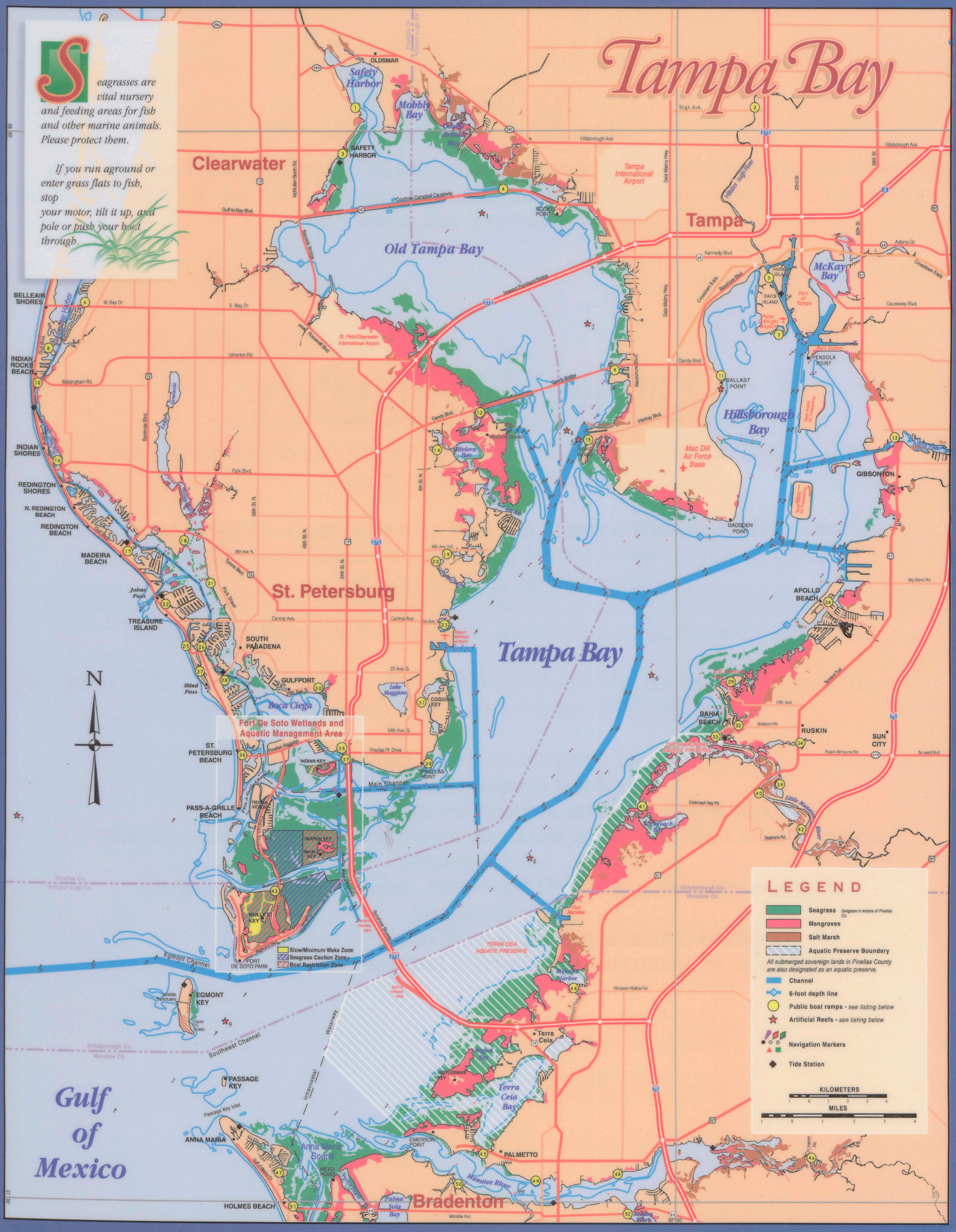
1999

Tampa Bay Estuary Program: 1999 Atlas

Florida Marine Research Institute

Tampa Bay Estuary Program

1999 Atlas



Tampa Bay Estuary Program

Purpose and Acknowledgements

Purpose

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Acknowledgements

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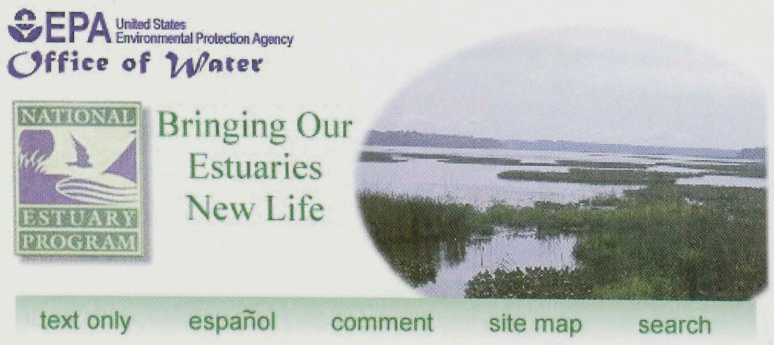
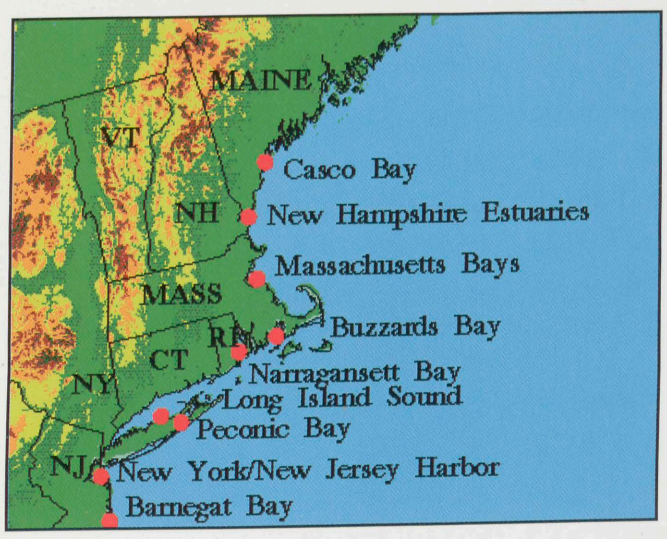
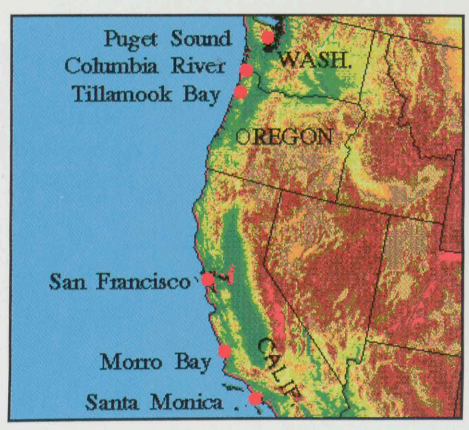
Coastal Environmental, Inc.
Florida Audubon Society
Florida Department of Environmental Protection
Florida Marine Research Institute, Fish and Wildlife Conservation Commission
National Ocean Service, National Oceanic and Atmospheric Administration
Southwest Florida Water Management District
United States Geological Survey, Department of Interior

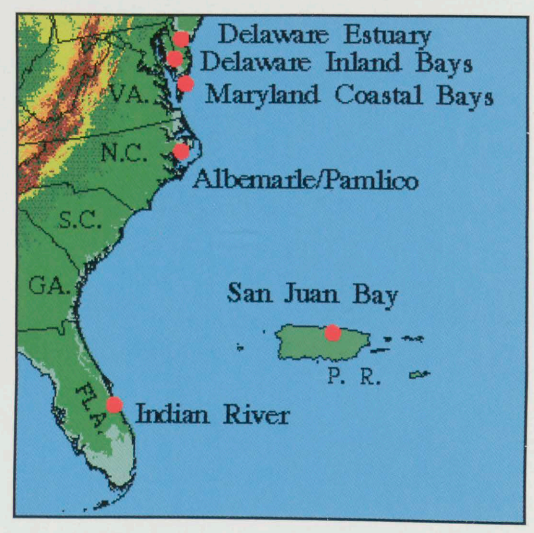
Tampa Bay Estuary Program



The National Estuary Program was authorized by Congress with the 1987 amendments to USEPA'S Clean Water Act. Since then, 28 estuaries across the nation have been designated to create Comprehensive Conservation and Management Plans using a "Watershed Approach." This approach acknowledges the importance of the activities in an estuary's watershed on overall estuarine health.







The National Estuary Program is modeled after the Great Lakes and Chesapeake Bay Programs. The National Estuary Program is a participatory planning process that ensures all stakeholder groups are represented in the development of the Comprehensive Conservation and Management Plan. Collaboration is accomplished through management, policy, technical and citizen advisory committees.

The United States Environmental Protection Agency (USEPA) is the federal agency responsible for administering the National Estuary Program. The USEPA builds partnerships with local governments to assist in the development of objectives and action plans.

Tampa Bay Estuary Program

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TAMPA BAY ESTUARY PROGRAM LOCATOR MAP

ABOUT THE TAMPA BAY ESTUARY PROGRAM

The Tampa Bay National Estuary Program (TBNEP) was established in 1991 to assist the region in developing and implementing a comprehensive plan for bay restoration and protection. The Program is part of a national network of 28 estuary programs established under the Clean Water Act and administered by the U.S. Environmental Protection Agency.

Tampa Bay is Florida's largest open-water estuary, a fertile junction of sea and stream that supports a diverse array of natural landscapes and wildlife, as well as an enviable quality of life for the nearly two million people who live around its borders.

The pressures associated with the region's rapid growth have taken a toll on the bay's natural systems. Dredging and pollution have destroyed many of the bay's seagrasses and clouded its waters, while development has whittled away its salt marshes and mangrove forests.

Despite these pressures, Tampa Bay has waged a remarkable comeback in recent years, thanks largely to improvements in sewage treatment and development standards. Maintaining this steady progress, even in the face of continued growth, is the mission of the Tampa Bay NEP. Achieving this goal will require time, new and innovative public-private partnerships, and continued community resolve.

In 1997, the NEP culminated nearly six years of scientific research into the bay's most pressing problems when an unprecedented coalition of community partners approved the comprehensive blueprint for bay restoration, *Charting the Course*. This landmark effort reflected broad-based input from citizens, groups and communities with a common interest in a healthy bay as the cornerstone of a prosperous economy.

Charting The Course presents cost-effective and environmentally beneficial strategies for addressing five of Tampa Bay's most pressing problems: water and sediment quality; dredging and dredged material management; bay habitats; spill prevention and response; and bay fisheries and wildlife.

Reducing the amount of harmful nitrogen entering the bay, even with increased growth, is a cornerstone of the plan. By holding the line on nitrogen, bay managers hope to encourage the recovery of more than 12,000 acres of vital underwater seagrasses-another key goal of the bay plan.

In March 1998, local government and agency partners of the Tampa Bay NEP signed a formal Interlocal Agreement that commits them to achieving the goals presented in *Charting The Course*. As part of that process, the Tampa Bay National Estuary Program has become simply the **Tampa Bay Estuary Program**, in recognition of its reorganization as a truly regional alliance.

Tampa Bay Estuary Program Partners:
Hillsborough County
Manatee County
Pinellas County
City of Clearwater
City of St. Petersburg
City of Tampa
Florida Department of Environmental Protection
Southwest Florida Water Management District
U.S. Environmental Protection Agency

Tampa Bay Estuary Program Locator Map

Tampa Bay Estuary Program

THE TAMPA BAY REGION

A sunny climate, the presence of beautiful beaches, lakes and other natural attractions, and an affordable quality of life have fueled tremendous growth in the Tampa Bay region over the last 50 years. That growth is expected to continue in the near future, although the epicenter of the increase is shifting from Pinellas County — which, until recently, led the tri-county area in both population and population growth — to Hillsborough and Manatee counties.

According to statistics compiled by the University of Florida Bureau of Economic and Business Research, approximately 942,322 people lived in Hillsborough County as of April 1998. Pinellas County's population was estimated at 892,178, and Manatee County's at 247,028. The total population of the three counties is expected to rise about 17 percent, to 2.34 million by the year 2010.

Pinellas is currently the most densely populated county in Florida, with nearly 3,000 people per square mile. However, the growth rate in Pinellas is slowing as land available for new development shrinks. In fact, the growth rate for Pinellas County from 1995-2000 is estimated at only .52%, compared with 1.55% in Hillsborough and 1.77% in Manatee.

At 309 square miles, Pinellas has the smallest land area of the three counties, followed by Manatee at 772 square miles and Hillsborough at 1,062 square miles.

Hillsborough and its county seat, the City of Tampa, are among the fastest growing urban areas in the United States. Population projections indicate that the number of people living in Hillsborough will increase by more than 600,000 by the year 2020. Manatee County is expected to grow by 262,060 people over the same period, more than doubling its current population. The number of residents in Pinellas County, on the other hand, is expected to grow by only 43,000 by the year 2020.

As more young professionals move into the area to take advantage of the favorable job climate and relatively low cost of living, the average age of residents throughout the three-county is declining. The median age for Hillsborough is 35.3 years, compared with 44.6 years for Manatee and 43.6 years for Pinellas.

Most of the region's population is concentrated in unincorporated areas of the three counties. The largest incorporated areas are as follows:

1998 Estimates:

Tampa — 293,390
St. Petersburg — 241,625
Clearwater — 102,874
Largo — 68,244
Bradenton — 48,029
Plant City— 27,855
Temple Terrace — 20,370

1994 Thematic Mapper Image of the Tampa Bay Region

Kilometers

10 0 10 20

Miles

6 0 6 12 18

Interstate Highways

County Boundaries

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NOAA NAUTICAL CHART OF THE TAMPA BAY REGION

Tampa Bay covers an area of about 1,030 square kilometers, or approximately 400 square miles, making it Florida's largest open-water estuary. It extends about 35 miles (56 km) inland from the Gulf of Mexico and varies from 5-10 miles in width along the majority of its length. Tampa Bay is crossed by four major causeways, and has 42 nautical miles of dredged channels with designed mean low water depths of 6 to 13 meters (20 to 43 feet). The major shipping channel has been dredged from the mouth of the bay to the upper reaches of Middle Tampa Bay, where it branches to the north into Old Tampa Bay and to the northeast into Hillsborough Bay, where the Port of Tampa is located.The bay is naturally shallow, with an average depth of approximately 4 meters (13 feet). The deepest natural area of 27 meters (89 feet) is found at the mouth of the bay in the Egmont Channel.

The bay's network of navigation channels serves the more than 100,000 pleasure boats registered to area residents, as well as thousands of barges, tankers and skyscraper-sized container ships bound for the bay's three seaports at Tampa, Port Manatee and St. Petersburg. The Port of Tampa is among the nation's busiest, annually ranking among the top 10 in the amount of cargo handled. Fertilizer and petroleum products comprise the bulk of the commercial cargo transported across the bay.

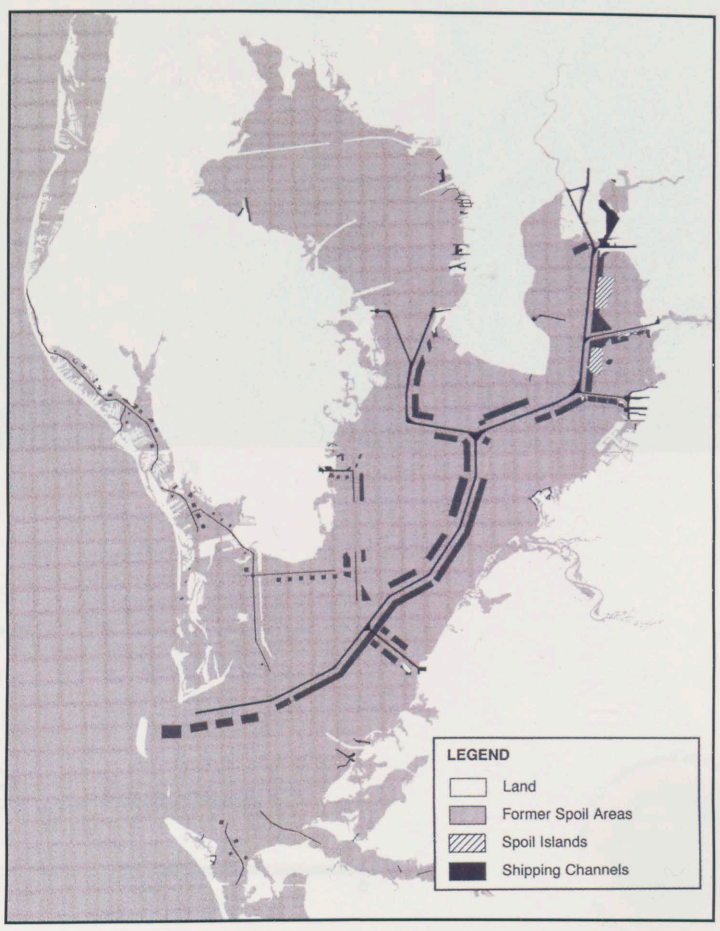
Dredging and Dredged Material Management
Maintaining the bay's navigational channels requires annual dredging that removes about 1 million cubic yards of material from the bay bottom each year — enough to fill 100,000 dump trucks. The initial dredging of the 40-mile main shipping channel in the 1970s required the removal of up to 100 million cubic yards of sediment.

Currently, most dredged material is deposited in two large spoil islands located in Hillsborough Bay, or at an offshore dumping site in the Gulf of Mexico. With the two spoil islands nearing capacity and the costs of offshore disposal rising to prohibitive levels, the U.S. Army Corps of Engineers is now developing, in concert with bay managers, a long-term dredge material management plan that will explore alternative, environmentally beneficial uses of dredge spoil.

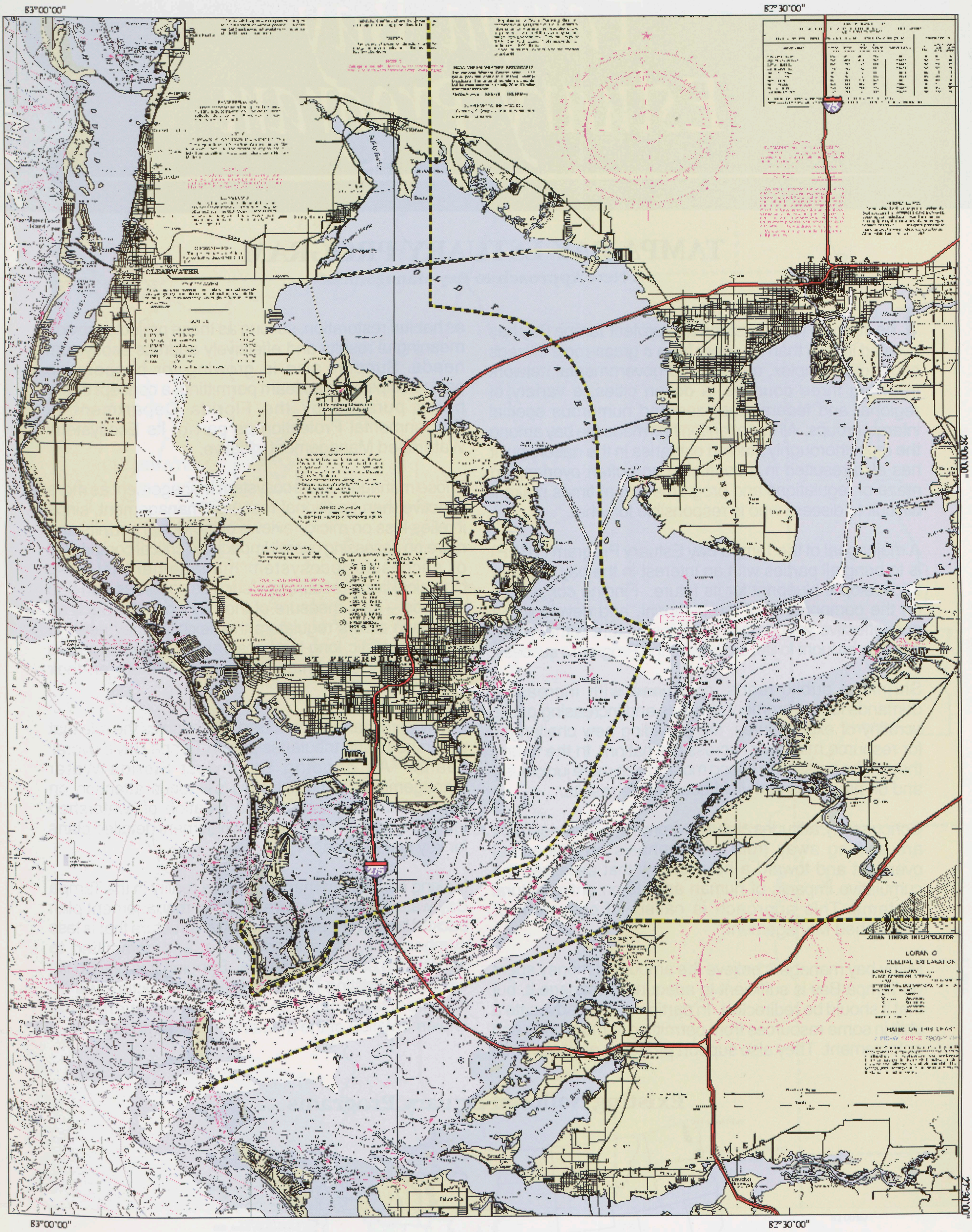
Additionally, bay managers are experimenting with alternatives to creating additional marked channels in the bay. These alternatives, aimed primarily at pleasure boaters who utilize shallow seagrass flats for fishing, include signs and buoys marking shallow waters, the creation of seagrass protection zones in which use of internal combustion engines is banned, and installation of inexpensive "stop and go sticks" that alert boaters when tides are too low to safely navigate a shallow area.

