Florida Seagrass Integrated Mapping and Monitoring Program

Summary Report for Charlotte Harbor, Cape Haze, Pine Island Sound, and Matlacha Pass

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General Assessment: Seagrass acreage in Charlotte Harbor, Cape Haze, Pine Island Sound, and Matlacha Pass has been stable or increasing in recent years (Figures 1 and 2). Acreage has increased since 2004, with recovery from the 2004/2005 hurricanes. In 2004, 57,213 acres were mapped throughout the region, and in 2006, 58,849 acres were mapped, an increase of 1,636 acres, or 2.9%. Seagrass-based water quality targets have been developed throughout the Charlotte Harbor region based on seagrass light requirements, water depth at the deep edge of seagrass beds, and acreage. Human development, with the resulting impacts of increasing nutrients and turbidity in coastal waters, is a threat to seagrass beds. Propeller scarring continues to impact seagrass beds throughout this region; beds in Pine Island Sound and Matlacha Pass in Lee County have experienced the most severe damage. In these two regions, 21,507 acres of seagrass beds have been scarred by propellers.

Seagrass Status and Stresses	Status	Trend	Assessment, Causes
Seagrass cover		Increasing	Improved since 2004–05
Water clarity		Local declines	Affected by runoff, storms
Natural events		Moderate impact	2004, 2005 hurricanes
Propeller scarring		Increasing	Increased boating

Geographic Extent: This chapter includes Charlotte Harbor, Gasparilla Sound, Cape Haze, Pine Island Sound, Matlacha Pass, San Carlos Bay, and the tidal Caloosahatchee and Peace rivers. The region is managed through both the Aquatic Preserve Program of the Florida Department of Environmental Protection (FDEP) and the Charlotte Harbor National Estuary Program (CHNEP). The Gasparilla Sound/Charlotte Harbor Aquatic Preserves extend from the tidal Peace and Myakka rivers through Lemon Bay to Pine Island Sound and Matlacha Pass. The CHNEP includes these estuaries, plus Lemon Bay to the north, all of Charlotte Harbor, and Estero Bay to the south. In addition, the northern estuaries of this region (those in Charlotte and Sarasota counties, including Lemon Bay, Upper Charlotte Harbor, Peace River, Myakka River,

Gasparilla Sound, and Cape Haze) fall within the jurisdiction of the Southwest Florida Water Management District. The southern estuaries (in Lee County, including Lower Charlotte Harbor, Pine Island Sound, Matlacha Pass, San Carlos Bay, and the tidal Caloosahatchee River) are within the jurisdiction of South Florida Water Management District.

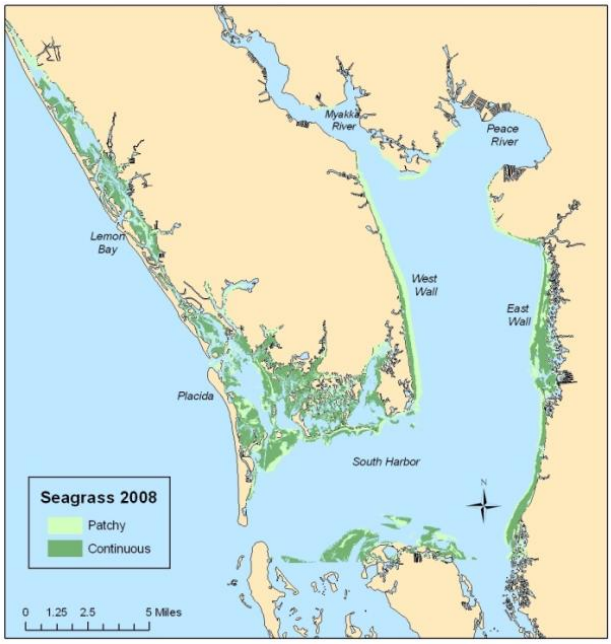

Figure 1. Seagrass in northern Charlotte Harbor, 2008.

