Summary Report for Estero Bay

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Seagrass Integrated Mapping and Monitoring Program

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General assessment: In 2014, there were 3,683 acres of seagrass in Estero Bay, an increase of 93 acres (2.6%) since the previous mapping effort in 2008. Long-term species composition is generally stable, with turtlegrass (*Thalassia testudinum*) and shoalgrass (*Halodule wrightii*) dominant, with expected seasonal fluctuations. Occurrence of manateegrass (*Syringodium filiforme*), paddlegrass (*Halophila decipiens*), and stargrass (*H. engelmannii*) varies from year to year. Widgeongrass (*Ruppia maritima*) has been observed in the central portion of the bay near New Pass (Schmid, 2009). Overall, seagrass abundance along five fixed transects appears to be declining (2006–2013). In addition, from 2012 through 2014, measurements of the density of seagrass shoots indicate increases in shoalgrass but declines in turtlegrass. Seasonal increases in the abundance of macroalgae decrease light availability to seagrasses and can diminish seagrass productivity. Seagrass-based water quality targets have been developed for Estero Bay, based on seagrass light requirements, bed depth at the deep edge, and historical acreage. Development, including new dredging projects as well as maintenance of utilities on existing easements, increases nutrients and turbidity in coastal waters, threatening seagrass beds. Propeller scarring also continues to impact seagrasses in the bay.

General Status of Seagrasses in Estero Bay

Status and stressors	Status	Trend	Assessment, causes
Seagrass cover	Green	Slight increase	
Water clarity	Yellow	Impacted	Runoff, turbidity
Natural events	Green	Minimal Impact	2004, 2005 hurricanes; 2014 rainfall events
Propeller scarring	Red	Significant	Baywide

Geographic extent: Estero Bay, entirely in Lee County, extends from south of Matanzas Pass to Bonita Springs. There are extensive seagrass beds in the central region of the bay, particularly along the eastern shoreline (Figure 1). Estero Bay is managed by the Estero Bay Aquatic Preserve (EBAP), is part of the Charlotte Harbor National Estuary Program (CHNEP), and is in the South Florida Water Management District (SFWMD).

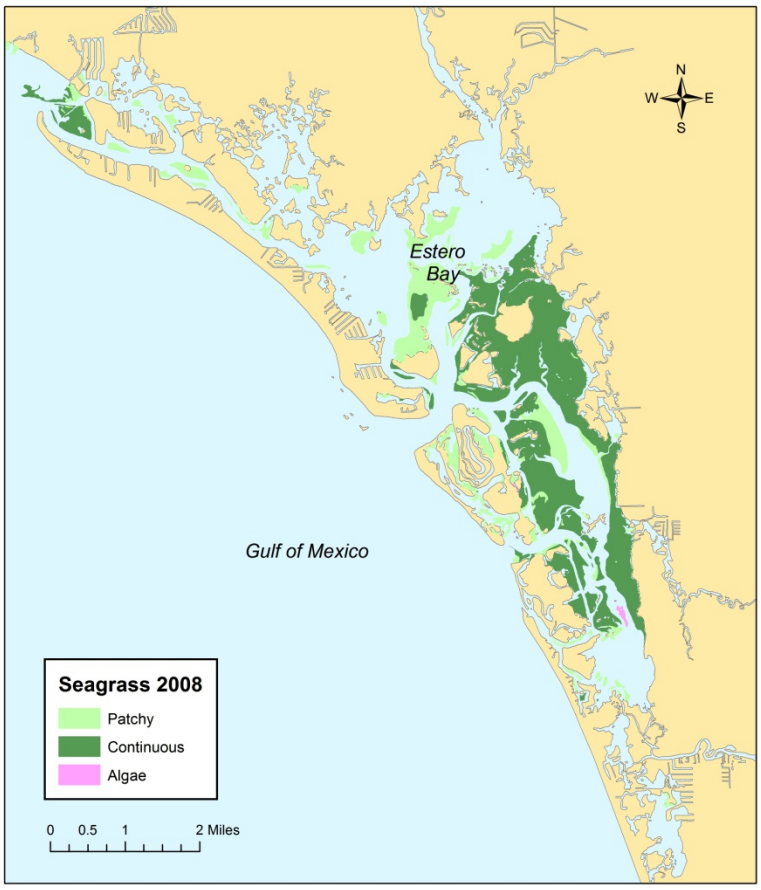

Figure 1 *Seagrass cover in Estero Bay, 2008.*

Mapping and Monitoring Recommendations

- Continue biannual seagrass monitoring by EBAP staff.
- Integrate mapping data from aerial photography acquired in 2014 into trend analysis and management plans.
- Implement strategies outlined in the 2015 EBAP Seagrass Protection and Restoration Plan.