Artificial Reefs
The first artificial reef in Tampa Bay was constructed by a local fishing club in 1959 from old cars. In 1965, two more reefs were constructed from old tires. Today, artificial reefs are built mainly of cement and other construction debris associated with road and bridge construction and demolition. There are presently 12 artificial reefs in Tampa Bay. These sites provide hard-bottom habitat that attracts a variety of fish and other marine life, and are popular fishing spots for local anglers.

Tampa Bay Shipping Channels



NOAA Nautical Chart Number 11412



Interstate Highways

County Boundaries

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TAMPA BAY ESTUARY PROGRAM

A New Approach to Bay Management

The struggle to understand and protect Tampa Bay has evolved in less than 25 years from a grass-roots citizens effort to a complex, multilayered governmental network involving three counties, a dozen cities, a variety of regional and federal agencies and numerous special interest groups. All this attention has made the bay among the most thoroughly studied estuaries in the nation, but it has also resulted in a confusing and often overlapping maze of regulations and programs that at times make it difficult to discern who is responsible for what.

A major goal of the Tampa Bay Estuary Program (TBEP) is to bring all parties with an interest in the bay together to develop a blueprint for its future. Finding consensus on the components of the blueprint, and developing a cost-effective yet comprehensive structure within which it can be brought to life, are keys to the Program's success.

Shrinking public funds, combined with increasing demands for government services and increasing public scrutiny of expenditures, are providing new challenges for resource managers across the nation. In the future, they will be pressed to spend money even more judiciously and on programs that yield quantifiable results.

Concurrently, attitudes about environmental management are shifting away from an emphasis on piecemeal oversight and toward a holistic view that assesses the cumulative impacts of human actions on entire natural systems. This approach is called "Ecosystem or Watershed Management."

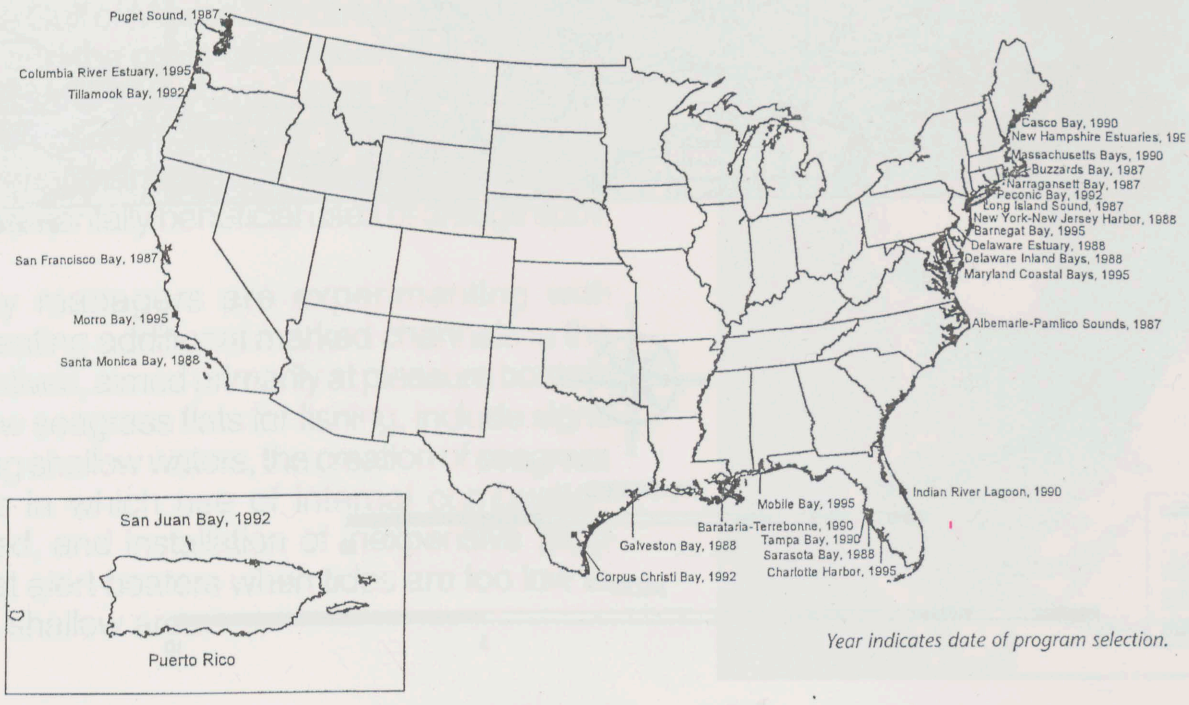
Many bay managers believe the amount of money spent on Tampa Bay is sufficient to adequately manage it, but that it should be redirected. In particular, they advocate a shift in some resources from permitting to monitoring and enforcement. They also support proactive projects, such as habitat restoration, so long as these projects provide meaningful results and effectively address ecosystem needs. Support also is growing for cooperative partnerships such as team permitting, a concept that is being pursued by the Florida Department of Environmental Protection as part of its Ecosystem/ Watershed Management initiative.

Those managers see ecosystem management as more effective than traditional resource management, since it relies less on micro-reviews of individual permits and more on assessing overall impacts. A critical component of successful ecosystem management is using biological living resources -- such as seagrass, fish and scallops -- as a measure of the bay's health. Such an approach allows regulators the flexibility they need to achieve realistic, long-term goals and provides taxpayers with a better benchmark to judge the return on their investments.

Ecosystem management also emphasizes the role that watersheds and tributaries play in Tampa Bay's overall health. An ongoing Southwest Florida Water Management District initiative will focus attention on these vital areas through the creation of "watershed teams" which will prepare and implement detailed plans for key watersheds.

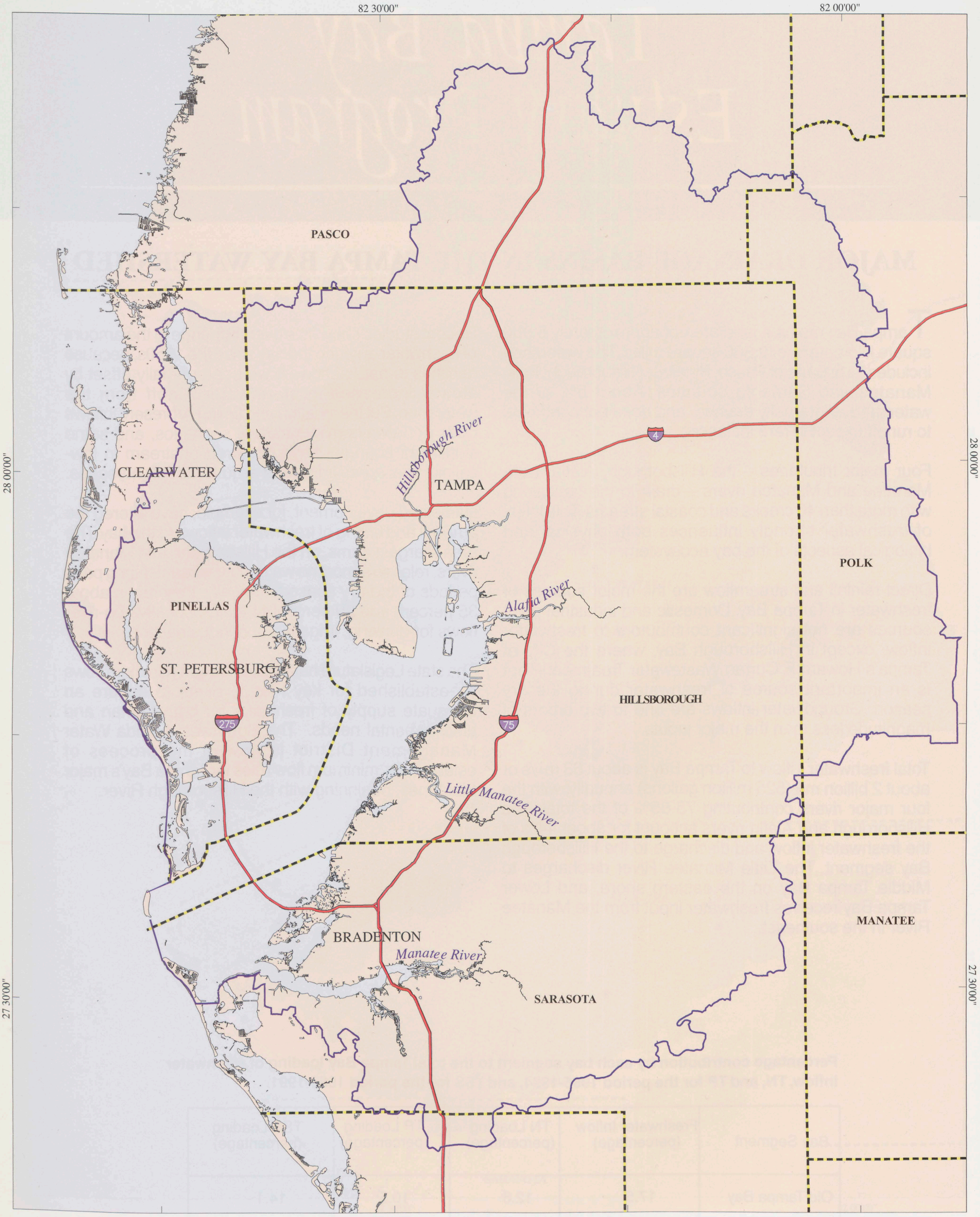
Making ecosystem management a reality in the Tampa Bay watershed will require a strong management plan backed by a stronger administrative structure that is less cumbersome, more accountable, and committed to addressing ecosystem needs. Bringing this plan to life within the existing bay management structure will be an important focus of the TBEP in overseeing implementation of the master plan for Tampa Bay.

Existing National Estuary Programs



Year indicates date of program selection.

Tampa Bay Estuary Program Boundary



MAJOR DRAINAGE BASINS IN THE TAMPA BAY WATERSHED

Tampa Bay drains a land area of approximately 5,950 square kilometers, or 2,300 square miles. The watershed includes all or parts of Pasco, Pinellas, Hillsborough, Polk, Manatee and Sarasota counties. About 5% of the watershed is internally drained, and does not contribute to runoff except in rare instances.

Four major tributaries – the Hillsborough, Alafia, Little Manatee and Manatee rivers – drain to the bay, along with more than 40 creeks and coastal streams. This influx of freshwater strongly influences both physical and biological aspects of the bay ecosystem.

Direct rainfall and streamflow are the major sources of freshwater in Tampa Bay. Domestic and industrial point sources are not significant contributors to freshwater inflow, except in Hillsborough Bay, where the City of Tampa's Howard F. Curran Wastewater Treatment Plant is an important source of freshwater during the dry season. Groundwater inflows are one to two orders of magnitude less than the major inputs.

Total freshwater inflow to Tampa Bay is about 63 m≈/s or about 2 billion m≈ (525 million gallons) annually, with the four major rivers contributing 75-85% of the total. The Hillsborough and Alafia rivers account for about 44% of the freshwater inflow and discharge to the Hillsborough Bay segment. The Little Manatee River discharges to Middle Tampa Bay on the eastern shore, and Lower Tampa Bay receives freshwater input from the Manatee River in the southeast.

Recent studies show little overall change in the amount of freshwater entering the bay since the 1950s, because declines in natural flows have been partially offset by steady increases in stormwater runoff from the watershed. But the location and timing of present inflows does not always mimic natural scenarios, and some significant changes have occurred upstream in low-salinity tidal areas important as juvenile fish nurseries.

Dams and development, for example, have altered the amount and timing of freshwater inflows to the bay. The area's largest dams, on the Hillsborough and Manatee rivers, release almost no water downstream during peak periods of the dry season; annually, they retain about 35 percent and 29 percent of their respective up-river flows for drinking, irrigation and industrial uses.

The state Legislature has mandated that minimum flows be established for key Florida rivers to ensure an adequate supply of freshwater for both human and environmental needs. The Southwest Florida Water Management District is now in the process of establishing minimum flow rules for Tampa Bay's major tributaries, beginning with the Hillsborough River.

Percentage contribution by each bay segment to the total Tampa Bay loading of freshwater inflow, TN, and TP for the period 1985-1994, and TSS for the period 1985-1991.

Bay Segment	Freshwater Inflow (percentage)	TN Loading (percentage)	TP Loading (percentage)	TSS Loading (percentage)
Old Tampa Bay	17.5	12.6	10.5	14.1
Hillsborough Bay	29.6	40.9	55.9	42.1
Middle Tampa Bay	22.5	19.0	13.8	14.7
Lower Tampa Bay	12.9	9.0	10.5	1.4
Boca Ciega Bay	6.4	5.6	3.6	12.3
Terra Ceia Bay	1.1	0.9	0.7	0.6
Manatee River	10.0	11.9	5.0	14.7

Major Drainage Basins in The Tampa Bay Watershed

82 30'00" 82 00'00"

28 00'00" 27 30'00"

PASCO

PINELLAS

HILLSBOROUGH

POLK

MANATEE

SARASOTA

275 75 4

82 30'00" 82 00'00"

N W E S

Kilometers
10 0 10 20

Miles
6 0 6 12 18

- USGS Gauge Locations
- Interstate Highways
- County Boundaries
- Manatee River Basin
- Little Manatee River Basin
- Alafia River Basin
- Hillsborough River Basin
- Coastal Drainage Into Tampa Bay
- Boca Ciega Basin

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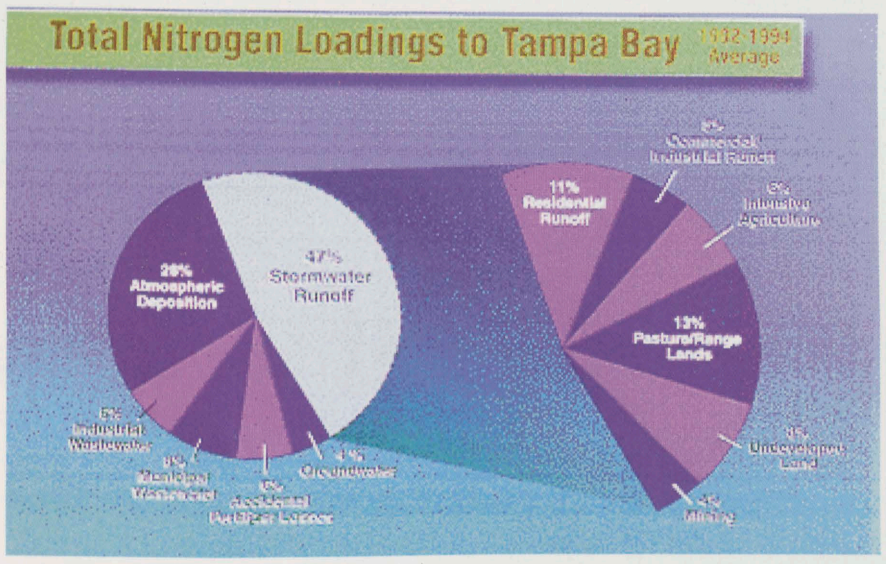
NITROGEN MANAGEMENT FOR TAMPA BAY

The Tampa Bay watershed is divided into 10 major drainage basins, which correspond to the drainage areas of the four major rivers (Hillsborough, Alafia, Little Manatee and Manatee) and the six ungauged drainage basins (Old Tampa Bay, Hillsborough Bay, Middle Tampa Bay, Lower Tampa Bay, Boca Ciega Bay and Terra Ceia Bay).

The 10 major drainage basins provide freshwater inflow to seven Tampa Bay segments. They also contain various sources of runoff which deliver not only freshwater, but associated nutrients and pollutants. These sources include nonpoint sources, atmospheric deposition (directly to the open water of the estuary), point sources (industrial, domestic and springs), groundwater, and septic tank leachate and wastewater residual solids.



Excessive nitrogen loading is of special concern in Tampa Bay because too much of this essential nutrient causes algae blooms, turbidity and resulting water quality deterioration. Nutrient enrichment of Tampa Bay was most serious from the late 1960s to the early 1980s; improvements in wastewater treatment, combined with stronger regulations governing pollutant sources have greatly reduced the loading of nitrogen and suspended solids to Tampa Bay in recent years.

The challenge facing bay managers now is to maintain that progress as the area's population continues to rise. *Charting The Course,* the Comprehensive Conservation and Management Plan for Tampa Bay, calls for Estuary Program partners to maintain nitrogen loadings to the bay at 1992-1994 levels — even with increased growth in the region. This "hold the line" strategy will allow the gradual recovery of more than 12,000 acres of seagrasses which serve as a vital life support system for the bay.

Loading estimates developed for the TBEP indicate that an additional 84 tons of nitrogen is expected to enter Tampa Bay by the year 2000 as a result of population growth and associated development. Therefore, local governments and industries will need to reduce or avoid increasing the amount of nitrogen they generate by this amount to maintain current levels. To achieve this goal, local government partners of the TBEP agreed to reduce nitrogen loadings associated with stormwater runoff and wastewater discharges by about 6 tons per year, or a cumulative total of 28 tons per year by 2000.

A Nitrogen Management Consortium of local utilities, industries, agricultural interests, local governments and environmental agencies was established in 1996 to develop a plan to address the remaining balance of 11 tons of nitrogen per year, or 56 tons per year by the year 2000, expected to come from atmospheric deposition, industrial point sources, fertilizer shipping and handling, and intensive agriculture.

Consortium members include representatives of the TBEP's Management Board as well as representatives of local electric utilities, phosphate companies, and agricultural interests. This innovative private-public partnership developed and adopted a Nitrogen Management Action Plan in March 1998 that identifies specific actions each Consortium member will take to meet its nitrogen management obligation. The action plan is accompanied by a formal Resolution signifying each Consortium member's firm commitment to achieving the agreed-upon goals.

Tampa Bay Nitrogen Management Consortium

Public Partners:

U.S. Environmental Protection Agency
Florida Department of Environmental Protection
Southwest Florida Management District
Hillsborough County
Manatee County
City of Clearwater
City of St. Petersburg
City of Tampa
Hillsborough County EPC
FDEP Florida Marine Research Institute
Tampa Bay Regional Council
U.S. Army Corp of Engineers
Tampa Port Authority
Manatee County Agricultural Extension Service

Private Partners:

Florida Phosphate Council
Eastern Associated Terminals, Inc.
Florida Power & Light Company
Florida Strawberry Growers Association
IMC-Agrico
CSX Transportation
Cargill Fertilizer, Inc.
CF Industries, Inc.
Pakhoed Dry Bulk Terminals

Nitrogen Management For Tampa Bay

82 30'00" 82 00'00"

28 00'00" 27 30'00"

PASCO

Old Tampa Bay

PINELLAS

Hillsborough Bay

HILLSBOROUGH

POLK

Middle Tampa Bay

Boca Ciega Bay

Lower Tampa Bay

Terra Ceia Bay

MANATEE

SARASOTA

275 75 4

N W E S

Kilometers

10 0 10 20

Miles

6 0 6 12 18

- Coastal Drainage into Old Tampa Bay
- Hillsborough River Drainage into Hillsborough Bay
- Little Manatee River and Coastal Drainage into Middle Tampa Bay
- Coastal Drainage into Lower Tampa Bay
- Boca Ciega Drainage into Boca Ciega Bay
- Coastal Drainage into Terra Ceia Bay
- Manatee River Drainage into Lower Tampa Bay
- Interstate Highways
- County Boundaries
- Bay Segments

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LAND USE IN THE WATERSHED

Developed lands constitute approximately 60% of the Tampa Bay watershed. That development includes industrial, commercial and residential development, as well as agricultural fields and range and pasture lands.

More than 68% of the bay watershed is uplands. These high and dry areas, which include pine flatwoods, oak hammocks and scrub communities, have received most of the development pressure. Increased attention has been paid in recent years to preserving upland habitats through public land acquisition programs, as well as through less-than-fee-simple arrangements such as conservation easements. Additionally, efforts are being made to preserve contiguous linear tracts that serve as wildlife corridors and buffers for rivers and wetlands.

Land use varies considerably by county. In Pinellas County, residential and commercial uses comprise the vast majority of development, and the county has no significant agricultural uses. The situation is reversed in Manatee and Hillsborough, where agricultural operations — particularly cattle ranching, row crops, tropical fish farms and dairy farms — are important economic engines. Overall, intensive agriculture or crops, tropical fish farms and dairy farms — are important economic engines. Overall, intensive agriculture or range and pasture lands account for nearly 35% of the available land in the bay watershed. Mining of phosphate rock for fertilizer production also is a significant land use in parts of Hillsborough and Manatee counties.

As urbanization spreads throughout the watershed, conversion of agricultural and undeveloped lands for residential uses follows. Land used for residential development currently encompasses about 15.5% of the watershed and is expected to increase at a steady pace.

The link between land use and water quality is well known. In Tampa Bay, the amount of nitrogen added to the bay is directly related to activities on land. Research indicates that the largest per-acre nitrogen loading is associated with intensively farmed lands (5.65 pounds per acre), followed by commercial/industrial uses (5.26 pounds per acre), mining (4.97 pounds per acre) and residential development (4.52 pounds per acre).

