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Cover photograph: *Spartina alterniflora* and *Laguncularia racemosa* in St. Petersburg, Florida.
Photograph by Ryan P. Moyer

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Contents

Scores of fiddler crabs (*Uca* spp.) in a *Spartina alterniflora* salt marsh in New Smyrna Beach, Florida. Photograph by Ryan P. Moyer.

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This report is a collaboration among many authors from governmental and independent agencies. The views, statements, findings, conclusions, and recommendations expressed herein are those of the authors and do not necessarily reflect the views of the State of Florida, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, the U.S. Fish and Wildlife Service, or any of their subagencies.

Coastal Habitat Integrated Mapping and Monitoring Program (CHIMMP)

The Coastal Habitat Integrated Mapping and Monitoring Program, or CHIMMP, was initiated by the Coastal Wetlands Group at the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute (FWRI) in St. Petersburg, Florida. CHIMMP was based on the framework established by the Seagrass Integrated Mapping and Monitoring (SIMM) program (myfwc.com/research/habitat/seagrasses/projects/active/simm/). The main objectives of CHIMMP were to build a network of collaboration among salt marsh and mangrove mapping and monitoring programs in Florida to identify the status and needs of coastal wetlands and to make recommendations for their management. An additional component of CHIMMP, still under way at the time of the writing of this report, is the side-by-side assessment of a variety of coastal wetland mapping and monitoring techniques.

Three CHIMMP workshops were held at the FWRI in April 2014, September 2015, and January 2017 to bring together coastal wetland scientists and managers from across Florida. Attendees presented their work on current mangrove and salt marsh mapping and monitoring efforts and compiled recommendations for CHIMMP and future coastal wetland endeavors in Florida. The regional boundaries and content for chapters in this report were established based upon recommendations of attendees at the 2014 workshop. See ocean.floridamarine.org/CHIMMP/ for further details concerning the CHIMMP workshops.

Many attendees of the 2014 workshop volunteered to contribute to the regional chapters of this report. Additional report coauthors were added based on regional need and personal recommendations. As a result of the collaborative nature of the report, the style and level of detail vary among chapters based upon contributing authors and regional data availability. Unless otherwise noted, all photographs in this document were taken by the CHIMMP editors for this report.

Contributors and Their Affiliations

See Appendix A for affiliation acronyms

Shauna Ray Allen	USNPS	Maria Merrill	FWC
Eric Anderson	Palm Beach County	Chris Miller	St. Leo University
Jeff Beal	FWC	Ryan P. Moyer	FWC
James W. Beever III	SWFRPC	E.J. Neafsey	FGCU
Lisa Beever	CHNEP	Andrea Noel	FDEP
Chris Bergh	TNC	Jon Perry	Janicki Environmental
Ron Brockmeyer	SJRWMD	Christina Powell	FWC
Hyun Jung Cho	Bethune-Cookman University	Ellen Raabe	USGS
Frank Courtney	FWC	Kara Radabaugh	FWC
Lindsay Cross	Florida Wildlife Corridor	Nicole Rankin	USFWS
Nikki Dix	GTMNERR	Pablo Ruiz	USNPS
William Ellis	St. Leo University	Christi Santi	FWC
Sharon Ewe	FCE LTER	Jill Schmid	RBNERR
Beth Fugate	FDEP	Brian Sharpe	FDEP
Laura Geselbracht	TNC	Ed Sherwood	TBEP
Randy Grau	FWC	Joseph M. Smoak	USF St. Petersburg
Marion Hedgepeth	SFWMD	Caitlin Snyder	ANERR
Craig van der Heiden	IRC	Linda Sunderland	Broward County
Kris Kaufman	NOAA Restoration Center	Theresa Thom	USNPS
Phyllis Klarmann	Palm Beach County	John Tucker	St. Lucie County
Katie Konchar	FWC	Craig van der Heiden	IRC
Curtis Kruer	Coastal Resources Group	Kathy Worley	CSWF
Jay Leverone	SBEP	Shannon Whaley	FWC
Roy R. (Robin) Lewis III	Coastal Resources Group	Amber Whittle	FWC
Shelly Marshall	Escambia County	Kim Wren	ANERR

A mixed forest of mature *Rhizophora mangle, Avicennia germinans,* and *Laguncularia racemosa* (red, black, and white mangroves) in Weedon Island Preserve on Tampa Bay, Florida. Photograph by Ryan P. Moyer.

Executive Summary

Mangrove swamps and salt marshes provide valuable ecological services to coastal ecosystems in Florida. Coastal wetlands are an important nursery for many ecologically and commercially important fish and invertebrates. The vegetation stabilizes shorelines, protecting the coast from wave energy, storm surge, and erosion. Coastal wetlands are also able to filter surface water runoff, removing excess nutrients and many pollutants. Peat deposits sequester large amounts of carbon, making coastal wetlands a key sink in global carbon cycles.