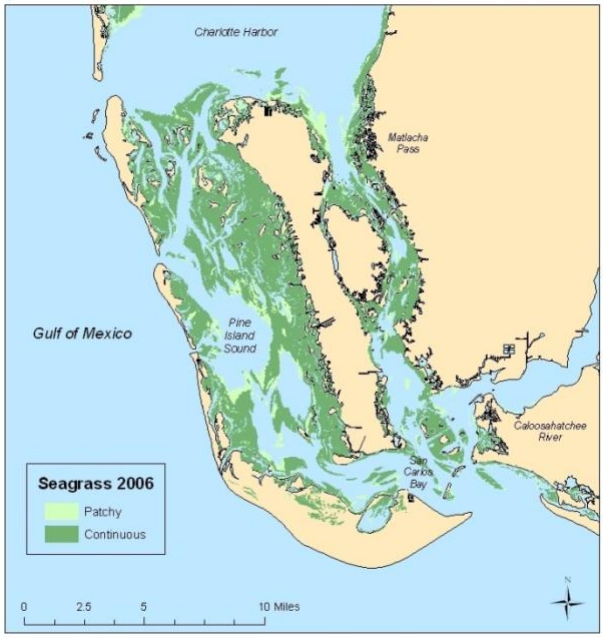

Figure 2. Seagrass in southern Charlotte Harbor, 2008.

Mapping and Monitoring Recommendations

• Continue biennial aerial photography, photointerpretation, and mapping by the Southwest Florida Water Management District (SWFWMD) for northern Charlotte Harbor and by South Florida Water Management District (SFWMD) for southern Charlotte Harbor to evaluate trends in seagrass acreage.

• Continue annual fall monitoring by staff of the Gasparilla Sound/Charlotte Harbor Aquatic Preserves to evaluate changes in species composition, abundance, and water depth at the deep edge of seagrass beds.

• Update the map of propeller scarring in Charlotte Harbor (Sargent et al. 2005) to assess trends in scarring and recovery.

Management and Restoration Recommendations

• As part of the regional management plan, evaluate water quality and light attenuation annually using available region-specific models and tools. For more accurate assessment and management, bay waters are divided into segments having generally homogeneous water quality and seagrass conditions (Figure 3). Within each segment, water quality results are compared with seagrass mapping and monitoring data on a biennial basis.

• Assess effects of development on storm runoff.

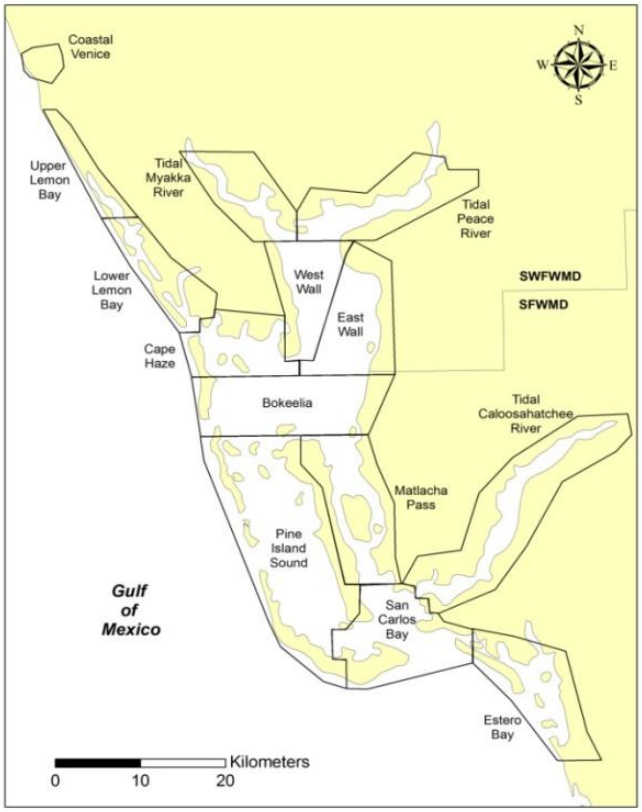

Figure 3. Estuary segments used for seagrass water quality analyses.

• Implement a region-wide program with the goal of decreasing propeller scarring and evaluate the effectiveness of the No Internal Combustion Motor Zones in Pine Island Sound and Matlacha Pass and the Pole and Troll zone near Blind Pass, once they are in place.