Per-Acre Nitrogen Loadings from Non-Point Sources

	% Loading	% Watershed
Residential	10	15.5
Commercial Industrial/Institutional	5	6.4
Mining	4	3.2
Range and Pasture	13	28.4
Intensive Agriculture	6	6.5
Undeveloped Land	7	39.93

Land Use In The Watershed

82 30'00" 82 00'00"

28 00'00" 28 00'00"

27 30'00" 27 30'00"

PASCO

PINELLAS

HILLSBOROUGH

POLK

MANATEE

SARASOTA

275 75 4

82 30'00" 82 00'00"

N W E

Kilometers
10 0 10 20

Miles
6 0 6 12 18

- Residential Uses
- Commercial and Industrial Uses
- Recreational Uses
- Agricultural Uses
- Other Land Use Categories
- Interstate Highways
- County Boundaries

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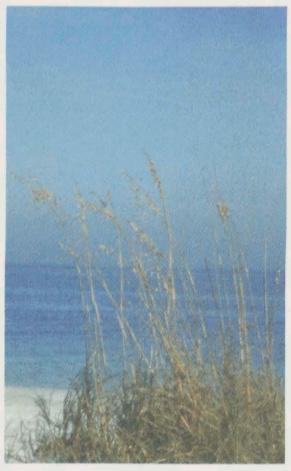
HABITAT LOSSES IN TAMPA BAY

Since 1950, almost half of Tampa Bay's original saltwater wetlands and nearly 40 percent of its seagrasses have been lost to dredging and filling for shoreline and port development. These losses have not been spread equally across habitat types, with oligohaline (low-salinity) tidal marshes experiencing the greatest decline.

In 1900, there were an estimated 16,200 acres of oligohaline marshes, which are critical nursery areas for many species of fish and invertebrates. By the mid-1990s, there were only 4,117 acres-a loss of almost 75%. By comparison, about 17% of the bay's mangrove forests have been lost since the turn of the century, along with about 13% of its salt barrens. Salt barrens experienced the smallest decline of the bay's coastal wetland habitats, shrinking from 1,012 acres in 1900 to 877 acres in 1990.

Estimated acreage of these three habitat types (tidal marshes, mangrove/cordgrass marshes, salt barrens) in 1950 shows that nearly 80% of the loss of tidal marshes occurred during the first half of the century. But between 1950 and 1990, relative losses of both tidal marshes and salt barrens far exceeded that of mangroves.



As a result of these differential losses, the relative proportions of each habitat type have changed dramatically since 1900. The ratio of mangroves: tidal marshes: salt barrens, based on percent of total emergent wetland acreage in 1900 is estimated to have been 49:48:3, respectively. By 1950 this had changed to 67:28:5, and by 1990 had reached 73:22:5.

Uplands also have been hit hard by development associated with the region's sustained growth. Based on soils, elevation and hydrology, it is estimated that at least 70% of the historic uplands in the watershed were pine forests. Today, only about 31% of the remaining uplands in the Tampa Bay area are pine flatwoods,, and coastal pine forests have been virtually eliminated.

The Tampa Bay Estuary Program's Comprehensive Conservation and Management Plan for the bay emphasizes recovering more than 12,000 acres of

seagrasses through improved water quality, and restoring the historic balance and diversity of coastal and associated upland habitats. Specific goals include the restoration of at least 100 acres of low-salinity tidal marsh every five years; protection and enhancement of the bay's mangrove and salt marsh communities (which total nearly 14,000 acres); and restoration over time of 150 acres of salt barrens. Recent assessments show that progress toward all these goals is on target, with more than 250 acres of low-salinity tidal marshes already restored, and an ambitious land-buying and habitat restoration program underway to preserve and enhance other coastal habitats.

In undertaking habitat restoration projects, TBEP's partner governments and regulatory agencies have agreed to implement the "restoring the balance" philosophy by creating habitat mosaics that feature a diversity of wetland and upland habitats.

Baywide emergent tidal wetland temporal trends for the period c. 1950 to 1990.

Habitat Type	1950 acres	1950 percent	1990 acres	1990 percent	NET CHANGE acres	NET CHANGE percent
Mangroves/Spartina marsh[1]	15,894	67%	13,764	73%	-2,130	-13%
Juncus marsh[2]	6,621	28%	4,117	22%	-2,504	-38%
Salt barren[3]	1,371	5%	877	5%	-494	-36%
TOTAL	23,886		18,758		-5,128	-21%

[1] Includes mangrove forests represented by *Rhizophora, Avicennia* and *Languncularia*, and successional polyhaline marshes represented predominantly by cordgrass (*Spartina*).

[2] Includes mesohaline and oligohaline marshes represented predominantly by needlerush (*Juncus*), leather fern (*Acrostichum)*, sawgrass (*Cladium*), and cattails (*Typha*) with a mix of black mangroves (*Avicennia)* and cordgrass.

[3] Includes hypersaline salt barrens represented predominantly by saltwort (Batis), glasswort (Salicornia) and saltgrass (Distichlis).

Selected Land Cover Categories In The Tampa Bay Region

82 30'00" 82 00'00"

28 00'00" 28 00'00"

27 30'00" 27 30'00"

PASCO

PINELLAS

HILLSBOROUGH

POLK

MANATEE

SARASOTA

4 275 75

82 30'00" 82 00'00"

N W E

Kilometers
10 0 10 20

Miles
6 0 6 12 18

- Upland Forests
- Range Lands
- Wetlands
- Barren Lands
- Other Land Cover/Use Categories
- Interstate Highways
- County Boundaries

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TAMPA Estuary Program

WATER MOVEMENT IN TAMPA BAY

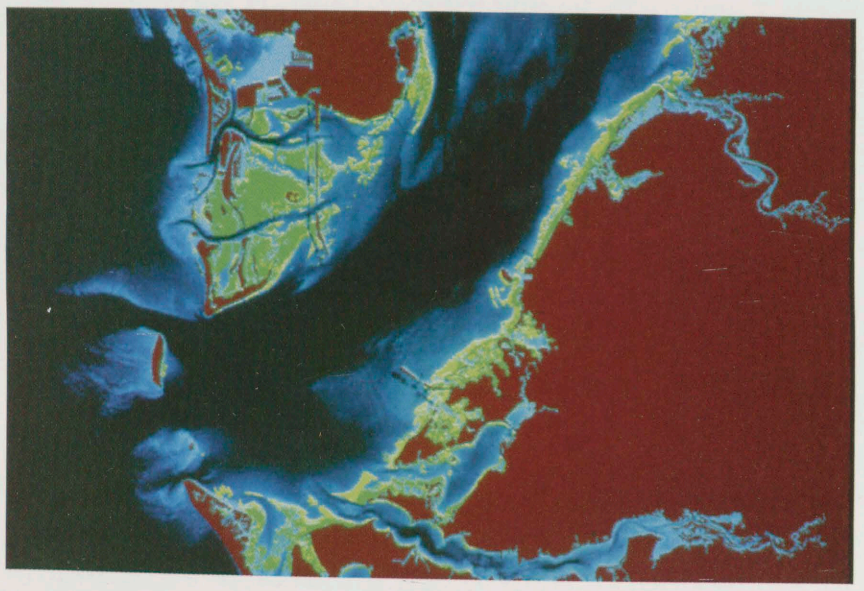
Tampa Bay is a shallow Y-shaped body of water with an average depth of about 4 meters (13 feet). About 75% of the bay is between 3 and 18 feet deep: exceptions are the man-made shipping channel that bisects the bay, 43 feet at its deepest, and a few pockets of natural deep water near the mouth of the bay.

Water movement in Tampa Bay is heavily influenced by tides from the Gulf of Mexico, as well as winds, freshwater inflow, and the physical structure of the bay itself. Tidal forcing is primarily mixed lunar semi-diurnal and solar diurnal, resulting in two unequal high and two unequal low tides daily, with an average tidal range of about 0.7 meters (2.3 feet). Storm surges associated with tropical storms and hurricanes can result in abnormally high tides. The highest recorded storm tide in Tampa Bay was 4.5 meters (15 feet) in 1848.

Tidal action results in currents of approximately 1.8 meters per second (5.9 feet per second) on ebb tides and about 1.2 m/s (3.9 ft/s) on flood tide at the mouth of Tampa Bay. It takes the flood tide 3.5 hours to propagate from the mouth to the upper reaches of the bay, with shorter duration for the ebb cycle.

Tidal forcing leads to water exchange between segments and with the Gulf of Mexico. Lower Tampa Bay interacts with the Gulf of Mexico, Boca Ciega Bay, Terra Ceia Bay, and Middle Tampa Bay, and tidally exchanges approximately 6.5 % of its total volume daily. Middle Tampa Bay has a daily tidal exhange of about 4.6% percent of its total volume, and interacts with Old Tampa Bay, Hillsborough Bay, and Lower Tampa Bay. Old Tampa Bay has a daily tidal exchange rate of approximately 4.6% of its volume, and interacts with Middle Tampa Bay. Hillsborough Bay has the least tidal exchange of any segment, with only about 1.4% of its volume exchanged daily.

Winds affect the general circulation of the estuary, as well as the magnitude of the tides. Winds from the northeast associated with fall and winter weather patterns result in a lowering of mean sea level by several inches, as well as lower water temperatures.

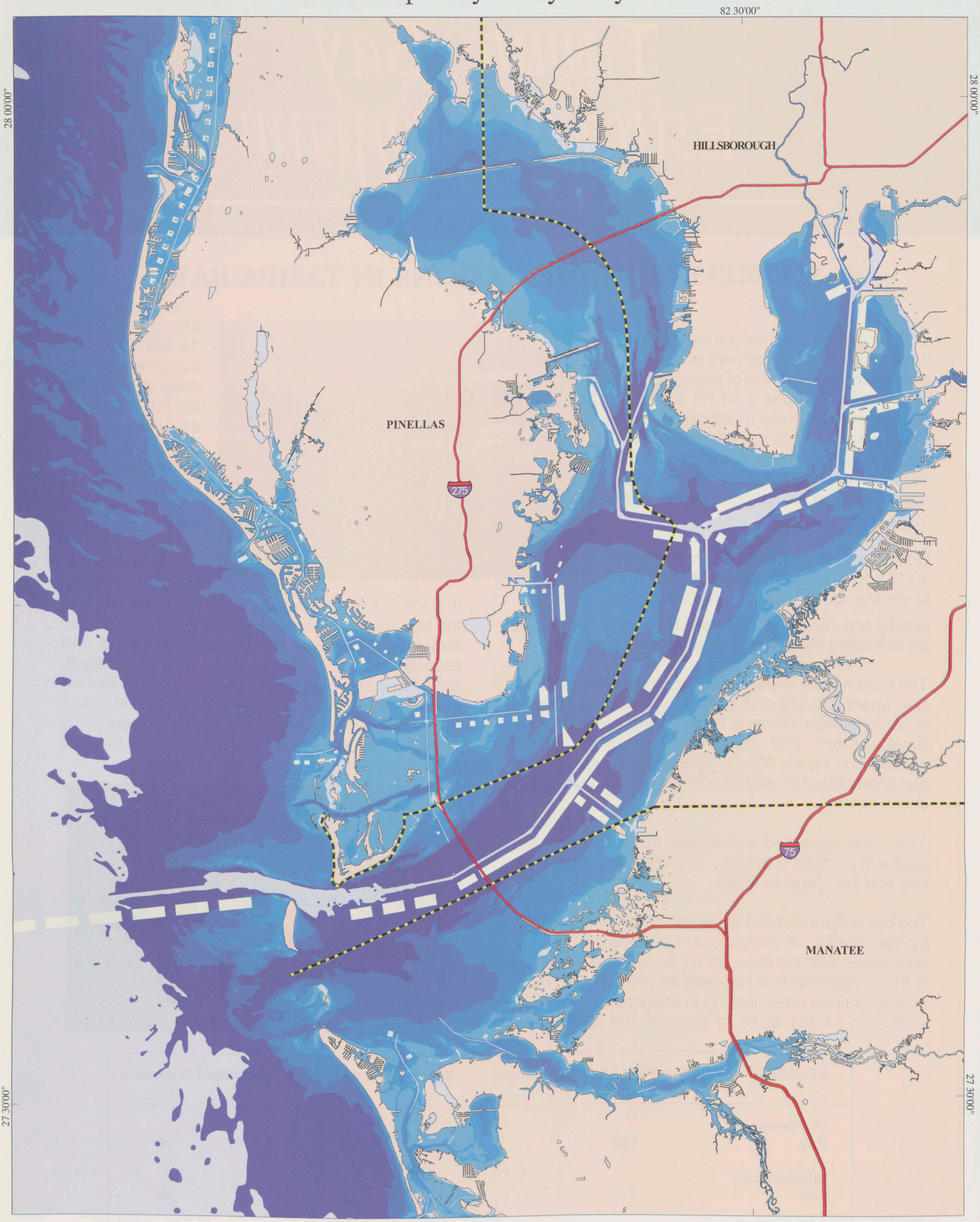


Winds blowing from the south-southwest result in an increase of mean sea level, and produce non-tidal currents from the middle to the bottom of the water column directed out of the bay within the deep channel, with return flow nearer the surface and along the sides. When winds blow in the opposite direction, the converse occurs.

Freshwater inflow in the bay results in horizontal salinity gradients important to the circulation and flushing of Tampa Bay, especially along its eastern shore where most of the freshwater inflow occurs. Despite the fact that freshwater inflow is only 63 m/s, compared to the average tidal flow at halftide of 25,500 m/s, these horizontal salinity gradients may dominate the residual (not tidal-induced) circulation of Tampa Bay. Modeling results indicate that freshwater exits the bay along its banks and near the surface, while saltier water enters the bay along its axis and nearer the bottom of the water column.

The physical structure of the bay also affects circulation and flushing. In addition to the tidal flow following the dredged main shipping channel, other circulation features are associated with man-made causeways of the four main bridges spanning the bay. A series of circular tidal gyres in the bay is thought to be caused by these man-made structures. The gyres can be from one to six miles in diameter, and may decrease the exchange of water, as well as the nutrient and pollutant loads associated with it, in the northern portions of the bay.

Tampa Bay Bathymetry



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- Depths Greater Than Thirty Feet
- Thirty Foot Depth Contour
- Eighteen Foot Depth Contour
- Twelve Foot Depth Contour
- Six Foot Depth Contour
- Three Foot Depth Contour
- Spoil Locations
- Interstate Highways
- County Boundaries

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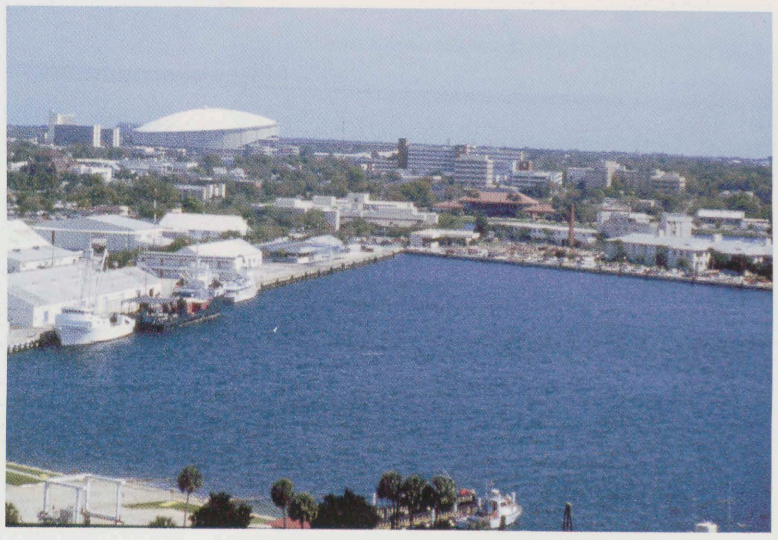
TAMPA
Estuary Program

SHORELINE MODIFICATIONS IN TAMPA BAY

About half the bay's natural shoreline has been altered by development or hardened through the construction of seawalls, piers and jetties. Dredge and fill activities associated with these modifications have had severe impacts on habitats in many areas, resulting in the loss of nearly half the bay's original saltwater wetlands and almost 40% of its seagrasses since the 1950s.



Going back farther in time, an estimated 13,161 acres of bay bottom have been filled since the early 1900s, with 91% of this activity occurring along the bay's shallow shoreline and an estimated 9% in the deeper portions of the bay.

The most heavily impacted bay segment is Boca Ciega Bay, where 73% of the natural shoreline has been altered in some fashion, primarily to accommodate residential development and associated finger-fill canal construction. Nearly 60% of Hillsborough Bay's shoreline has been altered, mostly for port-related and commercial development.

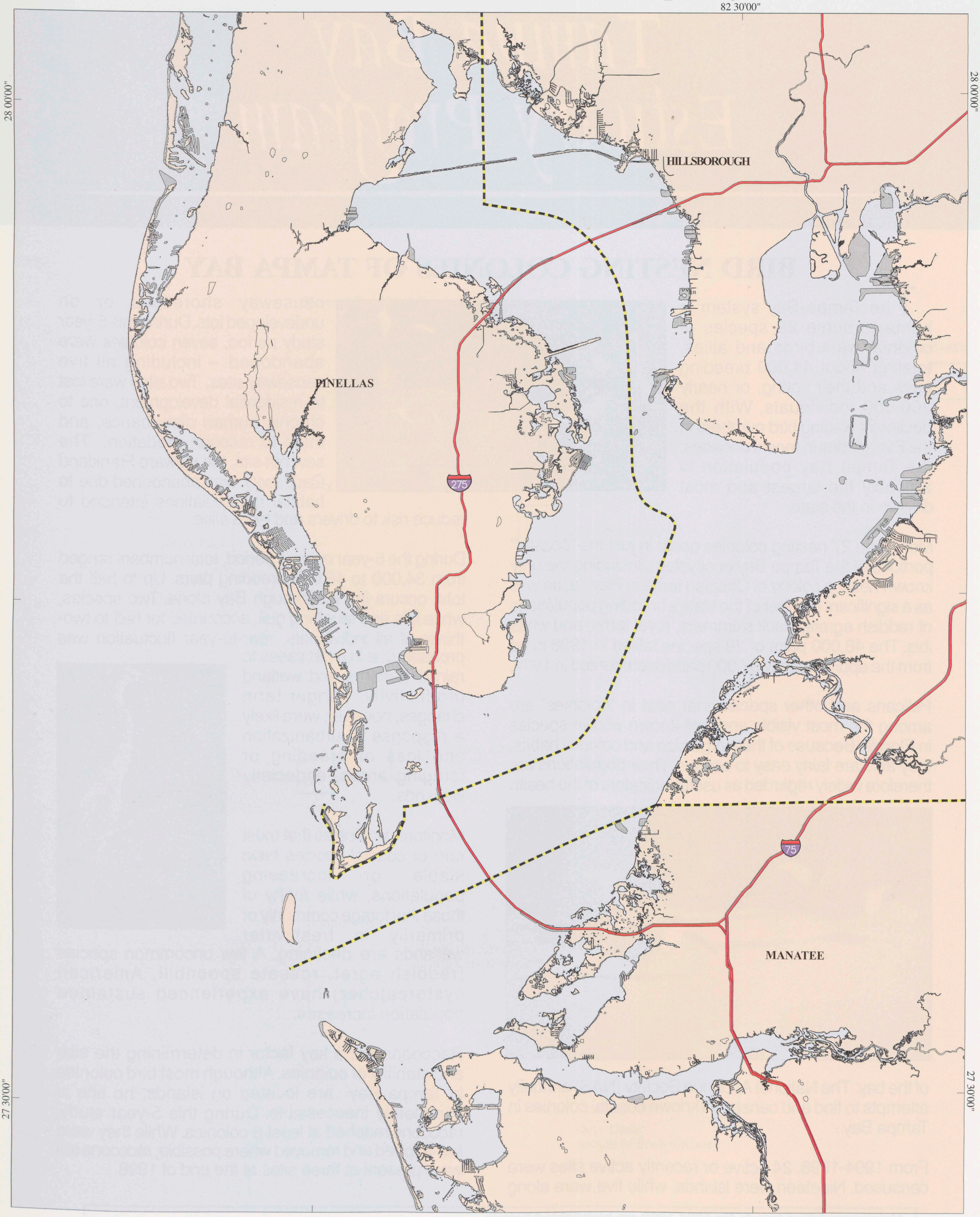
The least impacted shorelines are located in the southern portions of the bay, encompassing Terra Ceia Bay and the Manatee River.

The bay bottom and shoreline also have been impacted by the creation of navigational channels and dredge spoil areas. With the exception of Boca Ciega Bay, most of the navigational features were developed within deep coarse-grained areas lacking in seagrasses. Out of an estimated 14,381 acres of channel and spoil areas, about 76%, or 12,455 acres, has occurred in the deep portions of the bay. However, approximately 60% of the channels in Boca Ciega were estimated to have been dredged in or adjacent to shallow areas.

In addition to direct impacts to the living resources of the bay, the filled areas in Tampa Bay have caused substantial changes to circulation patterns and reduced the total volume of the bay. As a result, research conducted by the U.S. Geological Survey indicates the volume of water that enters and leaves the bay during each tidal cycle has been reduced by about 5% since 1880. In Hillsborough Bay, the tidal prism has been reduced by about 15%.

SEGMENT	Modified Shoreline Length (miles)	Total Shoreline Length (miles)	Modified Shoreline (%)
Old Tampa Bay	128	290	44
Hillsborough Bay	74	128	58
Middle Tampa Bay	170	329	52
Lower Tampa Bay	40	118	34
Boca Ciega Bay	172	237	73
Terra Ceia Bay	15	47	32
Manatee River	31	91	35

1950 and 1989/90 Shorelines of Tampa Bay



KILOMETERS

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MILES

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1950 Shoreline and Land Mass of Tampa Bay

1989/90 Shoreline and Land Mass of Tampa Bay (1:40,000 scale)

Interstate Highways

County Boundaries

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TAMPA BAY Estuary Program

Tampa Bay Estuary Program

BIRD NESTING COLONIES OF TAMPA BAY

The Tampa Bay system is home to some 29 species of colonial waterbirds and allies, totaling about 44,000 breeding pairs and their young, or nearly 200,000 individuals. With the decline of wading bird numbers in the Everglades in recent decades, the Tampa Bay population is arguably the largest and most diverse in the state.

