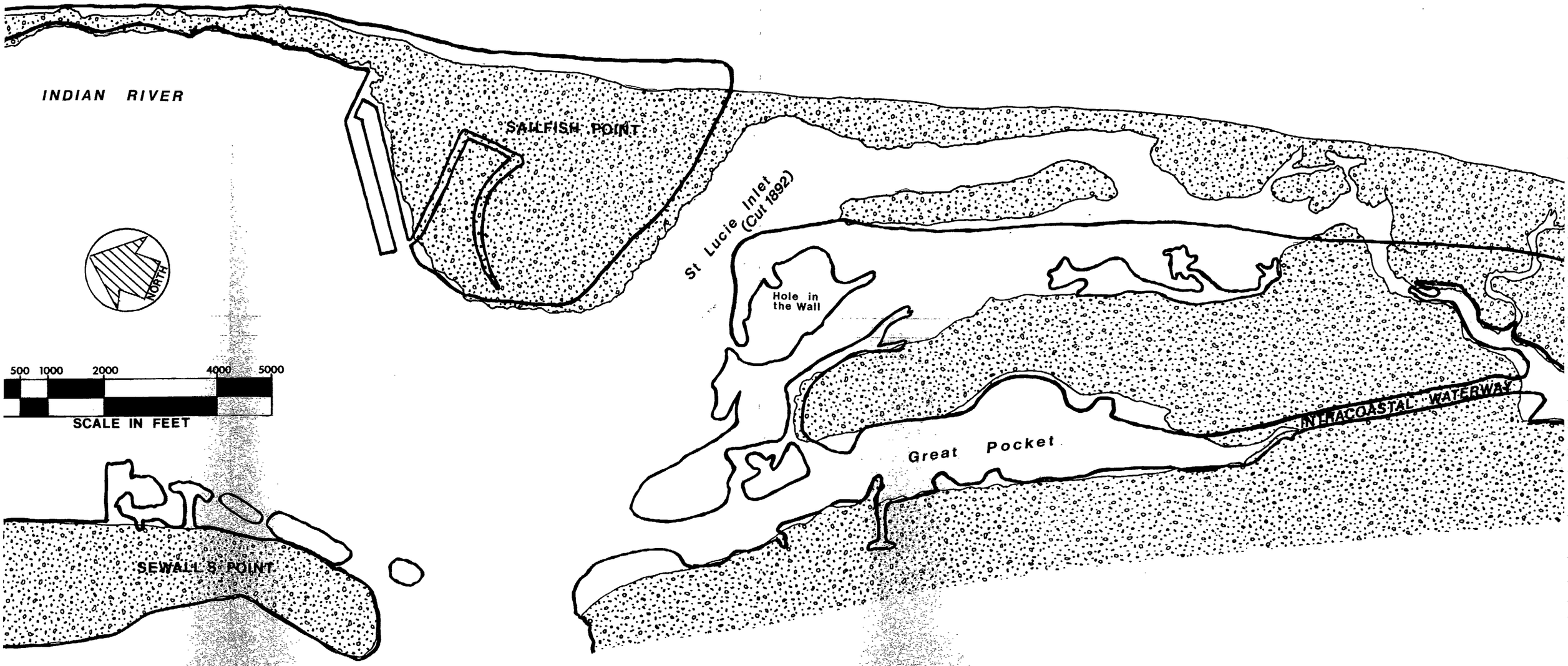


COASTAL ZONE MANAGEMENT STUDY

January - September 1982



HUT



CHINSON ISLAND - Martin County, Florida

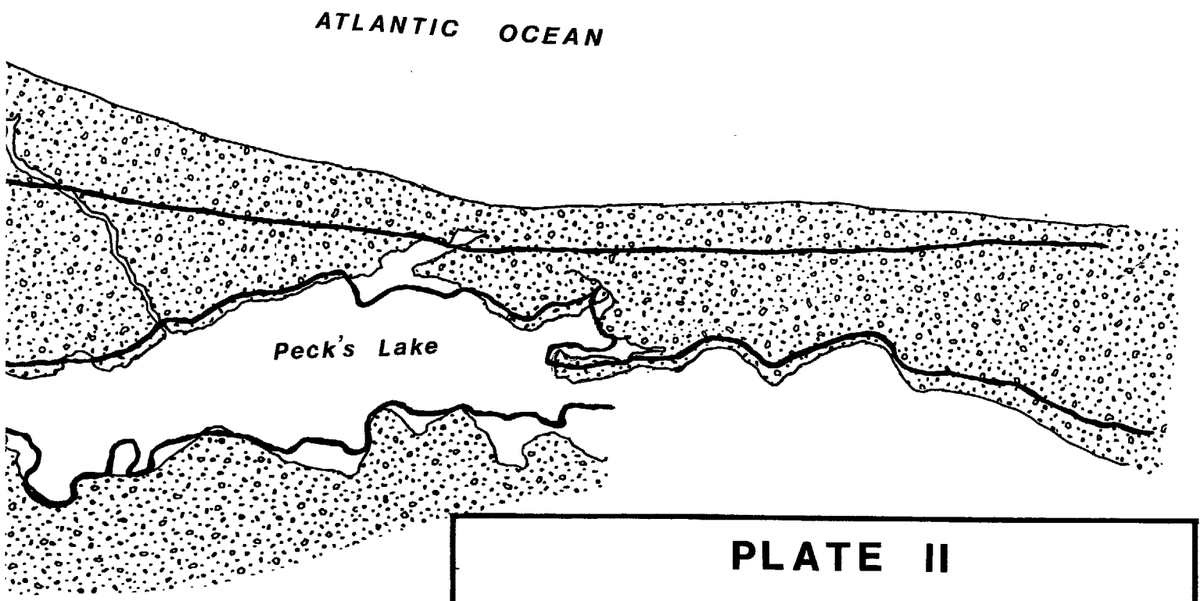
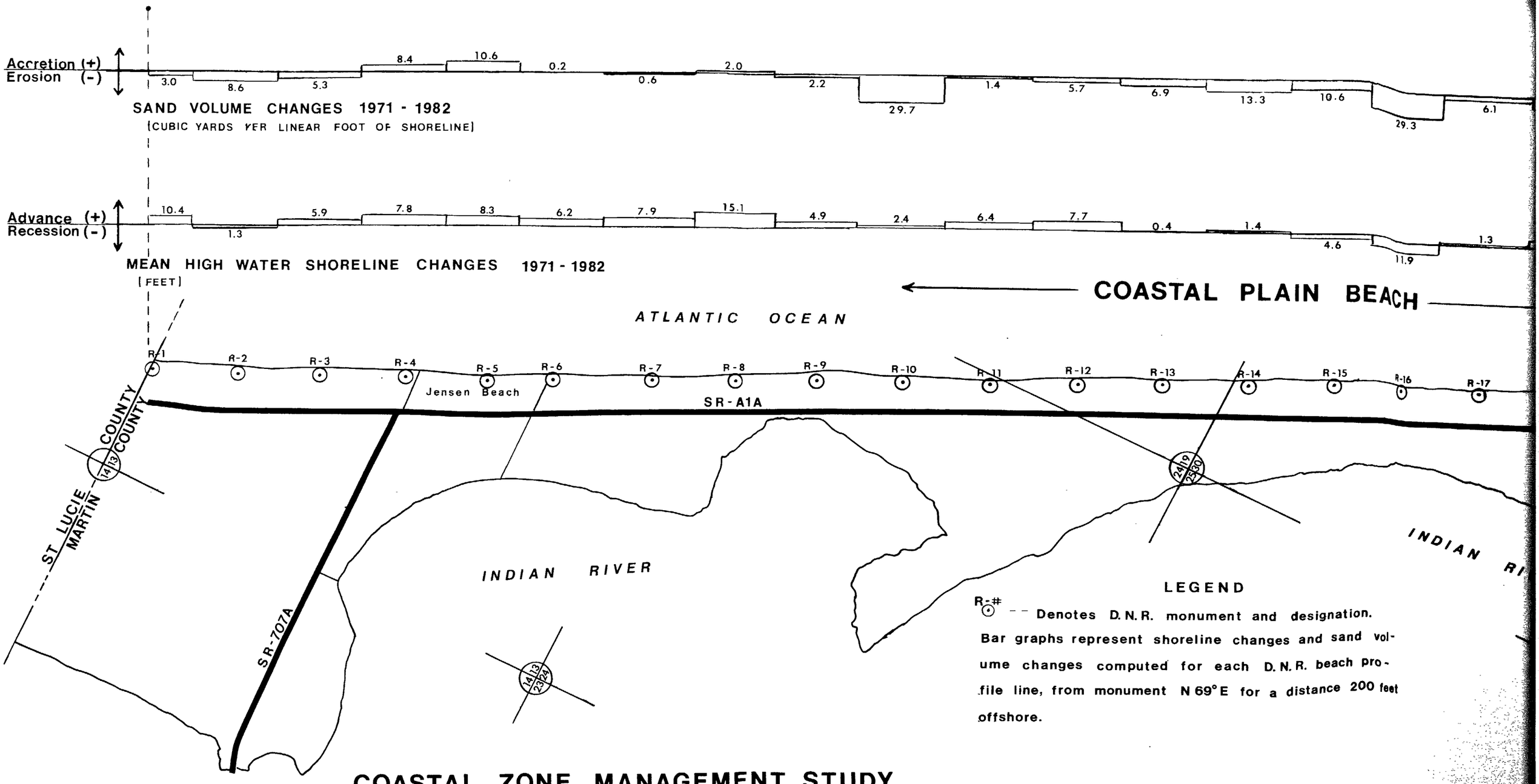


PLATE II

Historic Shoreline Change, St Lucie Inlet Vicinity - 1883/1972

PREPARED BY FLORIDA OCEANOGRAPHIC SOCIETY IN CONJUNCTION WITH THE MARTIN COUNTY COMMUNITY DEVELOPMENT DEPARTMENT.