Summary Assessment: Overall, seagrass acreage has declined from historical levels due to development and dredge-and-fill operations in coastal waters. More recently, seagrass acreage has been recovering, despite episodic runoff from hurricanes and tropical storms in 2004. From 2004 to 2006, seagrass acreage throughout the subestuaries of the Charlotte Harbor region increased from 57,213 acres to 58,849 acres, or 2.9%. However, monitoring studies indicate that seagrass meadow texture and species composition vary, especially between subestuaries. Overall, the abundance of shoal grass (*Halodule wrightii*) and turtle grass (*Thalassia testudinum*) is probably declining, and the number of monitored quadrats that are devoid of seagrasses has increased. Factors that affect water clarity, such as turbidity, color, and

chlorophyll-a concentration, are a concern in some subestuaries and watersheds. Propeller scarring is present throughout the study area and is particularly severe in Pine Island Sound and Matlacha Pass, where 44% of the 21,507 propeller-scarred acres are classified as severely impacted.

Seagrass Status Indicators	Status	Trend	Assessment, Causes
Seagrass cover		Increasing	Runoff, nutrients
Seagrass meadow texture		Changing	Increasing bare areas
Seagrass species composition		Fairly stable	Increase in shoal grass
Overall seagrass trends		Improving	Drought before 2010
Seagrass Stressors	**Intensity**	**Impact**	**Explanation**
Water clarity		Local declines	Affected by runoff, storms
Nutrients		Increasing	Affected by runoff, storms
Phytoplankton		Increasing	Affected by runoff, storms
Natural events		Moderate impact	2004, 2005 hurricanes
Propeller scarring		Increasing	Increased boating

Seagrass Mapping Assessment: From 2004 to 2006, seagrass acreage increased by 1,636 acres throughout the Charlotte Harbor region (Table 1). In Upper Charlotte Harbor, seagrass cover increased in all estuary segments except the Cape Haze area, which lost 553 acres of seagrass (a 7.4% loss). The largest percentage gains occurred along the West Wall of Charlotte Harbor and in the tidal portions of the Myakka and Peace rivers. In 2006, there were 16,650 acres of seagrass in the northern segments. In 2006, the Lower Charlotte Harbor estuary segments contained almost 2.5 times as many acres of seagrass as Upper Charlotte Harbor, and most of this acreage was in Pine Island Sound. All estuary segments in Lower Charlotte Harbor had gains in seagrass area between 2004 and 2006, and these gains (1,494 acres), which occurred mostly in Pine Island Sound, accounted for 91% of the increase in seagrass acreage for the entire Charlotte Harbor region.

TABLE 1. SEAGRASS ACREAGE IN THE CHARLOTTE HARBOR REGION

	1999	2004	2006	Change 2004–06	% Change 2004–06
A. Upper Charlotte Harbor (SWFWMD)					
Tidal Myakka River	539	331	375	44	13.3
Tidal Peace River	302	295	341	46	15.6
West Wall	1,993	1,784	2,121	337	18.9
East Wall	3,587	3,275	3,382	107	3.3
Cape Haze	6,709	7,464	6,911	−553	−7.4
Bokeelia	3,101	3,359	3,520	161	4.8
Total	16,231	16,508	16,650	142	0.9
B. Lower Charlotte Harbor (SFWMD)					
Pine Island Sound	25,941	28,034	29,204	1,170	4.2
Matlacha Pass	6,055	7,479	7,619	140	1.9
San Carlos Bay	3,709	5,192	5,376	184	3.5
Total	35,705	40,705	42,199	1,494	3.7
C. Total Charlotte Harbor Region					
	51,936	57,213	58,849	1,636	2.9

Monitoring Assessment: Monitoring has been conducted each fall since 1999 using 50 fixed transects. Evaluation of data from 1999 through 2009 suggests that, overall, seagrass beds are increasing or stable in size and in species composition (Table 2), with no changes in depth distribution (data not shown). Six species of seagrass are found in the Charlotte Harbor region: turtle grass (*T. testudinum*), shoal grass (*H. wrightii*), and manatee grass (*Syringodium filiforme*) are the most common, and widgeon grass (*Ruppia maritima*), paddle grass (*Halophila decipiens*), and star grass (*H. engelmannii*) are ephemeral. From 1999 to 2005, the abundance of shoal grass, turtle grass, and manatee grass declined, based on Braun-Blanquet quadrat assessments. At the same time, the number of bare quadrats increased from 10% to 24%. Greenawalt-Boswell et al. (2006) also found a significant increase in the number of quadrats having no seagrass. After 2005, shoal grass rebounded in percentage occurrence, and the fraction of bare quadrats decreased. However, the percentage abundance of turtle grass and

