Biscayne Bay Aquatic Preserves

Management Plan

Biscayne Bay Aquatic Preserves
1277 NE 79th Street Causeway • Miami, FL 33138
305.795.3486 • www.dep.state.fl.us/coastal/sites/biscayne/

Florida Department of Environmental Protection
Coastal and Aquatic Managed Areas
3900 Commonwealth Blvd., MS #235, Tallahassee, FL 32399
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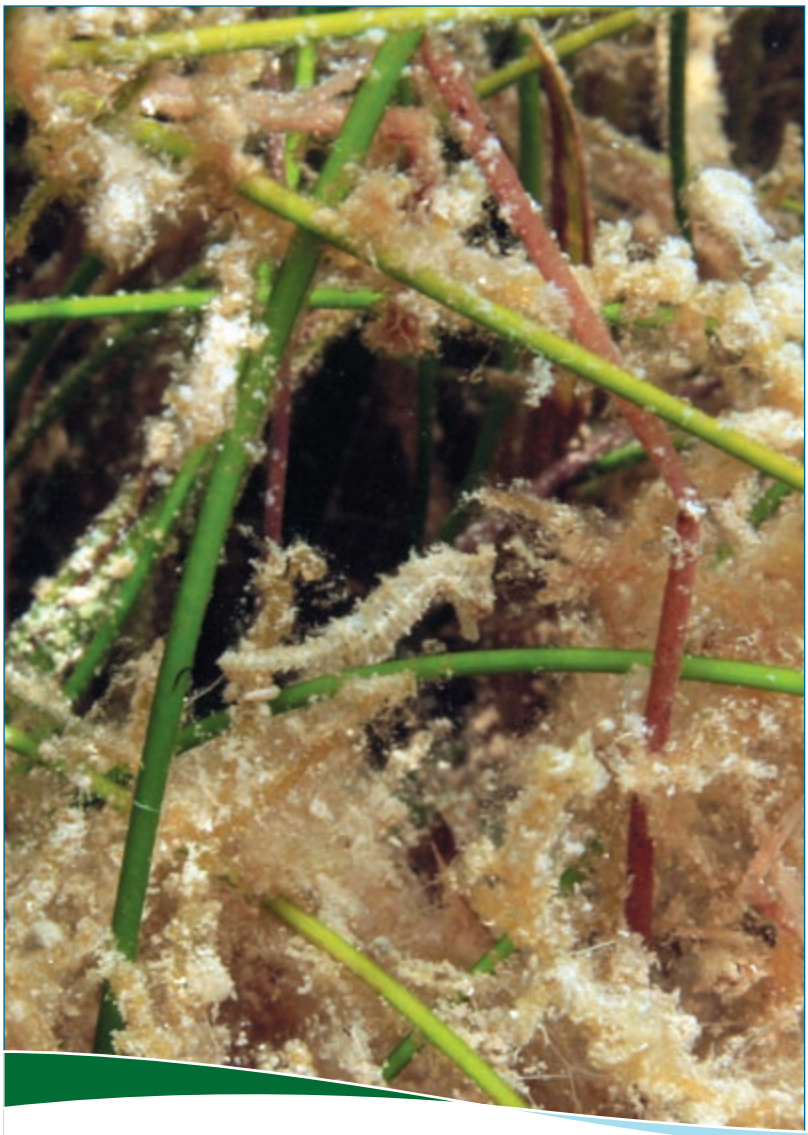

This publication funded in part through a grant agreement from the Florida Department of Environmental Protection, Florida Coastal Management Program by a grant provided by the Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act of 1972, as amended, National Oceanic and Atmospheric Administration Award No. NA07NOS4190071-CZ823 NA11NOS4190077-CM227. 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, National Oceanic and Atmospheric Administration, or any of its sub-agencies.

February 2013

This tiny dwarf seahorse, no bigger than the size of the tip of a finger, is seen here effectively blending into his environment, along a bed of Laurencia sp., a macroalgae, and holding onto a blade of manatee grass.

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Includes:

- Biscayne Bay Aquatic Preserve
- Biscayne Bay - Cape Florida to Monroe County Line Aquatic Preserve

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The backdrop of the pristine and protected Bill Sadowski Critical Wildlife Area is the downtown Miami skyline.

Mission Statement

Office of Coastal and Aquatic Managed Areas / The mission of the Office of Coastal and Aquatic Managed Areas in relation to Florida's 41 aquatic preserves, 3 National Estuarine Research Reserves, National Marine Sanctuary and Coral Reef Conservation Program is to protect Florida's coastal and aquatic resources.

The four long-term goals of the Office of Coastal and Aquatic Managed Areas' Aquatic Preserve Program are to:

1. protect and enhance the ecological integrity of the aquatic preserves;
2. restore areas to their natural condition;
3. encourage sustainable use and foster active stewardship by engaging local communities in the protection of aquatic preserves; and
4. improve management effectiveness through a process based on sound science, consistent evaluation, and continual reassessment.

Cover photogrpah: The Next Generation
Thank you to members of the public, agency partners, stakeholders, preserve interns and volunteers and DEP support staff for your time and dedication to protecting and preserving Biscayne Bay for future generations. This photo taken by volunteer, Miguel Hernandez, captures the essence of what we are trying to do, promote the beauty and wilderness of Biscayne Bay, a fragile yet resilient ecosystem, and preserve it for future generations of human and non-human inhabitants alike.

Executive Summary

Biscayne Bay Aquatic Preserves Management Plan	
Lead Agency:	Florida Department of Environmental Protection's (DEP) Office of Coastal and Aquatic Managed Areas (CAMA)
Common Name of Property:	Biscayne Bay Aquatic Preserves (BBAP)
Location:	Miami-Dade and Monroe counties, Florida
Acreage Total:	67,000 acres
Acreage Breakdown for CAMA Management Units According to Florida Natural Areas Inventory (FNAI) Natural Community Types	
FNAI Natural Communities	*Total Acreage according to GIS*
Beach Dune:	5.5
Coastal Berm:	0.8
Seagrass Bed:	48,255.21
Tidal Marsh:	31.17
Tidal Swamp:	903.77
Total Acreage:	49,196.45
Total acreage of above habitats only accounts for what FNAI has documented within BBAP and does not provide habitat information for all of the area comprised within the BBAP boundaries.	
Management Agency:	DEP's CAMA
Unique Features:	Biscayne Bay's cultural heritage owes its richness to the remnants and reminders of the Tequestas with rock middens and the as yet not fully understood "Miami Circle" bordering the bay. Early settlers along the bay noted the mystery of the natural limestone bridge in today's North Miami known as "Arch Creek." Virginia Key is one of the southeast coast's few remaining natural barrier islands and to the south, BBAP encompasses an offshore parcel of land in the open Atlantic. The southernmost extent of the worldwide distribution of Johnson's seagrass lies with BBAP's boundaries. BBAP borders the most populous county in the state of Florida and its natural resources have rebounded tremendously in areas that have been protected after decades of habitat loss and destruction. Biscayne Bay is an international sailing destination that is protected in its entirety by either a national park or state preserve and is part of the Kissimmee-Okeechobee-Everglades ecosystem, historically receiving freshwater from the Everglades.
Archaeological/Historical Sites:	Biscayne Bay's coastline was used by the native Tequesta Indians as well as the extant Seminole and Miccosukee tribes. Along Biscayne Bay's coastline there are overtures to the Tequesta including the Miami Circle, a 2,000 year old site that has been preserved at the immediate edge where the Miami River meets Biscayne Bay. The shoreline of Biscayne Bay is home to numerous sites recognized by the National Register of Historic Places.
Management Needs	
Ecosystem Science:	The existing water quality and benthic monitoring networks need to expand and add sites within BBAP's boundaries to better understand sources of changes in the system such as vegetative composition and algal blooms. Aerial photography needs to be more frequent and more accessible to staff and of a resolution that would allow layers to be digitized and used in GIS mapping efforts.
Resource Management:	Sewage mains need to be replaces and stormwater issues need to be addressed in a more comprehensive way to reduce nutrient loading into an oligotrophic system like BBAP. The proposed Reserved Allocation Area protection needs to be implemented to prevent consumptive use withdrawals that are inconsistent with restoration or would further impact Biscayne Bay. Unmanaged mooring areas should be evaluated against those that are managed to see if an effort should be made to bring unofficial, unmanaged areas under a less environmentally impactful arrangement.

Biscayne Bay Aquatic Preserves Management Plan (cont'd)	
Education and Outreach:	BBAP needs to have a greater presence in Miami-Dade County so that citizens are just as cognizant of the fact that there is an aquatic preserve in Biscayne Bay as they are that there is a national park.
Public Use:	Low-impact recreational opportunities need to be encouraged and greater access and awareness to the bay by these groups should be supported. Businesses and rental concessionaires that offer power boat experiences should be encouraged to have their patrons understand the rules and ecological value of Biscayne Bay before taking to the waterway.
Public Involvement:	One local public meeting, one Acquisition and Restoration Council public meeting and two advisory committee meetings were held to aid in the development, review and revision of the BBAP management plan.

CAMA/BTIITF Approval

CAMA approval date: March 20, 2012 **BTIITF approval date:**

ARC approval date: June 15, 2012

Comments:

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Red, white and black mangroves along Biscayne Bay help to stabilize sediments and protect the shoreline, cycle nutrients in the system, and provide shelter and a place to feed for resident and migratory wading birds.

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.

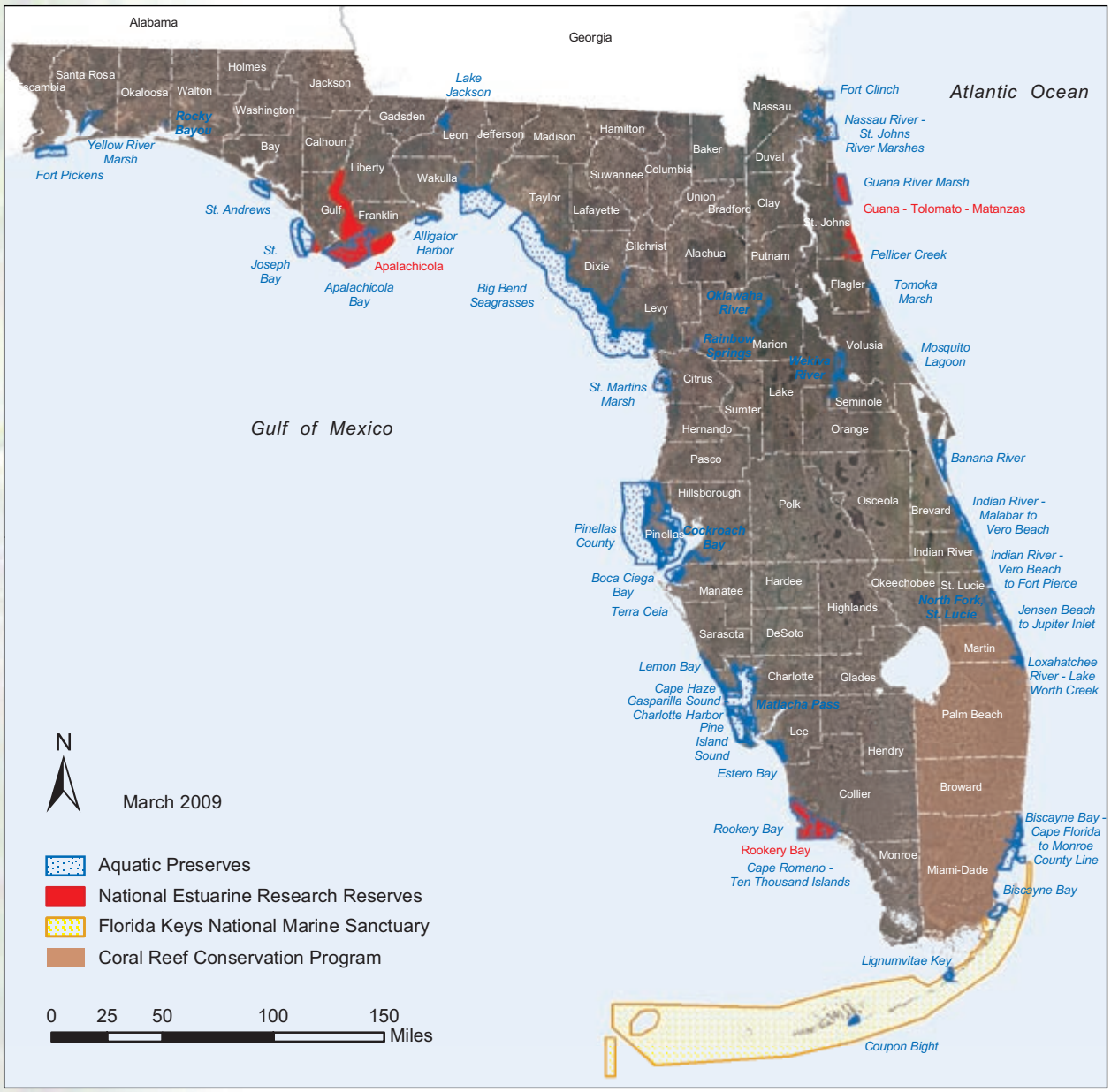
Title to submerged lands not conveyed to private landowners is held by the Board of Trustees of the Internal Improvement Trust Fund (the Trustees). The Governor and Cabinet, sitting as the Trustees, act as guardians for the people of the State of Florida (§253.03, Florida Statutes [F.S.]) and regulate 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



Map 1 / CAMA state-wide managed resources.

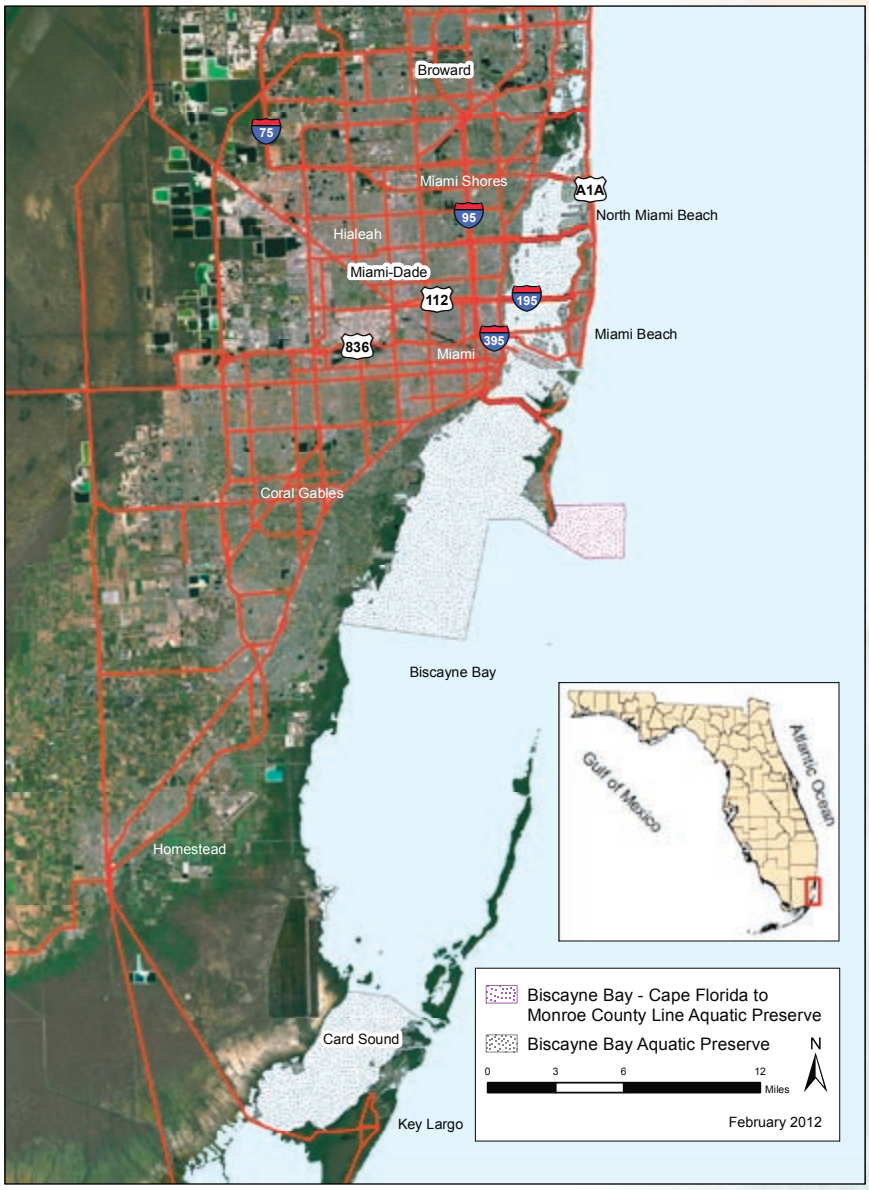
can reduce the health and viability of the ecosystems that contain them, requiring active management to ensure the long-term health of the entire network. Effective management plans for the aquatic preserves are essential to address this goal and each site's own set of unique challenges. The purpose of these plans is to incorporate, evaluate and prioritize all relevant information about the site into a cohesive management 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 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.



Map 2 / Biscayne Bay Aquatic Preserves Site Map

To date, there has never been an approved management plan that specifically focuses on the management efforts within the Biscayne Bay Aquatic Preserves (BBAP) boundaries. There have been management plans drafted by Miami-Dade County and the South Florida Water Management District that address Biscayne Bay, but none that focus specifically on the goals and issues of BBAP or related staff activities. In 1991, the "Biscayne Bay Card Sound Aquatic Preserve Management Plan" was drafted in part by staff from Miami-Dade County Department of Environmental Resources Management with support from the Department of Natural Resources, DEP's predecessor, but never received final approval.

*1.2 / **Public Involvement***

CAMA recognizes the importance of stakeholder participation and encourages their involvement in the management plan development process. CAMA is also committed to meeting the requirements of the Sunshine Law (§286.011, F.S.):

- 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 are to be taken during management plan development. First, staff organizes an advisory committee comprised of key stakeholders. Next, staff advertises and conducts one or more public meetings to receive input from stakeholders on the concerns and perceived issues affecting each of the sites. This input is used in the development of a draft management plan that is reviewed by CAMA staff and the advisory committee. After the initial reviews, the staff advertises and conducts, in conjunction with the advisory committee, additional public meetings to engage the stakeholders for feedback on the draft plan and the development of the final draft of the management plan. For additional information about the advisory committee and the public meetings refer to Appendix C - Public Involvement.

While sandy beaches and the reflection of city skyline have made Miami famous, staff and volunteers invite citizens to think about what lives and thrives just below the surface.

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 Water Policy and Ecosystem Restoration. 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 statute, 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 waterbodies 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 Preserves. 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 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 aquaculture 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.

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.

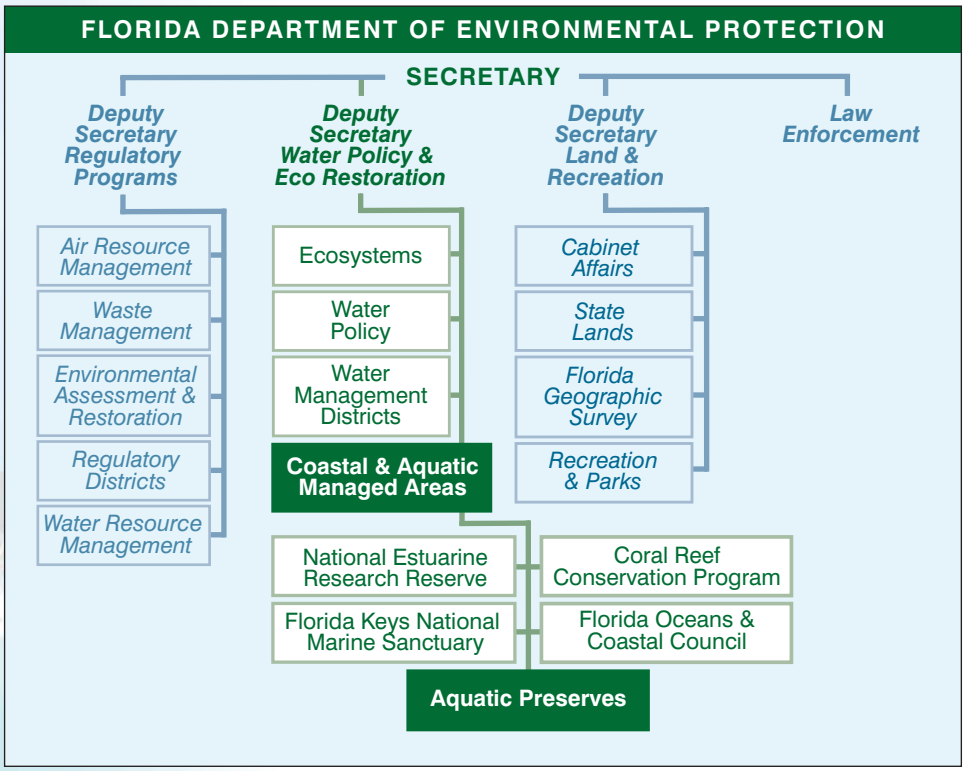


Figure 1 / State Structure for Managing Aquatic Preserves

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 Preserves 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.

Cushion sea stars are a favorite among visitors to Bill Baggs Cape Florida State Park.

Chapter Three

The Biscayne Bay Aquatic Preserves

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

3.1.1 / ***Historical Significance***

Pre-historic settlements along the shores of Biscayne Bay were established by the Tequesta Native American tribe of the Glades and Archaic cultures. Rock mounds, shell middens, burials, and other sites have been found along the Miami River and Biscayne Bay's shore. The Tequesta people lived primarily on the western coast of Biscayne Bay along an eroded limestone ridge that never elevates beyond 25 feet (7.62 meters) above sea level. Bullen (1965) found the Tequesta lived along the mouth of streams, inlets, and coastal beaches on both sides of Biscayne Bay, utilizing dugout canoes to access the bay and the Atlantic Ocean. The Tequesta ate numerous aquatic species which included marine turtles, sharks, sailfish, stingrays, manatees, and dolphins. The Miami Circle is one of the most significant sites, along with the nearby Granada, Miami One and Miami Midden 1 sites, documenting the Tequesta culture. The circle is believed to be part of a settlement that covered both shores of the Miami River's outlet to Biscayne Bay. On February 5, 2002, it was added to the National Register of Historic Places then declared a National Historic Landmark on January 16, 2009. The naming of Biscayne Bay has several possible explanations. Many believe the name is a reference to the Bay of Biscay which lies across the Atlantic Ocean between France and Spain. However, the name is also attributed to historical figures. Some believe the bay is named for Don Pedro el Biscaino who reportedly lived on a bay island before returning to Spain. Other credit Sebastian Viscaino, a wealthy Spanish merchant in the late 1500s and early 1600s. Viscaino was known for traveling the Pacific, where there is a Sebastian Viscaino Bay in Baja California, but there is no mention of visiting Florida (Browder & Wanless, 2001). Spanish exploration of Biscayne Bay began in the late 1500s and resulted in a series of missions also near the Miami River's mouth, though these missions left no physical evidence in the area. The south Florida Territory exchanged hands to the British, then back to Spanish rule, before any permanent settlements were established. During the British Period, William Gerald DeBrahm, was appointed Surveyor General of East

Florida in 1765, and began a six-year survey of the eastern coast of the United States (US), including the area around Biscayne Bay and the Miami River. In DeBrahm's 1770 map, he named the Miami River the Garbrand River and Biscayne Bay, Sandwich Gulf. Nowhere in any of DeBrahm's writings, is there any mention of a settlement on Biscayne Bay. By the early 1800s, few European settlers remained in south Florida. Native Americans, mostly Seminoles, settled along the bay and Everglades as they were displaced from the southern states. They replaced the indigenous tribes who had died or fled during the last hundred years of European habitation.

After Florida became a US territory in 1821, permanent settlements in South Florida were developed. William English established a plantation with slaves in 1844, on the north bank of the Miami River. From 1836 to 1857, during the second and third Seminole Wars, his plantation was occupied by the US Army, which used the buildings for its headquarters, naming it Fort Dallas. Other new settlers were escaped slaves from the southern states, who were welcomed by the Seminoles and became known as Black Seminoles. Many Seminoles and Black Seminoles used dugout canoes, launched from Cape Florida, to reach freedom in the Bahamas and Haiti to escape slavery and oppression by American settlers. William and Mary Brickell along with Julia Tuttle are considered to be the co-founders of the City of Miami. The Brickells moved from Cleveland, Ohio in 1871 and opened a trading post and post office on the south bank of the Miami River, near the site of Fort Dallas. The Brickell Trading Post became the primary source of trading between settlers and Seminoles in the area. Julia Tuttle moved to Fort Dallas in 1891, on land inherited from her father. Tuttle saw the potential of fort Dallas and convinced Henry Flagler to extend the Florida East Coast Railway to Fort Dallas, in exchange for parcels of her land to construct a hotel. Through this exchange, Flagler built the Royal Palm Hotel on the northern bank of the Miami River, as it empties into Biscayne Bay. Settlement of the shoreline of Biscayne Bay increased after the arrival of Flagler's railroad, which led to the incorporation of the City of Miami in 1896. Several other important settlements developed along the bay in the mid to late 1800s. After the Civil War, American settlers streamed into the area forming communities around the bay and the Miami River. Lemon City, 6 miles (9.7 kilometers (km)) to the north, was known for its citrus groves and settlements around a natural limestone arch crossing Arch Creek. The town of Biscayne (present day Miami Shores) was founded 5 miles (8 km) north of the Miami River. Cocoanut Grove, later shortened to Coconut Grove, was located 3 miles (4.8 km) south of the Miami River along a bight in the bay's shoreline. Commodore Ralph Middleton Munroe built his "Barnacle" inspired house along the Cocoanut Grove shoreline in 1891 when the primary travel means was by boat. He founded the Biscayne Bay Yacht Club and served as Commodore for 22 years. Commodore Munroe designed sharpies and other shallow draft sailing vessels that were fit for the shallow waters of Biscayne Bay. His house and property were listed on the National Register of Historical Places in 1973 as the Barnacle Historic State Park.

Biscayne Bay is the largest estuary in Florida and is contiguous with the southern Florida Everglades and Florida Bay. Marjory Stoneman Douglas foresaw the ecological impact the Everglades drainage program would have on the natural environment in Miami-Dade County (MDC). Long before scientists studied the effects on the natural ecosystems of south Florida, Mrs. Douglas challenged officials who were destroying wetlands, eliminating the natural flow of water and upsetting hydrological cycles, upon which the entire ecosystem depends. In the 1950s, the US Army Corps of Engineers (USACE) began a major construction program, creating a complex system of canals, levees, dams, and pump stations that were built to provide protection from seasonal flooding to former marsh land being used for agriculture and real estate development. Ms. Douglas advocated against these projects and worked her entire life to protect and restore natural systems from the Everglades to Biscayne Bay and Florida Bay. In honor of her dedication to environmental conservation, the State of Florida honored her by naming the Department of Environmental Protection's (DEP) headquarters in Tallahassee the Marjorie Stoneman Douglas Building in 1980. In April 2007, Florida placed her home in the care of the Florida Park Service, a division of the Florida DEP. Ms. Douglas and Mabel Miller, a prominent MDC environmental educator, helped to secure a permanent location for what became the Marjory Stoneman Douglas Biscayne Nature Center. This center now is an active proponent of environmental education efforts and environmental conservation, focusing on issues concerning Biscayne Bay.

Past Uses

Biscayne Bay has been a source of sustenance for many generations. The Tequesta people, who settled along the shores of the bay, were renowned anglers who relied on the bay's resources. They were not an agricultural society, but ate a varied diet that included palmetto berries, coco plum, sea grape, pigeon plum, and prickly pears along with their harvest from the sea of turtles, marine mammals and fish. Researchers have found little evidence to show that marine invertebrates were a major part of their diet, unlike other coastal tribes (Bullen, 1965). Instead, the Tequesta utilized shells and sharks' teeth for

a variety of tools, including hammers, chisels, fishhooks, drinking cups, and spearheads. The Tequesta used sharks' teeth to carve out logs to build dugout canoes and used those canoes to access Biscayne Bay and the Atlantic Ocean. Fish remains provide evidence that the Tequesta traveled great distances in dugout canoes to catch a variety of ocean species (Bullen, 1965). As new explorers settled the shores of Biscayne Bay, the Tequesta's lush land and bay continued to provide bountiful food and a source of fresh water for many periods to come. In the late 1800s, Biscayne Bay was known for its freshwater springs surfacing from the Biscayne Aquifer. One unique spring located near today's Coconut Grove Peacock Park, actually bubbled up through the saltwater of the bay. Dr. Jacob Rhett Motte describes the spring, "We were fortunate in hitting upon this spot, for there we found a remarkable spring of fresh water, of the coolest and most delicious flavour I ever drank" (Parks, 2004). The "Devil's Punch Bowl", located near what is now the western end of the Rickenbacker Causeway, was another favorite spring and local landmark for southeastern Florida pioneers. Most springs in and around Biscayne Bay disappeared early in the 20th century due to the hydrological changes from draining the Everglades, which lowered the water table, no longer allowing spring water to surface.

Until Arch Creek Military Trail (now Dixie Highway) was built during the US' third war with the Seminoles (1855-1859), Miami was only accessible by shallow draft sailboats. With no overland route, reaching Miami was a journey of itself. Travelers cruised from New York City to Key West (150 miles/240 km south of Miami) then chartered small sailboats back to Miami. The City of Miami grew and required larger draft vessels to deliver building supplies that could not travel through the shallow waters of Biscayne Bay. Henry Flagler is credited with receiving government financing to breach the south end of Miami Beach, creating Government Cut. The US Congress authorized this project in 1902; dredging began in 1903 and finished in the summer of 1905. The Atlantic Intracoastal Waterway (AIWW) was dredged into the bay by 1912 to further accommodate inshore travel by larger vessels. Seagrasses and algal beds were impacted when channels were dug to allow access for ships with deeper drafts as well as when the dredged material, called "spoil" was piled next to the channels. At least 20 islands were created or enlarged within BBAP through dredging and placing spoil material aside for port facilities and MDC owned islands. Today spoil islands in Biscayne Bay are home to recreation areas, neighborhoods and

Up until the late 1800s, freshwater springs were a source of freshwater for native Americans and travelers alike. The draining of the Everglades in the early 1900s severely lowered the water table, effectively discontinuing the freshwater springs. Photo © Munroe Collection, HISTORYMIAMI.

restoration projects to restore native vegetation. Additional dredging took place at Baker's Haulover Inlet, another channel connecting the northern end of Biscayne Bay with the Atlantic Ocean. This inlet was cut in 1925 through a narrow point in the peninsula where a man named Baker would regularly "haul" his sponge boat from Biscayne Bay over the thickly wooded dunes for access to the ocean. Mention of "Baker's Haulover" appears on maps as early as 1823. New access to the mainland greatly improved shipping access to the new port, which led to it becoming one of the busiest ports in Florida. In 1960, the Dade County Board of Commissioners and City of Miami approved a resolution to modernize the Port of Miami. Construction began on Dodge Island soon afterwards, expanding it with spoil material, to join Lummus Island and Sam's Island. Fisherman's Channel provides a shipping route to the Miami River by a dredged connection to the wharves on the south side of Dodge and Lummus Islands. The Port of Miami River is Florida's fifth largest port and is known as the shipping link for the shallow draft ports of the Caribbean and Central and South America (Florida Seaport Transportation and Economic Development Council [FSTEDC], 2010).

Map 3 / Spoil islands, North Biscayne Bay

Until the 1950s, there was no large-scale sewage treatment system within MDC and waste was released into bay waters. Cantillo, Hale, Collins, & Caballero (2000) reported three centralized treatment plants were built close to coastal locations in the 1970s so that treated sewage effluent could be piped off-shore (for Northern and Central MDC plants) or injected below the Biscayne Aquifer (for the southern plant). The confining and treatment of human waste is thought to be the cause of the largest improvement of water quality of the bay. Even in the 2000s some households remain on septic systems instead of being connected to county facilities. In addition, several cities have had to update their lines after numerous breaks and contamination events. Coinciding with water quality improvements in Biscayne Bay was a new public awareness of the bay's value. In the 1960s, citizens petitioned the federal government to stop proposed causeway construction to the barrier island of Elliot Key. As a result of intense lobbying, Biscayne National Monument was added to the NPS in 1968. Similar efforts by concerned citizens were successful at preventing an oil refinery and a jet port that were proposed for southern Biscayne Bay. In 1967, the Atomic Energy Commission (later to become the Nuclear

Regulatory Commission) granted a construction license to Florida Power and Light (FPL) to build Turkey Point Nuclear Power Plant on the shores of Biscayne Bay and Card Sound 25 miles (40.2 km) south of Miami and 10 miles (16.1 km) east of Homestead. FPL owns and operates all five electric generating units. Units I, 2, and 5 are fossil-fired and Units 3 and 4 are nuclear reactors. The operation of the Unit 3 began in 1972 followed by Unit 4 in 1973 and initially allowed heated water effluent, used to cool the reactors, to flow into Biscayne Bay. Early investigations funded by the US Atomic Energy Commission and the Federal Water Pollution Control Administration beginning in the summer of 1968 through winter of 1969 showed a significant loss such as dead or dying plants and reduced populations of animals. An elliptical area between 1640 and 2297 feet (500 and 700 meters) from shore and twice these dimensions north and south died (approximately 100 acres at the time) due to what was speculated to be elevated temperatures (10 C above surrounding outside temperatures) coupled with higher salinities. This investigation led to the discontinuation of warm water effluent into the bay. Turtle grass was successfully replanted after the heated water flow was stopped. Instead of releasing the water to Biscayne Bay, the company was permitted to build 168 miles (270.4 km) of cooling canals from 6,800 acres of mangroves. The cooling canals' impact on area wetlands is permanent, but now serves as a nursery ground for the American crocodile (*Crocodylus acutus*). Their successful nesting and reproduction sites on canal banks may have contributed to the down listing from endangered to threatened in 2007 by the US Fish and Wildlife Service (USFWS).

Biscayne Bay Aquatic Preserves Designation Date

Biscayne Bay is home to two state aquatic preserves. The first, Biscayne Bay Aquatic Preserve was established in 1974 and runs the length of Biscayne Bay, from the headwaters of the Oleta River down to Card Sound near Key Largo and comprises approximately 63,000 submerged acres. The second aquatic preserve, named the Biscayne Bay-Cape Florida to Monroe County Line, was established in 1975 and much of the submerged lands and islands originally included within the boundaries are now within either Biscayne National Park (BISC) or within the larger preserve. The original boundaries began offshore of southern Key Biscayne, extended out to the edge of Florida state waters and then went southward to the county line dividing Miami-Dade and Monroe counties. The waterbodies known as Card Sound and Little Card Sound are included in the boundaries of this aquatic preserve, located east of Key Largo and approximately 60 miles (96.5 km) south of Oleta River. The boundary returned northward along the AIWW, except where it included a series of shallow banks called the Featherbeds. The preserve concluded back at southern Key Biscayne including the waters of Bill Baggs Cape Florida State Park. Today, the remnant of this aquatic preserve, which is not included in the first aquatic preserve in Biscayne Bay or BISC, is approximately 4,000 acres off the eastern shore of Key Biscayne. It is a remnant piece of what was intended to be a larger footprint that was truncated when the boundaries of BISC were established. Together these two aquatic preserves comprise 67,000 submerged acres and are divided by 172,000 acres of BISC in the central section of Biscayne Bay. Unlike the other 40 aquatic preserves around the state whose management authorities are cited in Paragraph 18-20 Florida Administrative Code (F.A.C.), BBAP's boundaries, management authorities, and rules are established in Chapter 18-18 F.A.C., according to its designation in Chapter 258.397, Florida Statutes (F.S.). The Biscayne Bay-Cape Florida to Monroe County Line Aquatic Preserve authority is described in Chapter 258.39(11) F.S. The Legislative intent for establishing this aquatic preserve is stated in Chapter 258.36, F.S. Two distinct differences between the BBAP Rule 18-18 F.A.C. and 18-20 F.A.C. include the fact that both privately and publicly held submerged lands are included within the boundaries of BBAP; those aquatic preserves managed under 18-20 exclude privately held uplands from within their boundaries. Also, Chapter 18-18 includes an "extreme hardship" provision that ensures that most new leases for submerged lands require that applicants meet the criteria listed under Paragraph 18-18.006(3) (b). Through these provisions, BBAP was established for the purpose of preserving and enhancing Biscayne Bay and all natural waterways tidally connected to the bay in an essentially natural condition so that its biological and aesthetic values may endure for the enjoyment of future generations.

*3.1.2 / **General Description***

International/National/State/Regional Significance - Biscayne Bay is a unique waterbody along the Southeast Atlantic shoreline of the United States because it was not formed by the drowning of a river. Instead, Biscayne Bay formed between 5,000 and 2,400 years ago as sea level rose to fill the depression between these ridges. BBAP shares the bay with BISC, a division of the National Park Service (NPS) authorized as a National Monument in 1968 by President Lyndon B. Johnson. Its boundaries were expanded in 1974, then again in 1980, when it became a National Park and decreased BBAP's acreage. BBAP provides habitat for a wide variety of juvenile and adult marine species as well as several of Florida's imperiled species, including the Florida manatee (*Trichechus manatus latirostris*), the smalltooth sawfish (*Pristis pectinata*), the American crocodile, and Johnson's seagrass (*Halophila*

johnsonii). Johnson's seagrass was the first and only marine plant to be listed as threatened and resides in the northern section of BBAP. Per Florida Natural Areas Inventory (FNAI) (2010), an organization that documents Florida's significant natural resources, the BBAP is located within a significant region of natural areas and habitat for several rare species. Other vital resources of the preserve include expansive hardbottom communities with corals, sponges and algae; mangrove-lined shores; and a variety of animal species throughout the length of the bay. Seagrass beds within the preserve are prime feeding areas for wading birds and a valuable nursery area for juvenile fish and invertebrates, including many of commercial interest. The rich fauna found in Biscayne Bay results from the diverse habitats found in the bay. In addition to recreational fish species such as snook (*Centropomus spp.)*, the mangrove and estuarine areas support a diverse collection of other fishes that serve as links in food webs which benefit the entire Biscayne Bay ecosystem. BBAP offers water oriented recreational opportunities to the metropolitan areas of Southeast Florida and the Keys. The mission of BBAP is to protect the natural resources for the benefit of future generations and at the same time allow for traditional uses. Typical impacts to resources result from dredging, propeller scarring, and grounding damage to seagrass and hardbottom communities. Extended boat anchoring shades seagrasses, plus fishing and marine life collecting introduce gear and chemicals that impact water quality and have reduced species abundance over the past 100 years. Secondary impacts include suspension of sediments in the water column, wildlife disruption and water pollution due to upland development and pollution in the form of litter, stormwater run-off, and septic lechate. Through education and outreach activities, BBAP strives to enlist the public in "ownership" of the bay and its resources in order to protect one of south Florida's greatest resources. BBAP lies downstream of major urban and agricultural development and constantly faces new environmental challenges, yet remains amazingly resilient and filled with life.

Location/Boundaries

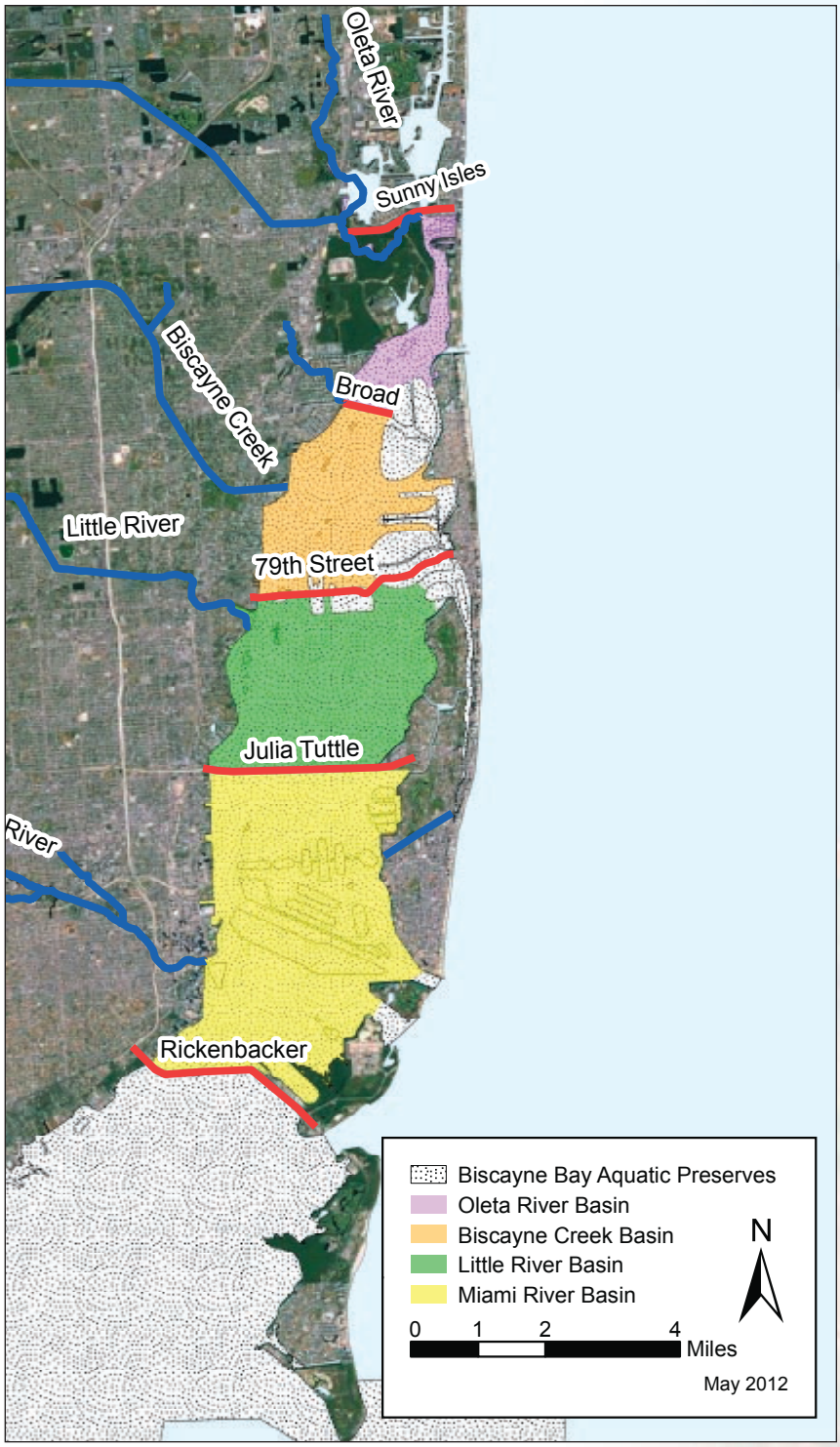
BBAP can be thought of as three distinctive sections: Northern, Central, and Southern. Northern Biscayne Bay begins where the Oleta River empties into Biscayne Bay and ends at the Rickenbacker Causeway, south of where the Miami River empties into the bay. Within the northern section, there are basins that vary in residence time (how long the water resides in a basin between natural and human-made tidal and meteorological changes), salinity, depths, adjacent hydrological alterations, shoreline type, and resources present. For ease of reference, BBAP staff named the basins in the northern part of the bay that are separated by causeways according to the major natural tributary that empties into the basin. The northernmost basin is located between Sunny Isles and Broad Causeways and is regarded as the Oleta River Basin; the Biscayne Creek Basin lies between Broad and John F. Kennedy (79th Street) Causeways; the Little River Basin lies between the John F. Kennedy and Julia Tuttle Causeways; and the Miami River Basin lies between the Julia Tuttle and Rickenbacker Causeways. According to Cantillo et al. (2000), the area in Biscayne Bay with the largest number of organisms occurs in northern Biscayne Bay, within the Little River Basin. The three sampling sites in this basin alone totaled over 5,500 organism, which is more than 2.5 times the amount in Southern Biscayne Bay, although slightly less diverse. This area is described as having "high water clarity, large diversity, and great productivity of organisms." BBAP's headquarters are located in the Northern section of the bay at the Biscayne Bay Environmental Center (BBEC), with direct access to the bay. The BBEC was founded in 2001 in a former Florida Marine Patrol office located in the Pelican Harbor Marina and County Park on the 79th Street/John F. Kennedy Causeway in the City of Miami.

South of the Rickenbacker Causeway is regarded as Central Biscayne Bay, where the bay experiences open flushing with the ocean at its eastern most edge and is not separated by any causeways or bridges. The central section extends south from the Rickenbacker Causeway to where BBAP meets the northern boundary of BISC and extends 3 nautical miles east of the southern tip of Key Biscayne. The central section of the bay also includes a 4,000-acre offshore parcel of submerged lands managed by BBAP that is part of the Biscayne Bay-Cape Florida to Monroe County Line Aquatic Preserve. This parcel is referred to as BBAP and is not referred to colloquially by its legal name. Here, the central section opens to the Atlantic Ocean at Bear Cut and south of Cape Florida, through the Safety Valve region of the bay. Several canal projects serve as tributaries to the central section of BBAP including the Coral Gables Waterway and Snapper Creek Canal. Matheson Hammock, the Charles Deering Estate, Bill Baggs Cape Florida State Park, and The Barnacle Historical State Park are just some of the many parks that are located on the shorelines of BBAP's central section and serve as public recreational access to BBAP. Matheson Hammock Park as well as R. Hardy Matheson Preserve are adjacent to Snapper Creek. The Snapper Creek and C-100 Canals also empty into the bay bypassing former mangrove creeks and reducing the natural flow of water to the bay. In order to restore natural conditions, the Biscayne Bay Coastal Wetlands Project of the Comprehensive Everglades Restoration Plan ([CERP], 2005)

developed the Deering Estate Flow-way. When complete, the Phase I element will redistribute excess freshwater runoff, diverting it away from existing canal discharges and spreading it out as sheetflow into BBAP. Sheetflow is another name for overland flow of water, where water moves over the land and not in distinct channels, historically common in the Kissimmee-Okeechobee-Everglades (KOE) watershed. There is a portion of submerged lands along Blackpoint Marina, which includes a part of the C-1 canal, located south of the Deering Estate in the central part of Biscayne Bay that is included within the BBAP boundaries despite being mostly surrounded by Biscayne National Park.

The Southern section of BBAP begins at the southern boundary of BISC at Cutter Bank, just south of the Arsenicker Keys and Broad Creek. The southern section terminates where Little Card Sound connects to Barnes Sound under the Card Sound Road Bridge. This southern section includes both Card Sound and Little Card Sound, but is referred to as Card Sound. Adjacent to and north of Card Sound is the Turkey Point power plant owned by Florida Power and Light. The Turkey Point peninsula and the immediate area surrounding the peninsula (outside the privately held uplands owned by FPL) are contained within the BBAP boundaries. Like Blackpoint Marina and Turkey Point, there are several other portions of submerged lands such as Homestead Bayfront Park Marina and the C-103 canal that are included within the BBAP boundaries. These parcels that are largely surrounded by BISC are included within the BBAP boundaries according to the language of the national park's establishment order and the BBAP statute that established the state aquatic preserve. Lands that fall outside the national park boundaries but inside Biscayne Bay are considered part of the BBAP. BBAP overlaps with the Florida Keys National Marine Sanctuary in the Card Sound region. The Florida Keys National Marine Sanctuary that includes Barnes Sound and is adjacent to Everglades National Park. Barnes Sound is to the south of Card Sound and, like Dumfoundling Bay, is now connected by water flow under a causeway with the AIWW dredged at its deepest depth.

There are several inlets or cuts that grant access to the open ocean from Biscayne



Map 4 / Northern Biscayne Bay basins and associated tributaries.

Bay. The Northern and Central sections of BBAP connect to the Atlantic Ocean through one natural and three human-made inlets between barrier islands. In the Northern section of BBAP, there are Baker's Haulover Inlet, Government Cut, and Norris Cut. Both Government Cut and Baker's Haulover Inlets were dredged through the Miami Beach barrier island, twenty years apart. Baker's Haulover Inlet improved water quality in the northern part of the bay by increasing circulation within Biscayne Bay from the Atlantic Ocean. Hurricanes that occurred in 1835 and 1838 opened Narrows Cut, referred to later by Commodore Ralph Munroe as Narres Cut, and known today as Norris Cut. Norris Cut separates Virginia Key from what is now Fisher Island at the south end of Miami Beach. Bear Cut lies between Virginia Key and Key Biscayne. An inlet in the northern bay was mapped in the 1770s and has since been closed by a hurricane or gradual silting. The Biscayne Channel and a series of connections, called the Safety Valve lie within BISC's northeastern section and cycle freely with BBAP waters. Angelfish Creek connects Card Sound to the ocean along with other smaller creeks such as Sands Cut, Caesar's Creek, and Broad Creek south of Old Rhodes Key and at the northern end of Key Largo. Experienced local boaters use boats that can clear the shallow cuts in these creeks without running aground. Little Card Sound connects to Card Sound at high tide and through dredging from AIWW development. Inlets through the barrier islands to the east of the bay were created by hurricanes and by dredging.

*3.1.3 / **Resource Description***

Surrounding Population Data and Future Projected Changes

The State of Florida has one of the longest coastlines in the US, with over 75% of residents living in coastal communities. Florida's three southeast counties (Miami-Dade, Broward, and Palm Beach) are the three most populous counties and account for almost 30% of Florida's population. Biscayne Bay extends the length of MDC, which continues to be Florida's most populous county with 2,472,344 residents and 13.2% of Florida's population. According to the Florida Legislature's Office of Economic and Demographic Research (2010), MDC continues to grow and is listed as one of the fasting growing counties in Florida. Future projections for MDC population data predict MDC population to increase to 2,558,134 people by 2015. Monroe County is adjacent to Card Sound and Southern Biscayne Bay and home to an estimated 77,995 residents in 2009, however visitors from other areas make use of the county, known as a premier fishing and scuba diving destination.

Table 1 / Population estimates for bay front cities in Miami-Dade County

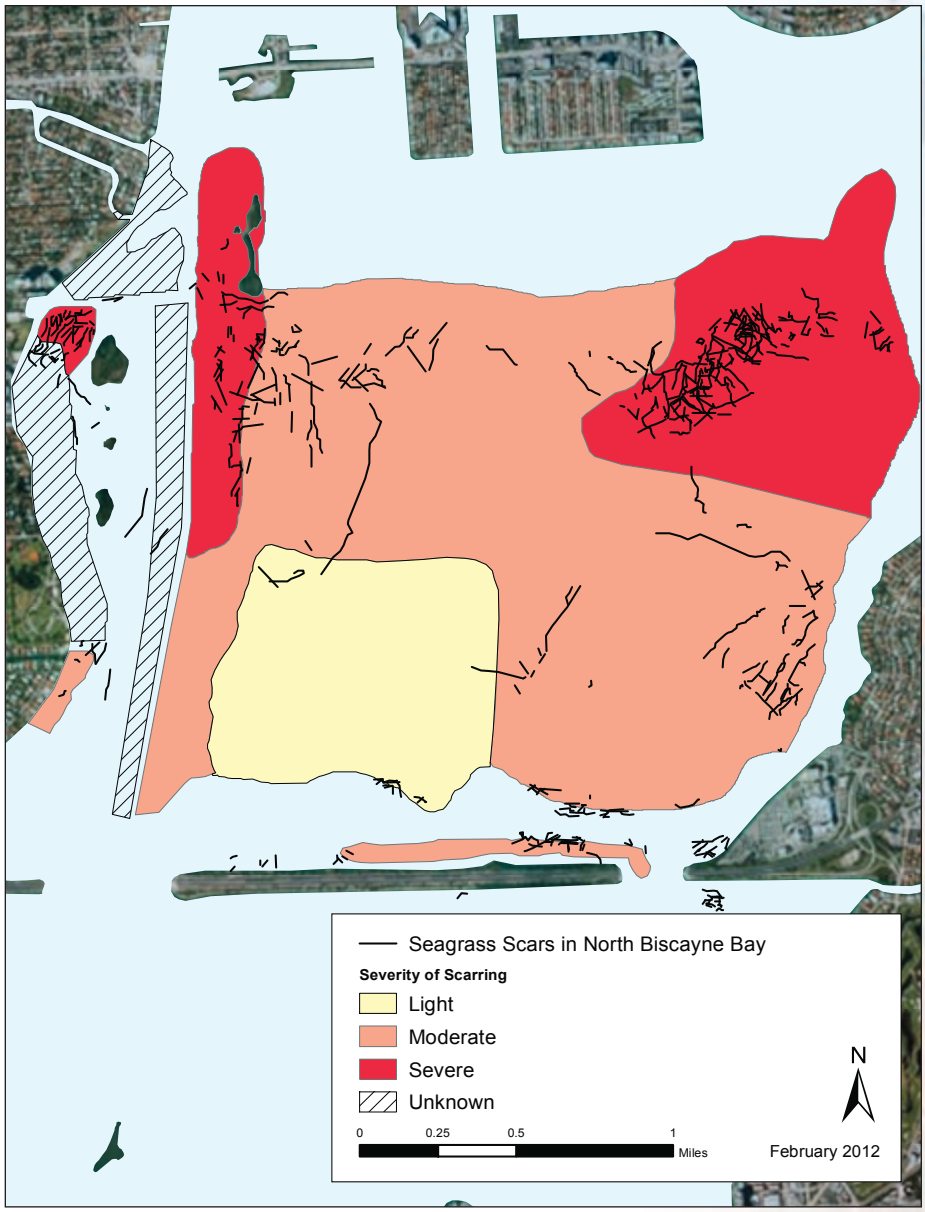
City Name	2000 *(US Census)*	2005 *(est.)*	2009 *(est.)*	2010 *(US Census)*
Bal Harbour	3,305	3,185	3,320	2,513
Bay Harbour Island	5,146	5,212	5,095	5,628
Coral Gables	42,249	44,561	45,501	46,780
Cutler Bay	*	30,331	41,194	40,286
Homestead	31,909	38,396	57,617	60,512
Indian Creek Village	33	56	60	86
Key Biscayne	10,507	11,425	11,411	12,344
Miami Beach	87,933	93,535	92,833	87,779
Miami	362,470	386,882	417,451	399,457
Miami Shores	10,380	10,486	11,170	10,493
North Bay Village	6,733	6,498	6,836	7,137
North Miami	59,880	60,312	58,469	58,786
North Miami Beach	40,786	41,131	40,142	41,523
Palmetto Bay	*	24,795	25,133	23,410
Sunny Isles Beach	15,315	16,703	19,540	20,832
Surfside	4,909	5,614	5,745	5,744
Population estimates for Cities in Monroe County				
Key Largo	11,886	*	*	10,433

** No data or projections found*

Rapid population growth and development in Southeast Florida contribute to impacts on natural resources. Loss of habitat due to human encroachment has affected many species, including those of commercial and recreational importance. Shortages in groundwater supply from the Biscayne Aquifer, caused by expanding infrastructure developments, are stressing natural systems throughout the region. Major population centers that depend on the Biscayne Aquifer for water supply include Miami-Dade, Broward and Palm Beach counties. Also, the Florida Keys are primarily supplied by water from the Biscayne Aquifer that is transported from the mainland by pipeline (Miller, 1990). Stormwater runoff, residents' septic systems near the bay and associated nutrient discharges negatively affect local water quality. The Biscayne Aquifer is highly permeable and lies at shallow depths just under Biscayne Bay, so it is readily susceptible to contamination. This aquifer is the only source of drinking water for about 3

million people in Miami-Dade and Monroe counties. There is a diversity of recreational and commercial in-water activities for residents and visitors, including power boating, sail boating, catamaraning, canoeing, sculling, water skiing, jet skiing, hang gliding, swimming, windsurfing, snorkeling, scuba diving, and fishing. However, other environmental impacts occur as a byproduct of the population's recreational uses. South Florida Water Management District (SFWMD) along with Hazen and Sawyer Environmental Engineers & Scientists in association with the Planning and Economics Group (2005) published the Biscayne Bay Economic Study. This study showed how people use the bay and how frequently they use it. This project estimated how many "person days" were spent in Biscayne Bay taking into account types of recreational activities in the bay. "Person days" describes the recreational use intensity of Biscayne Bay and is defined as one person participating in recreational activity for all or a portion of a day. This study reported the number of person days in 2004 to be 65,464,406 (SFWMD et al., 2005). The recreational vessel fleet in South Florida (Broward, Collier, Miami-Dade, Monroe and Palm Beach counties) has grown substantially. The number of licensed vessels grew by 444% between 1964 and 1998 (Ault et al., 2001). The commercial fishing fleet in South Florida grew 197% from 1964 to 1998 (Ault et al., 2001).

With increased visitors using the bay, the likelihood increases that resources will be damaged through incidents such as manatee vessel collisions, increased pollution, and seagrass scarring. According to Sargent (1995), "Scarring can refer to either the activity of scarring or to a group of scars in a seagrass bed. Seagrass beds can be scarred by many activities, but scars are most commonly made when a boat's propeller tears and cuts up roots, stems, and leaves of seagrasses, producing a long, narrow furrow devoid of seagrasses. Boats operating in shallow waters are severely scarring, and sometimes completely denuding, seagrass beds throughout the state." The basin between 79th Street and the Julia Tuttle Causeway is noted in this paper as being one of the most severely scarred basins in MDC, despite being regarded as one of the most diverse in terms of number of organisms. Future educational programs to be implemented within the BBAP to address responsible boating in a county with the highest amount of registered boaters include a Biscayne Bay-focused EcoMariner program, similar to that recently established in Florida Bay. EcoMariner is a web-based educational



Map 5 / Seagrass Scarring, North Biscayne Bay

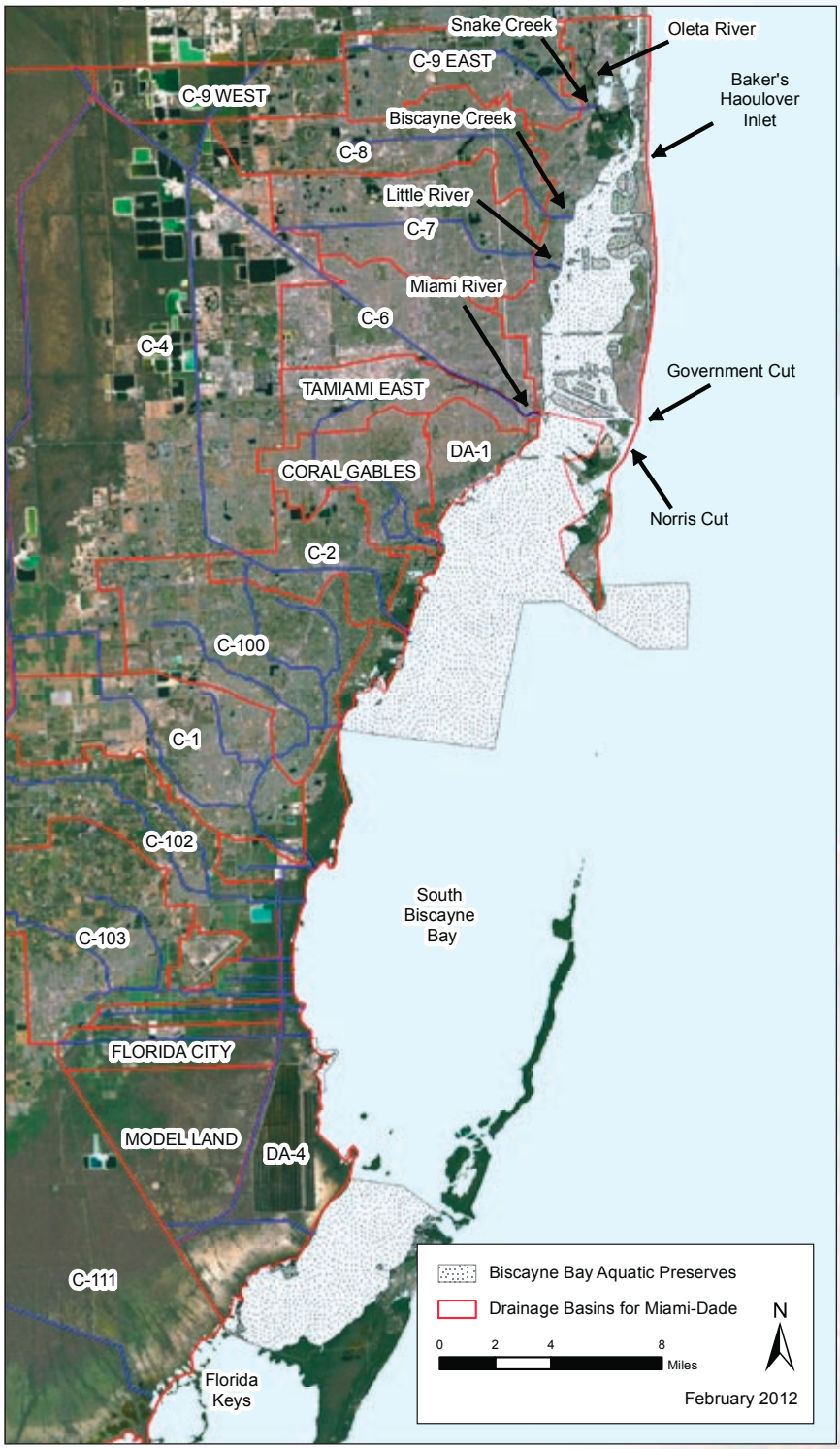
tool used by boaters interested in coursework that fosters a better understanding of the local ecosystem. EcoMariner educates boaters on impacts to and stewardship of natural resources, but does not currently have a class specific to Biscayne Bay. BBAP will continue education and outreach programs to increase awareness and appreciation of Biscayne Bay and encourage stewardship of the bay's resources by implementing such a program that focuses on Biscayne Bay's resources as a way of connecting the public to resources that promote responsible use and enhance stewardship.

Geology

The geology of southeastern Florida is characterized by the shallow surficial water (occurring near the surface) of the aquifer system and the deeper Floridan aquifer. Groundwater discharge flows into Biscayne Bay and provides a salinity regime that has allowed flora and fauna in all stages of their lifecycles to find a home. This flow originates from the Biscayne Aquifer, which is part of the surficial aquifer system. The Biscayne Aquifer is regarded as highly permeable, made up of porous limestone and its creation dates back from the Pliocene (5.3 to 5.1 million years ago (mya) to the Pleistocene (1.8 to 10,000 mya) epoch and is defined by its hydrogeologic properties (how groundwater is distributed and moves through soil and rocks). The Biscayne Aquifer runs less than 30 feet (9.1 meters) below sea level and is comprised of the Pamlico Sand, Miami Oolite (limestone), Anastasia Formation, Key Largo Limestone, and Fort Thompson Formation all of Pleistocene age, and contiguous highly permeable beds of the Tamiami Formation of the Pliocene Epoch (Scott et al., 2001). Permeability is highly variable in the aquifer and for this reason, numerical models of groundwater flow have been difficult to make accurate as experts must take into account various porosity of the limestone rock in various places. A long-standing objective of Biscayne Bay's scientific community is to define a water budget that would quantify the amount of freshwater entering the bay from sheetflow, rainfall, canals, groundwater seepage, and stormwater runoff. A water budget would also take into account how much water can be stored in the aquifer versus how much is moved to surface waters. Submerged groundwater springs can likely be explained by the occurrence of preferential pathways through limestone that are created when water dissolves the rock along fractures. This can increase the overall rate of transmissivity of the aquifer. Transmissivity is a property of an aquifer that defines the rate at which water moves through it. Biscayne is an unconfined aquifer in that it is not bounded on the top by a confining or semi-confining unit. Because of this, withdraws from an unconfined aquifer lower the water table by dewatering pores in the limestone; however, pores will refill if the water table is allowed to rise. When canals are drawn down during the wet season the water table is lowered and the aquifer is not given an opportunity to recharge. It is understood that canals are in direct hydraulic connection with the highly permeable Biscayne Aquifer as they recharge the aquifer during the dry season and drain the aquifer during the wet season (Langevin, 1999).

The Atlantic Coastal Ridge separates the Everglades from the Atlantic Ocean and Biscayne Bay and is made of oolitic limestone. This ridge follows the bay's western shore and reaches elevations of 20 feet (6.1 meters) above sea level in northern MDC to the northwest portion of the Card Sound. This oolite (spheres of calcium carbonate) ridge of Miami Limestone was formed chemically during times of higher sea level and extends east 2 miles (3.2 km) to the west shore of Biscayne Bay in its northern and central sections. Holocene sediments border the southwestern shore of Card Sound (www://sofia.usgs.gov/publications/maps/florida_geology/). The barrier islands of Card Sound and the Florida Keys were once submerged coral reefs with flourishing colonies, leaving calcareous remains that accumulated to form a highly porous rock formation called Key Largo Limestone (Florida Department of Natural Resource Management [DNR], 1991). In geology, calcareous formations refer to those that are formed from or contain a high proportion of calcium carbonate. The islands in northern and central BBAP (Miami Beach and Key Biscayne) have quartz sand deposits on top of the limestone. Sands originate in the Appalachian Mountains and are carried southward along the coast by what is called the longshore drift. Smaller amounts of this sand are transported further south to the barrier islands within BISC or Card Sound, where coral limestone is exposed. A carbonate platform underlies Florida and carbonate sediments predominate in BBAP. Through chemical processes, phosphorus binds with calcium carbonate from the limestone rock and becomes the limiting nutrient (the nutrient that is less available in the water column), as cited in Graves et al. (2005). These sediments utilize phosphorus from the water and make the bay phosphorus limited. Despite a substantial amount of nitrogen input from freshwater discharges, chlorophyll concentrations (a measure of the photosynthetic activity of plants) in the water column are low per a multi-decadal data set collected by Miami-Dade Department of Environmental Resource Management (DERM, hereinafter referred to as PERA [Permitting, Environment, and Regulatory Affairs]). The new mayor of Miami-Dade County, elected in the fall of 2010, consolidated half of the counties departments. DERM was combined with other permitting and regulatory departments and its name changed to PERA, or Permitting, Environment, and Regulatory Affairs. Data collected by

PERA and Florida International University Southeast Environmental Research Center indicate that algal blooms can follow rainfall events when freshwater is added to the bay both directly and indirectly through stormwater outfalls and canal releases and is generally only a problem in southern Biscayne Bay, Card Sound and Little Card Sound and Florida Bay to the south (Boyer, Kelble, Ortner, Rudnick, 2009). Biscayne Bay has eleven identified sedimentary environments, including rocky bottoms, dredged rocky bottoms, sandy bottoms, quartz sands, barrier island sands, skeletal carbonate sands, muddy bottoms, barren mud bottoms, carbonate mud, spoil margins, and mangrove soils. Alleman et al. (1995) reported in the Biscayne Bay Surface Water Improvement Management Plan, carbonate and sandy mud bottoms are found throughout the middle and eastern portions of the northern and central bay. The Card Sound has distinctive sediment gradients from north to south. Early and Goodell (1968) showed the northern Card Sound is influenced by the northern section of the bay and contains quartzous sands, while the southernmost section of the Little Card Sound contains calcarenite sands, which are also known as dune limestone formations. Storm sedimentation plays a major role in reworking and redistributing the sediments within Card Sound. Sediment cores taken in the central and southern sections of the bay assess sediments and provide clues to the bay's geologic past. Paleosalinity is the study of the amount of salt in the bay in the past as measured in the sediment cores. Foraminifera are a class of microscopic, shelled protists (single-celled organisms) found in sediment cores that can be used as bioindicators of coastal pollution and can also indicate what salinity conditions were like in the past. Bioindicators are species that are used to represent the presence of pollutants or to indicate the overall health of the area. In Biscayne Bay, several studies conducted by the United States Geological Survey (USGS) and various universities collected sediment cores. Cores collected in Card Sound show evidence of peat and high vegetation accumulation in their early history, followed by increased marine and or carbonate clastic deposition. Wingard et al. (2006) concluded that there has been a loss of estuarine, or less saline, habitats in Biscayne Bay especially in



Map 6 / Biscayne Bay Drainage Basins

the southern section, indicating that Biscayne Bay has become increasingly saline when compared to previous centuries. This could also be due to a reduction in freshwater entering the bay as groundwater, as well as the pulsed freshwater received from canals. However, the northern part of the bay maintains a lower salinity compared to the southern part of the bay.

Hydrology and Watershed

The hydrology of Southeast Florida is unique in its dynamic interaction between surface water and groundwater. BBAP is downstream of the KOE watershed that originally covered four million acres as estimated by the USGS South Florida Information Access. In Central Florida, the Kissimmee Chain of Lakes form the headwaters and flow through the Kissimmee River to Lake Okeechobee, then south to the Everglades basin with its sheetflow in the "River of Grass". The Everglades wetlands were historically connected to Biscayne Bay by water flow through rivers and creeks that carved through the Atlantic Coastal Ridge. The ridge parallels the coast along the northern part of MDC and is farther inland along the southern section. The transverse glades were low-lying areas that cut through the Atlantic Coastal Ridge and allowed surface water to flow into Biscayne Bay. Today, most of these waterways have been dredged into canals over the past 100 years. The Central and South Florida Flood Control Project beginning in 1948 was initiated to manage water flow. Meant to prevent flooding in low-lying developed areas and to prevent saltwater intrusion, the canals and levees throughout south Florida effectively route surface water towards Biscayne Bay. These water control structures have lowered the water table, reducing available groundwater to Biscayne Bay, while water is in demand for use in newly developed urban areas and for agricultural irrigation. Today, water flow is managed by SFWMD through a complex system of canals and levees; the boundaries of SFWMD include the KOE watershed and cover 16 counties. The Central and South Florida Flood Control Project was disbanded when SFWMD was formed in the late 1940s, following several hurricanes that caused extensive flooding for months in South Florida. Aside from groundwater inputs, Biscayne Bay historically received surface waters from the north and west from the KOE watershed. In the northern bay, the Oleta River, Arch Creek, Biscayne Creek, Little River, and the Miami River provided surface flow through low areas of the Atlantic Coastal Ridge. The Snake Creek and the Oleta River were historically lined with fresh water wetlands, where today salt-tolerant wetlands line the banks. The observation of widgeon grass (*Ruppia maritima)* in Northern Biscayne Bay in August 2007 by BBAP staff may show that the bay is still receiving enough freshwater inputs to allow species diversification. This could be from groundwater inputs, or from stormwater outfalls from surrounding urban areas. Stormwater can also bring nutrients and pollutants, such as metals and hydrocarbons, to the bay. Most of the other waterways were deepened and straightened, but the major tributary to Biscayne Bay, the Miami River, was extended across the Everglades to Lake Okeechobee through the creation of the Miami Canal. In the central part of the bay, freshwater once flowed through numerous creeks into Biscayne Bay.

Historically, Biscayne Bay did receive freshwater from various kinds of streams. Although the channelization of natural tributaries and creation of canals severely altered the location, timing and delivery of freshwater to the bay, morphologically these freshwater streams are still there or exist in a modified form even if almost none continue to flow naturally. Natural streams include Snake Creek (Oleta River lying downstream), Arch Creek (comprised of two creeks), Little River, the Miami River, and Black Creek. Unlike northern streams, these do not start at a headwater channel but instead emanate from transverse glades (wet prairies) that cross the main limestone ridge and delivered water from the Everglades to the coastal streams. These have all been channelized at some point upstream to accomplish the initial task of draining the Everglades, thus eliminating natural sheetflow to Biscayne Bay. Secondary and current uses of the channelized streams are to provide flood protection to the residential areas. Some springs are spring-fed streams, meaning the source of freshwater comes from underground sources. Snapper Creek and Cutler Creek were the most well known of these; however, there were several others south of Coconut Grove between the areas known today as Matheson Hammock and the Cutler Power Plant where the rocky outcrop is close to the bay. Arch Creek was a spring-fed stream in the geologic past before the arch collapsed (known as the "natural bridge"). These spring-fed streams no longer flow naturally due to canal construction or by regional lowering of the water table. Seepage streams that existed along the coastal plain of southern Biscayne Bay do not have names but were very common. A seepage stream will normally have one or more tree islands at its headwaters where the water seeps into the surface water as the tree island's rocky core provided a direct connection to the surface aquifer and provided a way for water to escape from under the marl blanket. It is possible that higher groundwater levels could reactivate many of these as few have been directly modified, although mangroves now grow at the downstream end of these streams, often at higher elevations, which would prevent flow from reaching the bay. Also, there are still a number of functioning springs with most of the known examples in the coastline area in or near the Charles Deering Estate. There are at least four

Where the Miami River forks at NW 27th Avenue is the site where Miami River rapids once existed. Those wanting to reach the Everglades by traveling up the Miami River had to brave these rushing rapids. Photo © Munroe Collection, HISTORYMIAMI.

of these and the presence of oysters in Biscayne Bay north of the Cutler Power Plant suggests there may be others. Historical examples include the one photographed by Commodore Ralph Middelton Munroe in the late 1890s located as much as 200 meters offshore of Coconut Grove (P. Harlem, personal communication, August 10, 2010).

Today water flows through canals, such as the Coral Gables Waterway, which was created by drilling through oolitic limestone and remains with 20' (6.1 m) walls. It is now a destination for canoeists and kayakers to paddle through the ridge. The Coral Gables Waterway was the dream of developer George Merrick. Merrick's master plan for Coral Gables in the 1920s created "Forty Miles of Waterfront" acreage for new residents to build on. Snapper Creek is now the main channel for freshwater, bypassing surrounding natural creeks, in Matheson Hammock and the R. Hardy Matheson Preserve. Water flows through canals in a pulsed discharge, creating highly variable salinity conditions at the mouths of 19 major canals. Two examples of projects designed to increase freshwater flow are a mitigation project with FPL where culverts breach the L-31 E levee and a CERP project with the C-111 Spreader Canal. To further encourage freshwater returning into the natural hydrological system, SFWMD and CERP have worked to restore the Cutler Drain within the Deering Estate as part of the Biscayne Bay Coastal Wetlands project. Phase I of Southeast Florida CERP projects include the Deering Estate Flow-way; the groundbreaking took place in May 2010. This project will redistribute excess freshwater runoff, directing it away from existing canal discharges and spreading it out as sheetflow prior to discharging into the aquatic preserve. This will result in healthier coastal wetlands and recreate the natural sheetflow of water through the land, into the bay. Improved freshwater flow and salinity distribution near the shore will also help re-establish productive nursery habitat for shrimp and shellfish. Intensive development of the KOE watershed has altered the natural cycle of freshwater inflows to the bay. Northern and Central Biscayne Bay are influenced by urban development associated with rapid population growth of MDC. In addition to these freshwater inputs from pulsed discharges, salt water flows into the bay through natural inlets, dredged inlets, and through the Safety Valve region of Biscayne Bay. The opening of inlets and further channelization has contributed to the bay's transition from a freshwater estuary to a marine lagoon. In the north Baker's Haulover Inlet and Government Cut were dredged to allow access for vessels in the early 1900s (Chardon, 1978). Through these inlets, saltwater mixing has increased in what was a typically less saline environment in the northern part of the bay. The central section of the bay adjacent to the Safety Valves is more of a marine system that is heavily influenced by daily tidal flushing, due to the

exposure of the Atlantic Ocean. Southern Biscayne Bay has been heavily influenced by drainage from the Everglades, which was altered by canals and agricultural activities. The Card Sound region was traditionally fed by sheetflow through freshwater wetlands and is greatly affected by the reduction in freshwater. Barnes Sound is located to the south of Card Sound and, like Dumfoundling Bay in the north, is now connected by water flow under a causeway with the AIWW dredged at its deepest depth. These wetlands suffer from saltwater intrusion. An extension of BBAP's boundaries, to include Barnes Sound, should be considered because of this connection (Alleman et al., 1995). Card Sound's freshwater wetlands have been significantly reduced as indicated by increased salinity levels during periods of low rainfall and mangrove establishment along the shoreline. Restoration and preservation of Biscayne Bay require research and understanding in order to determine the relationships between the hydrological system and the bay ecosystem, and of the natural versus human-induced variability of the ecosystem (SFWMD, 2010).

The Biscayne Aquifer is a surficial aquifer (water bearing rock) underlying MDC and Broward County. It is the sole source supply for the drinking water of both counties' residents and is recharged by rainwater. As surface water flow has changed, ground water recharge lessened. Groundwater flow into the bay is now studied by scientists from National Oceanic Atmospheric Association (NOAA) and USGS. The Biscayne Aquifer is vulnerable to saltwater intrusion that occurs when saltwater enters the freshwater aquifer beneath the land. Saltwater intrusion has occurred in the Biscayne aquifer for a variety of reasons, including: the drainage of freshwater by canals, the seepage of saltwater into the aquifer by canals, the over-pumping of freshwater by wells, and the lowering of the water table by drought. The deeper Floridan Aquifer is 1,200 to 1,600 feet (365.8 to 487.7 meters) below the Biscayne Aquifer. Unlike potable freshwater found in the Biscayne Aquifer, the Floridan's water is brackish. The aquifer is used for deep well injections of treated wastewater; because, it is separated from the Biscayne Aquifer by a confining layer. It is also receives surface waters into Aquifer Storage and Recovery wells. This water will be available for use during droughts to fulfill the dry-season needs of urban, agricultural, and industrial water users, with less impact to surface waters or shallow water-supply wells. Nonpotable water, stored in Aquifer Storage and Recovery wells, has many applications such as irrigation, fire department tank storage, and pressure-washing streets.