LEGEND

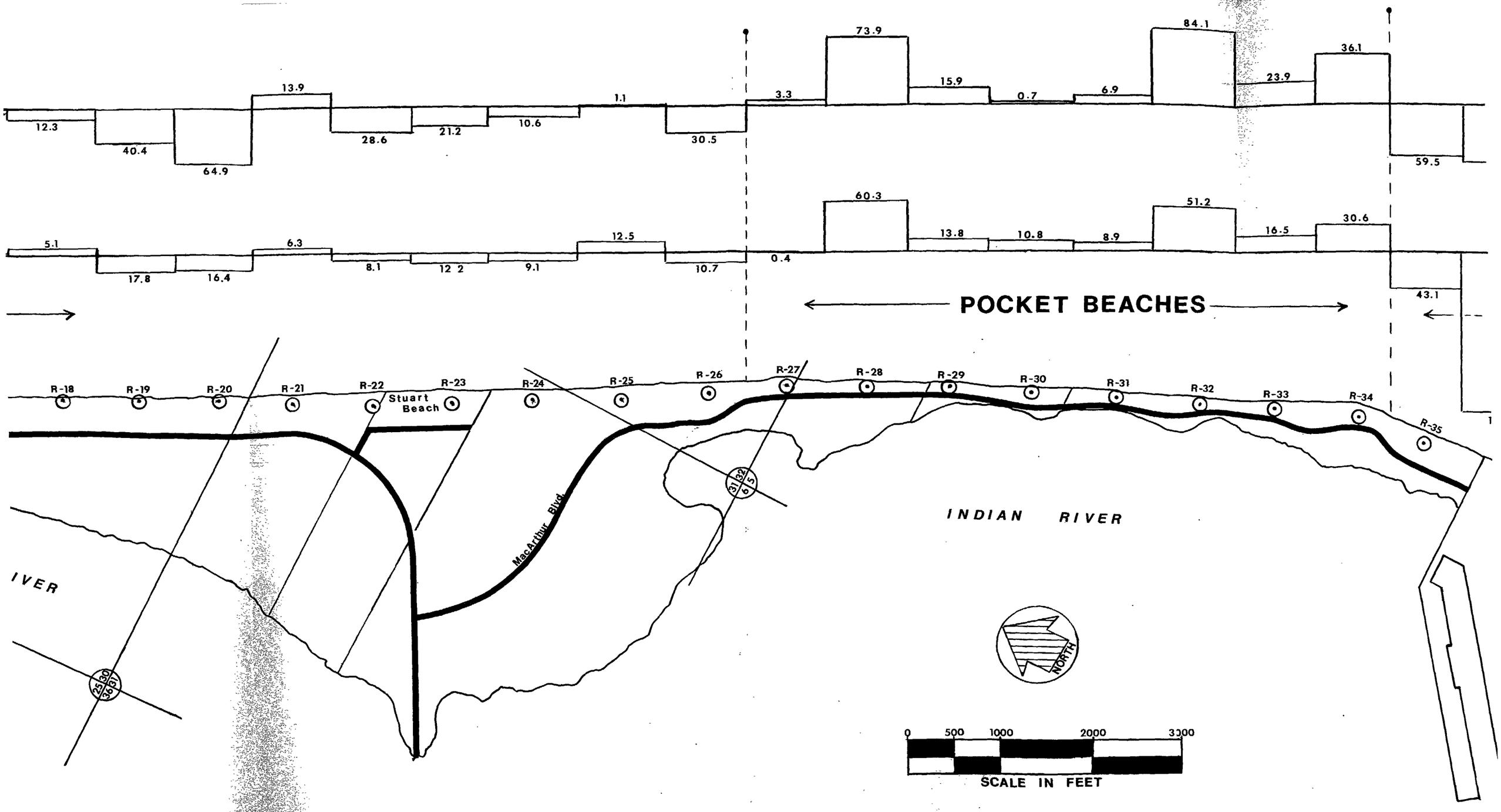
R-# ⊙ -- Denotes D.N.R. monument and designation.

Bar graphs represent shoreline changes and sand volume changes computed for each D.N.R. beach profile line, from monument N 69°E for a distance 200 feet offshore.

