Summary Report for the Charlotte Harbor Region

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Summary Report for the Charlotte Harbor Region

Including Lemon Bay, Charlotte Harbor, Cape Haze, Pine Island Sound, Matlacha Pass, and the Caloosahatchee River estuary

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General assessment: Seagrass acreage in the Charlotte Harbor region has increased in recent years. Acreage increased since 2008, with recovery from the 2004–2005 hurricanes. In 2008, 61,506 acres were mapped throughout the region, and in 2014 seagrasses covered 67,720 acres. Overall, seagrass acreage increased by about 6,200 acres or 10%. In the northern part of the region, under the jurisdiction of the Southwest Florida Water Management District (SWFWMD), seagrasses are mapped every two years, and acreage has increased since 2008 (Table 1). In the southern sub-region, seagrasses were mapped in 2006, 2008, and 2014 by the South Florida Water Management District (SFWMD), and seagrasses increased by 3,283 acres (8%) between 2008 and 2014. Seagrass-based water quality targets were developed throughout the Charlotte Harbor region based on seagrass light requirements, water depth at the deep edge of seagrass beds, and historical acreage of seagrass. Human development, with the resulting impacts of increasing nutrients and turbidity in coastal waters, is a threat to seagrass beds. Propeller scarring continues to affect seagrass beds throughout the 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.

General Status of Seagrasses in the Charlotte Harbor Region

Status and stressors	Status	Trend	Assessment, causes
Seagrass acreage	Green	Increasing	Improvements since 2008
Water clarity	Yellow	Local declines	Affected by runoff, storms
Natural events	Yellow	Moderate impacts	2004, 2005 hurricanes, and freshwater influences
Propeller scarring	Red	Increasing	Increased boating

Geographic extent: This chapter includes Lemon Bay, located between the Sarasota Bay region and Charlotte Harbor, Charlotte Harbor, Gasparilla Sound, Cape Haze, Pine Island Sound, Matlacha Pass, San Carlos Bay, and the tidal reaches of the Myakka, Caloosahatchee and Peace rivers (Figures 1 and 2). The region is managed through both

the aquatic preserve program of the Florida Department of Environmental Protection's (FDEP) Florida Coastal Office and the Charlotte Harbor National Estuary Program (CHNEP). The Charlotte Harbor Aquatic Preserves extend from Lemon Bay and the tidal Peace and Myakka rivers to Pine Island Sound and Matlacha Pass. The CHNEP includes these estuaries, all of Charlotte Harbor, and, to the south, Estero Bay. 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 in the jurisdiction of the SWFWMD. The southern estuaries (in Lee County), including Lower Charlotte Harbor, Pine Island Sound, Matlacha Pass, San Carlos Bay, and the tidal Caloosahatchee River are in the jurisdiction of the SFWMD.