TABLE 2. PERCENTAGE OCCURRENCE OF SEAGRASS SPECIES IN QUADRATS WITHIN THE CHARLOTTE HARBOR AQUATIC PRESERVES AREA

Year	No Seagrass	Shoal Grass	Turtle Grass	Manatee Grass	Widgeon Grass	Star Grass
1999	10	46.5	31.5	9.2	1.9	0.8
2000	11.9	47.8	30.4	9.3	0.7	0
2001	16.2	40.5	32	9.5	1.4	0.4
2002	15.5	44.5	31.7	8.3	0	0
2003	19.9	41.3	29.9	8.9	0	0
2004	19.9	41.6	30.1	8.4	0	0
2005	24.3	41	26.5	8.2	0	0
2006	20.3	44.5	27.2	7.9	0	0
2007	15.8	47.4	26.8	9.3	0	0.7
2008	16	47	25.4	8.7	2.8	0
2009	12.5	51.2	27.5	8.8	0	0

manatee grass has remained near 2005 levels. Within the Charlotte Harbor region, Greenawalt-Boswell et al. (2006) found net losses of seagrasses in the Peace River, Myakka River, and North Charlotte Harbor. Pine Island Sound, San Carlos Bay, and Matlacha Pass were stable in seagrass cover, while Southern Charlotte Harbor and Gasparilla Sound had increases.

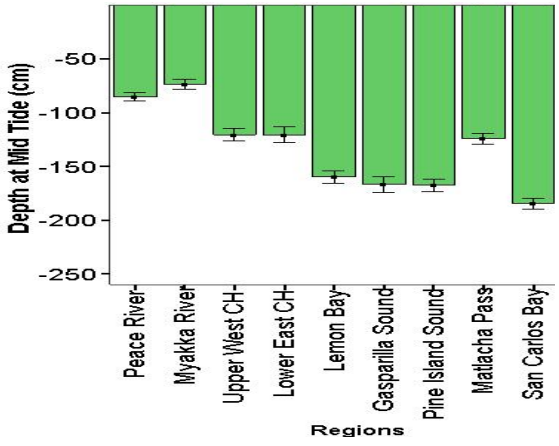

Figure 4. Average deep edge of seagrass growth.

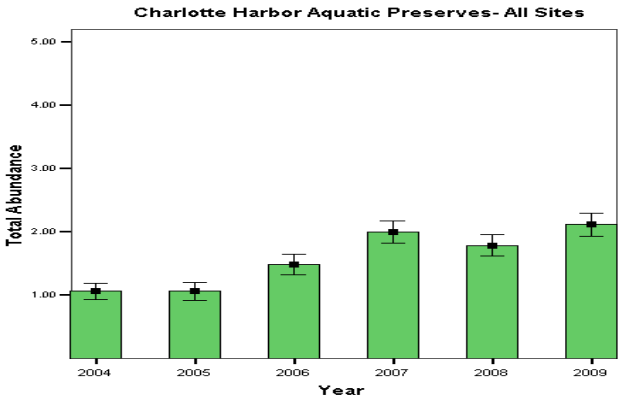

Figure 5. Mean total abundance of all seagrasses in the Charlotte Harbor Aquatic Preserves, reported by Braun-Blanquet score, 1999-2006.

The average water depth at the deep edge of seagrass beds varied by subestuary based on FDEP transect monitoring data from 1999 to 2006, ranging from approximately 70 cm in the Myakka River to 180 cm in San Carlos Bay (Figure 4). Mean total abundance of all seagrasses in the Charlotte Harbor region has steadily increased since 2005 (Figure 5). Propeller scarring in Pine Island Sound, increased nutrient inputs due to watershed development, and increases in the amount of suspended particles in the water continue to impact seagrass beds.