The waters of Florida's aquatic preserves are among those designated as Outstanding Florida Waters (OFW) and are considered worthy of special protection because of their natural attributes. DEP provides the highest protection to these waters and no degradation of water quality, other than that allowed by rule, is to be permitted. State and national parks, along with aquatic preserves and select other waterbodies, were granted this protection through designation in the F.A.C. The intent of OFW designation is to prevent activities requiring a permit from DEP from lowering existing water quality. Section 403.061(27), F.S., created additional protection for waterbodies that are classified as OFW. Biscayne Bay-Cape Florida to Monroe County Line Aquatic Preserve was designated OFW in 1979 [Rule 62-302.700(9), F.A.C.]. BBAP became an OFW in 1982. With some exceptions, DEP is not to permit a lowering of existing or ambient water quality through pollutant discharges directly to the OFW. In addition, indirect discharges cannot significantly degrade the waterbody (Florida Department of Environmental Protection [DEP], n.d.). The Monroe County waters of the BBAP (Card Sound and Little Card Sound) are classified as Class II waters for shellfish propagation or harvesting [Rule 62-302.300, F.A.C.]. The MDC waters of BBAP and the Biscayne Bay-Cape Florida to Monroe County Line Aquatic Preserve are Class III waters for recreation, fishing, and wildlife protection. These classifications set standards for pollutants according to the waterbodies' classification. Effective August 5, 2010 the definition of Class III waters was amended to be broken down into those that are "predominantly fresh" or "predominantly marine." BBAP waters in MDC are regarded as "predominantly marine" in that the chloride concentration in surface waters is greater than or equal to 1500 milligrams per liter.

Topography and Geomorphology

Biscayne Bay, Card Sound and Little Card Sound were formed three to five thousand years ago as sea level rose. These waterbodies are located between mainland MDC and Monroe County and the barrier islands that separate the bay from the Atlantic Ocean. Per USGS report 90-4108, geomorphological features have significantly controlled the environment, drainage, and ultimately, the land use in MDC. The Atlantic Coastal Ridge forms the highest ground in the county as is 2 to 10 miles in width and is a natural barrier to drainage of the interior part of the watershed, except where it is breached by shallow sloughs or rivers. The Everglades are by far the largest feature and, before development, were wet most years and least subject to seasonal flooding. Drainage was slow and generally to the south and southwest, channeled behind the higher coastal ridge. The Everglades form a natural trough in north-central, central, and southwestern MDC. Elevations range from about 9 ft above sea level in the northwestern corner to

about 3 ft above sea level in southwestern Dade County, except for tree islands or hammocks, which may be a few feet higher than the surrounding land. Most of the eastern part of the Everglades within MDC is now used for agriculture, rock quarrying, or urban development. Drainage from eastern MDC into BBAP is primarily controlled by the system of canals, levees, and control structures as part of the Central and South Florida Flood Control Program. Southeast of the Atlantic Coastal Ridge are mangroves and coastal glades which were historically low-lying wetlands that were and developed into urban and agricultural areas. The northern and central sections of BBAP are more urbanized with less development and increased agriculture in the southern section. Geomorphology is a science that deals with the relief features of the earth. BBAP has unique geomorphology due to the dredging and filling that have altered Biscayne Bay indefinitely. The first dredging projects were completed in the late 1800s to provide bay access to the mainland for deep draft vessels. The AIWW, Port of Miami, and Port of Miami River dredging projects led to the creation of spoil islands throughout the bay, by pumping dredged material behind bulkheads for port facilities, residential developments, and parks. Islands were also created to allow causeways to connect barrier islands to the mainland. The first of seven causeways in the northern part of the bay was the wooden Collins Bridge built in 1913; it was rebuilt to connect spoil islands then renamed the Venetian Causeway in 1925. The Collins Causeway was built in 1918 and renamed the MacArthur Causeway in 1942 and includes the 86 acre Watson Island. This was followed by the 79th Street/ John F. Kennedy Causeway in 1928, which was widened in 1938. The Rickenbacker Causeway replaced ferries to Virginia Key and Key Biscayne in 1943. Broad Causeway was opened in 1951 and Julia Tuttle in 1961. Port Boulevard was built to Dodge and Lummus Islands in the 1960s. These causeways create the artificial basins that are useful for discussing the bay and its resources (see Map 4). The onset of the Great Depression in the late 1920s stopped most of the island building within Biscayne Bay.

Climate

Florida's climatic zones are classified as hot-humid and BBAP is described as a Tropical Monsoon climate according to the Köppen-Geiger Climate Map (Peel et. al, 2007). Tropical is defined as having no month with an average temperature below 64.4 degrees (°) Fahrenheit (F) (18° Celsius (C)). The warm waters of the Gulf Stream largely influence this tropical climate. NOAA (2005) reports constant high temperatures with average monthly high temperatures varying from 90.9°F (32.2°C) in July to 76.5°F (24.72°C) in January. Average monthly lows vary from 59.6°F (15.3°C) in January to 76.5°F (24.72°C) in July and August, but temperatures have been recorded below freezing on occasion during winter months. The winter of 2009-2010 was unseasonably cold, causing fish kills and high manatee mortality. Temperatures near the Card Sound are slightly lower than in Miami during the summer months because of the cooling influence of prevailing winds (DNR, 1995). Southern Florida has two seasons that are determined more by precipitation than the weather. The dry season begins in December and lasts until May and the rainy season usually begins in May or June and ends after November. South Florida receives 70% of its annual rainfall during these months. The rainy season coincides with the Atlantic Hurricane Season. Peak hurricane months are September and October, which coincide with the warmest ocean temperatures. South Florida's exposed location makes it more vulnerable to hurricanes and tropical storms than any other area of equal size in the US (Schomer & Drew, 1982). Fluctuations in climate can also occur over a few months or seasons as a result on the El Niño Southern Oscillation phase (generally refers to El Niño and La Niña weather patterns). This phenomenon can result in climatic fluctuations in temperature and/or precipitation for a period of time.

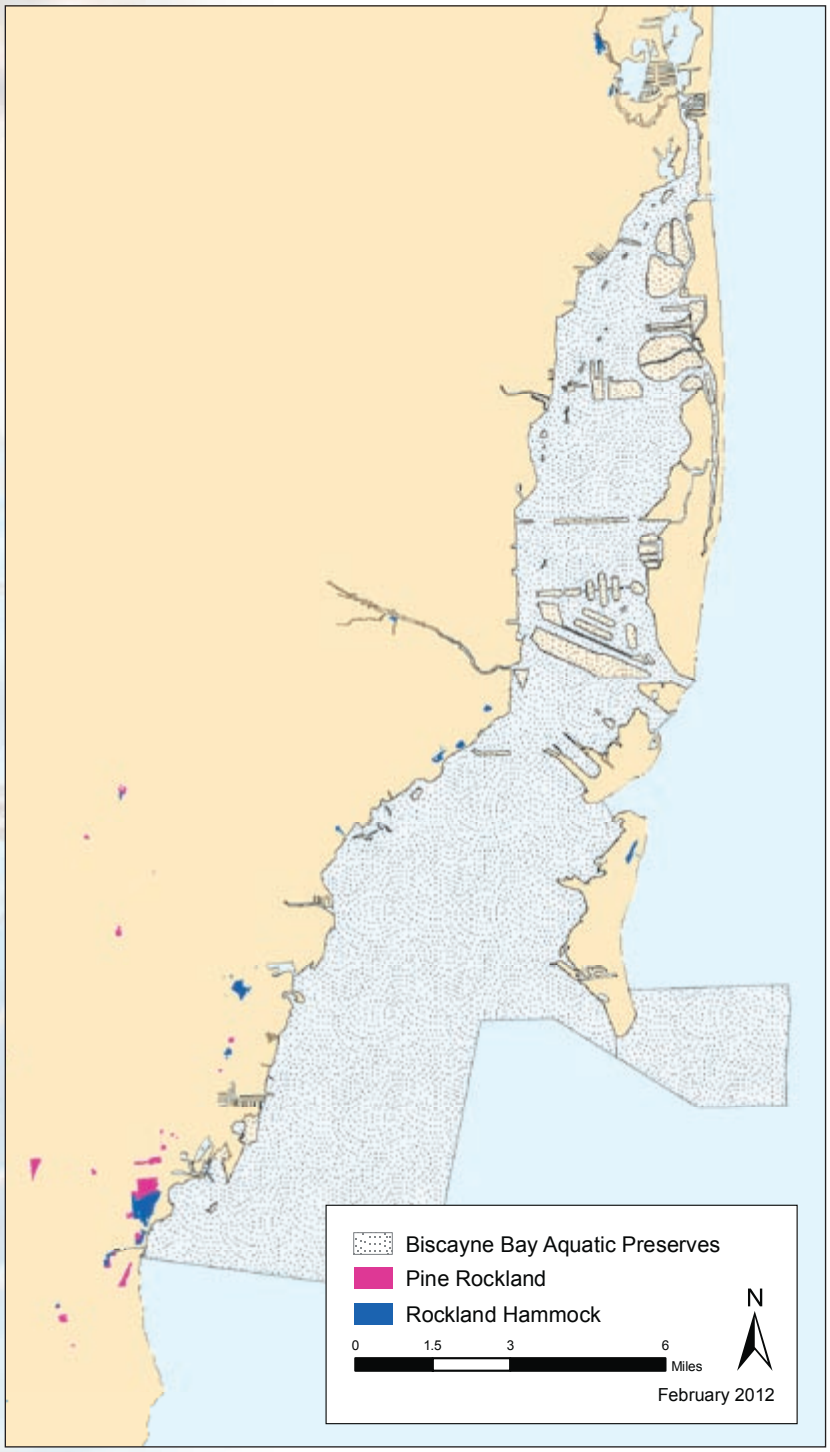
NOAA's National Climatic Data Center collected climate information at various points around BBAP from 1971 to the year 2000. The average rainfall in the BBAP ranges from 58.3 inches per year in the northern sections of the bay to 38.94 inches in Card Sound (NOAA, 2005). For the northern and central sections of BBAP, monthly precipitation is highest in June with 11.67 inches and lowest in December with 1.39 inches. The southern section finds September with the highest monthly precipitation at 5.45 inches and February as the driest with 1.51 inches (NOAA, 2005). Sheryen (1989) estimated the average annual wind speeds are 9.2 miles per hour (mph) (14.81 kilometers per hour (kph)) in Miami and 11.2 mph (18.2 kph) in the keys. Higher winds occur during summer thunderstorms (38-73 mph/61.6-117.5 kph), hurricanes (74 – 123 mph/119.1-198 kph) and great hurricanes (>124 mph/200kph) may be expected from June until October. Winds less than 6 mph (10kph) occur about 25% of the time and winds less than 11.5 mph (18.5 kph) occur 60% of the time. Water temperatures within BBAP average 66.2°F (19°C) in winter and 87°F (30.5°C) in summer. Cold fronts may cause 18°F (7.77°C) drops in temperatures within a few days (Bader, Roessler & Thorhaug, 1971).

Natural Communities

FNAI and DEP developed the natural community classification system used in this plan. The 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 and DEP, 2010). 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). Lower numbers reflect a higher degree of imperilment (e.g., G1 represents the most imperiled natural communities worldwide, S1 represents the most imperiled natural communities in Florida). Appendix B.6 provides a full explanation of the FNAI Community Types and the ranking system.

Data used to produce a map delineating the major natural community types found in and adjacent to BBAP were developed by FNAI using multiple sources that include, but were not limited to: SFWMD, Florida Land Use Cover and Forms Classifications System, digital ortho-photographs, black and white aerial photographs (1:25,000 scale), FNAI data on Element Occurrences, Potential Natural Areas and Areas of Conservation Interest. These data are not always based on comprehensive or site-specific field surveys, and no additional fieldwork was conducted for purposes of producing this map. The descriptions of the natural community types found in and adjacent to BBAP have been adapted from the Guide to the Natural Communities of Florida (FNAI & DEP, 2010).



Map 7 | Biscayne Bay Aquatic Preserves Florida Natural Areas Inventory Natural Communities- North

The marine natural communities in and adjacent to BBAP 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. Marine communities represent the majority of the area within BBAP and include seagrass beds, algal beds, consolidated marine sediments, unconsolidated marine sediments, composite marine sediments, limited shoreline of salt marsh and mangrove swamp, along with some ruderal or dredged areas. The following community types are located within BBAP. These descriptions were taken from the 2010 FNAI Field Guide to the Natural Communities of Florida, and site-specific comments have been added.

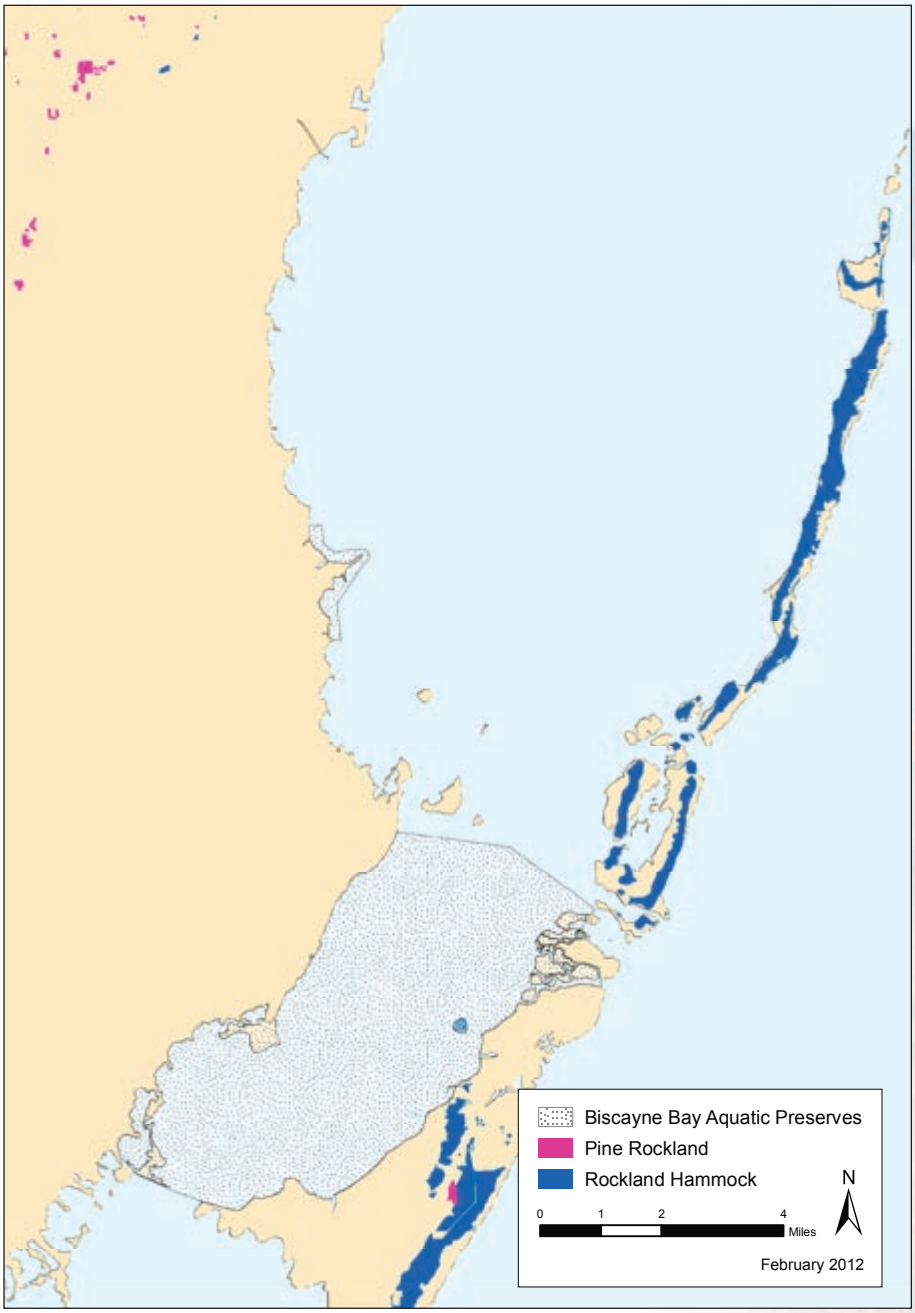
Beach Dune

Beach dune is a predominantly herbaceous community of wide-ranging coastal specialist plants on the vegetated upper beach and first dune above the beach (foredune). This community is usually built by seaoats (*Uniola paniculata*), a perennial rhizomatous grass, whose stems trap the sand grains blown off the beach, building up the dune by growing upward to keep pace

with sand burial. Other grasses that can tolerate some sand burial include bitter panicgrass (*Panicum amarum*) and saltmeadow cordgrass (*Spartina patens*). Camphorweed (*Heterotheca subaxillaris*) often grows with sea oats where sand burial is absent or moderate and seacoast marshelder (*Iva imbricata*), a succulent subshrub, is found at the seaward base of the foredune. These species may also occupy the seaward face and crests of taller backdunes or recent storm overwash plains where the sand is not stabilized by vegetation. Beach dune communities occurring along BBAP's boundaries occur within Oleta River State Park and Bill Baggs Cape Florida State Park. Within Oleta River State Park, the reclaimed narrow beach dune lies along the southeastern shoreline of a dredged lagoon. It was cleared of exotic vegetation and re-graded in 1988 to create a beach, swimming area and coastal berm. Today, beach sunflower (*Helianthus debilis*), railroad vine (*Ipomoea pes-caprae*), and necklace pod (*Sophora tomentosa*) occur in this area. At Bill Baggs Cape Florida State Park, the beach dune community parallels the Atlantic Ocean and runs approximately 1.2 miles from the Cape Florida lighthouse to the northern park boundary. Consisting of the wind-deposited foredune and the wave-deposited upper beach most of this beach dune was restored in 1987, as part of a larger project for the Village of Key Biscayne. All beach dune locations within BBAP are threatened by foot traffic from increased numbers of visitors each year. Signage and boardwalk areas may be needed in the future to reduce future impacts.

Coastal Berm

Coastal berm communities are found along low energy coastlines in South Florida and the Florida Keys. Coastal berm is a short forest or shrub thicket found on long narrow storm-deposited ridges of loose sediment formed by a mixture of coarse shell fragments, pieces of coralline algae, and other coastal debris. These ridges parallel the shore and may be found on the seaward edge or landward edge of the mangroves or further inland depending on the height of the storm surge that formed them. They range in height from 1 to 10 feet (.3 to 30.05 meters). Structure and composition of the vegetation is variable depending on height and time since the last storm event. Tree species may include gumbo limbo (*Bursera simaruba*), seagrape (*Coccoloba uvifera*), silver palm (*Coccothrinax argentata*), blolly (*Guapira discolor*), milkbark



Map 8 / Biscayne Bay Aquatic Preserves Florida Natural Areas Inventory Natural Communities- South

Table 2 / Summary of Natural Communities in Biscayne Bay Aquatic Preserves

FNAI Natural Community Type	#Acres	% of Area	Federal Rank	State Rank	Comments
Beach Dune	5.5	U	G4	S4	Active coastal dune with sand substrate; xeric; statewide; rare or no fire; marine influence; open herbaceous vegetation with no canopy; sea oats, railroad vine, bitter panicum, and/or mixed salt-spray tolerant grasses and herbs.
Coastal Berm	0.8	U	G3	S2	Old bar or storm debris with sand/shell substrate; xeric-mesic; southern peninsula and Keys; rare or no fire; marine influence; variable vegetation structure; mixed tropical herbs, shrubs, and trees.
Coastal Grasslands	U	U	G3	S2	Coastal flatland behind dunes with stable sand substrate; mesic-hydric; statewide excluding Keys; occasional fire; marine influence; herbaceous vegetation with no canopy; salt-tolerant grasses and herbs; sea oats, bitter panicum, camphorweed, hairawn muhly, Gulf bluestem.
Keys Tidal Rock Barren			G3	S3	Flatland with exposed limestone in supratidal zone; restricted to Keys; no fire; open, mainly herbaceous vegetation of upper salt marsh species and stunted shrubs and trees; buttonwood, christmasberry, perennial glasswort, saltwort, seashore dropseed, shoregrass.
Coastal Strand	U	U	G3	S2	Stabilized coastal dune with sand substrate; xeric; peninsula; rare fire; marine influence; primarily dense shrubs; saw palmetto in temperate coastal strand or seagrape and/or saw palmetto in tropical coastal strand.
Maritime Hammock	U	U	G3	S2	Stabilized coastal dune with sand substrate; xeric-mesic; statewide but rare in Panhandle and Keys; rare or no fire; marine influence; evergreen closed canopy; live oak, cabbage palm, red bay, red cedar in temperate maritime hammock; gumbo limbo, seagrape, and white or Spanish stopper in tropical maritime hammock.
Shell Mound	U	U			G2/S2) – Small hill of shells deposited by Native Americans; mesic-xeric; statewide; rare or no fire; marine influence; closed canopy of mixed hardwoods; soapberry, snowberry, white stopper.
Pine Rockland	U	U	G1	S1	Flatland with exposed limestone substrate; mesic-xeric; southern peninsula and Keys; frequent to occasional fire (3-7 years); open pine canopy with mixed shrubs and herbs in understory; South Florida slash pine, palms, mixed tropical and temperate shrubs, grasses, and herbs.
Rockland Hammock	U	U	G2	S2	Flatland with limestone substrate; mesic; southern peninsula and Keys; rare or no fire; closed canopy of evergreen mixed tropical hardwoods; gumbo limbo, pigeon plum, stoppers.
Mesic Flatwoods	U	U	G4	S4	Flatland with sand substrate; mesic; statewide except extreme southern peninsula and Keys; frequent fire (2-4 years); open pine canopy with a layer of low shrubs and herbs; longleaf pine and/or slash pine, saw palmetto, gallberry, dwarf live oak, wiregrass.
Marl Prairie	U	U	G3	S3	Flatland with marl over limestone substrate; seasonally inundated (<4 months); southern peninsula; frequent to occasional fire (2-10 years depending on density of herbs); purple muhly, sawgrass (stunted), spreading beaksedge, black bogrush, Florida little bluestem, and/or mixed grasses, sometimes with dwarf cypress.
Consolidated Substrate	U	U	G3	S3	Expansive subtidal, intertidal and supratidal area composed primarily of nonliving compacted or coherent and relatively hard, naturally formed mass of mineral matter (e.g., coquina limerock and relic reefs); octocorals, sponges, stony corals, nondrift macrophytic algae, blue-green mat-forming algae and seagrasses sparse, if present.
Unconsolidated Substrate	U	U	G5	S5	Expansive subtidal, intertidal and supratidal area composed primarily of loose mineral matter (e.g., coralgal, gravel, marl, mud, sand and shell); octocorals, sponges, stony corals, nondrift macrophytic algae, blue-green mat-forming algae and seagrasses sparse, if present.

Table 2 / Summary of Natural Communities in Biscayne Bay Aquatic Preserves

FNAI Natural Community Type	#Acres	% of Area	Federal Rank	State Rank	Comments
Coral Reef	U	U	G2	S1	Expansive subtidal area with elevational gradient or relief and occupied primarily by living sessile organisms of the Class Hydrozoa (e.g., fire corals and hydrocorals) and Class Anthozoa, Subclass Zoantharia (e.g., stony corals and black corals); includes deepwater bank reefs, fringing barrier reefs, outer bank reefs and patch reefs, some of which may contain distinct zones of assorted macrophytes, octocorals, & sponges.
Mollusk Reef	U	U	G3	S3	Substantial subtidal or intertidal area with relief from concentrations of sessile organisms of the Phylum Mollusca, Class Bivalvia (e.g., molluscs, oysters, & worm shells); octocorals, sponges, stony corals, macrophytic algae and seagrasses sparse, if present.
Octocoral Bed	U	U	G2	S1	Expansive subtidal area occupied primarily by living sessile organisms of the Class Anthozoa, Subclass Octocorallia (e.g., soft corals, horny corals, sea fans, sea whips, and sea pens); sponges, stony corals, nondrift macrophytic algae and seagrasses spares, if present.
Sponge Bed	U	U	G2	S2	Expansive subtidal area occupied primarily by living sessile organisms of the Phylum Porifera (e.g., sheepswool sponge, Florida loggerhead sponge and branching candle sponge); octocorals, stony corals, nondrift macrophytic algae and seagrasses sparse, if present.
Worm Reef	U	U	G1	S1	Substantial subtidal or intertidal area with relief from concentrations of sessile, tubicolous organisms of the Phylum Annelida, Class Polychaeta (e.g., chaetopterids and sabellarids); octocorals, sponges, stony corals, macrophytic algae and seagrasses sparse, if present.
Algal Bed	U	U	G3	S2	Expansive subtidal, intertidal or supratidal area, occupied primarily by attached thallophytic or mat-forming prokaryotic algae (e.g, halimeda, blue-green algae); octocorals, sponges, stony corals and seagrasses sparse, if present.
Seagrass Bed	48,255.21	U	G2	S2	Expansive subtidal or intertidal area, occupied primarily by rooted vascular macrophytes, (e.g., shoal grass, halophila, widgeon grass, manatee grass and turtle grass); may include various epiphytes and epifauna; octocorals, sponges, stony corals, and attached macrophytic algae sparse, if present.
Salt Marsh	U	U	G5	S4	Estuarine wetland on muck/sand/or limestone substrate; inundated with saltwater by daily tides; statewide; occasional or rare fire; treeless, dense herb layer with few shrubs; saltmarsh cordgrass, needle rush, saltgrass, saltwort, perennial glasswort, seaside oxeye.
Mangrove Swamp	U	U	G5	S4	Estuarine wetland on muck/sand/or limestone substrate; inundated with saltwater by daily tides; central peninsula and Keys; no fire; dominated by mangrove and mangrove associate species; red mangrove, black mangrove, white mangrove, buttonwood.
Composite Substrate	U	U	G3	S3	Expansive subtidal, intertidal, or supratidal area, occupied primarily by natural community elements from more than one natural community category (e.g., grass bed and algal bed species; octocoral and algal bed species); includes both patchy and evenly distributed occurrences.

Note: *Acreage of above habitats only accounts for what FNAI has documented within BBAP and does not provide habitat information for all of the area comprised within the BBAP boundaries.*

Coastal grasslands at Bill Baggs Cape Florida State Park. Largely a habitat type found on the gulf coast of Florida, coastal grasslands are unique in Southeast Florida where much of the uplands along the shoreline have been developed.

(*Drypetes diversifolia*), sevenyear apple (*Genipa clusiifolia*), and poisonwood (*Metopium toxiferum*). Characteristic tall shrub and short tree species include Spanish stopper (*Eugenia foetida*), hog plum (*Ximenia americana*), white indigoberry (*Randia aculeata*), Florida Keys blackbead (*Pithecellobium keyense*), and saffron plum (*Sideroxylon celastrinum*). Coastal berms share many of the same species with coastal strand communtites and may be confused with maritime hammock communities.

Coastal Grasslands

Coastal grassland is a predominantly herbaceous community occupying the drier portions of the transition zone between beach dunes on the immediate coast and communities dominated by woody species, such as coastal strand or maritime hammock, further inland. It occurs primarily on the broader barrier islands and capes along the sandy coasts of Florida. The specialized dune building grasses of the beach dune community, seaoats (*Uniola paniculata*), bitter panicgrass (*Panicum amarum*), and saltmeadow cordgrass (*Spartina patens*), are usually present, along with a variety of other herbaceous species typically found on more stable soils, such as bluestem grasses (*Andropogon* spp., *Schizachyrium* spp.), camphorweed (*Heterotheca subaxillaris*), and earleaf greenbrier (*Smilax auriculata*) (Johnson and Muller, 1993a). Coastal grassland develops in two ways: either as a barrier island builds seaward, developing new dune ridges along the shore which protect the inland ridges from sand burial and salt spray, or as a beach recovers after storm overwash and a new foredune ridge builds up along the shore, protecting the overwashed area behind it from sand burial and salt spray. Distance from the coast and the physical barrier of the first dune ridge above the beach (foredune) diminish the intensity of sand burial and salt spray, which affect the coastal grassland community to a lesser extent than they do the beach dune community. If storm waves breach the foredune and spread sand over the coastal grassland, a beach dune community will re-colonize at first. Fertilization from piles of seaweed washed up by the storm helps to speed plant growth and the re-colonization process. Once a new foredune ridge builds up above the beach and plant cover inhibits further sand movement behind this ridge, other herbaceous species can colonize and occur with the coastal pioneer species to form the coastal grassland community. As time passes, absent further storms, the coastal grassland community itself will gradually be replaced by woody species to form scrub, coastal strand, or maritime hammock communities. Coastal grassland occurs within Bill Baggs Cape Florida State Park and until the 1980s, foot and vehicle traffic routinely occurred in this community, resulting in patches and tracks of bare ground within this area in the park. The park installed boardwalks and other control measures and gradually excluded visitors from the coastal grassland community. Today, it is a healthy community that merges into the coastal strand community.

Keys Tidal Rock Barren
Keys tidal rock barren is a flat rockland in the supratidal zone with much exposed and eroded limestone and a sparse cover of stunted halophytic herbs and shrubs. The limestone has a white color, in contrast to the grey or black color of the limestone exposed in lower tidal zones (Stephenson & Stephenson, 1950), and it is inundated by salt water only during the extreme equinoctial high tides (Ross, O'Brian, & Flynn, 1992). Keys tidal rock barren occurs above the daily tidal range, but is subject to flooding by seawater during extreme tides and storm events. Salt spray from coastal winds, as well as shallow soils, may limit height growth of woody plants. Aside from bare rock substrate, discontinuous patches of thin marl soils may be present. Depressions with deeper peat and mud soils support mangrove swamp and salt marsh communities, dominated respectively by mangroves or Gulf cordgrass (*Spartina spartinae*) (Ross et al., 1992). At its seaward edge, Keys tidal rock barren borders regularly inundated mangrove swamp. Areas with greater than 50 percent cover of mangroves, either normal height or dwarfed, are considered mangrove swamp; areas with less than 50 percent cover of mangroves are Keys tidal rock barren. Dagny Johnson Key Largo Hammock Botanical State Park, adjacent to Card Sound and north of Key Largo contains one of the best examples of this community.

Coastal Strand
Coastal strand is an evergreen shrub community growing on stabilized coastal dunes in the peninsula of Florida, often with a smooth canopy due to pruning by salt spray. It usually develops as a band between dunes dominated by sea oats (*Uniola paniculata*) along the immediate coast, and maritime hammock, scrub, or mangrove swamp communities further inland. On broad barrier islands or prograding (depositing sediments) coasts, it may also occur as patches of shrubs within a coastal grassland matrix. Along the Atlantic coast, species composition of coastal strand changes from north to south. Bill Baggs Cape Florida State Park manages the coastal strand community within the park through restoration efforts and planting native trees.

Those looking for a passive way to enjoy Biscayne Bay can find reprieve from the heat by kayaking or canoeing down a tidal creek. Photo by Paul Marcellini.

Maritime Hammock
Maritime hammock is a predominantly evergreen hardwood forest growing on stabilized coastal dunes lying at varying distances from the shore. Species composition changes from north to south with temperate species dominating from the Georgia border to Cape Canaveral and tropical species increasingly prevalent south of Cape Canaveral. Temperate and tropical maritime hammocks serve as crucial resting and foraging areas for songbirds on their fall and spring migrations to and from the tropics (Cox, 1988). The uplands within the aquatic preserves are on publicly owned islands and include the imperiled maritime hammock that is natural or restored, ruderal areas with invasive exotics, and developed areas such as marinas providing access. Maritime Hammock is characterized as a narrow band of hardwood forest lying just inland of the coastal strand community. Migrating birds rely on these forests for food and shelter following trans-oceanic or trans-gulf 12 migrations. Although it originally occurred in virtually continuous bands with coastal strand, maritime hammock is now dissected into short strips by development and is rapidly disappearing.

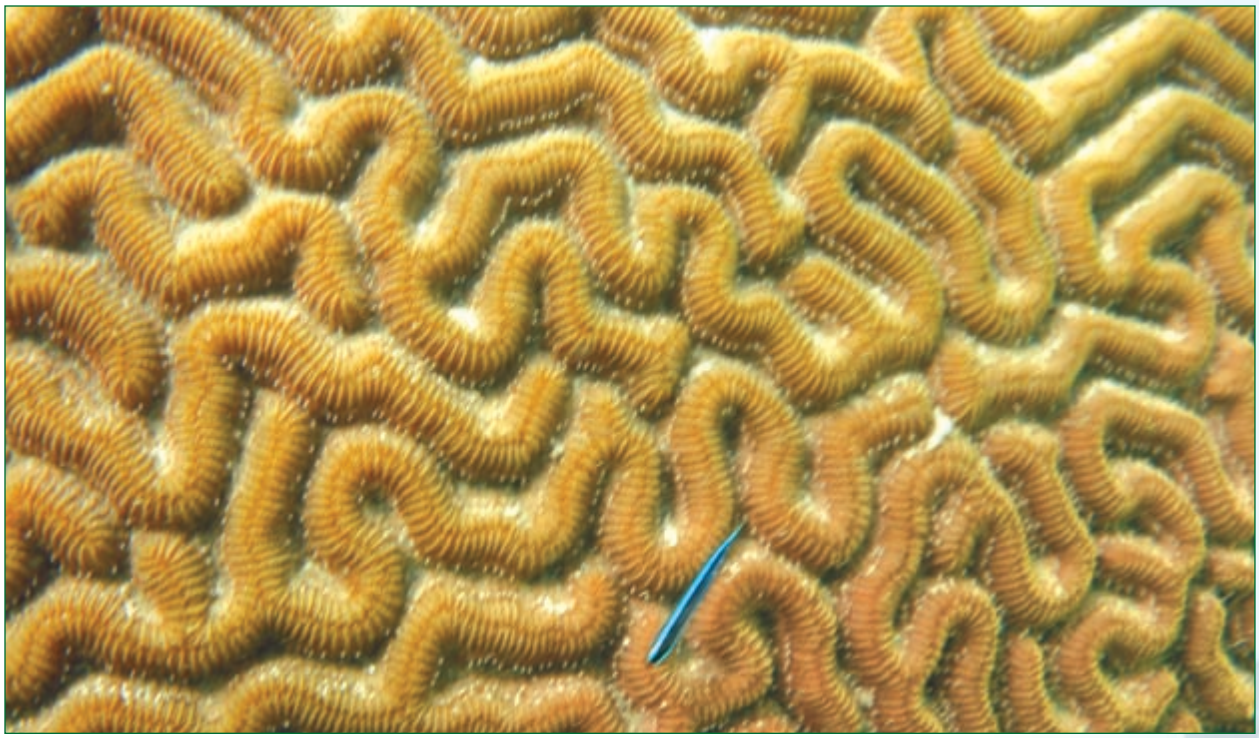
Shell Mound
Shell mounds are small hills, usually in coastal locations, composed entirely of shells (clams, oysters, whelks) discarded by generations of Native Americans, which support an assemblage of calciphilic (prefers lime or alkaline soils) plant species. Archaeological evidence indicates they were occupied at the time Europeans first landed in Florida. Several are now surrounded by mangroves, evidence that they were built when sea level was lower than today. A rich calcareous soil develops on the deposited shells which supports a diverse hardwood forest on undisturbed mounds. Central Florida mounds are often characterized by tropical species occurring north of their normal range. Biscayne Bay has numerous examples of shell mound communities that remain from the Tequesta Native American tribe along the shoreline of the bay (See Appendix B.7).

Pine Rockland
Pine rockland is characterized by an open canopy of South Florida slash pine (*Pinus elliottii* var. *densa*) with a patchy understory of tropical and temperate shrubs and palms and a rich herbaceous layer of mostly perennial species including numerous species endemic to South Florida. Outcrops of weathered oolitic limestone, known locally as pinnacle rock, are common, and solution holes may be present. This subtropical, pyrogenic flatland can be mesic or xeric depending on landscape position and associated natural communities. There are differences in species composition between the pine rocklands found in the Florida Keys and the mainland. Pine rockland is globally imperiled and extremely limited in distribution. In South Florida, pine rockland occurs along the southern extreme of the Atlantic Coastal Ridge, or the Miami Rock Ridge, which extends from around downtown Miami southwest to Long Pine Key in Everglades National Park.

Rockland Hammock
Rockland hammock is a rich tropical hardwood forest on upland sites in areas where limestone is very near the surface and often exposed. The forest floor is largely covered by leaf litter with varying amounts of exposed limestone and has few herbaceous species. Rockland hammock is a rare community that is susceptible to fire, frost, canopy disruption, and ground water reduction. Historically rockland hammocks in South Florida evolved with fire in the landscape, fire most often extinguishing near the edges when it encounters the hammock's moist microclimate and litter layer, or a natural moat that can form around hammocks in the Everglades caused by the dissolution of limestone (Whitney et al., 2004). However, rockland hammocks are susceptible to damage from fire during extreme drought or when the water table is lowered. In these cases fire can cause tree mortality and consume the organic soil layer (Olmsted, Loope & Hilsenbeck, 1980). Matheson Hammock State Park, Everglades National Park and John Pennekamp Coral Reef State Park boast exemplary rockland hammock communities.

Mesic Flatwoods
Mesic flatwoods is characterized by an open canopy of tall pines and a dense, low ground layer of low shrubs, grasses, and forbs. Longleaf pine (*Pinus palustris*) is the principal canopy tree in northern and central Florida, and South Florida slash pine (*Pinus elliottii* var. *densa*) forms the canopy south of Lake Okeechobee. Mesic flatwoods is the most widespread natural community in Florida, covering the flat sandy terraces left behind by former high stands of sea level during the Plio-Pleistocene. Drainage in this flat terrain can be impeded by a loosely cemented organic layer formed within several feet of the soil surface. The soils are alternately droughty during dry periods and saturated, or even inundated, after heavy rains. Unlike those of sandhill or scrub communities, plants of mesic flatwoods must be able to withstand the stress of soil saturation or inundation during the wet part of the year, as well as dry conditions at other times. Mesic flatwoods require frequent fire; all of its constituent plant species recover rapidly from fire and several species require fire to reproduce. South Florida slash and longleaf pines have thick bark to protect them from fire and their seeds need the mineral soil and open sunlight that fire provides to germinate; both form a grass stage for several years after germination that is resistant to fire.

Marl Prairie
Marl prairie is a sparsely vegetated (20-40% cover), graminoid-dominated community found on marl substrates in South Florida. It is seasonally inundated (two to four months) to a shallow depth averaging about 8 inches. It occupies large areas at intermediate elevations between marshes or dome and strand swamps with longer hydroperiod of six to twelve months, and pinelands or oak-palm hammocks that are seldom flooded (USFWS, 1999). Marls are fine white calcareous muds formed from calcite precipitated by a mixture of green algae, blue-green algae, and diatoms, known as periphyton. These soils are highly alkaline and impermeable, sealing off the underlying limestone and causing water to pond during the wet season. In the rocky glades region of the southeastern Everglades marl prairies occur on exposed limestone bedrock. Southeastern Everglades National Park is home to exemplary marl prairie community.



The 4,000 acres offshore of Bill Baggs Cape Florida State Park that partly comprise the Biscayne Bay Aquatic Preserves provides habitat for flora and fauna not seen within the estuary. Here, boulder brain coral growing on the rocky shoreline is being fed on by a neon blue goby - a tell tale sign of a healthy piece of coral.

In addition, a large portion of the county's Environmentally Endangered Lands' South Dade Wetlands Preserve is also marl prairie (Cynthia Guerra, personal communication).

Consolidated Substrates

The distinction between the marine and estuarine natural communities is often subtle, and the natural communities types found under these two community categories have the same descriptions. For these reasons they have been grouped together – subtidal, intertidal and supratidal zones of the sea, landward to the point at which seawater becomes significantly diluted with freshwater inflow from the land. Marine and estuarine consolidated substrates are mineral based natural communities generally characterized as expansive, relatively open areas of subtidal, intertidal, and supratidal zones which lack dense populations of sessile plant and animal species. Consolidated substrates are solidified rock or shell conglomerates and include coquina, limerock or relic 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). Limerock substrates occur as outcrops of bedded sedimentary deposits consisting primarily of calcium carbonate. This consolidated substrate is more widespread than coquina substrate and can be found in a patchy distribution under both marine and estuarine conditions from North Florida to the lower-most keys in Monroe County. Relic reefs, the skeletal remains of formerly living reefs, are more limited in distribution than limerock outcrops but more common than coquina substrate. Consolidated substrates are important in that they form the foundation for the development of other marine and estuarine natural communities when conditions become appropriate. Consolidated substrate communities are easily destroyed through siltation or placement of fill, and deliberate removal by actions such as blasting or nondeliberate destruction by forces such as vehicular traffic. Another type of disturbance involves the accumulation of toxic levels of heavy metals, oils, and pesticides in consolidated substrates. Significant amounts of these components in the sediments will kill the infauna, thereby eliminating a food source for certain fishes, birds and other organisms. A film of pollutants engulfing consolidated substrates can render these areas unsuitable for colonization by marine and estuarine flora and fauna.

Such problems occur in some of the major port cities, such as Miami, in areas where there is heavy industrial development, and along major shipping channels where oil spills are likely to occur. Hardbottom and algal beds are important benthic areas that transition into seagrass beds. Hardbottom areas also known as consolidated marine sediments contain solitary stony corals, gorgonians, and sponges.

Unconsolidated Substrates

Marine and estuarine unconsolidated substrates are mineral based natural communities generally 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 (e.g., tube worms, sand dollars, mollusks, isopods, amphipods, burrowing shrimp, and an assortment of crabs). In general, marine and estuarine unconsolidated substrate communities are the most widespread communities in the world. Unconsolidated sediments in BBAP originate from calcium carbonate depositions of plants or animals (e.g., coralgal, marl and shell substrates). Unconsolidated substrate communities are associated with and often grade into beach dunes, salt marshes, mangrove swamps, seagrass beds, coral reefs, mollusk reefs, worm reefs, octocoral beds, sponge beds, and algal beds. Unconsolidated substrate communities that are composed chiefly of sand (e.g., sand beaches) are the most important recreational areas in Florida, attracting millions of residents and tourists annually. This community is resilient and may recover from recreational disturbances. Generally these areas are easily re-colonized either by the same organisms or a series of organisms that eventually results in the community returning to its original state once the disturbance has ceased. Epifaunal and infaunal species include hundreds of species of marine worms, crustaceans, fish, and mollusks. Although sometimes regarded as “Barren” on maps or descriptions of the bay bottom, never are unconsolidated substrates devoid of life in Biscayne Bay.

Coral Reef

Marine and estuarine coral reefs are faunal based natural communities generally characterized as expansive conglomerates of hard, sessile, limestone-building coral occurring in warm subtidal waters. Coral reefs are formed from a diverse assemblage of carbonate precipitating organisms of the phylum Cnidaria (*Coelenterata*). Two classes of Cnidaria are the principal reef builders. Hydrozoa, the class which includes coral, are important fast growing, colonial reef builders that are capable of withstanding temperate water temperatures. Fire coral are distributed as far north in Florida as Tarpon Springs in the Gulf of Mexico and at least to Cape Kennedy in the Atlantic Ocean. The second class of reef-building Cnidarians are the Anthozoa. This class is divided into two subclasses, the Octocorallia (e.g., soft coral, sea fans and sea feathers) and the Zoantharia (e.g., true stony coral, and colonial anemones). The Octocorallia represent the group of organisms comprising octocoral bed communities. The Scleractinians, or true stony coral, are the primary hermatypic or reef building coral that belong in this subclass. Within the BBAP, stony corals are found in individual colonies, not in true reef formations, except the offshore portion east of Key Biscayne where patch reefs have been identified (Brian Walker). Lesser starlet coral (*Siderastrea radians*) dominates the northern part of the BBAP. In the Card Sound portion the following species have been observed: rose coral (*Manicina areolata*), fire coral (*Millepora alcicornis*), finger coral (*Porites porites*), massive starlet coral (*Siderastrea siderea*) and knobby star coral (*Solenastrea hyades*) (Roessler, Cantillo, & Garcìa-Gómez, 2002).

Mollusk Reef

Marine and estuarine mollusk reefs are faunal based natural communities typically characterized as expansive concentrations of sessile mollusks occurring in intertidal and subtidal zones to a depth of 40 feet (12.2 meters). In Florida, the most developed mollusk reefs are generally restricted to estuarine areas and are dominated by the American oyster. Mollusk reefs that are exposed during low tides (e.g., coon oysters) are frequented by a multitude of shorebirds, wading birds, raccoons, and other vertebrates. Mollusk reefs occupy a unique position among estuarine invertebrates and have been an important human food source since prehistoric times. They present a dynamic community of estuarine ecology, forming refugia, nursery grounds, and feeding areas for a myriad of other estuarine organisms. The mollusk reef is the rarest natural community in BBAP. American oysters are found attached to mangrove roots and structures built in the bay, including docks and pilings. But oyster reef formation is limited to upstream areas of the Oleta River possibly due to increased salinity.

Octocoral Reef

Marine and estuarine octocoral beds are soft faunal based natural communities characterized as large populations of sessile invertebrates of the Class Anthozoa, Subclass Octocorallia, Orders Gorgonacea and Pennatulacea. The dominant animal species are soft corals such as gorgonians, sea fans, sea feathers, sea fingers, sea pansies, sea plumes, sea rods, and sea whips. This community is confined to the subtidal zone since the sessile organisms are highly susceptible to desiccation. Other sessile animals typically occurring in association with these soft corals are sea anemones. An assortment of non-sessile benthic and pelagic invertebrates and vertebrates (e.g., sponges, mollusks, tube worms,

burrowing shrimp, crabs, isopods, amphipods, sand dollars, and fishes) are associated with octocoral beds. Specific species of interest living on or among the soft corals include the flamingo tongue shell, the purple shrimp, and the basket starfish. Sessile and drift algae can also be found scattered throughout octocoral beds. Octocoral beds require hard bottom (consolidated) substrate (i.e., coquina, limerock, relic reefs) on which to anchor. Hard bottom substrate occurs sparsely throughout Florida in marine and estuarine areas; however, soft corals prefer the warmer waters of the southern portion of the state, severely limiting the distribution (Roessler, et al., 2002). In the northern part of the BBAP purple sea fans (*Pseudoptergorgia acerosa*) and sea plumes (*Pterogorgia sp.*) are observed at limited sites in northern Biscayne Bay. In the Card Sound portion, the following species have been observed: sea fan (*Erythropodium polyanthes*), purple sea plume, sea plume, and orange spiny sea rod (*Muricea elongate*).

Sponge Bed

Marine and estuarine sponge beds are soft faunal based natural communities characterized as dense populations of sessile invertebrates of the phylum Porifera, Class Demospongiae. The dominant animal species are sponges such as branching candle sponge, Florida loggerhead sponge and sheepswool sponge. Although concentrations of living sponges can occur in marine and estuarine intertidal zones, sponge beds are confined primarily to subtidal zones. Other sessile animals typically occurring in association with these sponges are stony corals, sea anemones, mollusks, tube worms, isopods, amphipods, burrowing shrimp, crabs, sand dollars, and fishes. Sessile and drift algae can also be found scattered throughout sponge beds. Sponge beds require hard bottom (consolidated) substrate (i.e., coquina, limerock, relic reefs) on which to anchor. Hard bottom substrate occurs sparsely throughout Florida in marine and estuarine areas; however, sponges prefer the warmer waters of the southern portion of the state, significantly limiting the distribution. Sponge beds may grade into other marine and estuarine hard bottom subtidal, intertidal and supratidal communities (i.e., consolidated substrate, sponge bed, coral reef, mollusk reef, worm reef, hophytic algal bed) as well as soft bottom communities (i.e., unconsolidated substrate, ammophytic algal bed, seagrass bed, salt marsh, tidal swamp). Management considerations should include locating all true sponge beds within the state and providing protection for them from external degradation. Primary threats to sponge beds include siltation from beach “renourishment” or “restoration” projects, anchor damage by nautical craft, trawling by commercial fishermen, collecting for tourist-oriented trade, and water pollution, particularly oil spills. Sponging has been prohibited inside of Biscayne National Park since 1981, when the park was established and was no longer Biscayne National Monument.

Seagrass Beds

Marine and estuarine seagrass beds are floral based natural communities typically 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. The three most common species of seagrasses in Florida are turtle grass, manatee grass, and shoal grass. Nearly pure stands of any one of these species can occur, but mixed stands are also common. Species of *Halophila* may be intermingled with the other seagrasses, but species of this genus are considerably less common than turtle grass, manatee grass and shoal grass. Widgeon grass can also be found occurring with the previously listed seagrasses although they occur primarily under high salinities while widgeon grass occurs in areas of lower salinity. Attached to the seagrass leaf blades are numerous species of epiphytic algae and invertebrates. Together, seagrasses and their epiphytes serve as important food sources for manatees, marine turtles, and many fish, including spotted sea trout (*Cynoscion nebulosus*), spot (*Leiostomus xanthurus*), and sheepshead (*Archosargus probatocephalus)*. The dense seagrasses also serve as shelter or nursery grounds for many marine invertebrates, and fish such as tarpon (*Megalops atlanticus*), bonefish (*Albula vulpes*), seahorses (*Hippocampus, spp.),* and Florida pompano (*Trachinotus carolinus*). Marine and estuarine seagrass beds occur most frequently on unconsolidated substrates of marl, muck or sand, although they may also occur on other unconsolidated substrates. The dense blanket of leaf blades reduces the wave-energy on the bottom and promotes settling of suspended particulates. The dense roots and rhizomes of the seagrasses stabilize settled particles. Thus, marine and estuarine seagrass beds are generally areas of soil accumulation. Seagrasses occur most frequently in areas with moderate current velocities, as opposed to either low or high velocities. Although marine and estuarine seagrass beds are most commonly submerged in shallow subtidal zones, they may be exposed for brief periods of time during extreme low tides. One of the more important factors influencing seagrass communities is the amount of solar radiation reaching the leaf blades. In general, the water must be fairly clear because turbidity blocks essential light necessary for photosynthesis. The rapid growth rate of seagrass under optimum conditions rivals that of most intensive agricultural practices, without energy input from man. Marine and estuarine seagrass beds are often associated with and grade into unconsolidated

substrate, coral reefs, mangrove swamps, and salt marshes, but may also be associated with any other marine and estuarine natural community. Marine and estuarine seagrass beds are extremely vulnerable to human impacts. Many have been destroyed through dredging and filling activities or have been damaged by sewage outfalls and industrial wastes. In these instances, the seagrass beds are either physically destroyed, or succumb as a result of decreased solar radiation resulting from increased water turbidity. Seagrass beds are also highly vulnerable to oil spills. Low concentrations of oil are known to greatly reduce the ability of seagrasses to photosynthesize. Marine and estuarine seagrass beds are susceptible to long-term scarring cuts from boat propellers, anchors and trawls. Such gouges may require many years to become revegetated. When protected from disturbances, seagrasses have the ability to regenerate and recolonize areas; however, the best management is to preserve and protect marine and estuarine seagrass beds in their natural state. Lush seagrass beds form grassy undersea meadows throughout Biscayne Bay. There are six species of seagrasses found within BBAP. They are: turtle grass (*Thalassia testudinum)*; manatee grass (*Syringodium filiforme)*; shoal grass (*Halodule wrightii)*; paddle grass (*Halophila decipiens)*; star grass (*Halophila engelmannii)*; and Johnson's seagrass (*Halophila johnsonii*). In addition, a seagrass associate, widgeon grass, is also found within BBAP waters. It is not considered a true sea grass because it grows in waters that are either fresh or salty. Seagrasses are direct and indirect food sources for the endangered Florida manatee and green sea turtle (*Chelonia mydas*), as well as numerous invertebrate species. Johnson's seagrass became the first marine grass species to be listed on the Endangered Species Act (ESA) when it was listed as threatened in 1993. The Johnson's Seagrass Recovery Team working group was formed by NOAA's National Marine Fisheries Service to lead to the species' recovery. The worldwide distribution of Johnson's seagrass is from northern Biscayne Bay, through Broward and Palm Beach inshore waters, to St. Lucie Inlet of the Indian River in Martin County. BBAP from the Rickenbacker Causeway northward is listed as part of the species' critical habitat. BBAP's Miami River basin contains the Bill Sadowski Critical Wildlife Area. This is considered the southernmost occurrence of Johnson's seagrass and is especially significant in managing a wide variety of species.

Algal Beds

Marine and estuarine algal beds are floral based natural communities characterized as large populations of nondrift macro or micro algae. The dominant algal genera include *Calothrix, Caulerpa, Dictyota, Gracilaria, Halimeda, Laurencia, Pennicilus*, and *Sargassum*. 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 associated with algal beds will vary based on bottom type. For algal beds associated with hard bottom substrate, faunal populations will be similar to populations associated with octocoral beds and sponge beds. Those associated with soft bottom substrate may have similar benthic and pelagic species in addition to infauna species. Recent research has shown that algal beds provide critical habitat for juvenile spiny lobsters, a species of great commercial importance. Marine and estuarine algal beds may grade into seagrass beds, salt marsh, mangrove swamp, or many of the other marine or estuarine natural communities. Supratidal algal beds (e.g., blue-green algal mats) may grade into various coastal palustrine (non-tidal wetlands) and terrestrial natural communities. Distribution information for algal beds is lacking. The location of major beds must be determined before this natural community can be managed adequately. Existing state dredge and fill laws provide specific protection for marine and estuarine seagrass beds but not for algal beds. The primary threat to marine and estuarine algal beds are dredging and filling activities that physically remove or bury the beds. Recognizing the ecosystem services provided by marine algae in assessments of sites where submerged lands will be impacted will allow for more comprehensive management of the preserves resources. Other damage occurs from increased turbidity in the water column that reduces available light; pollution, particularly from oil spills; and damage from boats.

Salt Marsh

Salt marsh is a largely herbaceous community that occurs in the portion of the coastal zone affected by tides and seawater and protected from large waves, either by the broad, gently sloping topography of the shore, by a barrier island, or by location along a bay or estuary. The width of the intertidal zone depends on the slope of the shore and the tidal range. Salt marsh may have distinct zones of vegetation; each dominated by a single species of grass or rush. Salt marsh soils range from deep mucks with high clay and organic content in the deeper portions to silts and fine sands in higher areas. A large number of rare animals are found in salt marshes. The American crocodile utilizes salt marsh as well as mangrove swamp at the south end of the Florida peninsula, in the Florida Keys, and on islands in Florida Bay. Several bird species nest in salt marshes and are dependent on them for their entire life cycle. Among wading birds that are state and federally listed, the reddish egret (*Egretta rufescens*), tricolored heron (*Egretta tricolor*), and roseate spoonbill

(*Platalea ajaia*) favor coastal flats and marshes. Other wading birds that frequent coastal marshes include white ibis (*Eudocimus albus*), little blue heron (*Egretta caerulea*), and, in South Florida, great white heron (*Ardea herodias occidentalis*). Several rare mammals utilize the infrequently flooded upper marsh habitat, especially areas with saltgrass (*Distichlis spicata*). The common rice rat (*Oryzomys palustris*), which is found in salt marshes throughout the southeast, has two rare varieties in Florida: the Sanibel Island rice rat and the key rice rat. Several subspecies of mink utilize salt marshes in Florida, such as the southern mink *(Neovison vison)* found in the Everglades region, near Biscayne Bay. Little salt marsh and no freshwater marsh remain adjacent to Biscayne Bay. Some salt marsh is remnant in the Deering Estate North Addition, but additional marsh at the Estate and adjacent to Oleta River State Park are restored areas. Freshwater marsh has been lost due to saltwater intrusion and a reduction in the water table. Historically freshwater flowed through transverse glades and over shallow falls of the coastal ridge. The construction of canals and dredging of inlets has contributed to the bay's transition from a freshwater estuary to a marine lagoon. The wetlands on the western mainland adjacent to Card Sound have been described as having a "white zone" with reduced productivity due to a lack of freshwater flow. This area has been targeted for additional freshwater flow by CERP, from culverts breaching a levee and from a spreader canal from C-111. According to CERP, the spreader canal will improve water flow patterns in the Southern Glades and Model Lands Basin, adjacent to the Card Sound and southern Biscayne Bay. This will also contribute to the return of historical vegetation patterns and to restore historical sloughs with associated tributaries.

Mangrove crabs are a prey item for some marine birds. Research suggests that these crabs play an integral role in breaking down mangrove leaf litter, helping to recycle nutrients in the ecosystem.

Mangrove Swamp

Mangrove swamp is a dense forest occurring along relatively flat, low wave energy, marine and estuarine shorelines. The dominant plants of mangrove swamp are red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erectus*). Red mangrove often dominates the lowest (or deep-water) zone, followed by black mangrove in the intermediate zone, and white mangrove and buttonwood in the highest, least tidally-influenced zone. The density and height of mangroves and the diversity of associated herbaceous species can vary considerably within a mangrove swamp. Mangroves typically occur in dense stands but may be sparse, particularly in upper tidal reaches where salt marsh species predominate. Soils are generally anaerobic and are saturated with brackish water at all times, becoming inundated during high tides. Odum, McIvor, and Smith (1982) explain mangrove swamps occur on a wide variety of soils, ranging from sands and mud to solid limestone rock. Soils in south Florida are primarily calcareous marl muds or calcareous sands and, along the central Florida coastline, siliceous sands (Odum et al. 1982). In older mangrove swamps containing red mangroves, a layer of peat can build up from decaying plant material (mostly red and black mangrove roots), covering the soil (Odum et al., 1982). Black and white mangroves both may produce pneumatophores which are specialized aerial roots that enable plants to breathe air in habitats with waterlogged soil. The mangroves lining Biscayne Bay were used by ancient civilizations, dating back to the Glades cultures, 3,000 years ago. Mangroves provide protected nursery habitat for numerous recreational and commercial fish and invertebrates in Biscayne Bay including snook, tarpon, oysters, crabs, and shrimp. Large-scale clearance of these trees around Biscayne Bay did not begin until after the railroad arrived and the City of Miami incorporated in 1896.

Composite Substrate

Marine and estuarine 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 a limerock outcrop; algae and seagrasses scattered over a sand bottom; and patch reefs throughout a coralgal bottom. Any of the remaining marine and estuarine 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.

Ruderal/Disturbed Lands

Most of the islands within BBAP were formed from dredged materials and can be classified as either maritime hammock, ruderal or developed. Many communities have been severely altered by human activity and have usually been overtaken by exotic vegetation. Ruderal sites in and adjacent to BBAP are usually the result of deposition of dredged spoil material. Spoil islands are sensitive to infestation by invasive, exotic plants including Australian pines (*Casuarina spp.)* and Brazilian peppers (*Schinus teribinthifolius*). MDC Permitting, Environment, and Regulatory Affairs (PERA) has removed exotics from at least 10 of these islands within the northern part of the bay (Milano, 1999a). Native plants were replanted on the islands and trash pickup contracts continue to remove wastes from weekend users. In the northern area of the aquatic preserve, Sandspur Key, Bird Key, Brickell Key, and Belle Isle are thought to have begun as natural islands. All four have been altered by the addition of dredged material, but Sandspur and Bird Keys remain natural with both native and exotic plant cover. Sandspur is heavily visited by recreational boaters within Oleta River State Park and located just inside Baker's Haulover Inlet. Bird Key, just east of the mouths of the Little River, is the only pelican rookery left within the aquatic preserve. Contrastingly, both Brickell Key at the mouth of the Miami River and Belle Isle, the easternmost island on the Venetian Causeway, have extensive real estate developments. In the aquatic preserve's central area, Chicken Key and Fair Isle have had similar contrasting fates. Chicken Key is a bird rookery about 1 mile offshore of the Deering Estate that was impacted by the 16-foot storm tides during Hurricane Andrew in August of 1992. PERA restored the island afterwards and it continues to serve as a bird rookery. Fair Isle was expanded by dredge material and developed into Grove Isle. A marina and several residential high-rise structures are built on this island, which is just north of the Coconut Grove section of Miami. In Card Sound, the aquatic preserve includes several publicly owned natural islands to the north of Key Largo. Most of them are mangrove islands, but some have maritime hammock. Management for these islands is conducted by either John Pennekamp Coral Reef State Park personnel or the Crocodile Lake National Wildlife Refuge manager.

Native Species

The rich fauna found in Biscayne Bay results from the diverse habitats found in the bay. Not only does the bay provide habitat, but it also provides links in food webs, which benefit the entire Biscayne Bay ecosystem. Seagrass habitat covering the bottom of BBAP serves as a food source for the Florida manatee and as nursery grounds for several important species of fish and invertebrates. Corresponding fish fauna include bonefish (*Albula vulpes*), ladyfish (*Bodianus rufus)*, pompano (*Trachinotus carolinus)*, permit (*Trachinotus falcatus*), spotted sea trout (*Cynoscion nebulosus*), silver perch (*Bairdiella chrysoura)*, hogfish (*Lachnolaimus maximus*), Nassau grouper (*Epinephelus striatus*), red grouper (*Epinephelus morio*), black grouper (*Mycteroperca bonaci*), gag (*Mycteroperca microlepis)*, yellowfin mojarra (*Mycteroperca microlepis)*, and crevalle jack (*Caranx hippos)* (Alleman et al., 1995). Scientists reported that at least 512 fish species occur in the bay as documented by de Sylva (1976). At least some of this diversity is due to the overlap of the Atlantic and the Caribbean marine provinces. Fish species north of Cape Canaveral are typical of temperate waters, while Florida Keys fish species are tropical. Biscayne Bay Surface Water Improvement Management Plan scientists concluded that, "Biscayne Bay is part of a transition area where fish species of both kinds are well represented. There is some seasonal fluctuation, with tropical species more prevalent in the summer and temperate species partially replacing them in the winter" (Alleman et al., 1995). Benthic surveys tallied over 800 species of invertebrates that make BBAP their home, including over 150 species of shrimp, crabs, and lobsters. Many of these

Florida Fish and Wildlife Conservation Commission, marine law enforcement and the Marine Animal Rescue Society work to rescue injured manatees. This manatee suffered a fatal propeller strike near the MacArthur Causeway on a weekend afternoon.

species are commercially harvested including blue crab, stone crab, spiny lobster, penaeid shrimp, and sponges. BBAP's hardbottom community provides substrate for numerous invertebrates to colonize. Within the hardbottom communities in Biscayne Bay, the most common sponges are the loggerhead sponge (*Spheciospongia vesparia*) and the basket sponge (*Ircinia campana*) (Alleman et al., 1995). Other commercial sponge species occur in the central and southern portions of the bay. The importance of Biscayne Bay to juvenile spiny lobster (*Panulirus argus*) has resulted in a large portion of the bay (roughly from Cape Florida south through Card Sound) to be designated as the Biscayne Bay-Card Sound Spiny Lobster Sanctuary, as described in Chapter 68B-11, F. A. C. Stone crab (*Menippe mercenaria*) is considered a gourmet crab and Biscayne Bay is rumored to be the first harvest location. It continues to be a financially successful harvest for crabbers. They are sought for their regenerating claws and can be found in tidal mangrove areas, rocky shorelines, and inshore reefs, around jetties and on mud flats. While both claws can be harvested, often only one claw is harvested and the live animal is thrown back allowing for a sustainable crab resource. The central section of BBAP is home to two species of commercial shrimp: Pink shrimp (*Penaeus duorarum) and* brown shrimp (*Penaeus braziliensis).* Iverson, Allen, and Higman (1993) reported these two shrimp species belong to the family Penaeidae, which constistantly rank among the top five economically important seafood products in the US in terms of catch weight and dollar value (Iversen, Allen, & Higman, 1993). Together with a network of coastal bays (e.g., Florida and Whitewater bays), Biscayne Bay serves as nursery grounds for the mature pink shrimp population residing in the Dry Tortugas region of the lower Florida Keys (Ault et al., 1999).

Mangroves that once lined the entire shore, helped to protect the bay's water by trapping eroding soil and providing protection from wind, waves and floods. Settlers in the late 1800s regarded mangrove forests as being useless, mosquito-infested, and uninhabitable lands. They worked to clear as much of the south Florida wilderness as possible. Scientists today realize mangroves' critical role in coastal ecosystems. Seagrass beds also provide residences and nursery grounds for a variety of marine species. Seagrass beds create hiding places and food for sea animals such as the Florida spiny lobster, shrimp, fish, sea turtles and manatees. Johnson's seagrass, the first and only marine plant to be listed on the Endangered Species List (listed as Threatened), plays a major role in the health of benthic resources as a shelter and nursery habitat as so other seagrass species. In the shallow waters of Card Sound, herons egrets, and spoonbills have been documented to forage in the seagrass beds for fish, crustaceans, and other marine species exposed during low tides. Other native species

of interest include BBAP's resident Atlantic bottlenose dolphin (*Tursiops truncatus*) population. Some individuals have been sighted only in the southern and central portions of the Bay; some only in the northern and central portions of the Bay; and some have been sighted throughout all of Biscayne Bay. Litz, Garrison, Martinez, Contilo & Kucklick (2007) found these animals are part of one genetically mixed resident population, and that their home range differences depends on a variety of factors such as individual habitat use preferences, gender differences, overall social structure, or boundaries of the study area. Biscayne Bay is home to many commercially and recreationally important shark species such as bull sharks (*Carcharhinus leucas),* black-tip sharks *(Carcharhinus limbatus),* and nurse sharks *(Ginglymostoma cirratum)*. While some species only spend their juvenile years in the bay, others spend their whole life here such as one of the most commonly seen species the bonnnethead shark (*Sphyrna tiburo).* Bonnethead sharks can be found throughout the estuary but especially near dense mangrove regions of the central and southern bay. Spotted eagle rays (*Aetobatus narinari)*, are known to live close to the shoreline and are frequently seen, leaping from the water at the western edge of Bear Cut, in the central section of the bay. Other ray species within BBAP include the Southern stingray (*Dasyatis americana)*, yellow stingray (*Urobatis jamaicensis),* Atlantic stingray (*Dasyatis sabina)*, and the smooth butterfly ray (*Gymnura micrura).*

Listed Species

Listed species are those which are listed by organizations such as FNAI, USFWS, National Marine Fisheries Service, Florida Fish and Wildlife Conservation Commission (FWC) and the Florida Department of Agriculture and Consumer Services as endangered, threatened or species of special concern. Listed species include 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. State 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 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. Under Article IV, Section 9 of the Florida Constitution, the FWC has constitutional authority to "exercise the regulatory and executive powers of the state with respect to wild animal life and fresh water aquatic life, and shall also exercise regulatory and executive powers of the state with respect to marine life..." Sea turtles, manatees and dolphins are protected species under Florida law and particular authority is given to marine officers to issue citations to protect these species. This authority is granted through 379.2431 F.S. which lists "marine animal regulations" including 379.2431(1) protecting sea turtles, 379.2431(2) protecting manatees, and 379.2431(3) protecting dolphins. Florida has more threatened and endangered native species than any state, except California and Hawaii. Rapid human population growth in Florida stresses species that are dependent on coastal habitats. Listed species can become threatened due to habitat destruction, over-utilization, disease or natural or human-made factors. In November 2010, new threatened species rules approved by the Commission went into effect. The list of wildlife presented here reflects those changes to the rules. All federally listed species that occur in Florida are now included on Florida's list as Federally-designated endangered or Federally-designated threatened species. In addition, the state has a listing process to identify species that are not federally listed but at risk of extinction. These species will be called State-designated Threatened. All State-designated species that have recently undergone status reviews were presented and approved at the June 2011 Commission meeting. FWC will continue to maintain a separate Species of Special Concern category until all the species have been reviewed and those species are either designated as State-threatened and/or given a management plan and/or removed from the imperiled species list. More detailed descriptions and management prescriptions are available on the FWC website.

The federally and state listed endangered Florida manatee occupies BBAP, its river and creek tributaries, and its engineered canals that flow to the bay. Manatees dwell in shallow bay waters and feed on a variety of vegetation in the bay, from low-lying mangrove branches to lush seagrass beds of the shallows. They rely on sheltered coves for feeding, resting, and calving and require warm-water refuge during winter months. Manatees travel into warm water canals, and prior to water control structures being retrofitted with sensors to open when manatees are present, they were often trapped or crushed by canal locks. Manatees historically used a travel corridor between Dumfoundling Bay and northern Biscayne Bay near Baker's Haulover Inlet. Today, it accommodates the AIWW where vessels are allowed to travel at high rates of speed (Miami-Dade County Department of Environmental Protection, 1995). The Miami River and Little River remain critical warm water refuge areas for manatees during cold weather snaps, and all Biscayne Bay tributaries are considered Essential Manatee habitat in the state protection plan. Increased boat traffic, marine pollution, and expanding development around BBAP are one of the

greatest threats to endangered manatees. MDC PERA and FWC developed Manatee Protection Plans to focus collective efforts to create plans and evaluate the success of those plans, in regards to protection of manatees. The Marine Animal Rescue Society (MARS) is BBAP's local partner who responds to manatees and cetaceans (i.e. whales and dolphins) in distress in southeast Florida. BBAP and MARS collaborate to provide a coastal curriculum for teachers and quarterly trainings for the public on the basics of marine mammal rescue. BBAP, MARS, and other agencies host law enforcement workshops locally and around the state. These workshops focus on natural resource protection as well as what officers can do as first responders to support the efforts of the stranding network.

Endangered marine turtle species found in BBAP include the green sea turtle (*Chelonia mydas*), the hawksbill sea turtle (*Eretmochelus imbricata*), Kemp's Ridley sea turtle (*Lepidochelys kempii*) (United States National Parks Service, n. d.). The state listed threatened loggerhead sea turtle (*Caretta caretta*) and the leatherback sea turtle (*Dermochelys coriacea*) also are found in Biscayne Bay. Marine turtles depend on BBAP at every stage in their lives. Females lay their eggs in excavated nests on the same beaches where they themselves were hatched. Hatchlings use offshore sargassum mats and juveniles frequent the bay, inlets, and lagoons formed from tidal changes. Larger juvenile and adult green sea turtles feed on seagrasses and algae. Leatherbacks are rarely seen in coastal waters except as hatchlings, dispersing from nesting beaches and as adult females approaching the beach to nest. The coastal marine waters of Biscayne Bay provide feeding grounds and protective habitat for these turtle species; however, the increase in shrimping and other net-fishing increased turtle mortality due to trappings and drownings in nets. NOAA worked closely with the commercial shrimp trawling industry to develop Turtle Extruder Devices. These devices are installed in shrimp trawls and allow turtles and other larger marine life to escape through a hatch and avoid drowning due to entanglement (NOAA, n. d.). Decreasing numbers of nests sites are attributed to development, constant lighting of coastal areas, and armoring of beaches with seawalls. Today, new ordinances are now in place throughout some coastal areas in Florida "to enact or strengthen beach lighting ordinances in all counties that support nesting to reduce deaths of newly emerged hatchlings that become distracted by artificial lights" (FNAI, 2010). However, there currently is no ordinance prohibiting light pollution on or near nesting beaches in MDC for any part of the year. Establishing ordinances at the county or municipal level should be considered in the future in order to allow for higher nesting success.

The American crocodile was relisted by the FWC in 2011 to "Federally-designated Threatened" and is federally listed as Threatened by the USFWS, mostly due to the limited availability of its range. It inhabits coastal estuarine marshes, mangrove swamps, and creeks along edges of the mainland and islands and usually associated with mangroves. The American crocodile prefers to nest on beaches, stream banks, and levees. Breeding occurs in the southern section of BBAP. The crocodile's small population size leaves it vulnerable to catastrophes such as hurricanes and disease. Some crocodiles are reported killed by automobiles on US Route 1 and Card Sound road, but could be reduced with the installation of wildlife corridors beneath US Route 1. Another endangered species that is commonly found in the southern section of BBAP is the wood stork (*Mycteria Americana*). These large birds nest colonially in a variety of coastal wetlands including mangrove shorelines. Wood storks forage mainly in shallow water in marshes, swamps, lagoons, ponds, and tidal creeks, where they are attracted to falling water levels that concentrate fish and some other food sources. Wood storks require higher prey concentrations that coincide with seasonal flooding and increased fish production in inundated pools (FNAI, n. d.). Numerous other wading and shore birds, such as the roseate spoonbill, the tri-colored heron, and the reddish egret are listed as Species of Special Concern due to the critical habitat decline of salt marshes, hydrological changes due to draining and channeling, and a decline in water quality. These animals have significant vulnerability due to habitat modification, environmental alteration, human disturbance, or human exploitation. In the foreseeable future, this may result in these species becoming threatened species, unless appropriate protective measures or additional management techniques are initiated or maintained (Mazzoti, 2003). The first and only federally and state listed seagrass is Johnson's seagrass, which was listed as threatened in 1998. Johnson's seagrass can be found in tidal deltas inside inlets, sandy shoals, and mouths of canals; at water depths from shallow intertidal to 9 feet (2.7 meters) deep. It only occurs along 120 miles (193.1 km) of southeast Florida's coastline, from Sebastian Inlet in Brevard and Indian River counties to the northern section of BBAP. Although federal and state laws aim to protect seagrass beds, there is continual serious loss of these habitats. Because of small size and lack of sexual reproduction, Johnson's seagrass is especially vulnerable to disturbance. Only two populations occur on managed areas (FNAI, 2010). In order to preserve this valuable resource, further action is necessary to protect coastal waters and sediments from pollution, dredging, siltation, propeller disturbance, and shading by docks and jetties.

Invasive Non-native Species

Introduction of non-native species in Florida was accelerated with the arrival of European sailors and early settlers. They brought with them animals, fruits, vegetables, and 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 and 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, Burmese python (*Python molurus bivittatus*) breeding populations in the Everglades, or monitor lizards (*Varanus niloticus)* becoming established on Sanibel Island. Florida is second only to Hawaii in the number of established invasive species (Simberloff, Schmitz, & Brown, 1998). 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). The Exotic Pest Plant Council lists several species found within the BBAP, including Australian pine, Brazilian pepper, and seaside mahoe (*Thespia populnea*). Both PERA and MDC Parks and Recreation Department Natural Areas Management crews have worked for decades to remove these plants from the shoreline of Biscayne Bay and to replace them with native species. Island restoration projects have recreated four traditional habitat types, including wetlands, dune, coastal strand and tropical hardwood hammock communities, consisting of approximately 90 species, and have been successfully established on natural and spoil islands in Biscayne Bay (Milano, 2000). Several exotic marine animals have been documented within Biscayne Bay. These include a species of blue crab native to South America and several mollusk species. Several fish were introduced into marine waters of Biscayne Bay, Florida, in 1992 as a result of Hurricane Andrew (Courtenay, 1995). One of the largest problem species introduced to Biscayne Bay and surrounding waters is the Indo-Pacific red lionfish (*Pterois volitans)(USGS, n.d.)*. Agencies such as NOAA, BISC, and the Reef Environmental Education Foundation work with local anglers and scuba divers to record any sightings of these fish and work to remove these fish from Florida reefs. The Reef Environmental Education Foundation is a nonprofit organization of recreational divers who regularly conduct fish biodiversity and abundance surveys during their dives. Biscayne Bay is vulnerable to many exotic introductions because it is home to The Port of Miami with interoceanic cargo and cruise vessels. Ballast water is collected in the hull of the vessel to add to stability then released in other parts of the ocean. This water can transport a variety of species and introduce exotic species that have a planktonic life stage. Green (*Iguana iguana),* black spinytail (*Ctenosuara similis*), and Mexican spinytail (*Ctenosaura pectinata*) iguanas are three exotic species with established breeding populations on lands adjacent to BBAP. Green iguanas are native to neotropics, but since 1966, have been found on Key Biscayne and in other urban areas in South Florida (Dalrymple, 1994). This species is extremely popular in the pet trade and frequently escapes or is released (Bartlett and Bartlett, 1999). The black spinytail iguana is often confused with the Mexican spinytail iguana because of similar physical characteristics and habitat preferences. Both species prefer recently disturbed coastal uplands with early successional plant community. In January 2010, many iguanas died off due to three consecutive days below freezing and were reported to freeze and fall out of trees, due to the abnormal temperatures. Extreme weather conditions, such as this, help to reduce the number of all invasive or exotic species in South Florida.