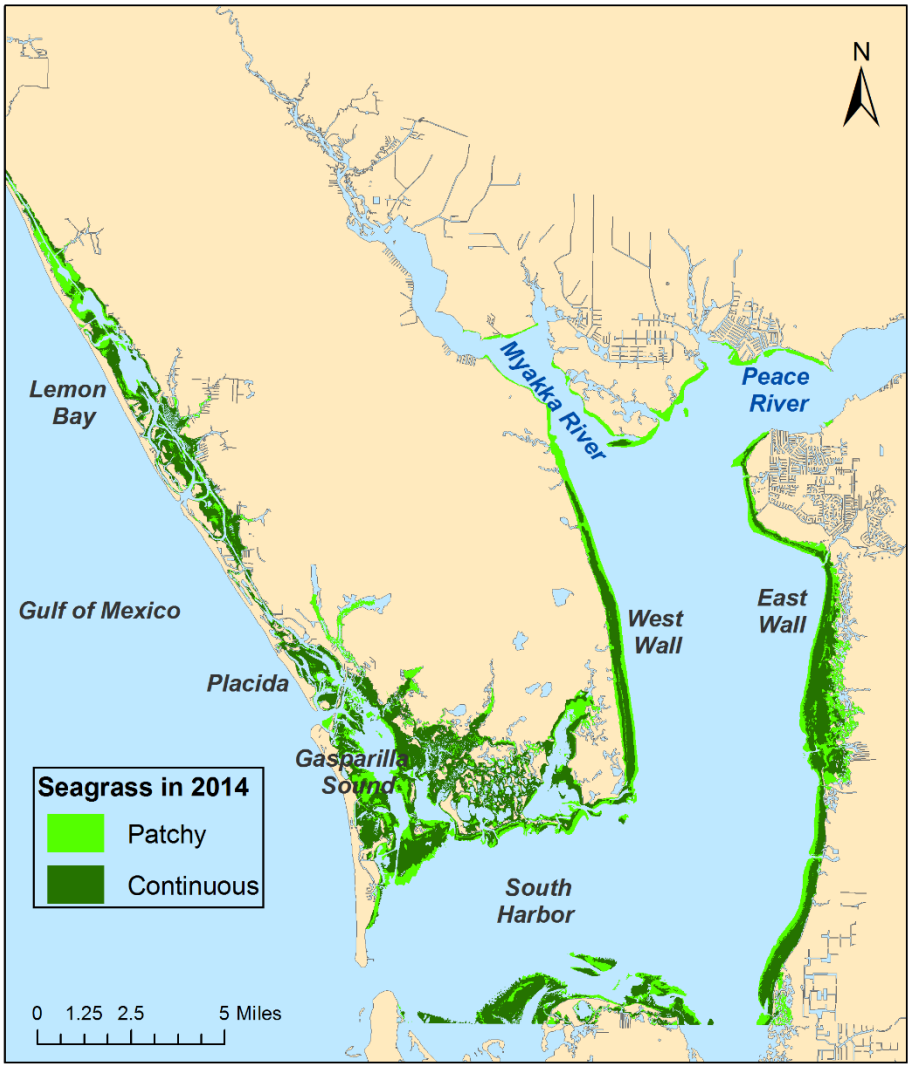

Figure 1 Seagrass in Lemon Bay and northern Charlotte Harbor, 2014. Data and shapefi