COASTAL ZONE MANAGEMENT STUDY

January - September 1982

HUTCHINS



ON ISLAND - Martin County, Florida

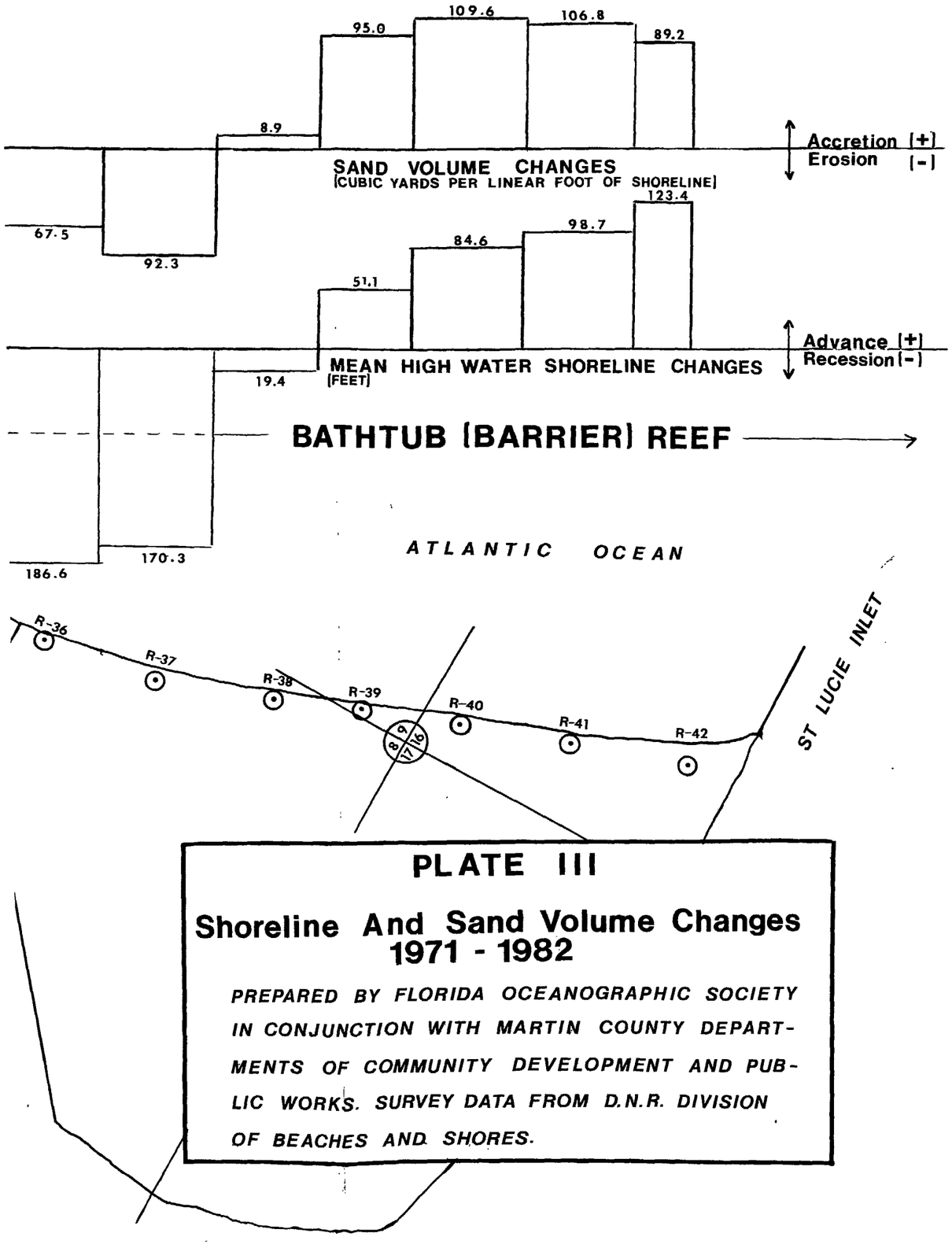
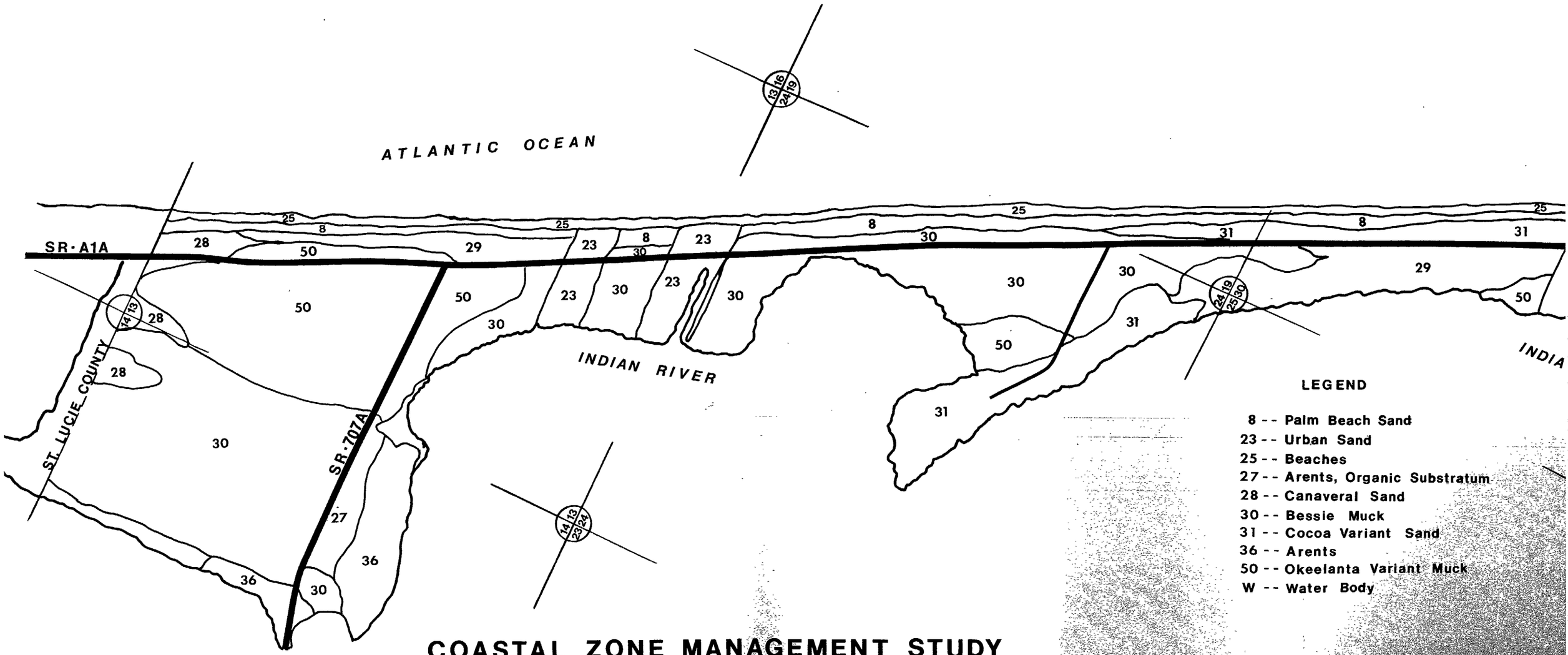


PLATE III

Shoreline And Sand Volume Changes 1971 - 1982

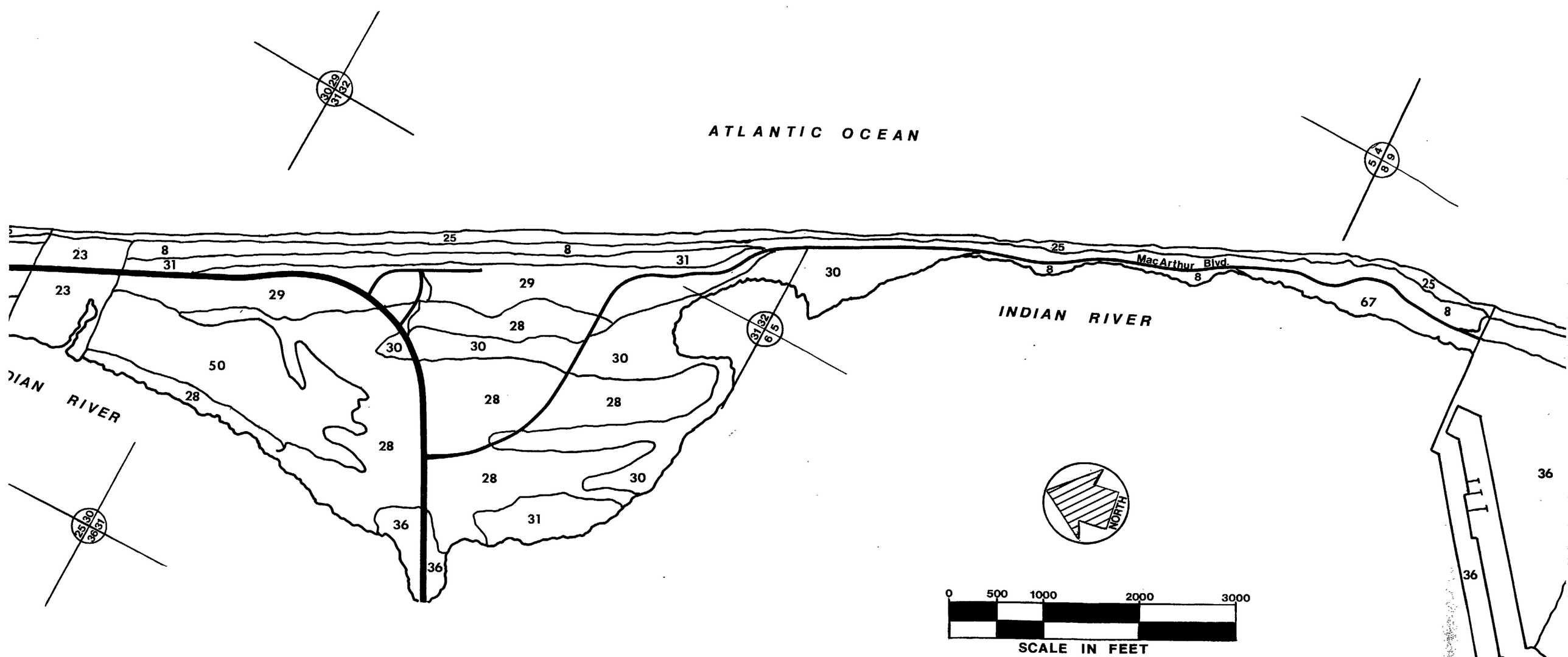
PREPARED BY FLORIDA OCEANOGRAPHIC SOCIETY IN CONJUNCTION WITH MARTIN COUNTY DEPARTMENTS OF COMMUNITY DEVELOPMENT AND PUBLIC WORKS. SURVEY DATA FROM D.N.R. DIVISION OF BEACHES AND SHORES.