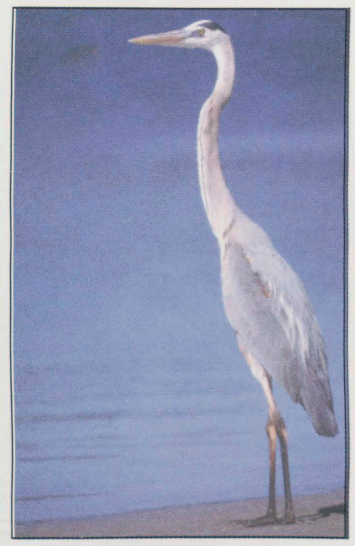
More than 27 nesting colonies occur in just the "coastal" portions of the Tampa Bay ecosystem, including the only known nesting colony of Caspian terns in Florida, as well as a significant number of the state's breeding populations of reddish egrets, black skimmers, royal terns, and white ibis. The 46,000 pairs of 29 species tallied in 1998 is up from the approximately 37,000 pairs documented in 1994.

Pelicans and other species that nest in "colonies" are among the most visible and well-known wildlife species in Florida. Because of their large size and colonial habits, they also are fairly easy to census. Their populations are therefore widely regarded as useful indicators of the health

of the bay. The National Audubon Society (NAS) annually attempts to find and census all known coastal colonies in Tampa Bay.

From 1994-1998, 24 active or recently active sites were censused. Nineteen were islands, while five were along causeway shorelines or on undeveloped lots. During this 5-year study period, seven colonies were abandoned – including all five causeway sites. Two sites were lost to residential development, one to chronic human disturbance, and three to raccoon predation. The seventh site, the Howard Frankland Causeway, was abandoned due to habitat manipulations intended to reduce risk to drivers and birds alike.

During the 5-year census period, total numbers ranged from 34,000 to 46,000 breeding pairs. Up to half the total occurs in Hillsborough Bay alone. Two species, white ibis and laughing gull, accounted for half to two-thirds of all individuals. Year-to-year fluctuation was probably due in most cases to rainfall patterns and wetland productivity. Longer-term changes, however, were likely a response to urbanization and loss of breeding or foraging areas, especially wetlands.



Monitoring indicates that most rare or coastal species have stable or increasing populations, while many of those that forage commonly or primarily in freshwater wetlands are declining. A few uncommon species (reddish egret, roseate spoonbill, American oystercatcher) have experienced sustained population increases.

Raccoons are a key factor in determining the size and stability of colonies. Although most bird colonies in Tampa Bay are located on islands, no site is completely inaccessible. During this 5-year study, raccoons reached at least 8 colonies. While they were live-trapped and removed where possible, raccoons still were present at three sites at the end of 1998.

Major population trends for 1994-1998 are highlighted below:

1. Brown Pelican — Numbers have remained stable since 1994, with about 1,600-2,00 breeding pairs – 20% of the state breeding population.

2. Reddish Egret — The numbers of this rare bird, the largest heron in North America, have increased to 60-75 pairs locally–15-20% of the state population.

3. Snowy Egret — About 800-1,000 pairs annually. Although the population appears stable for now, this species has declined significantly since the early 1980s, and probably statewide.

4. White Ibis — About 6,000-11,000 pairs locally, with a remarkable increase to 17,000 in 1998, due to expansion of wetland foraging areas associated with El Nino rainfall. Numbers were sharply lower in 1999. This species is believed to have declined locally by about two-thirds since the 1940s, due to loss of wetlands and wet pastures.

5. Roseate Spoonbill — Numbers continue to increase in the 1990s, with 110-150 pairs found at four sites, and more than 180 pairs in 1998 as a result of El Nino conditions.

6. Caspian Tern – Now three colonies in the state, with about 90 pairs in Hillsborough Bay. Numbers have increased since the early 1970s, when just 10-15 pairs were known.

7. Royal Tern – Two colonies in Tampa Bay with about 3,000 total pairs, about 85% of the state population. Numbers have increased over the past decade due to careful protection at Passage Key and Island 3-D.

8. Sandwich Tern — From fewer than 20 breeding pairs in the early 1980s, the local population now exceeds 500 pairs at two colonies.

9. Black Skimmer – About 600-700 pairs in six local colonies. Including another 300 pairs at colonies near Clearwater, 50-67% of the state population nests in the Tampa Bay region.

Important Bird Nesting Colonies of Tampa Bay

82 30'00"

28 00'00"

27 30'00"

Courtney Campbell Causeway

Alligator Lake

HILLSBOROUGH

Howard Frankland Causeway

Island 2D

Alafia Banks

Florida Power Rooftop
Weedon Island

Island 3D

PINELLAS

Dogleg Key

275

John's Pass

Coffee Pot Bayou

Cockroach Bay Shell Pit

Tarpon Key

Shell Key

Piney Point

75

Egmont Key

Washburn Sanctuary
(Terra Ceia Bird Key)

MANATEE

Passage Key

Dot - Dash
(mouth of Braden River)

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KILOMETERS

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MILES

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Bird Rookeries Located in Tampa Bay

Interstate Highways

County Boundaries

Florida Fish and Wildlife Conservation Commission
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MANATEE POPULATIONS IN TAMPA BAY

Manatees utilize Tampa Bay in several ways: feeding in its seagrass beds, calving in its quiet coves and tributaries, and basking during the winter in the warm-water outfalls of power plants bordering the bay.

In summer, the manatee population in Tampa Bay is approximately 70-100 animals that are typically widely dispersed as individuals range as far north as the Suwanee River and south to the Everglades. In winter, the population rises significantly and is more concentrated, as manatees seek refuge from cold temperatures in the heated effluent of power plants. Winter populations often exceed 200 animals; in February 1999, a record 230 manatees were sighted during aerial surveys of the bay. These animals are generally clustered near two power plants: the Big Bend station operated by Tampa Electric Co. in southern Hillsborough County, and the Bartow facility operated by Florida Power Corp. in northern St. Petersburg.

Scientists have been recovering and performing necropsies on manatee carcasses since 1974 to determine the causes of manatee deaths. Injured manatees also are rescued and treated at approved rehabilitation centers, for release back to the wild whenever possible. Both the salvage and rescue programs are coordinated by the Florida Marine Research Institute in St. Petersburg.

From 1985 through 1997, 157 manatee deaths were verified in Hillsborough, Manatee and Pinellas counties, an average of 12.1 animals per year. This is triple the annual mean of 3.1 deaths, or 33 total deaths, confirmed in Tampa Bay during the previous nine-year period between 1976 and 1984.

Manatee deaths are classified into seven categories. From 1985-1997, "perinatal" deaths (involving newborn manatees less than 1.5 meters long and still dependent on their mothers) accounted for the highest number of mortalities, with 31% of the total. That was followed by the "undetermined" category (24%) which includes juveniles and adults that are too decomposed to determine a specific cause of death. Collisions with watercraft caused 35 deaths, 22% of the total. Watercraft-related deaths include both propeller strikes as well as direct hull impacts.

To educate boaters about manatee and seagrass protection in Tampa Bay, the Tampa Bay Estuary Program's Manatee Awareness Coalition (MAC) has developed the "Manatee Watch" program. This innovative effort of several agencies, industries and interest groups is administered by Tampa Bay Watch and utilizes trained community volunteers to provide information to area boaters about manatee usage of the bay, and distribute tools such as polarized sunglasses and push poles that help boaters maneuver safely in shallow grass flats where manatees feed and rest.

Table 11-1. Causes and numbers of manatee deaths reported in the Tampa Bay area from 1985 to 1997. Data from the Florida Department of Environmental Protection, Endangered and Threatened Species Program.

CAUSE OF DEATH	YEAR DEATH REPORTED													TOTAL
	85	86	87	88	89	90	91	92	93	94	95	96	97	
Watercraft	3	2	0	1	3	1	3	4	0	5	5	4	4	35
Gate/Lock	0	2	0	0	0	0	0	0	0	0	0	0	0	2
Other Human	0	0	0	1	1	0	0	0	0	0	0	0	0	2
Perinatal	2	2	4	4	3	5	8	3	1	2	4	6	5	49
Other Natural	1	0	1	1	2	3	1	1	5	5	3	6	3	32
Undetermined	2	3	0	0	0	5	2	1	2	4	6	5	7	37
TOTAL	8	9	5	7	9	14	14	9	8	16	18	21	19	157

Manatee Mortality in Tampa Bay Since 1991

82 30'00"

28 00'00"

27 30'00"

HILLSBOROUGH

PINELLAS

MANATEE

275

75

N

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KILOMETERS

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MILES

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Manatee Mortality from January 1991 through December 1996

Manatee Mortality from January 1997 through December 1998

Interstate Highways

County Boundaries

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Estuary Program

SEA TURTLES IN TAMPA BAY

Four species of sea turtles are found in Tampa Bay: the loggerhead (*Caretta caretta)*, green (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii)* and hawksbill (*Eretmochelys imbricata*). The loggerhead is considered Threatened under the federal Endangered Species Act, while the Kemp's ridley, green and hawksbill are listed as Endangered. In fact, in the 1980s the Kemp's ridley was declared one of the 12 most endangered animals in the world by the International Union for the Conservation of Nature (IUCN).

Data collected from various sources suggests that sea turtles are common, if inconspicuous, inhabitants of Tampa Bay. They are nomadic, long-distance travelers that remain submerged most of the time; mature females come ashore only for short periods every few years to nest on the sandy beaches of Egmont Key and the barrier islands of Pinellas and Manatee counties.

Much of what is known about sea turtles in the bay has been compiled from nesting statistics and stranding reports. That information indicates that loggerheads are the most common species in Tampa Bay, followed by Kemp's ridleys, greens and hawksbills. It appears that at least the loggerhead and Kemp's ridley are year-round residents, and recent research indicates that the bay is an important foraging area for juvenile Kemp's ridleys. The Florida Marine Research Institute (FMRI) coordinates collection of data regarding sea turtle nesting in the Tampa Bay area, as well as the recovery and documentation of injured or dead sea turtles.

Historical literature suggests that turtles were once abundant in Tampa Bay — so much so they were once the focus of a lucrative fishery. However, overharvesting, poaching of eggs, loss of nesting beaches and numerous other factors have caused sea turtle populations to plummet worldwide, and Tampa Bay is no exception.

Table 13-2. Strandings of dead or injured marine turtles in inshore waters of the Tampa Bay area (from 27° 22'07" N to 28°07'05" N), 1980-1997 (Data source: Florida Sea Turtle Stranding and Salvage Network Database).

Year	Species					
	Caretta caretta	*Chelonia mydas*	*Lepidochelys kempii*	*Eretmochelys imbricata*	Unknown	Total
1980	0	0	0	0	0	0
1981	1	0	0	0	0	1
1982	3	0	0	0	0	3
1983	3	0	0	0	0	3
1984	2	0	0	0	0	2
1985	2	0	0	0	1	3
1986	11	0	0	0	0	11
1987	9	0	4	0	0	13
1988	9	1	3	0	2	15
1989	21	1	3	1	0	26
1990	14	0	3	0	0	17
1991	8	0	3	0	1	12
1992	8	1	1	0	1	11
1993	4	0	8	0	2	14
1994	5	3	4	0	1	13
1995	4	9	11	2	1	27
1996	7	9	6	3	0	25
1997	9	4	6	0	1	20
Total	120	28	52	6	10	216

Sea Turtle Nesting

Beaches in the Tampa Bay area were first monitored for nesting activity in 1982. With two notable exceptions (a Kemp's ridley nested in Madeira Beach in 1989 and a green turtle nested in Fort DeSoto Park in 1994), all the nests are believed to be those of loggerheads. The majority of nests were documented on Anna Maria Island, Egmont Key, the mid-Pinellas beaches and Fort DeSoto Park. Egmont Key is the most pristine nesting beach remaining in the area; it is a protected state park and nesting activity is monitored by park personnel.

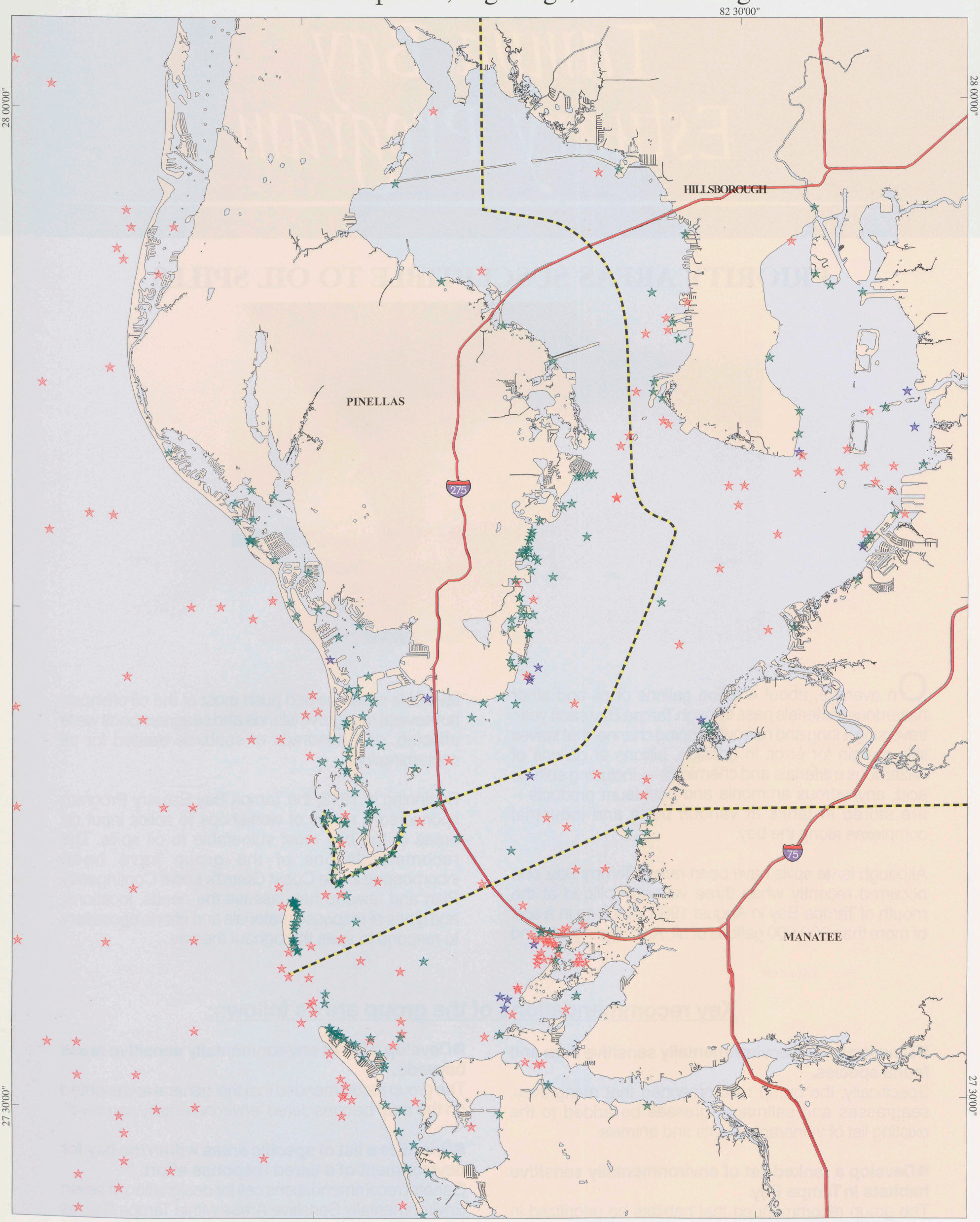
Because of variability in survey effort and data collection methods, the number of nests documented in the Estuary Program study area cannot be relied upon to evaluate long-term trends. Although, in general, nesting in the Tampa Bay area comprises only a small fraction of the total statewide nesting effort — only 0.05% of the 65,305 loggerhead nests documented in 1997 — the area is important from the standpoint of maintaining a wide geographic nesting range for the Florida loggerhead population. An extensive nesting range insulates the population from catastrophic events such as hurricanes, and also helps maintain genetic diversity.

Sea Turtle Strandings

Between 1980-1997, 216 dead or injured sea turtles were reported for the inshore waters of the Tampa Bay area. Strandings mirror population abundance, with loggerheads most frequently documented, followed by Kemp's ridley, greens and hawksbills. Increased public awareness of the importance of reporting dead or injured sea turtles is partially responsible for the increase in strandings over the reporting period. It is important to note that these records cover only inshore strandings; many more strandings occur offshore on Gulf beaches.
While stranded loggerheads recovered are mostly sexually mature adults, salvaged Kemp's ridley, green and hawksbill carcasses are nearly always juveniles and subadults. Dead or injured loggerheads and Kemp's ridleys have been recovered throughout the bay, while green turtle strandings have been primarily near the mouth of the bay, and hawksbills have been found only in the outer bay area.

Boat-related injuries were the most common carcass anomaly for loggerheads, visible on 33 of the 120 stranded loggerheads reported. Five ridleys and one hawksbill also showed evidence of boat injuries. Seven cases of entanglement were reported, affecting all species. Fibropapillomas, large tumors covering the soft parts of the turtle, were the most common carcass anomaly occuring on green turtles. The disease fibropapillomatosis is most commonly seen in green turtles, and tumors were not observed on any other species that stranded in Tampa Bay.

Sea Turtle Captures, Sightings, And Strandings



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- Captured Sea Turtles
- Sea Turtle Sightings
- Stranded Sea Turtles
- Interstate Highways
- County Boundaries

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Tampa Bay Estuary Program

PRIORITY AREAS SUSCEPTIBLE TO OIL SPILLS

On average, about 4 billion gallons of oil and other hazardous materials pass through Tampa Bay each year, traversing a long and narrow shipping channel that leaves little margin for error. In addition, billions of gallons of hazardous materials and chemicals — including sulfuric acid, anyhydrous ammonia and petroleum products -- are stored in tanks at various ports and industrial complexes along the bay.

Although large spills have been rare in Tampa Bay, one occurred recently when three vessels collided at the mouth of Tampa Bay in August 1993, resulting in a spill of more than 300,000 gallons of oil. An outgoing tide and favorable winds helped push most of the oil offshore, but several mangrove islands and seagrass beds were affected, and hundreds of seabirds treated for oil contamination.

Beginning in 1992, the Tampa Bay Estuary Program sponsored a series of workshops to solicit input on areas of the bay most vulnerable to oil spills. The recommendations of the group have been incorporated in the Coast Guard's Local Contingency Plan and used to help assess the needs, locations, and types of response materials and efforts necessary to respond to spills throughout the bay.

Key recommendations of the group are as follows:

■Develop lists of environmentally sensitive flora and fauna species.
Specifically, the group recommended that mangroves, seagrasses and saltmarsh grasses be added to the existing list of vulnerable plants and animals.

■Develop a ranked list of environmentally sensitive habitats in Tampa Bay.
The group recommended that habitats be prioritized in the following order (from least sensitive to most sensitive):

1. Vertical seawalls
2. Coarse-grained sand or fill beaches
3. Riprap
4. Fine-grained sand beaches
5. Tidal flats
6. Oyster bars
7. Seagrass beds
8. Mangroves and marshes

■Develop a list of environmentally sensitive areas baywide.
The group recommended that the general areas noted on the map be considered "environmentally sensitive".

■Prioritize a list of specific areas within the bay for development of a tiered response effort.
General recommendations call for designation of seven Environmentally Sensitive Areas within Tampa Bay, as follows. The areas are all ranked equally; however, the specifics at the time of a spill should determine which of these areas should be protected first.