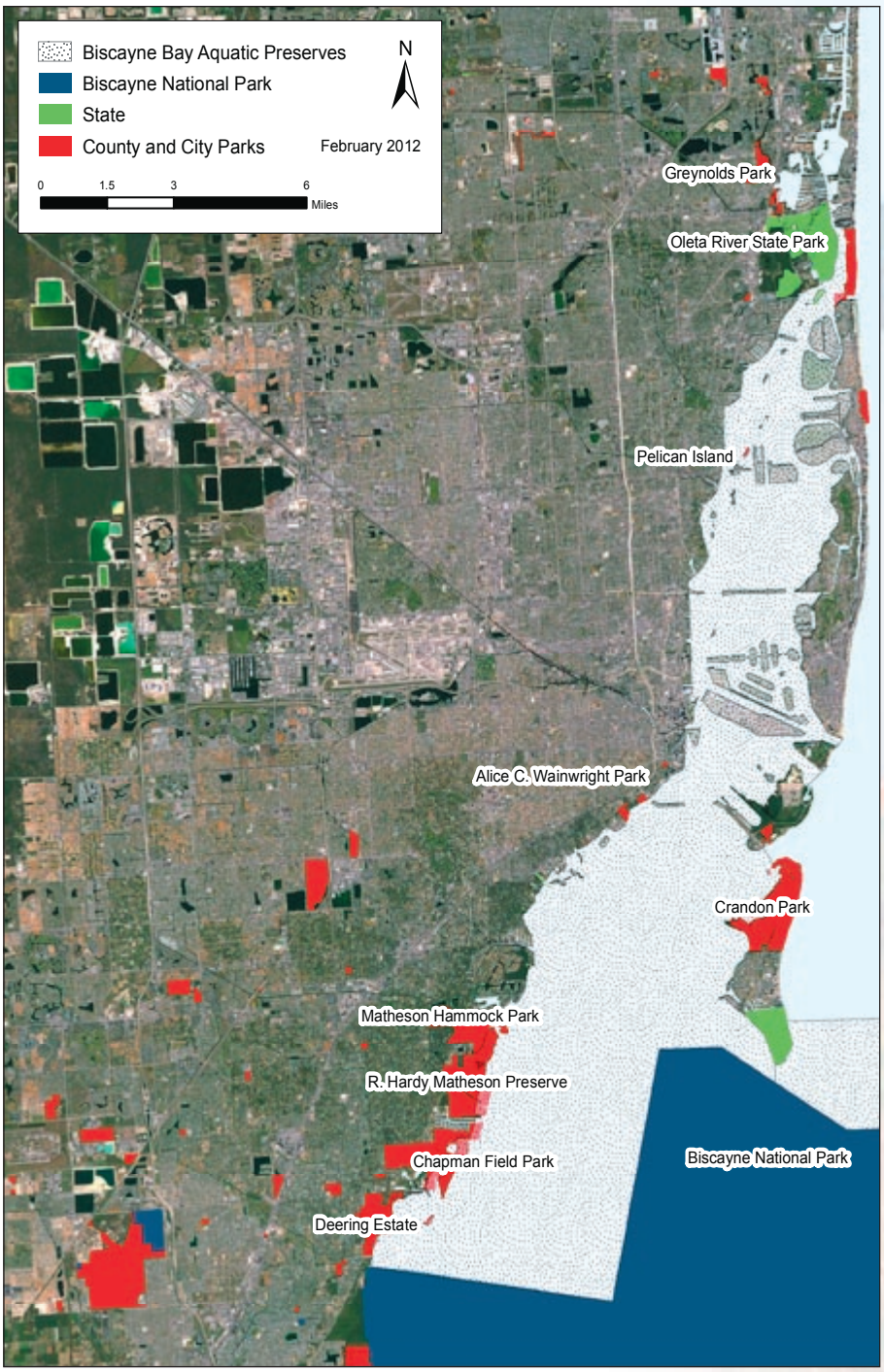
Problem Species

Problem species are defined as native species whose habits create specific concerns or management problems. There are several problem species found in and around BBAP, ranging from terrestrial vertebrates to microbial marine organisms. Black vultures (*Coragyps atratus)* in south Florida have developed a taste for car parts. They prey on rubber from areas of the car, such as windshield wipers and the seals around windshields, doors, and sunroofs. They are not consuming the car parts and no one is sure why the vultures destroy car parts. Warning signs are posted in parks that surround BBAP to warn visitors to cover cars with towels or a car cover when vultures are present. Raccoons (*Procyon lotor*) are problem species particularly in public parks, recreational islands, and in developed areas along the shorelines of BBAP where they scavenge for food. Raccoon over-population can be detrimental through predation of nesting birds, Florida east coast terrapin turtles *(Malaclemys terrapin tequesta)*, sea turtle eggs on the beach, and other native species. Mosquitoes are one of the largest problem species in south Florida, but in fact they are an important component to the food chain in a mangrove estuary. The most abundant of the 43 mosquito species in south Florida, is the tidal marsh mosquito (*Aedes taeniorhynchus*). It lays eggs on exposed moist soils, especially in black mangrove swamps. It is considered a natural vector for transmitting diseases such

as canine heart worms. Mosquitoes are more active in early morning hours and at dusk, so avoid peak hours and search for breezy open areas. The presence of the cyanobacteria (*Synechococcus spp.)* was documented as the cause of an "algal bloom" in the Card Sound. An algal bloom is defined as a rapid increase or accumulation in the population of algae in an aquatic system. The bloom began in November of 2005 and increased and decreased but persisted for several years through 2007 (Florida Keys National Marine Advisory Council, 2007). Marine cyanobacteria of the *Synechococcus spp.* group, occupy an important position at the base of the marine food web since they are a major primary producer (Woods Hole Oceanographic Institution, n.d.). With the influence of excess amounts of nutrients, a harmful algal bloom can occur. In the case of the Card Sound bloom, nutrient overload, particularly phosphorus is thought to have triggered the bloom. The source of the excess phosphorus may be a combination of water releases associated with hurricane threats, and a road construction project in northern Key Largo (Rudnick, Madden, Kelly, Bennett, & Cunniff, 2006).

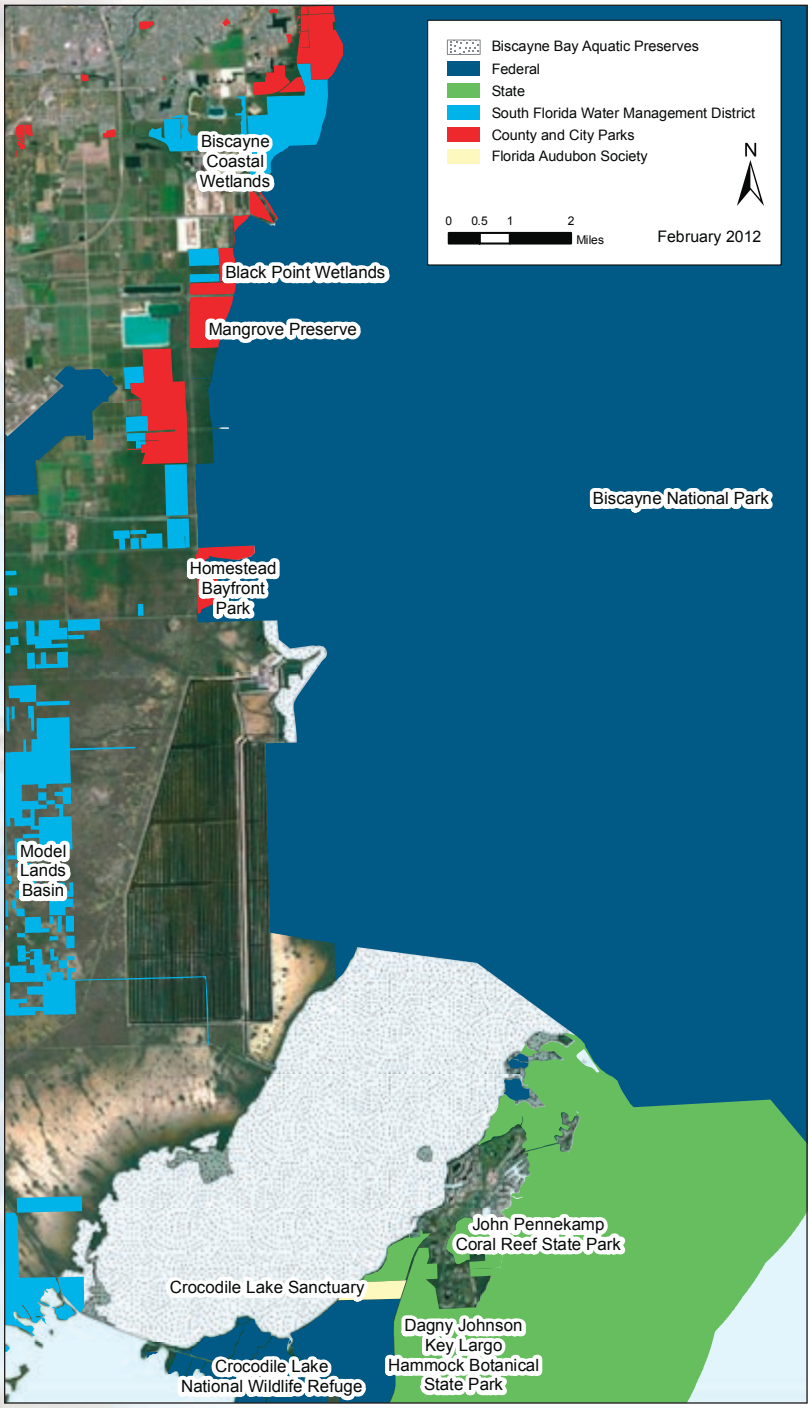
Archaeological and Historical Resources

The State of Florida Master File site report of June 2010 included 23 archaeological records, 27 historic bridges, 139 structures, 15 historic registers, with 22 resource groups, within a 30 foot buffer around BBAP's borders (see Appendix B.7). The Florida Master Site File is an active list of Florida's cultural resources that are over 50 years old, without regard to historical significance. The National Register of Historical Places is an active list of US properties that were formally determined by the NPS US Department of the Interior, to be historically significant. The Florida Historical Marker Program recognizes historic resources, persons, and events that are significant in the areas of architecture, archaeology, Florida history, and traditional culture by promoting the placing of historic markers and plaques at sites of historical and visual interest to visitors. Properties adjacent to BBAP that are listed by both the National Register of Historical Places and the Florida Historical Marker Program noted in Appendix B.7. The



Map 9 / Public Lands in Biscayne Bay - North

Miami Circle is one of the most significant archeological resource remaining on the shores of Biscayne Bay, with 85% of its features intact. This is thought to be the only oolitic limestone feature ever found in North America. It was discovered by chance during the demolition of an apartment building that was to be developed into a new skyscraper. It was discovered and excavated in 1998. The 2.2 acres along the Miami River and Biscayne Bay were purchased by the State of Florida in order to preserve the site. As of February 2008, the NPS is seeking public comment on how the site should be made accessible for the public to enjoy. As of 2010, the excavated artifacts reside at History Miami. The Florida Division of Historical Resources Bureau of Archeological Research manages the physical site. Since its discovery, five field investigations have taken place at the Miami Circle. Projects range from initial salvage excavations to auger testing across the entire parcel of land. Scientists from the University of Miami and the University of Florida have used three dimensional laser mapping to fully document the extent of the site. This important feature and corresponding artifacts hold answers to the history of the people who once inhabited Biscayne Bay.



Map 10 / Public Lands in Biscayne Bay - South

The oldest remaining structure in MDC is the lighthouse at Cape Florida. It was built in 1825, and then reconstructed with additional height, after the Seminole attack and fire of 1836. The structure is protected within Bill Baggs Cape Florida State Park at the southern tip of Key Biscayne. The top of the lighthouse provides a panoramic view of the Biscayne Bay-Cape Florida to Monroe County Line Aquatic Preserve section. The next oldest structure dates to when Florida became the 27th state in 1845. A plantation slave quarters from the 1800s and a wooden cabin used by an early settler named Wagner were relocated to Lummus Park, along the northern shores of the Miami River in downtown Miami. The Miami River was an area of intense settlement after statehood and the Wagner House stands as a testament to this era of Miami as the oldest residence in MDC. The Arch Creek State Archaeological Site was listed on the National Register of Historic Places in 1985 and contains a portion of the Military Trail, a wagon road built by the US Army. In 1856, Captains Abner Doubleday, John Brannan, and their troops constructed part of the Military Trail between Fort Dallas (on the Miami River) and Fort Lauderdale. It later became a portion of the first county road in 1892, passing over the Natural Bridge and Arch Creek. In 1915, it was renamed Dixie Highway. The road was designated a local historic site on January 18, 1995. Just off of the Rickenbacker

Causeway, Virginia Key Beach Park is an environmental and historic landmark. Its earliest recorded history is of an 1838 skirmish during the Second Seminole War in which three Seminoles were killed on this site. During the era of segregation laws, this location became the unofficial recreation area for African-Americans, known as Bear Cut. After lobbying from local citizens, Virginia Key Beach opened for the exclusive use of African-Americans on August 1, 1945. The new park, at first accessible only by boat, was an immediate success, attracting over 1,000 visitors on any given weekend. By the early 1960s, another courageous protest brought segregation to an end. The beach park symbolizes the struggle of African-American Miamians who persevered to bring about change for future generations. Numerous other cultural resources are located adjacent to BBAP and are listed in Appendix B.7.

*3.1.4 / **Economic Values***

The shoreline of Biscayne Bay is shared with MDC's growing population, estimated at 2.5 million people as of 2010. The bay allows citizens and numerous visitors each year to engage in recreational activities such as fishing, diving, snorkeling, swimming, picnicking, bird watching, sightseeing, sailing, and boating. SFWMD tasked contractors Hazen and Sawyer Environmental Engineers and Scientists to research and publish the Biscayne Bay Economic Study (2005) in order to evaluate the outcome of the Biscayne Bay Partnership Initiative. This initiative provided a broad community based forum, comprised of federal, state and local agencies, universities, non-governmental organizations, the private sector, and industry, to survey the status of Biscayne Bay's resources and the management of those resources (SFWMD et al., 2005). Biscayne Bay is accessible through many marinas, boat ramps, parks and private docks, so to estimate the amount of people utilizing the bay's resources, recreational estimates were made through surveys, where individuals were asked a series of questions either for residents or visitors. The survey found that 54% of MDC residents used the bay over a 12-month period. It also estimates 10,288,484 visitors to MDC in 2004, with 6, 832,112 visitors who used Biscayne Bay for recreation. This number does include BISC as well as BBAP, but is useful in assessing the number of individuals who use Biscayne Bay waters.

The Port of Miami is one of the US's busiest ports, known as the "Cruise Capital of the World" and the "Cargo Gateway to the Americas" by the shipping industry. One of the country's fastest-growing container ports, Miami serves markets in Asia, Europe, and Africa, as well as Central and South America. While the Port of Miami supports large draft ships, the Miami River provides services to smaller ships traveling between Caribbean ports with shallow draft ships. The cruising side of the port boasts a fleet of 18 ships (2010), including the newest megaships. In 2009, the Port of Miami accommodated 4.1 million multi-day cruise passengers, while moving 7 million tons of diversified commodities across its docks. It generates $17 billion annually to South Florida and accounts for 176,000 jobs as of 2009 (FSTEDC, 2010).

The commercial fishing industry relies on Biscayne Bay, not only as the harvest location of many fish species and pink shrimp, but also the critical habitat necessary to complete the life cycles of many fish and invertebrate species. Commercial fish species that are life stage dependent on Biscayne Bay are ballyhoo, barracuda, several grouper species (black, gag, and red), grunts, hog snapper, several species of jack (crevalle, almaco, yellow), mullet, parrotfish, all species of snapper, spiny lobster, bait shrimp, pink shrimp and white shrimp (SFWMD, et al., 2005). The Biscayne Bay Economic Study evaluated the "exvessel" value of Biscayne Bay dependent commercial fish, shellfish, and marine life species landed in MDC caught from 1986 to 2002. Exvessel value is defined as the value of the fish at dockside, just off the boat. This value was estimated in 2004 and found that values reached $3,703,710 for 2002. There are many other economic considerations that were studied for this project, such as commercial vessel sales and repairs, marketing and retailing of marine landings, and sales associated with commercial fisheries in Biscayne Bay. Commercial fishing in Biscayne Bay also ranked as the greatest economic contribution to MDC for the year 2004, and is projected to remain the financial frontrunner for years to come (SFWMD et al., 2005). Protecting the species targeted by commercial fisheries and the habitats these species depend on helps to ensure both a productive ecosystem and economy for MDC. Laws prohibiting certain kinds of commercial fishing methods, starting with regulation of nets in Biscayne Bay in 1913 ("Florida's Net Ban", n.d.), then traps and nets in 1939, and most notably the Constitutional amendment Limiting Marine Net Fishing was voted on and approved by Florida's citizens in November of 1994 and officially went in effect on July 1, 1995. The net ban was targeted at the mullet fishery, and the ban was largely supported by industry groups. Approximately 72% of voters approved the ban. Overfishing certain fish stocks by recreational anglers is not regarded as a leading threat to sustaining suitable populations of fish as opposed to commercial fishing operations (Dan Kipnis, personal communication). Much has changed since the time of Hugh M. Smith, the United States Commissioner

of Fish and Fisheries, who was sent on an expedition to Biscayne Bay in February 1895 with the express purpose of determining the feasibility of "constructing a station on the east coast of Florida for the purpose of preserving and increasing the supply of economic marine products of the region" and "pointing out the lines along which the fishery resources of the State may be developed, the essential point to be determined is the most advantageous location." Smith's Notes on Biscayne Bay provide invaluable insight into the past, not only to understand what kind of commercial fishing operations occurred in Biscayne Bay but what kinds of fish were found to be abundant or scare. Smith discusses how abundant tarpon and bonefish were at the time, and how Spanish mackerel were scarce—the commercial fishery from Gloucester (Massachusetts it is presumed) had overfished mackerel using seine nets up to a few years prior to Smith's arrival. Commercial consumption of species like mullet and mackerel fisheries are no longer viable, either due to a ban on the way they were harvested, species once heavily fished are now size regulated, or because the species is no longer present at all or in sufficient numbers.

The recreational boating industry is also an economic driver for the county and the region. The tri-county area, as defined by Murray and Associates (2010), includes Miami-Dade, Broward, and Palm Beach counties. According to their report, produced for the Marine Industries Association of South Florida to report on the economic impact of the recreational marine industry in the tri-county area, there has been a decrease in jobs, total earnings, and total output between 2005 and 2010 in the major sectors of the industry. Major sectors include manufacturing, wholesale trade, retail trade, dockage, and marine services and the tri-county area represents 49% of gross marine sales statewide. Total gross output from these sectors was $540.0 million in 2010, down from $932 million in 2005. Like many industries, the marine business sector is feeling the effects of a troubled economy. Despite recent dips in revenue, Miami-Dade County actually had a 17% increase in the amount of registered boaters during this timeframe, going from 48,566 in 2005 to 56,624 in 2010.

*3.1.5 / **Citizen Support Organization***

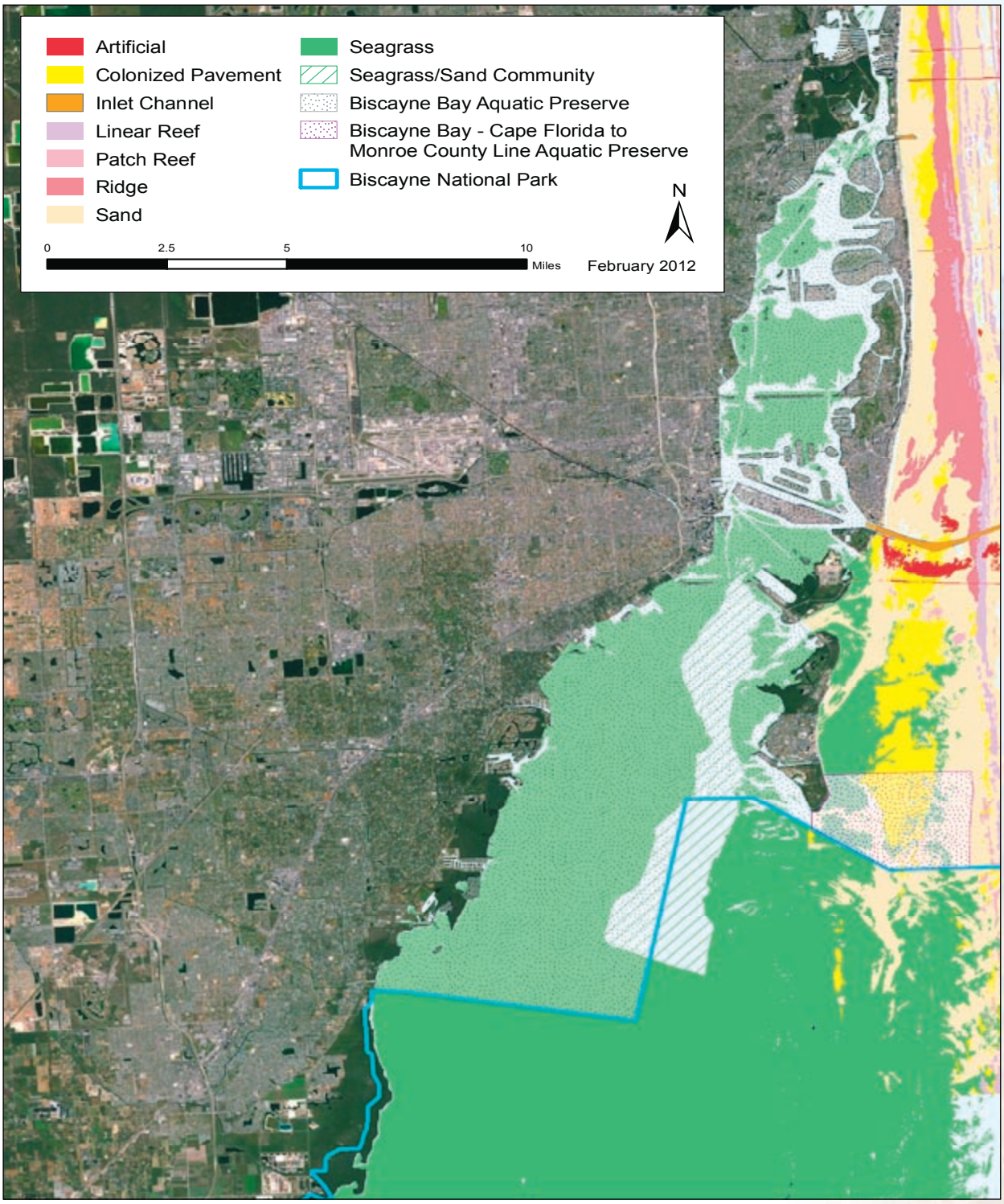
A coalition of local citizens founded the Friends of Biscayne Bay (FOBB) and gained official recognition by the state in April 2001. The purpose of FOBB is to support BBAP in its mission to preserve and enhance Biscayne Bay so that its biological and aesthetic values may endure for the enjoyment of future generations. Since its inception, FOBB has worked to support BBAP in securing facilities and funds to accomplish management goals. Prior to the establishment of FOBB, the BBAP manager's office was located within PERA's building in downtown Miami, with limited bay access and no room for additional employees. After discovering the Florida Marine Patrol building and dock at Pelican Harbor were unoccupied, the preserves manager encouraged local citizens, involved in preserving Biscayne Bay to become incorporated as a state Citizen Support Organization. These citizens worked to secure the now Biscayne Bay Environmental Center and dock for BBAP. Between the years of 2000 and 2005, the founding members of FOBB substantially supported the Biscayne Bay Environmental Center by paying for repairs, plumbing, appliances, and utilities, allowing CAMA to have a field office in Miami to focus on Biscayne Bay issues. While FOBB was negotiating a lease with DEP for BBAP and other lessees to use the building for Biscayne Bay-related work, the Coral Reef Conservation Program moved from Tallahassee to Miami to share facilities costs with the BBAP program. FOBB continues to support BBAP education and outreach initiatives through funding of hands-on training for children and adults in marine science, compensating travel costs, purchasing field supplies, and sponsoring marketing and other identified needs. They file their articles of incorporation with Florida Department of State and re-register annually as a nonprofit corporation. At the FOBB annual meeting in January, four officers are elected: President, Vice President, Secretary, and Treasurer. The officers' duties are defined in their by-laws. The FOBB Board of Directors meets periodically to discuss current issues and events within the aquatic preserve.

*3.1.6 / **Adjacent Public Lands and Designated Resources***

Northern Biscayne Bay

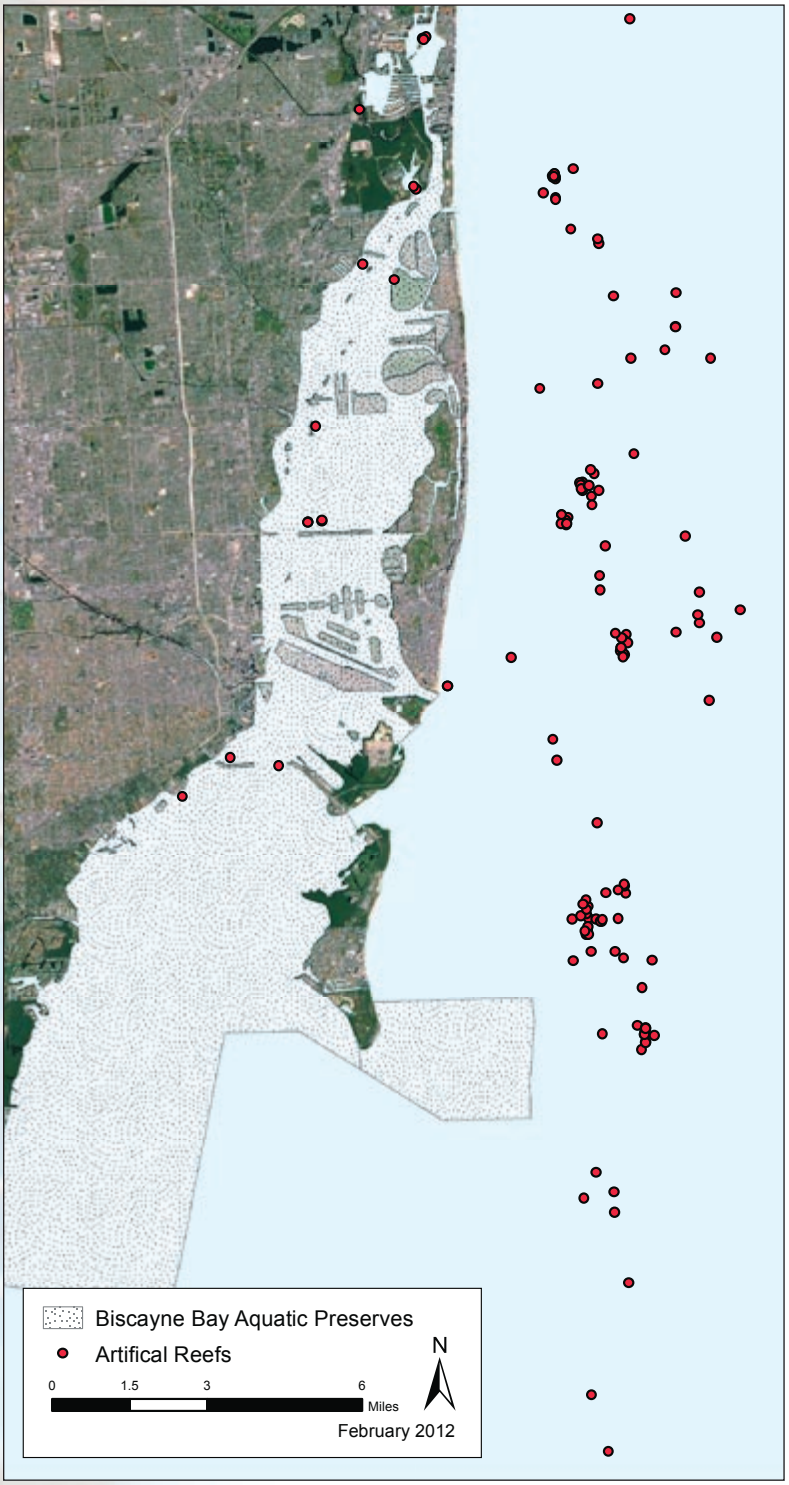
Highland Oaks County Park forms the headwaters of the Oleta River and is the northern boundary of BBAP (Chapter 18-18.002, F.A.C.). It is hydrologically connected to the preserve but bridges block access by boat including kayaks or canoes. Greynolds and East Greynolds County Parks straddle the Oleta River portion of the aquatic preserve. Oleta River State Park forms an important access point to the aquatic preserve along both the Oleta River and the northern boundary of the bay proper. Naturalists guide canoe trips among the mangroves growing along the river. The park has a primitive campsite for the Florida Saltwater

Circumnavigation Trail, a fishing pier, a swimming beach, canoe/kayak trails, mangrove swamp, two offshore islands, and seagrasses. A concessionaire rents kayaks along both the river and bay portions of the aquatic preserve within the park and offers guided tours of the preserve waters. Haulover County Park and Marina offers 5 lanes of boat ramps and 144 slips at the marina and a private company operates a dry stack with additional boat spots. Shoreline fishing is popular along a seawall on the bay and within Baker's Haulover Inlet. Head boats moor within the park and fish bay waters for bait fish before heading off-shore. Three shore-side parks allow visual access to the preserve in North Miami, Miami Shores, and the City of Miami. Broad Causeway Park had a fishing/observation platform but it has been closed due to hurricane damage since 2005. PERA has placed an artificial reef near the fishing platform. The Miami Shores linear



Map 11 / Inshore seagrass communities located in the Biscayne Bay Aquatic Preserve and offshore benthic resources in the Biscayne Bay-Cape Florida to Monroe county Line Aquatic Preserve. Both preserves under active management are regarded jointly by staff as the "Biscayne Bay Aquatic Preserves."

park provides a walkway along a mile of bay shoreline. Bayview Park is used by area residents to walk their dogs. Pelican Harbor Marina occupies a spoil island connected to the mainland and other islands by the John F. Kennedy/79th St. Causeway. It includes 98 wet slips, 8 boat ramp lanes, and paved and overflow parking for additional vehicles and trailers. Pelican Harbor Marina Park amenities include a sailing school and rental of a 45 foot pontoon boat. The pontoon boat, the Pelican Skipper, can be rented for boat trips to other county or city facilities, including Crandon Park, the Deering Estate, and Miamarina at Bayside. Rental of Pelican Island, with pavilions, picnic tables, grills, and a volleyball court, is available for parties or other celebrations. A dock makes the island accessible for private boaters, as well. Pelican Harbor Marina is also the site of one of three Miami-Dade Marine Patrol offices, county fuel docks and a pump-out station, and the Pelican Harbor Seabird Station. The nonprofit seabird station rents property from the county for offices and pens for rehabilitating or permanently housing injured birds. Fifty percent of their birds receiving treatment arrive at the island because it lies along the Atlantic Migratory Flyway, while the rest are brought in people or retrieved by staff or volunteers (Wendy Fox, personal communication). One of the most commonly treated birds each year is the brown pelicans (*Pelecanus occidentalis*) that are released back to the wild after having bands placed around their legs to identify them in the future. Pelicans and other birds nest at the center during January and February every year. The City of Miami's Legion and Morningside Parks offer boat ramps access along the western shoreline of the bay. Morningside Park offers kayak rental and was the site of the dedication of the Biscayne Bay Segment 16 of the Florida Saltwater Circumnavigation Trail in April 2007. In support of kayaking, the city launched kayak areas for both Morningside and Margaret Pace Parks. Margaret Pace Park is just north of the Venetian Causeway and mainly provides visual access to the bay for its users.



Map 12 / Artificial Reefs in Biscayne Bay - North

The Florida Inland Navigation District partners with CAMA to work on island enhancement projects. Multiple islands within the northern section of Biscayne Bay may be suitable for restoration to traditional uses. Within MDC, PERA has stabilized spoil islands' shorelines, removed exotic upland plants, and replanted with appropriate natives (Milano, 1999b). In addition, islands in the north part of the bay are being considered for a future partnership with an Adopt-an-Island program. Bird Key is an exception to all of the human-engineered islands within northern BBAP. It began as a natural island that was enlarged by dredged materials. Today, it is privately owned

and serves as a bird rookery for brown pelicans and double crested cormorants (*Phalacrocorax auritus*) and a roost for bald eagles (*Haliaeetus leucocephalus*), magnificent frigatebirds (*Fregata magnificens*), and other species.

The City of Miami Beach provides a boat ramp for motorized boats and kayak launching into the aquatic preserve at Island View Park. One popular trip, by motor or paddle, is to Monument Island with a 110-foot (34 m) tall obelisk and sculptures dedicated to Henry Flagler. The western shoreline of Monument Island serves as a swimming area. A private 125-slip marina is located just north of Island View Park. Further south, the Miami Beach Marina boasts 400 wet slips including some for mega-yachts up to 250 feet (76.2 meters) long. On the Miami River, Gerry Curtiss Park has boat ramps with wet slips and dry storage. Kayak or canoe launching is possible at some riverside parks including Curtis, Jose Marti, and Sewell. Lummus Park and Pointe Park, in the historic Spring Garden neighborhood, also provide visual access with no physical access. The Miami River Commission, along with the Trust for Public Land, has promoted increased visual access through a Miami River Greenway Plan. The Miami River Commission coordinates Miami River Day in the third or fourth month of the calendar year at Jose Marti Park. In the early 1900s, many Miami visitors took boats from the city up the Miami River to tourist attractions featuring Seminole or Miccosukee Native Americans. Many condominiums have marinas with wet slips along Brickell Avenue. Bayshore Drive to the east of Brickell provides a bay view of the mangrove shoreline on the western edge of Virginia Key. A sign provides information about the Bill Sadowski Critical Wildlife Area and its history. This road provides visual access to the bay from a walkway and road that line the bay, near the condominiums.

The Venetian Causeway connects a series of dredged materials islands created before the 1920s. The easternmost island, Belle Island, is a natural island with dredged material added. It contains several private marinas which provide access to the preserve. Another area was planned to become a spoil island north of DeLido Island, but the submerged land in the project footprint was spared when a recession began in Miami in 1926. To date, pilings stand around the perimeter of the failed project and concrete slabs lie fallen underneath that were never removed. Coral, sponges and acres of seagrass can be found growing here. Watson Island was created from spoil material and is bisected by MacArthur Causeway with downtown Miami to the west and Miami Beach to the east. This spoil island hosts 3 boat ramps with 53 oversized parking spaces to accommodate trailers, as well as the Miami Outboard Club and the Miami Yacht Club. The Miami Outboard Club provides wet slips, dry storage, ramps, and temporary storage for their members. The Miami Yacht Club was established in 1927 and offers sailing enthusiasts vessel storage space, as well as sailing classes available to members and the public. Several non-water dependent uses have been authorized on this large spoil island, including the Miami Children's Museum and Jungle Island (formerly Parrot Jungle and Parrot Jungle Island). In addition, a public marina, fishing retailer and fuel dock on the southwest side of the island has been removed for a planned hotel and restricted access mega-yacht marina. A ferry operates from a smaller dredged materials island called Terminal Island south of Watson to provide access to residents of Fisher Island. A separate ferry system operates from Dodge Island within the Port of Miami for workers on Fisher Island. Several islands created from dredged materials, contain large gated homes including Star, Hibiscus, and Palm Islands, and lie between the Venetian Causeway and the MacArthur Causeway. All of the dredged materials islands represent loss of aquatic habitat within the area that became BBAP waters. The US Coast Guard Sector Miami is headquartered on a dredged material island south of the MacArthur Causeway. The Port of Miami offers access to cruise ships as a beginning and ending point rather than as a port of call. Government Cut, which originates from Watson Island in the west and opens to the Atlantic Ocean in the east, is the location for cargo and cruise ships' transits and dockage. The port is county owned and also operates as a landlord for three cargo shipping terminals. The Biscayne Bay Pilots moor at the eastern end of Lummus and Dodge Islands. These spoil islands were built with bulkhead walls to allow mooring of ocean-going vessels. The Port facilities have impacted the most resources of all bay-related construction. Direct impacts alone have removed over 400 acres of seagrass, unconsolidated and consolidated marine sediment area, and mangroves.

The downtown Miami area has changed dramatically throughout Miami's first century. The current Biscayne Boulevard used to be the bay's shoreline, but massive dredging and filling in the 1920s led to land creation. Bicentennial Park was previously used as Port facilities, a Formula One car street racetrack, and a seasonal venue for visiting tent performances. In 2007, the City of Miami announced plans to build two museums and a bay-friendly viewing area in the renamed Museum Park Miami. To the south, the American Airlines Arena was built and opened in 1999 to Host Miami's professional basketball team. In 1987, Bayside Marketplace with retail shops and restaurants replaced Pier Five where commercial and headboat (commercial hire) fishing vessels sold their catches dockside.

The City of Miami Miamarina offers 131 slips including several scenic tour boats and charter fishing vessels. Boat tours include the Miami River and celebrity bayfront homes and can seat over 100 people. Aquatic preserve personnel have reached hundreds of people on bay and river tours. Bayfront Park is the oldest surviving bay park; it was dedicated in 1925. After the library was removed, two amphitheaters and several memorials were erected. These parks are connected by a Bay Walk providing visual access. Across from the mouth of the Miami River is the most protected area within Biscayne Bay. The Bill Sadowski Critical Wildlife Area was designated by the FWC in partnership with the City of Miami. This "No Entry Zone" was designated to offer protection from disturbance to birds that wade at low tide for fish. Since the tides vary, the most effective way of preventing disturbance is for the area to be removed from on-water visitation. After the area was protected for bird life, the designation was expanded to include protection of manatees and very shallow seagrass flats, where manatees graze. Plant communities on the island include seagrass beds, sand and mud flats, mangrove and herbaceous wetlands, beach dunes and coastal maritime hammock. Of the approximately 1,300 acres, submerged lands constitute 900 acres, coastal wetlands 235 acres, dunes 12 acres, maritime hammock 28 acres, with an additional 7 acres of reforested maritime hammock reclaimed from previously disturbed areas. A 13-acre maritime hammock forest at the center of the island is the best example of this forest type in MDC, where many plant and animal species are listed as rare or endangered. The forest is a vital resource for wildlife species, including rare, migrating songbirds that travel down the Atlantic coast.

Central Biscayne Bay

The Rickenbacker Causeway is the dividing line between North and Central Biscayne Bay. Water now flows under the bridge from Government Cut, to the south due to the currents from the Atlantic Ocean. This causeway was built in 1947, with several spoil islands supporting its western end. These are now used as visitor access and include activities like swimming, sailboarding, and other recreational activities. Hobie Beach or Dog Beach is the nickname for the southern edge of Virginia Key where the new causeway joins a fishing pier. This is one of the most popular swimming beaches in the bay and it is one that is monitored by the State of Florida Department of Health's Healthy Beaches program. It is also the only beach in MDC that allows dogs. The southern tip of Virginia Key also includes the University of Miami's Rosenstiel School of Marine and Atmospheric Science and two offices of the National Atmospheric and Oceanic Administration: The Southeast Fisheries Science Center and the Atlantic Oceanographic and Meteorological Laboratory, both of which provide BBAP with invaluable research and assistance. The county's marine technology magnet high school, the Maritime and Science Technology school shares the key with the Miami Seaquarium where manatees are rehabilitated from injuries. Other marine facilities include the City of Miami owned and operated Rickenbacker Marina and the City of Miami Marine Stadium. When the original causeway's drawbridge was replaced in 1985, the east portion of the bridge was left as a fishing pier. Between the two, 200 slips are offered. Four restaurants and two Atlantic Ocean front parks are also on the key. Across Bear Cut, on the bayside of Key Biscayne is Crandon Marina and associated boat ramps, with 425 slips supplemented by 60 moorings. The mangrove island opposite the mooring field is monitored for bird roosting and nesting. Red mangroves line the western shoreline of Key Biscayne, joining Bill Baggs Cape Florida State Park, at the southern tip of the island. The Biscayne Bay-Cape Florida to Monroe County Line Aquatic Preserve overlaps with the Atlantic shoreline and extends east 3 miles (4.8 km) into the Atlantic Ocean. BBAP borders the western shore up to the mean high water line and BISC's northeastern boundary is a few hundred yards south of the island's tip. From Cape Florida visitors can view the historical stilt houses within the bay, known as Stiltsville which are now included within the national park. Along BBAP's western shore, mangrove-lined parks begin at the Rickenbacker Causeway with Alice Wainwright Park and Vizcaya Museum and Gardens then alternate with high end residential developments, high density condominiums, and institutions such as Mercy Hospital. The state owned Vizcaya Museum & Gardens (180 acres) includes some of the oldest red mangroves along the bay. This museum is a 70 room mansion moved from Europe at the auspices of James Deering, half-brother of the Charles Deering of the Deering Estate. The Coconut Grove neighborhood of the City of Miami begins with David Kennedy Park, along the bay. Also along the waterfront are Kenneth Myers and Peacock Parks. The Kampong is one of the nation's five National Botanical Tropical Gardens and is situated directly on Biscayne Bay—the other four are located in Hawaii. The name "Kampong" was bestowed upon this property by its owner, the renowned horticulturalist Dr. David Fairchild, and means "village." This garden is home to many fruit trees and other plants that were originally brought here from Indo-Malaysia. It is regarded for its breathtaking vista of Biscayne Bay and is a little-known location where the groundwork was laid for the makings of Everglades National Park by famous conservationists such as Marjorie Stoneman Douglas (National Tropical Botanical Garden, n. d.). The Barnacle Historical State Park was founded in 1973 to provide access to the unique house of the Commodore Ralph Munroe and unspoiled maritime hammock. The Coconut Grove waterfront

also features the bay's (and the state's) largest marina with 582 wet slips. Dinner Key Marina is owned by the City of Miami and shares the area with several other marinas and yacht clubs offering wet slips and dry storage spaces. The City of Miami owns the Seminole Boat Ramps with 43 trailer parking spaces. The Coconut Grove Sailing Club has a clubhouse on land it rents from the city and moorings to the west of the southernmost Dinner Key Islands. The area's off-shore islands include Fair Isle and the Dinner Keys. Fair Isle was a natural island that was enlarged by dredged material and renamed Grove Isle. The Grove Isle marina has 100 wet slips on the island's western coast. The Dinner Key islands underwent exotic plant removal and replanting with mangroves and native plant species in 2007 and 2008. These islands were created when the area was used as a seaplane base for Pan Am beginning in 1931. The former Pan Am terminal now houses the City of Miami City Hall.

Further south, the Coral Gables Waterway was built through the Atlantic Coastal Ridge. Protected natural areas managed by MDC in this region include Matheson Hammock, R. Hardy Matheson Preserve and Chapman Field. These areas protect mangrove forests along the bay. Matheson Hammock Marina offers 244 slips, a swimming atoll beach, and areas of active recreation, such as kite and wind surfing. Snapper Creek marina and private yacht clubs in the vicinity also allow access. Chapman Field was a World War I air station and now serves as a US Department of Agriculture Station for Plant Experimentation. MDC has ball fields on part of the park and plans to allow kayak and canoe access. The Deering Estate is just north of the dividing line between BBAP and BISC. Its 458 acres are state owned, but managed by the MDC Environmentally Endangered Lands Program. Part of the estate, Chicken Key, is a mile off shore and serves as an important bird rookery within BBAP. Within its hammocks and pinelands, the park protects several important archaeological sites, including the Old Cutler fossil site (excavated mid-1980) and a shell midden. A three story wooden building served as the first inn between Cocoanut Grove and Key West beginning in 1900. James Deering purchased it in 1916 and built a three story stone house there in 1922. The estate was purchased by the State of Florida and MDC then added to the National Register of Historical Places in 1986. The northern eye wall of Hurricane Andrew came ashore at the Deering Estate to the south in August of 1992. The stone house suffered less damage than the wooden sections of the estate, but the wine cellar was flooded. People's Dock was rebuilt, then re-opened for fishing, canoe and kayak launching, and other public uses. BISC's Visitor Center and Headquarters are at Convoy Point. Two county facilities share boundaries BISC and BBAP: Black Point County Marina, with 188 wet slips and 10 boat ramps, along with dry storage and Homestead Bayfront Park including a swimming atoll and Hoover Marina with 175 wet slips and dry boat storage, with 10 boat ramps. BISC also has marina facilities and/or primitive campgrounds on three of the barrier islands: Boca Chita, Elliot Key, and Adams Key, which visitors often use to access the aquatic preserves.

Southern Portion of Biscayne Bay

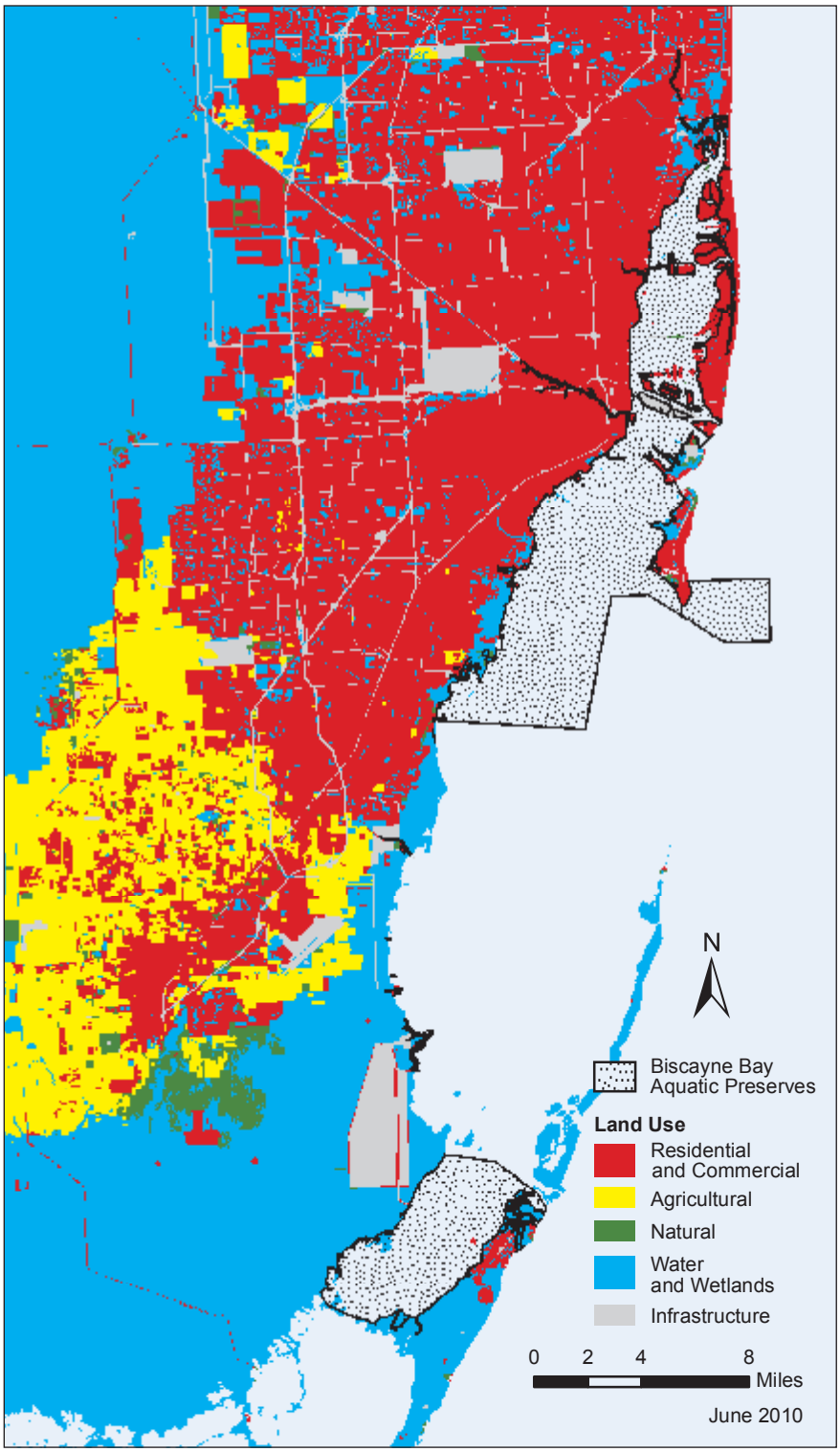
The portion of southern Biscayne Bay that lies within the aquatic preserve contains Card Sound and Little Card Sound. These two waterbodies are separated by a mud shallow called Card Bank but are often classified together as Card Sound. The western shoreline of Card Sound is dominated by the FPL Turkey Point power plant to the north and wetlands to the south. The State of Florida purchased portions of the adjacent lands through the South Florida Water Management District's Model Lands Project. Other land is purchased by MDC's Environmentally Endangered Lands program. The shoreline is lined with mangroves, but these and the freshwater wetlands nearer to the shoreline are showing signs of distress because they are cut off from freshwater connections to the Everglades. The CERP C-111 Spreader Canal project is expected to bring additional freshwater to the Card Sound portion of Biscayne Bay. FPL works to replace some of the affected wetlands through placement of culverts through levees as part of a mitigation bank for past and future impacts.

The northern boundary of Card Sound lies at Cutter Bank with a series of keys called the Arsenickers. These islands are prime bird rookeries. In northern Card Sound, Angelfish and other smaller creeks connect the bay to the Atlantic Ocean. A number of the islands formed to the north of Key Largo are protected as either state-owned lands within the John Pennekamp State Park or as part of the Crocodile Lakes National Wildlife Refuge. The eastern boundary of the national wildlife refuge is the northernmost section of Key Largo. Two major community developments were built in the mid-1900s: The Angler's Club and the Ocean Reef Club. Two state parks and a national wildlife refuge either overlap with or border BBAP. John Pennekamp Coral Reef State Park includes several islands north of Key Largo which also lie within the aquatic preserve because they are publicly owned. Pennekamp was founded in 1963 as the first undersea park in the US and has expanded to include areas bordering Card Sound as well as the Atlantic Ocean and Largo Sound. Dagny Johnson North Key Largo Botanical State Park, founded in 1982, includes mangroves within the preserve and Rockland hammock on the preserve's southeast border. Aside from several islands at the northern part of Key Largo, the Crocodile Lakes National Wildlife Refuge encompasses the Monroe county waters of BBAP

and the mangroves on the preserve's southern boundary. The Crocodile Lakes National Wildlife Refuge was founded in 1980 and includes 6,700 acres with 650 acres of that being open water. The southern boundary also includes the Card Sound Road Bridge where Little Card Sound is separated from Barnes Sound.

*3.1.7 / **Surrounding Land Use***

Land use in and adjacent to BBAP is classified according to the following categories: Commercial/ residential, agricultural, natural, water/wetlands, and infrastructure. Some examples of commercial and residential uses include municipal, business, housing, and industrial. The northern section of the bay is primarily commercial and residential, with numerous state and municipal parks. The northern section has lost its natural shoreline and is now armored with cement and rip rap to create seawalls and stabilize shorelines created through spoil island construction. The central section is surrounded in the north by commercial and residential lands, then the landscape shifts towards residential and agriculture surroundings. Agricultural lands in southern MDC are the most diverse in the US and made up primarily of row crops, citrus plants, and foliage nurseries, with year-round growing seasons. Though agricultural lands may provide open space that allows for wildlife habitat, it also contributes to low water quality that enters BBAP through canals. Water flow from agricultural areas may contain high levels of nutrients that cause algal blooms in the BBAP. Biscayne Bay is phosphorus limited and phosphorus inputs are considered the causal agent in the Southern Biscayne Bay cyanobacterial bloom initiated in the fall of 2005 (Graves, et al., 2004).The land adjacent to the Card Sound adjoins a primarily undeveloped shoreline, with the exception of the Model Land Company Canal and



Map 13 / Land Use Adjacent to Biscayne Bay Aquatic Preserves

the cooling canals that serve the Turkey Point Power Plant. The MDC Environmentally Endangered Lands (EEL) Program, which identifies and secures lands for preservation, began in 1990. From 1991 to 2010 nearly 20,000 acres were purchased, with a value of over $110 million (MDC EEL, n. d.; Cynthia Guerra, personal communication). Parcels that were adjacent to Biscayne Bay include additions to the Deering Estate and wetlands in the Model Lands Basin of southern MDC. The program is administered by PERA, with funding for the management of the natural areas provided by the MDC EEL Program and land management work conducted by the Natural Areas Management division of the Parks and Recreation Department with professional and volunteer crews. Florida Forever is Florida's conservation and recreation lands acquisition program, and works to conserve natural resources and renewing Florida's commitment to conserve the state's natural and cultural heritage. The land acquired has many uses, from recreation to water quality preservation to protecting our military. Florida Forever has touched nearly every county in Florida and greatly improved our great state's quality of life, and has partnered with MDC on environmental land acquisition. A national land conservation organization, the Trust for Public Land is a national, nonprofit, that conserves land for people to enjoy as parks, community gardens, historic sites, rural lands, and other natural places, ensuring livable communities for generations to come. This organization has preserved land adjacent to BBAP. The SFWMD is the state agency that has and will continue to purchase lands necessary for the Biscayne Bay Coastal Wetlands projects that are part of CERP. The increased cost of coastal lands and the shrinking state budget are overarching concerns affecting the likelihood that land necessary for Biscayne Bay and Everglades restoration will be acquired in a timely manner for projects to move forward if at all.

Staff have partnered with Tropical Audubon Society to conduct bird surveys in the Critical Wildlife Area. A special permit was obtained as this is a no-entry year round designation. Having data that documents how the Critical Wildlife Area is being used by birds and other species will help support its continued designation as a sanctuary.

Part Two

Management Programs and Issues

Chapter Four

The Office of Coastal and Aquatic Managed Areas' Management Programs

The 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 Biscayne Bay Aquatic Preserves***

There is a large body of scientific research, monitoring data and maps that have been compiled dating back to the early 1900s that took place in Biscayne Bay and specifically within the boundaries of the Biscayne Bay Aquatic Preserves (BBAP) before they were designated. This research documents numerous changes associated with the development of South Florida which have affected Biscayne Bay.

These include: canals that were built in the 1900s that successfully drained the Everglades ecosystem, of which Biscayne Bay is a part; elimination of natural sheetflow (rain water that flows into the estuary by traveling over natural shoreline) that supplied freshwater to Biscayne Bay; and substitution of a highly spatially concentrated and periodic point source flow through canal mouths. Inlets between barrier islands that were dredged into navigable channels to enhance large vessel access to the mainland also increased the amount of salt water in the bay and require periodic maintenance dredging that impacts bay habitats and inhabitants. Shorelines that were bulkheaded for stabilization to allow for urban development and increased population resulted in the loss of natural water filtration by wetlands and of nursery areas for many bay species. Some threats to Biscayne Bay have been recognized and mitigated. The raw sewage that had been dumped directly into Biscayne Bay since the human population increase of the late 1800s was diverted to a sewage disposal system in 1956. Starting in the early 1900's through the early 1980's, a substantial amount of research was invested in the northern part of the bay to determine impacts of development and mistreatment of the resource. A multi-day symposium called "Biscayne Bay: Past, Present, and Future" was held in the late 1970s to showcase this body of work and to provide a direction for research and monitoring in the future. According to the prologue in *Biscayne Bay Past, Present, Future* (1976), the symposium grew from what began as evening seminars in an attempt to unify diverse research activities in Biscayne Bay that were presented to and for faculty of the University of Miami (UM) Rosenstiel School of Marine and Atmospheric Science (RSMAS). The chair of the UM Research Council appointed a Biscayne Bay Ecology Committee in march 1974, and was headed by Dr. Anitra Thorhaug. The seminars were so successful that Dr. Thorhaug made the decision to hold a symposium with the express objective to not only present all the information that was known to date about Biscayne Bay but also all that is not known. Since this time, major restoration projects, such as the Comprehensive Everglades Restoration Plan (CERP), have been initiated and funnel federal, state and local dollars into developing baseline data in preparation for the restoration of freshwater flow and timing to Biscayne Bay. Most of the CERP projects are directed southward, within the boundaries of Biscayne National Park (BISC) and the Card Sound portion of BBAP. This has largely left a gap in the amount of money and time agencies, universities and organizations are able to spend in the northern part of Biscayne Bay.

An estimated 75% of the game fish and 90% of the commercial species in south Florida are dependent upon the mangrove system during at least part of their life cycles.

Despite claims in later years that development and hydrological alterations left the northern Biscayne Bay largely lifeless, historic and current research suggests otherwise. In fact, while diversity might be slightly lower in North Bay than South Bay, Schroeder (2003) concluded in 1981 that not only did north Biscayne Bay yield the sample with the most organisms, but most northern bay stations were quite diverse. The mean number of taxa at the northern sites ranged from 16-311, with an average number of organisms at all sites sampled totaling 1061. In the southern sites, the mean number of taxa ranged from 18-78 with an average number of organisms at all sites sampled totaling 633. There was no significant difference based on season between the north and south bay stations. Since the 1980s, the health of Biscayne Bay has improved through best management practices including the addition of storm water filtration systems and heightened public awareness of responsible fertilizer and pesticide use , restoration and enhancement of islands and shorelines, and improved oversight of activities within and adjacent to the bay, allowing resources to rebound significantly. The copious amount of data once

generated in the northern bay, such as studies conducted between the 1950s and 1990s, is no longer occurring. Studies include characterizing the bay bottom to document seagrass and algae cover, investigating the kinds of species that use northern Biscayne Bay such as fish and invertebrates key to recreational and commercial industries, and water quality sampling. Research questions are now driven by the kinds of baseline data needed for CERP projects, the benefits of which primarily apply to Biscayne National Park, to determine its success by identifying flora and fauna to serve as indicator species (those that illustrate a change in the ecosystem has taken place). As a result, research funding that comes mostly from state and federal agencies to help answer key questions about the health of Biscayne Bay has largely moved away from northern bay. While this part of the bay can be regarded as resilient and relatively healthy despite being impacted by decades of coastal development, concerns remain that minimal data collection may result in managers missing important cues should there be any degree of decline in ecosystem function or shift in species composition. Minimal data collection also makes it difficult to fulfill BBAP's mission to address cumulative impacts from coastal construction and to employ adaptive management strategies to protect natural resources.

Today, BBAP actively fosters strong working partnerships with multiple agencies and researchers who conduct research, monitoring, restoration, mapping, and modeling activities within Biscayne Bay. Numerous agencies, universities and scientists have contributed their time and resources to assist BBAP with these efforts. Leading partner agencies include the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service, BISC, United States Army Corps of Engineers (USACE), United States Geological Survey (USGS), US Environmental Protection Agency (EPA), US Fish and Wildlife Service (USFWS), Florida Sea Grant, South Florida Water Management District (SFWMD), Florida Fish and Wildlife Conservation Commission (FWC), and Miami-Dade County (MDC) Permitting, Environment, and Regulatory Affairs (PERA). Universities and non-profit organizations include, respectively, UM RSMAS, Florida International University (FIU), Barry University, Nova Southeastern University, Tropical Audubon Society (TAS), Trust for Public Land (TPL), Marine Animal Rescue Society (MARS), and Pelican Harbor Seabird Station. The support offered by these entities greatly enhances the BBAP's ability to manage resources effectively by providing the breadth of research and monitoring currently and historically done in Biscayne Bay.

Since the initial placement of an aquatic preserve manager at BBAP in the 1980s, the partner agencies' staff most often interacts with the SFWMD and PERA. Information collected from these agencies laid the foundation for the ecosystem science program at BBAP. BBAP's limited staff and financial resources, an expansive geographic coverage area, and a unique set of challenges such as managing two aquatic preserves adjacent to the most populous county in the state, means that fostering partnerships with agencies is crucial. In addition to obtaining data from partnership organizations, staff reviews scientific literature, participates in conferences, coordination meetings and other venues that feature work within and surrounding BBAP.

Mapping

Documented mapping efforts in South Florida date back to 1770-1876 (Roland, n.d.). Aerial photographs taken of Biscayne Bay date back to the 1940s and presumably were used for mapping purposes. Seagrasses within Biscayne Bay were mapped and characterized by Zieman (1982) for the USFWS as part of a larger project within South Florida. The first large-scale mapping project to document submerged aquatic resources first began in the early 1980s when PERA produced a map of bottom communities in the bay, based on extensive field work using staff surveys that physically identified community types instead of using high resolution photography that is often used today to achieve the same information. Seven biological cover classes were defined and mapped: sparse and dense hardbottom communities, turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), mixed grasses, and algae. Since the 1980s, mapping has used digitized images and Geographic Information System (GIS) software to depict natural resources in layers. In 1995, Sargent mapped South Florida's seagrass communities using aerial photography and categorized those seagrasses and those counties most heavily scarred and proposed ways to decrease this kind of injury. In addition, the Florida Department of Environmental Protection's (DEP) Coral Reef Conservation Program mapped the southernmost boundary of their coverage area which overlaps with a section of BBAP's boundaries at the Bill Baggs Cape Florida State Park offshore from Key Biscayne as part of a benthic mapping project. Ongoing collaboration between the multiple agencies has produced many digitized layers of GIS data, with less species detail than PERA's 1983 map.

Methods of mapping have evolved within the past four decades from the time when mapping efforts first began. From physically surveying submerged lands to document benthic cover through the 1980s, the 1990s began an era of high resolution aerial photography with spot checks done in the field to verify classification.

Monitoring

In 1979, PERA's Surface Water Quality Monitoring Program was established to collect baseline data and to create a routine surface water quality sampling program for Biscayne Bay and its watershed. This program began with 48 stations, and has expanded to 105 stations located in the bay and in major tributaries. By consistently using the same monitoring stations and measuring the same parameters, this allows scientists and managers to document any changes in water quality and to base future management decisions on interpreted results. In addition to water quality monitoring, PERA began to study the surface of bottom sediments in 1985, also known as epibenthic monitoring, via seagrass transects at 12 fixed stations in order to show changes in existing seagrass bed species composition. In 1999, 100 additional stations were added for visual density monitoring from the Miami River basin south, including Card Sound. During the growing season, each station is randomly sampled in one of its twelve subplots with Braun-Blanquet techniques, which is the most commonly used method to determine vegetation composition and cover of benthic sediments.

Monitoring of Biscayne Bay waters' physical parameters including salinity and temperature is being conducted using datasondes that measure conductivity, temperature, dissolved oxygen, turbidity and tide height data. BISC has been collecting data at six stations since 1990. In 1997, 12 additional datasondes were added to support a contract with the USACE to collect data that would be used to develop a computerized model of the bay's circulation. Additional monitoring of fish, invertebrates, and vegetative cover within BBAP and other areas affected by CERP has occurred through coordination with NOAA, the USGS, and other Restoration, Coordination and Verification (RECOVER) members.

FIU's Southeast Environmental Research Center (SERC) began the South Florida Coastal Water Quality Monitoring Network in 1991, with 5 monitoring stations in Biscayne Bay, as a part of a larger study with 177 stations reaching around the bottom of the peninsula to Southwest Florida (Boyer & Briceno, 2008). This monitoring project works to characterize status and trends in water quality of Florida Bay, and expanded to cover most of Southeast and Southwest Florida, including BBAP. The network provides an overview of what is happening in South Florida coastal waters, for scientists and natural resource managers. This monitoring effort was funded by SFWMD and managed by FIU SERC, but in 2008 the SFWMD, who was funding both PERA and SERC to conduct water quality sampling in Biscayne Bay, decided there was some duplication of effort. PERA was chosen as the agency to continue the monitoring and several sites were removed from the northern part of Biscayne Bay to compensate. Data that was once collected in the northern and central sections of BBAP are archived and available for use, but no further data has been collected since 2008. SERC's monthly grab samples were tested for ten chemical parameters while phytoplankton biomass was measured using chlorophyll a and four field parameters were measured at the sites. SERC had posted summaries of their data on-line and copied the aquatic preserve on their Quarterly Reports to SFWMD. Biscayne Bay's 25 sites were partitioned into six Zones of Similar Influence with two stations in Card Sound. SERC researchers have published numerous papers based on their data, but due to the small sample size, spatial resolution for North Bay is not available.

Research Coordination

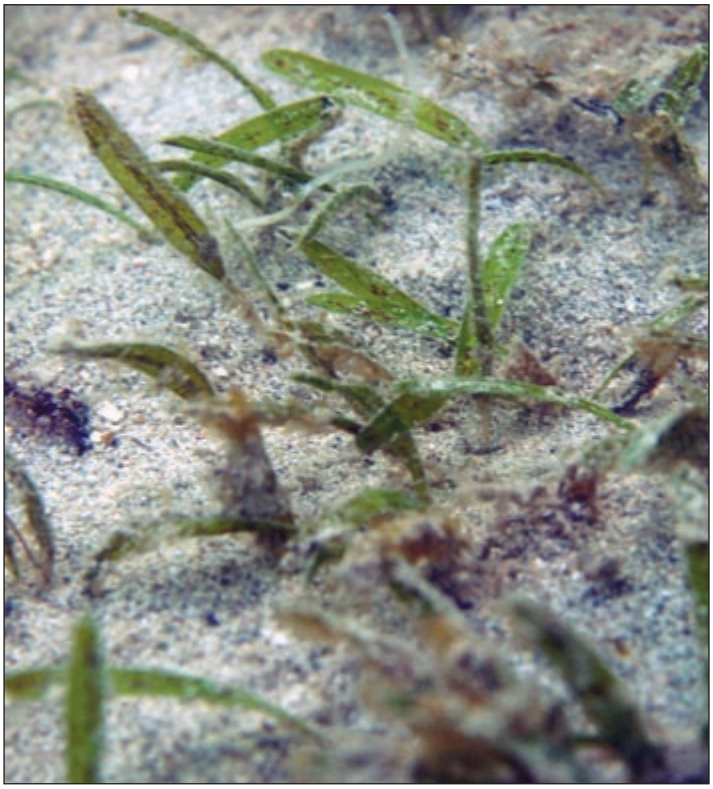
BBAP works to collect published research results and reports from south Florida agencies and universities that research natural resource issues within the bay and its watershed. BBAP requests published results from partner agencies and files literature at the Biscayne Bay Environmental Center (BBEC) library, where BBAP offices are located. UM's RSMAS has produced several works relating to the bay, including technical bulletins and a historical collection of references of Biscayne Bay and a room dedicated to very dated studies from the turn of the century. In addition to this, a bibliography of the marine environment within the bay was published (Cantillo, Hale, Collins, Pikula & Caballero, 2000). This bibliography provides mangers and researchers with a quick reference guide to peer reviewed work published on Biscayne Bay and the date of sampling. NOAA's Miami Regional Library at the Atlantic Oceanographic Meteorological Laboratory on Virginia Key houses a data recovery program that seeks out and rescues older documents and data that would otherwise be lost to the scientific community. The program is known as the Coastal Estuarine Data Archaeology and Rescue. BBAP staff regularly access this online resource to obtain historic Biscayne Bay scientific that date back several decades. Graduate students at FIU and RSMAS, along with professors, frequently utilize Biscayne Bay for field research and at the same time produce important research that contributes to BBAP management success. USGS's South Florida Information Access website compiles publications, data, metadata, and other information about BBAP and other natural areas of South Florida. Metadata is a summary document within GIS data that provides content, quality, type, creation, and spatial information about a data set. Spatial information consists of data pertaining to the location and dimensions of geographical entities. With this support, BBAP staff can interpret data and metadata in order to create maps and contribute to reports, publications, and public interest meetings. The USGS's South Florida

Ecosystem History Project was designed to integrate studies from a number of researchers compiling data from terrestrial, marine, and freshwater ecosystems within south Florida. Biscayne Bay is one of the three regions that are targeted in this project with the goal of providing information about the bay's recent ecosystem history. The USGS South Florida Ecosystem History Online Database contains data on site locations, field information, water chemistry and salinity, vegetation information, and biotic occurrence tables for foraminifers, mollusks, ostracodes, pollen, dinoflagellates, and diatoms, which all pertain to the sediments of Biscayne Bay. An interagency group, the Florida Bay and adjacent Marine Systems Program Management Committee, developed a "Strategic Science Plan for Biscayne Bay," that was published in 2002. This plan reviewed the variety of scientific monitoring and research that occurred in the bay and published a list of priority items to be studied for the next 5 years, in order to ensure agencies' goals are achieved and accomplish CERP's mission. NOAA, in coordination with the South Florida Ecosystem Research and Monitoring Program, published "Biscayne Bay Environmental History and Annotated Bibliography," in 2000. The bibliography and associated documents were scanned into the Coastal and Estuarine Data Archaeology and Rescue program for easy access online available from NOAA's Miami Regional Library at Atlantic Oceanographic and Meteorological Laboratories.

*4.1.2 / **Current Status of Ecosystem Science at Biscayne Bay Aquatic Preserves***

Mapping

Using GIS files accessible on DEP's and other local, state and federal agencies' websites, BBAP staff create maps of resources to use in support of comment letters to DEP's Environmental Resource Permitting program, in educational/outreach programs to illustrate resources to the general public, or to answer inquiries from the public. In 2004, SFWMD, the National Park Services (NPS), and the Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute (FWC-FWRI) initiated a new project to update the Submerged Aquatic Vegetation (SAV) maps in Biscayne Bay. Aerial photography conducted in May of 2005 and the imagery from this project will result in updated mapping layers for SAV and other benthic and emergent habitats within Biscayne Bay. BBAP staff relies on other agencies, including FWC-FWRI, PERA, SFWMD, NPS, USGS, and images obtained through CERP research, as sources to provide updated imagery and GIS files of Biscayne Bay. BBAP staff has undergone some GIS training in order to manipulate data from these projects and others. Additional training is needed for all staff in order to fully utilize GIS software to produce quality maps that will lead to management decisions, public forums, and contribute to BBAP educational efforts. BBAP staff is working to collect data in the field, through use of the Trimble™ Global Positioning System (GPS) receivers and to incorporate this data into GIS files to create maps. Additional training is also needed for these efforts. Biologists from FWRI have worked with BBAP staff when their schedules allow on how to use these instruments and properly update software.



The first and only marine plant to be listed under the Endangered Species Act, critical habitat for Johnson's seagrass was designated in the year 2000. Its entire worldwide distribution lies from northern Biscayne Bay, north of the Rickenbacker Causeway, to Sebastian Inlet. Mapping and restoration efforts are underway in coordination with FWC and PERA.

One tool that is projected to aid in sea level rise mapping for south Florida is NOAA's development of a "National VDatum" which converts different ways of measuring elevation data (regarded as "datum") along the shoreline into one national standard. Many legal boundaries, such as the official BBAP boundaries, are defined by a mean high water standard and

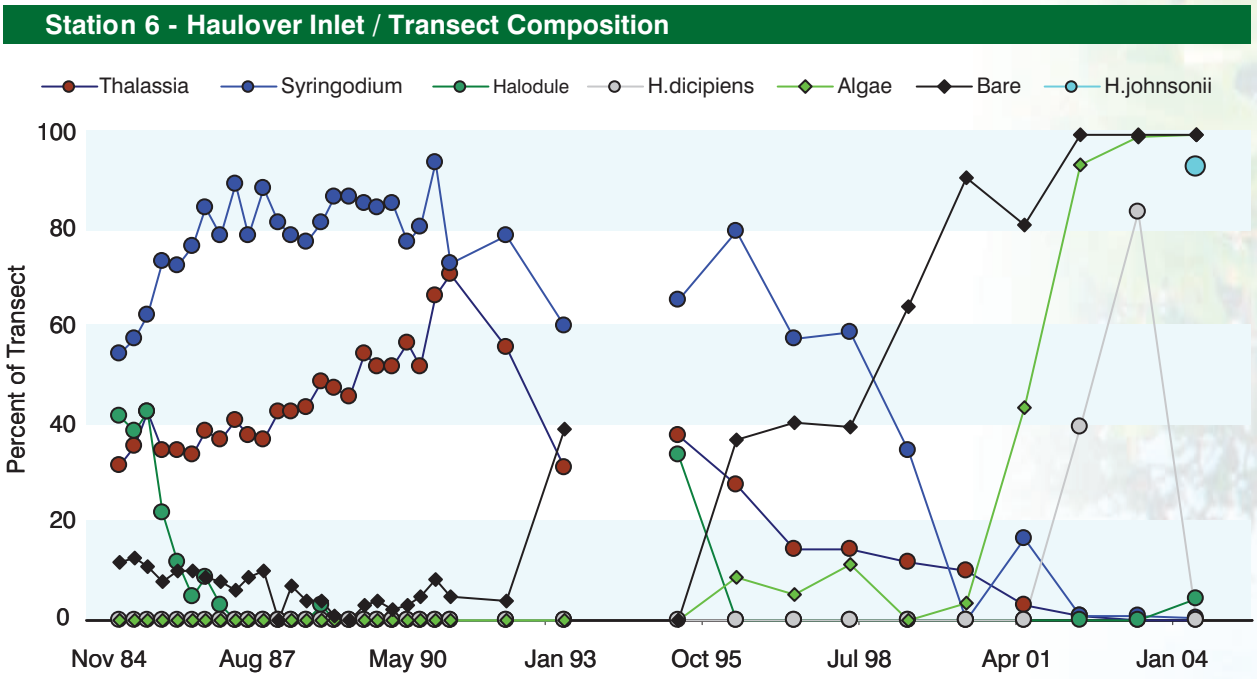
the legal shoreline for the U.S. is the mean high water shoreline depicted on the nautical charts produced by NOAA. However, it is extremely difficult to measure shoreline where every point on that shoreline truly represents the horizontal position of the land-water interface when the water level is exactly at the mean high water value for that exact position. In the future, BBAP staff would like to have the boundaries of the preserve professionally surveyed to ensure that all lands that should be legally included with BBAP boundaries are represented accurately in the total acreage managed by the preserve.

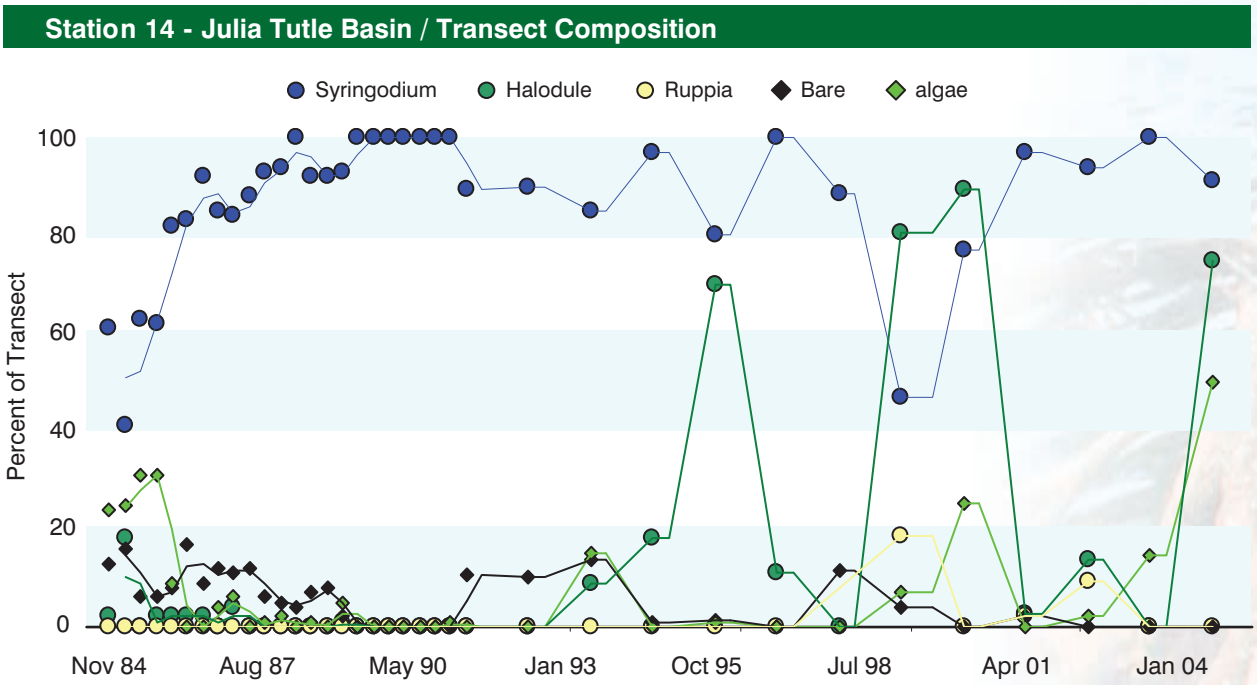
In 2010, the southwest region of CAMA managed through the Rookery Bay National Estuarine Research Reserve applied for NOAA funds to develop two geodatabase projects to serve as pilot regional coastal and marine spatial management tools. The development of geodatabases that integrate existing science-based data and information, linked to a spatial management framework through the application of GIS software will serve as powerful information tools for use by aquatic preserve managers and staff, regulatory personnel and other coastal management professionals. One geodatabase management tool will be developed by staff at the Estero Bay Aquatic Preserve and the other at BBAP. Citing the fact that preservation and promotion of seagrass habitat is specifically named in the 'intent' of the Biscayne Bay Aquatic Preserve rule and noting BBAP's many partnerships with agencies monitoring natural resources, the goal is to create a central repository, using a geodatabase tool, where locations of water quality stations, seagrass distribution and composition, and high resolution photo imagery are co-located. Expected outcomes of these geodatabase projects are improved protection of aquatic preserve resources through access to spatial data to achieve more informed decision-making by coastal managers and regulatory personnel. Information generated by the geodatabase tools will contribute to the protection and management of the aquatic preserves' water quality, living marine resources, public access opportunities, and an increased understanding of the cumulative effects of land use in adjacent watersheds. To develop the Estero Bay Aquatic Preserve and BBAP geodatabases, CAMA requested $75,000 for salaries, travel, equipment (GPS and computer hardware), supplies and contractual services.

Modeling

Modeling can be used not only as an environmental assessment tool and used to support sustainable natural resource management, but to use existing data such as rainfall or water quality parameters to predict changes in a system over time or under particular circumstances. It was produced as part of CERP by NOAA representatives, SFWMD, PERA, and USFWS. It relates ecological attributes of the bay to outside forcing functions that are identified as water management, watershed development, and sea-level rise (Browder et al., 2005). This model shows the effects that a change in water flow can have on Biscayne Bay, adjacent lands, and the species that reside there. Some concepts discussed from the model relate to roseate spoonbill (*Platalea ajaja)* habitat and how it is affected by changes in timing, location, and volume of water flow. Though areas studied in this modeling project were focused in the southern portion of Biscayne Bay, applications could potentially be applied to areas within the northern bay. BBAP staff attended a meeting sponsored by the SFWMD concerning modeling efforts for Biscayne Bay in 2007, where deficits in modeling were discussed. USGS is developing a combined surface water and groundwater model application to simulate past, present, and future hydrological conditions in Biscayne Bay. A water quality model for Biscayne Bay should be considered for future management considerations. The high cost of modeling projects limit the number of agencies that can conduct large scale modeling tasks.

Several Biscayne Bay and related watershed models were created to try to answer several key questions, including how much freshwater is delivered to Biscayne Bay, and from what source (groundwater seepage, rainfall, canal outflow, storm water runoff, etc.). Other models simulate salinity patterns and the hydrodynamics (how water moves) from the bay, such as water circulation and water residence times within particular basins (Wolfe, 2007). Models developed to illustrate how groundwater moves into the bay and what salinity patterns might be are significantly difficult to make accurate because of the Biscayne Aquifer. The aquifer is known to be highly porous with many cavities where water may travel at different speeds. The primary or secondary purpose of most Biscayne Bay models are to predict what effects or changes will be seen following the implementation of CERP projects designed to restore freshwater sheetflow to Southern and Central Biscayne Bay. The Biscayne Bay Hydrodynamic Model Phase I was developed by the USACE and is meant to model hydrodynamics and salinity in Biscayne Bay. The Biscayne Bay Box Model simulates salinity regimes in the bay and was expanded to include mass balance calculations of total phosphorus and dissolved inorganic nitrogen uses salinity and nutrient values to do so. The TABS-MDS also simulates salinity regimes and is considered a more complex model (Marshall & Nuttle, 2011). The PERA Storm Water Model, created by the agency, looks at stormwater and flood modeling in the county. A Groundwater Discharge to Biscayne Bay Model developed by USGS simulates groundwater discharge to Biscayne Bay. The South





C. Avila, DERM, 2009

Figure 2 / Transect Composition

Biscayne Bay Hydrodynamic Model was created by RSMAS' Dr. John Wang and is meant to illustrate salinity and flow due to tides, wind and freshwater input (Wand, Luo, & Ault, 2003). Other uses might include forecasting the fate and transport of suspended or dissolved matter. The North Biscayne Bay Hydrodynamic model, also developed by Dr. Wang models flow of water in north Biscayne Bay due to tides, wind, and freshwater input. The South Miami-Dade County Groundwater Flow Model was developed by Florida Atlantic University in cooperation with SFWMD and is meant to support the Lower East Coast Water Supply Plan by modeling groundwater and wetland flow as well as groundwater quarry interaction. The North Miami Dade County Ground Water Flow Model (also known as Version 3.0 of the Lake Belt Groundwater flow model) developed by the SFWMD supports the Lower East Coast Water Supply Plan and the Water Preserve Area Analyses for CERP. It models groundwater and wetland flow and groundwater quarry interactions. The South Florida Water Management Model was developed by the SFWMD and simulated responses to different regional water management strategies. The Integrated Wetlands Treatment Model developed by the University of Florida, in cooperation with SFWMD, simulates

space and time dynamics of surface and shallow groundwater hydrology and water quality. It is used to simulate effects of spatial land use configurations, development intensities, and wetland network arrangements. BISC, MDC and USACE are involved in updating the existing hydrodynamic and salinity transport model. The hydrodynamic data collection program was developed to better understand circulation patterns within Biscayne Bay as part of CERP. The data collected is used in the validation and verification of models used for the CERP Biscayne Bay Coastal Wetlands (BBCW) and as a monitoring tool for the RECOVER monitoring and assessment plan. The revised hydrodynamic model will reflect three-dimensional salinity conditions and will, in turn, help to determine the importance of freshwater inflow on salinity and circulation patterns in Biscayne Bay.