Management and Restoration Recommendations

- Continue to evaluate water quality and light attenuation of Estero Bay waters. Estero Bay is managed as one of several regions in the CHNEP (Figure 2). Under the regional management plan, water quality and light attenuation of bay waters are evaluated annually using available region-specific models and tools. These data are compared biennially to seagrass maps and monitoring data.
- Implement the newly created Seagrass Protection and Restoration Plan for Estero Bay.
- Increase efforts to prevent negative impacts to water quality and seagrass habitat in Estero Bay.

Table 1 Acreage of seagrasses in Estero Bay. Green highlight indicates acreage is above seagrass target for the bay. 2014 data from Photo Science Inc. and Kaufman (2015).

					Change 2008–2014	
Target	2004	2006	2008	2014	Acres	%
3,662	3,625	3,529	3,590	3,683	93	2.6%

Summary assessment: Seagrass acreage increased 93 acres, to 3,683 acres from 2008 through 2014 and was greater than the acreage target set at 3,662 acres for the first time since mapping began (Table 1). But this change is small and likely within the error of the mapping methodology, suggesting that seagrass acreage was more likely stable during this six-year period. The losses observed from 2004 through 2006 (96 acres) may reflect short-term impacts of the 2004 and 2005 storm seasons. Monitoring data indicate that seagrass species composition is stable over the long term and that shoalgrass and turtlegrass are the most common seagrasses in the bay. Occurrence of stargrass, paddlegrass, and manateegrass are variable. Propeller scarring remains a significant concern throughout the Bay (Figure 3). Pollution and nutrient inputs from runoff as well as increased freshwater inputs reduce water quality, potentially affecting seagrasses' ability to survive. Development projects, including new and maintenance dredging and maintenance of utility structures, threaten seagrass habitats through both physical damage and diminished water quality.

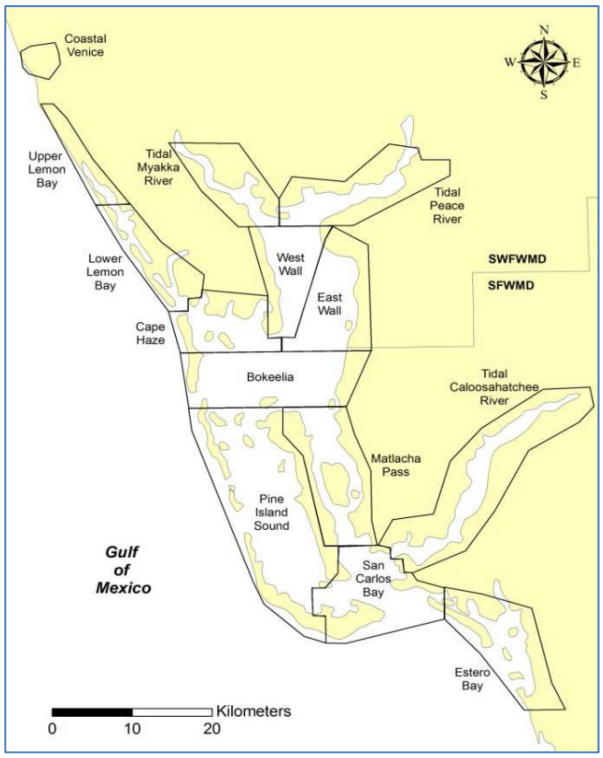

Figure 2 Estuary segments used for seagrass and water quality analyses.