A. Terra Ceia Bay
B. Bishops Harbor
C. Cockroach Bay/Little Manatee River
D. Bower Tract
E. Weedon Island
F. Fort DeSoto Park

Priority Areas Susceptible To Oil Spills

82 30'00"

28 00'00"

27 30'00"

HILLSBOROUGH

PINELLAS

MANATEE

275

75

KILOMETERS

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MILES

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Areas Sensitive to Oil Spills

Interstate Highways

County Boundaries

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ENVIRONMENTAL SENSITIVITY INDEX SHORELINE OF TAMPA BAY

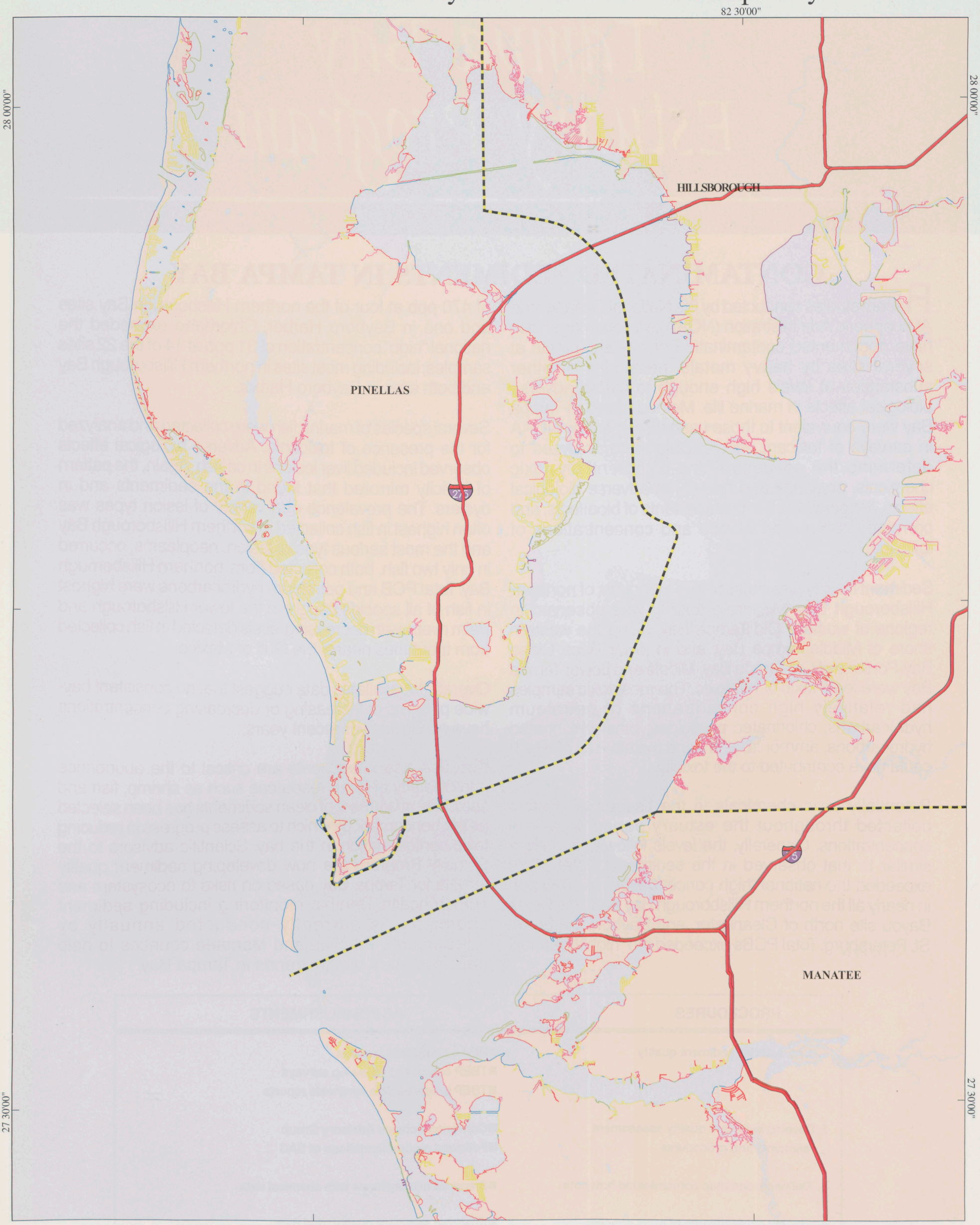
Oil spills can devastate ecosystems and severely impact water quality. The Environmental Sensitivity Index (ESI) was developed to reduce the environmental consequences of a spill and help prioritize the placement and allocation of resources during cleanup efforts. The successful use of analog and digital geographic information system versions of the ESI concept during the past ten years has led to improvements and refinements, including (1) the development of tidal inlet protection strategy maps produced before a spill that specify the type of response (e.g., boom, skimmer) and where and how to place it, (2) new large format seasonal summary maps, (3) geographic expansion of the ESI concept inland to classify the sensitivity of rivers using a river Reach Sensitivity Index (RSI), (4) regional watershed analysis to identify hazards and potential spill consequences, and (5) the identification of unusually sensitive areas to environmental damage if there is a hazardous liquid pipeline accident.

One of the primary objectives of oil spill planning and response, after protecting human life, is to reduce the environmental consequences of the spill and cleanup efforts. This objective is best achieved if the locations of sensitive resources are identified in advance, so that protection priorities can be established and cleanup strategies selected. With only a few hours to respond, there is no time for responders to contact all of the different resource managers for information on what areas are the most important to protect. For sensitive area mapping to be effective, it must be an integral component of an overall planning activity. A key requirement of the Oil Pollution Act of 1990 was the establishment of Area Committees who prepare Area Plans identifying sensitive areas, protection priorities, and protection methods. Area Committees are comprised of representatives of local, state, and federal agencies with regulatory authority and resource management responsibilities, as well as industry representatives who also must prepare facility and vessel response plans. These committees pre-plan how to implement an effective response during spill emergencies. The most widely used approach to sensitive area mapping, in both coastal and inland areas throughout the world, is known as the Environmental Sensitivity Index (ESI), an original concept which was first applied in 1979, when prototype ESI maps were prepared days in advance of the arrival of an oil slick into Texas waters from the Ixtoc I well blowout in the Gulf of Mexico.

The ESI is a spatial information system which is composed of three main components: a shoreline ranking system which ranks shoreline types on a scale of 1 to 10; oil-sensitive biological resources; and human-use resources of commercial, recreational, or subsistence value. Significant effort has been expended developing sensitivity mapping components of oil spill contingency plans around the world. Over the last 20 years, 61 ESI atlases (2,756 map sheets) have been prepared for the United States' coastline, including Alaska and the Great Lakes. This approach has been implemented in other countries such as Canada, United Arab Emirates, Israel, Jordan, El Salvador, Germany, South Africa, Mauritius, and New Zealand.

In the last few years, sensitivity mapping has moved from a static product of limited distribution focused only on coastal oil spills, to a more versatile and valuable tool for a wide range of natural resource management applications. In many areas, an ESI project becomes the impetus for compiling, synthesizing, and automating extensive data which have never been available in digital formats. In the United States, spill planning and response is organized under a tiered structure of national, regional, and area teams. The U.S. Coast Guard (USCG) is responsible for managing spills in navigable waters and the U.S. Environmental Protection Agency (USEPA) is responsible for inland spills.

Environmental Sensitivity Index Shoreline of Tampa Bay



KILOMETERS

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MILES

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- Exposed Vertical Rocky Shores
- Exposed Seawalls
- Fine Grained Sand Beaches
- Coarse - Grained Sand Beaches
- Mixed Sand and Gravel (Shell) Beaches/Fill
- Gravel Beaches/Riprap
- Exposed Tidal Flats
- Sheltered Rocky Shores/Seawalls
- Vegetated Banks, Solid Man - Made Structures
- Sheltered Tidal Flats
- Exposed Marshes and/or Mangroves
- Sheltered Marshes and/or Mangroves
- Interstate Highways
- County Boundaries

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TAMPA BAY Estuary Program

Tampa Bay Estuary Program

CONTAMINATED SEDIMENTS IN TAMPA BAY

Recent studies conducted by the National Oceanic and Atmospheric Administration (NOAA) and other agencies have documented contamination of bay sediments at several sites by heavy metals, pesticides or other substances at levels high enough to cause adverse biological effects in marine life. Methods used in Tampa Bay were equivalent to those used elsewhere by NOAA in surveys of toxicant effects. Data were analyzed to determine the concentrations of potentially toxic chemicals, presence and severity of adverse biological effects, the spatial patterns and extents of bioeffects, and correlations between effects and concentrations of toxicants.

Sediment toxicity was most severe in regions of northern Hillsborough Bay. Moderate toxicity was observed in regions of western Old Tampa Bay, along the western shore of Middle Tampa Bay, and in lower Boca Ciega Bay. Portions of Old Tampa Bay, Middle and Lower Tampa Bay were least toxic or nontoxic. The most toxic samples had relatively high concentrations of petroleum hydrocarbons, chlorinated pesticides, other chlorinated hydrocarbons, ammonia, and trace metals – all of which could have contributed to the toxicity.

Potentially toxic chemicals in the tissues of oysters collected throughout the estuary varied widely in concentrations. Generally, the levels followed a pattern similar to that observed in the sediments. Total PAHs exceeded the national "high concentration" of 1020 ppb in nearly all the northern Hillsborough Bay sites, the Cross Bayou site north of Clearwater, and Bayboro Harbor at St. Petersburg. Total PCBs exceeded the "high" threshold of 470 ppb at four of the northern Hillsborough Bay sites and one in Bayboro Harbor. Chlordane exceeded the national "high" concentration of 31 ppb at 14 of the 22 sites samples; including most sites in northern Hillsborough Bay and both sites in Bayboro Harbor.

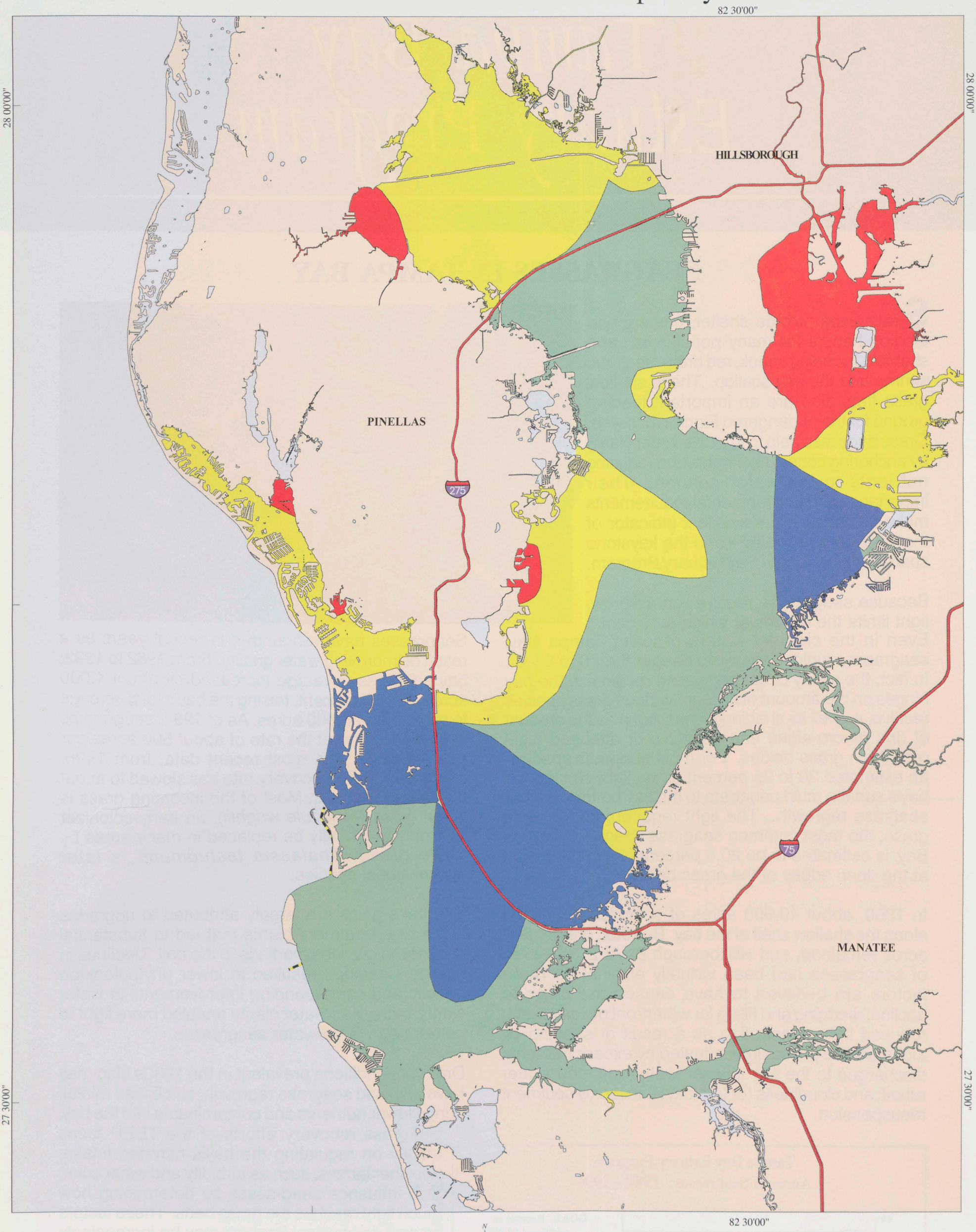
Several species of marine fish were collected and analyzed for the presence of toxicants. Adverse biological effects observed included liver lesions in catfish. Again, the pattern of toxicity mirrored that found in the sediments and in oysters. The prevalence of a variety of lesion types was often highest in fish collected in northern Hillsborough Bay and the most serious type of lesion, neoplasms, occurred in only two fish, both collected from northern Hillsborough Bay. Total PCB and petroleum hydrocarbons were highest in fish of all species caught in the lower Hillsborough and Palm rivers, with decreasing levels detected in fish collected from tributaries nearer the Gulf of Mexico.

Overall, the available data suggest that no consistent bay-wide patterns of increasing or decreasing concentrations have occurred over recent years.

Because clean sediments are critical to the abundance and diversity of living resources such as shrimp, fish and sea birds, attainment of clean sediments has been selected as the benchmark by which to assess progress in reducing toxic contamination in the bay. Scientific advisors to the Estuary Program are now developing sediment quality targets for Tampa Bay based on risks to ecosystem and human health. Benthic monitoring including sediment chemistry, is currently conducted annually by Hillsborough, Pinellas and Manatee counties to help track sediment quality trends in Tampa Bay.

PROCEDURES	ACCOMPLISHMENTS
1. Characterize sediment quality	■NOAA completed surveys ■TBEP completed follow-up surveys ■TBEP prepared data synthesis reports
2. Develop sediment quality assessment elements and procedures	■Convened Science Advisory Group ■Followed recommendations of SAG
3. Delineate and map contaminated hotspots	■Prepared overlay maps with chemical data
4. Identify contaminants of most concern	■Analyzed sediment quality triad data ■Prepared risk assessment for both wildlife and human health
5. Identify potential sources of chemicals of concern	■Analyzed categorical types of sources ■Identified specific potential sources in watershed
6. Develop indicators of sediment quality, specific metrics, and numerical targets	■Convened second SAG ■Prepared lists of each that satisfy goals and objectives of TBEP
7. Assess management options of potential sources	■Ongoing
8. Monitor sediment quality to assess changes, if any, and progress toward targets	■Prepared monitoring plans ■Initiated monitoring in 1995

Contaminated Sediments in Tampa Bay



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- Highest Sediment Degredation
- Intermediate Sediment Degredation
- Lowest Sediment Degredation
- Insufficient Data
- Interstate Highways
- County Boundaries

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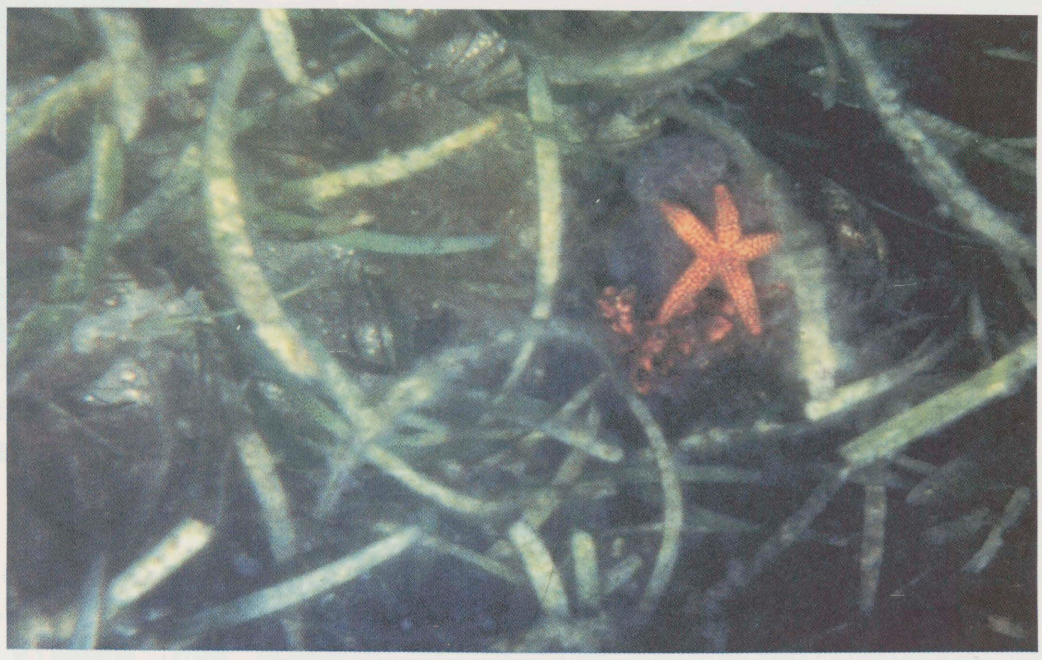
Tampa Bay Estuary Program

SEAGRASSES IN TAMPA BAY

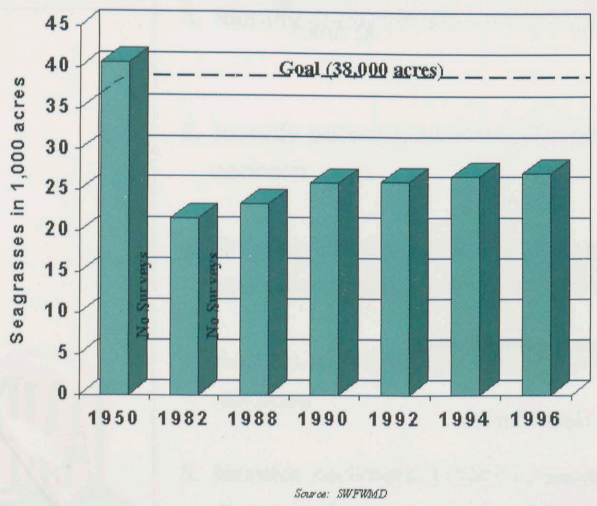
Seagrasses provide shelter, nursery and feeding habitat for many popular fish and shellfish, including snook, red drum, seatrout, shrimp and the bay scallop. These shallow grass flats also are an important feeding ground for the endangered Florida manatee. Grass beds also help to improve water clarity by anchoring bottom sediments and reducing nutrients in the water column. Their importance and environmental requirements make seagrasses an excellent indicator of the bay's overall health – and the keystone species for the Tampa Bay Estuary Program.



Because seagrasses require light to grow, light limits the depths at which they occur. Even in the clearest waters of lower Tampa Bay, seagrasses typically grow no deeper than 6 to 8 feet. In fact, the ability of seagrasses to recolonize the bay hinges on the amount of sunlight various grass species receive, as well as shading factors, such as the amount of drift macro-algae and epiphytic or attached algal growth on grass blades. For most seagrass species, an estimated 20 to 25 percent of the light striking the bay's surface must penetrate to the bay bottom to allow seagrass regrowth. The light requirement for turtle grass, the most common seagrass species in Tampa Bay, is estimated to be 20.5 percent of incoming light at the deep edges of the grass beds.

In 1950, about 40,000 acres of seagrass flourished along the shallow shelf of the bay. By 1982, only 21,600 acres remained, and Hillsborough Bay's 2,700 acres of seagrasses had been virtually eliminated. Three factors are believed to have caused the baywide decline: dredging and filling for waterfront development; reduced light penetration as a result of shading by algae and epiphytic growth fueled by excess nutrients discharged to the bay in wastewater and stormwater runoff; and cloudiness (or turbidity) caused by sediment resuspension.

Tampa Bay Estuary Program
Acres of Seagrasses: 1988 - 1996



Source: SWFWMD

GOAL: Recover an additional 12,350 acres of seagrass over 1992 levels, while preserving the bay's existing 25,600 acres.

STATUS: Since 1988, seagrass acreage is increasing at about 500 acres per year. At this rate, the goal will be reached in 25 years.

Seagrasses have rebounded in recent years as a result of improving water quality. From 1982 to 1992, bay seagrass coverage increased by about 4,000 acres, or 18.5 percent, raising the bay's total acreage to more than 25,600 acres. As of 1994, seagrasses were recovering at the rate of about 500 acres per year baywide. The most recent data, from 1996, indicates that the recovery rate has slowed to about 350 acres per year. Most of the incoming grass is shoal grass (*Halodule wrightii*), an early-colonizer that may eventually be replaced in many areas by turtle grass (*Thalassia testudinum*), a later successional species.

Seagrass gains are largely attributed to upgrades in sewage treatment plants that led to substantial declines in nitrogen loadings to the bay. Declines in nitrogen loadings resulted in lower phytoplankton density and corresponding improvements in water clarity. Increased water clarity enabled more light to penetrate to underwater seagrasses.

Drought conditions prevalent in the 1980s also may have assisted seagrass regrowth, since less rainfall brings fewer nutrients and contaminants into the bay.

Seagrass recovery efforts of the TBEP focus mainly on regulating the bay's nitrogen intake, but other factors, such as turbidity and water color, also influence seagrasses by determining how much light reaches the grass beds. These factors as well as physical impacts may be increasingly significant in areas of the bay where nitrogen management alone does not achieve seagrass restoration goals. Additional research being conducted by Hillsborough, Manatee, and Pinellas counties, the City of Tampa, SWFWMD, and FMRI will help identify the factors affecting seagrass growth.

Comparison of Seagrasses 1950 and 1996

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TAMPA Estuary Program

Tampa Bay Estuary Program

CURRENT RESTORATION LOCATIONS IN TAMPA BAY

Aquatic preserves are legislatively designated special management areas intended to protect and conserve some of Florida's most important coastal and aquatic ecosystems. There are four aquatic preserves in the Tampa Bay watershed: Cockroach Bay, Terra Ceia Bay, Boca Ciega Bay and the Pinellas preserve, encompassing all state-owned submerged lands in Pinellas County. Prohibited activities within the preserves are specified by state law. The preserves are managed by the Florida Department of Environmental Protection according to a comprehensive management plan tailored to each preserve's unique needs and resources.

Because the aquatic preserves feature some of the most ecologically important publicly owned, permanently protected lands within the bay system, they have been and continue to be high priorities for habitat restoration. In fact, the largest saltwater habitat restoration in the state is currently underway at the Cockroach Bay Aquatic Preserve, where 13 local, state and federal partners with coordination through SWFWMD are cooperating on a 500-acre project that will recreate a mosaic of habitats— including brackish and freshwater marshes, live-bottom reefs and upland forests — while providing stormwater retention and treatment for runoff from nearby agricultural lands.