Seagrass Monitoring

PERA's Benthic Habitat Monitoring Program design includes two levels of SAV monitoring. The first (Level 1 sampling) consists of sampling fixed locations throughout the bay, which helps identify trends in vegetation cover. The second (Level 2 sampling) consists of stratified random sampling methods that provide status, trend, and spatial data of benthic communities of the central and southern bay. Stratified random sampling divides the study population in the different sections, or strata, and looks at each stratum independently of the others. In September 1985, a series of fixed transects were positioned throughout the bay, and initially, sampling was conducted quarterly at 12 sites. Three additional sites were added 1989, two in Manatee Bay and one in Barnes Sound. Currently, sampling is conducted annually during the month of June at 10 of the original 12 sites. Monitoring stations, located near Black Ledge and Turkey Point, were discontinued in 1996. The three stations added in 1989, were incorporated into PERA's SAV monitoring program in Northeast Florida Bay, and as of 2010, sampling is conducted at these sites on a semiannual basis in May and November. Sampling parameters include, seagrass shoots, blade density, standing crop biomass by species, and seagrass composition along a 45 m transect. Level 2 sampling was initiated in 1999. It consists of stratified random sampling similar to the methods currently used in Florida Bay and the Florida Keys National Marine Sanctuary. The monitoring network consists of 101 stratified random sites sampled annually using modified Braun-Blanquet

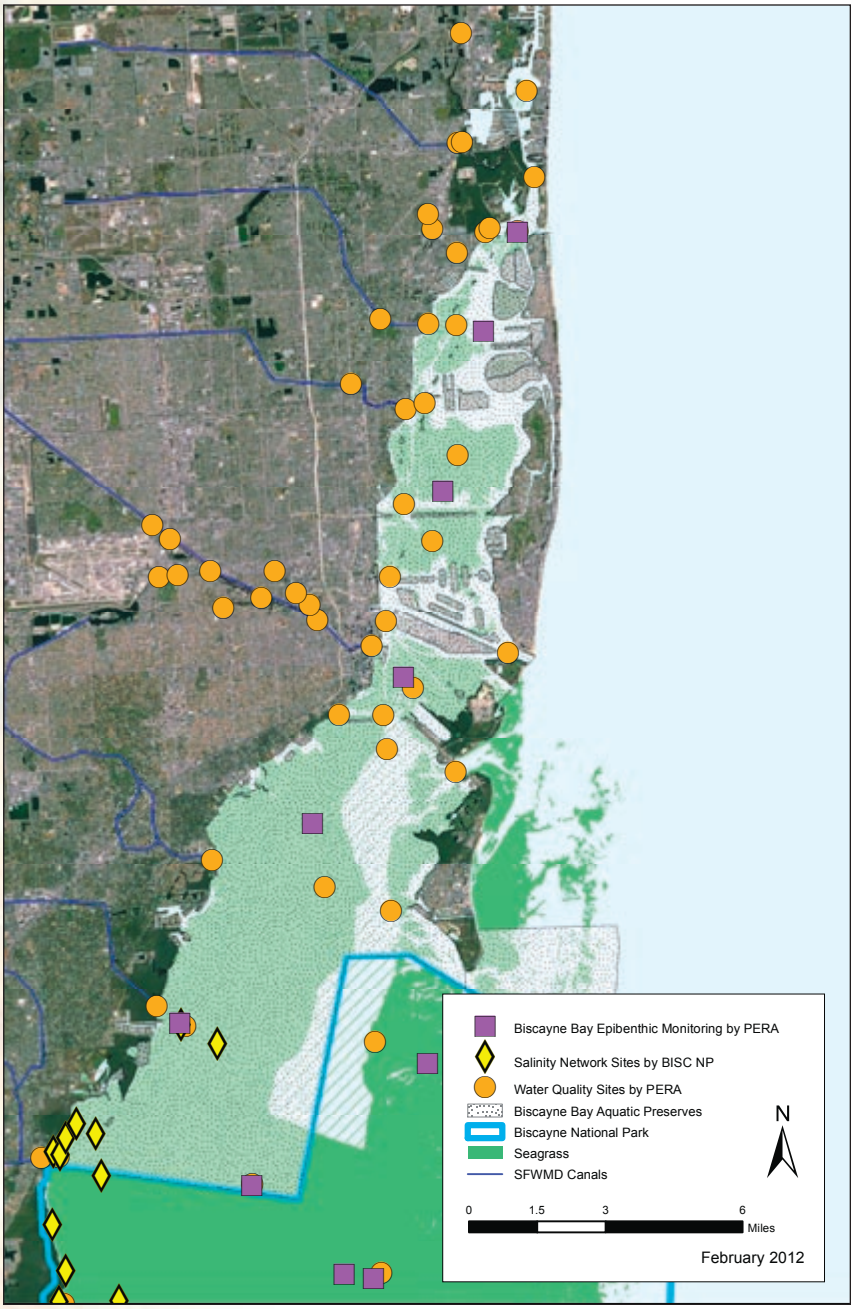


Figure 3 / Current PERA Epibenthic Monitoring Level 1 (Fixed Transect Sections), PERA Water Quality Monitoring Stations, and Biscayne National Park Salinity Network Sites - North.

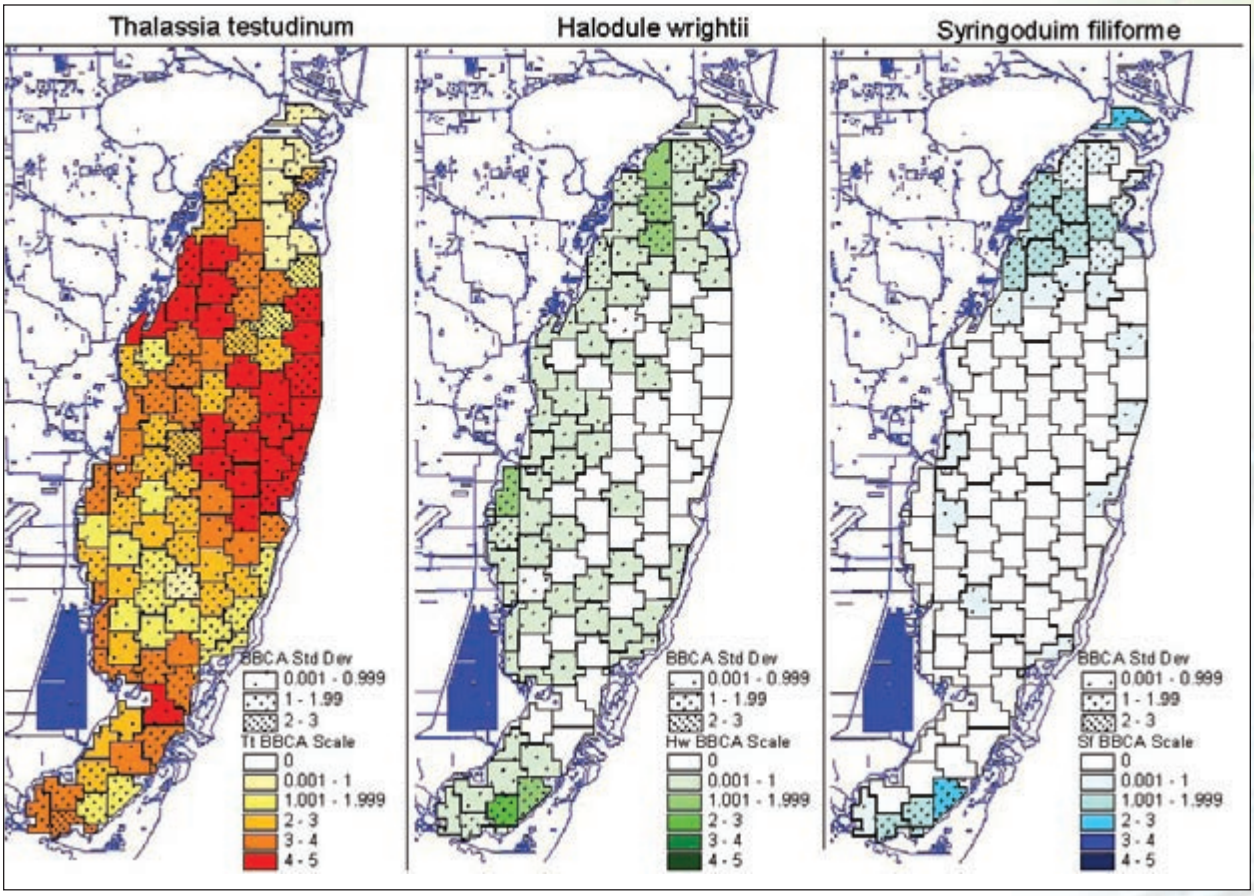


Figure 4 | Biscayne Bay Seagrass Monitoring, Nine Year Evaluation

cover-abundance scale, which describes how much and what kinds of vegetation covers an area. Frequency, abundance, and density of vegetation are calculated for each site. This information is used by BBAP staff to remain aware of any shifts in species composition, irregular water quality results that exceed standards or are of concern such as elevated levels of chlorophyll a, and other signs of potential impacts to natural resources.

FIU's Southeast Environmental Research Center's (SERC) primary mission is to serve as a resource center providing accurate, detailed, unbiased scientific information to those who make management decisions affecting the sustainability of our fragile resources. SERC facilitates linkages between scientists and local, state, and federal agencies, and provides an organizational structure for regional environmental research initiatives and interdisciplinary environmental investigations. SERC staff includes faculty, students, and technicians, from a variety of disciplines and works together on environmental research efforts to promote understanding, protection, and restoration of water resources, recreational lands, and natural ecosystems of the southeastern US and the Caribbean. Special emphasis is placed on work in Biscayne, Big Cypress, Everglades, and Dry Tortugas National Parks; the Greater Everglades ecosystem; the Florida Keys National Marine Sanctuary (FKNMS), and other freshwater and coastal areas. In addition, SERC houses the offices of the intergovernmental South Florida Ecosystem Restoration Task Force that coordinates the development of consistent policies, strategies, projects, and priorities addressing the restoration, preservation, and protection of the south Florida ecosystem. Federal, state, local, and tribal representatives work cooperatively and communicate with all stakeholders in this unprecedented conservation endeavor.

The Shallow Water Positioning System (SWaPS) is an innovative survey method developed by scientists from NOAA's National Geodetic Survey to establish the precise position of objects and organisms in shallow-water environments and provide a permanent, geocoded visual record of the bottom. SWaPS uses a GPS receiver centered over a digital video or still camera suspended in a glass enclosure, providing a clear view of the bay bottom. The digital images obtained are encoded with GPS position, time, date, depth, heading, and pitch and roll, providing an immediate permanent archive. Post-processing the GPS data allows the user to recover the same position again with a high level of accuracy. SWaPS is available in three survey platforms including boat, remote, and diver platforms,

that can access different types of habitats under different field conditions. The advantages of using a program like SWaPS include the ability to survey large areas rapidly without the need to deploy divers or specialized field personnel with a permanent photographic or video log of the assessment. Three major projects include SAV monitoring in Biscayne and Florida Bays, damage assessments such as seagrass scars and ship groundings, and coral reef monitoring. The goal of the Biscayne Bay SWaPS Project is to develop and implement a monitoring program to survey shallow, near-shore benthic habitats. These critical habitats have been under-represented in previous and ongoing monitoring efforts due to the difficult boat access to shallow areas less than three feet in depth. The location of these habitats makes them susceptible to potential changes in freshwater deliveries as proposed through CERP.

The goal of the South Florida Fisheries Habitat Assessment Program (FHAP-SF) lead by the FWC-FWRI is to provide information for the assessment of seasonal variability of seagrass communities, and to establish a baseline to monitor responses of seagrass communities to water management alterations associated with CERP activities. FHAP-SF is documenting the status and trends of seagrass distribution, abundance, reproductive, and physiological status which are indicators of ecosystem health. Other goals include providing data on photosynthetic rate and epiphyte loads, a measure of other organisms such as algae growing on seagrass blades. Resource managers are able to use these data to address ecosystem-response issues on a real-time basis and to weigh alternative restoration options. Various SAV species had been monitored at ten Florida Bay locations since 1995. The geographic scope of FHAP-FB was expanded in 2005 to a total of 22 locations extending into northern Biscayne Bay, and the program was renamed the FHAP-SF at that time.

The study of a macroalgal bloom is underway in Biscayne Bay that is being led by FIU researchers in collaboration with UM and with funding from BBAP (made available through unspent funds from a vacant position). In 2002 some spots with abundant growths of a green macroalgal complex made up of *Anadyomene stellata-A. pavonina* were detected in Biscayne Bay by MDC PERA. The bloom has since been observed with increasing abundance and distribution that now spans nearly nine miles of the length of the bay by a mile wide, starting south of the Rickenbacker Causeway and extending down past Chapman Field (see Map 15). Per Collado (2011) the recent increase in the abundance of *Anadyomene stellata* and *A. pavonina* highlights the need to explore the physical and biological factors behind this expansion. The use of isotopic composition of macroalgae has been used as a tracer of anthropogenic nutrient inputs in coastal zones (Lin & Fong, 2010). Because most algae will use carbon dioxide as their carbon source, any processes that affect dissolved carbon dioxide (such as productivity, light levels, salinity) will affect the carbon isotopic composition, whereas nitrogen isotopic composition of primary producers will depend on several factors. The aim of this project is to evaluate the role of nutrient conditions on the expansive growth of the species *Anadyomene stellata* and *A. pavonina* in Biscayne Bay as a function of distance to shore and specific areas known to be affected by particular sources of nutrients. Tissue nutrient content (C:N:P) will be used to evaluate the nutrient status of the bloom and stable isotopes 15N, will be used to trace the origin of nitrogen supply (Collado, 2011). BBAP staff received preliminary findings made available by collaborators by the end of June 2011.

Water Quality Monitoring

BBAP staff obtains access to data through established partnerships with agencies that collect and/or fund water quality monitoring programs within Biscayne Bay. PERA provides water quality and epibenthic data, based on its own monitoring stations throughout Biscayne Bay upon request. PERA's 105 stations are visited during the first week of each month in the Bay Run. Twenty-four parameters are measured on site or through laboratory analysis of grab samples collected. Most analyses are performed on samples taken at one meter's depth, but some samples are duplicated at the surface and bottom of the station. In August 2009, SFWMD entered into a five-year cooperative agreement with MDC to continue support for long-term environmental monitoring in Biscayne Bay, Barnes Sound and their associated tributaries. The monitoring program, known as the Biscayne Bay Surface Water Quality and Biological Monitoring Program, is conducted by PERA. PERA scientists collect water and seagrass samples from basins in the study area and analyze them for a variety of chemical, physical and biological features. The water samples provide information about water quality at 85 fixed monitoring stations. Seagrass samples provide information about fish and invertebrate habitat at 100 random monitoring stations. These monitoring stations stretch from Barnes Sound in southern MDC to the northern part of Biscayne Bay near the Broward County line. This long-term monitoring effort, which began in 1979, provides a substantial period of record that serves as a baseline to evaluate estuarine restoration. Coastal ecosystems, comprised of 10 major estuarine areas, are found throughout the SFWMD's 16-county region, including Biscayne Bay. SFWMD works with many organizations, including MDC, to produce a broad range of scientific and water resource information

for better managing freshwater inputs to these vital ecosystems and for supporting their restoration. The monitoring effort documents how changes in both estuarine water quality and seagrass growth impact the South Florida coastal ecosystem and the effects of various CERP projects adjacent to Biscayne Bay. At the time the new agreement was made, several northern Biscayne Bay sites were dropped. It was noted by SFWMD leadership that this kind of monitoring program provides SFWMD and its partners with quantifiable data needed to show the benefits or required enhancements of water quality improvement projects such as CERP. Cuts to the SFWMD budget in 2011 resulted in closure of the Miami Service Center, which provided outreach and information to the community as well as provided staff that could represent the SFMWD at stakeholder meetings and community events. In addition to staff losses and organizational changes, funding cuts to monitoring programs such as those implemented by PERA, with SFWMD funds, have been truncated, resulting in less water quality and benthic community data. Loss of spatial and temporal coverage reduces the ability of scientists and managers to detect changes in the ecosystem. When changes are detected, it becomes harder to pinpoint the source of the problem because one sampling station now represents a larger area of the bay. Management decisions to rectify the problem become more challenging.

PERA samples in the vicinity of the Miami Beach barrier islands, within BBAP, that are in part funded by the City of Miami Beach. There is a need to have additional sites closer to shore to better characterize the effects Miami Beach storm drains have on BBAP water quality. Currently all storm drains providing flood relief in the City of Miami Beach drain directly into Biscayne Bay. Some storm drains pass through the storm drains. City environmental staff has undertaken a “Drains to Biscayne Bay” campaign where small, coaster-sized plaques will be affixed to cement street surfaces to remind citizens to be responsible about refuse, as all drains lead to Biscayne Bay.

NOAA’s Atlantic Oceanographic and Meteorological Laboratory conduct hydrographic surveys of central and southern Biscayne Bay that began monthly in 2002 and became quarterly in 2007. These hydrographic surveys examine the physical conditions, boundaries, flow, and related characteristics of bay waters. When conducting surveys, shorelines, tides, currents, sea floor and submerged features are examined. Sampling equipment has an underwater flow-through system that collects data every seven seconds and measures temperature, salinity, light transmission, and chlorophyll fluorescence. Analysis of chlorophyll data helped detect and monitor a cyanobacterial bloom in the southern part of Biscayne Bay, including Card Sound, which began in the fall of 2005. A monitoring program locator for south Florida was developed by USACE in

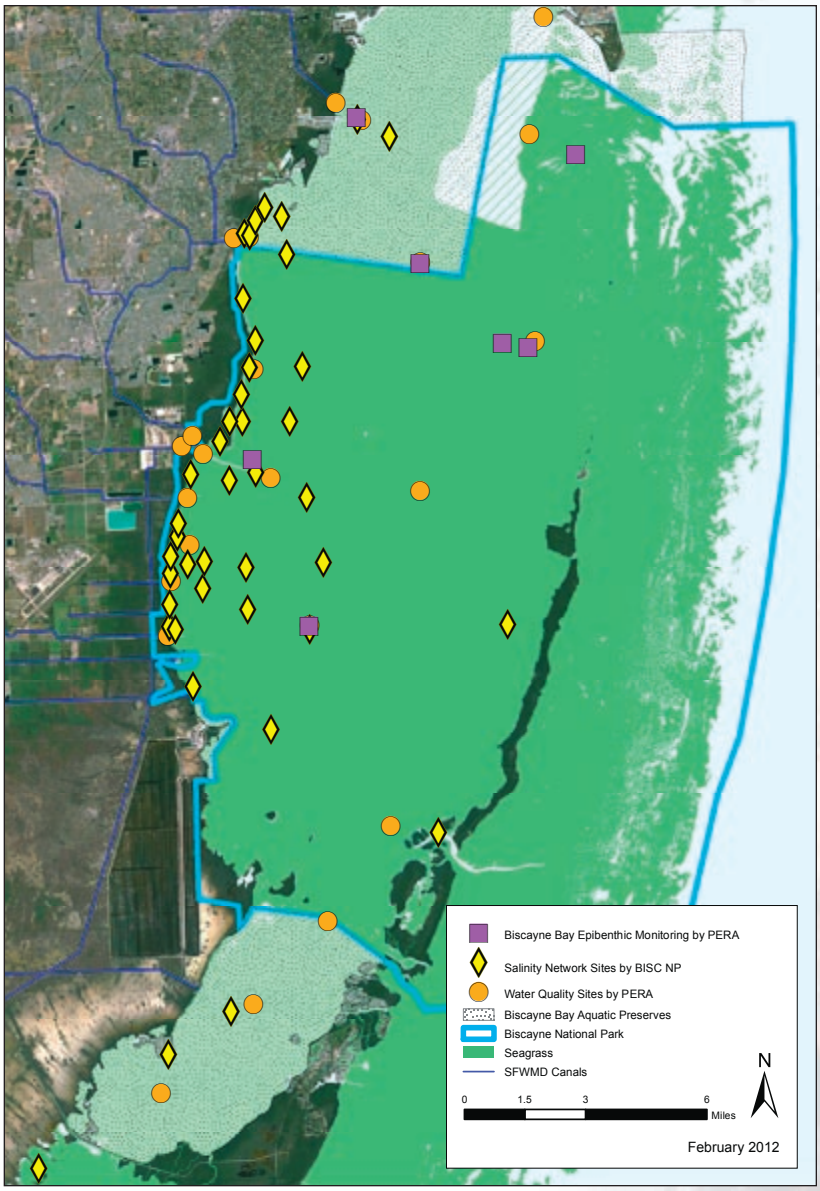


Figure 5 | Current PERA Epibenthic Monitoring Level 1 (Fixed Transect Sections), PERA Water Quality Monitoring Stations, and Biscayne National Park Salinity Network Sites - South.

conjunction with CERP projects the Florida Water Resources Monitoring Council. Initial reports published in 2008, discuss the strategy of coordinating existing local, state and federal monitoring programs and creating a statewide, integrated, water resource monitoring system. Additional monitoring associated with CERP or listed species include visual fish assessments in the mangroves, geospatial video monitoring of benthic habitats, and Johnson's Grass (*Halophila johnsonii*) transect monitoring by FWRI and the University of North Carolina, Wilmington (UNCW).

There are numerous agencies that monitor water quality in the bay, from the Rickenbacker Causeway, south to Card Sound, focusing on CERP restoration, but research does not spatially represent Biscayne Bay. Almost no research is conducted in the northern basins of BBAP. BBAP hopes to secure funding in the future to hire an additional staff scientist to work as an interagency research coordinator and to initiate and manage BBAP's own water quality monitoring program. Future monitoring project possibilities include the deployment of multiple dataloggers as part of CAMA's water quality monitoring program in order to be able to collect and record data at predetermined settings depending on objectives. At least one additional BBAP staff member is needed to deploy and retrieve the datalogger, as well as analyze data. The advantage of data collected by dataloggers is that it is continuous, taken at 15 minute or greater intervals, and that it can often collect parameters during weather events when grab sampling may not be an option. The Biscayne Bay Partnership Initiative (BBPI) published in 2001, stated clearly that one of the specific science-generated management and action recommendations from the science team co-chair's report was that "recovering northern Biscayne Bay" needs to be a priority.

Mangroves and other native flora provide habitat for nesting and roosting birds, like this juvenile yellow-crowned night heron seen here drying its feathers.

The USGS coordinates the South Florida Seagrass Fish and Invertebrate Assessment Network (FIAN), a monitoring program that will quantify change and identify trends in near shore epibenthic fish, shrimp and crab communities in south Florida seagrass habitats with the long-term objective of assessing the performance of the CERP projects. Since 1983, a series of studies, have been conducted by the National NOAA's National Marine Fisheries Service and the USGS in shallow seagrass dominated waters of south Florida for the purposes of quantifying abundance and species composition of seagrass-associated fish and invertebrates, including the pink shrimp (*Farfantepenaeus duorarum)*, in relation to habitat type. Collectively, a 20-year baseline dataset has been accumulated that includes within its period-of-record a seagrass die-off between 1987-1990 and 1998-2000, hypersalinity associated with the drought of 1989-1991, and persistent algal blooms in Florida Bay beginning about 1992. At present this dataset consists largely of data for Johnson Key Basin in Western Florida Bay. Over time this dataset compliments other studies, providing a bay-wide perspective on faunal distributions. More limited data is available from Biscayne Bay where, since October of 2002, a study funded by the SFWMD has been underway in southern Biscayne Bay (Chicken Key to Turkey Point) to characterize the near-shore epibenthic fish and invertebrate communities, including spatial and temporal variation.

In 2009 the EPA made a formal determination that numeric nutrient critieria are necessary for estuarine and coastal waters and proposed criteria and a method of breaking out waterbodies shortly thereafter. DEP launched a collaborative effort to develop scientifically defensible and protective criteria for marine and estuarine waters. Physical and chemical factors such as hydrogeology and geologic history were included in how units for which criteria will be set were established; other parameters such as nutrients,

salinity, and dissolved oxygen and regional models were considered (Frydenborg, n.d.). Several public meetings have been held in various parts of south Florida and elsewhere in the state. MDC PERA, FIU SERC, and BISC were the primary suppliers of data sets used by Dr. Henry Briceno of FIU in deriving protective nutrient criteria for Biscayne Bay. A technical supporting document was supplied to DEP for review by the Florida Marine Numeric Nutrient Criteria Technical Advisory Committee, of which FIU SERC's Dr. Joe Boyer is a member. Originally, the state of Florida was broken up into eco-regions where all of southwest and southeast Florida was considered one unit for which criteria would be derived. However, scientists and managers in MDC quickly made a case to set Biscayne Bay (and other coastal systems respectively) apart from each other based on geology and historic nutrient data. Because of Biscayne Bay's limestone foundation and historically oligotrophic nutrient condition, it was set apart and Dr. Briceno used datasets from local partners to justify this position and proceeded to break up the bay into sub-regions. Even in the northern part of Biscayne Bay, within the boundaries of BBAP where nutrient loading from anthropogenic inputs have historically been high, the median total phosphorus value is less than 10 parts per billion; total phosphorus in the 75th percentile of the dataset is just about 12 parts per billion and that is the highest in the Biscayne Bay ecosystem. Phosphorus values, in this phosphorus-limited system, rival those set in Everglades restoration with main threshold values at or below 8 parts per billion (Briceno, Boyer, Harlem & Castro, 2010). Despite considerable objections from various user groups and government agencies, nutrient criteria can be set for Biscayne Bay that will be protective of the bay's natural resources for generations to come, without imposing any additional best management practices to agriculture or other industries, and without any additional changes or investment of financial resources to accomplish this.

An aspect of water quality that needs to be addressed in Biscayne Bay and other coastal areas in south Florida with respect to the availability of freshwater for restoration projects is the quantity of freshwater available and that the volume being received by the waterbody is protected. Protecting volumes of freshwater from consumptive uses (for example, by local governments renewing consumptive use permits to pull freshwater for human consumption from the Biscayne Aquifer) is under the charge of the SFWMD. Water needed for use in CERP projects is in need of protection from consumptive uses that compete with restoration goals. There are different levels of protection from consumptive use that waterbodies can receive including the designation of minimum flows and levels (MFLs), restricted allocation areas (RAA) and water reservations. The Biscayne Aquifer has already been afforded a minimum flows and levels designation which is protection from further withdrawls that will cause "significant harm" to the water resources of the area per 373.042 and 373.0421, F.S. An MFL can be designated when there is a well established linkage between water resource needs and ecological response to changes in water delivery and the data needed to meet this requirement moves through a peer review process. Criteria for designating an RAA can include a specific geographic area and/or canal conveyance system from which allocations are restricted and it must be reasonable and beneficial, does not interfere with presently existing legal users of the water resource, and must be consistent with the public interest, per 373.223(1) F.S. As of 2010, Biscayne Bay is being considered for an RAA. This is particularly helpful in protecting freshwater currently being received by Biscayne Bay and Card Sound and would protect the amount of freshwater being conveyed through canals in the extreme northern and southern parts of the preserves, respectively. Because most of the freshwater received in the northern portion of BBAP that helps maintain the salinity regime comes from canal conveyances, not groundwater or sheetflow like southern portions of the bay, these conveyances need to be protected. An RAA protects existing flows of water as well as future restoration project volumes, protecting water against consumptive use activities. Water reservations are the most protective for wildlife per 373.223(4) F.S. which states that water can be set aside specifically for the protection of fish and wildlife or for public health and safety (Mills, 2009). All aforementioned rule-making to afford Biscayne Bay restricted allocation area protection is suspended until further notice per Executive Order 11-01 signed by Governor Rick Scott on January 4, 2011 which suspends all rule-making pending review by the newly established Office of Fiscal Accountability and Regulatory Reform.

Sediment Monitoring

Monitoring of the sediments in Biscayne Bay is another important way that scientists and managers can gather data on the historical conditions in the bay. This is helpful when determining what freshwater input restoration targets should be, as well as identifying what potential threats there are to the bay's ecology. The use of foraminifera, a class of microscopic shelled protists (single-celled organisms), can be used as bioindicators of coastal pollution. Forminifera have short lifespans and are among the last to disappear from the site they inhabit. They remain well preserved in the sedimentary record, are widely distributed, and are cost-effective to sample with minimal impact to the environment. They are commonly referred

to as “forams” and studies of foram assemblages (more than one species lives in a community) date back from the 1940s through present day. Studies have provided information on historic salinities in the bay and changes over time as well as heavy metal contaminants from industrial such as polychlorinated biphenyls and agricultural runoff, such as pesticides. Deformities of the forams shell can indicate presence of pollutants. The Foraminifera in Reef Assessment and Monitoring Index exists to provide resource managers with a measure independent of coral populations to determine whether or not water quality in an area is suitable for coral growth or recovery. This index is being adapted so that it can be used as a resource assessment tool in a subtropical estuary such as Biscayne Bay. In the future, a comprehensive document might be produced to indicate changes that have occurred in Biscayne Bay over the past six or seven decades and provide a baseline as CERP projects move forward.

Epibenthic Monitoring

Epibenthic organisms are those that live near the surface of bay bottom sediments. While some seagrass maps and maps of the bay bottom might sometimes describe areas without seagrass, macroalgae or coral as “barren,” this is hardly the case. Over 500 species of marine worms make their home in the sediments of Biscayne Bay as do many other organisms seeking shelter such as some species of fish, crabs and rays. Other organisms find the food they need as they stir up the sediments such as nurse sharks and rays. NOAA currently conducts field sampling twice a year in the wet and dry seasons along the shoreline in central to southern Biscayne Bay as part of an epibenthic monitoring program. The goal of the program is to be able to determine what species of fish, crabs and other organisms are live along the shoreline, able to survive at salinities that range from zero to 35 parts per thousand (ocean salinity). When the water control structures within the canals along the central-southern shoreline of the bay are opened, the freshwater pulse can turn the bay’s salinity from 30-35 parts per thousand to zero in a matter of minutes, creating a salinity regime that is inhospitable for many larval and adult stages of fish and invertebrates.

Monitoring of Marine Reptiles, Mammals and Birds

Sea Turtle Monitoring is conducted by MDC Parks and Recreation Department. Prior to 1980, there was no documented sea turtle activity largely due to the lack of available beach nesting habitat. In 1979, the Parks and Recreation Department’s Sea Turtle Conservation Program began a comprehensive beach renourishment project. After that time, sea turtle activity was more abundant and today. The program has documented over 6,886 nests (B. Ahern, personal communication, [September 2010]), which resulted in the release of over 550,300 hatchlings. County staff is permitted through the FWC to conduct their work. Staff walk the beaches of Key Biscayne that are not scoured by industrial machines each day during nesting season to remove seagrasses and other natural material, mark where nests are located, and monitor nest progress. The Marjorie Stoneman Douglas Biscayne Nature Center on the Atlantic Ocean side of Key Biscayne will rescue hatchlings where there is heavy public access and will incubate the eggs and release them during moonlit walks available to the public on a first-come, first-served basis. Sea turtles that are reported as injured within Biscayne Bay and near shore waters are taken in by the Miami Seaquarium and undergo rehabilitation. Bill Baggs Cape Florida State Park, at the southern tip of Key Biscayne and bordered by BBAP, is the preferred location for sea turtle release, once turtles are rehabilitated at an approved facility such as the Miami Seaquarium in Miami-Dade County.

Prior to 1900, it was an annual tradition in the Unites States to hunt birds each Christmas during the annual “Christmas ‘Side Hunt.’” Ornithologist Frank Chapman proposed a new tradition on Christmas day in 1900 – a Christmas Bird Census. Since then, the annual count that takes place across the country is known as the Christmas Bird Count (Audubon, n.d.). Northern Biscayne Bay has historically been a part of the count—from the years 1982 through 2002. Local TAS member Robert Kelley, who is thought to have bridged two generations of bird conservationists in south Florida, lead the Miami team who ventured into Biscayne Bay by boat to conduct the count. Specifically, volunteers traveled to Virginia Key and the Little River to document endangered species such as the peregrine falcon (*Falco peregrinus*) and the bald eagle (*Haliaeetus leucocephalus*), threatened species such as piping plover (*Charadrius melodus*), and species of special concern such as brown pelicans (*Pelecanus occidentalis*), black skimmer (*Rynchops niger*) and the tricolored heron (*Egretta tricolor*). This effort was brought to an end shortly before Kelley’s passing and in the past few years, only birds seen on land were counted. In December 2010, BBAP staff worked with leadership from TAS, to reinstate this annual count, albeit covering less area than previous counts due to weather. Staff will continue working with TAS to eventually pick up the route in its entirety either by motorized or non-motorized vessel, to be provided by BBAP.

NOAA’s Southeast Fisheries Science Center conducts a bottlenose dolphin (*Tursiops truncatus*), monitoring program in Biscayne Bay, using photo-identification techniques as a method of identifying

individual dolphins for population studies. Initiated in August 1990, a total of 180 individuals have been identified from 390 sightings during 250 surveys. Of these, approximately 75% are considered to be full time residents of Biscayne Bay. The study area runs from Haulover Inlet, south to Card Sound Bridge encompassing an area of approximately 250 square miles. The behavioral studies component includes observing and monitor habitat use, movement patterns, and other behaviors exhibited by Biscayne Bay bottlenose populations. Currently, a website is being developed to allow researchers to compare dolphin dorsal fin images from the photo-id projects in adjoining study areas to determine the extent animal ranges.

Support
BBAP staff provides support for research performed by public agencies and by private groups desiring to propose mitigation projects within the aquatic preserve. During fiscal year 2007-2008, aquatic preserve staff participated in a dock shading study performed by Deborah Shafer of USACE and Jocelyn Karaszia of NOAA National Marine Fisheries Service's Essential Fish Habitat Program. Aquatic Preserve staff visited single-family residence docks permitted by DERM with Shafer and Karaszia. Seagrass and algae cover surveys were performed and light measurements were taken under and adjacent to the built structures for comparison to surveys performed prior to the construction. Also in 2007-2008, staff accompanied a seagrass biologist from FWRI and employees of Seagrass Recovery, Inc., to use GPS receivers to assess propeller and grounding scars within seagrass beds of north Biscayne Bay. BBAP will conduct site surveys for regulatory staff headquartered in West Palm Beach at DEP's Southeast District Office. The BBAP manager has also supported the teacher training efforts of the Coral Reef Conservation Program's Awareness and Appreciation Coordinator by providing a presentation on the role of and connections between estuaries and coral reefs.

4.2 / The Resource Management Program

The Resource Management Program addresses how CAMA manages BBAP and its resources. The primary concept of BBAP Resource Management projects and activities are guided by CAMA's mission statement: "To protect Florida's coastal and aquatic resources." CAMA's sites accomplish resource management by physically conducting management activities on the resources for which they have direct management responsibility, and by influencing the activities of others within and adjacent to their managed areas and within their watershed. Watershed and adjacent area management activities, and the resultant changes in environmental conditions, affect the condition and management of the resources within their boundaries. CAMA managed areas are especially sensitive to upstream activities affecting water quality and quantity. CAMA works to ensure that the most effective and efficient techniques used in management activities 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. These programs work together to provide direction to the various agencies that manage adjacent properties, our partners and our stakeholders. The BBAP also collaborates with these groups by reviewing various protected area management plans. The sound science provided by the Ecosystem Science Program is critical in the development of effective management projects and decisions. The nature and condition of natural and cultural resources within BBAP are diverse. This section explains the history and current status of our Resource Management efforts.

4.2.1 / Background of Resource Management at Biscayne Bay Aquatic Preserves

Management Planning
The primary role of BBAP's role in managing bay resources has been to work as an informed source on ecological issues and cultural resources within and adjacent to the preserves, by coordinating with other resource management agencies. BBAP works to oversee activities that could potentially affect its natural resources, to ensure all laws are obeyed and enforced, and to ensure accurate information is available for management planning decisions. Other responsibilities include informing the public on natural resource issues, through educational and outreach events, such as lectures or outdoor classroom activities.

Miami-Dade County Biscayne Bay Management Plan
Past resource management efforts include the Biscayne Bay Management Plan adopted by the MDC Commissioners in 1981. This plan was developed by DERM and the County Planning Department and included areas extending to the north of the BBAP, but did not include Card Sound. In 1983, the Florida

Manatees are not discriminate about the kind of vegetation they eat. Adult manatees can weigh an excess of 2,000 lbs and eat 10% of their body weight a day.

Board of Trustees of the Internal Improvement Trust Fund (BOT) signed a Management Agreement with MDC for the latter to develop a management plan for the portion of BBAP to the north of BISC. This area excluded both Card Sound and the offshore areas of the Biscayne Bay Cape Florida to Monroe County Line Aquatic Preserve. The BBAP Management Plan was completed and submitted to the State of Florida in 1986, but was never adopted. One of the recommendations from MDC's Biscayne Bay Management Plan was the formation of the Biscayne Bay Management Committee (BBMC) to oversee bay restoration and Bay Management Programs. BBMC had thirteen to fifteen members including citizens and local, state, and federal agency representatives from its formation in 1981 until its sunset in 1993. The beginning of the Biscayne Bay Restoration and Enhancement Program, coordinated by DERM, coincided with management plan formation. During the previous two decades, prioritized Biscayne Bay Restoration and Enhancement Program projects were accomplished in this program using funding from MDC, the State of Florida, Florida Inland Navigation District (FIND), and SFWMD. Completed projects, as outlined by DERM, include the following: identifying shoreline areas that need stabilization or wave energy abatement, mapping benthic communities, attaching riprap to public shorelines, identifying sources of turbidity, planting seagrasses, and filling deep propeller scars in seagrass beds. Some continuing projects are: improving public awareness, improving bay access, obtaining baseline data on fisheries and fisheries pathology, monitoring existing mitigation and restoration efforts, developing a fisheries management program, obtaining baseline water chemistry and circulation data, stabilizing shorelines, obtaining baseline data on water epidemiology and pathology, planting mangroves, and installing artificial reefs. BISC's 1983 General Management Plan was reopened in 2000 and has gone through several public comment periods.

Card Sound Management Plan

The Biscayne Bay Card Sound Aquatic Preserve Management Plan was produced in 1991, in order to establish management guidelines for the Card Sound portion of BBAP, but was never adopted by the BOT. The plan stated that "on site management will be directed toward the maintenance of existing or essentially natural conditions and restoring damaged or degraded areas", as mentioned in Chapter 18-18, Florida Administrative Code (Florida Department of Natural Resource Management [FDNR], 1991). The plan also explains various agencies and their responsibilities in the management of Card Sound. The plan calls for the protection of natural resources and to allow for traditional uses

through management and protection of the preserve. Due to limited funding and staffing, many objectives have not been achieved through BBAP efforts, instead relying on the resources of other agencies. The majority of research that takes place in the Card Sound region is not conducted through BBAP, instead through other natural resource management agencies, such as SFWMD, USGS, and CERP. It still is unclear as to how precisely Card Sound got its name.

Biscayne Bay Surface Water Improvement Management Plan

The Biscayne Bay Surface Water Improvement Plan was developed by SFWMD and approved by the state in 1988. It addresses protection and enhancement of water quality through a variety of management strategies. The plan was most recently approved and updated with support from local, state and federal agencies in 1995. The plan has three goals: improve water quality, improve hydrology, and improve biological resources (Alleman, 1995). While portions of the original plan have been incorporated, the newest version replaces the 1988 plan. The purpose of this plan is to evaluate the effectiveness of initial strategies, identify new issues and opportunities facing the bay, and develop goals, objectives, strategies, and projects to address these items. Solutions may involve continuing current efforts, changing ongoing projects, or initiating new actions. The 1995 plan consists of two volumes, including the Planning Document and Technical Supporting Document, including appendices.

Management Plans of Adjacent Public Lands

The following plans for state and federal managed areas help BBAP staff to understand how the public uses natural areas, how these lands have changed, and how they are managed. Both Oleta River and Bill Baggs Cape Florida State Parks have management plans that have been approved and are in use. Oleta River's plan was revised in 2008 and Bill Baggs Cape Florida's plan was approved in 2001 with revisions underway in 2010. BISC's General Management Plan was completed in 1983 and is the primary management document for the park. Issues and the level of scientific understanding is somewhat outdated, management zones that were created are still in effect. The goals and objectives of the plan are divided into three sections including historical and natural resources, public enjoyment, and physical necessities. BISC's Resource Management Plan was completed in 1999 and this document implements the General Management Plan with regards to natural and cultural resources. It identifies resource problems and sets goals. The Florida Keys National Marine Sanctuary (FKNMS) is mandated to update its management plan every five years, and most recently updated the plan in 2007. Within the management document, the tools that FKNMS uses to achieve its goals, are presented under five management divisions: 1) science; 2) education, outreach & stewardship; 3) enforcement & resource protection; 4) resource threat reduction; and, 5) administration, community relations, & policy coordination. Each management division contains two or more action plans, which are implemented through supporting strategies and activities. In addition, FKNMS was mandated to develop an environmental impact statement that has allowed for, among other goals, seagrass restoration to take place according to viable method.

Interagency Coordination

Governor Chiles formed the Governor's Commission for the Sustainable South Florida and Federal Government that created the Central and South Florida Project Restudy, a forerunner of the CERP, in the 1990's. The South Florida Ecosystem Restoration Task Force (SFERTF) was formed by interagency agreement in 1993 and was formalized by Congress in the 1996 Water Resources Development Act [Subsection 528(f) of Public Law 104-303]. A Florida-based Working Group was established by the SFERTF in accordance with section 528(f)(2)(d) of the Water Resources Development Act of 1996. The Florida-based group consists of 25 members representing tribal, local, state and federal entities. The duties of the working group are to assist the Task Force in its efforts to coordinate the development of consistent policies, strategies, plans, programs, projects, activities, and priorities addressing the restoration, preservation, and protection of the South Florida ecosystem.

In 1999, the Florida legislature established the BBPI, a community-based forum funded through the SFWMD to survey public and private activities and programs affecting the Bay, and provided recommendations for actions to protect and enhance the Bay's resources. Ecological health was made a special priority. In 2001, the BBPI published the Survey Team Final Reports from their four survey teams, including recommendations in the areas of science, management, regulation, and social science & economics (which included education). Among the overarching themes identified by BBPI was the importance of unlocking access to Biscayne Bay. Based on recommendations of BBPI, the State of Florida in 2001 provided funding to TPL to develop a strategic public access plan for the Bay. Under the guidance and authority of SFWMD, TPL spearheaded a two-year, three-phase planning effort, in collaboration with an advisory team of informed, dedicated and highly able individuals who

know and love Biscayne Bay and who share the aim of making the Bay more accessible to greater numbers of people. This advisory team of about three dozen individuals reflected a cross-section of interests – the environment, tourism and recreation, government, education, business, and planning and resource management. Together, they represented a wealth of knowledge and experience in fields with a direct bearing on Biscayne Bay and the issues shaping its future. They also were familiar with the previous research and recommendations concerning the Bay and took advantage of this valuable body of knowledge. During 2003 TPL and the advisory team conducted a series of meetings, workshops, brainstorming sessions and research activities, from which emerged a vision for the future of the Bay and a strong consensus about what needs to happen in the coming years. The Policy Development Committee produced a summary entitled "A Bright Great Bay" with a recommendation to form another group to help oversee management of Biscayne Bay. The BBPI Final Report identified the Biscayne Bay Regional Restoration Coordination Team as the group that would lead a consensus process and prepare the Biscayne Bay Action Plan as recommended in the final report. The group was formed and began meeting in the fall of 2001. During this time, the Miami River, which is included within the BBAP, also had a coordinating committee appointed by the Florida Legislature in 1984. Soon after the coordinating committee sponsored a Miami River Study which recommended forming a coordination and oversight group. The Miami River Commission (MRC) was founded in 1998. The MRC working groups focus on dredging, public safety, economic development, and quality of life, and includes a storm water subcommittee.

*4.2.2 / **Current Status of Resource Management at Biscayne Bay Aquatic Preserves***

Listed Species/Critical Habitat Management

Over 173 species occurring in Biscayne Bay, its coastal wetlands or uplands, including barrier islands, can be found on a list of protected species (either Federal or state listings). The bay and adjacent wetlands may support more than 300 species of fish and possibly more invertebrates, Listed species occurring within BBAP include the Florida manatee, (*Trichechus manatus latirostris*), American crocodile, (*Crocodylus acutus*), smalltooth sawfish (*Pristis pectinate*), green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricate*), Key Largo cotton mouse (*Peromyscus gossypinus allapaticola*), Key Largo woodrat (*Neotoma floridana smalli*), wood stork (*Mycteria americana*), least tern (*Sterna antillarum*), loggerhead sea turtle (*Caretta caretta*), Kemp's Ridley (*Lepidochelys kempi*), piping plover (*Charadrius melodus*), and Johnson's seagrass. Several other shorebirds species are listed as Species of Special Concern due to habitat decline and degradation. Sea turtles were hunted in large numbers in Biscayne Bay in the 1800s and their populations were decimated until they were protected federally in the 1960s.

Manatees are regarded as the most seriously endangered animal in Biscayne Bay. The years 2009 and 2010 were the highest on record for manatee mortality, with an excess of 500 deaths in 2010. MDC comparatively has a low mortality rate due to watercraft but the FWC consistently reports that about one quarter of all mortality each year is attributed to watercraft injury. BBAP personnel have attended the Manatee Awareness Group coalition since 2003. The BBAP manager has served as chair for the quarterly meetings, which rotate between MDC, Broward, and Palm Beach counties. Federal, state, local and municipal law enforcement agencies, namely FWC, join marine industries, agencies, educators, non-profit organizations and education groups to look at issues involving enforcement, education and awareness and mortality data. FWRI provides mortality information and detailed necropsy reports for deaths occurring within BBAP. Manatee synoptic surveys are conducted by FWC and local surveys are conducted in MDC, Broward and Palm Beach counties per requirements of local manatee protection plans or through their respective county management plans. BBAP staff review data and information about topics such as rules for how protected species will be listed by FWC, data that is available from the updating of the PERA Manatee Protection Plan. The original Manatee Protection Plan was approved by the state and county in 1995 and between the years of 2007 and 2009 the plan underwent a review by a committee convened by county commissioners by a local ordinance. BBAP personnel participate in and encourage others to record and report all manatee sightings to PERA for incorporation into their database. The MDC Manatee Protection Plan considers Biscayne Bay and its tributaries essential habitat for the West Indian Manatee because they provide foraging areas in seagrass beds, warm water refugia during cold fronts, freshwater sources, other aggregation sites, and travel corridors between these areas.

America crocodile critical habitat includes Card Sound in northern Key Largo, where BBAP overlaps with the 6,600 acres of the Crocodile Lakes National Wildlife Refuge (founded in 1980). Crocodile Lakes National Wildlife Refuge focuses their management efforts on habitat restoration and enhancement in order to sustain the diverse array of resident and migratory wildlife. Management programs include

Although roseate spoonbill nesting grounds exist mainly along the southwest coast of Florida in the Everglades, both adult and juvenile spoonbills have been spotted recently in newly restored wetlands in northern Biscayne Bay. Photo by Sam van Leer.

hammock restoration, crocodile habitat enhancement, and Key Largo woodrat captive breeding. Critical nesting habitat exists within the Florida Power and Light cooling canal system and is largely responsible for the crocodile's comeback over the past 20 years. Florida Power and Light provides reports to the federal government several times a year to report on the number of adults, nests, and hatchlings as well as any deaths attributed to human causes.

The worldwide distribution of Johnson's seagrass, the first and only marine plant to be listed under the federal Endangered Species Act, extends only from Northern Biscayne Bay northward to Sebastian Inlet in Brevard County. A significant portion of the BBAP is considered to be critical habitat for Johnson's seagrass and this threatened species is generally not found south of the Rickenbacker Causeway. BBAP reviews project permits that might have negative impacts on Johnson's seagrass or its habitat. The way this species reproduces remains a question for researchers, as the male flower of this marine plan has never been documented and unlike other seagrasses it does not have a seed bank in the sediment from which it can regenerate year to year. Rather, it grows using its roots along the bay bottom and any disturbance to its habitat is thought to significantly impact its survival. In 2002 NOAA approved the recovery plan drafted to protect Johnson's seagrass and identified threats to the plant's survival, cryptic reproductive strategy, and critical habitat. In January 2011, BBAP staff met with staff from FWC, NOAA, and MDC PERA to begin the process of developing a restoration plan for this threatened species. MDC PERA documented Johnson's seagrass southward of the Rickenbacker Causeway, its previously documented southernmost boundary in Biscayne Bay. Staff from these agencies conducted a field survey to document the presence of Johnson's seagrass near Dinner Key Marina, the artificial reef near Mercy Hospital, and near the Normandy golf course in the northern part of the BBAP. FWC and NOAA have stated that the primary way in which Johnson's seagrass would be restored would be to restore habitat within its known distribution to the point where other seagrasses might be recruited in the vicinity and several key areas within BBAP were identified as possible restoration areas. In addition, opportunistic restoration by means of removing and relocating Johnson's seagrass that exists within the footprint of construction projects could be considered in the plan.

The Bill Sadowski Critical Wildlife Area (CWA) located on the western side of Virginia Key comprises 700 acres designated by the Florida FWC as a year round no-entry zone and contains BBAP's largest remaining portion of unaltered mangrove forest and relatively unaltered submerged lands. It was set aside for protection by the Florida Game and Freshwater Fish Commission and the City of Miami,

who holds deeds to some of the submerged lands, back in 1991, initially to protect wading and shorebird habitat. This critical nursery habitat is utilized by many species of fish, marine mammals, and invertebrates to feed, seek refuge, spawn or mate, or give birth to their young. According to FWC (website, 2012), CWAs are established under a Florida Administration Code rule to protect important wildlife concentrations from human disturbance during critical periods of their life cycles, such as nesting, and the Bill Sadowski CWA is one of the last remaining protected stopovers for birds migrating along the Atlantic Migratory Flyway. As one of the state's few marine CWAs, the reason for its establishment was expanded to include shallow seagrass beds important to manatees in addition to serving as critical bird habitat. The area was named for Bill Sadowski, a Miami native who died in an airplane crash while serving as the Secretary of the Florida Department of Community Affairs. BBAP staff jointly manages this area with FWC regional biologists who are headquartered in Palm Beach County. With support from the regional biologist, BBAP obtained a five year permit in 2010 from FWC to conduct semi-annual bird and wildlife surveys in partnership with the TAS within the boundaries of this year round no-entry zone to determine what species of birds are using this area and how they are using the area (nesting, feeding, roosting, etc). Staff is keenly aware that while surveys are necessary to ensure this area continues to function as a sanctuary for a variety of species, it is also important to minimize time spent in the CWA. Wildlife counts, water quality data, as well as seagrass data will be collected during the surveys. Law enforcement consistently informs BBAP staff about violators of the no-entry rule that protects this area. Jet skis, motor boats, kayakers, and commercial and recreational fishermen and their gear are observed in the CWA. Previous wildlife surveys done by land documented the negative impacts that even passive recreational traffic can have on CWA wildlife. When a powerboat or jet ski comes through, birds are flushed and *may* return to the area, despite having their behavior altered. Kayakers and canoeists observed in the area cause birds to flush and the paddlers' long-term presence is said to flush the birds and keep them away from feeding and nesting areas. In order to maintain essentially natural areas and restore degraded areas, BBAP is committed to working with the public and seeks the cooperation of citizens and municipalities in order to help conserve the resources found in the CWA. It is the goal of BBAP to work with the public so that they understand the responsibility to protect the resources that comes with their use and enjoyment of Biscayne Bay, including abiding by established no-entry zone rules. The City of Miami and community stakeholders have also engaged in the process to develop a revised master plan of Virginia Key to ensure that plans will cause minimal impact on the relatively natural setting of this coastal barrier island and the CWA.

Card Sound provides over 100 plant and animal species that are rare, endangered, or species of special concern with a protected area to make home. Card Sound encompasses 17,000 acres of seagrass meadows, hardbottom communities, and mangrove wetlands that are connected to a greater system of protected waters and lands in south Florida. These waters are so important to the Spiny lobster that they were included in an area designated as a sanctuary for the spiny lobster, in order to protect nursery habitat and enhance other fisheries. Known as the Biscayne Bay-Card Sound Spiny Lobster Sanctuary, this area encompasses all of Card Sound, Biscayne National Park's inshore waters, and all of BBAP south and due east of Matheson Hammock park. Seagrass beds and mangrove-lined shores that occur throughout BBAP and Card Sound in particular are prime feeding areas for wading birds, juvenile fish, invertebrates, manatees, and sea turtles.

Stranding Response

BBAP relies on MARS, a local non-profit that responds to calls of distressed and stranded marine animals reported within the preserves, including dolphins, whales, and manatees. MARS is permitted through the USFWS to rescue and/or transport injured manatees to rehabilitation centers, including the Miami Seaquarium, and to assist with FWC's Manatee Carcass Salvage Program. NOAA permits MARS to rescue, transport, rehabilitate, research and release stranded cetaceans found within or near Biscayne Bay. MARS holds an agreement with RSMAS to use a portion of their Virginia Key property as a rehabilitation center. A temporary pool is erected for the duration of the rehabilitation to bring the stranded dolphins or whales back to health in order to be released back into their natural environment. MARS was founded in 1996 and is dedicated to the conservation of marine mammals through rescue, rehabilitation, research, and education. In addition to reaching 1500 students and adults annually, MARS provides training to the law enforcement community and to the public at large on rescue and rehabilitation basics. BBAP personnel attend MARS trainings and presentations and receive reports on manatee and cetacean strandings within the preserves.

Habitat Restoration and Enhancement

Intertidal areas of disturbance are prone areas for nuisance plant species to become established. Mangrove shorelines and areas with disturbance are prone to invasion by exotic pest plant species.

The 200 feet (60.7 meters) of shoreline at the BBEC, where BBAP offices are located, has brazilian pepper (*Schinus terebenthifolius*), seaside mahoe (*Thespia populnea*), umbrella tree (*Schefflera actinophylla*), and Australian pines (*Causurina equisetifolia)* growing alongside mangroves, including red (*Rhizophora mangle*), white (*Laguncularia racemosa*), black (*Avicennia germinans*), as well as half flower (*Scaevola taccada*). The Park Service Specialist at the BBEC developed and implemented a plan to remove these invasive trees and to chemically treat them to prevent their re-growth without harming the adjacent water resources. These invasive species are expanding their ranges through efficient reproduction and seed dispersal. The Florida Exotic Pest Plant Council lists these species as the most serious threats to native vegetation.

There are more than 30 islands in Biscayne Bay that were created back in the early 1900s as a result of dredging operations to create the Atlantic Intracoastal Waterway (AIWW) and other navigable channels and harbors and there are three natural islands in the bay. The spoil material that was extracted from the dredged areas was used to create what are regarded as "spoil" islands located near the AIWW. Most of the islands are in public ownership, either by an adjacent municipality, the county or the state. These islands do offer habitat for wildlife and birds, but eroding shorelines, exotic vegetation and debris washing ashore have degraded the habitat services offered by the islands as well as decreased the public's ability to recreate on them. Through financial support from the FIND Waterways Assistance Program, PERA's Biscayne Bay Environmental Enhancement Trust Fund, DEP and SFWMD, restoration of these islands has been ongoing for nearly 20 years. Various habitats have been restored including one mile (1.6 kilometers (km)) of dunes, 12 acres of mangroves (wetlands), 11 acres of coastal strand and 38 acres of tropical hardwood hammock have been restored for $3.8 million. PERA's restoration expert makes use of readily available material such as limestone boulders for shoreline stabilization or to fill a large dredge hole that would otherwise need to be disposed. Specialized techniques have been developed to allow for mangrove fringe to grow along the islands and PERA is renown across the state and the nation for their expertise and success in island restoration. PERA has actively engaged local residents, students, universities and organizations to not only achieve restoration goals but also to foster a sense of stewardship and ownership of their natural resources for years to come. Maintenance of these islands is largely contracted by PERA to outside sources but not all islands are continuously monitored for trash and debris. Several years ago CAMA was charged with developing a local Adopt-

BBAP staff joined the staffs of Boating and Waterways and FWC CWA staff to to ensure that buoys and other waterway markers were correctly placed and enforceable.

a-Spoil Island program dedicated to developing and implementing aquatic preserves-wide incentive programs designed to motivate citizens and organizations who are interested in removing marine debris and litter from the islands. BBAP staff work to engage members of the public who would like to spearhead this program as volunteers leading volunteers, under the supervision of staff. This program would be expanded to include species identification of plants and animals on and near the adopted island and create incentives such as photography contest or staff-led kayak tours to motivate adopt-a-spoil-island volunteers.

PERA's Coastal Habitat Restoration Program Coordinator has also directed restoration efforts on land (Milano, 2000). The largest restoration project was within Bill Baggs Cape Florida State Park, where invasive exotic Australian Pines replaced native vegetation. Approximately 380 acres of Key Biscayne's native vegetation was filled from material dredged from Biscayne Bay in the 1950s (Milano, 1999a). After Hurricane Andrew in August of 1992 left few Australian pines standing, PERA joined with Florida Park Service Staff and the American Littoral Association to recreate 75 acres of mangrove wetlands in addition to restoring freshwater wetlands, hammocks, and dunes. PERA worked with Deering Estate staff to restore Chicken Key after a sixteen foot storm surge washed over the natural island during Hurricane Andrew. PERA projects stripped exotic plant species from the spoil islands within the northern part of Biscayne Bay and restored them with natives, and stabilized their shorelines with riprap to reduced sources of turbidity. In the first ten years of PERA's Biscayne Bay Restoration and Enhancement Program's Biscayne Bay Wetlands Restoration program, approximately 300 acres of wetlands at ten coastal sites have been restored and enhanced (Milano, 1999b). In 2007, PERA initiated several restoration efforts including projects on the Dinner Key Island and in the mangroves of Chapman Field and Virginia Key. Exotics were removed from five islands at Dinner Key then replanted with mangroves. BBAP personnel recruit volunteers to help with the restoration projects, as well as providing review and comments, when proposed to DEP's Environmental Resource Permitting (ERP) program at the Southeast District. It is through coordination with DEP's ERP program that seagrass restoration projects are implemented in BBAP. Current and historic budget levels do not allow for restoration projects both in terms of limited staff and time as well as limited funds to administer and later monitor restoration. Instead, staff coordinate with South District (based out of Marathon) and Southeast District (based out of West Palm Beach) staff to suggest mitigation projects to benefit seagrass communities when unauthorized impacts occur.

The Jobs and Dollars report (2011) presents the concept of coastal habitat restoration as a job-creating, economy-boosting enterprise that also returns otherwise disturbed or impacted areas to some level of ecological function. It is estimated that restoration projects can yield 30 jobs for each million dollars invested, twice as many as the oil, gas, and road construction industries combined. Coastal counties provided half of the US gross domestic product in 2007 and claimed 40% of the nation's jobs. The report also cited Everglades-specific economic benefits to south Florida where water conveyance systems constructed almost a century ago to drain the Everglades led to the loss of more than half of south Florida's wetlands. Beyond the ecological benefits to Everglades restoration, it is said that there is a direct benefit to citizens in the region through protection of water supply and reducing future costs of have to purify water by allowing the aquifer to recharge naturally; through increased property values due to higher water quality in waterways and groundwater; and more fishing, hunting, and tourism as wildlife populations increase. Jobs would increase in various sectors to the tune of 440,000 over the next 50 years. All of these benefits equate to a 4:1 benefit-to-cost ratio in terms of benefits yielded to ecosystem and society per cost incurred.

Permitting and Enforcement

BBAP staff work with DEP's Southeast District office and DERM's permitting staff to conduct joint site visits when a summary of the biological resources in an area are relevant to the review of a coastal construction application. DERM and FWC partner to obtain funding and hire contractors to remove derelict vessels from the BBAP, both in the northern part of the bay and in Card Sound. BBAP staff work closely with the lead FWC officer who responds to derelict vessels and have created a list of vessels that need to be removed in cases where the owner cannot be found and held accountable. BBAP staff work closely with municipal, local, state and federal officers by meeting monthly through the Marine Advisory Support Team, coordinated by the county's marine patrol lieutenant. Relevant Biscayne Bay protection issues including human health and safety as well as natural resources are discussed. BBAP staff is currently working on training marine enforcement officers on the new seagrass protection law for seagrasses in aquatic preserves. Officers are interested in understanding more about what new versus old scars look like, how to identify seagrass species, where seagrasses are located and what areas of the bay can be patrolled because of the threat of repetitive propeller scar injury.

The colors of Biscayne Bay are as diverse and interesting as Miami's communities, as showcased here by nature photographer Paul Marcellini in this photo of the bay's mangrove islands. Photo "Mangrove Magic" by Paul Marcellini.

BBAP facilitated a meeting with FWC's Boating and Waterways Section in Tallahassee in early 2011 by hosting a representative at a quarterly Manatee Awareness Group meeting coordinated by the BBAP manager. Over two dozen attendees, most of them law enforcement, attended the meeting. The goal was to provide input into the updating of waterway signage and markers to increase efficiency, in terms of ease of understanding for boaters and ability for enforcement to use signage to enforce speed zones while keeping waterways as unobstructed by signage as possible. Those in attendance from municipal, county, state and federal law enforcement agencies were able to provide insight and feedback into areas where signage is troublesome either because of damage from natural or human impacts, incorrectly posted signage, or signage that is hard to see and therefore enforce. The Boating and Waterways staff also wanted to ensure that buoys and other waterway markers were correctly placed and enforceable. In support of this effort, BBAP joined FWC CWA staff to map existing buoys that mark off the boundary of the Bill Sadowski CWA versus what it should be based on the language in the enacting legislation. Staff found there were a significant amount of buoys missing, making the boundaries of the no-entry zone nearly impossible for law enforcement partners to enforce.

BISC rangers and biologists worked together to implement a program to reduce recidivism in on-water offenders who are charged with fisheries, speeding or other violations within the boundaries of the national park. The class contains information on how to identify fish species to reduce incidence of recreational fishers mistaking their catch for a species legal to catch at a particular size as well as how fishing regulations support the future of fishing in Biscayne Bay. There is also a segment on responsible angling techniques to increase efficiency and reduce impacts to fish. The class is offered in English and in Spanish on weekends, and is free to anyone in the community who would like to take it for their own information. At the ranger's discretion, the offender can choose to take the class and pay a reduced fee relative to the fines that would have been imposed by the violation. This program was devised in coordination with the United States Attorney's Office that would otherwise prosecute the offenders but have agreed to have offenders take part in this program. BISC staff has documented a nearly zero percent recidivism rate indicating that the class is changing the behavior of those fishing or speeding within the national park boundaries. BBAP staff will work with BISC staff and rangers as well as state enforcement agencies to encourage offenders outside park boundaries to participate in this class as a way of avoiding financial penalties and/or court appearances.

Several times each year staff will host about a dozen students as part of Fairchild Botanic Garden's Environmental Immersion Day, part of their world renowned event to increase students' interest in science from all grade levels in the county. Environmental Immersion Day activities are sponsored by the Friends of Biscayne Bay and is spent seining in seagrasses, riding in the county catamaran, conducting water quality testing, and doing estuarine plant ID—all within the boundaries of the island where BBAP offices are located.

Mitigation

Impacts to natural resources must be avoided or minimized by applicants wishing to construct within the preserve (Chapter 18-20 F.A.C.). Resources often are degraded or completely removed from the preserve and be must be mitigated. In such situations, BBAP staff are to recommend mitigation options (e.g. land acquisition, habitat and hydrologic restoration, water quality improvement projects, shoreline stabilization with native plants, planting of emergent and submerged vegetation) that would directly benefit the quality of natural resources within the preserve. The largest impacts within BBAP have been caused by the county-owned Port of Miami. The original port was on spoil areas on the bay's western shoreline, but in the 1960's the port moved to spoil islands between the mainland and the barrier islands of Miami Beach and Fisher Island. As greater amounts of habitat were impacted through enlarging the spoil islands by bulkheading and filling, as well as through deepening and widening the access channels, the Port of Miami Mangrove and Seagrass Mitigation Project was initiated. By 1983, 251 acres of the bay had been impacted with 81 acres of seagrasses lost. In 2003, the USACE predicted that the cumulative natural resource impacts were 349.9 acres total with 251 seagrass acres lost. Including the Phase III expansion projects that were authorized by Water Resources Development Act in 2007, the totals are anticipated to rise to 415.6 acres of total impact and 257.3 acres of seagrass impact (USACE, 2003; Table 23, p. 98). New dredging to depths of 50 feet from 42 feet to accommodate large draft mega-cruise ships was proposed in 2010, which seeks to offset impacts to the bay through mitigation projects. Mitigation for some of these impacts has never been successfully demonstrated. BBAP staff continues to work with the DEP's ERP program to minimize and avoid impacts to resources in the bay. Common impacts include damage to seagrasses, macroalgae, mudflats, listed species and other species as mentioned in Chapter 18-18, F.A.C. BBAP personnel have also evaluated proposals from applicants for mitigation, visited sites where mitigation is proposed, and evaluated sites for their appropriateness as potential mitigation sites. BBAP staff regularly writes comment letters and correspond with regulators from the state, county, and federal agencies with permitting delegations, such as the state's delegation of authority to DERM to permit single family docks within the BBAP.

Incident Response

Most incidents in the preserve involve unlawful speed of vessels traversing the bay causing accidents, potential permit noncompliance violations and environmental emergencies such as downed planes, sunken vessels, and sea wall collapses. Depending on the reported incident, preserve staff coordinate with DEP, FWC, or SFWMD compliance and enforcement staff, or MDC Parks and Recreation Department. Maintaining a strong partnership with compliance and enforcement staff is critical to the success of incident response within the preserve. Preserve staff also encourage stewardship among homeowners, who often serve as the eyes and ears of the preserve. Future coordination with law enforcement officials will help preserve staff document additional incidents and incident locations within the preserve that are not reported. Identified trends will be documented and discussed with law enforcement officials for localized support. In the case of large-scale incidents, the State Warning Point Hotline notifies DEP's Bureau of Emergency Response district offices when an incident occurs within their district. One DEP Coral Reef Conservation Program staff person is the lead contact for our office and receives notices when there is an environmental emergency such as a vessel grounding or boat fire within the BBAP and Coral Reef Conservation Program boundaries. During fiscal year 2007-2008, BBAP staff worked closely with DEP's Office of General Counsel and other state, local, and federal agencies and interested parties to respond to a seawall collapse at the mouth of the Miami River. The seawall provided protection to the archeological site known as the Miami Circle, which is owned by the Florida Board of Trustees of the Internal Improvement Trust Fund and is managed by the Florida Department of State. DEP's Bureau of Emergency Response responded to the seawall collapse at Office of General Counsel's request and has notified aquatic preserve personnel of chemical contamination, unseaworthy vessels, groundings, and other potential threats to the biology and aesthetics of Biscayne Bay.

Land Use

Miami-Dade County Comprehensive Development Master Plan

MDC's Comprehensive Development Master Plan developed by its planning department with considerable public input from the Citizen's Advisory Task Force originally adopted in 1975 meant to guide development within the county. MDC and Monroe counties are required by the Local Government Comprehensive Planning and Land Development Regulation Act to have a comprehensive management plan with elements relating to different governmental functions (e.g., housing, physical facilities, conservation, land use, coastal zone protection, etc.). Each plan, in effect, is intended to guide the future development of each respective county. Cities and counties are to adopt land development regulations and conform to the criteria, policies, and practices of their comprehensive plans, which must' be updated periodically as required by recent statutory amendments. MDC's original plan did not contain a

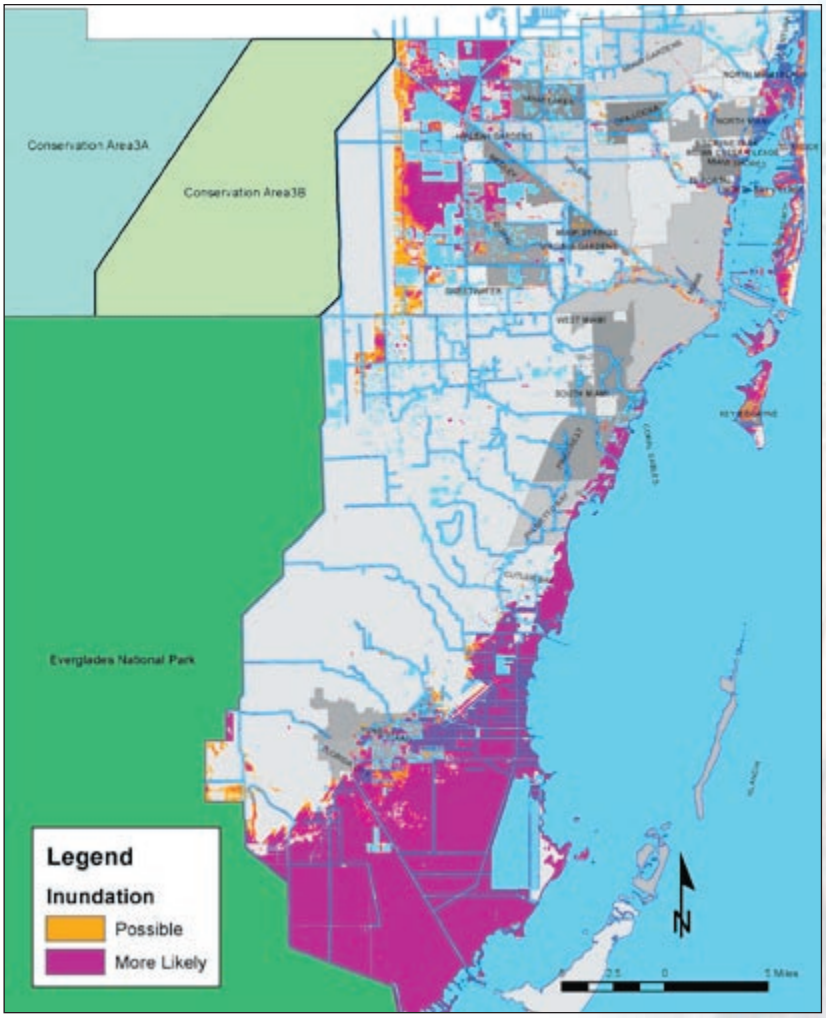


Figure 6 / The likelihood of inundation in Miami-Dade County under 3-foot sea level rise. Courtesy of Southeast Florida Regional Climate Change Compact Inundation Mapping and Vulnerability Assessment Work Group.

coastal element. A separate coastal management element first appeared in the 1988 Comprehensive Development Master Plan pursuant to the Growth Management Act of 1985 that required all local governments abutting the Atlantic Ocean or which include waters of the state where marine species of vegetation constitute the dominant plant community include such an element. In addition, a storm water management plan has been developed by MDC to help address concerns with impaired waters under the DEP's Total Maximum Daily Load (TMDL) program. The TMDL program employs a watershed management approach to dealing with impaired waterbodies in that a five-phase cycle is rotated through all basins in the state over a five-year period. The first phase includes a preliminary assessment of the basin based on available data. DEP staff will reach out to local governments and other agencies to obtain relevant data. During Phase 2, impairment is verified and lists of impaired waters are developed. Also, waters to be delisted are noted and submitted to the EPA for approval during this strategic monitoring and assessment phase. In Phase 3 TMDLs are developed and adopted and in Phase 4 a Basin Management Action Plan (BMAP) is developed. During the final phase, Phase 5, TMDLs are implemented. Wagner Creek is the first waterbody listed for the Biscayne Bay region and its impairment for fecal coliform (bacteria found in human and animal excrement) is being addressed in a Basin Management Plan. In 2011, among the TMDLs to be developed to address current impairment are the Miami River, Miami Canal, Little River and Biscayne Canal—all for levels of fecal coliform that exceed state standards. Additionally, there are several canals is south MDC that are impaired because of levels of mercury, dissolved oxygen, and/or fecal coliform. There currently are no BMAPs being developed or implemented in south MDC and no BMAPs are anticipated for the fecal coliform TMDLs. DEP will soon be providing a fecal coliform guidance document to assist stakeholders in addressing fecal coliform impairments and restoring water quality (Espy, 2011). One goal in having a management plan for BBAP is to guide county governments during their planning process, or as comprehensive plans are revised, toward developing local planning criteria and standards that will be consistent with the objectives of the program.

The South MDC Watershed Study and Plan was mandated by the MDC Comprehensive Development Master Plan Land Use Policy 3E, adopted in 1996. It was supported by the South Florida Regional Planning Council (SFRPC), MDC, and SFWMD, in order to help keep Biscayne Bay and other natural areas of southern MDC healthy. The study and plan was presented to the County Commission in 2007 and was referred for review to the County Planning Department. The study portion reviewed population projections, land uses, water quality and supply, transportation options, economics, and natural resources for the southern part of the county. The plan made recommendations for planning decisions through 2050. Other land use planning initiatives are the Strategic Regional Policy Plan for South Florida promoting sustainability, connectivity, and responsibility authored by the SFRPC. Revitalizing South Florida's Urban Core developed by SFRPC and the MRC's Urban Infill Plan are previous planning efforts. BISC and the TPL are collaborating on a Biscayne Bay Greenprint Map with recommendations for purchase or conservation of lands near the bay. In 1990, MDC voters approved a property tax increase to acquire, protect, and manage environmentally endangered lands, through the creation of the Environmentally Endangered Lands Program. This program considers sites proposed for acquisition with the goal to help protect, restore, and conserve the air, water, land, and ecosystem resources of MDC. Over 8,100 hectares of rockridge pineland, tropical hardwood hammock, salt marsh, mangrove and riverfront are preserved through this program (MDC Environmentally Endangered Lands Program [EEL], 2010).

Cultural Resources

The cultural resources adjacent to BBAP are managed by their respective agencies. Previous documents showing cultural resources with BBAP only depict those resources on the shorelines adjacent to the water. BISC has documented marine archaeological sites and has begun interpreting some of them as a maritime trail. Due to close proximity with BISC, there is a high possibility of additional cultural resources within BBAP submerged lands. Additional research is needed to perform a submerged cultural resource inventory in order to locate and begin to protect these resources. There are over 75 historical locations that are listed on the National Register of Historic Places that lie immediately adjacent to the BBAP boundaries which include historical and archeological districts, rural historic landscapes, and designated historical landscapes. In addition, over two dozen archeological sites are listed in the Florida Master Site File. There are 26 bridges listed in the Florida Master Site File.

Global and Regional Change Events

Global and regional change events, both natural and human induced, have the potential for significant impacts to the ecologic integrity of BBAP. Analysis of climate data worldwide and trends in global temperatures indicate that accelerated changes in climate are occurring, driven primarily by an atmospheric increase in carbon dioxide emissions related to the burning of fossil fuels (Bates, 2008). Per the NOAA Coastal Services Center's report on their joint collaboration with MDC's Office of

Sustainability (n.d.), MDC is particularly vulnerable to sea level rise because of its highly populated cities and low lying topography. In order to adapt to the changes that sea level rise will bring to this heavily populated, ecologically important area, MDC recognizes the need for a cohesive approach to planning for climate change and the two agencies jointly hosted a public workshop. They concluded in their findings that the comprehensive approach should include creating a centralized location for recording and sharing data representing hazards, climate, and vulnerabilities; developing outreach and education programs on the value of natural areas and their connection to adapting to climate change; developing and implementing climate-adaptive zoning and building codes and permit process modifications; and accelerating existing restoration efforts to help protect the community against rising sea level rise.

The most significant impact on BBAP associated with climate change will be sea level rise as a result of thermal expansion and the melting of continental ice sheets. Current projections by NOAA of sea level rise by 2100 vary; conservative estimates range from of 1 to 2 feet of sea level rise while other scientists estimate higher levels of 7 feet of sea level rise or more.

As sea level rise continues, BBAP can anticipate significant and potentially catastrophic changes to the natural habitats and wildlife within the region. Priority concerns include protected species that depend upon beach habitats for nesting (e.g. loggerhead sea turtle) and resting, foraging and nesting (e.g. shorebirds including the least tern). Also of concern is the anticipated loss of emergent wetlands as the migration of marine wetlands continues to track rising sea levels, until reaching a static urban boundary. The long-term impacts of sea level rise will likely be the single most significant threat to the ecological integrity of BBAP due to the potential for catastrophic and irreversible change. Implementation of CERP's Biscayne Bay Coastal Wetlands Project is one defense against harmful effects of sea level rise, and saltwater intrusion in particular. The projects will help maintain lower salinities along the nearshore areas of Biscayne Bay which may stave off the effects of sea level rise by creating freshwater sheetflow that will permeate nearshore areas.