COASTAL ZONE MANAGEMENT STUDY

January - September 1982

HUTCHINSO



ON ISLAND - Martin County, Florida

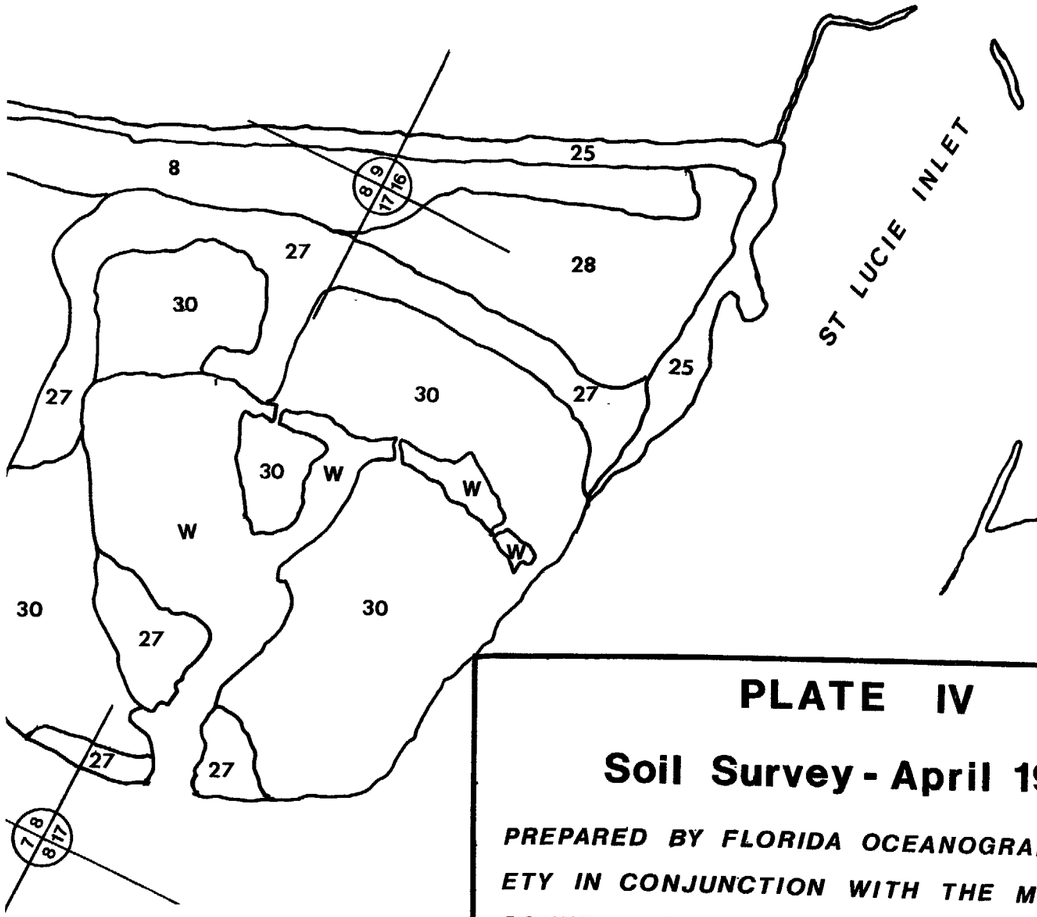
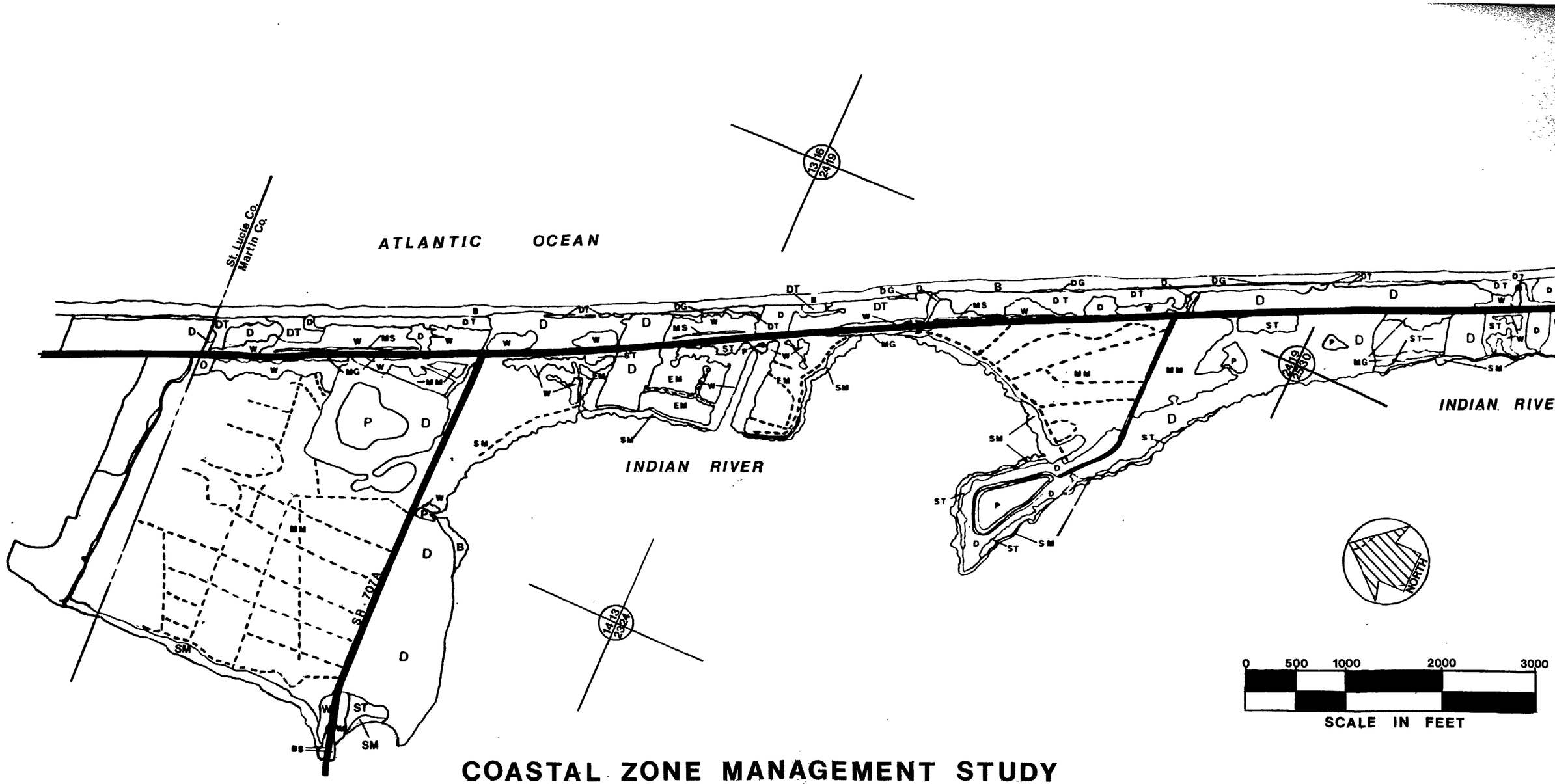


PLATE IV

Soil Survey - April 1981

PREPARED BY FLORIDA OCEANOGRAPHIC SOCIETY IN CONJUNCTION WITH THE MARTIN COUNTY COMMUNITY DEVELOPMENT DEPT.

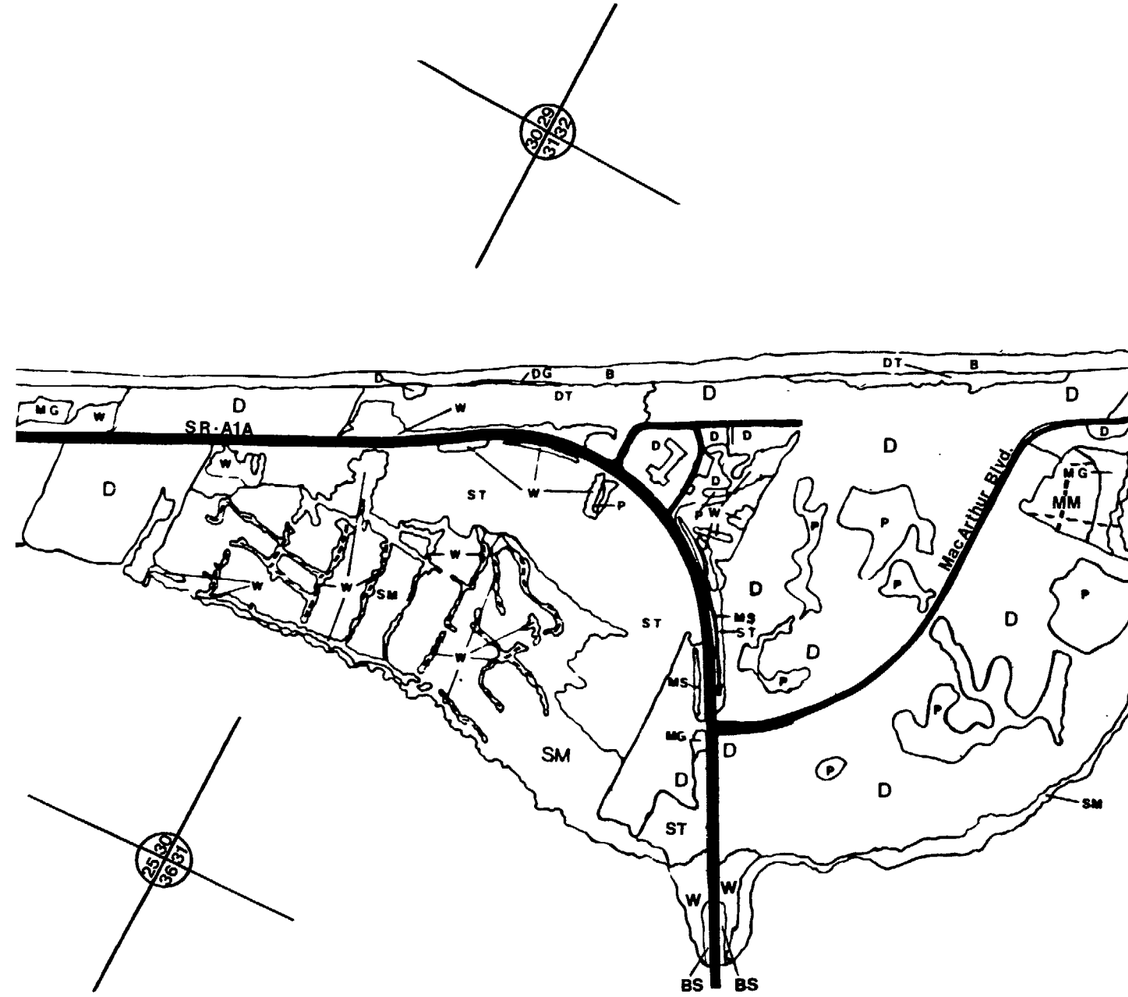
SOURCE: Soil Survey Of Martin County Area, Florida, United States Department of Agriculture, Soil Conservation Service, April 1981.



