



**A SUMMARY OF SEAGRASS COVERAGE  
DATA FOR TAMPA BAY  
DATA REPORT: 1997**

**FINAL REPORT**

**August 2000**



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DATA REPORT: 1997**

Prepared for:

**Tampa Bay Estuary Program**

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### **NOTE FROM TBEP STAFF**

The most recent aerial photographs used by the Southwest Florida Water Management District (SWFWMD) to generate the mapping products in this data report were taken in 1996-1997. The SWFWMD is currently (at the time of this printing) photointerpreting aerial photographs taken in 1999. To provide timely interpretation of progress towards seagrass restoration goals, interpretation is not included in this data report, but will be discussed when the 1999 photointerpretation results are available.

This report serves a both the SWFWMD and TBEP data report for the 1996 Tampa Bay seagrass coverage.

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# 1 INTRODUCTION

The Comprehensive Conservation and Management Plan (CCMP) of the Tampa Bay National Estuary Program (TBNEP) established the restoration of seagrasses in the bay to levels similar to those observed in the 1950's as one of its primary goals. Seagrasses are very important to the health of the bay ecosystem, and are thus of concern to those who manage this important resource. The TBNEP identified seagrasses as an excellent indicator of overall bay health. Seagrasses provide critical habitat for many of the bay's important biological resources, including finfish, shellfish, and benthos.

Seagrass losses have been particularly apparent since 1950 and were due to a variety of factors, including dredge and fill projects, poor water clarity, altered bay hydrodynamics, and prop scarring (Lewis and Estevez, 1988; Wade and Janicki, 1993). Seagrass restoration rate is a function of many variables, including water quality, physical factors such as prop scarring and currents, and location of seagrass beds in relation to offshore transverse sandbars (Sargent et al., 1995; Sargent et al., 1996). Additionally, sustained cold weather can be detrimental to the rate of restoration. Seagrasses in Tampa Bay may be subject to biological damage as well, such as that due to *Labyrinthula*, a microorganism associated with seagrass disease. The Tampa Bay Estuary Program (TBEP) Technical Advisory Committee (TAC) recognizes that these and other factors may affect progress towards reaching adopted seagrass restoration goals, and is currently initiating actions which will assist with addressing factors in addition to water clarity and quality (including the initiation of measuring the depth of water at various seagrass beds around the bay, and the monitoring of potential seagrass disease). Actions needed to address additional factors, such as the bay-wide effects of prop scarring or the location of various seagrass beds, will be included in discussions of future monitoring needs.

To address the issue of seagrass habitat loss, recommended seagrass protection and restoration targets were developed (Janicki et al., 1995). Seagrass restoration targets were determined by comparing 1990 seagrass extent to that observed in 1950. Seagrass restoration targets were defined as those portions of Tampa Bay that had seagrasses in 1950, did not have seagrasses in 1990, and had not been permanently altered to preclude restoration of seagrasses. The establishment of the bay-wide seagrass restoration target was dependent upon the availability and quality of bathymetric data (Janicki et al., 1995). The restoration targets were defined as areas that had lost seagrass coverage from 1950 to 1990 and were illuminated by at least 20.5% of the incident subsurface light.

Based on the results of the Janicki et al. (1995) study, the TBNEP TAC recommended seagrass restoration and protection goals to the TBNEP Management Committee. The TBNEP Management and Policy Committees adopted a minimum seagrass acreage goal of 38,000 acres bay-wide. This goal includes protection of existing seagrasses estimated at 25,600 acres in 1992 and a restoration target of an additional 12,350 acres. The TBNEP Management and Policy Committees also adopted a recommendation that progress towards seagrass acreage goals be reported to the Management Board every fifth year.

## 1.1 Objectives

This report is an element of the data review and analysis performed by the Estuary Program to determine the status of seagrass restoration as a result of management activities designed to improve water quality in Tampa Bay. This data report examines the areal extents of seagrasses in Tampa Bay for in 1950, 1990, 1992, 1994, and 1996. The specific objective of this report is to provide an analysis of trends in seagrass areal extent baywide and by bay segment through 1996. Interpretation of progress towards seagrass restoration goals will be deferred until the 1999 photointerpretation results are available. Figure 1 displays a location map for the bay, including the bay segments. ArcView seagrass coverages for 1950, 1990, 1992, 1994, and 1996 are available on the accompanying CD, which also contains the TBEP 1950 and current era shoreline coverages and bay segment boundaries.

## 1.2 Importance of Seagrasses in Tampa Bay

Seagrasses in Tampa Bay provide critical habitat for recreationally and commercially important fish and invertebrate species. Seagrasses in Florida provide juvenile nursery and adult feeding areas for red drum, spotted seatrout, spot, silver perch, sheepshead, snook, shrimp, and the bay scallop (Zieman and Zieman, 1989). Seagrass meadows are also important feeding areas for the Florida manatee. Seagrasses serve to improve water quality by reducing nutrients in the water column and are an important component of the energy and nutrient cycles in coastal environments.

Five species of seagrasses are found in Tampa Bay. These are turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), widgeon grass (*Ruppia maritima*), and star grass (*Halophila engelmannii*) (Lewis et al., 1985). Increases in seagrass bed extents in Tampa Bay are typically accomplished by vegetative growth and propagule colonization. Propagules are defined as any portion of a seagrass plant that is capable of colonizing a new site, and include seeds and plant fragments with leaves and roots ((Fonseca et al., 1998).

In Tampa Bay, seagrasses typically grow at depths no deeper than six to eight feet. Light is one of the limiting factors on the depth at which seagrasses can be found. Light requirements for growth vary by seagrass species. Turtle grass, the most common seagrass species in Tampa Bay, has an estimated light requirement of 20.5% of the incident subsurface light (Dixon and Leverone, 1995). For the purposes of seagrass restoration target setting, this was assumed to be the minimum light requirement for seagrasses in Tampa Bay (Janicki and Wade, 1996).

## 1.3 Establishing the Seagrass Target for Tampa Bay

To establish a seagrass restoration target for Tampa Bay, a benchmark time period was needed. The 1950 period was selected as the benchmark period for historical seagrass coverage, given that this was the earliest period for which a complete data set existed and this period preceded the most rapid population growth in the Tampa Bay watershed. The

areal coverage of the 1950 seagrass beds was developed using data collected by the Florida Department of Natural Resources (FDNR) and the U.S. Fish and Wildlife Service (USFWS). Seagrass meadows were mapped from 1:24,000-scale color photography, and obtained in digital form from the FDNR. A GIS coverage of the data was created, and horizontally rectified to geographically coincide with mapped data for the time period (Janicki and Wade, 1995).

The 1950 seagrass coverage was compared with the 1990 seagrass coverage using GIS technology and the best available bathymetry for 1990. The seagrass restoration target for Tampa Bay was derived from comparison of these data sets (Janicki et al., 1995). The 1990 seagrass coverage data were obtained from the Southwest Florida Water Management District (SWFWMD) Surface Water Improvement and Management (SWIM) Program. SWFWMD developed the GIS coverage from photo-interpretation of 1:24,000-scale aerial photography flown in December 1990.

A GIS coverage of bathymetry was developed using hydrographic soundings data from the NOAA National Geophysical Data Center that contained more than 350,000 data points collected during the years 1947-1958 in the Tampa Bay area (Janicki et al., 1995). The point soundings and shoreline delineation were used to interpolate a bathymetric GIS coverage utilizing Triangular Irregular Network interpolation software from ESRI(1993) (Janicki et al., 1995).

The 1950 GIS seagrass coverage was overlain with the 1990 GIS seagrass coverage to determine where seagrass losses had occurred. The areas from which seagrasses were lost were overlain on the 1990 bathymetry and shoreline coverages to identify those areas where restoration might be expected. Those areas that had been dredged or filled since 1950 were classified as non-restorable. The seagrass restoration acreage was estimated by the difference in the 1950 and 1990 coverages less these non-restorable areas (Janicki et al., 1995). Based on the results of this study, the TBNEP Management and Policy Committees adopted a minimum seagrass acreage goal of 38,000 acres bay-wide, including the protection of 25,650 acres and restoration of an additional 12,350 acres (TBNEP, 1996).

As noted above, evaluation of progress toward goals will be conducted once the most recent photointerpretation products (1999) are available.

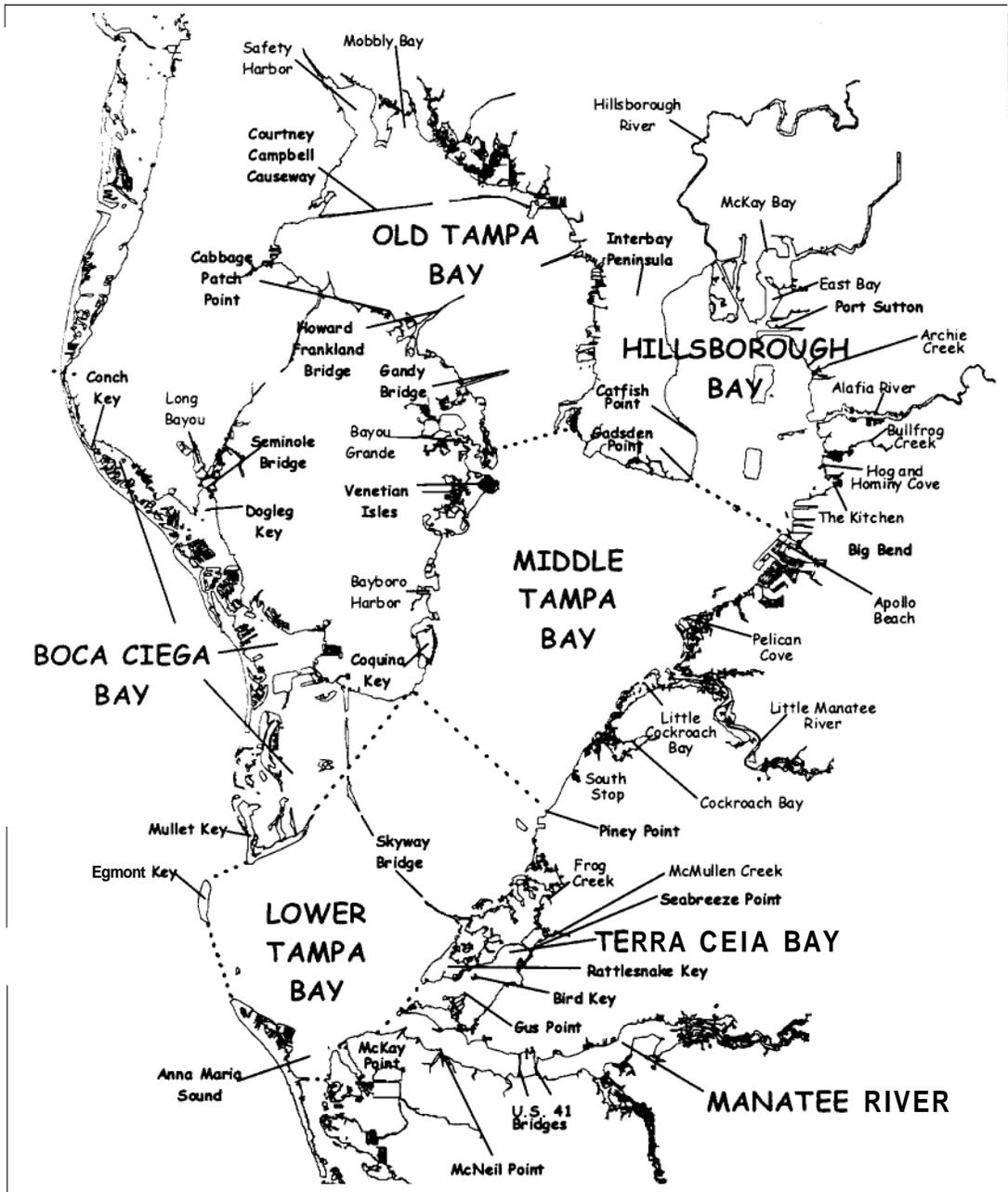


Figure 1. Tampa Bay segments and locations.