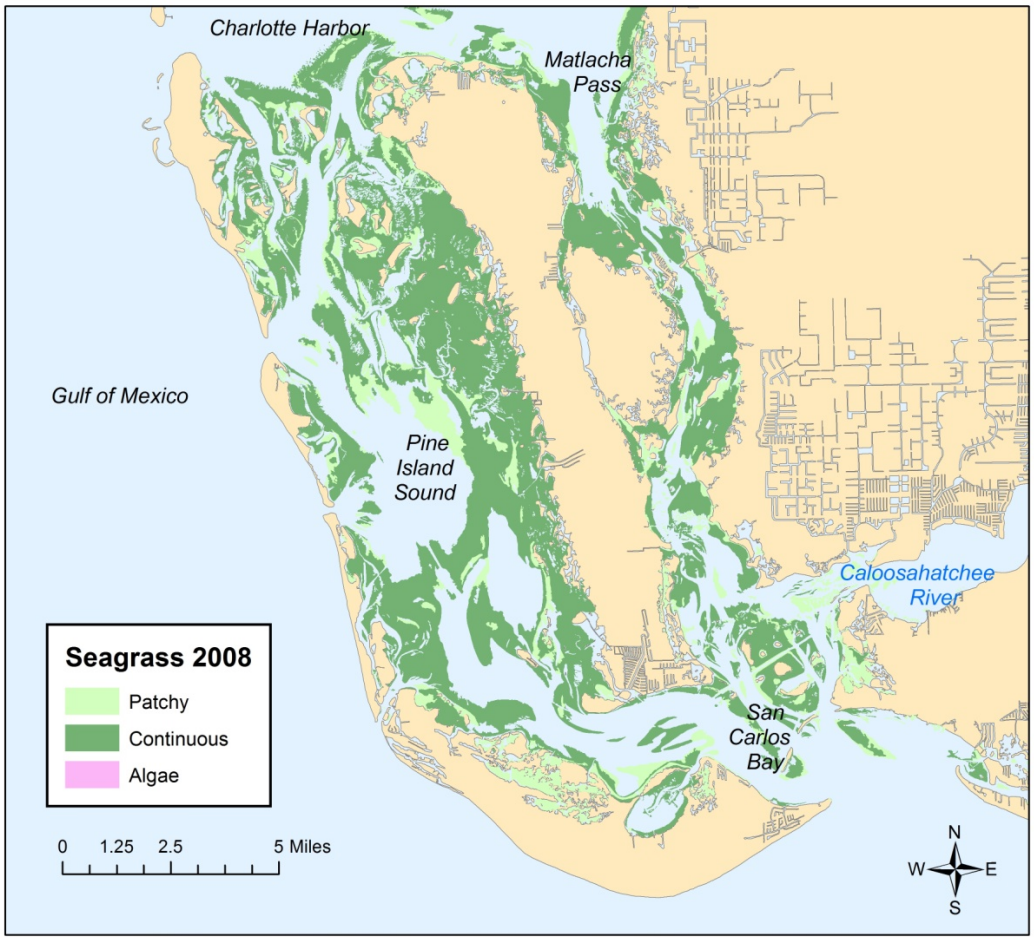

Figure 2 *Seagrass in southern Charlotte Harbor, 2008. Data and shapefiles from SFWMD.*

Mapping and Monitoring Recommendations

- Continue biennial aerial photography, photo-interpretation, and mapping by SWFWMD for Lemon Bay and northern Charlotte Harbor and by SFWMD for southern Charlotte Harbor to evaluate trends in seagrass acreage.

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,
- Continue annual fall monitoring by staff of the Charlotte Harbor Aquatic Preserves to evaluate changes in seagrass species composition and abundance, and water depth at the deep edge of seagrass beds.
- Update the map of propeller scarring in Charlotte Harbor (Madley, *et al.* 2004) to assess trends in scarring and recovery.

water quality results are compared with seagrass mapping and monitoring data every other year.
- Assess effects of development on storm runoff.
- 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 the Pole and Troll zone near Blind Pass, once they have been implemented.

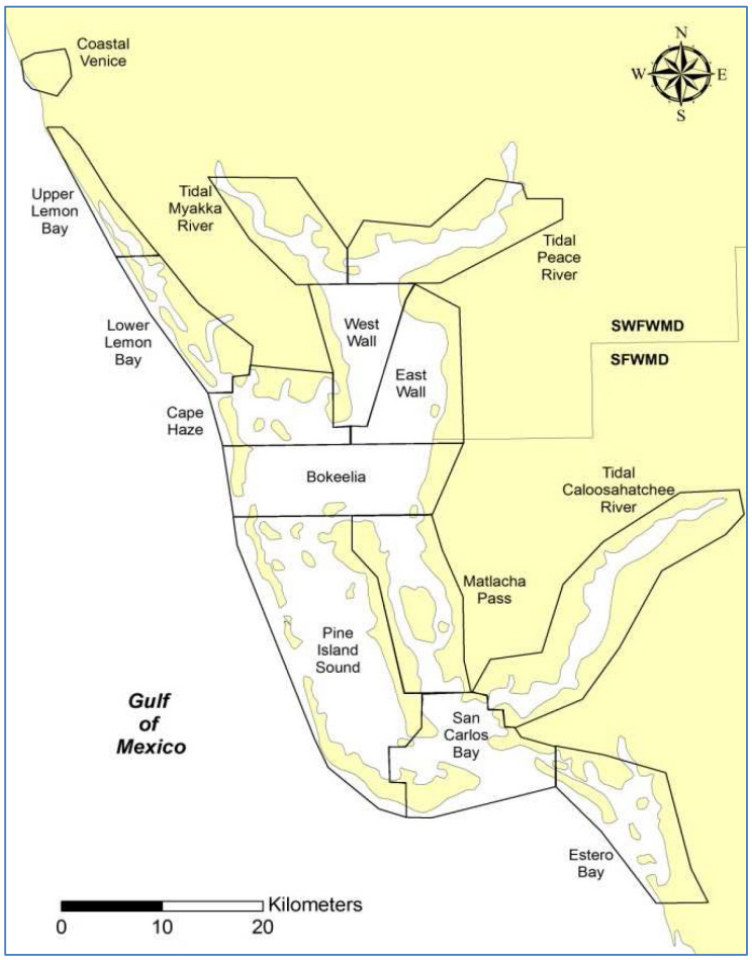

Figure 3 *Estuary segments used for seagrass water quality analyses.*

Summary assessment: Overall, seagrass acreage has declined from historical levels in the mid-20th century due to development and dredge-and-fill operations in coastal waters. In the last ten years, seagrass acreage has increased overall, despite short-term losses due to runoff from the hurricanes and tropical storms in 2004. From 2006 to 2008, seagrass acreage throughout the sub-estuaries of the Charlotte Harbor region decreased from 63,279 to 61,506 acres or -2.8%. Losses during this period occurred in sub-regions most affected by storm runoff from the 2004 tropical cyclones: the tidal portions of the Myakka and Peace rivers, the eastern portions of Charlotte Harbor, as well as in Pine Island Sound. Since 2008, seagrass