COASTAL ZONE MANAGEMENT STUDY

January - September 1982

HUTCHINSO



LEGEND

FISH AND WILDLIFE — **PLANT COMMUNITIES**

- **Open Ocean and Seashore**
  - B – Beach
  - DG – Dune Grassland
- **Scrub and Forest Areas**
  - DT – Dune Thicket
  - ST – Scrub Thicket
  - W – Woodland
  - MG – Mixed Grassland
- **Mangrove Marsh / Wetland and Lagoon**
  - SM – Submerged Mangrove
  - MM – Mixed Mangrove
  - EM – Emergent Mangrove
  - MS – Mangrove Slough
- **Ponds, Lakes and Developed Areas**
  - P – Ponds
  - D – Developed
- BS – Bare Soil
- ---- Mosquito Impoundment Ditch

ON ISLAND - Martin County, Florida

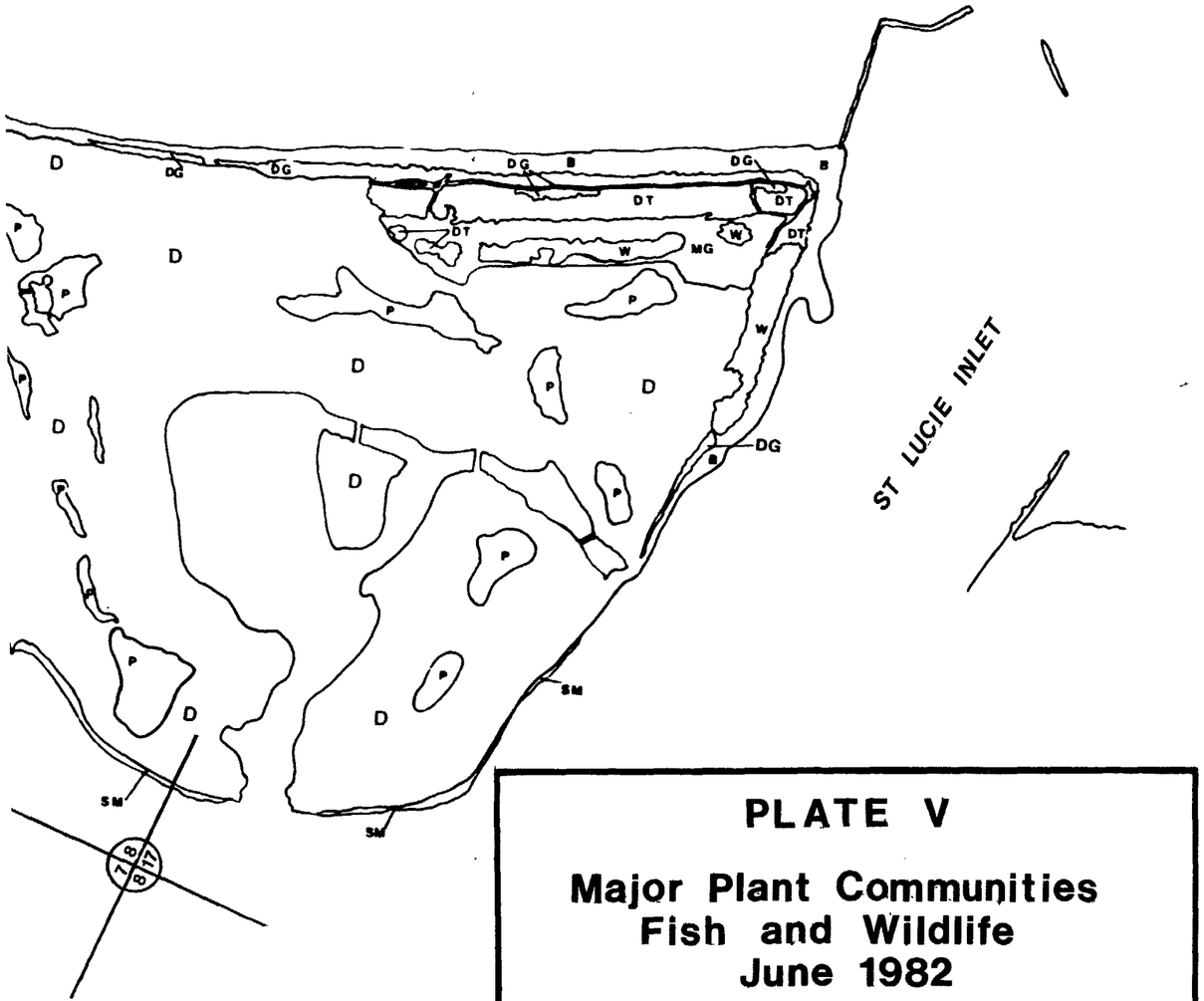


PLATE V

Major Plant Communities
Fish and Wildlife
June 1982

PREPARED BY FLORIDA OCEANOGRAPHIC SOCIETY IN CONJUNCTION WITH THE MARTIN COUNTY COMMUNITY DEVELOPMENT DEPARTMENT.