Catastrophic Events

In addition to long-term sea level rise, short-term catastrophic events such as periodic hurricanes and algal blooms could impact natural resources within BBAP. Barrier islands such as Virginia Key, Key Biscayne and the beaches as well as nearshore areas along Biscayne Bay are particularly vulnerable to effects of hurricanes. Recent studies suggest that while global climate change may decrease the overall number of hurricanes, the number of extreme, and more damaging, hurricanes will increase (Bender et al. 2010). Therefore, BBAP may suffer periodic, but significant, storm damage in the future. BBAP will continue to work with USFWS to promote the living shorelines program in Miami-Dade County, as natural shorelines will provide the best defense against extreme hurricanes.

Not only do catastrophic events impact coastal systems, but red tides and other harmful algal blooms can have a significant effect on wildlife. In 1996, a severe red tide event resulted in the mass mortality of over 150 West Indian manatees, an endangered species. The active 2005 hurricane season, in conjunction with road construction that incorporated mulched mangroves along the causeways leading to the Florida Keys, were the cause of a cyanobacterial bloom (*Syncheccocus sp.*) in Florida Bay, Card Sound and southern Biscayne Bay that persisted for two years before chlorophyll level returned to background levels (Rudnick, 2007).

The severe cold event observed in January 2010, when temperatures in south Florida's coastal areas dropped to temperatures of 30 to 40 degrees Fahrenheit, resulted in 197 confirmed manatee deaths across the state and mass mortality of cold susceptible fishes and reptiles. Ecological changes resulting from such events following the cold event warrants close observation and monitoring to improve understanding of coastal processes and to determine appropriate responses. Biscayne Bay tributaries, both natural (Miami River and Little River) and artificial (Coral Gables waterway), serve as critical habitat for manatees per the FWC's state protection plan and during colder winter months serve as much-needed warm water refuges, particularly. These tributaries are heavily used by recreational and commercial vessels, including cargo vessels in the case of the Miami River, where balancing manatee protection and user needs is particularly challenging.

The Deepwater Horizon oil disaster in the Gulf of Mexico, beginning in April 2010, is an example of a regional catastrophic event with the potential for significant environmental effects within BBAP and adjacent coastal areas. Oil disasters can result in loss of emergent wetlands (e.g. saltmarsh and mangroves) and submerged habitats (e.g. seagrass and corals), mortality of marine mammals and sea turtles, and long-term lethal and sub-lethal effects to estuarine organisms at various life stages. The potential loss of coastal wetlands off the southeast Florida coast related to the oil disaster event amplifies the need to sustain and

restore remaining intact wetland ecosystems that can help sustain wildlife. CAMA served as the designated office within DEP to carry out the response to the Deepwater Horizon event. Under the guidance of CAMA's director, the designated Trustee for the State of Florida per the Governor, CAMA staff carried out pre-event and, if needed, post-event water and sediment sampling activities. BBAP staff in particular worked with MDC DERM and BISC staff to identify areas most vulnerable to oil and continue to work with the United States Coast Guard in their maintenance of an index of South Florida coastal environments and wildlife vulnerable in the event of another oil disaster. The country of Cuba recently approved a permit to drill for oil off of the Cuban coastline, which could potentially have dire consequences for the Florida Keys, Biscayne Bay, and Everglades and Biscayne National Parks should there be a similar situation in the southern Atlantic as there was in the Gulf of Mexico.

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

The Education and Outreach Management 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 and training activities. These activities include: field studies 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; however, each represents key stakeholders and decision-makers. These efforts by the Education and Outreach Program allow the preserve 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 Biscayne Bay Aquatic Preserves***

There was no formal education or outreach program at the BBAPs prior to 2003, and other agencies were mandated to conduct environmental education about Biscayne Bay, such as Miami-Dade DERM as mandated in county's Manatee Protection Plan. Instead, the previous staff participated in outreach events, distributed literature and created signs for four county marinas. In response to a perceived need for education and outreach about Biscayne Bay, SFWMD sponsored a local non-profit group Citizens for a Better South Florida (CBSF) to form the Biscayne Bay Environmental Education Alliance (The Alliance). The Alliance is no longer active, but BBAP staff has gained access to the information that was compiled by CBSF. The Alliance was an initiative "to expand public understanding and appreciation of [Biscayne] Bay" by focusing "on education, community and neighborhood leaders so they can better understand Bay issues and help educate their constituents about the ecological and economic importance of the Bay." CBSF defined five target audiences as: local students and educators, public officials, bay users (particularly boaters), tourists, and MDC residents, especially minority communities." BBAP continues to use information collected from these programs in order to accommodate a variety of educational programs within the area. Educational programs involving Biscayne Bay have also been developed by the national, state, and local parks that work on and around Biscayne Bay. Programs at the Marjory Stoneman Douglas Biscayne Nature Center and BISC include overnight camping, traveling trunks, backpacks and classroom visits. Biscayne Nature Center, even though it is located on the Atlantic, is also instrumental in reaching fifth grade students, teachers and members of the general public, with information about seagrass, mangrove, other habitats and species also found in Biscayne Bay. They have programs specifically designed for minorities and physically or mentally challenged individuals. Other programming that serves to educate the public about Biscayne Bay includes ranger programs at Oleta River and Bill Baggs Cape Florida State Parks, summer camp experiences with the Miami Science Museum and MDC Parks and Recreation Department. In addition, MDC Parks and Recreation Department sponsors the Eco-Adventure Program, which provides access to the bay on guided canoe or kayak trips. Beginning in 1996, FWC produced the "Biscayne Bay Boating and Angling Guide" with both English and Spanish versions. The guide depicts boat ramps, marinas, artificial reefs, manatee slow speed zones and other information to further resource protection within the bay. FWC also provides brochures explaining Biscayne Bay habitats and animals, including the manatee, seagrasses, and mangroves. BBAP houses these brochures and pamphlets at its office library for distribution at educational and outreach events. BBAP staff are currently developing summer camp curriculum, following several inquiries from parents participating in kid-friendly Baynanza 2011 events held by BBAP and area educators who are hoping to offer additional hands-on learning experiences to students and parents.

In 2003, CBSF decided to kick off the "Discover Biscayne Bay" campaign, awareness and appreciation campaign that was the product of the BBPI's recommendations. Circumnavigating the entire bay was an extreme sporting experience meant to raise awareness of Biscayne Bay and the lead kayaker was the head of CBSF who worked out a fundraising plan where she earned money for Biscayne Bay restoration and enhancement through sponsorships and pledges as she made her way around the bay in eight days. While the Discover Biscayne Bay website is still in existence, it is no longer functional as links are broken and it is no longer being managed by CBSF or any particular entity.

4.3.2 / Current Status of Education and Outreach at Biscayne Bay Aquatic Preserves

Education

BBAP's Education and Outreach program consists of three target audiences: Adults, youth and formal and informal educators. Adults are taught about bay area habitats and species through team-taught coursework such as the forty contact hour Florida Master Naturalist Courses. The BBAP manager has partnered with MDC Parks and Recreation Department and Florida Sea Grant/MDC Extension Office to offer two coastal modules and a wetlands module. The third module featuring uplands is scheduled to be offered in the future. Educators participate in workshops about Biscayne Bay that emphasize how the educator can bring Biscayne Bay into their classrooms. This "Train-the-Trainer" program has a multiplier effect for the aquatic preserve. Miami-Dade College faculty and staff participated in this program through their Environmental Ethics Institute. Future goals are to expand the Biscayne Bay specific curricula and to offer trainings for primary and secondary educators. Additional materials need to be adapted to Biscayne Bay by aquatic preserve staff or interns. BBAP staff recently partnered with Florida Sea Grant/MDC Extension Office to submit a grant to train teachers on supplanting local natural resources in science curriculum in lieu of more traditional example. The idea is that using manatees and seagrass to teach about critical scientific principles such as habitat niches and photosynthesis, respectively might engage students to a greater degree because these are familiar experiences.

Youth receive "hands-on" training by aquatic preserve staff with water quality or weather instruments along with specimen collection methods at the BBEC. This youth program arose from partnering with Fairchild Tropical Botanic Garden on their Challenge program. The Fairchild Tropical Botanic Garden Challenge began in 2002 to foster MDC student interest in the environment and grew from 1,400 students to 25,000 participants in its first five years. BBAP participates in the Environmental Immersion Day program where students spend the full day learning about aquatic preserve management tasks. A shorter 2-3 hour version of this program has been offered to summer camp groups, and Miami-Dade College classes. Nature Links is a program that is stationed at Shake-a-Leg, a sailing club geared toward providing access to the bay for children and adults with physical limitations. Nature Links is the first program of its kind in that it provides environmental education for public school students are developmentally delayed and offer students internships and volunteering opportunities. The goal is to place students exiting the program, geared for older high school students, in jobs that facilitate teaching others about nature or supporting natural habitats such as employment in local or state parks. Staff has joined Nature Links students on seagrass walks and boat rides at the BBAP office as well as at Shake-a-Leg and have coordinated with other state partners to facilitate learning experiences for the students.

Future involvement in the DEP Office of Environmental Education's Learning in Florida's Environment, widely known as LIFE, program would require additional aquatic preserve staff and coordination with middle school instructors and park managers adjacent to the aquatic preserve. BBAP staff coordinated with DEP's Office of Environmental Education in the winter of 2010 to apply for funds through NOAA's Environmental Literacy program to bring the LIFE program to Biscayne Bay. Proposed partners in the LIFE program include FIU's Biscayne Bay Campus staff and Florida Sea Grant/MDC Extension staff. This program targets 7th grade science or social science students whose schools need improvement in science standardized test scores. The program works to improve students' ability to excel on standardized exams as well as foster a sense of stewardship and appreciation for local natural resources.

BBAP personnel continue to rely on partnerships to participate in outreach programs. MDC coordinates and publicizes environmental education events within the community. Aquatic preserve staff increase their effectiveness through attending quarterly Environmental Education Providers (EEP) meetings and participating in member outreach events, including MDC DERM's Baynanza clean-up day, the MRC's Miami River Day, and numerous Earth Day events. BBAP personnel form alliances with partner organizations including agencies, not-for-profits, consultants, user groups, and formal and informal educators, when invited to provide more individualized programs. The mascot for the US Coast Guard's water quality

awareness campaign is Officer Snook. BBAP staff recently worked with the creators of the Officer Snook coloring book series to create "Officer Snook Visits Biscayne Bay" with credit given to the aquatic preserve for habitat consultation. At outreach events BBAP personnel and volunteers challenge youth to participate in a learning game about Biscayne Bay such as spinning a wheel with pictures of plants or animals in the bay and answering a question about the organism. Staff also uses hands-on learning by incorporating live organisms into outreach curriculum at events and in schools. Youth are rewarded for their participation with an "Aquatic Preserves are Exceptional" or "Officer Snook Visits Biscayne Bay" coloring book. Adults are often drawn in by aerial photography displays or other eye-catching imagery. Motivated adults will sign up to receive periodic email announcements from BBAP about upcoming events. BISC, FWRI, CBSF, and BBAP developed and printed a Spanish language version of a map, "Discover Biscayne Bay." The Southeast Florida Public Area Managers created and printed the "South Florida Nature Guide: Discover the Hidden Treasures" specifically designed for tourists in South Florida. Both publications are housed within the BBEC library and distributed at local events throughout the community. BISC is considering a headquarters office farther north and within the boundaries of the BBAP to draw more people into the park and will likely be located on or near Virginia Key. Staff of BBAP and BISC are coordinating efforts to include an educational display related to the unique natural resources and rich cultural history of the BBAP. Guided tours leaving the BBAP to venture into park waters would also include information about BBAP's resources. BBAP staff have partnered with Florida Sea Grant to co-teach the three modules and special-topic workshops part of the Florida Master Naturalist certification. Partnerships with FIU's Biscayne Bay campus has included training naturalists hired to provided guided tours of northern Biscayne Bay to faculty, staff and students. In turn, staff is working with FIU to allow for the use of kayaks to take members of the public and Friends of Biscayne Bay volunteers out on the water periodically for guided tours.

Community Engagement

Community engagement is achieved through participation of staff on teams and advisory panels and at neighborhood special events. BBAP personnel and volunteers have participated in events in El Portal, North Bay Village, Little Haiti, Little River, Miami Beach, North Miami, Morningside, Coconut Grove and City of Miami, and Surfside within recent years. Adults of all ages are the primary audience for presentations that are offered to the community, even though the events are family friendly. Presentations can be arranged in response to an invitation from an organization, such as an environmental organization, user group, or civic association, or in coordination with a community-centered event, such as "Baynanza. Baynanza began as a daylong, bay-wide cleanup effort that dates back to 1982 that is still an annual event hosted and sponsored by DERM. Now associated with Baynanza is an events calendar that spans two months, March through April. Since Baynanza begins in March and coincides with Seagrass Awareness Month, presentations about Biscayne Bay's seagrasses and other flora and fauna are offered starting in March and running through April and are advertised in the calendar of events. Seagrass Awareness Month has been declared by the Governor and grew from projects initiated in the Florida Keys by the Seagrass Outreach Partnership that BBAP staff has supported. In 2009, 2010, and 2011, MDC Commissioners Sorenson, Gimenez (now Miami-Dade County's mayor), and Heyman, respectively, have honored Biscayne Bay by declaring March Seagrass Awareness Month in MDC, following Monroe County as a model who has incorporated local decision-makers into the awareness and appreciation of Florida Bay. Since 2003, BBAP personnel have hosted a site for the International Coastal Cleanup at BBEC and Pelican Harbor Marina. Volunteers record trash on data cards as they remove it from the mangroves and riprap on the same day as 80 other countries around the world. The Ocean Conservancy compiles the data and issues reports emphasizing reuse, recycling, and reduction.

Biscayne Bay has inspired several art projects in honor of the bay and its resources, which in turn have promoted awareness, appreciation, and increased stewardship. Several events have captured both public and media attention for Biscayne Bay, including local and international artists. Artists Cristo and Jean Claude initiated the county's largest and longest running cleanup event in its history, Baynanza, with an art project in the 1980s. Events to celebrate Baynanza are offered by various organizations and agencies to offer access to and information about Biscayne Bay with an associated event calendar spanning two months. BBAP staff host three public lectures each year since 2004 as well as host a booth on cleanup day. Local eco-artist Xavier Cortada was born in Miami and attending UM and pursued a Bachelor of Science degree in Biology. BBAP's partnership with the artist began with "The Reclamation Project," which the artist refers to as "a collaborative eco-art intervention" meant to raise awareness about the loss of mangrove habitat in MDC, namely along Miami Beach. Another successful collaboration with artist Xavier Cortada has grown over several years called The Reclamation Project. This is an outreach project inspired by the artist, who witnessed mangrove destruction for a transportation project. Mr. Cortada championed mangroves for years in his paintings on canvas and on concrete overpasses and bridge supports. In 2006-07, he collaborated with BBAP staff to

display mangrove seedlings in public places where the built environment has replaced their habitats. Numerous venues and press articles touted and explained the project. In 2008, Cortada worked with MDC DERM's restoration ecologist, to plant some of these mangroves in permitted restoration projects. The mural "Discover Biscayne Bay" by Miami artist Xavier Cortada is on permanent exhibition at the Miami Children's Museum, next to aquaria containing animals common to Biscayne Bay seagrass beds. Cortada created original artwork in honor of MDC's 10th Annual Miami River Day in March 2006 titled "River Manatee." The Museum is on Watson Island in northern Biscayne Bay. Cortada's work is also on display in the Florida State Capitol.

Marketing

BBAP utilizes a State of Florida website under CAMA. The current website is based on a two page brochure that was published with the aquatic preserve accomplishments for 2006 and is currently being updated. The printed version was designed to be distributed with the CAMA Program Overview booklet. BBAP staff also developed roll-up displays that feature premier habitats and several interesting species found within the preserves such as an up-side-down jellyfish (*Cassiopea xamachana*) and a Caribbean Reef octopus (*Octopus briareus)*. The display accompanies staff and volunteers to educational and outreach events and serves to draw visitors into BBAP exhibits. Since 2003, BBAP has been recognized as a sponsor (through in kind donations) of BISC's Family Fun Fest. Family Fun Fests are held at Convoy Point one Sunday a month from January to May. On average 150 youth and parents visit five "hands on" stations to learn about Biscayne Bay. SFWMD provides funds for the development and maintenance of the www.DiscoverBiscayneBay.org web site by the Florida Atlantic University Center for Urban and Environmental Solutions. The site contains historic information as well as links to publications and Biscayne Bay related organizations.

BBAP staff have partnered with local radio and television stations to try to increase appreciation and awareness of Biscayne Bay's natural resources. During 2007, BBAP personnel appeared on a local radio talk show and had audio interviews taped for display at a local museum for a six month showing. In 2009, the City of Miami's "Think Green" public access television program featured BBAP in a public service program about the natural resources in the BBAP, what threatens its survival and what local citizens can do to protect the bay. Although the program is now defunct, the free service announcement has been an incredible asset to BBAP as it has been used at public lectures and meetings to highlight the beauty and threats to the bay and is linked to BBAP's website for easy public access. BBAP's volunteer videographer provided footage of benthic resources for use in the program. In 2010, Public Broadcasting Service's "Changing Seas" national program featured BBAP and Rookery Bay National Estuarine Research Reserve in its production titled "Seagrasses and Mangroves." The discussion included the ecological services and economic importance of seagrasses and mangroves, as well as the effects of sea level rise on these submerged resources.

Volunteers

The Friends of Biscayne Bay, Inc., BBAP's Citizen Support Organization, meets periodically to discuss current issues and events related to Biscayne Bay and raises funds to support the management programs of the aquatic preserves. Membership will be offered to local citizens who would like to be contacted about upcoming events or to receive newsletters once one is developed, likely by volunteers or interns. In addition to Friends of Biscayne Bay, there are two major categories of volunteers at the BBAP, student interns and general volunteers. Student interns attend one of the local colleges or universities and receive credit for the hours they volunteer through their classes or institutions for "service learning". Service learning is a hands-on way of learning and providing a service that offers more to the student than volunteering (which tends to only benefit the organization with little room for career development) and offers more to the agency than an internship (which tends to fit the student's needs without a strong focus on meeting the agency's goals). Service learning also promotes civic engagement as part of the philosophy of hands-on work experience to increase participation in, and awareness of, issues facing the student's community. BBAP internship projects usually include education and outreach or resource management components and are assigned according to the student's skill level and amount of hours to be completed. Students interview with the Environmental Specialist II before placement and are mentored throughout their tenure. General volunteers attend organized events, such as coastal clean-ups and habitat restoration projects, as either individuals or as members of groups such as school and community clubs. All volunteers are asked to complete individual State of Florida Volunteer Applications as an individual or as a member of a group in order to be covered by workers' compensation and liability insurance. In addition, all volunteers are offered the opportunity to be added to an email distribution list currently maintained in Microsoft Outlook to

The Miami Circle, thought to be about 2,000 years old, is a relic of a site used by native Tequesta Indians at the mouth of the Miami River. It consists of 24 large holes cut into the limestone and is listed on the National Register of Historic Places. Nearly covered over by skyscrapers, local archeologists unearthed the site during a pre-construction survey of the area where they found animal bones including manatees, fish and sea turtles. BBAP staff coordinated the effort to replace the adjacent fallen seawall in 2007 to ensure preservation of the site and safe passage at the Miami River mouth.

receive information about future events. Those who volunteer on more than one occasion receive a copy of the BBAP Volunteer Guide. Repeat volunteers are awarded certificates to recognize the various levels of time they have dedicated to the aquatic preserves each year. Increasing contact with volunteers and members of the public could be coordinated through a Friends of Biscayne Bay website the group has proposed to create where activities and events can be posted. Another way of keeping stakeholders engaged, informed and active, might be to have the Friends of Biscayne Bay join the online community via social networking sites, where pictures can be showcased and activities advertised.

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

The Public Use Management Program addresses the delivery and management of public use opportunities at the preserve. The components of this program focus on providing the public 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 supports the research, education, and stewardship mission of CAMA."

While access by the general public has always been a priority, the conservation of CAMA's sites is the primary management concern for CAMA. 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 balancing anticipated increases in public use with the need to ensure preservation of site resources. This section explains the history and current status of our Public Use efforts.

4.4.1 / Background of Public Use at Biscayne Bay Aquatic Preserves

As part of BBPI, a report was commissioned by the Florida Legislature and the SFWMD to study the status of Biscayne Bay access. The report was undertaken by TPL and was titled "Get Your Feet Wet... The Plan to Discover Biscayne Bay--A Public Access Plan for Biscayne Bay." The plan highlights impediments to resident and visitor access to the Bay and recommends the necessary steps to increase access, which is defined as both visual and physical contact. The plan is the result of a two-year planning process, which involved an advisory council of almost three dozen local civic, business, agency and community leaders, as well as public meetings, workshops, and research.

Public Access
Public forums were held in 1982 by DERM and were planned annually to update the public about new information acquired each year. In the future, aquatic preserve personnel can explore if the public would attend such sessions. Access was addressed in DERM's Biscayne Bay Restoration and Enhancement Program with a proposed County Urban Waterfront Project. The County created a Shoreline Review Committee was to balance development with bay access and to recommend set backs from the bay's shoreline. Several proposals for bay walks or greenways along the aquatic preserve have been initiated by the county, the City of Miami, the Miami River Commission, and TPL.

Boating/Moorings
BBAP and other DEP staff served as advisory members for the Dinner Key Mooring Plan in the Coconut Grove area of Miami. BBAP personnel also provided MDC Environmental Resource Personnel comments when the plan was submitted for permitting. MDC's Manatee Protection Plan included Marine Facility Siting Criteria and DERM developed a Marine Facilities Annual Operating Permit system in 1989. The permit system ensures that marine facilities are following Best Management Practices developed by DERM for marine facilities

Interpretation/Signage
The aquatic preserve managers in the 1990's worked with four MDC marina managers and received funding from FIND to place environmental education signs at boat ramps adjacent to the aquatic preserve. The signs were double-sided, one side English and the other Spanish, and they explained how to "Be a Better Boater", what manatees are, and the importance of seagrasses. Future projects include working with the marina managers to replace these signs.

4.4.2 / Current Status of Public Use at Biscayne Bay Aquatic Preserves

Public Access
BBAP staff served on the Biscayne Bay Public Access Plan Advisory Team with thirty community members from agencies, non- and for profit groups. TPL and the South Florida Regional Planning Council coordinated the meetings in 2005. "Get your Feet Wet: The Public Access Plan for Biscayne Bay" was produced with seven recommended initial actions and five goals. One of those recommendations was to create water trails for non-motorized boats and in 2007 the FDEP Office of Greenways and Trails dedicated the Biscayne Bay section of the Florida Circumnavigational Saltwater Paddling Trail in 2007. Access points for canoes have also been created at the Deering Estate and at the C-100 canal mouth near where BBAP meets BISC. Towards the northern end of the Aquatic Preserves, canoes and kayaks can be launched from East Greynolds County Park and the concessionaire at Oleta River State Park rents kayaks from two different park locations so that people can paddle on the Oleta River below towering red mangroves as well as in the more open waters of the bay. Guided canoe or kayak trips are provided by the County Eco-Adventures program and involve trips inside BBAP from Key Biscayne to Matheson Hammock County Park and Preserve. The Wildlife Research Team, which has volunteered with BBAP, uses its thirty-five canoes for clean-ups in shallow mangrove creeks that motorized vessels can't access.

In 2005, the City of Miami mayor launched "Miami 21," a planning program that calls for the revitalization of the city's parks. One of the four main themes of the plan geared at encouraging people to get outdoors in the 21st century is called "Nature." There are five specific plans to be developed to re-master park space that front on Biscayne Bay including: Bicentennial/Museum Park, Bayfront Park, Downtown, Coconut Grove Waterfront, and Virginia Key.

Disability Access
Both Oleta River and Bill Baggs Cape Florida State Parks offer beach wheel chairs that can be reserved for use by persons with physical disabilities to obtain access to the bay. In addition, Oleta River State Park also has accessible fishing piers. Most county and municipal parks provide bay access, either visual or physical, to individuals with disabilities. Some bay front parks offer sports programs for individuals of all ages.

The mission of Shake-a-Leg Miami is to provide a gateway to Biscayne Bay for children and adults with physical or developmental disabilities to sail and kayak, sometimes in modified vessels. Shake-a-Leg also provides kayak rentals, moonlight sails, and environmental education to the public at large. Nature Links/ Project Bridge is a collaborative project initiated by UM and Shake-a-Leg Miami. Nature Links' goal is to build partnerships in the community to provide MDC Public School students ages 16-22 with developmental delays or disabilities greater educational, employment and volunteer opportunities that are environmentally oriented. BBAP works in cooperation with Nature Links to provide educational field day activities.

Boating/Mooring

BBAP staff reviews and offers comment on several development initiatives for bay front land. The City of Miami is developing master plans for Virginia Key, for Museum (formerly Bicentennial) Park, and for Dinner Key in Coconut Grove. In 2002, regulatory agencies and the City of Miami put together technical and field assessment teams and produced a report to evaluate the feasibility of establishing a managed anchorage and mooring field in the Dinner Key area. The Dinner Key Master Plan incorporated a managed mooring field that was permitted through DEP's Southeast District's Environmental Resource Permitting program incorporating comments from aquatic preserve staff. This is one of the only managed mooring fields serving the City of Miami residents and other visiting boaters and one of the largest in the southeast with 175 mooring buoys currently installed and up to 225 buoys to be added at a later date. Dinner Key marina also employs a pump out vessel to travel from boats in the mooring field. Both county and municipal-run marinas have become part of the DEP's Clean Marina program. Each marina follows best management practices, some mandatory and some optional, that help keep stop pollution at the source. DEP also challenges the public to pledge to be Clean Boaters and use facilities where boat repairs are made to become Clean Boatyards. The Florida *Clean Marina* Program is a voluntary designation program with a proactive approach to environmental stewardship, where participants receive assistance in implementing Best Management Practices through on-site and distance technical assistance, mentoring by other *Clean Marinas* and continuing education. Marinas must implement a set of environmental measures that address critical environmental issues such as sensitive habitat, waste management, storm water control, spill prevention and emergency preparedness.

Many powerboat, yacht, sailboat, jet ski, canoe, kayak rentals are in business throughout Biscayne Bay, some as concessionaires out of public parks. In addition to canoeing and kayaking, other lower impact water sports popular in Biscayne Bay include windsurfing and kitesurfing, rowing, dragonboat racing and outriggers. Rentals and schools to teach people these sports exist in Miami Beach, Coconut Grove, and Virginia Key. Biscayne Bay is an international destination for sailing Olympians to train. Dozens of regattas a year occur in Biscayne Bay both for youth and adults, and staff works with the US Coast Guard to review marine event permits for regattas and other water-based recreational activities on the bay. The Ronald W. Shane Watersports Center, part of Miami Beach Rowing Club, provides access to the bay for underprivileged youth.

Consumptive Use

Predominant consumptive use within BBAP comes from recreational fishing, commercial fishing, lobstering, shrimping, and crabbing. BBAP staff attends monthly meetings of the Marine Advisory Support Team (MAST). MAST is a coalition of marine law enforcement officers within MDC including several municipal, county, state, and federal agencies that meet to organize major enforcement events such as the Spiny Lobster Mini-Season, Columbus Day Regatta, and annual manatee protection operations. MAST's goal is to increase coordination of law enforcement agencies to provide maximum protection for human safety and environmental resources. Aquatic Preserve personnel provide educational materials to marine officers for use when issuing boating violation citations or warnings. These materials serve to increase the public's awareness of local speed zones and natural resources such as seagrass beds and manatees. The Aquatic Preserve personnel's attendance at MAST meetings has facilitated increases in public education about Biscayne Bay's resources, repairs of downed or incorrect manatee signage, and greater knowledge of Aquatic Preserve staff about marine laws and procedures. Participation has also facilitated a law enforcement response to illegal harvesting of sponges near Chapman Field.

The Local Government Comprehensive Plans for Dade and Monroe counties are required by the Local Government Comprehensive Planning and Land Development Regulation Act to have a comprehensive management plan with elements relating to different governmental functions (e.g., housing, physical facilities, conservation, land use, coastal zone protection, etc.) Each plan, in effect, is intended to guide the future development of each respective county. Cities and counties are to adopt land development regulations and conform to the criteria, policies, and practices of their comprehensive plans, which must'

be updated periodically as required by recent statutory amendments. One goal in having a management plan for BBAP is to guide county governments during their planning process, or as comprehensive plans are revised, toward developing local planning criteria and standards that will be consistent with the objectives of the program. MDC has completed and adopted a comprehensive plan.

Non-Consumptive Use

Water trails for non-motorized boats were created in 2007 the DEP Office of Greenways and Trails dedicated the Biscayne Bay section of the Florida Circumnavigational Saltwater Paddling Trail in 2007. When the trail was being developed, BBAPs personnel provided access by vessel to the northern portion of the bay and introduced the Office of Greenways and Trails coordinator to local paddling experts with SFWMD, DERM, and TPL. The Biscayne Bay segment, 16 of 26 around the state, begins in the north at Oleta River State Park and ends at John Pennekamp Coral Reef State Park covering 68 miles (109.4 km). While the circumnavigational trail is designed for multi-day, overnight trips, TPL, MDC Park and Recreation, and SFWMD are working to define day trips for residents and visitors. TPL is working to map Biscayne Bay Blueways, the county is looking for trails in tributaries as well as the bay, and the City of Miami has applied to create access points at Morningside and Margaret Pace Parks, both on the shoreline of the aquatic preserve.

Interpretation

SFWMD formerly contracted with FIND to permit, install, or replace signs within the water or at boat ramps. Recently, FWC became responsible for manatee speed zone and boating safety signs. Several of the signs within the BBAP must be adjusted in November and April at the beginning and end of manatee season. Following the Florida legislature's passing of a seagrass protection bill in 2009 to protect seagrasses within aquatic preserves, DEP and FWC partnered to create signage explaining the new statute. Staff posted these signs at local boat ramps and marinas. To accompany these signs, staff created signage depicting BBAP boundaries and seagrass coverage.

The Miami Circle, a historic Tequesta Indian structure approximately 2,000 years old, lies along the southern bank of the Miami River mouth. This site consists of a perfect circle of 24 holes cut into the limestone rock, surrounded by a large number of smaller holes. It is the only known evidence of a prehistoric permanent structure cut into the bedrock in the United States, and predates other known permanent settlements on the east coast. Built by the Tequesta Indians and discovered by state archeologist in 1998, the site was listed on the National Register of Historic Places in 2002 and declared a National Historic Landmark in 2009. The function the circle served for the native Tequestas is unclear. It could have served as a celestial calendar or a chief's house or temple. Two delicately crafted stone axes were discovered along the eastern part of the circle. Both of these stone axes were made of basalt, an effusive rock not native to Florida. Animal offerings included a complete sea turtle carapace and the articulated remnant of a six foot shark discovered from inside the circle. HistoryMiami (formerly known as the Historical Museum of Southern Florida) signed a 44-year lease of the site in March 2008 and Miami River advocates are working to install an educational program on the site. BBAP has been invited to provide information about the preserve for educational signage to commemorate the cultural and natural resource history of the site, as this site looks out on the waters of the BBAP.

Shake-a-Leg Miami has a series of colorful, child-friendly signs that illustrate habitat types and flora and fauna of Biscayne Bay. FIU's Biscayne Bay campus has partnered with BBAP to create signage that will front the bay and provide information about cultural and natural resources along the BBAP.

Bill Baggs Cape Florida State Park, located on the tip of Key Biscayne and shares a shore with both Biscayne Bay and the Atlantic Ocean is in close proximity to the Miami Seaquarium. Many sea turtles rehabilitated following marine debris or vessel strike injuries are release here for a second chance at life.

Chapter Five

Issues

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

The hallmark of Florida's Aquatic Preserve Program is that each site's natural resource management efforts are in direct response to, and designed for unique local and regional issues. When issues are addressed by an aquatic preserve it allows for an integrated approach by the staff using principles of the Ecosystem Science, Resource Management, Education and Outreach, and Public Use Programs. This complete treatment of issues provides a mechanism through which the goals, objectives and strategies associated with an issue have a greater chance of being met. 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), creating a display or program on preventing water quality degradation (Education and Outreach), and offering training to municipal officials on retrofitting stormwater facilities to increase levels of treatment (Education and Outreach).

Issue-based management is a means through which any number of partners may become involved with an aquatic preserve in addressing an issue. Most aquatic preserves are endowed with very few staff, therefore partnering is a necessity Bringing issues into a broad public consciousness allows partners who wish to be involved the ability to do so. Involving partners in issue-based management ensures that a particular issue receives attention from angles that the aquatic preserve may not normally address.

Figure 7 / Issue-based Adaptive Management.

This section will explore issues that directly impact the management of Biscayne Bay Aquatic Preserves (BBAP) or are of significant local or regional importance that warrants the preserve's participation. While an issue may be the same from preserve to preserve, the goals, objectives and strategies employed to address the issue will likely vary depending on the ecological and socioeconomic conditions present within and around a particular aquatic preserve's boundary. In this management plan, BBAP will characterize each of its issues and delineate the unique goals, objectives and strategies that will set the framework for meeting the challenges presented by the issues.

Each issue will have goals, objectives and strategies associated with it. Goals are broad statements of what the organization plans to do and/or enable in the future. They should address identified needs and advance the mission of the organization. Objectives are a specific statement of expected results that contribute to the associated goal, and strategies are the general means by which the associated objectives will be met. Appendix D contains a summary table of all the goals, objectives and strategies associated with each issue.

*5.2 / **Issue One: Water Quality and Quantity***

Water quality has improved substantially in the last 30 years, particularly in northern Biscayne Bay. Water quality now generally meets or exceeds local, state and federal standards for recreational uses and propagation of fish and wildlife. However, past development, hydrologic changes, water management practices and adjacent land uses have contributed to loss of wetland and seagrass communities, which has contributed to physical and ecological changes in water quality. Biscayne Bay still receives a considerable amount of nutrients, trace metals, organic chemicals and particulates from storm water runoff, canal discharge, and other sources. Specific water and sediment quality related problems include turbidity, nutrients, sewage main breaks and residual and persistent contaminants. Other water quality concerns have to do with the quantity of fresh water currently received by Biscayne Bay from natural sheetflow, groundwater, and inputs from tributaries—albeit often in the form of pulsed, point source discharges that bring with it debris, contaminants, yard and pet waste, and nutrients from fertilizers. Timing and distribution

of this much needed freshwater also adds to water quality concerns. BBAP will remain engaged throughout the planning and implementation processes that are part of Comprehensive Everglades Restoration Plan (CERP). Recently, funds that help support other regional monitoring and research programs that will support Everglades restoration initiatives that are part of CERP were severely cut. Data collected as part of CERP's Monitoring and Assessment Program and other key programs help give managers insight as to the current status of the ecosystem by evaluating, among other things, species present that might indicate salinity levels. As CERP Biscayne Bay Coastal Wetlands projects come online and salinity levels decrease in an attempt to bring back a lower salinity environment in the near shore area, scientists expect to see a shift to the kinds of species that can tolerate and thrive in lower salinities. With gaps in monitoring or outright extinction of parts of the program occurring due to these recent cuts in 2011, managers may not be able to see the full scale of impacts of CERP on different parts of the bay.

In addition to staff losses and organizational changes resulting from budget cuts, monitoring programs such as those implemented by Miami-Dade County Permitting, Environment, and Regulatory Affairs (MDC PERA) with support from SFWMD funds have been truncated, resulting in less water quality and benthic community data. Loss of spatial and temporal coverage reduces the ability of scientists and managers to detect changes in the ecosystem. When changes are detected, it becomes harder to pinpoint the source of the problem because one sampling station now represents a larger area of the bay. Management decisions to rectify the problem become more challenging. Despite these setbacks, MDC PERA still has decades of water quality and benthic monitoring data which provide managers with information about the bay's overall health and the obstacles it faces. Getting this kind of information to the general public—those residents that live inland as well as along the water's edge—is extremely challenging for many reasons. Not all households have access to internet service or a computer where online interpretive information is available, and not all of this material is available in other languages such as Spanish or Haitian Creole. This excludes part of the community from having access to important information about the status of Biscayne Bay, its tributaries, and the coastal ocean, and what residents can do to become stewards of their local natural resources regardless of their proximity to the water.

Balancing coastal construction projects with environmental protection to minimize impacts allows aquatic preserve staff to work with regulators as well as the public to provide information on the importance of maintaining the health of Biscayne Bay's natural communities.

Goal 1: Maintain and improve water quality within and entering the preserves to meet the needs of the natural resources.

Objective 1: Support local, state and federal efforts to produce a status and trends analysis of water quality in Biscayne Bay.

Integrated Strategy 1: (Ecosystem Science) Support the work of county and state staff to compile and summarize a 30 year water quality data set.

Integrated Strategy 2: (Ecosystem Science) Support and assist in the improvement of the existing water quality monitoring network to ensure that monitoring provides sufficient quality and quantity of data.

Integrated Strategy 3: (Ecosystem Science) Identify sources of pollutants and sources of turbidity impacting BBAP and its tributaries, with specific focus on the Miami River.

Integrated Strategy 4: (Ecosystem Science) Support the identification of gaps in current sediment testing programs with particular focus on identifying loads of polychlorinated biphenyl (PCB) concentrations, heavy metals, petroleum hydrocarbons, and other insecticides, pesticides, and contaminants that may be present.

Integrated Strategy 5: (Resource Management) Support the development of total maximum daily load levels for Biscayne Bay and its tributaries.

Integrated Strategy 6: (Resource Management) Support the development of nutrient criteria protective of Biscayne Bay and Card Sound.

Integrated Strategy 7: (Resource Management) Facilitate access by the public and other stakeholders to historical data and resource information.

Integrated Strategy 8: (Resource Management) Work with county government partners to include Biscayne Bay in the National Estuary Program.

Integrated Strategy 9: (Resource Management) Partner with DEP's Coral Reef Conservation Program to support and promote projects to reduce marine debris and land based sources of pollution.

Integrated Strategy 10: (Resource Management) Facilitate logistical, financial, and/or staff support that would allow Miami-Dade County, Biscayne National Park, the South Florida Water Management District, Florida International University, and other institutions to expand their water quality monitoring efforts.

Integrated Strategy 11: (Education and Outreach) Implement a citizen science water quality monitoring network to enhance existing monitoring with volunteers and to instill in the community an appreciation of the benefits of restoration, enhancement and management of natural resources.

Performance Measure 1: Consult with Miami-Dade County, Biscayne National Park, the South Florida Water Management District, and other institutions to expand their water quality monitoring efforts. Meeting minutes, including participants'deliverables, will be disseminated.

Performance Measure 2: Host an annual meeting with county and local government to discuss implementation of a program to analyze point source stormwater discharge of Miami Beach drainage system (i.e., storm water runoff, upland activities contributing to water degradation).

Performance Measure 3: Host a meeting between relevant agencies and stakeholders to discuss how to analyze existing sediment contaminant data, identify potential sources of contaminants, and where to expand sediment monitoring as needed to answer relevant and pertinent questions. Minutes, including participants' deliverables, will be disseminated.

Performance Measure 4: Expand the existing water quality monitoring program in northern Biscayne Bay through sharing equipment (i.e., datasondes), financial support, and/or staff support.

Performance Measure 5: Create and/or obtain and maintain GIS maps of water quality monitoring sites to help determine problem areas and possible sources of pollution.

Performance Measure 6: Host a minimum of three public presentations wherein existing websites and/or other means of access to historical data and resource information is made available. Presentations can include public presentations, professional lectures, bay-related committee meetings, and other venues.

Performance Measure 7: Host a meeting between NOAA, the University of Miami, the National Institutes of Health, and/or other institutions who are attempting to learn more about bioaccumulation of contaminants and associated impacts to human and coastal ocean health.

Objective 2: Reduce water quality impacts to surface water and groundwater caused by stormwater and septic system sources within the watershed.

Integrated Strategy 1: (Resource Management) Facilitate the inventory of stormwater drains and identify future improvement needs and incorporate data into GIS map.

Integrated Strategy 2: (Resource Management) Support stormwater system retrofitting at the municipal, county and state levels and facilitate dialog to encourage this to happen.

Integrated Strategy 3: (Resource Management) Facilitate the inventory of existing municipalities or portions thereof still using septic systems and incorporate data into GIS map.

Integrated Strategy 4: (Resource Management) Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and relevant best management practices.

Performance Measure 1: Meet with half of the municipalities whose borders lie along Biscayne Bay and/or those who lie inland and discuss efforts being undertaken to retrofit stormwater systems and catalog outfalls. Meeting minutes and participants' deliverables will be disseminated.

Performance Measure 2: Meet with half of the municipalities and/or homeowners associations, whose borders lie along Biscayne Bay and use septic systems, to foster awareness of proper septic system maintenance and discuss possible reimbursements that may be available through municipal/county programs for homeowners who maintain their system and/or hook up to municipal/county sewer lines. Meeting minutes and participants' deliverables will be disseminated.

Shake a Leg is a non-profit organization in Coconut Grove that serves as the "Gateway to Biscayne Bay" for adults and children with physical, developmental, and economic challenges. These modified vessels, called "Access Dinghies," allow these individuals to experience Biscayne Bay as captain of their own vessel.

Performance Measure 3: Obtain GIS maps of at least 5 municipalities' stormwater drainage systems through coordination with relevant municipalities and Miami-Dade County.

Objective 3: Preserve natural shorelines and restore armored shorelines adjacent to the aquatic preserve to maintain or restore water quality and natural resources.

Integrated Strategy 1: (Resource Management) Identify and support acquisition of lands that, if acquired, directly benefit the preserves' natural resources.

Integrated Strategy 2: (Resource Management) BBAP staff can support the regulatory permitting process by informing decisions made by regulatory staff regarding resources present in the AP.

Integrated Strategy 3: (Resource Management) Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program that integrates removal and documentation of marine debris, wildlife surveys, and habitat restoration and enhancement projects including exotic plant removal.

Integrated Strategy 4: (Resource Management) Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.

Integrated Strategy 5: (Education and Outreach) Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.

Integrated Strategy 6: (Education and Outreach) Implement new and/or enhance existing marine debris and pollution removal programs such as DEP's Clean Boater, Marina, and Boatyard Programs to incorporate the community in restoration, enhancement and management of natural resources.

Performance Measure 1: Engage with DEP regulatory staff at the Southeast and/or South District offices on BBAP-specific issues via joint classroom and in-water training at least once per year in an effort to streamline the permitting process while ensuring that important information regarding the natural resources is shared.

Performance Measure 2: Engage with county and federal regulatory staff on BBAP-specific issues via joint classroom and in-water training at least once per year in an effort to streamline the permitting process while ensuring that important information regarding the natural resources is shared.

Performance Measure 3: Continue an active role in the Biscayne Bay Regional Restoration Coordination Team by attending at least 50% of meetings to participate in the dialog about regional projects and issues that might affect uplands adjacent to or coastal wetlands contained within BBAP.

Performance Measure 4: Host a meeting of municipal, local, and state planners and the public about the benefits of pervious pavement to stormwater management and the water quality of the bay. Encourage the use of pervious pavement to increase water percolation into surface soils and the permeable substrate and filtration by the substrate. Meeting minutes and participants' deliverables will be disseminated.

Performance Measure 5: Meet every two years with the Department of Agriculture, Master Gardeners, and/or Sea Grant to keep current on best management practices for homeowners and landscape businesses to reduce waste of water and over application of fertilizers and pesticides. Information will be disseminated through at least one presentation offered to the public.

Objective 4: Protect the current quantity and quality of fresh water being received through specific tidally connected waterways.

Integrated Strategy 1: (Resource Management) Support the Biscayne Bay Coastal Wetlands portion of the Comprehensive Everglades Restoration Plan, with particular attention paid to source of water slated for use in flooding coastal wetlands.

Integrated Strategy 2: (Ecosystem Science) Support development of water reservation rule to protect existing levels of freshwater received in all areas of Biscayne Bay.

Performance Measure 1: Assist in the compilation of and/or facilitate new data gathering that would provide agencies the information needed to establish water reservation rule for Biscayne Bay groundwater and surface water.

Performance Measure 2: Continue to participate in Project Delivery Team meetings, communicating with CAMA senior staff on status of coastal wetlands CERP projects, providing feedback to other agencies on the matter when requested.

Performance Measure 3: Continue to participate in the Power Plant Sitings process and related processes to address potential impacts to restoration projects and coastal wetlands, as needed and as directed.

Objective 5: Protect and restore seagrasses and habitat suitable for seagrass growth.

Integrated Strategy 1: (Ecosystem Science) Facilitate the funding for or expansion of existing aerial photography to assess incidence of scarring, progress of restoration, and composition of benthic community where the resolution is such that these parameters can be discerned and digitized in GIS.

Integrated Strategy 2: (Resource Management) Continue to coordinate with law enforcement through training opportunities, monthly meetings and other venues where natural resource information and roadblocks to effective enforcement against environmental violations can be discussed and better understood.

Integrated Strategy 3: (Resource Management) In collaboration with FWC, local governments and law enforcement, review outcomes of pilot mooring projects and facilitate management of existing mooring areas through collaboration with law enforcement and local governments in order to decrease impacts to the benthic community and water quality.

Integrated Strategy 4: (Resource Management) Work with law enforcement and partnering resource agencies to minimize the number of derelict vessels within BBAP boundaries.

Integrated Strategy 5: (Education and Outreach) Continue to develop curriculum for teachers as well as presentations and activities for the public of all ages to learn about the ecosystem services provided by Biscayne Bay resources and the natural history of Biscayne Bay.

Performance Measure 1: Partner with FWC, the county, and other agencies to develop and implement the Johnson's Seagrass Management Plan and other seagrass monitoring and mapping efforts.

Performance Measure 2: Include contact information for natural resource related issues such as derelict vessels, groundings, oil slicks, and marine dumping during each presentation offered to stakeholder and user groups.

Performance Measure 3: Host coordination meetings twice per year with FWC, local governments, and law enforcement agencies to identify (using GPS coordinates, perhaps through an existing database) and facilitate removal of derelict vessels in Biscayne Bay and Card Sound at every opportunity.

Performance Measure 4: Identify residential areas that might be appropriate for Living Shorelines program, namely by determining presence/absence of resources in the bay along seawalls and bulkheads that might preclude property from successfully participating in the program.

Performance Measure 5: Hold annual meetings to share the newest, best available science related to conducting coastal construction projects in a way that minimizes impacts to seagrasses.

Performance Measure 6: In coordination with the county, maintain an updated GIS layer of seagrass scars and other impacted areas that might benefit from mitigation when the opportunity arises.

Performance Measure 7: Create a geodatabase for BBAP and have staff trained on how to maintain and add to it.

Performance Measure 8: Coordinate with county and municipal agencies as well as CAMA staff to maintain an updated list of public interest projects.

Performance Measure 9: Obtain aerial photography at a resolution that would allow coastal managers in various agencies to catalog seagrass scars and other features that can be mapped and data managed using GIS.

Performance Measure 10: Participate in outreach events such as those organized by BBAP for Baynanza and Environmental Immersion Day where the natural resources of BBAP are highlighted, with some activities being interactive; partner with volunteers and other organizations to facilitate information exchange for residents who speak Spanish or Haitian Creole.

Goal 2: Increase public and industry awareness about water quality issues in BBAP and what actions can be taken to improve water quality.

Objective 1: Inform the public and partners about water quality conditions within BBAP.

Integrated Strategy 1: (Ecosystem Science) Develop a "report card" for Biscayne Bay with easy-to-understand but pertinent information about the status of the health of Biscayne Bay with a focus on water quality, submerged aquatic vegetation, hardbottom community, and possibly other parameters such as abundance and diversity of species if that data is available.

Performance Measure 1: Partner with local and state agencies to transmit important water quality information to the public by assisting in translation of materials, promulgation and dissemination of materials at each outreach event conducted, with a focus on providing information to underserved communities.

Objective 2: Facilitate knowledge and understanding of how activities in the watershed impact the BBAP.

Integrated Strategy 1: (Education and Outreach) Coordinate and/or participate in three public presentations per year, including outreach events where staff can provide information to the public regarding how to reduce negative impacts on water quality.

Integrated Strategy 2: (Education and Outreach) Encourage homeowners to maintain septic systems and educate them on the benefits of joining municipal or county sewage systems.

Integrated Strategy 3: (Education and Outreach) Expand existing and previous "drains to bay" signage program along storm drains across watershed.

Integrated Strategy 4: (Education and Outreach) Engage in outreach and education with decision-makers at all levels of government and serve as a point of contact for information regarding the health of Biscayne Bay's natural resources.

Performance Measure 1: Hold an annual "Seagrass Awareness Month" event wherein local decision-makers play an active role in highlighting the importance of water quality and seagrasses to residents and visitors.

Performance Measure 2: Meet with decision-makers at the local and municipal levels once a year about the importance of BBAP's resources with specific focus on how upland uses can affect the quality, both ecological and aesthetic, of BBAP.

Performance Measure 3: Meet with half of the municipalities and/or homeowners associations, whose borders lie along Biscayne Bay and use septic systems, to foster awareness of proper septic system maintenance and discuss possible reimbursements that may be available through municipal/county programs for homeowners who maintain their system and/or hook up to municipal/county sewer lines. Meeting minutes and participants' deliverables will be disseminated.

*5.3 / **Issue Two: Habitat Loss***

The uplands surrounding Biscayne Bay have changed dramatically in the past century. Natural tributaries were channelized and additional canals were dug to drain the Everglades, resulting in pulsed-point sources of freshwater. Two inlets created through north and south Miami Beach barrier islands changed the natural circulation patterns in northern Biscayne Bay and there are now compartments or basins separated by causeways in the northern part of Biscayne Bay. Wetlands were filled and shorelines bulkheaded so that business and residences could be constructed. Raw sewage emptied into the bay for a period of time until diverted to a sewage treatment plant in the early 1950s. Dredging operations that excavated seagrasses and created causeways and spoil islands deepened parts of the bay, resulting in a loss of natural benthic communities and increased turbidity. Despite these changes, the bay has rebounded in many ways and is considered highly productive, with dense and discontinuous seagrass as well as hardbottom and soft bottom communities. However, there are many threats still facing coastal wetlands (e.g. seagrasses, mangroves, and hardbottom communities). Coastal construction, maintenance of waterways, land based sources of pollution and other activities result in the loss of these habitats through direct and indirect impacts, with resources being impacted at a rate faster than they can be recovered due to logistical and financial circumstances.

Goal 1: Protect Biscayne Bay from impacts related to land use changes that disrupt the ecological functions of natural resources within CAMA's purview.

Objective 1: Reduce impacts to submerged resources by coastal construction.

Integrated Strategy 1: (Ecosystem Science) Continue to partner with agencies and/or secure funding for research aimed at understanding the direct impacts of coastal construction projects and to develop effective avoidance and minimization criteria.

Integrated Strategy 2: (Ecosystem Science) Partner with local, state, and/or federal agencies to obtain high resolution aerial photography as it becomes available to track changes (i.e., halo around pilings where seagrass once thrived; erosion of shoreline; etc.) in Biscayne Bay's coastline and benthic community from coastal construction projects such as seawalls, docks, and marinas as well as propeller damage.

Integrated Strategy 3: (Resource Management) Use digital photos as they are updated to help assess cumulative impacts to natural resources.

Integrated Strategy 4: (Resource Management) Encourage, when possible, maintenance of existing boat ramps and marinas as opposed to creation of new facilities that would introduce new impacts.

Integrated Strategy 5: (Resource Management) Partner with local, state and federal agencies to secure funding and conduct marine habitat restoration projects and employ non-regulatory methodologies to reduce marine habitat impacts.

Performance Measure 1: Establish partnerships with FWC, the county, and stakeholders by meeting annually to evaluate methods of successfully restoring seagrass and mangrove habitats and to implement these methodologies. Track outputs and products associated with these partnering efforts.

Performance Measure 2: Create and maintain the BBAP geodatabase so that information regarding current and past mitigation projects occurring in BBAP is co-located on a map with important metadata related to each project.

Performance Measure 3: Provide online access to layers of the BBAP geodatabase to other agencies, the public, and stakeholder groups.

Performance Measure 4: Track the extent of BBAP assistance requested and provided to various local, state, and federal agencies on how to best avoid and minimize impacts to submerged resources based on research conducted in Biscayne Bay and elsewhere.

Performance Measure 5: (Resource Management) Digitize, analyze, and compile aerial photos into a GIS geodatabase that is created for BBAP.

Objective 2: Participate in the regulatory process by which small and large coastal construction projects are permitted in the Biscayne Bay watershed.

Integrated Strategy 1: (Ecosystem Science) Create a tool with a mapping component to assess cumulative impacts on natural resources that can be used by CAMA and regulatory staff from all relevant regulatory agencies.

Integrated Strategy 2: (Resource Management) Conduct training for and coordinate on-site field surveys with staff of DEP's Southeast (West Palm Beach) and South (Marathon) District offices.

Integrated Strategy 3: (Resource Management) Participate in reviews of Comprehensive Development Master Plans and management plans of adjacent managed areas.

Integrated Strategy 4: (Resource Management) Partner with local, state (non-DEP) and federal agencies on applications for proposed construction projects to offer biological survey information or public interest projects.

Integrated Strategy 5: (Resource Management) Work with Miami-Dade County staff and leadership to allow restoration-focused permits to fill seagrass scars and other habitat restoration activities to be evaluated as providing a benefit to Biscayne Bay ecology.

Integrated Strategy 6: (Resource Management) Partner with municipal, local, and state government agencies to promote the appropriate usage of available fill for use in restoration projects.

Integrated Strategy 7: (Education and Outreach) Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.

Performance Measure 1: Analyze the cumulative impact tool created by the DEP Coral Reef Conservation Program and adapt it to BBAP to be functional for regulatory staff.

Performance Measure 2: Meet annually with DEP regulatory staff to discuss implementation of a tool used to assess cumulative impacts in BBAP.

Performance Measure 3: Develop curriculum and host classroom and in-water training, related to BBAP and its natural resources, at least once a year for all levels of regulatory staff.

Performance Measure 4: Coordinate a meeting between municipal, county, state and/or federal regulatory staff and resource managers to discuss implementation of the United Stated Fish and Wildlife Service Living Shorelines program, to be modeled on the success of Palm Beach County's implementation of this program. Meeting minutes and participant deliverables will be disseminated.
Performance Measure 5: Create partnerships with other agencies to compile GIS layers that document where Living Shorelines projects are taking place and/or identify potential areas that could participate in the Living Shorelines program.

Performance Measure 6: Partner with regulatory agencies to create a GIS layer of past and present mitigation and restoration-related projects to track progress over time.

Objective 3: Describe and/or quantify function of ecological services provided by coastal habitats.

Integrated Strategy 1: (Resource Management) Quantify and better understand loss of native biodiversity and ecosystem integrity within BBAP boundaries.

Integrated Strategy 2: (Ecosystem Science) Better understand the form and function as well as the interactions between flora and fauna within BBAP boundaries and the stresses experienced at the habitat or organism level.

Integrated Strategy 3: (Ecosystem Science) Partner with other resource agencies and non-governmental organizations to better understand potential impacts to human health by way of studying the health of Biscayne Bay flora and fauna.

Integrated Strategy 4: (Ecosystem Science) When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.

Integrated Strategy 5: (Education and Outreach) Convey knowledge gained regarding the function of ecosystem services provided by coastal habitats to the public and students, from grade school through university.

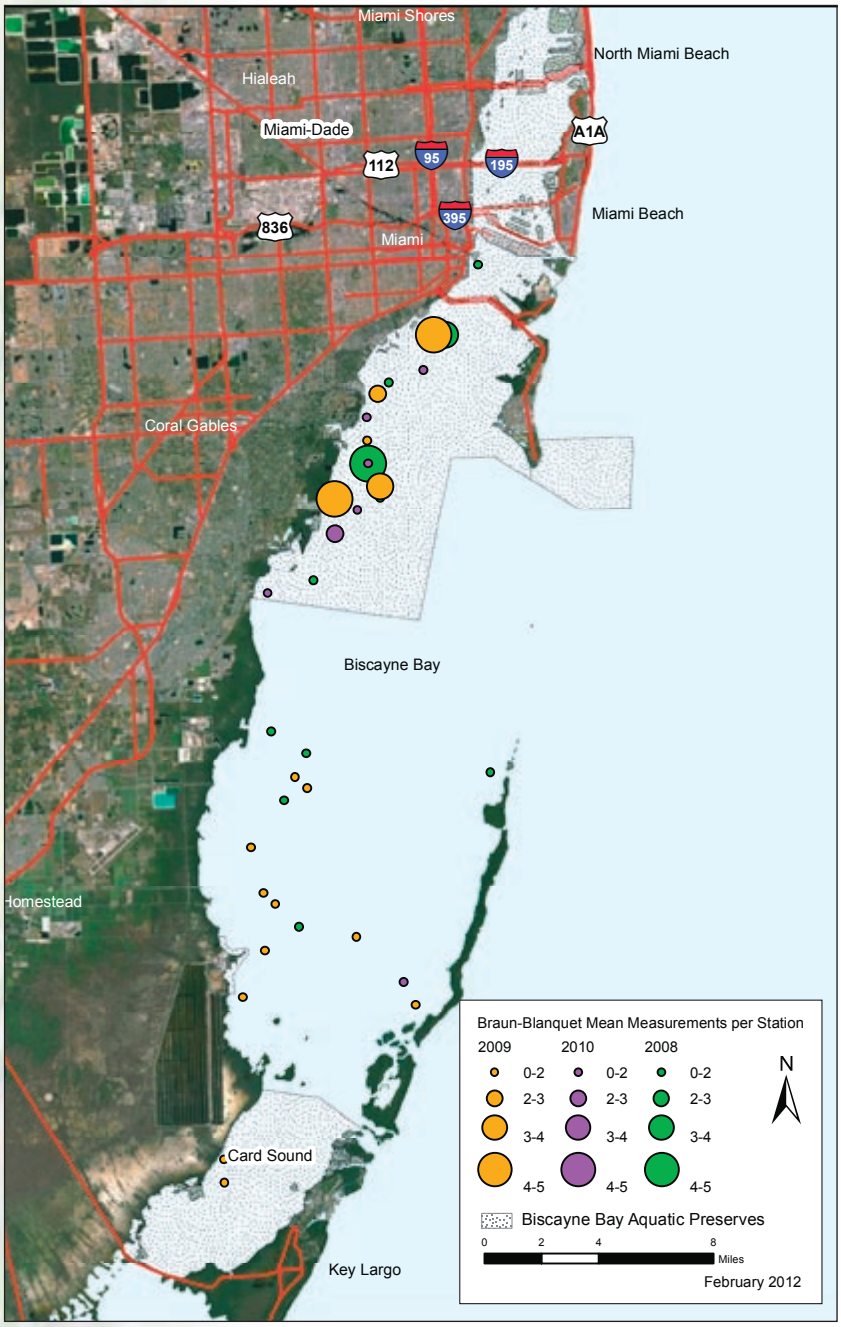
Performance Measure 1: Partner with agencies, universities and non-governmental organizations to compile data and/or conduct a literature search on historic and current levels of biodiversity and coastal habitat resiliency that can be synthesized and presented to the public and in professional forums.

Performance Measure 2: Attend professional conferences and meetings wherein the ecological value of BBAP's resources is conveyed and discuss how BBAP undertakes management and protection of these resources.

Performance Measure 3: Host a meeting between relevant agencies and institutions who are attempting to learn more about effects of contaminants on human and coastal health.

5.4 / Issue Three: Obstacles in Natural Resource Management

Having a baseline understanding of presence and distribution of habitats, composition and abundance of species that depend on those habitats (including salinity and temperature ranges), and updated maps to graphically represent these parameters and how they change over time are all essential tools needed to effectively manage BBAP. Addressing issues such as marine debris and pollution is important in assessing the overall health of Biscayne Bay. Marine debris presents a real and chronic threat to wildlife and public safety. Entanglement and ingestion of marine debris and toxins can cause immediate or prolonged injury to marine animals, from corals to marine mammals. The presence of debris detracts from the aesthetic value of natural landscapes. Marine debris can include paper and plastic products, construction debris, derelict vessels and derelict fisheries gear. Significant change events such as sea level rise and climate change may drastically alter the status of Biscayne Bay's benthic community and may have regional impacts, such as affecting drinking water supply. Research suggests that aquatic vegetation which represents less than 0.5% of the ocean floor, sequesters up to 70% of the earth's carbon dioxide emissions for hundreds or thousands of years, beyond the decadal scale of rainforest trees (Nelleman et al., 2009). These ecosystems—including seagrasses, mangroves, and macroalgal communities—are being lost at a rate faster than rainforests. Catastrophic events such as oil disasters and harmful algal blooms are also major issues that could affect the health of Biscayne Bay's resources.



Map 14 / Distribution and Abundance of Macroalgae (Anadyomene Complex) in Biscayne Bay

Managing nearly 70,000 acres of submerged lands across three counties with a staff of two (one being a temporary OPS assignment) and limited financial resources, poses quite a challenge if managing the bay's resources is to be undertaken in a proactive, holistic manner. State funding for BBAP was cut by 60% in the 2009/2010 fiscal year, posing an even greater challenge to successful management of two aquatic preserves that lie in the most populous county in the state and whose boundaries run the length of the three counties that border it. The need for a dedicated staff person to manage and maintain GIS data in the newly-created BBAP geodatabase will be essential to providing adequate protection and management of BBAP. Dedicated interns and volunteers have also proven essential for the function of BBAP management and protection. Additionally, fostering partnerships that exist between all levels of government agencies,

Lionfish occurrences inside Biscayne Bay Aquatic Preserves are becoming more frequent. This lionfish was hovering near a French angelfish (intermediate stage, not quite an adult) in hardbottom habitat near Haulover Inlet.

universities and colleges, and non-profit organizations that are Biscayne Bay stakeholders is essential to be able to leverage BBAP staff time and funds to effectively maintain levels of community outreach and to obtain critical ecosystem science information that is used to make management decisions about the current and future health of Biscayne Bay. One of the greatest obstacles to natural resources management of the BBAP is the lack of awareness of the existence of the preserves among Miami-Dade County residents. While staff have demonstrated an increase in awareness about the preserves through community outreach endeavors, greater awareness of the preserves and the level of protection they are afforded this unique ecosystem may translate into greater stewardship of its resources. Fostering an appreciation, awareness, and understanding of the importance of Biscayne Bay's resources in people's quality of life is paramount to successful management of the preserves. Per the wisdom of Baba Dioum, Senegalese poet, "In the end, we conserve only what we love. We love only what we understand. We will understand only what we are taught."

Goal 1: Document the natural resources with the preserves.

Objective 1: Establish a baseline and/or add to the current knowledge base of the current location, composition and abundance of the various habitat types and associated fauna, with specific focus on seagrass habitat.

Integrated Strategy 1: (Ecosystem Science) Partner with other natural resource agencies who capture aerial photography of managed areas to obtain photography of BBAP for use in BBAP geodatabase.

Integrated Strategy 2: (Ecosystem Science) Conduct wildlife and groundtruthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.

Integrated Strategy 3: (Resource Management) Partner with other resource agencies and non-governmental organizations to support invasive exotic plant and animal eradication, such as lionfish, by advertising exotic plant and animal removal volunteer activities at outreach events.

Integrated Strategy 4: (Resource Management) Continue to partner with the USCG and local and state agencies to participate in oil disaster Area Contingency Planning.

Performance Measure 1: Maintain oil disaster response credentials.

Performance Measure 2: Maintain wildlife injury response credentials through partnership with Marine Animal Rescue Society, FWC, and NOAA NMFS by attending semi-annual trainings.

Performance Measure 3: Partner with other resource agencies and non-governmental organizations to conduct quarterly wildlife surveys, with a specific focus on seagrass (presence/absence and species type), and manatees, particularly in the FWC-designated Bill Sadowski Critical Wildlife Area.

Objective 2: Develop specific restoration goals for impacted seagrass areas.

Integrated Strategy 1: (Ecosystem Science) Partner with other natural resource agencies to develop an environmental impact statement similar to what was drafted for the Florida Keys National Marine Sanctuary so that BBAP is poised to apply for competitive funding for restoration projects.

Integrated Strategy 2: (Resource Management) Work with Miami-Dade County to obtain permits in a timely fashion that are needed to conduct seagrass restoration in BBAP.

Integrated Strategy 3: (Resource Management) Work with the FWC as the lead along with other local, state and federal resource agencies to develop a restoration plan for Johnson's seagrass and its associated critical habitat.

Integrated Strategy 4: (Resource Management) Coordinate with other resource agencies and law enforcement to support efforts to address derelict and/or illegal fisheries gear and harvesting activities.

Integrated Strategy 5: (Resource Management) Work with law enforcement to encourage enforcement of the seagrass law prohibiting destruction of seagrasses in aquatic preserves.

Integrated Strategy 6: (Resource Management) Work with other agencies to respond to vessel groundings and quantify injuries through the use of surveys and Trimble™ GPS technology to map location, size, and volume of injury.

Integrated Strategy 7: (Resource Management) Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff.

Integrated Strategy 8: (Resource Management) Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.

Integrated Strategy 9: (Ecosystem Science) When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.

Performance Measure 1: Partner with FWC, the county, and other agencies to increase the number of acres of seagrass and mangrove habitat restored, or restoration of substrate so that it is suitable for seagrasses or mangroves.

Performance Measure 2: Take the lead in facilitating emergency meetings in partnership with FWC, the county, universities and other agencies when support is needed to track algal blooms, groundings, injured wildlife or other natural resource-related impacts.

Performance Measure 3: Continue to partner with FWC and other local, state, and federal agencies and organizations to conduct the Natural Resource Workshop wherein marine law enforcement learn about the importance of coastal wetlands and reefs and their ecological and economic value, marine mammal rescue basics, and their role in protecting these resources.

Performance Measure 4: Attend at least half of Marine Advisory Support Team meetings facilitate the enforcement of Critical Wildlife Area laws in coordination with FWC staff to actively manage the area.

Performance Measure 5: Create partnerships with other agencies to compile GIS layers that document where Living Shorelines projects are taking place and/or identify potential areas that could participate in the Living Shorelines program.

Objective 3: Expand the benthic monitoring program in Biscayne Bay with particular focus on the northern bay, to include more frequent monitoring of existing sites and include additional sites.

Integrated Strategy 1: (Ecosystem Science) Partner with other resource agencies to conduct a survey of the preserves' boundaries for an updated account of acreage and scope of protected areas.

Integrated Strategy 2: (Ecosystem Science) Obtain funding to extend baseline monitoring being conducted ahead of Comprehensive Everglades Restoration Plan projects coming online in northern

Biscayne Bay to be able to determine potential impacts from reduced freshwater flow should certain projects seek to move water from the northern part of the system.

Integrated Strategy 3: (Ecosystem Science) Increase the number of epibenthic monitoring sites within the preserve boundaries.

Performance Measure 1: Maintain equipment and update associated software for Trimble™ GPS unit and/or acquire new equipment to aid in the mapping and monitoring of benthic resources so that data can be uploaded into BBAP's geodatabase for access by BBAP staff and agency partners.

Performance Measure 2: Host a meeting with university staff, Sea Grant, and local, state, and federal partners to determine what it would entail to recreate key research projects undertaken in Biscayne Bay that provided critical information regarding abundance, diversity, and composition of species to compare and contrast past and present conditions. Meeting minutes will be disseminated.

Performance Measure 3: Continue to participate in an active role in the Biscayne Bay Regional Restoration Coordination Team by attending at least 50% of meetings.

Goal 2: Facilitate knowledge about and the importance of BBAP's natural resources and history and cultural resources to the public.

Objective 1: Partner with other agencies and/or non-governmental organizations to promote greater understanding and interpretation of resources including threats to those resources that businesses, residents, and visitors can minimize.

Integrated Strategy 1: (Education and Outreach) Partner with county and municipal governments to provide environmental education related to outstanding cultural sites such as the Miami Circle, Arch Creek, the Deering Estate, and the Miami Marine Stadium.

Integrated Strategy 2: (Education and Outreach) Partner with county and municipal governments to provide environmental education related to outstanding natural resource sites such as the existing FWC's Critical Wildlife Area, Chicken Key, Arch Creek, and Cutler Wetlands.

Integrated Strategy 3: (Resource Management) Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program that integrates removal and documentation of marine debris, wildlife surveys, and habitat restoration and enhancement projects including exotic plant removal.

Integrated Strategy 4: (Resource Management) Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.

Integrated Strategy 5: (Resource Management) Use existing programs as a guide to develop and implement a citizen science monitoring program specifically focused on documenting the affects of climate change in south Florida.

Integrated Strategy 6: (Resource Management) Work with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.

Integrated Strategy 7: (Resource Management) Facilitate a greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.

Integrated Strategy 8: (Resource Management) Work with CAMA legal staff, law enforcement and local and state legal staff to educate magistrates and judges to prevent the dismissal of environmental-related violations such as manatee zone or fisheries violations.

Performance Measure 1: Initiate dialog with county and municipal park staff about the presence of feral and/or nuisance animals that can carry disease and eradicate native wildlife and prey items.

Performance Measure 2: Host quarterly Manatee Awareness Group meeting to facilitate dialog between marine law enforcement, formal and informal educators, resource managers, scientists, non-profit organizations and marine industries on the subject of manatee survival and protection of manatee habitat in Miami-Dade, Broward, and Palm Beach counties.

Performance Measure 3: Attend 50% of Marine Advisory Support Team meetings wherein marine law enforcement in Miami-Dade County facilitates coordination between interested stakeholders on the critical issues facing protection of natural resources and human health and safety in Biscayne Bay and its tributaries.

Performance Measure 4: Continue dialog with faculty and leadership of area colleges and universities to promote science and research that will serve to answer long-standing questions about the health of Biscayne Bay and the flora and fauna the BBAP supports.

Performance Measure 5: Conduct at least one naturalist training each year that is made available to eco-tour staff and vessel operators.

Performance Measure 6: Identify and meet with senior county and city parks' staff who manage natural areas along Biscayne Bay to encourage incorporation of BBAP-related information into presentations, tours, and other outreach activities. Staff will work with parks that participate in promoting awareness and appreciation of BBAP in tracking attendance to infer number of visitors exposed to educational messages about BBAP.

Performance Measure 7: Repair, replace, or install aquatic preserve signage at outstanding cultural sites such as the Miami Circle, Arch Creek, the Deering Estate, and the Miami Marine Stadium.

Performance Measure 8: Repair, replace, or install aquatic preserve signage at outstanding natural resource sites such as the existing FWC's Critical Wildlife Area, Chicken Key, Arch Creek, and Cutler Wetlands.

Objective 2: Partner with state, county and municipal parks to incorporate information about BBAP history and resources into guided tours, signage, staff training, and promotional materials.

Integrated Strategy 1: (Education and Outreach) Encourage tour guides as well as county and municipal park staff to present information about the natural and cultural resources of Biscayne Bay as part of a tour of BBAP.

Performance Measure 1: Attend one meeting per year hosted by City of Miami, City of Miami Beach, Miami-Dade County, the Miami River Commission, and other agencies or organizations.

Performance Measure 2: Identify and meet with senior county and city park staff who manage natural areas along Biscayne Bay to encourage incorporation of BBAP-related information into presentations, tours, and other outreach activities. Staff will work with parks that participate in promoting awareness and appreciation of BBAP in tracking attendance to infer number of visitors exposed to educational messages about BBAP.

Performance Measure 3: Coordinate and host an annual naturalist training (interpretive and ecology-based information) for eco-tour operators and other concessionaires.

5.5 / Issue Four: Public Awareness, Access, and Use

There is a perception that Biscayne Bay is difficult to access, and to better understand this issue a study was conducted by the Trust for Public Land (n.d.) that took aim at determining how best and where to increase public access to the bay. This document can be revisited for potential solutions. Interestingly, the Trust for Public Land's (TPL) Biscayne Bay Access Plan provides a succinct thought on the importance of maintaining public submerged lands as authors recount a 1947 Miami Herald article in which a private landowner's fight with the City of Miami is examined. The landowner contended that he ought to be able to purchase 1,400 acres of publicly-owned submerged lands to be able to expand this property at the mouth of the Miami River. His argument was that the city had not used the land for municipal purposes as intended by the Florida Legislature when it deeded the bay bottom to the municipality. But the city retorted by stating, as reported by the Miami Herald, that municipal purposes "…include even the important right merely to sit in beautiful Bayfront Park and look over the waters of Biscayne Bay. If private ownership …were recognized, it is contended that the bay would be filled in and hotels, apartments and stores built on islands, thereby depriving the public of enjoyment of the bay" (TPL, n.d.). Other documents and policy changes such as those proposed by Miami-Dade County's Manatee Protection Plan Review Committee in 2009 severely alter existing rules on where marina expansion and other development may occur. Expanding boating access on the Miami River contradicts recent research illustrating that manatees are using Miami River more than they have since monitoring was instituted, while seeking freshwater, foraging and warm-water habitat.

Existing access to Biscayne Bay such as kayak launches and boat ramps should be maintained and improved, with new impacts elsewhere from the creation of new access points can be avoided or minimized. There are several boat ramps and kayak launches in Miami-Dade and Monroe counties that are decidedly (by city or county officials) not going to be improved or maintained which reduces access to the water by most registered boaters who do not or cannot keep their vessel or personal watercraft at a marina or dry dock storage. Ensuring that operators of motorized vessels know

Biscayne Bay's waters and applicable laws and have appropriate access to the waterway is essential in balancing responsible use with environmental protection. Additionally, visual access to Biscayne Bay needs to be improved. Per Trust for Public Land's Biscayne Bay Access Plan (n.d.) there are a multitude of ways to go about doing this, from encouraging end-of-street parks being created using dead-end right-of-ways that otherwise may sit unkempt, or taking the opportunity to use existing infrastructure along developed and natural shorelines to provide seating and activities that can be enjoyed at the water's edge. Promoting low-impact, passive use of the preserves is a means to not only allow citizens to intimately explore parts of Biscayne Bay otherwise inaccessible by some motor craft—either due to noise flushing wildlife or draft limits in shallow water habitat—but to develop an awareness and appreciation of the bay's resources in a way that many citizens and visitors often overlook or do not consider. While Biscayne Bay is an international boating and sailing destination, it is less known for its waterway birding trails, presence of resident marine mammals, or elusive yet fascinating marine invertebrates.

With increased or enhanced public access must come increased access to information on how to responsibly enjoy Biscayne Bay. Public presentations, various training opportunities, education targeted at user groups and youth education play a role in fostering stewardship of the bay's resources. However, increasing numbers of registered vessels, an increasing population of residents and a steady stream of tourists warrant equal and adequate levels of on-water law enforcement protection. Staffing levels have remained the same as they were decades ago or in many cases have declined, as Miami-Dade County remains in the top two counties for most boating accidents on the water. An obligation to support Port of Miami patrols as well as international threats such as terrorism and drug trafficking often pulls officers away from on-water safety patrols that benefit the boating community and the environment.

Residents and visitors alike should have physical access to the bay as well as access to information about what the bay needs to thrive and endure and what role one plays in supporting the bay's future health. The balance between public use and long-term protection and management of BBAP so that its ecological and aesthetic values may endure is a difficult one to maintain. While access to Biscayne Bay can always be increased, better signed, and available to a wider range of users, access must be balanced against the ecological needs of Biscayne Bay.

Goal 1: Maintain a safe environment for Biscayne Bay's wildlife, habitats and user groups.

Objective 1: Facilitate research to identify human use conflicts with natural resources.

Integrated Strategy 1: (Resource Management) Partner with other agencies and organizations to advance to the next phase of the Biscayne Bay Economic Study where ecosystem services of natural resources and impacts of uses are quantified.

Integrated Strategy 2: (Resource Management) Work with regulatory staff, law enforcement, legal staff and resource management staff from other agencies to address uses of BBAP that are not water-dependent, are potentially illegal, or harm resources.

Integrated Strategy 3: (Resource Management) Digitize, analyze, and compile all aerial photos into a GIS geodatabase that is updated periodically to help assess cumulative impacts.

Integrated Strategy 4: (Education and Outreach) Facilitate Biscayne Bay-specific boater education and safety given that over 60% of boating accidents in Miami-Dade County involve boat operators with no formal boating education.

Integrated Strategy 5: (Education and Outreach) Continue to conduct formal and informal outreach activities in counties BBAP serves, with particular focus on underserved communities, to promote awareness and appreciation of BBAP's natural resources to foster stewardship and appreciation.

Integrated Strategy 6: (Education and Outreach) Partner with and actively support the National Park Service's effort to have a visitor center near downtown Miami where the opportunity exists to educate the visiting public about BBAP resources.

Integrated Strategy 7: (Education and Outreach) Support development of a Biscayne Bay-appropriate Eco-Mariner Program as developed and implemented in Everglades National Park by the National Parks Conservation Association.

Performance Measure 1: Identify and meet with senior county and city parks' staff who manages natural areas along Biscayne Bay to encourage incorporation of BBAP-related information into presentations, tours, and other outreach activities. Staff will work with parks that participate in promoting awareness and appreciation of BBAP in tracking attendance to infer number of visitors exposed to educational messages about BBAP.

Performance Measure 2: In partnership with all levels of government and non-governmental organizations, coordinate natural resource protection workshops every two years for marine law enforcement officers, resource managers, and parks' staff.

Performance Measure 3: Collaborate with the national parks, National Park Conservation Association, and other stakeholders to fund and implement an EcoMariner program specific to Biscayne Bay for residents and visitors to Miami-Dade County.

Performance Measure 4: Meet with authors of Biscayne Bay Economic Study and relevant agencies to determine how to advance to the next phase of the economic study where ecosystem services of natural resources and impacts of uses are quantified.

Performance Measure 5: Establish a committee made up of law enforcement, resource managers, regulatory staff, and stakeholders to determine where and what kinds of non-water dependent, potentially illegal, and/or harmful activities are occurring in BBAP and how each incidence should be addressed.