Management and Restoration

Assessment: Seagrass acreage targets for each subestuary of Charlotte Harbor (Table 3) were established by CHNEP, using the maximum historical extent and inter-annual variability of seagrass cover. In turn, seagrass target acreages were used to establish water quality targets for each estuarine segment (CHNEP 2009). Based on aerial photography, persistence of seagrass locations and acreage was determined for each estuary segment. An example is shown in Figure 6 for Pine Island Sound.

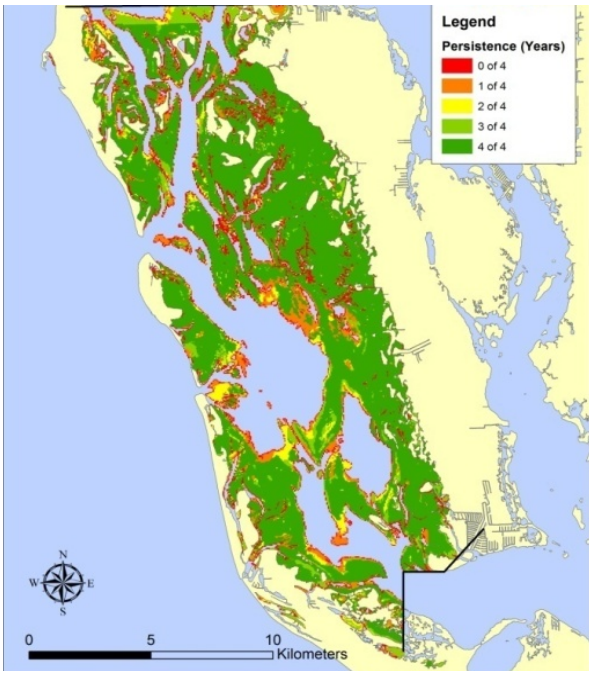

Figure 6. Persistence of seagrass locations from 1999-2006 in Pine Island Sound.

TABLE 3. SEAGRASS PROTECTION AND RESTORATION TARGETS FOR THE CHARLOTTE HARBOR REGION

Estuarine Segment	Target (acres)
Tidal Peace and Myakka rivers	1,430
Charlotte Harbor	9,350
Cape Haze	7,000
Pine Island Sound	26,840
Matlacha Pass	9,320
San Carlos Bay	4,370
Tidal Caloosahatchee River	90
Total	**58,400**

Mapping and Monitoring Recommendations

• Continue biennial mapping and annual monitoring programs.

• Update the 2003 propeller scarring maps of Charlotte Harbor produced by Sargent et al. (2005) to assess trends in scarring and to evaluate areas where severe propeller scarring continues.

Management and Restoration Recommendations

• Evaluate water quality and light attenuation annually using available region-specific models and tools.

• Address levels of nutrient inputs, and identify sources of nutrients and other factors that reduce water clarity.

• Minimize propeller scarring and evaluate the effectiveness of the No Internal Combustion Motor Zones in Pine Island Sound and Matlacha Pass and the Pole and Troll zone near Blind Pass, once they are in place.

Mapping Data and Imagery: SWFWMD is responsible for mapping seagrasses in the northern portion of the Charlotte Harbor Aquatic Preserves, and aerial photography is obtained every two years. In 2008, seagrass imagery was photointerpreted from 1:24,000 scale natural color aerial photography and classified using the SWFWMD modified Florida Land Use Cover Classification System (FLUCCS). The minimum mapping unit for classification was 0.5 acre. Lower Charlotte Harbor, Pine Island Sound, Matlacha Pass, and the Caloosahatchee Estuary are under the jurisdiction of SFWMD. For these subregions, seagrass data were photointerpreted from 2006 1:24,000 scale natural color aerial photography and classified using SFWMD modified FLUCCS. Features were stereoscopically interpreted from the aero-triangulated aerial photography, and vector data were compiled using digital stereo plotters. The minimum mapping unit for classification was 0.5 acre.