Another comprehensive habitat restoration is occurring in phases at Emerson Point in the Terra Ceia Preserve, an area rich in both in natural and cultural history. Now managed by Manatee County as Emerson Point Nature Park, the area features an environmental education center visited annually by hundreds of schoolchildren.

More than 190 habitat restoration projects have been completed or initiated in the Tampa Bay watershed in the last 20 years. This total is exclusive of mitigation or other enhancement work required as part of a development permit. While the majority of these restoration projects have encompassed less than 5 acres, in recent years the emphasis has shifted to larger, more complex projects that embrace a variety of habitats.

Aquatic Preserves And Current Restoration Locations In Tampa Bay

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- Restoration Sites Around The Tampa Bay Area
- Interstate Highways
- County Boundaries
- Boca Ciega Bay Aquatic Preserve
- Cockroach Bay Aquatic Preserve
- Pinellas County Aquatic Preserve
- Terra Ceia Aquatic Preserve

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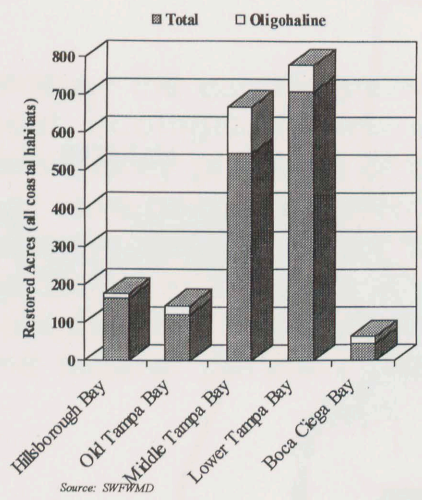
TAMPA Estuary Program

PROPOSED RESTORATION SITES IN THE TAMPA BAY REGION

In promoting rehabilitation of damaged natural systems in the Tampa Bay watershed, the overall goal of the Tampa Bay Estuary Program is to *restore the historic balance* of coastal habitats, recognizing that some vital habitats have declined more rapidly than others. Declines have been particularly severe for tidal streams and tributaries, which are critical nurseries for numerous species of fish, such as snook and mullet.

As of 1999, very good progress has been documented in achieving those goals. The 250 acres of low-salinity tidal marsh that will be restored by TBEP partners by the year 2000 will collectively exceeds the target by 150%. The 1,340 acres of mangroves and saltmarshes that will be restored from 1995-2000 add significantly to the 18,800 acres of those habitats that existed in 1994. Furthermore, all 28 priority sites identified for protection in the Estuary Program's habitat restoration and protection master plan have been given the highest priority for acquisition through land-buying programs administered by the Southwest Florida Water Management District.

Tampa Bay Estuary Program
Estimated Estuarine Restoration Acres: 1995 - 1999



- Expected oligohaline habitat: 250 acres.
- Expected total estuarine restoration: 1589 acres.

GOAL: Restore historic balance of coastal wetland habitats in Tampa Bay by restoring at least 100 acres of oligohaline habitat every five years, for a total increase of 1800 acres.

STATUS: A total of 250 acres of oligohaline habitat will be restored in all bay segments, exceeding the goal by 150 acres.

Currently, 40 habitat restoration projects are underway in the Tampa Bay watershed. Most are cooperative efforts involving multiple governments and agencies. Additionally, many of the 28 stormwater retrofit and treatment projects provide for rehabilitation or enhancement of wetland habitats.

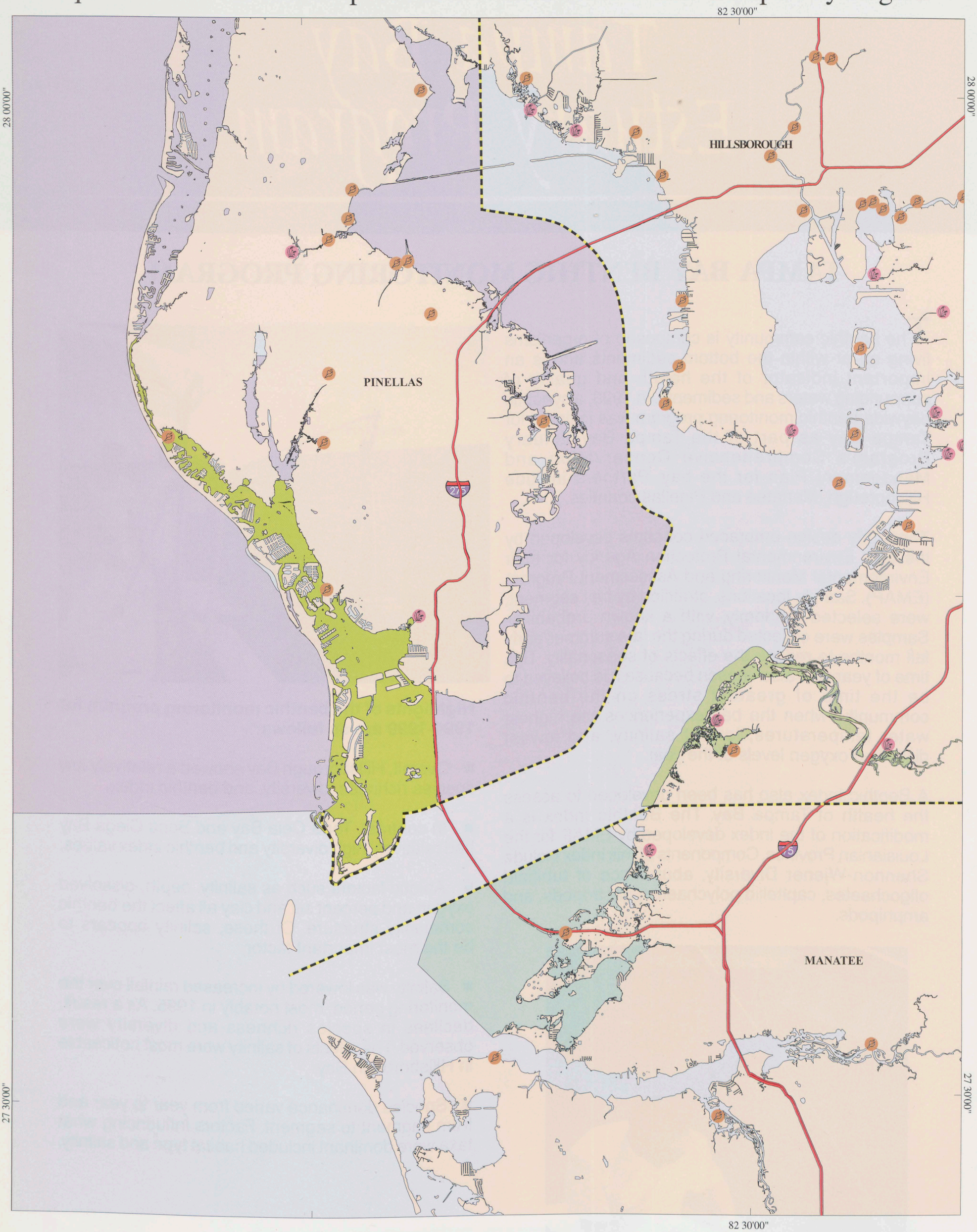
The most extensive habitat restoration in the watershed is underway at Cockroach Bay in south Hillsborough County. This 500-acre project, which will create a mosaic of habitat types in addition to providing stormwater treatment for surrounding agricultural lands, is the largest saltwater restoration of its kind in Florida.

In ranking sites for future restoration, technical advisers working with the TBEP and Tampa BayWatch evaluated the size and location of the proposed project, as well as the net ecological benefit to the bay from the restoration. Large-scale restoration projects such as those conducted by state or regional agencies were designated Group A sites and given the highest priority. Smaller projects, such as those being accomplished by local governments, were placed in Group B. The advisory group agreed that the process of ranking restoration sites will ensure that areas in greatest need will be first in line for funding.

Habitat-specific goals adopted by the Estuary Program include the following:

■ Restoration of at least 100 acres of *low-salinity tidal stream habitat* every five years, for a total increase over time of 1,800 acres, and:
■ Preservation of existing salt marshes and mangroves, either through habitat restoration or enhancement of existing areas that have been severely degraded.
■ Creation of "habitat mosaics" featuring a diversity of ecotones, including uplands such as pine forests and oak hammocks that have been heavily impacted by development.

Aquatic Preserves and Proposed Restoration Sites In The Tampa Bay Region



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Class "A" Sites:
Sites are noted in the
SWFWMD five year restoration plan

Class "B" Sites:
Sites are not part of the
SWFWMD five year restoration plan

Interstate Highways

County Boundaries

Boca Ciega Bay Aquatic Preserve

Cockroach Bay Aquatic Preserve

Pinellas County Aquatic Preserve

Terra Ceia Aquatic Preserve

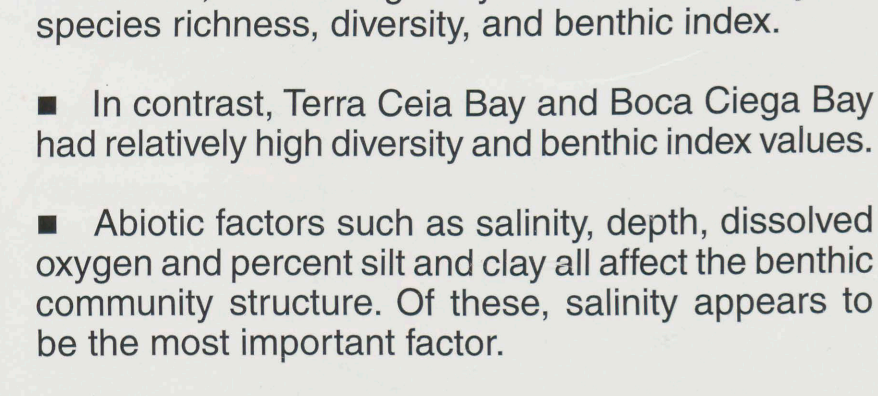
TAMPA BAY Estuary Program

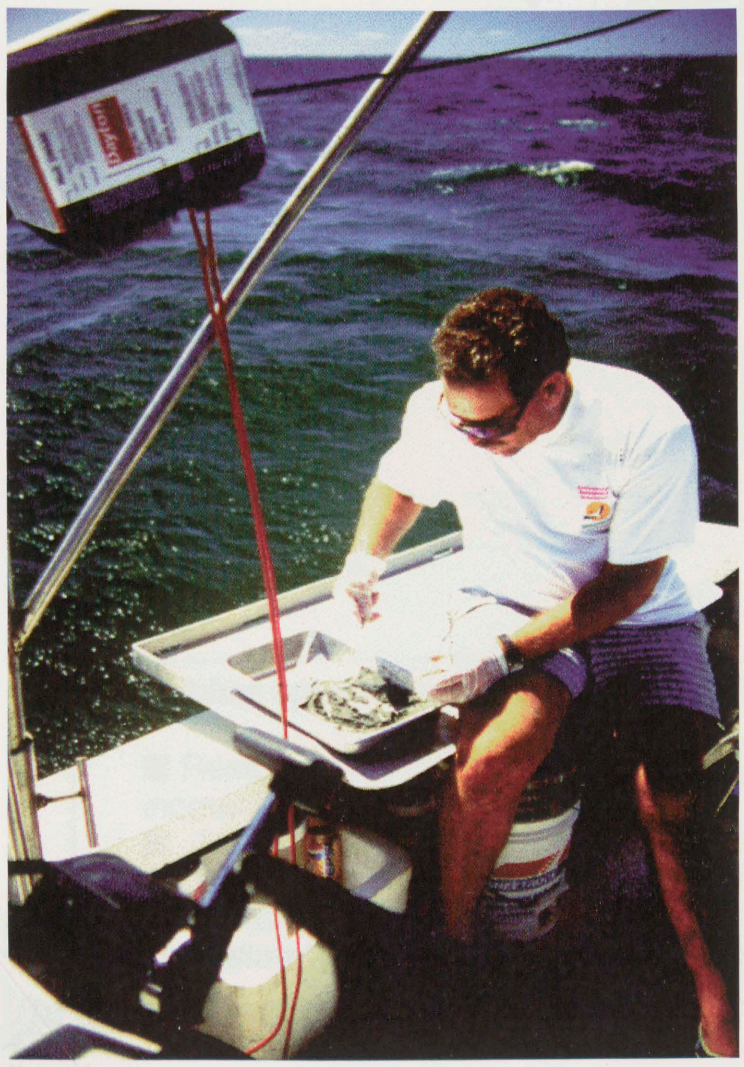
TAMPA BAY BENTHIC MONITORING PROGRAM

The benthic community is composed of organisms living on or within the bottom sediments and is an important indicator of the health and quality of surrounding waters and sediments. In 1993, a synoptic baywide benthic monitoring program was initiated for Tampa Bay as part of the Tampa Bay Estuary Program's Comprehensive Conservation and Management Plan for the bay. Partners include Hillsborough, Manatee and Pinellas counties.

The study design embraced concepts developed by the U.S. Environmental Protection Agency for their Environmental Monitoring and Assessment Program (EMAP). Sample locations, stratified by bay segment, were selected randomly, with a known probability. Samples were collected during the late summer/early fall months to reduce the effects of seasonality. This time of year was also chosen because it is believed to be the time of greatest stress on the benthic community, when the bay experiences the highest water temperatures, lowest salinity, and lowest dissolved oxygen levels of the year.

A Benthic Index also has been developed to assess the health of Tampa Bay. The Benthic Index is a modification of the index developed by EMAP for the Louisianian Province. Components of this index include Shannon-Wiener Diversity, abundance of tubificid oligochaetes, capitellid polychaetes, gastropods, and amphipods.





Highlights of the benthic monitoring program for 1994-1999 are as follows:

- Overall, Hillsborough Bay showed a relatively low species richness, diversity, and benthic index.

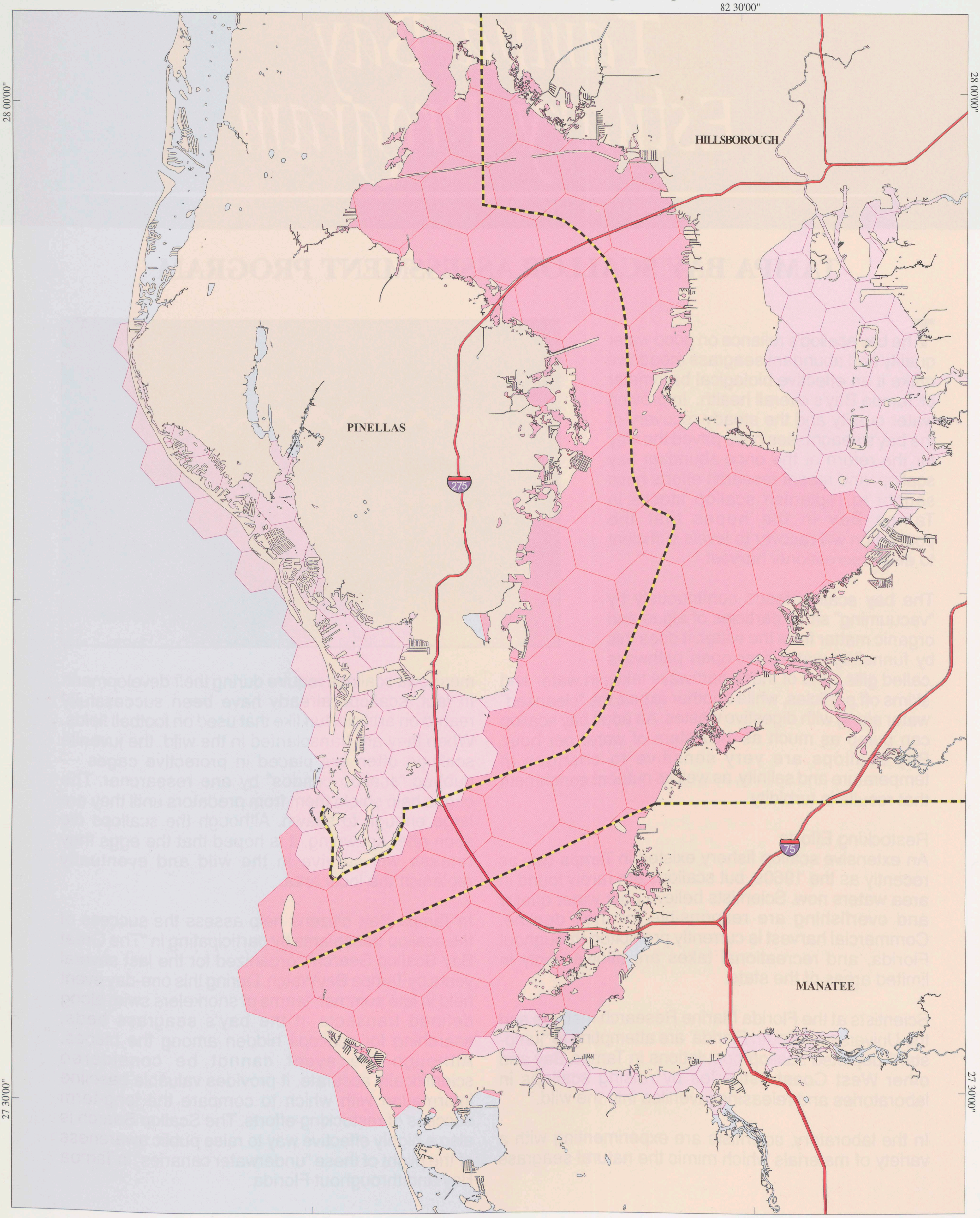
- In contrast, Terra Ceia Bay and Boca Ciega Bay had relatively high diversity and benthic index values.

- Abiotic factors such as salinity, depth, dissolved oxygen and percent silt and clay all affect the benthic community structure. Of these, salinity appears to be the most important factor.

- Salinity was lowered by increased rainfall over the monitoring period, most notably in 1995. As a result, declines in species richness and diversity were observed. The effects of salinity were most noticeable in Hillsborough Bay.

- Species dominance varied from year to year and from segment to segment. Factors influencing what taxa were dominant included habitat type and salinity.

Tampa Bay Benthic Monitoring Program



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Old and Middle Tampa Bay Benthic Sampling Hexagons

Boca Ciega Bay, Manatee River and Hillsborough Bay Benthic Sampling Hexagons

Middle and Old Tampa Bay Sampling Hexagon Boundaries

Boca Ciega Bay, Manatee River, and Hillsborough Bay Sampling Hexagon Boundaries

Interstate Highways

County Boundaries

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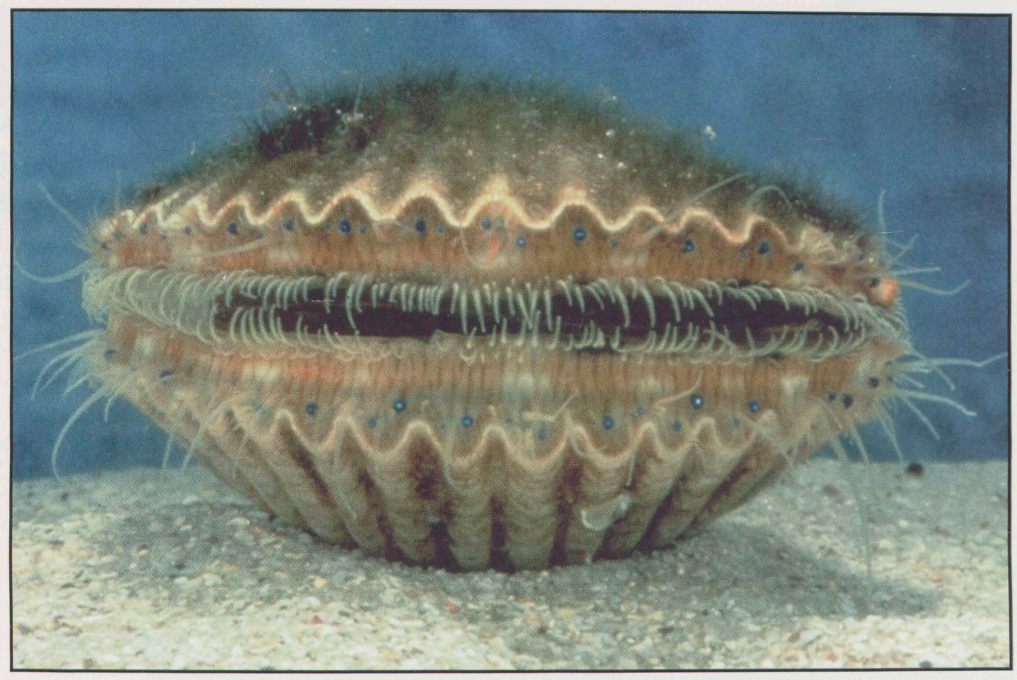
TAMPA Estuary Program

TAMPA BAY SCALLOP ASSESSMENT PROGRAM

The bay scallop's reliance on good water quality and abundant seagrass meadows make it an effective biological barometer of Tampa Bay's overall health. Improving water quality and the steady recovery of the bay's seagrasses have paved the way for the return of the once-abundant bay scallop, and recent research efforts have sought to replenish scallop stocks in Tampa Bay in the hopes that the population will recover to levels sufficient to allow recreational harvest.



The bay scallop feeds continuously by "vacuuming" small particles of algae and organic matter from the water. It does this by funneling water over open pathways called gills. One of these pathways takes in water and skims off particles, while another expels the "cleansed" water along with digestive wastes. An adult bay scallop can pump as much as 14.7 liters of water per hour. Bay scallops are very sensitive to changes in temperature and salinity, as well as nutrient enrichment that results in turbidity.

