Summary Report for the Ten Thousand Islands

Contacts:

Paul R. Carlson Jr., Florida Fish and Wildlife Conservation Commission

Kevin Cunniff, Rookery Bay National Estuarine Research Reserve

Seagrass Integrated Mapping and Monitoring Program

Mapping and Monitoring Report No. 2.0

FWRI Technical Report TR-17 version 2

2016

Edited by Laura A. Yarbro and Paul R. Carlson, Jr.

Florida Fish and Wildlife Conservation Commission

Fish and Wildlife Research Institute

100 Eighth Avenue Southeast

St. Petersburg, Florida 33701 USA

Summary Report for the Ten Thousand Islands

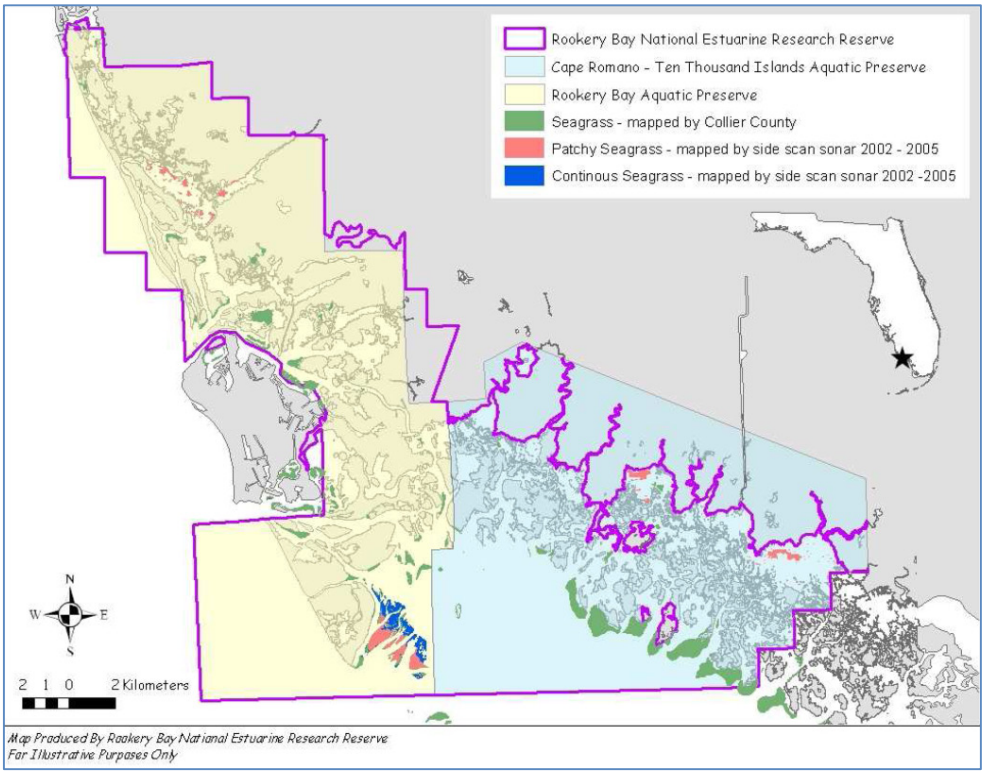
Contacts: Paul R. Carlson, Florida Fish and Wildlife Conservation Commission (mapping); Kevin Cunniff, Rookery Bay National Estuarine Research Reserve (monitoring and mapping)

General assessment: With the exception of beds in the Cape Romano area, seagrasses in the Ten Thousand Islands region of southwest Florida are difficult to assess. Overlying waters remain turbid and darkly colored most of the year, preventing remote sensing of seagrasses, and the remoteness of the region has slowed field monitoring efforts. However, sidescan sonar in 2002–2005 and aerial photography in late 2014 produced imagery for seagrass mapping of most of the region. Mapping data from the 2014 imagery showed that 1,499 acres of seagrass and about 3,350 acres of mostly macroalgae were found between Brush Key and Turtle Key in Gullivan Bay. A field monitoring program is needed. Seagrasses are generally very sparse but include turtlegrass (*Thalassia testudinum*), shoalgrass (*Halodule wrightii*), and stargrass (*Halophila engelmannii*).

General Status of Seagrasses in the Ten Thousand Islands

Status and stressors	Status	Trend	Assessment, causes
Seagrass cover	Orange	Very sparse, declining	Runoff, turbidity
Water clarity	Red	Poor	Runoff, turbidity
Natural events	Orange	Moderate	2004, 2005 hurricanes
Propeller scarring	Yellow	Localized	Cape Romano

Geographic extent: The Ten Thousand Islands is a shallow coastal region off Collier and Monroe counties, on Florida's far southwest coast. The region gets its name from the many islands and mangrove marshes that extend from the mainland. Coastal waters receive drainage from the Big Cypress and Everglades areas via the Turner and Chatham rivers, as well as the Fakha-Union canal. Construction of the Fakha–Union canal in the late 1960's increased the freshwater flow into Fakha–Union Bay but decreased flow to nearby coastal waters; in addition, flow extremes, both high and low, are now more pronounced. The region is divided into the Cape Romano–Ten Thousand Islands Aquatic Preserve and the Rookery Bay Aquatic Preserve (Figure 1). In addition, the northern part of the Ten Thousand Islands is located in the Rookery Bay National Estuarine Research Reserve (NERR), and the southern part is in Everglades National Park.



