Mosquito Lagoon Aquatic Preserve

Management Plan • August 2009 - July 2019

Florida Department of Environmental Protection
Coastal and Aquatic Managed Areas

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Recreational fishing and boating are two popular activities that allow the public to enjoy the beauty and bounty of Florida's coastal resources found within the Mosquito Lagoon Aquatic Preserve.

Mission Statement

The mission of the Office of Coastal and Aquatic Managed Areas in relation to Florida's 41 Aquatic Preserves, three National Estuarine Research Reserves, National Marine Sanctuary, and Coral Reef Conservation Program is to protect Florida's coastal and aquatic resources.

Long-term goals of the Aquatic Preserve Program

- Protect and enhance the ecological integrity of the aquatic preserves.
- Restore areas to their natural condition.
- Encourage sustainable use and foster active stewardship by engaging local communities in the protection of aquatic preserves.
- Improve management effectiveness through a process based on sound science, consistent evaluation, and continual reassessment.

Cover photo: White ibis (Eudocimus albus) *amongst healthy mollusk reef habitat and emergent red mangroves.*

Title page photo: The preserve offers an abundance of prey items for horseshoe crabs (Limulus polyphemus) *as can be evidenced by the size of this female's molted exoskeleton.*

Executive Summary

Mosquito Lagoon Aquatic Preserve Management Plan	
Lead Agency	Florida Department of Environmental Protection Office of Coastal and Aquatic Managed Areas
Common Name of Property	Mosquito Lagoon Aquatic Preserve
Location	Volusia County, Florida
Acreage Total	4,740 acres (1,918 hectares)
Acreage Breakdown According to Florida Natural Areas Inventory Natural Community Types	
FNAI Natural Communities	*Acreage according to GIS*
Consolidated Substrate	unknown
Unconsolidated Substrate	unknown
Mollusk Reef	unknown
Algal Bed	unknown
Seagrass Bed	51 acres
Tidal Marsh & Tidal Swamp	1240 acres (combined total acreage)
Composite Substrate	unknown
Total acreage	3,500 acres of acres (1,416 hectares) submerged lands, 4,740 acres (1,918 hectares) including islands
Management Agency	Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas
Designation	Aquatic Preserve
Unique Features	The Mosquito Lagoon is one of the most diverse and productive estuaries in North America. The preserve's extensive oyster reefs and clam beds are economically important to the region. The habitat in and surrounding Mosquito Lagoon supports 12 federally endangered or threatened species (see Appendix B.4.1) and numerous nationally registered cultural resource sites, including Turtle Mound.
Archeological/Historical	The adjacent barrier island and uplands are rich with pre-Columbian archaeological sites. The most well known historical site near the Mosquito Lagoon Aquatic Preserve is Turtle Mound, which is the largest shell midden on the east coast of Florida.
Management Needs	
Ecosystem Science	The preserve fosters strong working partnerships with multiple agencies and researchers, and assists with equipment and staff as needed to support research projects and monitoring programs. These research and monitoring programs provide invaluable information on the status of issues involving the natural resources, and form the basis for making sound resource management decisions.
Resource Management	Continue to support the multiagency restoration efforts of rotary-ditched and impounded wetlands in the Mosquito Lagoon. Increase monitoring efforts to support the ongoing project. Develop a seagrass prop scar restoration plan to repair damaged submerged aquatic vegetation to protect this economically vital resource.
Education & Outreach	Expand the Island Enhancement Project to islands in the preserve to encourage responsible recreational users to participate in the stewardship of the preserve's natural resources.

Mosquito Lagoon Aquatic Preserve Management Plan	
Public Use	Rapid population growth is expected to continue in coastal areas of Florida. Information and data contained within this Plan is intended to assist preserve managers, working closely with other state entities and local governments, to make decisions that will assure a balance between sustainable resource protection and waterway management.
Public Involvement	The Mosquito Lagoon Aquatic Preserve formed an advisory committee consisting of a variety of stakeholders to provide guidance throughout the development of this management plan. In addition to the five advisory committee meetings, two public meetings were held to capture the public's concerns and input. The plan was presented to the Acquisition and Restoration Council and the Governor and Cabinet at public hearings for approval.

CAMA / BTIITF Approval

CAMA approval date: March 13, 2009 **BTIITF approval date:** August 11, 2009

Comments:

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The first Public Scoping Meeting for Mosquito Lagoon Aquatic Preserve Management Plan was held in August 2007.

Part One

Basis for Management

Chapter One

Introduction

The Florida aquatic preserves are administered on behalf of the state by the Florida Department of Environmental Protection's (DEP) Office of Coastal and Aquatic Managed Areas (CAMA) as part of a network that includes 41 aquatic preserves, 3 National Estuarine Research Reserves (NERRs), a National Marine Sanctuary, the Coral Reef Conservation Program and the Florida Oceans and Coastal Council. This provides for a system of significant protections to ensure that our most popular and ecologically important underwater ecosystems are cared for in perpetuity. Each of these special places is managed with strategies based on local resources, issues and conditions.

Our expansive coastline and wealth of aquatic resources have defined Florida as a subtropical oasis, attracting millions of residents and visitors, and the businesses that serve them. Florida's submerged lands play important roles in maintaining good water quality, hosting a diversity of wildlife and habitats (including economically and ecologically valuable nursery areas), and supporting a treasured quality of life for all. In the 1960s, it became apparent that the ecosystems that had attracted so many people to Florida could not support rapid growth without science-based resource protection and management. To this end, state legislators provided extra protection for certain exceptional aquatic areas by designating them as aquatic preserves.

Title to submerged lands not conveyed to private landowners is held by the Board of Trustees of the Internal Improvement Trust Fund (the Trustees). The Governor and Cabinet, sitting as the Trustees, act as guardians for the people of the State of Florida (§253.03, Florida Statutes [F.S.]) and regulate the use of these public lands. Through statute, the Trustees have the authority to adopt rules related to the management of sovereignty submerged lands (Florida Aquatic Preserve Act of 1975, §258.36, F.S.). A higher layer of protection is afforded to aquatic preserves including areas of sovereignty lands that have been

"set aside forever as aquatic preserves or sanctuaries for the benefit of future generations" due to "exceptional biological, aesthetic, and scientific value" (Florida Aquatic Preserve Act of 1975, §258.36, F.S.).

This tradition of concern and protection of these exceptional areas continues, and now includes: the Rookery Bay NERR in Southwest Florida, designated in 1978; the Apalachicola NERR in Northwest Florida, designated in 1979; and the Guana Tolomato Matanzas NERR in Northeast Florida, designated in 1999. In addition, the Florida Oceans and Coastal Council was created in 2005 to develop Florida's ocean and coastal research priorities, and establish a statewide ocean research plan. The group also coordinates public and private ocean research for more effective coastal management. This dedication to the conservation of coastal and ocean resources is an investment in Florida's future.

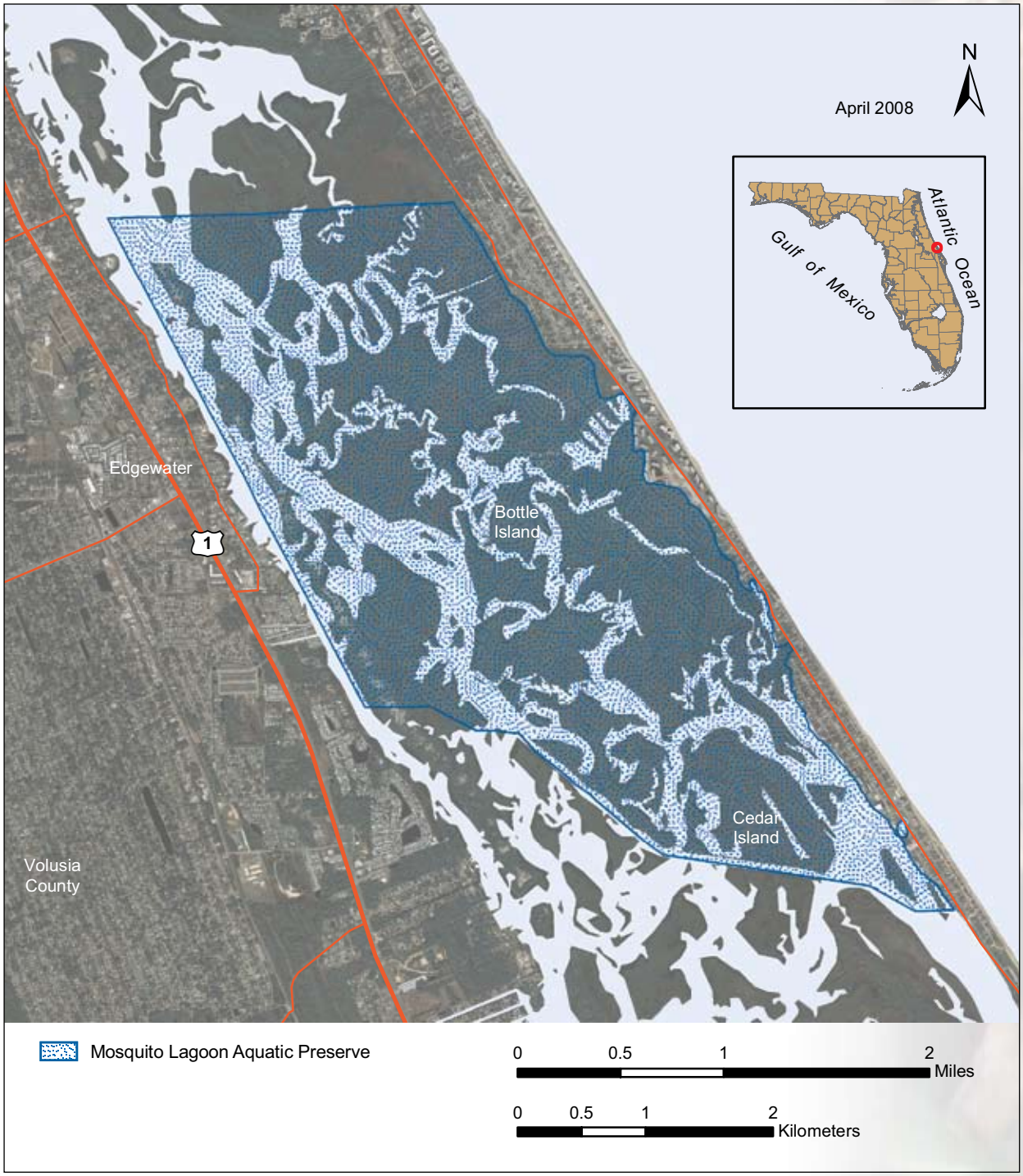
*1.1 / **Management Plan Purpose and Scope***

With increasing development, recreation and economic pressures, our aquatic resources have the potential to be significantly impacted, either directly or indirectly. These potential impacts to resources can reduce the health and viability of the ecosystems that contain them, requiring active management to ensure the long-term health of the entire network. Effective management plans for the aquatic preserves are essential to address this goal and each site's own set of unique challenges. The purpose of these plans is to incorporate, evaluate and prioritize all relevant information about the site into a cohesive man-

Map 1 / Coastal and Aquatic Managed Areas System

agement strategy, allowing for appropriate access to the managed areas while protecting the long-term health of the ecosystems and their resources.

The mandate for developing aquatic preserve management plans is outlined in Section 18-20.013 and Subsection 18-18.013(2) of the Florida Administrative Code (F.A.C.). Management plan development and review begins with the collection of resource information from historical data, research and monitoring, and includes input from individual CAMA managers and staff, area stakeholders, and members of the general public. The statistical data, public comment, and cooperating agency information is then used to identify management issues and threats affecting the present and future integrity of the site, its boundaries, and adjacent areas. This information is used in the development and review of the management plan, which is examined for consistency with the statutory authority and intent of the Aquatic Preserve Program. Each management plan is evaluated periodically and revised as necessary to allow for strategic improvements. Intended to be used by site managers and other agencies or private groups involved



Map 2 / Mosquito Lagoon Aquatic Preserve Site

with maintaining the natural integrity of these resources, the plan includes scientific information about the existing conditions of the site and the management strategies developed to respond to those conditions.

To aid in the analysis and development of the management strategies for the site plans, four comprehensive management programs are identified. In each of these management programs, relevant information about the specific sites is described in an effort to create a comprehensive management plan. It is expected that the specific needs or issues are unique and vary at each location, but the four management programs will remain constant. These management programs are:

- Ecosystem Science
- Resource Management
- Education and Outreach
- Public Use

In addition, unique local and regional issues are identified, and goals, objectives and strategies are established to address these issues. Finally, the program and facility needs required to meet these goals as identified. These components are all key elements in an effective coastal management program and for achieving the mission of the sites.

*1.2 / **Public Involvement***

CAMA recognizes the importance of stakeholder participation and encourages their involvement in the management plan development process. CAMA meets the requirements of the Sunshine Law (§286.011, F.S.) which mandates:

- meetings of public boards or commissions must be open to the public;
- reasonable notice of such meetings must be given; and
- minutes of the meetings must be recorded.

Several key steps were taken during Mosquito Lagoon Aquatic Preserve Management Plan development. First, staff organized an advisory committee comprised of key stakeholders, neighbors and interested citizens. Next, Mosquito Lagoon Aquatic Preserve staff advertised and conducted a public meeting in September 2007 to listen and discuss concerns and issues affecting each of the sites. This input was used in the development of a draft management plan that was reviewed by CAMA staff and the advisory committee. After the initial reviews, the staff advertised and conducted, in conjunction with the advisory committee, an additional public meeting in June 2008 and a total of five advisory committee meetings to engage the stakeholders in the development of the final draft of the management plan. During the planning process, a Mosquito Lagoon Working Group and public use subcommittee were formed to assist in the implementation of the management plan. For additional information about the advisory committee and the public meetings refer to Appendix C - Public Involvement.

Crabs are an important part of the food web in the Mosquito Lagoon. They construct their burrows on sandy and muddy intertidal areas near salt marshes and along the shorelines in the preserve.

Chapter Two

The Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas

2.1 / ***Introduction***

The Florida Department of Environmental Protection (DEP) protects, conserves and manages Florida's natural resources and enforces the state's environmental laws. The DEP is the lead agency in state government for environmental management and stewardship and commands one of the broadest charges of all the state agencies, protecting Florida's air, water and land. The DEP is divided into three primary areas: Regulatory Programs, Land and Recreation, and Planning and Management. Florida's environmental priorities include restoring America's Everglades; improving air quality; restoring and protecting the water quality in our springs, lakes, rivers and coastal waters; conserving environmentally-sensitive lands; and providing citizens and visitors with recreational opportunities, now and in the future.

The Office of Coastal and Aquatic Managed Areas (CAMA) is the unit within the DEP that manages more than four million acres of submerged lands and select coastal uplands. This includes 41 aquatic preserves, 3 National Estuarine Research Reserves (NERRs), the Florida Keys National Marine Sanctuary and the Coral Reef Conservation Program. The three NERRs, the Florida Keys National Marine Sanctuary and the Coral Reef Conservation Program are managed in cooperation with the National Oceanic and Atmospheric Administration (NOAA).

CAMA manages sites in Florida for the conservation and protection of natural and historical resources and resource-based public use that is compatible with the conservation and protection of these lands. CAMA is a strong supporter of the NERR system and its approach to coastal ecosystem management. The State of Florida has three designated NERR sites, each encompassing at least one aquatic preserve within its boundaries. Rookery Bay NERR includes Rookery Bay Aquatic Preserve and Cape Romano - Ten Thousand Islands Aquatic Preserve; Apalachicola NERR includes Apalachicola Bay Aquatic Preserve; and Guana Tolomato Matanzas NERR includes Guana River Marsh Aquatic Preserve and Pellicer Creek Aquatic Preserve. These aquatic preserves provide discrete areas designated for additional protection beyond that of the surrounding NERR and may afford a foundation for additional protective zoning in the future.

Each of the Florida NERR managers serves as a regional manager overseeing multiple other aquatic preserves in their region. This management structure advances CAMA's ability to manage its sites as part of the larger statewide system.

*2.2 / **Management Authority***

Established by law, aquatic preserves are submerged lands of exceptional beauty that are to be maintained in their natural or existing conditions. The intent was to forever set aside submerged lands with exceptional biological, aesthetic, and scientific values as sanctuaries, called aquatic preserves, for the benefit of future generations.

The laws supporting aquatic preserve management are the direct result of the public's awareness of and interest in protecting Florida's aquatic environment. The extensive dredge and fill activities that occurred in the late 1960s spawned this widespread public concern. In 1966, the Board of Trustees of the Internal Improvement Trust Fund (the Trustees) created the first aquatic preserve, Estero Bay, in Lee County.

In 1967, the Florida Legislature passed the Randall Act (Chapter 67-393, Laws of Florida), which established procedures regulating previously unrestricted dredge and fill activities on state-owned submerged lands. That same year, the Legislature provided the statutory authority (§253.03, Florida Statutes [F.S.]) for the Trustees to exercise proprietary control over state-owned lands. Also in 1967, government focus on protecting Florida's productive water bodies from degradation due to development led the Trustees to establish a moratorium on the sale of submerged lands to private interests. An Interagency Advisory Committee was created to develop strategies for the protection and management of state-owned submerged lands.

In 1968, the Florida Constitution was revised to declare in Article II, Section 7, the state's policy of conserving and protecting natural resources and areas of scenic beauty. That constitutional provision also established the authority for the Legislature to enact measures for the abatement of air and water pollution. Later that same year, the Interagency Advisory Committee issued a report recommending the establishment of 26 aquatic preserves.

The Trustees acted on this recommendation in 1969 by establishing 16 aquatic preserves and adopting a resolution for a statewide system of such preserves. In 1975 the state Legislature passed the Florida Aquatic Preserve Act of 1975 (Act) that was enacted as Chapter 75-172, Laws of Florida, and later became Chapter 258, Part II, F.S. This Act codified the already existing aquatic preserves and established standards and criteria for activities within those preserves. Additional aquatic preserves were individually adopted at subsequent times up through 1989.

In 1980, the Trustees adopted the first aquatic preserve rule, Chapter 18-18, Florida Administrative Code (F.A.C.), for the administration of the Biscayne Bay Aquatic Preserve. All other aquatic preserves are administered under Chapter 18-20, F.A.C., which was originally adopted in 1981. These rules apply standards and criteria for activities in the aquatic preserves, such as dredging, filling, building docks and other structures that are stricter than those of Chapter 18-21, F.A.C., which apply to all sovereignty lands in the state.

This plan is in compliance with the Conceptual State Lands Management Plan, adopted March 17, 1981 by the Board of Trustees of the Internal Improvement Trust Fund and represents balanced public utilization, specific agency statutory authority, and other legislative or executive constraints. The Conceptual State Lands Management Plan also provides essential guidance concerning the management of sovereignty lands and aquatic preserves and their important resources, including unique natural features, seagrasses, endangered species, and archaeological and historical resources.

Through delegation of authority from the Trustees, the DEP and CAMA have proprietary authority to manage the sovereignty lands, the water column, spoil islands (which are merely deposits of sovereignty lands), and some of the natural islands and select coastal uplands to which the Trustees hold title.

Enforcement of state statutes and rules relating to criminal violations and non-criminal infractions rests with the Florida Fish and Wildlife Conservation Commission Marine Patrol, DEP law enforcement, and local law enforcement agencies. Enforcement of administrative remedies rests with CAMA, the DEP Districts, and Water Management Districts.

*2.3 / **Statutory Authority***

The fundamental laws providing management authority for the aquatic preserves are contained in Chapters 258 and 253, F.S. These statutes establish the proprietary role of the Governor and Cabinet, sitting as the Board of Trustees of the Internal Improvement Trust Fund, as Trustees over all sovereignty lands. In addition, these statutes empower the Trustees to adopt and enforce rules and regulations for managing all sovereignty lands, including aquatic preserves. The Florida Aquatic Preserve Act was enacted by the Florida Legislature in 1975 and is codified in Chapter 258, F.S.

The legislative intent for establishing aquatic preserves is stated in Section 258.36, F.S.: "It is the intent of the Legislature that the state-owned submerged lands in areas which have exceptional biological, aesthetic, and scientific value, as hereinafter described, be set aside forever as aquatic preserves or sanctuaries

for the benefit of future generations." This statement, along with the other applicable laws, provides a foundation for the management of aquatic preserves. Management will emphasize the preservation of natural conditions and will include lands that are specifically authorized for inclusion as part of an aquatic preserve.

Management responsibilities for aquatic preserves may be fulfilled directly by the Trustees or by staff of the DEP through delegation of authority. Other governmental bodies may also participate in the management of aquatic preserves under appropriate instruments of authority issued by the Trustees. CAMA staff serves as the primary managers who implement provisions of the management plans and rules applicable to the aquatic preserves. CAMA does not "regulate" the lands per se; rather, that is done primarily by the DEP Districts (in addition to the Water Management Districts) which grant regulatory permits. The Florida Department of Agriculture and Consumer Services through delegated authority from the Trustees, may issue proprietary authorizations for marine aquaculture within the aquatic preserves and regulates all aquacultural activities as authorized by Chapter 597, Florida Aquaculture Policy Act, F.S. Staff evaluates proposed uses or activities in the aquatic preserve and assesses the possible impacts on the natural resources. Project reviews are primarily evaluated in accordance with the criteria in the Act, Chapter 18-20, F.A.C., and this management plan.

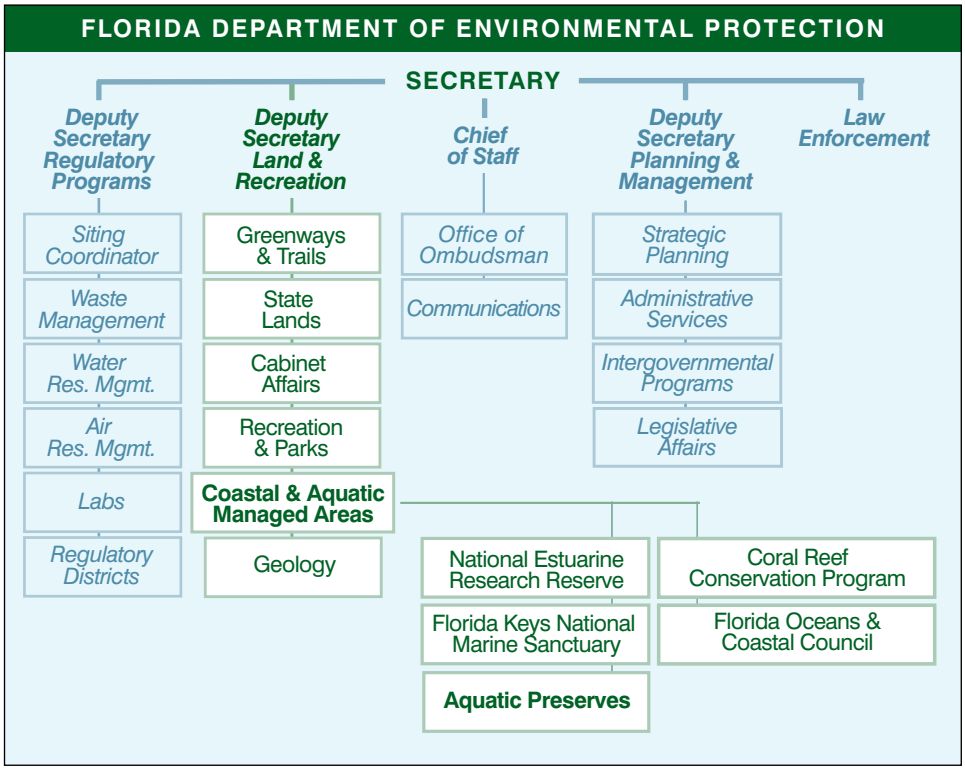


Figure 1 / State structure for managing aquatic preserves.

CAMA staff comments, along with comments of other agencies and the public are submitted to the appropriate permitting staff for consideration in their issuance of any delegated authorizations in aquatic preserves or in developing recommendations to be presented to the Trustees. This mechanism provides a basis for the Trustees to evaluate public interest and the merits of any project while also considering potential environmental impacts to the aquatic preserves. Any activity located on sovereignty lands requires a letter of consent, a lease, an easement, or other approval from the Trustees.

Many provisions of the Florida Statutes that empower non-CAMA programs within DEP or other agencies may be important to the management of CAMA sites. For example, Chapter 403, F.S., authorizes rules concerning the designation of "Outstanding Florida Waters" (OFWs), a program that provides aquatic preserves with additional regulatory protection. Chapter 379, F.S., regulates saltwater fisheries, and provides enforcement authority and powers for law enforcement officers. Additionally, it provides similar powers relating to wildlife conservation and management. The sheer number of statutes that affect aquatic preserve management prevents an exhaustive list of all such laws from being provided here.

*2.4 / **Administrative Rules***

Chapters 18-18, 18-20 and 18-21, F.A.C., are the three administrative rules directly applicable to the uses allowed in aquatic preserves specifically and sovereignty lands generally. These rules are intended to be cumulative, meaning that Chapter 18-21, F.A.C., should be read together with Chapter 18-18, F.A.C., or Chapter 18-20, F.A.C., to determine what activities are permissible within an aquatic preserve. If Chapter 18-18, F.A.C., or Chapter 18-20, F.A.C., are silent on an issue, Chapter 18-21, F.A.C., will control; if a conflict is perceived between the rules, the stricter standards of Chapter 18-18, F.A.C.,

or Chapter 18-20, F.A.C., supersede those of Chapter 18-21, F.A.C. Because Chapter 18-21, F.A.C. concerns all sovereignty lands, it is logical to discuss its provisions first.

Originally codified in 1982, Chapter 18-21, F.A.C., is meant "to aid in fulfilling the trust and fiduciary responsibilities of the Board of Trustees of the Internal Improvement Trust Fund for the administration, management and disposition of sovereignty lands; to insure maximum benefit and use of sovereignty lands for all the citizens of Florida; to manage, protect and enhance sovereignty lands so that the public may continue to enjoy traditional uses including, but not limited to, navigation, fishing and swimming; to manage and provide maximum protection for all sovereignty lands, especially those important to public drinking water supply, shellfish harvesting, public recreation, and fish and wildlife propagation and management; to insure that all public and private activities on sovereignty lands which generate revenues or exclude traditional public uses provide just compensation for such privileges; and to aid in the implementation of the State Lands Management Plan."

To that end, Chapter 18-21, F.A.C., contains provisions on general management policies, forms of authorization for activities on sovereignty lands, and fees applicable for those activities. "Activity," in the context of the rule, includes "construction of docks, piers, boat ramps, boardwalks, mooring pilings, dredging of channels, filling, removal of logs, sand, silt, clay, gravel or shell, and the removal or planting of vegetation" (Rule 18-21.003, F.A.C.). To be authorized on sovereignty lands, activities must be not contrary to the public interest (Rule 18-21.004, F.A.C.).

Chapter 18-21, F.A.C., also sets policies on aquaculture, geophysical testing (using gravity, shock wave and other geological techniques to obtain data on oil, gas or other mineral resources), and special events related to boat shows and boat displays. Of particular importance to CAMA site management, it additionally addresses spoil islands, preventing their development in most cases.

Chapters 18-18 and 18-20, F.A.C., apply standards and criteria for activities in the aquatic preserves that are stricter than those of Chapter 18-21, F.A.C. Chapter 18-18, F.A.C., is specific to the Biscayne Bay Aquatic Preserve and is more extensively described in that site's management plan. Chapter 18-20, F.A.C., is applicable to all other aquatic preserves. It further restricts the type of activities for which authorizations may be granted for use of sovereignty lands and requires that structures that are authorized be limited to those necessary to conduct water dependent activities. Moreover, for certain activities to be authorized, "it must be demonstrated that no other reasonable alternative exists which would allow the proposed activity to be constructed or undertaken outside the preserve" (Paragraph 18-20.004(1)(g), F.A.C.).

Chapter 18-20, F.A.C., expands on the definition of "public interest" by outlining a balancing test that is to be used to determine whether benefits exceed costs in the evaluation of requests for sale, lease, or transfer of interest of sovereignty lands within an aquatic preserve. The rule also provides for the analysis of the cumulative impacts of a request in the context of prior, existing, and pending uses within the aquatic preserve, including both direct and indirect effects.

Chapter 18-20, F.A.C., directs management plans and resource inventories to be developed for every aquatic preserve. Further, the rule provides provisions specific to certain aquatic preserves and indicates the means by which the Trustees can establish new or expand existing aquatic preserves.

As with statutes, aquatic preserve management relies on the application of many other DEP and outside agency rules. Perhaps most notably, Chapter 62-302, F.A.C., concerns the classification of surface waters, including criteria for OFW, a designation that provides for the state's highest level of protection for water quality. All aquatic preserves contain OFW designations. No activity may be permitted within an OFW that degrades ambient water quality unless the activity is determined to be in the public interest. Once again, the list of other administrative rules that do not directly address CAMA's responsibilities but do affect CAMA sites is so long as to be impractical to create within the context of this management plan.

A great egret (Ardea alba) *overlooks the preserve from its lofty vantage point.*

Chapter Three

The Mosquito Lagoon Aquatic Preserve

3.1 / ***Description of Representative Ecosystem Region***

3.1.1 / Historical Background

For some 10,000 years before European settlers arrived, indigenous people of Florida inhabited this east central coastal region. Until the early 20th century, the east central Florida coastline was strewn with ancient mounds of clam and oyster shells that testified to the presence of these natives. Timucuan Indian artifacts surrounding the Mosquito Lagoon and the MLAP indicate this aquatic feature was a food source of even greater importance to early inhabitants than to today's residents. Most mounds have been destroyed and the shell used for roadways and building fill. Shellfish harvesting, fishing and hunting-game species were important consumptive uses from the time of indigenous occupation into the early 1900s. The MLAP and surrounding waters were the main travel corridor for early settlers.

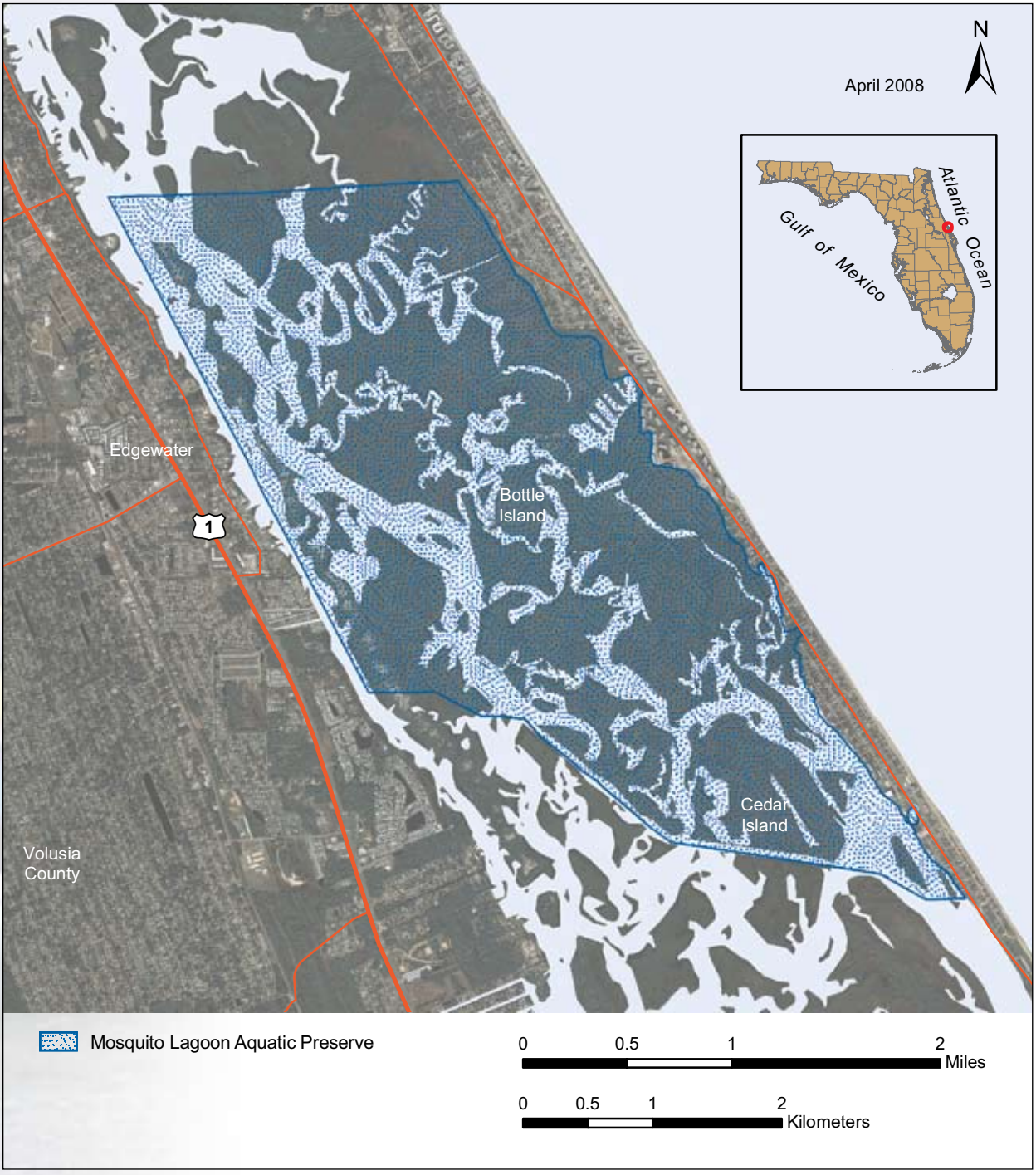
Several large sugar plantations were established during early European and Afro-American settlement, but later abandoned. As settlements grew, commercial uses such as the harvest of seafood and transport of goods by steamboat became more important. Resettlement began in earnest after the Civil War. The town of New Smyrna Beach was incorporated in 1887, with a population of 150 people. The Florida East Coast Railroad spurred development and seasonal tourism to areas like St. Augustine and New Smyrna Beach. Mosquito Lagoon was named appropriately based on the Lagoon's location in the historic Mosquito County and the abundance of mosquitoes.

According to Grant Gilmore's research on historic fisheries, fishing in the 1870's was predominantly for family use (Gilmore, 1977). Gilmore reviewed anecdotal information regarding Mosquito Lagoon and found records such as, "waters abound in fish.., and mullet are remarkably abundant." Low commercial export numbers during that period support those reports of sustenance fishing, compared to the commercial importance of the area later in history. Mosquito Lagoon catches for export in 1879 consisted of "150 green turtles, 300-400 mullet roes and a few barrels of salt mullet." (Provancha, Hall & Oddy, 1992).

Areas just north of the MLAP such as Mosquito Inlet, now called Ponce de Leon Inlet, have major historical significance. For instance, Mosquito Inlet was featured in National Geographic Magazine in 1932 as a wildlife viewing destination. According to the author of the article,

"The inlet and the waters and sand bars back of it, are wonderful places for sea birds. At low tide hundreds of brown pelicans and black skimmers may be seen resting on sand bars and mud flats, together with gulls, terns, herons, and shore birds. A federal game reserve was set aside in approximately 1925 specifically for brown pelicans in the Mosquito Lagoon" (Shiras, 1932).

Historically, Mosquito Lagoon's only opening to the Atlantic Ocean was at Ponce de Leon Inlet, to the northeast. The current southern opening at the southwest end of the Mosquito Lagoon (the original Haulover Canal) was manually excavated in the 1850s during the Seminole Wars (Hanna & Hanna, 1950). The existing, and larger, 1.2 mile (1.9 km) long canal connecting the IRL to Mosquito Lagoon was created in 1887 and improved in 1930 and 1959 as part of the Atlantic Intracoastal Waterway (AIWW).



Map 2 / Mosquito Lagoon Aquatic Preserve Site

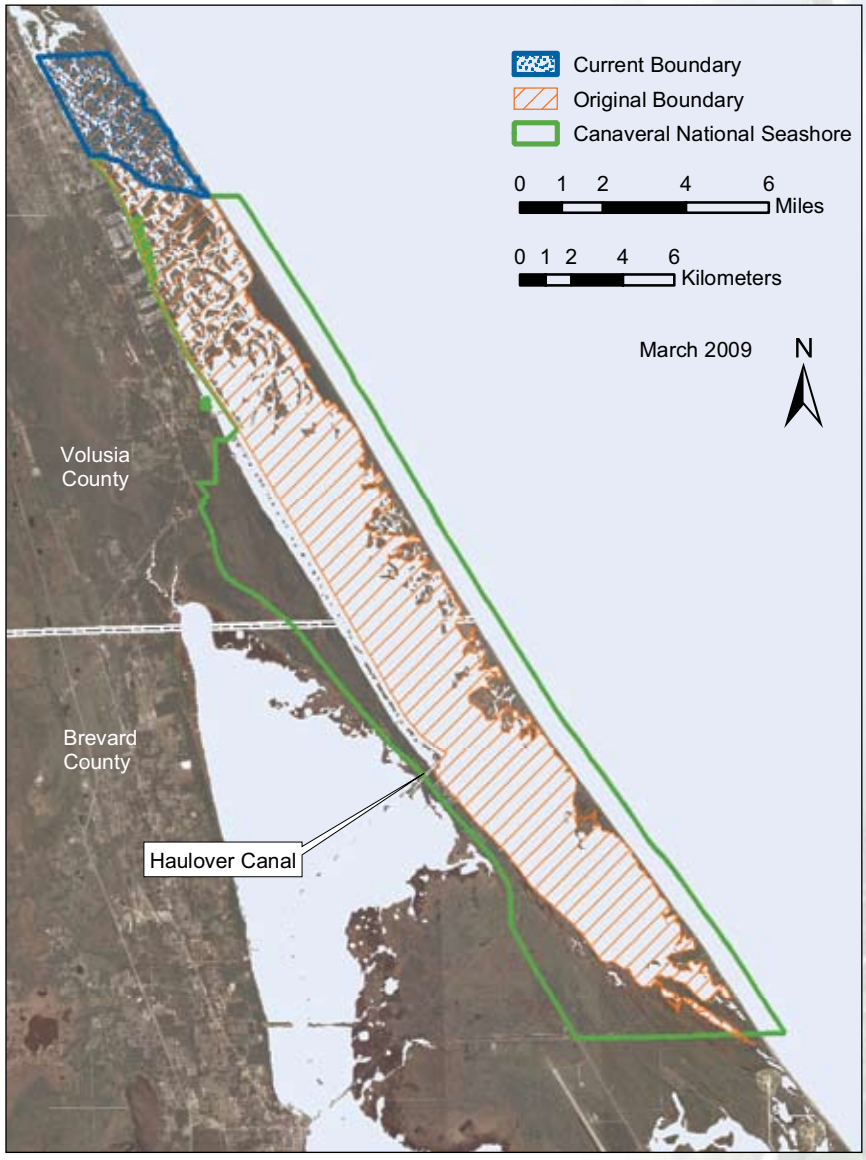
Today, the AIWW channel is a busy travel corridor and provides important economic support to the region. All southbound AIWW vessel traffic must pass through Mosquito Lagoon and Haulover Canal to reach the IRL. During spring and fall, large transient yachts and vessels greater than 25 feet (7.6 m) in length pass by the western boundary of the MLAP while traveling the AIWW to points south and north (Tyson, 2001). Titusville Marina transient dock records were inventoried as a component of a 1998 AIWW boating activity study concerning the Haulover Canal. Researchers learned that of 282 slip rental receipts from April 1998, the origin of transient vessel operators passing through Haulover Canal represented 24 states and 5 foreign countries. Florida residents represented 36.5% of vessel operator origin in these data (Tyson, 2001).

During the 1960s and 1970s, the Florida Legislature recognized the importance of preserving the Mosquito Lagoon and adjacent barrier island (Florida Aquatic Preserve Act of 1975, §258.36, F.S.). MLAP was first designated in 1970 for the purpose of maintaining Mosquito Lagoon in essentially a natural condition. The first MLAP management plan was adopted July 9, 1991.

Historically, aquatic preserve boundaries were designated based primarily on water quality. Many cities discharged wastewater with only primary treatment during the 1960s through the 1970s. This practice resulted in poor water quality surrounding many population centers. Other consideration was given to the habitat function, economic value of resources and beauty of areas proposed for inclusion as aquatic preserves. Commercial interests and private inholdings within proposed preserves were also given consideration as dredge and fill were still not heavily regulated. These designations were established prior to the common usage of geographic information systems (GIS) for mapping. For ease of reference, boundaries were chosen where there were landmarks, bridges, ditches or city boundaries that were already established. Today, it is recognized that sometimes these boundaries do not make ecological sense due to previous mapping constraints or because conditions have changed.

Historical Boundaries of the MLAP

The original MLAP boundaries included 28 miles (45 km) of Mosquito Lagoon, stretching from the southern city limits of New Smyrna Beach to the southern terminus of the basin in Brevard County and encompassed approximately 39,000 acres (158 km^2). During the 1960s and again in 1980, much of the submerged bottom was conveyed to the United States of America for development of the U.S. space program at Cape Canaveral and the expansion of CNS. Since most of the originally designated MLAP is now under the ownership and management of the federal government, the primary focus of the present management plan will concern that part of the MLAP under the ownership and management of the State of Florida.



Map 3 / Previous Mosquito Lagoon Aquatic Preserve Boundaries

On July 31, 1962 the state dedicated, " … to the exclusive use of the United States all of the land, beach, and water areas ... for so long a period of time as the same may be used or required by the United States for the Manned Lunar Landing Program." This dedication included the southern part of Mosquito Lagoon, the northern end of Merritt Island, and the northern end of the Banana River (Board of Trustees, 1962). A modification to this dedication in 1967 provided for "an additional use of the property as a National Wildlife Refuge" (Board of Trustees, 1967). In 1965, another portion of Mosquito Lagoon and north IRL was dedicated. This dedication was for the area north of the old Haulover Canal down to the approximate southern city limits of Oak Hill. It included the barrier island, Mosquito Lagoon, the eastern portion of the northern Indian River Lagoon and some uplands. Another dedication in 1980 included the submerged bottom in Mosquito Lagoon from its southern reaches north to about 1/2 mile (0.8 km) south of the southern city limits of Edgewater.

The Mosquito Lagoon is the backdrop for shuttles launched from the Kennedy Space Station (photo: NASA).

Stipulations were added to the original dedications, including but not limited to security areas and uses necessary for National Aeronautics and Space Administration (NASA), with a secondary use as a wildlife refuge or for public park and recreation purposes upon a determination by NASA. The 1980s deed "is for the express purpose of inclusion in the CNS to manage the lands for wilderness/preservation purposes...In the event that any development proposals are contemplated which may be contrary to these objectives, concurrence of the said Board of Trustees shall be required" (Board of Trustees, 1986).

3.1.2 / General Description

International/National/State/Regional Significance

As a component of the IRL complex, Mosquito Lagoon is designated an Estuary of National Significance by the U.S. Environmental Protection Agency (Indian River Lagoon National Estuary Program, 1996). It was designated by the Florida Legislature as an aquatic preserve in 1970, included in the Aquatic Preserves Act of 1975 passed by the Florida Legislature, and designated as an Outstanding Florida Water in 1979 (Rule 62-302.700 (9), F.A.C.). The Florida Department of Environmental Protection (DEP) affords the highest level of protection to these waters. In addition, areas within the MLAP are also classified as: Class II, Shellfish Harvesting waterbodies (approved for shellfish propagation or harvesting).

The MLAP is a component of one of the most diverse estuaries in North America, providing habitat for nine federally-protected species while simultaneously supporting multi-million dollar recreational and commercial fisheries (United States Fish and Wildlife Service, 2006). The extensive oyster reefs and clam beds of the MLAP are economically important to the region. There are more than 1,240 acres (5.02 km^2) of saltmarsh located within the MLAP. The habitat in and surrounding Mosquito Lagoon potentially supports 12 federally-designated endangered or threatened species (Appendix B.4.1) and numerous nationally-registered cultural resource sites, including Turtle Mound, which is the largest shell midden on the east coast of Florida. (For further detail, see Section 3.1.3, Archaeological and Historical Resources.)

Estuarine communities such as the MLAP are characterized by both high productivity and high biodiversity (Provancha et al*.,* 1992). In fact, estuaries are among the most productive ecosystems on earth (Bertness, 1999). The high primary productivity of estuaries reflects their nutrient-rich conditions and the presence of many primary producers (Walters et al., 2001). The green plants (seagrasses, emergent vegetation and mangroves), micro- and macroalgae, fungi and cyanobacteria gather up nutrients from mud, oxygen and solar energy, generating detritus which nourishes hundreds of species in the salt marsh. Detritus is composed of non-living particulate organic material including the bodies of dead organisms and fecal material colonized by decomposer microorganisms. Only a small fraction of plant tissue is eaten by herbivores while it is living, the larger percentage ends up in the water column and settling to the bottom, becoming detritus (Whitney, Means & Rudloe, 2004). The detrital food chain, together with plankton, are the major components of the estuarine food chain. The estuarine ecosystem is an important spawning and nursery habitat for many species of fish and invertebrates. Approximately 72% of commercial and 74% of sport species of fishes and invertebrates must spend all or part of their lives in or associated with an estuarine system (Durako, Murphy & Haddad, 1988). Wildlife, fishes and water birds benefit from productive estuaries.

Factors that threaten biodiversity in estuaries are generally the same as those that affect biodiversity in terrestrial systems: overexploitation, physical alteration of habitat areas and exotic species introductions. Many of the current threats to aquatic species originate on land. Siltation, nutrient loading, air and water pollution, human population growth and wasteful resource consumption all contribute to habitat degradation, which inevitably leads to loss of species from an ecosystem and thus, a loss of biodiversity (Smithsonian Marine Station, 2007c).

The MLAP is unique among the inland waters of the Atlantic Coast of Florida and a feeling of relative isolation is attainable just a short distance from nearby boat ramps. Generally, kayaks or shallow draft vessels smaller than 16 feet in length are the boats of choice for this system. Once outside the AIWW, local knowledge of water depths and channels of the Lagoon system is essential. Elevated landmarks are difficult to see at times, and it is easy to become disorientated among the winding turns and dead-end waterways.

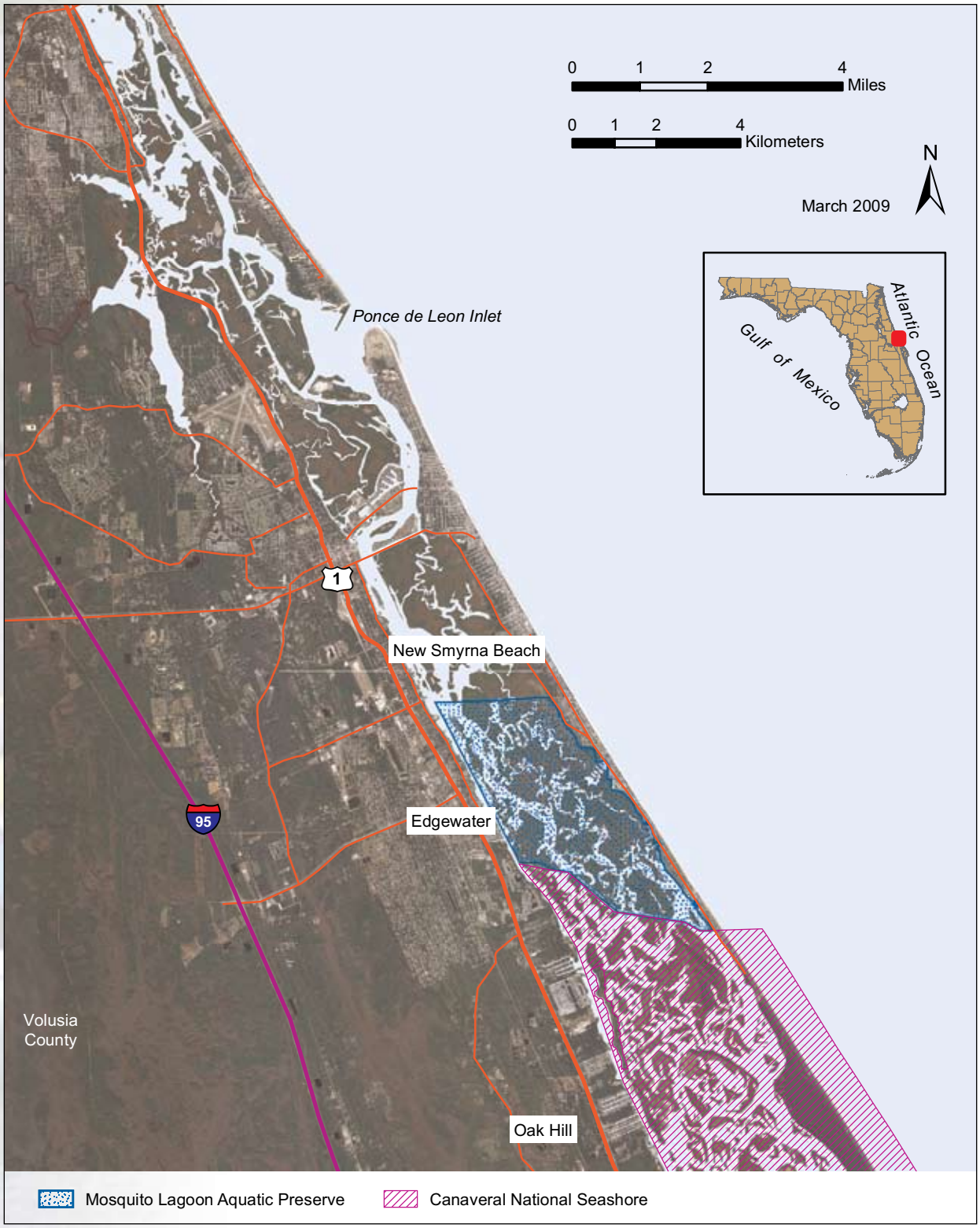
The barrier island running along the eastern side of the MLAP contains the City of New Smyrna Beach, Bethune Beach and the CNS and includes 24 miles (38.6 km) of remote, undeveloped beach along the Atlantic seaboard. The CNS consists of a coastline that includes one of the world's foremost sea turtle-nesting beaches. Playalinda Beach and Apollo Beach, both within the CNS, are managed by the National Park Service (NPS) and are important attractions to tourists, birders, commercial and recreational fishermen. Mosquito Lagoon, MLAP and CNS are the nearest natural coastal areas to three major urban areas, offering opportunities to enjoy the true tranquility of nature. The Orlando area (population 1.8 million, 2003 census), Daytona Beach (population 497,000, 2003 census) and Brevard County (population 534,359, 2006 census) each lie within 60 miles (96.6 km) of the MLAP. The importance of protecting the unspoiled nature of the MLAP in the middle of this bustling environment is increased when you consider that stress reduction can be a key benefit of wilderness recreation (Davis, 2004). The MLAP and surrounding waters have been long recognized as important places for fishing and water sports by residents of central Florida and tourists alike.

The waters of Mosquito Lagoon that are managed as the MLAP lie immediately north of the CNS and Merritt Island National Wildlife Refuge (MINWR). In contrast to the highly developed southern reaches of the IRL, the protected public areas of the MLAP and CNS offer more than 20 miles of estuarine shoreline views interrupted only occasionally by man-made structures. The western shoreline near the City of Edgewater is also characterized by low-density development, with no high rise buildings in view from the interior of the MLAP. Oak Hill, to the south of the MLAP, is lined with fish camps, a vestige of by-gone eras. In the waters of the MLAP, visitors find mangroves towering above narrow tidal creek waterways, bordered by oyster bars reaching out into the shallow waters and brimming with marine life of every description. Conversely, the eastern barrier island, within the City of New Smyrna Beach, provides a horizon interrupted by towering residential high-rises along the beach and riverfront. To some this seems out of place so near to the tranquility of the lagoon.

Location/Boundaries

The Mosquito Lagoon Aquatic Preserve (MLAP) is located in east-central Florida, in southern Volusia County, south of Ponce de Leon Inlet (Map 4 /Location map). It is 50 miles (80.5 km) northeast of Orlando. The MLAP is part of the Indian River Lagoon (IRL) system, a long, wide, shallow estuarine lagoon bounded on the west by the Florida mainland, and on the east by a chain of barrier islands. The

MLAP sub-basin covers 111.4 mi^2 (288.5 km^2) and extends from Ponce de Leon Inlet to the north, to an area just south of the Haulover Canal (White, 1970). Mosquito Lagoon is connected to the northern tip of the IRL via the manmade Haulover Canal. Adjacent to the MLAP are two incorporated municipalities: New Smyrna Beach and Edgewater. The MLAP is accessible from the east by State Route A1A in New Smyrna Beach and from the west off U.S. Highway 1. Vessels traveling in the Atlantic Intracoastal Waterway (AIWW) will encounter the MLAP just south of the George Musson Bridge (State Road 44 Causeway), starting near channel marker 50 and extending south to the Canaveral National Seashore (CNS) boundary at North Government Cut.



Map 4 / Mosquito Lagoon Aquatic Preserve Location

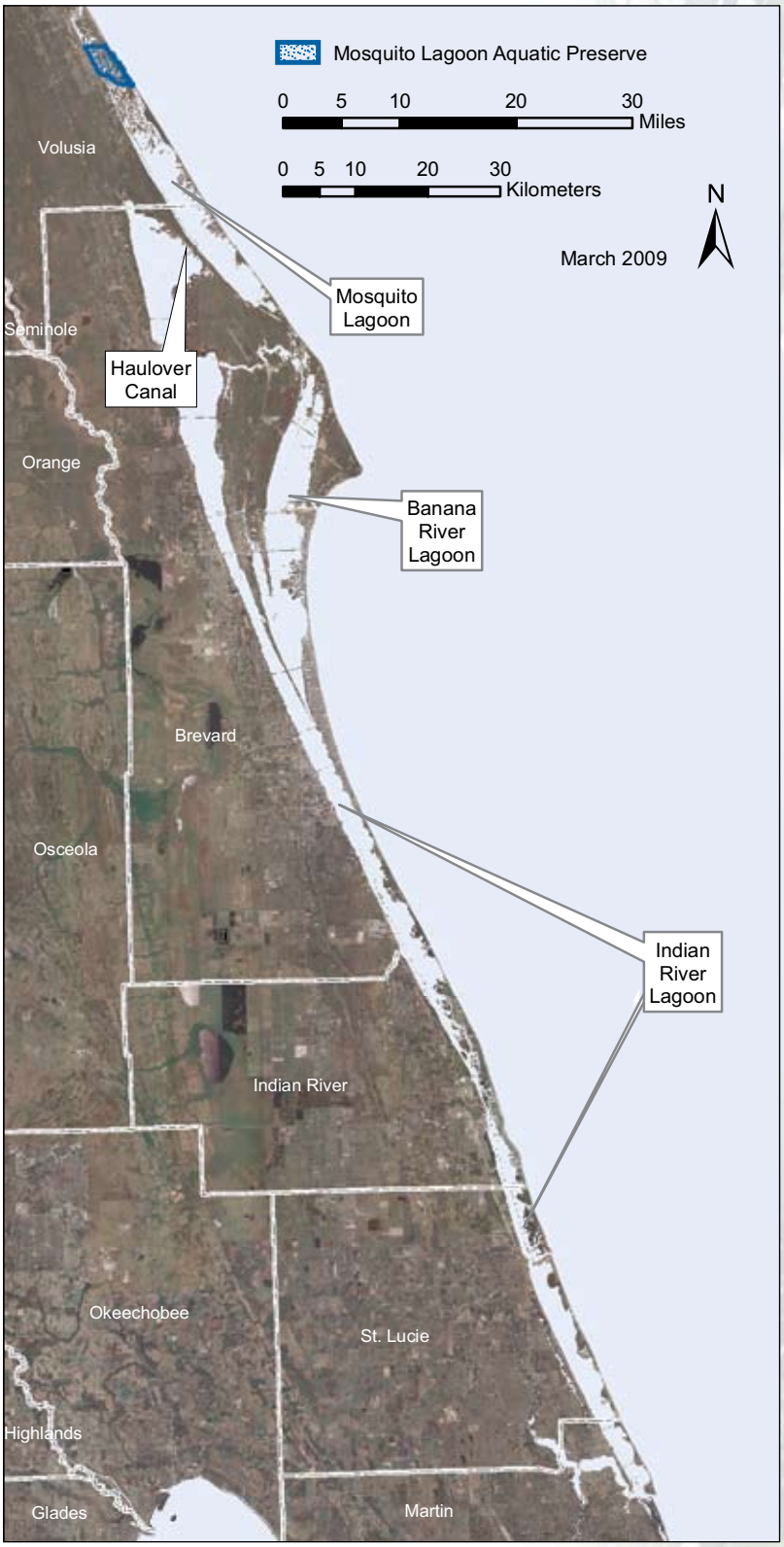
The MLAP is the northernmost sub-basin of the IRL system and is a bar-built type of estuary occupying 59 mi^2 (152.8 km^2) (Clapp, 1987). The IRL system stretches 156 miles (251 km) from Ponce de Leon Inlet at the northern end, to Jupiter Inlet at the southern end and, covers a full 40% of the length of Florida's Atlantic Coast. Despite its name, the Indian River is not a river but is a lagoon or a shallow estuarine water body. Lagoons are estuaries characterized by restricted outlets to the sea, limiting the mixing of oceanic saltwater with terrestrially derived freshwater from rivers, streams and rainwater runoff. Three distinct bodies of water comprise the IRL system: the Indian River Lagoon, the Banana River Lagoon and Mosquito Lagoon.

3.1.3 / Resource Description

Surrounding Population Data and Future Projected Changes

The State of Florida has one of the longest coastlines (8,436 miles/132,567 km) in the United States. Over 75% of the state's population resides in coastal communities. Volusia County is the 11th most populous county in Florida with a 19.6% growth in population from 1990-2000 (http://edr.state.fl.us/county%20profiles/volusia.pdf). Volusia County's total population in 2006 was 505,700, with a projected increase of 2.2% during 2007 (Michael, 2007). New Smyrna Beach population in 2000 was 20,048. Estimates in 2007 indicate the population has increased to just under 23,000 with another projected 2.03% increase by the year 2012. Based on the 2000 census survey data, the U.S. Census Bureau estimated the 2005 population of the city of Edgewater at 21,132, a 13.2% increase in population in five years.

Rapid population growth and development in coastal regions of, Florida, and the resultant impacts on natural resources, are cause for concern. Loss of habitat has affected many species including those of economic and recreational importance. Shortages in groundwater supply, caused by expanding infrastructure developments, are stressing natural systems throughout the region. Stormwater runoff and associated nutrient discharges into Mosquito Lagoon negatively affect local water quality. These subjects are discussed throughout this plan, but are more specifically addressed in Chapter 5, Issue II.



Map 5 / Mosquito Lagoon Aquatic Preserve Relative to Indian River

Topography and Geomorphology

Over the millennia, the Mosquito Lagoon basin, like the rest of peninsular Florida, has alternately been covered by seawater and exposed as dry land. This has created areas where marine and terrestrial sediments have been deposited in alternating layers. The barrier island complex, including the Mosquito Lagoon sub-basin, has been formed over an estimated 240,000 years and is the result of multiple changes in sea level (Fernald & Patton, 1984).

The east coast of Florida is formed mainly by eroded relict dune lines and broad marine terraces, as well as the present barrier islands. Behind the barrier islands, is a lagoon system. Following many land forming processes, flat plains emerged as flatlands when the sea level subsided. The lowest terrace in the Mosquito Lagoon watershed is called the Silver Bluff Terrace. As the sea level receded, dune ridges, including the Atlantic Coastal Ridge, formed on this terrace (Schnable & Goodell, 1968). The Mosquito Lagoon sub-basin of 111 mi^2 (288.5 km^2) extends from Ponce de Leon Inlet in the north to the southernmost extent south of the Haulover Canal (White, 1970). The Mosquito Lagoon drainage basin is bordered by the Atlantic Coastal Ridge, which lies to the west and averages 25 feet (7.6 m) above mean sea level and the Atlantic Beach Ridge (barrier islands) on the east (Walters, Roman, Stiner & Weeks, 2001).