Seagrass mapping assessment: Seagrass acreage in Estero Bay increased 93 acres, or 2.6%, from 2008 through 2014 (Table 1). In 2008, continuous seagrass beds totaled 68% of mapped seagrasses, and patchy seagrass beds accounted for the remaining area. In addition, photo–interpretation found nearly 12 acres of attached–algae beds in the bay (Figure 1).

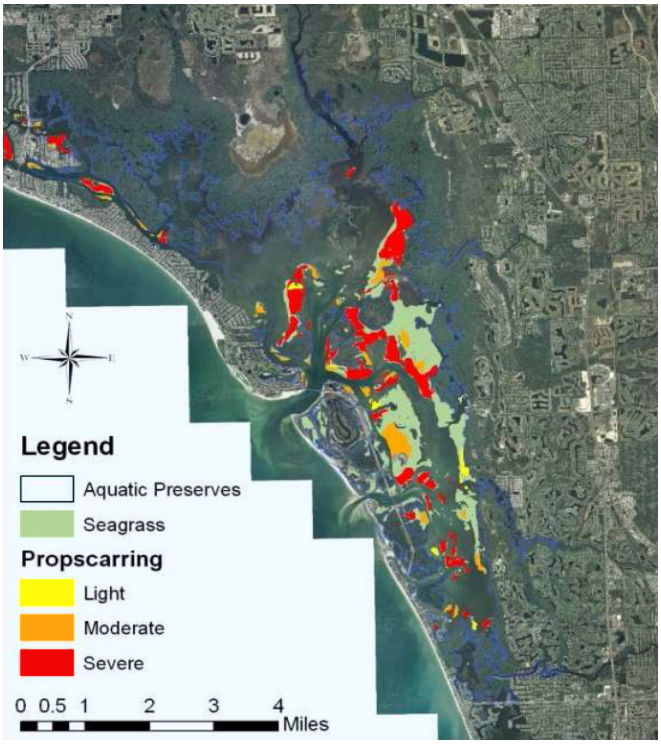

Figure 3 *Seagrass beds affected by propeller scarring in Estero Bay.*

Seagrass Status and Potential Stressors in Estero Bay			
Status indicators	**Status**	**Trend**	**Assessment, causes**
Seagrass cover	Green	Slight increase	No significant changes
Seagrass meadow texture	Green	Fairly stable	No significant changes
Seagrass species composition	Green	Fairly stable	Shoalgrass, turtlegrass
Overall seagrass trends	Yellow	Declining	Water clarity, macroalgae
Seagrass stressors	**Intensity**	**Impact**	**Explanation**
Water clarity	Yellow	Impacted	Turbidity, runoff
Nutrients	Yellow	Impacted	Affected by runoff, storms
Phytoplankton	Green	Local impacts	Affected by runoff, storms
Natural events	Green	Minimal impacts	Tropical cyclones
Propeller scarring	Red	Significant	Baywide

Monitoring assessment: The Florida Department of Environmental Protection EBAP has monitored seagrasses at 5 fixed transects twice a year since 2002. Since 2006, species composition (Figure 5) and abundance have varied by season and year, with abundance greater in summer (Figure 4). Over the past eight years, total seagrass abundance within seagrass beds, measured during the summer monitoring period,

declined slightly. The average depth at the deep edge of each bed also varied by year, ranging from about 120 cm in 2003 to 112 cm in 2012. From 2009 through 2014, the length of each transect fluctuated, but the average length remained relatively consistent (Figure 6). From winter 2012 through winter 2014, shoot densities of turtlegrass declined about 50%, but densities of shoalgrass increased 23.5% (Figure 7). Turbidity due to resuspension of bottom sediments in this very shallow system continues to affect water clarity, as do seasonal increases in macroalgae.