Islands Aquatic Preserve, and Rookery Bay Aquatic Preserve, along with seagrass mapped by Col. County, 2002–2005.

Mapping and Monitoring Recommendations

- Continue efforts to map seagrasses because of concerns about continuing losses. Seagrasses of the nearshore Cape Romano region were mapped by sidescan sonar in 2003–2005. Seagrasses in Gullivan Bay were mapped from aerial photography acquired in December 2014.
- Evaluate alternative mapping techniques, such as underwater videography.
- Continue developing projects for evaluating seagrass cover, optical water quality conditions, and forage available for manatees. This work has been undertaken by several investigators (Daniel Slone, U.S. Geological Survey; Jud Kenworthy, National Oceanographic and Atmospheric Administration, now retired; Margaret O. Hall and Paul Carlson, Florida Fish and Wildlife Research Institute).
- Implement a monitoring program for seagrass beds that uses a spatially distributed, random sampling design (Figure 3).

Figure 2 Turbidity in the Ten Thousand Islands following Hurricane Wilma in 2005 (Ikonos satellite imagery).

Management and Restoration Recommendations

- Investigate causes of continuing turbid conditions.
- Assess water quality impacts on seagrasses from water entering the region from canals.
- Establish a framework for detecting effects of climate change and ocean acidification on coastal marine resources in the region.

Summary assessment: Seagrass maps produced by sidescan sonar in 2003–2005 show 680 acres of seagrass near Cape Romano, and half of this area was continuous beds (Shirley *et al.*, 2006). Maps created from aerial photography in 2014 show 1,499 acres of seagrass between Brush Key and Turtle Key in Gullivan Bay (Stadler, 2015). A change analysis on a subset of the area using imagery collected in 1962 and 2014 showed a 53% decline in seagrass cover. The region is known for its turbid waters which likely restrict seagrass growth because of light limitation. Poor water clarity, especially after storm events (see Figure 2), limits the opportunity for imagery acquisition for mapping purposes.

Monitoring assessments of nearshore Cape Romano seagrasses by staff of the Rookery Bay NERR from 1998 to 2005 showed that seagrass beds were declining and had been scarred by propellers. Turtlegrass, shoalgrass, and stargrass were dominant species. A preliminary monitoring effort in October 2010 by Fish and Wildlife Research Institute (FWRI) personnel showed that seagrasses were very sparse. Species included turtlegrass, manateegrass (*Syringodium filiforme*), and stargrass. A monitoring program is needed to evaluate seagrass cover, species composition, and optical water quality.

Seagrass Status and Potential Stressors in Ten Thousand Islands			
Status indicators	**Status**	**Trend**	**Assessment, causes**
Seagrass cover	Yellow	Very sparse	Runoff, turbidity
Seagrass meadow texture	Green	Fairly stable	
Seagrass species composition	Green	Fairly stable	Turtle, manatee, shoal, star grasses
Overall seagrass trends	Orange	Declining	Water clarity
Seagrass stressors	**Intensity**	**Impact**	**Explanation**
Water clarity	Red	Poor	Runoff, turbidity
Nutrients	Yellow	Impacted	Canals, runoff, storms
Phytoplankton	Yellow	Impacted	Canals, runoff, storms
Natural events	Orange	Moderate	2004, 2005 hurricanes
Propeller scarring	Yellow	Localized	Cape Romano

Seagrass mapping assessment: Sidescan sonar measured 680 acres of seagrass in the nearshore Cape Romano area in 2003–2005. High-resolution aerial photography was acquired in December 2014 between Brush Key and Turtle Key in Gullivan Bay, and mapping found about 3,350 acres of submerged aquatic vegetation, consisting of macroalgae, both drifting and attached, with limited signatures of seagrass (Stadler, 2015). Seagrasses covered 1,499 acres, and most (1,372 acres, 91%) were discontinuous or patchy.