Mosquito Lagoon was formed by a small number of physiographic features (terrain, geologic structure and age). A pronounced physical feature of the barrier island system is Cape Canaveral. Cape Canaveral is described by Stauble (1988), and Walters, et al. (2001) as a cuspate sandy foreland similar to Cape Hatteras in North Carolina, both of which developed where offshore currents meet. The Mosquito Lagoon barrier islands were created, in part, by this cuspate foreland of Cape Canaveral. To the north, the flood tide delta of Ponce de Leon Inlet and a now-closed second inlet that was located near Bethune Beach influenced the physical geography of Mosquito Lagoon (Stauble, 1988). According to Mehta and Brooks (1973), there have been at least five separate inlets opening directly into the lagoon during the past 6,000 to 7,000 years, the most recent of which was in the vicinity of Turtle Mound more than 1,500 years ago. The current barrier islands associated with Mosquito Lagoon have only a single dune ridge averaging 12 feet (3.7 m) in height (Woodward-Clyde Consultants, 1994). The 24 miles (38.6 km) of CNS has a stable dune system vegetated with coastal strand species. Several public parking areas and other CNS facilities are located along northern and southern portions of the narrow barrier island. The barrier island north of the CNS is developed with a network of roads and commercial, single family and high rise residential units. Sections of this dune are considered more vulnerable to erosion due to pressures associated with coastal development.

The Atlantic Coastal Ridge (mainland) is characterized as a sandy ridge, dominated by the Daytona-Satellite-Astatula soil series. This series consists of sandy, siliceous, hyperthermic, uncoated families of soils with predominantly marine origins. The barrier island is dominated by soils of the Palm Beach-Paola-Canaveral series. These soils are carbonitic, hyperthermic families of soils dominated by marine sands and shell fragments (Schmalzer & Hinkle, 1990).

Hydrology and Watershed

MLAP, located within the Mosquito Lagoon estuary, encompasses 3,500 acres (14.2 km^2) of submerged aquatic lands and overlying water column. As an estuary, the salinity varies and is generally lower than adjoining marine waters. The amount of fresh water entering an estuary by any route is affected by rainfall, infiltration, evapotranspiration, watershed size and human alterations of the landscape (Fernald & Patton, 1984).

Because of the 9 mile (14.5 m) distance between Ponce de Leon Inlet and the northern extent of the MLAP, water movement within the MLAP is characterized by minimal currents, minimal water level changes and low tidal flushing. Water level changes within the MLAP are thus normally forced by: 1) wind speed and direction, and to a lesser extent by 2) rainfall, 3) local tide effects and 4) barometric pressure (Woodward-Clyde Consultants, 1994; Paulic, Xueqing, Auilo, Sawistoski, Bess & Pluchino, 2006). Tidal flushing and currents within the MLAP are restricted by the numerous islands, shoals and constricting channels that characterize the area. The mean tidal range at Ponce de Leon inlet is 2.3 feet (0.7 m), but average water depths of 4 feet (1.3 meters) throughout the Mosquito Lagoon limit water exchange and flushing within the MLAP. Woodward and Clyde (1994) determined that under certain conditions there may be no mass flow of water or flushing in this segment of the IRL. Due to the limited tidal exchange with the Atlantic Ocean and the generally sluggish circulation patterns, Mosquito Lagoon is particularly susceptible to influxes of pollutants and the detrimental effects of those pollutants (Paulic et al., 2006).

Water Quality Classifications

The surface waters of the MLAP were designated as Outstanding Florida Waters (OFW) in 1979 (Rule 62-302.700 (9) F.A.C.). This is a state designation implementing a provision of the federal Clean Water Act, intended to afford the highest level of protection to existing high quality waters. The OFW designation is for "special protection due to their natural attributes" (Section 403.061, F.S.). Designated waters are to be preserved in a non-degraded state and protected in perpetuity for the benefit of the public. No degradation of water quality, other than that allowed in Rule 62-4.232(2) is to be authorized. Most OFWs are associated with managed areas in the state or federal park system, such as aquatic preserves, national seashores or wildlife refuges.

A large section of the Mosquito Lagoon is designated as Class II Shellfish Propagation and Harvesting Area (Refer to Table 1, Description of the 82 South Volusia shellfish harvesting area). The Florida Department of Agriculture and Consumer Services (DACS) manages and classifies shellfish areas and establishes regulations implementing the National Shellfish Sanitation Program standards concerning shellfish harvesting. Most of these standards are based on water quality pertaining to public health concerns. Daily status of the harvesting areas can be accessed at www.shellfish.floridaaquaculture.com/seas/seas_statusmap.htm. The MLAP is considered a highly productive system with both wild clam and oyster harvesting. On most days, people can be observed harvesting shellfish while wading in shallows of the lagoon.

There are a small number of active aquaculture and/or oyster leases in the southern Mosquito Lagoon within CNS boundaries and the MLAP. The MLAP currently has three lease sites within its boundaries that total 34 acres (0.14 km^2) of submerged lands dedicated to aquaculture. Location and suitability for new lease sites is determined by DACS staff, with a review of proposals by the MLAP manager. The following map and Table 1 describe the shellfish harvesting areas within the MLAP.

Description of the 82 South Volusia Shellfish Harvesting Area
Shellfish Area 2-Digit # & Name: 82 South Volusia
Map Number(s): 82
County(s): Volusia
Brief description of extents: All waters of the Mosquito Lagoon north of ICWW marker 29 located west of Three Cabbage Island and south of the State Road 44 bridge in New Smyrna Beach.
Types of shellfish present: Clam, Oyster
Current classification effective on: August 9 , 2000
Description of Management for Closures and Acres
• **8201 South Volusia approved:** Closed during emergency conditions, including hurricanes, tropical storms, sewage discharges, red tides, and illnesses. 7,859 acres.
• **8212 South Volusia conditionally approved Zone 1:** Closed when two-day cumulative rainfall measured at the Edgewater Wastewater Treatment Plant exceeds 1.15 inches. 1,794 acres.
• **8222 South Volusia conditionally approved Zone 2:** Closed when two-day cumulative rainfall measured at the Edgewater Wastewater Treatment Plant exceeds 4.03 inches. 6,186 acres.
• **8206 South Volusia conditionally restricted:** Closed when two-day cumulative rainfall measured at the Edgewater Wastewater Treatment Plant exceeds 5.36 inches. 1,008 acres.
• **South Volusia prohibited:** 1,342 acres.
Table obtained from DACS website: www.floridaaquaculture.com/seas_sums/82_southvol.htm

Table 1 / Description of the 82 South Volusia Shellfish Harvesting Area

Surface Water and Drainage Patterns

Mosquito Lagoon receives freshwater inputs from precipitation, surface runoff, groundwater seepage, a few tributaries, man-made canals and wastewater treatment plants. Surface runoff is the predominant fresh water drainage input into Mosquito Lagoon. Few natural streams contribute fresh water to the system (Woodward-Clyde Consultants, 1994). Sheetflow and groundwater seepage are also important hydrological contributors to the IRL system. The average groundwater seepage rate for Mosquito Lagoon

Shellfish harvesting is a well-known historical use of the Mosquito Lagoon. Today recreational and commercial users can be seen harvesting the mollusks as evidenced by this oyster harvester.

over a 24-year study was found to be high at 1251 milliliters per meter squared per hour (Belanger, Heck & Andrews, 1997). This rate indicates there is significant groundwater input into the lagoon. Several manmade drainage ditches extend the natural watershed to the west and there are a few natural creeks that discharge into the lagoon. There are two large culverted canals in the City of Edgewater that drain into Mosquito Lagoon: the Gabordy Canal (10th Street) and the 18th Street Canal.

Compared to the other more densely-developed areas of the IRL system, Mosquito Lagoon's drainage basin is small. Total watershed for the Mosquito Lagoon is 79,422 acres (327 km^2). The surface drainage basin consists of 42,000 acres (168 km^2) and is located entirely within Brevard and Volusia counties extending from Ponce de Leon Inlet to the southernmost extent of the Mosquito Lagoon (Provancha et al., 1992; Woodward-Clyde Consultants, 1994). The drainage basin is the total land area draining into the body of water, whereas the watershed includes both the land area and the water body.

Two point-source wastewater discharges operate under permits from the Florida Department of Environmental Protection (DEP) in the Mosquito Lagoon Basin, with a total maximum design flow of 6.5 million gallons per day (Woodward-Clyde Consultants, 1994). The City of Edgewater disposes of treated wastewater by discharge to Mosquito Lagoon and through a reclaimed water treatment system for public access irrigation. The Utilities Commission of New Smyrna Beach disposes of 65% of its treated wastewater via reuse irrigation, with the remaining effluent disposed of through outfall piping into the IRL (Utilities Commission of New Smyrna Beach, 2007). As water reuse systems expand to greater capacities, the volume of excess flows to the IRL might be expected to decrease.

While city sewer infrastructure is available for households in most of the municipalities around Mosquito Lagoon, approximately one third of the area surrounding the MLAP is dependent upon septic systems, also known as on-site sewage treatment and disposal systems. The widespread use of septic systems in the Mosquito Lagoon region can affect water quality, in particular when older systems are not properly maintained or fall into disrepair and leach nutrients and bacteria into the surrounding water bodies. The leaching of septic systems can introduce phosphorus, nitrogen and fecal coliform bacteria into the lagoon system.

Groundwater and Wells

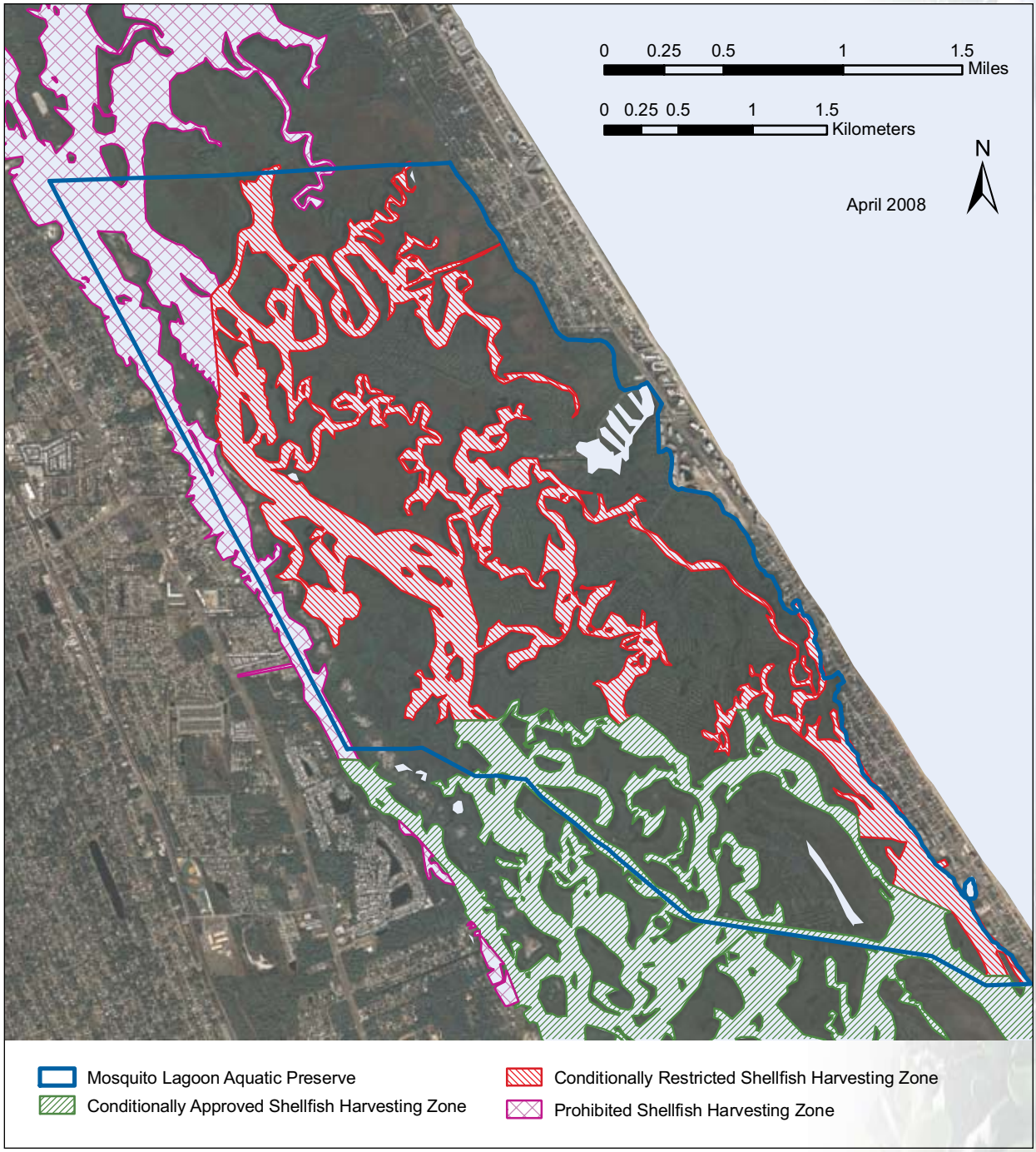
There are three basic units of the hydrogeologic framework underlying Florida and the IRL system: the Floridan Aquifer, the intermediate aquifer and the surficial aquifer. The Floridan Aquifer is a system of limestone and dolomite beds and is the main source of potable water in Volusia County (Phelps, 1990).

The top of the Floridan Aquifer, under northern Mosquito Lagoon, is found at -23 meters in reference to mean sea level (Woodward-Clyde Consultants, 1994).

The two largest municipalities adjacent to the MLAP boundaries are New Smyrna Beach and Edgewater. The raw water supply for the Utilities Commission of New Smyrna Beach is derived from 19 deep wells obtaining groundwater from the Floridan Aquifer (Phelps, 1990). Groundwater for the city of Edgewater is also drawn from the Floridan Aquifer from two well fields comprised of ten wells (City of Edgewater, 2007).

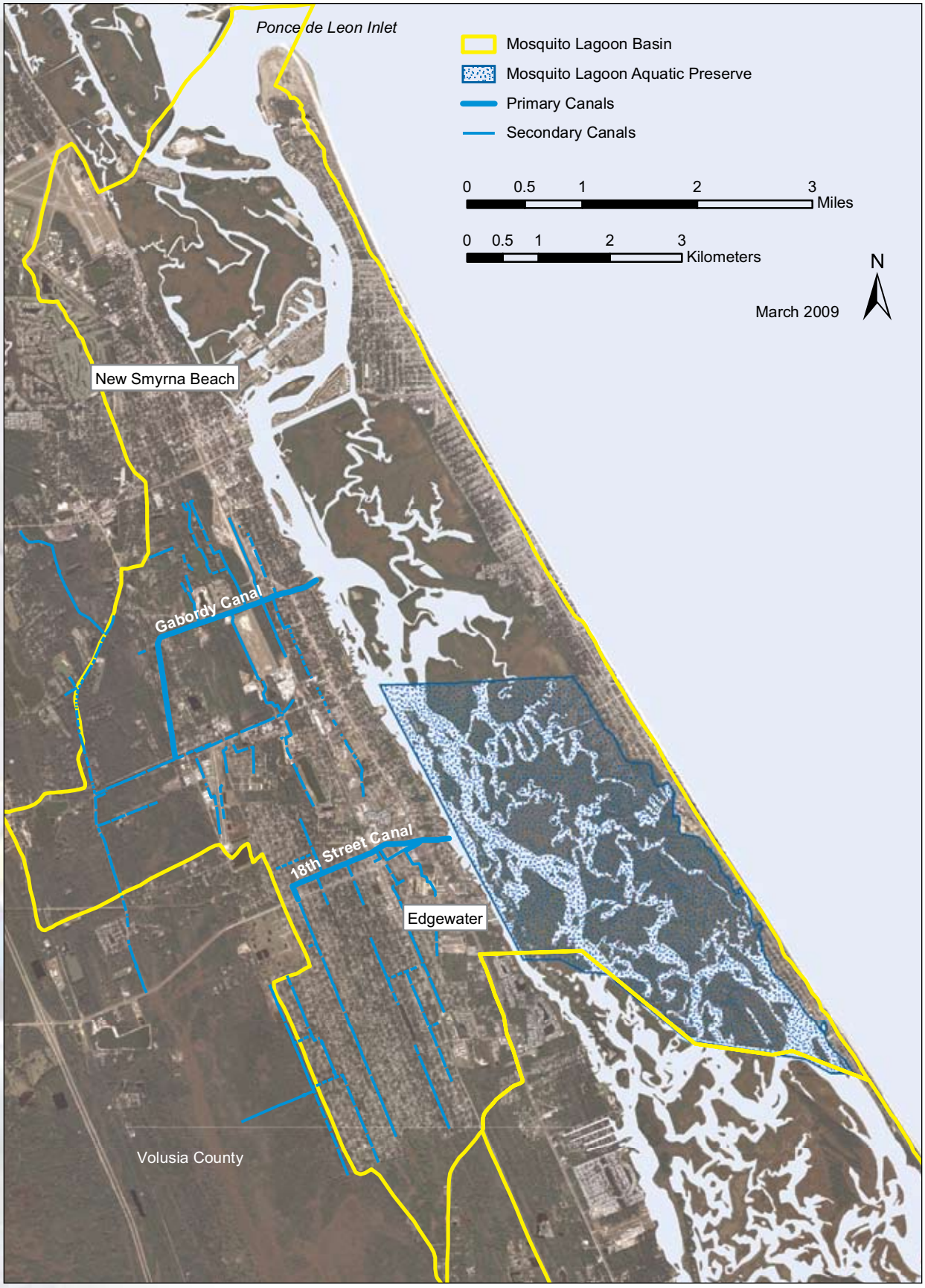
Surface Water Quality and Monitoring

Water quality monitoring is necessary to determine that water bodies meet public health standards, will support fisheries and maintain standards to meet their specific designations such as OFW and Shellfish Propagation and Harvesting (Class II Waters). Besides providing a general summary of the condition



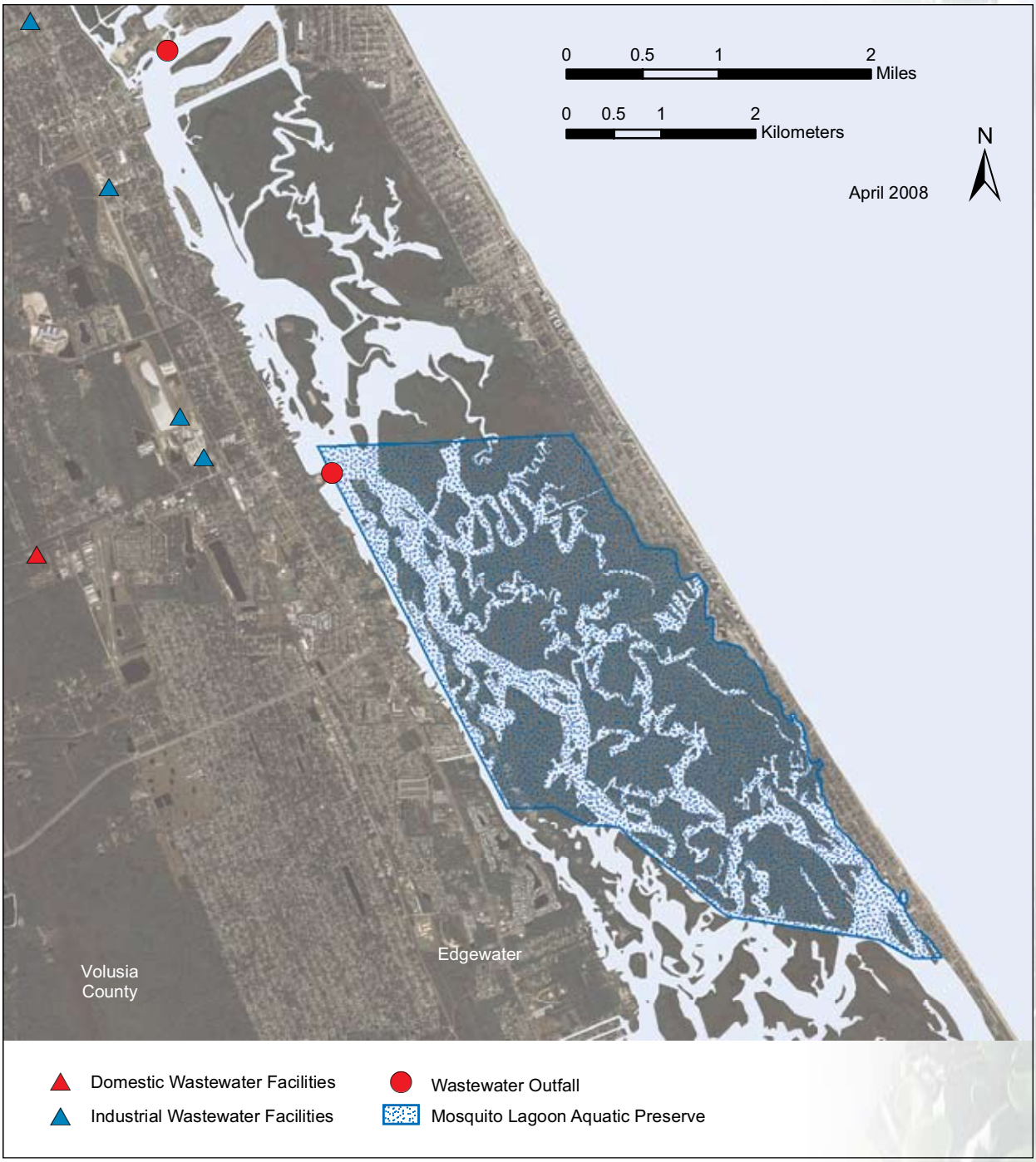
Map 6 / Aquaculture Zones within Mosquito Lagoon Aquatic Preserve

of water quality, monitoring can identify seasonal, as well as shorter and longer-term trends, specific pollution sources or events, freshwater inflows and pollutant loadings, and is essential for State Total Maximum Daily Load determinations.



Map 7 / Mosquito Lagoon Aquatic Preserve Drainage Basin and Water Conveyence Canals

Parameters, such as water temperature, are measured to gauge the effect of the solubility of oxygen, the rate of photosynthesis, and the metabolic rates of numerous aquatic organisms. Dissolved oxygen is essential for the survival of fish and other aquatic organisms and indicates the amount of oxygen dissolved in a body of water. Turbidity provides a measure of water clarity, as it is affected by the amount of suspended solids in the water column. Suspended solids range from clay, silt, topsoils and plankton to industrial and agricultural wastes and sewage. Turbidity increases when suspended solids are carried into water bodies by wind, rain and runoff. These sediments can severely limit the amount of sunlight penetrating the water column, thus affecting seagrasses. Salinity values specify the total concentration of salts in the water. Salinity values fluctuate according to volumes of seawater entering through inlets and freshwater inputs from tributaries, rain, stormwater and groundwater seepage. Long-term analysis of each water quality parameter helps to establish a clear picture of the status and trends in water quality within the MLAP.



Map 8 / Location of Wastewater Outfalls in the Mosquito Lagoon

See Section 4.2.2 for more information on the Volusia County Environmental Health Laboratory that collects water quality data in the MLAP, and Section 4.2.1 for information on the historical water quality data set.

Historic Hydrologic Alterations

Since humans first inhabited Florida, manmade alterations have occurred throughout the region to provide crops, dispose of waste, aid navigation, drain floodwaters, raise land elevations with fill for building construction, mosquito control, provide access to the barrier islands and stabilize tidal inlets. These projects have substantially changed the topography and physical features of the lagoon, including infiltration, runoff, shallow-aquifer storage and land drainage capacities (Walters et al., 2001). Long-term efforts throughout the Mosquito Lagoon basin by Volusia County and St. Johns River Water Management District to reconnect mosquito impoundments with culverts or removing dikes to allow tidal exchange have almost been completed. Progress on restoring natural functions to dragline-ditched wetlands is underway.

Major human-induced changes that have historically altered the hydrology of the Mosquito Lagoon include:

1. the Atlantic Intracoastal Waterway (AIWW);
2. Haulover Canal constructed in the 1850s, which connected Mosquito Lagoon to the northern IRL;
3. mosquito impoundments, which isolated large tracts of wetlands from the lagoon;
4. residential navigation canals and drainage canals;
5. causeways; and
6. lands created by dredge and fill activities.

Hydrologic Restoration Projects

The New Smyrna Beach City Marina has a stormwater retrofit project underway to install a baffle box that will capture runoff from three existing outfalls servicing a 20 acre (0.08 km^2) basin discharging to the Mosquito Lagoon (Paulic et al., 2006). The City of Edgewater has identified the need for retrofit improvement projects for the Gabordy Canal and 18th Street Canal to reduce impacts caused by these canals as they discharge into the Mosquito Lagoon and the Intracoastal Waterway (Professional Engineering Consultants, 2007).

It is anticipated that the U.S. Army Corps of Engineers (ACOE) will soon dredge muck material from the AIWW as part of its channel maintenance program. During a 1989 survey, very little muck sediment was found in the Mosquito Lagoon except between New Smyrna Beach and Oak Hill (Trefry et al., 1990). The AIWW, in the vicinity of the MLAP has been maintenance dredged in several different events during the last several years. The section of the AIWW including the Haulover Canal and the AIWW for about five miles north was completed in 2001. This dredged material was placed in an upland Dredged Material Management Area located in Scottsmoor/Mims area. The section of the AIWW from the State Road 44 Bridge in New Smyrna to about 17 miles south in southern Edgewater was maintenance-dredged in 2005. The dredged material was placed in an upland Dredged Material Management Area located on the Gabordy Canal in Edgewater (D. Roach, personal communication, June 2, 2008).

Mosquito Lagoon contains approximately 20,000 acres (80.9 km^2) of salt marsh wetlands including over 6,750 acres (27.3 km^2) that were impounded to control salt-marsh mosquito populations (Steward, Brockmeyer, Gostel, Sime, & Van Arman, 2003). The restoration of approximately 1,300 acres (5.3 km^2) of dragline-impacted wetlands throughout Mosquito Lagoon is an ongoing project in partnership with the St. Johns River Water Management District, Volusia County Mosquito Control, CNS, MINWR and the East Central Florida Aquatic Preserves. The C-8 impoundment is the first permitted project located within the MLAP to be restored to historic marsh elevations. The University of Central Florida is currently collecting data on the re-vegetation of the restored marshes by utilizing plant species such as glasswort, saltwort and mangroves.

Climate

Climate plays a critical role in natural community structure and composition within the Mosquito Lagoon. The east central Florida area falls in the middle of the biogeographic transitional zone from

The Mosquito Lagoon has approximately 1,300 acres (5.3 km^2) of altered wetland habitats due to rotary ditch practices for mosquito control purposes.

warm temperate to sub-tropical (Taylor, 1993). The distribution of many tropical species is limited by temperature. Due to its central location in the state, cyclic climatic fluctuations can affect the floral and faunal compositions of Mosquito Lagoon through changes in salinity regimes, temperatures or catastrophic events such as hurricanes. Rainfall and temperature extremes in this shallow system directly modify salinity levels. For example, global weather events such as La Niña and El Niño can also rapidly change the salinity regime of this semi-closed estuarine system. In summer and fall months, tropical depressions, tropical storms and hurricanes can impact the MLAP. During the past decade several strong hurricanes have struck the east coast of Florida, including, in 1999, hurricanes Dennis, Floyd and Irene, and in 2004, hurricanes Francis and Jeanne. These storms can cause wave related erosion, flooding and increased runoff. Decreases in salinity level from fresh water runoff can cause seagrass declines. High winds and waves associated with storms increase water turbidity by re-suspending bottom sediments impacting living resources.

The year-round climate of east central Florida and Mosquito Lagoon is characterized as moderate. Average summertime temperatures may range between 91 degrees Fahrenheit (32 degrees Celsius) and 72 degrees Fahrenheit (22 degrees Celsius). Average winter temperatures may range between 70 degrees Fahrenheit (21 degrees Celsius) and 48 degrees Fahrenheit (8 degrees Celsius) (Weather Underground, 2007).

The 10-year freeze line in Florida is located south of the MLAP (Walters et al., 2001). Since the time weather has been recorded in Florida (1890), at least one extreme cold event has been recorded per decade with the exception of the 1920s (National Weather Service, 2007). In east central Florida, extended cold events affecting the flora and fauna have been reported approximately once a decade with statewide freezes occurring in 1835, 1895, 1958, 1966, 1977, 1984 and 1989, resulting in impacts to the biota and economy of Florida (National Weather Service, 2007).

Low temperature events can have drastic impacts on aquatic organisms (Taylor, 1993). Abrupt temperature changes producing frost or freezing temperatures often result in the cold stress and death of manatees *(Trichechus manatus),* fish species, sting rays, sea turtles, mangroves and seagrasses

(Gilmore, *Bullock & Berry,* 1978, Provancha, Scmalzer & Hall, 1986). In particular, three freeze events during the winters of 1984 -1985 and 1989 -1990 caused extensive damage to crops, fish and animal populations in east central Florida and killed most mangroves in the MLAP basin.

Minimum and maximum water temperatures ranging from 39 degrees Fahrenheit (4 degrees Celsius) to 93 degrees Fahrenheit (34 degrees Celsius) have been recorded in Mosquito Lagoon. Alternatively, extremely high water temperatures suppress dissolved oxygen levels and accelerate the rate at which sediments become anoxic (lack oxygen) or anaerobic (related to chemical processes that occur with little oxygen) (Windsor, 1988). This, in turn, kills many organisms, especially sessile invertebrates (animals that have limited mobility such as sea squirts) and submerged aquatic vegetation (L. Walters, unpublished data). Temperature also affects salinity levels. In the southern sections of Mosquito Lagoon, recent summer salinities have reached 55 parts per thousand for extended periods of time (Walters et al., 2001).

Due to the low elevations of the marsh systems (100 year flood plain) of the MLAP, predicted trends, including global warming or increasing ocean water levels (R.E. Brockmeyer, personal communication, 2007), would influence the habitat structure and species distribution in the lagoon. New inlet formations could also lead to changes within the system. These potential events could flood low marsh habitat and shellfish beds causing more open water habitat, drastically changing species composition. The potential effects on surrounding developed areas in low lying barrier islands could substantially alter the man-made landscape.

Natural Communities

The natural community classification system used in the current MLAP management plan was developed by the Florida Natural Areas Inventory (FNAI) and the Florida Department of Natural Resources (DNR, now DEP). The natural community types are defined by a variety of factors, such as vegetation structure and composition, hydrology, fire regime, topography and soil type. The community types are named for the most characteristic biological or physical feature (FNAI & DNR, 1990). FNAI also assigns global (G) and state (S) ranks to each natural community and species that FNAI tracks. These ranks reflect the status of the natural community or species worldwide (G) and in Florida (S). The most imperiled communities are assigned lowest numerical ranks (e.g., G1 represents the most imperiled natural communities worldwide, S1 represents the most imperiled natural communities in Florida). Appendix B.6 provides an explanation of the FNAI community types and the ranking system.

FNAI Natural Community Type	# Acres	% of Area	Federal Rank	State Rank	Comments
Consolidated Substrate	Unknown	Unknown	G3	S5	
Unconsolidated Substrate	Unknown	Unknown	G3	S3	
Mollusk Reef	Unknown	Unknown	G2	S1	
Algal Bed	Unknown	Unknown	G2	S2	
Seagrass Bed	51	1.1	G4	S4	
Tidal Marsh	1240	26.2	G3	S3	Calculation combined with tidal swamp
Tidal Swamp	1240	26.2	G3	S3	Calculation combined with tidal marsh
Composite Substrate	Unknown	Unknown	G3	S3	

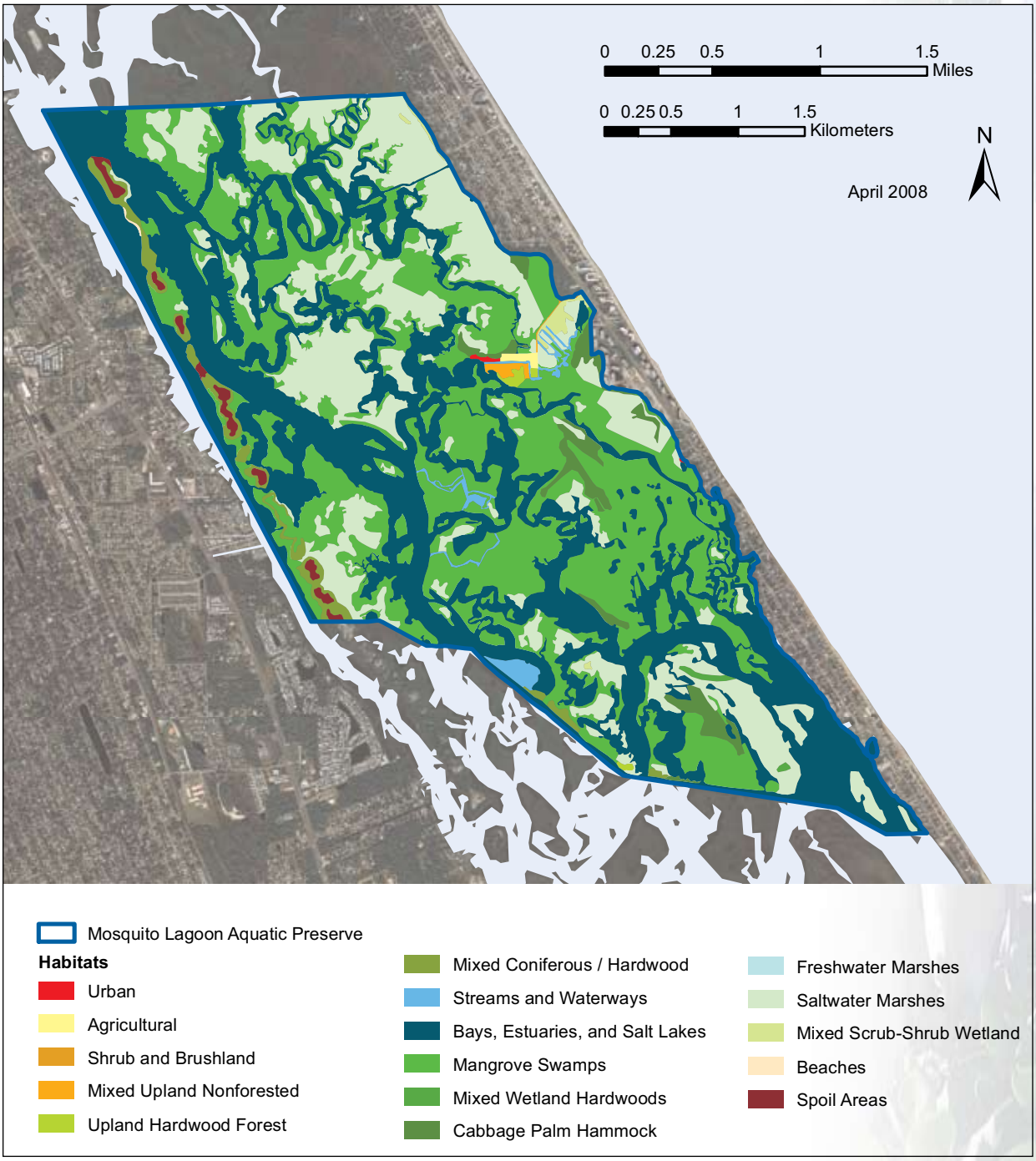
Table 2 / Summary of Natural Communities on Mosquito Lagoon Aquatic Preserve

Consolidated Substrate - (synonyms: hard bottom, coquina bottom). Consolidated substrates are mineral-based natural communities generally characterized as expansive, relatively open areas of subtidal (areas submerged most of the time), intertidal (transitional zone bounded by high tide line and low tide line), and supratidal zones (above the mean high tide and mean wrack line) which lack dense populations of sessile plant and animal species. Consolidated substrates are solidified rock or shell conglomerates and include coquina, limerock or relic mollusk reef materials. These communities may be sparsely inhabited by sessile, planktonic, epifaunal and pelagic plants and animals but house few infaunal organisms (i.e., animals living within the substrate). Consolidated substrates are important in that they form the foundation for the development of other marine and estuarine natural communities when environmental conditions become appropriate.

Unconsolidated Substrate - (synonyms: sand bottom, sand bar, mud flat, tidal flat). Unconsolidated substrates are important in that they form the foundation for the development of other marine and

estuarine natural communities when environmental conditions become appropriate. Mosquito Lagoon's unconsolidated substrate supports salt marshes, seagrasses and mollusk beds and other communities that are rich in estuarine invertebrates. While these areas can be relatively barren, the densities of infaunal organisms in subtidal zones can reach the tens of thousands per square meter, making these areas important feeding grounds for many bottom-feeding fish.

The hard clam (*Mercenaria mercenaria)* can be found throughout Mosquito Lagoon and has historically had the highest economic value of any fishery species in the IRL. The statewide commercial catch of wild-harvested hard clams, between 1987 – 2001, was 13.5 million pounds with a dollar value of over $98.9 million. This ranks the hard clam first in commercial value within the IRL, and ninth in pounds of commercially important fishery species harvested (Smithsonian Marine Station Fort Pierce, 2007b). The IRL had large larval clam sets during the early 1980s. Within the next two years, commercial fishing pressures on these wild clam populations may have reduced the species' ability to recover. Naturally occurring and disruptive conditions such as reductions in food supply, disease,



Map 9 / Natural Communities within Mosquito Lagoon Aquatic Preserve

lowered salinities caused by excessive stormwater from major storms and hurricanes or elevated salinities caused by drought conditions may have taken their toll as well.

Disturbances directly affecting unconsolidated substrates within MLAP may result from unmanaged anchorages, sunken/abandoned boats and propeller scarring from boats in shallow waters. In addition, runoff from roads, stormwater discharges and leachate from septic tanks may all contribute to sediment contamination. Significant amounts of these compounds in the sediments may kill infaunal organisms, eliminating a major food source for a variety of fish, birds and other organisms.

The preserve provides ample opportunities for the public to enjoy nature.

Mollusk Reef – (synonyms: oyster bar, oyster reef, mussel reef). Mollusk reefs are faunal-based natural communities typically characterized as expansive concentrations of sessile mollusks/bivalves occurring in intertidal and subtidal zones. In Florida, the most developed mollusk reefs are generally restricted to estuarine areas dominated by the American or Eastern oyster (*Crassostrea virginica)*, typically found growing in clusters attached to hard bottom (consolidated substrates), while hard clams are generally found burrowed into soft bottoms (unconsolidated sediments).

Mollusk reefs are a dominant community in the Mosquito Lagoon. The MLAP has large expanses of mollusk reefs along its shorelines and surrounding islands. The American oyster is a recreationally and commercially important species that occupies bottom substrates in brackish and saltwater environments.

Mollusk reefs occupy a unique position among estuarine invertebrates and have been an important human food source since prehistoric times as evidenced by numerous shell middens found throughout the Mosquito Lagoon. Mollusk reefs present a dynamic community within estuarine ecology, providing refuges, nursery grounds and feeding areas for a myriad of other estuarine organisms.

Mollusks are filter feeders, filtering up to 100 gallons of water a day. During this process they can accumulate toxins from polluted waters and harmful algal blooms. Sources of these pollutants can be from considerably distant areas, but are often more damaging when nearby (runoff, stormwater inputs and sewage). Substrate degradation and erosion can also negatively impact mollusk reef formations and occurs when silts, sludge and dredge spoils cover and bury the mollusk reefs. Declining mollusk reef populations can be expected in coastal waters that are being dredged or are receiving chemicals mixed with rainwater flowing off the land or from drainage of untreated residential or industrial sewage systems.

Natural predators impacting mollusk reefs within the MLAP include stone crabs (*Minippe mercenaria),* blue crabs (*Callinectes sapidus*), oyster drills (*Thais haemastoma*), sheepshead (*Archosargus probatocephalus),* black drum (*Pogonias cromis*) and other fishes and invertebrates.

Algal Bed - (synonyms: algal mats, periphyton mats). Estuarine algal beds are floral-based natural communities characterized as large populations of macro- or micro-algae. The dominant algal species include red, green, blue-green and brown algae. This community may occur in subtidal, intertidal and supratidal zones on soft and hard bottom substrates. Vascular plants (e.g., seagrasses) may occur in algal beds associated with soft bottoms. Sessile animals (describes marine animals with limited mobility) associated with algal beds will vary based on bottom type. Harmful algal blooms (*Pyrodinium*

bahamense and Karenia brevis) and cyanobacteria (blue green algae) have been reported in the Mosquito Lagoon. More information on recent algal bloom occurrences or monitoring efforts can be found in Chapter 4.1.2, Fecal Coliform and Dinoflagellate Monitoring.

Seagrass Bed – (synonyms: submerged aquatic vegetation (SAV), seagrasses). The FNAI definition of seagrass bed (Appendices B6) describes expansive stands of submerged vascular flowering plants occurring primarily in subtidal zones. Seagrasses are not true grasses. Unlike algae and seaweed, seagrasses are angiosperms (flowering plants). Turtle grass (*Thallassia testudinum)* and the paddle-shaped grasses (*Halophila species*) are not present in the MLAP; the MLAP is beyond the northern limit of these species' range. SAV species found in the Mosquito Lagoon include manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*) and widgeon grass (*Ruppia maritima*). Together, seagrasses and their epiphytes serve as important food sources as well as nursery areas to a myriad of species. Often, numerous species of epiphytic algae, egg casings and invertebrates attach to the seagrass leaf blades.

Shallow flats of sand, shell-hash, or mud provide important mating habitat for horseshoe crabs (photo: Marine Discovery Center).

Seagrass beds occur most frequently on unconsolidated substrates of marl, muck or sand, although they may also occur on other unconsolidated substrates or consolidated substrates. The blanket of leaf blades and rhizomes (root system) holds sediment particles in place and reduces the wave-energy on the bottom to promote settling of suspended particulates. The settled particles become stabilized by the dense rhizomes of the seagrasses. Thus, marine and estuarine seagrass beds are generally areas of soil accumulation. Other factors affecting the establishment and growth of seagrass beds include water temperature, salinity, wave-energy, tidal activity and available light. Seagrasses occur most frequently in areas with moderate currents, as opposed to little or no currents. Seagrasses require some active current or flushing, so the terminal ends of narrow tidal creeks are generally devoid of SAV cover. Although marine and estuarine seagrass beds are most commonly submerged in shallow subtidal zones, they may be exposed for brief periods of time during low tides.

Immature yellow-crowned night heron (Nyctanassa violacea) *foraging in healthy mollusk reef habitat.*

One of the more important factors influencing the seagrass community is the amount of solar radiation/sunlight reaching the plants. In general, water must not be turbid or muddy as this restricts photosynthesis, adequate light must reach the plant. In Mosquito Lagoon, the elevated levels of suspended solids may be impacting SAV by restricting the amount of light that is reaching the seagrass. When light penetration and circulation are good, seagrasses can regenerate and recover from periodic hurricane or freeze events.

Seagrass beds are extremely vulnerable to human impacts. Many seagrass beds have been destroyed by dredging or filling activities while others have been impacted by pollutant discharges from wastewater treatment plants, industrial discharges or other sources. Seagrasses may also be severely impacted by oil spills. Low concentrations of oils and greases are known to significantly affect the photosynthetic capability of seagrasses.

Seagrasses are susceptible to scarring from boat propellers, anchors and trawls. While seagrasses will recolonize areas when water quality is good and disturbances are removed, revegetation of scarred areas may require many years. Construction of traditional wooden boat docks through seagrass areas may result in a "halo" effect (area devoid of seagrass) around the dock as the result of shading by the dock or boats moored at the dock. Newer technologies, such as light penetrating, grated material have shown promise in reducing shading effects. Boat traffic to and from the dock may contribute to the halo effect as well. Seagrass beds and their associated fish and invertebrate communities, which typically grow along the shoreline in a linear fashion, can be fragmented by dock construction and formation of halos. This fragmentation inhibits vegetative (spread through shoot growth) recolonization by seagrasses.

Oysters are subject to many population pressures, one of which is attacks from natural predators like these snails.

Ruddy turnstone feeding on mudflats that support rich invertebrate diversity.

According to the St. Johns River Water Management District (SJRWMD) Surface Water Improvement and Management Plan, 2002 Update, findings from the 1999 resource assessment revealed that the Mosquito Lagoon segment, consisting primarily of the MLAP, represented the greatest loss of coverage since 1943, a 94% loss (Steward et al., 2003). Approximately 51 acres (0,21 km^2) of seagrass remains within the MLAP. Despite dramatic losses of historic seagrass coverage in the MLAP, Mosquito Lagoon overall has one of the more extensive seagrass coverages in the IRL system. Please refer to the monitoring results section in 4.1.2, Current Status of Ecosystem Science for more detailed information.

Tidal Marsh - (synonyms: saltmarsh, coastal wetlands, tidal wetlands). Tidal marshes are floral based natural communities generally characterized as expanses of grasses, rushes and sedges along coastlines of low wave energy and river mouths. They are most abundant and most extensive in Florida north of the normal freeze line, being largely displaced by and interspersed among tidal swamps below this line. Attributable to Mosquito Lagoon's proximity to this freeze line, MLAP supports approximately 1,240 acres (5.02 km2) of tidal marsh and tidal swamp combined. Estimated acreage for the MLAP was combined due to the interspersed community composition making verification by ground-truthing surveys necessary. Black needlerush (*Juncus roemerianus*) and smooth cordgrass (*Spartina alterniflora*) are the dominant species which usually form dense, uniform stands. The stands may be arranged in well-defined zones according to tide levels or may grade subtly over a broad area, with elevation as the primary determining factor.

Tidal fluctuation is the most important ecological factor in tidal marsh communities, cycling nutrients and allowing marine and estuarine fauna access to the marsh. This exchange helps to make tidal marshes one of the most biologically productive natural communities in the world. A myriad of invertebrates and fishes, including most of the commercially and recreationally important species such as shrimp (*Panaeus spp*.), blue crab, oysters, sharks (*Carcharhinus spp*.), grouper (*Epinephelus spp*.), snapper (*Lutjanus spp*.) and mullet (*Mugil spp*.), also use tidal marshes throughout part or all of their life-cycles.

Tidal Swamps - (synonyms: mangrove forest, mangrove swamp). Tidal swamps are floral-based natural communities characterized as dense, low forests occurring along relatively flat, intertidal and supratidal shorelines of low wave energy along north and central Florida. The dominant plants of tidal swamp natural communities in Florida are red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*) and buttonwood (*Conocarpus erectus*). Generally in south Florida these four species can be distributed by elevation or zones defined by varying water levels, with red mangrove occupying the lowest zone, black mangrove the intermediate zone and white mangrove and buttonwood the highest zone. In the MLAP, zonation of mangrove species is rare in part because sections of Mosquito Lagoon are microtidal. Buttonwoods are the species generally found at slightly higher elevations.

Early fall is marked by red mangrove trees loaded with propagules (seeds) which will travel along the estuary to establish new mangroves.

The prop roots of red mangroves, the extensive pneumatophores (aerial roots) of black mangroves and the dense root mats of the white mangrove serve to entrap sediments and recycle nutrients from upland areas and from tidal import. This process serves in “island formation” and is a part of the successional process involved in land formation in north and central Florida. These root structures also provide substrate for the attachment of and shelter for numerous marine and estuarine organisms.

Temperature, salinity, tidal fluctuation, substrate and wave energy are five physical factors influencing the size and extent of tidal swamps. Red mangroves require an annual average water temperature above 66 degrees Fahrenheit (19 degrees Celsius) to survive. They do not tolerate temperatures below freezing or temperatures which fluctuate widely over the course of a year. Saltwater is a key element in reducing competition from other plants and allowing mangroves to flourish. In addition, mangroves have adapted to the saltwater environment by either excluding or excreting salt from plant tissues. Mangroves can survive in fresh water but are usually not found in large stands under such conditions in nature because they succumb to competition. Tidal swamps are closely associated with and often grade into seagrass beds, unconsolidated substrates, tidal marshes, shell mounds, coastal berms, maritime hammocks and other coastal communities. Seagrass beds and unconsolidated substrates are usually found in the subtidal regions surrounding tidal swamps.

The tidal swamp communities are very productive systems because they function as nursery grounds for most of the state’s commercially and recreationally important fishes and shellfish. These natural communities are also the breeding grounds for substantial populations of wading birds, shorebirds and other animals. The continuous shedding of mangrove leaves and other plant components produce as much as 80% of the total organic material available in the aquatic food web. Additionally, tidal swamps help protect other inland communities by absorbing the brunt of tropical storms and hurricanes. Tidal swamps within the MLAP continue to be areas of environmental concern because many acres were destroyed through diking and flooding, ditching for mosquito control, and dredging and filling activities.

Composite Substrate - Composite substrates consist of a combination of natural communities such as “beds” of algae and seagrasses or areas with small patches of consolidated and unconsolidated bottom with or without sessile floral and faunal populations. Composite substrates may be dominated by any combination of marine and estuarine sessile flora or fauna or mineral substrate type. Typical combinations of plants, animals and substrates representing composite substrates include soft and stony corals with sponges on a hard bottom such as coquina outcrops; psammophytic (grows in sand or sandy soil) algae and seagrasses scattered over a sand bottom; and patch reefs throughout a

coralline algal bottom. Any of the remaining natural communities can grade into composite substrate communities. Although composite substrates can occur in any marine or estuarine area in Florida, some combinations are common while others are extremely rare. Combinations of consolidated and unconsolidated substrate components offer the greatest opportunity for diversity, and should be high priority areas for protection. Management requirements are negligible, providing the composite community is adequately protected. Protection efforts will vary slightly based on components of the composite substrate community. Generally, degradation of physical and chemical water quality parameters should be prevented, as well as mechanical disturbance from anchoring, dredging, trawling and similar activities. Several common activities within the Mosquito Lagoon that can alter the natural diversity of estuaries include aquaculture, vessel beaching and blowouts from boat jets or propellers.

Bobcats (Felis rufus) *may occasionally be seen prowling the uplands around the Mosquito Lagoon Aquatic Preserve.*

Fiddler crabs serve an important role in the ecology of salt marshes and serve as an environmental indicator as they are sensitive to environmental contaminants, especially insecticides.

Native Species

East central Florida consists of diverse ecosystems, including beach dunes, pine flatwoods, estuaries, freshwater and tidal marshes and tidal swamps. These ecosystems provide clean air, drinking water, stable soils, flood protection, recreation and beauty. Within each ecosystem, native plants are critical sources of food, shelter and breeding areas for wildlife. Many species have evolved depending on specific native plants or habitats. Surrounding natural upland and marsh communities buffer and contribute to the overall health and biodiversity of the estuarine systems.

The many small animals and insects of the saltmarsh support the larger migrant and resident species. Among the most important species in the food chain is the fiddler crab. The most common fiddler crab species occurring in MLAP are the Atlantic sand fiddler crab (*Uca pugilator*) and mud fiddler crabs (*Uca pugnax*). The presence of hundreds of fiddler crabs in colonies is an indication of a healthy ecosystem. Fiddler crabs are keystone species. They not only prosper in a marsh system that is healthy, they provide many services. Fiddler crabs depend on intertidal zones of salt marshes, marsh edges and tidal creeks. Their burrows aerate the soil freeing nutrients, they break up algae carpeting the surface and bury organic matter that fertilizes the soils. They are important prey items for fish, birds, raccoons *(Procyon lotor)* and other animals (Whitney et al., 2004). They can also serve as an indicator species of the detrimental effects of insecticides. Fiddler crabs are commercially and recreationally exploited as bait for recreational fishing. Many areas of the IRL have lost most of their fiddler crab populations due to a variety of causes. The fiddler crab population was negatively impacted when wetlands were impounded and drag-line ditched within Mosquito Lagoon including the MLAP boundaries. Ongoing wetland restoration efforts involving multi-agency partners may improve shoreline and high marsh habitat for fiddler crabs. Monitoring prior to the restoration and post restoration will provide valuable insight into the values added to the entire food web through restoration efforts,

A commercially important invertebrate found in the IRL is the blue crab. Blue crabs, like other swimming crabs, have adapted a last pair of walking legs into paddle-like swimmerets. Blue crabs also have three pairs of walking legs, and a powerful set of chelae/claws. Blue crabs are considered estuary dependent because they reproduce there. Blue crabs migrate within the estuary and use different regions depending on season and salinity level.

Snail species are one of the predominant predator species in the mollusk reefs and emergent plant communities. Several types of snails, such as whelks (*Busycon spp*.), moon snails (*Polinices duplicates*) and oyster drills, prey on all sizes of commercially important bivalves/mollusks. One type of snail that commonly preys on mollusks in the estuary is the oyster drill. These drills are small carnivorous snails that inhabit the shallow waters of the Mosquito Lagoon. Oyster drills are very effective hunters which feed mainly on bivalves but can also penetrate the defenses of barnacles, periwinkles and when times get tough even other snails.

The neotropical killifish, formerly known as the mangrove rivulus (*Kryptolebias marmoratus*) reaches a length of approximately two inches (4.9 cm) and is widely distributed but locally rare within coastal south and central Florida. In eastern Florida, this species prefers unimpounded, high marsh habitats inside the burrows of the great land crab (*Cardisoma guanhumi)*. Within the IRL, the neotropic killifish prefers the high marsh above the intertidal zone, which floods seasonally, after very high tides or by heavy rainfall. Habitat alteration has affected the species throughout the state, especially on the east coast where the destruction of mangroves and impounding of high marsh for mosquito control has altered and fragmented suitable habitat.

Important game fish species include red drum, spotted sea trout (*Cynoscion nebulosus*), snook (*Centropomus spp*.) and ladyfish (*Elops saurus*). Mosquito Lagoon is touted as a world famous red drum fishing habitat by recreational fishermen. Red drum inhabit estuarine, nearshore and offshore waters, depending on age and size. Typically, juveniles utilize estuaries as nursery grounds for several years until they attain 30 inches (73.5 cm) in length. They then migrate to nearshore and offshore coastal waters to join spawning adults. Mosquito Lagoon and other parts of the IRL

Redfish are one of the most sought after catches in the preserve for both commercial and recreational anglers (photo: Doug Adams, FWC-FMRI).

An Atlantic bottlenose dolphin frolicking in a boat wake (photo: NASA).

The preserve offers prime feeding habitat for sea turtles (photo: NASA).

are exceptions to the migratory rule, potentially due to higher salinity levels or behavioral adaptations. Red drum eggs require a sufficiently dense medium (higher salinity) for buoyancy. Dr. Grant Gilmore and other scientists believe that there is a resident red drum population in the Mosquito Lagoon (Levine, 2008). In the MLAP, on some night-time excursions, you can hear the drumming of spawning redfish from above the surface of the water.

Recent studies indicate that there is a resident population of Atlantic bottlenose dolphins (*Tursiops truncates*) utilizing the Mosquito Lagoon region. "Analyses of dolphin ranges amongst or between three study regions were based on…photo-identification data collected between 1996 – 2003… There was virtually no overlap in range between the dolphins sighted in these three areas. It thus appears that these dolphins may represent separate subpopulation units within the IRL system" (Mazzoil, McCulloch & Defran, 2005).

Listed Species

Listed species are those which are listed by the FNAI, U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), Florida Fish and Wildlife Conservation Commission (FWC) and the Florida Department of Agriculture and Consumer Services (DACS) as endangered, threatened or of special concern. Listed species includes any species that are determined to be in danger of extinction or likely to become extinct within the foreseeable future throughout all or a significant portion of its range based upon the best scientific and commercial data available. States and/or federal agencies provide special protection and conservation measures to promote recovery of a listed species. A major distinction between the federal and Florida Endangered Species Acts (ESA) is that federal authorizations and intent (ESA, Section 2(a)), include provisions providing a means to conserve the ecosystems upon which listed species depend (conserve is defined under the ESA, as all measures and procedures needed to delist a species).

Twenty-eight plant and 65 vertebrate species listed as endangered, threatened, species of special concern, or FNAI–designated, potentially inhabit the MLAP or surrounding areas (See Appendix B-3, species list). These species may spend some portion of their time in the uplands, beaches, islands, waters or associated wetlands of Mosquito Lagoon (Epstein & Blihovde, 2002). Specific management strategies for listed species preservation are addressed in Chapters 3 and 4 of this plan. All MLAP management actions are in compliance with the federal recovery plans for these species and, when necessary, in accordance with all permitting and agency consultation requirements.

Florida has more threatened and endangered native species than any state except California and Hawaii. Rapid human population growth in Florida increasingly stresses species that are dependent on coastal habitats. Listed species can become threatened due to habitat destruction, over-utilization, disease or natural or manmade factors. Species such as the state and federally-endangered green sea turtle (*Chelonia mydas*) and Atlantic saltmarsh snake (*Nerodia clarkia taeniata*) found within Mosquito Lagoon have been impacted by habitat destruction and alteration, as well as other man made impacts. Loss of seagrass and algal beds affect food supplies for juvenile green sea turtles. In addition to sea turtles foraging in the lagoon, three sea turtle species nest on the adjacent CNS ocean beaches and surrounding municipal beaches.

Atlantic salt marsh snake literature is limited. The reason cited by FWS for the current species status is that extensive drainage and development within the coastal zone has reduced the available habitat of this species. Continued filling of coastal wetlands will further limit the range of this already restricted reptile. Additionally, creating impoundments in marshlands for mosquito control may eliminate habitat by changing water salinity. There is also a concern that habitat disturbance within these regions may have broken down natural isolating mechanisms between the Atlantic salt marsh snake and the adjacent freshwater snake (*Nerodia fasciata pictiventris*). This breakdown may be responsible for hybridization between these species (FWS, 1993). The snake is difficult to detect in saltmarshes making state or federal regulatory protection of individuals and the occupied habitat difficult. Currently, Florida Institute of Technology scientists are conducting research on range and taxonomic status of the snake within CNS (J. Stiner, personal communication, January 14, 2009).

Loss of breeding and feeding habitat to urban development of saltmarsh and freshwater wetlands has stressed recovering colonial waterbird species: wood stork (*Mycteria americana*), little blue heron (*Egretta caerulea*), reddish egret (*Egretta rufescens*), snowy egret (*Egretta thula*) and white ibis (*Eudocimus albus*). Current recreation on and around islands and shoals in the MLAP and surrounding areas continue to negatively impact waterbird colonies.

The American oystercatcher (*Haematopus palliatus*) is a large, conspicuous shorebird with a bright red beak found in coastal salt marshes and sand beaches. One of the few birds to specialize on bivalve mollusks living

in saltwater, this species is completely restricted to marine/estuarine habitats. The species feeds mostly by sight, preying upon oysters, clams and mussels but it also probes for marine worms and other food items in the intertidal zone. Although the oystercatcher inhabits coastal areas where human encroachment, habitat loss and destruction are threats, this species adapts well to spoil islands and is often the most common breeder in such locations. It is believed that there is a resident nesting population of American oystercatchers within the MLAP and CNS but further study is warranted. American oystercatchers nest on sandy dunes, salt marsh islands and spoil islands, building nests well above the high tide mark. Future population success will depend on its coexistence with humans in salt marsh and dune areas and possibly on the mitigation of factors affecting potential increases in sea level (Nol & Humphrey, 1994). The U.S. Shorebird Conservation Plan designates the American oystercatcher as a "Species of High Concern," due to low relative abundance, threats on breeding grounds, threats on non-breeding grounds and rather restricted non-breeding distribution. The American oystercatcher is listed as a Species of Special Concern in Florida (Audubon Watch List, 2007).

Manatees can be seen eating, sunbathing and resting throughout the preserve (photo: NASA).

The Florida manatee (*Trichechus manatus latirostris)* experiences low natural adult mortality, although the species population is impacted by man-made alterations to estuarine and freshwater systems and by fast moving boat traffic in the waters where the species breeds, sleeps and feeds. The Mosquito Lagoon serves as a travel corridor and supports a resident population during most seasons. A study conducted in 1998 in Haulover Canal just south of the MLAP documented larger manatee aggregations in the canal during spring months (158 manatees) than winter months (32 manatees) (Tyson, 2001). This is consistent with aerial surveys of the region performed during the same year. South of the MLAP in Brevard County, a two day synoptic survey count during March in MINWR, North Banana River Sanctuary, documented a record count of 700 manatees (Florida Fish and Wildlife Conservation Commission, 1998). It also is a relatively short distance from two warm water aggregation sites (Florida Power and Light Cape Canaveral Power Plant and Reliant Energy Power Plant, Frontenac) from which manatee forage during warm spells in winter. One well-known aggregation and viewing area is located within the MLAP at Mary McLeod Bethune Beach Park. Although survival and reproduction rates are adequate in a small portion of its range, survivability studies indicate a cause for concern for the species population in the Atlantic region of Florida. Approximately 50% of Florida's total manatee population remains static or is experiencing decline (FWS, 2001). Declining water clarity and seagrass beds in the MLAP are of concern when considering support of the manatee population.