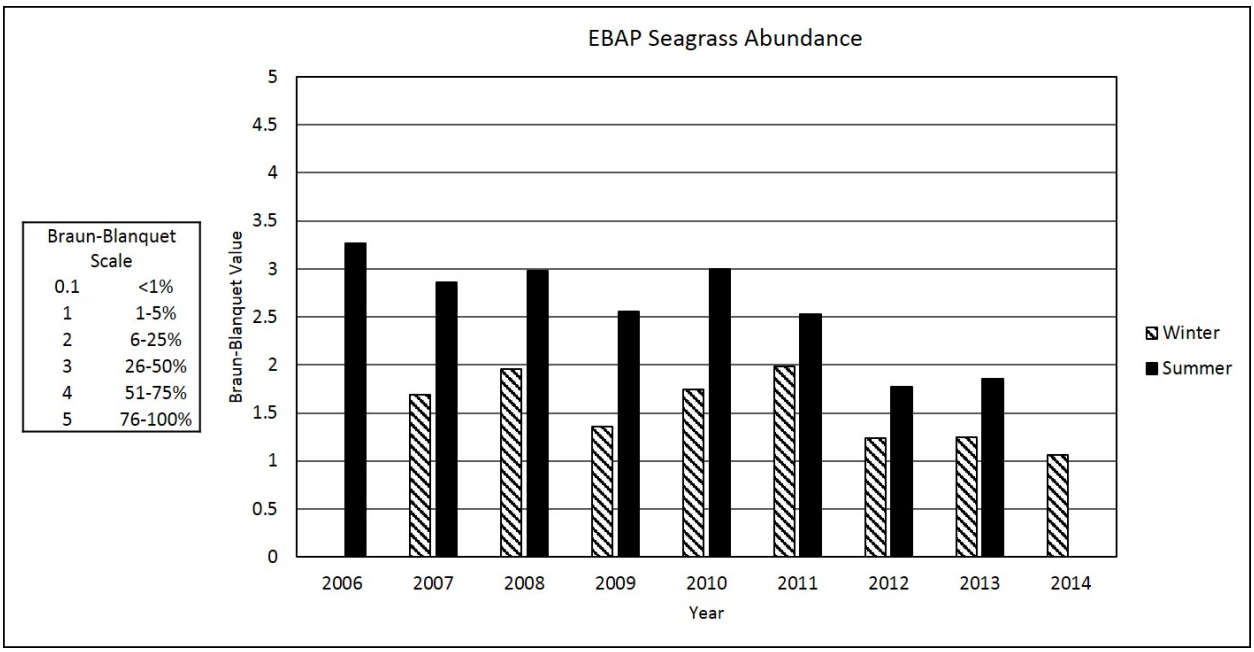

Figure 4 *Seagrass abundance in EBAP, measured on fixed transects and based on Braun-Blanquet scores, 2006–2014.*

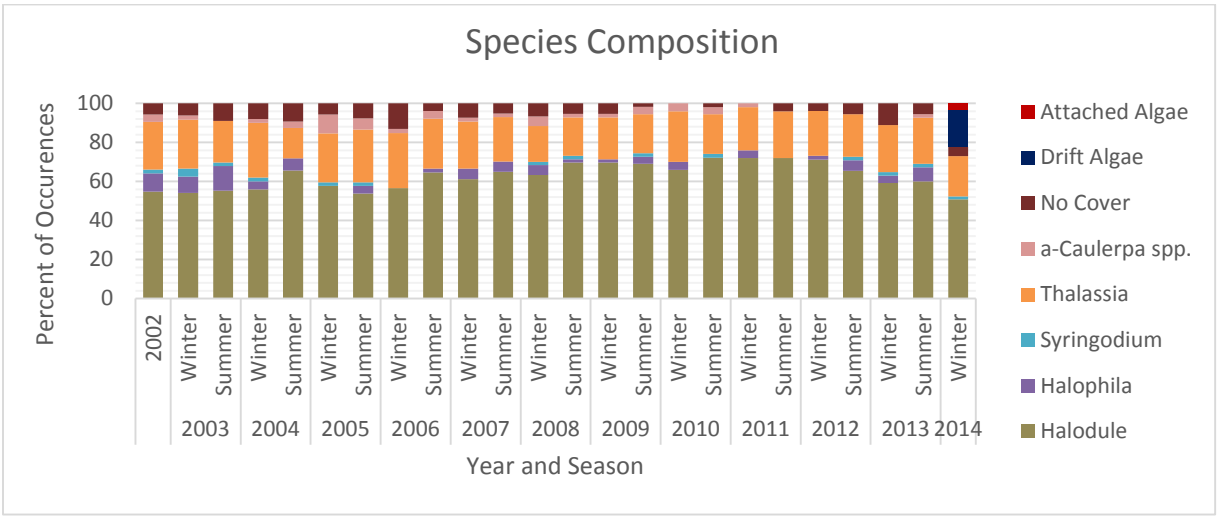

Figure 5 *Average species composition along fixed transects in EBAP, shown by cumulative percent occurrence of each species or category. Presence means that a seagrass species or type of cover (including no cover) occurred in a quadrat along one of the fixed transects. The percent occurrence is the percentage of all quadrats in which a species or category was observed.*