Monitoring assessment: Monitoring data from 1998 through 2005 indicated that seagrass beds near Cape Romano were in decline and had been scarred by propellers. Turtlegrass, shoalgrass, and stargrass were common species near Cape Romano. In general, traditional field monitoring techniques of assessing seagrass cover in quadrats do not work well because seagrass shoots are very small and sparsely distributed and waters are usually turbid and often darkly colored, limiting visibility. A preliminary field effort in October 2010 provided limited information on seagrass cover, optical water quality, and the seagrass species present. Turtlegrass, manateegrass, shoalgrass, and stargrass were observed, but were very sparsely distributed. Water column turbidity was high, but dissolved color (similar to colored dissolved organic matter or CDOM) and chlorophyll-a values were low. Slone et al. (2013) used telemetry records from radio-tagged manatees from 2002 through 2005 to identify high density manatee use areas, where, presumably, the animals were grazing on seagrasses. These locations were visited in 2008 and 2009, and an in-water camera was used to record the presence of seagrass and macroalgae on the bottom. In

general, Slone et al. found that high–density manatee–use areas were located on the western side of islands and at depths <2 m. Five species of seagrasses were observed: turtlegrass, shoalgrass, manateegrass, stargrass and paddlegrass (*Halophila decipiens*).

Water quality and clarity: Nutrient water quality was monitored in the Ten Thousand Islands by Florida International University until 2008. Data analysis by Joffre Castro of the National Park Service (Proposed Numeric Nutrient Criteria for South Florida Estuaries and Coastal Waters, 2012) showed that total phosphorus (TP), total nitrogen (TN), and chlorophyll-a concentrations in all segments of the Ten Thousands were much greater than values found in waters of Florida Bay and the Florida Keys. TP and TN concentrations averaged 2.2 and 43.1 μM, respectively, and mean chlorophyll-a concentration was 3.4 μg/l. Continuation of water quality monitoring of nutrients and optical parameters (turbidity, color, chlorophyll-a) with more frequent sampling is needed to evaluate the effects of changing hydrology associated with Everglades restoration on coastal water quality.

Mapping methods, data, and imagery: Sidescan sonar data were collected and interpreted by Stan Locker of the University of South Florida College of Marine Science during 2002 through 2005 to produce seagrass maps for the nearshore Cape Romano area. Aerial photography was acquired on December 10, 2014, by Aerial Cartographics of America (Miami, FL), under contract by Florida Gulf Coast University. PhotoScience (now Quantum Spatial, St. Petersburg, FL) interpreted the imagery. Bottom features were assigned to one of six categories: oysters, hard bottom, tunicates, submerged aquatic vegetation, and continuous and patchy seagrass, using the South Florida Water Management District modified Florida Land Use Cover and Forms Classification System (Florida Department of Transportation, 1999). During photo-interpretation, 215 sites were visited to characterize the benthic habitat (Stadler, 2015).

Monitoring methods and data: Seagrasses near Cape Romano were monitored annually or quarterly from 1998 to 2005 by personnel of the Rookery Bay NERR using a fixed-transect, modified Braun-Blanquet methodology. In the fall of 2010, Paul Carlson (FWRI) conducted reconnaissance sampling for development of a seagrass monitoring program in the Ten Thousand Islands. We hope that, through collaboration with Everglades National Park and Rookery Bay NERR, a monitoring program will be established, and that the initial project will sample 1-km² grid cells extending from Cape Romano to the Everglades City/Chokoloskee area (see Figure 3). At a randomly chosen sampling point within each grid cell, seagrass and macroalgal cover and abundance will be measured in eight quadrats. Optical water quality parameters (turbidity, color, chlorophyll-a concentrations, and light extinction coefficients) will be measured at a subset of 30 sites chosen to achieve representative coverage.

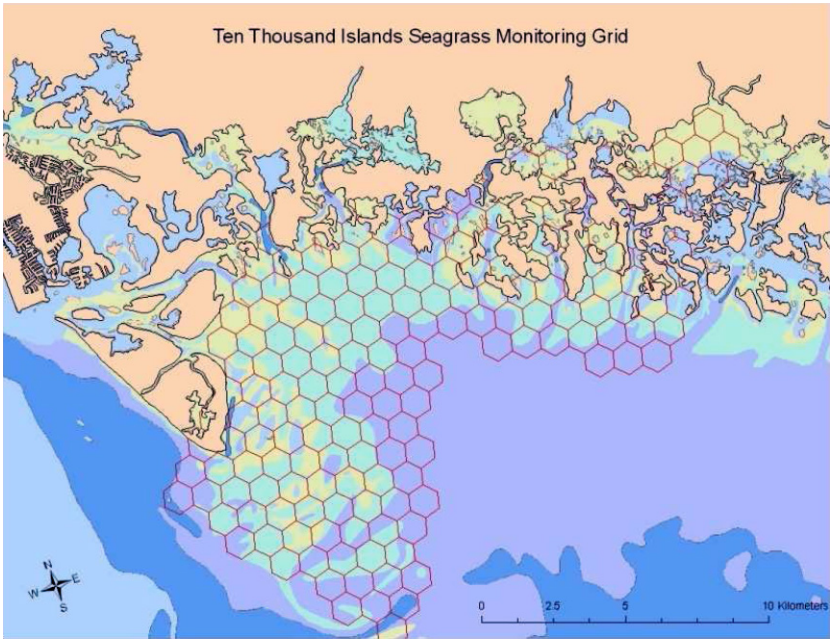


Figure 3 *Suggested seagrass monitoring grid for the Ten Thousand Islands.*

Pertinent Reports and Scientific Publications

BOYER, J. N. 2006. Shifting N and P limitation along a north-south gradient of mangrove estuaries in South Florida. Hydrobiologia 569: 167–177.