## 2 METHODS

Aerial photography of seagrasses in the bay has been gathered approximately every two years since 1988 by the SWFWMD, resulting in seagrass coverages for 1988, 1990, 1992, 1994, and 1996. Some of the 1988 areas mapped as seagrasses were later found to actually represent attached macro-algae. From 1990 on, the aerial photography was field checked to verify presence of seagrasses (Kurz et al., 1999). For the purposes of this data report, only the SWFWMD seagrass coverages for 1990, 1992, 1994, and 1996 are utilized, as the seagrass coverages from each of these years were field checked for accuracy. The 1990-1996 period includes all seagrass coverages for which data were collected using consistent methods, and is the period during which progress towards TBEP seagrass goals is estimated.

The SWFWMD aerial photography was 1:24,000-scale true color, and with the exception of the 1996 photography, was obtained during the late fall/early winter time period (November-February) when water clarity in Tampa Bay is typically greatest (Kurz et al., 1999). The month(s) during which the aerial photos were taken varied from sampling period to sampling period (Tomasko, 1999), so that the greatest water clarity conditions would prevail, as follows:

1990 - November, December 1990  
1992 - February 1993  
1994 - January 1995  
1996 - April, May 1997.

To develop GIS coverages from the aerial photography, the SWFWMD analyzed the photos using zoom transfer methodology registered to U.S. Geological Survey (USGS) 7.5-minute quadrangles. The minimum mapping unit for seagrasses was 0.5 acres. Seagrass polygons were delineated on mylar overlays and transferred to an ARC/INFO database.

The SWFWMD coverages for 1990, 1992, 1994, and 1996 contain two classes of seagrass coverage, patchy and continuous. For the purposes of this data report, the acreages of both classes were combined to yield total seagrass acreage. The coverages containing both classes of seagrass acreage can be found on the CD accompanying this report. The seagrass classes are given by the coverage attribute "Lev4", where Lev4=9113 denotes patchy seagrass, and Lev4=9116 denotes continuous seagrass.

In addition to the SWFWMD seagrass photography, the City of Tampa Bay Study Group has been monitoring seagrasses in Hillsborough Bay since 1986. The data from this monitoring program for Hillsborough Bay do not show the same areal extent of seagrasses as those from the SWFWMD photography, possibly due to the different mapping techniques utilized by the two monitoring programs. These data are discussed later in this document, in Section 3.3.

Additional aerial photography exists for 1982, as described in Lewis et al. (1985). The methodology used in developing the 1982 seagrass coverage was different than that employed by the SWFWMD for the 1990, 1992, 1994, and 1996 seagrass coverages, so that direct comparisons between 1982 coverages and later coverages were not made. The 1990, 1992, 1994, and 1996 SWFWMD seagrass coverages provide the best dataset for examining changes in seagrass coverage in Tampa Bay.

Bay segment-specific seagrass acreages for 1990, 1992, 1994, and 1996 were estimated by intersecting the SWFWMD seagrass coverages with the segmentation scheme for Tampa Bay. Changes in seagrass acreage between years resulted from the difference in seagrass acreage within each bay segment. Trends in bay-wide seagrass acreage were estimated using the 1950 seagrass acreage and the 1990, 1992, 1994, and 1996 acreages. Bay segment-specific trends were based on changes in seagrass acreage within each bay segment. Changes in seagrass acreage from 1990 to 1996, for the entire bay and for each bay segment, were estimated, providing recent seagrass changes from coverages developed utilizing the same methodology for seagrass delineation. These recent changes in seagrass acreage provide the TBEP with data for tracking progress towards its seagrass goals.

### 3 RESULTS

Seagrass beds covered approximately 40,400 acres in Tampa Bay during the 1950 baseline period (Figure 2). Of this total, approximately half was found in Old Tampa Bay (OTB) and Boca Ciega Bay (BCB) (10,700 acres and 10,800 acres, respectively), with most of the remainder found in Middle Tampa Bay (9,600 acres) (MTB) and Lower Tampa Bay (LIB) (6,100 acres). Hillsborough (HB) Bay contained approximately 2,300 acres, and Terra Ceia Bay (TCB) and Manatee River (MR) contained approximately 700 and 200 acres, respectively.

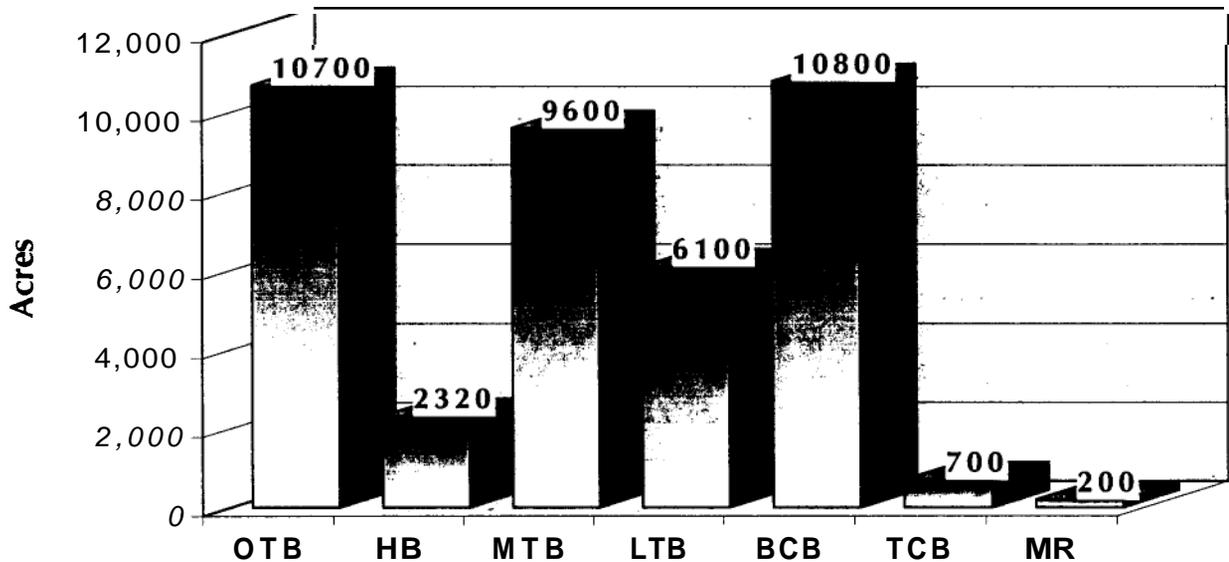


Figure 2. 1950 seagrass acreage for Tampa Bay segments.

#### 3.1 Bay-wide Summary of Trends

The estimated seagrass acreage in Tampa Bay in 1990 was approximately 25,200 acres (Figure 3). In 1992, seagrasses covered approximately 25,800 acres (Figure 4), increasing to 26,500 acres in 1994 (Figure 5) and 26,900 acres in 1996 (Figure 6). Acreages for all segments are rounded to the nearest 10 acres in Figures 3-6. These bay-wide seagrass acreages are shown by year in Table 1. The following figures present maps of the seagrass areas: Figure 7 – 1950, Figure 8 - 1990, Figure 9 - 1992, Figure 10 - 1994, and Figure 11 – 1996. ArcView seagrass coverages for 1950, 1990, 1992, 1994, and 1996 are available on the accompanying CD.

Year	Seagrass Acreage	Net Change Since 1950	Net Change Since 1990
1950	40,420	—	—
1990	25,230	-15,200	—
1992	25,750	-14,670	+530
1994	26,520	-13,900	+1,290

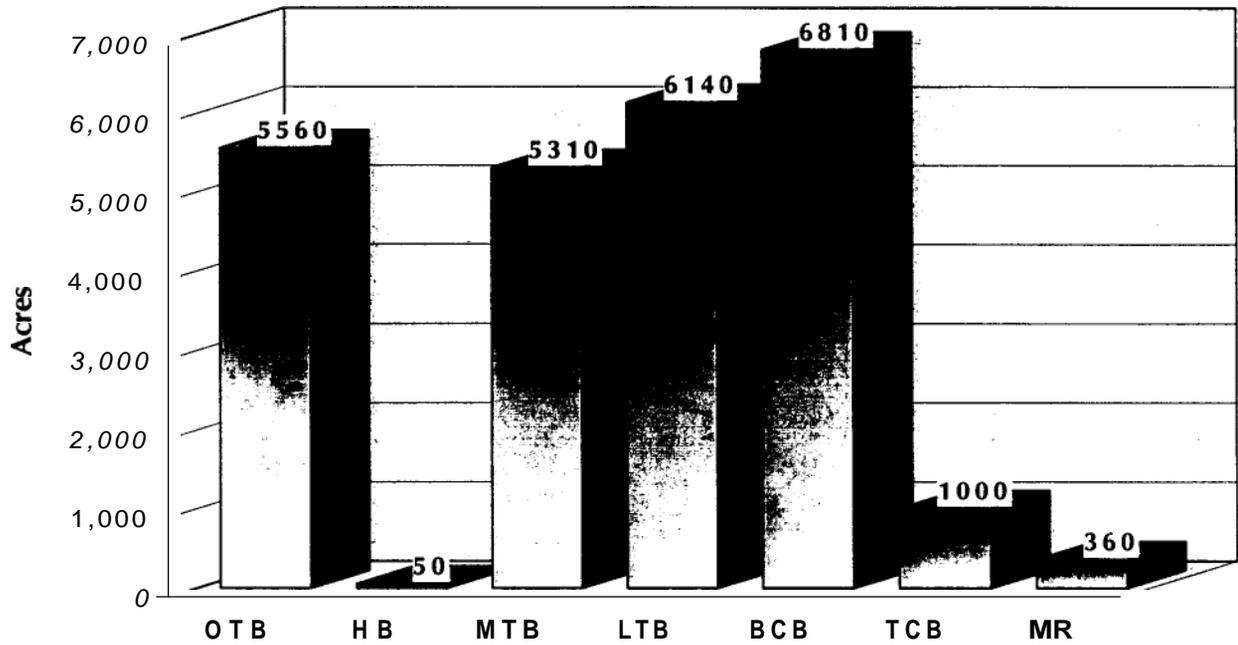


Figure 3. 1990 seagrass acreage for Tampa Bay segments.

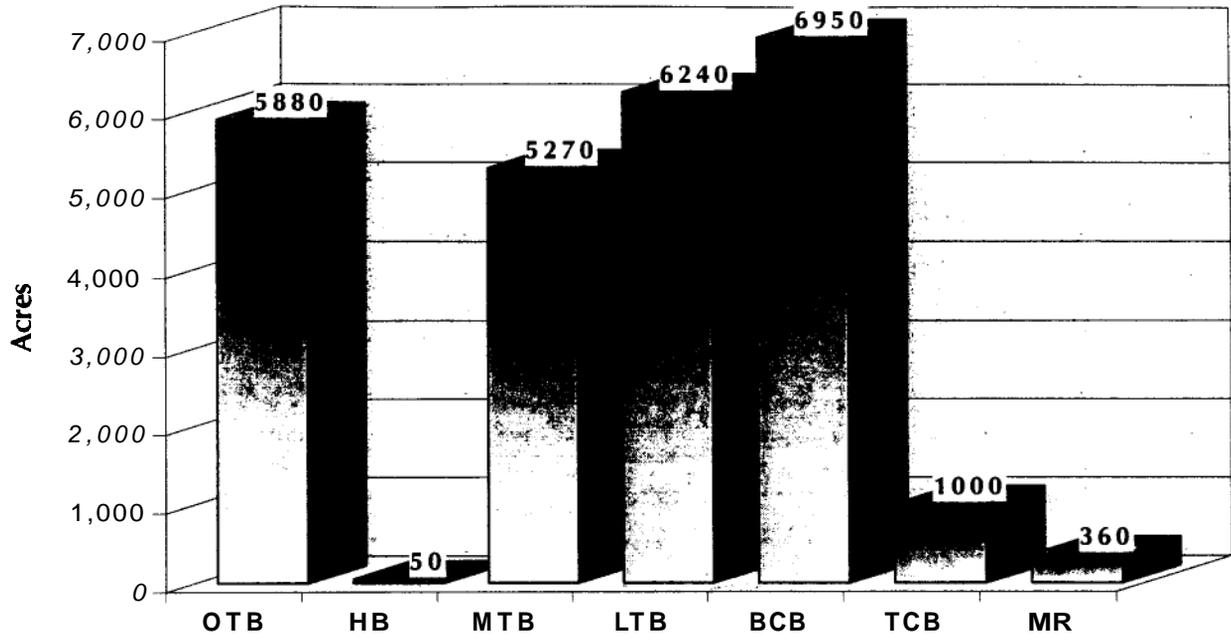


Figure 4. 1992 seagrass acreage for Tampa Bay segments.