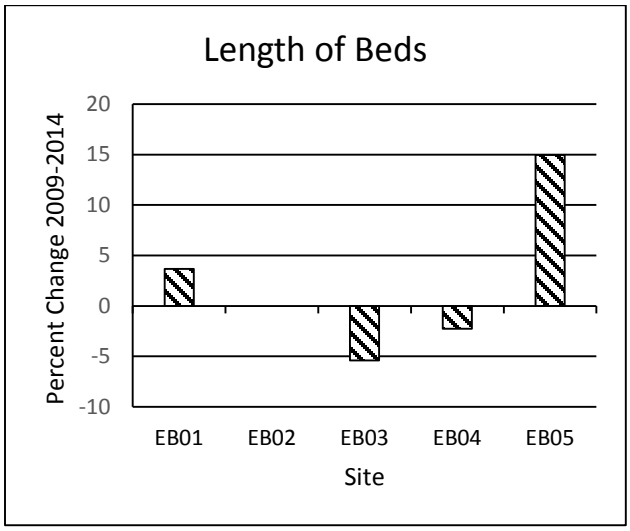

Figure 6 *Change in the length of seagrass beds as measured by change in the length of monitoring transects between 2009 and 2014. The length of transect EB02 did not change.*

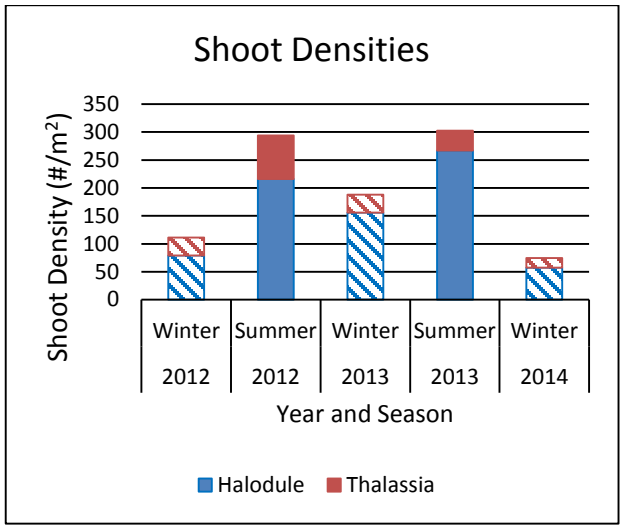

Figure 7 *Average shoot densities of shoalgrass and turtlegrass in Estero Bay, 2012–2014.*