Rare in most of Florida, roseate spoonbills (Platalea ajaja) *are commonly seen roosting and feeding in the preserve (photo: Marine Discovery Center).*

Invasive Non-native Species

Introduction of non-native species in Florida was accelerated with the arrival of Europeans, sailors and early settlers (Austin, 1978). They brought with them animals, fruits, vegetables and landscape plants from around the world. Exotic species are, by definition, organisms that have moved beyond their natural geographical range either via human induced, accidental or purposeful introductions. Invasive species are known to have a negative impact on the ecosystem of a particular habitat or another species. Global commerce has provided increased opportunities for biotic invasions (Jacoby, Walters, Baker & Blyler, 2003). Some of these foreign invaders come to our shores as seeds adrift in the ocean. Additionally, cargo ship bilges introduce invasive marine species. New invasive species are still arriving today. News stories frequently shock the Florida public with tales of imported venomous snakes arriving in potted plants at department stores or monitor lizards (*Varanus niloticus)* becoming established on Sanibel Island. Florida is second only to Hawaii in the number of established invasive species (Simberloff, 1994). The threats invasive species pose to biodiversity and natural ecosystem function translate directly into negative economic consequences. The costs for control measures and economic losses due to crop failure, forest loss and effects on fisheries have been well documented (Jacoby et al., 2003).

It is hardly a coincidence that the two states with the most severe non-native species problems are Florida and Hawaii. Florida fulfills both of the criteria for invasion described by Simberloff (1994): 1) habitats created and disturbed by humans and 2) islands. The Florida peninsula forms an island habitat. Much of the state consists of a patchwork of habitats resulting from human activities such as agriculture, water management, dredging and filling and residential development. Due to the lack of naturally limiting predators, unoccupied niches or where an introduced species outcompetes native species, invasive plants are dominating ecosystems in many areas of Florida (Haller & Sutton, 1975).

The South Florida Restoration Science Forum website (www.sofia.usgs.gov/sfrsf), states that preventing invasion or establishment of noxious species is more cost-effective than post-establishment control. The most effective means of prevention would be prohibitions on import and sale of invasive species. Prohibition would have effects on commerce and trade and likely would be detrimental to the economy. An impending threat is the further development of global free trade (Yu, 1996).

Terrestrial Animal Species

Black rats (*Rattus rattus*) are established on wetlands and on islands within the MLAP and can be detrimental to recreational campers, native bird species and other ground or arboreal nesters. Armadillos occasionally are found on islands within the Mosquito Lagoon; however, they have not caused extensive damage to native habitats.

Two species of fire ants are found in Florida. Most notorious is *Solenopsis invicta*, the red imported fire ant (RIFA), followed by the much less common *S. geminata*, the tropical or native fire ant. RIFA was first introduced from Brazil into either Mobile, Alabama or Pensacola, Florida between 1933 and 1945. Since the introduction of RIFA, it has become a major agricultural and urban pest throughout the southeastern states. In addition, fire ants cause both medical and environmental harm. Opportunistic feeding on young tender plants by RIFA occurs throughout the year and can cause significant damage not only to soybean crops but citrus, corn, okra, bean, cabbage, cucumber, eggplant, potato, sweet potato, peanut, sorghum and sunflower. Monetary losses occur when RIFA interfere with the root system of the plant, mechanically disable combine operation or feed on the young growth of plants to reduce stands (Stimac & Alves, 1994). The human toll from RIFA stings is an important public health concern. Stings may produce a swelling leading to anaphylactic shock (Collins & Scheffrahn, 2001).

RIFA have been reported to reduce ground-nesting populations of rodents and birds. In certain instances, RIFA may completely eliminate ground-nesting species from a given area. Because there is a 10 to 20 year lag before reductions in bird populations are observed, it has been suggested that actual effects of RIFA on animal populations may be underestimated (Mount, 1981). The cost associated with the control of RIFA is significant. State and federal agencies have spent more than $250 million in order to control or eradicate this fire ant.

Aquatic Species

An invasion of a non-native species has been classified as “the second most important threat to native species, behind habitat destruction” (Ecological Society of America, 2009). Introductions of non-native marine invertebrates and seaweeds to coastal habitats in the United States have increased one hundred-fold in the last 200 years (Jacoby et al., 2003). Introduction of non-native species are both deliberate and accidental.

Ships transport living organisms across oceans and between coastlines, from fouling organisms on their hulls to species living in ballast water (Jacoby et al., 2003). Saltwater species from four communities are generally spread from ballast waters: plankton, nekton, fouling organisms and benthic organisms. Other potential activities that may cause the spread of non-native organisms are the movement of navigation buoys, marine floats, dry docks, drilling, treasure hunting platforms and seaplanes. Disposal of dredge spoil, beach nourishment materials and equipment may also be responsible for transporting non-native species (Jacoby et al., 2003). The MLAP is several miles from an international port facility (Port Canaveral), but could be impacted by vessels or commercial traffic traveling the AIWW channel, utilizing nearby marinas or vectors transported through Ponce de Leon Inlet.

The invasive green mussel (Perna viridis) has been found in the Mosquito Lagoon within the boundaries of Canaveral National Seashore (photo: Buck Albert, USGS).

Florida is second only to California in the number of non-native fish species. Twenty-one non-native species of fish have been documented in east central Florida, however the majority of these are primarily fresh water species. Fish species such as tilapia (*Tilapia spp*.) are able to breed and survive in both fresh and brackish systems and are known to be established in the IRL. Historically, non-native fish species were introduced through the commercial fish farm industry accidental release and aquarium release, while bait bucket and stocking were minor contributors.

In the IRL, a number of invertebrate species have invaded in recent years. For example, the Australian spotted jellyfish (*Phyllorhiza punctata*) was first documented in the summer of 2001 (Smithsonian Marine Station at Fort Peirce, 2001). This species is known for its voracious ability to consume zooplankton, including fish larvae. Other IRL invaders include crabs (*Scylla serrata* and *Charybdis hellerii)*. It is not known if reproductive populations of either of these crabs are still present in the lagoon.

Preserve staff clips small, exotic invasive Australian pines as the first step to permanent removal.

The charru mussel (*Mytella charruana*) now appears to be established within the Mosquito Lagoon (The Nature Conservancy, 2006). Although first observed in 2004 (Boudreaux, Stiner & Walters, 2006), as of April 2007, charru mussel numbers were declining where they previously occurred in Mosquito Lagoon. Focused efforts to collect specimens had yielded only about 600 animals since the species was discovered in the region (Smithsonian Marine Station, 2007a). The first report of the charru mussel on the east coast of Florida occurred in 1986, in Jacksonville. Large numbers of mussels fouled intake pipes of a power plant on the St. Johns River. A nearby port with Venezuelan tanker traffic was implicated as the agent that transported the non-native species. The population subsequently died off. The species may compete with important native oyster populations already in decline (Boudreaux et al., 2006). Another non-native invasive bivalve is the Asian green mussel (*Perna viridis*). This species is pervasive in parts of upper Tampa Bay and is present in high numbers in Jacksonville. As of March 2008, less than 12 individuals of Asian green mussel have been found in CNS waters but new observations were reported in northern Mosquito Lagoon in late 2008 (L. Walters, personal communication, December 2008).

Plant Species

Non-native plants, imported and cultivated by Native American cultures even before European settlement (Ryerson, 1967), now threaten the state's remaining natural areas and state lands. Of the 4,012 plant species now growing without cultivation in Florida, 29% are non-native (Wunderlin as cited in Langeland & Stocker, 2000). When these naturalized non-native plants spread extensively into natural areas and dominate by displacing native plants and by disrupting natural processes such as fire or water flow, they are called invasive (Langeland & Stocker, 2000). Human disturbance of soils in native habitats allows invasive species to out-compete successional native species. The spread of invasive plant species was exacerbated by the fact that successful non-native plants that survived heat, propagated successfully, grew without pest infestations or fertilizer were shared amongst early settlers. Brazilian pepper trees were introduced in South Florida in the late 1800s as an ornamental landscape plant. Australian pines were introduced for use as windbreaks around citrus groves and crops (Marine Resource Council of East Central Florida, 1998).

The dragline ditching process produced sediment spoil piles that are prone to invasion by exotic plant species like Brazilian pepper.

The Florida Exotic Pest Plant Council maintains the list of species considered to be most invasive or potentially most invasive in Florida. Category I plants on this list are considered to be non-native invasive plants that are currently disrupting native plant communities in certain areas or throughout the state. Category II plants have the potential to disrupt native plant communities. A copy of the list of Florida's invasive plants can be obtained at the University of Florida/Institute of Food and Agricultural Science, Center for Aquatic and Invasive Plants (352-392-9614) or on the Florida Exotic Pest Plant Council web site (www.fleppc.org). CNS and MINWR are aggressively treating Brazilian pepper and a number of other non-native invasive plant species to the south of the MLAP (J. Stiner, personal communication, January 14, 2009). Coordination of future efforts between CNS, MINWR and MLAP would enhance removal efforts.

Brazilian pepper and Australian pine are the most problematic invasive plant species on shorelines, within impoundment and dragline ditch berms and on natural and spoil islands of the MLAP. Both species are at the northern extent of their range and severe invasive plant densities seen further south within the IRL are not currently observed in MLAP. This is also due to local government non-native invasive control efforts. The Volusia County Mosquito Control (VCMC) removes and maintains Brazilian pepper and other invasive plants through physical and chemical methods. These plants are not directly related to mosquito control but are often closely associated with mosquito production sites. Lead tree (*Leucaena luecocephala*) and carrotwood (*Cupaniopsis anacardioides*) are among other invasive non-native species that may be increasing in coverage in natural areas of east central Florida.

Native Nuisance or Problem Species

Problem species are defined as native species whose habits create specific management problems or concerns. Raccoons (*Procyon lotor*) are problem species particularly in public parks, recreational islands and in developed areas along the shorelines of the MLAP where they scavenge for food. They can be a problem to wildlife when populations become over abundant due to lack of predators and other population dynamics. Raccoon over-population can be detrimental through predation of nesting birds, diamondback terrapin turtles *(Malaclemys terrapin)*, sea turtle eggs on the beach and other native species.

Mosquitoes and other biting flies can be a concern for visitors to the MLAP as well as residents surrounding the area. There are approximately 42 species of mosquitoes in Volusia County of which 5 species are associated with salt marshes. These species are the land crab hole mosquito (*Deinocerites cancer*), *Culex nigripalpus*, often associated with West Nile virus, brackish water mosquito *(Anopheles*

atropos), black saltmarsh mosquito *(Ochlerotatus taeniorhynchus),* and golden saltmarsh mosquito *(Ochlerotatus sollicitans)*. The latter two mosquito species listed are the dominant mosquito species in the MLAP. Female adults lay eggs on exposed mud flats where they can remain for extended periods until submerged by rain or high tide, when they develop into larvae and eventually adults.

Organized mosquito control in Volusia County started in the late 1920s and 1930s. The focus of this work was hand-ditching mosquito production sites in the salt marshes. Methods used in the past played a major role in alteration of natural salt marsh habitats and their function. The primary focus of mosquito control in the county is the same now as it was in the past, reduce mosquito production in salt marshes by creating pathways for native fish to prey on immature mosquitoes (i.e. rotary ditching). This mosquito control method can often eliminate mosquito production completely from a site for years. If this technique is not appropriate to reduce or alter a mosquito production site, larviciding is the next best method to control immature mosquitoes. The method of last resort for mosquito control is the adulticide, a spray to control adult mosquitoes. Treating for adult mosquitoes is only done in the adjacent upland residential areas, not in the salt marshes. A combination of all of the above control techniques are used regularly in and around the MLAP.

The Volusia County Mosquito Control (VCMC) is active in restoration of salt marshes that have been spoiled upon or impounded with berms; thereby reducing their ability to perform natural marsh functions. Mosquito Control has two amphibious trackhoes that are used to level spoil areas back to natural marsh elevation. Several restoration projects have been successfully completed in CNS and Tomoka Marsh Aquatic Preserve. These leveling projects are partnerships with the SJRWMD, VCMC, CNS and MLAP.

Early settlers utilized native Eastern red cedar trees (Juniperus virginiana) *for building materials, turpentine and the pencil industry.*

Archaeological and Historical Resources

Volusia County contains many historic landmarks, including 14 sites listed on the National Register of Historic Places (Florida Office of Cultural and Historic Programs, 2007). Please refer to the website found at www/Volusia.com/history/natives to view the self-guided tour of Volusia County's prehistoric past. There are several cultural resource sites surrounding the MLAP which contain artifacts from indigenous people of Florida reflecting human habitation from 2000 B.C. to early 20th century Florida settlements.

Prehistoric sites:

The North Lagoon Archaeological District lists the following six prehistoric sites: Shipyard Island, Turtle Mound, Saltworks, Ross Hammock Midden and Mound and Cat Hammock. Archaeological surveys conducted on CNS and MINWR properties revealed 140 historic archaeological sites all in close proximity to the MLAP (J. Stiner, personal communication, 2007). Seminole Rest at Oak Hill was added to the National Register in 1997. It is one of the few remaining sites from the poorly understood St. Johns I Period (500 B.C. to 800 A.D.) in this part of Florida. It also contains components dating as far back as the Orange Period (2000-500 B.C.).

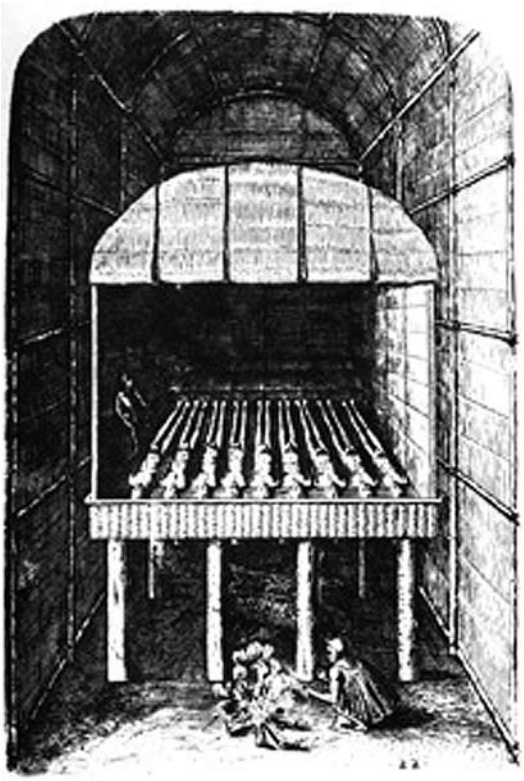
Two shell middens are most notable. Turtle Mound is the largest shell midden in the nation located in CNS. It has been estimated that the two-acre site contains over 35,000 cubic yards (26,759 m^3) of

oyster shell or 1.5 million bushels of oysters (Lelis, 2007). The mound extends over 600 feet (182.9 m) along the Indian River shoreline and currently measures over 35 feet (10.7 m) in height. Visible for miles offshore, the mound has been used as a navigational landmark since the early days of Spanish exploration. In 1605, Alvaro Mexia documented the Timucuan Indians of Surruque who launched their dugout canoes at the base of the mound. A second site in CNS is Castle Windy, the first coastal midden in Florida verified with radiocarbon dating. This site was developed around 1200 A.D. and continued to be used until 1500 A.D. The late St. Johns period inhabitants at Castle Windy were the same population who lived at Turtle Mound (Ste. Claire, 2007).

Turtle Mound is also unique botanically. Eliane Norman of Stetson University conducted a botanical survey in 1976 and recorded eight species of sub-tropical plants at their northernmost known location, although freezes in the 1980's have eliminated some of these plants (Norman, 1976).

Spruce Creek Mound is located in Spruce Creek State Park and is one of the most impressive prehistoric earthen works in Florida. The Spruce Creek Mound is situated on the banks of the blackwater stream that is a tributary to the Mosquito Lagoon. Human skeletons and status artifacts have been recovered from the mound. The huge earthen mound with its long ramp and causeway leading from the banks of the creek served as a ceremonial, social and political center for the hundreds of late St. Johns people that inhabited the lower Spruce Creek basin. The site was being actively used when Europeans arrived in the early 1500s (Ste. Claire, 2007).

Old Fort Mound, in the city of New Smyrna Beach, is mostly known for its "old fort" ruins, a misnomer for the massive, intact coquina stone foundations of an early 19th century structure that existed on-site, it is the enormous shell mound on which the "Old Fort" foundation rests that is of great antiquity" (Ste. Claire, 2007). Pottery and shards uncovered during the excavations indicate that the site was first occupied around 500 A.D. and continued to be used well into the late St. Johns period, around 1500 A.D. (Ste. Claire, 2007).



Spruce Creek Mound is one of the most impressive earthen works in Florida (photo: "The Tomb of the Weroans", drawing by John White, C. 1585).

Historic sites:

The area's first great plantation was started in 1768 by a Scotsman, Dr. Andrew Turnbull. The plantation was a 60,000-acre (24,280 hectares) land grant reaching from New Smyrna to Cape Canaveral. This plantation failed in 1778. Later plantation owners succeeded until the Seminole Indian War of 1835 when sugar plantations were burned or destroyed. Volusia, Brevard and Indian River counties were originally part of a much larger region along the central Florida Atlantic coastline known as Mosquito County. The 1830 census of Mosquito County counted only 733 residents, mostly slaves. The 1840 census stated that the only whites were soldiers stationed at New Smyrna and Fort Pierce. Neither census included the local Indian population.

Recent archaeological investigations and archival surveys have uncovered exciting evidence on the Elliot Plantation just south of Oak Hill. Contemporary with the Turnbull enterprise, it dated from approximately 1767-1779. The 2,200 acre (890.3 hectares) Elliot Plantation was the southernmost British plantation in east Florida, the terminus to the Kings Road and site of Florida's oldest still-standing sugar-processing facility (J. Stiner, personal communication, January 14, 2009).

African-American heritage:

The MLAP is historically important to African-American heritage because of its proximity to the historic location of the pioneering settlement known as Freemanville, located just north of Mosquito Lagoon in the modern day city of Port Orange. Freemanville was an 1866 settlement of former slaves.

The Mosquito Lagoon Aquatic Preserve is part of the Florida Circumnavigational Saltwater Paddling Trail. Kayakers can access this trail from Menard-May Park in Edgewater.

Another more recent important African-American heritage historical site, the Harry T. Moore House, is located in Mims, Florida, just southwest of the MLAP. Harry T. Moore is a nationally significant African-American historical figure credited with being the first civil rights activist of the modern civil rights era, who settled in Mims, Brevard County. He founded the first branch of the National Association for the Advancement of Colored People in Brevard County. In 1945, he founded the Florida Progressive Voters League. A December 25, 1951 bomb attack killed Moore and his wife. Harry T. Moore is considered to be the first martyr in the modern civil rights movement.

Clifton Colored School, dating to the late 1890's was one of the first schools in Brevard County for African-American students. The remains of the school were located several years ago north of Haulover Canal not far from the banks of Mosquito Lagoon.

Modern sites:

The southern extent of Mosquito Lagoon and surrounding region is culturally and economically significant as it is owned and co-managed by the United States government as Kennedy Space Center, MINWR and CNS. Many historic space program events have taken place since the 1960s, when humans first embarked on manned space flight. The achievements and events of today will be a part of tomorrow's historic record of the U.S. space program.

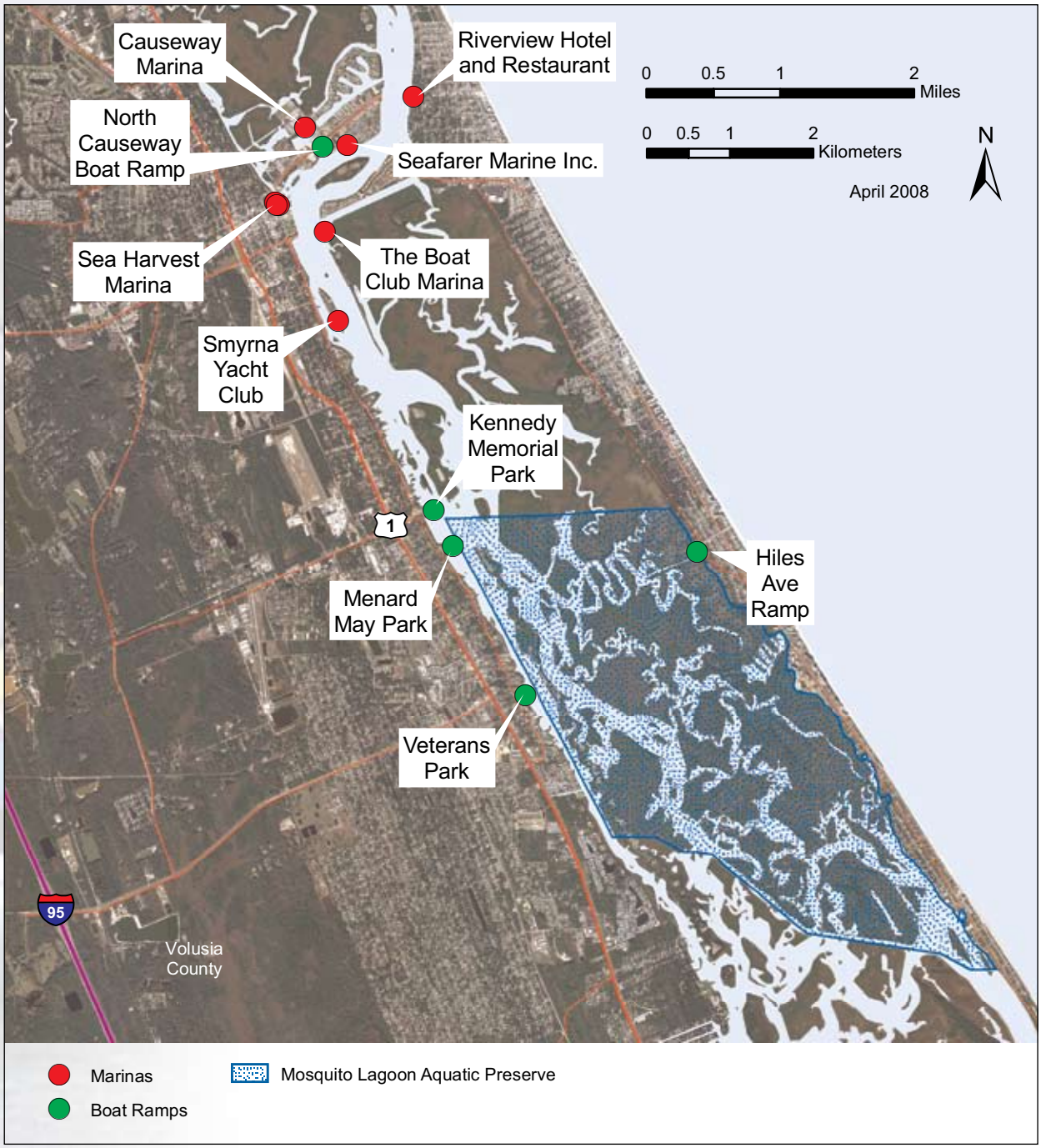
Helpful Hints for a Great Visit

Information to make any visit to the MLAP more enjoyable. Mosquitoes can be very bothersome but here are some tips. The saltmarsh mosquito may bite at any time of day but is most active during the warmest part of the day. The black saltmarsh mosquito bites mainly in the cooler hours of the morning and dusk. Remember, mosquitoes are attracted to dark colors, wear light-colored long sleeved shirts, long pants and a hat if you plan to be out at times or in areas frequented by mosquitoes. Avoiding shade during the warm part of the day can help too. Carry plenty of mosquito and no-see-um repellent, just in case. There are new fish-friendly products on the market. Other safety gear might include watershoes in case you have to get out of a boat in oyster reef habitat. Refer to Section 3.1.3 – Resource Description, Nuisance or Problem Species for more information.

Other Associated Visitor Resources

The MLAP is surrounded by scenic vistas and offers visitors numerous opportunities to view wildlife up close. Several municipal and county parks located along the eastern and western shorelines of the Mosquito Lagoon provide access to abundant natural resources. Visitors to the MLAP can almost be guaranteed to see turtles, manatees, dolphins and a wide variety of bird life.

The MLAP is part of the Florida Circumnavigation Saltwater Paddling Trail Segment 22, also known as the Space Coast Saltwater Paddling Trail. This paddling trail was designated by DEP's Office of Greenways and Trails. A map with the paddling trail can be accessed at www.volusia.org/parks/trails.htm. Paddlers can reach the MLAP and the trail at various locations both beachside and on the mainland (see Map 10). Indian River Lagoon Park in New Smyrna Beach and Mary McLeod Bethune Park in Bethune Beach provide entry points to the paddling trail from the east. The city of Edgewater on the western shoreline has Kennedy Point Park, Menard-May Park and Veterans Park which also provide access to the paddling trail.



Map 10 / Public Access Points within and near the Mosquito Lagoon Aquatic Preserve

Mosquito Lagoon and its islands provide great year-round feeding habitats for numerous wading birds. It also supports rookeries for several species of colonial nesting birds and migratory species. The MLAP is flanked on its northern and southern borders by four Great Florida Birding Trail sites. These sites provide birders with great locations to view various species that utilize different habitat types characterizing the area. These birding trails include Smyrna Dunes Park to the north of the MLAP and several sites to the south including: Riverbreeze Park, CNS and several sites at MINWR bordering the Mosquito Lagoon.

3.1.4 / Values

Florida's economic well-being is firmly linked to its marine resources. Statewide coastal communities, such as the 16 cities within Volusia County, increasingly must learn how to sustain economic viability while maintaining and restoring the environmental integrity of coastal resources. Rapid coastal population growth, a concurrent increase in recreational boating and other water-related activities and declining quality of natural environments all contribute to this challenge.

With more than one million registered recreational boats in Florida as well as 300,000 visiting vessels annually, 2,200 marinas, 8,400 miles (13,520 km) of shoreline, 7,000 lakes, and 51,000 miles (82,076.6 km) of rivers and streams, the state ranks first in the nation in boating activity.

The importance of marine interests and marine industries in Volusia County is reflected by 28 boat launch ramps, several major marinas (including Halifax Harbor Marina, the first Clean Marina on Florida's east coast), boatyards and boat manufacturing facilities such as Boston Whaler, Triton, Edgewater and Parker Boats. Approximately 80 recreational fishing guides also provide a major year-round economic impact in the area. This industry, and therefore all related commerce, is boosted by advertisements about "world famous" redfish and seatrout fishing in Mosquito Lagoon.

For decades during the 20th century, coastal development in Florida routinely resulted in damage or destruction to vast regions of natural wildlife habitat, compromising the viability of key populations of marine species found throughout Florida's natural food chains. Degradation of aquatic habitat around the state can pose future economic impacts to the state. Florida's fishermen harvested more than 90 million pounds of seafood in 2005, with a dockside value of $165 million. In Volusia County, Mosquito Lagoon has historically supported large populations of oysters and clams, as is evidenced by countless large Native American shell middens (shellfish mounds) and later profitable commercial fisheries in both clams and oysters. Mosquito Lagoon, together with the IRL, has demonstrated to be valuable nursery habitat for countless marine species of significant ecological and economic importance to Florida's

Great egrets are commonly found year round along the shorelines of the Mosquito Lagoon Aquatic Preserve.

Commercial fishing is an economically important historic use of the Mosquito Lagoon.

commercial and recreational fisheries, including shrimp, redfish, seatrout and grouper. The previously listed goliath grouper has recently seen dramatic increases in stock within local lagoon systems.

Mosquito Lagoon supports 160 species of fishes within 56 fish families and remains one of the state's most ecologically functional waterbodies, despite historic alterations and increasing local human population growth. The economic importance of the waterbody as both a nursery and feeding habitat for commercial species is important for the future especially during downturns in the economy. Volusia County seafood landings, at 1.7 million pounds (7711.1 metric tons), ranks 18th in importance for Florida. Examples of values for Volusia County offshore and inshore commercial seafood harvests for the period of 1987 through 2001 by commercial product: the hard clam, more than $3.3 million, brown shrimp (*Penaeus aztecus*), more than $3.6 million, white shrimp (*Penaeus setiferus*) more than $4.4 million and blue crab more than $5.1 million (Smithsonian Marine Station, 2007b). (Appendix E.2 contains detailed reports and information on commercial markets.) FWC maintains records on harvests throughout Florida (see the 2006 Annual Landings Summary (FWC, 2007) at www.research.myfwc.com/features/view_article.asp?id=19224).

Fish painting at Goby Fest, the annual nature festival held by our citizen support group to raise awareness about the state parks and aquatic preserves in East Central Florida.

Protection of irreplaceable coastal environments, such as MLAP, assures continued economic growth of both commercial and recreational fishing industries through protection of fishery nursery areas important to shrimp, crabs, sea turtles and a variety of economically important fish species including sea trout and red drum. Recent increases in numbers of previously declining species, such as the goliath grouper, clearly demonstrate that protected areas, such as aquatic preserves, successfully serve important biological and economic purposes.

Recognition by environmentally-aware citizens of dangers inherent in human-induced chronic environmental damage can contribute to establishment of protected areas for wildlife, including parks, sanctuaries and aquatic preserves such as the MLAP. In Florida, as the local and statewide human population continues to explode in the 21st century, the establishment and maintenance of protected areas for wildlife continues to grow in importance.

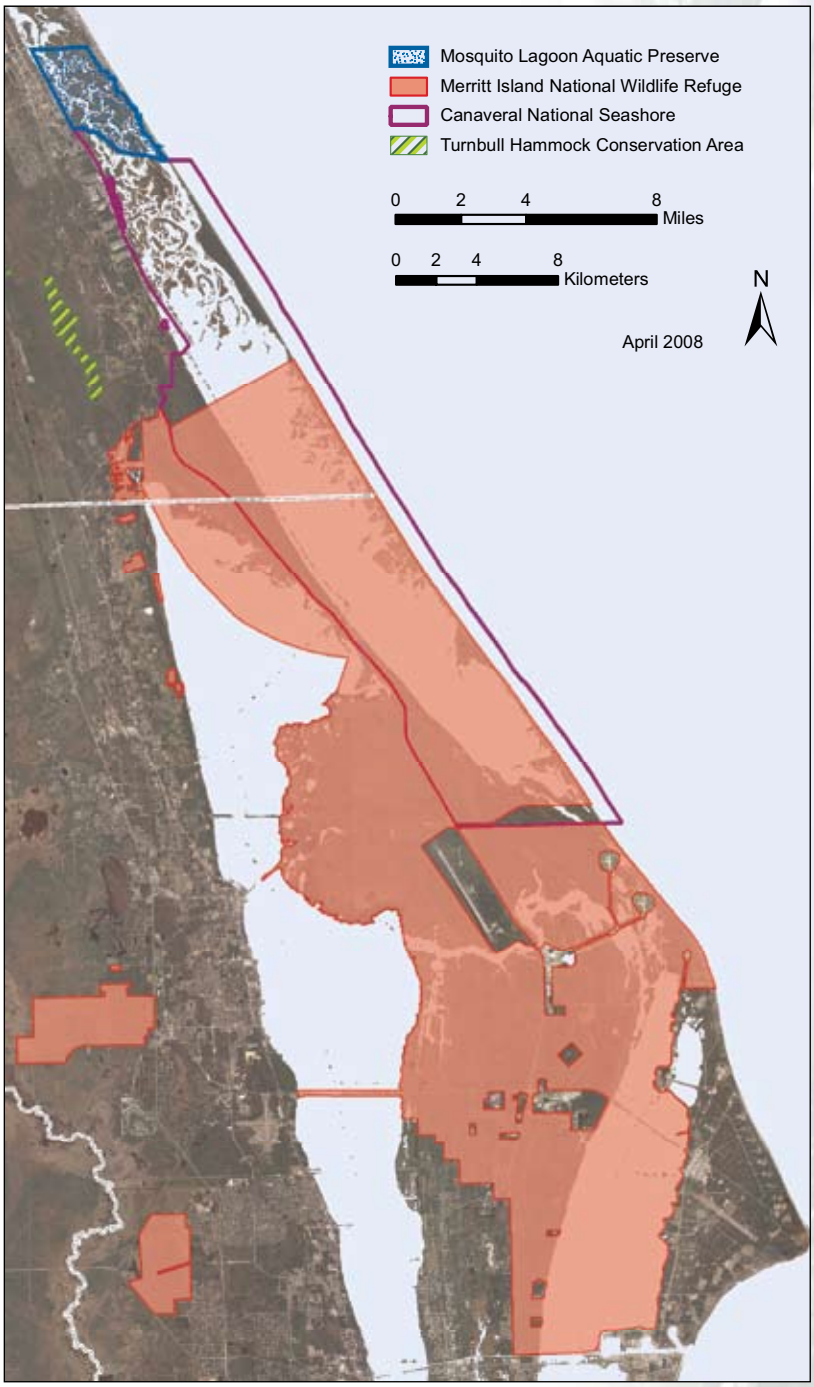
Competing uses of coastal resources have increased the number of user conflicts. In the past three years, the loss of public waterway access for recreational boaters because of rapid increases in sales of waterfront property and marine-related businesses has increased waterfront property values, but is concurrently threatening the stability and growth of boating-related marine industries. Public marinas have been privatized as condominium developments displace moored vessels. There is a growing need to foster compatible and equitable community economic development and resource management strategies, and the Volusia County Department of Economic Development is making great strides in that direction (Volusia County, 2007).

The existence of the MLAP helps buffer against negative environmental impacts that might result from coastal development. This preserve and others around Florida can help provide a much-needed "buffer zone" within which environmental compromise is far less likely to occur than in unprotected marine environments.

3.1.5 / Citizen Support Organization

The Coastal Preserves Alliance of East Central Florida (CPA) works to protect and restore natural areas that provide important habitat for endangered species and serve as the watershed of the IRL. This citizen support organization was formed in 2003, to support the St. Sebastian River Buffer Preserve, Indian River Lagoon Preserve State Park, Indian River - Malabar to Vero Beach Aquatic Preserve, Banana River Aquatic Preserve and MLAP, most of which are managed by DEP's Office of Coastal and Aquatic Managed Areas (CAMA). Since the inception of CPA, the DEP reorganized both the Division of Recreation and Parks and CAMA.

The upland areas previously established as buffer preserves under management by CAMA were transferred to the state park system and designated as preserve state parks. The St. Sebastian River Buffer Preserve was renamed the St. Sebastian River Preserve State Park (SSRPSP) and has continued to be supported by the CPA. The CPA is composed of neighbors, private business owners, artists, stakeholders and government partners providing funds for research and management efforts through fund-raising activities. CPA also serves as a means to accept donations of funds or equipment from individuals, corporations or community organizations desiring to contribute to the restoration or management of public lands or waters. In addition, the CPA is a source of volunteers and grant funding for all the preserves it supports. Since 2004, the East Central Florida Aquatic Preserves (ECFAP) office has directly benefited from the receipt of $1,550 dollars for resource monitoring, volunteer activities and purchase of native plants for restoration of spoil islands.



Map 11 / Managed Areas Adjacent to the Mosquito Lagoon Aquatic Preserve

3.1.6 / Adjacent Public Lands and Designated Resources

Federal public lands lay immediately to the south of the MLAP. These formerly state-owned lands and submerged lands were conveyed or dedicated to the United States of America during the 1960s

and later in 1980. CNS and MINWR work closely together to manage the contiguous and overlapping ecosystems located to the south of the MLAP. While the missions of the NPS and FWS are not identical, they are compatible.

MINWR was established in 1963. Approximately 65% of Mosquito Lagoon falls within the boundaries of Kennedy Space Center and is managed as part of the MINWR. The protected scrub lands and mostly tidal wetlands of MINWR provide important key habitat for several endangered species. The MINWR mission statement is: "To protect, enhance, and manage wetlands and uplands for biodiversity and for the benefit of all species native to MINWR; provide feeding, resting, and wintering habitat for waterfowl and other migratory birds; protect and manage threatened and endangered species and their habitats; and provide opportunities for compatible public recreation and environmental education." This mission is consistent with CAMA's mission. Approximately 34,345 acres (13,899 hectares) of this area are jointly managed with the NPS where CNS is responsible for management of cultural resources.

The CNS manages approximately 17% of Mosquito Lagoon and maintains a number of facilities to accommodate approximately 1.5 million visitors per year. There is a visitor information center in the Northeast District of CNS, approximately 5 miles (8 km) from the MLAP. Playalinda and Apollo beaches provide an opportunity for the public to experience an uncrowded, undeveloped beachfront. Several parking areas with comfort stations and chemical toilets are maintained. Other popular attractions and activities at CNS include Eldora House, Turtle Mound, walking trails, campgrounds on some of the small barrier islands (accessible only via boat), fishing and horseback riding during the winter months. Fellers House Field Station is located directly south of the historic Eldora House on the lagoon. It is used and maintained by CNS and the Biology Department at the University of Central Florida and other visiting institutions. University faculty and their students conduct monitoring, research studies and restoration that benefits CNS and the ecosystem.

High density development is evidence of exponential population growth in coastal Volusia County.

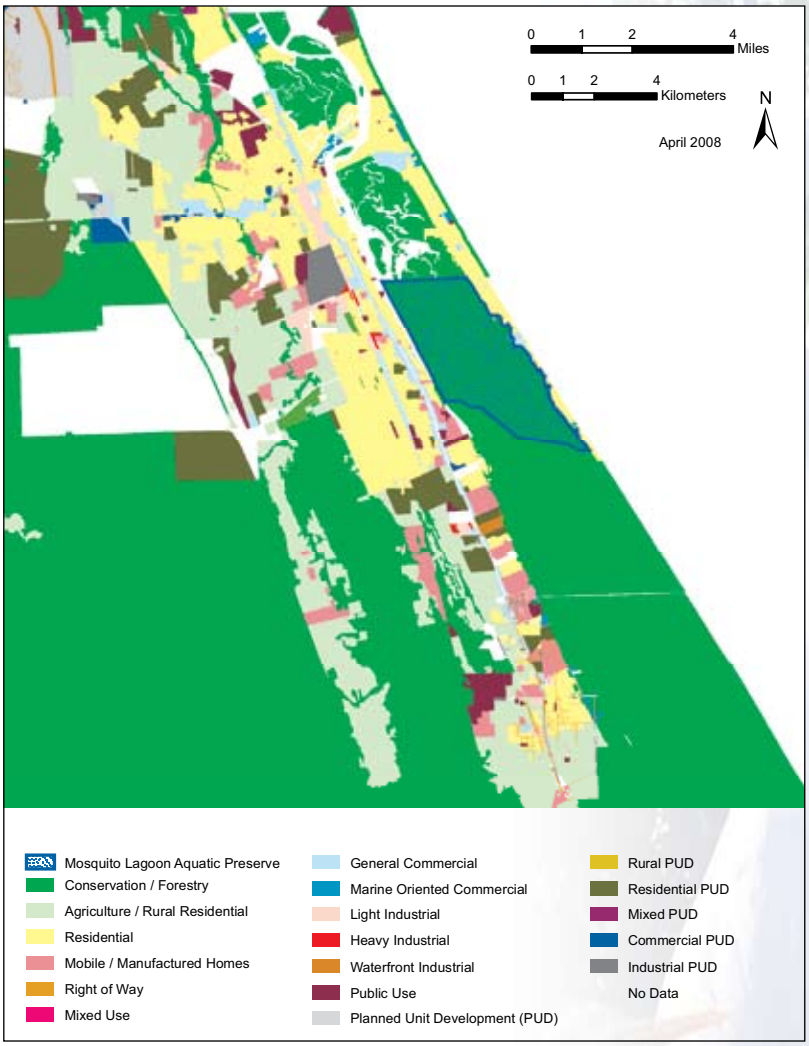
Maintenance and operation of the AIWW federal channel is under the jurisdiction of the U.S. Army Corps of Engineers (ACOE) and the Florida Inland Navigation District. The AIWW forms the northwestern boundary of the MLAP for a distance of 3 miles (3.8 km). It then extends south forming the western boundary of the CNS for about 8 miles (12.9 km). Further south the AIWW enters CNS and extends another 10 miles (16.1 km) until exiting through Haulover Canal. The AIWW was dredged to its present size of 125 feet wide (38.1 m) by 12 feet deep (3.7 m) in 1952. Future maintenance dredging of the AIWW is scheduled for 2009 (D. Roach, personal communication, October 19, 2007). Dredging and the environmental monitoring of the dredging activity will be overseen by the ACOE and the Florida Inland Navigation District. Dredged material from the next AIWW dredging, the central portion of Mosquito Lagoon, will be pumped to an upland dredged material management site in Oak Hill.

3.1.7 | Surrounding Land Use

As described in the previous sections, a large segment of land and water south of the MLAP is federally-owned and managed conservation land. This area includes the CNS, MINWR and Kennedy Space Center. Kennedy Space Center and Canaveral Air Force Base continue to develop large tracts of land on the federal property for support of the national space program and private science- and space-related enterprises. These federal conservation lands have acted as buffers from coastal development for the areas south of the MLAP.

In contrast, urban development and land-use patterns immediately upland surround the MLAP boundary. Over time, agricultural and other rural land uses have given way to residential and commercial land uses on the mainland and the barrier island surrounding MLAP. Within the city of Edgewater, the predominant zoning is low density residential which allows a maximum of four units per acre while the city of New Smyrna has both low density residential and medium density residential zoning allowing a maximum of five dwelling units per acre and eight dwelling units per acre respectively. North and east of MLAP a series of high-rise condominium developments are present (primarily along the oceanfront) which can impact vistas of the MLAP. There are numerous single-family residences and several multi-family residences along the eastern and western shores of the MLAP. All upland development adjacent to MLAP must comply with specific development regulations set by Volusia County. These special criteria (Class II Overlay Zone) include retention of native vegetation, shoreline setbacks and requirements for stormwater management.

There are a few exceptions to the urban development found surrounding the MLAP. A 190 acre (76.9 hectare) parcel of wetlands and upland shoreline just outside the northeastern boundary of the MLAP has been designated for conservation as the IRL Preserve Park. This parcel of land is managed by the city of New Smyrna Beach and the Marine Discovery Center, a nonprofit corporation dedicated to education and preservation of local coastal resources. The park contains old Florida hammock with native vegetation and several walking trails. Two acres (0.008 hectare) are developed with a covered pavilion, restrooms and limited parking. There is a fishing dock and canoe/kayak launch that overlooks Brown's Bay and the MLAP.



Map 12 | Land Use Surrounding the Mosquito Lagoon Aquatic Preserve

The Mosquito Lagoon Working Group monitoring seagrass coverage.

Part Two

Management Programs

Chapter Four

CAMA's Management Programs

TThe work performed by the Office of Coastal and Aquatic Managed Areas (CAMA) is divided into components called management programs. In this management plan all site operational activities are explained within the following four management programs: Ecosystem Science, Resource Management, Education and Outreach, and Public Use.

*4.1 / **The Ecosystem Science Management Program***

The Ecosystem Science Management Program supports science-based management by providing resource mapping, modeling, monitoring, research and scientific oversight. The primary focus of this program is to support an integrated approach (research, education and stewardship) for adaptive management of each site's unique natural and cultural resources. CAMA ensures that, when applicable, consistent techniques are used across sites to strengthen the State of Florida's ability to assess the relative condition of coastal resources. This enables decision-makers to more effectively prioritize restoration and resource protection goals. In addition, by using the scientific method to create baseline conditions of aquatic habitats, the Ecosystem Science Management Program allows for objective analyses of the changes occurring in the state's natural and cultural resources.

4.1.1 / Background of Ecosystem Science at Mosquito Lagoon Aquatic Preserve

\There is a very large and committed group of partners and agencies that conduct extensive monitoring, modeling and research in the Mosquito Lagoon. These include the St. Johns River Water Management District (SJRWMD), Volusia County Environmental Health Laboratory (VCEHL), Dynamac, Florida

Department of Agriculture and Consumer Services (DACS), Florida Department of Health, Canaveral National Seashore (CNS), the University of Central Florida (UCF) and numerous other groups.

The Ecosystem Science Management Program within the Mosquito Lagoon Aquatic Preserve (MLAP) is geared to assist various partner agencies and/or university researchers with ongoing research and monitoring efforts. The East Central Florida Aquatic Preserves (ECFAP) office manages three aquatic preserves spanning a distance of more than 100 miles from Volusia County to Indian River County. It is challenging to maintain a regular research or monitoring presence within these three aquatic preserves because of their sizes, distances and the logistics between them. Therefore, CAMA fosters strong working partnerships with multiple agencies and researchers, and assists with equipment and staff as needed to complete research projects and monitoring efforts. These joint efforts include conducting seagrass surveys (SJRWMD), monitoring juvenile fish abundance and distribution (Fish and Wildlife Research Institute), assisting with oyster reef restoration (UCF and The Nature Conservancy), and monitoring birds, vegetation, and invertebrate species-recovery in restored marshes (SJRWMD, UCF, and the Volusia County Mosquito Control).

Historically, an MLAP team inventoried natural resources for land use planning by Volusia County (Refer to section 4.2.1. for information on early resource management efforts). Resource inventories characterizing each habitat type were used to develop Resource Protection Areas (RPA) designations. More recently, a substantial amount of the monitoring and research conducted in the Mosquito Lagoon occurs just south of the MLAP boundary in the vicinity of CNS. Numerous studies are currently underway and others have historically been conducted within the Mosquito Lagoon area managed by the CNS. The nature of the northern Mosquito Lagoon with its convoluted, winding waterways, extremely shallow waters, and large number of impounded areas makes it difficult and at times impossible to access a large portion of the MLAP. The southern portion of the Mosquito Lagoon has substantially more open water and access points than the northern portion where the MLAP is located. Southern and middle portions of the Mosquito Lagoon also have more land-based facilities for on-site support along its shorelines, for instance CNS has the Fellers House Field Station. The Fellers House Field Station is located on the barrier island at CNS and is used by visiting researchers, professors, and students from UCF and other agencies and institutions. Accessibility and open water habitat may be reasons that a majority of existing research has taken place just south of the MLAP boundary. More detailed information on individual studies can be found in Section 4.1.2.

Water quality data-sets are available online that include both historical and current data for Mosquito Lagoon. All Mosquito Lagoon water quality data collected by the Indian River Lagoon (IRL)-Water Quality Monitoring Network (WQMN) is accessible on STORET at www.epa.gov/storet/ and at the VCEHL web page at www.volusiahealth.net/lab/wqdata.htm. Historic Water Quality Index values (1994-2004) for individual water quality stations compiled by the VCEHL can also be obtained at the same web address. It will be possible to access more information concerning Volusia County's water quality data and water resources by visiting the Volusia County Water Atlas webpage (www.volusia.wateratlas.usf.edu/).

4.1.2 / Current Status of Ecosystem Science at Mosquito Lagoon Aquatic Preserve

Florida continues to undergo tremendous growth and the resulting developmental pressure is anticipated to negatively affect estuarine habitats such as MLAP. Major management concerns within MLAP include:

1. impact to seagrass beds and oyster reefs from increased public use of the waterways;
2. changes in water quality and sediment loads from increased development pressures and land use changes;
3. loss of habitat functionality; and
4. need for protecting and maintaining species diversity.

Effective resource monitoring programs are essential to help recognize and document changes and trends occurring over time. Current research and monitoring programs provide invaluable information on the status of issues involving our natural resources and form the basis for making sound resource management decisions. Measures and protocols are in place to ensure that all MLAP management actions are in compliance with the federal recovery plans for these species and are in accordance with all permitting and agency consultation requirements.

Current Ecosystem Science Programs within MLAP, as well as plans for future research, are discussed in the following sections.

Diamondback Terrapin Turtle Monitoring

Diamondback terrapin turtle monitoring will be implemented as a new program within the MLAP concurrent with the ongoing terrapin turtle research being conducted in both the Indian River and Banana River aquatic preserves. All work is conducted under authorization of the Florida Fish and Wildlife Conservation Commission (FWC) permit number WX08174. "The diamondback terrapin is the only turtle in the world known to be entirely restricted to estuarine habitats" (Dunson & Mazotti, 1989). The terrapin turtle is an indicator species that uses the water column, seagrass beds, islands, and the intertidal zone of the estuary.

Little is known about diamondback terrapin populations in the MLAP. A few individuals have been reported by animal rehabilitation facilities, and by both commercial and recreational fishermen. Abundance and distribution studies are needed within MLAP to determine population dynamics for this rare species. Areas preferentially used by terrapins for feeding and nesting need to be identified in order to preserve these zones for this species into the future.

Monitoring will be accomplished via opportunistic sightings, recovery of specimens from rehabilitators and commercial fishermen and planned biannual captures. Both cast-netting and modified crab pots will be utilized for planned in-water captures. The objectives of ECFAP's monitoring effort are to obtain distribution, survivability and genetic data for this indicator species. Terrapin monitoring will be performed by MLAP staff with assistance from commercial fishermen and volunteers.

Residing in the salt marshes, mangroves and tidal creeks, the diamondback terrapin is the only North American turtle that lives exclusively in brackish water environments.

Colonial Water Bird Monitoring and Management

Bird monitoring surveys involve identifying the locations, species and number of aquatic birds utilizing MLAP for nesting and roosting. During nesting season (February-August), occasional nesting and roosting surveys will be conducted by boat or kayak to document the individual species of water birds within MLAP. Assistance from volunteers or local Florida Audubon chapters will be solicited for boat surveys.

Aerial surveys are performed at least annually, quarterly surveys are optimum. Aerial surveys, rather than boat surveys, better identify the number of nests or individuals using colonies. Aerial surveys are performed with the assistance of Volusia County Mosquito Control equipment and staff, Florida Audubon, volunteers, and potentially through future grant funding. Future research may include nesting success and other data.

The purpose of surveying for waterbird activity is to document avian presence and distribution within the Mosquito Lagoon estuary. These surveys will identify essential wading bird, waterfowl and shorebird nesting and roosting habitats. By identifying important habitat types and areas, wildlife officials can provide protection or manage public use around these sites and plan for restoration of appropriate native habitats, as needed. Staff strives to eventually provide adequate vegetation structure for use by roosting and nesting wading birds in the MLAP.

Water Quality Monitoring

Water quality monitoring within the MLAP is conducted by VCEHL. Monthly sampling under the SJRWMD's IRL-WQMN program is done by VCEHL at station ML11. The VCEHL also does quarterly sampling at other sites in the MLAP. Several water quality parameters are collected (Table 3). The list of parameters for the two sampling programs differ somewhat (no bacterial sampling under IRL WQMN but total organic carbon, dissolved organic carbon, dissolved ammonium and photosynthetically active radiation are included). The county and the SJRWMD water quality monitoring programs have been ongoing since 1989. Sampling selected sites once a month and/or quarterly provides a distinct snap-

The islands within the Mosquito Lagoon Aquatic Preserve are used by numerous bird species for its valuable foraging and roosting habitats (photo: Marine Discovery Center).

shot picture of water quality within the MLAP for that specific period in time. Alternative techniques for monitoring water quality are undertaken by MLAP staff in the St. Sebastian River by use of dataloggers that allow continuous, 24-hour in-situ monitoring, providing a bi-hourly picture of water quality. A similar, continuous, in-situ water quality monitoring program for the MLAP would provide a more detailed picture of the status and trends of this water body, but currently logistics and budgetary constraints make this option improbable. Additionally, sediments sampling could provide a more thorough picture of the Mosquito Lagoon and surrounding environments. Sediment sampling was recently completed for the southern Mosquito Lagoon as part of a study performed by Florida Institute of Technology for the SJRWMD (Trefry et al., 2007). There are plans to extend this work into the northern Mosquito Lagoon in 2009 to try to identify sources of suspended solids and turbidity into the system.

Data collected by VCEHL and SJRWMD provide a good picture of water quality within the Mosquito Lagoon, so there is no need for the MLAP to duplicate monitoring efforts. The VCEHL and SJRWMD surface water monitoring programs are committed to continue identifying and documenting the conditions and trends in water quality and to provide information necessary to establish priorities for the cleanup and restoration of the waterways within the Mosquito Lagoon (Volusia County Environmental Health Laboratory, 2007b; Steward et al., 2003). Refer to Map 13 Water Quality Monitoring to view water quality monitoring stations sampled by the VCEHL.

Data collected by the VCEHL from 1994-2004 indicate that the 10-year water quality index average for stations in the Mosquito Lagoon (ML01 through ML12) was rated as good. Mosquito Lagoon is considered a pristine habitat with good to fair water quality correlated with low urbanization and a minimal amount of agricultural discharges and other point sources of pollution (Sigua, Steward & Tweedale, 2000; Florida Department of Environmental Protection, 1996). Peaks in turbidity, chlorophyll a, and total phosphorus have been documented in the area between Edgewater and Oak Hill (Woodward-

Physical Parameter	Unit	Chemical Parameter	Unit
water temperature	degrees Celsius	Color	CPU
pH	pH units	Turbidity	NTU
Dissolved Oxygen	mg/liter	Total Suspended Solids	mg/l
Conductivity	umhos/cm	Total Kjeldahl Nitrogen	mg/l
Salinity	parts per thousand	Nitrate/Nitrite-Nitrogen	mg/l
Secchi Depth	meters	Total Nitrogen	mg/l
Depth of collection	meters	Total Phosphorus	mg/l
Depth at sample site	meters	Ortho-Phosphate	mg/l
Air temperature	degrees Celsius	Chlorophyll a, b, c	ug/l
Wind direction	degrees	Pheophytin a	ug/l
Wind velocity	miles per hour	Fecal Coliform	CFU
Cloud cover	percent	Enterococcus 24	CFU

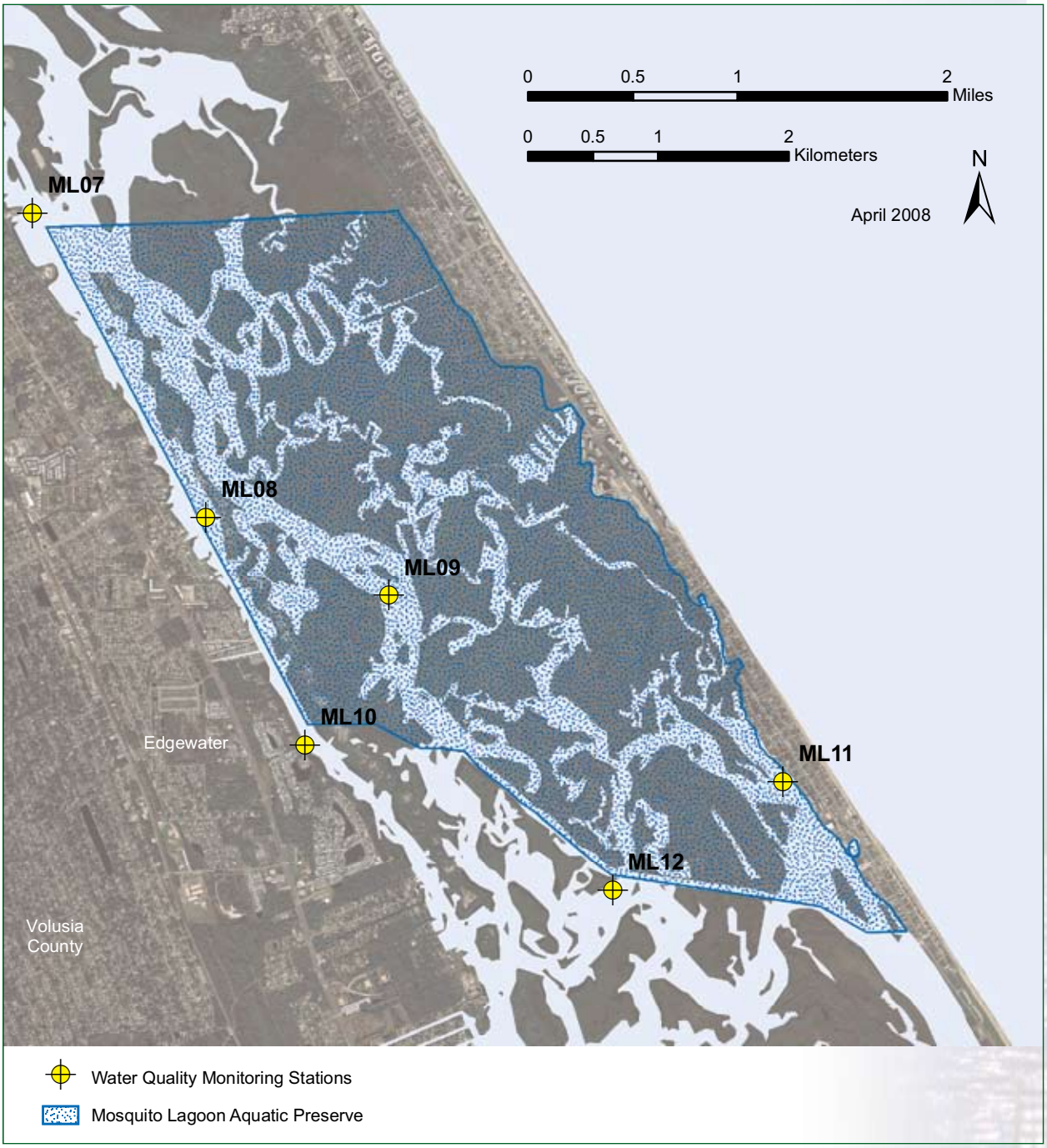
Note: CPU = chloroplatinate units; mg/l = milligrams per liter, CFU = colony forming units.

Table 3 | Physical and Chemical Water Quality Parameters Collected by the Volusia County Environmental Health Laboratory (2007a)

Clyde Consultants, 1994). With the exception of total kjeldahl nitrogen (0.7 to 1.4 mg/L), values of measured water quality parameters in Mosquito Lagoon were generally near the more favorable end of the range of values reported for the entire IRL complex (Woodward-Clyde Consultants, 1994).

The average dissolved oxygen value for Mosquito Lagoon in 2000 was 6.47 mg/L (Sigua et al., 2000), well within the state standard of 4.0 mg/l or greater for estuarine waters. Turbidity, in recent years, has been reported as an important factor limiting light availability in the water column. Higher turbidity causes waters to appear muddy or clouded to the average observer making it difficult to see the bottom. Mosquito Lagoon's 10-year average turbidity has been reported to be more than six nephelometric turbidity units, higher than most other Indian River Lagoon areas (Steward et al., 2003). Turbidity in this case was apparently strongly influenced by total suspended solids.

The SJRWMD reports that the sites in the Mosquito Lagoon at Oak Hill and farther north all had good and improving water quality, due to decreasing concentrations of phosphorus and chlorophyll a (Winkler & Ceric, 2006). The water quality index for the northern portion of the IRL (Mosquito Lagoon sites) was



Map 13 | Stations Monitored by Volusia County for Water Quality in the Mosquito Lagoon Aquatic Preserve

An example of the aerial photographs used to monitor seagrass coverage and the effects of propeller damage on otherwise healthy seagrass beds (photo: Doug Adams, FWC-FWRI).

rated "good" based on sampling performed in 2001 and 2002 (National Estuary Program, 2007). This index used National Coastal Assessment data based on five component indicators; dissolved nitrogen and phosphorus, chlorophyll a, water clarity and dissolved oxygen. Regardless of generally good reports in terms of overall water quality, the northern part of Mosquito Lagoon (WBID 2924B) has recently been listed as potentially impaired for nutrients (elevated chlorophyll a) (Paulic et al., 2006).