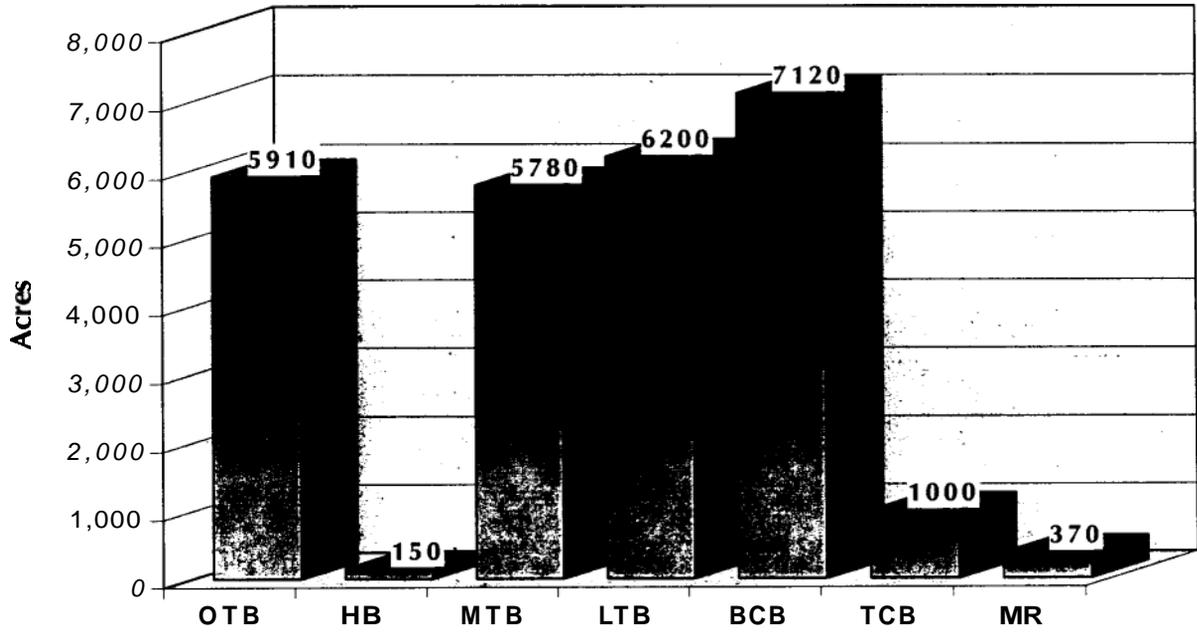


Figure 5. 1994 seagrass acreage for Tampa Bay segments.

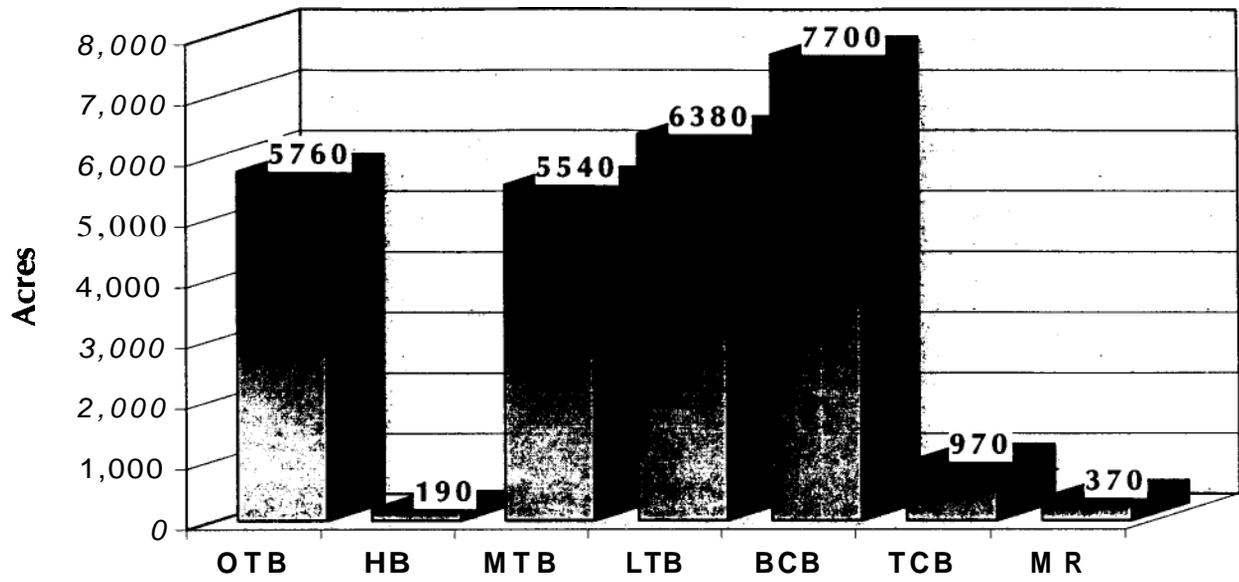


Figure 6. 1996 seagrass acreage for Tampa Bay segments.

### 3.2 Bay Segment Summary of Historical Trends

The greatest losses between 1950 and 1990 occurred in Old Tampa Bay (approximately 5,100 acres), Middle Tampa Bay (approximately 4,300 acres), and Boca Ciega Bay (approximately 4,000 acres). Lower Tampa Bay seagrass coverage increased by approximately 100 acres during the 1950 to 1990 time period. Hillsborough Bay experienced the largest percentage decrease, losing approximately 98% of its seagrass coverage over the time period. The changes in seagrass coverage between 1950 and 1990 are shown in Figure 12, with the restorable seagrass acreage signified by declines in seagrass acreage. Figure 13 shows the change in seagrass acreage between 1990 and 1996. The following describes the trends in seagrass coverage by bay segment.

#### Old Tampa Bay

- 1950 - Seagrass coverage in Old Tampa Bay during the 1950 baseline period was extensive, covering the entire shoreline with the exception of some parts of the northwestern portions of the segment. Safety Harbor contained only a small area of seagrass, and the northern shoreline of Mobbly Bay had no seagrass. Another area of shoreline with no seagrasses extended from north of the western end of the Courtney Campbell Causeway to an area about halfway to Safety Harbor. The total seagrass acreage for the segment was approximately 10,700 acres in 1950.
- 1990 - By 1990, net seagrass losses of approximately 5,100 acres had occurred, leaving only 5,600 acres in Old Tampa Bay. Some of the largest areas sustaining losses included the eastern shoreline of the Old Tampa Bay, where dredging and filling had occurred. The western shoreline of the segment had also experienced seagrass losses, especially north of the Howard Frankland Bridge, due to dredging and filling and likely due to water quality impacts of runoff from the adjacent urban area. The area of seagrasses around the mouth of Mobbly Bay was also greatly reduced in size.
- 1992 - By 1992, net seagrass coverage in Old Tampa Bay had increased since 1990 by approximately 300 acres, to a total of approximately 5,900 acres. A large portion of this increase occurred inside and around the western mouth of Mobbly Bay. The increased seagrass acreage in Mobbly Bay was largely due to *Halophila* (Johansson, 2000). Increased seagrass coverage was also found south of the eastern end of the Courtney Campbell Causeway, where seagrasses had increased shoreward from those found in 1990.
- 1994 - Seagrass coverage in Old Tampa Bay during 1994 showed very little change from that in 1992. Overall, a net increase of approximately 30 acres of seagrass occurred. A small decrease in seagrass cover was noted just north of the western end of the Howard Frankland Bridge, due north of Cabbage Patch Point.

1996 - Between 1994 and 1996, net seagrass acreage in Old Tampa Bay declined by approximately 150 acres, to approximately 5,800 acres. Seagrass losses were most evident in the Mobbly Bay area, which had seen a large increase in seagrass acreage from 1990 to 1992. Losses also occurred along the northeastern shore north of the Courtney Campbell Causeway. Several small areas of increased seagrass coverage were also found, however. The seagrass cover north of Cabbage Patch Point, where losses had occurred between 1992 and 1994, increased between 1994 and 1996. Increases in seagrass coverage were also found both north and south of the mouth of Allen Creek, with offshore expansion of 1994 seagrass beds.

Table 2 summarizes the seagrass acreage data for Old Tampa Bay. The acreages presented in tabular format are rounded to the nearest 10 acres. From 1950 to 1990, seagrass coverage in Old Tampa Bay declined by approximately 5,100 acres. From 1990 to 1996, net seagrass coverage in Old Tampa Bay increased by approximately 200 acres.

Year	Seagrass Acreage	Net Change Since Previous Measurement (Gains : Losses)	Net Change Since 1990
1950	10,700	—	—
1990	5,560	-5,140	—
1992	5,880	+ 320 (+ 600 : -280)	+ 320
1994	5,910	+ 30 (+ 370 : -340)	+ 350
1996	5,760	-150 (+ 840 : -990)	+ 200

### **Hillsborough Bay**

1950 - Seagrass coverage in Hillsborough Bay in 1950 totaled approximately 2,320 acres. Large areas of seagrasses were found along the eastern shore of the bay from East Bay southward towards the Alafia River, and from the mouth of the Alafia River southward through The Kitchen and towards Big Bend. Along the western shore of Hillsborough Bay, smaller seagrass beds were found off Gadsden Point, from Catfish Point northward to Ballast Point, and north of Ballast Point. Seagrasses were also found in McKay Bay.

1990 - By 1990, Hillsborough Bay contained only 47 acres of seagrasses, most of which was in the mouth of The Kitchen. Extensive dredging and filling had resulted in the loss of seagrasses in the Big Bend area and in the Port Sutton area. Only very small remnants of the western shore seagrass beds of 1950 existed in 1990.

1992 - Seagrass acreage in 1992 was approximately the same as in 1990, although the distribution of seagrasses within Hillsborough Bay was not the same as in 1990. The seagrass beds found at the mouth of The Kitchen in 1990 had declined slightly in extent, and the seagrass patches along the western shore of Hillsborough Bay had increased slightly in extent.

1994 - Seagrass coverage in 1994 in Hillsborough Bay showed a net increase of more than 100 acres over that found in 1992, totaling 147 acres. The seagrass beds at the mouth of The Kitchen, which had decreased in size from 1990 to 1992, increased in size from 1992 to 1994. Seagrasses, primarily *Ruppia* (Johansson, 2000), were found along the eastern shore of the bay between the Port Sutton peninsula and Archie Creek, and the seagrass beds found along the western shore in 1992 increased in size.

1996 - By 1996, seagrass beds in Hillsborough Bay covered 193 acres. The seagrass beds between the Port Sutton peninsula and Archie Creek, along the eastern shore, had increased in extent, as had the beds near the mouth of The Kitchen. The seagrass beds found along the western shore between Catfish Point and Ballast Point also increased in size. There were no significant seagrass losses between 1994 and 1996 in this segment.

Table 3 summarizes the seagrass coverage data for Hillsborough Bay. The acreages presented in tabular format are rounded to the nearest acres, given the relatively small amount of seagrasses found in Hillsborough Bay. By 1990, seagrass area declined by approximately 2,300 acres from the benchmark period of 1950. From 1990 to 1996, seagrass coverage in Hillsborough Bay increased by approximately 150 acres (Table 3).