Restocking Efforts

An extensive scallop fishery existed in Tampa Bay as recently as the 1960s, but scallops are rarely found in area waters now. Scientists believe poor water quality and overfishing are responsible for their decline. Commercial harvest is currently prohibited throughout Florida, and recreational takes are allowed only in limited areas of the state.

Scientists at the Florida Marine Research Institute and the University of South Florida are attempting to "jump-start" depleted scallop populations in Tampa Bay and other West Coast estuaries by raising scallops in laboratories and releasing juveniles into the wild.

In the laboratory, scientists are experimenting with a variety of materials which mimic the natural seagrass meadows scallops require during their development. In fact, scallops already have been successfully reared on artificial turf like that used on football fields. When they are transplanted in the wild, the juvenile scallops often are placed in protective cages — dubbed "scallop condos" by one researcher. The cages help shield them from predators until they are large enough to spawn. Although the scallops die soon after spawning, it is hoped that the eggs they release will survive in the wild and eventually replenish the local area.

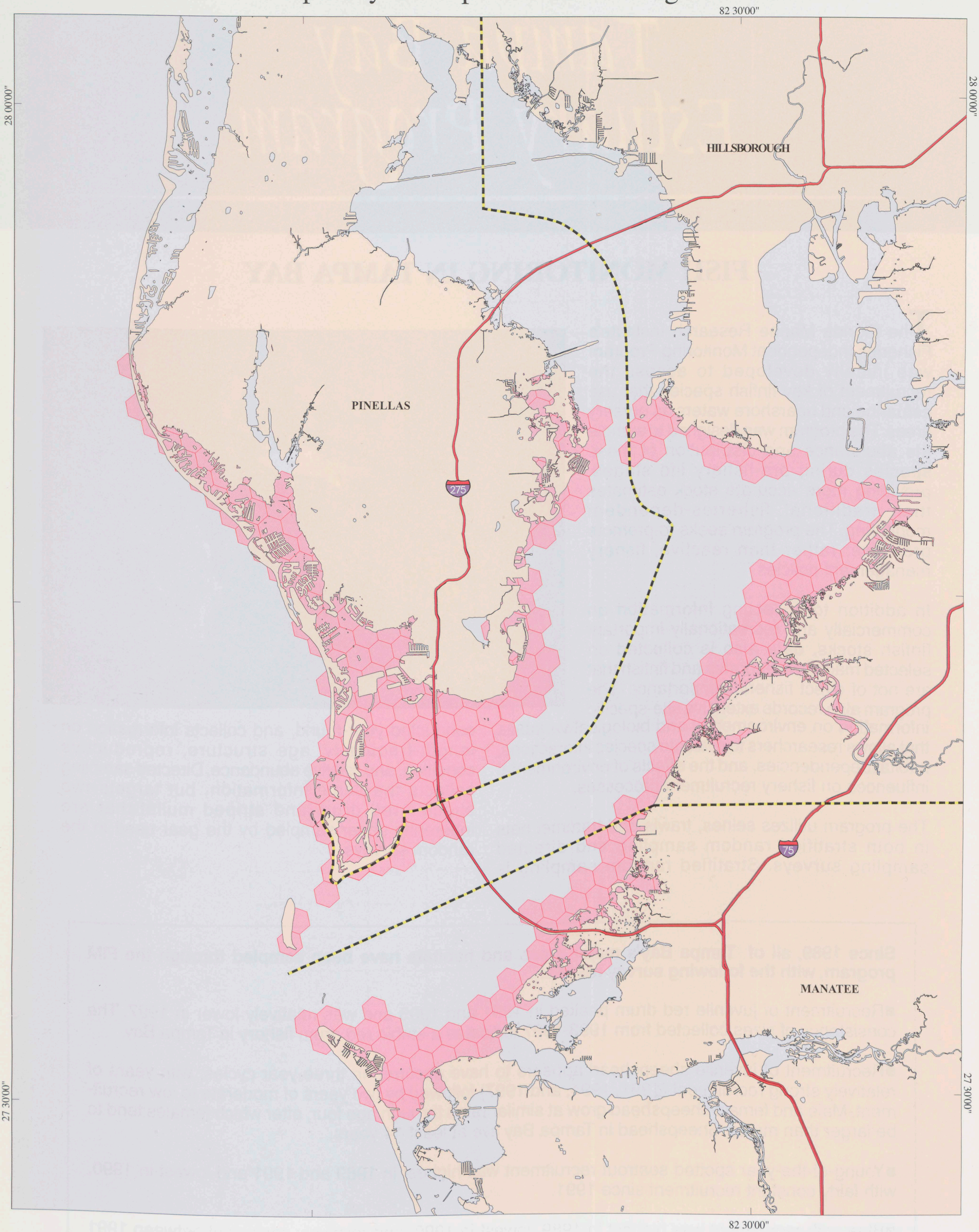
In Tampa Bay, citizens help assess the success of the scallop transplants by participating in "The Great Bay Scallop Search", organized for the last several years by Tampa BayWatch. During this one-day event held in late summer, teams of snorkelers swim along defined transects in the bay's seagrass beds, searching for scallops hidden among the blades. Although the event cannot be considered scientifically accurate, it provides valuable baseline information with which to compare the long-term success of restocking efforts. The Scallop Search is also a highly effective way to raise public awareness of the plight of these "underwater canaries" in Tampa Bay and throughout Florida.

Great Bay Scallop Search Results

Year	1999	1998	1997	1996*	1995	1994	1993
Total	22	27	79	75	3	6	6

*Beginning in 1996, the Scallop Search survey area was reduced from the entire lower half of Tampa Bay to just the waters of southernmost Pinellas County, surrounding Fort DeSoto Park. The higher scallop tallies in subsequent years reflect this more concentrated search grid.

Tampa Bay Scallop Assessment Program



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Scallop Sampling Hexagons

Interstate Highways

County Boundaries

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TAMPA BAY Estuary Program

FISH MONITORING IN TAMPA BAY

The Florida Marine Research Institute's Fisheries Independent Monitoring Program was initially developed to assess the recruitment of key finfish species that use estuarine and nearshore waters as nursery areas. The program was designed to sample the abundance and distribution of these species during pre-fishery life stages, providing more accurate stock estimates than traditional fisheries-dependent monitoring. The program seeks to promote proactive, rather than reactive, fishery management policies.

In addition to collecting information on commercially and recreationally important finfish stocks, data also is collected on selected macroinvertebrates and finfish that are not of direct fisheries importance. The program also records extensive site-specific information on environmental and biological variables that allows researchers to evaluate species interactions, habitat dependencies, and the effects of environmental influences on fishery recruitment processes.

The program utilizes seines, trawls and trammel nets in both stratified random sampling and directed sampling surveys. Stratified random sampling is conducted year-round, and collects information on length-frequency, age structure, reproductive condition, and relative abundance. Directed sampling collects the same information, but targets two species-red drum and striped mullet-that are inherently under-sampled by the gear used in the random surveys.

Since 1989, all of Tampa Bay's major areas and habitats have been sampled through the FIM program, with the following survey results:

■Recruitment of juvenile red drum peaked in 1991 and 1995 and was relatively lower in 1997. The consistency of sizes collected from 1993-1997 indicates a stable red drum fishery in Tampa Bay.

■Recruitment of juvenile sheepshead appears to have occurred in three-year cycles, with years of relatively strong recruitment (1991, 1994, and 1997) followed by two years of moderate to low recruitment. Male and female sheepshead grow at similar rates through age four, after which females tend to be larger than males. Sheepshead in Tampa Bay live at least 14 years.

■Young-of-the-year spotted seatrout recruitment was highest in 1989 and 1991 and lowest in 1990, with fairly constant recruitment since 1991.

■Blue crab recruitment was highest in 1989, lowest in 1990, and relatively consistent between 1991 and 1996.

Florida Marine Research Institute's Fisheries Independent Monitoring Grid

82 30'00"

28 00'00"

27 30'00"

HILLSBOROUGH

PINELLAS

MANATEE

275

75

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FMRI Fisheries Independent Monitoring Grid

Interstate Highways

County Boundaries

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TAMPA BAY

Estuary Program

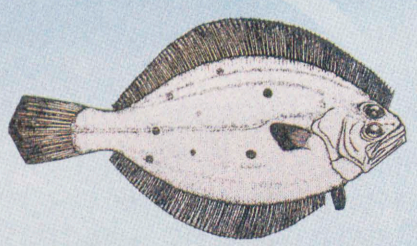
Tampa Bay Estuary Program

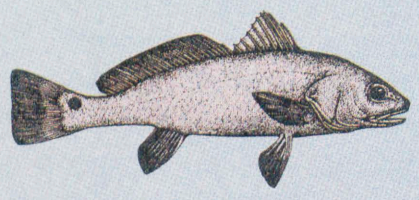
TAMPA BAY BOATER'S GUIDE

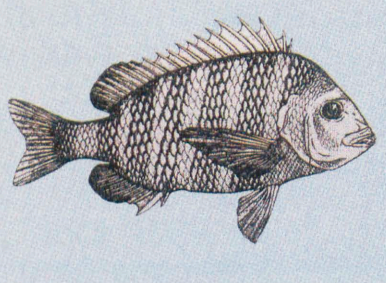
The Tampa Bay Boater's Guide is part of an ongoing project that the staff at the Florida Marine Research Institute (FMRI) have participated in over the last four years. Development of a recreational fishery component of the Marine Resources GIS (MRGIS) has received substantial attention over the last four years and efforts have focused on identifying, locating, and obtaining information to better address the following: recreational fish life history, habitats, biology, and environmental conditions; threatened and endangered species; fishery habitat locations, status and trend; assessment of propeller damage to seagrasses; relationship between fish and habitat; bathymetry; recreational angler access maps; navigational aids; artificial reef locations and database; demography of boat-license holders; shipwreck locations and database; National Wetlands Inventory (NWI), state aquatic preserve boundaries; and manatee protection zones.

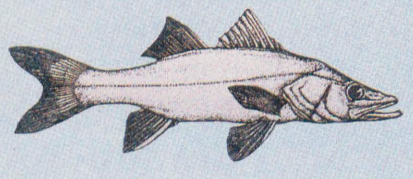
These data and information are synthesized and given to anyone requesting such information. There are completed guides for Tampa Bay, Charlotte Harbor, Lee County, Indian River Lagoon, Citrus County, Brevard County, Pensacola Bay and Biscayne Bay. The success of these boater's and angler's guides indicates that regional references of this nature are needed and desired. Similar guides for Collier County, St. Andrews Bay, Nassau/Duval County, and the Florida Keys are in progress.

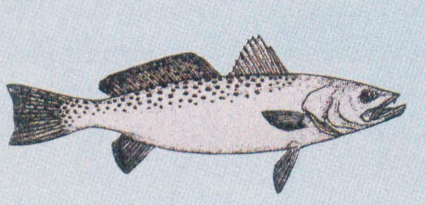
The purpose of these guides is to effectively distribute marine resource information to the general public in a user-friendly format. Presentations are highly visible, provide complex information in understandable formats, and also show the geographic nature of many recreational fisheries resources. Production of the boater's guides is part of a larger FMRI goal to: collect, identify, and maintain information to be used in analyzing recreational fishery resources and angler access, and to develop maps, tabular summaries, reports, presentations, etc., for regulatory and management agencies and other recreational fisheries interests.











Name & Habitat

FLOUNDER-Channel edges on sandy bottoms, near tidal passes and docks.

REDFISH (Red Drum)-Near docks and pilings, deeper holes and channels during warmest and coolest months; around grass beds and oyster bars.

SHEEPSHEAD-Near bridges, docks, seawalls, and pilings.

SNOOK-Canals, tidal creeks, and other deep, warm waters in cool months; near tidal passes and mangrove fringe at high tide.

SPOTTED SEATROUT-Seagrass beds when water temperatures are moderate, and deeper waters adjacent to beds during warmest and coolest months.

Tampa Bay Boater's and Angler's Guide (version 2)

Seagrasses are vital nursery and feeding areas for fish and other marine animals. Please protect them.

If you run aground or enter grass flats to fish, stop your motor, tilt it up, and pole or push your boat through.

Public Access Boat Ramps

No.	Location	Address	Location	Open 24 hours	Usable at all tides	Boats over 15'	Gasoline	Seagrass Caution Zone	Pump-out	Pay ramp
1	Philippe Park	2355 Bayshore Drive N	Safety Harbor			•				
2	Lowry Park Boat Ramp	Sligh Avenue	Tampa		•	•				
3	Safety Harbor Marina & Pier	South Boulevard & Bayshore	Safety Harbor		•	•				
4	Courtney Campbell Causeway	SR 60 (W Bound)	Tampa	•		•				
5	Marjorie Park and Marina	115 Columbia Dr. (Davis Island)	Tampa	•		•				
6	Belleair Boat Ramp	3900 W Bay Drive	Belleair Bluffs	•	•	•				
7	Davis Island Boat Ramp	Martinique Ave. (S End)	Tampa	•	•	•	•			
8	Indian Rocks Beach Boat Ramp	15th Avenue & Bayshore Blvd.	Indian Rocks Beach	•	•	•				
9	Gandy Boat Ramp	Gandy Bridge, E Causeway	Tampa	•	•	•				
10	Indian Rocks Beach Boat Ramp	3rd Avenue & 1st Street	Indian Rocks Beach	•	•	•				
11	Ballast Point Park	Ballast Point & Interbay Blvd.	Tampa	•	•	•				
12	Gandy Bridge Marina	13050 Gandy Boulevard	St. Petersburg	•	•	•				
13	Williams Park	6401 Riverview Drive	East Tampa	•	•	•	•			•
14	Sunlit Cove Park	Bay Street NE & Sunlit Cove Dr.	St. Petersburg	•	•	•				
15	Picnic Island Beach and Park	End Of Commerce Road	Port Tampa							
16	Park Boulevard Boat Ramp	Park Boulevard & Gulf Blvd.	Indian Shores	•	•	•				
17	Madeira Beach Municipal Marina	503 150th Avenue	Madeira Beach	•	•	•				
18	War Veterans Memorial Park	9600 Bay Pines Blvd.(US Alt. 19)	St. Petersburg	•	•	•	•	•		•
19	Crisp Park	Poplar Street & 35th Ave. NE	St. Petersburg	•	•	•				
20	Coffee Pot Park	1st Street & 31st Avenue NE	St. Petersburg	•	•	•				
21	Jungle Prada	Park Street & Elbow Lane N	St. Petersburg	•	•	•				
22	123rd Avenue Ramp	123rd Avenue & Lagoon Lane	Treasure Island	•	•	•				
23	Demens Landing South	1st Avenue S & Bayshore Drive	St. Petersburg	•	•	•				
24	Apollo Beach Boat Ramp	Apollo Beach Boulevard	Apollo Beach	•	•	•	•	•		•
25	Treasure Island Pub. Boat Ramp	Gulf Boulevard & 100 Avenue	Treasure Island	•	•	•				
26	Egan Park	9101 Blind Pass Road	St. Petersburg Beach	•	•	•				

No.	Location	Address	Location	Open 24 hours	Usable at all tides	Boats over 15'	Gasoline	Seagrass Caution Zone	Pump-out	Pay ramp
27	Treasure Island Boat Ramp	Gulf Boulevard & 84th Avenue	Treasure Island	•	•	•				
28	Bay Winds Sports Motel	Corey Avenue & Bay Street	St. Petersburg Beach		•	•				
29	E G Simmons Park	2401 19th Avenue NW	Ruskin		•	•				
30	Gulfport Marina Complex	4630 29th Avenue S	Gulfport	•	•	•				•
31	Grandview Park	6th Street & 38th Avenue S	St. Petersburg	•	•	•	•			•
32	Bahia Beach Marina	3301 Sea Grape Drive	Ruskin		•	•				
33	Shell Point Marina	3324 West Shell Road	Ruskin	•	•	•				
34	Ruskin Commongood Park	1st Avenue NW & 2nd Street	Ruskin		•	•				
35	Maximo Park	34th Street S & Pinellas Point Drive	St. Petersburg		•	•				
36	St. Petersburg Beach Boat Ramp	East 33rd Avenue	St. Petersburg Beach		•	•				
37	O'Neill's Skyway Boat Basin	6701 34th Street S	St. Petersburg	•	•	•	•			•
38	Bay Vista Park	4th Street & Pinellas Point Drive	On Tampa Bay	•	•	•				
39	Domino Boat Ramp	22nd Avenue SW & 8th Street SW	Ruskin	•	•	•				
40	Sun City Heritage Park	US Highway 41 N	Ruskin		•	•				
41	Cockroach Bay	Cockroach Bay Road	Ruskin	•	•	•				
42	Wildcat Creek Park	Stephens Rd. & Little Manatee Rv.	Ruskin		•	•				
43	Fort De Soto Park	3500 Pinellas Bayway S	Tierra Verde	•	•	•				
44	Bishop Harbor Boat Ramp	Bishop Harbor Road	On Bishop Harbor	•	•	•				
45	Tropic Isles Marina	3100 10th Street	Palmetto	•	•	•	•			•
46	Fort Hamer Boat Ramp	Fort Hamer Road	3 Miles S of Parrish	•	•	•				
47	63rd Street Memorial Park	East End 63rd Street	Holmes Beach	•	•	•				
48	Highland Shores Boat Ramp	351 Shore Drive	Ellenton	•	•	•				
49	Riverside Park	801 Riverside Drive	Palmetto	•	•	•				
50	Warners Bayou County Park	NW Riverview Boulevard	Bradenton	•	•	•				
51	Kingfish Boat Ramp	Manatee Ave. (W of Intracoastal)	Bradenton	•	•	•				
52	Highway 64 Boat Ramp	Highway 64 & Braden River	Bradenton	•	•	•				

Artificial Reefs

	Name And Site	Loran(W)	Loran(Y)	Depth
1	Hillsborough Co. Reef *Courtney Campbell Site*	14267.6	44701.9	16'
2	Hillsborough Co. Reef *Howard Frankland Site*	14266.2	44648.5	16'
3	Hillsborough Co. Reef *Ballast Point Pier Site*	14272.3	44592.3	8'
4	Hillsborough Co. Reef *Port of Tampa Site*	14257.5	44632.3	24'
5	Hillsborough Co. Reef *Picnic Island Pier Site*	14257.9	44648.5	18'
6	Hillsborough Co. Reef *Bahia Beach Site*	14245.4	44560.2	24'
7	Pinellas Co. Reef *St. Pete Beach Site*	14192.9	44704.1	34'
8	Hillsborough Co. Reef *Port Manatee Site*	14225.0	44557.4	21'
9	Hillsborough Co. Reef *Egmont Key Site*	14193.5	4608.0	23'

Additional artificial reefs are located off of Pinellas County outside the boundaries of this chart. For more information, call (813) 464-7514.

Tampa Bay Estuary Program

Sport Fish Restoration

Department of Environmental Protection — Florida

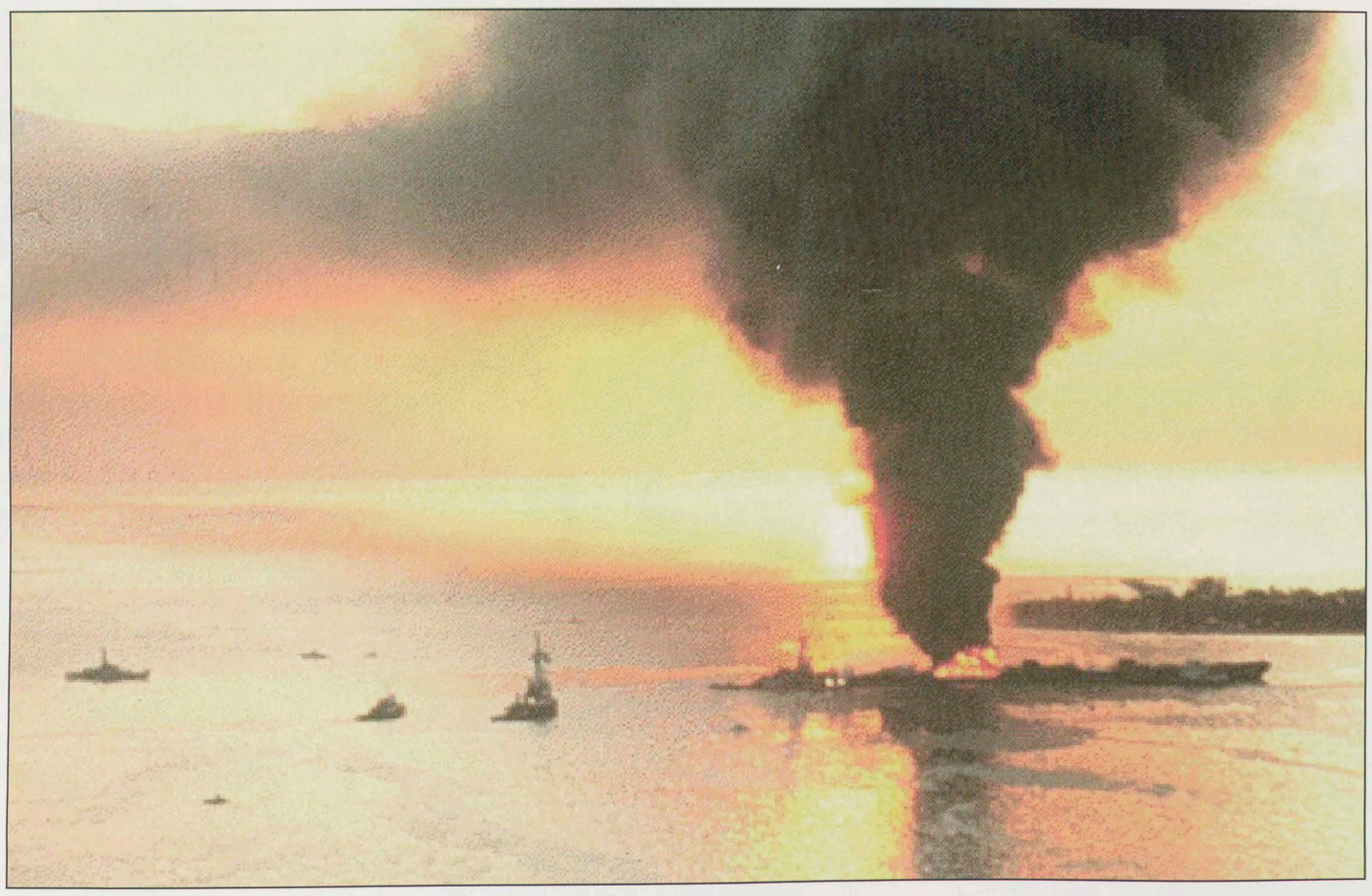
Printed on recycled paper.