Seagrass Monitoring

Seagrass monitoring within the Mosquito Lagoon is conducted by the SJRWMD and Dynamac through bi-annual seagrass surveys using permanent underwater transects and by examination of aerial photography. Seagrass beds (acreage, depth of the edge of seagrass bed, sunlight penetration to 1.7 m target depth) are the primary indicators used to measure estuary health throughout the entire IRL basin (Steward et al., 2003). SJRWMD has defined specific seagrass coverage targets as indicators of the health of the waters (Virstein, Carter, Morris & Steward, 2000). The primary goal for the SJRWMD seagrass monitoring program is to return the number of acres of seagrass to historic (1943) levels based on aerial photographs from that period.

The SJRWMD and research network partners have divided Mosquito Lagoon into three segments for research, analysis and management. MLAP is located in the northernmost segment, referred to as segment ML-1. Segment ML-1 runs from Ponce de Leon Inlet south to Government Cut, the southern boundary of MLAP. A resource assessment conducted by the IRL-Surface Water Improvement and Managment Program found a 94% loss of seagrass acreage in segment ML-1 since 1943, the greatest loss of any Mosquito Lagoon segment (Steward et al., 2003). Seagrass survey data from the 1990s shows a steady decline in seagrass coverage with 2003 coverage ranked as "poor."

Ongoing research conducted by the SJRWMD is designed to assist in understanding why the northern Mosquito Lagoon has poor seagrass coverage when compared to 1943 data. Physical factors such as light limitations, strong current velocities and suspended sediment particles may be factors. Human impacts have caused extreme physical changes to this unique estuarine system. SJRWMD scientists theorize that other factors, such as hydrodynamics causing loss of suitable substrate, may play a role (Steward et al., 2003). Further investigations by the SJRWMD and partners are underway to determine whether suspect factors such as strong currents, unstable sediments and/or light limitations are indeed affecting seagrass abundance in the northern Mosquito Lagoon. Despite losses of seagrass beds in the northern Mosquito Lagoon segment, the 2001 FWC study showed fish densities south of the Ponce De Leon Inlet to be high (Paperno, Mille & Kadison, 2001).

Fecal Coliform and Dinoflagellate Monitoring

DACS/Division of Aquaculture conducts routine monitoring for fecal coliform and other parameters such as toxic dinoflagellate abundance in Class II shellfish harvesting waters within the MLAP. Mosquito Lagoon has had several red tide and harmful algal bloom events that led to the closure of shellfish harvesting areas due to the large concentration of phytoplankton cells and/or toxins in the water, most recently in the fall-winter of 2007. Harvesting of shellfish is prohibited in an area when concentrations of red tide organisms reach 5,000 cells per quart (Bronson, 2002).

Florida's red tide is formed by a dense concentration (bloom) of a single-celled, plant-like marine organism (phytoplankton) that produces toxins. It can make the water appear reddish-brown or green and can kill fish and cause breathing problems in people. *Pyrodinium bahamense* and *Karenia brevis* are two phytoplankton species associated with red tides and harmful algal blooms in the Mosquito Lagoon.

Pyrodinium bahamense has been associated with the production of saxitoxin within the IRL (Landsberg et al., 2006). Paralytic Shellfish Poisoning is caused by saxitoxins, and affects humans through consumption of shellfish that have filtered significant quantities of *Pyrodinium bahamense*. Toxin produced by the dinoflagellate will concentrate within shellfish tissues, particularly during harmful algal bloom events. Meanwhile *Karenia brevis* is associated with the production of brevetoxins and Neurotoxic Shellfish Poisoning. Brevetoxins can also affect humans as the toxins become airborne in sea spray and cause eye irritation and respiratory problems.

Very productive oyster reefs can be found along the shorelines and islands throughout the Mosquito Lagoon Aquatic Preserve.

DACS monitors these parameters closely in order to determine if any shellfish closures are necessary due to elevated fecal coliform or toxic dinoflagellate counts. Shellfish meats are rigorously tested for the presence of the toxin which may require several weeks to clear after the dinoflagellate is no longer present in a harvest area (Bronson, 2002). DACS closely monitors shellfish harvesting areas and closes harvests if necessary to ensure that shellfish harvested in Florida waters are free of harmful bacteria and safe for human consumption.

Volusia County Mosquito Control operates an amphibious bucket loader at work restoring impacted wetlands to natural marsh elevations.

Monitoring Marsh Restoration Projects

The SJRWMD and the Volusia County Mosquito Control partner and cost share in the restoration of wetlands originally impounded or ditched for mosquito control throughout the Mosquito Lagoon basin. Monitoring the resulting success of vegetation and species recruitment to these restored marsh habitats and surrounding waters is an important component of the project. The agencies have contracted monitoring studies conducted by UCF that report on the re-vegetation of the restored marshes by plant species such as glasswort (*Salicornia depressa*), saltwort (*Salicornia bigelovii*), and red, black and white mangroves as well as the presence of fiddler crabs (*Uca* spp.). MLAP staff presently support monitoring efforts including juvenile fish studies and will assist in future revegetation studies as staffing levels allow. The MLAP program will seek funding and assistance of partners to expand monitoring of vegetation and fiddler crab abundance in recently restored wetlands.

The bighead searobin (Prinotus tribulus) measured as part of the Fisheries Independent Monitoring Program by the Florida Marine Research Institute (photo: Doug Adams, FWC-FWRI).

Staff from the Florida Marine Research Institute using a 21-meter seine to sample for fish in the preserve (photo: Doug Adams, FWC-FWRI).

One of the most popular animals to view in Mosquito Lagoon Aquatic Preserve is the Atlantic bottlenose dolphin seen cruising beside the channel.

Oyster Reef Monitoring and Restoration

The Nature Conservancy and UCF have several staff and researchers involved in oyster reef monitoring and restoration efforts throughout the Mosquito Lagoon. Various studies are currently underway to determine the factors affecting existing oyster reefs, oyster recruitment and restoration success.

Oysters are a keystone species in coastal ecosystems such as the IRL. Their current status and trends are important parameters to monitor, especially in light of recent reports indicating significant decreases in the extent of oyster reefs due to physical disturbance by boat wakes within the Mosquito Lagoon (Grizzle, Adams & Walters, 2002; Wall, Walters, Grizzle & Sacks, 2005). Because oysters filter large volumes of water daily, they have long been recognized as valuable components of estuaries by helping to improve water quality. Their extensive reef formations help stabilize shorelines, bottom habitats, sediments, and provide refuge and essential intertidal habitat for wildlife (shrimp, crabs, other invertebrates, red fish, seatrout, and wading birds).

Mapping of existing oyster reefs within the southern to middle portions of the Mosquito Lagoon (Canaveral National Seashore) is currently underway. This mapping effort stops very near the southern boundary of MLAP. A need to extend many of the ongoing research efforts has been identified in the “resource inventory and assessment strategies” under Issue 1 in Chapter 5.

Fisheries-Independent Monitoring Program

The Fisheries Independent Monitoring Program in the Mosquito Lagoon is conducted by the Florida Marine Research Institute, Indian River Field Laboratory, in association with SJRWMD, Volusia County Mosquito Control, and MLAP staff. Twenty stratified-random sampling sites are sampled each month. A 21-meter center bag-seine is used to collect juvenile, small adult fish and macrocrustaceans. Standard length measurements are taken from up to 20 individuals per fish species, the remaining individuals are counted to determine species abundance. Water quality parameters, including salinity, temperature, dissolved oxygen and pH are collected at each sampling site.

Goals of this monitoring effort are: 1) to obtain an accurate, quantitative sample of juvenile and small adult fishes which utilize shallow-water habitats; and 2) to estimate relative abundance of small fishes and macrocrustaceans that use shallow water regions of the estuary (Florida Marine Research Institute, 2007). MLAP staff have assisted the Florida Marine Research Institute with personnel during their monthly surveys throughout the Mosquito Lagoon since 2007.

Critical Analysis of Wild Dolphin Health

Scientists from Harbor Branch Oceanographic Institution (HBOI) and the National Ocean Service, along with other marine mammal experts, conducted a 5-year comprehensive assessment of the health of wild dolphins in the IRL and in Charleston, S.C from 2003 to 2008. In 2008, HBOI reapplied for permits to continue with these studies in the IRL. The main goal of the project was to identify serious health threats to wild dolphins, such as pollutants, so that effective management plans could be designed. Wild captures of dolphins have been conducted in the southern end of the Mosquito Lagoon, and a wide range of measurements and diagnostic tests were performed to obtain a comprehensive examination of each animal's health. The project was prompted by concerns raised during HBOI's ongoing photo-identification study of IRL dolphins. More than 30% of the 500 dolphins studied through 2003 had unexplained skin disorders and tumors (Bossart, 2007). Researchers have investigated the deaths of numerous IRL dolphins and found evidence of a variety of diseases such as hepatitis, meningitis, pneumonia, and central nervous system disorders, including some caused by fungi and protozoa. Some of these afflictions have never before been seen in dolphins.

Dr. Gregory Bossart, director of HBOI's Division of Marine Mammal Research and Conservation, and project leader, agrees, "We not only are going to learn about the health of the dolphins, we're also going to learn about the health of the environment, which directly impacts humans" (Bossart, 2007). The IRL-Charleston project was approved by special permit from the National Marine Fisheries Service after a rigorous review. Marine mammals act as sentinels for oceans and for human health. As such diseases emerge and the effects of global climate change are better understood, some investigators are raising concerns about deteriorating aquatic ecosystems. In turn, these warnings can help experts characterize and manage the effects these trends pose to the oceans, other water bodies and on human health. Doing so is especially important since much of the present emerging disease data suggest that complex interactions occur among anthropogenic toxins, immunologic and genetic factors and infectious organisms in the marine mammals that share coastal environments with humans.

Resource Inventory and Assessment of Islands and Submerged Lands

The Mosquito Lagoon Advisory Committee has identified the need for an updated resource inventory documenting the status of all species and habitat types present in the MLAP. Resource inventories are imperative to understand the current status and trends of the natural resources found within the MLAP in order to develop and implement successful resource management and protection efforts.

Recommended inventories include information on submerged aquatic vegetation, emergent vegetation (mangroves, marsh grasses and other shoreline vegetation), important roosting and nesting areas for wading birds and other designated species and their habitats. Abundance and distribution of invasive non-native species, such as the charru mussel need to be documented and studied with the purpose of identifying their effect on the native biological communities within the MLAP. Please see the Issues Section, Chapter 5, to review future action plans.

Other research and monitoring efforts underway in the Mosquito Lagoon include the CNS and National Park Service's (NPS) Inventory and Monitoring Program. This program aims to establish natural resource inventory and monitoring as a standard practice throughout the national park system. Completed or in progress are inventories of fish, birds, vascular plants, amphibians and reptiles, small mammals, bats and evidence of Chytrid fungus in frogs. A partial list of vital signs to be monitoried include marine water quality, groundwater dynamics, coastal shoreline change, saltmarsh elevation, invasive non-native plants, shorebirds, fisheries take, amphibians and plant communities. Additionally, the U.S. Geological Service has a water-stage recorder at Haulover Canal which monitors gauge height, discharge, precipitation, wind speed and direction, specific conductivity and water temperature.

Other long term studies underway in the Mosquito Lagoon by the Fish and Wildlife Research Institute in cooperation with Dynamac, include acoustic tagging and monitoring of several commercially important species (e.g. red drum, spotted sea trout and bull sharks (*Carcharhinus leucas*)). Tracking acoustic-tagged fish is a tool that provides biologists with information on movement patterns and habitat preferences.

Fishing is enjoyed by the young and the young at heart throughout the Mosquito Lagoon (photo: Captain Jeff Dorobiala).

*4.2 / **The Resource Management Program***

The Resource Management Program addresses how CAMA manages the MLAP and its resources. The primary concept of MLAP resource management projects and activities are guided by CAMA's mission statement: "To protect Florida's coastal and aquatic resources." CAMA's marine protected area managers accomplish resource management by physically conducting management activities on the resources for which they have direct management responsibility, and through science and partnering influence the activities of others within and adjacent to their managed areas. CAMA works to ensure that the most current, effective and efficient restoration techniques are used consistently within our sites, throughout our program, and when possible, throughout the state. The strongly integrated Ecosystem Science, Education and Outreach and Public Use Programs, provide guidance and support to the Resource Management Program. The MLAP collaborates with other managing entities by reviewing various protected area management plans. This section explains the history and current status of our resource management efforts.

4.2.1 / Background of Resource Management at Mosquito Lagoon Aquatic Preserve

Resource management in the MLAP has focused on partnering with Volusia County and other local government entities to encourage comprehensive plans consistent with Florida Administrative Code (F.A.C.) Chapter 18-20 and CAMA's mission. Since the program's establishment in 1970, the MLAP team has enhanced its ability to achieve conservation goals through outreach efforts with law enforcement and local citizens. The resource management program within the MLAP focuses on maintaining the MLAP in "essentially natural or existing condition so that their aesthetic, biological and scientific values may endure for the enjoyment of future generations" (F.A.C. 18-20). It is essential to manage the MLAP's resources in a manner that supports both habitat integrity and species diversity while encouraging sustainable public use. The local community and the general public rely on resource managers to maintain the MLAP for continued enjoyment and recreation such as swimming, boating, fishing and clamming.

Early Department of Natural Resources (DNR, now DEP) management efforts concentrated on the classification of management areas and writing the original MLAP management plan. Specific management areas were delineated by the DNR for the MLAP, identifying boundaries, descriptions and allowable uses for each area based on bathymetry, seagrass or bivalve coverage, and dock structures or other infrastructure present within the area. The resulting classifications reflected the designated zoning and land uses of adjacent uplands. This allowed consistent uses that aligned with habitat values and RPA designations for state-owned submerged lands. Characteristics were determined for each area within the MLAP and included: the bathymetry, seagrass and/or mollusk coverage and dock structures or other infrastructure within the area. These same RPA designations are used today to assist those entities responsible for permitting development or dredging activities within the MLAP.

From 1970 through the late 1990s, DNR staff were responsible for reviewing permit applications and aquaculture leases within MLAP boundaries. During this period, aquaculture leases could be authorized within the CNS boundaries (B. Poole, personal communication, 2008). In 1996 the NPS determined that issuance of aquaculture leases within CNS waters was not compatible with NPS policies and guidelines. It is important to note that prior to 1980 the MLAP boundary encompassed waters down to the City of Oak Hill that now lie within CNS. For a few years, from about 1986 – 1989, CNS assumed administrative responsibility for oyster leases within its boundaries. In 1989, responsibility for management of these leases was reassigned to DACS through Chapter 253.68(2)(a) Florida Statutes and 18-20.003(31-33) Florida Administrative Code.

Other resource management efforts taken by partners during the mid 1990s included education signage to address concerns of manatee/human interaction problems at a park in Bethune Beach. The Save the Manatee Club requested that enforcement measures be taken to reduce human contact with manatees at this aggregation site and requested investigation of unauthorized structures in the manatee basin.

From 1970-1995, the ECFAP office focused efforts among three aquatic preserves in the IRL including the Mosquito Lagoon. In 1995 the ECFAP office was given the responsibility to jointly manage a large tract of land at the St. Sebastian River Buffer Preserve (now known as the St. Sebastian River Preserve State Park (SSRPSP)) located on the St. Sebastian River. This new acquisition required most of the staff's time, thus very little work was conducted in the MLAP for a 10-year period. In 2004, the management responsibilities for almost all the state's buffer preserves, including the St. Sebastian River Buffer Preserve, were transferred to DEP's Division of Recreation and Parks. The local CAMA program reverted exclusively to management of submerged lands and islands. During reorganization, several staffing positions, buildings and equipment were transferred to the Division of Recreation and Parks. In the past three years the program has been retooling to focus on management of submerged resources.

The natural resources within the preserve can be found in close proximity to developed shorelines.

Following the reorganization of CAMA and the renewed focus of CAMA's programs on submerged lands the ECFAP has expanded its programs from a previously narrow focus on the region around the St. Sebastian River to currently include the Indian River – Malibar to Vero Beach Aquatic Preserve, the Banana River Aquatic Preserve, and the MLAP. Until recently, most resource management efforts involved coordinating with partner agencies and groups conducting research, monitoring, or habitat restoration, and assisting partners with grant-match or permitting requirements as needed. Through 2008, the MLAP ecosystem science efforts were focused on providing manpower to assist partners with resource monitoring efforts and introducing two new projects to the MLAP, annual aerial bird surveys and island enhancement events.

Strategic Approach to Management with Minimal Staffing

From the 2007-2009 fiscal years, the ECFAP program had two full time employees and two temporary positions tasked with the management responsibility for a geographic area spanning 107 linear miles of coastline, creating logistical challenges for resource management. ECFAP experiences high turnover of temporary positions. Two positions remained unfilled from summer through December 2007 due to potential budget holdbacks resulting in hiring freezes. For these reasons, the ECFAP's management strategy for the MLAP has been to work closely with partners that have similar and overlapping jurisdiction or complementary management responsibilities. These partners include the Volusia County Environmental Management Office, Volusia County Mosquito Control, CNS, Marine Discovery Center and the SJRWMD. Please refer to Chapters 6 and 7 for further facilities and staffing information.

Staff performs cut-stump treatment with herbicide on recruiting Australian pines to remove this invasive tree that causes erosion of island shorelines.

Starting in 2007, the ECFAP program significantly increased efforts to improve the existing understanding of the status of aquatic resources and ecosystems in the MLAP. This represented the continued implementation of a five-year strategy of expanding efforts to all the aquatic preserves under ECFAP management. The advisory committee for the MLAP Management Plan has assisted with the renewal and expansion of partnerships.

ECFAP and the Mosquito Lagoon Working Group have identified the need to understand the current status of MLAP natural resources and what pressures may be negatively affecting them. Public comments were received recommending assessment of potential affects of restoration on possible submerged historic or prehistoric sites. In the Issues section of this plan, priority issues have been defined and resources and partner agencies identified to help resolve these concerns. This network of city, county, state, and federal agencies and partners serve as points of contact to coordinate management strategies. This team approach allows all participants to maximize the effectiveness of limited programmatic resources, resulting in benefits for the overall MLAP resource management program. By tapping into and incorporating the vast knowledge and experience that these partner agencies possess, management goals are accomplished for all partners in the Mosquito Lagoon region, while saving time and money.

Marsh Restoration

The SJRWMD and the Volusia County Mosquito Control are partnering in the rehabilitation of impacted coastal wetlands, particularly wetlands originally impounded or dragline ditched for mosquito control throughout the Mosquito Lagoon and other systems. These agencies have been involved in marsh restoration efforts for the past several years working from south to north in the Mosquito Lagoon basin. In 2008 they reached several impoundments and dragline ditches needing restoration within the MLAP. The C-8 impoundment on the southern boundary of the MLAP is currently being restored to historic marsh elevations.

Several studies have determined that upon restoration and reconnection to surrounding marshes, these impacted coastal wetlands are able to rapidly recruit native vegetation and the number of fish species

that use the restored habitat will significantly and quickly increase. As tidal exchange was restored to one impounded area in the IRL, the cover of salt tolerant plants increased 1,056% in less than three years (Brockmeyer, Rey, Virnstein, Gilmore & Earnest, 1997). Habitat use by fish after an impounded wetland was reconnected showed an increase to 40 fish species from the nine species present before reconnection of the wetlands to the lagoon (Poulakis, Shenker & Taylor, 2002). Ongoing research has lead to the development of methods for reconnecting and managing impounded wetlands that allow a large degree of ecological recovery and sustainability while still providing for mosquito control (Steward et al., 2003).

Oyster Reef Restoration Efforts

Restoration efforts currently underway within the Mosquito Lagoon (inside CNS boundaries) involve the placement of artificial mats with attached oyster shells, near existing oyster reefs and/or impacted areas, that serve as recruitment sites for oysters. The oyster mats provide suitable recruitment habitat for settlement of oyster larvae. Within six months of deployment, restored reefs had approximately half the number of live oysters as reference reefs (L. Walters, personal communication, 2008). The goal of restoring oyster reefs within the Mosquito Lagoon is to reduce the loss of existing oyster reefs and increase species diversity by providing essential habitat for numerous other estuarine inhabitants that would normally utilize this resource. In previous studies, a total of 105 different species of macroorganisms were documented utilizing oyster reefs in Mosquito Lagoon (Boudreaux et al., 2006). Similar studies in locations other than the IRL, indicate that as many as 300 different species have been found associated with similar oyster reefs (Wells, 1961).

Several organizations are providing funding to continue this work and plans include expanding oyster restoration efforts in areas within the MLAP. Permits for potential temporary impacts to resources are being obtained through federal and state agencies.

Seagrass Restoration Efforts

Propeller scar studies were conducted as part of a Master's thesis by Katie Grablow for UCF. Research also served to document areas with intense seagrass scarring throughout the Mosquito Lagoon. During aerial surveys, Grablow identified "four main areas with intense scarring, three of which were within the Pole-Troll Zone boundaries" (Grablow, 2008). These findings suggest that improved enforcement of the Pole-Troll Zone boundaries and/or additional educational signage is necessary to reduce the occurrence of damage to seagrass beds. Scheidt concluded increased law enforcement of these areas was needed (Scheidt & Garreau, 2007). Merritt Island National Wildlife Refuge (MINWR) has established two Pole-Troll Zones in the middle portion (Tiger Shoals) of Mosquito Lagoon to protect vulnerable seagrass beds. CNS is considering establishment of additional zones farther north in the shallow areas southwest of Shipyard Island.

Propeller scar studies were conducted using artificially created scarring in the Mosquito Lagoon to assess the recovery time of four types of seagrass scars based on different restoration efforts. Glablow described each type of seagrass propeller scar depending on severity. Glablow also used different restoration methods such as planting, filling, and planting and filling of scar trenches (Grablow, 2008). Type I (most severe) and Type II scarring received transplantation treatment. After a year of monitoring, none of the areas receiving restoration treatment proved as successful as natural recovery in untreated scarring. Seagrass transplantation and filling of scarring was unsuccessful at the conclusion of the study. There was complete mortality of seagrass in all scars receiving transplants after two months. Recovery of impacted shoal grass (*Halodule wrightii*) beds was due to recolonization of shoal grass from the dense adjacent seagrass beds. Type IV (least severe) scars completely recovered naturally within a year unlike any of the other scar types and restoration treatments. Grablow's recommendations are to concentrate effort on preventing seagrass destruction rather than expending resources on restoration (Grablow, 2008).

Additional Impacts to Submerged Resources

Wastewater discharges and their effects on water quality and natural resources are of particular concern to the general public and MLAP staff. Two local wastewater treatment facilities, the Edgewater and New Smyrna Beach wastewater treatment plants, have permitted wet-weather overflow discharges of treated wastewater into the Mosquito Lagoon and MLAP. Additionally, the Mosquito Lagoon region has a large number of homes and businesses with septic systems or on-site sewage treatment and disposal systems. The areas surrounding the Mosquito Lagoon basin are characterized by soils and high water tables not recommended for septic systems. Many are older septic systems, increasing the possibility of pollutants seeping into the MLAP and impacting water quality. Two researchers from Florida Institute of Technology, Drs. Zarillo and Belanger are currently developing a hydrologic model of Mosquito Lagoon that will assess effects of septic systems on lagoon water quality.

Volunteer participation is essential for the success of the island restoration activities such as the revegetation of heavily used islands by planting native species.

*4.3 / **The Education and Outreach Program***

The Education and Outreach Program components are essential management tools used to increase public awareness and promote informed stewardship by local communities. Education programs include on- and off-site education activities, training, and workshops. These activities include: field based restoration events for students and teachers; the development and distribution of media; the distribution of information at local events; the recruitment and management of volunteers; and training workshops for local citizens and decision-makers. The design and implementation of education programs incorporates the strategic targeting of select audiences. These audiences include all ages and walks of life. These efforts by the Education and Outreach Program allow the MLAP to build and maintain relationships and convey knowledge to the community, invaluable components to successful management.

4.3.1 / Background of Education and Outreach at Mosquito Lagoon Aquatic Preserve

The primary outreach programs established under management of the ECFAP office have been the Island Enhancement Program (IEP), regular presentations to local elected officials, governing boards and committees, an annual regulatory based workshop, three half-day summer camps at the Environmental Field Station (EFS), regular EFS visitation by the general public, and the annual Goby Fest.

The IEP includes four components:

1. Volunteer island enhancement workdays
2. Eagle Scout projects
3. Adopt-A-Spoil Island project
4. Colonial waterbird monitoring and management.

The ECFAP office modeled their IEP after a program initiated by the Southeast Florida Aquatic Preserves office and under the advisement of the Spoil Island Working Group. During the winter 2006-2007 season, these two offices shared staff and equipment while developing the four components of the IEP.

In 2005 and 2006, the ECFAP IEP was expanded beyond the Indian River-Malabar to Vero Beach Aquatic Preserve, to include work in the Sebastian area as well as the Banana River Aquatic Preserve. In Fiscal Year 2006, ECFAP received full-time funding for a position to coordinate the IEP. In June 2007, the ECFAP office acquired a second boat through DEP surplus for transporting plants and volunteers. In 2008, the office acquired a 12-passenger platform style planning-hull vessel through a donation, allowing them to better facilitate transport of volunteers and equipment. During the 2007-2008 winter season, the IEP expanded to islands in MLAP.

In the MLAP, the IEP coordinates with the Volusia County Natural Resources staff and the Marine Discovery Center at New Smyrna Beach. Partnerships will also be sought with various non-profit groups such as the Keep Volusia Beautiful program.

Volunteer Island Enhancement Workdays

Seven workdays per "enhancement season" are coordinated by ECFAP staff during the fall and winter months, one of which coincides with the International Annual Coastal Cleanup. A variety of activities may take place during a typical enhancement workday: non-native vegetation removal, native vegetation plantings, shoreline restoration and stabilization, trash cleanup and construction and maintenance of public facilities (grills, picnic tables and docks). Both CAMA and the Florida Inland Navigation District provide funding for these activities. Volunteer groups that participate include neighbors of the MLAP, commercial businesses, high school groups, church groups, non-profits, and other government partners.

Volunteers lovingly plant red and black mangrove seedlings to restore eroded island shorelines.

Eagle Scout Program

This component facilitates and encourages the youth-oriented leadership and responsibility of Boy Scouts. In order to earn the Eagle Scout rank, a Boy Scout must fulfill requirements in the areas of leadership, service and outdoor skills. The Spoil Island Program provides an ideal opportunity for Boy Scouts to take a leading role in the enhancement of the spoil islands, helping them to meet the requirements for the Eagle Scout rank.

Adopt-A-Spoil Island Program

This program provides groups in the community the opportunity to initiate scheduled maintenance of one or more adopted islands. Maintenance consists of removing debris and litter four times a year and may include habitat restoration projects or public access improvements. One cleanup date coincides with the annual International Annual Coastal Cleanup held each September.

Colonial Waterbird Monitoring and Management

The ECFAP team regularly monitors the larger waterbird nesting and roosting colonies within two of three aquatic preserves during nesting season. Nesting season normally starts in early December for great blue herons (*Ardea herodias*) and cormorants (*Phalacrocorax auritus*) , then peaks during spring and ends in early October. Current efforts are concentrated in Brevard County and Indian River County on the ten largest colonies, including the largest brown pelican (*Pelecanus occidentalis*) colony on the east coast of Florida in the Banana River Aquatic Preserve, large wood stork (*Mycteria americana*) colonies

in Grant and Wabasso and a mixed colony (over 2,000 nests) including white ibis and roseate spoonbill located in the northern IRL. An annual aerial survey has been conducted since 2006 in Brevard and Indian River counties in cooperation with Florida Audubon.

The colonial waterbird monitoring program has served to document several poaching incidents on islands in the Banana River Aquatic Preserve and the IRL. To help educate the public about this issue the ECFAP cooperates with FWC by maintaining educational signage targeting recreational boaters and duck hunters recreating in the vicinity of larger nesting colony islands. The public has responded positively to educational and law enforcement efforts and a decrease in disturbance has been observed on some nesting colony islands. ECFAP staff also coordinated with hunting organizations to educate hunters about local nesting conflicts with hunting. These groups responded very positively to help resolve any potential conflicts. During late 2007 and early 2008, few additional poaching incidents have been documented since educational posting of islands started. Efforts are underway by FWC to provide special protective designations for important nesting colonies. On islands serving as bird rookeries, cleanups and habitat restoration projects focus on planting native tree species to provide nesting structure. Restoration events are scheduled annually at times when it will not disturb nesting behavior.

Staff co-hosts half-day summer camp at the Environmental Field Station where students learn about the IRL estuary.

The ECFAP office located in Cocoa is also known as the Brevard County Environmental Field Station/City Point Community Church. This historic, 123 year-old building and its environmental education exhibits are open to the public from Monday to Friday, 8:00 a.m. to 5:00 p.m. Two-hundred twenty-seven visitors toured the facility during fiscal year 2006-2007. Additionally, three half-day camps for children are held during summer in coordination with Brevard County Natural Resources Management Office.

Other education and outreach programs undertaken by the ECFAP office are public workshops held annually concerning resource management or regulatory topics of concern to the citizens or businesses surrounding the aquatic preserves. In 2005, ECFAP sponsored a multi-agency workshop for marina owners to explain emergency permitting requirements following the active and destructive 2004 hurricane season. Those individuals who were rebuilding their businesses were able to ask questions and to fill out permit applications during the Emergency Permitting Workshop with the help of federal and state permitting staff. A multi-agency and marine industry Anchoring and Mooring Workshop was held in 2006 in response to citizens' questions about permitting individual mooring buoys or mooring fields. In 2007, in response to illegal killing of protected bird species in the IRL, the ECFAP team and Florida Audubon co-hosted a workshop for the IRL law enforcement community about federal and state resource protection laws. Law enforcement agents, deputies, and officers attended from Volusia, Brevard, St. Johns and Indian River counties.

4.3.2 / Current Status of Education and Outreach at Mosquito Lagoon Aquatic Preserve

Several of the outreach programs mentioned above are currently being established within the MLAP. For instance, during spring 2008 two of the six IEP workdays were scheduled in the MLAP. Staff is recruiting a volunteer network interested in removing non-native vegetation, planting native vegetation, restoring and stabilizing shorelines, and participating in trash cleanups on the islands within the MLAP.

The ECFAP plans to assist partners by recruiting volunteers and providing logistical support to help with oyster restoration efforts spearheaded by The Nature Conservancy and UCF. The office has coordinated volunteers from IEP workdays to participate in the construction of oyster mats in coordination with The Nature Conservancy for placement in Mosquito Lagoon to recruit and form new oyster reefs.

Volunteers help in the restoration of oyster reefs in the Mosquito Lagoon by attaching oyster shells to mesh mats that will encourage the growth of new, healthy reefs.

Educating the public about nesting birds utilizing the islands in the MLAP is an important component of the colonial waterbird monitoring program. The staff, in partnership with the East Volusia Mosquito Control District and Florida Audubon, is coordinating an annual aerial survey to identify and monitor existing waterbird nesting and roosting colonies. Volunteers are needed to regularly inspect islands and replace educational signage informing recreational users they are on or near a large active nesting colony island.

The Eagle Scout program will be initiated once the Volusia County Island Management Plan is completed. Staff is coordinating with Volusia County to determine which islands could benefit from enhancement or restoration projects through the Eagle Scout program. Scouts may be able to assist with installation of universal signage clearly indicating island designations such as education, conservation and recreation.

Staff annually conducts various educational and outreach events, including Goby Fest held in spring at SSRPSP and several half-day summer camps held at the Environmental Field Station. These events feature information about each of the MLAP programs and serve to educate the public about the uniqueness of the aquatic preserves found right in their own backyards. The MLAP staff plans to participate in the annual FishStock Festival and Tournament held on Memorial Day weekend at Riverside

Park in New Smyrna Beach. This tournament provides a great opportunity to interact with the local and visiting fishing community and their families. Another outreach venue that targets anglers and fishing guides using the MLAP is Coastal Angler Magazine.

The staff has a partnership with the Marine Discovery Center, a non-profit educational group, to educate the local community on the protection and conservation of the natural resources found within the MLAP. Staff also coordinates with United Waterfowlers-Florida to address permitting and resource management goals within the MLAP.

The staff, working with partner agencies, has identified the goal of reinitiating the bi-annual State of the Mosquito Lagoon Conference. As in the past, this popular conference brings together a large group of scientists, resource managers and the general public to discuss the current monitoring, restoration and research efforts underway throughout the Mosquito Lagoon estuary. It also provides a pertinent venue to discuss research results, the status of the Mosquito Lagoon ecosystem as a whole and identify some of the future research and management needs that must be addressed to ensure the protection of this unique ecosystem. When the conference was originally initiated by CNS and MINWR in 1989, the primary goal was for researchers working in Mosquito Lagoon to gather in an informal atmosphere to describe current activities, share recent findings and identify possible collaborative efforts (J. Stiner, personal communication, January 14, 2009). The staff looks forward to meeting with the other managers in the Mosquito Lagoon to discuss the focus and format of future conferences.

*4.4 / **The Public Use Management Program***

The Public Use Management Program addresses the management of public use conditions and opportunities at the preserve. The components of this program focus on facilitating recreational opportunities within the site's boundaries which are compatible with resource management objectives. The goal for public access management in CAMA managed areas is to "promote and manage public use of our preserves and reserves that are consistent with the research, education, and stewardship mission of CAMA."

While access by the general public has always been a priority, the conservation of aquatic preserves and other marine protected areas is the primary management concern for CAMA. CAMA strives to fulfill the goal outlined under F.A.C. Chapter 18-20, "To preserve, protect, and enhance these exceptional areas of submerged lands by reasonable regulation of human activity within the preserves through the development and implementation of a comprehensive management program." For implementation of comprehensive management, it is essential for staff to analyze existing public uses and define management strategies that balance these activities where compatible in a manner that protects natural, cultural, and aesthetic resources. This requires gathering existing information on use, needs, and opportunities as well as a thorough consideration of the existing and potential impacts to critical upland, wetland and submerged habitats. This includes the coordination of visitor program planning with social science research. One of CAMA's critical management challenges during the next 10 years is obtaining funding and staff to adequately assess public use while balancing anticipated increases in public use with the need to ensure preservation of site resources.

Corresponding agency challenges and responsibilities rest with the FWC Boating and Waterways law enforcement program. Public comment during the planning process identified funding of enforcement as very important, "spend money on protection of resources," "not enough presence on the water"; were common remarks. The following section explains the history and current status of our public use efforts.

4.4.1 / Background of Public Use at Mosquito Lagoon Aquatic Preserve

Historically, public use of Mosquito Lagoon has mainly been consumptive. Shellfish harvesting, fishing, and hunting game species were important consumptive uses from the beginnings of indigenous human occupation into the early 1900s. Lagoon waters were also the main travel corridor for early settlers. As settlements grew, commercial uses of the lagoon became more important for harvest of seafood and transport of goods.

During the last century, commercial fishing and agriculture became the economic base of the surrounding small communities, along with some seasonal tourism, especially in New Smyrna Beach. Important commercially-harvested marine species included shellfish, shrimp, and mullet. Commercial fishing continued as an important industry and component of the local economy until 1995 when the citizens of Florida passed a constitutional amendment banning the use of gill nets for commercial fishing. Commercial harvest of shrimp for food and bait, blue crab and cast-netting for mullet continue after the net ban; however, some harvest levels are greatly reduced.

Statewide there were decreases in landings, numbers of fishermen and dockside value of fisheries after the net ban was in place. The impact on communities adjacent to the Mosquito Lagoon heavily dependent on local commercial fishing activities was much greater. Evidence of this was seen in the closure of local commercial fish houses (e.g. Oak Hill, Mims, Titusville, Cocoa, Port Canaveral) that were not experienced throughout the rest of the state (Adams, Jacob & Smith, 2000).

Recreational fishing became a popular pastime for early visitors to Florida and continues as a popular recreational activity. Recreational shrimping, primarily a night time activity, has been a long tradition among central Floridians. Central Mosquito Lagoon is the most popular harvest area in the region. Other consumptive uses include hunting. Historically, hunting use consisted mostly of waterfowl hunting by residents with local knowledge of the shallow tidal creek systems of the MLAP. In recent years, breeched impounded marshes and managed marshes within MINWR receive more extensive waterfowl hunting use than areas in the MLAP.

In the past, impacts of nonconsumptive uses were limited due to small population size of the surrounding communities and lack of access points. Local residents and visitors primarily engaged in nonconsumptive activities, such as swimming, boating, canoeing, nature watching, and waterskiing.

4.4.2 | Current Status of Public Use at Mosquito Lagoon Aquatic Preserve

Access Points

Three public waterfront parks are located east of U.S. Highway 1 along Riverside Drive, in the city of Edgewater, adjacent to the MLAP. Two of these parks have boat ramps: 1) Kennedy Point Memorial Park has boat launching facilities including four paved ramps and parking; 2) Menard-May Park, a short distance south of Kennedy Memorial, has a shallow dirt ramp suitable for Class A (less than 16 feet) trailerable watercraft, canoes, and kayaks. Menard-May Park also offers the public a riverfront playground, pavilion, restrooms, sandy beach, native plants, mangrove habitat, and two fishing/observation piers. 3) Veterans Park, just south of Menard-May Park, has a parking area and a fishing/observation pier that jets directly onto Mosquito Lagoon.

The backwaters of the Mosquito Lagoon historically supported game bird activities (photo: NASA).

Additional public boat and kayak launches are available around the Mosquito Lagoon outside MLAP boundaries. Public access ramps on the eastern side of Mosquito Lagoon are listed from north to south: Hiles boat ramp in New Smyrna Beach, Bethune Beach and two at the CNS. Shipyard Island ramp is located inside the CNS north entrance, accessible via Route A1A. This ramp has limited parking. There is a canoe/kayak launch site along the Eldora Loop Road at Parking Area #7. There is also a small unpaved ramp at Parking Area #5 (end of road) in the north end of CNS. A small vessel ramp is accessible from the south entrance of CNS at Eddy Creek across from Playalinda Beach (off State Road 402).

Along the western shore of the Mosquito Lagoon there are three boat ramps, besides Menard May Park and Kennedy Point Memorial Park, in Edgewater and River Breeze Park in Oak Hill. Three launches are located inside MINWR, two dirt ramps along the central, mainland side of Mosquito Lagoon (off of State Road 3) and another developed launch, Baer's Cove, located along Haulover Canal (off State Road 3). In addition, boats can enter the MLAP from the Atlantic Intracoastal Waterway (AIWW) that runs along the western MLAP boundary. There are no existing public mooring fields or traditional anchorages within the boundaries of the MLAP.

Current Commercial Public Uses (Consumptive)

There are several commercially-important aquatic species that spend at least a portion of their life cycle in the Mosquito Lagoon and are a significant source of revenue for the area. These include the hard clam, American oyster , brown shrimp, pink shrimp, white shrimp, and blue crab. The importance of the system as a nursery for commercially-important species can not be overemphasized.

Kennedy Point Memorial Park in Edgewater offers four paved boat ramps and parking.

Commercial inshore and offshore harvest data for Volusia County:

2006 Annual Volusia County Landings (FWC, 2007)

- Blue crab landings totaled 374,654 pounds (169,940 kg)
- White shrimp offshore landing totaled 92,395 pounds (41,910 kg)
- Hard clams landings totaled 25,993 pounds (11,790 kg)
- Eastern or American oyster a total of 1,972 pounds (894 kg)
- Brown shrimp landings totaled 22,927 pounds (10,400 kg)
- Spiny lobster offshore landing were 3,633 pounds (1,648 kg)

One of the most important commercial species in the Mosquito Lagoon is very dependent on consistent salinity levels and good water quality. The hard clam, common in sandy bottoms throughout the IRL, is farmed commercially from Indian River County northward to Volusia County including the MLAP. The hard clam had the greatest commercial value of any fishery species in the IRL for many years but catches have declined dramatically in recent years. This region accounted for 10.5 million pounds (4,762,720 kg) of the commercially harvested hard clams valued at over $70.3 million. Much of this revenue is generated from wild stock harvest in the Mosquito Lagoon. Volusia County made up 4.5% of this region's catch, valued at over $3.3 million for the period of 1987 through 2001 (Smithsonian Marine Station, 2007b).

As a consequence of more consistent salinity levels, increases in wild hard clam harvest totals for Volusia County have continued while other IRL county harvests have declined. Annual 2006 landings for hard clams in Volusia County alone totaled 25,993 pounds (11,790 kg) versus 15,312 pounds (6,945 kg) in Brevard County (FWC, 2007). While increased harvest is positive, monitoring efforts are important to ensure that clam bed populations are sustainable at current harvest levels. Hard clams also account for a large percent of the total aquaculture production (farm production) in Florida, behind only tropical fish and aquatic plants.

Future commercial exploitation of other species such as whelks or snails (for the production of buttons), or the harvest of horseshoe crabs or other undeveloped markets should be brought to the attention of CAMA and monitored for adverse affects to local resources.

Current Recreational Public Uses (Consumptive)

Recreational and charter fishing along with shellfish harvesting are the most popular consumptive uses in Mosquito Lagoon according to the Resource Use Characterization Study of Mosquito Lagoon within the boundaries of the MINWR (Holloway-Adkins, Scheidt, Reyier, Lowers & Epstein, 2005). Results from aerial watercraft use survey conducted from June 2006 until May 2007 showed a sharp decrease in commercial clamming; however, the authors learned water quality closures due to heavy rainfall may account for differences (Scheidt & Garreau, 2007). One of the underestimated consumptive use groups is the recreational shrimpers, not captured during the recent boating study conducted during daytime hours. On moonlit nights during the winter, flotillas of shrimpers and their lanterns can be seen harvesting shrimp on the waters of Mosquito Lagoon. This is a common sight throughout much of Mosquito Lagoon with a large portion of these activities centered around Oak Hill near Riverbreeze Park and Haulover Canal.

Some of the fish that call the Mosquito Lagoon home include ladyfish, American shad, sheepshead, and Spanish mackeral (photo: Doug Adams, FWC-FWRI).

During the 2007 watercraft usage study, researchers found a strong statistical relationship existed between the number of watercraft trailers at boat launch ramps and the number of trailerable watercraft observed on Mosquito Lagoon during aerial surveys (Scheidt & Garreau, 2007).

Increasing population size, awareness of the MLAP, increased number of ramps and improved access to backwaters using shallow-draft watercraft have all contributed to increased recreational fishing. A conclusion from the use characterization study was that MINWR infrastructure (boat ramp facilities) were the limiting factor behind the number of watercraft using lower Mosquito Lagoon (Holloway-Adkins et al., 2005). Researchers noted during 2006 – 2007 surveys that "the greatest number of watercraft were observed in the northern portion of CNS" which was not surveyed in 2002 studies (Scheidt & Garreau, 2007). This region is bounded by urbanized areas to the east and west, unlike other portions of the CNS and wildlife refuge study area (bordering the MLAP). This condition results in high watercraft densities, especially within the AIWW and Shipyard Channel. CNS is expected to be an area where visitor impacts to sensitive seagrass beds, oyster reefs, and wildlife is most severe (Scheidt & Garreau, 2007).

The feisty blue crab fends off a curious onlooker (photo: Marine Discovery Center).

Mosquito Lagoon is one of the most important recreational fishing destinations in inland waters on the east coast of Florida. Numerous fishing guides bring clientele to the area for shallow-water sports fishing. Recreational fishing contributes heavily to the local economy. Mosquito Lagoon is an important recreational destination for residents of the Orlando area and surrounding counties. Researchers found that 52% of people traveled distances of 51-100 miles to use the Mosquito Lagoon within the boundaries of MINWR and CNS (Holloway-Adkins et al., 2005). There are a total of 42 fish camps, hotels, and

Many locals and visitors to the Mosquito Lagoon enjoy casting a fishing line right off the shoreline.

campgrounds surrounding Mosquito Lagoon within 15 miles of the MLAP. There are 48 bait and fishing related businesses in the vicinity of the Mosquito Lagoon. Popularity of fishing tournaments on inland waters is increasing. Despite the obvious benefits of educational opportunities afforded by these events, resource impacts may be associated with these tournaments. Based on study findings, researchers concluded that the peak in boat traffic associated with special events such as fishing tournaments can certainly become a heavy resource impact (Holloway-Adkins et al*.,* 2005). Coordination and management of the number and frequency of planned tournament events could minimize potential impacts.

Fishing data from creel surveys conducted during the 2002 through 2003 Resource Use Characterization Study of Mosquito Lagoon showed recreational anglers normally targeted redfish, spotted sea trout and/or black drum. Nearly 59% of all anglers fished for redfish and spotted sea trout (Holloway-Adkins et al*.,* 2005). A later boat-ramp exit study saw similar results with the overwhelming majority of anglers targeting those two species (Scheidt & Garreau, 2007). Over 53% of the charter groups targeted redfish exclusively. Anglers targeting redfish were successful 32.4% of the time. Anglers targeting spotted sea trout were successful 68.9% of the time while anglers targeting black drum were successful 45.1% of the time (Holloway-Adkins et al*.,* 2005).

Current Recreational Public Uses (Nonconsumptive)

Current popular nonconsumptive uses include: boating, sun bathing, wading, sight-seeing, nature viewing, picnicking, and limited camping. Recreational boating and use of personal watercraft has increased dramatically in recent years in the MLAP near the city of Edgewater. Kayaking has become very popular in the last ten years. Kayaks are great for travel through the shallow bottoms and narrow creeks. Visitors are served by several kayak rental and ecotourism operators working in the vicinity of the MLAP.

Rental of motor boats and personal watercraft is available near the preserve. High speed recreational sports such as water skiing, and tubing are popular on weekends in channels through this shallow system. High-speed use is primarily focused in Government Cut, Shipyard Channel and the AIWW. A study of historical aerial photographs taken between 1943 and 2000, found an increasing number of dead margins (mounds of disarticulated shells) rising up sharply from the seaward sides of intertidal Eastern oyster reefs in major boating channels (e.g. Government Cut, Shipyard Channel) in Mosquito Lagoon (Wall et al., 2005). Some oyster reefs along the AIWW migrated away from the channel as much as 50 meters and consisted primarily of piles of sun-dried shells (Grizzle et al., 2002). In Mosquito

Lagoon, low oyster survival was positively correlated with high sediment loads and high silt/clay levels in the sediments (Wall et al., 2005). High speed corridors within the MLAP are characterized by oyster bars with dead margins. Consideration of techniques for minimizing impacts to these important resources requires consideration. Restoration of habitat is an important tool, but minimizing future impacts is vital.

MINWR and CNS Boating and Resource Use Characterization Study (2005) and Identification of Watercraft Use Patterns in Canaveral National Seashore (2007)

A brief summary of findings from two studies of southern and central Mosquito Lagoon are found below. Although data were not collected within the MLAP itself, these data from the Mosquito Lagoon and nearby areas are applicable and likely give insight into user opinion, public use levels, patterns, and harvest success in the MLAP itself. Both areas share the AIWW channel, consequently those boats traveling to distance destinations travel through MLAP, CNS and MINWR waters. However, consideration should be given to the fact that the MLAP is closer to population centers, is less regulated than CNS and MINWR waters, and areas such as Shipyard Channel experience a higher level of high-speed recreational activity such as water skiing and personal watercraft use than the study area.

A study was conducted to document boat-use patterns from January 2002 through February 2003 within the boundaries of MINWR and CNS, located immediately south of MLAP. To improve resource management strategies, the MINWR and CNS were seeking quantification of potential impacts to natural resources and wildlife, data on harvest quantity, fish measurements, fish type as well as travel areas. A later study extending further north to the boundary of the MLAP was conducted during June 2006 through May 2007. Aerial flight surveys were conducted from January 2002 through February 2003. During a 14-month period, 108 flight surveys were completed.

Creel Surveys

Creel intercept surveys were conducted during a one-year period from January 2002 to January 2003 at two boat ramps located within MINWR. Boaters in the sport-fishing activity group made up 87.5% of the interviews. During the weekdays, commercial and charter fishing activity increased while sport fishing activity decreased nearly 30%. The typical boater was male between 41 and 55 years old with an average length of stay of 5 hours and 18 minutes. The average fishing party size was 2.2 persons.

Both studies determined that the average boat size was approximately 16 feet and four inches. Creel and aerial flight survey discrepancies revealed that 538 commercial clammers observed in the northern survey limits during the aerial surveys were not seen at the refuge boat ramps. It was concluded that many clammers are utilizing boat ramps other than those in the MINWR (Holloway-Adkins, Scheidt, Reyier, Lowers, & Epstein, 2005). Some of those commercial users may be traveling south from ramps in Oak Hill or the MLAP.

Watercraft/ Activity	Total	Percent Watercraft Observed
Fishing Boat	5586	79.28
Clammer Boat	538	7.64
Crabber Boat	17	0.24
Shrimp / Dipnetter	0.27	
Canoe	208	2.95
Kayak	307	4.36
Duck Hunter	5	0.07
Water Ski Boat	0.01	
Personal Water Craft	9	0.13
Sailboat	202	2.87
Yacht/Cruiser	107	1.52
Camping	0.16	
Other	36	0.51
TOTAL	7046	100.00

Table 4 | The total number and percent of watercraft observed during the 2002 – 2003 study for each watercraft/activity classification category

Future Public Use

Rapid population growth rates of coastal areas in Florida are expected to continue. Over the lifetime of this plan, decisions vital to the balance between sustainable resource protection and waterway management will need to be made by MLAP managers working closely with other state entities and local governments. In addition, a public-use subcommittee of the Mosquito Lagoon Working Group has been formed to assist staff in identifying concerns or resource management alternatives.

Mooring fields, live-aboards or anchorages pose few problems in the MLAP at present. With the ongoing trend of converting existing marinas to private use and the subsequent decrease in availability of wet slips, the movement of vessels into open water anchorages may increase. This could result in areas within MLAP such as Government Cut becoming unauthorized mooring fields. This trend could have additional impacts to MLAP and adjacent waters due to the lack of marine sanitation device pumpout facilities, emergency clean-up capabilities and increased potential for derelict vessels.

It is beneficial for staff to stay actively engaged in the local planning processes when new marine facilities such as boat ramps, marinas, mooring fields and similar siting decisions are being considered by local government and municipalities. MLAP staff involvement early in planning processes for marine siting can aid local government by providing expertise in permitting requirements and result in less environmental impact to the MLAP. Efforts should be made to accommodate the small shallow-draft vessels historically used to access much of the MLAP area. However, providing increased public access or additional dredging through new marine facility siting may result in additional impacts to water quality and the valued habitats and resources found in the preserve. Facilities providing boater access, such as boat ramps and marinas, are portals to MLAP and their impacts to the preserve and its resources should be considered by local government and permitting agencies in the planning and permit review process for any new or expanded facilities.

Nonconsumptive uses that could cause conflicts in the future include water based signage and advertising, commercial vending, movie production involving high speed activity or explosives, waterbased air strips or boat races and ecotour operators competing with the public for limited resources such as camping areas or boat launch sites. Existing state and FWC regulations may prohibit activities such as private advertising signs posted on or near the water (F.S. 327.40, 68D-23.101 F.A.C). Regulation of activities that can result in conflict or loss of enjoyment of other users should be considered.

Potential future uses should be considered when planning waterway management. In the MLAP these future uses may include expansion of fishing (commercial and recreational), boating, and ecotourism and may also include a variety of new enterprises ranging from consumptive uses to the provision of various goods and services. Some of these future uses may not be consistent with the goals and objectives of MLAP and may impact the resources that MLAP was established to protect. Proactive planning, including setting aside areas within the MLAP where some categories of use are restricted or prohibited, may lessen future conflicts. out and emergency cleanup facilities are unavailable. An increase of anchored out vessels that sink during severe weather has augmented throughout the years. The number of derelict vessels requiring removal has increased, along with the costs to natural resources due to spills, contaminants, and debris. The numbers of ghost crab pots (no identifying marks/permits) have also been greater than in previous years. The Ponce de Leon Inlet and Port District has been designated as the local agency in Volusia County to address marine environmental hazards such as derelict vessels. In cooperation with the FWC, the Ponce de Leon Inlet and Port District initiates a grant proposal and contracting process for removal of the illegally abandoned vessels.

Habitat restoration within the Mosquito Lagoon Aquatic Preserve (photo: Volusia County Mosquito Control).

Chapter Five

Issues

5.1 / ***Introduction to Issue-Based Management***

The hallmark of Florida's Aquatic Preserve Program is that each site's management efforts are in direct response to, and designed for unique local and regional issues. Aquatic preserve staff use the Ecosystem Science, Resource Management and Education and Outreach strategies to address these issues. This integrated approach provides a management method through which the goals, objectives and strategies associated with each issue have a greater chance of being accomplished. For instance, an aquatic preserve may address declines in water clarity by monitoring levels of turbidity and chlorophyll (Ecosystem Science - research), planting eroded shorelines with marsh vegetation (Resource Management - habitat restoration), and creating a display or program on ways of preventing water quality degradation (Education and Outreach). Partnering with local stakeholders is essential to expand the capabilities of the local aquatic preserve office, to increase public awareness and to foster a more diverse set of solutions to a particular issue.

Issue-based management is a means through which stakeholders may become involved with an aquatic preserve in addressing an issue. Each issue is addressed through goals, objectives and strategies. Goals are broad statements of aspiration necessary to advance the mission of the organization. Objectives are specific statements of expected results that contribute to the associated goal within the timeframe of the management plan. Strategies are tools by which the associated objectives will be met. Performance measures are metrics used to assess progress towards reaching each objective and its associated strategies. Performance measures must be tracked on a regular cycle to ensure that the management plan objectives are being achieved. In some cases strategies may need to be adapted to increase their efficiency or to respond to new challenges and opportunities. Appendix D contains a summary table of all the goals, objectives and strategies associated with each issue.

To be successful, the strategies identified in this plan will be accomplished in partnership with local citizens, city, county, state, and federal officials, college and university students and faculty, nongovernmental organizations, and the business community. Full implementation of the strategies identified in this management plan is dependent upon administrative support and funding for reassigning or otherwise acquiring staff, volunteers, contract services, equipment, training, and supplies. Management will seek additional administrative staffing support to process contracts and grants to expand its ability to pursue outside funding and process contracts for services.

Issue I / Loss of Natural Community Function and Species Diversity

Habitats within the Mosquito Lagoon Aquatic Preserve (MLAP) primarily consist of shallow water communities. These communities comprise some of the most diverse and productive ecosystems in the IRL. Major ecological communities present include tidal wetlands, mudflats, oyster reefs, seagrass beds, and islands.

While many of these communities within and adjacent to MLAP continue to be highly diverse and productive, they have suffered impacts as the result of growth and development in the region. These impacts threaten long-term sustainability of MLAP's natural resources. As described in other chapters of this plan, there have been losses to wetlands and seagrass acreage, impacts to oyster reef extent and function, and an influx of non-native, invasive plants and animals. In addition, there is the potential for additional losses of these habitats in the future from incompatible landuse practices and public use.

Native railroad vine flowers (Ipomoea pes-caprae) *offer bright purple accents to the typical green backdrop of East Central Florida's coastal vegetation.*

Significant habitat restoration efforts are underway and additional opportunities to conserve and restore species diversity within MLAP. In the last two decades several thousand acres of impounded coastal wetlands, originally altered to control mosquitoes, have been reconnected to the IRL basin. Research and monitoring studies have determined that upon reconnection to the surrounding marsh these impacted coastal wetlands are able to rapidly recruit native vegetation and exhibit significant increases in the number of fish species. For example, as tidal exchange was restored to one impounded area in the IRL, the cover of salt-tolerant plants increased by 1,056% in less than three years (Brockmeyer et al., 1997). After an impounded wetland was reconnected fish population diversity increased from nine fish species to 40 fish species (Poulakis et al., 2002). Ongoing research has led to the refinement of methods for reconnecting and managing impounded wetlands that allow for habitat restoration while providing effective mosquito control (Steward et al., 2003).

Cycles in climate patterns, and associated temperature extremes, have a significant influence on the relative composition of mangrove forests and saltmarsh habitats within MLAP. At present, the red mangrove component in the northern portion of the Mosquito Lagoon has experienced an increase in abundance in an area historically dominated by more cold-tolerant black mangroves. Adding to the complications associated with setting future restoration targets is uncertainty of the importance of climate change on patterns of species composition within MLAP.

Seagrass habitat within MLAP has suffered substantial loss over the past 60 years. Recent studies indicate that the area with the least seagrass coverage in the Mosquito Lagoon, and with the greatest loss since 1943, is the northern portion of the Lagoon (Mosquito Lagoon Segment 1), which includes MLAP (Steward et al., 2003). This study reported that 1999 seagrass coverage totaled 51 acres, which represents a 94% loss since 1943. Further investigations are underway to determine whether factors such as strong currents, unstable sediments, light limitations or other variables are affecting seagrass abundance in the northern Mosquito Lagoon.

Oysters are an example of a keystone species in coastal ecosystems such as the Mosquito Lagoon. Oysters function as filter feeders, helping to improve water quality. Oyster reefs help stabilize shorelines, bottom habitats and sediments and they provide refuge and essential intertidal habitat for juvenile fisheries and other wildlife (e.g., shrimp, crabs, red fish, sea trout and wading birds). Oyster populations are significantly stressed by factors such as siltation, disease and altered water quality. There is a need to determine the relative importance of these factors to prioritize efforts to conserve this valuable resource. Current research indicates significant decreases in live oyster reefs are occurring within the Mosquito Lagoon due to physical disturbances by boat wakes (Grizzle et al., 2002; Wall et al., 2005). The expansion of oyster habitat restoration efforts into MLAP is currently being initiated and, dependent on its success, will be supported in the future.

Listed species are those species with populations that have declined enough for scientists to determine that the species is in danger of extinction or likely to become extinct within the foreseeable future. Among the many listed species found in MLAP, federally-designated endangered species include the Florida manatee, green sea turtle, wood stork and Atlantic saltmarsh snake. The Florida Fish and Wildlife Conservation Commission and federal agencies provide special conservation measures to promote recovery of a listed species. Staff will ensure that management strategies are compatible with local, state or federal species management and recovery plans.

Invasive plants and animals are threatening ecosystems in many areas of Florida (Haller & Sutton, 1975). These species may outcompete native species because they may have been removed from naturally evolved population controls (e.g., predators, parasites and disease), or they may be more efficient at exploiting disturbed habitats. Invasive species can have a dramatic effect on species composition, habitat stability and function. These changes may be equally damaging to natural communities as well as local recreational and commercial interests.

Brown pelican with young chicks (photo: Marine Discovery Center).

Goal 1 / **Conserve and restore natural community function, productivity and species diversity in MLAP.**

Objective 1.1 / **Determine the status and trends of key natural communities and species.**

Integrated Strategies:

1.1.1 / Collect and compile existing and on-going research studies, reports and data on MLAP into the Volusia County Water Atlas (VCWA) (Education and Outreach). FY 2009-2010, recurring.
Performance Measures: 1. Entry of new research studies, reports and data into the VCWA.

1.1.2 / Co-host and/or sponsor the biennial Mosquito Lagoon Conference including publication of abstracts from this Meeting (Education and Outreach). FY 2009-2010, recurring.
Performance Measures: 1. The biennial Mosquito Lagoon Conference (including publication of abstracts) occurs.

1.1.3 / Analyze and assess assembled data into a report on baseline conditions for key natural communities and species and identify research and monitoring information gaps, prioritize threats and prioritize new monitoring initiatives. Convene a working group, if appropriate (Ecosystem Science). FY 2009-2010, recurring.
Performance Measures: 1. Reports completed that assess the status and trends of key natural communities and species. 2. A prioritized list of monitoring and research gaps to address community and species condition is developed.

1.1.4 / Use and build on existing monitoring efforts to facilitate and support long-term monitoring efforts to track trends and locations of key natural communities and species in MLAP (Ecosystem Science). FY 2010-2011, recurring.
Performance Measures: 1. A comprehensive (GIS based) species and habitat inventory for MLAP is developed and updated annually as information becomes available.

The accumulation of dead oyster shells along this shoreline is worsened by disturbances such as large boat wakes.