BOYER, J. N. and many authors. 2012. Integrated conceptual ecosystem model development for the Southwest Florida Shelf coastal marine ecosystem. NOAA Technical Report, OAR AOML and NOS NCCOS, Miami, 54 p. http://ourfloridareefs.org/wp-content/uploads/2013/06/habitat3-MARES_ICEM_SWFS_main_body_draft.pdf. Accessed April 2016.

FLORIDA DEPARTMENT OF TRANSPORTATION. 1999. Florida Land Use, Cover and Forms Classification System, a Handbook, Division of Surveying and Mapping, Geographic Mapping Section, Tallahassee, Florida, 92 p.

HEIL, C. A., M. REVILLA, P. M. GLIBERT, and S. MURASKO. 2007. Nutrient quality drives differential phytoplankton community composition on the southwest Florida shelf. Limnology and Oceanography 52: 1067–1078.

MAIE, N., J. N. BOYER, C. YANG, and R. JAFFE. 2006. Spatial, geomorphological, and seasonal variability of CDOM in estuaries of the Florida Coastal Everglades. Hydrobiologia 569: 135–150.

PROPOSED NUMERIC NUTRIENT CRITERIA FOR SOUTH FLORIDA ESTUARIES AND COASTAL WATERS. 2012. South Florida Natural Resources Center, Everglades National Park, Homestead. 28 p. https://www.nps.gov/ever/learn/nature/upl

oad/enp-nnc-report-revised-05-12.pdf. Accessed April 2016.

SHIRLEY, M. A., S. D. LOCKER, and J. L. SCHMID. 2006. A comparison of side scan sonar and aerial photography for submerged aquatic vegetation mapping. Final Report, Rookery Bay National Estuarine Research Reserve, Naples, Florida. 20 p.

SLONE, D. H., J. P. REID, and W. J. KENWORTHY. 2013. Mapping spatial resources with GPS animal telemetry: foraging manatees locate seagrass beds in the Ten Thousand Islands, Florida, USA. Marine Ecology Progress Series 476: 285–299.

STADLER, T. W. 2015. Restoring the Rookery Bay Estuary: a project connecting people and science for long-term community benefit. Final report submitted to the National Estuarine Research Reserve System. Silver Springs, MD. 28 p. http://50.87.232.11/wp-content/uploads/2015/06/project-page_final-report_managing-freshwater-for-the-future-in-florida.pdf. Accessed April 2016.

General References and Additional Information

Identifying changes in aquatic habitats. Rookery Bay National Research Reserve, http://ian.umces.edu/pdfs/ian_newsletter_470.pdf. Accessed April 2016.

Rookery Bay National Estuarine Research Reserve: https://rookerybay.org/visit/environmental-learning-center/178-learn/research/mapping-monitoring/642-seagrass.html. Accessed April 2016.

Rookery Bay & Cape Romano – Ten Thousand Islands Aquatic Preserves: http://www.dep.state.fl.us/coastal/sites/rookery/pub/Cape_Romano_Rookery_Bay_AP_Flyer.pdf. Accessed April 2016.

Ten Thousand Islands National Wildlife Refuge: http://www.fws.gov/refuges/profiles/index.cfm?id=41555. Accessed April 2016.

Boating and Angling Guide to Collier County. 2007: http://ocean.floridamarine.org/boating_guides/collier/. Accessed April 2016.

Contacts

Mapping and monitoring: Kevin Cunniff, Research Coordinator, Rookery Bay National Estuarine Research Reserve, 239-417-6310, Kevin.cunniff@dep.state.fl.us.

Mapping: Paul Carlson, Florida Fish and Wildlife Conservation Commission, 727-896-8626, paul.carlson@myfwc.com.

Document Citation:

Carlson, P. R. Jr., and K. Cunniff. 2016. Summary report for the Ten Thousand Islands. pp. 206-213, *in* L. A. Yarbro and P. R. Carlson Jr., eds. Seagrass Integrated Mapping and Monitoring Report No. 2. Fish and Wildlife Research Institute Technical Report TR-17, version 2, Florida Fish and Wildlife Conservation Commission, St. Petersburg. 281 p. DOI: 10.13140/RG.2.2.12366.05445.