This chart is not intended for navigational use.

(For navigation, see N.O.A.A. charts #11412 - #11414.)

Published January 1997

1993 TAMPA BAY OIL SPILL



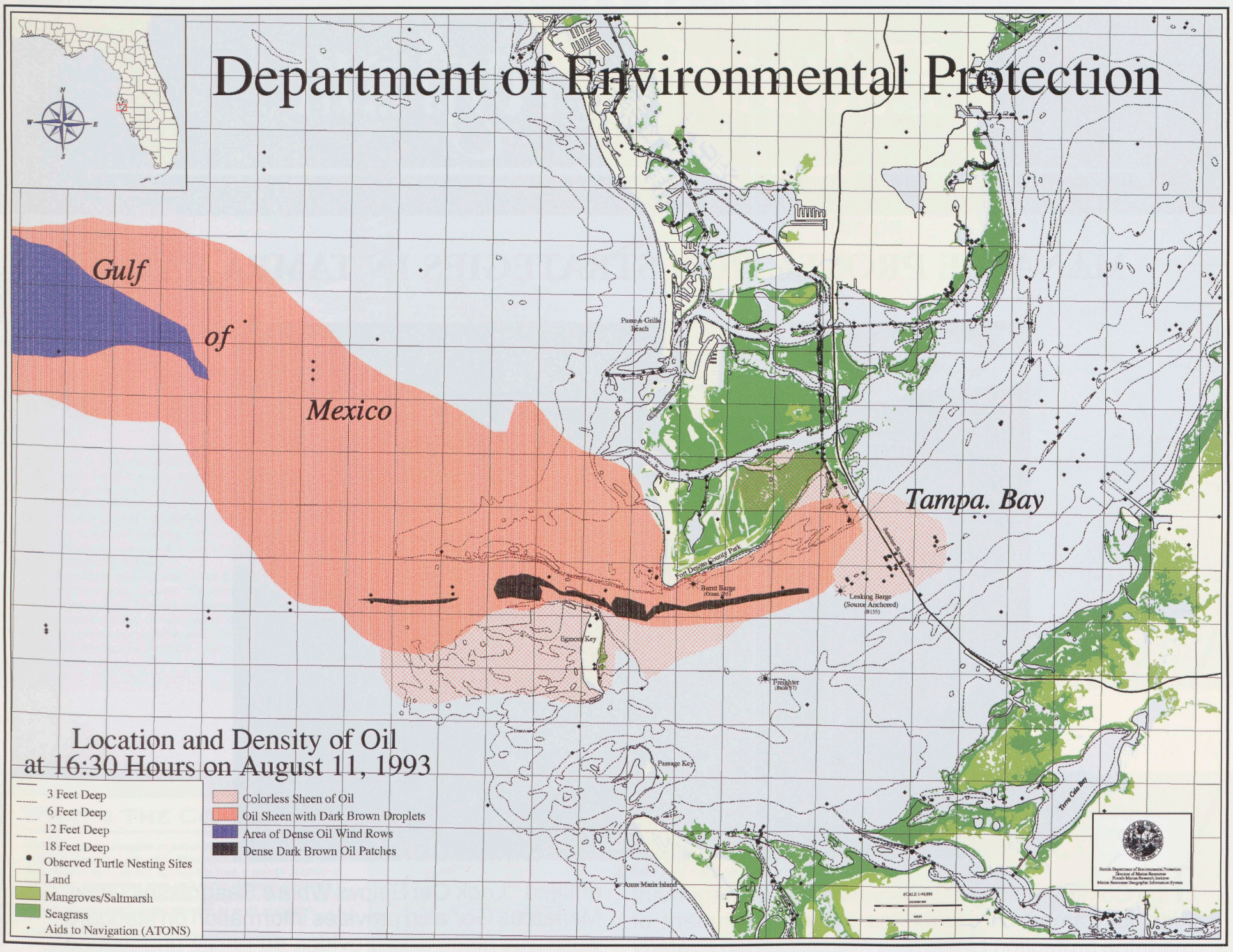
In 1991, Governor Bob Martinez established a legislative task force to evaluate Florida's spill prevention and cleanup cabpabilites. Of the several areas for improvement identified, the most significant shortcoming noted was the lack of current, accurate information concerning natural resources in the coastal zone. The only maps available at the time for use in spill response, *The Sensitivity of Coastal Environments and Wildlife to Spilled Oil in Florida Atlas* had been developed in 1979-80. The maps depicted what are called "Environmental Sensitivity Index" (ESI) shoreline ranking. ESI ranking allow spill responders to quickly determine the shoreline's fragility and sensitivity to oil. These ESI maps were used widely across the state. However, as Florida's coastline continued to change with the effects of industry, tourism, and population, these maps became increasingly unreliable and outdated.

The Florida Marine Research Institute's (FMRI) Coastal and Marine Resource Assessment (CAMRA) section took on the task of creating a GIS, digitally updatable, and automated atlas of these Florida ESI maps. This atlas would be used in marine spill response episodes and contain reliable, consistent database structures that would be created independently of many individuals and maintained over time. This Florida Marine Spill Analysis System (FMSAS) was built and used to support the many facets of marine spill response, planning, and injury assement and provide accurate, up-to-date information to researchers and resource managers.

The prototype FMSAS arrived at FMR1 in July of 1993 only weeks before the occurrence of a major oil spill in Tampa Bay. On August 10, 1993, the *Balsa* 37, an outbound freighter, collided with two inbound tugs, the *Seafarer* and the *Fred Bouchard,* near the mouth of Tampa Bay. *Seafarer's* barge burst into flames and burned for more than 14 hours before firefighters on local government and Coast Guard vessels managed to control the blaze. Leaking chemicals, including Jet A fuel and No. 6 fuel oil, created a slick 17 miles long and 2.5 miles wide. During the course of the spill, salt marsh, mud flats, mangroves, pristine beaches, and oyster and seagrass beds were coated with thick oil as the slick moved with the tides.

CAMRA analysts provided agencies with maps of the spill area that depicted existing natural and cultural resources in the predicted path of the oil movement. CAMRA and the Marine Mammal Program researchers used Global Positioning System (GPS) receivers to collect data on the locations of the vessels and the changing perimeter and state of the spill. CAMRA was thus able to plot the first maps of the spill only hours after it occurred and continued to map the slick's movement after the oil had hit land. These FMSAS generated maps were critical tools for use in the response management of the spill, identifying resources-at-risk, and in prioritizing protection measures.

1993 Tampa Bay Oil Spill



Map date: 8/11/93

Florida Fish and Wildlife Conservation Commission
GREAT SEAL OF THE STATE OF FLORIDA
IN GOD WE TRUST
Florida Marine Research Institute

TAMPA
Estuary Program

MANATEE PROTECTION STRATEGIES IN TAMPA BAY

The Comprehensive Conservation and Management Plan for Tampa Bay identifies the establishment of manatee protection zones as a recommended strategy to reduce manatee mortality related to watercraft. To implement this goal, the Tampa Bay Estuary Program and the Tampa Bay Regional Planning Council's Agency on Bay Management convened the Manatee Protection Strategies Task Force.

This diverse group of citizens, scientists and regulators worked for more than a year on a baywide manatee protection plan. The group concluded that a voluntary, rather than regulatory, approach offered the best hope for long-term success — especially given the manpower limitations of the Florida Marine Patrol and other marine law enforcement agencies.

Upon releasing its report, the Task Force disbanded. However, interested members joined new participants in forming the Manatee Awareness Coalition (MAC) in the summer of 1998. This offshoot group's primary mission is to increase awareness among boaters of the relationship between manatees and seagrasses, and educate boaters about safe navigation in shallow waters. Coordinated by the Tampa Bay Estuary Program, the MAC includes representatives of the Florida Conservation Association, Save The Manatee Club, the Marine Industries Association and other interest groups. The ambitious campaign being developed by the coalition includes:

■Creating a special brochure showing areas of the bay where boaters are urged to go slow to protect manatees. These voluntary slow-speed areas, identified by the original Task Force, generally coincide with shallow seagrass beds where manatees feed. This brochure, entitled "Look Out Below! Where Seagrasses Grow, Manatees Go," also provides information on standard waterway signs and provides an easily understood definition of slow speed. The brochure was designed as a companion to TBEP's popular Boater's Guide to Tampa Bay.

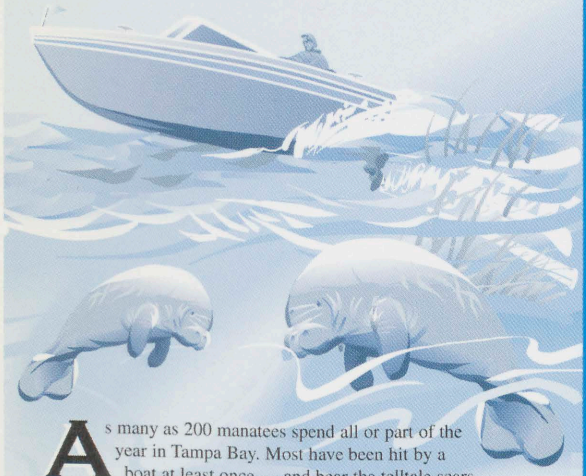
■Developing an on-water trained volunteers corps of boaters that will educate other boaters about the importance of protecting manatees and their habitat. This group, called "Manatee Watch," is coordinated by Tampa BayWatch, an existing stewardship program for the bay that enlists volunteers for bay improvement projects . The Manatee Watch program was launched in summer 1999. Volunteers who complete the training program answer questions from boaters about manatees and distribute free "boater kits" containing safe boating tools such as polarized sunglasses, push poles and the voluntary slow-speed zone maps. The volunteers work at area boat ramps and on the water in a specially equipped, manatee-friendly pontoon boat.

■Working with Save The Manatee Club to expand its Adopt-A-Manatee Program to include manatees in Tampa Bay and other parts of Southwest Florida. Previously, the adoption program only included animals in Homosassa and Blue springs. In 1999, Save The Manatee Club agreed to add five Tampa Bay manatees to its adoption list, helping to raise awareness of the critical importance of Tampa Bay as a feeding area, nursery and winter refuge for more than 200 manatees.

Manatee Speed Zone Map (Front and Back)

LOOK OUT BELOW!

WHERE SEAGRASSES GROW, MANATEES GO



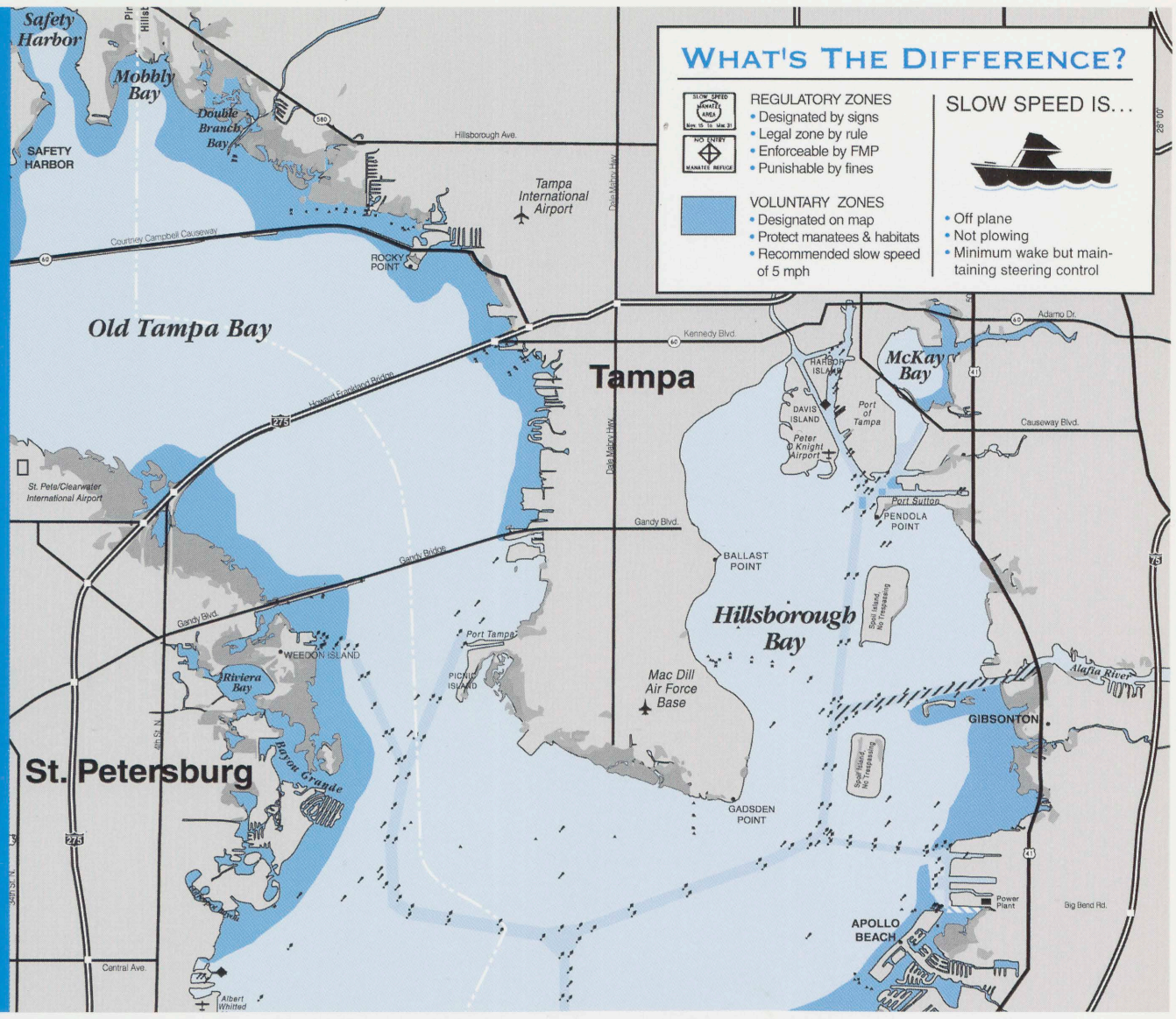
As many as 200 manatees spend all or part of the year in Tampa Bay. Most have been hit by a boat at least once — and bear the telltale scars of those encounters.

Manatees are at greatest risk from speeding boats when they are feeding or resting in or near seagrass meadows. In these shallow waters, manatees often cannot swim fast enough or dive deep enough to get out of harm's way.

This map highlights areas of the bay where boaters are encouraged to use slow speed to protect manatees. The zones were developed by a coalition of area citizens, fishermen and scientists. Just as you put on the brakes when you drive through a school zone, we urge you to back off your throttle when you are boating in these areas.

Take it easy. Please. And remember... where seagrasses grow, manatees go.

MANATEE AWARENESS COALITION



WHAT'S THE DIFFERENCE?

REGULATORY ZONES
- Designated by signs
- Legal zone by rule
- Enforceable by FMP
- Punishable by fines

VOLUNTARY ZONES
- Designated on map
- Protect manatees & habitats
- Recommended slow speed of 5 mph

SLOW SPEED IS...
- Off plane
- Not plowing
- Minimum wake but maintaining steering control

FRONT

WHAT'S THE CONNECTION?

Manatees graze in seagrass meadows at high tide, and on the deeper fringes of grass beds at low tide. They aren't the only residents that need seagrasses to survive. Spotted sea trout, a popular sportfish in Tampa Bay, depend upon grass beds during all stages of their life cycle. Seagrasses also nurture crabs, shrimp and smaller bait fish that are consumed by such coveted gamefish as snook and redfish.

HOW TO PROTECT MANATEES AND SEAGRASSES

- Stay in marked channels when travelling from one part of the bay to another.
- Go slow, pole or troll while in shallow grass beds.
- If you run aground, turn off your engine, lift your motor and push your boat out.
- Look for the manatee's snout, back, tail, or flipper in the water. A swirl on the surface of the water signals a manatee may be swimming below.
- Look, but don't touch. Resist the urge to feed manatees or give them water.

This brochure was produced by the Tampa Bay Estuary Program's Manatee Awareness Coalition (MAC). For more information, contact the Estuary Program at (727) 893-2765.

TAMPA Estuary Program

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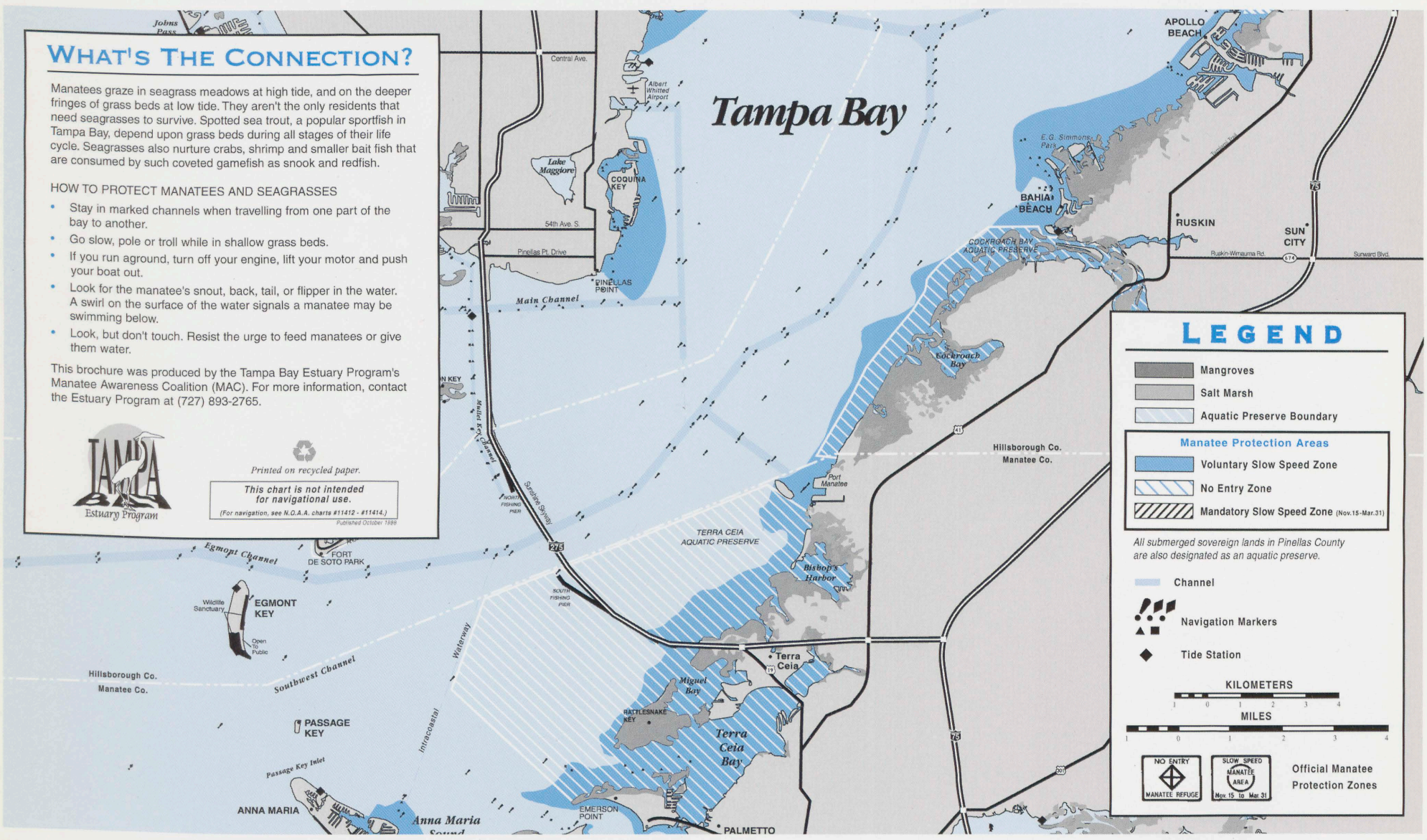

LEGEND

- Mangroves
- Salt Marsh
- Aquatic Preserve Boundary

Manatee Protection Areas
- Voluntary Slow Speed Zone
- No Entry Zone
- Mandatory Slow Speed Zone (Nov.15-Mar.31)

All submerged sovereign lands in Pinellas County are also designated as an aquatic preserve.

- Channel
- Navigation Markers
- Tide Station

KILOMETERS 1 0 1 2 3 4
MILES 1 0 1 2 3 4

NO ENTRY MANATEE REFUGE
SLOW SPEED MANATEE AREA Nov. 15 to Mar. 31
Official Manatee Protection Zones

BACK

Florida Fish and Wildlife Conservation Commission
Florida Marine Research Institute

TAMPA Estuary Program