Year	Seagrass Acreage	Net Change Since Previous Measurement (Gains : Losses)	Net Change Since 1990
1950	2,321	—	—
1990	47	-2,274	—
1992	46	-1 (+24:-25)	-1
1994	147	+101 (+106:-5)	+100
1996	193	+46 (+60:-14)	+146

### **Middle Tampa Bay**

1950 - The seagrass beds in Middle Tampa Bay comprised almost one-quarter of all the seagrasses found in the bay in 1950, covering approximately 9,600 acres. Extensive

seagrass beds occurred along the eastern shoreline from the Big Bend area southward to the mouth of the Little Manatee River, into the mouth of the river, and southward into Cockroach Bay and towards Piney Point. Along the western shore, seagrass beds were found along the shoreline of northeast St. Petersburg to the North Shore area, and again from just north of Coquina Key southward to Pinellas Point. The region along the southern shoreline of the Interbay Peninsula also contained extensive seagrass beds.

- 1990 - Seagrass acreage in this segment had a net decline of approximately 5,300 acres by 1990, with the greatest reductions in acreage occurring along the eastern shore. From the Big Bend area southward to the Little Manatee River, only the shoreward seagrass beds remained, with the exception of one small area offshore. Similarly, south of the river, only the most shoreward seagrass beds remained, although the losses here were not as severe. Along the western shore, dredging and filling for the Venetian Isles area resulted in seagrass losses, with some offshore losses south of downtown St. Petersburg. In the northern part of the segment, along the Interbay Peninsula, seagrass losses were not as severe, with only the most offshore areas showing a decline in seagrass coverage.
- 1992 - Between 1990 and 1992, seagrass acreage in Middle Tampa Bay showed a slight net decline, by approximately 40 acres. No obvious changes were found when comparing the 1990 and 1992 seagrass coverages.
- 1994 - By 1994, seagrass beds in Middle Tampa Bay had a net increase of more than 500 acres from those observed in 1992. New seagrass beds appeared southwest of Apollo Beach, and the 1992 seagrass beds between the mouth of the Little Manatee River and Cockroach Bay spread shoreward. It should be noted that the attached macro-algae *Caulerpa* was also observed north and south of the channel into Cockroach bay during the early 1990's (Johansson, 2000). An increase of seagrass acreage occurred just west of Gadsden Point south of the Interbay Peninsula.
- 1996 - Between 1994 and 1996, the Middle Tampa Bay segment lost seagrasses, with a net seagrass acreage reduction of more than 240 acres to approximately 5,500 acres. The major areas of loss included the beds west of Gadsden Point south of the Interbay Peninsula, and north of the mouth of the Little Manatee River, around Pelican Cove.

Table 4 summarizes the seagrass coverage data for Middle Tampa Bay. The acreages presented in tabular format are rounded to the nearest 10 acres. From 1950 to 1990, seagrass coverage in Middle Tampa Bay declined by approximately 4,300 acres, while from 1990 to 1996, seagrass coverage showed a net increase of approximately 200 acres.

Year	Seagrass Acreage	Net Change Since Previous Measurement (Gains : Losses)	Net Change Since 1990
1950	9,600	—	—
1990	5,310	-4,290	—
1992	5,270	-40 (+ 340 : -380)	-40
1994	5,780	+510 (+680 : -170)	+470
1996	5,540	-240 (+380 : -620)	+230

### Lower Tampa Bay

1950 - Lower Tampa Bay contained approximately 6,100 acres of seagrasses in 1950. Almost the entire nearshore area of this segment supported seagrass beds, with the exceptions of a few areas near the mouth of the bay.

1990 - Very little change was evident in the total seagrass extent found in Lower Tampa Bay by 1990. Seagrass acreage had a net increase of only a small increment (40 acres), with most of this found along the northwestern shoreline of the segment. Seagrass increases were found south of Pinellas Point and in association with the Skyway Bridge causeway, with some seagrass losses found along the southeastern shoreline, west of Terra Ceia Bay and near the mouth of the bay.

1992 - Seagrass acreage showed a net increase of approximately 100 acres in Lower Tampa Bay between 1990 and 1992. An area of new seagrasses was observed west of the mouth of Bishop Harbor offshore of the beds found in 1990. There were no other obvious changes in seagrass coverage.

1994 - Seagrass acreage in Lower Tampa Bay showed a net decline of approximately 40 acres between 1992 and 1994. Losses of seagrasses occurred southwest of Pinellas Point, and along the southeastern shore of Mullet Key.

1996 - Between 1994 and 1996, seagrass acreage showed a net increase in Lower Tampa Bay of approximately 200 acres. The seagrass beds west of the mouth of Bishop Harbor first seen in 1992 were not found in the 1996 coverage. Seagrass bed coverage north of the mouth of Anna Maria Sound extended northeastward into Tampa Bay. Some increase in seagrasses was found east of Egmont Key. The seagrasses along the southeastern shore of Mullet Key that had disappeared between 1992 and 1994 were again found in 1996, although they did not cover the same extent as in 1992. It is not known if the decrease in seagrass acreage along this portion of Mullet Key between 1992 and 1994, and the following increase between

1994 and 1996, is an artifact of the photointerpretation or if these changes represented “real world” conditions. Seagrass coverage in Lower Tampa Bay in 1996 totaled approximately 6,400 acres.

Table 5 summarizes the seagrass coverage data for Lower Tampa Bay. The acreages presented in tabular format are rounded to the nearest 10 acres. From 1950 to 1990, seagrass coverage in Lower Tampa Bay increased by approximately 40 acres. From 1990 to 1996, seagrass coverage in Lower Tampa Bay increased by approximately 200 acres.

Year	Seagrass Acreage	Net Change Since Previous Measurement (Gains : Losses)	Net Change Since 1990
1950	6,100	—	—
1990	6,140	+40	—
1992	6,240	+100 (+120:-20)	+100
1994	6,200	-40 (+80:-120)	+60
1996	6,380	+180 (+510:-330)	+240

### **Boca Ciega Bay**

1950 - There were approximately 10,800 acres of seagrasses in Boca Ciega Bay in 1950. The interior of Mullet Key was almost completely covered with seagrass beds, as was the area around Cabbage Key and Pine Key. Seagrass beds covered what is now the area of Isla del Sol, extending eastward to the mainland north of Maximo Channel. Seagrasses were found in Clam Bayou, and along the west coast of Gulfport nearly to Treasure Island. Seagrass beds also extended along the northeastern shore of Boca Ciega Bay, southeast of Conch Key.

1990 - By 1990, seagrass coverage in Boca Ciega Bay showed a net decline to approximately 6,800 acres, with some areas lost to dredge and fill activities. This was especially evident along the eastern shore of Treasure Island and Redington Shores, with very few small patches of seagrass found from Isla del Sol northward.

1992 - Between 1990 and 1992, seagrass coverage in Boca Ciega Bay showed a net increase of approximately 140 acres. A small area of seagrasses was found north of Isla del Sol, which had expanded since 1990. An area of seagrasses was also found east of Conch Key, at the northern end of Boca Ciega Bay, where none were found in 1990.

1994 - Seagrass coverage in 1994 showed a net increase of 170 acres of seagrasses over that found in 1992. The most significant expansion was found in the northern portion of Boca Ciega Bay, where the patch east of Conch Key extended southeastward along the shoreline of mainland. Additional gains occurred at the southeastern mouth of Long Bayou, around Dog Leg Key.

1996 - A net increase in seagrass coverage of 580 acres was found between 1994 and 1996 in Boca Ciega Bay, to a total of approximately 7,700 acres. The area near Conch Key showed expanded seagrass coverage, with lesser expansions of the area around Indian Key, the area east of the Skyway Bridge Causeway, and the seagrass beds west of Summer Resort Key.

Table 6 summarizes the seagrass coverage data for Boca Ciega Bay. From 1950 to 1990, seagrass coverage in Boca Ciega Bay decreased by approximately 4000 acres. From 1990 to 1996, seagrass coverage in Boca Ciega Bay increased by approximately 900 acres.

Year	Seagrass Acreage	Net Change Since Previous Measurement (Gains : Losses)	Net Change Since 1990
1950	10,800	—	—
1990	6,810	-3,990	—
1992	6,950	+140 (+160: -20)	+140
1994	7,120	+170 (+300: -130)	+310
1996	7,700	+580 (+650: -70)	+890

### **Terra Ceia Bay**

1950 - In 1950, seagrasses covered approximately 700 acres in Terra Ceia Bay. Seagrasses were found along the southern shoreline from the mouth of Terra Ceia Bay eastward into Clambar Bayou and Champlain Bayou. Seagrasses also extended along the eastern shore from the Snead Island Cutoff northward to Palmetto Point, covering Peterson Bayou. Seagrasses were also found along the northwestern shore, from Sea Breeze Point to Flounder Pass.

1990 - Seagrass coverage in Terra Ceia Bay experienced a net increase of approximately 300 acres between 1950 and 1990. Seagrasses beds had declined in size in Peterson Bayou, but increased in size from Sea Breeze Point to Flounder Pass, and extended west of Flounder Pass along the southern shore of Rattlesnake Key to the mouth of Terra Ceia Bay. Seagrasses had also extended along the eastern shore of

Snead Island, and beds were found north of Sea Breeze Point near the northern end of Terra Ceia Bay.

1992 - There was no net change in total seagrass coverage between 1990 and 1992.

1994 - Total seagrass acreage did not change between 1992 and 1994, but some changes in location of beds were found. The 1994 coverage showed no seagrasses north of Sea Breeze Point, and the bed found in 1992 between Bird Key and Gus Point had expanded in size.

1996 - Seagrass coverage in Terra Ceia Bay experienced a net decline of approximately 30 acres between 1994 and 1996. No obvious changes in seagrass bed size are seen in the 1996 coverage. The total seagrass coverage in Terra Ceia Bay in 1996 was approximately 970 acres.

Table 7 summarizes the seagrass coverage data for Boca Ciega Bay. The acreages presented in tabular format are rounded to the nearest 10 acres. From 1950 to 1990, seagrass coverage in Terra Ceia Bay increased by approximately 300 acres. From 1990 to 1996, seagrass coverage in Terra Ceia Bay decreased by approximately 30 acres.

<b>Table 7. Terra Ceia Bay seagrass acreages.</b>			
Year	Seagrass Acreage	Net Change Since Previous Measurement (Gains : Losses)	Net Change Since 1990
1950	700	—	—
1990	1,000	+300	—
1992	1,000	0 (0 : 0)	0
1994	1,000	0 (0 : 0)	0
1996	970	-30 (+ 30 :-60)	-30

### **Manatee River**

1950 - In 1950, approximately 200 acres of seagrasses were found in the Manatee River. These were found along the northern bank from just upstream of Hooker Point downstream to Hooker Point, and downstream of McKay Point. Along the southern shore, seagrasses extended from McNeil Point downstream. The largest seagrass beds were near the mouth of the river

1990 - Seagrass coverage in the Manatee River experienced a net increase of 160 acres between 1950 and 1990. Along the northern shoreline, seagrasses had extended upstream past Point Ogden, from Hooker Point downstream to McKay Point, and

from McKay Point to the mouth of the river. Seagrasses along the southern shoreline extended from Point Pleasant downstream to the mouth of the river.

1992 - Total seagrass acreage in 1992 was the same as that for 1990, with no obvious changes apparent.

1994 - By 1994, seagrass coverage in the segment showed a net increase of 10 acres.

1996 - The seagrass coverage in 1996 remained unchanged from that found in 1994.

Table 8 summarizes the seagrass coverage data for Manatee River. The acreages presented in tabular format are rounded to the nearest 10 acres. From 1950 to 1990, seagrass coverage in the Manatee River increased by approximately 160 acres. From 1990 to 1996, seagrass coverage in the Manatee River remained relatively unchanged.

Year	Seagrass Acreage	Net Change Since Previous Measurement (Gains : Losses)	Net Change Since 1990
1950	200	—	—
1990	360	+160	—
1992	360	0 (0:0)	0
1994	370	+10 (+10:0)	+10
1996	370	0 (+10:-10)	+10

### 3.3 Trends in Seagrass Coverage (1990 to 1996)

To examine recent trends in Tampa Bay seagrass acreage, the most appropriate comparison is between the seagrass coverage in 1990 (Figure 3) and that in 1996 (Figure 6). This comparison is made over the longest time span for which data were collected using the same methods, as discussed previously. In 1990, approximately 25,200 acres of seagrasses were found in Tampa Bay (Janicki et al., 1995). From 1990 to 1996, areas from which seagrasses were lost totaled approximately 2,400 acres, while new seagrass beds covered approximately 4,000 acres (Figure 13). This resulted in a net gain of approximately 1,700 acres of seagrasses bay wide. Over half of this gain occurred in Boca Ciega Bay, with the remainder distributed more or less evenly among the four mainstem segments of the bay. The following discusses recent trends in seagrasses by bay segment.