beds in all sub-regions have expanded, from 61,506 to 67,720 acres or 10%. Field monitoring studies indicate that seagrass meadow texture and species composition vary, especially among sub-estuaries. Since 2005, the abundance of shoalgrass (*Halodule wrightii*) and turtlegrass (*Thalassia testudinum*) has increased, while the abundance of manateegrass (*Syringodium filiforme*) has remained stable at about 10% (Table 2). The number of monitored quadrats that are devoid of seagrasses has decreased by 50% since 2005. Factors that affect water clarity, such as turbidity, color, and chlorophyll-a concentration, are a concern in some sub-estuaries 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 and Potential Stressors in the Charlotte Harbor Region

Status indicators	Status	Trend	Assessment, causes
Seagrass cover	Green	Increasing	Runoff, nutrients
Seagrass meadow texture	Yellow	Changing	Annual changes; 50% decrease in bare areas since 2005
Seagrass species composition	Green	Fairly Stable	Increase in 2 most common species since 2005
Overall seagrass trends	Green	Improving	Drought 2006–2010
Seagrass stressors	**Intensity**	**Impact**	**Explanation**
Water clarity	Yellow	Local declines	Affected by runoff and storms
Nutrients	Yellow	Increasing	
Phytoplankton	Yellow	Increasing	
Macroalgae, epiphytic growth	Yellow	Local declines	Under investigation
Freshwater runoff	Yellow	Local declines	Increased storminess
Natural events	Yellow	Moderate impact	2004–2005 hurricanes
Propeller scarring	Red	Increasing	Increased boating

Seagrass mapping assessment: The distribution of seagrass beds in the Charlotte Harbor region is shown in Figures 1 and 2. In northern Charlotte Harbor, mapping data are from photo-interpretation of imagery collected in 2014 (Figure 1). In southern Charlotte Harbor, mapping data are from 2008 (Figure 2); acreage data have been publicly released by the SFWMD, but the shapefiles for drawing maps are not yet available. From 2006 to 2008, seagrass acreage decreased by 1,773 acres, or 2.8%,

throughout the Charlotte Harbor region (Table 1), likely because of continuing impacts on water clarity from the 2004 tropical cyclones. Not all areas experienced seagrass loss during this time, however: the western part of Charlotte Harbor, Placida, Matlacha Pass, and San Carlos Bay increased seagrass acreage between 2006 and 2008. Since 2008, seagrass acreage has increased in all sub-regions, by 6,214 acres or 10%. The tidal portions of the Myakka and Peace rivers had the greatest percentage increase between 2008 and 2014, by 93 acres or 42%, and by 443 acres and 131%, respectively. The greatest increase in area (2,030 acres) over the same period occurred in Pine Island Sound. The lowest percentage increase in area occurred in Placida (1.6%, 239 acres) and in West Charlotte Harbor (2.9%, 65 acres). In 2014, about 37% of seagrass beds were patchy in the northern Charlotte Harbor region.

Table 1 Seagrass acreage in the Charlotte Harbor region. Data for Lemon Bay and the northern Charlotte Harbor sub-regions are from the SWFWMD (Photo Science Inc. and Kaufman, 2015), and data for the southern Charlotte Harbor subregion are from the SFWMD. n.d. = no data.