SR·A1A

INDIAN RIVER

SR·707A

14 13

14 13
23 24

1982

1971

SR·A1A

INDIAN RIVER

SR·707A

14 13

14 13
23 24

24 19
25 30

NORTH

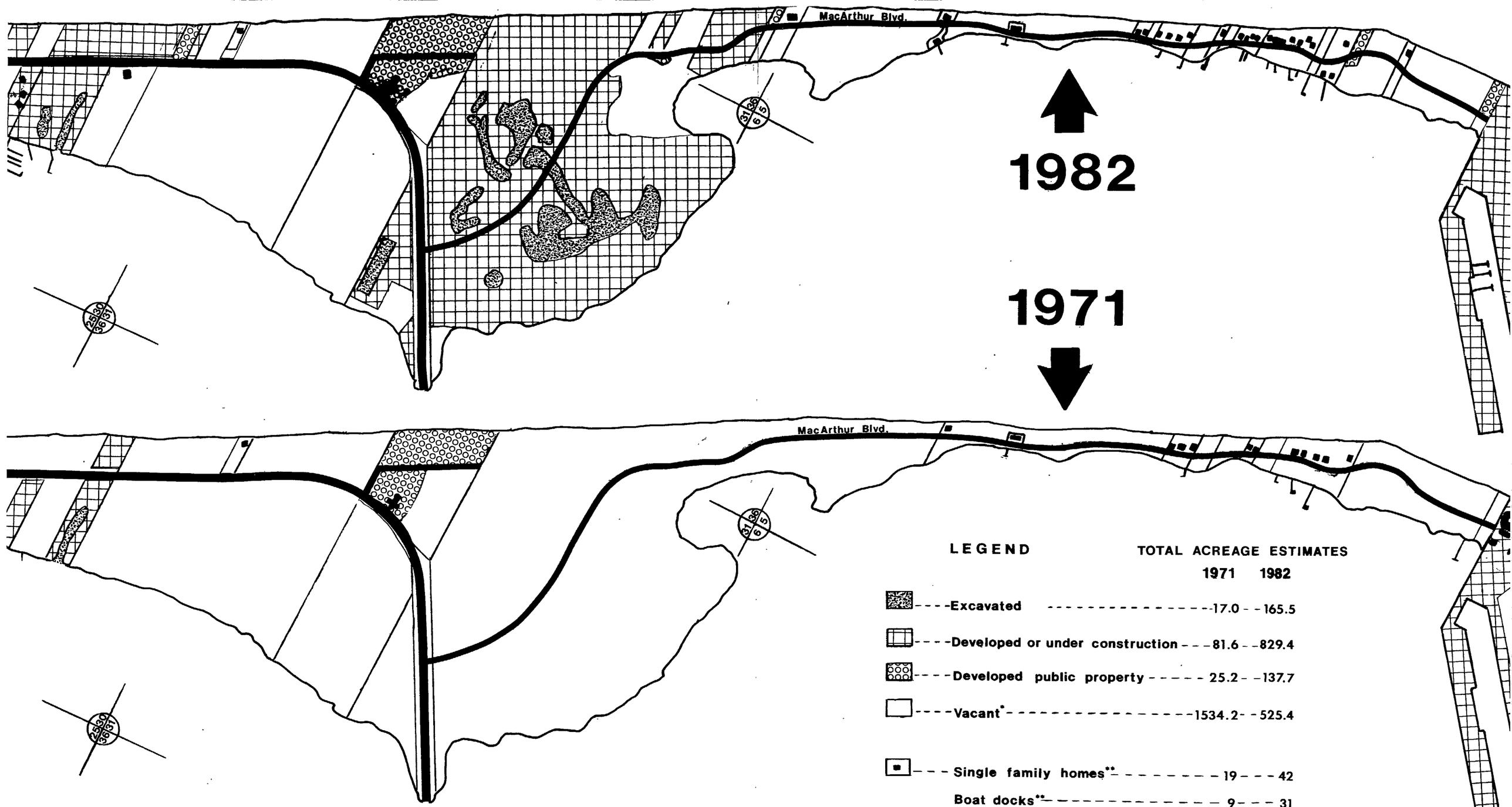
0 500 1000 2000 3000

SCALE IN FEET

COASTAL ZONE MANAGEMENT STUDY

January - September 1982

HUTCHIN



LEGEND

TOTAL ACREAGE ESTIMATES

	1971	1982
Excavated	17.0	165.5
Developed or under construction	81.6	829.4
Developed public property	25.2	137.7
Vacant*	1534.2	525.4
Single family homes**	19	42
Boat docks**	9	31

*Includes all road and single family home acreage.
**Figures represent total number not total acreage.

SON ISLAND - Martin County, Florida

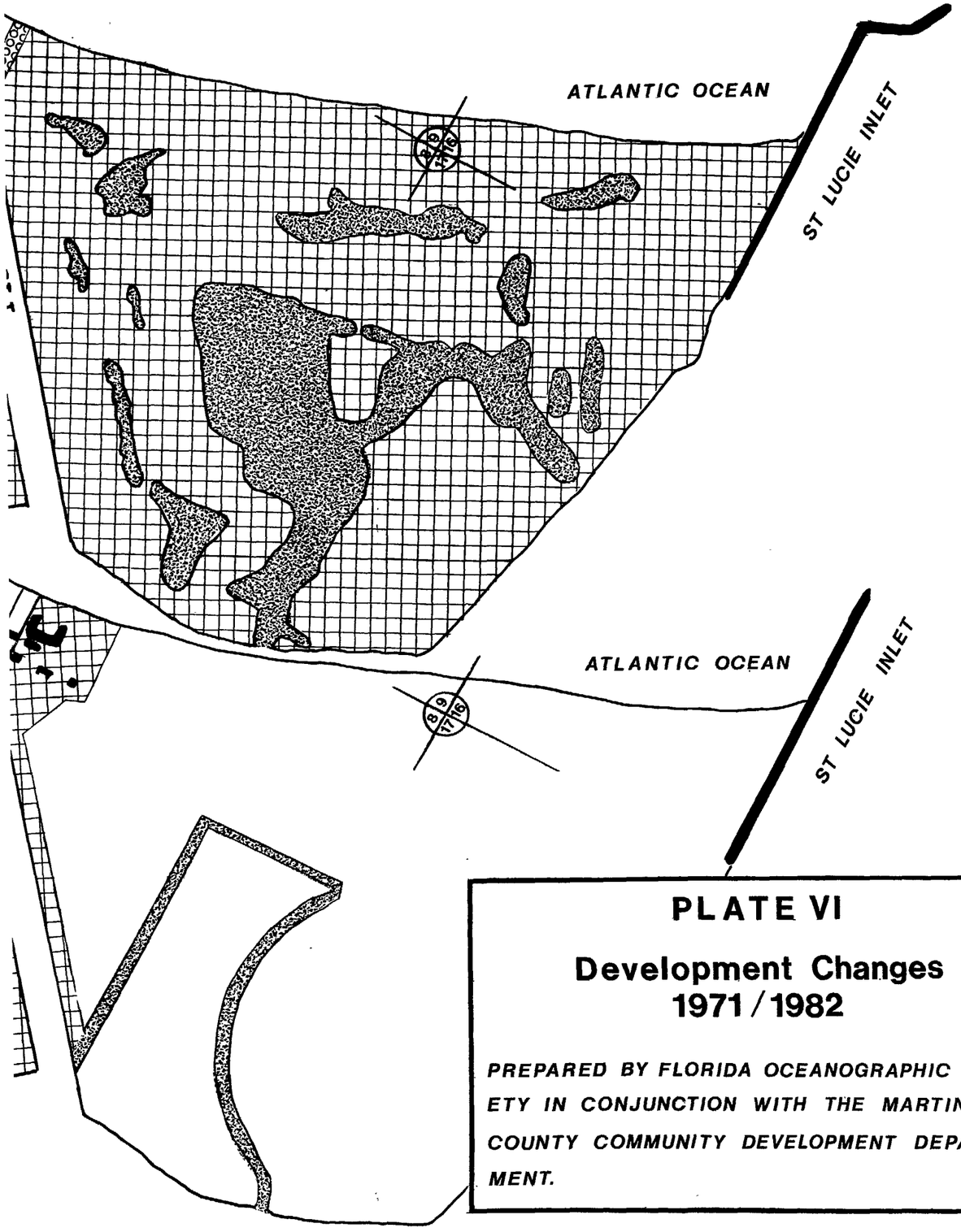
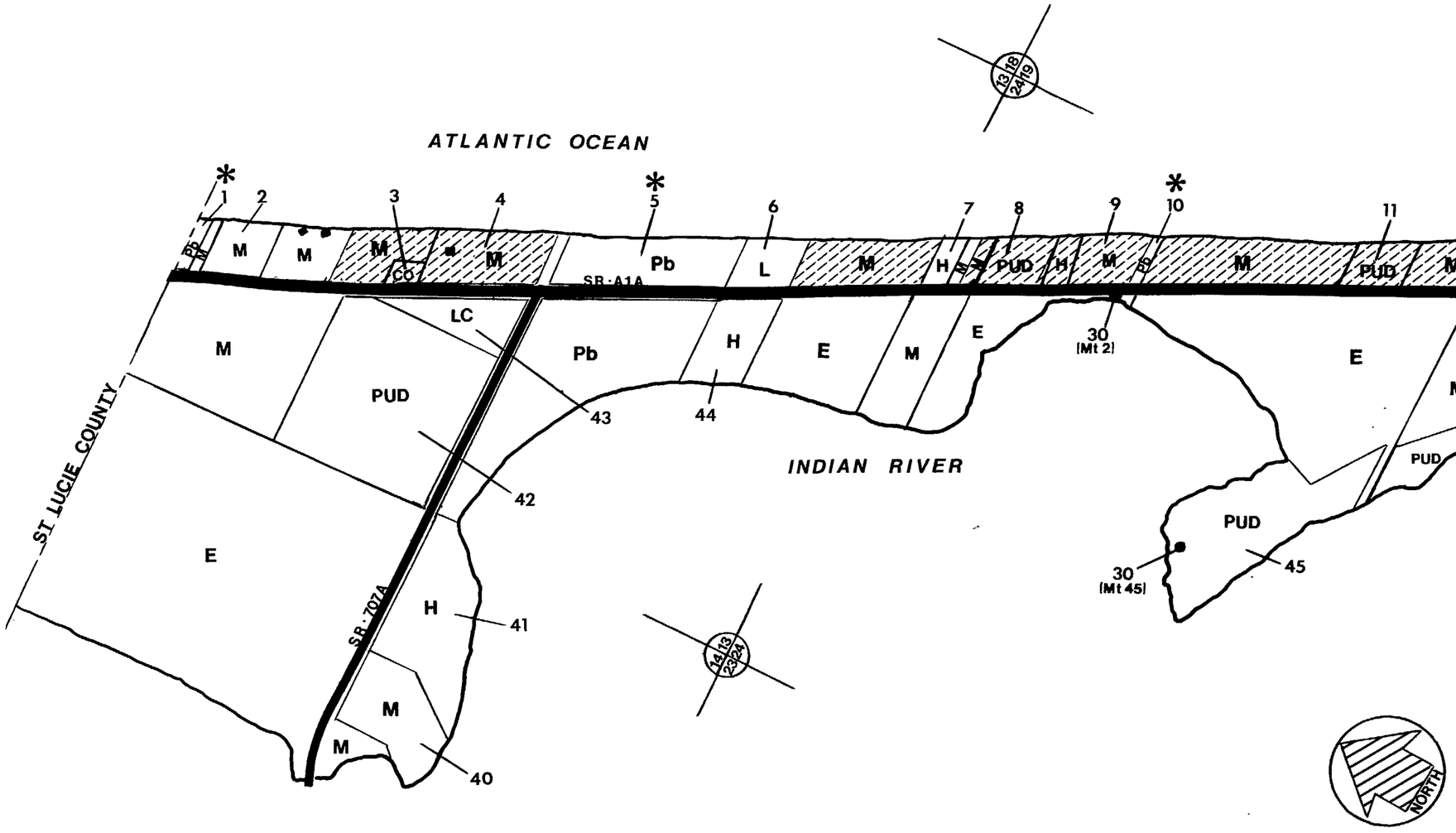


PLATE VI

Development Changes 1971 / 1982

PREPARED BY FLORIDA OCEANOGRAPHIC SOCIETY IN CONJUNCTION WITH THE MARTIN COUNTY COMMUNITY DEVELOPMENT DEPARTMENT.