Performance Measure 6: Meet with National Park Service staff to discuss how BBAP resource-related information could be incorporated into the new Park Service visitor center.

Objective 2: Reduce the amount of debris, contaminants, and resource injuries associated with user group activities.

Integrated Strategy 1: (Ecosystem Science) Determine effectiveness and management practices of mooring fields and potentially create new mooring fields to better protect resources from direct impacts (anchors) and indirect impacts (dumping of sewage).

Integrated Strategy 2: (Ecosystem Science) Better understand consumptive use impacts from fisheries such as shrimping, crabbing, and others that employ gear and methods that can be harmful to Biscayne Bay resources while recognizing their importance to the local economy.

Performance Measure 1: Meet with the county, state and federal partners, and in particular the DEP Coral Reef Conservation Program and FWC, to discuss how resource injuries are assessed and what initiatives have been undertaken in Miami-Dade, southern Broward, and Monroe counties to address these threats. Track the number of meetings and participants.

Performance Measure 2: Schedule and coordinate annual workshops with the assistance of Sea Grant, marine industries, non-profit organizations and agency partners to provide citizens with information related to recreational fishing gear, vessel impacts, and other threats to the marine environment. Track the number of meetings and participants who attend planning and informational workshops.

Objective 3: Identify ways to increase and enhance effective on-water law enforcement patrols in BBAP.

Integrated Strategy 1: (Education and Outreach) Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.

Integrated Strategy 2: (Education and Outreach) Coordinate increasing or replacing regulatory signage and buoys so they are correct, legible and enforceable.

Integrated Strategy 3: (Resource Management) Partner with other agencies and organizations to identify funding sources to conduct greater or targeted marine law enforcement.

Integrated Strategy 4: (Resource Management) Work with CAMA legal staff, law enforcement and local and state legal staff to implement a class such as that run by Biscayne National Park where on-water citations for violations related to fisheries, speed zones, and safety issues can result in no financial restitution if the offender participates in a class designed to educate him/ her and prevent future offenses.

Performance Measure 1: Develop partnerships with marine law enforcement and targeted BBAP stakeholders to facilitate dialog with tow boat companies who operate within BBAP boundaries to encourage them to voluntarily report groundings or other resource impacts to authorities. The memorandum of agreement that Biscayne National Park maintains with tow boat operators will be used as a model. Track the number of reports by tow boat companies as a result of these efforts.

Performance Measure 2: Coordinate with FWC and other local, state and federal agencies and non-governmental organizations to host quarterly coordination meetings and conduct natural resource workshops every two years wherein marine law enforcement learn about the ecological and economic value of coastal wetlands, seagrass, and reef habitat; marine mammal rescue basics; and law enforcement's role in protecting these resources. Track the number of participants and measure knowledge gained through post-program surveys.

Performance Measure 3: Collaborate with the national parks, National Park Conservation Association, and other stakeholders to fund and implement an EcoMariner program specific to Biscayne Bay for residents and visitors to Miami-Dade County.

Performance Measure 4: Meet with law enforcement agencies to identify what resources are needed, financial or otherwise, that would promote increased on-water presence in BBAP.

Performance Measure 5: Coordinate a meeting between FWC and DEP legal staff to discuss the possibility of implementing a class modeled after that established by Biscayne National Park or in partnership with Biscayne National Park and feasibility of waiving fees in lieu of offenders attending such a class.

Goal 2: Promote low-impact, sustainable recreational opportunities.

Objective 1: Increase awareness of non-consumptive use opportunities such as paddle boarding, sailing, kayaking, canoeing, swimming, and snorkeling and promote sustainable use of motorized vessels.

Integrated Strategy 1: (Education and Outreach) Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.

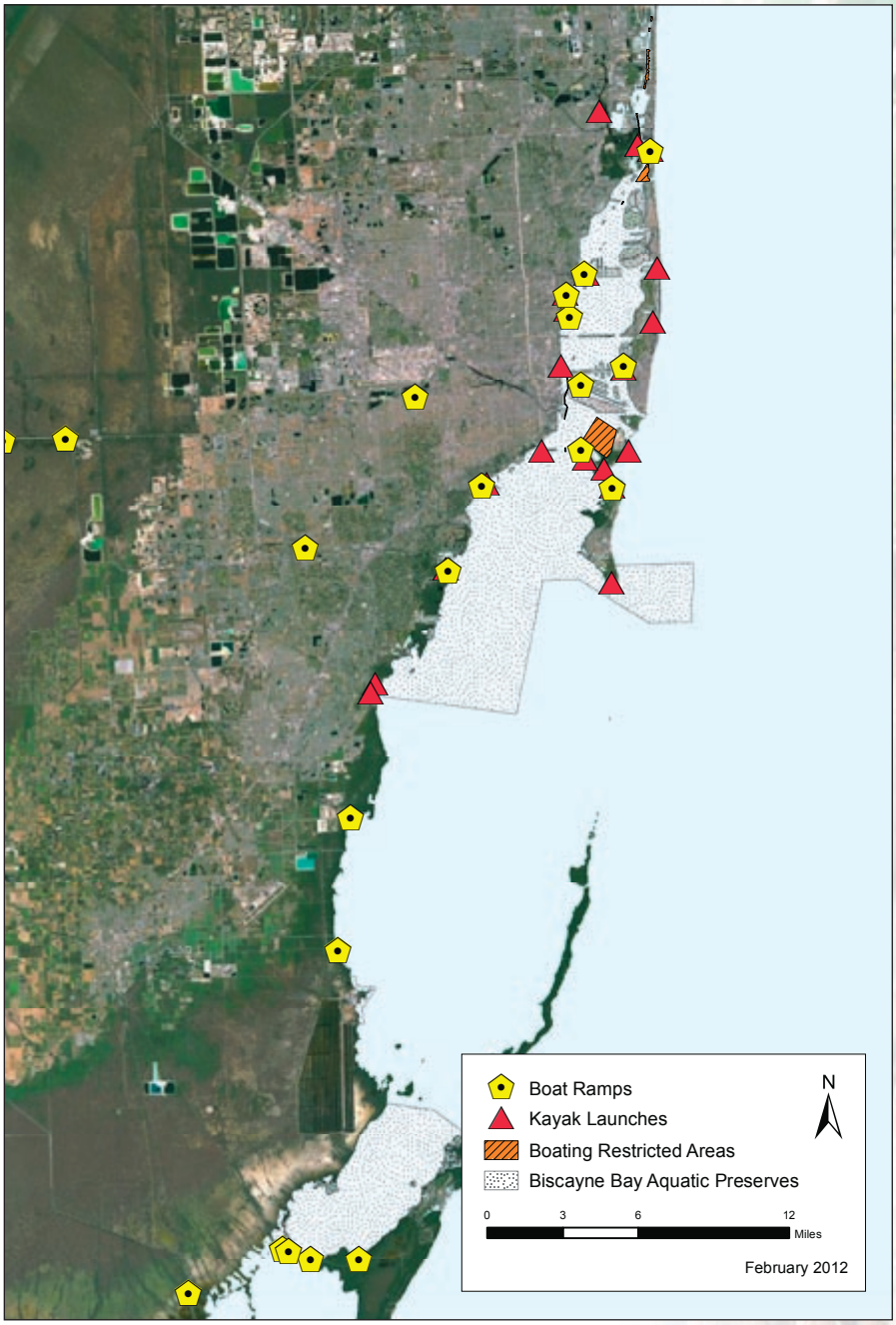
Performance Measure 1: Host a meeting between the national parks, National Park Conservation Association, and other stakeholders to fund and implement an EcoMariner program specific to Biscayne Bay for residents and visitors to Miami-Dade County.

Performance Measure 2: Coordinate a meeting between FWC and DEP legal staff to discuss the possibility of implementing a class modeled after that established by Biscayne National Park or in partnership with Biscayne National Park and feasibility of waiving fees in lieu of offenders attending such a class.

Performance Measure 3: BBAP staff and volunteers will become certified environmental interpreters.

Objective 2: Identify and support appropriate locations for paddling launch sites and desirable destinations to access via kayak, canoe, or paddleboard.

Integrated Strategy 1: (Education and Outreach) Develop



Map 15 / Kayak and Boat Access in Biscayne Bay Aquatic Preserves.

an awareness and access guide to be used by paddlers and other passive recreational users to be disseminated by concessionaires, businesses, and leaders of organizations.

Performance Measure 1: Launch a campaign to promote paddling and other non-motorized activities. Campaign will include creating a guide that highlights launch locations, safety guidelines, and natural resource information. Distribute guide to social networks of paddlers, eco-tour concessionaires and municipal and county-run eco-tour concessionaires. Make it available on the BBAP website.

Performance Measure 2: Host a meeting with non-profit organizations and other government agencies to promote themed paddling tours of BBAP that provide all levels of paddlers with ecological interpretation of the bay's natural resources. A specific focus on welcoming decision-makers to tour the bay via kayak should be considered, as well as formal and informal educators, journalists and eco-tour operators.

Objective 3: Provide formal and informal opportunities for various types of user groups (motorized vessels, SCUBA divers, kite surfers, birders) to learn about BBAP's natural resources in order to promote a sense of stewardship and conservation.

Integrated Strategy 1: (Education and Outreach) Participate and assist in the coordination of informal teaching opportunities such as teacher trainings, evening lectures, town hall meetings, user-group specific presentations and other venues as well as formal education opportunities such as guest lecturing at universities and in statewide programs.

Performance Measure 1: Partner with Sea Grant and other agencies and non-profits to offer various Florida Master Naturalist courses available to the public in Miami-Dade County. Track the number of programs and participants.

Performance Measure 2: Coordinate and host an annual naturalist training (interpretive and ecology-based information) for eco-tour operators and other concessionaires.

Performance Measure 3: Obtain and keep current with Florida Marine Science Educator Association certifications to be compliant with the law in order to conduct seining and other collection activities.

Performance Measure 4: Maintain an up-to-date GIS map of all existing marine facilities, boat ramps, and kayak launches in Miami-Dade, southern Broward and northern Monroe counties.

Performance Measure 5: Meet with agencies and stakeholders who previously sponsored the development and printing of the "Boating and Angling Guide to Biscayne Bay" in order to reproduce this extremely popular resource for user groups.

*5.6 / **Issue Five: Sustainable Economic Use and Viability***

Biscayne Bay's significant ecological value is the very reason why it serves as an economic engine for Miami-Dade County. Turquoise waters rising up over seagrass and hard bottom communities— the natural systems helping to keep bay waters clear and healthy—is the first vista held by international visitors coming into the city on cruise ships, by plane, or over a causeway. Boating, sailing, and recreational fishing excursions for tourists bring millions of dollars into local and regional economies every year. Commercial fishing landings data on the FWC website document the inflow of dollars to Miami Dade from the harvest of some of the many species that spend parts of their life cycle in Biscayne Bay's seagrasses and/or mangroves. The bay's ecology, as it translates to economic viability, affects the citizens of Miami-Dade County not only in the way it supports the economy but also in how the bay serves as the people's source of a good time. Local boating, sailing, paddling, and fishing enthusiasts need not travel far to enjoy the beauty and bounty of a subtropical ecosystem.

The Biscayne Bay Economic Study (2005) concluded that the four most popular recreation activities for both visitors and residents as defined by the amount of "Person-Days" (one person participating in a recreational activity for all or part of a day) spent recreating were "1) Viewing the bay from shore while dining, shopping, jogging or strolling; 2) swimming from shore; 3) fishing from a boat; and 4) sailing." Biscayne Bay is an international boating and sailing destination. Dozens of sailing regattas happen each year. Furthermore, an Olympic sailing team trains in Miami-Dade's gyms and on Biscayne Bay's waters. The Miami International Boat Show brings a large amount of money into the local economy each year, not only in boat sales but also in dollars spent in local hotels, restaurants, and sightseeing—including fishing and boating tours of Biscayne Bay. Many tour guides make a living providing tours of Hollywood stars' homes, and one company in particular will take you through Miami's most popular sites on water and land without ever leaving your seat.

Food shrimp are harvested in Biscayne Bay with wing nets, which are open nets attached to either side of a vessel (like wings). This method is preferred to other trawling methods as the wing nets don't cause bottom damage because the nets are used in shallow water at night when shrimp are near the surface. Photo courtesey of Christopher Boykin.

Miami-Dade County remains at the top of the list in terms of number of recreational vessels with nearly 59,000 registered vessels (FWC, 2010). In recent years, boating industry related sales have decreased in large part due to the recent economic downturn. Murray and Associates (2010) produced a report for the Marine Industries Association of South Florida that highlighted the decrease in jobs, total earnings, and total output between 2005 and 2010 in the major sectors of the industry: manufacturing, wholesale trade, retail trade, dockage, and marine services. Despite recent dips in revenue, Miami-Dade County actually had an increase in the amount of registered boaters during this timeframe. With job losses and a reduction of hundreds of millions in total gross output, like many industries, the marine business sector is feeling the effects of a troubled economy.

Commercial fisheries operations also provide economic input into the local and regional economy, although certain practices and deteriorating vessels pose great risk to the future health of Biscayne Bay. Commercial fishing in Biscayne Bay ranked as the greatest economic contribution to MDC for the year 2004 according to the Biscayne Bay Economic Study, and is projected to remain the financial frontrunner for years to come (SFWMD et al., 2005). Protecting the species targeted by commercial fisheries and the habitats these species depend on helps to ensure both a productive ecosystem and economy for MDC. Overall the numbers of wing net landings of bait shrimp have gone down, while food shrimp landings have increased. The area known as "Shrimper's Row" near Blackpoint Marina in the national park is now largely devoid of shrimping vessels as their leases have been terminated and are currently displaced in Coconut Grove. Approximately four or five stone crab boats still harvest in Biscayne Bay, and boats from the Keys come up to harvest stone crab in Biscayne Bay waters as well. About two boats still use hook-and-line method to fish for mackerel in the bay. Mullet are no longer fished the way they once were because gill nets used to catch the fish were banned in the 1990s. Bait fish such as goggle eye and pilchards are caught using cast nets and sold as bait offshore, to fishers hoping to catch sailfish, and these numbers are not reported as landings (Dan Kipnis, personal communication). The Port of Miami is also a local economic engine for Miami-Dade County and is regarded as one of the county's leading sources of economic income, to the tune of over $4.4 billion in 2004. But with a shallow

estuary supporting the operations of a port of call for cruise ships and cargo vessels alike, there are also environmental impacts endured due to long-term operations, expansions, and other activities.

In defining what sustainability means, there is ample literature available to highlight that there are various definitions of sustainability depending upon the context in which it is used. Goodland and Daly (1996) identify environmental sustainability, or overall preservation of the environment as a whole, is the goal with practices such as sustainable development or sustainable fisheries being an approach used as a means to reach that goal. For purposes of defining what sustainable economic use might mean in the context of how this issue affects Biscayne Bay, the definition cited in Johnston, Everard, Santillo and Robert (2007) is more apt: "…of, relating to, or being a method of harvesting or using a resource so that the resource is not depleted or permanently damaged." That Biscayne Bay is a resilient ecosystem that has rebounded from substantial pressures and degradation has been clearly documented. But the future of Biscayne Bay as an economic engine is directly linked to its ecological function.

Goal 1: Promote sustainable economic use and viability of Biscayne Bay Aquatic Preserves' resources.

Objective 1: Increase the number of local boatyards, marinas and local citizens who become members of DEP's Clean Boatyard, Clean Marina, or Clean Boater program, respectively.

Integrated Strategy 1: (Resource Management) Encourage vessel owners and/or operators to use pumpouts at marinas that offer services and overall to frequent marinas that are designed Clean Marinas.

Integrated Strategy 2: (Resource Management) Work more closely with DEP's Clean Marina, Boatyard, and Boater programs to advertise location of pumpout facilities, existence of Clean programs and access to guidelines.

Integrated Strategy 3: (Education and Outreach) In coordination with DEP Clean Marina program staff, Sea Grant, and industry representatives, encourage boatyards, marinas and boaters, especially those in the Miami River, to join DEP's Clean programs.

Integrated Strategy 4: (Ecosystem Science) Work with agencies, Sea Grant, universities, and local non-governmental organizations to develop a volunteer monitoring program to investigate sediment, water quality, species presence, and seagrass to evaluate whether or not water quality and benthos benefit from being in proximity to Clean Marinas/Boatyards as opposed to non-Clean Marina/ Boatyards. Attempt to track changes over time once a marina or boatyard is designated Clean.

Performance Measure 1: Meet with DEP Clean Marina program manager once a year. Meeting minutes will be disseminated.

Performance Measure 2: Coordinate with the DEP Clean Marina program to track the number of marinas and boatyards that participate in the Clean Marina and Boatyard program, using GIS as a tool to track Clean and non-Clean Marinas and Boatyards.

Performance Measure 3: Work with county and state agencies to determine the number of marinas with pumpouts and determine the real or estimated number of boaters using pumpouts.

Objective 2: Coordinate with other resource agencies, law enforcement agencies, and institutions to evaluate what current commercial fisheries practices operate in Biscayne Bay today and what ecological impacts might be.

Integrated Strategy 1: (Resource Management) In coordination with FWC, compile historical and present data to determine number and type of commercial fishing operations including target species, incidence of bycatch, and type and location of gear set in Biscayne Bay or areas where wing nets or other gear is used.

Integrated Strategy 2: (Resource Management) Coordinate with local, state, and federal resource managers and law enforcement, namely FWC, to ensure that commercial fishing vessels' equipment is functioning properly to ensure protection of the benthic habitat and water quality.

Integrated Strategy 3: (Resource Management) Partner with local, state, and federal agencies to encourage area colleges and universities to revisit past commercial fishing studies as well as other resource-related studies, now antiquated, that can be reproduced to determine species presence and abundance over time.

Performance Measure 1: Host a meeting with university staff, Sea Grant, and local, state, and federal partners to determine what it would entail to recreate key research projects undertaken in Biscayne Bay that provided critical information regarding abundance, diversity, and composition of species to compare and contrast past and present conditions. Meeting minutes will be disseminated.

Performance Measure 2: Attend 50% of Marine Advisory Support Team meetings wherein marine law enforcement in Miami-Dade County facilitates coordination between interested stakeholders on the critical issues facing protection of natural resources and human health and safety in Biscayne Bay and its tributaries.

Performance Measure 3: Partner with agencies, universities and non-governmental organizations to compile data and/or conduct a literature search on historic and current commercial fisheries practices including type of gear used as well as target and incidental species taken.

Objective 3: Coordinate with other resource agencies, law enforcement agencies, and institutions to evaluate what current recreational fishing practices operate in Biscayne Bay today and what ecological impacts might be.

Integrated Strategy 1: (Education and Outreach) Partner with all levels of governmental agencies and non-governmental agencies to promote proper use of equipment (e.g., circle hooks, monofilament line disposal, etc.) and potential impacts of gear among recreational anglers.

Performance Measure 1: In coordination with FWC, compile historical and present data and/or conduct a literature search to determine number and type of recreational fishers and charter operations existing/existed in Biscayne Bay as well as target species and type and location of gear used in Biscayne Bay.

Performance Measure 2: In coordination with FWC and Sea Grant, host a meeting for fishing-related user groups to provide educational information on proper use of recreational fishing gear, including proper disposal, and techniques such as catch and release.

Objective 4: Reduce impacts from tourism-driven industries.

Integrated Strategy 1: (Resource Management) Determine what types of recreational tour operations are occurring in Biscayne Bay and its tributaries as well as the economic contribution of these endeavors and possible environmental impacts.

Integrated Strategy 2: (Resource Management) Determine what kinds of on-water transportation operations occur in Biscayne Bay and its tributaries including water taxis, ports, shipping, gasoline barges, and aircraft as well as the economic contribution of these endeavors.

Integrated Strategy 3: (Resource Management) Work with local and municipal governments on finding appropriate locations and types of activities for the filming industry and other on-water activities related to entertainment.

Performance Measure 1: Meet with local, state and federal agencies to discuss a methodology by which potential impacts from tour operations and recreational fishing activities can be quantified. Meeting minutes, including participants' deliverables, will be disseminated.

Performance Measure 2: In coordination with FWC, meet with relevant staff, at the county and municipal level who grant permission to the film and television industry, to discuss appropriate locations allowing certain activities to take place, such as explosions and simulated gunfire.

Each year, the BBAP hosts a site for the International Coastal Cleanup. More than 120 volunteers and nearly 2 tons of garbage are collected.

Part Three

Additional Plans

Chapter Six

Administrative Plans

Successful implementation of the Biscayne Bay Aquatic Preserves (BBAP) programs and the goals outlined in this management plan are dependent upon adequate staffing, facilities, and funding. Citizen support and the cooperation of partnering agencies, non-governmental organizations, and other groups are also critical. Staff leverage state dollars and advance BBAP's mission with support from local partners, namely Florida SeaGrant, Florida International University's Biscayne Bay Campus, Miami-Dade College's Center for Community Involvement Environmental Education Providers, Inc., University of Miami's Rosenstiel School of Marine and Atmospheric Science, National Oceanographic and Atmospheric Administration's Southeast Fisheries Science Center, marine law enforcement agencies, and the state parks that border the BBAP.

Regional Office

There are three National Estuarine Research Reserves (NERR) offices in the state of Florida including the Guana Tolomato Matanzas NERR in Ponte Vedra Beach near St. Augustine, Apalachicola NERR in Apalachicola, and Rookery Bay NERR (RBNERR) in Naples. All of the state's 41 aquatic preserves are supervised by one of the three NERRS as the regional headquarters. Despite being on the southwest coast of Florida, RBNERR is the closest in proximity to the BBAP field office. The Environmental Administrator at RBNERR also supervises three other field offices on the southwest coast including Charlotte Harbor, Estero Bay, Tampa Bay, and Rookery Bay.

Local Office

The BBAP program is housed with the Coral Reef Conservation Program (CRCP) in the Biscayne Bay Environmental Center, the Coastal and Aquatic Managed Areas' field office in Miami. BBAP staff is comprised of an Aquatic Preserves Manager and an Environmental Specialist II. A Park Services

Specialist and an Office Manager share their time between BBAP and CRCP. This dedicated team manages 67,000 acres spreading across two counties. The Aquatic Preserves Manager is a permanent, Career Service Full Time Employee (FTE) position. The Environmental Specialist II is a full-time Other Personal Services (OPS) employee who provides vital support to the Environmental Science, Resource Management, and Education and Outreach programs of the preserves. The Office Manager is an FTE position performs the administrative duties for BBAP including budgeting, purchasing, accounting, reporting, and serving as BBAP property custodian. The Park Services Specialist is a full-time contract employee who maintains the facilities and the grounds, as well as the vessels and vehicles for the BBAP and the CRCP. In order to retain the most qualified employees, the Environmental Specialist II, OPS and Park Service Specialist positions should be upgraded to FTEs. To fully accommodate potential growth, it would be beneficial for BBAP to potentially support these positions on their own in order to accomplish management objectives.

If BBAP is to continue to coordinate and improve the scope of scientific research by identifying and filling gaps in knowledge, additional funding will be needed for a permanent FTE position. As financial resources remain strapped and monitoring programs within the BBAP conducted by other agencies shrink, a permanent FTE position may allow BBAP to participate in CAMA's statewide water quality monitoring initiative. This staff person would deploy data collection devices such as datasondes that continuously monitor parameters as well as maintain, download and analyze data such as dissolved oxygen, salinity, temperature, turbidity, nutrients, pH and chlorophyll. Submerged aquatic vegetation (SAV) would also be monitored. Like water quality data, monitoring sites would include those previously monitored, where historic data exists, or where monitoring should occur. These additional data will supplement monthly data currently collected by other agencies and fill gaps where information is absent, namely in northern Biscayne Bay, Card Sound and Little Card Sound. Capturing this data will allow for a more comprehensive characterization of water quality and SAV status and trends as well as species diversity, abundance and distribution in these areas. This position would also supervise and coordinate any citizen science monitoring initiatives.

Internships and Volunteers

Limited staff resources are supplemented by active intern and volunteer programs. Students from colleges, universities, local schools, community groups and businesses contribute to numerous volunteer projects and help staff accomplish BBAP's mission. Partnerships through Florida International University Biscayne Bay Campus and Miami Dade College Center for Community Involvement allow BBAP to maintain a consistent internship program. As many as six interns per semester work several hours per week with BBAP staff on various projects that support students' career goals as well as accomplish BBAP's mission. The Friends of Biscayne Bay, Incorporated is BBAP's Citizen Support Organization which also provides support for staff activities and funding for community outreach and education opportunities. Staff realizes the value of community stakeholder participation in protecting, promoting, and managing Biscayne Bay. Staff is developing a tool to effectively record the contact information and interests of the stakeholders who currently participate in bay protection and awareness activities. In addition, individual's interests, assistance provided (educational docents, shoreline cleanup, outreach booths, etc) and time committed to project-specific activities will be recorded and accessible for future needs.

The Biscayne Bay Environmental Center was founded by the Friends of Biscayne Bay and is the home of both the Biscayne Bay Aquatic Preserves and Coral Reef Conservation Programs.

Chapter Seven

Facilities Plans

The Biscayne Bay Aquatic Preserves (BBAP) office is housed within the Biscayne Bay Environmental Center (BBEC) at Pelican Harbor in the City of Miami, which was created from dredged material associated with Atlantic Intracoastal Waterway construction in 1928. Throughout the decades, dredged material was added on both the north and south side of the causeway creating Pelican Harbor, owned by Miami-Dade County (MDC), with boat slips to the north and boat ramps and a parking area to the south; riprap has been placed to allow for shoreline stabilization. The .73 acre of land that BBEC occupies was submerged land that was deeded to MDC by the Board of Trustees of the Internal Improvement Fund of the State of Florida in 1934 (Appendix A). The property also contains a 300 foot tall tower with an 800 MHz trunked radio system used by state agencies for law enforcement communications, in addition to a support building containing a propane generator to support the tower in case of power failure. These facilities are managed by contractors hired by the Florida Department of Management Services. The state also owns a 700 square foot wood-framed storage outbuilding. All maintenance tools and equipment; dive and field equipment; hurricane shutters for BBEC; and kayaks are stored in the outbuilding. This building has a cement projection yard an asphalt lot where the vessels and trailers are stored when they are not in use. Both are enclosed within an eight foot protective fence with two feet of barbed wire lining the top. The fence and barb-wire need to be replaced due to damage from trees and eroding shoreline. A mangrove shoreline protects the eastern 200 feet of the property, of which 100 feet is severely eroded and needs to be replaced. The BBEC has nine office spaces, shared between BBAP and Coral Reef Conservation Program (CRCP) staff, and the majority of which are occupied by CRCP. The need for more office space in the future may require the addition of a trailer or another building on the property. Florida Marine Patrol (FMP) used a trailer on the north side of BBEC leased property before their relocation, so

it is feasible to add one in its footprint. BBEC includes a conference room, break room, several storage rooms, a library, restrooms, and educational support closets. The financial responsibility of running BBEC is shared between BBAP and CRCP. Following a theft on BBEC property in 2010, CRCP installed a security system and video recording devices. In case of an emergency the buildings, vehicles, and vessels are secured according to the BBEC Emergency Action Plan which is updated annually by the Park Service Specialist. The Emergency Action Plan includes the hurricane plan for the office and defines necessary preparations for other potential disasters. A copy of this plan is stored in the Park Service Specialist's office and emailed to each staff member as it is updated.

Vehicles and Vessels

All major vehicles and vessels identified in the strategic plan as necessary to accomplish program goals have been acquired. Both programs' vessels and vehicles are shared between staff, depending on staff and project needs. As part of the programs' strategic planning cycle, all vehicles and vessels undergo a monthly inspection and maintenance by the Park Services Specialist. For fiscal year 2009/2010, the annual cost for fuel and maintenance was approximately $1,558 for the BBAP vessels and $1,523 for the BBAP vehicles, respectively. These numbers are expected to increase with increasing cost of fuel and vessel and vehicle age. Each staff member who has access to vehicles and vessels is granted a personal identification number to use in tandem with the Florida State Fuel Card Program.

Vehicles

- **1998 F250 1/2 ton 4WD Pick-up Truck with Towing Capacity**: Was acquired in 2002 to tow BBAP vessels. The transmission was replaced in 2009 and the entire vehicle will be due for replacement by 2013, as it will be 15 years old. Until funding becomes available, BBAP will look to obtain other department's surplus vehicles if and when they become available. This vehicle undergoes routine preventative maintenance either conducted by the Park Services Specialist and or an authorized service provider.

Vessels

Biscayne Bay Aquatic Preserves

- **2 Single & 1 Double Person Ocean Kayaks:** Available for shallow water access and are racked in the outbuilding. These kayaks are in good condition, but on-water safety equipment will need to be replaced as soon as funding becomes available.

- **21 foot 1990 Mako Cuddy Cabin with a 2007 Yamaha 225 HP Four-stroke Outboard Engine with Jack Plate:** This vessel is either docked on the property, or trailered within the fenced-in area adjacent to the maintenance garage. This vessel receives its regular 100 hour routine maintenance at an authorized Yamaha dealer as needed. Within the next 10 years the deck and hull will need to be repainted.

Available from CRCP: The following vehicles and vessels are maintained by CRCP.

Vehicles

- 2005 Ford Escape Hybrid Sport Utility
- 2007 Dodge 3/4 ton 4WD Pick-up Truck with Towing Package

Vessels

- 26 foot 2007 Catamaran Twin Vee with 2-2007 Yamaha 150 HP Four-stroke Outboard Engines

Future personnel, construction and maintenance needs include, but are not limited to:

1. Hire a biologist to supplement additional monitoring needs
2. Hire an Environmental Specialist to support future BBAP and Biscayne National Park Visitor Center
3. Hire an Environmental Specialist to support a field office in the Card Sound portion of the BBAP, 60 miles south of the BBAP field office
4. Certify pertinent BBAP staff as DEP divers
5. Acquisition of additional kayaks for BBAP outreach and education
6. Restore eroding riprap shoreline along BBEC property line, adjacent to dock
7. Replace field equipment and supplies as needed
8. Replace office furniture, flooring, and equipment as necessary
9. Continue management of exotic and/or invasive plant species and native plantings
10. Maintenance and eventual purchase of new 4WD truck
11. Reinforce eroding shoreline along BBEC property near the dock

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Legal Documents

*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 hereunder 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***

Florida Statutes, Chapter 253: State Lands
http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=0200-0299/0253/0253.html

Florida Statutes, Chapter 258: State Parks and Preserves
http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=0200-0299/0258/0258.html

Part II (Aquatic Preserves):
http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0200-0299/0258/0258PARTIIContentsIndex.html

Florida Statutes, Chapter 259: Land Acquisitions for Conservation or Recreation
http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=0200-0299/0259/0259.html

Florida Statutes, Chapter 379: Fish and Wildlife Conservation
http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&URL=0300-0399/0379/0379.html

Florida Statutes, Chapter 403: Environmental Control
(Statute authorizing DEP to create Outstanding Florida Waters is at 403.061(27))
http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=0400-0499/0403/0403.html

Florida Statutes, Chapter 597: Aquaculture
http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=0500-0599/0597/0597.html

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

All rules can be found according to **Florida Administrative Code, Capter 18-18: Biscayne Bay Aquatic Preserve**
http://www.dep.state.fl.us/legal/Rules/shared/18-18.pdf

Florida Administrative Code, Chapter 18-20: Florida Aquatic Preserves
http://www.dep.state.fl.us/legal/Rules/shared/18-20.pdf

Florida Administrative Code, Chapter 18-21: Sovereignty Submerged Lands Management
http://www.dep.state.fl.us/legal/Rules/shared/18-21.pdf

Florida Administrative Code, Chapter 18-23: State Buffer Preserves
http://www.dep.state.fl.us/legal/Rules/shared/18-23.pdf

Florida Administrative Code, Chapter 62-302: Surface Water Quality Standards
(Rule designating Outstanding Florida Waters is at 62-302.700)
http://www.dep.state.fl.us/legal/Rules/shared/62-302/62-302.pdf

Resource Data

B.1 / Acronym List

Abbreviation	Meaning	Abbreviation	Meaning
AIWW	Atlantic Intracoastal Waterway	**MAST**	Marine and Science Technology High School
BBAP	Biscayne Bay Aquatic Preserve	**MDC**	Miami-Dade County
BBEC	Biscayne Bay Environmental Center	**MMPA**	Marine Mammal Protection Act
BBCS	Bureau of Beaches and Coastal Systems	**MRC**	Miami River Commission
BBCW	Biscayne Bay Coastal Wetlands	**NOAA**	National Oceanic and Atmospheric Administration
BBMC	Biscayne Bay Management Committee	**NMFS**	National Marine Fisheries Service
BBPI	Biscayne Bay Partnership Initiative	**NPS**	National Park Service
BISC	Biscayne National Park	**OFW**	Outstanding Florida Waters
BOT	Board of Trustees	**PERA**	Permitting, Environment, and Regulatory Affairs
C	Celsius	**RSMAS**	University of Miami Rosenstiel School of Marine and Atmsopheric Science
CAMA	Coastal and Aquatic Managed Areas	**SAV**	Submerged Aquatic Vegetation
CERP	Comprehensive Everglades Restoration Plan	**SERC**	Southeast Environmental Research Center
CSO	Community Support Organization	**SFER**	South Florida Ecosystem Restoration (Task Force)
DEP	Florida Department of Environmental Protection	**SEFCRI**	South East Florida Coral Reef Initiative
DERM	Miami-Dade Department of Environmental Resource Management	**SEFSC**	South East Fisheries Science Center
DOH	Florida Department of Health	**SFRPC**	South Florida Regional Planning Council
EPA	Environmental Protection Agency	**SFWMD**	South Florida Water Management District
ESA	Endangered Species Act	**SWIM**	Surface Water Improvement
EVER	Everglades National Park	**TMDL**	Total Maximum Daily Load
F. A. C.	Florida Administrative Code	**TPL**	Trust for Public Land
F	Farenheit	**TREC**	Tropical Research and Education Center
FIND	Florida Inland Navigation District	**UFL**	University of Florida
FIU	Florida International University	**UM**	University of Miami
FOBB	Friends of Biscayne Bay	**UNCW**	Univeristy of North Carolina Wilmington
FWC	Florida Fish and Wildlife Conservation Commission	**US**	United States
FWRI	Fish and Wildlife Research Institute	**USACE**	United States Army Corp of Engineers
FWS	United State Fish and Wildlife Service	**USFWS**	United States Fish and Wildlife Services
GIS	Geographic Information System	**USGS**	United State Geological Survey
GPS	Global Positioning System	**CBSF**	Citizens for a Better South Florida
km	kilometers	**NERR**	National Estuarine Research Reserve
KOE	Kissimmee-Okeechobee-Everglades	**RBNERR**	Rookery Bay National Estuarine Research Reserve
MARS	Marine Animal Rescue Society		

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

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

ambient – of, or related to surrounding environmental conditions (Blackwell's)

Anastasia formation – Underlies Miami fm. in places, outcrops and forms the Atlantic coastal ridge from Palm Beach Co. north. Ranges in composition from shelly sandstone, to coquina limestone

aquaculture – the cultivation of aquatic organisms. (Lincoln, Boxshall & Clark, 2003)

aquatic – living in or near water; used of plants adapted for a partially or completely submerged life.

aquifer – permeable underground rock strata that holds water.

archaeology – the scientific study of ancient cultures through the examination of their material remains such as buildings, graves, tools, and other artifacts (Encarta)

archaic – belonging or relating to a much earlier period (Encarta)

Atlantic Coastal Ridge – a low elevation ridge on eastern coast (20- 24 ft high in Coconut Grove); an extensive feature that extends north to Georgia

Atlantic Intracoastal Waterway (AIWW) – a system of inland and coastal waterways along the Atlantic coast of the US from Cape Cod to Florida Bay.

ballast water – water carried in the hold of a ship, especially one that has no cargo, in the keel of a sailing boat, or in the gondola of a balloon, to give the craft increased stability (Encarta)

barrier island – a sand body that is essentially parallel to the shore, the crest of which is above normal high water level.

baseline data – data describing some original or 'normal' state of the system (Blackwell's)

basin/sub-basin – the entire tract of land drained by a river and its tributaries; smaller portion of a larger tract of land drained by a river and its tributaries.

benthic – of, related to, or occurring at the bottom of a body of water.

benthic community – organisms that live on the sea floor.

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

berm – A mound of earth usually engineered by humans, especially the bank of a canal.

biocide – a genetic term for anything that kills (or inhibits) organisms (Blackwell's)

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.

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.

brackish – applied to water that is saline, but less so than sea water. (Oxford Dictionary of ecology)

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

brood – to incubate eggs.

brooding – production by or as if by incubation.

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

bulkhead – a retaining wall along a waterfront

calcareous – applied to areas containing calcium carbonate (Allaby, 1998)

canopy – the part of the woodland or forest community that is formed by the trees. (Allaby, 1998)

Clean Water Act (CWA) – The Clean Water Act is a 1977 amendment to the federal Water Pollution Control Act of 1972, which sets the basic structure for regulating discharges of pollutants to waters of the United States.

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.

Comprehensive Everglades Restoration Plan (CERP) – A comprehensive plan for the water resources of central and southern Florida authorized in the Water Resources Development Act of 2000. The overarching objectives of this CERP are the restoration, preservation, and protection of the south Florida ecosystem while providing for the other water-related needs of the region.

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 government agency or nonprofit organization to protect the natural resources of a property permanently or for some designated period of time. The property still belongs to the landowner, but restrictions are placed both on the current landowner and subsequent landowners.

consolidated substrate – A compacted mass of sediment, typically stratified.

contamination – release of a byproduct of human activity, chemical or physical. (Calow, 1999)

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

conveyance – The act of moving something from one location to another.

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.

culverts – a sewer or drain crossing under a road or embankment.

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 mass of data in a computer, arranged for rapid expansion, updating, and retrieval.

datasonde – an automated electronic instrument for measuring and recording water quality parameters.

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 that decompose the material. Together with plankton are components of the estuarine food chain.

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

disseminate – to scatter widely or disperse.

organic matter – the organic material present in soils, more generally the organic components of the ecosystem

disturbance – any process that destroys plant or animal biomass. (Calow, 1999)

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

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

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

dredge spoil – material or soil taken out of an area mechanically and stored in a pile or ridge, or graded evenly.

dune – a ridge or mound of loose, wind-blown material, usually sand.

easement – a right that one may have in another's land. (Neufeldt & Sparks, 1990)

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 community of organisms and their physical environment interacting as an ecological unit. (Lincoln et al., 2003)

effluent – wastewater that flows into a receiving stream by way of a domestic or industrial point source.

emergent – an aquatic plant having most of the vegetative parts above water; a tree, which reaches above the level of the surrounding canopy. (Lincoln et al., 2003)

encroachment – influencing strongly; impact

endangered species – an animal or plant species in danger of extinction throughout all or a significant portion of its range. (U.S. Fish and Wildlife Service [FWS], 2005)

endemic – native to, and restricted to, a particular geographical region. (Lincoln et al., 2003)

environment – the physical, chemical and biological surroundings of an organism at any given time.

epibenthic – living on the surface of (usually) sea bottom. (Calow, 1999)

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

epiphyte – a plant that usually lives on other plants without damaging them.

equilibrium – a state of balance between opposing forces.

established – introduced from another region and persisting

estuary – 1) A coastal embayment where there is freshwater input that is influenced by tides. 2) The part of a river that is affected by tides. 3) The region near a river mouth in which the fresh water of the river mixes with the salt water of the sea.

evergreen – a forest where there is no seasonal loss of leaves (Allaby, 1998)

exotic – an introduced nonnative species. (Allaby, 1998)

extinction – the disappearance of a species from a given habitat; dying out, usually global, of a species for extinction throughout all or a significant portion of its range.

fauna – the animal life of a given region, habitat or geological stratum. (Lincoln et al., 2003)

floodplain – the part of the river valley that is made of unconsolidated, river borne sediment and is periodically flooded. (Allaby, 1998)

floodstage – The stage, on a fixed river gage, at which overflow of the natural banks of the stream begins to cause damage in any portion of the reach for which the gage is used as an index.

flora – the plant life of a given region, habitat or geological stratum. (Lincoln et al., 2003)

Florida Forever (FF) – the 10-year, $3 billion program established by the Florida Legislature to conserve environmentally sensitive lands, restore waterways, and preserve important cultural and historical resources. Florida Forever replaced Preservation 2000.

foredune – a coastal dune or ridge that is parallel to the shoreline of a large lake or ocean and is stabilized by vegetation.

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. (Lincoln et al., 2003)

Geology – the structure of a specific region of the earth's crust.

Geomorphology – the study of form, nature, and evolution of the earth's surface.

georeferencing – providing geographic location coordinates for data or images.

Glades culture – an archaeological culture in southernmost Florida that lasted from about 500 BCE until shortly after European contact.

Global Positioning System (GPS) - a navigational system involving satellites and computers that can determine the latitude and longitude of a receiver on Earth by computing the time difference for signals from different satellites to reach the receiver

greater everglades ecosystem – an area consisting of the lands and waters within the boundary of the South

groundwater – water that occurs below the earth's surface, contained in pore spaces within regolith and bedrock. (Allaby, 1998)

groundwater recharge – a hydrologic process where water moves downward from surface water to groundwater.

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

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

hardbottom communities – hardbottom refers to a classification of coral communities that occur in temperate, subtropical, and tropical regions that lack the coral diversity, density, and reef development of other types of coral communities

harmful algal bloom (HAB) – a dense concentration (bloom) of a single-celled, plant like marine organism

hazardous waste – by-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity), or appears on special EPA lists.

headwaters – the place from which the water in the river or stream originates

herbaceous – characteristic of a nonwoody herb or plant part.

hydrocarbons – a naturally occurring compound that contains carbon and hydrogen. (Allaby, 1998)

hydrodynamic – the branch of science that deals with the dynamics of fluids, especially incompressible fluids, in motion.

hydrologic – dealing with the properties, distribution, and circulation of water.

hydrology – the study of the hydrologic cycle. (Allaby, 1998)

hydroperiod – the cyclical changes in the amount or stage of water in an aqueous habitat.

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. (Lincoln et al., 2003)

inlet – a narrow channel that connects the open sea with a lagoon or bay. (Allaby, 1998)

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 that have been introduced into an ecosystem and, because of their aggressive growth habits and lack of natural predators, displace native species.

Key Largo limestone – true coraline limestone, Formed from skeletons of living corals. Underlies sands of barrier islands Miami Beach and Key Biscayne.

listed species – a species, subspecies, or distinct population segment that has been added to the Federal list of endangered and threatened wildlife and plants. (FWS, 2005)

littoral – the intertidal zone of the seashore; sometimes used to refer to both the intertidal zone

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

longshore transport – a wave and/or tide-generated movement of shallow-water coastal sediments parallel to the shoreline.

low energy environments – coastlines where wave and tidal forces are typically relatively small

macroalgae – algae large enough to be detected with the naked eye. Often used as a synonym of seaweeds. (Levinton, 2009)

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. (Neufeldt & Sparks, 1990)

marl – Marls are fine white calcareous muds formed from calcite precipitated by a mixture of green algae, blue-green algae, and diatoms, known as periphyton. These soils are highly alkaline and impermeable, sealing off the underlying limestone and causing water to pond during the wet season. (Florida Natural Areas Inventory, 2010)

marsh – an area of soft, wet, or periodically inundated land, generally treeless and characterized by grasses.

mean high water – The average elevation of all high waters recorded at a particular point or station over a considerable period of time, usually 19 years. www.csc.noaa.gov/text/glossary.html

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

midden – a refuse heap; used especially in archeology.

mitigation – actions taken to compensate for the negative effects of a particular project or action.

modeling – designing and analyzing a mathematical representation of an economic system to study the effect of changes to system variables.

monitoring – measurement of environmental characteristics over an extended period of time to determine

moorings – 1.) the act or an instance of making fast an aircraft or a vessel, as by a cable or anchor. 2.) a place or structure to which a vessel or aircraft can be moored. 3.) equipment, such as anchors or chains, for holding fast a vessel or an aircraft.

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

nearshore – in beach terminology, an indefinite zone extending seaward from the shoreline well beyond the breaker zone.

nonpoint sources (NPSs) – Diffuse runoff without a single point of origin that flows over the surface of the ground by stormwater and is then introduced to surface or ground waters. NPSs include atmospheric deposition and runoff or leaching from agricultural lands, urban areas, unvegetated lands, onsite sewage treatment and disposal systems, and construction sites.

oolitic limestone – forms coastal ridge in eastern Dade Co. Often misidentified as coral rock. Oolitic facies formed from a shallow offshore bar composed of ooid sand that was reworked by waves and currents

paleosalinity – the salinity of a body of water in the geologic past, as evaluated on the basis of chemical analyses of sediment or formation water.

parameters – a variable, measurable property whose value is a determinant of the characteristics of a system; e.g. temperature, pressure, and density are parameters of the atmosphere.

particulate – 1.) Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog, found in air or emissions. 2.) Very small solids suspended in water; they can vary in size, shape, density and electrical charge and can be gathered together by coagulation and flocculation.

patch reefs – A small, irregular organic reef with a flat top forming a part of a reef complex.

pelagic – relating to, living, or occurring in the open sea.

percolate – 1.) The movement of water downward and radially through subsurface soil layers, usually continuing downward to ground water. Can also involve upward movement of water. 2.) slow seepage of water through a filter.

perennial – present during all seasons of the year.

peripheral – organisms on or near the edge of their geographical ranges.

periphyton – Microscopic underwater plants and animals that are firmly attached to solid surfaces such as rocks, logs, and pilings.

permeable – a substance, substrate, membrane or material that absorbs or allows the passage of water

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

photosynthesis – The manufacture by plants of carbohydrates and oxygen from carbon dioxide mediated by chlorophyll in the presence of sunlight.

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

pneumatophores – vertical extensions of mangrove roots thought to bring oxygen to roots in oxygen-poor sediment. point source - An identifiable and confined discharge point for one or more water pollutants, such as a pipe, channel, or vessel.

pollutant – Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

pollution – the contamination of a natural ecosystem.

population – all individuals of one or more species within a prescribed area. A group of organisms of one species, occupying a defined area and usually isolated to some degree from other similar groups. (Lincoln et al., 2003)

porous – full of tiny pores that allow fluids or gasses to pass through.

potable water – water that is palatable and safe for human consumption, in which any toxic substances,

prokaryotic – a group of organisms that lack a cell nucleus, or any other membrane-bound organelles

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

regime – a regular pattern of occurrence, action, or conditions (as of seasonal rainfall).

relict – Remnant left after decay, disintegration, or disappearance.

reservoir – any natural or artificial holding area used to store, regulate, or control water.

residence time – the duration of persistence of a mass or substance in a medium or place.

resource management – managing human impact on the environment in a way that is sustainable

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.

riparian – related to, living, or occurring on the bank of a natural watercourse.

ruderal – pertaining to or living amongst rubbish or debris, or inhabiting disturbed sites. (Lincoln et al., 2003) (FNAI describes ruderal as areas impacted by development measures such as roadways, drainage ditches, and navigational channels or are considered hydrological alterations.)

runoff – part of precipitation that is not held in the soil but drains freely away. (Lincoln et al., 2003)

saline – consisting of or containing salt.

salinity - a measure of the total concentration of dissolved salts in seawater. (Lincoln et al., 2003)

salt spray – sea spray is a spray of water that forms when ocean waves crash.

saltwater intrusion – The invasion of fresh surface or ground water by salt water. If it comes from the ocean it may be called seawater intrusion.

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

sediment core – a hollow tube is driven into the sediment and taken up to obtain a continuous, undisturbed cross-section of the seafloor. www.csc.noaa.gov/benthic/mapping/techniques/sensors/cores.htm

sedimentation – The action or process of forming or depositing sediments.

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

seine – a small-meshed net suspended vertically in the water, with floats along the top margin and weights along the bottom margin, which encloses and concentrates fish, and does not entangle them in the meshes. (68B-4.002(12), F.A.C.).

septic lechate – forms in landfills (even those that are closed or abandoned) when water from rain, sleet, or snow soaks through and becomes polluted after coming into contact with the decaying waste www.csc.noaa.gov/magazine/2002/01/ncarolina.html

sessile – non-motile; permanently attached at the base. (Lincoln et al., 2003)

shapefile – computerized maps and images depicting different natural features created with geographic information

sharpie – long, narrow sailboats with flat bottoms, extremely shallow draft, centerboards and straight, flaring sides.

sheet flow – the flow of water across a given surface area such as a field, parking lot, or road during a rain event without a formal conveyance system (pipe, swale, etc).

shoal – a shallow place in a river, sea etc.; a sand bar forming a shallow place.

shoreline stabilization - measures to retard erosion to protect upland property.

silt – Sedimentary materials composed of fine or intermediate-sized mineral particles.

slough – A depression associated with swamps and marshlands containing areas of slightly deeper water and a slow current, such as the broad, shallow rivers of the Everglades.

South Florida Water Management District (SFWMD) –

sovereignty of lands – supreme and independent power or authority in government as possessed or claimed by a

spatial data - data pertaining to the location and spatial dimensions of geographical entities.

species - a group of organisms, minerals or other entities formally recognized as distinct from other groups; the basic unit of biological classification. (Lincoln et al., 2003)

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

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

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, to the necessity for listing as threatened or endangered. Such species receive no legal protection and use of the term does not necessarily imply that a species will eventually be proposed for listing. "Imperiled species" is another general term for listed as well as unlisted species that are declining. (FWS, 2005)

spoil material – sediment that results from an excavation, and discarded off site on spoil heaps

stakeholder – individual or organization that stand to gain or lose from the success or failure of a system or program.

storm tide – a rise above normal water level on the open coast due to the action of wind stress on the water surface.

stormwater – Diffuse runoff without a single point of origin that flows over the surface of the ground by stormwater and is then introduced to surface or ground waters. NPSs include atmospheric deposition and runoff or leaching from agricultural lands, urban areas, unvegetated lands, onsite sewage treatment and disposal systems, and construction sites.

stratification – separating into layers.

stratified random sampling – divides a population into segments (strata), then samples each stratum independently of the others.

submerged – occurring below the surface of the water; completely underwater.

submerged aquatic vegetation (SAV) – aquatic plants, also called hydrophytic plants or hydrophytes, are plants that have adapted to living in or on aquatic environments; seagrasses.

subsidence – a lowering of land elevation often caused by underground processes like groundwater removal.

substrate – the soils and sediments that comprise the ground. (Allaby, 1998)

subtidal – environment which lies below the mean low water level. (Allaby, 2005)

supratidal – the zone on the shore above mean high tide level. (Lincoln et al., 2003)

Surface Water Quality Standards – state-adopted and EPA approved ambient standards for water bodies.

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 Floridian aquifer by a confining bed of soil.

suspension – suspending the use of a pesticide when EPA deems it necessary to prevent an imminent hazard resulting from its continued use. An emergency suspension takes effect immediately; under an ordinary suspension a registrant can request a hearing before the suspension goes into effect. Such a hearing process might take six months.

sustainability - of, relating to, or being a method of harvesting or using a resouce so that the resource is not depleted or permanently damaged. (Johnston, Everard, Santillo and Robert, 2007)

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

temperate – free from extremes; mild; or characteristic of such weather or climate

threatened species – an animal or plant species likely to become endangered within the foreseeable future throughout all or a significant portion of its range. (FWS, 2005)

tidal flat – unvegetated sandy or muddy land area that is covered and uncovered by the rise and fall of the tide.

topography – the surface features of a place or region.

trawl or trawl net – a net in the form of an elongated bag with the mouth kept open by various means and fished by being towed or dragged on the bottom. (68B-31.002(2), F.A.C.)

tributaries – a stream or river that flows into a main stem (or parent) river

trophic – pertaining to nutrition, food or feeding.

turbid – cloudy; opaque with suspended matter. (Lincoln et al., 2003)

unconsolidated substrate – loose, un-compacted and un-stratified sediment.

understory – the area of a forest that grows at the lowest height level below the forest canopy.

upland – land elevated above other land. (Neufeldt & Sparks, 1990)

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. (Lincoln et al., 2003)

water column – the vertical column of water in a sea or lake extending from the surface to the bottom. (Lincoln et al., 2003)

water table – the upper limit of where groundwater permeates the ground

watershed – an elevated boundary area separating tributaries draining in to different river systems; drainage basin. (Lincoln et al., 2003)

wetland – an area of low lying land, submerged or inundated periodically by fresh or saline water. (Lincoln et al., 2003)

xeric – having very little moisture; tolerating or adapted to dry conditions. (Lincoln et al., 2003)

B.3 / ***References***

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B.4.1 / Native Species List

Common Name	Species Name	Status State	Status Fed
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern			
PROTISTS - PROTISTA			
Golden-brown Algae - Chrysophyta			
Bacillariophyta spp.	*Diatom spp.*		
Dinoflagellate Algae - Pyrrophyta			
Dinoflagellate sp.	*Prorocentrum micans*		
Green Algae - Chlorophyta			
Umbrella alga sp.	*Acetabularia sp.*		
Soft fan alga sp.	*Avrainvillea sp.*		
	Caulerpa cupressoides		
	Caulerpa lanuginosa		
	Caulerpa mexicana		
Common caulerpa	*Caulerpa prolifera*		
Feather alga	*Caulerpa sertularioides*		
	Caulerpa verticillata		
Cactus alga sp.	*Halimeda discoidea*		
Cactus alga sp.	*Halimeda goreauii*		
Disk alga	*Halimeda opuntia*		
Shaving brush sp.	*Penicillus capitatus*		
Shaving brush sp	*Penicillus dumetosus*		
Hard fan alga spp.	*Udotea spp.*		
Sea lettuce spp.	*Ulva spp.*		
Smooth bubble alga	*Valonia ventricosa*		
Brown Algae - Phaeophyta			
	Dictyota cervicornus		
	Dictyota spp.		
Petticoat alga spp.	*Padina spp.*		
Sargassum weed spp.	*Sargassum spp.*		
Red Algae - Rhodophyta			
Laurence's weed spp.	*Laurencia spp.*		
Heterotrophs - Protozoa			
Foraminfera spp.	*Foraminfera spp.*		
PLANTS - PLANTAE			
Vascular Plants - Tracheophyta			
Pteridophytes – Pteridophyta			
Golden leather fern	*Acrostichum aureum*	T	
Flowering Plants – Anthophyta			
Monocots - Monocotyledones			
Southern sandbur	*Cenchrus echinatus*		
Coastal sandbur	*Cenchrus incertus*		
Cowhorn orchid	*Cyrtopodium punctatum*	E	
Saltgrass	*Distichlis spicata*		
Dollar orchid	*Encyclia boothiana var. erythronioides*	E	
Butterfly orchid	*Encyclia tampensis*		
Finger grass	*Eustachys petraea*		
Hurricane grass	*Fimbristylis cymosa*		

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Shoal weed	*Halodule wrightii*		
Caribbean seagrass	*Halophila decipiens*		
Engelmann's seagrass	*Halophila englemannii*		
Johnson's seagrass	*Halophila johnsonii*		T
Muhly grass	*Muhlenbergia capillaris*		
Seashore paspalum	*Paspalum vaginatum*		
Widgeon grass	*Ruppia maritima*		
Smooth cordgrass	*Spartina alterniflora*		
Saltmeadow cordgrass	*Spartina patens*		
Gulf cordgrass	*Spartina spartinae*		
Coral dropseed grass	*Sporobolus domingensis*		
Coastal dropseed	*Sporobolus virginicus*		
Manatee grass	*Syringodium filiforme*		
Turtle grass	*Thalassia testudinum*	T	
Banded Wild-pine	*Tillandsia flexuosa*		
Southern cattail	*Typha domingensis*		
Dicots - Eudicotyledones			
Black mangrove	*Avicennia germinans*		
False willow	*Baccharis angustifolia*		
Water hyssop	*Bacopa monnieri*		
Saltwort	*Batis maritima*		
Sea oxeye	*Borrichia frutescens*		
Buttonwood	*Conocarpus erectus*		
Coin vine	*Dalbergia ecastophyllum*		
Seaside gentian	*Eustoma exaltatum*		
Scorpion tail	*Heliotropium angiospermun*		
Seaside heliotrope	*Heliotropium curassavicum*		
White mangrove	*Laguncularia racemosa*		
Christmasberry	*Lycium carolinianum*		
Mangrove mallow	*Pavonia paludicola*	E	
Mangrove rubber vine	*Rhabdadenia biflora*		
Red mangrove	*Rhizophora mangle*		
Annual glasswort	*Salicornia bigelovii*		
Perennial glasswort	*Salicornia perennis*		
Sea purslane	*Sesuvium portulacastrum*		
Seaside goldenrod	*Solidago sempervirens*		
ANIMALS - METAZOA			
Sponges - Porifera			
Sponge sp.	*Aaptose aaptose*		
Branching sponge sp.	*Aplysina sp. (Verongia sp.)*		
Chicken liver sponge	*Chondrilla nucula*		
Sponge sp.	*Cinachyra cavernosa*		
Sponge sp.	*Cliona varians (Anthosigmella varians)*		
Lumpy overgrowing sponge	*Desmapsamma anchorata (Holopsamma helwigi)*		
Heavenly blue sponge	*Dysidea etherea*		
White sponge	*Geodia gibberosa*		
Purple sponge	*Haliclona molitba*		
Green sponge	*Haliclona viridis*		
Sheepswool sponge	*Hippospongia lachne*		

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Vase sponge	*Ircinia campana*		
Black-ball sponge	*Ircinia strobilina*		
Sprawling sponge	*Neopetrosia longleyi*		
Pink vase sponge	*Niphates digitalis*		
Bleeding sponge	*Oligoceras hemorrhages*		
Sponge sp.	*Sarcotragus fasciculatus (Ircinia fasciculata)*		
Sponge sp.	*Scypha* sp.		
Loggerhead sponge	*Spheciospongia vesparium*		
Yellow sponge	*Spongia barbara*		
Glove sponge	*Spongia cheiris*		
Grass sponge	*Spongia graminea*		
Sponge sp.	*Spongia tubulifera*		
Fire sponge	*Tedania ignis*		
Cnidarians – Cnidaria			
Hydrozoans - Hydrozoa			
Hydroid sp.	*Aglaophenia constricta*		
Hydroid sp.	*Aglaophenia dichotoma*		
Hydroid sp.	*Aglaophenia elongata*		
Hydroid sp.	*Aglaophenia pelagica*		
Hydroid sp.	*Aglaophenia tridentata*		
Hydroid sp.	*Campanularia sp.*		
Hydroid sp.	*Cladocarpus flexuosus*		
Hydroid sp.	*Clytia gracilis*		
Hydroid sp.	*Clytia hemisphaerica*		
Hydroid sp.	*Cnidoscyphus marginatus*		
Hydroid sp	*Dentitheca dendritica*		
Hydroid sp.	*Diphasia tropica*		
Hydroid sp.	*Dynamena quadridentata*		
Red stickhydroid	*Eudendrium carneum*		
Hydroid sp.	*Eudendrium eximium*		
Stickhydroid	*Eudendrium ramosum*		
Hydroid sp.	*Halecium tenellum*		
Christmas tree hydroid	*Halocordyle disticha*		
Hydroid sp.	*Hydractinea carnea*		
White stinger	*Macrorhynchia philippina*		
Sea thread hydroid	*Obelia dichotoma*		
Hydroid sp.	*Parawrightia robusta*		
Portuguese man-of-war	*Physalia physalis*		
Hydroid sp.	*Plumularia floridana*		
Hydroid sp.	*Plumularia strictocarpa*		
Hydroid sp.	*Rhizogeton sterreri*		
Hydroid sp.	*Tridentata distans*		
Hydroid sp.	*Tridentata marginata*		
Hydroid sp.	*Tubularia cristata*		
Hydroid sp.	*Turritopsis nutricula*		
Hydroid sp.	*Ventromma halecioides*		
Hydroid sp.	*Zyzzyzus warreni*		
Jellyfish - Scyphozoa			
Moon jelly	*Aurelia aurita*		
Upside-down jellyfish	*Cassiopea xamachana*		
Corals and Anemones - Anthozoa			

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Giant Caribbean anemone	*Condylactis gigantea*		
Boulder brain coral	*Colpophylla natans*		
Encrusting gorgonian	*Erythropodium caribaeorum*		
Ten-ray star coral	*Madracis decactis*		
Rose coral	*Manicina areolata*		
Maze coral	*Meandrina meandrites*		
Fire coral	*Millepora alcicornis*		
Orange spiny sea rod	*Muricea elongata*		
Diffuse ivory bush coral	*Oculina diffusa*		
Giant slit-pore sea rod	*Plexaurella nutans*		
Finger coral sp.	*Porites furcata*		
Clubtip finger coral	*Porites porites*		
Purple sea plume	*Pseudopterogorgia acerosa*		
Angular sea ship	*Pterogorgia anceps*		
Massive starlet coral	*Siderastrea siderea*		
Lesser starlet coral	*Siderastrea radians*		
Smooth star coral	*Solenastrea bournoni*		
Knobby ctar coral	*Solenastrea hyades*		
Blushing star coral	*Stephanocoenia intersepta*		
Comb Jellies - Ctenophora			
Sea walnut	*Mnemiopsis mccradyi*		
Peanut Worms - Sipuncula			
Peanut worm sp.			
Mollusks - Mollusca			
Chitons - Polyplacophora			
West Indian fuzzy chiton	*Acanthopleura granulata*		
Gastropods - Gastropoda			
Limpet sp.	*Acmaea* sp.		
Striate barrel-bubble	*Acteocina bullata*		
Channeled barrel-bubble	*Acteocina canaliculata*		
Barrel-bubble sp.	*Acteocina candei*		
West Indian alvania	*Alvania auberiana*		
Greedy dovesnail	*Anachis avara*		
Fat dovesnail	*Anachis obesa*		
Beautiful dovesnail	*Anachis pulchella*		
Well-ribbed dovesnail	*Anachis lafresnayi*		
Spotted seahare	*Aplysia dactylomela*		
Longspined starsnail	*Astralium phoebium*		
Caribbean glassy-bubble	*Atys caribaeus*		
Intricate phos	*Bailya intricata*		
Barleysnail sp.	*Barleeia sp.*		
West Indian false cerith	*Batillaria minima*		
Striate bubble	*Bulla striata*		
Ragged seahare	*Bursatella leachi pleii*		
Pearwhelk	*Busycotypus spiratus (Busycon spiratum)*		
Keys topsnail	*Calliostoma adelae*		
Mauve-mouth drill	*Calotrophon ostrearum*		
Ladder hornsmail	*Cerithidea scalariformis*		
Cerith sp.	*Cerithiopsis emersonii*		
Cerith sp.	*Cerithiopsis greenii*		
Cerith sp. / wide aclis	*Cerithiopsis lata or Aclis lata*		

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Ivory cerith	*Cerithium eburneum*		
Stocky cerith	*Cerithium litteratum*		
Flyspeck cerith	*Cerithium muscarum*		
Variable cerith / cerith sp.	*Cerithium variabile or Cerithium lutosum*		
Tea drillia	*Cerodrillia thea*		
Lace murex	*Chicoreus dilectus (Murex florifer dilectus*)		
Crenulate horn	*Chondropoma dentatum*		
West Indian dovesnail	*Columbella mercatoria*		
Rusty dovesnail	*Columbella rusticoides*		
Jasper cone	*Conus jaspideus*		
Drill sp.	*Crassispira fuscescens*		
White-knob drill	*Crassispira leucocyma*		
Drill sp.	*Crassispira ostrearum*		
Common Atlantic slippersnail	*Crepidula fornicata*		
Convex slippersnail	*Crepidula convexa*		
Spotted slippersnail	*Crepidula maculosa*		
Eastern white slippersnail	*Crepidula plana*		
Snail sp.	*Cyclostremiscus beauii*		
Tuskshell sp.	*Dentalium antillarum*		
Texas tuskshell	*Dentalium texasianum*		
Cayenne keyhole limpet	*Diodora cayenensis*		
Lister's keyhole limpet	*Diodora listeri*		
False prickly winkle	*Echininus nodulosus*		
Wide-coil wentletrap	*Epitonium echinaticosta*		
Wrinkle-rib wentletrap	*Epitonium foliaceicosta*		
Sharp-rib drill	*Eupleura sulcidentata*		
Banded tulip	*Fasciolaria lilium hunteria*		
True tulip	*Fasciolaria tulipa*		
Snail sp.	*Felimare bayeri*		
Snail sp.	*Finella dubia (Alabina cerithioides)*		
Snowflake marginella	*Gibberula lavalleeana (Marginella lavalleeana)*		
Teardrop marginella	*Granulina ovuliformis*		
Antilles glassy-bubble	*Haminoea antillarum*		
Elegant glassy-bubble	*Haminoea elegans*		
Amber glassy-bubble	*Haminoea succinea*		
Pallid marginella	*Hyalina pallida*		
American starsnail	*Lithopoma americanum*		
Carved starsnail	*Lithopoma caelatum*		
Sargassum snail	*Litiopa melanostoma*		
Mangrove periwinkle	*Littorina angulifera*		
Zebra periwinkle	*Littorina ziczac*		
Sea slug sp.	*Lobiger souverbii*		
Fleshy limpet sp.	*Lucapina sowerbii*		
Cancellate fleshy limpet	*Lucapina suffusa*		
Mangelia sp.	*Mangelia* sp.		
Dentate marginella	*Marginella denticulata*		
Marginella sp.	*Marginella* sp.		
Eulima sp.	*Melanella intermedia (Balcis intermedia)*		
Tinted cantharus	*Polia tincta (Pisania tincta)*		
Little oat marginella	*Prunum avenaceum (Hyalina avenacea)*		
Knave marginella	*Prunum torticulum (Hyalina torticula)*		

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Snail sp.	*Mangelia trilineata*		
Coffee melampus	*Melampus coffeus*		
Snail sp.	*Microdochus sp.* (*M. floridana? Cingulus floridana?*)		
Florida miter	*Mitra florida*		
Miter sp.	*Mitra hanleyi*		
Lunar dovesnail	*Mitrella lunata*		
White-spot dovesnail	*Mitrella ocellata*		
Buttonsnail	*Modulus modulus*		
Pitted murex	*Murex cellulosa*		
White nassa	*Nassarius albus*		
Nassa sp.	*Nassarius* sp.		
Bruised nassa	*Nassarius vibex*		
Moonsnail sp.	*Natica sp.*		
Bleeding-tooth nerite	*Nerita peloronta*		
Checkered nerite	*Nerita tessellata*		
Virgin nerite	*Neritina virginea*		
Dovesnail sp.	*Nitidella* sp.		
Odostome sp.	*Odostomia laevigata*		
Milky odostome	*Odostomia nivosa*		
Variable dwarf olive	*Olivella mutica*		
Antilles oxynoe	*Oxynoe antillarum*		
Princess marginella	*Persicula catenata*		
Common Atlantic marginella	*Prunum apicinum*		
Orange marginella	*Prunum carneum*		
Snail sp.	*Pyramidella candida*		
Snail sp.	*Pyrgocythara canoidissima*		
Pitted baby-bubble	*Rictaxis punctostriatus*		
Snail sp.	*Rissoina cancellata*		
Snail sp.	*Rissoina chesnelii / Schwartziella catesbyana*		
Snail sp.	*Rissoina multicostata*		
Snail sp.	*Seila adamsi*		
Snail sp.	*Stellatoma stellata*		
Grooved moonsnail	*Stigmaulax sulcatus*		
Rustic rocksnail	*Stramonita rustica (Thais rustica)*		
Milk conch	*Strombus costatus*		
Queen conch	*Strombus gigas*		
Hawkwing conch	*Strombus raninus*		
Beaded periwinkle	*Tectarius muricatus*		
Silky tegula	*Tegula fasciata*		
Snail sp.	*Teinostoma cryptospira*		
Snail sp.	*Teinostoma* sp.		
Checkered pheasant	*Tricolia affinis*		
Shouldered pheasant	*Tricolia bella*		
Pheasant snail sp.	*Tricolia tessellata*		
Black-line triphora	*Triphora nigrocincta*		
Four-spot trivia	*Trivia quadripunctata*		
Beautiful truncatella	*Truncatella pulchella*		
Chestnut turban	*Turbo castanea*		
Interrupted turbonilla	*Turbonilla interrupta*		
Turbonilla sp.	*Turbonilla sp.*		

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Caribbean vase	*Vasum muricatum*		
West Indian wormsnail	*Vermicularia spirata*		
Sulcate miter	*Vexillum albocinctum*		
Gem miter	*Vexillum gemmatum*		
Orange-band marginella	*Volvarina avena (Hyalina avena)*		
Bivalves - Bivalvia			
Rough scallop	*Lindapecten muscosus (Aequipecten muscosus)*		
Atlantic strawberry-cockle	*Americardia media*		
Eared ark	*Anadara notabilis*		
Transverse ark	*Anadara transversa*		
Buttercup lucine	*Anodontia alba*		
Pointed venus	*Anomalocardia auberiana*		
Common jingle	*Anomia simplex*		
Mossy ark	*Arca imbricata*		
Turkey wing	*Arca zebra*		
Adams ark	*Arcopsis adamsi*		
Nucleus or Atlantic calico scallop	*Argopecten gibbus or nucleus*		
Bay scallop	*Argopecten irradians*		
Red-brown srk	*Barbatia cancellaria*		
Scorched mussel	*Brachidontes exustus*		
Antillean scallop	*Bractechlamys antillarum*		
Broad-ribbed carditid	*Carditamera floridana*		
Leafy jewelbox	*Chama macerophylla*		
Cross-barred venus	*Chione cancellata*		
Venus sp.	*Chione sp.*		
Tiger lucine	*Codakia orbicularis*		
Lucine sp.	*Codakia sp.*		
Eastern oyster	*Crassostrea virginica*		
Spreading-sculpture crenella	*Crenella divaricata*		
Contracted semele	*Cumingia coarctata*		
Thin cyclinella	*Cyclinella tenuis*		
Elegant dosinia	*Dosinia elegans*		
Pearly entodesma	*Entodesma beana (Lyonsia beana)*		
Zigzag scallop	*Euvola ziczac (Pecten ziczac)*		
Southern pigtoe	*Fusconaia cerina*		
Waxy gouldclam	*Gouldia cerina*		
False beanclam	*Heterodonax bimaculatus*		
Flat tree-oyster	*Isognomon alatus*		
Purse-oyster sp.	*Isognomon sp.*		
Eggcockle	*Laevicardium laevigatum*		
Morton eggcockle	*Laevicardium mortoni*		
Antillean fileclam	*Lima pellucida*		
Glassy lyonsia	*Lyonsia hyalina*		
Waxy macoma	*Macoma cerina*		
Macoma sp.	*Macoma sp.*		
Bivalve sp.	*Mactridae sp.*		
American horsemussel	*Modiolus americanus*		
Lateral mussel	*Musculus lateralis*		
Atlantic nutclam	*Nucula proxima*		
Atlantic pearl-oyster	*Pinctada imbricata*		
Amber penshell	*Pinna carnea*		

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Threetooth carditid	*Pleuromeris tridentate*		
Atlantic wing-oyster	*Pteria colymbus*		
Atlantic semele	*Semele proficua*		
Benedict scallop	*Spathochlamys benedicti (Chlamys benedicti)*		
Purplish tagelus	*Tagelus divisus*		
Stout tagelus	*Tagelus plebeius*		
Martinique tellin	*Tellina martinicensis*		
Pure tellin	*Tellina mera*		
Shiny dwarf-tellin	*Tellina nitens*		
Florida pricklycockle	*Trachycardium egmontianum*		
Cephalopods - Cephalopoda			
Atlantic brief squid	*Lolliguncula brevis*		
Atlantic pygmy octopus	*Octopus joubini*		
Common octopus	*Octopus vulgaris*		
Segmented Worms - Annelida			
Segmented worm sp.	*Eteone sp.*		
Segmented worm sp.	*Eusthenelais sp.*		
Segmented worm sp.	*Glycera sp.*		
Segmented worm sp.	*Lumbrineris impatiens*		
Segmented worm sp.	*Lumbrineris tenuis*		
Segmented worm sp.	*Myriochele sp.*		
Segmented worm sp.	*Nereis sp.*		
Segmented worm sp.	*Notomastus sp.*		
Segmented worm sp.	*Owenia fusiformis*		
Segmented worm sp.	*Pholoe sp.*		
Segmented worm sp.	*Pista cristata*		
Segmented worm sp.	*Polydora sp.*		
Segmented worm sp.	*Polyphthalmus sp.*		
Segmented worm sp.	*Scoloplos sp.*		
Segmented worm sp.	*Sthenelais boa*		
Segmented worm sp.	*Syllis sp.*		
Segmented worm sp.	*Terebellides sp.*		
Arthropods - Arthropoda			
Chelicerates - Chelicerata			
Spiders, Scorpions - Arachnida			
Golden silk orbweaver	*Nephila clavipes*		
Horseshoe Crabs - Xiphosura			
Horseshoe crab	*Limulus polyphemus*		
Crustaceans - Crustacea			
Copepod sp.	*Acartia tonsa*		
Copepod spp.	*Oithona spp.*		
Copepod sp.	*Paracalanus parvus*		
Amphipod sp.	*Caprella sp.*		
Tanaidacean sp.	*Apseudes sp.*		
Mangrove boring isopod	*Sphaeroma terebrans*		
Bigclaw snapping shrimp	*Alpheus heterochaelis*		
Green snapping shrimp	*Alpheus normanni*		
Snapping shrimp sp.	*Automate evermanni*		
Pink-spotted shrimp	*Farfantepenaeus brasiliensis*		
Pink shrimp	*Farfantepenaeus duorarum*		
False zostera shrimp	*Hippolyte pleuracanthus*		

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Slender sargassum shrimp	*Latreutes fucorum*		
Brown glass shrimp	*Leander tenuicornis*		
Peppermint shrimp	*Lysmata wurdemanni*		
Seawhip shrimp	*Neopontonides beaufortensis*		
Brackish grass shrimp	*Palaemonetes intermedius*		
Clear sponge shrimp	*Periclimenaeus wilsoni*		
American grass shrimp	*Periclimenes americanus*		
Iridescent shrimp	*Periclimenes iridescens*		
Longtail grass shrimp	*Periclimenes longicaudatus*		
Spotted cleaner shrimp	*Periclimenes yucatanicus*		
Night shrimp sp.	*Processa sp.*		
Banded coral shrimp	*Stenopus hispidus*		
Speckled snapping shrimp	*Synalpheus fritzmuelleri*		
Snapping shrimp sp.	*Synalpheus longicarpus*		
Minor snapping shrimp	*Synalpheus minus*		
Townsend snapping shrimp	*Synalpheus townsendi*		
Bryozoan shrimp	*Thor floridanus*		
Arrow shrimp	*Tozeuma carolinense*		
Caribbean spiny lobster	*Panulirus argus*		
Mangrove tree crab	*Aratus pisonii*		
Box crab sp.	*Calappa sp.*		
Shelligs	*Callinectes ornatus*		
Blue crab	*Callinectes sapidus*		
Lesser blue crab	*Callinectes similis*		
Blue land crab	*Cardisoma guanhumi*		
Tricolor hermit crab	*Clibanarius tricolor*		
Thinstripe hermit crab	*Clibanarius vittatus*		
Land hermit crab	*Coenobita clypeatus*		
Sponge crab sp.	*Dromia sp.*		
Winged mime crab	*Epialtus dilatatus*		
Land crab sp.	*Gecarcinus sp.*		
Longnose spider crab	*Libinia dubia*		
Florida decorator crab	*Macrocoeloma camptocerum*		
Spongy decorator crab	*Macrocoeloma trispinosum*		
Florida stone crab	*Menippe mercenaria*		
Speck-claw decorator crab	*Microphrys bicornutus*		
Shaggy clinging crab	*Mithrax pleuracanthus*		
Green clinging crab	*Mithrax sculptus*		
Channel clinging crab	*Mithrax spinossisimus*		
Florida grassflat crab	*Neopanope packardii*		
Shorthorn spiny crab	*Nibilia antilocarpa*		
Atlantic ghost crab	*Ocypode quadrata*		
Bandeye hermit	*Paguristes tortugae*		
Hermit crab sp.	*Pagurus maclaughlinae*		
Atlantic mud crab	*Panopeus herbstii*		
Furrowed mud crab	*Panopeus occidentalis*		
Cryptic teardrop crab	*Pelia mutica*		
Shortspined hairy crab	*Pilumnus dasypodus*		
Roseate hairy crab	*Pilumnus holosericus*		
Quadrate hairy crab	*Pilumnus marshi*		
Beaded hairy crab	*Pilumnus pannosus*		

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Longspined hairy crab	*Pilumnus spinosissimus*		
Oval urn crab	*Pitho anisodon*		
Broadback urn crab	*Pitho lherminieri*		
Urn crab sp.	*Pitho mirabilis*		
Longfinger neck crab	*Podochela riisei*		
Flatface simming crab	*Portunus depressifrons*		
Iridescent swimming crab	*Portunus gibbesii*		
Redhair swimming crab	*Portunus ordwayi*		
Ocellate swimming crab	*Portunus sebae*		
Blotched swimming crab	*Portunus spinimanus*		
Marsh crab sp.	*Sesarma sp.*		
Yellowline arrow crab	*Stenorhynchus seticornis*		
Fourhorn crab	*Tyche emarginata*		
Burger's fiddler crab	*Uca burgersi*		
Dwarf fiddler crab	*Uca leptodactyla*		
Sand fiddler crab	*Uca pugilator*		
Caribbean fiddler crab	*Uca rapax*		
Ive's fiddler crab	*Uca speciosa*		
Ciliated false squilla	*Pseudosquilla ciliate*		
Acorn barnacle sp.	*Balanus improvisus*		
Light striped barnacle	*Balanus amphitrite*		
Ivory barnacle	*Balanus eburneus*		
Barnacle sp.	*Lepas sp.*		
Hexapods - Hexapoda			
Insects - Insecta			
Robinson's anomala scarab beetle	*Anomala robinsoni*		
Ataenius beetle	*Ataenius brevicollis*		
Ataenius beetle	*Ataenius wenzelii*		
Bicolored burrowing scarab beetle	*Bolbocerosoma hamatum*		
Miami chafer beetle	*Cyclocephala miamiensis*		
Saltmarsh tiger beetle	*Cicindela marginata*		
Strohecker's ivory-spotted long-horned beetle	*Eburia strohecker*i		
Mangrove long-horned beetle	*Heterachthes sablensis*		
Tropical white-spotted long-horned beetle	*Linsleyonides albomaculatus*		
Elongate june beetle	*Phyllophaga elongata*		
Round-necked romulus long-horned beetle	*Romulus globusus*		
Handsome flower scarab beetle	*Rutela formosa*		
Mangrove skipper	*Phocides pygmalion*		
Mangrove buckeye	*Junonia evarete*		
Echinoderms - Echinodermata			
Starfishes - Asteroidea			
Spiny sea star	*Echinaster sentus*		
Cushion sea star	*Oreaster reticulatus*		
Brittle Stars - Ophiuroidea			
Brittle star sp.	*Amphiodia pulchella*		
Brittle star sp.	*Amphioplus coniortodes*		
Brittle star sp.	*Amphioplus thrombodes*		
Brittle star sp.	*Amphipholis pachybactera*		
Brittle star sp.	*Amphipholis squamata*		
Brittle star sp.	*Amphiura stimpsoni*		
Brittle star sp.	*Micropholis gracillima*		