## **Old Tampa Bay**

In 1990, seagrasses covered approximately 5,600 acres in Old Tampa Bay. By 1996, seagrass coverage had a net increase of approximately 200 acres, to approximately 5,800 acres, an increase of 3.6%.

Three areas displayed appreciable loss of seagrasses, including the areas northwest of the eastern end of the Courtney Campbell Causeway, along the northeastern shore of Old Tampa Bay, and around the southern end of the peninsula separating Safety Harbor from Mobbly Bay. Seagrass losses were also found along the western shore of Old Tampa Bay, north of the western end of the Howard Franklin Bridge and north of Cabbage Patch Point.

Increases in seagrass coverage were greatest along the western shore of Old Tampa Bay. A large patch of seagrass formed south of the western end of the Howard Frankland Bridge. More new seagrasses were found north and south of Largo Inlet, extending from the mouth of the Cross Bayou Canal almost to the Courtney Campbell Causeway. Between the Courtney Campbell Causeway and Safety Harbor, seagrass beds found in 1990 extended both shoreward and offshore. Some new small seagrass beds were found in Safety Harbor in 1996, along the western and eastern shores, and up into Mobbly Bay. Along the eastern shore of Old Tampa Bay, very few areas of new seagrasses were found, with the most extensive extending from Rocky Point to south of the mouth of Fish Creek.

## **Hillsborough Bay**

Only 47 acres of seagrasses were found in Hillsborough Bay in 1990. This acreage increased to 193 acres by 1996. The net increase in coverage of 146 acres is similar to that found in Old Tampa Bay over the same time period, and this 311 % increase over the 1990-1996 time period was the greatest percentage increase of any bay segment.

Very few areas lost seagrasses in Hillsborough Bay between 1990 and 1996. Some small losses occurred around Green Key, offshore of The Kitchen, and along the western shore of Hillsborough Bay. A few small seagrass patches around the Big Bend area were also lost.

The largest new seagrass area found in 1996 occurred offshore of The Kitchen. The seagrass beds found in 1990 had extended northward, and into Hog and Hominy Cove. Another small patch of new seagrasses was found south of the mouth of Bullfrog Creek. Additional new seagrass beds along the eastern shore of Hillsborough Bay were found between the mouth of Archie Creek and the Port Sutton peninsula. Along the western shore of Hillsborough Bay, between Catfish Point to just north of Ballast Point, new small scattered seagrass beds were found near the shore.

Data from the City of Tampa Bay Study Group also show increased in seagrass acreage in Hillsborough Bay, although the acreages reported are not the same as those obtained from the SWFWMD photography. The SWFWMD coverages yield an increase of 146 acres by 1996 over the 47 acres reported in 1990. The City of Tampa monitoring program found

only 5 acres of seagrass in 1990, 13 acres in 1992, 49 acres in 1994, and 100 acres in 1996 (Kurz and Avery, 1999).

### **Middle Tampa Bay**

Seagrasses covered approximately 5,300 acres in Middle Tampa Bay during 1990. By 1996, seagrasses covered approximately 5,500 acres.

In Middle Tampa Bay, most seagrass losses between 1990 and 1996 occurred along the northeastern shore of the segment, along the offshore edge of the 1990 seagrass beds. This was most prominent from north of the mouth of the Little Manatee River to the southern shore of Apollo Beach. Other offshore edge seagrass losses occurred south of the mouth of the river, southward past Little Cockroach Bay. Some small seagrass losses were found along the offshore edge of the beds south of the Interbay Peninsula, and scattered along the northwestern shore of the segment.

The most significant increases in Middle Tampa Bay seagrass acreage from 1990 through 1996 were found along the southeastern shore of the segment. These increases were generally in the shoreward direction from those beds found in 1990, especially in Little Cockroach Bay and south of the mouth of Cockroach Bay, in South Stop. Other increases were found inshore of the 1990 beds along the southern shore of the Interbay Peninsula, and in Bayou Grande along the northwestern shore of the segment.

### **Lower Tampa Bay**

Lower Tampa Bay contained approximately 6,100 acres of seagrasses in 1990. By 1996, approximately 6,400 acres of seagrasses were found in the segment.

Seagrass losses from 1990 to 1996 in Lower Tampa Bay occurred primarily along the offshore edge of the beds along the southeastern shore of the segment. Small areas of seagrass loss were found from north of the southern end of the Skyway Bridge to south of Rattlesnake Key.

Increases in seagrass acreage were generally distributed around the coastline of Lower Tampa Bay. The most significant single new seagrass bed was found north of the mouth of Anna Maria Sound. The seagrass bed found east of Egmont Key in 1990 had extended southward by 1996. Other new seagrass beds, that were small and dispersed, were found along both the southeastern and northwestern shores of the segment.

### **Boca Ciega Bay**

Boca Ciega Bay contained approximately 6,800 acres of seagrasses in 1990. This acreage had increased to approximately 7,700 in 1996, accounting for 900 acres of the net bay-wide 1,700-acre increase in seagrass coverage. In Boca Ciega Bay, this increase amounted to a 13% increase in coverage.

Areas from which seagrasses were lost between 1990 and 1996 in Boca Ciega Bay were dispersed in the southern region of the segment, with the total area amounting to approximately 150 acres. The largest single loss was found southwest of Pinellas Point, where approximately 20 acres were lost along the western side of a bed.

New seagrasses were found covering approximately 1,000 acres in 1996. Approximately half the increases were found in the southern portion of Boca Ciega Bay, where 1990 seagrass beds had expanded. Most significantly, the northern portion of the segment experienced two large seagrass bed expansions. At the head of Boca Ciega Bay, east of Conch Key and southward along the northeastern shore of the segment, a large new area of seagrasses was found, accounting for approximately 200 acres of the new seagrasses found since 1990. Along the eastern mouth of Long Bayou, around Dog Leg Key, a large bed extended from around the Jungle area northward to the Seminole Bridge and about half the distance across the mouth of the bayou. This area of seagrass accounted for almost 90 acres of the increase in the segment. New seagrasses were found along the western shore near the mouth of the bayou as well.

### **Terra Ceia Bay**

In 1990, seagrasses in Terra Ceia Bay covered approximately 1,000 acres. Very little change was found in 1996, when 970 acres of seagrasses were found.

Seagrass losses in Terra Ceia Bay were found near the mouth of the bay, along the southeastern shore of the bay, and near the head of the bay, north of Seabreeze Point. The losses in the northern region were mainly along the northwestern shore, at the mouth of Frog Creek, with some losses around the mouth of McMullen Creek as well. These losses in the northern portion of Terra Ceia Bay amounted to approximately 20 acres.

Only one significant area of seagrass increases was found. This occurred on the western side of the seagrass bed found in 1990 between Gus Point and Bird Key, where seagrass coverage increased by approximately 20 acres from the 1990 bed.

### **Manatee River**

Very little change in seagrass coverage was found in the Manatee River between 1990 and 1996. The 1990 coverage of 360 acres increased to 370 acres by 1996. Small areas of seagrass losses were found near the mouth of the river along the southern shoreline, and some small losses were found around McKay Point on the northern shore of the river as well. Two areas of seagrass increase were found, one near McNeil Point along the southern shore of the river, and the other along the northern shore of the river between the two bridges for US 41.

### 3.4 Comparison of Spatial Characteristics of 1950 and 1996 Seagrass Coverages

A comparison of the spatial characteristics of the 1950 and 1996 seagrass coverages was made to estimate the extent of the areas that supported seagrasses in 1950 but did not support seagrasses in 1996. A polygon-by-polygon comparison of the 1950 and 1996 seagrass coverages (less non-restorable areas) results in the maps shown in Figures 14 and 15. The coverages used to create these maps are available on the CD accompanying this report.

Table 9 presents the breakdown by bay segment of the area of bay bottom that supported seagrasses in 1950 that did not support seagrasses in 1996, as shown in Figure 14. These data show that approximately two-thirds of the areal difference between the 1996 coverage polygons and the 1950 coverage polygons is found in Old Tampa Bay and Middle Tampa Bay.

Segment	Area (acres)
Old Tampa Bay	5,660
Hillsborough Bay	1,670
Middle Tampa Bay	4,060
Lower Tampa Bay	1,270
Boca Ciega Bay	1,660
Terra Ceia Bay	120
Manatee River	40

Portions of the 1950 seagrass acreage were in areas that are non-restorable due to dredging and filling operations. The total and non-restorable acreages based on the 1950 seagrass coverage and bay bottom alterations since then are shown in Table 10 for each segment.

Segment	Total 1950 Seagrass Area (acres)	Non-Restorable Area (acres)
Old Tampa Bay	10,700	1,230
Hillsborough Bay	2,320	510
Middle Tampa Bay	9,600	1,260
Lower Tampa Bay	6,100	690
Boca Ciega Bay	10,800	3,560
Terra Ceia Bay	700	150
Manatee River	200	30

Table 11 presents the breakdown by bay segment of the area of bay bottom that supported seagrasses in 1996 that did not support seagrasses in 1950, as shown in Figure 15. These data show that approximately 8,190 acres of the 26,900 acres of seagrasses found in 1996 were found in areas that did not support seagrasses in 1950. The acreages shown in Table 11 result from the differences in acreages between the 1996 acreages and the restorable acreages not supporting 1996 seagrasses. These acreages correspond to those identified in Figure 15. The coverages used to create Figure 15 are available on the CD accompanying this report.

Segment	Area (acres)
Old Tampa Bay	1,960
Hillsborough Bay	50
Middle Tampa Bay	1,250
Lower Tampa Bay	2,240
Boca Ciega Bay	1,910
Terra Ceia Bay	540
Manatee River	240