Objective 1.2 / **Develop and implement conservation and restoration projects for key natural communities and species based on the best available scientific data and information.**

Integrated Strategies:

1.2.1 / Support present conservation and restoration programs and projects within MLAP (Resource Management). FY 2009-2010, recurring.
Performance Measures: 1. Acres of dragline ditches excavated for mosquito control and impounded marshes restored by Volusia County Mosquito Control and St. Johns River Water Management District. 2. An island management plan is developed and implemented in coordination with Volusia County Environmental Management. 3. Numbers of exotic species removal projects initiated and exotic species removed, and the number of acres of habitats restored from these activities 4. Acres of oyster reef restoration completed.

1.2.2 / Assess existing conservation and restoration strategies (including invasive species management) and develop new plans as required. Convene a working group, if appropriate (Resource Management). FY 2009-2010, recurring.
Performance Measures: 1. A prioritized plan for habitat and resource restoration and conservation strategies for key estuarine habitats is developed. 2. A standardized protocol for monitoring the success of habitat restoration is developed and implemented.

Residential and commercial development along the shorelines of the Mosquito Lagoon Aquatic Preserve can negatively impact water quality.

Issue II / Water and Watershed

While water quality within and adjacent to MLAP has been found to be "good" (Sigua et al., 2000; DEP, 1996), declining water quality trends resulting from incompatible development occurring in the watershed is a concern. Alterations in the quality, quantity and timing of freshwater and associated pollutant inputs threaten the sustainability of natural resources found within MLAP. MLAP is especially vulnerable because it has few natural freshwater tributaries and maintains higher than average salinity compared to the rest of the IRL.

In the past, numerous drainage systems were constructed throughout the IRL watershed. Much of this development predated present-day stormwater treatment requirements and as a consequence stormwater, with its associated pollutants and volumes of freshwater, reach the estuary with little or no pre-treatment. Cumulative impacts of past and present human activities present a significant challenge to conserving the viability of these coastal resources. Promoting best management practices for retrofitting older developments and planning new developments, educating homeowners and making certain accurate resource information is provided to regulatory personnel are important activities for sustaining the natural resources of MLAP.

In addition to dramatic watershed changes, shoreline and benthic communities have also been directly impacted. In many areas of MLAP seawalls, docks and rip-rap have replaced natural mangroves, seagrasses and oyster habitats along the shorefront. Natural shorelines help stabilize the sediments, dissipate wave action, filter stormwater runoff and provide quality intertidal habitat for numerous birds and aquatic organisms. It is important to promote appropriate set-backs for buildings and natural "living" shoreline stabilization options to regulatory staff, local governments and riparian land owners in order to restore these lost habitat functions. In recent years, the impacts of stormwater discharges and incompatible development practices have been recognized and many local governments have taken action to address these impacts.

Goal 2 / **Maintain and improve water and sediment quality within and adjacent to MLAP.**

Objective 2.1 / **Determine status and trends of water and sediment quality within and adjacent to MLAP.**

Integrated Strategies:

2.1.1 / Compile existing water and sediment quality data, including meta data, and included these in the VCWA (Ecosystem Science). FY 2009-2010, recurring.
Performance Measures: 1. Amount of water and sediment quality monitoring data and metadata that is compiled and included in the VCWA.

2.1.2 / Analyze and assess compiled data to identify status, trends and information gaps. Convene a working group, if appropriate (Ecosystem Science). FY 2009-2010, recurring.
Performance Measure: 1. Reports completed that assess the status and trends of water and sediment quality. 2. A prioritized list of monitoring and research needs to address water and sediment quality is developed.

Island enhancement partners volunteer to plant mangroves and buttonwoods along the shoreline.

2.1.3 / Use or build on existing monitoring efforts to address information gaps and to implement a long-term onitoring program to support status and trend assessment of water and sediment quality in MLAP (Ecosystem Science). FY 2009-2010, recurring.
Performance Measures: 1. Continuation of essential water and sediment quality monitoring efforts. 2. Data gaps in the monitoring program are addressed. 3. Existing projects such as the Volusia County Environmental Health Laboratory (VCEHL) water quality monitoring program are continued.

Objective 2.2 / **Coordinate with regulatory programs, local government and land owners to reduce the impacts from development in the watershed.**

Integrated Strategies:

2.2.1 / Support projects to enhance stormwater and sewage treatment within MLAP's watershed (Resource Management). FY2009-2010, recurring.
Performance Measures: 1. Number of water quality improvement projects and programs. 2. Acreage

of expanded centralized sewer services to mainland areas where potential septic tank contamination has been identified. 3. Promote the reduction and ultimate elimination of wet-weather discharges from the New Smyrna Beach and Edgewater's Waste Water Treatment Plant.

2.2.2 / Support projects to restore stormwater pollution filtering capacity of the shoreline and watershed of MLAP (Resource Management). FY 2009-2010, recurring.
Performance Measures: 1. Development of a GIS-based inventory of all known stormwater outflow and point source discharges into MLAP. 2. Successful implementation of regional water quality improvement or management programs. 3. Miles of living shorelines used for shoreline stabilization/erosion control projects. 4. Increased use of water quality and stormwater best management practices (BMPs) and their incorporation in local regulations and ordinances.

2.2.3 / Prioritize, develop and implement water quality improvement education programs within MLAP (Education Outreach). F 009-2010, recurring.
Performance Measures: 1. Number of MLAP staff initiated or co-sponsored education programs targeting the watershed's stakeholders on the topic of pollution load reduction goals and BMP's. 2. The creation of a citizens adopt-a-drain outfall monitoring program.

2.2.4 / Provide review and comment on permit applications for activities on lands within or in the watershed of MLAP (Resource Management). FY 2009-2010, recurring.
Performance Measures: 1. Permit applications reviewed with comments submitted to regulatory and planning staff. 2. Area in compliance with Volusia County Class II overlay zone protection and shoreline setbacks for new development around MLAP.

During Island Enhancement Project events young volunteers collect mangrove propagules (seeds) in buckets alongside adult volunteers removing bags full of trash collected from the islands.

2.2.5 / Review and provide recommendations for local government comprehensive growth management plans and Land development rules and ordnances to enhance abatement of nonpoint source pollutants and address potential impacts of climate change (Resource Management). FY 2009-2010, recurring.
Performance Measures: 1. The number of rules and ordinances to reduce nonpoint sources pollutants or addressing climate change that are incorporated into comprehensive growth management plans and local rules and ordinances.

2.2.6 / Support land acquisition efforts in MLAP's watershed (Resource Management). FY 2009-2010, *recurring.*
Performance Measures: 1. A GIS-based priority list of privately-owned in-holdings within MLAP or its watershed is developed. 2. Acres of lands acquired in the IRL Blueway Project by state, regional and conservation organizations throughout the watershed.

Lucky anglers can fish big catches from the Mosquito Lagoon such as this red fish (photo: Captain Jeff Dorobiala).

Issue III / Sustainable Public Use

Mosquito Lagoon is a popular destination for many recreational fishermen, boaters, kayakers, birders and a host of other user groups. Mosquito Lagoon also supports several commercial uses including commercial fishing (finfish and shellfish), fishing guides and several ecotourism operations. MLAP was designated in 1970 for the primary purpose of preserving the biological resources in the area and maintaining these resources in an essentially natural condition for the benefit of future generations (Florida Department of Natural Resources [DNR], 1991).

When considering the importance of public use on MLAP into the future, it is important to take into account the location of the preserve in proximity to three major, growing metropolitan areas. MLAP and the Canaveral National Seashore are the closest natural estuarine areas offering local citizens from these three metropolitan areas, and tourists, opportunities to enjoy the tranquility of nature within close driving distances. The Orlando area (1.8 million census data, 2003), Daytona vicinity (497,000 census data, 2003) and Brevard County (534,359 census data, 2006) are within 90 miles or less of MLAP.

The main public use within MLAP is water-dependent recreation activities: boating, commercial and recreational fishing, camping, sunbathing, nature-watching, swimming, clamming and oyster harvesting. Water-dependent public uses are classified as either consumptive or non-consumptive for purposes of this plan. Consumptive use is defined as harvesting an animal or substrate for human use and subsequently removing it from the ecosystem. Non-consumptive uses are passive uses, such as bird watching. Boats, kayaks and shallow-drafted vessels are the principal means of access to the estuarine resources within MLAP.

Perceived areas of concern identified at public scoping meetings for future management of MLAP include: 1) degradation of oyster reefs near channels linked to the impact of boat wakes; 2) high-speed recreational boating such as water skiing or personal watercraft; and 3) potential overharvesting by

recreational fishing and wild shellfish harvesting. Providing management objectives and strategies that address recreational use of islands is also an important need identified at these scoping meetings to be addressed in this plan.

Projected commercial uses within MLAP include: 1) increased or expanded harvesting of resources by commercial fishing and shellfish harvesting; 2) increased or expanded commercial tourism such as fishing guides or ecotourism potentially resulting in crowding and conflicts at access points or disturbance to wildlife; and 3) increases in nontraditional uses such as vendors, crew rowing sculls, kite sailing and parasailing businesses. Proactive assessment and management of these activities is essential to ensure that they do not damage the sustainability of MLAP natural resources or impinge on the activities of traditional stakeholder groups.

By examining existing public use and natural resource patterns and trends MLAP staff can proactively identify potential conflicts and work with stakeholders to prioritize strategies to sustain a healthy ecosystem for the benefit of Florida residents and visitors. Ecological services derived from healthy ecosystems include aesthetics, water, food, carbon storage, storm buffers and pollution abatement that sustain human life and support social and economic prosperity (Turner et al., 2007). Raising public awareness for the valuable services that a healthy MLAP provides is a priority objective to build stakeholder support to conserve and restore this important natural resource.

Goal 3 / **Encourage user experiences and public recreation opportunities consistent with natural resources conservation.**

Objective 3.1 / **Educate visitors, local residents and users about MLAP.**

Integrated Strategies:

3.1.1 / Provide kiosks, signage, brochures or similar informational materials to inform the public and user groups about the value of the resources of MLAP and efforts to conserve and restore these resources (Education and Outreach). FY 2010-2011, recurring.
Performance Measures: 1. Signs and kiosks are installed that identify islands and their designations as Passive Recreation, Active Recreation or Conservation. 2. Numbers of educational signage posted on islands used as rookeries or roosting areas to educate the public. 3. Number and types of informational brochures distributed and presentations provided that describe efforts to conserve and restore MLAP natural resources and the ecological goods and services provided by healthy ecosystems.

Partnerships with existing organizations (i.e. Marine Discovery Center) are essential to provide outreach to the public (photo: Marine Discovery Center).

3.1.2 / Examine public use patterns and trends within MLAP to proactively identify potential resource/public use conflicts and, working with key stakeholders, develop conservation strategies to minimize damage to the natural resources (Resource Management). FY 2010-2011, recurring.
Performance Measures: 1. Number of user surveys developed and conducted. 2. Reports produced to

Law enforcement officers work patrol the waters of the Mosquito Lagoon (photo: FWC).

summarize existing and new user survey results from fisheries data, boat ramp and aerial studies and integrated into MLAP outreach and resource management programs. 3. Annual completion of an updated map that summarizes existing data on public access facilities and usage areas within MLAP. 4. A GIS based analysis of public use trends and patterns is compared to habitat maps to assess potential conflicts. 5. Number of stakeholder workshops hosted. 6. Numbers and area of Critical Wildlife Areas adopted or other conservation strategies implemented for the conservation of sensitive species or habitats.

Objective 3.2 / **Inform local residents and visitors about MLAP and actions they can take to conserve and restore the resources found there.**

Integrated Strategies:

3.2.1 / Compile and develop outreach materials for residents, visitors, ecotourism groups, fishing guides and boat charter services and other user groups (Education and Outreach). FY 2009-2010, recurring.
Performance Measures: 1. Number and types of educational materials distributed and presentations given summarizing current conditions of the resources in MLAP and highlighting ongoing resource management programs implemented to conserve resources. 2. Number of presentations and outreach activities targeting various user groups.

3.2.2 / Provide hands-on volunteer opportunities within MLAP to promote stewardship of resources (Education and Outreach). FY2009-2010, recurring.
Performance Measures: 1. Numbers of MLAP volunteer hours.

3.2.3 / Support and assist the law enforcement community in natural resource conservation (Resource Management and Education and (Outreach). FY 2009-2010, recurring.
Performance Measures: 1. Assist with law enforcement investigations and notify the appropriate entities about natural resource and user issues within MLAP. 2. Provide information on the application of state, federal, and DEP statutes involving conservation of natural resources to the public and law enforcement agencies.

Issue IV / Environmental Incident Assessment and Response

The IRL, Comprehensive Conservation and Management Plan (CCMP) Update, (Indian River Lagoon National Estuary Program, 2008) identified several types of major environmental incidents with potential to significantly affect the natural resources of the IRL. These incidents include hurricanes, frosts or freezes, the arrival of new aquatic invasive exotic species, pollutant spills and other events that may have widespread impacts. While pollutant spills, fish kills, marine mammal strandings and certain other categories of environmental incidents do have organized assessment and response strategies, many types of incidents do not. MLAP staff will support efforts to improve assessment and response strategies for major environmental incidents.

Invasion of non-indigenous species is classified as one of the five most critical environmental issues presently facing life in aquatic habitats (National Research Council, 1995). Non-native marine species are generally introduced into new environments from a ship's ballast waters, from releases from home aquaria, from the relocation of buoys, dry docks or marine platforms, or through industrial cooling system intakes and discharges. Invasions of exotic species (Australian jellyfish, Asian green mussel, charru mussel and the pink barnacle (*Megabalanus coccopoma*)), have all been reported in the Mosquito Lagoon. Other biotic threats to the native organisms of the lagoon include red tide events, harmful algal blooms (*Pyridinium bahamense* and *Karenia brevis*) and cyanobacteria. MLAP is susceptible to these threats in part because it is very near to the Ponce Inlet, many marinas and the Atlantic Intracoastal Waterway (AIWW). The AIWW is Florida's east coast commercial and recreational boating corridor used by local, out-of-state and international boaters.

Golden silk weaver spider (Nephila clavipes) *spins its web (photo: NASA).*

MLAP is bordered by several municipalities, a causeway, wastewater treatment facilities and industrial areas and is heavily used by powerboats, including powered sailing yachts passing through the AIWW. These variables increase the likelihood of accidents that require emergency action. The IRL CCMP, states that most pollutant spills (oil, hazardous chemicals and wastewater) have established emergency response and assessment protocols in place, in addition to a "hot line". Volusia County has trained Environmental Emergency Response and Hazardous Materials teams (Hazmat), and has established emergency plans, particularly for pollution-related events.

The following are existing incident response plans for the Mosquito Lagoon region:

1. Volusia County Emergency Response Plan and 2007 Disaster Preparedness Guide (Volusia County Emergency Management);
2. Emergency Response to Sea Turtle Cold Stun Events (NASA/Dynamac Corp/Florida Fish and Wildlife Conservation Commission);
3. IRL CCMP, Environmental Incident Assessment and Response Action Plan (IRL National Estuarine Program);
4. Implementation Guidance for Immediate Responses to Petroleum Product Releases (Florida Department of Environmental Protection's, Bureau of Emergency Response); and
5. Marine Safety Detachment (U.S. Coast Guard) in conjunction with the National Response Center have established protocols and online vessel reports to notify the agency of emergency incidents such as oil spills operating under the National Oil and Hazardous Substances Pollution Contingency Plan.

The following are existing incident monitoring studies for the IRL region:

1. Preliminary strategic plan for algal toxins and aquatic animal health; and
2. Health-related water quality testing to determine the status of aquaculture harvesting areas (Florida Department of Agriculture and Consumer Services).

Immature white ibis feeding in the intertidal zone of the Mosquito Lagoon Aquatic Preserve.

The East Central Florida Aquatic Preserve field office has developed a hurricane response plan which stages equipment (boats, cameras, GPS units) in locations that allow rapid access to the lagoon to assess post-storm conditions, such as grounded vessels, erosion of causeways and wayward debris (broken docks and other free-floating marine hazards). The primary focus of this issue is to ensure that MLAP staff is fully integrated into existing emergency response and assessment plans and gaps can be proactively identified in existing protocols and procedures.

Goal 4 / **Integrate MLAP into strategies to assess and respond to environmental incidents within MLAP.**

Objective 4.1 / **Identify existing assessment and response programs, gaps in these programs and strategies to address these gaps.**

Integrated Strategies:

4.1.1/ Identify/inventory existing rapid assessment response programs for MLAP and identify classes of incidents not addressed by these programs (Education and Outreach). FY 2009-2010, recurring.
Performance Measures: 1. An inventory of response services, support agencies and equipment available within the Mosquito Lagoon basin is created and maintained. 2. A listing of appropriate contacts and procedures for marine-related emergency response is created and maintained.

4.1.2 / Develop assessment and response strategies for categories of incidents not addressed by existing programs (Resource Management). FY 2009-2010, recurring.
Performance Measures: 1. Strategies are developed for monitoring, reporting and response protocols to address incidents that may not be incorporated into existing programs (marine invasive species, algal blooms, chemical spills and climate change).

Kayaking is a perfect way to visit and enjoy the plentiful natural resources found in the Mosquito Lagoon Aquatic Preserve.

Part Six

Additional Plans

Chapter Six

Administrative Plans

The mission of the East Central Florida Aquatic Preserves (ECFAP) is to effectively implement the management plans for three aquatic preserves under the charge of the Office of Coastal and Aquatic Managed Areas (CAMA). These three aquatic preserves are located within three adjacent counties and together total approximately 63,000 acres (255 km2) of sovereign submerged lands extending over a distance of 107 miles (172.2 km).

Through a community-based program, the field office strives to:

1. implement CAMA's programs consistent with all Florida Department of Environmental Protection (DEP) regulations, policies and procedures;
2. accurately provide fiscal tracking;
3. manage contracts and grants; and
4. provide all pertinent information to the CAMA Central Office in Tallahassee.

As of fiscal year (FY) 2007-2008 the ECFAP staff includes two full time equivalent (FTE) (permanent) positions and two other personal services (OPS) positions. The two FTE positions include an Environmental Specialist II, serving as the aquatic preserve manager, and an Environmental Specialist I, overseeing the water quality and other monitoring programs. In fiscal year (FY) 2007 - 2008, two state-funded OPS positions were allocated. These OPS positions include one administrative position and a field/data management position responsible for data management, volunteer coordination and the Island Enhancement Program (IEP).

Three additional part-time, temporary, grant-funded OPS positions have supported specific projects intermittently during the last two years. One team member managed two large federal habitat restoration grants and contracts, the second a mangrove restoration project, and the third assisted with the Mosquito Lagoon Aquatic Preserve (MLAP) Management Plan.

In order to accomplish the goals set out in this plan the MLAP field office must maintain a minimum of four positions. To attract and retain qualified and dedicated staff, the OPS positions should be upgraded to FTE status. Having adequate staff is crucial to the success of the program. Maintaining sufficient support staff in the CAMA Central Office to assist with grant management is also crucial to allow the aquatic preserves to take timely action on issues as they arise.

The ECFAP program maintains a program-wide planning horizon of 5-10 years. CAMA has developed a three year budget and strategic work plan that addresses ongoing staffing needs by program area, a capital equipment replacement schedule and facility and program needs. Both the work plan and budget are revised on an annual basis. Equitable and dependable distribution of funding among the field offices is necessary to sustain CAMA programs. Successful implementation of the strategies identified in this management plan will depend on consistent and appropriate level of funding to maintain staff.

To accomplish proper management of three preserves, ECFAP staff relies on partners. The ECFAP has a citizen support organization, the Coastal Preserves Alliance of East Central Florida (CPA) that assists staff and coordinates volunteers for various events. In addition to a volunteer citizen support organization, a group was formed from members of the MLAP Management Plan Advisory Committee. The Mosquito Lagoon Working Group consists of partners that share management responsibilities and similar management goals for Mosquito Lagoon. These partners include private individuals and organizations, non-profits, and governmental agencies. A network approach incorporates the vast knowledge and experience that these partners possess, maximizing the effectiveness of limited programmatic resources to benefit the implementation of strategies identified within this plan. To carry out planned activities, staff is supplemented by regular partnership-based volunteer efforts. Successful implementation of the strategies identified in this plan depends on the dedication of working group members.

Vessels are essential in the restoration of islands along the preserve, helping to take supplies to the islands and remove trash and debris.

Chapter Seven

Facilities Plans

Facilities

During fall 2004, extensive hurricane damage forced East Central Florida Aquatic Preserves (ECFAP) staff to relocate from existing office facilities at Sebastian Inlet State Park to temporary housing at the Marine Resources Council's Lagoon House, Palm Bay, for one year. Because of the 107 mile distance spanning the three different preserves, Staff now use two facilities to accomplish the implementation of the aquatic preserve programs, a centralized field office in Cocoa and a southern modular office/lab facility in Fellsmere to implement the water quality monitoring and other programs in southern Brevard County, and Indian River County.

ECFAP is the sole tenant of the Brevard County Environmental Field Station, historically known as City Point Church, Cocoa. Staff partners with the Brevard County Natural Resources Management office to provide opportunities for environmental education by hosting several summer camps, environmental displays, and public visitation to the nationally-registered historic building. The building consists of a 123-year old, 1,200 square foot, one room design. ECFAP and Brevard County partnered on a historic preservation grant, awarded in fiscal year 2007-2008, to stabilize the structure. Brevard County supports the ECFAP program by providing the use of the building in return for the cost of utilities. A portable 21 square foot (2 m2) shed on the property is used for field supply storage.

The southern office/lab facility is a 476 square foot (44 m2) modular building constructed in 1997 at the St. Sebastian River Preserve State Park (SSRPSP) in Fellsmere and has been occupied by ECFAP staff since summer 2008. The state park has agreed to the use of a shared wet laboratory for calibrating water quality monitoring equipment located at the new SSRPSP Visitors Center. In the interim, partners at the St. Johns River Water Management District Indian River Lagoon National Estuary Program had provided office and lab space for the water quality monitoring staff from fall 2005 to spring 2008.

Equipment Storage and Nursery

A 21 square foot (2 m^2) chemical storage shed with cement pad and apron was constructed in 2006, near the modular office at the SSRPSP. This structure with apron was designed to meet federal standards to retain potential chemical spills associated with herbicides. A second larger storage building was constructed in summer 2008 at the park to store materials and equipment for the Island Enhancement

Program (IEP). Two uncovered boat storage compounds are used by ECFAP. One gated compound, suitable for storage of two boats, is located at the Brevard County Sheriff's East Precinct office on Merritt Island, five miles from the Cocoa office; another gated equipment compound is located at the SSRPSP property. One vehicle is stored at each office. The ECFAP hurricane plan, updated annually, ensures that all vehicles and vessels will be relocated to the mainland on high ground to allow post-storm access.

A native plant nursery for the Shoreline Revegetation Project and IEP was rebuilt during 2008 at the southern entrance to the SSRPSP in Indian River County. This nursery, manned by volunteers, will save costs by growing and staging mangroves and other plants for both projects.

Vehicles and Vessels

The motor vehicles and vessels currently necessary to achieve the goals of the ECFAP have been acquired or are in the process of being donated. As part of the program's strategic planning cycle, the condition of all vehicles and vessels in the program are evaluated annually. The need to replace equipment is expected during the next ten years. CAMA is considering establishing a replacement-schedule policy based on vehicle mileage similar to other bureaus and divisions in DEP. Fuel and maintenance costs are expected to increase with fuel costs and vessel and vehicle aging.

Vehicles

- **2007 Ford F-150, crew cab, 4x4 pickup with topper** – Acquired in 2007 for ECFAP to transport up to four staff or volunteers, heavy equipment and/or towing boats. Used to support all programs, long-distance travel, training and coordination meetings. New condition.
- **2001 Dodge Ram extended cab 4x4 with diamond plate tool box and kayak rack** – Acquired in December 2006 from DEP's Division of Law Enforcement for the water quality program and for towing boats to the three aquatic preserves. The Dodge has over 110, 000 miles (177,028 km), is becoming increasingly costly to maintain and gets low gas mileage. This is the primary vehicle used for travel between offices, aquatic preserves, meetings and events. A replacement four-wheel drive vehicle will be needed in the near future to maintain efficient office operations. Fair to good condition - The automatic transmission replaced in 2007 is only in fair condition. Maintenance costs during early 2008 exceeded $2,500.

Vessels

- **Two - 2005 kayaks** – low cost logistics, primary transportation for the water quality and bird monitoring programs and to navigate shallow or narrow waters. Good condition.
- **Two - jon boats** – One14-foot (4.3 m) with 25 horsepower outboard and one16-foot (4.9 m) with 18 horsepower outboard. One vessel and outboard was donated in 2007 by a volunteer and the other obtained through a non-profit in 2008 for support of the Shoreline Revegetation Project and transporting equipment in narrow shallow waters in Mosquito Lagoon. Good condition.
- **18' (5.5 m) 2000 Parker with 2000 115 hp 2-stroke Mercury** – Purchased for implementation of all ECFAP programs. Good overall condition.
- **19' (5.8 m) 1997 Wahoo with 150 hp, 4-stroke Mercury** – June 2007 transfer from Southeast Florida Aquatic Preserves. Transportation for volunteers and equipment (Island Enhancement Program and monitoring projects). Fair condition.
- **New 24' (7.3 m) Windsorcraft platform boat** – recently acquired through a SJRWMD regulatory public interest donation during 2008 for use in restoration events. A Florida Inland Navigation District grant was awarded for a new 115 hp Yamaha outboard to power the vessel. This vessel would considerably improve the logistics and safety of transporting volunteers and equipment to IEP restoration events. Good condition.

Furniture & Office Equipment

Replacement of office furniture and other equipment such as cabinets, desks, and phones needs to occur as necessary. ECFAP has been gradually building its computer base to provide each position with a desktop computer or laptop. Upgrading at least one computer per year continuously is anticipated to maintain updated technology and to ensure that the office staff maintains the ability to operate. Annual inventories are conducted and restocking of all needed items will remain an ongoing task.

Lists of Appendices

*A.1 / **Aquatic Preserve Resolution***

WHEREAS, the State of Florida, by virtue of its sovereignty, is the owner of the beds of all navigable waters, salt and fresh, lying within its territory, with certain minor exceptions, and is also the owner of certain other lands derived from various sources; and

WHEREAS, title to these sovereignty and certain other lands has been vested by the Florida Legislature in the State of Florida Board of Trustees of the Internal Improvement Trust Fund, to be held, protected and managed for the long-range benefit of the people of Florida; and

WHEREAS, the State of Florida Board of Trustees of the Internal Improvement Trust Fund, as a part of its overall management program for Florida's state-owned lands, does desire to insure the perpetual protection, preservation and public enjoyment of certain specific areas of exceptional quality and value by setting aside forever these certain areas as aquatic preserves or sanctuaries; and

WHEREAS, the ad hoc Florida Inter-Agency Advisory Committee on Submerged Land Management has selected through careful study and deliberation a number of specific areas of state—owned land having exceptional biological, aesthetic and scientific value, and has recommended to the State of Florida Board of Trustees of the Internal Improvement Trust Fund that these selected areas be officially recognized and established as the initial elements of a statewide system of aquatic preserves for Florida;

NOW, THEREFORE, BE IT RESOLVED by the State of Florida Board of Trustees of the Internal Improvement Trust Fund:

THAT it does hereby establish a statewide system of aquatic preserves as a means of protecting and preserving in perpetuity certain specially selected areas of state-owned land: and

THAT specifically described, individual areas of state-owned land may from time to time be established as aquatic preserves and included in the statewide system of aquatic preserves by separate resolution of the State of Florida Board of Trustees of the Internal Improvement Trust Fund; and

THAT the statewide system of aquatic preserves and all individual aquatic preserves established thereunder shall be administered and managed, either by the said State of Florida Board of Trustees of the Internal Improvement Trust Fund or its designee as may be specifically provided for in the establishing resolution for each individual aquatic preserve, in accordance with the following management policies and criteria:

(1) An aquatic preserve is intended to set aside an exceptional area of state-owned land and its associated waters for preservation essentially in their natural or existing condition by reasonable regulation of all human activity which might have an effect on the area.

(2) An aquatic preserve shall include only lands or water bottoms owned by the State of Florida, and such private lands or water bottoms as may be specifically authorized for inclusion by appropriate instrument from the owner. Any included lands or water bottoms to which a private ownership claim might subsequently be proved shall upon adjudication of private ownership be automatically excluded from the preserve, although such exclusion shall not preclude the State from attempting to negotiate an arrangement with the owner by which such lands or water bottoms might be again included within the preserve.

(3) No alteration of physical conditions within an aquatic preserve shall be permitted except: (a) minimum dredging and spoiling for authorized public navigation projects, or (b) other approved activity designed to enhance the quality or utility of the preserve itself. It is inherent in the concept of the aquatic preserve that, other than as contemplated above, there be: no dredging and filling to create land, no drilling of oil wells or excavation for shell or minerals, and no erection of structures on stilts or otherwise unless associated with authorized activity, within the confines of a preserve - to the extent these activities can be lawfully prevented.

(4) Specifically, there shall be no bulkhead lines set within an aquatic preserve. When the boundary of a preserve is intended to be the line of mean high water along a particular shoreline, any bulkhead line subsequently set for that shoreline will also be at the line of mean high water.

(5) All human activity within an aquatic preserve shall be subject to reasonable rules and regulations promulgated and enforced by the State of Florida Board of Trustees of the Internal Improvement Trust Fund and/or any other specifically designated managing agency Such rules and regulations shall not interfere unduly with lawful and traditional public uses of the area, such as fishing (both sport and commercial), hunting, boating, swimming and the like.

(6) Neither the establishment nor the management of an aquatic preserve shall infringe upon the lawful and traditional riparian rights o private property owners adjacent to a preserve. In furtherance of these rights,

reasonable improvement for ingress and egress, mosquito control, shore protection and similar purposes may be permitted by the State of Florida Board of Trustees of the Internal Improvement Trust Fund and other jurisdictional agencies, after review and formal concurrence by any specifically designated managing agency for the preserve in question.

(7) Other uses of an aquatic preserve, or human activity within a preserve, although not originally contemplated, may be permitted by the State of Florida Board of Trustees of the Internal improvement Trust Fund and other jurisdictional agencies, but only after a formal finding of compatibility made by the said Trustees on the advice of any specifically designated managing agency for the preserve in question.

IN TESTIMONY WHEREOF, the Trustees for and on behalf of the State of Florida Board of Trustees of the Internal Improvement Trust Fund have hereunto subscribed their names and have caused the official seal of said State of Florida Board of Trustees of the Internal
Improvement Trust Fund to be hereunto affixed, in the City of Tallahassee, Florida, on this the 24th day of November A. D. 1969.

CLAUDE R. KIRK, JR, Governor
TOM ADAMS, Secretary of State
EARL FAIRCLOTH, Attorney General
FRED O. DICKINSON, JR., Comptroller
BROWARD WILLIAMS, Treasurer
FLOYD T. CHRISTIAN, Commissioner of Education
DOYLE CONNER, Commissioner of Agriculture

As and Constituting the State of Florida Board of Trustees of the Internal Improvement Trust Fund.

*A.2 / **Florida Statutes (F.S.)***

All the statutes can be found according to number at www.leg.state.fl.us/Statutes

- ***Florida Statutes, Chapter 253: State Lands***
- ***Florida Statutes, Chapter 258: State Parks and Preserves***
  Part II (Aquatic Preserves)
- ***Florida Statutes, Chapter 370: Saltwater Fisheries***
- ***Florida Statutes, Chapter 372: Wildlife***
- ***Florida Statutes, Chapter 403: Environmental Control***
  (Statute authorizing the Florida Department of Environmental Protection (DEP) to create Outstanding Florida Waters is at 403.061(27))

*A.3 / **Florida Administrative Codes (F.A.C.)***

- ***Florida Administrative Code, Chapter 18-20: Florida Aquatic Preserves***
  www.dep.state.fl.us/legal/Rules/shared/18-20.pdf
- ***Florida Administrative Code, Chapter 18-21: Sovereignty Submerged Lands Management***
  www.dep.state.fl.us/legal/Rules/shared/18-21.pdf
- ***Florida Administrative Code, Chapter 62-302: Surface Water Quality Standards***
  (Rule designating Outstanding Florida Waters is at 62-302.700)
  www.dep.state.fl.us/legal/Rules/shared/62-302/62-302.pdf

B.1 / *Acronym List*

Acronym	Definition
ACOE	U.S. Army Corps of Engineers
AIWW	Atlantic Intracoastal Waterway
BTIITF	Board of Trustees of the Internal Improvement Trust Fund
CAMA	Office of Coastal and Aquatic Managed Areas
CNS	Canaveral National Seashore
CPA	Coastal Preserves Alliance
CSO	Citizen Support Organization
DACS	Florida Department of Agriculture and Consumer Services
DEP	Florida Department of Environmental Protection
DNR	Florida Department of Natural Resources
ECFAP	East Central Florida Aquatic Preserves
ESA	Endangered Species Act
F.A.C.	Florida Administrative Code
FNAI	Florida Natural Areas Inventory
F.S.	Florida Statutes
FTE	Full-Time Equivalent
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Fish and Wildlife Research Institute
FWS	U.S. Fish and Wildlife Service
HBOI	Harbor Branch Oceanographic Institute
IEP	Island Enhancement Program
IRL	Indian River Lagoon
MINWR	Merritt Island National Wildlife Refuge
MLAP	Mosquito Lagoon Aquatic Preserve
NASA	National Aeronautics and Space Administration
NERR	National Estuarine Research Reserve
NMFS	National Marine Fisheries Service
NPS	National Park Service
OFW	Outstanding Florida Waters
OPS	Other Personal Services
ppt	parts per thousand
RIFA	red imported fire ant
RPA	Resource Protection Areas
SAV	submerged aquatic vegetation
SJRWMD	St. Johns River Water Management District
SSRPSP	St. Sebastian River Preserve State Park
UCF	University of Central Florida
VCEHL	Volusia County Environmental Health Laboratory
VCMC	Volusia County Mosquito Control
VCWA	Volusia County Water Atlas
WQMN	Water Quality Monitoring Network

adaptive management – an continual process of planning, monitoring, research, evaluation and adjusting management to meet pre-defined goals.

algal bloom – an explosive increase in the density of phytoplankton (microscopic, single-celled plants) within an area.

alternative – a reasonable way to fix the identified problem or satisfy the stated need; a choice between things.

anaerobic – growing or occurring in the absence of molecular oxygen.

anoxic – lacking or not involving or requiring oxygen.

aquaculture – the cultivation of aquatic animals and plants, especially fish, shellfish and seaweed, in natural or controlled marine or freshwater environments; underwater agriculture.

aquatic – growing in, living in or dependent upon water; living in or near water; plants adapted for a partially or completely submerged life.

aquifer – permeable underground rock strata that holds water.

anthropogenic – caused or produced by humans: *anthropogenic air pollution.*

atmospheric pressure (barometric pressure) – the downward force exerted by the weight of the overlying atmosphere.

attenuate – to weaken or reduce in force, intensity, effect, quantity or value.

benthos – organisms that dwell on the unconsolidated bottoms of marine and freshwater systems (worms and zooplankton).

biodiversity – the existence of a wide variety of species of plants, animals and microorganisms in a natural community or habitat or of communities within a particular environment; genetic variation within a species.

biogeography – the science that studies the geographic distribution of organisms; the study of the geographical distributions of organisms, their habitats and the historical and biological factors which produced them.

biological integrity – biotic composition, structure and function at the genetic, organism and community levels consistent with natural conditions and the biological processes that shape genomes, organisms and communities.

biological or natural diversity (also biodiversity) – the abundance, variety, and genetic constitution of animals and plants in nature; the total variety of life and its processes, including the variety of living organisms and the genetic differences between them and the communities and ecosystems in which they occur.

biota – all the organisms living in a particular region, including plants, animals and microorganisms.

biotic community – biological community or association, ecological community; an assemblage of species living in a prescribed area or physical habitat; a group of interacting species coexisting in a particular habitat.

bivalve – any mollusk, as the oyster, clam, scallop or mussel of the class Bivalvia, having two shells hinged together, a soft body and lamellate gills.

breeding habitat – habitat used by migratory birds or other animals during the breeding season.

brood – to incubate eggs.

buffer – to protect a system from change by external factors; anything that reduces an impact.

buffer zones – protective land borders around critical habitats or water bodies that reduce runoff and non-point source pollution loading; areas created or sustained to lessen the negative effects of land development on animals, plants and their habitats.

carrying capacity (K) – the size of the population that can be sustained by a given environment; the maximum population of a given organism that a particular environment can sustain.

codify – to arrange laws and rules systematically.

community – a grouping of populations of different organisms found living together in a particular environment.

community type – a particular assemblage of plants and animals, named for the characteristic plants.

conjunction – a joining together; combination.

conservation – the management of natural resources to prevent loss or waste; the planned management of natural resources; the retention of natural balance, diversity and evolutionary change in the environment; preservation.

conservation easement – a legal agreement between a landowner and a land trust (a private, nonprofit conservation organization) or government agency that permanently limits a property's uses in order to protect its conservation values.

convective – to transfer (heat or a fluid) by convection.

cultural resource – evidence of historic or prehistoric human activity, such as buildings, artifacts, archaeological sites, documents, oral or written history. Cultural resources include historical, archaeological and/or architecturally significant resources.

cuspate – having a cusp or shaped like a cusp.

cuspate foreland – a large, triangular area of coastal deposition that is dominated by many shingle ridges and is often terminated on the landward side by poorly-drained terrain.

cyanobacteria – the blue-green bacteria or chloroxybacteria. Both groups obtain their food by photosynthesis in a manner very similar to that of green plants and true algae, producing oxygen in the process. They occur in all aquatic habitats.

database – a collection of data arranged for ease and speed of analysis and retrieval, usually computerized; a mass of data in a computer, arranged for rapid expansion, updating and retrieval.

dechloriniation – to remove the chlorine from (a substance, as water); to dechlorinate tap water for use in an aquarium.

degradation – breakdown into smaller or simpler parts; reduction of complexity.

derelict – deserted by the owner; abandoned.

detritus – non-living particulate organic material. It includes the bodies of dead organisms colonized by microorganisms which decompose the material. Together with plankton are components of the estuarine food chain.

dinoflagelalte – any of numerous one-celled organisms found mostly in the ocean, usually having two flagella of unequal length and often an armorlike covering of cellulose. Dinoflagellates are one of the main components of plankton. They include bioluminescent forms and forms that produce red tide.

dispersal – the movement of organisms away from a location, such as point of origin.

dissemination – scattering or spreading, as of infections agents, seeds or spores; distribution.

diversity – a measure of the number of species and their relative abundance in a community.

dragline – an excavating machine in which the bucket is attached by cables and operates by being drawn toward the machine.

drainage basin – the total land area that drains into a body of water.

dredge – an apparatus for scooping up mud, for deepening channels.

easement – an agreement by which a landowner gives up or sells one of the rights on his/her property. For example, a landowner may donate a right-of-way across his/her property to allow access; a right that one may have in another's land.

ecological integrity – the integration of biological integrity, natural biological diversity and environmental health; the replication of natural conditions.

ecology – the branch of science that studies the distribution and abundance of organisms and the relationship between organisms and their environment; the study of the inter-relationships between living organisms and their environment.

ecosystem – a biological community together with its environment, functioning as a unit; a community of organisms and their physical environment interacting as an ecological unit.

ecosystem approach – a way of looking at socio-economic and environmental information based on ecosystem boundaries, rather than town, city or county boundaries.

ecosystem-based management – an approach to making decisions based on the characteristics of the ecosystem in which a person or thing belongs. This concept takes into consideration interactions between the plants, animals and physical characteristics of the environment when making decisions about land use or living resource issues.

ecotourism – travel to an area of ecological, geographical or natural history interest, with an emphasis on avoiding bringing additional pressures upon the region and concern to ensure that both local human culture and the environment are enhanced rather than damaged.

El Niño – a weakening of the equatorial current, allowing warm water to accumulate off the South American Pacific coast.

emergent – an aquatic plant having most of the vegetative parts above water; a tree which reaches above the level of the surrounding canopy.

endangered species – an animal or plant species in danger of extinction throughout all or a significant portion of its range.

endemic – native to and restricted to a particular geographical region.

environment – the complex of climatic, geologic, hydrologic, soils and biotic factors acting upon organisms.

environmental health – abiotic composition, structure, and functioning of the environment consistent with natural conditions, including the natural abiotic processes that shape the environment.

ephemeral – short-lived or of brief duration.

epifauna – the animal life inhabiting a sediment surface or water surface.

epiphyte – a plant that uses another plant, typically a tree, for its physical support but which does not draw nourishment from it.

estuary – semi-enclosed coastal water, open to the sea, having a high fresh-water drainage and with marked cyclical fluctuations in salinity; usually the mouth of a river.

evapotranspiration – the combined processes of evaporation, sublimation and transpiration of the water from the earth's surface into the atmosphere; the total amount of water transferred from the earth to the atmosphere.

extinction – the disappearance of a species from a given habitat; dying out, usually global, of a species for any reason.

extirpation – extermination of the population of a given species from an area; the removal, elimination or disappearance of a species or subspecies from a part of its range.

fauna – the animal life of a given region, habitat or geological stratus.

federally listed species – a species listed under the federal Endangered Species Act of 1973, as amended, either as endangered, threatened or species at risk.

federally threatened species – any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

flora – the plant life of a given region, habitat or geological stratum.

fouling organisms – an assemblage of organisms growing on the surface of floating or submerged man-made objects, that increases resistance to water flow or otherwise interferes with the desired operation of the structure.

fragmentation – the act of breaking up.

geographic information system (GIS) – computer system supporting the collection, storage, manipulation and query of spatially referred data, typically including an interface for displaying geographical maps.

habitat – the living place of an organism or community, characterized by its physical or biotic properties.

habitat conservation - the protection of an animal or plant's habitat to ensure that the use of that habitat by the animal or plant is not altered or reduced.

habitat degradation – the process of transitioning from a higher quality to a lower quality wildlife habitat.

habitat fragmentation – breaking up of a specific habitat into smaller unconnected areas. A habitat area that is too small may not provide enough space to maintain a breeding population of the species in question.

harmful algal bloom – (HAB) a dense concentration (bloom) of a single-celled, plant like marine organism (phytoplankton) that produces toxins which are detrimental to plants and animals. An algal bloom can still kill fish and other aquatic life by decreasing sunlight available to the water and by using up all of the available oxygen in the water. A harmful algal bloom specifically produces harmful toxins.

herbicide – a chemical agent used to kill plants or inhibit plant growth.

heterogeneous – having a non-uniform structure or composition.

homogeneous – similar throughout; or uniform structure or composition.

hydric – pertaining to water; wet.

hydrogeologic – the science dealing with the occurrence and distribution of underground water.

hydrology – the scientific studies of the properties, distribution and effects of water in the atmosphere, on the earth's surface and in soil and rocks, emphasizing the study of bodies of surface water on land and how they change with time.

hypoxic – oxygen-deficient.

immunologic- the branch of science dealing with the components of the immune system, immunity from disease, the immune response and immunologic techniques of analysis.

indicator species – a species, the presence or absence of which is indicative of a particular habitat, community or set of environmental conditions.

indigenous – native to a particular area; used of an organism or species occurring naturally in an environment or region.

infauna – the animal life within a sediment; epifauna.

insolation – exposure to solar radiation.

intertidal zone – the shore zone between the highest and lowest tides; littoral.

introduction – a plant or animal moved from one place to another by man.

invasive exotic species – non-native species which have been introduced into an ecosystem and, because of their aggressive growth habits and lack of natural predators, displace native species.

keystone species – a species whose presence and role within an ecosystem has a disproportionate effect on other organisms within the system. A keystone species is often a dominant predator whose removal allows a prey population to explode and often decreases overall diversity. Other kinds of keystone species are those, such as coral or beavers, that significantly alter the habitat around them and thus affect large numbers of other organisms.

La Niña – similar to El Niño in the Atlantic; a strengthening of the equatorial countercurrent, warm surface waters flow eastwards to overlie the cold waters of the Peru Current.

larvicide – an agent for killing larvae; an insecticide designed to kill larval pests

limiting factor – any environmental factor or group of related factors which exist at suboptimal level and thereby prevent an organism from reaching its full biotic potential.

limnetic – lakes or other bodies of standing fresh water; open water of a lake away from the bottom.

listed species – a species, subspecies or distinct population segment that has been added to the federal list of endangered and threatened wildlife and plants.

lithification – to change sediment to stone or rock.

littoral – the intertidal zone of the seashore; sometimes used to refer to both the intertidal zone of the seashore and the adjacent continental shelf to a depth of about 200 m.

load – the total amount of material carried by a stream or river.

loam – a fertile soil that is made up of organic matter mixed with clay, sand and silt.

local community – the area or locality in which a group of people resides and shares the same government.

management alternative – a set of objectives and the strategies needed to accomplish each objective.

mandate – an order or command; the will of constituents expressed to their representative, legislature, etc.

marginal habitat – a habitat with low species diversity due to adverse physical or other conditions.

mesic – pertaining to conditions of moderate moisture or water supply; used of organisms occupying moist habitats.

mesohaline – brackish water having a salinity between 3 and 10 ppt, or sea water having a salinity between 30 and 34 parts per thousand (ppt).

midden – a refuse heap; used especially in archeology.

mitigation – actions taken to compensate for the negative effects of a particular project or action. Wetland mitigation usually takes the form of restoration or enhancement of a previously damaged wetland or creation of a new wetland.

monitoring – measurement of environmental characteristics over an extended period of time to determine status or trends in some aspect of environmental quality.

muck – highly decomposed plant material typically darker and with higher mineral content than peat.

native – the plant and animal species, habitats or communities that originated in a particular region or area or those that have established in a particular region or area without human influence.

native plant – a plant that has grown in the region since the last glaciation and occurred before European settlement.

nekton – those actively swimming pelagic organisms able to move independently of water currents; typically with in the size range 20 mm-20 m.

nephelometric – an instrument for studying the density of suspended particles in a liquid by measuring the degree to which the suspension scatters light.

neurotoxic – a toxin that damages or destroys nerve tissue.

niche – the ecological role of a species in a community; micro habitat in the sense of the physical space occupied by a species.

non-point source pollution – nutrients or toxic substances that enter water from dispersed and uncontrolled sites.

nekton – marine species that swim freely.

oligohaline – brackish water having a salinity between 0.5 and 3.0 ppt, or sea water having a salinity between 17 and 30 ppt.

organochlorine insecticide – type of pesticide; are very persistent and not easily biodegradable. Example: DDT.

paralytic – pertaining to or of the nature of paralysis.

pelagic – of or pertaining to the open seas or oceans. Living or growing at or near the surface of the ocean, far from land.

pesticide – a chemical agent that kills insects and other animal pests.

physiography – physical geography is one of the two major subfields of geography; focuses on understanding the processes and patterns in the natural environment, as opposed to the built environment which is the domain of human geography.

phytoplankton – are microscopic, single-celled plants that live in the sea.

plankton – organisms that drift passively or swim modestly; organisms that are unable to maintain their position or distribution independent of the movement of water or air masses.

planktonic – of/or relating to plankton.

pollution – the contamination of a natural ecosystem.

population – a group of organisms of one species, occupying a defined area and usually isolated to some degree from other similar groups.

population monitoring – assessments of the characteristics of populations to ascertain their status and establish trends related to their abundance, condition, distribution or other characteristics.

potable water – water that is palatable and safe for human consumption, in which any toxic substances, pathogenic organisms and factors have been reduced to safe or acceptable levels; drinkable.

psammophyte – a plant growing or moving in unconsolidated sand.

refugium – an isolated habitat that retains the environmental conditions that were once widespread.

reintroduction – the process of relocating a plant or animal species to a location where it historically occurred.

restoration – management actions that return a vegetative community or ecosystem to its original, natural condition or to something close to its natural state.

rhizomes – a horizontal, usually underground stem that often sends out roots and shoots from its nodes. Also called *rootstalk*, *rootstock*.

riparian – pertaining to, living or situated on the banks of rivers and streams.

ruderal – pertaining to or living amongst rubbish or debris or inhabiting disturbed sites.

runoff – water from rain, melted snow or agricultural or landscape irrigation that flows over the land surface into a water body.

salinity – a measure of the total concentration of dissolved salts in seawater.

sediment – material derived from preexisting rock deposited at or near the Earth's surface.

seine – a large fishing net weighted along the bottom.

sessile – non-motile; permanently attached at the base.

sheet-wash – a process in which a thin, mobile sheet of water flows over the surface of a hill-slope and may transport unconsolidated material on the surface.

spat – a young oyster or oysters.

spawn – the eggs of certain aquatic organisms; the act of producing such eggs or egg masses.

species – a group of organisms, minerals or other entities formally recognized as distinct from other groups; the basic unit of biological classification; a distinctive kind of plant or animal having distinguishable characteristics that can interbreed and produce viable young; a category of biological classification.

species abundance – the relative distribution of the number of individuals of each species in a community.

species of concern – an informal term referring to a species that might be in need of conservation action. This may range from a need for periodic monitoring of populations and threats to the species and its habitat or to the necessity for listing as threatened or endangered.

species diversity – either the absolute number of species or a measure of both the number of species and their relative abundance.

stakeholder – any person or organization who has an interest in the actions discussed or is affected by the resulting outcomes of a project or action.

stopover habitat – habitat used during bird migration for rest and feeding.

subtidal – environment which lies below the mean low water level.

submerged aquatic vegetation – seagrasses.

succession – a natural sequence of changes in plant species and community structure over time, leading to a hypothesized stable climax community.

supratidal – the zone on the shore above mean high tide level.

surficial – relating to, or occurring on or near the surface of the earth.

surficial aquifer – shallow beds of shells and sand that lie less than 100 feet (30.5 m) underground. They are separated from the Floridan aquifer by a confining bed of soil.

synoptic – affording or taking a general view of the principal parts of a subject.

take – to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect or attempt to collect or to engage in any such conduct.

threatened species – an animal or plant species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

transect – a line or narrow belt used to survey the distributions of organisms across a given area.

transverse – situated across; crosswise.

trawl – a large net dragged along the bottom of a fishing bank.

turbid – cloudy; opaque with suspended matter.

unfragmented habitat – large blocks of unbroken habitat of a particular type.

upland – dry soils; elevations above mean high water other than wetlands; land or an area of land lying above the level where water flows or where flooding occurs.

vector – any agency responsible for the introduction or dispersal of an animal or plant species.

vegetation – plant life or cover in an area; also used as a general term for plant life.

vegetation type – a plant community with distinguishable characteristics.

viable population – a population that will continue to occur in the area for the foreseeable future. In population modeling, minimum viable population (MVP) is the smallest number of individuals that are needed to maintain a species population in the long term; having the capacity to live, grow, germinate or develop.

vestigal – degenerate or imperfectly developed; used of structure or function that have become diminished or reduced during the course of evolution.

vestige – a trace, mark or sign, especially of something that has passed away. A degenerate part, more fully developed in an earlier stage.

water column – the vertical column of water in a sea or lake extending from the surface to the bottom.

watershed - the geographic area within which water drains into a particular river, stream or body of water. A watershed includes both the land and the body of water into which the land drains.

wetlands – The U.S. Fish and Wildlife Service's definition of wetlands states that "Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water"; an area of low lying land, submerged or inundated periodically by fresh or saline water.

wildlife – the mix of living organisms; includes plants and animals.

wildlife diversity – a measure of the number and relative abundance of wildlife species in an area.

wildlife management – the practice of manipulating wildlife populations, either directly through regulating the numbers, ages and sex ratios harvested or indirectly by providing favorable habitat conditions and alleviating limiting factors.

xeric – dry or desert-like conditions; having very little moisture; tolerating or adapted to dry conditions.

zooplankton – plankton that consists of animals, including the corals, rotifers, sea anemones, jellyfish, small crustaceans and fish larvae.