Monitoring Data: Seagrass beds in the Charlotte Harbor Aquatic Preserves are monitored each fall using 50 transects from shore to deep edge. Total abundance and species abundance are assessed in 1 m × 1 m quadrats using the Braun-Blanquet method (1: < 5%, 2: 6–25%, 3: 26–50%, 4: 51–75%, 5: 76–100%). Shoot counts, blade lengths, and epiphyte loading on seagrass blades are evaluated as well. Data summaries and reports are available on the Charlotte Harbor Aquatic Preserves website: (http://www.dep.state.fl.us/coastal/sites/charlotte/research/Seagrass_Data_Summary.pdf).

Pertinent Reports and Scientific Publications

CHAMBERLAIN, R. H., P. H. DOERING, B. ORLANDO, and B. M. SABOL. 2009. Comparison of manual and hydroacoustic measurement of seagrass distribution in the Caloosahatchee Estuary, Florida. Florida Scientist 72: 386–405.

CHARLOTTE HARBOR NATIONAL ESTUARY PROGRAM. 2009. Water quality target refinement project, task 1: harbor segmentation scheme. Interim Report 1, Janicki Environmental, Inc., St. Petersburg, Florida. 33 p., http://www.chnep.org; accessed March 2011.

CHARLOTTE HARBOR NATIONAL ESTUARY PROGRAM. 2009. Water quality target refinement project, task 2: seagrass target development. Interim Report 2, Janicki Environmental, Inc., St. Petersburg, Florida. 62 p., http://www.chnep.org/NEP/agendas-2010/TAC/WQQOS_WQ%20Target%20Refine%20Report%202%20Seagrass%20targets.pdf; accessed March 2011.

CORBETT, C. A. 2006. Seagrass coverage changes in Charlotte Harbor, Florida. Florida Scientist 69: 7–23.

CORBETT, C. A., and J. A. HALE. 2006. Development of water quality targets for Charlotte Harbor, Florida, using seagrass light requirements. Florida Scientist 69: 36–50.

GREENAWALT-BOSWELL, J. M., J. A. HALE, K. S. FUHR, and J. A. OTT. 2006. Seagrass species composition and distribution trends in relation to salinity fluctuations in Charlotte Harbor, Florida. Florida Scientist 69: 24–35.

OTT, J. A., R. M. DUFFEY, S. E. ERICKSON, K. S. FUHR, B. A. RODGERS, and M. A. SCHNEIDER. 2006. Comparison of light limiting water quality factors in six Florida aquatic preserves. Florida Scientist 69: 73–91.

SARGENT, F. J., T. J. LEARY, D. W. CREWZ, and C. R. KRUER. 1995. Scarring of Florida's seagrasses: assessment and management options. Florida Marine Research Institute Technical Report TR-1, Florida Department of Environmental Protection, St. Petersburg, Florida. 37 p. plus appendices.

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION CHARLOTTE HARBOR AQUATIC PRESERVES. 2007. Seagrass annual data summary from the Charlotte Harbor & Estero Bay Aquatic Preserves Seagrass Transect Monitoring Program, 1999–2006. Prepared by Celia Stearns. 50 p.
http://www.dep.state.fl.us/coastal/sites/charlotte/research/Seagrass_Data_Summary.pdf; accessed March 2011.

WESSEL, M. R., and C. A. CORBETT. 2009. Assessing the performance of an optical model used in setting water quality targets in Lemon Bay, Charlotte Harbor and Estero Bay, Florida. Florida Scientist 72: 367–385.

General References and Additional Information

Charlotte Harbor Aquatic Preserves: http://www.dep.state.fl.us/coastal/sites/charlotte/info.htm; accessed March 2011.

Charlotte Harbor National Estuary Program: http://www.chnep.org/; accessed March 2011.

Sarasota County Wateratlas: http://www.sarasota.wateratlas.usf.edu/; accessed March 2011.

Contacts

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Mapping: Kris Kaufmann, Surface Water Improvement and Management Program, Southwest Florida Water Management District, 813-985-7481, Kristen.Kaufman@swfwmd.state.fl.us; Peter Doering, South Florida Water Management District 561-682-2772, pdoering@sfwmd.gov.

Resource Management Coordination: Judy Ott, Charlotte Harbor National Estuary Program, 239-338-2556, jott@swfrpc.org.