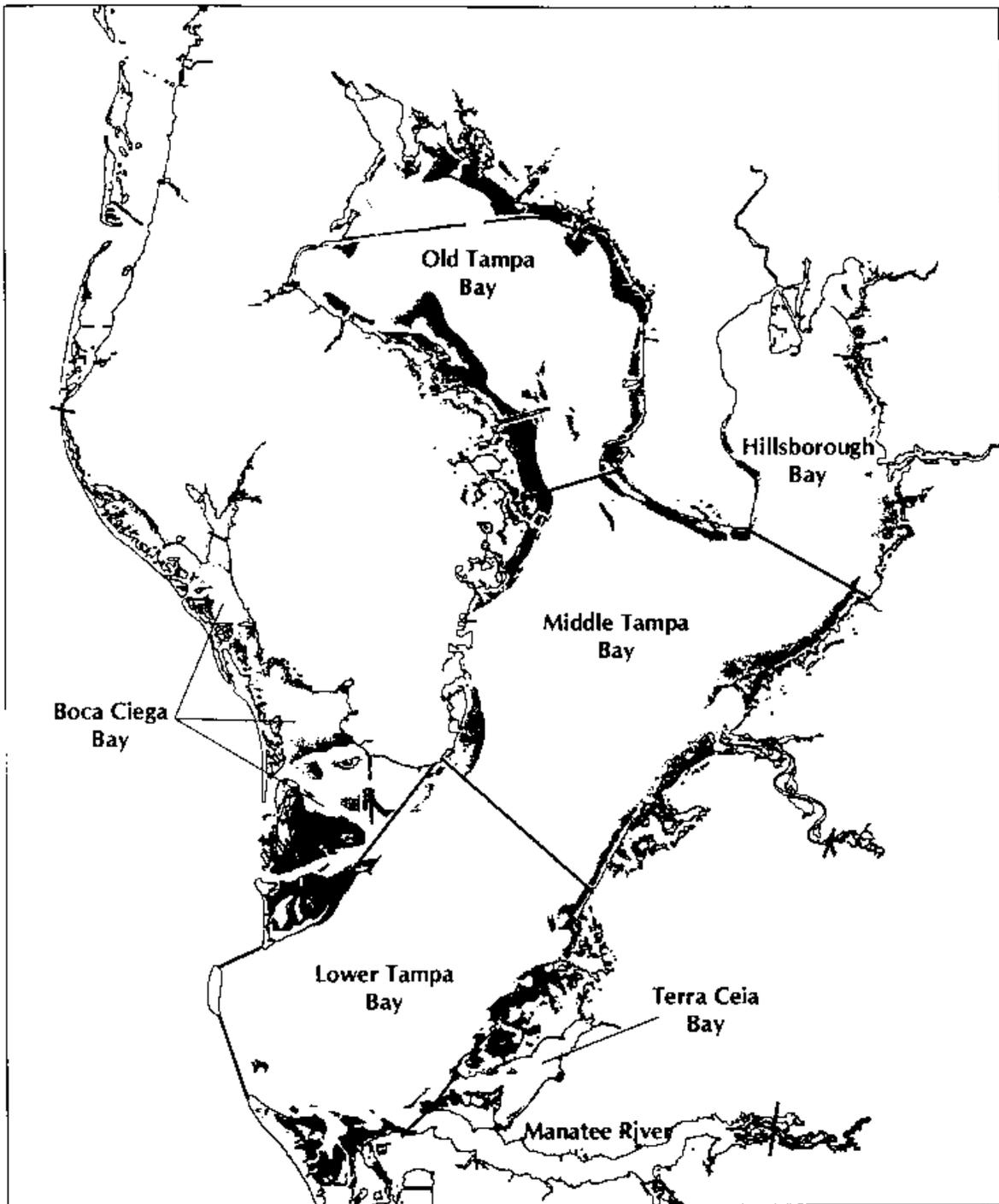


Figure 7. 1950 seagrass coverage (Florida Department of Natural Resources and U.S. Fish and Wildlife Service [TBRPC, 1986]).

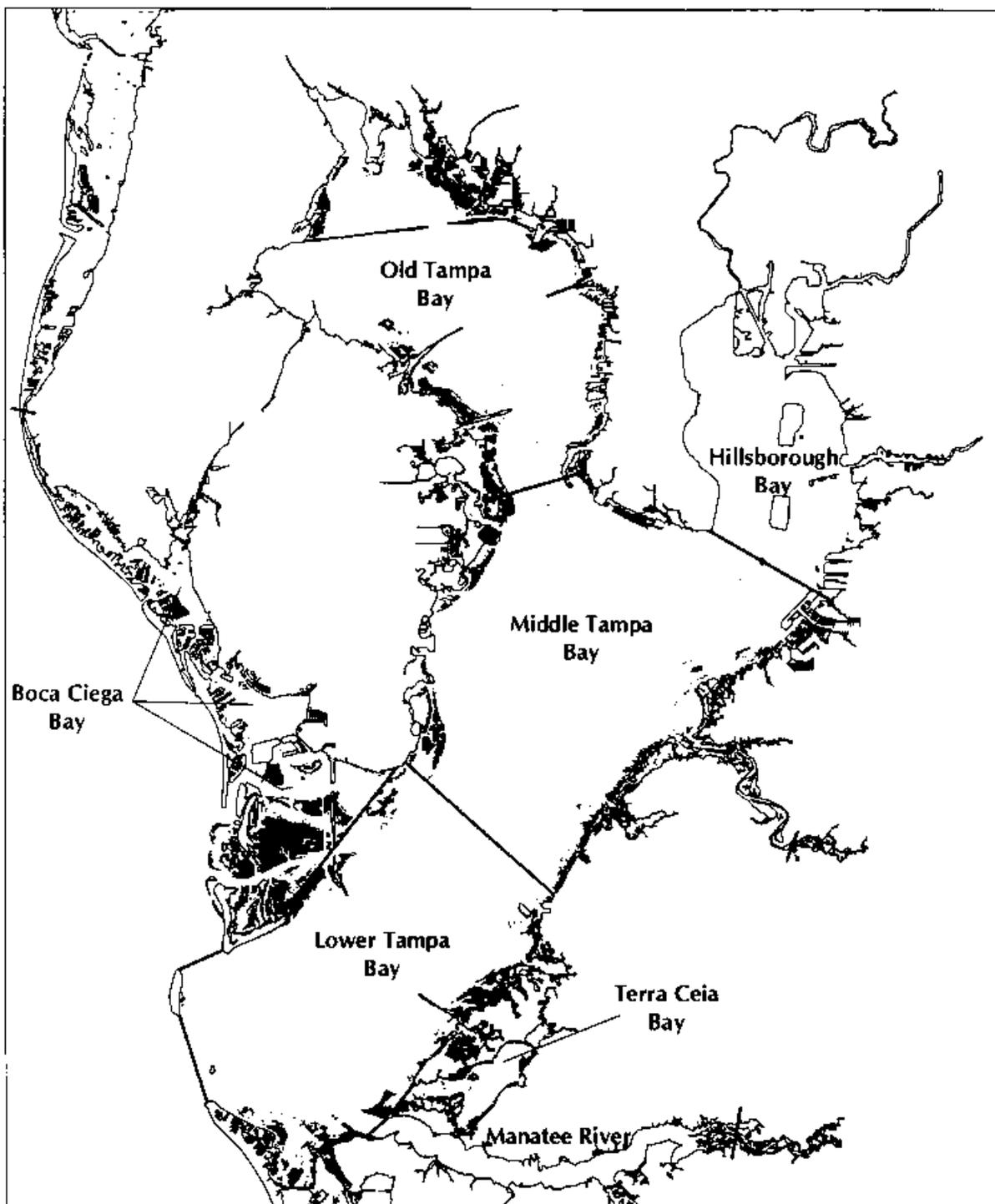


Figure 8. 1990 seagrass coverage (SWFWMD).

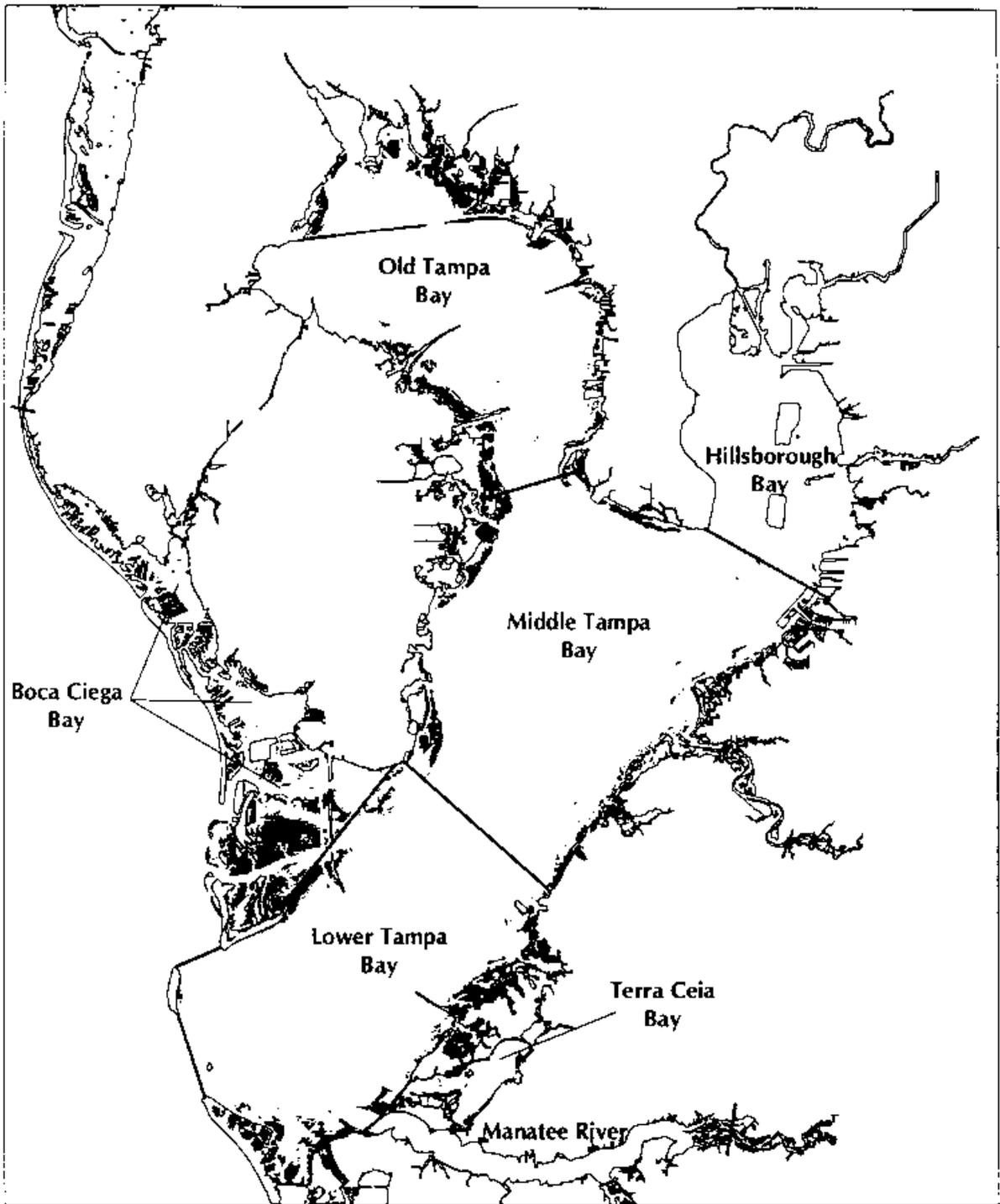


Figure 9. 1992 seagrass coverage (SWFWMD).

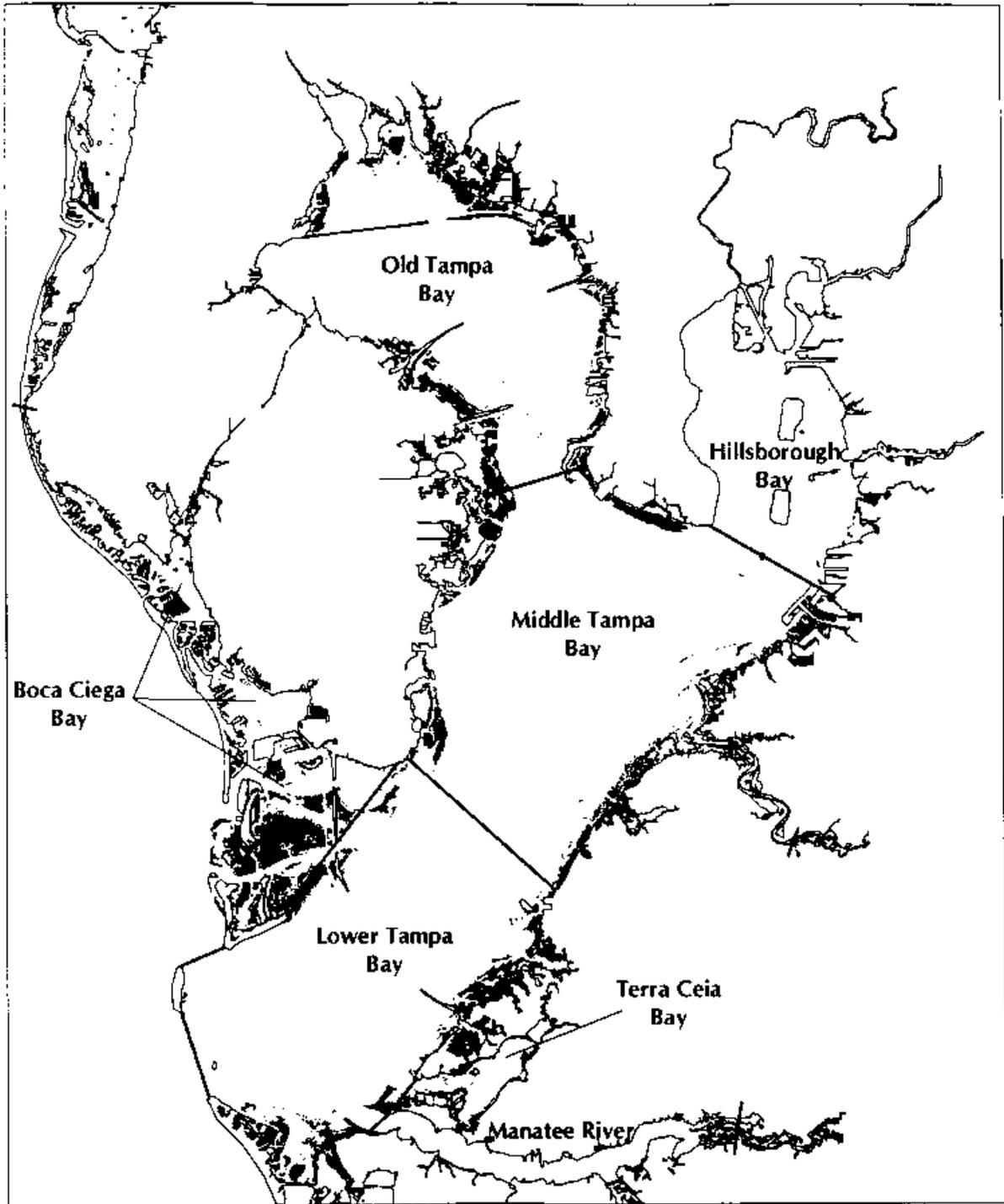


Figure 10. 1994 seagrass coverage (SWFWMD).