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B.4.1 / Native Species Within and Adjacent to the Mosquito Lagoon Aquatic Preserve

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
Plants			
Class Liliopsida (Grass-like flowering plants)			
Subclass Arecidae			
Order Arecales			
Saw palmetto	*Serenoa repens*		
Subclass Caryophyllidae			
Order Caryophyllales			
Beach chaff-flower	*Alternanthera maritima*		
Glasswort	*Salicornia spp.*		
Prickly-pear cactus	*Opuntia humifusa*		
Prickly-pear cactus	*Opuntia stricta*		
Samphfire	*Blutaparon vermiculare*		
Sea purslane	*Sesuvium portulacastrum*		
Yellow joyweed	*Alternanthera flavescens*		
Subclass Commelinidae			
Order Cyperales			
Bitter panic grass	*Panicum amarum*		
Muhly grass	*Muhlenbergia capillaris*		
Saltgrass	*Distichlis spicata*		
Saltmeadow cordgrass	*Spartina patens*		
Seashore dropseed	*Sporobolus virginicus*		
Seashore paspalum	*Paspalum vaginatum*		
Smooth Cordgrass	*Spartina alterniflora*		
Subclass Liliidae			
Order Liliales			
Black needle rush	*Juncus roemerianus*		
Celestial Lily	*Nemastylis floridana*	E	
Florida Beargrass	*Nolina atopocarpa*	T	
Spanish bayonet	*Yucca aloifolia*		
Spider lily	*Hymenocallis latifolia*		
Order Orchidales			
Giant Orchid	*Pteroglossaspis ecristata*	T	
Many-flowered Grass-pink	*Calopogon multiflorus*	E	
Yellow Fringeless Orchid	*Platanthera integra*	E	
Subclass Alismatidae			
Order Najadales			
Manatee grass	*Syringodium filiforme*		
Shoal grass	*Halodule wrightii*		
Wigeongrass	*Ruppia maritima*		
Class Magnoliopsida (Woody flowering plants)			
Subclass Asteridae			
Order Asterales			
Beach elder	*Iva imbricata*		
Blanket flower	*Gaillardia pulchella*		
Coastal ragweed	*Ambrosia hispida*		
Dune sunflower	*Helianthus debilis*		
Sea oxeye daisy	*Borrichia spp.*		

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
Order Gentianales			
Devil's potato	*Echites umbellata*		
Florida Spiny-pod	*Matelea floridana*	E	
Golden creeper	*Ernodia littoralis*		
Seaside gentian	*Eustoma exaltatum*		
Wild allamanda	*Pentalinon luteum*		
Order Lamiales			
Atlantic Coast Florida Lantana	*Lantana depressa var. floridana*	E	
Beach verbena	*Glandularia maritima*		
Black mangrove	*Avicennia germinans*		
Coastal Vervain	*Glandularia maritima*	E	
Dotted horsemint	*Monarda punctata*		
Large-flowered Rosemary	*Conradina grandiflora*	T	
Tropical sage	*Salvia coccinea*		
Order Scrophulariales			
Florida privet	*Forestiera segregata*		
Order Solanales			
Beach morning glory	*Ipomoea imperati*		
Railroad vine	*Ipomoea pes-caprae*		
Standing cypress	*Ipomopsis rubra*		
Subclass Caryophyllidae			
Order Caryophyllales			
Glasswort	*Salicornia depressa*		
Saltwort	*Salicornia bigelovii*		
Simpson's Prickly Apple	*Harrisia simpsonii*	E	
Subclass Dilleniidae			
Order Violales			
Corkystem passionflower	*Passiflora suberosa*		
Nodding Pinweed	*Lechea cernua*	T	
Pine pinweed	*Lechea divaricata*	E	
Purple passionflower	*Passiflora incarnata*		
Subclass Magnoliidae			
Order Magnoliales			
Rugel's Pawpaw	*Deeringothamnus rugelii*	E	E
Subclass Rosidae			
Order Euphorbiales			
Beach croton	*Croton punctatus*		
Dune spurge	*Chamaesyce spp.*		
Sand dune spurge	*Chamaesyce cumulicola*	E	
Order Fabales			
Beach bean	*Canavalia rosea*		
Coral bean	*Erythrina herbacea*		
Necklace pod	*Sophora tomentosa*		
Partridge pea	*Chamaecrista spp.*		
Sand Butterfly Pea	*Centrosema arenicola*	E	
Order Myrtales			
Buttonwood	*Conocarpus erectus*		
Seaside evening primrose	*Oenothera humifusa*		
Simpson stopper	*Myrcianthes frangrans*		
White mangrove	*Laguncularia racemosa*		
Order Rhizophorales			
Red mangrove	*Rhizophora mangle*		

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
Order Rosales			
Bay cedar	*Suriana maritima*		
Gopher apple	*Licania michauxii*		
Green cocoplum	*Chrysobalanus icaco*		
Order Sapindales			
Varnish leaf	*Dodonaea viscosa*		
Birds			
Order Anseriformes (Geese, Ducks)			
American Black Duck	*Anas rubripes*		
American Wigeon	*Anas americana*		
Black Scoter	*Melanitta nigra*		
Black Vulture	*Coragyps altratus*		
Blue-winged Teal	*Anas discors*		
Brant	*Branta bernicla*		
Bufflehead	*Bucephala albeola*		
Canada Goose	*Branta canadensis*		
Canvasback	*Aythya valisineria*		
Common Goldeneye	*Bucephala clangula*		
Eurasian Wigeon	*Anas penelope*		
Fulvous Whistling-Duck	*Dendrocygna bicolor*		
Gadwall	*Anas strepera*		
Greater Scaup	*Aythya marila*		
Green-winged Teal	*Anas crecca*		
Hooded Merganser	*Lophodytes cucullatus*		
Lesser Scaup	*Aythya affinis*		
Mallard	*Anas Platyrynchos*		
Mottled Duck	*Anas fulvigula*		
Northern Pintail	*Anas acuta*		
Northern Shoveler	*Anas clypeata*		
Oldsquaw	*Clangula hyemalis*		
Redhead	*Aythya americana*		
Red-breasted Merganser	*Mergus serrator*		
Ring-necked Duck	*Aythya collaris*		
Ruddy Duck	*Oxyura jamaicensis*		
Snow Goose	*Chen caerulescens*		
Surf Scoter	*Melanitta perspicillata*		
White-winged Scoter	*Melanitta fusca*		
Wood Duck	*Aix sponsa*		
Order Apodiformes (Swift)			
Chimney Swift	*Chaetura pelagica*		
Order Caprimulgiformes (Goatsuckers)			
Chuck-will's-widow	*Caprimulgus carolinensis*		
Common Nighthawk	*Chordeiles minor*		
Whip-poor-will	*Caprimulgus vociferus*		
Order Charadriiformes (Plovers, Sandpipers, Gulls, Terns)			
American Avocet	*Recurvirostra americana*		
American oystercatcher	*Haematopus palliatus*	SSC	
American Woodcock	*Scolopax minor*		
Black Skimmer	*Rhynchops niger*	SSC	
Black Tern	*Chlidonias niger*		
Black-bellied Plover	*Charadrius thoracicus*		

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
Black-legged Kittiwake	*Rissa tridactyla*		
Black-necked Stilt	*Himantopus mexicanus*		
Bonaparte's Gull	*Larus philadelphia*		
Bridled Tern	*Sterna anaethetus*		
Caspian Tern	*Sterna caspia*		
Common Snipe	*Gallinago gallinago*		
Common Tern	*Sterna hirundo*		
Dunlin	*Calidris alpina*		
Forster's Tern	*Sterna forsteri*		
Great Black-backed Gull	*Larus marinus*		
Greater Yellowlegs	*Tringa melanoleuca*		
Gull-billed Tern	*Sterna nilotica*		
Herring Gull	*Larus argentatus*		
Killdeer	*Charadrius vociferus*		
Laughing Gull	*Larus atricilla*		
Least Sandpiper	*Calidris minutilla*		
Least Tern	*Sterna antillarum*	T	E
Lesser Yellowlegs	*Tringa flavipes*		
Long-billed Curlew	*Numenius americanus*		
Marbled Godwit	*Limosa fedoa*		
Northern Phalarope	*Lobipes lobatus*		
Parasitic Jaeger	*Stercorarius parasiticus*		
Pectoral Sandpiper	*Calidris melanotos*		
Piping Plover	*Charadrius melodus*	T	T
Pomarine Jaeger	*Stercorarius pomarinus*		
Red Knot	*Calidris canutus*		
Ring-billed Gull	*Larus delawarensis*		
Roseate Tern	*Sterna dougallii*	T	T
Royal Tern	*Sterna maxima*		
Ruddy Turnstone	*Arenaria interpres*		
Sanderling	*Calidris alba*		
Sandwich Tern	*Sterna sandvicensis*		
Semipalmated Plover	*Charadrius semipalmatus*		
Semipalmated Sandpiper	*Calidris pusilla*		
Short-billed Dowitcher	*Limnodromus griseus*		
Solitary Sandpiper	*Tringa solitaria*		
Sooty Tern	*Sterna fuscata*		
Spotted Sandpiper	*Actitis macularia*		
Stilt Sandpiper	*Calidris himantipus*		
Upland Sandpiper	*Bartramia longicauda*		
Wilson's Phalarope	*Phalaropus tricolor*		
Western Sandpiper	*Calidris mauri*		
Whimbrel	*Numenius phaeopus*		
White-rumped Sandpiper	*Calidris fuscicollis*		
Wilson's Plover	*Charadrius wilsonia*		
Willet	*Catoptrophorus semipalmatus*		
Order Ciconiiformes (Heron, Egret, Ibis, Spoonbill)			
American Bittern	*Botaurus lentiginosa*		
Black-crowned Night-Heron	*Nycticorax nycticorax*		
Cattle Egret	*Ardea ibis*		
Glossy Ibis	*Plegadis falcinellus*		
Great Blue Heron	*Ardea herodias*		
Great Egret	*Ardea alba*		

Common Name	Species Name	State Status	Federal Status
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Greater Flamingo	*Phoenicopterus ruber*		
Green Heron	*Butorides virescens*		
Least Bittern	*Ixobrychus exilis*		
Little Blue Heron	*Egretta caerulea*	SSC	
Reddish Egret	*Egretta rufescens*	SSC	
Roseate Spoonbill	*Platalea ajaja*	SSC	
Snowy Egret	*Egretta thula*	SSC	
Tri-colored Heron	*Egretta tricolor*	SSC	
Turkey Vulture	*Cathartes aura*		
White Ibis	*Eudocimus albus*	SSC	
Wood Stork	*Mycteria americana*	E	E
Yellow-crowned Night-Heron	*Nycticorax violaceus*		
Order Columbiformes (Doves)			
Common Ground-Dove	*Columbina passerina*		
Mourning Dove	*Zenaida macroura*		
Rock Dove	*Columba livia*		
Order Coraciiformes (Kingfisher)			
Belted Kingfisher	*Ceryle alcyon*		
Order Cuculiformes (Cuckoos, Ani)			
Black-billed Cuckoo	*Coccyzus erythropthalmus*		
Smooth-billed Ani	*Crotophaga ani*		
Yellow-billed Cuckoo	*Coccyzus americanus*		
Order Falconiformes (Hawks, Falcons, Osprey, Vultures			
Bald Eagle	*Haliaeetus leucocephalus*	T	
Broad-winged Hawk	*Buteo platypterus*		
Cooper's Hawk	*Accipiter cooperii*		
Merlin	*Falco columbarius*		
Northern Harrier	*Circus cyaneus*		
Osprey	*Pandion haliaetus*	SSC	
Peregrine Falcon	*Falco peregrinus*	E	
Red-shouldered Hawk	*Buteo lineatus*		
Red-tailed Hawk	*Buteo jamaicensis*		
Sharp-shinned Hawk	*Accipiter striatus*		
Swainson's Hawk	*Buteo swainsoni*		
Swallow-tailed Kite	*Elanoides forficatus*		
Order Galliformes (Quail, Turkey)			
American Kestrel	*Falco sparverius*		
Northern Bobwhite	*Colinus virginianus*		
Wild Turkey	*Melagris gallopavo*		
Order Gaviiformes (Loon)			
Common Loon	*Gavia immer*		
Red-throated Loon	*Gavia stellata*		
Order Gruiformes (Limpkins, Rails, Gallinule, Coot)			
American Coot	*Fulica americana*		
Black Rail	*Laterallus jamaicensis*		
Clapper Rail	*Rallus longirostris*		
Common Moorhen	*Gallinula chloropus*		
King Rail	*Rallus elegans*		
Limpkin	*Aramus guarauna*	SSC	
Florida Sandhill Crane	*Grus canadensis pratensis*	T	
Sora	*Porzana carolina*		
Virginia Rail	*Rallus limicola*		

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
Order Passeriformes (Sparrow)			
Lincoln's Sparrow	*Melospiza lincolnii*		
Acadian Flycatcher	*Empidonax virescens*		
Alder Flycatcher	*Empidonax alnorum*		
American Goldfinch	*Carduelis tristis*		
American Redstart	*Setophaga ruticilla*		
American Robin	*Turdus migratorius*		
Bachman's Sparrow	*Aimophila aestivalis*		
Bank Swallow	*Riparia riparia*		
Barn Swallow	*Hirundo rustica*		
Bay-breasted Warbler	*Dendroica castanea*		
Black-and-white Warbler	*Mniotilta varia*		
Blackburnian Warbler	*Dendroica fusca*		
Blackpoll Warbler	*Dendroica striata*		
Black-throated Blue Warbler	*Dendroica caerulescens*		
Black-throated Green Warbler	*Dendroica virens*		
Black-whiskered Vireo	*Vireo altiloquus*		
Blue Grosbeak	*Guiraca caerulea*		
Blue Jay	*Cyanocitta cristata*		
Blue-gray Gnatcatcher	*Polioptila caerulea*		
Blue-winged Warbler	*Vermivora pinus*		
Boat-tailed Grackle	*Quiscalus major*		
Bobolink	*Dolichonyx oryzivorus*		
Brown Thrasher	*Toxostoma rufum*		
Brown-headed Cowbird	*Molothrus ater*		
Cape May Warbler	*Dendroica tigrina*		
Carolina Wren	*Thryothoorus ludovicianus*		
Cedar Waxwing	*Bombycilla cedrorum*		
Chestnut-sided Warbler	*Dendroica pensylvanica*		
Chipping Sparrow	*Spizella passerina*		
Cliff Swallow	*Petrochelidon pyrrhonota*		
Common Grackle	*Quiscalus quiscula*		
Common Yellowthroat	*Geothlypis trichas*		
Connecticut Warbler	*Oporornis agilis*		
Dickcissel	*Spiza americana*		
Eastern Kingbird	*Tyrannus tyrannus*		
Eastern Meadowlark	*Sturnella magna*		
Eastern Phoebe	*Sayornis phoebe*		
European Starling	*Sturnus vulgaris*		
Field Sparrow	*Spizella pusilla*		
Fish Crow	*Corvus ossifragus*		
Florida Prairie Warbler	*Dendroica discolor paludicola*		
Florida Scrub-jay	*Aphelocoma coerulescens*	T	
Fox sparrow	*Passerella iliaca*		
Golden-winged Warbler	*Vermivora chrysoptera*		
Grasshopper Sparrow	*Ammodramus savannarum*		
Gray Catbird	*Dumetella carolinensis*		
Gray Kingbird	*Tyrannus dominicensis*		
Gray-cheeked Thrush	*Catharus minimus*		
Great Crested Flycatcher	*Myiarchus crinitus*		
Henslow's Sparrow	*Ammodramus henslowii*		
Hermit Thrush	*Catharus guttatus*		

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
Hooded Warbler	*Wilsonia citrina*		
House Sparrow	*Passer domesticus*		
House Wren	*Troglodytes aedon*		
Indigo Bunting	*Passerina cyanea*		
Kentucky Warbler	*Oporornis formosus*		
Lark Sparrow	*Chondestes grammacus*		
Least Flycatcher	*Empidonax minimus*		
Lincoln's Sparrow	*Melospiza lincolnii*		
Loggerhead Shrike	*Lanius ludovicianus*		
Louisiana Waterthrush	*Seiurus motacilla*		
Magnolia Warbler	*Dendroica magnolia*		
Marsh Wren	*Cistothorus palustris*		
Nashville Warbler	*Vermivora ruficapilla*		
Northern Cardinal	*Cardinalis cardinalis*		
Northern Mockingbird	*Mimus polyglottos*		
Northern Oriole	*Icterus galbula*		
Northern Parula	*Parula americana*		
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*		
Northern Waterthrush	*Seiurus noveboracensis*		
Orange-crowned Warbler	*Vermivora celata*		
Orchard Oriole	*Icterus spurius*		
Ovenbird	*Seiurus aurocapillus*		
Painted Bunting	*Passerina ciris*		
Palm Warbler	*Dendroica palmarum*		
Pine Siskin	*Carduelis pinus*		
Pine Warbler	*Dendroica pinus*		
Prairie Warbler	*Dendroica discolor*		
Prothonotary Warbler	*Protonotaria citrea*		
Purple Martin	*Progne subis*		
Red-eyed Vireo	*Vireo olivaceus*		
Red-winged Blackbird	*Agelaius phoeniceus*		
Rose-breasted Grosbeak	*Pheucticus ludovicianus*		
Ruby-crowned Kinglet	*Regulus calendula*		
Rufous-sided Towhee	*Pipilo erythrophthalmus*		
Rusty Blackbird	*Euphagus carolinus*		
Savannah Sparrow	*Passerculus sandwichensis*		
Scarlet Tanager	*Piranga olivacea*		
Seaside Sparrow	*Ammodramus maritimus*		
Sedge Wren	*Cistothorus platensis*		
Solitary Vireo	*Vireo solitarius*		
Song Sparrow	*Melospiza melodia*		
Summer Tanager	*Piranga rubra*		
Swainson's Thrush	*Catharus ustulatus*		
Swainson's Warbler	*Limnothlypis swainsonii*		
Swamp Sparrow	*Melospiza georgiana*		
Tennessee Warbler	*Vermivora peregrina*		
Tree Swallow	*Trachycineta bicolor*		
Tufted Titmouse	*Baeolophus bicolor*		
Veery	*Catharus fuscescens*		
Vesper Sparrow	*Pooecetes gramineus*		
Water Pipit	*Anthus spinoletta*		
Western Kingbird	*Tyrannus verticalis*		

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White-eyed Vireo	*Vireo griseus*		
White-throated Sparrow	*Zonotrichia albicollis*		
Wilson's Warbler	*Wilsonia pusilla*		
Wood Thrush	*Hylocichla mustelina*		
Worm-eating Warbler	*Helmitheros vermivorum*		
Yellow Warbler	*Dendroica petechia*		
Yellow-breasted Chat	*Icteria virens*		
Yellow-rumped Warbler	*Dendroica coronata*		
Yellow-throated Vireo	*Vireo flavifrons*		
Yellow-throated Warbler	*Dendroica dominica*		
Order Pelecaniformes (Pelican, Gannet, Cormorant)			
American White Pelican	*Pelecanus erythrorhynchos*		
Anhinga	*Anhinga anhinga*		
Brown Pelican	*Pelecanus occidentalis*	SSC	E
Double-crested Cormorant	*Phalacrocorax auritus*		
Magnificent Frigatebird	*Fregata magnificens*		
Northern Gannet	*Morus bassanus*		
Order Piciformes (Woodpeckers)			
Downy Woodpecker	*Picoides pubescens*		
Hairy Woodpecker	*Picoides villosus*		
Northern Flicker	*Colaptes auratus*		
Pileated Woodpecker	*Dryocopus pileatus*		
Red-bellied Woodpecker	*Melanerpes carolinus*		
Red-headed Woodpecker	*Melanerpes erythrocephalus*		
Yellow-bellied Sapsucker	*Sphyrapicus varius*		
Order Podicipediformes (Grebe)			
Horned Grebe	*Podiceps auritus*		
Pied-billed Grebe	*Podilymbus podiceps*		
Order Procellariiformes (Shearwater, Storm-petrel)			
Audubon's Shearwater	*Puffinus lherminieri*		
Greater Shearwater	*Puffinus gravis*		
Wilson's Storm-Petrel	*Oceanites oceanicus*		
Order Strigiformes (Owls)			
Barred Owl	*Strix varia*		
Common Barn Owl	*Tyto alba*		
Eastern Screech-Owl	*Otus asio*		
Great Horned Owl	*Bubo virginianus*		
Short-eared Owl	*Asio flammeus*		
Order Trochiliformes (Hummingbird)			
Ruby-throated Hummingbird	*Archilochus colubris*		
Mammals			
Order Carnivora			
Florida Long-tailed Weasel	*Mustela frenata peninsulae*		
Florida panther	*Puma concolor coryi*	E	E
Order Cetacea			
Atlantic Bottlenose dolphin	*Tursiops truncatus*		
Order Rodentia			
Florida mouse	*Podomys floridanus*	SSC	
Round-tailed Muskrat	*Neofiber alleni*		
Southeastern Beach Mouse	*Peromyscus polionotus niveiventris*	T	T

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Order Sirenia			
West Indian manatee	*Trichechus manatus*	E	E
Amphibians			
Order Anura			
Gopher Frog	*Rana capito*	SSC	
Fishes			
Class Chondrichthyes (Cartilaginous fishes)			
Order Carcharhiniformes (sharks)			
Family Carcharhinidae			
Blacktip shark	*Carcharhinus limbatus*		
Bull shark	*Carcharhinus leucas*		
Lemon shark	*Negaprion brevirostris*		
Sandbar shark	*Carcharhinus plumbeus*		
Family Sphyrnidae			
Scalloped hammerhead	*Sphyrna lewini*		
Order Pristiformes(Sawfish)			
Family Pristidae			
Smalltooth sawfish	*Pristis pectinata*		E
Order Rajiformes (Rays)			
Family Dasyatidae			
Atlantic stingray	*Dasyatis sabina*		
Bluntnose stingray	*Dasyatis sayi*		
Southern stingray	*Dasyatis americana*		
Smooth butterfly ray	*Gymnura micrura*		
Family Myliobatidae			
Cownose ray	*Rhinoptera bonasus*		
Spotted eagle ray	*Aetobatus narinari*		
Class Actinopterygii (Ray-finned fishes)			
Order Acipenseriformes (Sturgeon)			
Family Acipenseridae			
Atlantic Sturgeon	*Acipenser oxyrinchus oxyrinchus*	SSC	SSC
Order Anguilliformes (Eels)			
Family Anguillidae			
American eel	*Anguilla rostrata*		
Family Ophichthidae			
Shrimp eel	*Ophichthus gomesi*		
Speckled worm eel	*Myrophis punctatus*		
Order Atheriniformes (Silversides)			
Family Aplocheilidae			
Mangrove rivulus	*Rivulus marmoratus*	SSC	
Family Atherinidae			
Inland silverside	*Menidia beryllina*		
Rough silverside	*Membras martinica*		
Tidewater silverside	*Menidia peninsulae*		
Family Belonidae			
Atlantic needlefish	*Strongylura marina*		
Redfin needlefish	*Strongylura notata*		
Timucu	*Strongylura timucu*		
Family Cyprinodontidae			
Bluefin killifish	*Lucania goodei*		

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
Flagfish	*Jordanella floridae*		
Golden topminnow	*Fundulus chrysotus*		
Goldspotted killifish	*Floridichthys carpio*		
Gulf killifish	*Fundulus grandis*		
Longnose killifish	*Fundulus similis*		
Marsh killifish	*Fundulus confluentus*		
Mummichog	*Fundulus heteroclitus*		
Rainwater killifish	*Lucania parva*		
Seminole killifish	*Fundulus seminolis*		
Sheepshead minnow	*Cyprinodon variegatus*		
Family Hemiramphidae			
Halfbeak	*Hyporhamphus unifasciatus*		
Family Poeciliidae			
Least killifish	*Heterandria formosa*		
Mosquitofish	*Gambusia affinis*		
Sailfin molly	*Poecilia latipinna*		
Order Aulopiformes (Grinners)			
Family Synodontidae			
Inshore lizardfish	*Synodus foetens*		
Order Batrachoidiformes (Toadfish)			
Family Batrachoididae			
Oyster toadfish	*Opsanus tau*		
Order Clupeiformes (Herring, Anchovies)			
Family Clupeidae			
Atlantic thread herring	*Opisthonema oglinum*		
Atlantic menhaden	*Brevoortia tyrannus*		
Gizzard shad	*Dorosoma cepedianum*		
Scaled sardine	*Harengula jaguana*		
Yellowfin menhaden	*Brevoortia smithi*		
Family Engraulidae			
Bay anchovy	*Anchoa mitchilli*		
Cuban anchovy	*Anchoa cubana*		
Longnose anchovy	*Anchoa nasuta*		
Striped anchovy	*Anchoa hepsetus*		
Order Cypriniformes (Minnows)			
Family Catostomidae			
Lake chubsucker	*Erimyzon sucetta*		
Family Cyprinidae			
Golden shiner	*Notemigonus crysoleucas*		
Order Elopiformes (Tarpons, Tenpounders, Ladyfish)			
Family Albulidae			
Bonefish	*Albula vulpes*		
Family Elopidae			
Ladyfish	*Elops saurus*		
Tarpon	*Megalops atlanticus*		
Order Gadiformes (Cod)			
Family Ophidiidae			
Striped cusk-eel	*Ophidion marginatum*		
Order Gasterosteiformes (Seahorse, Pipefish)			
Family Syngnathidae			
Chain pipefish	*Syngnathus louisianae*		
Dwarf seahorse	*Hippocampus zosterae*		

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
Gulf pipefish	*Syngnathus scovelli*		
Lined seahorse	*Hippocampus erectus*		
Order Gobiesociformes (Clingfishes)			
Family Gobiesocidae			
Skilletfish	*Gobiesox strumosus*		
Order Perciformes (Perch)			
Family Blenniidae			
Crested blenny	*Hypleurochilus geminatus*		
Florida blenny	*Chasmodes saburrae*		
Family Carangidae			
Atlantic bumper	*Chloroscombrus chrysurus*		
Atlantic moonfish	*Selene setapinnis*		
Blue runner	*Caranx cyrsos*		
Crevalle jack	*Caranx hippos*		
Florida pompano	*Trachinotus carolinus*		
Horse-eye jock	*Caranx latus*		
Leatherjacket	*Oligoplites saurus*		
Lookdown	*Selene vomer*		
Permit	*Trachinotus falcatus*		
Family Centrarchidae			
Black crappie	*Pomoxis nigromaculatus*		
Bluegill	*Lepomis macrochirus*		
Dollar sunfish	*Lepomis marginatus*		
Largemouth bass	*Micropterus salmoides*		
Redear sunfish	*Lepomis microlophus*		
Spotted sunfish	*Lepomis punctatus*		
Warmouth	*Lepomis gulosus*		
Family Centroponidae			
Common snook	*Centropomus undecimalis*		
Family Cichlida			
Blackchin Tilapia	*Sarotherodon melanotheron*		
Family Echeneidae			
Sharksucker	*Echeneis naucrates*		
Whitefin sharksucker	*Echeneis neucratoides*		
Family Elecotridae			
Fat sleeper	*Dormitator maculatus*		
Family Ephippidae			
Atlantic spadefish	*Chaetodipterus faber*		
Family Gobiidae			
Clown goby	*Microgobius gulosus*		
Code goby	*Gobiosoma robustum*		
Darter goby	*Gobionellus boleosoma*		
Emerald goby	*Gobionellus smaragdus*		
Frillifin goby	*Bathygobius soporator*		
Green goby	*Microgobius thalassinus*		
Highfin goby	*Gobionellus oceanicus*		
Lyre goby	*Evarthodus lyricus*		
Naked goby	*Gobiosoma bosci*		
Violet goby	*Gobioides broussoneti*		
Family Gerreidae			
Irish pompano	*Diapterus auratus*		
Silver jenny	*Eucinostomus gula*		

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
Striped mojarra	*Diapterus plumieri*		
Spotfin mojarra	*Eucinostomus argenteus*		
Family Haemulidae			
French grunt	*Haemulon flavolineatum*		
Pigfish	*Orthopristis chrysoptera*		
Family Lobotidae			
Tripletail	*Lobotes surinamensis*		
Family Lutjanidae			
Gray snapper	*Lutjanus griseus*		
Family Mugilidae			
Mountain mullet	*Agonostomus monticola*		
Striped mullet	*Mugil cephalus*		
White mullet	*Mugil curema*		
Family Pomatomidae			
Bluefish	*Pomatomus saltatrix*		
Family: Rajidae			
Clearnose skate	*Raja eglanteria*		
Family Scaridae			
Emerald parrotfish	*Nicholsina usta*		
Family Sciaenidae			
Atlantic croaker	*Micropogonias undulatus*		
Black drum	*Pogonias cromis*		
Red drum	*Sciaenops ocellata*		
Silver perch	*Bairdiella chrysoura*		
Southern kingfish	*Menticirrhus americanus*		
Spot	*Leiostomus xanthurus*		
Spotted seatrout	*Cynoscion nebulosus*		
Weakfish	*Cynoscion regalis*		
Family Scombridae			
Spanish mackerel	*Scomberomorus maculatus*		
Family Serranidae			
Gray Grouper	*Mycteroperca microlepis*		
Rock sea bass	*Cetropristis philadelphica*		
Family Sparidae			
Pinfish	*Lagodon rhomboides*		
Sheepshead	*Archosargus probatocephalus*		
Family Sphyraenidae			
Great barracuda	*Sphyraena barracuda*		
Northern sennet	*Sphyraena borealis*		
Family Trichiuridae			
Atlantic cutlassfish	*Trichiurus lepturus*		
Family Uranoscopidae			
Southern stargazer	*Astroscopus y-graccum*		
Order Pleuronectiformes (Flatfish)			
Family Bothidae			
Bay whiff	*Citharichthys spilopterus*		
Fringed flounder	*Etropus crossotus*		
Gulf flounder	*Paralichthys albigutta*		
Southern flounder	*Paralichthys lethostigma*		
Family Cynoglossidae			
Blackcheek tonguefish	*Symphurus plagiusa*		
Family Soleidae			

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
Hogchoker	*Trinectes maculatus*		
Lined sole	*Achirus lineatus*		
Order Scorpaeniformes ("Mail-cheeked" fishes)			
Family Scorpaenidae			
Barbfish	*Scorpaena brasiliensis*		
Family Triglidae			
Bighead searobin	*Prionotus tribulus*		
Leopard searobin	*Prionotus scitulus*		
Order Siluriformes (Catfish)			
Family Ariidae			
Hardhead catfish	*Arius felis*		
Gafftopsail catfish	*Bagre marinas*		
Family Ictaluridae			
Yellow bullhead	*Ictalurus natalis*		
Order Tetraodontiformes (Boxfishes, Pufferfishes, Filefishes)			
Family Balistidae			
Orange filefish	*Aluterus schoepfi*		
Planehead filefish	*Monacanthus hispidus*		
Family Tetraodontidae			
Bandtail puffer	*Sphoeroides spengleri*		
Checkered puffer	*Sphoeroides testudineus*		
Southern puffer	*Sphoeroides nephelus*		
Striped burrfish	*Chilomycterus schoepfi*		
Insects			
Tropical fire ant (native)	*Solenopsis geminata*		
Land crab hole mosquito	*Deinocerites cancer*		
St. Louis encephalitis	*Culex nigripalpus*		
Brackish water mosquito	*Anopheles atropos*		
Black Saltmarsh mosquito	*Ochlerotatus taeniorhynchus*		
Golden Saltmarsh mosquito	*Ochlerotatus sollicitans*		
Mollusks and Crustaceans			
Phylum Arthropoda (Insects, Arachnids, Crustaceans)			
Class Malacostraca (Crustaceans)			
Atlantic mud crab	*Panopeus herbstii*		
Atlantic sand fiddler crab	*Uca pugilator*		
Bigclaw snapping shrimp	*Alpheus heterochaelis*		
Blue crab	*Callinectes sapidus*		
Broad-backed mud crab	*Eurytium limosum*		
Brown shrimp	*Penaeus aztecus*		
Common mantis shrimp	*Squilla empusa*		
Doubtful spider crab	*Libnia dubia*		
Grass shrimp	*Palaemonetes vulgaris*		
Great land crab	*Cardisoma guanhumi*		
Green porcelain crab	*Petrolisthes armatus*		
Harris's mud crab	*Rhithropanopeus harrisii*		
Longnosed spider crab	*Libinia dubia*		
Mud fiddler crab	*Uca pugnax rapax*		
Narrow mud crab	*Hexapanopeus angustifrons*		
Oyster pea crab	*Pinnotheres ostreum*		
Pentagon crab	*Heterocrypta granulate*		

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Pink shrimp	*Penaeus duorarum*		
Say's mud crab	*Neopanope sayi*		
Spiny Lobster	*Panulirus argus*		
Stone crab	*Menippe mercenaria*		
Striped hermit crab	*Clibanarius vittatus*		
White shrimp	*Penaeus setiferus*		
Class Maxillopoda (Barnacles, Copepods)			
Ivory barnacle	*Balanus eburneus*		
Purple striped barnacle	*Balanus amphitrite*		
Class Merostomata (Horseshoe crabs, Eurypterids)			
Horseshoe crab	*Limulus polyphemus*		
Phylum Mollusca (Mollusks)			
Class Bivalvia (Scallops, Clams, Oysters, Mussels)			
Blood ark	*Anadara ovalis*		
Charru mussel	*Mytella charruana*		
Coquina shells	*Donax variabilis*		
Eastern oyster	*Crassostrea virginica recruits*		
Flat mud crab	*Eurypanopeus depressus*		
Hard shelled clam	*Mercenaria mercenaria*		
Jacknife clam	*Tagelus divisus*		
Jingle shell	*Anomia simplex*		
Mahogany date mussel	*Lithophaga bisulcata*		
Pen shell	*Atrina rigida*		
Ribbed mussel	*Geukensia demissa*		
Scorched mussel	*Brachidonetes exuctus*		
Striated wood paddock	*Martesia cuneiformis*		
Tranverse ark	*Anadara transversa*		
Tulip mussel	*Modiolus americans*		
Class Gastropoda (Snails)			
Atlantic moon snail	*Polinices duplicates*		
Atlantic oyster drill	*Urosalpinx cinerea*		
Atlantic slipper shell	*Crepidula fornicata*		
Awl miniature cerith	*Cerithiopsis emersoni*		
Banded tulip	*Fasciolaria hunteria*		
Convex slipper shell	*Crepidula convexa*		
Crown conch	*Melongena corona*		
Eastern slipper shell	*Crepidula astrasolea*		
Florida cerith	*Cerithium atratum*		
Florida horse conch	*Pleuroploca gigantean*		
Florida rock snail	*Thais haemastoma floridana*		
Green's miniature cerith	*Cerithiopsis greeni*		
Keyhole limpet	*Diodora cayensis*		
Lemon drop sea slug	*Doriopsilla pharpa*		
Lightening whelk	*Busycon contrarium*		
Marsh periwinkle	*Littorina irrorata*		
Mottled dog whelk	*Nassarius vibex*		
Oyster mosquito	*Boonea impressa*		
Pear whelk	*Busycon spiratum*		
Plicate mangelia	*Pyrgocythara plicosa*		
Salle's auger snail	*Terebra salleana*		
Sooty sea hare	*Aplysia brasiliana*		
Thick-lipped drill	*Eupleura caudata*		
True tulip	*Fasciolaria mlipa*		

Common Name	Species Name	State Status	Federal Status
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Other Invertebrates			
Phylum Annelida (Segmented worms)			
Feather duster worm	*Sabella spp.*		
Green oyster worm	*Phyllodoce fragilis*		
Oyster mud worm	*Pal vdora websteri*		
Tube worms	*Hydroides spp.*		
Phylum Bryozoa (Moss animals)			
Common bryozoan	*Bugula neritina*		
Lacy bryozoan	*Hippoporina verrilli*		
Lacy crust bryozoan	*Conopeum spp.*		
Spaghetti bryozoan	*Zoobotryon verticillatum*		
	Vittaticella contei		
	Watersipora subovoidea		
Phylum Chordata			
Subphylum Urochordata (Sea squirts, Tunicates)			
Black tunicate	*Botrylloides nigrum*		
Encrusting ascidian	*Perophora viridis*		
Goldenstar tunicate	*Botrylloides schlosseri*		
Rough sea squirt	*Styela plicata*		
Royal tunicate	*Botryllus planus*		
Sea grape	*Mogula manhattensis*		
Tunicate	*Didemnum sp.*		
Phylum Cnidaria (Corals, Sea anemones, Jellyfish)			
Sea anemone	*Aiptasia pallida*		
Striped anemone	*Haliplanella luciae*		
Cannonball jellyfish	*Stomolophus meleagris*		
Moon jelly	*Aurelia aurita*		
Portuguese Man O' War	*Physalia physalis*		
Upside-down jelly	*Cassiopeia xamachana*		
Phylum Ctenophora (Comb jellies)			
Comb jelly	*Mnemiopsis leidyi*		
Phylum Echinodermata (Starfish, Brittle stars, Sea urchin, Sand dollars)			
Brooding brittle star	*Axiognathus squamatus*		
Reticulated brittle star	*Ophionereis reticulata*		
Phylum Porifera (Sponges)			
Black volcano sponge	*Halichondria melandocia*		
Boring sponge	*Cliona spp.*		
Sun sponge	*Hymeniacidon heliophila*		
Phytoplankton			
blue-green algae	*Calothrix sp.*		
blue-green algae	*Digenia sp.*		
blue-green algae	*Cyanobacterium sp.*		
blue-green algae	*Oscilatoria sp.*		
blue-green algae	*Synechococcus elongatus*		
brown algae	*Dictyota sp.*		
diatoms	*Asterionellopis glacialis*		
diatoms	*Bacillaria paxilifera*		
diatoms	*Bellerochea sp.*		
diatoms	*Cerataulina pelagica*		
diatoms	*Chaetoceros sp.*		
diatoms	*Chaetoceros aequatorialis*		
diatoms	*Chaetoceros curvisetus*		

Common Name	Species Name	State Status	Federal Status
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diatoms	*Chaetoceros decipiens*		
diatoms	*Chaetoceros diversus*		
diatoms	*Chaetoceros lorenzianus*		
diatoms	*Chaetoceros minimus*		
diatoms	*Chaetoceros simplex*		
diatoms	*Chaetoceros subtilis*		
diatoms	*Chaetoceros wighamii*		
diatoms	*Corethron*		
diatoms	*Coscinodiscus granii*		
diatoms	*Coscinodiscus sp.*		
diatoms	*Dactyiisolen fragilissimus*		
diatoms	*Ditylum brightwellii*		
diatoms	*Grammatophora marina*		
diatoms	*Guinardia delicatula*		
diatoms	*Guinardia sp.*		
diatoms	*Guinardia striata*		
diatoms	*Hermiaulus sinensis*		
diatoms	*Leptocylindrus danicus*		
diatoms	*Licmophora gracillis*		
diatoms	*Lithodesmium sp.*		
diatoms	*Navicula sp.*		
diatoms	*Nitzchia sp.*		
diatoms	*Nitzschia closterium*		
diatoms	*Odontella aurita*		
diatoms	*Odontella mobiliensis*		
diatoms	*Odontella regia*		
diatoms	*Paralia sulcata*		
diatoms	*Pleurosigma/Gyrosigma*		
diatoms	*Pseudo-nitzschia*		
diatoms	*Pseudosolenia calcar-avis*		
diatoms	*Rhizosolenia imbricata*		
diatoms	*Rhizosolenia setigera*		
diatoms	*Skeletonema costatum*		
diatoms	*Skeletonema menzellii*		
diatoms	*Stictocyclus stictodiscus*		
diatoms	*Thalassionema nitzschiodes*		
dinoflagellates	*Akashiwo sanguinea*		
dinoflagellates	*Amphidinium operculatum*		
dinoflagellates	*Ceratium fusus*		
dinoflagellates	*Ceratium hircus*		
dinoflagellates	*Coolia monotis*		
dinoflagellates	*Dinophysis sp.*		
dinoflagellates	*Dinophysis caudata var. acutiformis*		
dinoflagellates	*Gambierdiscus toxicus*		
dinoflagellates	*Gonyaulax polygramma*		
dinoflagellates	*Gonyaulax scrippsae*		
dinoflagellates	*Gonyaulax spinifera*		
dinoflagellates	*Gymnodinium sp.*		
dinoflagellates	*Gyrodinium estuariale*		
dinoflagellates	*Gyrodinium instriatum*		
dinoflagellates	*Gyrodinium spirale*		
dinoflagellates	*Heterocapsa niei*		
dinoflagellates	*Karenia brevis*		

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
dinoflagellates	*Katodinium glaucum*		
dinoflagellates	*Oxyphysis oxytoxoides*		
dinoflagellates	*Oxytoxum scolopax*		
dinoflagellates	*Pheopolykrikos hartmannii*		
dinoflagellates	*Polykrikos schwartzii*		
dinoflagellates	*Prorocentrum balticum*		
dinoflagellates	*Prorocentrum emarginatum*		
dinoflagellates	*Prorocentrum gracile*		
dinoflagellates	*Prorocentrum micans*		
dinoflagellates	*Prorocentrum minimum*		
dinoflagellates	*Protoperidinium depressum*		
dinoflagellates	*Protoperidinium pellucidium*		
dinoflagellates	*Pyrodinium bahamense var. bahamense*		
dinoflagellates	*Pyrophacus horologium*		
dinoflagellates	*Pyrophacus steinii*		
dinoflagellates	*Scrippsiella trochoidea*		
euglena	*Euglena sp.*		
green algae	*Avrainvillea sp.*		
green algae	*Batophora sp.*		
green algae	*Bryopsis sp.*		
green algae	*Caulerpa sp.*		
green algae	*Cladophora sp.*		
green algae	*Halimeda sp.*		
green algae	*Nannochloris c.f.*		
green algae	*Oscillatoria sp.*		
green algae	*Rhipocephalus sp.*		
green algae	*Ulva sp.*		
red algae	*Acanthophora sp.*		
red algae	*Agardiella sp.*		
red algae	*Chondria sp.*		
red algae	*Gracilaria sp.*		
reg algae	*Laurencia sp.*		
zooflagellate	*Hernesinum adriaticum*		
Reptiles			
Class Reptilia (Reptiles)			
Order Crocodilia (Crocodiles, Alligators)			
American alligator	*Alligator mississipiensis*	SSC	SAT
Order Squamata (Lizards, Snakes)			
Atlantic salt marsh snake	*Nerodia clarkii taeniata*	T	T
Eastern indigo snake	*Drymarchon corais couperi*	T	T
Florida banded water snake	*Nerodia fasciata pictiventris*		
Order Testudines (Turtles, Tortoises, and Terrapins)			
Diamondback Terrapin	*Malaclemys terrapin tequesta*		
Gopher Tortoise	*Gopherus polyphemus*	SSC	
Green Sea Turtle	*Chelonia mydas*	E	E
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	E
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	E	E
Leatherback	*Dermochelys coriacea*	E	E
Loggerhead Sea Turtle	*Caretta caretta*	T	T

B.4.2 / Invasive Non-native Species List

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
Plants			
Brazilian pepper	*Schinus terebinthifolius*		
Australian pine	*Casuarina equisetifolia*		
Birds			
Scarlet ibis	*Eudocimus ruber*		
Mammals			
Feral pig	*Sus scrofa*		
Insects			
Red imported fire ant (RIFA)	*Solenopsis invicta*		
Mollusks & Crustaceans			
Asian Green Mussel	*Perna viridis*		
Charru mussel	*Mytella charruana*		
Indo-Pacific swimming crab	*Charybdis hellerii*		
Serrated swimming crab	*Scylla serrata*		
Other Invertebrates			
Australian Spotted Jellyfish	*Phyllorhiza punctata*		
Reptiles			
Cuban treefrog	*Osteopilus septentrionalis*		
Brown anole	*Anolis sagrei*		

B.4.3 / Problem Species List

Common Name	Species Name	State Status	Federal Status
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
Mammals			
Black rats	*Rattus rattus*		
Racoons	*Procyon lotor*		

B.5 / ***Florida Natural Areas Inventory Descriptions***

Eighty-one Natural Communities are classified by the Florida Natural Areas Inventory (FNAI). A Natural Community is defined as a distinct and reoccurring assemblage of populations of plants, animals, fungi and microorganisms naturally associated with each other and their physical environment. The levels of this classification become increasingly more complex and finely subdivided. At all levels, however, there are overlaps between types because of overlapping species distributions and intergrading physical conditions.

At the broadest level, the natural communities are grouped into seven natural community categories based on hydrology and vegetation. A second level of the hierarchy splits the natural community categories into natural community groups. The third level of the classification, natural community types, is the level at which natural communities are named and described. Natural communities are characterized and defined by a combination of physiognomy, vegetation structure and composition, topography, land form, substrate, soil moisture condition, climate and fire. They are named for their most characteristic biological or physical feature.

Levels of Natural Communities

- CATEGORIES – based on hydrology and vegetation
- Groups – defined by landform, substrate, and vegetation
- Types – characterized and defined by a combination of physiognomy, vegetation structure and composition, topography, land form, substrate, soil moisture condition, climate, and fire

Natural Community Categories

1. ***Terrestrial Natural Communities*** - upland habitats dominated by plants which are not adapted to anaerobic soil conditions imposed by saturation or inundation for more than 10% of the growing season.

2. ***Palustrine Natural Communities*** - freshwater wetlands dominated by plants adapted to anaerobic substrate conditions imposed by substrate saturation or inundation during 10% or more of the growing season.
3. ***Lacustrine Natural Communities*** - nonflowing wetlands of natural depressions lacking persistent emergent vegetation except around the perimeter.
4. ***Riverine Natural Communities*** - natural, flowing waters from their source to the downstream limits of tidal influence, and bounded by channel banks.
5. ***Subterranean Natural Communities*** occur below ground surface.
6. ***Estuarine Natural Communities*** - subtidal, intertidal, and supratidal zones of coastal water bodies, usually partially enclosed by land but with a connection to the open sea, within which seawater is significantly diluted with freshwater inflow from the land.
7. ***Marine Natural Communities*** – occur in subtidal, intertidal, and supratidal zones of the sea, landward to the point at which seawater becomes significantly diluted with freshwater inflow from the land.

Descriptions of the Natural Community Types found in Mosquito Lagoon Aquatic Preserve

Marine and Estuarine

Mineral Based - communities which occur in subtidal, intertidal and supratidal zones.

Consolidated Substrate - characterized as expansive, relatively open areas of subtidal, intertidal and supratidal zones which lack dense populations of sessile plant and animal species. Composition is solidified rock or shell conglomerates and includes coquina, limerock or relic reef materials.

Unconsolidated Substrate - characterized as expansive, relatively open areas of subtidal, intertidal and supratidal zones which lack dense populations of sessile plant and animal species. Unconsolidated substrates are unsolidified material and include coralgal, marl, mud, mud/sand, sand or shell. This community may support a large population of infaunal organisms as well as a variety of transient planktonic and pelagic organisms.

Faunal Based - communities which occur in subtidal zones.

Mollusk Reef - characterized as expansive concentrations of sessile mollusks occurring in intertidal and subtidal zones to a depth of 40 feet. In Florida, the most developed mollusk reefs are generally restricted to estuarine areas and are dominated by the American oyster.

Floral Based - communities which occur in intertidal and supratidal zones.

Algal Bed - characterized as large populations of non-drift macro or micro algae.

Seagrass Bed -characterized as expansive stands of vascular plants. This community occurs in subtidal (rarely intertidal) zones, in clear, coastal waters where wave energy is moderate. Seagrasses are not true grasses.

Tidal Marsh - characterized as expanses of grasses, rushes and sedges along coastlines of low wave energy and river mouths. They are most abundant and most extensive in Florida north of the normal freeze line, being largely displaced by and interspersed among tidal swamps below this line.

Tidal Swamp - characterized as dense, low forests occurring along relatively flat, intertidal and supratidal shorelines of low wave energy along the southern Florida coast.

Composite Substrate

Composite Substrate – consist of a combination of natural communities such as “beds” of algae and seagrasses or areas with small patches of consolidated and unconsolidated bottom with or without sessile floral and faunal populations. Composite substrates may be dominated by any combination of marine and estuarine sessile flora or fauna or mineral substrate type. Typical combinations of plants, animals and substrates representing composite substrates include soft and stony corals with sponges on a hard bottom such as a limerock outcrop; psammophytic algae and seagrasses scattered over a sand bottom; and patch reefs throughout a coralgal bottom.

Florida Natural Areas Inventory, Natural Communities Rankings

Below are the relative ranks of the natural communities. FNAI uses several criteria to determine the relative rarity and threat to each community type; these are translated or summarized into a global and a state rank, the G and S ranks, respectively. Most G ranks for natural communities are temporary pending comparison and coordination with other states using this methodology to classify and rank vegetation types (contact FNAI for the most recent natural community ranks). A few natural communities and several plant communities occur only or mostly in Florida and can be considered endemic to Florida (Muller, Hardin, Jackson, Gatewood & Caire, 1989). The only opportunity for protection of these communities is in Florida and they should be given special consideration in Florida’s protection efforts.

Marine and Estuarine

Mineral Based

G3 S3 Consolidated Substrate

G5 S5 Unconsolidated Substrate

Faunal Based

G2 S1 Coral Reef

G3 S3 Mollusk Reef

G2 S1 Octocoral Bed

G2 S2 Sponge Bed

G1 S1 Worm Reef

Floral Based

G3 S2 Algal Bed

G2 S2 Seagrass Bed

G4 S4 Tidal Marsh

G3 S3 Tidal Swamp

Composite Substrate

G3 S3 Composite Substrate

**G3 S2 Coastal Interdunal Swale*

**G3 S3 Mesic Hammock*

Definition of Global (G) element ranks:

G1 - Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very little remaining area, e.g., <2,000 acres) or because of some factor(s) making it especially vulnerable to extinction;

G2 - Imperiled globally because of rarity (6-20 occurrences or very little remaining area, e.g., <10,000 acres) or because of some factor(s) making it very vulnerable to extinction throughout its range;

G3 - Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range or because of other factors making it vulnerable to extinction throughout its range, 21 to 100 occurrences;

G4 - Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery;

G5 - Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery;

G? - uncertain Global rank.

Definition of State (S) element ranks:

S1 - Critically imperiled in state because of extreme rarity (5 or fewer occurrences or very little remaining area) or because of some factor(s) making it especially vulnerable to extinction;

S2 - Imperiled in state because of rarity (6-20 occurrences or little remaining area) or because of some factor(s) making it very vulnerable to extinction throughout it range;

S3 = Rare or uncommon in state (on the order of 21 to 100 occurrences);

S4 - Apparently secure in state, although it may be rare in some parts of its state range;

S5 - Demonstrably secure in state and essentially ineradicable under present conditions;

S? - uncertain State rank.

*C.1 / **Advisory Committee***

The following Appendixes contain information about who serves on the Advisory Committee, when meetings were held, copies of the public advertisements for those meetings, and summary of each meeting (as required by Ch. 259.032(10), F.S.)

C.1.1 / List of Members and their Affiliations

Name	Affiliation
Anne Birch	The Nature Conservancy
Fielding Cooley	Marine Discovery Center, Inc., Executive Director
Bob Day	SJRWMD
Capt. Jeff Dorobiala	Commercial fishing guide
Jack Hayman	Volusia County Commission
Capt. Budd Neviaser	Coastal Conservation Association; Florida Guides Association; Halifax Sport Fishing Club
Jonas Stewart	Volusia County Mosquito Control Director
John Stiner	Canaveral National Seashore
Dr. Linda Walters	UCF
Officer Audrey Warren	Florida Fish and Wildlife Conservation Commission
Kelly Young	Volusia County Environmental Lab
Georgia K. Zern	Manatee Protection Program Manager; Marine Mammal Stranding Coordinator

C.1.2 / Florida Administrative Weekly (F.A.W.) Postings

July 19, 2007 Advisory Committee Meeting FAW Notice

Florida Administrative Weekly, Volume 33, Number 25, June 22, 2007
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 2830

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, as staff to the Board of Trustees of the Internal Improvement Trust Fund, announces a public meeting to which all persons are invited.

Date & Time: July 19, 2007, 6:30 p.m.

Place: Mary DeWees Park, 178 North Gaines Street, Oak Hill, FL 32759

General subject matter to be considered: The purpose is for members of the Advisory Committee to discuss the revision of the Mosquito Lagoon Aquatic Preserve Management Plan.

A copy of the agenda may be obtained by contacting Mayra Ashton at (321)634-6148.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting Mayra Ashton at (321)634-6148. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1(800) 955-8771 (TDD) or 1(800) 955-8770 (Voice).

September 20, 2007 Advisory Committee Meeting FAW Notice

Florida Administrative Weekly, Volume 33, Number 34, August 24, 2007
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 3950

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, as staff to the Board of Trustees of the Internal Improvement Trust Fund, announces a public meeting to which all persons are invited.

Date & Time: Thursday, September 20, 2007, 1:00 p.m.

Place: Edgewater Public Library, 103 Indian River Blvd., Edgewater, FL 32132

General subject matter to be considered: The purpose is for members of the Advisory Committee to discuss the revision of the Mosquito Lagoon Aquatic Preserve Management Plan.

A copy of the agenda may be obtained by contacting Dianne Bradley at (321)634-6148.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting Dianne Bradley at (321)634-6148. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1(800)955-8771 (TDD) or 1(800)955-8770 (Voice).

December 11, 2007 Advisory Committee Meeting FAW Notice

Florida Administrative Weekly, Volume 33, Number 46, November 16, 2007
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 5451

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, acting as staff to the Board of Trustees of the Internal Improvement Trust Fund announces a public meeting to which all persons are invited.

Date & Time: Tuesday, December 11, 2007, 1:00 p.m.

Place: Oak Hill City Hall, 234 South U.S. 1, Oak Hill, FL 32759

General subject matter to be considered: The purpose is for members of the Advisory Committee to discuss the revision of the Mosquito Lagoon Aquatic Preserve Management Plan.

A copy of the agenda may be obtained by contacting: Aquatic Preserve Manager, Sharon Tyson at (321) 634-6148.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting: Aquatic Preserve Manager, Sharon Tyson at (321)634-6148. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1(800)955-8771 (TDD) or 1(800)955-8770 (Voice).

January 7, 2009 Advisory Committee Meeting FAW Notice

Florida Administrative Weekly, Volume 34, Number 51, December 19, 2008
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 8707

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, acting as staff to the Board of Trustees of the Internal Improvement Trust Fund announces a public meeting to which all persons are invited.

Date & Time: Wednesday, January 7, 2009, 3:00 p.m. – 5:30 p.m.

Place: Edgewater Public Library, 103 W. Indian River Blvd., Edgewater, FL 32132

General Subject Matter to be Considered: The purpose is for the members of the Advisory Committee to discuss the revision of the Mosquito Lagoon Aquatic Preserve Management Plan.

A copy of the agenda may be obtained by contacting: Eileen Szuchy at (321) 634-6148.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting: Eileen Szuchy at (321)634-6148. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1(800)955-8771 (TDD) or 1(800)955-8770 (Voice).

March 4, 2009 Advisory Committee Meeting FAW Notice

Florida Administrative Weekly, Volume 35, Number 5, February, 2009
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 620

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, acting as staff to the Board of Trustees of the Internal Improvement Trust Fund announces a workshop to which all persons are invited.

Date & Time: Wednesday, March 4, 2009, 2:30 p.m. – 5:00 p.m.

Place: Edgewater Public Library, 103 W. Indian River Blvd., Edgewater, FL 32132

General Subject Matter to be Considered: The purpose is for the members of the Advisory Committee to discuss the revision of the Mosquito Lagoon Aquatic Preserve Management Plan.

A copy of the agenda may be obtained by contacting: Eileen Szuchy at (321)634-6148.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting: Eileen Szuchy at (321)634-6148. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1(800)955-8771 (TDD) or 1(800)955-8770 (Voice).

Florida Department of Environmental Protection
Office of Coastal and Aquatic Managed Areas Public Meeting
Mosquito Lagoon Aquatic Preserve Advisory Committee Briefing
Thursday, July 19, 2007 at 6:30 p.m.
Mary De Wees Park, 178 North Gaines Street, Oak Hill, FL 32759

Attendance

Name	Affiliation	AC Member
Anne Birch	Nature Conservancy	Yes
Fielding Cooley	Marine Discovery Center	Yes
Robert Day	SJRWMD	Yes
Jonas Stewart	Volusia Mosquito Control	Yes
John Stiner	Canaveral National Seashore	Yes
Audrey Warren	FWC	Yes
Georgia Zern	Volusia Environmental Management	Yes
Ron Brockmeyer	SJRWMD	No
Jim Gray	CCA	No
Sharon Gray	CCA	No

Meeting Summary

The meeting opened with a brief introduction by Ellen McCarron, Assistant Director of the Office of Coastal and Aquatic Managed Areas (CAMA). Ellen introduced the East Central Florida Aquatic Preserves (ECFAP) staff. The Mosquito Lagoon Aquatic Preserve Manager, Sharon Tyson, gave a presentation about the current state of the Aquatic Preserve. Ron Brockmeyer, St. Johns River Water Management District (SJRWMD) presented an overview of an ongoing marsh restoration project being accomplished through a partnership with the CAMA and Volusia County Mosquito Control District.

Karen Bareford, CAMA Planning Manager, provided a summary of the management plan review process and the proposed Committee calendar with key meeting dates. The Sunshine Law and how it applies to this Committee was reviewed. The meeting was turned over to Advisory Committee members to provide an opportunity for discussion among members, and receive input on concerns for the Mosquito Lagoon Aquatic Preserve. The group reached consensus that the scope of review for issues related to the management plan revision should include the entire Mosquito Lagoon watershed.

Opportunity for public comment followed discussion among the Committee members.

Advisory Committee Comments

Robert "Bob" Day – SJRWMD, National Estuary Program

- Suggested, and the Committee agreed, that it may be beneficial to have people identify favorite spots for fishing, clamming, and active recreation by placing dots on a map at the Public Scoping Meeting
- Exponential growth in the Oak Hill and Edgewater area is affecting natural resources within the Aquatic Preserve (AP) because environmental degradation outside the boundaries has direct impacts within the Preserve.
- Committee should recommend that cities consider addressing their actions that may have a direct effect on the AP
- Stressed the importance of including information in the Mosquito Lagoon Aquatic Preserve Management Plan (Plan) about the management plans of other entities also responsible for management efforts in Mosquito Lagoon (many of these plans are currently being revised, including: the Comprehensive Conservation and Management Plan (CCMP), Indian River Lagoon Surface Water Improvement and Management SWIM, Canaveral National Seashore, The Nature Conservancy, Volusia County Spoil Island Plan, Florida Inland Navigation District (FIND), and Merritt Island National Wildlife Refuge. (MINWR))
- Public health concerns over effects of recent outbreak in Mosquito Lagoon of Saxitoxin (*Pyrodinium bahamense)* related to shellfish closures
- Request that Department of Agriculture, aquaculture, (DACs) participate in the planning process

- Suggested that Bureau of Invasive Plant Management (BIPM) should give preference for exotic removal grant projects within Aquatic Preserves
- Stressed the need to get an idea of current public uses of the MLAP using resource mapping techniques
- Will provide to the Committee the Mosquito Lagoon issues identified at the "SJRWMD New Smyrna Beach Listening Session public meeting" to capture any missed issues
- We/the Plan need(s) to identify land acquisition projects to include into AP boundaries

Georgia Zern – (Volusia County)

- In response to discussion of planning efforts in the Lagoon, progress was reported on Volusia County's Island Management Planning process. Currently, planning consists of surveying public use, vegetation and species.
- Identified need for consistency of the Volusia Island Plan with the Plan, specifically designations for each island, (conservation, recreation and education) similar to the 1991 FIND plan that ECFAP uses as a template
- Conservation of important resource areas with regulatory signage, such as bird colonies
- Need more clean-ups of abandoned crab pot, hazards to boating and wildlife
- Need invasive exotic species surveys (Brazilian pepper, green mussels)
- Contributing to the discussion on resource mapping techniques and ranking priorities for restoration, a suggestion was offered on a technique Volusia County uses for restoration plans. They rank areas using a matrix leading to a list of sites to be restored

Fielding Cooley – (Marine Discovery Center)

- Who manages State-owned parcels north of AP boundaries?
- Need for education about areas that are to be conserved. Involve and coordinate with the non-profit organizations • and the public
- Survey public use of resources
- When questions arose about ownership and management of areas surrounding the AP, provided information that • Marine Discovery Center managing a parcel NE of the Aquatic Preserve boundary (near Brown's Bay)

John Stiner – (The National Park Service, Canaveral National Seashore)

- During discussions on resource mapping, suggested the need to create base maps for areas or zones with important resources, heavy use or critical areas
- The seashore has restricted uses for sensitive areas or resources and suggests same for the Mosquito Lagoon Aquatic Preserve
- More resource inventories and public use surveys are needed
- Suggested developing a kayak/canoe trail that connects local areas/parks/conservation areas

Jonas Stewart – (Volusia County Mosquito Control)

- Request information from the public on favorite places at the Public Scoping Meeting.
- Asked Ron Brockmeyer about coverage area for contract aerial boater activity survey (Dynamac Corp.). Produce a needed Base Map
- State-owned Islands upland exotics, whose management jurisdiction?
- Research BIPM grant availability for exotic control through dike removal.
- Department of Environmental Protection may fund dike removal as an exotic removal technique
- Define resource-based wetland restoration priorities for MLAP and arrange in order of priority.
- Volusia Mosquito Control needs a wish list of restoration projects to be accomplished.
- Mosquito production problems in the Aquatic Preserve – WPA hand ditches & spoil islands are breeding areas
- More discussion regarding prioritization, provide a matrix for restoration priorities. Use numeric values for habitats (exotics, oysters)
- Tomoka AP Plan identified a need for a restoration project that connected wetland zones

- Plan should recognize necessity of mosquito control for public health.
- Added to the discussion on benefits of a suggested change allowing extra points to be awarded during grant proposal review for BIPM projects in Aquatic Preserves
- Clarifying the County's role in restoration, Volusia County Mosquito Control is required to perform restoration in conjunction with mosquito control

Officer Audrey Warren – (Florida Fish and Wildlife Conservation Commission)

- Offered first hand knowledge of islands and resources being used and impacted by recreational users. Will provide locations.
- The last oyster harvest was one of the largest in years and economically beneficial.

Anne Birch – (The Nature Conservancy, Indian River Lagoon LCA Program)

- The overall approach to the MLAP management plan should be to map resources and give recommendations for uses with the protection of natural resources as the backbone of the plan
- Damage to oyster bar habitat by boat wakes has been demonstrated by scientific research
- Need to increase level of enforcement
- Document heavy recreational use, low enforcement level
- Coordinate local law enforcement with all agencies available
- Request increased funding of enforcement on the water and permit compliance
- Increase funding for AP program, need more staff to run programs
- Current and historic oyster mapping needed in MLAP
- We need information about historical and current recreational boating use that could be used as a baseline for the future
- Coordination of AP staff with regulatory (permitting agencies) needs improvement
- Coordinate early on impacts during development planning
- Regulatory permitting issues: need "public alert system" for timely public comment
- Identify land acquisition: inside and outside AP boundaries into watershed
- Climate/water level changes – how to plan, coordinate with entities
- Address changes through adaptive management planning
- Coordinate and provide consistency with other plans and programs
- Acquisition under Florida Forever project – needs designated land managers
- Land acquisition is a key component to protect watershed
- Need coordination between all other plans and agencies that are working within the Mosquito Lagoon
- Suggested a centralized database is needed on issues and data collected in the Mosquito Lagoon

Other Comments

Ron Brockmeyer – (SJRWMD, Division of Environmental Science)

- Atlantic Saltmarsh Snake and other listed species need management plans
- Grant funding is available through the following source, FWC Wildlife Legacy Program
- Private inholdings within the MLAP. Purchase with Blueways funds?
- Studies or data are available: Mapped oyster reefs north of the Ponce Inlet up to Guana Tolomato Matanzas contract complete in September 2007, Submerged aquatic vegetation is mapped by SJRWMD every other year in the ML area. Bathymetry mapping is difficult because of depths in the AP. Little data.

Public Comments

Jim Gray - (Coastal Conservation Association)

-Outstanding job tonight. Need to protect important fishing areas

Florida Department of Environmental Protection
Office of Coastal and Aquatic Managed Areas
Mosquito Lagoon Aquatic Preserve Advisory Committee Meeting
Thursday, September 20, 2007 at 1:00 p.m.
Edgewater Public Library, 103 Indian River Blvd, Edgewater, FL 32132

Attendance

Name	Affiliation	AC Member
Anne Birch	TNC	Yes
Robert Day	SJRWMD	Yes
John Stiner	CANA - NPS	Yes
Kelli Mcgee	Volusia Cty.	Yes
Georgia K. Zern	Volusia Cty.	Yes
Ron Brockmeyer	SJRWMD	adjunct staff

Meeting Summary

The meeting started with brief introductions of everyone in attendance. The agenda for this meeting was reviewed by Sharon Tyson, Mosquito Lagoon Aquatic Preserve manager. The Advisory Committee voted early in the meeting to include adjunct staff to assist with the management plan. The Advisory Committee welcomed Ron Brockmeyer, who was in attendance, as adjunct staff. The Advisory Committee had previously requested individuals with special expertise be included in this and all future meetings to contribute information and scientific insight regarding the Mosquito Lagoon and its resources.

A summary of comments from the previous Advisory Committee meeting held July 19, 2007 was discussed, followed by a review of comments received from the general public at the Public Scoping meeting, August 14, 2007.

On this occasion, the Advisory Committee met to discuss issues of concern for the future management of the Mosquito Lagoon Aquatic Preserve and the steps that will be taken to address them. The Advisory Committee strived to incorporate concerns and comments provided by the general public and fellow committee members at the two previous meetings mentioned above. A summary of the discussion provided by attendees at this meeting follows below.

Advisory Committee Comments

- A letter was sent to express that the timeframe allotted for the development of a management plan for the Mosquito Lagoon Aquatic Preserve and other Coastal Aquatic Managed Area sites is unrealistic. *This view was expressed to the Director of the Office of Aquatic Managed Areas, Stephanie Bailenson.*
- *Gerald Ward's* verbal comments at the Public Scoping meeting should be included in the meeting summary posted on the Coastal and Aquatic Managed Areas website. Previously, only written comments were included in the meeting summary.
- Aquatic Preserve staff and the committee discussed potential issue categories and suggested four broad areas under which issues could be developed.
    1. Loss of Natural Community Function and Species Diversity
    2. Water and Watershed
    3. Public Use and Sustainability
    4. Environmental Incidence Assessment and Response

The group then discussed several topics and developed strategies under the four broad categories listed above.

Discussions on loss of natural community function and species diversity lead to the development of several objectives and strategies that must be included in the management plan.

An overall goal developed by the committee: Conserve and enhance the function and integrity of the natural community.

Loss of Natural Community Function and Species Diversity

One strategy that needs to be implemented to address these issues is to identify any existing gaps in knowledge and/or natural resource data collected within the Mosquito Lagoon.

For each species under the species management section

1. Need to identify baseline information
2. Summary of status
3. Integrate endangered species recovery plans into the management
4. Monitor species status after the integration of recovery plan is put into practice

- Canaveral National Seashore Comprehensive plan has a list of species with management needs within the Mosquito Lagoon.
- Need to include the Atlantic salt marsh snake and the manatee as two topics to work on under the species management section within the Mosquito Lagoon Aquatic Preserve management plan.
- Seagrass management/restoration has been identified at a lower priority due to environmental factors placing seagrass at the edge of its range within the Northern Mosquito Lagoon/Mosquito Lagoon Aquatic Preserve.
- Colonial waterbird and shorebird management (nesting and roosting status) were identified as two important topics to include in the management plan.
- Identified the need (if possible) to combine the monitoring of different species (seagrass/oyster reefs/bird surveys/seagrass scarring) via aerial surveys. Several different aerial surveys are regularly conducted by different agencies but only for one particular resource at a time. Can any of these aerial surveys be integrated?
- Integrate aerial monitoring strategies and resource mapping between agencies.
- Canaveral National Seashore is schedule to map oysters in 2009.

Public Use and Sustainability

To assist Aquatic Preserve staff in accomplishing listed goals, discussions included listing existing available data from different agencies.