COASTAL ZONE MANAGEMENT STUDY

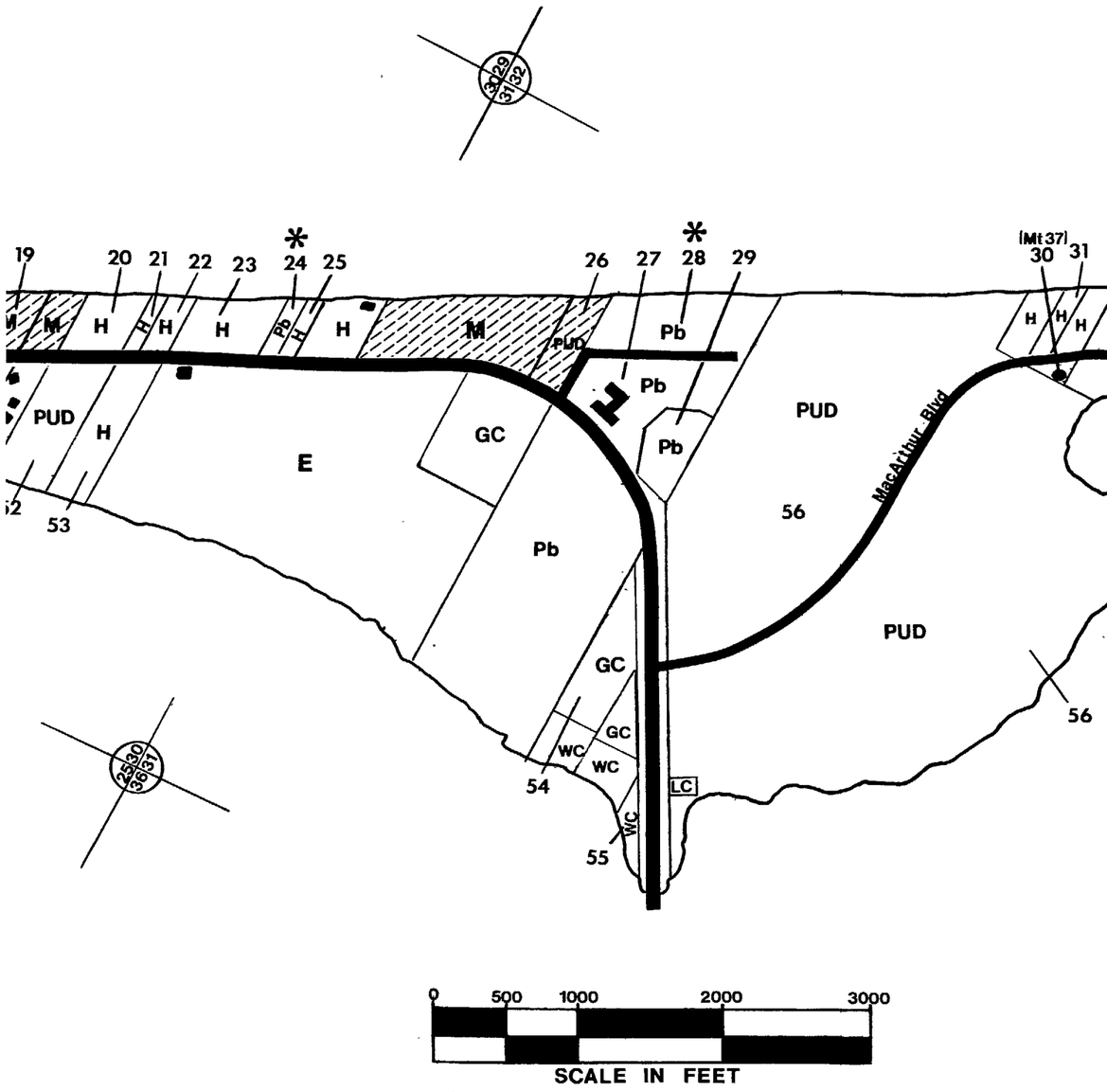
January - September 1982

LAND USE LEGEND

- E – Estate Density – up to 2 u.p.a.*
- L – Low Density – up to 5 u.p.a.
- M – Medium Density – up to 8 u.p.a.
- H – High Density – up to 15 u.p.a.
- PUD – Planned Unit Development – up to 12 u.p.a.
- GC – General Commercial
- LC – Limited Commercial
- CO – Commercial Office Residential
- WC – Waterfront Commercial
- Pb – Public
- D – Developed
- UC – Under Construction
- P – Pending Approval
- UD – Undeveloped
- ▨ – Proposed Beach Acquisition
- ▣ – Single Family Homes
- * – Public Beach Access

*units per acre

HUTCHIN



DEVELOPMENT LEGEND

1 - Access Strip*- D
2 - The Dune - UC
3 - First Federal Bank - UC
4 - The Beach House - UC
5 - Jensen Beach*- D
6 - Holiday Inn - D
7 - Seaside of Stuart - D
8 - Surf Club - P
9 - Ocean Cove - UC
10 - Park and Fish*- D
11 - Beach Walk - UC
12 - Bryn Mawr Strip*- D
13 - Sandpebble Beach Club - UC
14 - Pelican's Landing - UC
15 - Ocean View - D
16 - Beachwood Villas - D
17 - Maritimes East - D
18 - Virginia Forrest Strip*- D
19 - Buttonwood - UC
20 - Hutchinson House East - D
21 - Little Ocean Place - D
22 - Little Ocean Club - D
23 - Suntide - D
24 - Tiger Shores* - D
25 - Islander 12 - D
26 - Spyglass - P
27 - Elliott Museum - D
28 - Stuart Beach*- D
29 - H.I. Fire Department - D
30 - Indian Mound or Midden Sites (Vicinity)
31 - Dunes Club - D
32 - Santa Lucea - UC
33 - Fletcher Strip* D
34 - House of Refuge Historic Site - D
35 - Chastain Strip*- D
36 - County Strip*- UD
37 - City Strip*- UD
38 - Sailfish Point Strip*- D
39 - Sailfish Point - UC
40 - Indian River Point - D
41 - Fairwinds Cove - UC
42 - Middleton Gardens - UC
43 - Commercial Services - UC
44 - Green Turtle Cove - D
45 - Joe's Point - UC
46 - Sandpebble Beach Club - UC
47 - Pelican's Landing - UC
48 - Ocean View - D
49 - Rose Walk - P
50 - Maritimes West - UC
51 - Shore Village - UC
52 - Hutchinson House West - D
53 - Angler's Cove - D
54 - Commercial Services - D
55 - Cat Cove Rental - D
56 - Indian River Plantation - UC