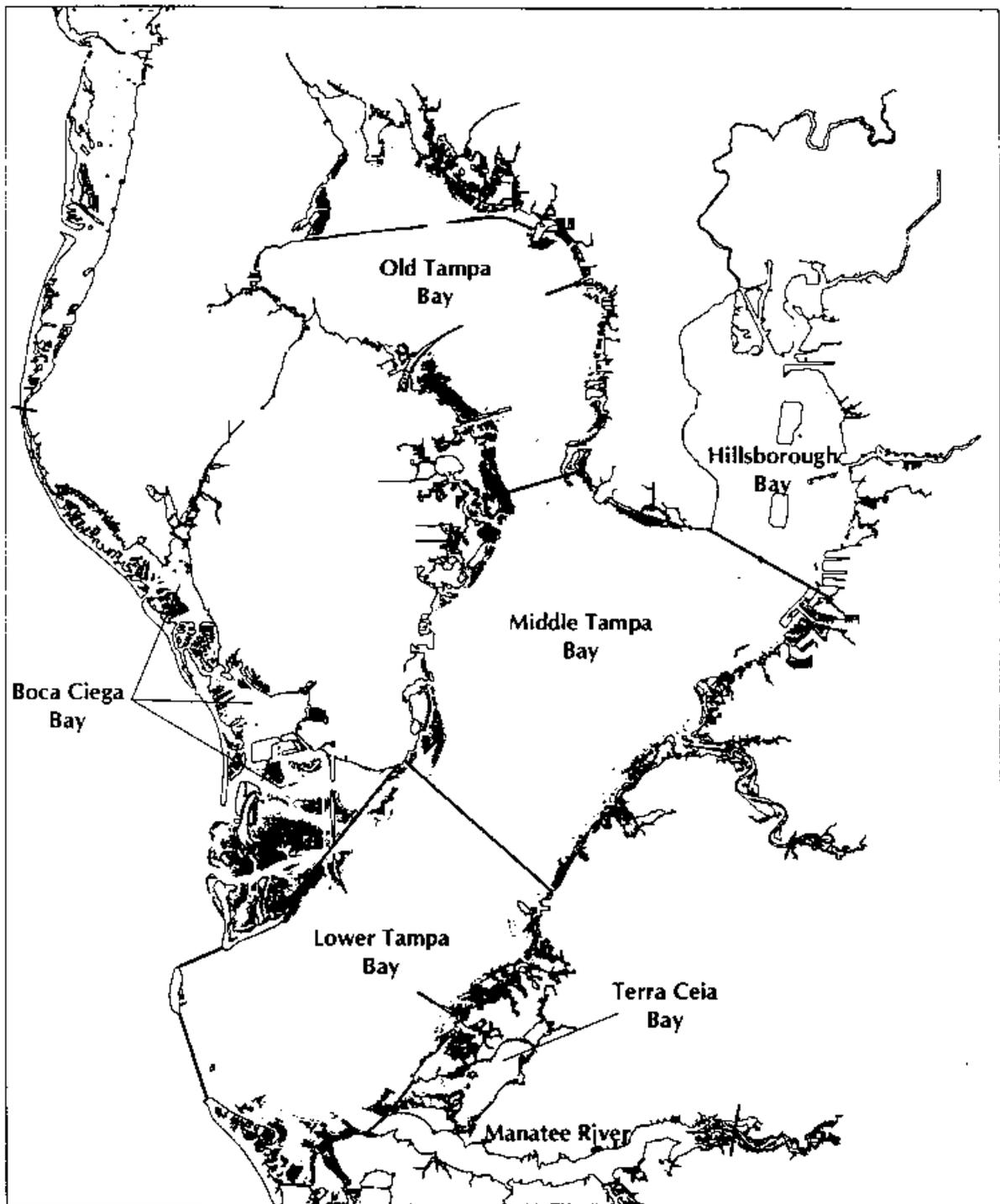


Figure 11. 1996 seagrass coverage (SWFWMD).

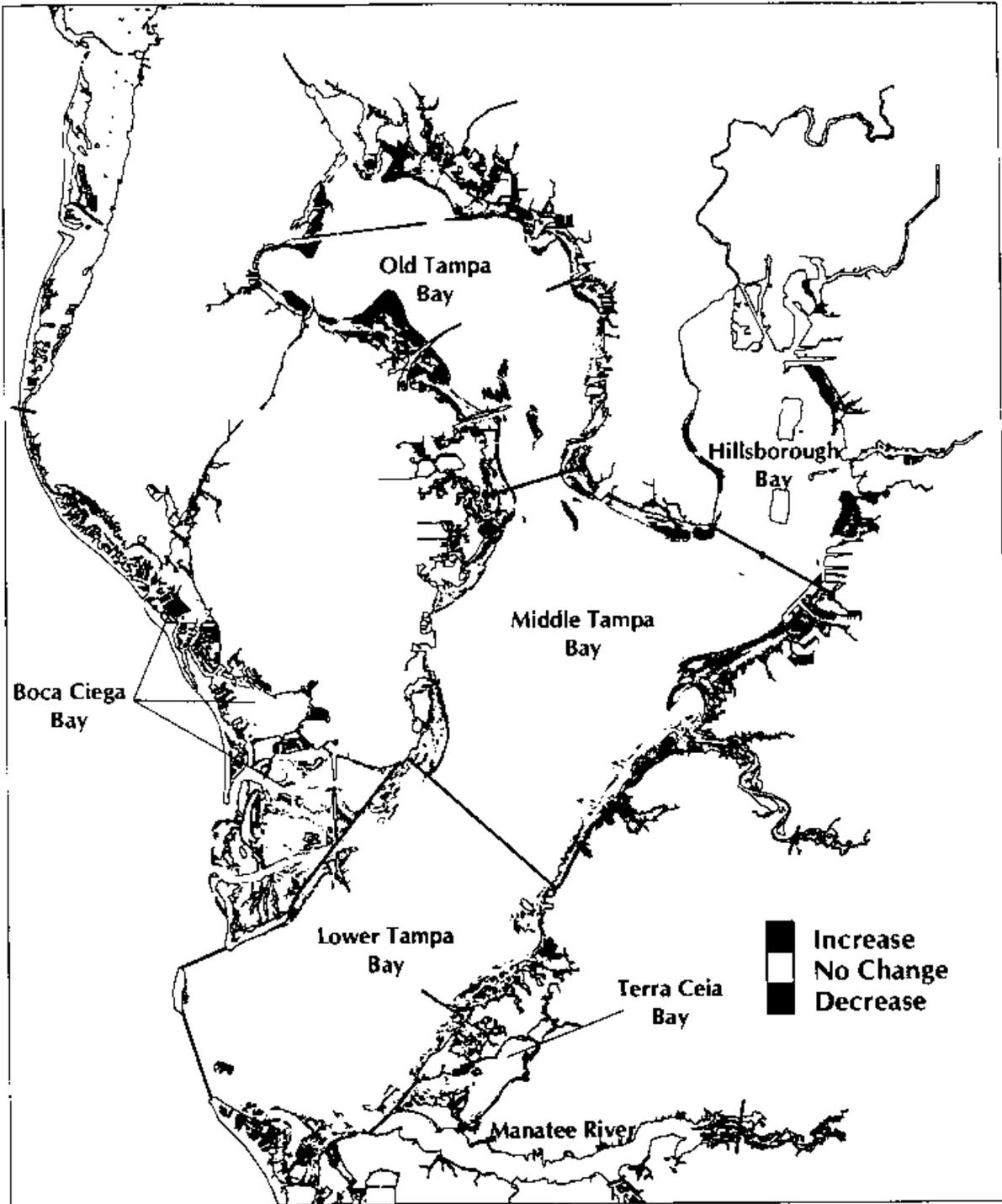


Figure 12. 1950-1990 seagrass change.

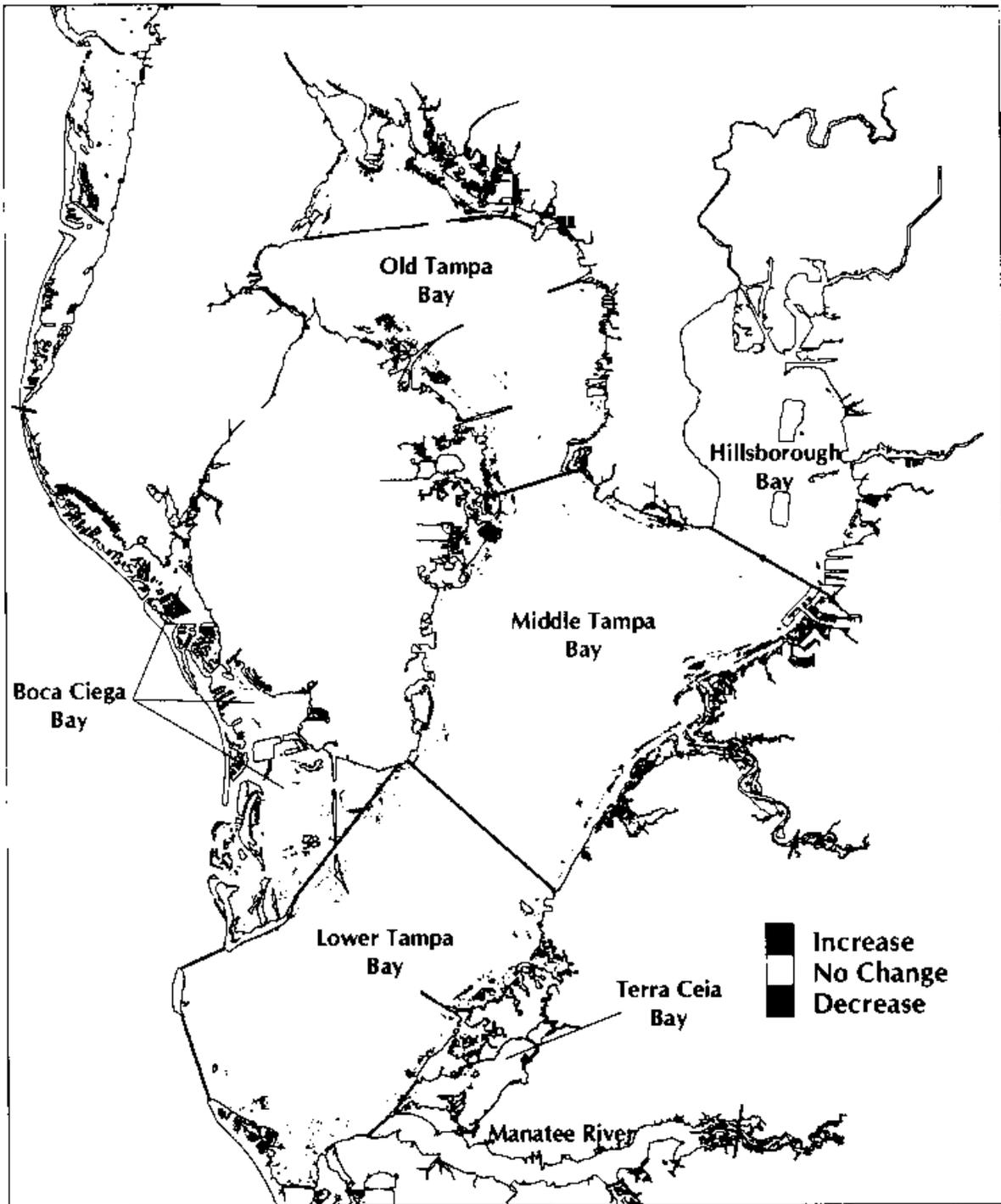


Figure 13. 1990-1996 seagrass change.