Subregion	2006	2008	2010	2012	2014	Change 2012–2014
A. Lemon Bay (SWFWMD)	2,714	2,863	3,039	3,106	3,272	166
B. Upper Charlotte Harbor (SWFWMD)						
Tidal Myakka River	340	277	256	254	370	116
Tidal Peace River	346	194	199	382	637	255
West Charlotte	1,975	2,023	2,006	2,030	2,088	58
East Charlotte N	3,358	2,672	3,194	3,489	3,638	149
East Charlotte S	1,461	1,166	1,246	1,372	1,428	56
Placida	3,877	4,473	4,546	4,640	4,712	72
Southern Charlotte	2,270	2,294	2,280	2,358	2,489	131
Turtle Bay, Bull Bay	4,739	4,274	4,380	4,385	4,533	148
Subtotal	**18,366**	**17,373**	**18,107**	**18,910**	**19,895**	**985**

Subregion	2006	2008	2010	2012	2014	Change 2008–2014
C. Lower Charlotte Harbor (SFWMD)						
Pine Island Sound	29,204	27,084	n.d.	n.d.	29,114	2,030
Matlacha Pass	7,619	7,704	n.d.	n.d.	8,272	568
San Carlos Bay	5,376	6,482	n.d.	n.d.	7,167	685
Subtotal	**42,199**	**41,270**	n.d.	n.d.	**44,553**	**3,283***
D. Charlotte Harbor region						
Total	**63,279**	**61,506**	n.d.	n.d.	**67,720**	**6,214***

*change between 2008 and 2014.

Monitoring assessment: Monitoring has occurred each fall since 1999 using 50 fixed transects. Evaluation of data from 1999 through 2015 suggests that overall, seagrass beds are increasing or stable in size and in species composition (Table 2). Six species of seagrass are found in the Charlotte Harbor region: turtlegrass, shoalgrass, and manateegrass are the most common, and widgeongrass (*Ruppia maritima*), paddlegrass (*Halophila decipiens*), and stargrass (*Halophila engelmannii*) are ephemeral. From 1999 through 2005, the abundance of shoalgrass, turtlegrass, and manateegrass 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. From 2005 through 2011, the frequency of the three most common species of seagrass increased somewhat, and the percentage of quadrats with no cover decreased, from 24% to 16%. Since 2011, the abundance of shoalgrass has decreased by about 10%, while abundances of turtlegrass and manateegrass have remained stable.

Table 2 Percentage occurrence of seagrass species in quadrats in the Charlotte Harbor Aquatic Preserves area, 1999–2015.

Year	Shoalgrass	Turtlegrass	Manateegrass	No seagrass
1999	48	33	10	10
2000	48	31	9	12
2001	41	33	10	16
2002	44	32	8	16
2003	41	30	9	20
2004	42	30	8	20
2005	41	26	8	24
2006	44	27	8	20
2007	47	27	9	16
2008	47	29	8	16
2009	51	28	9	12
2010	51	29	10	11
2011	50	30	9	12
2012	47	30	9	14
2013	45	30	9	16
2014	46	31	10	14
2015	46	30	11	12