*Public beach access

ISON ISLAND - Martin County, Florida

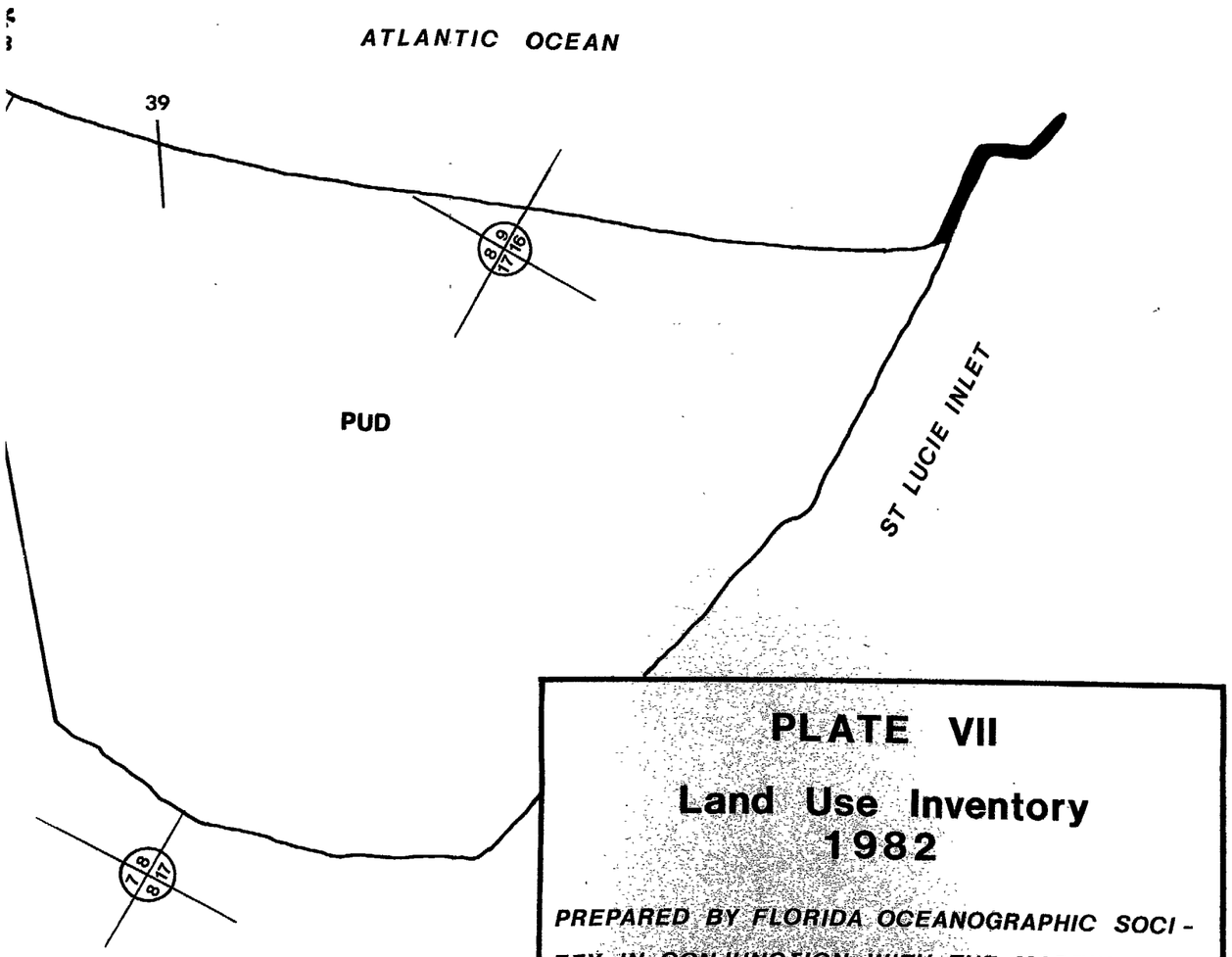
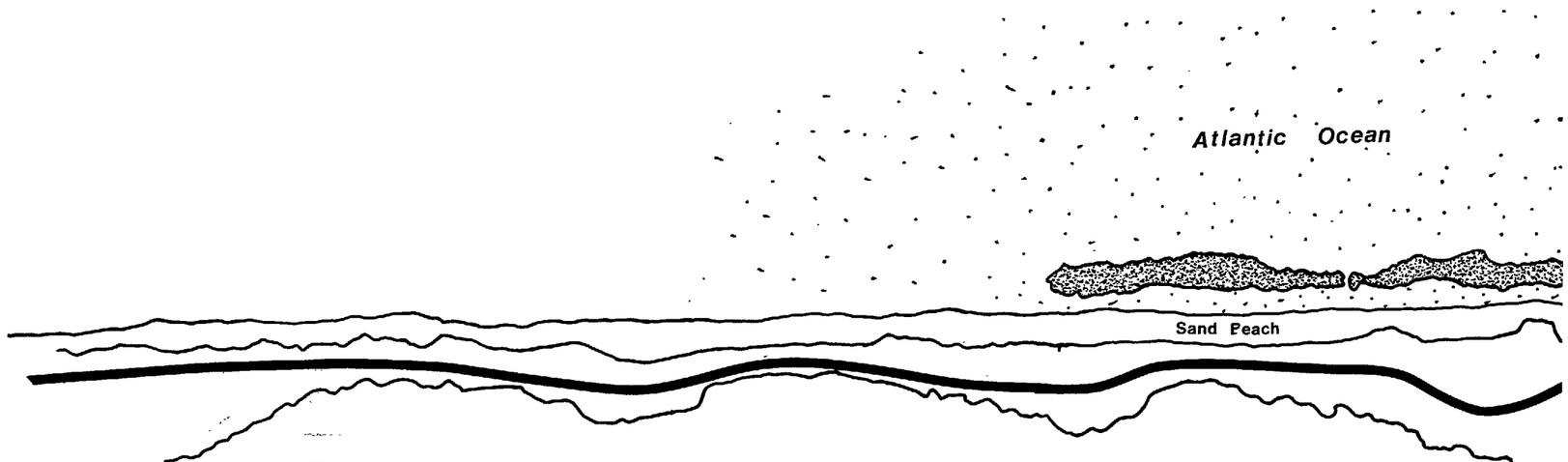


PLATE VII

Land Use Inventory 1982

PREPARED BY FLORIDA OCEANOGRAPHIC SOCIETY IN CONJUNCTION WITH THE MARTIN COUNTY COMMUNITY DEVELOPMENT DEPARTMENT.



COASTAL ZONE MANAGEMENT STUDY

January - September 1982

LEGEND

- Primary reef system
- Intertidal zone of primary
- Secondary reef system l
- Rock outcropping
- Sand Bottom

R-34

P-35

R-36

R-37

Atlantic Ocean

Sand Beach

R-38

R-39

R-40

R-41

R-42

Sand Beach

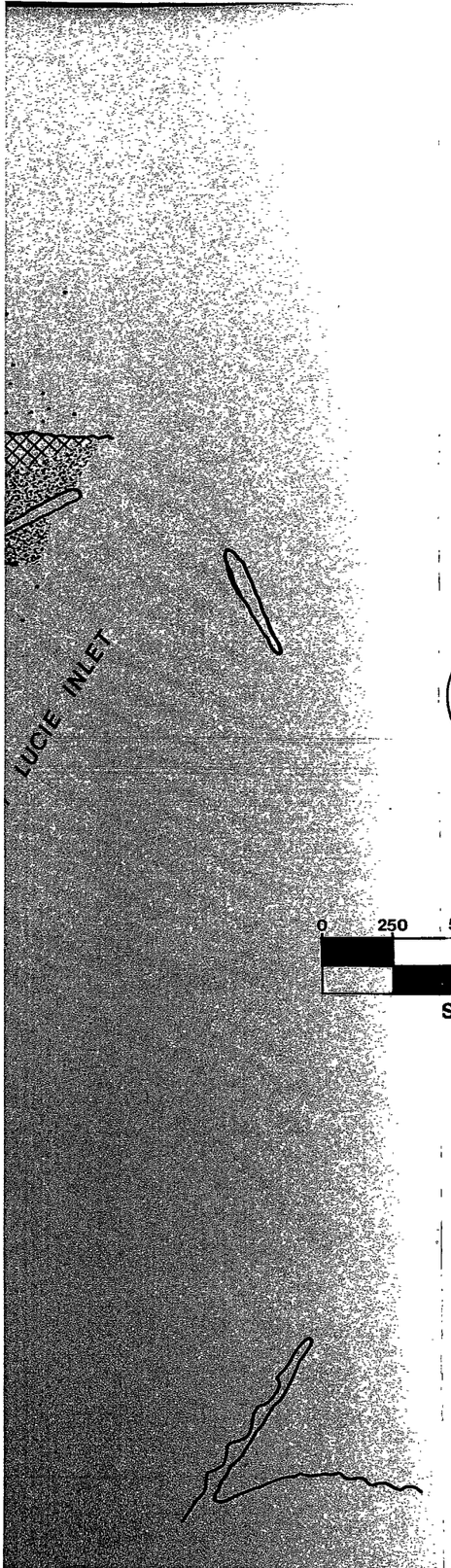
Approximate Vegetation Line

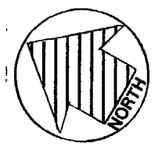
ST LUC

y reef system

approximate)

Sailfish Point





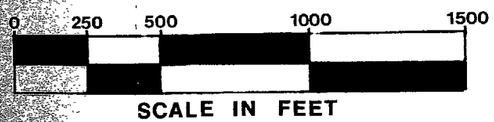


PLATE VIII

Bathtub Reef Survey

PREPARED BY FLORIDA OCEANOGRAPHIC SOCIETY IN CONJUNCTION WITH THE MARTIN COUNTY COMMUNITY DEVELOPMENT DEPARTMENT.