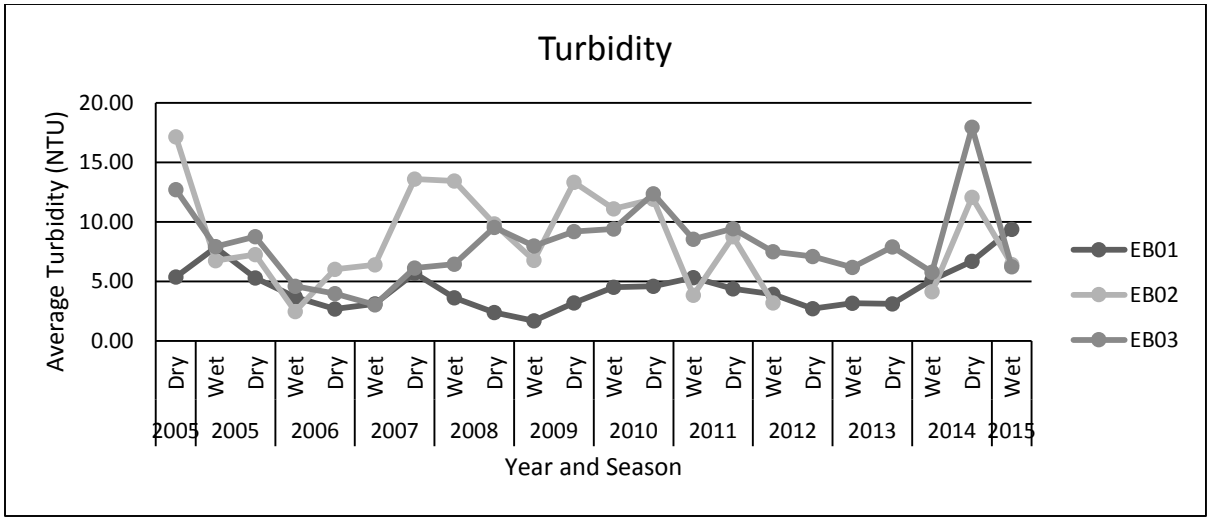

Figure 8 *Average turbidity from each datasonde during each season (2005–2015) shows that it is highly variable.*

Water quality and clarity: Since 2004, EBAP has continuously monitored water quality using datasondes (automated water quality sensors) located at three sites in Estero Bay. An example of these data is turbidity values (Figure 8). Turbidity readings were averaged by wet and dry season in each year; means fluctuated by datasonde and over time.

Management and restoration assessment: Propeller scarring is a significant problem in Estero Bay (Figure 3). No internal combustion motor zones (Figure 9) were established by permit (#62-341.494 Noticed

General Permit for Public Navigation Channel and Canal Infrastructure, the West Coast Inland Navigation District, Lee County). A restoration target of 3,660 acres for Estero Bay has been established by the CHNEP using the maximum historical extent of seagrass beds and inter–annual variability of seagrass cover. The seagrass target acreage was then used to establish water quality targets for the bay (Charlotte Harbor National Estuary Program, 2009a, b). From aerial photography, persistence of seagrass locations and acreage was determined for each estuary segment (Figure 10).

Mapping and Monitoring Recommendations

- Continue monitoring by staff of the EBAP and mapping by SFWMD.
- Schedule the frequency of acquiring, interpreting, and mapping aerial photography to occur at least every 3-4 years to evaluate trends in seagrass acreage.
- Update the map of propeller scarring in Estero Bay (Madley *et al.*, 2004) to assess trends in scarring and recovery.
- Augment summer monitoring sites to increase representativeness and comparability of data from this region.

Management and Restoration Recommendations

- Evaluate progress toward seagrass and water quality targets annually.
- Estimate potential increases in nutrient concentrations in bay waters resulting from development and determine the local sources of nutrients. Evaluate other factors such as turbidity that contribute to decreased water clarity.
- Increase efforts to minimize urban runoff and resulting turbidity in bay waters.
- Collaborate with managers to minimize the impacts of development and navigation maintenance projects to prevent damage to bay resources and to reduce increases in turbidity.
- Establish a framework for detecting the effects of climate change and ocean acidification on coastal marine resources in the region.
- Conduct seagrass restoration in areas with propeller scarring, and eliminate or minimize new scarring.
- Implement no–internal–combustion–motor–zones (Rule 62-341.494, Florida Administrative Code).
- Post EBAP boundaries with signage citing Section 253.04(3)(a), Florida Statute.