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Oersted's brittle star	*Ophiothrix oerstedii*		
Savigny's brittle star	*Ophiactis savignyi*		
Coralline brittle star	*Ophiocomella ophiactoides*		
Short spine brittle star	*Ophioderma brevispinum*		
Brittle star sp.	*Ophionephthys limicola*		
Reticulated brittle star	*Ophionereis reticulata*		
Brittle star sp.	*Ophionereis squamulosa*		
Brittle star sp.	*Ophiophragmus pulcher*		
Brittle star sp.	*Ophiopsila riisei*		
Brittle star sp.	*Ophiostigma isacanthum*		
Brittle star sp.	*Ophiuroidea juvenile*		
Sea Urchins - Echinoidea			
Sea biscuit	*Clypeaster rosaceus*		
Long-spined sea urchin	*Diadema antillarum*		
Rock boring urchin	*Echinometra lucunter*		
Green sea urchin	*Lytechinus variegatus*		
Urchin sp.	*Moira atropos*		
Sea Cucumbers - Holothuroidea			
Worm cucumber	*Chiridota rotifera*		
Sticky sea cucumber	*Leptosynapta parvipatina*		
Florida sea cucumber	*Ludwigothuria floridana*		
Chordates - Chordata			
Sessile Tunicates - Ascidiacea			
Black tunicate	*Ascidia nigra*		
Sessile tunicate spp.			
Cartilaginous Fishes - Chondrichthyes			
Spotted eagle ray	*Aetobatus narinari*		
Bull shark	*Carcharhinus leucas*		
Blacktip shark	*Carcharhinus limbatus*		
Southern stingray	*Dasyatis americana*		
Atlantic stingray	*Dasyatis sabina*		
Bluntnose stingray	*Dasyatis say*		
Nurse shark	*Ginglymostoma cirratum*		
Smooth butterfly ray	*Gymnura micrura*		
Manta	*Manta birostris*		
Lesser electric ray	*Narcine brasiliensis*		
Hammerhead shark sp.	*Sphyrna sp.*		
Yellow stingray	*Urobatis jamaicensis*		
Bony Fishes - Osteichthyes			
Sergeant major	*Abudefduf saxatiallis*		
Scrawled cowfish	*Acanthostracion quadricornis*		
Clown goby	*Acanthurus bahianus*		
Doctorfish tang	*Acanthurus chirurgus*		
Blue tang	*Acanthurus coeruleus*		
Lined sole	*Achirus lineatus*		
Emerald clingfish	*Acyrtops beryllinus*		
Bonefish	*Albula vulpes*		
Silverside	*Allanetta harringtonensis*		
Orange filefish	*Alutera schoepfi*		
Bowfin	*Amia calva*		
Big-eye anchovy	*Anchoa lamprotaenia*		

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Shortfinger anchovy	*Anchoa lyolepis*		
Bay anchovy	*Anchoa mitchelli*		
Flat anchovy	*Anchoviella perfasciata*		
American eel	*Anguila rostrata*		
Porkfish	*Anisotremus virginicus*		
Flame cardinal	*Apogon maculatus*		
Sheepshead	*Archosargus probatocephalus*		
Sea bream	*Archosargus rhomboidalis*		
Bronze cardinalfish	*Astrapogon alutus*		
Conchfish	*Astrapogon stellatus*		
Southern stargazer	*Astroscopus y-graecum*		
Hardhead silverside	*Atherinomorus stipes*		
Silver perch	*Bairdiella chrysura*		
Grey triggerfish	*Balistes capriscus*		
Undescribed goby	*Bathygobius sp.*		
Spanish hogfish	*Bodianus rufus*		
Eyed flounder	*Bothus ocellatus*		
Flounder	*Bothus sp.*		
Yellowfin menhaden	*Brevoortia smithi*		
Atlantic menhaden	*Brevoortia tyrannus*		
Grass porgy	*Calamus acrtifrons*		
Spotted oceanic triggerfish	*Canthidermis maculatus*		
Checkered puffer	*Canthigaster rostrata*		
Yellow jack	*Caranx bartholomaei*		
Blue runner	*Caranx crysos*		
Crevalle jack	*Caranx hippos*		
Horse-eye jack	*Caranx latus*		
Bar jack	*Caranx ruber*		
Spotted whiff	*Catherichthys macrops*		
Common snook	*Centropomus undecimalis*		
Atlantic spadefish	*Chaetodipterus faber*		
Foureye butterflyfish	*Chaetodon capistratus*		
Reef butterflyfish	*Chaetodon sedentarius*		
Banded butterflyfish	*Chaetodon striatus*		
Bridled burrfish	*Chilomycterus antennatus*		
Striped burrfish	*Chilomycterus schoepfi*		
Atlantic bumper	*Chloroscombrus chrysurus*		
Hardhead halfbeak	*Chriodorus atherinoides*		
Blue reef damselfish	*Chromis cyaneus*		
Bay whiff	*Citharichthys spilopterus*		
Creole wrasse	*Clepticus parrai*		
Common dolphinfish	*Coryphaena hippurus*		
Bridled goby	*Coryphopterus glaucofraenum*		
Whitenose pipefish	*Corythoichthys albirostris*		
Crested pipefish	*Corythoichthys brachycephalus*		
Spottail goby	*Ctenogobius stigmaturus*		
Spotted seatrout	*Cynoscion nebulosus*		
Sheepshead minnow	*Cyprinodon variegates*		
Clearwing flyingfish	*Cypselurus comatus*		
Sand stargazer	*Dactyloscopus tridigitatus*		
Striped mojarra	*Dasyatis americana*		

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Round scad	*Decapterus punctatus*		
Balloon fish	*Diodon holacanthus*		
Porcupinefish	*Diodon hystrix*		
Dwarf sand perch	*Diplectrum bivittatum*		
Sand perch	*Diplectrum formosum*		
Spotted dragonet	*Diplogrammus pauciradiatus*		
Dwarf wrasse	*Doratonotus megalepis*		
Fat sleeper	*Dormitator maculates*		
Shad	*Dorosoma spp.*		
Rainbow runner	*Elagatis bipinnulata*		
Ladyfish	*Elops saurus*		
Sailfin blenny	*Emblemaria pandionis*		
Red grouper	*Epinephelus morio*		
High hat drum	*Equetus acuminatus*		
Striped drum	*Equetus pulcher*		
Spotted drum	*Equetus punctatus*		
Spotfin mojarra	*Eucinostomus argenteus*		
Jenny mojarra	*Eucinostomus gula*		
Bigeye mojarra	*Eucinostomus havana*		
Mojarra sp.	*Eucinostomus sp.*		
Goldspotted killifish	*Floridichthys carpio*		
Longnose killifish	*Fundulus similis*		
Sea catfish	*Galeichthys felis*		
Eastern mosquitofish	*Gambusia holbrooki*		
Yellowfin mojarra	*Gerres cinereus*		
Orangespotted goby	*Gobiosoma longum*		
Code goby	*Gobiosoma robustum*		
Green moray	*Gymnothorax funebris*		
Spotted moray	*Gymnothorax moringa*		
Tomtate	*Haemulon aurolineatum*		
Smallmouth grunt	*Haemulon chrysargyreum*		
French grunt	*Haemulon flavolineatum*		
Sailor's choice	*Haemulon parra*		
White grunt	*Haemulon plumieri*		
Bluestriped grunt	*Haemulon sciurus*		
Slippery dick wrasse	*Halichoeres bivittatus*		
Clown wrasse	*Halichoeres maculipinna*		
Puddingwife wrasse	*Halichoeres radiatus*		
Redear herring	*Harengula humeralis*		
Scaled herring	*Harengula jaguana*		
Scaled sardine	*Harengula pensacolae*		
Pearly razorfish	*Hemipteronotus novacula*		
Green razorfish	*Hemipteronotus splendens*		
Lined seahorse	*Hippocampus erectus*		
Dwarf seahorse	*Hippocampus zosterae*		
Sargassumfish	*Histrio histrio*		
Blue angelfish	*Holacanthus bermudensis*		
Queen angelfish	*Holacanthus ciliaris*		
Rock beauty angelfish	*Holacanthus tricolor*		
Grouper sp.	*Hypoplectrus sp.*		
Round Herring sp.	*Jenkinsia sp.*		

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Bermuda chub	*Kyphosus sectatrix*		
Hairy blenny	*Labrisomas nuchipinnis*		
Hogfish	*Lachnolaimus maximus*		
Scrawled cowfish	*Lactophrys quadricornis*		
Buffalo trunkfish	*Lactophrys trigonus*		
Smooth trunkfish	*Lactophrys triqueter*		
Pinfish	*Lagodon rhomboides*		
Atlantic tripletail	*Lobotes surinamensis*		
Crested goby	*Lophogobius cyprinoides*		
Bluefin killifish	*Lucania goodei*		
Rainwater killifish	*Lucania parva*		
Mutton snapper	*Lutjanus analis*		
Schoolmaster snapper	*Lutjanus apodus*		
Gray snapper	*Lutjanus griseus*		
Dog snapper	*Lutjanus jocu*		
Lane snapper	*Lutjanus synagris*		
Tarpon	*Megalops atlantica*		
Black durgon triggerfish	*Melichthys niger*		
Gulf kingfish	*Menticirrhus littoralis*		
Northern kingfish	*Menticirrhus saxatilis*		
Clown goby	*Microgobius gulosus*		
Banner goby	*Microgobius microlepis*		
Atlantic croaker	*Micropogonias undulatus*		
Fringed filefish	*Monacanthus ciliatus*		
Planehead filefish	*Monacanthus hispidus*		
Striped mullet	*Mugil cephalus*		
White mullet	*Mugil curema*		
Gag grouper	*Mycteroperca microlepis*		
Emerald parrotfish	*Nicholsina usta*		
Yellowtail snapper	*Ocyurus chrysurus*		
Reef croaker	*Odontoscion dentex*		
Shortnose batfish	*Ogcocephalus nasutus*		
Leatherjacket	*Oligoplites saurus*		
Bank Cusk-eel	*Ophidion holbrooki*		
Redlip blenny	*Ophioblennius atlanticus*		
Thread herring	*Opisthonema oglinum*		
Gulf toadfish	*Opsanus beta*		
Pigfish	*Orthopristis chrysoptera*		
Marbled blenny	*Paraclinus marmoratus*		
Gulf flounder	*Paralichthys albigutta*		
Sailfin molly	*Poecilia latipinna*		
Black drum	*Pogonias cromis*		
Barbu	*Polydactylus virginicus*		
Gray angelfish	*Pomacanthus arcuatus*		
French angelfish	*Pomacanthus paru*		
Leopard searobin	*Prionotus scitulus*		
Freckled driftfish	*Psenes cyanophrys*		
Spotted goatfish	*Pseudupeneus maculates*		
Mangrove rivulus	*Rivulus marmoratus*	SSC	SC
Spanish sardine	*Sardinella anchovia*		
Blue parrotfish	*Scarus coeruleus*		

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Rainbow parrotfish	*Scarus gaucamaia*		
Spanish mackerel	*Scomberomorous maculatus*		
Barbfish	*Scorpaena brasiliensis*		
Lookdown	*Selene vomer*		
Lesser amberjack	*Seriola fasciata*		
Almaco jack	*Seriola rivoliana*		
Redband parrotfish	*Sparisoma aurofrenatum*		
Redtail parrotfish	*Sparisoma chrysopterum*		
Bucktooth parrotfish	*Sparisoma radians*		
Redfin parrotfish	*Sparisoma rubripinne*		
Spotlight parrotfish	*Sparisoma viride*		
Bandtail puffer	*Sphoeroides spengleri*		
Sharpnose puffer	*Sphoeroides testudineus*		
Checkered puffer	*Sphoeroides testudineus*		
Great barracuda	*Sphyraena barracuda*		
Southern sennet	*Sphyraena picudilla*		
Beaugregory	*Stegastes leucostictus*		
Bicolor damselfish	*Stegastes partitus*		
Cocoa damselfish	*Stegates variabilis*		
Planehead filefish	*Stephanolepis hispidus*		
Pygmy filefish	*Stephanolepis setifer*		
Atlantic needlefish	*Strongylura marina*		
Redfin needlefish	*Strongylura notata*		
Atlantic needlefish	*Strongylura timucu*		
Dusky flounder	*Syacium papillosum*		
Blackcheek tonguefish	*Symphurus palgiusa*		
Dusky pipefish	*Syngnathus floridae*		
Gulf pipefish	*Syngnathus scovelli*		
Inshore lizardfish	*Synodus foetens*		
Bluehead wrasse	*Thalassoma bifasciatum*		
Florida pompano	*Trachinotus carolinus*		
Permit	*Trachinotus falcatus*		
Palometa	*Trachinotus goodie*		
Rough scad	*Trachurus lathami*		
Hogchoker	*Trinectes maculates*		
Hound needlefish	*Tylosurus crocodilus*		
Mottled mojarra	*Ulaema lefroyi*		
Sand drum	*Umbrina coroides*		
Amphibians - Amphibia			
Squirrel treefrog	*Hyla squirella*		
Reptiles - Reptilia			
Green anole	*Anolis carolinensis*		
Florida Keys mole skink	*Eumeces egregious egregius*		
Florida cottonmouth	*Agkistrodon piscivorus*		
Racer	*Coluber constrictor*		
Eastern indigo snake	*Drymarchon couperi*	T	T
Corn snake	*Elaphe guttata*		
Mangrove salt marsh snake	*Nerodia clarkia compressicauda*		
Florida water snake	*Nerodia fasciata pictiventris*		
American crocodile	*Crocodylus accutus*	T	T
Florida softshell	*Trionyx ferox*		

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Florida cooter	*Pseudemys floridana*		
Diamondback terrapin	*Malaclemys terappin*		
Loggerhead sea turtle	*Caretta caretta*	T	T
Green sea turtle	*Chelonia mydas*	E	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Birds - Aves			
Cooper's hawk	*Accipiter cooperii*		
Sharp-shinned hawk	*Accipiter striatus*		
Spotted sandpiper	*Actitus macularia*		
Red-winged blackbird	*Agelaius phoeniceus*		
Northern pintail	*Anas acuta*		
Northern shoveler	*Anas clypeata*		
Green-winged teal	*Anas crecca*		
Blue-winged teal	*Anas discors*		
Eurasian wigeon	*Anas penelope*		
Gadwall	*Anas strepera*		
Anhinga	*Anhinga anhinga*		
Brown noddy	*Anous stolidus*		
Great egret	*Ardea alba*		
Great blue heron	*Ardea herodias herodias*		
Great white heron	*Ardea herodias occidentalis*		
Ruddy turnstone	*Arenaria interpres*		
Lesser scaup	*Aythya affinis*		
Redhead	*Aythya americana*		
Ring-necked duck	*Aythya collaris*		
Canvasback	*Aythya valisineria*		
American bittern	*Botaurus lentiginosus*		
Cattle egret	*Bubulcus ibis*		
Bufflehead	*Bucephala albeola*		
Short-tailed hawk	*Buteo brachyurus*		
Red-tailed hawk	*Buteo jamaicensis*		
Red-shouldered hawk	*Buteo lineatus*		
Broad-winged hawk	*Buteo platypterus*		
Green-backed heron	*Butorides striatus*		
Green heron	*Butorides virescens*		
Sanderling	*Calidris alba*		
Dunlin	*Calidris alpina*		
Red knot	*Calidris canutus*		
White-rumped sandpiper	*Calidris fuscicollis*		
Stilt sandpiper	*Calidris himantopus*		
Western sandpiper	*Calidris mauri*		
Pectoral sandpiper	*Calidris melanotos*		
Least sandpiper	*Calidris minutilla*		
Semipalmated sandpiper	*Calidris pusilla*		
Chuck-will's widow	*Caprimulgus carolinensis*		
Northern cardinal	*Cardinalis cardinalis*		
Turkey vulture	*Cathartes aura*		
Willet	*Catoptrophorus semipalmatus*		
Chimney swift	*Chaetura pelagica*		
Piping plover	*Charadrius melodus*	T	T

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Semipalmated plover	*Charadrius semipalmatus*		
Killdeer	*Charadrius vociferus*		
Wilson's plover	*Charadrius wilsonia*		
Black tern	*Chlidonias niger*		
Common nighthawk	*Chordeiles minor*		
Northern harrier	*Circus cyaneus*		
Yellow-billed cuckoo	*Coccyzus americanus*		
Mangrove cuckoo	*Coccyzus minor minardi*		
Eastern wood-pewee	*Contopus virens*		
Black vulture	*Coragyps atratus*		
Smooth-billed ani	*Crotophaga ani*		
Blue jay	*Cyanocitta cristata*		
Black-throated blue warbler	*Dendroica caerulescens*		
Yellow-rumped warbler	*Dendroica coronate*		
Prairie warbler	*Dendroica discolor*		
Yellow-throated warbler	*Dendroica dominica*		
Palm warbler	*Dendroica palmarum*		
Yellow warbler	*Dendroica petechia*		
Bobolink	*Dolichonyx oryzivorus*		
Gray catbird	*Dumetella carolinensis*		
Little blue heron	*Egretta caerulea*	SSC	
Reddish egret	*Egretta rufescens*	SSC	
Snowy egret	*Egretta thula*	SSC	
Tricolored heron	*Egretta tricolor*	SSC	
American swallow-tailed kite	*Elanoides forficatus*		
White ibis	*Eudocimus albus*	SSC	
Merlin	*Falco columbarius*		
Peregrine falcon	*Falco peregrinus*		
American kestrel	*Falco sparverius*		
Magnificent frigatebird	*Fregata magnificens*		
American coot	*Fulica americana*		
Wilson's snipe	*Gallinago gallinago*		
Common moorhen	*Gallinula chloropus*		
Common loon	*Gavia immer*		
Common yellowthroat	*Geothlypis trichas*		
American oystercatcher	*Haematopus palliatus*	SSC	
Bald eagle	*Haliaeetus leucocephalus*		
Worm-eating warbler	*Helmitheros vermivorus*		
Black-necked stilt	*Himantopus mexicanus*		
Barn swallow	*Hirundo rustica*		
Mississippi kite	*Ictinia mississippiensis*		
Tree swallow	*Iridoprocne bicolor*		
Least bittern	*Ixobrychus exilis*		
Loggerhead shrike	*Lanius ludovicianus*		
Herring gull	*Larus argentatus*		
Laughing gull	*Larus atricilla*		
Ring-billed gull	*Larus delawarensis*		
Lesser black-backed gull	*Larus fuscus*		
Great black-backed gull	*Larus marinus*		
Bonaparte's gull	*Larus philadelphia*		
Short-billed dowitcher	*Limnodromus griseus*		

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Long-billed dowitcher	*Limnodromus scolopaceus*		
Marbled godwit	*Limosa fedoa*		
Belted kingfisher	*Megaceryle alcyon*		
Red-bellied woodpecker	*Melanerpes carolinus*		
Black scoter	*Melanitta nigra*		
Red-breasted merganser	*Mergus serrator*		
Northern mockingbird	*Mimus polyglottos*		
Black-and-white warbler	*Mniotilta varia*		
Northern gannet	*Morus bassanus*		
Wood stork	*Mycteria americana*	E	E
Great-crested flycatcher	*Myiarchus crinitus*		
Brown-crested flycatcher	*Myiarchus tyrannulus*		
Long-billed curlew	*Numenius americanus*		
Whimbrel	*Numenius phaeopus*		
Yellow-crowned night heron	*Nyctanassa violacea*		
Black-crowned night heron	*Nycticorax nycticorax*		
Wilson's storm-petrel	*Oceanites oceanicus*		
Band-rumped storm-petrel	*Oceanodroma castro*		
Leach's storm-petrel	*Oceanodroma leucorhoa*		
Eastern screech owl	*Otus asio*		
Osprey	*Pandion haliaetus*		
Northern parula	*Parula americana*		
White-crowned pigeon	*Patagioenas leucocephala*	T	
American white pelican	*Pelecanus erythrorhynchos*		
Brown pelican	*Pelecanus occidentalis*	SSC	
Cave swallow	*Petrochelidon fulva*		
Cliff swallow	*Petrochelidon pyrrhonota*		
Double-crested cormorant	*Phalacrocorax auritus*		
Wilson's phalarope	*Phalaropus tricolor*		
Roseate spoonbill	*Platalea ajaja*	SSC	
American golden plover	*Pluvialis dominica*		
Black-bellied plover	*Pluvialis squatarola*		
Horned grebe	*Podiceps auritus*		
Pied-billed grebe	*Podilymbus podiceps*		
Blue-gray gnatcatcher	*Polioptila carulea*		
Purple gallinule	*Porphyrula martinica*		
Sora	*Porzana carolina*		
Purple martin	*Progne subis*		
Prothonotary warbler	*Protonotaria citrea*		
Greater shearwater	*Puffinus gravis*		
Sooty shearwater	*Puffinus griseus*		
Audubon's shearwater	*Puffinus lherminieri*		
Common grackle	*Quiscalus quiscula*		
Virginia rail	*Rallus limicola*		
Clapper rail	*Rallus longirostris*		
American avocet	*Recurvirostra americana*		
Bank swallow	*Riparia riparia*		
Snail kite	*Rostrhamus sociabilis*	E	E
Black skimmer	*Rynchops niger*	SSC	
Eastern phoebe	*Sayornis phoebe*		
Ovenbird	*Seiurus aurocapillus*		

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Louisiana waterthrush	*Seiurus motacilla*		
Northern waterthrush	*Seiurus noveboracensis*		
American redstart	*Setophaga ruticilla*		
Yellow-bellied sapsucker	*Sphyrapicus varius*		
Northern rough-winged swallow	*Stelgidopteryx serripennis*		
Least tern	*Sterna antillarum*	T	
Caspian tern	*Sterna caspia*		
Roseate tern	*Sterna dougalli*		
Forster's tern	*Sterna forsteri*		
Sooty tern	*Sterna fuscata*		
Common tern	*Sterna hirundo*		
Gull-billed tern	*Sterna nilotica*		
Sandwich tern	*Sterna sandvicensis*		
Royal tern	*Thalasseua maximus*		
Brown thrasher	*Toxostoma rufum*		
Lesser yellowlegs	*Tringa flavipes*		
Greater yellowlegs	*Tringa melanoleuca*		
Solitary sandpiper	*Tringa solitaria*		
Gray kingbird	*Tyrannus dominicensis*		
Black-whiskered vireo	*Vireo altiloquus*		
White-eyed vireo	*Vireo griseus*		
Red-eyed vireo	*Vireo olivaceous*		
Mourning dove	*Zenaida macroura*		
Mammals - Mammalia			
Opossum	*Didelphis marsupialis*		
Florida bonneted bat	*Eumops floridanus*	T	C
Marsh rabbit	*Sylvilagus palustris*		
Key Largo cotton mouse	*Peromyscus gossypinus allapaticola*		
Raccoon	*Procyon lotor*		
River otter	*Lutra canadensis*		
Florida manatee	*Trichechus manatus latirostris*	E	E
Bottlenose dolphin	*Tursiops truncatus*		
Atlantic spotted dolphin	*Stenella frontalis*		
Pigmy sperm whale	*Kogia breviceps*		

B.4.2 / ***Invasive Non-native Species List***

Common Name	Species Name
PLANTS	
Australian pine	*Casuarina equisetifolia*
Bermuda grass	*Cynodon dactylon*
Brazilian pepper	*Schinus terebenthifolius*
Washington fan palm	*Washingtonia robusta*
ANIMALS	
Mollusks	
Red-rim melania	*Melanoides tuberculatus*
Crustaceans	
Bocourt swimming crab	*Callinectes bocourti*
Fish	
Peacock bass	*Cichla ocellaris*

Common Name	Species Name
Black acara	*Cichlasoma bimaculatum*
Mayan cichlid	*Cichlasoma urophthalmus*
Lionfish	*Pterois volitans*
Spotted tilapia	*Tilapia mariae*
Amphibians	
Cuban treefrog	*Osteopilus septentrionalis*
Reptiles	
Brown anole	*Anolis sagrei*
Green iguana	*Iguana iguana*
Burmese python	*Python molurus bivittatus*
Birds	
Muscovy duck	*Cairina moschata*
Mammals	
Feral cat	*Felis catus*
Black rat	*Rattus rattus*

B.4.3 / ***Problem Species List***

Common Name	Species Name
Legend: T = Threatened • E = Endangered • SSC = Species of Special Concern	
Plants	
Cyanobacteria	
Blue green algae	*Synechococcus spp.*
Blue green algae	*Synechocytis spp.*
Birds	
Black vulture	*Coragyps atratus*
Mammals	
Raccoon	*Prycyon lotor*

*Only in Card Sound according to Iverson & Roessler, 1969
+Biscayne National Park papers by DiResta; verify with Card Sound papers
** Low, Jr. 1973. Fishes in grassbeds in Biscayne Bay, Florida.
^DERM survey of Baker's Haulover Atlantic Intra-coastal Waterway area pre dredging 2005, 2006
^ ^Oleta River State Park Unit Plan, Appendix 4, (2008?)

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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 - non-flowing 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 the Biscayne Bay Aquatic Preserves

TERRESTRIAL

Coastal Uplands - substrate and vegetation influenced primarily by such coastal (maritime) processes as erosion, deposition, salt spray, and storms.

Beach Dune - characterized as a wind-deposited, foredune and wave-deposited upper beach that are sparsely to densely vegetated with pioneer species, especially sea oats.

Coastal Berm - generally a ridge of storm-deposited marine debris that is parallel to the shore, occasionally occurring in a series with alternating swales, usually found along low-energy coastlines, and are often surrounded by mangrove or salt marsh communities.

Coastal Grassland - characterized as a treeless flat land or gently undulating land with barren sand or a sparse to dense ground cover of grasses, prostrate vines, and other herbaceous or suffrutescent species that are adapted to harsh maritime conditions.

Keys Tidal Rock Barren – flatland with exposed limestone in supratidal zone; restricted to Keys; no fire; open, mainly herbaceous vegetation of upper salt marsh species and stunted shrubs and trees; buttonwood, christmasberry, perennial glasswort, saltwort, seashore dropseed, shoregrass.

Coastal Strand - characterized as stabilized, wind-deposited coastal dunes that are vegetated with a dense thicket of salt-tolerant shrubs, especially saw palmetto.

Maritime Hammock - characterized as a narrow band of hardwood forest lying just inland of the Coastal Strand community.

Shell Mound - characterized as an elevated mound of mollusk shells and aboriginal garbage on which a hardwood, closed canopy forest develops.

Rocklands - low, generally flat limestone outcrops with tropical vegetation or limestone exposed through karst activities with tropical or temperate vegetation.

Pine Rockland - characterized as an open canopy forest of slash pines with a patchy understory of tropical and temperate shrubs and palms and a variable ground cover of grasses and herbs.

Rockland Hammock - characterized as a hardwood forest on upland sites in regions where limestone is very near the surface and is often exposed.

Mesic Flatlands - flat, moderately well-drained sandy substrates with a mixture of organic material, often with a hard pan.

Mesic Flatwoods - characterized as an open canopy forest of widely spaced pine trees with little or no understory but a dense ground cover of herbs and shrubs.

PALUSTRINE

Wet Flatlands - flat, poorly drained sand, marl or limestone substrates.

Marl Prairie - sparsely vegetated seasonal marshes on flatlands along the interface between deeper wetlands and coastal or upland communities where limestone is near the surface. This community has minimal distribution on lands adjacent to southern Biscayne Bay.

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. Are solidified rock or shell conglomerates and include 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.

Coral Reef - generally characterized as expansive conglomerates of hard, sessile, limestone-building coral occurring in warm subtidal waters.

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.

Octocoral Bed - characterized as large populations of sessile invertebrates of the Class Anthozoa, Subclass Octocorallia, Orders Gorgonacea and Pennatulacea. This community is confined to the subtidal zone since the sessile organisms are highly susceptible to desiccation.

Sponge Bed - characterized as dense populations of sessile invertebrates of the phylum Porifera, Class Demospongiae. Although concentrations of living sponges can occur in marine and estuarine intertidal zones, Sponge Beds are confined primarily to subtidal zones.

Worm Reef - substantial subtidal or intertidal area with relief from concentrations of sessile, tubicolous organisms of the Phylum Annelida, Class Polychaeta (e.g., chaetopterids and sabellarids); octocorals, sponges, stony corals, macrophytic algae and seagrasses sparse, if present.

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.

Salt 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.

Mangrove Swamp - characterized as dense, low forests occurring along relatively flat, intertidal and supratidal shorelines of low wave energy along Southern Florida.

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.

FNAI 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.

TERRESTRIAL

Coastal Uplands
G3 S2 Beach Dune
G3 S2 Coastal Berm
G3 S2 Coastal Grasslands
G3 S3 Keys Tidal Rock Barren
G3 S2 Coastal Strand
G3 S2 Maritime Hammock
G2 S2 Shell Mound

Rocklands
G1 S1 Pine Rocklands
G2 S2 Rockland Hammock

Mesic Flatlands
G4 S4 Mesic Flatwoods

PALUSTRINE

Wet Flatlands
G3 S3 Marl Prairie

MARINE & 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

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., less than2,000 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., less than 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 factor(s) making it vulnerable to extinction throughout its range, 21-100 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 (21-100 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.

Archaeological Sites Listed on Florida Master Site File June 2010

Site ID	Site Name	Site Type 1	Culture 1	Survey #	D_NR Listed
DA06764	1855 US Coast Survey Key Biscayne Bsae	Land-terrestrial	Nineteenth century American, 1821-1899	0	
DA06880	Key Biscayne Shipwreck	Historic shipwreck		0	
DA00004	Biscayne Key Mound	Prehistoric burial mound(s)	Prehistoric	602	
DA00010	Munroe	Prehistoric midden(s)	Glades I, 1000 B.C.-A.D. 750	602	
DA00011	Granada	Prehistoric midden(s)	American Acquisition/Territorial Developmt 1821-45	602	
DA00012	MiamiCircle at Brickell Point	Building remains	Nineteenth century American, 1821-1899	15971	2/5/2002
DA00013	Miami Sand Mound 4	Prehistoric burial mound(s)	Prehistoric	602	
DA00015	Miami Sand Mound 2	Prehistoric burial mound(s)	Prehistoric with pottery	602	
DA00016	Miami Rock Mound 1	Prehistoric mound(s)	Prehistoric	602	
DA00017	Miami Rock Mound 2	Prehistoric mound(s)	Prehistoric	602	
DA01024	Oleta River 2	Prehistoric midden(s)	Glades I, 1000 B.C.-A.D. 750	602	
DA01027	Snake Creek Crossing	Prehistoric midden(s)	American, 1821-present	602	
DA01028	Greynolds	Artifact scatter-low density (< 2 per sq meter)	Glades, 1000 B.C.-A.D. 1700	602	
DA01033	Bay	Prehistoric midden(s)	Glades I, 1000 B.C.-A.D. 750	602	
DA01034	Sutton	Specialized site for procurement of raw materials	Glades Ia	8928	
DA01049	Fish Camp	Artifact scatter-low density (< 2 per sq meter)	Glades, 1000 B.C.-A.D. 1700	602	
DA01083	Button	Historic refuse / Dump	Spanish-First or Second	602	
DA01655	Miami River Rapids	Campsite (prehistoric)	Nineteenth century American, 1821-1899	4293	
DA02132	Santa Maria	Prehistoric midden(s)	Glades I, 1000 B.C.-A.D. 750	602	
DA03220	Jose Marti	Prehistoric burial(s)	Glades I, 1000 B.C.-A.D. 750	0	
DA05254	Kirk Munroe Homesite	Building remains	Nineteenth century American, 1821-1899	3731	
MO01978	Pumpkin Key	Prehistoric shell midden	Glades II, A.D. 750-1200	0	
MO02062	Ocean Reef	Prehistoric shell midden	Prehistoric	0	

Historic Waterways, Roads, and Districts

Site ID	Site Name	Type 1	Culture 1 or Year Built	Survey #	D_NR Listed
DA05360	Brickell Resource Group	Archaeological District	Glades I, 1000 B.C.-A.D. 750		
DA11799	Bal Harbour Yacht Basin	Designed Historic Landscape		18338	
DA01087	South Miami Avenue Bridge	Historic Bridge	1917	0	
DA02384	Seybold Canal Bridge	Historic Bridge	1919	3801	
DA04736	Venetian Causeway	Historic Bridge	1925	3801	7/13/1989
DA05096	Little River Bridge	Historic Bridge	1928	3801	
DA05098	Brickel Avenue Bridge	Historic Bridge	1929	3801	
DA05182	Sunset Lake Canal Bridge	Historic Bridge	1936	3801	
DA05276	NW South River Drive Swing Bridge	Historic Bridge	1921	13012	
DA05766	La Gorce Canal Bridge	Historic Bridge	1934	4466	
DA05823	Biscayne Point Bridge	Historic Bridge	1950	4146	
DA05828	Sunset Islands Bridge Number 2	Historic Bridge	c1929		
DA05829	Sunset Islands Bridge Number 4	Historic Bridge	1929	4173	
DA05886	NW 17th Ave Bridge	Historic Bridge	1929	4507	
DA06218	NW 5th Street Bridge	Historic Bridge	1929	7093	
DA06222	SW 1st Street Bridge	Historic Bridge	1929	18795	
DA06341	NW 12th Avenue Bridge	Historic Bridge	1928	5199	
DA06424	Oleta River	Historic Bridge	1925	3801	
DA06425	Oleta River	Historic Bridge	1935	3801	
DA06426	NW 27th Avenue	Historic Bridge	1938	3801	
DA06430	Ocean Canal	Historic Bridge	1940	3801	
DA06433	Ocean Canal	Historic Bridge	1925	3801	
DA06434	SW 2nd Avenue	Historic Bridge	C1923	3801	
DA06435	Ocean Canal	Historic Bridge	1940	3801	
DA06439	Indian Creek	Historic Bridge	C1929	3801	
DA06441	Sunny Isles	Historic Bridge	c1927		
DA09897	West 63rd Street Bridge	Historic Bridge	1953	11498	
DA10123	Broad Causeway	Historic Bridge	1951	13458	
DA11716	Rickenbacker West Fishing Pier	Historic Bridge	1944		
DA11746	41st Street Bridge	Historic Bridge	1953	18285	
DA11747	29th Street Footbridge	Historic Bridge	c1950		
DA11936	FDOT Bridge 870054	Historic Bridge	1956	18285	
DA06352	Little River Canal	Historic Canal		17998	
DA06453	Tamiami Canal	Historic Canal	20th century American, 1900-present	17445	0
DA06525	Miami Canal	Historic Canal		17583	
DA06537	Biscayne Canal	Historic Canal	Unspecified on form by the recorder	6678	
DA10754	Snapper Creek Canal	Historic Canal	Other	18284	
DA11346	Lawrence Canal	Historic Canal	20th century American, 1900-present	16528	
DA06901	Biscayne Blvd	Historic Roadway	Other	14845	
MO01486	Card Sound Road Intersection	Historic Roadway	20th century American, 1900-present	10204	
DA04577	South River Drive Historic District	Historical District	Spanish-American War, 1898-1916	18795	8/10/1987
DA05201	Bay Shore Historic District	Historical District	Boom Times, 1921-1929		10/2/1992
DA05377	Edgewater Historic District	Historical District	Other	14845	
DA02815	Charles Deering Estate	Mixed District	Glades, 1000 B.C.-A.D. 1700		3/11/1986

Appendix C

Public Involvement

C.1 / Biscayne Bay Aquatic Preserves Advisory Committee

The following appendices contain information about who serves on the Biscayne Bay Aquatic Preserves Advisory Committee, when meetings were held, copies of the public advertisements for those meetings, and summaries of each meeting.

C.1.1 / List of Biscayne Bay Aquatic Preserves Advisory Committee members and their affiliations

Category	Name	Affiliate	Strengths
General Population & Economic Interests	**Charles Munroe**	Friends of Biscayne Bay, Inc.	*Historic knowledge; member & founder Biscayne Bay Yacht Club*
	Captain Dan Kipnis	Miami Beach Rod & Reel Club	*Recreational & Charter Fishing*
	Phil Everingham	Miami Marine Council	*Port; commercial users; marine industry; historic bay involvement*
Government Agencies	**Honorable Harvey Ruvin**	Miami-Dade County Clerk of Courts	*County Government & historic participation in bay protection*
	Dr. Rick Alleman	SFWMD	*Authored BB's Surface Water Improvement (SWIM) plan*
	Steve Blair	Miami-Dade PERA	*Water quality; benthic resources, restoration, clean-up events*
	Superintendent Mark Lewis	Biscayne National Park Superintendent	*South Miami-Dade Biscayne Bay mgmt*
	Dr. Joan Browder	NOAA NMFS	*Fisheries Science of Biscayne Bay*
	Pete Harlem	FIU	*Historic hydrogeologic and fauna/flora knowledge*
	Adam Belden	Oleta River State Park	*North Miami; assistant park manager*
	Ron Mezich	FWC Habitats (marine, estuarine)	*Seagrass, benthics*
	Jill King	DEP Southeast District	*Regulatory background; extremely familiar w/ BBAP FAC & FS*
NGOs	**Dr. Tom Lodge**	Tropical Audubon Society	*Ecologist; user impact; birds; TAS historically bay advocate*

A copy of the agenda may be obtained by contacting: Rachel Truxell, (850)410-7116 or racheltruxell@fdle.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: Rachel Truxell, (850)410-7116 or racheltruxell@fdle.state.fl.us. 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).

For more information, you may contact: Rachel Truxell, (850)410-7116 or racheltruxell@fdle.state.fl.us.

The Florida **Department of Law Enforcement** announces a public meeting to which all persons are invited.

DATE AND TIME: Wednesday, August 31, 2011, 1:00 p.m.

PLACE: Florida Department of Law Enforcement, Tampa Bay Regional Operations Center, 4211 North Lois Avenue, Tampa, Florida, 33614, (813)878-7300

GENERAL SUBJECT MATTER TO BE CONSIDERED: Medical Examiners Commission Meeting

A copy of the agenda may be obtained by contacting: Bureau Chief Glen Hopkins at (850)410-8600.

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: Medical Examiners Commission Staff at (850)410-8600. 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).

If any person decides to appeal any decision made by the Board with respect to any matter considered at this meeting or hearing, he/she will need to ensure that a verbatim record of the proceeding is made, which record includes the testimony and evidence from which the appeal is to be issued.

For more information, you may contact: Medical Examiners Commission Staff, Post Office Box 1489, Tallahassee, Florida 32302, (850)410-8600.

DEPARTMENT OF TRANSPORTATION

The **Commercial Motor Vehicle Review Board** announces a public meeting to which all persons are invited.

DATE AND TIME: August 11, 2011, 8:30 am.

PLACE: Florida Department of Transportation, Burns Building Auditorium, 605 Suwannee St., Tallahassee, FL 32301

GENERAL SUBJECT MATTER TO BE CONSIDERED: This is a monthly meeting of the Commercial Motor Vehicle Review Board for the purpose of reviewing penalties imposed upon any vehicle or persons under the provisions of Chapter 316, Florida Statutes, relating to weights imposed on the highway by the axles and wheels of motor vehicles, to special fuel and motor fuel tax compliance, or to violations of safety regulations.

A copy of the agenda may be obtained by contacting: Sharon Day, Executive Assistant, Commercial Motor Vehicle Review Board, Rhyne Building, Traffic Engineering and Operations Office, 2740 Centerview Dr., Tallahassee, FL 32301

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 48 days before the workshop/meeting by contacting: Sharon Day, Executive Assistant. 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).

The Florida **Department of Transportation**, District Five announces a public hearing to which all persons are invited.

DATE AND TIMES: August 18, 2011, Open House: 5:30 p.m. – 7:30 p.m.; Presentation: 6:15 p.m.

PLACE: Altamonte Springs City Hall, 225 Newburyport Avenue, Altamonte Springs, Florida

GENERAL SUBJECT MATTER TO BE CONSIDERED: FM Project: 238002-3-52, SR 436 at Robin Road – Turn Lane and Median Modifications. To correct a crash trend, the westbound directional median opening at Robin Road will be closed. The project will also extend the eastbound left turn lane at the signal serving the shopping plaza just east of Robin Road.

A copy of the agenda may be obtained by contacting: A flyer will be distributed at the hearing and also mailed to affected property owners.

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 7 days before the workshop/meeting by contacting: Ms. Bonnie Pfuntner, Public Information Officer, at (850)556-3485 or bpfuntner@lpagroup.com. 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).

For more information, you may contact: Ms. Angela Wilhelm, (386)943-5333, angela.wilhelm@dot.state.fl.us.

BOARD OF TRUSTEES OF INTERNAL IMPROVEMENT TRUST FUND

The Florida **Department of Environmental Protection**, Office of Coastal and Aquatic Managed Areas announces a public meeting to which all persons are invited.

DATE AND TIME: Wednesday, September 7, 2011, 6:30 p.m. – 9:30 p.m.

PLACE: University of Miami, Rosenstiel School of Marine and Atmospheric Science Auditorium, 4600 Rickenbacker Causeway, Miami FL 33149

GENERAL SUBJECT MATTER TO BE CONSIDERED: The purpose is to receive public comment on the draft Biscayne Bay Aquatic Preserves Management Plan.

A copy of the draft plan will be available for viewing starting July 29, 2011 at www.dep.state.fl.us/coastal. The Biscayne Bay Aquatic Preserves Advisory Committee will be participating.

A copy of the agenda may be obtained by contacting: Aquatic Preserve Manager, Pamela Sweeney by e-mail: Pamela.Sweeney@dep.state.fl.us by phone: (305)795-3486, or by mail: Biscayne Bay Environmental Center, 1277 N.E. 79th Street Causeway, Miami, FL 33138-4206.

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, Pamela Sweeney at (305)795-3486. 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).

The Florida **Department of Environmental Protection,** Office of Coastal and Aquatic Managed Areas announces a public meeting to which all persons are invited.

DATE AND TIME: Thursday, September 8, 2011, 10:00 a.m. – 3:00 p.m.

PLACE: University of Miami, Rosenstiel School of Marine and Atmospheric Science Seminar Room, 4600 Rickenbacker Causeway, Miami, FL 33149

GENERAL SUBJECT MATTER TO BE CONSIDERED: The purpose is for the members of the Advisory Committee to discuss the revision of the Biscayne Bay Aquatic Preserves Management Plan.

A copy of the agenda may be obtained by contacting: Aquatic Preserve Manager, Pamela Sweeney by e-mail: Pamela.Sweeney@dep.state.fl.us, by phone: (305)795-3486 or by mail: Biscayne Bay Environmental Center, 1277 N.E. 79th Street Causeway, Miami, FL 33138-4206.

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, Pamela Sweeney at (305)795-3486. 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).

PUBLIC SERVICE COMMISSION

The Florida **Public Service Commission** announces a status conference in the following docket to which all persons are invited.

DATE AND TIME: Monday, August 8, 2011, 9:30 a.m.

PLACE: Commission Hearing Room 148, Betty Easley Conference Center, 4075 Esplanade Way, Tallahassee, Florida

GENERAL SUBJECT MATTER TO BE CONSIDERED: Docket No.100437-EI – Examination of the outage and replacement fuel/power costs associated with the CR3 steam generator replacement project, by Progress Energy Florida, Inc.

The purpose of the conference is to discuss the scope of the docket and the case schedule. One or more of the Commissioners of the Florida Public Service Commission may attend and participate in this conference. For questions, contact Commission staff, Lisa Bennett at (850)413-6230.

Emergency Cancellation of STATUS CONFERENCE: If a named storm or other disaster requires cancellation of the conference, Commission staff will attempt to give timely direct notice to the parties. Notice of cancellation of the conference will also be provided on the Commission's website (http://www.psc.state.fl.us/) under the Hot Topics link found on the home page. Cancellation can also be confirmed by calling the Office of the General Counsel at (850)413-6199.

In accordance with the American with Disabilities Act, persons needing a special accommodation to participate at this proceeding should contact the Office of Commission Clerk no later than five days prior to the conference at 2540 Shumard Oak Boulevard, Tallahassee, Florida 32399-0850, via 1(800)955-8770 (Voice) or 1(800)955-8771 (TDD), Florida Relay Service.

REGIONAL PLANNING COUNCILS

The **West Florida Regional Planning Council** announces a public meeting to which all persons are invited.

DATE AND TIMES: Monday, August 15, 2011, 4:00 p.m.; Executive Committee Meeting, 3:00 p.m.

PLACE: Crestview City Hall, 198 North Wilson Street, Crestview, FL

GENERAL SUBJECT MATTER TO BE CONSIDERED: General business of the Council and the above referenced Committee.

A copy of the agenda may be obtained by contacting: Deb Brown at (850)332-7976, ext. 235.

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 2 days before the workshop/meeting by contacting: WFRPC at (850)332-7976. If you are hearing or

Biscayne Bay Aquatic Preserves (BBAP) Management Plan
Advisory Committee Meeting Condensed Summary

Thursday, September 8, 2011, 10:00 a.m. – 3:00 p.m.
University of Miami, Rosenstiel School of Marine and Atmospheric Science
4600 Rickenbacker Causeway
Miami, FL 33149

Facilitator:	*Lisa Krimksy, SeaGrant*
Advisory Committee present:	*Dan Kipnis, Jill King, Ron Mezich, Mark Lewis, Adam Belden, Phil Everingham, Stephen Blair, Rick Alleman, Joan Browder, Charles Munroe, Pete Harlem*
DEP Staff present:	*Pamela Sweeney - BBAP Manager, Penny Isom, Pam Phillips, Susan Leser, Breanne Markley (BBAP Intern)*

Introduction

- Pamela introduced herself and Lisa Krimsky as the individuals leading the meeting. She described the role of the Advisory Committee. Staff and committee members introduced themselves.
- Lisa reviewed meeting procedures.
- The large notes with oral comments from the Public Meeting (9/7/11) were displayed and reviewed. Lisa read written comments from the meeting and Pamela summarized the contents of emailed comments she had received.

Morning and Afternoon Sessions

- Member asked if the meeting focus could be "Goals & Objectives" (Chapter 5) and that a full review of the management plan and history of the BBAP be omitted from the discussion in the interest of time.
- Member noted that there should be strategies common to many objectives to show overlap to illustrate that efforts undertaken to accomplish one goal might also contribute to other goals/objectives/strategies.
- There was a brief discussion on the public meeting itself followed by one on the omission of the economic significance of BBAP in the management plan. Many members felt the economic significance needs to be emphasized.
- Member asked for clarification on the process of the management plan and revisions.
- Chapter 5 (Issues) was the main focus of the meeting.

Wrap-up

- The economic importance of a healthy bay needs to be emphasized.
- Climate change needs to be addressed.
- Pamela provided information on how the management plan process would move forward after this meeting.

Minutes from BBAP Management Plan Advisory Committee Meeting

February 17, 2012

Present:	*Brian Older, Oleta River State Park; Joan Browder, NOAA; Mark Lewis, BISC; Jill King, DEP; Susan Leser, BBAP; Pamela Sweeney, BBAP; Erin McDevitt, FWC; Pete Harlem, FIU SERC; Dr. Rick Alleman, SFWMD; Captain Dan Kipnis, Miami Marine Council; Penny Isom, DEP (phone)*
Moderator:	*Dr. Lisa Krimsky, SeaGrant*

5.6 / Issue 5

Sustainable Economic Use and Viability

Narrative –

- Check for redundancies
- Separate into separate paragraphs (bulleted)

Quantify $ amounts

Standardize details (job #s, years, $)

Include diving industry

Verify $400B stat

Ref. Objective 2: commercial fishing practices in narrative

Fisheries

- Shrimp – food vs. bait
- Crabs – stone crab and blue crab
- Bait fish – goggle eye and pilchards

Past fisheries that are no longer here

- Mullet (gill nets) – UM 50s Ref: Smith & Michelle

Previous economic use thru years

- Changes (eg. mackerel fishery)

Rec boats – increased size, increased impacts from props

- new performance measure?

Objective 1

Strategy 1 – Geared towards users

Strategy 2 – Partner with DEP, CMP

Strategy 3 – Geared towards industries

Performance Measures – make them measurable (yes or no OR numbers)

Obstacles to Natural Resource Management (compliance)

- Commercial operations using bay to operate business without permit / licenses
- No MOAs with tow boat operators
- Greater participation in municipal water-related cmtes (MR, NBV, COM – KEY BISC) – new strategy
- BBRRCT supposed to integrate these cmtes

Performance Measure 2 – make a goal

Develop monitoring program with partners

Metric - # of marinas monitored

New concept – P.O.M.

Objective 2

Evaluate current commercial fishing practices within BBAP & determine impacts

Objective 3 - impact of recreational fishing practices

NEW

For Objective 3 & 4 (commercial and recreational)

Strategy 1 – Compile historical & present data on use in partnership with FWC

Strategy 2 – Compile impact data in partnership with FWC . . .

Objective 2

Performance Measure 1 – change to a new strategy with focus on gear maintenance, not se worthiness (Ed – L.E.)

Objective 3 (recreational)

New Strategy – proper use of recreational fishing gear (Educational – public)

Objective 2

Performance Measure 3 – create new strategy

- Compile existing manuscripts/ reports on trawling, bycatch, etc.
- Coordinate with universities/agencies to repeat old studies
- Find resources to do studies

NEW OBJECTIVES

OBJ – Reduce impacts from tourism-driven commercial industries

Strategy 1 – Identify what the impacts are/where they occur

Strategy 2 – Design P.A. training program to address issues

Strategy 3 – Get buy-in/promotion of campaign

Performance measure - # of businesses participating

Strategy 4 – Compile and review success (effectiveness) of existing certification programs

GOAL –

Overarching – promote sustainable economic use and viability of BBAP's natural resources

OBJ – create objective that discusses who, what, and hows of "rogue" industries, tow boats, and transport operators

(move to Seagrass Impacts / Groundings strategy)

Commercial Industries

Boat Rentals / Jet Skis

(Motor-Nonmotor) – Education

Sight-seeing charters

Value of restored habitat

Cont. **Water Taxis** / **Transportation Uses**

Scuba Charters

Eco-Tour Ops

What Marine Industries exist in BBAP?

- Shipping

Movie Industries – new strategy

5.3 / **Habitat Loss**

NEW Strategy – promote appropriate usage of available fill for mitigation

NEW Strategy – identify and quantify value of restoration activities within BBAP – name partner agencies, universities, NGOs, etc.

Public Awareness and Access

Narr – MPP mentioned as an example to reinforce statement

Objective 2 & 3 not supported within narrative

New Strategy – copy and pasted from other issue (Issue 2, Goal 1, Obj. 1, Strategy 1); encourage/promote existing boat ramps

New Strategy – reiterate public awareness

Water Quality & Quantity

Performance Measures – make them strategies

All encompassing Performance Measure - # of strategies reached/addressed

Narr – temporal time-frame not appropriate for 10-year scope of plan (too negative in tone)

NEW STRATEGIES

- Encourage use of pervious pavements
- Promote Florida Friendly Landscaping Program
- Large boat water sedimentation

OBJECTIVE – word choice – "protect"

Objective 3 – Add Living Shorelines

Strategy 2 – Partner / Adopt SEFCRI, marine debris program,

NEW Strategy – Catalogue of existing shorelines

Narr – word change "more seagrass communities"? "benthic"?

Objective 2 – Include groundwater

Objective 6

Performance Measures 5 & 6: combine and make more mapping specific

Obstacles in Natural Resource Management

Narr – obstacle is general awareness of aquatic preserve (last sentence) - emphasize importance

- Shift focus away from $ cuts to needs/wants
- Paragraph 1 – SLR wording – Joan to send SLR affect on freshwater supply

NEW Strategy – Citizen Science for Climate Change Monitoring & Documentation

Locate FWC 2050 climate change maps?

C.2 / Formal Public Meeting(s)

The following Appendices contain information about the Formal Public Meeting(s) which was held in order to obtain input from the public about the Biscayne Bay Aquatic Preserves Draft Management Plan.

C.2.1 / Florida Administrative Weekly Posting(s)

A copy of the agenda may be obtained by contacting: Rachel Truxell, (850)410-7116 or racheltruxell@fdle.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: Rachel Truxell, (850)410-7116 or racheltruxell@fdle.state.fl.us. 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).

For more information, you may contact: Rachel Truxell, (850)410-7116 or racheltruxell@fdle.state.fl.us.

The Florida **Department of Law Enforcement** announces a public meeting to which all persons are invited.

DATE AND TIME: Wednesday, August 31, 2011, 1:00 p.m.

PLACE: Florida Department of Law Enforcement, Tampa Bay Regional Operations Center, 4211 North Lois Avenue, Tampa, Florida, 33614, (813)878-7300

GENERAL SUBJECT MATTER TO BE CONSIDERED: Medical Examiners Commission Meeting

A copy of the agenda may be obtained by contacting: Bureau Chief Glen Hopkins at (850)410-8600.

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: Medical Examiners Commission Staff at (850)410-8600. 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).

If any person decides to appeal any decision made by the Board with respect to any matter considered at this meeting or hearing, he/she will need to ensure that a verbatim record of the proceeding is made, which record includes the testimony and evidence from which the appeal is to be issued.

For more information, you may contact: Medical Examiners Commission Staff, Post Office Box 1489, Tallahassee, Florida 32302, (850)410-8600.

DEPARTMENT OF TRANSPORTATION

The **Commercial Motor Vehicle Review Board** announces a public meeting to which all persons are invited.

DATE AND TIME: August 11, 2011, 8:30 am.

PLACE: Florida Department of Transportation, Burns Building Auditorium, 605 Suwannee St., Tallahassee, FL 32301

GENERAL SUBJECT MATTER TO BE CONSIDERED: This is a monthly meeting of the Commercial Motor Vehicle Review Board for the purpose of reviewing penalties imposed upon any vehicle or persons under the provisions of Chapter 316, Florida Statutes, relating to weights imposed on the highway by the axles and wheels of motor vehicles, to special fuel and motor fuel tax compliance, or to violations of safety regulations.

A copy of the agenda may be obtained by contacting: Sharon Day, Executive Assistant, Commercial Motor Vehicle Review Board, Rhyne Building, Traffic Engineering and Operations Office, 2740 Centerview Dr., Tallahassee, FL 32301

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 48 days before the workshop/meeting by contacting: Sharon Day, Executive Assistant. 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).

The Florida **Department of Transportation**, District Five announces a public hearing to which all persons are invited.

DATE AND TIMES: August 18, 2011, Open House: 5:30 p.m. – 7:30 p.m.; Presentation: 6:15 p.m.

PLACE: Altamonte Springs City Hall, 225 Newburyport Avenue, Altamonte Springs, Florida

GENERAL SUBJECT MATTER TO BE CONSIDERED: FM Project: 238002-3-52, SR 436 at Robin Road – Turn Lane and Median Modifications. To correct a crash trend, the westbound directional median opening at Robin Road will be closed. The project will also extend the eastbound left turn lane at the signal serving the shopping plaza just east of Robin Road.

A copy of the agenda may be obtained by contacting: A flyer will be distributed at the hearing and also mailed to affected property owners.

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For more information, you may contact: Ms. Angela Wilhelm, (386)943-5333, angela.wilhelm@dot.state.fl.us.

BOARD OF TRUSTEES OF INTERNAL IMPROVEMENT TRUST FUND

The Florida **Department of Environmental Protection**, Office of Coastal and Aquatic Managed Areas announces a public meeting to which all persons are invited.

DATE AND TIME: Wednesday, September 7, 2011, 6:30 p.m. – 9:30 p.m.

PLACE: University of Miami, Rosenstiel School of Marine and Atmospheric Science Auditorium, 4600 Rickenbacker Causeway, Miami FL 33149

GENERAL SUBJECT MATTER TO BE CONSIDERED: The purpose is to receive public comment on the draft Biscayne Bay Aquatic Preserves Management Plan.

A copy of the draft plan will be available for viewing starting July 29, 2011 at www.dep.state.fl.us/coastal. The Biscayne Bay Aquatic Preserves Advisory Committee will be participating.

A copy of the agenda may be obtained by contacting: Aquatic Preserve Manager, Pamela Sweeney by e-mail: Pamela.Sweeney@dep.state.fl.us by phone: (305)795-3486, or by mail: Biscayne Bay Environmental Center, 1277 N.E. 79th Street Causeway, Miami, FL 33138-4206.

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, Pamela Sweeney at (305)795-3486. 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).

The Florida **Department of Environmental Protection,** Office of Coastal and Aquatic Managed Areas announces a public meeting to which all persons are invited.

DATE AND TIME: Thursday, September 8, 2011, 10:00 a.m. – 3:00 p.m.

PLACE: University of Miami, Rosenstiel School of Marine and Atmospheric Science Seminar Room, 4600 Rickenbacker Causeway, Miami, FL 33149

GENERAL SUBJECT MATTER TO BE CONSIDERED: The purpose is for the members of the Advisory Committee to discuss the revision of the Biscayne Bay Aquatic Preserves Management Plan.

A copy of the agenda may be obtained by contacting: Aquatic Preserve Manager, Pamela Sweeney by e-mail: Pamela.Sweeney@dep.state.fl.us, by phone: (305)795-3486 or by mail: Biscayne Bay Environmental Center, 1277 N.E. 79th Street Causeway, Miami, FL 33138-4206.

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PUBLIC SERVICE COMMISSION

The Florida **Public Service Commission** announces a status conference in the following docket to which all persons are invited.

DATE AND TIME: Monday, August 8, 2011, 9:30 a.m.

PLACE: Commission Hearing Room 148, Betty Easley Conference Center, 4075 Esplanade Way, Tallahassee, Florida

GENERAL SUBJECT MATTER TO BE CONSIDERED: Docket No.100437-EI – Examination of the outage and replacement fuel/power costs associated with the CR3 steam generator replacement project, by Progress Energy Florida, Inc.

The purpose of the conference is to discuss the scope of the docket and the case schedule. One or more of the Commissioners of the Florida Public Service Commission may attend and participate in this conference. For questions, contact Commission staff, Lisa Bennett at (850)413-6230.

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In accordance with the American with Disabilities Act, persons needing a special accommodation to participate at this proceeding should contact the Office of Commission Clerk no later than five days prior to the conference at 2540 Shumard Oak Boulevard, Tallahassee, Florida 32399-0850, via 1(800)955-8770 (Voice) or 1(800)955-8771 (TDD), Florida Relay Service.

REGIONAL PLANNING COUNCILS

The **West Florida Regional Planning Council** announces a public meeting to which all persons are invited.

DATE AND TIMES: Monday, August 15, 2011, 4:00 p.m.; Executive Committee Meeting, 3:00 p.m.

PLACE: Crestview City Hall, 198 North Wilson Street, Crestview, FL

GENERAL SUBJECT MATTER TO BE CONSIDERED: General business of the Council and the above referenced Committee.

A copy of the agenda may be obtained by contacting: Deb Brown at (850)332-7976, ext. 235.

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 2 days before the workshop/meeting by contacting: WFRPC at (850)332-7976. If you are hearing or

Florida Department of Environmental Protection • Office of Coastal & Aquatic Managed Areas

Biscayne Bay Aquatic Preserves Management Planning

Public Meeting

Wednesday, Sept. 7, 2011, 6:30 p.m.

University of Miami
Rosenstiel School of Marine
and Atmospheric Science Auditorium
4600 Rickenbacker Causeway
Miami, Florida 33149

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), a 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. A ten-year plan has been drafted to manage Biscayne Bay Aquatic Preserves. CAMA is seeking input on the draft Biscayne Bay Aquatic Preserves Management Plan.

Meeting objectives:

1. Review purpose for developing the Biscayne Bay Aquatic Preserves Management Plan and discuss the approval process.
2. Present current draft plan with a focus on issues, goals, objectives and strategies.
3. Receive input on the draft management plan.

For more information, please contact Pamela Sweeney, (305) 795-3486 / Biscayne.Bay@dep.state.fl.us or visit our website at www.aquaticpreserves.org. Written comments are welcome and can be submitted via fax: (850) 245-2110, Attn: Biscayne Bay; or email Biscayne.Bay@dep.state.fl.us. on or before September 22, 2011.

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 Pamela Sweeney at (305) 795-3486 or Biscayne.Bay@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 was 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 #NA10NOS4190178. 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. July 2011.

C.2.3 / ***Summary of the Formal Public Meeting(s)***

Public comments have been reviewed and incorporated, as appropriate, within the management plan. The meeting summary is below but for a full list of comments received, contact the Biscayne Bay Aquatic Preserves office at 1277 NE 79th Street Causeway, Miami, Florida 33138-4206, 305/795-3486.

Biscayne Bay Aquatic Preserves (BBAP) Management Plan
Public Hearing

Wednesday, September 7, 2011, 6:30 – 9:30 p.m.

Facilitated by Dr. Lisa Krimsky
University of Miami, Rosenstiel School of Marine and Atmospheric Science
4600 Rickenbacker Causeway
Miami, FL 33149

Welcome, introductions and housekeeping [Sweeney]

Presentation of Biscayne Bay Aquatic Preserves [Sweeney]

Management plan process [Isom]

Public comment process (fill out comment card, name will be called, 2 minute limit on speakers with option of additional 2 minutes after everyone's had a chance to speak, September 22 deadline to submit comments) [Krimsky]

Public Comments:

Stephanie Cornejo (Tropical Audubon Society)- Thanked all for saving BBAP via grassroots efforts. Six points: 1) future of BBAP; 2) quantity and timing of water input; 3) water quality concerns (new Class III standards); 4) climate change (not mentioned enough in the plan); 5) CAMA's priority for the preserves; 6) BBAP rule-making process.

Don Pybas- Bay dependent economic indicators are not described enough in the plan. Passive boating type facilities. Need to maintain current public access.

Captain Dan Kipnis- Port of Miami dredging will cause turbidity and fish kills which will impact corals and seagrasses. There are 65,467,000 user days annually on Biscayne Bay.

Blanca Mesa (Sierra Club and Friends of Biscayne Bay)- Port of Miami dredging. Florida reef system under stress. What is DEP going to do to protect the resources within BBAP? Secondary and cumulative impacts from the dredging aren't known.

Bob Skinner (Isaac Walton League)- Against Port of Miami. Port would cause problems with business and environment of area. Unnecessary business expense.

Steven Mahoney (Sierra Club and self)- Concerned about turbidity from dredging in Port of Miami. Corals will be severely impacted.

Larry Harris- Concerned about water and sewer infrastructure impacts to bay from sewage spills into the bay.

Stephanie Cornejo (2) (Tropical Audubon Society)- Wanted to know BBAP's current budget. DEP's policy has changed dramatically concerning the numeric nutrient criteria. How is CAMA taking climate change into account? Doesn't seem aggressive enough in light of the size of the projected problem relative to BBAP.

Kim Ogren- Having a draft plan available would have been nice. What is CAMA's role in regulatory and enforcement matters?

David Neblet (lawyer familiar with maritime law, is an avid fisherman)- Reviewed public access alternatives set forth. Alternative #5 is a red herring put out. No take, no anchor zones. (*Comments were regarding Biscayne National Park's management plan.*)

Alexis Segal (Biscayne Bay Waterkeeper Executive Director)- Port of Miami. May 4, 2011 CAMA provided insightful comments on Port of Miami that the environmental impact statement used was old (2004) regarding potential coral impacts. How were CAMA's comments incorporated in the draft permit?

Christopher Mallet- Sections up for closure. Money is made and spent in tournaments. Should not close area. Takes exception to Alternatives 3-5.

(*Comments were regarding Biscayne National Park's management plan.*)

Sam van Leer (Urban Paradise Guild Executive Director)- Concerned with deep water dredge for Port of Miami. 70% of GDP ???… Concerned about mitigation. Monitoring of mitigation sites is only five years.

Juan Comadero- Water quality is outrageous. Fish can't live in bad water. Dredging will ruin quality of water. Biggest battle in South Florida is water quality.

Sam van Leer (2) (Urban Paradise Guild Executive Director)- Curtains proposed to limit turbidity will not be adequate in the Port of Miami dredging.

Blanca Mesa (2)- Urges everyone to contact Sierra Club and Audubon Society to make sure Port of Miami project is done appropriately. Check Friends of Virginia Key website.

Joe Degray (Sierra Club and Tropical Audubon Society)- His father was a pilot and flew all over the world. His father said there is no bay as beautiful as Biscayne Bay. Water quality has been lost over the years.

Stephanie Cornejo (3) (Tropical Audubon Society)- Concerned about nuclear expansion and dredging within/around the bay. More resources need to be dedicated for management and there needs to be more coordination with the National Park Service.

Thanked everyone for their participation and closed. [Sweeney]

Goals, Objectives, and Strategies Table

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 "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
Issue One: Water Quality and Quantity				
Goal 1: Maintain and improve water quality within and entering the preserves to meet the needs of the natural resources.				
Objective 1: Support local, state and federal efforts to produce a status and trends analysis of water quality in Biscayne Bay.				
Strategy 1: Support the work of county and state staff to compile and summarize a 30 year water quality data set.	Ecosystem Science	2013-2014	2 years	$3,000
Strategy 2: Support and assist in the improvement of the existing water quality monitoring network to ensure that monitoring provides sufficient quality and quantity of data.	Ecosystem Science	2012-2013	Recurring	$30,000
Strategy 3: Identify sources of pollutants and sources of turbidity impacting BBAP and its tributaries, with specific focus on the Miami River.	Ecosystem Science	2012-2013	Recurring	$10,000
Strategy 4: Support the identification of gaps in current sediment testing programs with particular focus on identifying loads of PCB concentrations, heavy metals, petroleum hydrocarbons, and other insecticides, pesticides, and contaminants that may be present.	Ecosystem Science	2014-2015	Recurring	$10,000
Strategy 5: Support the development of total maximum daily load levels for Biscayne Bay and its tributaries.	Resource Management	2012-2013	3 years	$1,000
Strategy 6: Support the development of nutrient criteria protective of Biscayne Bay and Card Sound.	Resource Management	2012-2013	3 years	$500
Strategy 7: Facilitate access by the public and other stakeholders to historical data and resource information.	Resource Management	2014-2015	1 year	$250
Strategy 8: Work with county government partners to include Biscayne Bay in the National Estuary Program.	Resource Management	2014-2015	3 years	$1,000
Strategy 9: Partner with DEP's Coral Reef Conservation Program to support and promote projects to reduce marine debris and land based sources of pollution.	Resource Management	2012-2013	Recurring	$500
Strategy 10: Facilitate logistical, financial, and/or staff support that would allow Miami-Dade County, Biscayne National Park, the South Florida Water Management District, Florida International University, and other institutions to expand their water quality monitoring efforts.	Resource Management	2015-2016	Recurring	$10,000
Strategy 11: Implement a citizen science water quality monitoring network to enhance existing monitoring with volunteers and to instill in the community an appreciation of the benefits of restoration, enhancement and management of natural resources.	Education and Outreach	2014-2015	Recurring	$3,000

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
Objective 2: Reduce water quality impacts to surface water and groundwater caused by stormwater and septic system sources within the watershed.				
Strategy 1: Facilitate the inventory of stormwater drains and identify future improvement needs and incorporate data into GIS map.	Resource Management	2012-2013	4 years	$1,000
Strategy 2: Support stormwater system retrofitting at the municipal, county and state levels and facilitate dialog to encourage this to happen.	Resource Management	2014-2015	Recurring	$500
Strategy 3: Facilitate the inventory of existing municipalities or portions thereof still using septic systems and incorporate data into GIS map.	Resource Management	2012-2013	4 years	$500
Strategy 4: Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and relevant best management practices.	Resource Management	2012-2013	Recurring	$500
Objective 3: Preserve natural shorelines and restore armored shorelines adjacent to the aquatic preserve to maintain or restore water quality and natural resources.				
Strategy 1: Identify and support acquisition of lands that, if acquired, directly benefit the preserves' natural resources.	Resource Management	2015-2016	2 years	$500
Strategy 2: BBAP staff can support the regulatory permitting process by informing decisions made by regulatory staff regarding resources present in the AP.	Resource Management	2012-2013	Recurring	$3,000
Strategy 3: Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program that integrates removal and documentation of marine debris, wildlife surveys, and habitat restoration and enhancement projects including exotic plant removal.	Resource Management	2013-2014	Recurring	$8,000
Strategy 4: Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	Resource Management	2013-2014	Recurring	$3,000
Strategy 5: Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	Education and Outreach	2012-2013	Recurring	$1,000
Strategy 6: Implement new and/or enhance existing marine debris and pollution removal programs such as DEP's Clean Boater, Marina, and Boatyard Programs to incorporate the community in restoration, enhancement and management of natural resources.	Education and Outreach	2013-2014	3 years	$2,500
Objective 4: Protect the current quantity and quality of fresh water being received through specific tidally connected waterways.				
Strategy 1: Support the Biscayne Bay Coastal Wetlands portion of the Comprehensive Everglades Restoration Plan, with particular attention paid to source of water slated for use in flooding coastal wetlands.	Resource Management	2012-2013	Recurring	$1,000
Strategy 2: Support development of water reservation rule to protect existing levels of freshwater received in all areas of Biscayne Bay.	Ecosystem Science	2012-2013	5 years	$500

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
Objective 5: Protect and restore seagrasses and habitat suitable for seagrass growth.				
Strategy 1: Facilitate the funding for or expansion of existing aerial photography to assess incidence of scarring, progress of restoration, and composition of benthic community where the resolution is such that these parameters can be discerned and digitized in GIS.	Ecosystem Science	2017-2018	1 year	$3,000
Strategy 2: Continue to coordinate with law enforcement through training opportunities, monthly meetings and other venues where natural resource information and roadblocks to effective enforcement against environmental violations can be discussed and better understood.	Resource Management	2013-2014	Recurring	$6,000
Strategy 3: In collaboration with FWC, local governments and law enforcement, review outcomes of pilot mooring projects and facilitate management of existing mooring areas through collaboration with law enforcement and local governments in order to decrease impacts to the benthic community and water quality.	Resource Management	2016-2017	4 years	$1,000
Strategy 4: Work with law enforcement and partnering resource agencies to minimize the number of derelict vessels within BBAP boundaries.	Resource Management	2014-2015	Recurring	$10,000
Strategy 5: Continue to develop curriculum for teachers as well as presentations and activities for the public of all ages to learn about the ecosystem services provided by Biscayne Bay resources and the natural history of Biscayne Bay.	Education and Outreach	2012-2013	Recurring	$5,000
Goal 2: Increase public and industry awareness about water quality issues in BBAP and what actions can be taken to improve water quality.				
Objective 1: Inform the public and partners about water quality conditions within BBAP.				
Strategy 1: Develop a "report card" for Biscayne Bay with easy-to-understand but pertinent information about the status of the health of Biscayne Bay with a focus on water quality, submerged aquatic vegetation, hardbottom community, and possibly other parameters such as abundance and diversity of species if that data is available.	Ecosystem Science	2016-2017	3 years	$3,000
Objective 2: Facilitate knowledge and understanding of how activities in the watershed impact the BBAP.				
Strategy 1: Coordinate and/or participate in three public presentations per year, including outreach events where staff can provide information to the public regarding how reduce negative impacts on water quality.	Education and Outreach	2012-2013	Recurring	$2,000
Strategy 2: Encourage homeowners to maintain septic systems and educate them on the benefits of joining municipal or county sewage systems.	Education and Outreach	2015-2016	3 years	$5,000
Strategy 3: Expand existing and previous "drains to bay" signage program along storm drains across watershed.	Education and Outreach	2016-2017	3 years	$1,500
Strategy 4: Engage in outreach and education with decision-makers at all levels of government and serve as a point of contact for information regarding the health of Biscayne Bay's natural resources.	Education and Outreach	2015-2016	Recurring	$2,000

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
Issue Two: Habitat Loss				
Goal 1: Protect Biscayne Bay from impacts related to land use changes that disrupt the ecological functions of natural resources within CAMA's purview.				
Objective 1: Reduce impacts to submerged resources by coastal construction.				
Strategy 1: Continue to partner with agencies and/or secure funding for research aimed at understanding the direct impacts of coastal construction projects and to develop effective avoidance and minimization criteria.	Ecosystem Science	2017-2018	Recurring	$500
Strategy 2: Partner with local, state, and/or federal agencies to obtain high resolution aerial photography as it becomes available to track changes in Biscayne Bay's coastline and benthic community from coastal construction projects such as seawalls, docks, and marinas as well as propeller damage.	Ecosystem Science	2016-2017	2 years	$10,000
Strategy 3: Use digital photos as they are updated to help assess cumulative impacts to natural resources.	Resource Management	2014-2015	Recurring	$2,000
Strategy 4: Encourage, when possible, maintenance of existing boat ramps and marinas as opposed to creation of new facilities that would introduce new impacts.	Resource Management	2013-2014	Recurring	$200
Strategy 5: Partner with local, state and federal agencies to secure funding and conduct marine habitat restoration projects and employ non-regulatory methodologies to reduce marine habitat impacts.	Resource Management	2015-2016	Recurring	$10,000
Objective 2: Participate in the regulatory process by which small and large coastal construction projects are permitted in the Biscayne Bay watershed.				
Strategy 1: Create a tool with a mapping component to assess cumulative impacts on natural resources that can be used by CAMA and regulatory staff from all relevant regulatory agencies.	Ecosystem Science	2017-2018	3 years	$3,000
Strategy 2: Conduct training for and coordinate on-site field surveys with staff of DEP's Southeast and South District offices.	Resource Management	2012-2013	Recurring	$1,000
Strategy 3: Participate in reviews of Comprehensive Development Master Plans and management plans of adjacent managed areas.	Resource Management	2014-2015	Recurring	$200
Strategy 4: Partner with local, state (non-DEP) and federal agencies on applications for proposed construction projects to offer biological survey information or public interest projects.	Resource Management	2012-2013	Recurring	$200
Strategy 5: Work with Miami-Dade County staff and leadership to allow restoration-focused permits to fill seagrass scars and other habitat restoration activities to be evaluated as providing a benefit to Biscayne Bay ecology.	Resource Management	2013-2014	3 years	$500
Strategy 6: Partner with municipal, local, and state government agencies to promote the appropriate usage of available fill for use in restoration projects.	Resource Management	2020-2021	Recurring	$500
Strategy 7: Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	Education and Outreach	2012-2013	Recurring	$2,000

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
Objective 3: Describe and/or quantify function of ecological services provided by coastal habitats.				
Strategy 1: Quantify and better understand loss of native biodiversity and ecosystem integrity within BBAP boundaries.	Resource Management	2018-2019	3 years	$7,000
Strategy 2: Better understand the form and function as well as the interactions between flora and fauna within BBAP boundaries and the stresses experienced at the habitat or organism level.	Ecosystem Science	2017-2018	3 years	$10,000
Strategy 3: Partner with other resource agencies and non-governmental organizations to better understand potential impacts to human health by way of studying the health of Biscayne Bay flora and fauna.	Ecosystem Science	2016-2017	3 years	$25,000
Strategy 4: When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	Ecosystem Science	2014-2015	Recurring	$5,000
Strategy 5: Convey knowledge gained regarding the function of ecosystem services provided by coastal habitats to the public and students, from grade school through university.	Education and Outreach	2012-2013	Recurring	$2,000
Issue Three: Obstacles in Natural Resource Management				
Goal 1: Document the natural resources with the preserves.				
Objective 1: Establish a baseline and/or add to the current knowledge base of the current location, composition and abundance of the various habitat types and associated fauna, with specific focus on seagrass habitat.				
Strategy 1: Partner with other natural resource agencies who capture aerial photography of managed areas to obtain photography of BBAP for use in BBAP geodatabase.	Ecosystem Science	2018-2019	2 years	$1,000
Strategy 2: Conduct wildlife and groundtruthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.	Ecosystem Science	2012-2013	Recurring	$10,000
Strategy 3: Partner with other resource agencies and non-governmental organizations to support invasive exotic plant and animal eradication, such as lionfish, by advertising exotic plant and animal removal volunteer activities at outreach events.	Resource Management	2014-2015	Recurring	$3,000
Strategy 4: Continue to partner with the USCG and local and state agencies to participate in oil disaster Area Contingency Planning.	Resource Management	2012-2013	Recurring	$1,000
Objective 2: Develop specific restoration goals for impacted seagrass areas.				
Strategy 1: Partner with other natural resource agencies to develop an environmental impact statement similar to what was drafted for the Florida Keys National Marine Sanctuary so that BBAP is poised to apply for competitive funding for restoration projects.	Ecosystem Science	2015-2016	3 years	$25,000
Strategy 2: Work with Miami-Dade County to obtain permits in a timely fashion that are needed to conduct seagrass restoration in BBAP.	Resource Management	2015-2016	2 years	$500
Strategy 3: Work with the FWC as the lead along with other local, state and federal resource agencies to develop a restoration plan for Johnson's seagrass and its associated critical habitat.	Resource Management	2013-2014	2 years	$1,000

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
Strategy 4: Coordinate with other resource agencies and law enforcement to support efforts to address derelict and/or illegal fisheries gear and harvesting activities.	Resource Management	2013-2014	Recurring	$20,000
Strategy 5: Work with law enforcement to encourage enforcement of the seagrass law prohibiting destruction of seagrasses in aquatic preserves.	Resource Management	2012-2013	Recurring	$1,000
Strategy 6: Work with other agencies to respond to vessel groundings and quantify injuries through the use of surveys and Trimble™ GPS technology to map location, size, and volume of injury.	Resource Management	2014-2015	Recurring	$3,000
Strategy 7: Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff.	Resource Management	2013-2014	Recurring	$500
Strategy 8: Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	Resource Management	2015-2016	Recurring	$10,000
Strategy 9: When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	Ecosystem Science	2015-2016	Recurring	$12,000
Objective 3: Expand the benthic monitoring program in Biscayne Bay with particular focus on the northern bay, to include more frequent monitoring of existing sites and include additional sites.				
Strategy 1: Partner with other resource agencies to conduct a survey of the preserves' boundaries for an updated account of acreage and scope of protected areas.	Ecosystem Science	2021-2022	1 year	$50,000
Strategy 2: Obtain funding to extend baseline monitoring being conducted ahead of CERP projects coming online.	Ecosystem Science	2012-2013	5 years	$75,000
Strategy 3: Increase the number of epibenthic monitoring sites within the preserves' boundaries.	Ecosystem Science	2014-2015	Recurring	$25,000
Goal 2: Facilitate knowledge about and the importance of BBAP's natural resources and history and cultural resources to the public.				
Objective 1: Partner with other agencies and/or non-governmental organizations to promote greater understanding and interpretation of resources including threats to those resources that businesses, residents, and visitors can minimize.				
Strategy 1: Partner with county and municipal governments to provide environmental education related to outstanding cultural sites.	Education and Outreach	2013-2014	Recurring	$5,000
Strategy 2: Partner with county and municipal governments to provide environmental education related to outstanding natural resource sites.	Education and Outreach	2013-2014	Recurring	$10,000
Strategy 3: Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	Resource Management	2012-2013	Recurring	$10,000
Strategy 4: Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	Resource Management	2014-2015	Recurring	$20,000

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
Strategy 5: Use existing programs as a guide to develop and implement a citizen science monitoring program specifically focused on documenting the affects of climate change in south Florida.	Resource Management	2015-2016	5 years	$10,000
Strategy 6: Work with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.	Resource Management	2012-2013	Recurring	$500
Strategy 7: Facilitate a greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.	Resource Management	2012-2013	Recurring	$1,000
Strategy 8: Work with CAMA legal staff, law enforcement and local and state legal staff to educate magistrates and judges to prevent the dismissal of environmental-related violations such as manatee zone or fisheries violations.	Resource Management	2016-2017	3 years	$1,000
Objective 2: Partner with state, county and municipal parks to incorporate information about BBAP history and resources into guided tours, signage, staff training, and promotional materials.				
Strategy 1: Encourage tour guides as well as county and municipal park staff to present information about the natural and cultural resources of Biscayne Bay as part of a tour of BBAP.	Education and Outreach	2013-2014	Recurring	$1,000
Issue Four: Public Awareness, Access, and Use				
Goal 1: Maintain a safe environment for Biscayne Bay's wildlife, habitats and user groups.				
Objective 1: Facilitate research to identify human use conflicts with natural resources.				
Strategy 1: Partner with other agencies and organizations to advance to the next phase of the Biscayne Bay Economic Study where ecosystem services of natural resources and impacts of uses are quantified.	Resource Management	2014-2015	3 years	$50,000
Strategy 2: Work with regulatory staff, law enforcement, legal staff and resource management staff from other agencies to address uses of BBAP that are not water-dependent, are potentially illegal, or harm resources.	Resource Management	2013-2014	Recurring	$500
Strategy 3: Digitize, analyze, and compile all aerial photos into a GIS geodatabase that is updated periodically to help assess cumulative impacts.	Resource Management	2018-2019	2 years	$6,000
Strategy 4: Facilitate Biscayne Bay-specific boater education and safety given that over 60% of boating accidents in Miami-Dade County involve boat operators with no formal boating education.	Education and Outreach	2017-2018	Recurring	$5,000
Strategy 5: Continue to conduct formal and informal outreach activities in counties BBAP serves, with particular focus on underserved communities, to promote awareness and appreciation of BBAP's natural resources to foster stewardship and appreciation.	Education and Outreach	2012-2013	Recurring	$4,000
Strategy 6: Partner with and actively support the National Park Service's effort to have a visitor center near downtown Miami where the opportunity exists to educate the visiting public about BBAP resources.	Education and Outreach	2016-2017	3 years	$100,000
Strategy 7: Support development of a Biscayne Bay-appropriate Eco-Mariner Program as developed and implemented in Everglades National Park by the National Parks Conservation Association.	Education and Outreach	2015-2016	2 years	$50,000

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
Objective 2: Reduce the amount of debris, contaminants, and resource injuries associated with user group activities.				
Strategy 1: Determine effectiveness and management practices of mooring fields and potentially create new mooring fields to better protect resources from direct impacts and indirect impacts.	Ecosystem Science	2014-2015	3 years	$15,000
Strategy 2: Better understand consumptive use impacts from fisheries such as shrimping, crabbing, and others that employ gear and methods that can be harmful to Biscayne Bay resources while recognizing their importance to the local economy.	Ecosystem Science	2020-2021	3 years	$6,000
Objective 3: Identify ways to increase and enhance effective on-water law enforcement patrols in BBAP.				
Strategy 1: Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.	Ecosystem Science	2014-2015	Recurring	$2,000
Strategy 2: Coordinate increasing or replacing regulatory signage and buoys so they are correct, legible and enforceable.	Ecosystem Science	2018-2019	Recurring	$1,500
Strategy 3: Partner with other agencies and organizations to identify funding sources to conduct greater or targeted marine law enforcement.	Resource Management	2014-2015	Recurring	$2,000
Strategy 4: Work with CAMA legal staff, law enforcement and local and state legal staff to implement a class such as that run by Biscayne National Park.	Resource Management	2016-2017	3 years	$1,500
Goal 2: Promote low-impact, sustainable recreational opportunities.				
Objective 1: Increase awareness of non-consumptive use opportunities.				
Strategy 1: Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.	Education and Outreach	2014-2015	Recurring	$2,000
Objective 2: Identify and support appropriate locations for paddling launch sites and desirable destinations to access via kayak, canoe, or paddleboard.				
Strategy 1: Develop an awareness and access guide to be used by paddlers and other passive recreational users to be disseminated by concessionaires, businesses, and leaders of organizations.	Education and Outreach	2012-2013	Recurring	$5,000
Objective 3: Provide formal and informal opportunities for various types of user groups.				
Strategy 1: Participate and assist in the coordination of informal teaching opportunities.	Education and Outreach	2012-2013	Recurring	$3,000
Issue Five: Sustainable Economic Use and Viability				
Goal 1: Promote sustainable economic use and viability of Biscayne Bay Aquatic Preserves resources.				
Objective 1: Increase the number of local boatyards, marinas and local citizens who become members of DEP's Clean Boatyard, Clean Marina, or Clean Boater program, respectively.				
Strategy 1: Encourage vessel owners and/or operators to use pumpouts at marinas that offer services and overall to frequent marinas that are designed Clean Marinas.	Resource Management	2018-2019	4 years	$3,000
Strategy 2: Work more closely with DEP's Clean Marina, Boatyard, and Boater programs to advertise location of pumpout facilities, existence of Clean programs and access to guidelines.	Resource Management	2017-2018	Recurring	$5,000
Strategy 3: In coordination with DEP Clean Marina program staff, Sea Grant, and industry representatives, encourage boatyards, marinas and boaters, especially those in the Miami River, to join DEP's Clean programs.	Education and Outreach	2013-2014	Recurring	$2,500

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
Strategy 4: Work with agencies, Sea Grant, universities, and local non-governmental organizations to develop a volunteer monitoring program.	Ecosystem Science	2019-2020	3 years	$10,000
Objective 2: Coordinate with other resource agencies, law enforcement agencies, and institutions to evaluate what current commercial fisheries practices operate in Biscayne Bay today and what ecological impacts might be.				
Strategy 1: In coordination with FWC, compile historical and present data to determine number and type of commercial fishing operations including target species, incidence of bycatch, and type and location of gear set in Biscayne Bay or areas where wing nets or other gear is used.	Resource Management	2014-2015	3 years	$6,000
Strategy 2: Coordinate with local, state, and federal resource managers and law enforcement, namely FWC, to ensure that commercial fishing vessels' equipment is functioning properly to ensure protection of the benthic habitat and water quality.	Resource Management	2013-2014	Recurring	$250
Strategy 3: Partner with local, state, and federal agencies to encourage area colleges and universities to revisit past commercial fishing studies as well as other resource-related studies, now antiquated, that can be reproduced to determine species presence and abundance over time.	Resource Management	2014-2015	3 years	$25,000
Objective 3: Coordinate with other resource agencies, law enforcement agencies, and institutions to evaluate what current recreational fishing practices operate in Biscayne Bay today and what ecological impacts might be.				
Strategy 1: Partner with all levels of governmental agencies and non-governmental agencies to promote proper use of equipment and potential impacts of gear among recreational anglers.	Education and Outreach	2013-2014	3 years	$2,500
Objective 4: Reduce impacts from tourism-driven industries.				
Strategy 1: Determine what types of recreational tour operations are occurring in Biscayne Bay and its tributaries as well as the economic contribution of these endeavors and possible environmental impacts.	Resource Management	2013-2014	2 years	$2,500
Strategy 2: Determine what kinds of on-water transportation operations occur in Biscayne Bay and its tributaries including water taxis, ports, shipping, gasoline barges, and aircraft as well as the economic contribution of these endeavors.	Resource Management	2013-2014	2 years	$2,000
Strategy 3: Work with local and municipal governments on finding appropriate locations and types of activities for the filming industry and other on-water activities related to entertainment.	Resource Management	2012-2013	Recurring	$500

*D.2 / **Budget Table***

The following table provides a cost estimate for conducting the priority 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. This budget was developed using data from 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.