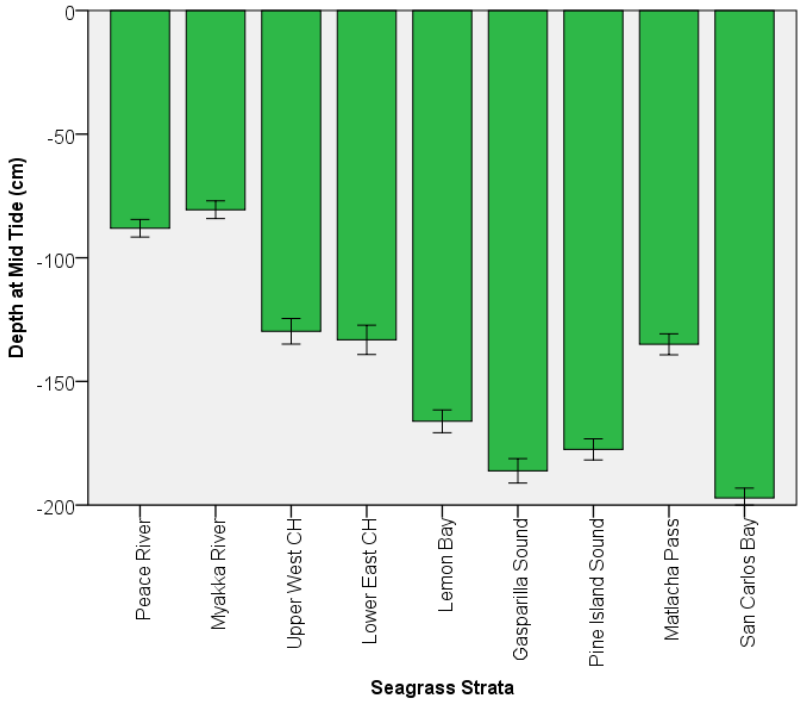

Figure 4 *Average depth of deepest seagrass growth, 1999–2013.*

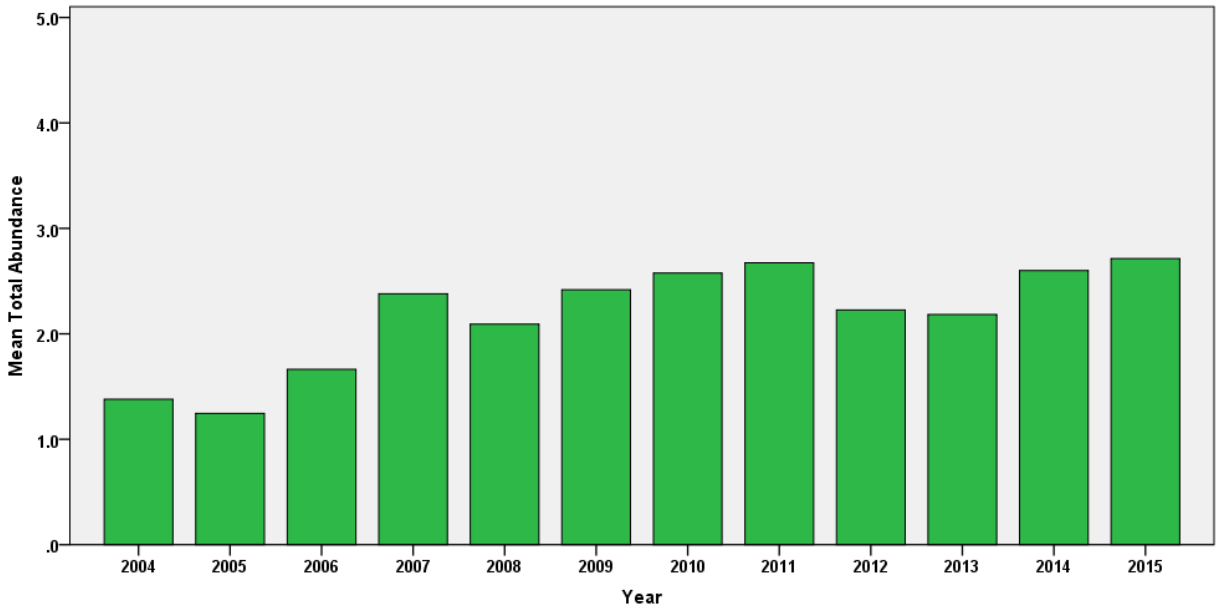

Figure 5 *Average Braun-Blanquet score as an estimate of mean total abundance of all seagrasses (including quadrats with no seagrass cover) in the Charlotte Harbor Aquatic Preserves, 2004–2015.*

The average water depth at the deep edge of seagrass beds varied by sub-estuary, based on FDEP transect monitoring data from 1999 through 2013, ranging from approximately 0.8 m in the Myakka River to 1.97 m in San Carlos Bay (Figure 4). Brown et al. (2013) found a significant increase in the maximum depth of seagrass beds from 1999 through 2009.

Mean total abundance of all seagrasses in the Charlotte Harbor region has increased steadily and stabilized since 2005, with the greatest abundances measured in 2011 (Figure 5). The variations in annual seagrass frequency and abundance in the CHAP can be attributed to the amount of freshwater and associated pollutants the estuary receives. 2004 and 2005 were characterized by higher than average rainfall and hurricane events that resulted in lower seagrass abundances and frequencies. Seagrass in San Carlos Bay is stressed by large freshwater flows stemming from the Caloosahatchee River (Brown *et al.*, 2013). 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 in the region.

Management and restoration assessment: Seagrass acreage targets for each sub-estuary 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 and persistence of seagrass locations, acreage was established for each estuary segment. An example is shown in Figure 6 for Pine Island Sound. Two sub-regions, Pine Island Sound and San Carlos Bay, have had seagrass acreage greater than the target acreages since 2006. All other sub-regions remain below target acreages.

Table 3 Seagrass protection and restoration targets for the Charlotte Harbor region.