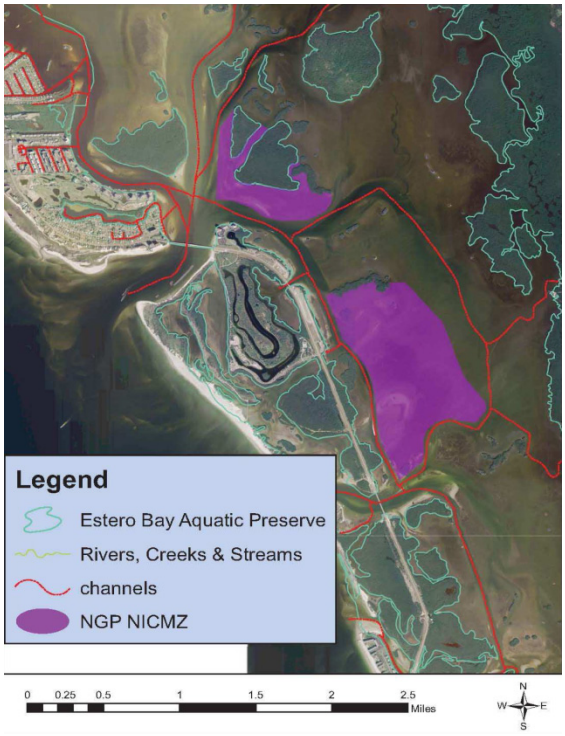

Figure 9 *Location of no-internal-combustion-motor-zones in Estero Bay, 1999–2006.*

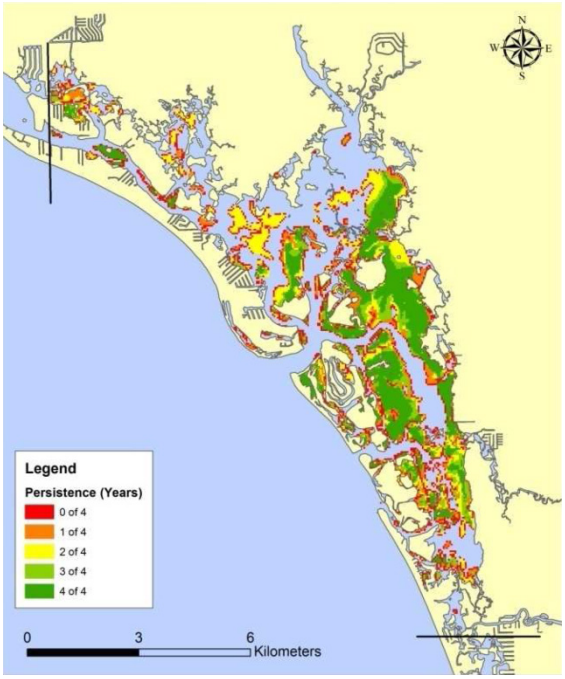

Figure 10 *Persistence of seagrass locations in Estero Bay, 1999–2006.*

Mapping methods, data, and imagery: Seagrass mapping data were acquired from photo–interpretation of 1:24,000 scale-natural color photography taken in 2008 and then classified using the SFWMD-modified Florida Land Use Cover and Forms Classification System (Florida Department of Transportation, 1999). Features were stereoscopically interpreted from the aero-triangulated aerial photography, and vector data were compiled using digital stereoplotters. The minimum mapping unit for classification was 0.5 acre. Imagery was acquired in the winter of 2014, and photo–interpretation is underway; release of mapping data is expected in 2016.

Monitoring methods and data: Seagrass beds are monitored twice a year (during the summer growing season and the winter dormant season) by EBAP in coordination with the Charlotte Harbor Aquatic Preserves (CHAP) monitoring program. Staff collect data on species composition, species abundance, total seagrass abundance (Braun-Blanquet cover-abundance method), blade length, shoot counts, and epiphyte loading from five fixed transects located in seagrass beds. Shoot count procedures were changed in 2012 to match regional standards; therefore we present data from 2012 in Figure 7. Species composition and abundance of macroalgae are also assessed. During surveys, sediment type, water depth, dissolved oxygen (DO) concentration, Secchi depth, salinity, and water temperature are recorded. These data are

used to determine trends in the health of seagrass habitat. Data summaries and reports are available through the CHAP website (http://www.dep.state.fl.us/coastal/sites/charlotte/research/seagrass.htm, accessed May 2016).

Water quality data are collected by two programs: the Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network (CHEVWQMN) and the Continuous Water Quality programs. Water quality is monitored at seven sites in Estero Bay at sunrise once a month by volunteers as part of CHEVWQMN. Data collection is supervised by CHAP personnel. Since 2004, EBAP has conducted continuous water quality monitoring using datasondes located at three sites in Estero Bay. Sondes collect data on seven water quality parameters (temperature, specific conductivity, salinity, dissolved oxygen, depth, pH, and turbidity) every 15 minutes. The data were evaluated and verified and any "rejected" or "suspect" data are not presented in Figure 8.

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Contacts

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Mapping: 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@swfpc.org.

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