Mangroves and salt marshes, however, are vulnerable to both direct and indirect threats from human development. Current threats include continued habitat loss, hydrologic alteration of surface and groundwater, sea-level rise, and invasive vegetation. Florida has extensive flood control and drainage structures that concentrate freshwater flow, resulting in widely variable salinity in coastal wetlands. From the early to mid-1900s, many coastal wetlands were ditched or impounded in attempts to control the mosquito population, drastically altering local hydrology and increasing the range of tidal influence. Urban and agricultural water demand has also reduced flow of both surface and groundwater, further exacerbating saltwater intrusion in conjunction with sea-level rise. While salt marshes and mangroves can accumulate substrate by trapping sediment and organic deposits, they may be forced to migrate inland if accretion rates cannot keep pace with rising waters. This process may result in reduced habitat extent if coastal wetlands are pinched out by nearby coastal development or sloped topography. Native vegetation must also compete for space against invasive species such as *Schinus terebinthifolius* (Brazilian pepper) and *Casuarina* spp. (Australian pines), which have encroached upon the edges of coastal wetland habitat.

Mangrove and salt marsh ecosystems are often in flux. Marsh vegetation can rapidly overtake regions of

cold-induced mangrove die-offs. As mangroves recover, they slowly shade out the marsh vegetation. In the past few decades, mangrove acreage has increased in many regions of Florida. A recent decreased frequency in cold events has facilitated the northern expansion of mangroves. In southern Florida, mangroves are also encroaching into adjacent inland habitats, particularly salt marshes. The effects of mangrove expansion on coastal wetland ecosystem services are the subject of multiple ongoing research projects throughout Florida. Such projects rely on quality spatial and temporal data of wetland habitat coverage.

According to the 2016 Cooperative Land Cover Map (version 3.2), Florida contains approximately 378,690 acres (153,250 ha) of salt marshes and 571,750 acres (231,380 ha) of mangrove swamp. The Cooperative Land Cover maps are one example of the numerous land cover data sets that include mapping of coastal wetland extent in Florida. These national, state, or local mapping programs use an array of land cover classification techniques. While nomenclature may vary, most of these classification schemes include categories for salt marsh and mangrove habitats. Land cover maps are created by classifying land cover in satellite images or aerial photography. Randomized ground truthing is critical for determining classification accuracy. Areal land classifications may vary widely among mapping data sets, requiring careful awareness on the part of the user, and are often available for only one time period. The land use/land cover (LULC) maps from Florida's water management districts provide the foundation for the most recent mapping data. However, the years when LULC maps were created vary among the districts and refinement of methods can hinder direct comparison of land cover extent over time.

Coastal wetland monitoring programs are often short-lived and vary widely in methodology. Monitoring most commonly occurs on protected public lands or at wetland mitigation or restoration sites. These monitoring projects are rarely long-term due to a lack of funding; restoration sites are generally monitored for only a few years. Although long-term funding is difficult to secure, monitoring over long time scales is increasingly important due to regional uncertainties as to how coastal wetland vegetation and substrate accretion will respond to sea-level rise, altered freshwater hydrology, and other disturbances. While periodic land cover mapping programs can capture large-scale changes in habitat extent, smaller-scale species shifts among mangrove and salt marsh vegetation are best captured by on-the-ground monitoring.

The chapters in this report summarize recent mapping and monitoring programs in each region of Florida. Content of each chapter includes a general introduction to the region, location-specific threats to salt marshes and mangroves, a summary of selected mapping and monitoring programs, and recommendations for protection, management, and monitoring. Land cover maps in this report generally use data from the most recent water management district LULC maps.

Through feedback compiled at the CHIMMP workshops and during the writing of this collaborative report, several needs and recommendations were identified for Florida coastal wetlands:

- Methodologically consistent, long-term statewide monitoring is needed to track coastal wetland responses to altered environmental conditions.
- Land classification schemes are not designed to categorize a mixture of salt marsh and mangrove vegetation. This deficiency hinders tracking mangrove expansion, as mangroves often occur as individuals or clusters in salt marsh vegetation.
- Management of freshwater inflow is key to maintaining appropriate salinity levels for coastal ecosystems.
- Through the early identification of stressed mangroves, managers can address hydrologic issues to prevent or lessen mangrove die-offs induced by poor hydrologic flushing.
- Cooperation is necessary among federal, state, and local governmental agencies and nonprofit groups to coordinate connectivity among preserved lands and to establish buffer zones for landward coastal wetland migration.
- Invasive vegetation encroaches on the boundaries of coastal wetlands. Preventing the further spread of these exotics requires constant effort and vigilance.