Estuarine Segment	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**

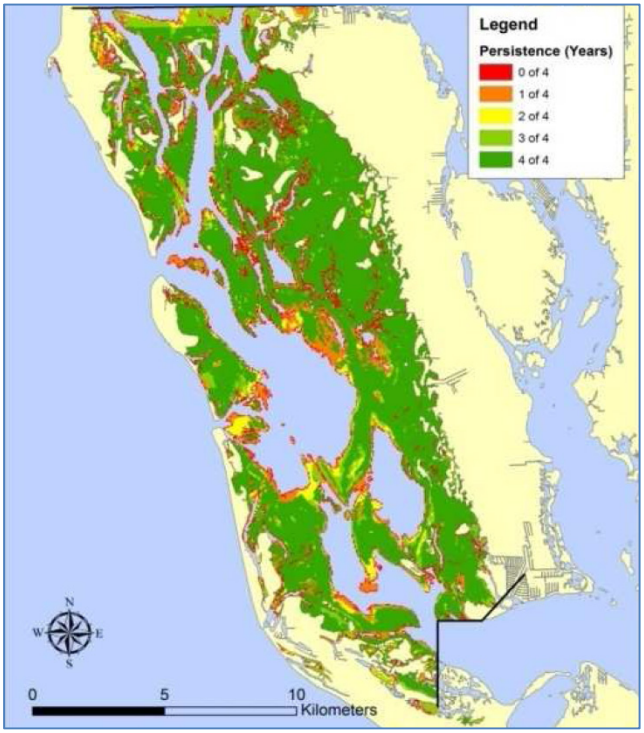

Figure 6 Persistence of seagrass locations in Pine Island Sound, 1999–2006.

Mapping and Monitoring Recommendations

- Continue biennial mapping and annual monitoring programs.
- Assess macroalgae distribution, abundance, and effects on seagrasses.
- Update the 2003 propeller scarring maps of Charlotte Harbor produced by Madley *et al.* (2004) to assess trends in scarring and 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 Pole and Troll Zone near Blind Pass and the No Internal Combustion Motor Zones in Pine Island Sound and Matlacha Pass, once they are implemented.

Mapping methods, data, and imagery: SWFWMD is responsible for mapping seagrasses in the northern portions of the Charlotte Harbor Aquatic Preserves, and aerial photography is obtained every two years. In 2014, seagrass imagery was photo-interpreted from 1:24,000–scale natural–color aerial photography and classified using the SWFWMD modified Florida Land Use Cover and Forms Classifications

System (FLUCCS; Florida Department of Transportation, 1999). The minimum mapping unit for classification was 0.5 acre. Lower Charlotte Harbor, Pine Island Sound, Matlacha Pass, and the Caloosahatchee Estuary are mapped by the SFWMD. For these sub-regions, seagrass data were photo-interpreted from 2014 1:24,000–scale natural–color aerial photographs and classified using the SFWMD modified FLUCCS. The minimum mapping unit for classification was 0.5 acre. Summary information on seagrass acreage in 2014 in the southern region are publicly available, but the shapefiles for creating maps have not yet been released.

Monitoring methods and 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 x 1 m quadrats using the Braun-Blanquet method (1: <5%, 2: 6–25%, 3; 26–50%, 4: 51–85%, 5: 76–100%). Shoot counts, blade lengths, and epiphyte loading on seagrass blades, depth at mean water, and sediment type 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/CHAP_Seagrass_Report_1999-2009.pdf. Accessed May 2016.

Seven areas in the Caloosahatchee River estuary are monitored 4 or 8 times a year depending on location. Two sites are located upstream in the Ft. Myers area, two sites are downstream in the Iona Cove area and two sites are in San Carlos Bay. The location of one site changes with each sampling period and is located in the area upstream of Ft. Myers. A 1–2 acre polygon has been established at each of the six permanent sampling locations. Thirty random points are generated within each polygon using ArcMap for each sampling event. Total abundance, species abundance, and canopy height of seagrass are assessed at each point using a 1-m^2 quadrat that is subdivided into 25 20 cm x 20 cm quadrants (cells). In addition, 20 randomly–chosen points are monitored four times a year between Bird Island and the railroad trestle in the Caloosahatchee River using a 3–square meter quadrat. Cover of submerged aquatic vegetation (SAV) is evaluated in nine 1–square meter sub–quadrats, and cover is recorded as sparse (<5%) moderate (>5%-75%) or dense (>75%).

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