- Canaveral National Seashore contracted public use surveys for the southern section the Mosquito Lagoon. The information on usage was obtained from boat ramp surveys.
- There is also boating activity information (boating/fishing/clamming/skiing) available from Dynamac through aerial and boat surveys conducted throughout the Mosquito Lagoon.
- Volusia County conducted a boating activity study in 1995-1996 for the Manatee Protection Plan process that provides information on boat ramp activity and facilities.
- This information can be useful in determining carrying capacity for the area based on usage patterns.
- Identified the need to incorporate sustainable public use within the Aquatic Preserve.

Water and Watershed

Discussions included some information on background issues and what strategies need to be included in the management plan.

Topics identified for development within the management plan.

1. the effect of population growth on water quality
2. the effect of stormwater on water quality
3. the effect of point and non point sources on water quality

Other strategies and issues identified within the topic of water and watershed include:

- Concern with overflow of treated wastewater into the Aquatic Preserve via outfall pipes from wastewater treatment plants in the area.
- DEP wastewater program may want to educate the public on issues related to wastewater treatment plants and the chlorination of treated wastewater for use as reclaimed water.
- Need to research the health department for status on septic tanks and seepage issues in the Mosquito Lagoon area. Identify all studies or surveys dealing with septic systems conducted throughout Volusia County.

- In the past the Aquatic Preserve worked with Volusia County to establish buffer areas and setback requirements for septic systems located within the Mosquito Lagoon Aquatic Preserve.
- Volusia County presently has buffer requirements such as vegetation for the "overlay zone".
- Need to compile and characterize the status of shorelines (armored versus natural) throughout the Mosquito Lagoon Aquatic Preserve as part watershed development issues.

Environmental Incidence Assessment and Response

- Identified the need to develop protocols for environmental incident assessment and response within the Aquatic Preserve. Special emphasis on fish kills, hurricanes, cold-stun events, and contaminant spills.
- Incorporate Volusia County's existing emergency response plan.

Educational Strategies

The committee developed various educational strategies to include under different issue categories.

- Need to reinitiate the biannual "State of the Mosquito Lagoon". Plan and host this scientific meeting with partner agencies, researchers and educational institutions. Use this opportunity to exchange current knowledge and management strategies between managers, researchers and the public.
- Need to bridge the gap between citizen education and meetings that are targeted at researchers and managers.
- Target education for the general public and for the scientific community in separate ways.

Florida Department of Environmental Protection
Office of Coastal Aquatic Managed Areas
Mosquito Lagoon Aquatic Preserve Advisory Committee Meeting
Tuesday, December 11, 2007, 1:00 p.m.
Oak Hill City Hall, 234 South U.S. 1, Oak Hill, FL 32759

Attendance

Name	Affiliation	AC Member
Robert Day	SJRWMD	Yes
Ron Brockmeyer	SJRWMD	adjunct staff
Anne Birch	The Nature Conservancy	Yes
Michelle Peters-Snyder	The Nature Conservancy	No
Georgia K. Zern	Volusia County	Yes
Lyn Hoffmann (for Fielding Cooley)	Marine Discovery Center	Stand-in
Linda Wenz		No
Henry Wenz	Mid Coast FlyFishers	No
Capt. Budd Nevasier	Coastal Conservation Association & Florida Guides Association	Yes
Mike Shirley	FDEP/GTMNERR	No
Jonas Stewart	Volusia County Mosquito Control	Yes
Audrey Warren	FWC	Yes
Kelli McGee	Volusia Cty. Environmental Management	Yes
Sharon Tyson	FDEP-CAMA	
Mayra Ashton	FDEP-CAMA	

Meeting Summary

The Advisory Committee (AC) meeting started with brief introductions of everyone in attendance. Two new AC members were in attendance. After receiving complaints from individual AC members, a poll of members revealed most only had time to skim through or review Chapter 5 of the plan. The AC proceeded to discuss Chapter 5, Environmental Incident and Emergency Response Issue and integrated strategies of the management plan. The AC helped to extensively streamline and further develop the objectives and strategies under issues three and four. The AC spent some time commenting on issues one and two. When the Issues review was complete, the AC expressed the desire to have more time to comment on all other chapters in the existing draft. They also proposed changes to the current schedule that will allow them another opportunity to review suggested edits to the Issues Section. A proposed amended calendar was reviewed.

The AC voted unanimously to extend the management planning process to include more time for comments on the first draft plan and supports delaying the second draft plan until April 4, 2008. A final date of February 15, 2008, was chosen to receive comments from the committee on the first draft of the Mosquito Lagoon Aquatic Preserve Management plan. The AC expressed that by extending the deadline they would be able to complete a comprehensive review of the plan and provide thorough comments to the Aquatic Preserve team. Additionally, this would allow staff sufficient time to incorporate comments and changes into the management plan. The AC plans to provide a very active role in review of draft revisions.

The AC also stated concerns that another meeting might be necessary to provide further input of the 2nd draft of the management plan before the 2nd public meeting is held. This possibility will be considered as the writing and review process continues. The meeting concluded following the AC request to receive a Word document of the 1st draft of the management plan so they can incorporate comments directly into the text. To ensure better local advertisement of the second public meeting Volusia County members offered assistance of their public information office. Several committee members volunteered to write articles and advertise the next public meeting in local newspapers and venues.

Advisory Committee Comments

Issue 1 / **Loss of Natural Community Function and Species Diversity**

- Under goal one/objective one. Summarize the current status of key natural communities or indicator species within the AP. Indicator species should be changed to key species and key species should be identified and listed within the plan.
- Under goal one/objective two/ Ecosystem Science. Need to address NOAA trust species and resources directly. This is necessary to help tap into research and monitoring monies for these specific species.
- Need to address listed species such as the Atlantic Salt Marsh Snake in a specific objective and develop integrated strategies. (Connie Kesler from FWC has completed studies on Shipyard Island).
- Need to address sea level rise and its the impacts to the environment and resources in issue 1. Proposed objective: Facilitate research addressing the impacts to the environment and resources caused by sea level rise.

Issue 2 / **Water and Watershed**

- Goal two/objective one. Should change objective to read; assess and evaluate pollutant loadings from onsite sewage disposal systems to the Mosquito Lagoon AP.
- Goal two/objective two/Resource management. Eliminate reference to Halifax Indian River task force (no longer exists) and substitute with Volusia County Estuarine Restoration Program.
- Goal two/objective three. Need to provide a map of water conveyance canals that carry water into the MLAP system. Gary Cook and/or Aden Fontaine from Volusia County were mentioned as appropriate people to contact for this information.
- Goal two/objective three/partnering. This strategy should read, collaborate with Volusia County Resource Management and municipal and city governments to minimize the effects of stormwater discharges within the watershed. Need to include local jurisdictions into the present strategy.

Issue 3 / **Sustainable Public Use.**

- The main concern expressed was the need to reinforce that sustainable public use must include public recreation that complements resource management. Need to work this statement into the introduction of this section.

- Need to address specific commercial uses within the AP that do not fall under consumptive use (such as concessions on islands, boat-based food and alcohol vendors, commercial signage on the waterway, etc).
- New commercially harvested species such as a new industry of harvesting crown conch within the Mosquito Lagoon. The conch is being harvested for its shell as a source of revenue in response to the closure of aquaculture harvesting due to harmful algal blooms.
- Confirmed marine collection permits (FWC) would need to be obtained to harvest the marine specimens.
- Add to strategies: areas of concern for management of public use include high speed recreational boating impacting resources and causing conflict of use with fishermen and sightseers (add) and manatees and other species.
- Under objective one/goal one. Obtain (add) and evaluate existing public use data for the MLAP.
- Under objective one/goal one/ecosystem science. Use public use data to identify areas subject to heavy recreational use.
- Goal one/objective two. (add) Identify and integrate existing recreational plans from partner agencies. Remove severely impact sensitive natural resources since severely is subjective in this context.
- Goal one/objective two/resource management. Explore traffic calming techniques. Encourage reduction of boat speeds such as interpretative signs or trails on the waterway next to sensitive resources.
- Committee suggested signs should be kept at a minimum unless regulatory or conservation issues are present. Only consider signage in critical resource areas. Signs add to marine debris.
- Design a map or trails for the MLAP and/or a map with island numbers and designations for all the islands within the ML. FIND would be the source of funding for navigation maps for the AP.
- Designing electronic maps and GPS charts of the MLAP should be a CAMA wide strategy.
- Goal one/objective three/Ecosystem Science. (add bird and other species) to; Assist partner agencies in monitoring fish stock health and aquaculture resources to ensure fishing and harvesting pressure is not affecting the populations.

Issue 4 / Environmental Incident Assessment and Response

- The main concern for the Advisory Committee was to streamline the strategies and refocus language to emphasis coordination of efforts remain with other agencies with well established emergency response protocols. Just establish protocols in areas that may have gaps, for example algae blooms, and new marine exotic invasive species.
- Set up teams or committees for each type of incident, gap analysis (protocols), establish protocols where needed, identify phone contacts, establish outreach to public.
- Committee identified the need to establish a universal symbol to be used as a standardized website link accessible at multiple agencies. This link would list the same hotline numbers for each agency in charge of specific environmental incident assessment and response issues.
- Need to identify environmental incident assessment and response issues that are not addressed by other agency emergency response personnel.
- Need to identify agencies that are charged with responding to each type of environmental incident and assessment response. As an education strategy, create and distribute a list of contact people and numbers for a quick and coordinated response to an environmental incident or emergency.
- Must identify in what specific instances AP staff and its resources can be of assistance to an event. The AP does and should not intend to be the central point of contact for environmental incident and assessment response. Education coordination should be the AP's main role.
- The AP needs to concentrate on education and outreach aimed towards local users within the ML. Need to list what agencies and resources are available to deal with environmental incident and assessment response.
- As an education strategy the AP can handout boat cards with a list of the agencies, contact persons and numbers for specific instances requiring environmental incident and assessment response within the Mosquito Lagoon.
- Identified the need for a public information officer for the Mosquito Lagoon area. The public information officer coordinates all environmental incident and assessment responses and is the media liaison.

Florida Department of Environmental Protection
Office of Coastal Aquatic Managed Areas
Mosquito Lagoon Aquatic Preserve Advisory Committee Meeting
Wednesday, January 7, 2009, 3:00 p.m.
Edgewater Public Library, 103 Indian River Blvd, Edgewater, FL 32132

Attendance

Name	Affiliation	AC Member
Anne Birch	TNC	Yes
Troy Rice	SJRWMD/IRLNEP	No
Audrey Warren	FWC	Yes
Lyn A Hoffmann	Marine Discovery Center	Yes
Kelly Young	Volusia County Env. Health Lab	No
Ron Brockmeyer	SJRWMD	Yes
Robert Day	SJRWMD/IRLNEP	Yes
Jack Hayman	Volusia County	Yes
John Stiner	Canaveral National Seashore	Yes
Budd Nevasier	FGA/CCA	Yes
Ted Wyka	Mid Coast Chapter Coastal Conservation	Yes
Mike Shirley	FDEP-CAMA	No
Fielding Cooley	Marine Discovery Center	Yes
Sharon Tyson	FDEP-CAMA	No
Eileen Szuchy	FDEP-CAMA	No
Mayra Ashton	FDEP-CAMA	No

The meeting started with an introduction of Advisory Committee (AC) members and interested parties present. The Aquatic Preserve manager continued with agenda items and gave a brief description of budget reduction issues that have affected the office. In particular some of the key challenges for Aquatic Preserve staff include limited personnel, equipment and funding to support programs throughout the 107 mile distance covered by the three Aquatic Preserves managed by the office.

The meeting continued with a schedule of proposed dates for deliverables. Aquatic Preserve staff requested all comments from AC members be completed by January 23, 2009 for staff to incorporate into the 4th and final draft of the management plan to be handed to CAMA-Tallahassee February 28, 2009. The final draft of the Mosquito Lagoon Aquatic Preserve Management Plan (MLAPMP) would then be ready for the Acquisition and Restoration Council (ARC) review in March 2009.

AC members requested to have these dates extended since they need more time to provide substantial comments especially for Chapter 5 Issues. After discussing dates for extending deliverables the AC requested comments be due to aquatic preserve staff January 30th, 2009 for Chapters 1-4 and requested another meeting be scheduled for February 12th to concentrate solely on rewriting Chapter 5 Issues. At this meeting AP, staff would provide AC members with a new draft incorporating all of the comments previously received for Chapters 1-4. The draft for Chapter 5, Issues needs to be reviewed by AC members by March 27th. The final draft of the management plan would be due to CAMA-Tallahassee on April 10th for it to be ready for ARC review in May 2009. Mike Shirley suggested that a formal written request be prepared for CAMA director stating AC concerns and requesting an extension of deadlines for the final version of the MLAPMP. This letter should be accompanied by the current draft of Chapters 1-4 and 6-7 which have substantial information and are already completed. Please review tables below to view the “old” and the “new” proposed schedules.

Schedule Proposed by AP Staff

Date	Deliverable	Responsible Party
Jan. 23	All comments for Chapters 1-7 due to AP staff	Advisory Committee
Feb. 28	4TH draft of MLAP Management Plan due to CAMA-Tallahassee office	AP staff
April	Final version ready for ARC review	AP staff and CAMA-Tallahassee

New Schedule Proposed by Advisory Committee

Date	Deliverable	Responsible Party
Jan. 30	All comments for Chapters 1-4 due to AP staff	Advisory Committee
Feb. 12	Additional AC meeting to refine and finalize Chapter 5	Advisory Committee/ AP staff
Feb. 12	Draft with all comments incorporated for Chapters 1-4 due to AC	AP staff
March 27	Draft of Chapter 5 incorporating all comments due to AC	AP staff
April 3	Final review of Chapter 5 and comments received by AC members	Advisory Committee
April 10	Final draft due to CAMA-Tallahassee	AP staff
June	Final version ready for ARC review	AP staff and CAMA-Tallahassee

Next item on the agenda discussed was to change or keep the name of the Mosquito Lagoon Working Group (MLWG). The MLWG refers to members of the AC and any interested public that will act as a guidance committee following completion of AC duties. This working group will help implement strategies and goals of the MLAPMP, partners and stakeholders. The general consensus was to keep the name as the MLWG.

Discussion continued on the Plan's definitions for restoration goals for habitats. AC members indicated that we should aim to prevent any further degradation of water quality or habitat and should strive to maintain the present day or recent conditions. No degradation of resources based on rule. Need to identify most healthy habitats found currently and restore impacted or stressed habitats up to that state. Need to work with experts in each habitat area that indicate what level is practical to conserve and restore. There is no golden baseline but need to do more than what had been done in the past. Need to get baseline conditions for habitats and produce maps. Several restoration efforts are now monitoring structure and function of restored ecosystems and obtaining important recovery data. Marsh restoration work has resulted in a clearly measurable reduction of exotic plants (high in exotics before restoration with no exotics after work completed).

Another concern was to include the yearly cost estimates for each goal and strategy in Chapter 5. It may be a disservice to partners that are asking for more funds than what is currently allocated in the plan. Some AC members expressed it was not practical to include cost estimates for projects the AP is not directly involved with while other members indicated they could help with some cost estimates associated with strategies they are working on. The final determination was that the current issues and strategies need to be streamlined and well defined first before delving into cost estimates. Another approach suggested by AC members was that the AP should only concern themselves with costs associated with the AP staff and its resources and pull out those strategies and costs done entirely by partners. The budget table should have two columns one with costs for the AP and another with unknown costs for the partners. The AP should not have to breakdown costs for partners involved in a particular strategy. One request was that the language of responsible partners be changed to potential partners or lead partners when it comes to describing the goals and strategies in Chapter 5.

The AC was asked to help prioritize the top ten strategies or objectives by January 30th and this should help with defining and finalizing them at the next meeting in February. AC members suggested that broad categories be used and immediate to long term goals be established.

AC requested that the use of MLAP, AP or Preserve be standardized throughout the plan to one name when referring to the Mosquito Lagoon Aquatic Preserve. The addition of an executive summary or narrative at the beginning of the plan with MLAP statistics was deemed necessary to add to the plan. The executive summary should include the most important aspects of the management plan and as of the date of the plan what the priorities are.

AC members tried to define criteria to use for prioritizing goals and strategies particularly since different groups have different priorities. The AC discussed that the different perspectives are in fact important in this process particularly because of the diverse issues and concerns affecting the Mosquito Lagoon.

Meeting was adjourned with AC members awaiting a new schedule for completing reviews and comments for the draft of the MLAPMP.

Florida Department of Environmental Protection
Office of Coastal Aquatic Managed Areas
Mosquito Lagoon Aquatic Preserve Advisory Committee Meeting
Wednesday, March 4, 2009, 2:30 p.m.
Edgewater Public Library, 103 Indian River Blvd, Edgewater, FL 32132

Attendance

Name	Affiliation	AC Member
Anne Birch	The Nature Conservancy	Yes
Ron Brockmeyer	SJRWMD	Yes
Robert Day	SJRWMD	Yes
Fielding Cooley	Marine Discovery Center	Yes
Jonas Stewart	Volusia County Mosquito Control	Yes
Audrey Warren	FWC	Yes
Kelly Young	Volusia County Surface Water Specialist	Yes
Georgia K. Zern	Volusia County	Yes
David Biega	ECFAP Vounteer	No
Gerald M. Ward, P.E.	Marine Industries Assoc. of the Treasure Coast & FESCEO	No
John S. Yeend	Consulting Engineer	No

Meeting Summary

Mike Shirley opened the meeting with a capsulation of the status of EFCAP and describing the hiring strategy for the future ESII and ESI. The focus of the meeting was for the Advisory Committee to review and provide comments on Chapter 5 of the Mosquito Lagoon Management Plan. Two versions of Chapter 5 were distributed: One labeled *"Submitted to the Advisory Committee"* and the other labeled *"Adjusted Format"*. The Advisory Committee preferred the format where the performance measures are linked to the listed objectives (the *adjusted format*). However, the committee chose to focus on the *submitted* format, because the members were familiar with its contents, and decide at the end of the meeting which format would be optimal to use.

Details of changes will be reflected in the draft that is slated to be sent to the AC on Monday, March 09, 2009.

Advisory Committee Comments

G. Zern: the abundance and frequency of acronyms should be eliminated.

K. Young: described the attributes of the Volusia County Water Atlas (VCWA) – it's not just about water.

Several Members: identified how the VCWA is a valuable resource and CAMA should have an electronic link to it.

J. Stewart: emphasized that it is important to keep in mind that the readers are the stakeholders. Be sure that a complete bibliography is included with the plan.

R. Brockmeyer: asked how much water quality monitoring is done in the Aquatic Preserve.

K. Young: Volusia County has three water quality monitoring sites.

G. Zern: announced the May 28th "Living Shoreline Workshop".

Public Comments

Gerald Ward requested that for broader capability to access documents that electronic files are saved in older MS formats not MSX. The MLAP is one of the most non-urban APs and deserves the highest protection. Eliminate acronyms and abbreviations and shorten Chapter 5 so that is relevant to the stakeholder. There is too much beating up the boating public. Make the document short and specific. This plan should be a repository of information and a living document. There should be a description of references specific to Volusia and Brevard counties, the CNS, and the Refuge. Workshops should continue to be a part of the process The Volusia County Water Atlas is a "jump start". Education, outreach and physical alteration (e.g. dredging) would be positive actions. A frequency of reporting needs to be mandated. AP staff does not need to be involved in the "nuts and bolts', but should bring items/issues to the attention of higher level government. The process for navigational aid, markers has been established.

C.2 / Public Scoping Meeting

The following Appendixes contain information about the Public Scoping Meeting(s) which was held in order to obtain input from the public as what they thought the issues in Mosquito Lagoon Aquatic Preserve were. There are copies of the public advertisements for those meetings, a list of attendees, a summary of the meeting(s) (as required by Ch. 259.032(10), F.S.), and a copy of the written comments received.

C.2.1 / F.A.W. Posting

August 14, 2007 Public Scoping Meeting FAW Notice

Florida Administrative Weekly, Volume 33, Number 27, July 6, 2007
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 3042

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, acting as staff to the Board of Trustees of the Internal Improvement Trust Fund announces a public meeting to which all persons are invited.

Date & Time: Tuesday, August 14, 2007, 6:30 p.m.

Place: New Smyrna Beach Regional Library, 1001 S. Dixie Freeway, New Smyrna Beach, FL 32168

General subject matter to be considered: To inform the public on the management plan review process and to solicit input on issues they are interested in seeing addressed in the Mosquito Lagoon Aquatic Preserve management plan. The Mosquito Lagoon Aquatic Preserve Advisory Committee meeting will be participating.

A copy of the agenda may be obtained by contacting Mayra Ashton at (321)634-6148.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting Mayra Ashton at (321)634-6148. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1(800)955-8771 (TDD) or 1(800)955-8770 (Voice).

Florida Department of Environmental Protection • Office of Coastal & Aquatic Managed Areas

Mosquito Lagoon Aquatic Preserve

Public Meeting

Tuesday, August 14, 2007, 6:30 pm

New Smyrna Beach Regional Library
1001 S. Dixie Freeway
New Smyrna Beach, FL 32168

The Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas (CAMA) is responsible for the management of Florida's 41 Aquatic Preserves, 3 National Estuarine Research Reserves (NERR), 1 National Marine Sanctuary, and the Coral Reef Conservation Program. These protected areas comprise more than 4 million acres of the most valuable submerged lands and select coastal uplands in Florida. CAMA is updating the site specific management plans. This site will be holding a public meeting to receive input on the new draft plan.

This meeting will assist in crafting the content for individual site management plans. The information from the meeting will be recorded, compiled, and presented to CAMA by facilitators. The objectives of the public meeting are to:

- Inform the public about the history, purpose, and scope of management plan development
- Solicit public input regarding issues and opportunities that should be addressed in the management plan

For more information, please contact Mayra Ashton, (321) 634-6148/ Mayra.AshtonUrrego@dep.state.fl.us or visit our website at www.aquaticpreserves.org. Written comments are welcome and can be submitted by fax: (850) 245-2110, Attn: Mosquito Lagoon; or email Mosquito.Lagoon@dep.state.fl.us.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting Mayra Ashton at (321) 634-6148 or Mayra.AshtonUrrego@dep.state.fl.us. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, (800) 955-8771 (TDD) or (800) 955-8770 (Voice).

This publication funded in part through a grant agreement from the Florida Department of Environmental Protection, Florida Coastal Management Program by a grant provided by the Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act of 1972, as amended, National Oceanic and Atmospheric Administration (NOAA) Award No. NA06NOS4190129-CZ709. The views, statements, finding, conclusions, and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the State of Florida, NOAA, or any of its subagencies. June, 2007.

Florida Department of Environmental Protection

Office of Coastal and Aquatic Managed Areas

Mosquito Lagoon Aquatic Preserve Public Scoping Meeting

August 14, 2007, New Smyrna Beach Public Library

Attendance

Name	Affiliation
K. Rawley	
Matthew Msvery	Mid Coast Fly Fishers
Jeff Dorobiala	Reel Shallow Charters
Linda Wenz	Mid Coast Fly Fishers
Hank Wenz	Mid Coast Fly Fishers
Ted Wyka	CCA
Seth Greenstine	JC Pont
Mike Mann	Fat Fish Guide Service
Mike Thomas	City of Edgewater
Gerald Ward	MIATC FES CEQ
Troy Rice	IRC National Estuary SJRWMD Program
John Stine	Canaveral NW
Jay Lovett	Lovett Enterprises, Inc
Jerry Fanolla	Boat Max USA
Robert Day	SJRWMD IRC Program
Audrey Warren	FWC
Fielding Cooley	MDC
Georgia Kern	Volusie Co.
Michael Savedow	Edgewater River Guide
Randy Clark	United Water Fowlers
Marle Johusa	News International
Bill Browning	FL Dep. Of AG
Tony Kozlosk	Guide Mosquito Lagoon
Paul Sacks	UCF Biology and SCPS, WSHS
Linda Walters	UCF
Virginia Schow	
John Tarr	Guide / LEO
Kevin Willeke	FL Council Yacht Clubs
Kelli McGee	Volusie Co. Env'l Mgt
John Frazier	Fishing Guide
Diane Yeaton	Marine Discovery
Danny Olliala	Canaveral Fly Fishing
Randall Brett	
Bill Greening	Vol. Co. Mosquito Committee
Joe Porcelli	Trail Spotted
Brian Clancy	
John Winn	John Winn the Traveling Fisherman

Meeting Summary

Introduction - On August 14, 2007 the Mosquito Lagoon Aquatic Preserve conducted a public meeting to address the following objectives:

1. Review purpose of and process for reviewing the site management plan.

2. Receive public input regarding the perceived issues and concerns for the Mosquito Lagoon Aquatic Preserve.

This was the first public meeting related to the review of the Mosquito Lagoon Aquatic Preserve's management plan. A second meeting will be planned to review the draft management plan once it is created.

The meeting followed the agenda below:

- Official Welcome and introduction to meeting
- Overview Presentations: Described the management area's boundaries, available management resources, current projects, and other background information to assist participant's formulation of input.
- Public Comment and Stakeholder Feedback: An opportunity was provided for written and verbal comments to the Preserve staff and committee members at four "kiosks." (Public Use, Outreach and Education, Ecosystem Science, and Resource Management).
- Kiosk Reports: Staff provides a verbal summary of the comments they received at their kiosk.
- Public Comment: Participants who signed a "speakers list" were given three minutes to make a public statement to the full assembly. Only written comments were included in this meeting summary.

The workshop was designed to encourage dialogue between business owners, governmental representatives, recreational users and the committee teams at kiosks on specific issues. The meeting provided a forum for general comments and observations.

Coastal and Aquatic Managed Areas Background - The Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas (CAMA) is responsible for the management of Florida's 41 Aquatic Preserves, 3 National Estuarine Research Reserves (NERR), 1 National Marine Sanctuary, and the Coral Reef Conservation Program. These protected areas comprise more than 4 million acres of the most valuable submerged lands and select coastal uplands in Florida. CAMA is currently in the process of revising its site management plans, including the plan for the Mosquito Lagoon Aquatic Preserve. These plans will provide a critical management framework for the sites, setting priorities and guiding implementation for the next ten years.

This document includes both written comments received at the workshops and by email/postal mail during the comment period. It also includes a summary of the reports made by the staff at the end of the kiosk period. This summary is not meant to be a detailed description of the proceedings, but a record of the major themes and comments received. Only written comments were included in this meeting summary.

Summary of comments

Below is an overall summary of the comments received by the Mosquito Lagoon Aquatic Persevere during the public meeting process:

- The importance of managing and, where possible, improving water quality, especially in terms of impacts from stormwater and aging septic systems adjacent to the Aquatic Preserve.
- Further integrate the community into the management of the Aquatic Preserve. Need to enhance coordination between the varying government agencies to improve management of the Aquatic Preserve.
- Increase the Aquatic Preserve's efforts in the areas of educational outreach and public engagement in resource management activities.
- Increase understanding of current and future public use of the Aquatic Preserve. The importance of maintaining and enhancing public access to the Aquatic Preserve.
- Protection zones essential for seagrass protection. Public use deteriorating resources. Increase enforcement.

Written comments received on comment cards at meeting

Comments from the Resource Management Kiosk

It would be very beneficial if there was an easy way for people in the area to report management issues, so that managers are more aware of issues. I would also like to see existing management plans enforced before stringent plans are put into action. *Comment provided by Anonymous.*

How can we include rest of Mosquito Lagoon area (into the Aquatic Preserve boundaries) up to South Causeway? Comment provided by Diane Yeaton.

Concerned about quality of water and land for the marine life and birds who live there. Boating, fishing, etc can leave human residue. Our marine life habitats should be protected for the enjoyment of the future generations. Comment provided by Virginia Schow.

We need to increase restoration work on mangrove and oyster beds. *Comment provided by Anonymous.*

I don't want anyone telling me that I can't go anyplace or fishing anytime. *Comment provided by John- The Traveling Fisherman.*

Restoration work needs to be explained to public users. This is both education and outreach, but also important to success of restoration projects. *Comment provided by Paul Sacks.*

Improve water quality (oyster beds), lessen run off from homes and streets. *Comment provided by Anonymous.*

1. Old septic systems on Saxon Blvd should be connected to sewer. 2. Canal on Saxon Blvd is silted – no water movement. 3. Runoff on Hiles Blvd to boat ramp needs to be stopped. 4. Keep all boat access. *Comment provided by Brian Clancy.*

Science based management and science based restoration are critical to the success and survival of the Lagoon. *Comment provided by Anonymous.*

Main concern (about water quality) would be the downstream runoff from residential and commercial properties and the effects. *Comment provided by Matthew McNew.*

It seems that oyster reef mapping and other resources should be mapped over larger areas, with coordination of other agencies. It would eliminate the gaps in coverage. *Comment provided by Paul Sacks.*

Water Quality Improvement/ Remove old septic systems/ fresh water run off/ improve oyster beds. *Comment provided by Anonymous.*

Edgewater sewer treatment plant dumps treated sewage into the river. This sewage has floated into my back yard many days. *Comment provided by Capt. Joe Porcelli.*

Run off into the lagoon affects the quality of the water and marine life. We need to be careful about inland creeks, etc, that bad things don't creep into the fragile ecosystem of the lagoon. *Comment provided by Amy Dahan, Director, Heathcote Botanical Gardens, by Virginia Schow.*

I would like to see the researchers work more with professionals (guides and local fisherman) and local residents when conducting studies on whether various conditions are improving or worsening. This would give them more information on which to base their findings on. *Comment provided by Anonymous.*

Old septic systems affect Canaveral Seashore. What effect do lawn chemicals washing into the water along Riverside Drive have on the ecosystem? Fishkills (water-quality related) in canals in Merrit Island Wildlife Refuge. *Comment provided by Seth Greenstine.*

Comments from the Education and Outreach Kiosk

We sorely need more education and outreach to preserve and protect this magnificent body of water- before its too late. *Comment provided by Anonymous*.

Education and outreach needs to address all uses of the lagoon and should include best practices for management based on science. Should be addressed toward boaters and fishermen, etc. *Comment provided by Paul Sacks.*

Education and outreach should both promote the unique beauty and importance of the lagoon and best management practices for all to enjoy *Comment provided by Anonymous.*

(Education is) Essential to the future of our Lagoon! Children are the environmentalist of the future. If they are unaware of issues about the lagoon they will be uncaring. We need to educate stewards of the lagoon for future generations. *Comment provided by Virginia Schow*.

Comments from the Public Use Kiosk.

More and more recreational boaters are using our lagoon every day and a lot of people need more education on abusing our waters such as running through grass beds leaving prop scars, throwing trash in the water and not properly handling undersize fish. If we can control some of this, the future of the lagoon will be in a "natural condition" as it is today for future generations to enjoy. *Comment provided Capt. Jeff Dorobiala..*

Public use is important, but restrictions must be honestly and adequately explained to enhance acceptance. There also needs to be more enforcement of regulations. *Comments provided by Paul Sacks.*

I enjoy kayaking and canoeing all of the area around New Smyrna Beach Port Orange, Oak Hill. I especially enjoy the public access ramps in Oak Hill and surrounding area. I would like to see more camping and

hiking in the area like the Turtle Mound for hiking and the camp grounds in Oak Hill nearby the State (Preserve). *Comments provided by Randall Brett.*

I have only been on the Mosquito Lagoon in a boat. I enjoyed seeing the birds and other animals and the peaceful time on the water. It is also a wonderful place to bring guests to see our (Aquatic) Preserve. *Comment provided by Virginia Schow.*

Keep Boating Access. *Comment provided by Anonymous.*

Concerns with continued access 1. boating 2. fishing. *Comment provided by Ted Wyka.*

Preserve Access. *Comment provided by Brian Clancy*

Public use needs to be monitored and its effects reported, so that detrimental usage can be reduced through education. The public needs to be more informed of how their use impacts the area and what they can do to minimize the impact. If needed, certain limitations may need to be utilized. (i.e., pollution zones). *Comment provided by Anonymous.*

Monitor public usage to determine how it is deteriorating quality of resources. *Comment provided by Anonymous.*

My main concern would be limiting boating by (creating) pole and troll zones and the impact on recreational fishing. *Comment provided by Matthew McNerny.*

I don't want anyone telling me I can go fishing any where any place. *Comment provided by John- The Traveling Fisherman.*

I want (waterfowl) hunting to continue here. *Comment provided by Matt Clark.*

I want to insure that the historic use of duck hunting continues in this area. *Comment provided by Randy Clark.*

The seagrass beds are critical. Restoration needed. Pole zones are essential. How long until seagrass regrows, then remove pole zones? Kayakers should have their own areas (motor free zones). Many weekend boaters with large outboards have NO RESPECT for the seagrass beds; they put their motors down and use them as anchors. I am not sure why I came to this public scoping meeting. I was interested in the decision making process. I was concerned that the Lagoon was to become motor free. This estuary is a treasure that I value and respect. I plan on living and fishing another 50 years in it. If there are to be off limit areas until they recover, I am fine with it. I just did not want things to change overnight- and would regret not bearing witness and possibly a voice. *Comment provided by Seth Greenstine.*

Written comments submitted during comment period

These are written comments received within the comment period, which ended on August 21st.

From: wenzh@bellsouth.net • Sent: Saturday, August 18, 2007 10:28 AM

To: Mosquito Lagoon • Subject: Public Scoping Meeting Comments

Attn: Michael Shirley, Ecosystem Science, Mosquito Lagoon Aquatic Preserve

Because pollution in storm-water runoff, the main contributor to declining water quality in all of Florida's water resources, is difficult to detect, public awareness and concern is almost nonexistent. Yet it is an ever increasing threat to both humans and wildlife.

Because waterways like the Indian River and the Mosquito Lagoon draw an enormous number of fishing enthusiasts, publishing the source, types and amount of pollution from storm-water runoff after each period of heavy rain would go a long way in achieving public awareness and concern. Fishing magazines would be an effective conveyor.

The main culprits in water pollution are pesticides, herbicides and fertilizer. The Department of Environmental Protection is fully aware of this pollution problem. So why hasn't the Department located and identified all major storm-water sources, and scheduled staff and trained volunteers to monitor these sources when runoffs occur?

For example, the City of Deltona in Volusia County has a storm-water runoff system in place that will result in millions of gallons of polluted runoff into Lake Monroe (part of the St. Johns River) during inundating rain periods. This system has no filtering system to address the three main culprits (pesticides, herbicides, and fertilizer). The City of DeBary will do the same in the near future. There must be hundreds of systems in place throughout Florida without any monitoring or filtering system. And, this is not by accident. Having been on the Deltona Comprehensive Plan Committee which was dominated by developer related interests, this omission was not by accident.

So, the question is when is the Department of Environmental Protection going to grow a backbone and require monitoring and filters?

Hank Wenz, 658 Whitemarsh Avenue, Deltona, FL 3225

(386) 574-7083, Wenzh@bellsouth.net

*C.3 / **Formal Public Meeting***

The following Appendixes contain information about the Formal Public Meeting(s) which was held in order to obtain input from the public about the Mosquito Lagoon Aquatic Preserve Draft Management Plan. There are copies of the public advertisements for those meetings, a list of attendees, a summary of the meeting(s) (as required by Ch. 259.032(10), F.S.), and a copy of the written comments received.

C.3.1 / F.A.W. Posting

June 4, 2008 Formal Public Meeting FAW Notice

Florida Administrative Weekly, Volume 34, Number 17, April 25, 2008
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 2237

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, acting as staff to the Board of Trustees of the Internal Improvement Trust Fund announces a public meeting to which all persons are invited.

Date & Time: Wednesday, June 4, 2008, 6:30 p.m.

Place: New Smyrna Beach Regional Library, 1001 S. Dixie Freeway, New Smyrna Beach, FL 32168

General Subject Matter to be Considered: The purpose is to receive public comment on the draft Mosquito Lagoon Aquatic Preserve Management Plan. The Mosquito Lagoon Aquatic Preserve Advisory Committee will be participating.

A copy of the draft plan will be available for viewing starting May 2, 2008, at www.dep.state.fl.us/coastal.

A copy of the agenda may be obtained by contacting: Jessica Bruckler at (321)634-6148.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting: Jessica Bruckler at (321)634-6148. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1(800)955-8771 (TDD) or 1(800)955-8770 (Voice).

Florida Department of Environmental Protection • Office of Coastal & Aquatic Managed Areas

Mosquito Lagoon Aquatic Preserve

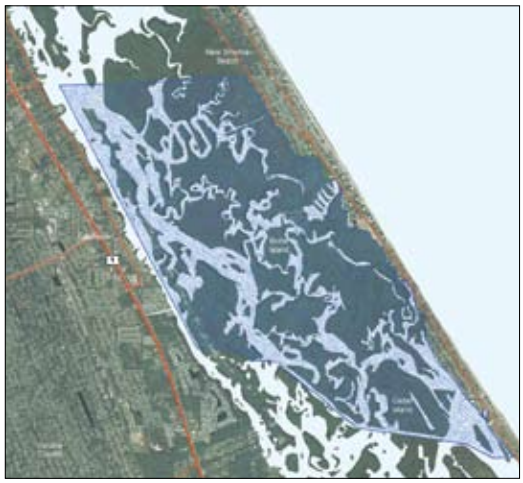
Public Meeting

Wednesday, June 4, 2008, 6:30 pm

New Smyrna Beach Regional Library
1001 S. Dixie Freeway
New Smyrna Beach, FL 32168

The Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas (CAMA) is responsible for the management of Florida's 41 Aquatic Preserves, three National Estuarine Research Reserves (NERR), one National Marine Sanctuary, and the Coral Reef Conservation Program. These protected areas comprise more than 4 million acres of the most valuable submerged lands and select coastal uplands in Florida. CAMA is updating these management plans, and is currently working on the Mosquito Lagoon Aquatic Preserve plan. This site will hold a public meeting to receive input on the draft plan. The information from the meeting will be compiled and presented to CAMA by a facilitator.

For more information, please contact Jessica Bruckler, (321) 634-6148 / Jessica.Bruckler@dep.state.fl.us or visit our website at www.aquaticpreserves.org. Written comments are welcome and can be submitted by fax: (850) 245-2110, Attn: Mosquito Lagoon; or email Mosquito.Lagoon@dep.state.fl.us.



Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting Jessica Bruckler at (321) 634-6148 or Jessica.Bruckler@dep.state.fl.us. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, (800) 955-8771 (TDD) or (800) 955-8770 (Voice).

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Name	Affiliation	AC Member
Rich Adamovic	Coastal Conservation Association; Halifax Sport Fishing Club	No
W. V. Alderman		No
Tina Benefield		No
Robert Bullard	Ahimsa Technic, Inc.	No
Bob Campbell		No
Linda Campbell		No
Buck Carr		No
Fielding Cooley	Marine Discovery Center	Yes
Kelly Cuculianski	News Journal	No
Robert Day	SJRWMD	Yes
Gail Domroski	Southeast Volusia Audubon	No
Rosemarie Gore	League of Women Voters in Volusia County	No
Gary Haddle		No
Neil Harrington		No
Jack Hayman	Volusia County Council	No
Dave Herbster	DEP	No
Lynn Hoffman, Ph. D	Marine Discovery Center	Yes
Rachelle Leblanc		No
Kelli McGee	Volusia County, Natural Resources	No
Dale McGinnis	Florida Tech	No
Dot Moore	Archaeology	No
George Myers	DEP	No
Capt. Bud Neviaser	Coastal Conservation Association; Florida Guides Association; Halifax Sport Fishing Club	Yes
David Ray	Marine Industry Association Central Florida	No
Troy Rice	IRL National Estuary Program, SJRWMD	No
Alfred Rodriguez	ACI Dredging	No
Sandra Rodriguez	ACI Dredging	No
J. Sachs		No
K. Shepard		No
Sally Spencer		No
Jonas Stewart	Volusia Mosquito Control	Yes
Mike Thomas	Mayor for City of Edgewater	No
Joel Timyan		No
Audrey Warren	FWC	Yes
Ted Wyka	Coastal Conservation Association, Mid Coast Chapter	No
Georgia Zern	Volusia Environmental Management	Yes

Meeting Summary
Introduction

On June 4, 2008 the Mosquito Lagoon Aquatic Preserve conducted a public meeting to address the following objectives:

1. Present current draft of Site Management Plan, with a focus on issues and objectives.

2. Receive feedback from the public on the current draft management plan.

This was the second public meeting related to the drafting of the Mosquito Lagoon Aquatic Preserve Management Plan.

The meeting followed the agenda below:

- Official Welcome and Introduction
- Overview Presentation: Described the management area's boundaries, available management resources, current projects, and proposed issues and management actions.
- Public Comment and Stakeholder Feedback: An opportunity was provided for the public to provide written and verbal comments to Aquatic Preserve staff and Advisory Committee members at four "kiosks" organized according to the issues identified in the draft plan (Water and Watershed, Loss of Natural Community Function and Species Diversity, Environmental Incidence and Assessment Response, and Sustainable Public Use).
- Kiosk Reports: Staff provided a verbal summary of the comments they received at their kiosk.
- Public Comment: Participants were given three minutes to make a public statement to the full assembly. Only written comments were included in this meeting summary.

The meeting was designed to encourage dialogue between all interested parties including local citizens, business owners, governmental representatives, recreational users and the Aquatic Preserve staff and Advisory Committee. The meeting provided a forum for general comments and observations on the current draft of the Mosquito Lagoon Aquatic Preserve Management Plan. The public was invited to provide comments at four kiosks that identified the specific issues and goals in the current draft of the management plan.

Coastal and Aquatic Managed Areas Background - The Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas (CAMA) is responsible for the management of Florida's 41 aquatic preserves, 3 National Estuarine Research Reserves (NERRs), 1 National Marine Sanctuary, and the Coral Reef Conservation Program. These protected areas comprise more than 4 million acres of the most valuable submerged lands and select coastal uplands in Florida. CAMA is currently in the process of revising its site management plans, including the plan for the Mosquito Lagoon Aquatic Preserve. These plans will provide a critical management framework for the sites, setting priorities and guiding implementation for the next 10 years.

This Document - This document includes both written comments received at the meeting and by email/postal mail during the comment period. It also includes a summary of the reports made by the staff at the end of the kiosk period. This summary is not meant to be a detailed description of the proceedings, but a record of the major themes and comments received. Only written comments were included in this meeting summary.

Summary of Comments

Below is an overall summary of the comments received by the Mosquito Lagoon Aquatic Preserve during the public meeting process:

- Overall, the public acknowledged the efforts of the Aquatic Preserve staff and the Advisory Committee to create a comprehensive management plan for the Mosquito Lagoon Aquatic Preserve. The public recognized many of the same management issues that were identified in the plan and provided ideas and actions to improve the plan.
- The public supports the planning efforts and wants to directly participate in the process. Six individuals signed up to become members of the Public Use Advisory Subcommittee and four additional individuals signed up to be members of the Mosquito Lagoon Aquatic Preserve Advisory Committee.
- Comments received from the Loss of Natural Community Function and Species Diversity section identified the need to protect the historic and cultural resources found in the Preserve and promote restoration efforts that enhance habitat quality and water quality.
- The proactive component of the Environmental Incidence Assessment and Response section should be increased and the importance of partnering with other agencies was also identified.
- The Water and Watershed section should consider the need to retrofit older storm water systems and a specific strategy to capture data on destruction of oyster reefs by boat wakes.
- Issues and solutions related to human impacts and invasive species should be included in the Sustainable Public Use section.

Written Comments Received on Comment Cards at the Meeting

Comments from the Loss of Natural Community Function and Species Diversity Kiosk:

Will prehistoric and historical archaeology sites be considered prior to any ground (under and above water) disturbance related to restoration efforts? There are many undocumented sites that are not obvious to untrained personnel, some sites may have components that are currently inundated; some may have portions now underwater, at the shoreline and on the uplands near the water. Comment provided by Dot Moore

Perform species tissue sampling from fish and filter feeders in the area to determine what they are taking in. Restore manmade canals in our area to original depths to provide manatee habitat and enhance natural fishing and therefore enhance water quality. Comment provided by Al & Sandra Rodriguez

Objective I.B.1 & I.B.1.1 Both read like governement-ese. Translation please.

I.B.1.2 thru I.B.1.8 are solid, hands-on objectives. I hope you succeed with each one. They are all potential "trophies" for CAMA and "wins" for the environment. Comment provided by Dave Herbster

Kiosk Comments Summarized on the Flipchart:

- Need to address historic and cultural resources.
- Re-examine writing of objective I.B.1 and strategy I.B.1.1 (improve readability).
- Canal water quality and sediment quality influences natural communities in the Aquatic Preserve.
- Understanding impact of restoration on water quality and fish.

Comments from the Environmental Incidence Assessment and Response Kiosk:

Potential partnering with other federal agencies eg. Air Force, Navy, Wildlife, State, County, municipal HAZMAT responders. Comment provided by Jack Hayman

This one needs a proactive component. As written, non-incidence assessment and response is reactive. But in most cases- whether fish kills or green mussels or spotted jelly fish- when we find "incidents" in the lagoon, the horse has left the barn. Important focus on keeping "incidents" out (whether by awareness raising or some other means) rather than to address them after they're entrenched. Comment provided by Dave Herbster

Can one use 911 cell # to report incident? An Volusia Cty. The 911 call goes to SO's comm. dept for dispatch to proper agency. Comment provided by Jack Hayman, Volusia County Council, District 3

This sounds like a huge enterprise. Unclear where you will start on Day 1 and what can be reasonably accomplished in your time frame! Would be most interested in commitment from various levels of government-Federal-State-County-City-Local interest groups. Who can be counted on? Where should $ be put for highest accomplishment? Comment provided by Anonymous

Interested in becoming a partner with you in reporting incidence and promoting public awareness. Comment provided by Al & Sandra Rodriguez

Kiosk Comments Summarized on the Flipchart:

- Sounds like a HUGE enterprise. How to complete in time frame? What commitment levels from all responsible parties? Who will deliver greatest accomplishment?
- Use 911? Does Volusia County Sherriff's office know how to dispatch correctly?
- Needs a proactive component. Reactive response may be too late. A focus needs to be on keeping "incidents" out. (i.e. green mussels, spotted jellyfish).
- Air force, Navy, Fish & Wildlife Conservation Commission, State, County, Municipal, etc. as other potential HAZMAT responders.

Comments from the Water and Watershed Kiosk:

Who does water quality studies in MLAP and do you accept volunteers? Comment provided by Buck Carr

One thing this one should be getting at is specifically retrofit older storm water systems that discharge directly to the preserve and connected waters. Current storm water regulations are tight and getting tighter. But the old systems provide little to no protection. So identify key systems that need retrofitting, then help identify funding to fix them. Comment provided by Dave Herbster

Need to review section 2008- 1972 Clean Water Act study from 1978-1982. Comment provided by R R Bullard, P.E.

How was the boundary of the aquatic preserve determined? Comment provided by Joel Timyan

Would like to see a specific strategy to capture data on boat wake destruction of oyster beds. That naturally filter and clean water. Need newspaper articles on this every year supported by data. Comment provided by Anonymous

Kiosk Comments Summarized on the Flipchart:

- Need to retrofit older storm water systems that discharge directly to the Preserve.
- Need specific strategy to capture data on destruction of oyster reefs by boat wakes.
- Need to review section 208 study from the Clean Water Act (1979-1982).
- Who does water quality studies in the lagoon?

Comments from the Sustainable Public Use Kiosk:

Would like a better connection between all those who educate the public on sustainable lagoon use. Sometimes seems like a large educational overlap concerning some species like turtles and manatees but very little on less engaging species but equally important to lagoon sustainability. Comment provided by Anonymous

I think you are trying to get at four things here: measure public use of the preserve, measure what levels of use are sustainable, compare 1&2, and manage accordingly. If I understand this one, then consider a "plaid-spear" re-write like my attempt above. If I don't understand, then a rewrite might be still be a good idea (to make it understandable). Comment provided by Dave Herbster

If you could get a grant to manage invasive plants and get them knocked back, then annual maintenance and monitoring thereafter would be less effort. Comment provided by Anonymous

Acquire recreational fish data from MRFSS program from FWRI, and link to SJRWMD website. Comment provided by Gary Haddle

The public needs more of the fine wildlife officers that we seldom see. With overcrowding and poaching not to mention marine violations, our waters need more enforcement. The FWC should spend more money on our resources. Comment provided by Anonymous

Cultural resources (prehistoric and historic) should be considered when determining the permitted public use of areas in the lagoon (island and uplands along both shorelines). Some spoil islands may have been created by depositing spoil on top of small natural islands. Comment provided by Dot Moore

MLAP borders on the NSB City Mosquito Lagoon Preserve Park. The public will increase its access to that area as a result of that new park. Kayaking, Trails, Fishing, Etc. monitoring of that potential impact could be worth collecting. Comment provided by Fielding Cooley

Mosquito Lagoon southern portion has infestation of Brazilian pepper on all islands and shoreline. Comment provided by Anonymous

Kiosk Comments Summarized on the Flipchart:

- Recommend collection of human use impacts to MLAP from access through Mosquito Lagoon Preserve Park.
- Southern ML has in infestation of exotic Brazilian pepper on all shorelines and islands.
- Get grant to manage invasive plants, once knocked back, maintenance and monitoring will be easier.
- Get fisheries data from FloridaWildlife Research Institute Marine Recreational Fisheries Statistics Survey (MRFSS) and link to SJRWMD webpage.
- Need more wildlife enforcement officers, FWC should spend more money on our resources.
- Consider cultural resources, historic sites- when permitting public use of some areassome spoil islands may top over natural historic islands.
- Better coordination between education providers- increase education on lesser-known species in addition to manatee and turtles.

Written Comments Submitted during Comment Period

These are written comments received within the comment period, which ended on June 11, 2008.

From: Absolute Engineering Group [mailto:absenggroup@yahoo.com]
Subject: Mosquito Lagoon Aquatic Preserve Management Plan - Random Comments, Suggestions and Opinions

1. A compelling and credible definition of "sustainable recreational and commercial uses" needs to be promulgated and subject to the scrutiny of the concerned citizenry. Personally, after 35 years in the business, my conclusion is that the term is an oxymoron, defying definition.

2. About one-half of the Aquatic Preserve is in Brevard County. The draft plan presented at the public forum on 4 JUNE in NSB made no mention of Brevard County.

3. Speaking of Brevard County, one could opine that the environmental/ecological conditions in the Brevard Co. portion of the Preserve are superior to those in the Volusia portion, which give rise to some other points:

3.1. Has anyone at any time promulgated a quantitative definition of what constitutes a "pristine" environmental/ecological condition for the Preserve?

3.2. Assuming such a definition might be reasonably developed by the scientific community and, subsequently, "politicized" in the court of public opinion, would not the over-riding goal of the Preserve's Management Plan be the restoration of "pristiness"?

3.3. If "pristiness" is not the goal, then what is? Prevention of further degradation? If so, what are the degraded quantitative ecological/environmental standards? Are these standards the current conditions, conditions a decade or two ago, or those expected some date in the future?

4. Ecologically, the characterization of the Lagoon should be understood quantitatively in terms of "attritional" degradation (or "accretional" enhancement) and "episodic" degradation. The two degradations are related ecologically and that relationship must be quantitatively characterized for proper incorporation in a defensible management plan.

5. The management plan should be adopted by FAC rule making. The Mosquito Lagoon deserves nothing less.

Robert R. Bullard, P. E.
Absolute Engineering Group, div. of Ahimsa Technic, Inc.
Office Location and Parcel Mailing Address: 440 Western Road (via Lakeshore Dr., off SR 415, Samsula) New Smyrna Beach, FL 32168
Correspondence Mailing Address: P. O. Box 291278, Port Orange, FL 32129-1278
(ph) 386.428.7361 (fx) 386.427.2198

From: Gerald M. Ward [mailto:wardgm@gate.net]
Subject: Chapter 18-20 FAC - mosquito lagoon aquatic preserve plan update (not/IAW 120 F.S.) - Volusia & Brevard counties, Florida

Mr. Shirley & Ms Tyson

I have tried by telephone to reach you both, but, find that you are out-of-communications.

This evening's FDEP second so-called public meeting in new Smyrna beach unfortunately conflicts with too many other meetings, so marine industries association of treasure coast, inc (MIATC). Does not have folk available to attend in person. Given that this trustees preserve is the first of many within the Indian River Lagoon (Ponce de Leon inlet to Jupiter inlet) to suffer an attempt at revision of what should have been a simple routine process the MIATC has great concern over both the content and process being accomplished by the office of coastal & aquatic managed areas.

Since the meeting format and process utilized by the FDEP for 2006-2008 has been extremely restrictive to the public views we expect to reserve most of our input to the ultimate chapter 120 Florida statutes administrative law process. We do note that the eight page handout of so-called goals & objectives for this evening's meeting grossly deviate from chapter 258 Florida statutes and its implementing rules contained within 18-20 Florida administrative code.

We also note that you (like some other of these proceedings) think that an extremely short one week is all the time the public needs to comment on untold pages of material not really related to the required "management plan". At least 30 days comment period is hereby requested instead of one week.

Like on other so-called plans, the association will issue more formal responses in due course.

Gerald M. Ward, P.E.
Marine industries association of the treasure coast, inc. - legislative committee
P.O. Box 1639, Stuart, Florida 34995; P.O. Box 10441, Riviera Beach, Florida 33419
561/863-1215, 561/863-1216 fax, 0803mosquitonlagoonap

From: HEYJUDESMATE@aol.com [mailto:HEYJUDESMATE@aol.com]
Subject: Mosquito Lagoon Aquatic Preserve Management Plan

In the early 1970's I worked with the Florida Department of Pollution Control and assisted Dr. Provost of the Florida Department of Natural Resources Entomological Center and the Volusia Mosquito Control District to establish the mosquito control plan for the Mosquito Lagoon, which included a series of small canals dredged to drain and flush the interior pools of water on the islands within the lagoon.

I was also the Chief of Environmental Permitting and Director of the Division of State Land Management for the Internal Improvement Trust Fund when Joel Kuperberg and Jay Landers were the Directors of the TIITF, and

Research Coordinator for the Coastal Zone Plan which was responsible for the designation of the Coral Reef Sanctuary in the Florida Keys.

Later in my career with the Florida Department of Environmental Regulation as Assistant Secretary under DER-Secretary Jay Landers, I was on the state and federal team that was responsible for designation of that area of the of the Mosquito Lagoon known as the Canaveral National Seashore. I am now retired and live in Oak Hill, Florida, fishing regularly in the Mosquito Lagoon and further south in the Indian River Lagoon.

My main concern with the Mosquito Lagoon Management Plan is that the drainage canals (mosquito dragline canals) into the interior islands which harbor mosquito breeding pools formed by wave berms of sea grass and sand have not been maintained over the past 35 years as designed by Dr. Provost. The mosquito drainage canals should be restored as the canals have established black and red mangroves along the canal banks and act as breeding and feeding habitat for many species of aquatic animals, including mullet and shrimp, which I have personally observed.

Quick Facts about Mosquito Lagoon Aquatic Preserve

Location: Brevard and Volusia counties
Acreage: 23,000 acres of sovereign submerged lands, of which 20,000 is part of Merritt Island National Wildlife Refuge
Contact: Sharon Tyson, Aquatic Preserve Manager, 3783 North Indian River Drive, Cocoa, FL 32926, 321-634-6148

High Marsh Restoration - Coastal and Aquatic Managed Areas, St. John's River Water Management District, Volusia County Mosquito Control District, and Florida Fish and Wildlife Conservation Commission are partnering on ongoing marsh restoration activities. The high marsh restoration project involves re-establishing marsh elevations to historic levels allowing recruitment of native vegetation and species such as fiddler crabs. The aquatic preserve staff has agreed to assist with resource monitoring of existing conditions of impoundments and mosquito control ditches and document post-restoration effects.

The high marsh area which has been ditched should be left alone as many aquatic plants and animals have established an ecosystem similar to those found in the Mosquito Lagoon Aquatic Preserve and contrary to Dr. Provost's plan for mosquito control.., however the High Marsh Restoration project within the diked impounded areas should proceed as planned, removing the dikes and opening the impounded areas to the Mosquito Lagoon and northern parts of the Halifax River.

- This aquatic preserve represents one of the state's most pristine waterbodies.
- The northern Mosquito Lagoon supports 160 species and 56 families of fish.
- The fish within the estuarine system form a species-rich assemblage important to commercial and recreational fisheries,
- Salinity levels in the Mosquito Lagoon are comparable to ocean levels (32-34 ppt) allowing several fish species to spawn in the lagoon that would normally spawn in the ocean.
- The Mosquito Lagoon supports the northernmost extent of red and black mangrove habitat, low marsh and high marsh habitats, extensive oyster bars, and tidal flats.

While the Non-native Species section mentioned several alien pests, there are also native pest species that Canaveral National Seashore (CANA) must contend with. Two of those are the mosquito and raccoon. It is notable that Volusia County was once named Mosquito County, before an attempt was made to attract tourists to the area. The two most common and bothersome mosquito species found here are the salt marsh mosquito (Adeas sollicitans), also known as the "salt marsh terror", and black salt marsh mosquito (Aedes taeniorhynchus). Female adults lay eggs on exposed mud flats, where they can remain for extended periods until submerged by rain or high tides, when they develop into aquatic larvae and eventually adults. Unlike freshwater mosquitoes, these two species are adapted to saltwater; the larvae can excrete excess salt through the anal gills. The saltmarsh mosquito may bite at any time, but is most active during the warmest parts of the day. The black saltmarsh mosquito bites mainly in the cooler hours of the morning and dusk. Remember mosquitoes are attracted to dark colors, so it is advisable to wear light-colored long-sleeved shirts and long pants if you plan to be out in times or areas frequented by mosquitoes.

When CANA was created, both NASA (which owns the southern two-thirds of the park) and the State of Florida (which transferred the northern portion of the park to the National Park Service) stipulated that CANA must cooperate with the local mosquito control districts. In addition, on former state lands, existing ditches dug for mosquito control are to be maintained. Under these agreements, the park has sought to utilize control methods that cause the least amount of damage to the environment. Two very different approaches are being used. The first is chemical control.

Breeding areas are closely monitored by the mosquito control districts. When large amounts of mosquito larvae are observed, a larvacide is applied at those locations. Rather than kill the larvae, the larvicide retards development and prevents them from entering the adult stage. It is thought that the larvicide is very specific and has little impact on other organisms. Several thousand acres of the park have been treated in this manner.

The other approach involves a combination of physical and biological control. Before the park was created, much of Mosquito Lagoon was ditched and impounded for mosquito control. The impoundments were created by constructing earthen walls or dikes around marsh areas. These were then flooded, eliminating the exposed mud needed by female saltmarsh mosquitoes to lay their eggs. While effective for mosquito control, this had a devastating ecological effect. It isolated valuable salt marshes that formerly provided significant amounts of food to the lagoon, served as critical nursery areas for many species of fish, and acted as a filtration system for lagoon waters. Today CANA is working with the state and county to reconnect impounded areas by breaching or completely removing the dikes.

Another technique called rotary ditching, addresses the mosquito control ditches, some of which date from the 1920's. Over time, many ditches became clogged and would collect water during rainy periods, actually increasing mosquito breeding habitat. To correct this, a special rubbertired machine is being used to reopen the ends of the mosquito control ditches.

Thank you for considering my suggestions for management of the Mosquito Lagoon Aquatic Preserve.

James W. (Buck) Carr former Assistant Secretary of the DER (1974-76)

From: John Gamble [mailto:jgamble@co.volusia.fl.us]
Subject: Attn: Mosquito Lagoon

I have reviewed your objectives titled Mosquito Lagoon Aquatic Preserve Issue-based Management and offer the following comments:

1. Most if not all of these goals are reflected in other programs like TMDLs, MS4 NPDES and the IRL National Estuary Program.

2. Like the TMDL program, science should provide the information we make decisions based on.

Are not sea grass beds expanding in Mosquito Lagoon as reported by SJRWMD? Are there specific water quality parameters that are trying to be reached?

3. Under II.B.2.5: there is a reference to fertilizers and pesticides. Fertilizers are an acknowledged and verified problem in urban areas. What are the verified pesticide issues in Mosquito Lagoon? This wording about pesticides is routinely thrown out in such documents with no validity what so ever. I have been following the TMDL process in Florida for some years and have never heard of a water body that is impaired by pesticides. In fact, in freshwater systems, pesticides are used to restore habitat and improve water bodies.