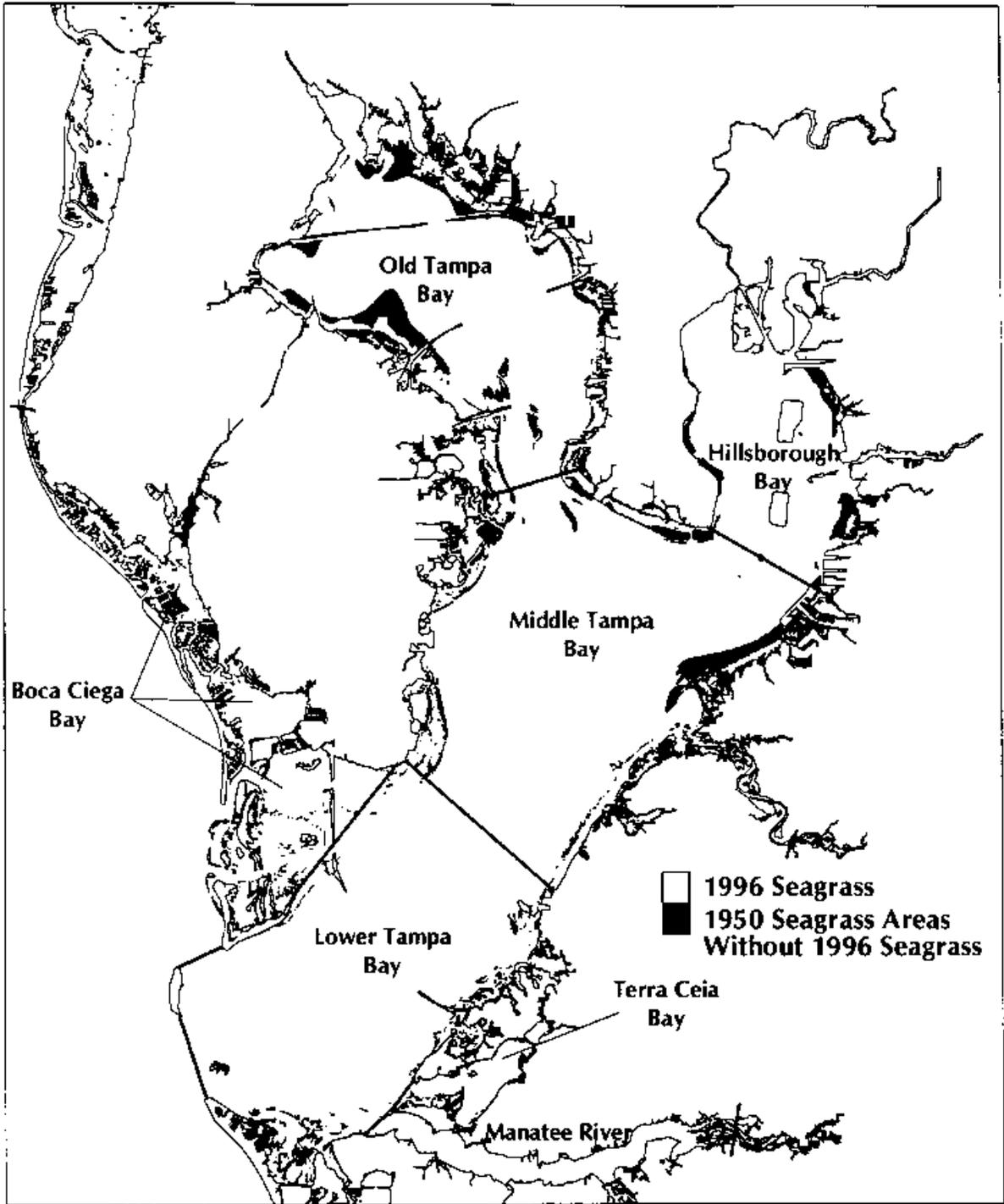


Figure 14. Spatial differences between 1950 seagrass coverage and 1996 seagrass coverage – 1950 seagrass areas without 1996 seagrass.

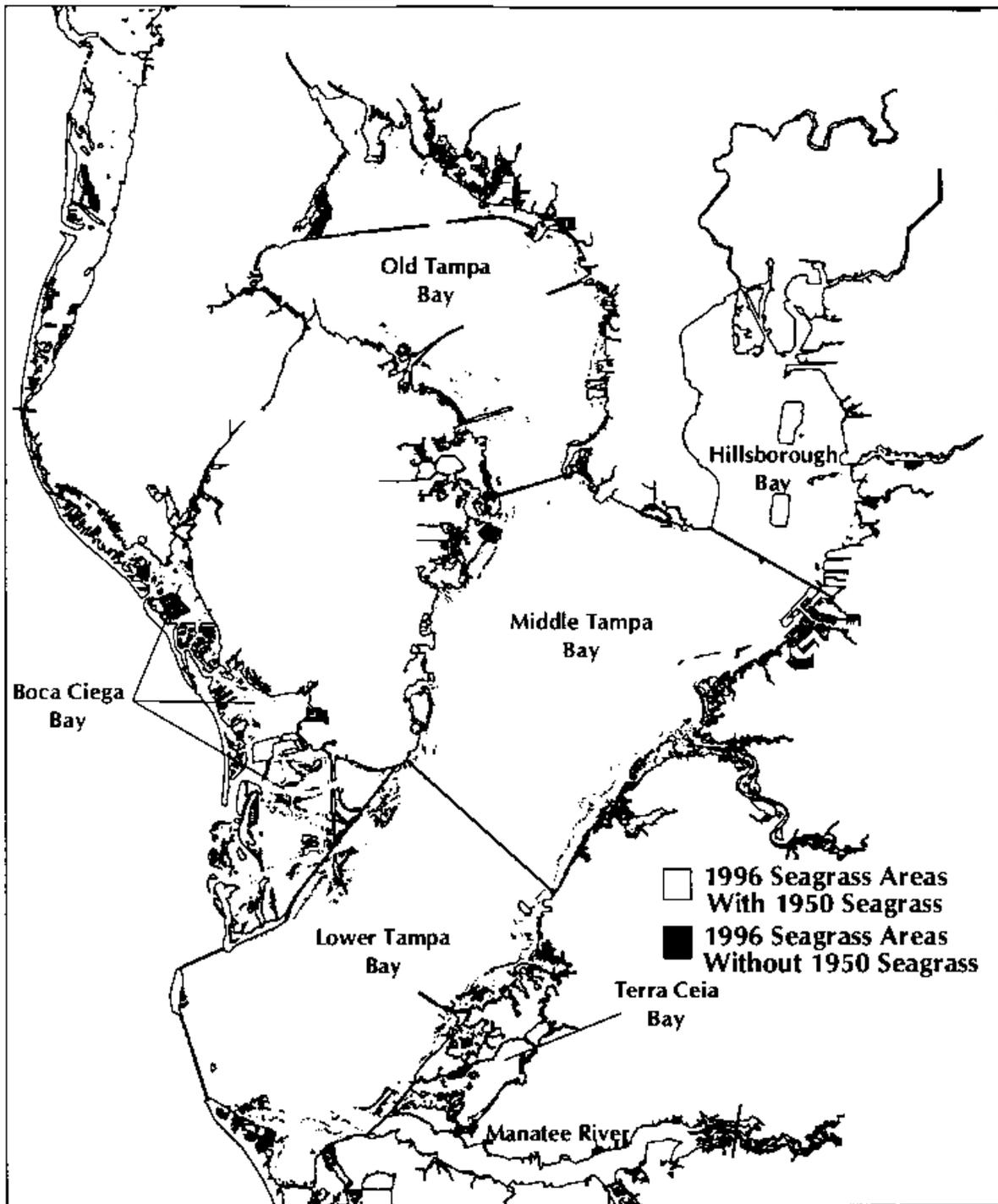


Figure 15. Spatial differences between 1950 seagrass coverage and 1996 seagrass coverage – 1996 seagrass areas without 1950 seagrass.

## 4 CONCLUSIONS

In 1950, seagrasses covered approximately 40,420 acres in Tampa Bay. By 1990, seagrass acreage in the bay had declined to approximately 25,230 acres. The causes of this decline include declining water quality, physical factors such as dredge and fill projects, prop scarring, and altered bay hydrodynamics, and location of seagrass beds in relation to offshore transverse sandbars.

Net increases in seagrass acreage occurred bay-wide from 1990 to 1996. In 1990, the bay-wide seagrass acreage was 25,230 acres. Seagrass acreage increased to 25,750 acres in 1992, to 26,520 acres in 1994, and to 26,920 acres in 1996. From 1990 to 1996, seagrasses extended over an additional 1,690 acres in the bay.

Increases in seagrass acreage within each bay segment varied from 1990 to 1996. More than half of the increase, approximately 900 acres, occurred in Boca Ciega Bay, where the northern portion of the segment had significant gains in seagrass acreage. In Boca Ciega Bay, seagrass acreage increased by 13% from 1990 to 1996. The Old Tampa Bay, Middle Tampa Bay, and Lower Tampa Bay segments experienced increases of more than 200 acres each, or about 4% within each segment. An increase of approximately 150 acres was found in Hillsborough Bay, resulting in a four-fold increase in seagrass acreage in that segment. The Manatee River segment gained almost no seagrass acreage during the period, and the Terra Ceia Bay segment lost approximately 30 acres of seagrass beds (3%).

The rate of increase in seagrass acreage from 1990 to 1996 was approximately 1 %per year bay-wide. Seagrass restoration rate is a function of many variables, including water quality, physical factors such as prop scarring and currents, and location of seagrass beds in relation to offshore transverse sandbars. Additionally, sustained cold weather can be detrimental to the rate of restoration. Seagrasses in Tampa Bay may be subject to biological damage as well, such as that due to *Labyrinthula*, a microorganism associated with seagrass disease.

The TBEP Technical Advisory Committee (TAC) recognizes that these and other factors may affect progress towards reaching adopted seagrass restoration goals, and is currently initiating actions which will assist with addressing factors in addition to water clarity and quality (including the initiation of measuring the depth of water at various seagrass beds around the bay, and the monitoring of potential seagrass disease). Actions needed to address additional factors, such as the bay-wide effects of prop scarring or the location of various seagrass beds, will be included in discussions of future monitoring needs.

The major findings of this report are summarized as follows:

- the 1990 seagrasses covered approximately 2,400 acres in areas where seagrasses were not found in 1996;

- the 1996 seagrasses covered approximately 4,000 acres in areas where seagrasses were not found in 1990; and
- the rate of increase in bay-wide seagrass acreage slowed during 1994 to 1996, when seagrass acreage increased by approximately 400 acres, compared to the increases observed between 1992 and 1994 (700 acres) and between 1990 and 1992 (600 acres).

The causes leading to these findings should be the subject of further study. As discussed above, the TBEP recognizes that factors other than water quality should be considered when examining progress towards seagrass restoration goals. The causes of bay-wide and segment-specific seagrass acreage losses and gains should be addressed, so that future management decisions can be based on a fuller understanding of the factors involved in seagrass recovery in Tampa Bay.

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