4. The major issue for local governments at this time is funding. To help Volusia County and cities work on these objectives, will the Mosquito Lagoon Aquatic Preserve be providing grants or other type of funding?

5. Is it clear that sea grass bed decline in the north end of the lagoon is a results of pollution or possibly the turbidity caused by boat traffic? Do we have any science here?

6. I would encourage Mosquito Lagoon Aquatic Preserve staff to really evaluate the science and make a solid case to the taxpayers with a prioritized list of the largest current threats and develop a plan to work on those. The shotgun approach needs to be focused if you're really trying to do something.

John C. Gamble
Special Projects Manager, Volusia County Public Works
123 W. Indiana Ave., DeLand, FL 32720-4262, 386-736-5965 X5527, jgamble@co.volusia.fl.us

From: David Ray [mailto:dray@miacf.org]
Subject: Meeting last night

Sharon

It was great meeting you last night. Your doing an unbelievable job with such limited resources. If I can help, please let me know. Thanks for you efforts.

David Ray

From: Zajicek, Paul [mailto:zajicep@doacs.state.fl.us]
Subject: Draft Mosquito Lagoon AP Plan Comments

Dear Ms. Tyson:

To follow are comments from the Division relative to the draft Mosquito Lagoon Aquatic Preserve Management Plan dated May 2, 2008. Overall, we are impressed by the scope and indepth analysis provided in the draft plan. Clearly you and your staff have invested considerable time and energy in producing a quality document.

Our comments focus upon the recognition afforded aquaculture by the Legislature in Florida law and especially in respect to the authorized use of sovereign submerged lands. Please note that the propriety authorizations

alluded to on draft page 7 include aquaculture. We specifically request that the management plan include both recognition of aquaculture as an authorized use and that the Legislature has declared aquacultural activities as being in the public interest.

"The Legislature declares that aquaculture shall be recognized as a practicable resource management alternative to produce marine aquaculture products, to protect and conserve natural resources, to reduce competition for natural stocks, and to augment and restore natural populations. Therefore, for the purpose of this section, the Legislature declares that aquaculture is in the public interest." (253.68(2)(a)).

"…aquaculture is in the public interest and aquaculture leases may be authorized in aquatic preserves…"(258.42(1)(b))

"It is the intent of the Legislature to enhance the growth of aquaculture in this state, while protecting Florida's environment." (597.0021(1)).

We are concerned with certain statements in the draft text. Language on draft page 63, within a brief paragraph that describes aquaculture leasing, implies that no new aquaculture leases may be authorized. As provided in law and rule, the Division responds to application by local government or individuals that are interested in an aquaculture lease and so cannot predict when such applications maybe received. Authorization to act upon lease applications remains a responsibility of state government. Language on draft page 98 implies that shellfish aquaculture is a consumptive use. We respectfully disagree and have cited Florida law that recognizes the value of shellfish aquaculture to Florida's natural resources and natural resource management.

Cultured shellfish are a significant sink for nutrients and the non-consumptive, sustainable production of shellfish is well recognized in the scientific literature as well as by the environmental community.

The Division is vitally interested in continuing a constructive relationship with the Coastal and Aquatic Managed Areas program. We believe that clean coastal water, productive estuaries, and aquaculture are compatible and mutually beneficial goals and activities. We hope that you agree and will respond favorably to our comments.

Thank you,

Paul Zajicek, Biological Administrator

Charles H. Bronson, Commissioner of Agriculture
Florida Department of Agriculture and Consumer Services, Division of Aquaculture
1203 Governors Square Blvd, Fifth Floor, Tallahassee, Florida 32301, Telephone: 850-488-4033, Fax: 850-410-0893
Website: http://www.FloridaAquaculture.com

From: Margaret Lasi [mailto:mlasi@sjrwmd.com]
Subject: Comments on the draft Mosq. Lagoon Aquatic Preserve Management Plan

Hello Sharon & Myra

I got notice of the June 4 Mosquito Lagoon Aquatic Preserve Management Planning meeting.

Unfortunately I will not be able to attend, but I thought you would be interested in my comments pertaining to the water quality monitoring section of the draft report.

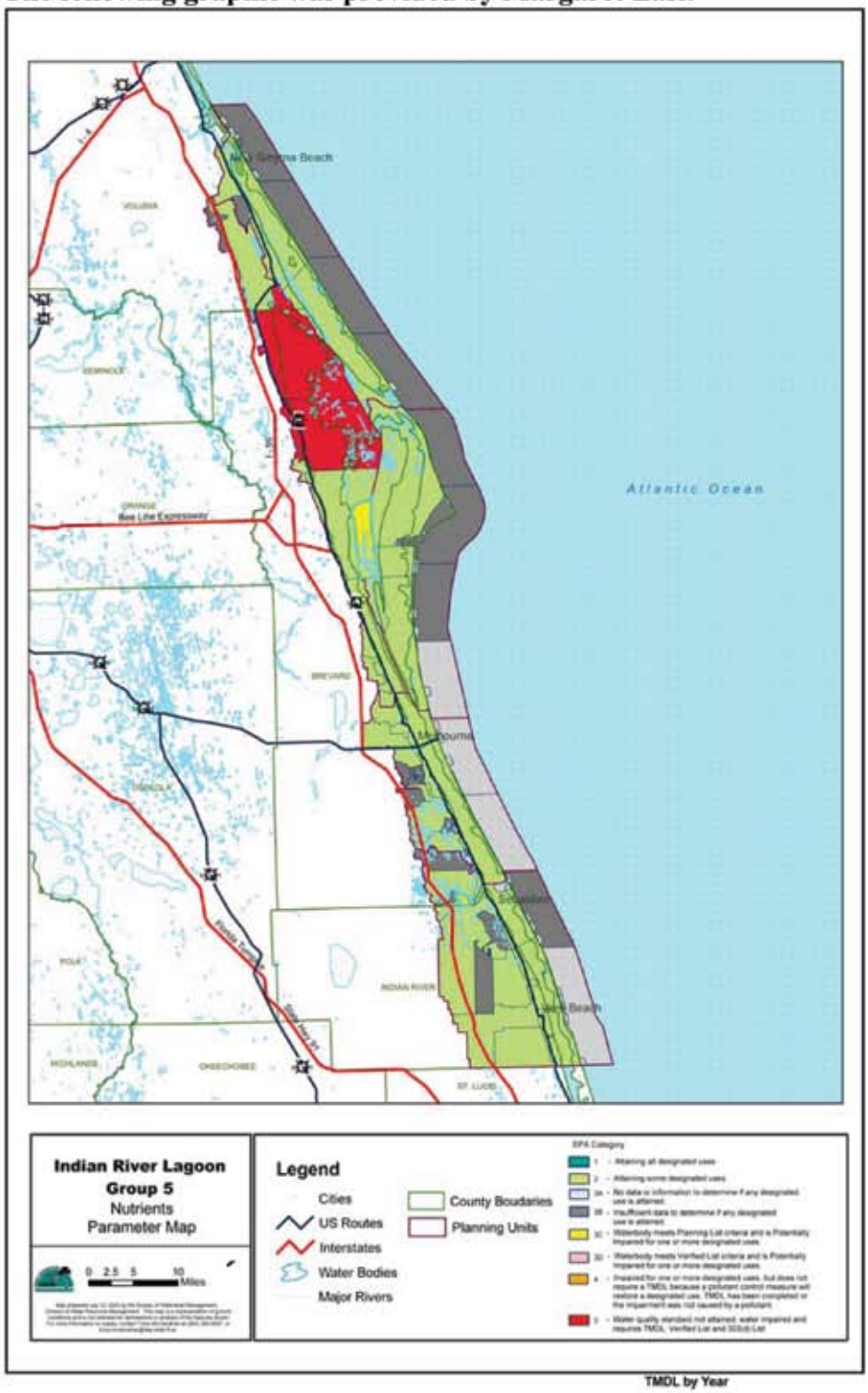
Please see the two-page pdf document attached (pages 56 and 57 of the draft MLAP Management Plan). Also attached is a graphic I obtained from FDEP's website to illustrate one of the points made in my comments. Text additions are indicated by blue vertical carets, deletions show up as red cross-out lines, and comments are indicated by yellow comment balloons. Parking or clicking on the carets and comment balloons will display their contents.

I hope you find my comments helpful. If you have any questions, please feel free to call.

Regards,
Margie

The following table is a summary of the comments by Margaret Lasi of pages 56-57 from the Mosquito Lagoon Aquatic Preserve Management Plan Draft (5/02/08):	
Page 56 Paragraph 1 Sentence 1	Note: Monthly sampling under the District's IRL WQMN program is done by VCEHL at station IRLV11 (indicated on the map as ML11). VCEHL also does quarterly sampling at other sites in MLAP on their own. The list of parameters for the two sampling programs differ somewhat (no bacterial sampling under IRL WQMN but TOC, DOC, and PAR are included).
Paragraph 1 Sentence 1	Replace sentence with "Water quality monitoring within the MLAP is conducted by the VCEHL at one station on a monthly basis under the SJRWMD IRL Water Quality Monitoring Network, and at additional stations on a quarterly basis."
Paragraph 1 Sentence 2	Replace "IRL-Water Quality Monitoring Network" with "VCEHL monitoring program"
Paragraph 1 Sentence 3	Replace sentence with "The county and the SRJWMD water quality monitoring programs have been ongoing since 1989."
Paragraph 1 Sentence 4	Replace sentence with "Sampling selected sites once a month and/or quarterly provides a distinct snap-shot picture of water quality within the preserve for that specific period in time."
Paragraph 1	Note: Sediment sampling was recently completed for southern ML as part of a study performed by FIT for SJRWMD (Turbidity Consitituents, Sources and Effects on Light Attenuation in Mosquito Lagoon, Trefry et al., 2007). There are plans to extend this work into northern ML (in 2009) to try to identify sources of suspended solids and turbidity into the system.
Page 57 Paragraph 1 Sentence 1	Replace sentence with "Data provided by the VCEHL and SJRWMD provide a good picture of water within the Mosquito Lagoon, so there is no need for the preserve to duplicate monitoring efforts."
Paragraph 1	Replace sentence with "The VCEHL and SJRWMD surface water monitoring
Sentence 2	programs are committed to continue…" Add citation "Steward et al., 2003"
Table 7	Note: The WQ parameters for the IRL WQMN do not include Fecal Coliform nor Enterococcus, but they do include TOC, DOC, NH4-Dissolved, in addition to the ones listed above. Samples collected under the different programs go to different labs for analysis (SJRMWD's lab is Advanced Environmental Labs in Gainesville, FL).
Paragraph 2 Sentence 2	Note: Reference?
Paragraph 3 Sentence 6	Delete sentence. Note: This was not a true increase in TSS. It was an artifact of changing analytical labs and the unfamiliarity of the new lab with modified procedures for dealing with saline samples (incomplete rinsing of salt residue on filters). I therefore recommend deleting this reference.
Paragraph 4 Sentence 2	Replace sentence with "The water quality index for the northern portion of the IRL (Mosquito Lagoon sites) was rated "good" based on sampling performed in 2001 and 2002 (National Estuary Program, 2007). Note: As far as I can tell from looking at DEP's latest Impaired Water Rule assessments ML waters are not identified as 'potentially impaired' for nutrients (see ftp://ftp.dep.state.fl.us/pub/water/basin411/indianriver/maps/indian_river_lagoon_nutrients.pdf). You may want to double check this. I have no access to Paulic et al.'s 2006 report.
Page 58 Map 13	Note: Please verify with VCEHL the correct name for station ML11 on Map 13 (page 58). This is the station VCEHL samples monthly under IRL WQMN and under that program it is called IRLV11.

The following graphic was provided by Margaret Lasi:



TMDL by Year

Margaret A. Lasi, Ph.D.
Environmental Scientist V,
St. Johns River Water Management District
P.O. Box 1429, Palatka, FL 32178
voice 386-329-4825; fax 386-329-4585
mlasi@sjrwmd.com

Save the Manatee® Club

The Voice For Manatees For More Than 25 Years

May 30, 2008

Ms. Sharon Tyson
Mosquito Lagoon Aquatic Preserve
3783 North Indian River Drive
Cocoa, Florida 32926

Subject: Mosquito Lagoon Aquatic Preserve Management Plan Comments

Dear Ms. Tyson:

Save the Manatee Club is offering a comment on the subject management plan. Manatees regularly use a cove in Bethune Beach near the northern boundary of the aquatic preserve. This area has developed into a de facto manatee park over the years, with some human/manatee interaction and disturbance problems. Canaveral National Seashore personnel initially tried to address the interaction problem by posting educational signs almost 15 years ago, even though the area is outside of their boundaries. We are concerned that manatee/human interactions are still occurring and urge you to further investigate actions that could be taken to minimize this conflict.

Thank you for your consideration of our comment.

Sincerely,

Katie Tripp

Katie Tripp, Ph.D.
Director of Science and Conservation
Save the Manatee Club

Marine Industries Association
of the Treasure Coast, Inc.
Serving, protecting & promoting marine interests since 1974

P.O. Box 1639
Stuart, Florida 34995
Telephone (772) 692-7599
Fax (772) 692-7699
E-mail: mia_tc@bellsouth.net

June 11, 2008

VIA FACSIMILE
321/634-6149
@ 3:45 PM

Trustees of the Internal Improvement Trust Fund
% Florida Department of Environmental Protection
Office of Coastal and Aquatic Managed Areas
3783 North Indian River Drive
Cocoa, Florida 32926

Attention: Sharon.Tyson@dep.state.fl.us,
Manager, Aquatic Preserve (321)-634-6148
Re: Mosquito Lagoon Aquatic Preserve Management Plan Update
DRAFTS – vol 18-20.005(7) Florida Administrative Code

Gentlemen:

As staff to the Trustees of the Internal Improvement Trust Fund, you have not initiated Rule Development for referenced Rule and Management Plan Update. Several of our association members have participated with some difficulty in notice and process, since the Summer of 2006 for your Indian River Lagoon and vicinity meetings and we do wish to continue to be fully involved in your updating of not just the Mosquito Lagoon Management Plan which is the northernmost Aquatic Preserve in the Indian River Lagoon, but, all plans affecting our association's area.

None of our members were able to attend last Wednesday's meeting in New Smyrna Beach, but the structure of the meeting once again did not lend itself to correcting your draft of almost 2/3 the size of the so-called North Fork St. Lucie River Management Plan document. The one week given until 11 June 2008 for further written comments is grossly inadequate for providing such comments regardless of the short time the materials were posted prior to your 2 May 2008 "Formal Public Meeting", since the Department is required to use the Chapter 120 Florida Statues rulemaking process as its further means of accomplishing a Mosquito Lagoon Management Plan. We hereby request particular notice to the letterhead addresses of any future actions, meetings and rulemaking.

We do understand that the Department may be intending to further "rewrite" the DRAFT materials to more correctly provide a "management" plan format. We request we be notified at each time changes are made in the DRAFT materials.

Very truly yours,

MARINE INDUSTRIES ASSOCIATION
OF THE TREASURE COAST, INC.

Vera Locke

Vera Locke, Executive Director

*D.1 / **Current Goals, Objectives and Strategies Table***

The following table is a summary of the issues, goals, objectives and strategies identified in Chapter 5. The "Management Program" column identifies which Management Program each strategy falls within. The "Implementation Date" column identifies the fiscal year when the strategy was, or will be, initiated. The "Project Initiation" column indicates if this is an activity that is already underway, currently under initial development, or will occur in the future. The "Length of Initiative" column indicates how long it is expected to complete the strategy, and the "Estimated Yearly Cost" column identifies the anticipated expenses associated with the strategy.

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
Project Initiation Legend: C = Currently Underway D = Under Initial Development F = Future Implementation				
Issue 1: Los of Natural Community Function and Species Diversity				
Goal 1: Conserve and restore natural community function, productivity and species diversity in MLAP.				
Objective 1.1: Determine status and trends of key natural communities and species.				
1.1.1: Collect and compile existing and on-going research studies, reports and data on MLAP into the Volusia County Water Atlas.	Education & Outreach	2009-2010	Recurring	-$800
1.1.2: Co-host and/or sponsor the biennial Mosquito Lagoon Conference including publication of abstracts from this meeting	Education & Outreach	2009-2010	Recurring	$500
1.1.3: Analyze and assess assembled data into a report on baseline conditions for key natural communities and species and identify research and monitoring information gaps, prioritize threats and prioritize new monitoring initiatives.	Ecosystem Science	2009-2010	Recurring	$2,000
1.1.4: Use and build on existing monitoring efforts to facilitate and support long-term monitoring efforts to track trends and locations of key natural communities and species in MLAP.	Ecosystem Science	2010-2011	Recurring	$2,000
Objective 1.2: Develop and implement conservation and restoration projects for key natural communities and species based on the best available scientific data and information.				
1.2.1: Support present conservation and restoration programs and projects within MLAP.	Resource Management	2009-2010	Recurring	$600
1.2.2: Assess existing conservation and restoration strategies (including invasive species management) and develop new plans as required.	Resource Management	2009-2010	Recurring	$600
Issue 2: Water and Watershed				
Goal 2: Maintain and improve water and sediment quality within and adjacent to MLAP.				
Objective 2.1: Determine status and trends of water and sediment quality within and adjacent to MLAP.				
2.1.1: Compile existing water and sediment quality data, including meta data, and included these in the Volusia County Water Atlas .	Ecosystem Science	2009-2010	Recurring	$800
2.1.2: Analyze and assess compiled data to identify status, trends and information gaps.	Ecosystem Science	2009-2010	Recurring	$800
2.1.3: Use or build on existing monitoring efforts to address information gaps and to implement a long-term monitoring program to support status and trend assessment of water and sediment quality in MLAP.	Ecosystem Science	2009-2010	Recurring	$2,000
Objective 2.2: Coordinate with regulatory programs, local government and land owners to reduce the impacts from development in the watershed.				
2.2.1: Support projects to enhance stormwater and sewage treatment within MLAP's watershed.	Resource Management	2009-2010	Recurring	$800
2.2.2: Support projects to restore stormwater pollution filtering capacity of the shoreline and watershed of MLAP.	Resource Management	2009-2010	Recurring	$800
2.2.3: Prioritize, develop and implement water quality improvement education programs within MLAP.	Education and Outreach	2009-2010	Recurring	$800
2.2.4: Provide review and comment on permit applications for activities on lands within or in the watershed of MLAP.	Resource Management	2009-2010	Recurring	$500
2.2.5: Review and provide recommendations for local government comprehensive growth management plans and land development rules and ordnances to enhance abatement of nonpoint source pollutants and address potential impacts of climate change.	Resource Management	2009-2010	Recurring	$250
2.2.6: Support land acquisition efforts in MLAP's watershed.	Resource Management	2009-2010	Recurring	$250

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
Project Initiation Legend: C = Currently Underway D = Under Initial Development F = Future Implementation				
Issue 3: Sustainable Public Use				
Goal 3: Encourage user experiences and public recreation opportunities consistent with natural resources conservation.				
Objective 3.1: Educate visitors, local residents and users about the MLAP.				
3.1.1: Provide kiosks, signage, brochures or similar informational materials to inform the public and user groups about the value of the resources of MLAP and efforts to conserve and restore these resources.	Education & Outreach	2010-2011	Recurring	$800
3.1.2: Examine public use patterns and trends within MLAP to proactively identify potential resource/public use conflicts and, working with key stakeholders, develop conservation strategies to minimize damage to the natural resources.	Resource Management	2010-2011	Recurring	$2,500
Objective 3.2: Inform local residents and visitors about LAP and actions they can take to conserve and restore the resources found there.				
3.2.1: Compile and develop outreach materials for residents, visitors, ecotourism groups, fishing guides and boat charter services and other user groups.	Education & Outreach	2009-2010	Recurring	$800
3.2.2: Provide hands-on volunteer opportunities within the MLAP to promote stewardship of resources.	Education & Outreach	2009-2010	Recurring	$1,500
3.2.3: Support and assist the law enforcement community in natural resource conservation.	Resource Management	2009-2010	Recurring	$600
Issue 4: Environmenal Incident Assessment and Response				
Goal 4: Integrate MLAP into strategies to assess and respond to environmental incidents within MLAP.				
Objective 4.1: Identify existing assessment and response programs, gaps in these programs and strategies to address these gaps.				
4.1.1: Identify/inventory existing rapid assessment response programs for MLAP and identify classes of incidents not addressed by these programs.	Education & Outreach	2009-2010	Recurring	$250
4.1.2: Develop assessment and response strategies for categories of incidents not addressed by existing programs.	Resource Management	2009-2010	Recurring	$350

*D.2 / **Budget Table***

The following table provides a cost estimate for conducting the management activities identified in this plan. The data is organized by year and Management Program with subtotals for each program and year. The following represents the actual budgetary needs for managing the resources of the aquatic preserve. This budget was developed using data from the Office of Coastal and Aquatic Managed Areas (CAMA) and other cooperating entities, and is based on actual costs for management activities, equipment purchases and maintenance, and for development of fixed capital facilities. The budget below exceeds the funds CAMA has been receiving through the state appropriations process, but is consistent with the direction necessary to achieve the goals and objectives identified in the Goals, Objectives and Strategies Table in Appendix D.1. Budget categories identified correlate with the CAMA Management Program Areas.

Issue	Strategy	Project Initiation	Estimated Yearly Cost
2009-2010 Cost Estimate			
Ecosystem Science			
Natural Community Function	1.1.3: Analyze and assess assembled data into a report on baseline conditions for key natural communities and species and identify research and monitoring information gaps, prioritize threats and prioritize new monitoring initiatives.	2009-2010	$2,000
Water and Watershed	2.1.1: Compile existing water and sediment quality data, including meta data, and included these in the Volusia County Water Atlas .	2009-2010	$800
Water and Watershed	2.1.2: Analyze and assess compiled data to identify status, trends and information gaps.	2009-2010	$800
Water and Watershed	2.1.3: Use or build on existing monitoring efforts to address information gaps and to implement a long-term monitoring program to support status and trend assessment of water and sediment quality in MLAP.	2009-2010	$2,000
	Ecosystem Science Subtotal		**$5,600**

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Resource Management			
Natural Community Function	1.2.1: Support present conservation and restoration programs and projects within MLAP.	2009-2010	$600
Natural Community Function	1.2.2: Assess existing conservation and restoration strategies (including invasive species management) and develop new plans as required.	2009-2010	$600
Water and Watershed	2.2.1: Support projects to enhance stormwater and sewage treatment within MLAP's watershed.	2009-2010	$800
Water and Watershed	2.2.2: Support projects to restore stormwater pollution filtering capacity of the shoreline and watershed of MLAP.	2009-2010	$800
Water and Watershed	2.2.4: Provide review and comment on permit applications for activities on lands within or in the watershed of MLAP.	2009-2010	$500
Water and Watershed	2.2.5: Review and provide recommendations for local government comprehensive growth management plans and land development rules and ordnances to enhance abatement of nonpoint source pollutants and address potential impacts of climate change.	2009-2010	$250
Water and Watershed	2.2.6: Support land acquisition efforts in MLAP's watershed.	2009-2010	$250
Sustainable Public Use	3.2.3: Support and assist the law enforcement community in natural resource conservation.	2009-2010	$600
Environmental Incidents	4.1.2: Develop assessment and response strategies for categories of incidents not addressed by existing programs.	2009-2010	$350
	Resource Management Subtotal		**$4,750**
Education & Outreach			
Natural Community Function	1.1.1: Collect and compile existing and on-going research studies, reports and data on MLAP into the Volusia County Water Atlas.	2009-2010	$800
Natural Community Function	1.1.2: Co-host and/or sponsor the biennial Mosquito Lagoon Conference including publication of abstracts from this meeting	2009-2010	$500
Water and Watershed	2.2.3: Prioritize, develop and implement water quality improvement education programs within MLAP.	2009-2010	$800
Sustainable Public Use	3.2.1: Compile and develop outreach materials for residents, visitors, ecotourism groups, fishing guides and boat charter services and other user groups.	2009-2010	$800
Sustainable Public Use	3.2.2: Provide hands-on volunteer opportunities within the MLAP to promote stewardship of resources.	2009-2010	$1,500
Environmental Incidents	4.1.1: Identify/inventory existing rapid assessment response programs for MLAP and identify classes of incidents not addressed by these programs.	2009-2010	$250
	Education & Outreach Subtotal		**$4,650**
$15,000	**2009-2010 Total**		**$15,000**

2010-2011 Cost Estimate

Ecosystem Science			
Natural Community Function	1.1.3: Analyze and assess assembled data into a report on baseline conditions for key natural communities and species and identify research and monitoring information gaps, prioritize threats and prioritize new monitoring initiatives.	2009-2010	$2,000
Natural Community Function	1.1.4: Use and build on existing monitoring efforts to facilitate and support long-term monitoring efforts to track trends and locations of key natural communities and species in MLAP.	2010-2011	$2,000
Water and Watershed	2.1.1: Compile existing water and sediment quality data, including meta data, and included these in the Volusia County Water Atlas .	2009-2010	$800
Water and Watershed	2.1.2: Analyze and assess compiled data to identify status, trends and information gaps.	2009-2010	$800
Water and Watershed	2.1.3: Use or build on existing monitoring efforts to address information gaps and to implement a long-term monitoring program to support status and trend assessment of water and sediment quality in MLAP.	2009-2010	$2,000
	Ecosystem Science Subtotal		**$7,600**

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Resource Management			
Natural Community Function	1.2.1: Support present conservation and restoration programs and projects within MLAP.	2009-2010	$600
Natural Community Function	1.2.2: Assess existing conservation and restoration strategies (including invasive species management) and develop new plans as required.	2009-2010	$600
Water and Watershed	2.2.1: Support projects to enhance stormwater and sewage treatment within MLAP's watershed.	2009-2010	$800
Water and Watershed	2.2.2: Support projects to restore stormwater pollution filtering capacity of the shoreline and watershed of MLAP.	2009-2010	$800
Water and Watershed	2.2.4: Provide review and comment on permit applications for activities on lands within or in the watershed of MLAP.	2009-2010	$500
Water and Watershed	2.2.5: Review and provide recommendations for local government comprehensive growth management plans and land development rules and ordnances to enhance abatement of nonpoint source pollutants and address potential impacts of climate change.	2009-2010	$250
Water and Watershed	2.2.6: Support land acquisition efforts in MLAP's watershed.	2009-2010	$250
Sustainable Public Use	3.1.2: Examine public use patterns and trends within MLAP to proactively identify potential resource/public use conflicts and, working with key stakeholders, develop conservation strategies to minimize damage to the natural resources.	2010-2011	$2,500
Sustainable Public Use	3.2.3: Support and assist the law enforcement community in natural resource conservation.	2009-2010	$600
Environmental Incidents	4.1.2: Develop assessment and response strategies for categories of incidents not addressed by existing programs.	2009-2010	$350
	Resource Management Subtotal		**$7,250**
Education & Outreach			
Natural Community Function	1.1.1: Collect and compile existing and on-going research studies, reports and data on MLAP into the Volusia County Water Atlas.	2009-2010	$800
Natural Community Function	1.1.2: Co-host and/or sponsor the biennial Mosquito Lagoon Conference including publication of abstracts from this meeting	2009-2010	$500
Water and Watershed	2.2.3: Prioritize, develop and implement water quality improvement education programs within MLAP.	2009-2010	$800
Sustainable Public Use	3.1.1: Provide kiosks, signage, brochures or similar informational materials to inform the public and user groups about the value of the resources of MLAP and efforts to conserve and restore these resources.	2010-2011	$800
Sustainable Public Use	3.2.1: Compile and develop outreach materials for residents, visitors, ecotourism groups, fishing guides and boat charter services and other user groups.	2009-2010	$800
Sustainable Public Use	3.2.2: Provide hands-on volunteer opportunities within the MLAP to promote stewardship of resources.	2009-2010	$1,500
Environmental Incidents	4.1.1: Identify/inventory existing rapid assessment response programs for MLAP and identify classes of incidents not addressed by these programs.	2009-2010	$250
	Education & Outreach Subtotal		**$5,450**
$20,300	**2010-2011 Total**		**$20,300**

2011-2012 Cost Estimate

Ecosystem Science			
Natural Community Function	1.1.3: Analyze and assess assembled data into a report on baseline conditions for key natural communities and species and identify research and monitoring information gaps, prioritize threats and prioritize new monitoring initiatives.	2009-2010	$2,000
Natural Community Function	1.1.4: Use and build on existing monitoring efforts to facilitate and support long-term monitoring efforts to track trends and locations of key natural communities and species in MLAP.	2010-2011	$2,000
Water and Watershed	2.1.1: Compile existing water and sediment quality data, including meta data, and included these in the Volusia County Water Atlas .	2009-2010	$800
Water and Watershed	2.1.2: Analyze and assess compiled data to identify status, trends and information gaps.	2009-2010	$800
Water and Watershed	2.1.3: Use or build on existing monitoring efforts to address information gaps and to implement a long-term monitoring program to support status and trend assessment of water and sediment quality in MLAP.	2009-2010	$2,000
	Ecosystem Science Subtotal		**$7,600**

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Resource Management			
Natural Community Function	1.2.1: Support present conservation and restoration programs and projects within MLAP.	2009-2010	$600
Natural Community Function	1.2.2: Assess existing conservation and restoration strategies (including invasive species management) and develop new plans as required.	2009-2010	$600
Water and Watershed	2.2.1: Support projects to enhance stormwater and sewage treatment within MLAP's watershed.	2009-2010	$800
Water and Watershed	2.2.2: Support projects to restore stormwater pollution filtering capacity of the shoreline and watershed of MLAP.	2009-2010	$800
Water and Watershed	2.2.4: Provide review and comment on permit applications for activities on lands within or in the watershed of MLAP.	2009-2010	$500
Water and Watershed	2.2.5: Review and provide recommendations for local government comprehensive growth management plans and land development rules and ordnances to enhance abatement of nonpoint source pollutants and address potential impacts of climate change.	2009-2010	$250
Water and Watershed	2.2.6: Support land acquisition efforts in MLAP's watershed.	2009-2010	$250
Sustainable Public Use	3.1.2: Examine public use patterns and trends within MLAP to proactively identify potential resource/public use conflicts and, working with key stakeholders, develop conservation strategies to minimize damage to the natural resources.	2010-2011	$2,500
Sustainable Public Use	3.2.3: Support and assist the law enforcement community in natural resource conservation.	2009-2010	$600
Environmental Incidents	4.1.2: Develop assessment and response strategies for categories of incidents not addressed by existing programs.	2009-2010	$350
	Resource Management Subtotal		**$7,250**
Education & Outreach			
Natural Community Function	1.1.1: Collect and compile existing and on-going research studies, reports and data on MLAP into the Volusia County Water Atlas.	2009-2010	$800
Natural Community Function	1.1.2: Co-host and/or sponsor the biennial Mosquito Lagoon Conference including publication of abstracts from this meeting	2009-2010	$500
Water and Watershed	2.2.3: Prioritize, develop and implement water quality improvement education programs within MLAP.	2009-2010	$800
Sustainable Public Use	3.1.1: Provide kiosks, signage, brochures or similar informational materials to inform the public and user groups about the value of the resources of MLAP and efforts to conserve and restore these resources.	2010-2011	$800
Sustainable Public Use	3.2.1: Compile and develop outreach materials for residents, visitors, ecotourism groups, fishing guides and boat charter services and other user groups.	2009-2010	$800
Sustainable Public Use	3.2.2: Provide hands-on volunteer opportunities within the MLAP to promote stewardship of resources.	2009-2010	$1,500
Environmental Incidents	4.1.1: Identify/inventory existing rapid assessment response programs for MLAP and identify classes of incidents not addressed by these programs.	2009-2010	$250
	Education & Outreach Subtotal		**$5,450**
$20,300	**2011-2012 Total**		**$20,300**

2012-2013 Cost Estimate

Ecosystem Science			
Natural Community Function	1.1.3: Analyze and assess assembled data into a report on baseline conditions for key natural communities and species and identify research and monitoring information gaps, prioritize threats and prioritize new monitoring initiatives.	2009-2010	$2,000
Natural Community Function	1.1.4: Use and build on existing monitoring efforts to facilitate and support long-term monitoring efforts to track trends and locations of key natural communities and species in MLAP.	2010-2011	$2,000
Water and Watershed	2.1.1: Compile existing water and sediment quality data, including meta data, and included these in the Volusia County Water Atlas .	2009-2010	$800
Water and Watershed	2.1.2: Analyze and assess compiled data to identify status, trends and information gaps.	2009-2010	$800
Water and Watershed	2.1.3: Use or build on existing monitoring efforts to address information gaps and to implement a long-term monitoring program to support status and trend assessment of water and sediment quality in MLAP.	2009-2010	$2,000
	Ecosystem Science Subtotal		**$7,600**

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Resource Management			
Natural Community Function	1.2.1: Support present conservation and restoration programs and projects within MLAP.	2009-2010	$600
Natural Community Function	1.2.2: Assess existing conservation and restoration strategies (including invasive species management) and develop new plans as required.	2009-2010	$600
Water and Watershed	2.2.1: Support projects to enhance stormwater and sewage treatment within MLAP's watershed.	2009-2010	$800
Water and Watershed	2.2.2: Support projects to restore stormwater pollution filtering capacity of the shoreline and watershed of MLAP.	2009-2010	$800
Water and Watershed	2.2.4: Provide review and comment on permit applications for activities on lands within or in the watershed of MLAP.	2009-2010	$500
Water and Watershed	2.2.5: Review and provide recommendations for local government comprehensive growth management plans and land development rules and ordnances to enhance abatement of nonpoint source pollutants and address potential impacts of climate change.	2009-2010	$250
Water and Watershed	2.2.6: Support land acquisition efforts in MLAP's watershed.	2009-2010	$250
Sustainable Public Use	3.1.2: Examine public use patterns and trends within MLAP to proactively identify potential resource/public use conflicts and, working with key stakeholders, develop conservation strategies to minimize damage to the natural resources.	2010-2011	$2,500
Sustainable Public Use	3.2.3: Support and assist the law enforcement community in natural resource conservation.	2009-2010	$600
Environmental Incidents	4.1.2: Develop assessment and response strategies for categories of incidents not addressed by existing programs.	2009-2010	$350
	Resource Management Subtotal		**$7,250**
Education & Outreach			
Natural Community Function	1.1.1: Collect and compile existing and on-going research studies, reports and data on MLAP into the Volusia County Water Atlas.	2009-2010	$800
Natural Community Function	1.1.2: Co-host and/or sponsor the biennial Mosquito Lagoon Conference including publication of abstracts from this meeting	2009-2010	$500
Water and Watershed	2.2.3: Prioritize, develop and implement water quality improvement education programs within MLAP.	2009-2010	$800
Sustainable Public Use	3.1.1: Provide kiosks, signage, brochures or similar informational materials to inform the public and user groups about the value of the resources of MLAP and efforts to conserve and restore these resources.	2010-2011	$800
Sustainable Public Use	3.2.1: Compile and develop outreach materials for residents, visitors, ecotourism groups, fishing guides and boat charter services and other user groups.	2009-2010	$800
Sustainable Public Use	3.2.2: Provide hands-on volunteer opportunities within the MLAP to promote stewardship of resources.	2009-2010	$1,500
Environmental Incidents	4.1.1: Identify/inventory existing rapid assessment response programs for MLAP and identify classes of incidents not addressed by these programs.	2009-2010	$250
	Education & Outreach Subtotal		**$5,450**
$20,300	**2012-2013 Total**		**$20,300**

2013-2014 Cost Estimate

Ecosystem Science			
Natural Community Function	1.1.3: Analyze and assess assembled data into a report on baseline conditions for key natural communities and species and identify research and monitoring information gaps, prioritize threats and prioritize new monitoring initiatives.	2009-2010	$2,000
Natural Community Function	1.1.4: Use and build on existing monitoring efforts to facilitate and support long-term monitoring efforts to track trends and locations of key natural communities and species in MLAP.	2010-2011	$2,000
Water and Watershed	2.1.1: Compile existing water and sediment quality data, including meta data, and included these in the Volusia County Water Atlas .	2009-2010	$800
Water and Watershed	2.1.2: Analyze and assess compiled data to identify status, trends and information gaps.	2009-2010	$800
Water and Watershed	2.1.3: Use or build on existing monitoring efforts to address information gaps and to implement a long-term monitoring program to support status and trend assessment of water and sediment quality in MLAP.	2009-2010	$2,000
	Ecosystem Science Subtotal		**$7,600**

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Resource Management			
Natural Community Function	1.2.1: Support present conservation and restoration programs and projects within MLAP.	2009-2010	$600
Natural Community Function	1.2.2: Assess existing conservation and restoration strategies (including invasive species management) and develop new plans as required.	2009-2010	$600
Water and Watershed	2.2.1: Support projects to enhance stormwater and sewage treatment within MLAP's watershed.	2009-2010	$800
Water and Watershed	2.2.2: Support projects to restore stormwater pollution filtering capacity of the shoreline and watershed of MLAP.	2009-2010	$800
Water and Watershed	2.2.4: Provide review and comment on permit applications for activities on lands within or in the watershed of MLAP.	2009-2010	$500
Water and Watershed	2.2.5: Review and provide recommendations for local government comprehensive growth management plans and land development rules and ordnances to enhance abatement of nonpoint source pollutants and address potential impacts of climate change.	2009-2010	$250
Water and Watershed	2.2.6: Support land acquisition efforts in MLAP's watershed.	2009-2010	$250
Sustainable Public Use	3.1.2: Examine public use patterns and trends within MLAP to proactively identify potential resource/public use conflicts and, working with key stakeholders, develop conservation strategies to minimize damage to the natural resources.	2010-2011	$2,500
Sustainable Public Use	3.2.3: Support and assist the law enforcement community in natural resource conservation.	2009-2010	$600
Environmental Incidents	4.1.2: Develop assessment and response strategies for categories of incidents not addressed by existing programs.	2009-2010	$350
	Resource Management Subtotal		**$7,250**
Education & Outreach			
Natural Community Function	1.1.1: Collect and compile existing and on-going research studies, reports and data on MLAP into the Volusia County Water Atlas.	2009-2010	$800
Natural Community Function	1.1.2: Co-host and/or sponsor the biennial Mosquito Lagoon Conference including publication of abstracts from this meeting	2009-2010	$500
Water and Watershed	2.2.3: Prioritize, develop and implement water quality improvement education programs within MLAP.	2009-2010	$800
Sustainable Public Use	3.1.1: Provide kiosks, signage, brochures or similar informational materials to inform the public and user groups about the value of the resources of MLAP and efforts to conserve and restore these resources.	2010-2011	$800
Sustainable Public Use	3.2.1: Compile and develop outreach materials for residents, visitors, ecotourism groups, fishing guides and boat charter services and other user groups.	2009-2010	$800
Sustainable Public Use	3.2.2: Provide hands-on volunteer opportunities within the MLAP to promote stewardship of resources.	2009-2010	$1,500
Environmental Incidents	4.1.1: Identify/inventory existing rapid assessment response programs for MLAP and identify classes of incidents not addressed by these programs.	2009-2010	$250
	Education & Outreach Subtotal		**$5,450**
$20,300	**2013-2014 Total**		**$20,300**

2014-2015 Cost Estimate

Ecosystem Science			
Natural Community Function	1.1.3: Analyze and assess assembled data into a report on baseline conditions for key natural communities and species and identify research and monitoring information gaps, prioritize threats and prioritize new monitoring initiatives.	2009-2010	$2,000
Natural Community Function	1.1.4: Use and build on existing monitoring efforts to facilitate and support long-term monitoring efforts to track trends and locations of key natural communities and species in MLAP.	2010-2011	$2,000
Water and Watershed	2.1.1: Compile existing water and sediment quality data, including meta data, and included these in the Volusia County Water Atlas .	2009-2010	$800
Water and Watershed	2.1.2: Analyze and assess compiled data to identify status, trends and information gaps.	2009-2010	$800
Water and Watershed	2.1.3: Use or build on existing monitoring efforts to address information gaps and to implement a long-term monitoring program to support status and trend assessment of water and sediment quality in MLAP.	2009-2010	$2,000
	Ecosystem Science Subtotal		**$7,600**

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Resource Management			
Natural Community Function	1.2.1: Support present conservation and restoration programs and projects within MLAP.	2009-2010	$600
Natural Community Function	1.2.2: Assess existing conservation and restoration strategies (including invasive species management) and develop new plans as required.	2009-2010	$600
Water and Watershed	2.2.1: Support projects to enhance stormwater and sewage treatment within MLAP's watershed.	2009-2010	$800
Water and Watershed	2.2.2: Support projects to restore stormwater pollution filtering capacity of the shoreline and watershed of MLAP.	2009-2010	$800
Water and Watershed	2.2.4: Provide review and comment on permit applications for activities on lands within or in the watershed of MLAP.	2009-2010	$500
Water and Watershed	2.2.5: Review and provide recommendations for local government comprehensive growth management plans and land development rules and ordnances to enhance abatement of nonpoint source pollutants and address potential impacts of climate change.	2009-2010	$250
Water and Watershed	2.2.6: Support land acquisition efforts in MLAP's watershed.	2009-2010	$250
Sustainable Public Use	3.1.2: Examine public use patterns and trends within MLAP to proactively identify potential resource/public use conflicts and, working with key stakeholders, develop conservation strategies to minimize damage to the natural resources.	2010-2011	$2,500
Sustainable Public Use	3.2.3: Support and assist the law enforcement community in natural resource conservation.	2009-2010	$600
Environmental Incidents	4.1.2: Develop assessment and response strategies for categories of incidents not addressed by existing programs.	2009-2010	$350
	Resource Management Subtotal		**$7,250**
Education & Outreach			
Natural Community Function	1.1.1: Collect and compile existing and on-going research studies, reports and data on MLAP into the Volusia County Water Atlas.	2009-2010	$800
Natural Community Function	1.1.2: Co-host and/or sponsor the biennial Mosquito Lagoon Conference including publication of abstracts from this meeting	2009-2010	$500
Water and Watershed	2.2.3: Prioritize, develop and implement water quality improvement education programs within MLAP.	2009-2010	$800
Sustainable Public Use	3.1.1: Provide kiosks, signage, brochures or similar informational materials to inform the public and user groups about the value of the resources of MLAP and efforts to conserve and restore these resources.	2010-2011	$800
Sustainable Public Use	3.2.1: Compile and develop outreach materials for residents, visitors, ecotourism groups, fishing guides and boat charter services and other user groups.	2009-2010	$800
Sustainable Public Use	3.2.2: Provide hands-on volunteer opportunities within the MLAP to promote stewardship of resources.	2009-2010	$1,500
Environmental Incidents	4.1.1: Identify/inventory existing rapid assessment response programs for MLAP and identify classes of incidents not addressed by these programs.	2009-2010	$250
	Education & Outreach Subtotal		**$5,450**
$20,300	**2014-2015 Total**		**$20,300**

2015-2016 Cost Estimate

Ecosystem Science			
Natural Community Function	1.1.3: Analyze and assess assembled data into a report on baseline conditions for key natural communities and species and identify research and monitoring information gaps, prioritize threats and prioritize new monitoring initiatives.	2009-2010	$2,000
Natural Community Function	1.1.4: Use and build on existing monitoring efforts to facilitate and support long-term monitoring efforts to track trends and locations of key natural communities and species in MLAP.	2010-2011	$2,000
Water and Watershed	2.1.1: Compile existing water and sediment quality data, including meta data, and included these in the Volusia County Water Atlas .	2009-2010	$800
Water and Watershed	2.1.2: Analyze and assess compiled data to identify status, trends and information gaps.	2009-2010	$800
Water and Watershed	2.1.3: Use or build on existing monitoring efforts to address information gaps and to implement a long-term monitoring program to support status and trend assessment of water and sediment quality in MLAP.	2009-2010	$2,000
	Ecosystem Science Subtotal		**$7,600**

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Resource Management			
Natural Community Function	1.2.1: Support present conservation and restoration programs and projects within MLAP.	2009-2010	$600
Natural Community Function	1.2.2: Assess existing conservation and restoration strategies (including invasive species management) and develop new plans as required.	2009-2010	$600
Water and Watershed	2.2.1: Support projects to enhance stormwater and sewage treatment within MLAP's watershed.	2009-2010	$800
Water and Watershed	2.2.2: Support projects to restore stormwater pollution filtering capacity of the shoreline and watershed of MLAP.	2009-2010	$800
Water and Watershed	2.2.4: Provide review and comment on permit applications for activities on lands within or in the watershed of MLAP.	2009-2010	$500
Water and Watershed	2.2.5: Review and provide recommendations for local government comprehensive growth management plans and land development rules and ordnances to enhance abatement of nonpoint source pollutants and address potential impacts of climate change.	2009-2010	$250
Water and Watershed	2.2.6: Support land acquisition efforts in MLAP's watershed.	2009-2010	$250
Sustainable Public Use	3.1.2: Examine public use patterns and trends within MLAP to proactively identify potential resource/public use conflicts and, working with key stakeholders, develop conservation strategies to minimize damage to the natural resources.	2010-2011	$2,500
Sustainable Public Use	3.2.3: Support and assist the law enforcement community in natural resource conservation.	2009-2010	$600
Environmental Incidents	4.1.2: Develop assessment and response strategies for categories of incidents not addressed by existing programs.	2009-2010	$350
	Resource Management Subtotal		**$7,250**
Education & Outreach			
Natural Community Function	1.1.1: Collect and compile existing and on-going research studies, reports and data on MLAP into the Volusia County Water Atlas.	2009-2010	$800
Natural Community Function	1.1.2: Co-host and/or sponsor the biennial Mosquito Lagoon Conference including publication of abstracts from this meeting	2009-2010	$500
Water and Watershed	2.2.3: Prioritize, develop and implement water quality improvement education programs within MLAP.	2009-2010	$800
Sustainable Public Use	3.1.1: Provide kiosks, signage, brochures or similar informational materials to inform the public and user groups about the value of the resources of MLAP and efforts to conserve and restore these resources.	2010-2011	$800
Sustainable Public Use	3.2.1: Compile and develop outreach materials for residents, visitors, ecotourism groups, fishing guides and boat charter services and other user groups.	2009-2010	$800
Sustainable Public Use	3.2.2: Provide hands-on volunteer opportunities within the MLAP to promote stewardship of resources.	2009-2010	$1,500
Environmental Incidents	4.1.1: Identify/inventory existing rapid assessment response programs for MLAP and identify classes of incidents not addressed by these programs.	2009-2010	$250
	Education & Outreach Subtotal		**$5,450**
$20,300	**2015-2016 Total**		**$20,300**

2016-2017 Cost Estimate

Ecosystem Science			
Natural Community Function	1.1.3: Analyze and assess assembled data into a report on baseline conditions for key natural communities and species and identify research and monitoring information gaps, prioritize threats and prioritize new monitoring initiatives.	2009-2010	$2,000
Natural Community Function	1.1.4: Use and build on existing monitoring efforts to facilitate and support long-term monitoring efforts to track trends and locations of key natural communities and species in MLAP.	2010-2011	$2,000
Water and Watershed	2.1.1: Compile existing water and sediment quality data, including meta data, and included these in the Volusia County Water Atlas .	2009-2010	$800
Water and Watershed	2.1.2: Analyze and assess compiled data to identify status, trends and information gaps.	2009-2010	$800
Water and Watershed	2.1.3: Use or build on existing monitoring efforts to address information gaps and to implement a long-term monitoring program to support status and trend assessment of water and sediment quality in MLAP.	2009-2010	$2,000
	Ecosystem Science Subtotal		**$7,600**

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Resource Management			
Natural Community Function	1.2.1: Support present conservation and restoration programs and projects within MLAP.	2009-2010	$600
Natural Community Function	1.2.2: Assess existing conservation and restoration strategies (including invasive species management) and develop new plans as required.	2009-2010	$600
Water and Watershed	2.2.1: Support projects to enhance stormwater and sewage treatment within MLAP's watershed.	2009-2010	$800
Water and Watershed	2.2.2: Support projects to restore stormwater pollution filtering capacity of the shoreline and watershed of MLAP.	2009-2010	$800
Water and Watershed	2.2.4: Provide review and comment on permit applications for activities on lands within or in the watershed of MLAP.	2009-2010	$500
Water and Watershed	2.2.5: Review and provide recommendations for local government comprehensive growth management plans and land development rules and ordnances to enhance abatement of nonpoint source pollutants and address potential impacts of climate change.	2009-2010	$250
Water and Watershed	2.2.6: Support land acquisition efforts in MLAP's watershed.	2009-2010	$250
Sustainable Public Use	3.1.2: Examine public use patterns and trends within MLAP to proactively identify potential resource/public use conflicts and, working with key stakeholders, develop conservation strategies to minimize damage to the natural resources.	2010-2011	$2,500
Sustainable Public Use	3.2.3: Support and assist the law enforcement community in natural resource conservation.	2009-2010	$600
Environmental Incidents	4.1.2: Develop assessment and response strategies for categories of incidents not addressed by existing programs.	2009-2010	$350
	Resource Management Subtotal		**$7,250**
Education & Outreach			
Natural Community Function	1.1.1: Collect and compile existing and on-going research studies, reports and data on MLAP into the Volusia County Water Atlas.	2009-2010	$800
Natural Community Function	1.1.2: Co-host and/or sponsor the biennial Mosquito Lagoon Conference including publication of abstracts from this meeting	2009-2010	$500
Water and Watershed	2.2.3: Prioritize, develop and implement water quality improvement education programs within MLAP.	2009-2010	$800
Sustainable Public Use	3.1.1: Provide kiosks, signage, brochures or similar informational materials to inform the public and user groups about the value of the resources of MLAP and efforts to conserve and restore these resources.	2010-2011	$800
Sustainable Public Use	3.2.1: Compile and develop outreach materials for residents, visitors, ecotourism groups, fishing guides and boat charter services and other user groups.	2009-2010	$800
Sustainable Public Use	3.2.2: Provide hands-on volunteer opportunities within the MLAP to promote stewardship of resources.	2009-2010	$1,500
Environmental Incidents	4.1.1: Identify/inventory existing rapid assessment response programs for MLAP and identify classes of incidents not addressed by these programs.	2009-2010	$250
	Education & Outreach Subtotal		**$5,450**
$20,300	**2016-2017 Total**		**$20,300**

2017-2018 Cost Estimate

Ecosystem Science			
Natural Community Function	1.1.3: Analyze and assess assembled data into a report on baseline conditions for key natural communities and species and identify research and monitoring information gaps, prioritize threats and prioritize new monitoring initiatives.	2009-2010	$2,000
Natural Community Function	1.1.4: Use and build on existing monitoring efforts to facilitate and support long-term monitoring efforts to track trends and locations of key natural communities and species in MLAP.	2010-2011	$2,000
Water and Watershed	2.1.1: Compile existing water and sediment quality data, including meta data, and included these in the Volusia County Water Atlas .	2009-2010	$800
Water and Watershed	2.1.2: Analyze and assess compiled data to identify status, trends and information gaps.	2009-2010	$800
Water and Watershed	2.1.3: Use or build on existing monitoring efforts to address information gaps and to implement a long-term monitoring program to support status and trend assessment of water and sediment quality in MLAP.	2009-2010	$2,000
	Ecosystem Science Subtotal		**$7,600**

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Resource Management			
Natural Community Function	1.2.1: Support present conservation and restoration programs and projects within MLAP.	2009-2010	$600
Natural Community Function	1.2.2: Assess existing conservation and restoration strategies (including invasive species management) and develop new plans as required.	2009-2010	$600
Water and Watershed	2.2.1: Support projects to enhance stormwater and sewage treatment within MLAP's watershed.	2009-2010	$800
Water and Watershed	2.2.2: Support projects to restore stormwater pollution filtering capacity of the shoreline and watershed of MLAP.	2009-2010	$800
Water and Watershed	2.2.4: Provide review and comment on permit applications for activities on lands within or in the watershed of MLAP.	2009-2010	$500
Water and Watershed	2.2.5: Review and provide recommendations for local government comprehensive growth management plans and land development rules and ordnances to enhance abatement of nonpoint source pollutants and address potential impacts of climate change.	2009-2010	$250
Water and Watershed	2.2.6: Support land acquisition efforts in MLAP's watershed.	2009-2010	$250
Sustainable Public Use	3.1.2: Examine public use patterns and trends within MLAP to proactively identify potential resource/public use conflicts and, working with key stakeholders, develop conservation strategies to minimize damage to the natural resources.	2010-2011	$2,500
Sustainable Public Use	3.2.3: Support and assist the law enforcement community in natural resource conservation.	2009-2010	$600
Environmental Incidents	4.1.2: Develop assessment and response strategies for categories of incidents not addressed by existing programs.	2009-2010	$350
	Resource Management Subtotal		**$7,250**
Education & Outreach			
Natural Community Function	1.1.1: Collect and compile existing and on-going research studies, reports and data on MLAP into the Volusia County Water Atlas.	2009-2010	$800
Natural Community Function	1.1.2: Co-host and/or sponsor the biennial Mosquito Lagoon Conference including publication of abstracts from this meeting	2009-2010	$500
Water and Watershed	2.2.3: Prioritize, develop and implement water quality improvement education programs within MLAP.	2009-2010	$800
Sustainable Public Use	3.1.1: Provide kiosks, signage, brochures or similar informational materials to inform the public and user groups about the value of the resources of MLAP and efforts to conserve and restore these resources.	2010-2011	$800
Sustainable Public Use	3.2.1: Compile and develop outreach materials for residents, visitors, ecotourism groups, fishing guides and boat charter services and other user groups.	2009-2010	$800
Sustainable Public Use	3.2.2: Provide hands-on volunteer opportunities within the MLAP to promote stewardship of resources.	2009-2010	$1,500
Environmental Incidents	4.1.1: Identify/inventory existing rapid assessment response programs for MLAP and identify classes of incidents not addressed by these programs.	2009-2010	$250
	Education & Outreach Subtotal		**$5,450**
$20,300	**2017-2018 Total**		**$20,300**

2018-2019 Cost Estimate

Ecosystem Science			
Natural Community Function	1.1.3: Analyze and assess assembled data into a report on baseline conditions for key natural communities and species and identify research and monitoring information gaps, prioritize threats and prioritize new monitoring initiatives.	2009-2010	$2,000
Natural Community Function	1.1.4: Use and build on existing monitoring efforts to facilitate and support long-term monitoring efforts to track trends and locations of key natural communities and species in MLAP.	2010-2011	$2,000
Water and Watershed	2.1.1: Compile existing water and sediment quality data, including meta data, and included these in the Volusia County Water Atlas .	2009-2010	$800
Water and Watershed	2.1.2: Analyze and assess compiled data to identify status, trends and information gaps.	2009-2010	$800
Water and Watershed	2.1.3: Use or build on existing monitoring efforts to address information gaps and to implement a long-term monitoring program to support status and trend assessment of water and sediment quality in MLAP.	2009-2010	$2,000
	Ecosystem Science Subtotal		**$7,600**

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Resource Management			
Natural Community Function	1.2.1: Support present conservation and restoration programs and projects within MLAP.	2009-2010	$600
Natural Community Function	1.2.2: Assess existing conservation and restoration strategies (including invasive species management) and develop new plans as required.	2009-2010	$600
Water and Watershed	2.2.1: Support projects to enhance stormwater and sewage treatment within MLAP's watershed.	2009-2010	$800
Water and Watershed	2.2.2: Support projects to restore stormwater pollution filtering capacity of the shoreline and watershed of MLAP.	2009-2010	$800
Water and Watershed	2.2.4: Provide review and comment on permit applications for activities on lands within or in the watershed of MLAP.	2009-2010	$500
Water and Watershed	2.2.5: Review and provide recommendations for local government comprehensive growth management plans and land development rules and ordnances to enhance abatement of nonpoint source pollutants and address potential impacts of climate change.	2009-2010	$250
Water and Watershed	2.2.6: Support land acquisition efforts in MLAP's watershed.	2009-2010	$250
Sustainable Public Use	3.1.2: Examine public use patterns and trends within MLAP to proactively identify potential resource/public use conflicts and, working with key stakeholders, develop conservation strategies to minimize damage to the natural resources.	2010-2011	$2,500
Sustainable Public Use	3.2.3: Support and assist the law enforcement community in natural resource conservation.	2009-2010	$600
Environmental Incidents	4.1.2: Develop assessment and response strategies for categories of incidents not addressed by existing programs.	2009-2010	$350
	Resource Management Subtotal		**$7,250**
Education & Outreach			
Natural Community Function	1.1.1: Collect and compile existing and on-going research studies, reports and data on MLAP into the Volusia County Water Atlas.	2009-2010	$800
Natural Community Function	1.1.2: Co-host and/or sponsor the biennial Mosquito Lagoon Conference including publication of abstracts from this meeting	2009-2010	$500
Water and Watershed	2.2.3: Prioritize, develop and implement water quality improvement education programs within MLAP.	2009-2010	$800
Sustainable Public Use	3.1.1: Provide kiosks, signage, brochures or similar informational materials to inform the public and user groups about the value of the resources of MLAP and efforts to conserve and restore these resources.	2010-2011	$800
Sustainable Public Use	3.2.1: Compile and develop outreach materials for residents, visitors, ecotourism groups, fishing guides and boat charter services and other user groups.	2009-2010	$800
Sustainable Public Use	3.2.2: Provide hands-on volunteer opportunities within the MLAP to promote stewardship of resources.	2009-2010	$1,500
Environmental Incidents	4.1.1: Identify/inventory existing rapid assessment response programs for MLAP and identify classes of incidents not addressed by these programs.	2009-2010	$250
	Education & Outreach Subtotal		**$5,450**
$20,300	**2018-2019 Total**		**$20,300**

*D.3 / **Budget Summary Table***

The following table provides a summary of cost estimates for conducting the management activities identified in this plan.

2009-2010 Cost Estimate	
Ecosystem Science Subtotal	$5,600
Resource Management Subtotal	$4,750
Education & Outreach Subtotal	$4,650
2009-2010 Total	**$15,000**

2010-2011 Cost Estimate	
Ecosystem Science Subtotal	$7,600
Resource Management Subtotal	$7,250
Education & Outreach Subtotal	$5,450
2010-2011 Total	**$20,300**

2011-2012 Cost Estimate	
Ecosystem Science Subtotal	$7,600
Resource Management Subtotal	$7,250
Education & Outreach Subtotal	$5,450
2011-2012 Total	**$20,300**

2012-2013 Cost Estimate	
Ecosystem Science Subtotal	$7,600
Resource Management Subtotal	$7,250
Education & Outreach Subtotal	$5,450
2012-2013 Total	**$20,300**

2013-20141 Cost Estimate	
Ecosystem Science Subtotal	$7,600
Resource Management Subtotal	$7,250
Education & Outreach Subtotal	$5,450
2013-2014 Total	**$20,300**

2014-2015 Cost Estimate	
Ecosystem Science Subtotal	$7,600
Resource Management Subtotal	$7,250
Education & Outreach Subtotal	$5,450
2014-2015 Total	**$20,300**

2015-2016 Cost Estimate	
Ecosystem Science Subtotal	$7,600
Resource Management Subtotal	$7,250
Education & Outreach Subtotal	$5,450
2015-2016 Total	**$20,300**

2016-2017 Cost Estimate	
Ecosystem Science Subtotal	$7,600
Resource Management Subtotal	$7,250
Education & Outreach Subtotal	$5,450
2016-2017 Total	**$20,300**

2017-2018 Cost Estimate	
Ecosystem Science Subtotal	$7,600
Resource Management Subtotal	$7,250
Education & Outreach Subtotal	$5,450
2017-2018 Total	**$20,300**

2018-2019 Cost Estimate	
Ecosystem Science Subtotal	$7,600
Resource Management Subtotal	$7,250
Education & Outreach Subtotal	$5,450
20186-2019 Total	**$20,300**

Mosquito Lagoon Aquatic Preserve
Management Plan • August 2009 - July 2019

Mosquito Lagoon Aquatic Preserve
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(321) 634-6148

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Coastal and Aquatic Managed Areas
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