2012-2013 Cost Estimate

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Ecosystem Science			
Water Quality and Quantity	Support and assist in the improvement of the existing water quality monitoring network to ensure that monitoring provides sufficient quality and quantity of data.	2012-2013	$30,000
Water Quality and Quantity	Identify sources of pollutants and sources of turbidity impacting BBAP and its tributaries, with specific focus on the Miami River.	2012-2013	$10,000
Water Quality and Quantity	Support development of water reservation rule to protect existing levels of freshwater received in all areas of Biscayne Bay.	2012-2013	$500
Obstacles in Natural Resource Management	Conduct wildlife and groundtruthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.	2012-2013	$10,000
Obstacles in Natural Resource Management	Obtain funding to extend baseline monitoring being conducted ahead of CERP projects coming online.	2012-2013	$30,000
	Ecosystem Science Subtotal		$80,500
Resource Management			
Water Quality and Quantity	Support the development of total maximum daily load levels for Biscayne Bay and its tributaries.	2012-2013	$1,000
Water Quality and Quantity	Support the development of nutrient criteria protective of Biscayne Bay and Card Sound.	2012-2013	$500
Water Quality and Quantity	Facilitate the inventory of stormwater drains and identify future improvement needs and incorporate data into GIS map.	2012-2013	$1,000
Water Quality and Quantity	Facilitate the inventory of existing municipalities or portions thereof still using septic systems and incorporate data into GIS map.	2012-2013	$500
Water Quality and Quantity	Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and relevant best management practices.	2012-2013	$500
Water Quality and Quantity	Partner with DEP's Coral Reef Conservation Program to support and promote marine debris and land based sources of pollution projects	2012-2013	$500
Water Quality and Quantity	Support the Biscayne Bay Coastal Wetlands portion of the Comprehensive Everglades Restoration Plan, with particular attention paid to source of water slated for use in flooding coastal wetlands.	2012-2013	$1,000
Habitat Loss	Conduct training for and coordinate on-site field surveys with staff of DEP's Southeast and South District offices.	2012-2013	$1,000
Habitat Loss	Partner with local, state (non-DEP) and federal agencies on applications for proposed construction projects to offer biological survey information or public interest projects.	2012-2013	$200
Obstacles in Natural Resource Management	Continue to partner with the USCG and local and state agencies to participate in oil disaster Area Contingency Planning.	2012-2013	$1,000

2012-2013 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Obstacles in Natural Resource Management	Work with law enforcement to encourage enforcement of the seagrass law prohibiting destruction of seagrasses in aquatic preserves.	2012-2013	$1,000
Obstacles in Natural Resource Management	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Obstacles in Natural Resource Management	Work with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.	2012-2013	$500
Obstacles in Natural Resource Management	Facilitate a greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.	2012-2013	$1,000
Sustainable Economic Use and Viability	Work with local and municipal governments on finding appropriate locations and types of activities for the filming industry and other on-water activities related to entertainment.	2012-2013	$500
	Resource Management Subtotal		$20,200
Education & Outreach			
Water Quality and Quantity	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$1,000
Water Quality and Quantity	Continue to develop curriculum for teachers as well as presentations and activities for the public of all ages to learn about the ecosystem services provided by Biscayne Bay resources and the natural history of Biscayne Bay.	2012-2013	$5,000
Water Quality and Quantity	Coordinate and/or participate in three public presentations per year, including outreach events where staff can provide information to the public regarding how reduce negative impacts on water quality.	2012-2013	$2,000
Habitat Loss	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$2,000
Habitat Loss	Convey knowledge gained regarding the function of ecosystem services provided by coastal habitats to the public and students, from grade school through university.	2012-2013	$2,000
Public Awareness, Access, and Use	Continue to conduct formal and informal outreach activities in counties BBAP serves, with particular focus on underserved communities, to promote awareness and appreciation of BBAP's natural resources to foster stewardship and appreciation.	2012-2013	$4,000
Public Awareness, Access, and Use	Develop an awareness and access guide to be used by paddlers and other passive recreational users to be disseminated by concessionaires, businesses, and leaders of organizations.	2012-2013	$5,000
Public Awareness, Access, and Use	Participate and assist in the coordination of informal teaching opportunities.	2012-2013	$3,000
Public Awareness, Access, and Use	Partner with all levels of governmental agencies and non-governmental agencies to promote proper use of equipment and potential impacts of gear among recreational anglers.	2013-2014	$2,500
	Education & Outreach Subtotal		$26,500
2012-2013 Total			**$127,200**

2013-2014 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Ecosystem Science			
Water Quality and Quantity	Support the work of county and state staff to compile and summarize a 30 year water quality data set.	2013-2014	$3,000
Water Quality and Quantity	Support and assist in the improvement of the existing water quality monitoring network to ensure that monitoring provides sufficient quality and quantity of data.	2012-2013	$30,000
Water Quality and Quantity	Identify sources of pollutants and sources of turbidity impacting BBAP and its tributaries, with specific focus on the Miami River.	2012-2013	$10,000
Water Quality and Quantity	Support development of water reservation rule to protect existing levels of freshwater received in all areas of Biscayne Bay.	2012-2013	$500
Obstacles in Natural Resource Management	Conduct wildlife and groundtruthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.	2012-2013	$10,000
Obstacles in Natural Resource Management	Obtain funding to extend baseline monitoring being conducted ahead of CERP projects coming online.	2012-2013	$30,000
	Ecosystem Science Subtotal		$83,500
Resource Management			
Water Quality and Quantity	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Water Quality and Quantity	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2013-2014	$3,000
Water Quality and Quantity	Continue to coordinate with law enforcement through training opportunities, monthly meetings and other venues where natural resource information and roadblocks to effective enforcement against environmental violations can be discussed and better understood.	2013-2014	$6,000
Water Quality and Quantity	Support the development of total maximum daily load levels for Biscayne Bay and its tributaries.	2012-2013	$1,000
Water Quality and Quantity	Support the development of nutrient criteria protective of Biscayne Bay and Card Sound.	2012-2013	$500
Water Quality and Quantity	Facilitate the inventory of stormwater drains and identify future improvement needs and incorporate data into GIS map.	2012-2013	$1,000
Water Quality and Quantity	Facilitate the inventory of existing municipalities or portions thereof still using septic systems and incorporate data into GIS map.	2012-2013	$500
Water Quality and Quantity	Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and relevant best management practices.	2012-2013	$500
Water Quality and Quantity	Partner with DEP's Coral Reef Conservation Program to support and promote marine debris and land based sources of pollution projects	2012-2013	$500
Water Quality and Quantity	Support the Biscayne Bay Coastal Wetlands portion of the Comprehensive Everglades Restoration Plan, with particular attention paid to source of water slated for use in flooding coastal wetlands.	2012-2013	$1,000
Habitat Loss	Conduct training for and coordinate on-site field surveys with staff of DEP's Southeast and South District offices.	2012-2013	$1,000

2013-2014 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Habitat Loss	Partner with local, state (non-DEP) and federal agencies on applications for proposed construction projects to offer biological survey information or public interest projects.	2012-2013	$200
Habitat Loss	Encourage, when possible, maintenance of existing boat ramps and marinas as opposed to creation of new facilities that would introduce new impacts.	2013-2014	$200
Habitat Loss	Work with Miami-Dade County staff and leadership to allow restoration-focused permits to fill seagrass scars and other habitat restoration activities to be evaluated as providing a benefit to Biscayne Bay ecology.	2013-2014	$500
Obstacles in Natural Resource Management	Work with the FWC as the lead along with other local, state and federal resource agencies to develop a restoration plan for Johnson's seagrass and its associated critical habitat.	2013-2014	$1,000
Obstacles in Natural Resource Management	Coordinate with other resource agencies and law enforcement to support efforts to address derelict and/or illegal fisheries gear and harvesting activities.	2013-2014	$20,000
Obstacles in Natural Resource Management	Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff.	2013-2014	$500
Obstacles in Natural Resource Management	Continue to partner with the USCG and local and state agencies to participate in oil disaster Area Contingency Planning.	2012-2013	$1,000
Obstacles in Natural Resource Management	Work with law enforcement to encourage enforcement of the seagrass law prohibiting destruction of seagrasses in aquatic preserves.	2012-2013	$1,000
Obstacles in Natural Resource Management	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Obstacles in Natural Resource Management	Work with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.	2012-2013	$500
Obstacles in Natural Resource Management	Facilitate a greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.	2012-2013	$1,000
Sustainable Economic Use and Viability	Work with local and municipal governments on finding appropriate locations and types of activities for the filming industry and other on-water activities related to entertainment.	2012-2013	$500
Public Awareness, Access, and Use	Work with regulatory staff, law enforcement, legal staff and resource management staff from other agencies to address uses of BBAP that are not water-dependent, are potentially illegal, or harm resources.	2013-2014	$500
Sustainable Economic Use and Viability	Coordinate with local, state, and federal resource managers and law enforcement, namely FWC, to ensure that commercial fishing vessels' equipment is functioning properly to ensure protection of the benthic habitat and water quality.	2013-2014	$250
Sustainable Economic Use and Viability	Determine what types of recreational tour operations are occurring in Biscayne Bay and its tributaries as well as the economic contribution of these endeavors and possible environmental impacts.	2013-2014	$2,500
Sustainable Economic Use and Viability	Determine what kinds of on-water transportation operations occur in Biscayne Bay and its tributaries including water taxis, ports, shipping, gasoline barges, and aircraft as well as the economic contribution of these endeavors.	2013-2014	$2,000
	Resource Management Subtotal		$66,650

2013-2014 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Education & Outreach			
Water Quality and Quantity	Implement new and/or enhance existing marine debris and pollution removal programs such as DEP's Clean Boater, Marina, and Boatyard Programs to incorporate the community in restoration, enhancement and management of natural resources.	2013-2014	$2,500
Water Quality and Quantity	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$1,000
Water Quality and Quantity	Continue to develop curriculum for teachers as well as presentations and activities for the public of all ages to learn about the ecosystem services provided by Biscayne Bay resources and the natural history of Biscayne Bay.	2012-2013	$5,000
Water Quality and Quantity	Coordinate and/or participate in three public presentations per year, including outreach events where staff can provide information to the public regarding how reduce negative impacts on water quality.	2012-2013	$2,000
Habitat Loss	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$2,000
Habitat Loss	Convey knowledge gained regarding the function of ecosystem services provided by coastal habitats to the public and students, from grade school through university.	2012-2013	$2,000
Obstacles in Natural Resource Management	Partner with county and municipal governments to provide environmental education related to outstanding cultural sites.	2013-2014	$5,000
Obstacles in Natural Resource Management	Partner with county and municipal governments to provide environmental education related to outstanding natural resource sites.	2013-2014	$10,000
Obstacles in Natural Resource Management	Encourage tour guides as well as county and municipal park staff to present information about the natural and cultural resources of Biscayne Bay as part of a tour of BBAP.	2013-2014	$1,000
Public Awareness, Access, and Use	Continue to conduct formal and informal outreach activities in counties BBAP serves, with particular focus on underserved communities, to promote awareness and appreciation of BBAP's natural resources to foster stewardship and appreciation.	2012-2013	$4,000
Public Awareness, Access, and Use	Develop an awareness and access guide to be used by paddlers and other passive recreational users to be disseminated by concessionaires, businesses, and leaders of organizations.	2012-2013	$5,000
Public Awareness, Access, and Use	Participate and assist in the coordination of informal teaching opportunities.	2012-2013	$3,000
Public Awareness, Access, and Use	Partner with all levels of governmental agencies and non-governmental agencies to promote proper use of equipment and potential impacts of gear among recreational anglers.	2013-2014	$2,500
Public Awareness, Access, and Use	In coordination with DEP Clean Marina program staff, Sea Grant, and industry representatives, encourage boatyards, marinas and boaters, especially those in the Miami River, to join DEP's Clean programs.	2013-2014	$2,500
Public Awareness, Access, and Use	Partner with all levels of governmental agencies and non-governmental agencies to promote proper use of equipment and potential impacts of gear among recreational anglers.	2013-2014	$2,500
	Education & Outreach Subtotal		$50,000
2013-2014 Total			**$200,150**

2014-2015 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Ecosystem Science			
Water Quality and Quantity	Support the identification of gaps in current sediment testing programs with particular focus on identifying loads of PCB concentrations, heavy metals, petroleum hydrocarbons, and other insecticides, pesticides, and contaminants that may be present.	2014-2015	$10,000
Water Quality and Quantity	Support and assist in the improvement of the existing water quality monitoring network to ensure that monitoring provides sufficient quality and quantity of data.	2012-2013	$30,000
Water Quality and Quantity	Identify sources of pollutants and sources of turbidity impacting BBAP and its tributaries, with specific focus on the Miami River.	2012-2013	$10,000
Water Quality and Quantity	Support development of water reservation rule to protect existing levels of freshwater received in all areas of Biscayne Bay.	2012-2013	$500
Water Quality and Quantity	Support the development of total maximum daily load levels for Biscayne Bay and its tributaries.	2012-2013	$1,000
Water Quality and Quantity	Support the development of nutrient criteria protective of Biscayne Bay and Card Sound.	2012-2013	$500
Water Quality and Quantity	Support the work of county and state staff to compile and summarize a 30 year water quality data set.	2013-2014	$3,000
Habitat Loss	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2014-2015	$5,000
Obstacles in Natural Resource Management	Conduct wildlife and groundtruthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.	2012-2013	$10,000
Obstacles in Natural Resource Management	Obtain funding to extend baseline monitoring being conducted ahead of CERP projects coming online.	2012-2013	$30,000
Obstacles in Natural Resource Management	Increase the number of epibenthic monitoring sites within the preserves' boundaries.	2014-2015	$25,000
Public Awareness, Access, and Use	Determine effectiveness and management practices of mooring fields and potentially create new mooring fields to better protect resources from direct impacts and indirect impacts.	2014-2015	$15,000
Public Awareness, Access, and Use	Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.	2014-2015	$2,000
	Ecosystem Science Subtotal		$142,000

Resource Management			
Water Quality and Quantity	Facilitate access by the public and other stakeholders to historical data and resource information.	2014-2015	$250
Water Quality and Quantity	Work with county government partners to include Biscayne Bay in the National Estuary Program.	2014-2015	$1,000
Water Quality and Quantity	Support stormwater system retrofitting at the municipal, county and state levels and facilitate dialog to encourage this to happen.	2014-2015	$500
Water Quality and Quantity	Work with law enforcement and partnering resource agencies to minimize the number of derelict vessels within BBAP boundaries.	2014-2015	$10,000
Water Quality and Quantity	Facilitate the inventory of stormwater drains and identify future improvement needs and incorporate data into GIS map.	2012-2013	$1,000

2014-2015 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Water Quality and Quantity	Facilitate the inventory of existing municipalities or portions thereof still using septic systems and incorporate data into GIS map.	2012-2013	$500
Water Quality and Quantity	Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and relevant best management practices.	2012-2013	$500
Water Quality and Quantity	Partner with DEP's Coral Reef Conservation Program to support and promote marine debris and land based sources of pollution projects	2012-2013	$500
Water Quality and Quantity	Support the Biscayne Bay Coastal Wetlands portion of the Comprehensive Everglades Restoration Plan, with particular attention paid to source of water slated for use in flooding coastal wetlands.	2012-2013	$1,000
Water Quality and Quantity	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Water Quality and Quantity	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2013-2014	$3,000
Water Quality and Quantity	Continue to coordinate with law enforcement through training opportunities, monthly meetings and other venues where natural resource information and roadblocks to effective enforcement against environmental violations can be discussed and better understood.	2013-2014	$6,000
Habitat Loss	Encourage, when possible, maintenance of existing boat ramps and marinas as opposed to creation of new facilities that would introduce new impacts.	2013-2014	$200
Habitat Loss	Work with Miami-Dade County staff and leadership to allow restoration-focused permits to fill seagrass scars and other habitat restoration activities to be evaluated as providing a benefit to Biscayne Bay ecology.	2013-2014	$500
Habitat Loss	Conduct training for and coordinate on-site field surveys with staff of DEP's Southeast and South District offices.	2012-2013	$1,000
Habitat Loss	Partner with local, state (non-DEP) and federal agencies on applications for proposed construction projects to offer biological survey information or public interest projects.	2012-2013	$200
Obstacles in Natural Resource Management	Work with the FWC as the lead along with other local, state and federal resource agencies to develop a restoration plan for Johnson's seagrass and its associated critical habitat.	2013-2014	$1,000
Obstacles in Natural Resource Management	Coordinate with other resource agencies and law enforcement to support efforts to address derelict and/or illegal fisheries gear and harvesting activities.	2013-2014	$20,000
Obstacles in Natural Resource Management	Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff.	2013-2014	$500
Obstacles in Natural Resource Management	Continue to partner with the USCG and local and state agencies to participate in oil disaster Area Contingency Planning.	2012-2013	$1,000
Obstacles in Natural Resource Management	Work with law enforcement to encourage enforcement of the seagrass law prohibiting destruction of seagrasses in aquatic preserves.	2012-2013	$1,000
Obstacles in Natural Resource Management	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000

2014-2015 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Obstacles in Natural Resource Management	Work with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.	2012-2013	$500
Obstacles in Natural Resource Management	Facilitate a greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.	2012-2013	$1,000
Sustainable Economic Use and Viability	Work with local and municipal governments on finding appropriate locations and types of activities for the filming industry and other on-water activities related to entertainment.	2012-2013	$500
Obstacles in Natural Resource Management	Work with other agencies to respond to vessel groundings and quantify injuries through the use of surveys and Trimble™ GPS technology to map location, size, and volume of injury.	2014-2015	$3,000
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2014-2015	$20,000
Public Awareness, Access, and Use	Work with regulatory staff, law enforcement, legal staff and resource management staff from other agencies to address uses of BBAP that are not water-dependent, are potentially illegal, or harm resources.	2013-2014	$500
Public Awareness, Access, and Use	Partner with other agencies and organizations to advance to the next phase of the Biscayne Bay Economic Study where ecosystem services of natural resources and impacts of uses are quantified.	2014-2015	$50,000
Public Awareness, Access, and Use	Partner with other agencies and organizations to identify funding sources to conduct greater or targeted marine law enforcement.	2014-2015	$2,000
Sustainable Economic Use and Viability	Coordinate with local, state, and federal resource managers and law enforcement, namely FWC, to ensure that commercial fishing vessels' equipment is functioning properly to ensure protection of the benthic habitat and water quality.	2013-2014	$250
Sustainable Economic Use and Viability	Determine what types of recreational tour operations are occurring in Biscayne Bay and its tributaries as well as the economic contribution of these endeavors and possible environmental impacts.	2013-2014	$2,500
Sustainable Economic Use and Viability	Determine what kinds of on-water transportation operations occur in Biscayne Bay and its tributaries including water taxis, ports, shipping, gasoline barges, and aircraft as well as the economic contribution of these endeavors.	2013-2014	$2,000
	Resource Management Subtotal		$151,900

Education & Outreach			
Water Quality and Quantity	Implement a citizen science water quality monitoring network to enhance existing monitoring with volunteers and to instill in the community an appreciation of the benefits of restoration, enhancement and management of natural resources.	2014-2015	$3,000
Water Quality and Quantity	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$1,000
Water Quality and Quantity	Continue to develop curriculum for teachers as well as presentations and activities for the public of all ages to learn about the ecosystem services provided by Biscayne Bay resources and the natural history of Biscayne Bay.	2012-2013	$5,000

2014-2015 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Water Quality and Quantity	Coordinate and/or participate in three public presentations per year, including outreach events where staff can provide information to the public regarding how reduce negative impacts on water quality.	2012-2013	$2,000
Habitat Loss	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$2,000
Habitat Loss	Convey knowledge gained regarding the function of ecosystem services provided by coastal habitats to the public and students, from grade school through university.	2012-2013	$2,000
Public Awareness, Access, and Use	Continue to conduct formal and informal outreach activities in counties BBAP serves, with particular focus on underserved communities, to promote awareness and appreciation of BBAP's natural resources to foster stewardship and appreciation.	2012-2013	$4,000
Public Awareness, Access, and Use	Develop an awareness and access guide to be used by paddlers and other passive recreational users to be disseminated by concessionaires, businesses, and leaders of organizations.	2012-2013	$5,000
Public Awareness, Access, and Use	Participate and assist in the coordination of informal teaching opportunities.	2012-2013	$3,000
Public Awareness, Access, and Use	Partner with all levels of governmental agencies and non-governmental agencies to promote proper use of equipment and potential impacts of gear among recreational anglers.	2013-2014	$2,500
Public Awareness, Access, and Use	Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.	2014-2015	$2,000
Sustainable Economic Use and Viability	Partner with all levels of governmental agencies and non-governmental agencies to promote proper use of equipment and potential impacts of gear among recreational anglers.	2013-2014	$2,500
	Education & Outreach Subtotal		$34,000
2014-2015 Total			**$178,000**

2015-2016 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Ecosystem Science			
Water Quality and Quantity	Support and assist in the improvement of the existing water quality monitoring network to ensure that monitoring provides sufficient quality and quantity of data.	2012-2013	$30,000
Water Quality and Quantity	Identify sources of pollutants and sources of turbidity impacting BBAP and its tributaries, with specific focus on the Miami River.	2012-2013	$10,000
Water Quality and Quantity	Support development of water reservation rule to protect existing levels of freshwater received in all areas of Biscayne Bay.	2012-2013	$500
Water Quality and Quantity	Support the identification of gaps in current sediment testing programs with particular focus on identifying loads of PCB concentrations, heavy metals, petroleum hydrocarbons, and other insecticides, pesticides, and contaminants that may be present.	2014-2015	$10,000
Habitat Loss	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2014-2015	$5,000

2015-2016 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Public Awareness, Access, and Use	Partner with other agencies and organizations to advance to the next phase of the Biscayne Bay Economic Study where ecosystem services of natural resources and impacts of uses are quantified.	2014-2015	$50,000
Public Awareness, Access, and Use	Partner with other agencies and organizations to identify funding sources to conduct greater or targeted marine law enforcement.	2014-2015	$2,000
Public Awareness, Access, and Use	Determine effectiveness and management practices of mooring fields and potentially create new mooring fields to better protect resources from direct impacts and indirect impacts.	2014-2015	$15,000
Public Awareness, Access, and Use	Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.	2014-2015	$2,000
Obstacles in Natural Resource Management	Increase the number of epibenthic monitoring sites within the preserves' boundaries.	2014-2015	$25,000
Obstacles in Natural Resource Management	Partner with other natural resource agencies to develop an environmental impact statement similar to what was drafted for the Florida Keys National Marine Sanctuary so that BBAP is poised to apply for competitive funding for restoration projects.	2015-2016	$25,000
Obstacles in Natural Resource Management	Conduct wildlife and groundtruthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.	2012-2013	$10,000
Obstacles in Natural Resource Management	Obtain funding to extend baseline monitoring being conducted ahead of CERP projects coming online.	2012-2013	$30,000
Obstacles in Natural Resource Management	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2015-2016	$12,000
	Ecosystem Science Subtotal		$226,500

Resource Management			
Water Quality and Quantity	Work with county government partners to include Biscayne Bay in the National Estuary Program.	2014-2015	$1,000
Water Quality and Quantity	Support stormwater system retrofitting at the municipal, county and state levels and facilitate dialog to encourage this to happen.	2014-2015	$500
Water Quality and Quantity	Work with law enforcement and partnering resource agencies to minimize the number of derelict vessels within BBAP boundaries.	2014-2015	$10,000
Water Quality and Quantity	Facilitate logistical, financial, and/or staff support that would allow Miami-Dade County, Biscayne National Park, the South Florida Water Management District, Florida International University, and other institutions to expand their water quality monitoring efforts.	2015-2016	$10,000
Water Quality and Quantity	Identify and support acquisition of lands that, if acquired, directly benefit the preserves' natural resources.	2015-2016	$500
Water Quality and Quantity	Facilitate the inventory of stormwater drains and identify future improvement needs and incorporate data into GIS map.	2012-2013	$1,000
Water Quality and Quantity	Facilitate the inventory of existing municipalities or portions thereof still using septic systems and incorporate data into GIS map.	2012-2013	$500
Water Quality and Quantity	Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and relevant best management practices.	2012-2013	$500

2015-2016 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Water Quality and Quantity	Partner with DEP's Coral Reef Conservation Program to support and promote marine debris and land based sources of pollution projects	2012-2013	$500
Water Quality and Quantity	Support the Biscayne Bay Coastal Wetlands portion of the Comprehensive Everglades Restoration Plan, with particular attention paid to source of water slated for use in flooding coastal wetlands.	2012-2013	$1,000
Water Quality and Quantity	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Water Quality and Quantity	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2013-2014	$3,000
Water Quality and Quantity	Continue to coordinate with law enforcement through training opportunities, monthly meetings and other venues where natural resource information and roadblocks to effective enforcement against environmental violations can be discussed and better understood.	2013-2014	$6,000
Habitat Loss	Encourage, when possible, maintenance of existing boat ramps and marinas as opposed to creation of new facilities that would introduce new impacts.	2013-2014	$200
Habitat Loss	Work with Miami-Dade County staff and leadership to allow restoration-focused permits to fill seagrass scars and other habitat restoration activities to be evaluated as providing a benefit to Biscayne Bay ecology.	2013-2014	$500
Habitat Loss	Conduct training for and coordinate on-site field surveys with staff of DEP's Southeast and South District offices.	2012-2013	$1,000
Habitat Loss	Partner with local, state (non-DEP) and federal agencies on applications for proposed construction projects to offer biological survey information or public interest projects.	2012-2013	$200
Habitat Loss	Partner with local, state and federal agencies to secure funding and conduct marine habitat restoration projects and employ non-regulatory methodologies to reduce marine habitat impacts.	2015-2016	$10,000
Public Awareness, Access, and Use	Work with regulatory staff, law enforcement, legal staff and resource management staff from other agencies to address uses of BBAP that are not water-dependent, are potentially illegal, or harm resources.	2013-2014	$500
Sustainable Economic Use and Viability	Coordinate with local, state, and federal resource managers and law enforcement, namely FWC, to ensure that commercial fishing vessels' equipment is functioning properly to ensure protection of the benthic habitat and water quality.	2013-2014	$250
Obstacles in Natural Resource Management	Work with other agencies to respond to vessel groundings and quantify injuries through the use of surveys and Trimble™ GPS technology to map location, size, and volume of injury.	2014-2015	$3,000
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2014-2015	$20,000
Obstacles in Natural Resource Management	Coordinate with other resource agencies and law enforcement to support efforts to address derelict and/or illegal fisheries gear and harvesting activities.	2013-2014	$20,000
Obstacles in Natural Resource Management	Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff.	2013-2014	$500

2015-2016 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Obstacles in Natural Resource Management	Continue to partner with the USCG and local and state agencies to participate in oil disaster Area Contingency Planning.	2012-2013	$1,000
Obstacles in Natural Resource Management	Work with law enforcement to encourage enforcement of the seagrass law prohibiting destruction of seagrasses in aquatic preserves.	2012-2013	$1,000
Obstacles in Natural Resource Management	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Obstacles in Natural Resource Management	Work with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.	2012-2013	$500
Obstacles in Natural Resource Management	Facilitate a greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.	2012-2013	$1,000
Obstacles in Natural Resource Management	Work with local and municipal governments on finding appropriate locations and types of activities for the filming industry and other on-water activities related to entertainment.	2012-2013	$500
Obstacles in Natural Resource Management	Work with Miami-Dade County to obtain permits in a timely fashion that are needed to conduct seagrass restoration in BBAP.	2015-2016	$500
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2015-2016	$10,000
Obstacles in Natural Resource Management	Use existing programs as a guide to develop and implement a citizen science monitoring program specifically focused on documenting the affects of climate change in south Florida.	2015-2016	$10,000
	Resource Management Subtotal		$135,150

Education & Outreach			
Water Quality and Quantity	Encourage homeowners to maintain septic systems and educate them on the benefits of joining municipal or county sewage systems.	2015-2016	$5,000
Water Quality and Quantity	Engage in outreach and education with decision-makers at all levels of government and serve as a point of contact for information regarding the health of Biscayne Bay's natural resources.	2015-2016	$2,000
Water Quality and Quantity	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$1,000
Water Quality and Quantity	Continue to develop curriculum for teachers as well as presentations and activities for the public of all ages to learn about the ecosystem services provided by Biscayne Bay resources and the natural history of Biscayne Bay.	2012-2013	$5,000
Water Quality and Quantity	Coordinate and/or participate in three public presentations per year, including outreach events where staff can provide information to the public regarding how reduce negative impacts on water quality.	2012-2013	$2,000
Habitat Loss	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$2,000

2015-2016 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Habitat Loss	Convey knowledge gained regarding the function of ecosystem services provided by coastal habitats to the public and students, from grade school through university.	2012-2013	$2,000
Public Awareness, Access, and Use	Continue to conduct formal and informal outreach activities in counties BBAP serves, with particular focus on underserved communities, to promote awareness and appreciation of BBAP's natural resources to foster stewardship and appreciation.	2012-2013	$4,000
Public Awareness, Access, and Use	Develop an awareness and access guide to be used by paddlers and other passive recreational users to be disseminated by concessionaires, businesses, and leaders of organizations.	2012-2013	$5,000
Public Awareness, Access, and Use	Participate and assist in the coordination of informal teaching opportunities.	2012-2013	$3,000
Public Awareness, Access, and Use	Support development of a Biscayne Bay-appropriate Eco-Mariner Program as developed and implemented in Everglades National Park by the National Parks Conservation Association.	2015-2016	$50,000
Sustainable Economic Use and Viability	Partner with all levels of governmental agencies and non-governmental agencies to promote proper use of equipment and potential impacts of gear among recreational anglers.	2013-2014	$2,500
	Education & Outreach Subtotal		$83,500
2015-2016 Total			**$445,150**

2016-2017 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Ecosystem Science			
Water Quality and Quantity	Support and assist in the improvement of the existing water quality monitoring network to ensure that monitoring provides sufficient quality and quantity of data.	2012-2013	$30,000
Water Quality and Quantity	Identify sources of pollutants and sources of turbidity impacting BBAP and its tributaries, with specific focus on the Miami River.	2012-2013	$10,000
Water Quality and Quantity	Develop a "report card" for Biscayne Bay with easy-to-understand but pertinent information about the status of the health of Biscayne Bay with a focus on water quality, submerged aquatic vegetation, hardbottom community, and possibly other parameters such as abundance and diversity of species if that data is available.	2016-2017	$3,000
Water Quality and Quantity	Support development of water reservation rule to protect existing levels of freshwater received in all areas of Biscayne Bay.	2012-2013	$500
Water Quality and Quantity	Support the identification of gaps in current sediment testing programs with particular focus on identifying loads of PCB concentrations, heavy metals, petroleum hydrocarbons, and other insecticides, pesticides, and contaminants that may be present.	2014-2015	$10,000
Habitat Loss	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2014-2015	$5,000
Obstacles in Natural Resource Management	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2015-2016	$12,000

2016-2017 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Obstacles in Natural Resource Management	Partner with other natural resource agencies to develop an environmental impact statement similar to what was drafted for the Florida Keys National Marine Sanctuary so that BBAP is poised to apply for competitive funding for restoration projects.	2015-2016	$25,000
Obstacles in Natural Resource Management	Increase the number of epibenthic monitoring sites within the preserves' boundaries.	2014-2015	$25,000
Obstacles in Natural Resource Management	Conduct wildlife and groundtruthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.	2012-2013	$10,000
Obstacles in Natural Resource Management	Obtain funding to extend baseline monitoring being conducted ahead of CERP projects coming online.	2012-2013	$30,000
Public Awareness, Access, and Use	Determine effectiveness and management practices of mooring fields and potentially create new mooring fields to better protect resources from direct impacts and indirect impacts.	2014-2015	$15,000
Public Awareness, Access, and Use	Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.	2014-2015	$2,000
Habitat Loss	Partner with local, state, and/or federal agencies to obtain high resolution aerial photography as it becomes available to track changes in Biscayne Bay's coastline and benthic community from coastal construction projects such as seawalls, docks, and marinas as well as propeller damage.	2016-2017	$10,000
Habitat Loss	Partner with other resource agencies and non-governmental organizations to better understand potential impacts to human health by way of studying the health of Biscayne Bay flora and fauna.	2016-2017	$25,000
	Ecosystem Science Subtotal		$212,500

Resource Management			
Water Quality and Quantity	Facilitate logistical, financial, and/or staff support that would allow Miami-Dade County, Biscayne National Park, the South Florida Water Management District, Florida International University, and other institutions to expand their water quality monitoring efforts.	2015-2016	$10,000
Water Quality and Quantity	Identify and support acquisition of lands that, if acquired, directly benefit the preserves' natural resources.	2015-2016	$500
Water Quality and Quantity	In collaboration with FWC, local governments and law enforcement, review outcomes of pilot mooring projects and facilitate management of existing mooring areas through collaboration with law enforcement and local governments in order to decrease impacts to the benthic community and water quality.	2016-2017	$1,000
Water Quality and Quantity	Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and relevant best management practices.	2012-2013	$500
Water Quality and Quantity	Partner with DEP's Coral Reef Conservation Program to support and promote marine debris and land based sources of pollution projects	2012-2013	$500
Water Quality and Quantity	Support the Biscayne Bay Coastal Wetlands portion of the Comprehensive Everglades Restoration Plan, with particular attention paid to source of water slated for use in flooding coastal wetlands.	2012-2013	$1,000
Water Quality and Quantity	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000

2016-2017 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Water Quality and Quantity	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2013-2014	$3,000
Water Quality and Quantity	Continue to coordinate with law enforcement through training opportunities, monthly meetings and other venues where natural resource information and roadblocks to effective enforcement against environmental violations can be discussed and better understood.	2013-2014	$6,000
Water Quality and Quantity	Work with county government partners to include Biscayne Bay in the National Estuary Program.	2014-2015	$1,000
Water Quality and Quantity	Support stormwater system retrofitting at the municipal, county and state levels and facilitate dialog to encourage this to happen.	2014-2015	$500
Water Quality and Quantity	Work with law enforcement and partnering resource agencies to minimize the number of derelict vessels within BBAP boundaries.	2014-2015	$10,000
Habitat Loss	Encourage, when possible, maintenance of existing boat ramps and marinas as opposed to creation of new facilities that would introduce new impacts.	2013-2014	$200
Habitat Loss	Work with Miami-Dade County staff and leadership to allow restoration-focused permits to fill seagrass scars and other habitat restoration activities to be evaluated as providing a benefit to Biscayne Bay ecology.	2013-2014	$500
Habitat Loss	Conduct training for and coordinate on-site field surveys with staff of DEP's Southeast and South District offices.	2012-2013	$1,000
Habitat Loss	Partner with local, state (non-DEP) and federal agencies on applications for proposed construction projects to offer biological survey information or public interest projects.	2012-2013	$200
Habitat Loss	Partner with local, state and federal agencies to secure funding and conduct marine habitat restoration projects and employ non-regulatory methodologies to reduce marine habitat impacts.	2015-2016	$10,000
Obstacles in Natural Resource Management	Work with other agencies to respond to vessel groundings and quantify injuries through the use of surveys and Trimble™ GPS technology to map location, size, and volume of injury.	2014-2015	$3,000
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2014-2015	$20,000
Obstacles in Natural Resource Management	Coordinate with other resource agencies and law enforcement to support efforts to address derelict and/or illegal fisheries gear and harvesting activities.	2013-2014	$20,000
Obstacles in Natural Resource Management	Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff.	2013-2014	$500
Obstacles in Natural Resource Management	Continue to partner with the USCG and local and state agencies to participate in oil disaster Area Contingency Planning.	2012-2013	$1,000
Obstacles in Natural Resource Management	Work with law enforcement to encourage enforcement of the seagrass law prohibiting destruction of seagrasses in aquatic preserves.	2012-2013	$1,000
Obstacles in Natural Resource Management	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000

2016-2017 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Obstacles in Natural Resource Management	Work with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.	2012-2013	$500
Obstacles in Natural Resource Management	Facilitate a greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.	2012-2013	$1,000
Obstacles in Natural Resource Management	Work with Miami-Dade County to obtain permits in a timely fashion that are needed to conduct seagrass restoration in BBAP.	2015-2016	$500
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2015-2016	$10,000
Obstacles in Natural Resource Management	Use existing programs as a guide to develop and implement a citizen science monitoring program specifically focused on documenting the affects of climate change in south Florida.	2015-2016	$10,000
Sustainable Economic Use and Viability	Coordinate with local, state, and federal resource managers and law enforcement, namely FWC, to ensure that commercial fishing vessels' equipment is functioning properly to ensure protection of the benthic habitat and water quality.	2013-2014	$250
Sustainable Economic Use and Viability	Work with local and municipal governments on finding appropriate locations and types of activities for the filming industry and other on-water activities related to entertainment.	2012-2013	$500
Obstacles in Natural Resource Management	Work with CAMA legal staff, law enforcement and local and state legal staff to educate magistrates and judges to prevent the dismissal of environmental-related violations such as manatee zone or fisheries violations.	2016-2017	$1,000
Public Awareness, Access, and Use	Partner with other agencies and organizations to advance to the next phase of the Biscayne Bay Economic Study where ecosystem services of natural resources and impacts of uses are quantified.	2014-2015	$50,000
Public Awareness, Access, and Use	Partner with other agencies and organizations to identify funding sources to conduct greater or targeted marine law enforcement.	2014-2015	$2,000
Public Awareness, Access, and Use	Work with regulatory staff, law enforcement, legal staff and resource management staff from other agencies to address uses of BBAP that are not water-dependent, are potentially illegal, or harm resources.	2013-2014	$500
Public Awareness, Access, and Use	Work with CAMA legal staff, law enforcement and local and state legal staff to implement a class such as that run by Biscayne National Park.	2016-2017	$1,500
	Resource Management Subtotal		$189,150

Education & Outreach			
Water Quality and Quantity	Expand existing and previous "drains to bay" signage program along storm drains across watershed.	2016-2017	$1,500
Water Quality and Quantity	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$1,000
Water Quality and Quantity	Continue to develop curriculum for teachers as well as presentations and activities for the public of all ages to learn about the ecosystem services provided by Biscayne Bay resources and the natural history of Biscayne Bay.	2012-2013	$5,000

2016-2017 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Water Quality and Quantity	Coordinate and/or participate in three public presentations per year, including outreach events where staff can provide information to the public regarding how reduce negative impacts on water quality.	2012-2013	$2,000
Habitat Loss	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$2,000
Habitat Loss	Convey knowledge gained regarding the function of ecosystem services provided by coastal habitats to the public and students, from grade school through university.	2012-2013	$2,000
Public Awareness, Access, and Use	Continue to conduct formal and informal outreach activities in counties BBAP serves, with particular focus on underserved communities, to promote awareness and appreciation of BBAP's natural resources to foster stewardship and appreciation.	2012-2013	$4,000
Public Awareness, Access, and Use	Develop an awareness and access guide to be used by paddlers and other passive recreational users to be disseminated by concessionaires, businesses, and leaders of organizations.	2012-2013	$5,000
Public Awareness, Access, and Use	Participate and assist in the coordination of informal teaching opportunities.	2012-2013	$3,000
Public Awareness, Access, and Use	Partner with and actively support the National Park Service's effort to have a visitor center near downtown Miami where the opportunity exists to educate the visiting public about BBAP resources.	2016-2017	$100,000
Sustainable Economic Use and Viability	Strategy 1: Partner with all levels of governmental agencies and non-governmental agencies to promote proper use of equipment and potential impacts of gear among recreational anglers.	2013-2014	$2,500
	Education & Outreach Subtotal		$128,000
2016-2017 Total			**$529,650**

2017-2018 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Ecosystem Science			
Water Quality and Quantity	Support and assist in the improvement of the existing water quality monitoring network to ensure that monitoring provides sufficient quality and quantity of data.	2012-2013	$30,000
Water Quality and Quantity	Identify sources of pollutants and sources of turbidity impacting BBAP and its tributaries, with specific focus on the Miami River.	2012-2013	$10,000
Water Quality and Quantity	Facilitate the funding for or expansion of existing aerial photography to assess incidence of scarring, progress of restoration, and composition of benthic community where the resolution is such that these parameters can be discerned and digitized in GIS.	2017-2018	$3,000
Water Quality and Quantity	Support the identification of gaps in current sediment testing programs with particular focus on identifying loads of PCB concentrations, heavy metals, petroleum hydrocarbons, and other insecticides, pesticides, and contaminants that may be present.	2014-2015	$10,000
Water Quality and Quantity	Develop a "report card" for Biscayne Bay with easy-to-understand but pertinent information about the status of the health of Biscayne Bay with a focus on water quality, submerged aquatic vegetation, hardbottom community, and possibly other parameters such as abundance and diversity of species if that data is available.	2016-2017	$3,000

2017-2018 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Obstacles in Natural Resource Management	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2015-2016	$12,000
Obstacles in Natural Resource Management	Partner with other natural resource agencies to develop an environmental impact statement similar to what was drafted for the Florida Keys National Marine Sanctuary so that BBAP is poised to apply for competitive funding for restoration projects.	2015-2016	$25,000
Obstacles in Natural Resource Management	Increase the number of epibenthic monitoring sites within the preserves' boundaries.	2014-2015	$25,000
Obstacles in Natural Resource Management	Conduct wildlife and groundtruthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.	2012-2013	$10,000
Public Awareness, Access, and Use	Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.	2014-2015	$2,000
Habitat Loss	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2014-2015	$5,000
Habitat Loss	Continue to partner with agencies and/or secure funding for research aimed at understanding the direct impacts of coastal construction projects and to develop effective avoidance and minimization criteria.	2017-2018	$500
Habitat Loss	Create a tool with a mapping component to assess cumulative impacts on natural resources that can be used by CAMA and regulatory staff from all relevant regulatory agencies.	2017-2018	$3,000
Habitat Loss	Better understand the form and function as well as the interactions between flora and fauna within BBAP boundaries and the stresses experienced at the habitat or organism level.	2017-2018	$10,000
Habitat Loss	Partner with local, state, and/or federal agencies to obtain high resolution aerial photography as it becomes available to track changes in Biscayne Bay's coastline and benthic community from coastal construction projects such as seawalls, docks, and marinas as well as propeller damage.	2016-2017	$10,000
Habitat Loss	Partner with other resource agencies and non-governmental organizations to better understand potential impacts to human health by way of studying the health of Biscayne Bay flora and fauna.	2016-2017	$25,000
	Ecosystem Science Subtotal		$183,500

Resource Management			
Water Quality and Quantity	Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and relevant best management practices.	2012-2013	$500
Water Quality and Quantity	Partner with DEP's Coral Reef Conservation Program to support and promote marine debris and land based sources of pollution projects	2012-2013	$500
Water Quality and Quantity	Support the Biscayne Bay Coastal Wetlands portion of the Comprehensive Everglades Restoration Plan, with particular attention paid to source of water slated for use in flooding coastal wetlands.	2012-2013	$1,000
Water Quality and Quantity	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000

2017-2018 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Water Quality and Quantity	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2013-2014	$3,000
Water Quality and Quantity	Continue to coordinate with law enforcement through training opportunities, monthly meetings and other venues where natural resource information and roadblocks to effective enforcement against environmental violations can be discussed and better understood.	2013-2014	$6,000
Water Quality and Quantity	Support stormwater system retrofitting at the municipal, county and state levels and facilitate dialog to encourage this to happen.	2014-2015	$500
Water Quality and Quantity	Work with law enforcement and partnering resource agencies to minimize the number of derelict vessels within BBAP boundaries.	2014-2015	$10,000
Water Quality and Quantity	Facilitate logistical, financial, and/or staff support that would allow Miami-Dade County, Biscayne National Park, the South Florida Water Management District, Florida International University, and other institutions to expand their water quality monitoring efforts.	2015-2016	$10,000
Water Quality and Quantity	In collaboration with FWC, local governments and law enforcement, review outcomes of pilot mooring projects and facilitate management of existing mooring areas through collaboration with law enforcement and local governments in order to decrease impacts to the benthic community and water quality.	2016-2017	$1,000
Habitat Loss	Encourage, when possible, maintenance of existing boat ramps and marinas as opposed to creation of new facilities that would introduce new impacts.	2013-2014	$200
Habitat Loss	Conduct training for and coordinate on-site field surveys with staff of DEP's Southeast and South District offices.	2012-2013	$1,000
Habitat Loss	Partner with local, state (non-DEP) and federal agencies on applications for proposed construction projects to offer biological survey information or public interest projects.	2012-2013	$200
Habitat Loss	Partner with local, state and federal agencies to secure funding and conduct marine habitat restoration projects and employ non-regulatory methodologies to reduce marine habitat impacts.	2015-2016	$10,000
Public Awareness, Access, and Use	Partner with other agencies and organizations to identify funding sources to conduct greater or targeted marine law enforcement.	2014-2015	$2,000
Public Awareness, Access, and Use	Work with regulatory staff, law enforcement, legal staff and resource management staff from other agencies to address uses of BBAP that are not water-dependent, are potentially illegal, or harm resources.	2013-2014	$500
Public Awareness, Access, and Use	Work with CAMA legal staff, law enforcement and local and state legal staff to implement a class such as that run by Biscayne National Park.	2016-2017	$1,500
Obstacles in Natural Resource Management	Work with other agencies to respond to vessel groundings and quantify injuries through the use of surveys and Trimble™ GPS technology to map location, size, and volume of injury.	2014-2015	$3,000
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2014-2015	$20,000
Obstacles in Natural Resource Management	Coordinate with other resource agencies and law enforcement to support efforts to address derelict and/or illegal fisheries gear and harvesting activities.	2013-2014	$20,000

2017-2018 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Obstacles in Natural Resource Management	Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff.	2013-2014	$500
Obstacles in Natural Resource Management	Continue to partner with the USCG and local and state agencies to participate in oil disaster Area Contingency Planning.	2012-2013	$1,000
Obstacles in Natural Resource Management	Work with law enforcement to encourage enforcement of the seagrass law prohibiting destruction of seagrasses in aquatic preserves.	2012-2013	$1,000
Obstacles in Natural Resource Management	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Obstacles in Natural Resource Management	Work with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.	2012-2013	$500
Obstacles in Natural Resource Management	Facilitate a greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.	2012-2013	$1,000
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2015-2016	$10,000
Obstacles in Natural Resource Management	Use existing programs as a guide to develop and implement a citizen science monitoring program specifically focused on documenting the affects of climate change in south Florida.	2015-2016	$10,000
Obstacles in Natural Resource Management	Work with CAMA legal staff, law enforcement and local and state legal staff to educate magistrates and judges to prevent the dismissal of environmental-related violations such as manatee zone or fisheries violations.	2016-2017	$1,000
Sustainable Economic Use and Viability	Work with local and municipal governments on finding appropriate locations and types of activities for the filming industry and other on-water activities related to entertainment.	2012-2013	$500
Sustainable Economic Use and Viability	Coordinate with local, state, and federal resource managers and law enforcement, namely FWC, to ensure that commercial fishing vessels' equipment is functioning properly to ensure protection of the benthic habitat and water quality.	2013-2014	$250
Sustainable Economic Use and Viability	Work more closely with DEP's Clean Marina, Boatyard, and Boater programs to advertise location of pumpout facilities, existence of Clean programs and access to guidelines.	2017-2018	$5,000
	Resource Management Subtotal		$141,650

Education & Outreach			
Water Quality and Quantity	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$1,000
Water Quality and Quantity	Continue to develop curriculum for teachers as well as presentations and activities for the public of all ages to learn about the ecosystem services provided by Biscayne Bay resources and the natural history of Biscayne Bay.	2012-2013	$5,000
Water Quality and Quantity	Coordinate and/or participate in three public presentations per year, including outreach events where staff can provide information to the public regarding how reduce negative impacts on water quality.	2012-2013	$2,000

2017-2018 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Habitat Loss	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$2,000
Habitat Loss	Convey knowledge gained regarding the function of ecosystem services provided by coastal habitats to the public and students, from grade school through university.	2012-2013	$2,000
Public Awareness, Access, and Use	Continue to conduct formal and informal outreach activities in counties BBAP serves, with particular focus on underserved communities, to promote awareness and appreciation of BBAP's natural resources to foster stewardship and appreciation.	2012-2013	$4,000
Public Awareness, Access, and Use	Develop an awareness and access guide to be used by paddlers and other passive recreational users to be disseminated by concessionaires, businesses, and leaders of organizations.	2012-2013	$5,000
Public Awareness, Access, and Use	Participate and assist in the coordination of informal teaching opportunities.	2012-2013	$3,000
Public Awareness, Access, and Use	Facilitate Biscayne Bay-specific boater education and safety given that over 60% of boating accidents in Miami-Dade County involve boat operators with no formal boating education.	2017-2018	$5,000
Sustainable Economic Use and Viability	Strategy 1: Partner with all levels of governmental agencies and non-governmental agencies to promote proper use of equipment and potential impacts of gear among recreational anglers.	2013-2014	$2,500
	Education & Outreach Subtotal		$31,500
2017-2018 Total			**$356,650**

2018-2019 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Ecosystem Science			
Water Quality and Quantity	Support and assist in the improvement of the existing water quality monitoring network to ensure that monitoring provides sufficient quality and quantity of data.	2012-2013	$30,000
Water Quality and Quantity	Identify sources of pollutants and sources of turbidity impacting BBAP and its tributaries, with specific focus on the Miami River.	2012-2013	$10,000
Water Quality and Quantity	Support the identification of gaps in current sediment testing programs with particular focus on identifying loads of PCB concentrations, heavy metals, petroleum hydrocarbons, and other insecticides, pesticides, and contaminants that may be present.	2014-2015	$10,000
Water Quality and Quantity	Develop a "report card" for Biscayne Bay with easy-to-understand but pertinent information about the status of the health of Biscayne Bay with a focus on water quality, submerged aquatic vegetation, hardbottom community, and possibly other parameters such as abundance and diversity of species if that data is available.	2016-2017	$3,000
Habitat Loss	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2014-2015	$5,000
Habitat Loss	Partner with other resource agencies and non-governmental organizations to better understand potential impacts to human health by way of studying the health of Biscayne Bay flora and fauna.	2016-2017	$25,000

2018-2019 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Habitat Loss	Continue to partner with agencies and/or secure funding for research aimed at understanding the direct impacts of coastal construction projects and to develop effective avoidance and minimization criteria.	2017-2018	$500
Habitat Loss	Create a tool with a mapping component to assess cumulative impacts on natural resources that can be used by CAMA and regulatory staff from all relevant regulatory agencies.	2017-2018	$3,000
Habitat Loss	Better understand the form and function as well as the interactions between flora and fauna within BBAP boundaries and the stresses experienced at the habitat or organism level.	2017-2018	$10,000
Obstacles in Natural Resource Management	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2015-2016	$12,000
Obstacles in Natural Resource Management	Increase the number of epibenthic monitoring sites within the preserves' boundaries.	2014-2015	$25,000
Obstacles in Natural Resource Management	Conduct wildlife and groundtruthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.	2012-2013	$10,000
Public Awareness, Access, and Use	Coordinate increasing or replacing regulatory signage and buoys so they are correct, legible and enforceable.	2018-2019	$1,500
Public Awareness, Access, and Use	Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.	2014-2015	$2,000
	Ecosystem Science Subtotal		$147,000

Resource Management			
Water Quality and Quantity	Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and relevant best management practices.	2012-2013	$500
Water Quality and Quantity	Partner with DEP's Coral Reef Conservation Program to support and promote marine debris and land based sources of pollution projects	2012-2013	$500
Water Quality and Quantity	Support the Biscayne Bay Coastal Wetlands portion of the Comprehensive Everglades Restoration Plan, with particular attention paid to source of water slated for use in flooding coastal wetlands.	2012-2013	$1,000
Water Quality and Quantity	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Water Quality and Quantity	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2013-2014	$3,000
Water Quality and Quantity	Continue to coordinate with law enforcement through training opportunities, monthly meetings and other venues where natural resource information and roadblocks to effective enforcement against environmental violations can be discussed and better understood.	2013-2014	$6,000
Water Quality and Quantity	Support stormwater system retrofitting at the municipal, county and state levels and facilitate dialog to encourage this to happen.	2014-2015	$500
Water Quality and Quantity	Work with law enforcement and partnering resource agencies to minimize the number of derelict vessels within BBAP boundaries.	2014-2015	$10,000

2018-2019 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Water Quality and Quantity	Facilitate logistical, financial, and/or staff support that would allow Miami-Dade County, Biscayne National Park, the South Florida Water Management District, Florida International University, and other institutions to expand their water quality monitoring efforts.	2015-2016	$10,000
Water Quality and Quantity	Facilitate logistical, financial, and/or staff support that would allow Miami-Dade County, Biscayne National Park, the South Florida Water Management District, Florida International University, and other institutions to expand their water quality monitoring efforts.	2015-2016	$10,000
Water Quality and Quantity	In collaboration with FWC, local governments and law enforcement, review outcomes of pilot mooring projects and facilitate management of existing mooring areas through collaboration with law enforcement and local governments in order to decrease impacts to the benthic community and water quality.	2016-2017	$1,000
Habitat Loss	Encourage, when possible, maintenance of existing boat ramps and marinas as opposed to creation of new facilities that would introduce new impacts.	2013-2014	$200
Habitat Loss	Conduct training for and coordinate on-site field surveys with staff of DEP's Southeast and South District offices.	2012-2013	$1,000
Habitat Loss	Partner with local, state (non-DEP) and federal agencies on applications for proposed construction projects to offer biological survey information or public interest projects.	2012-2013	$200
Habitat Loss	Partner with local, state and federal agencies to secure funding and conduct marine habitat restoration projects and employ non-regulatory methodologies to reduce marine habitat impacts.	2015-2016	$10,000
Obstacles in Natural Resource Management	Work with other agencies to respond to vessel groundings and quantify injuries through the use of surveys and Trimble™ GPS technology to map location, size, and volume of injury.	2014-2015	$3,000
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2014-2015	$20,000
Obstacles in Natural Resource Management	Coordinate with other resource agencies and law enforcement to support efforts to address derelict and/or illegal fisheries gear and harvesting activities.	2013-2014	$20,000
Obstacles in Natural Resource Management	Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff.	2013-2014	$500
Obstacles in Natural Resource Management	Continue to partner with the USCG and local and state agencies to participate in oil disaster Area Contingency Planning.	2012-2013	$1,000
Obstacles in Natural Resource Management	Work with law enforcement to encourage enforcement of the seagrass law prohibiting destruction of seagrasses in aquatic preserves.	2012-2013	$1,000
Obstacles in Natural Resource Management	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Obstacles in Natural Resource Management	Work with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.	2012-2013	$500
Obstacles in Natural Resource Management	Facilitate a greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.	2012-2013	$1,000

2018-2019 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2015-2016	$10,000
Obstacles in Natural Resource Management	Use existing programs as a guide to develop and implement a citizen science monitoring program specifically focused on documenting the affects of climate change in south Florida.	2015-2016	$10,000
Obstacles in Natural Resource Management	Work with CAMA legal staff, law enforcement and local and state legal staff to educate magistrates and judges to prevent the dismissal of environmental-related violations such as manatee zone or fisheries violations.	2016-2017	$1,000
Public Awareness, Access, and Use	Partner with other agencies and organizations to identify funding sources to conduct greater or targeted marine law enforcement.	2014-2015	$2,000
Public Awareness, Access, and Use	Work with regulatory staff, law enforcement, legal staff and resource management staff from other agencies to address uses of BBAP that are not water-dependent, are potentially illegal, or harm resources.	2013-2014	$500
Public Awareness, Access, and Use	Work with CAMA legal staff, law enforcement and local and state legal staff to implement a class such as that run by Biscayne National Park.	2016-2017	$1,500
Sustainable Economic Use and Viability	Coordinate with local, state, and federal resource managers and law enforcement, namely FWC, to ensure that commercial fishing vessels' equipment is functioning properly to ensure protection of the benthic habitat and water quality.	2013-2014	$250
Sustainable Economic Use and Viability	Work with local and municipal governments on finding appropriate locations and types of activities for the filming industry and other on-water activities related to entertainment.	2012-2013	$500
Sustainable Economic Use and Viability	Work more closely with DEP's Clean Marina, Boatyard, and Boater programs to advertise location of pumpout facilities, existence of Clean programs and access to guidelines.	2017-2018	$5,000
	Resource Management Subtotal		$151,650

Education & Outreach			
Water Quality and Quantity	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$1,000
Water Quality and Quantity	Continue to develop curriculum for teachers as well as presentations and activities for the public of all ages to learn about the ecosystem services provided by Biscayne Bay resources and the natural history of Biscayne Bay.	2012-2013	$5,000
Water Quality and Quantity	Coordinate and/or participate in three public presentations per year, including outreach events where staff can provide information to the public regarding how reduce negative impacts on water quality.	2012-2013	$2,000
Habitat Loss	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$2,000
Habitat Loss	Convey knowledge gained regarding the function of ecosystem services provided by coastal habitats to the public and students, from grade school through university.	2012-2013	$2,000

2018-2019 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Public Awareness, Access, and Use	Continue to conduct formal and informal outreach activities in counties BBAP serves, with particular focus on underserved communities, to promote awareness and appreciation of BBAP's natural resources to foster stewardship and appreciation.	2012-2013	$4,000
Public Awareness, Access, and Use	Develop an awareness and access guide to be used by paddlers and other passive recreational users to be disseminated by concessionaires, businesses, and leaders of organizations.	2012-2013	$5,000
Public Awareness, Access, and Use	Participate and assist in the coordination of informal teaching opportunities.	2012-2013	$3,000
	Education & Outreach Subtotal		$24,000
2018-2019 Total			**$322,650**

2019-2020 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Ecosystem Science			
Water Quality and Quantity	Support and assist in the improvement of the existing water quality monitoring network to ensure that monitoring provides sufficient quality and quantity of data.	2012-2013	$30,000
Water Quality and Quantity	Identify sources of pollutants and sources of turbidity impacting BBAP and its tributaries, with specific focus on the Miami River.	2012-2013	$10,000
Water Quality and Quantity	Support the identification of gaps in current sediment testing programs with particular focus on identifying loads of PCB concentrations, heavy metals, petroleum hydrocarbons, and other insecticides, pesticides, and contaminants that may be present.	2014-2015	$10,000
Habitat Loss	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2014-2015	$5,000
Habitat Loss	Continue to partner with agencies and/or secure funding for research aimed at understanding the direct impacts of coastal construction projects and to develop effective avoidance and minimization criteria.	2017-2018	$500
Habitat Loss	Create a tool with a mapping component to assess cumulative impacts on natural resources that can be used by CAMA and regulatory staff from all relevant regulatory agencies.	2017-2018	$3,000
Habitat Loss	Better understand the form and function as well as the interactions between flora and fauna within BBAP boundaries and the stresses experienced at the habitat or organism level.	2017-2018	$10,000
Obstacles in Natural Resource Management	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2015-2016	$12,000
Obstacles in Natural Resource Management	Increase the number of epibenthic monitoring sites within the preserves' boundaries.	2014-2015	$25,000
Obstacles in Natural Resource Management	Conduct wildlife and groundtruthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.	2012-2013	$10,000
Public Awareness, Access, and Use	Coordinate increasing or replacing regulatory signage and buoys so they are correct, legible and enforceable.	2018-2019	$1,500

2019-2020 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Public Awareness, Access, and Use	Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.	2014-2015	$2,000
	Ecosystem Science Subtotal		$119,000
Resource Management			
Water Quality and Quantity	Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and relevant best management practices.	2012-2013	$500
Water Quality and Quantity	Partner with DEP's Coral Reef Conservation Program to support and promote marine debris and land based sources of pollution projects	2012-2013	$500
Water Quality and Quantity	Support the Biscayne Bay Coastal Wetlands portion of the Comprehensive Everglades Restoration Plan, with particular attention paid to source of water slated for use in flooding coastal wetlands.	2012-2013	$1,000
Water Quality and Quantity	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Water Quality and Quantity	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2013-2014	$3,000
Water Quality and Quantity	Continue to coordinate with law enforcement through training opportunities, monthly meetings and other venues where natural resource information and roadblocks to effective enforcement against environmental violations can be discussed and better understood.	2013-2014	$6,000
Water Quality and Quantity	Support stormwater system retrofitting at the municipal, county and state levels and facilitate dialog to encourage this to happen.	2014-2015	$500
Water Quality and Quantity	Work with law enforcement and partnering resource agencies to minimize the number of derelict vessels within BBAP boundaries.	2014-2015	$10,000
Water Quality and Quantity	Facilitate logistical, financial, and/or staff support that would allow Miami-Dade County, Biscayne National Park, the South Florida Water Management District, Florida International University, and other institutions to expand their water quality monitoring efforts.	2015-2016	$10,000
Water Quality and Quantity	In collaboration with FWC, local governments and law enforcement, review outcomes of pilot mooring projects and facilitate management of existing mooring areas through collaboration with law enforcement and local governments in order to decrease impacts to the benthic community and water quality.	2016-2017	$1,000
Habitat Loss	Encourage, when possible, maintenance of existing boat ramps and marinas as opposed to creation of new facilities that would introduce new impacts.	2013-2014	$200
Habitat Loss	Conduct training for and coordinate on-site field surveys with staff of DEP's Southeast and South District offices.	2012-2013	$1,000
Habitat Loss	Partner with local, state (non-DEP) and federal agencies on applications for proposed construction projects to offer biological survey information or public interest projects.	2012-2013	$200
Habitat Loss	Partner with local, state and federal agencies to secure funding and conduct marine habitat restoration projects and employ non-regulatory methodologies to reduce marine habitat impacts.	2015-2016	$10,000

2019-2020 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Obstacles in Natural Resource Management	Work with other agencies to respond to vessel groundings and quantify injuries through the use of surveys and Trimble™ GPS technology to map location, size, and volume of injury.	2014-2015	$3,000
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2014-2015	$20,000
Obstacles in Natural Resource Management	Coordinate with other resource agencies and law enforcement to support efforts to address derelict and/or illegal fisheries gear and harvesting activities.	2013-2014	$20,000
Obstacles in Natural Resource Management	Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff.	2013-2014	$500
Obstacles in Natural Resource Management	Continue to partner with the USCG and local and state agencies to participate in oil disaster Area Contingency Planning.	2012-2013	$1,000
Obstacles in Natural Resource Management	Work with law enforcement to encourage enforcement of the seagrass law prohibiting destruction of seagrasses in aquatic preserves.	2012-2013	$1,000
Obstacles in Natural Resource Management	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Obstacles in Natural Resource Management	Work with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.	2012-2013	$500
Obstacles in Natural Resource Management	Facilitate a greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.	2012-2013	$1,000
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2015-2016	$10,000
Obstacles in Natural Resource Management	Use existing programs as a guide to develop and implement a citizen science monitoring program specifically focused on documenting the affects of climate change in south Florida.	2015-2016	$10,000
Public Awareness, Access, and Use	Partner with other agencies and organizations to identify funding sources to conduct greater or targeted marine law enforcement.	2014-2015	$2,000
Public Awareness, Access, and Use	Work with regulatory staff, law enforcement, legal staff and resource management staff from other agencies to address uses of BBAP that are not water-dependent, are potentially illegal, or harm resources.	2013-2014	$500
Sustainable Economic Use and Viability	Coordinate with local, state, and federal resource managers and law enforcement, namely FWC, to ensure that commercial fishing vessels' equipment is functioning properly to ensure protection of the benthic habitat and water quality.	2013-2014	$250
Sustainable Economic Use and Viability	Work with local and municipal governments on finding appropriate locations and types of activities for the filming industry and other on-water activities related to entertainment.	2012-2013	$500
Sustainable Economic Use and Viability	Work more closely with DEP's Clean Marina, Boatyard, and Boater programs to advertise location of pumpout facilities, existence of Clean programs and access to guidelines.	2017-2018	$5,000
	Resource Management Subtotal		$139,150

2019-2020 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Education & Outreach			
Water Quality and Quantity	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$1,000
Water Quality and Quantity	Continue to develop curriculum for teachers as well as presentations and activities for the public of all ages to learn about the ecosystem services provided by Biscayne Bay resources and the natural history of Biscayne Bay.	2012-2013	$5,000
Water Quality and Quantity	Coordinate and/or participate in three public presentations per year, including outreach events where staff can provide information to the public regarding how reduce negative impacts on water quality.	2012-2013	$2,000
Habitat Loss	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.__	2012-2013	$2,000
Habitat Loss	Convey knowledge gained regarding the function of ecosystem services provided by coastal habitats to the public and students, from grade school through university.	2012-2013	$2,000
Public Awareness, Access, and Use	Continue to conduct formal and informal outreach activities in counties BBAP serves, with particular focus on underserved communities, to promote awareness and appreciation of BBAP's natural resources to foster stewardship and appreciation.	2012-2013	$4,000
Public Awareness, Access, and Use	Develop an awareness and access guide to be used by paddlers and other passive recreational users to be disseminated by concessionaires, businesses, and leaders of organizations.	2012-2013	$5,000
Public Awareness, Access, and Use	Participate and assist in the coordination of informal teaching opportunities.	2012-2013	$3,000
	Education & Outreach Subtotal		$24,000
2019-2020 Total			**$282,150**

2020-2021 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Ecosystem Science			
Water Quality and Quantity	Support and assist in the improvement of the existing water quality monitoring network to ensure that monitoring provides sufficient quality and quantity of data.	2012-2013	$30,000
Water Quality and Quantity	Identify sources of pollutants and sources of turbidity impacting BBAP and its tributaries, with specific focus on the Miami River.	2012-2013	$10,000
Water Quality and Quantity	Support the identification of gaps in current sediment testing programs with particular focus on identifying loads of PCB concentrations, heavy metals, petroleum hydrocarbons, and other insecticides, pesticides, and contaminants that may be present.	2014-2015	$10,000
Habitat Loss	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2014-2015	$5,000
Habitat Loss	Continue to partner with agencies and/or secure funding for research aimed at understanding the direct impacts of coastal construction projects and to develop effective avoidance and minimization criteria.	2017-2018	$500

2020-2021 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Obstacles in Natural Resource Management	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2015-2016	$12,000
Obstacles in Natural Resource Management	Increase the number of epibenthic monitoring sites within the preserves' boundaries.	2014-2015	$25,000
Obstacles in Natural Resource Management	Conduct wildlife and groundtruthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.	2012-2013	$10,000
Public Awareness, Access, and Use	Coordinate increasing or replacing regulatory signage and buoys so they are correct, legible and enforceable.	2018-2019	$1,500
Public Awareness, Access, and Use	Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.	2014-2015	$2,000
	Ecosystem Science Subtotal		$106,000

Resource Management			
Water Quality and Quantity	Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and relevant best management practices.	2012-2013	$500
Water Quality and Quantity	Partner with DEP's Coral Reef Conservation Program to support and promote marine debris and land based sources of pollution projects	2012-2013	$500
Water Quality and Quantity	Support the Biscayne Bay Coastal Wetlands portion of the Comprehensive Everglades Restoration Plan, with particular attention paid to source of water slated for use in flooding coastal wetlands.	2012-2013	$1,000
Water Quality and Quantity	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Water Quality and Quantity	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2013-2014	$3,000
Water Quality and Quantity	Continue to coordinate with law enforcement through training opportunities, monthly meetings and other venues where natural resource information and roadblocks to effective enforcement against environmental violations can be discussed and better understood.	2013-2014	$6,000
Water Quality and Quantity	Support stormwater system retrofitting at the municipal, county and state levels and facilitate dialog to encourage this to happen.	2014-2015	$500
Water Quality and Quantity	Work with law enforcement and partnering resource agencies to minimize the number of derelict vessels within BBAP boundaries.	2014-2015	$10,000
Water Quality and Quantity	Facilitate logistical, financial, and/or staff support that would allow Miami-Dade County, Biscayne National Park, the South Florida Water Management District, Florida International University, and other institutions to expand their water quality monitoring efforts.	2015-2016	$10,000
Habitat Loss	Encourage, when possible, maintenance of existing boat ramps and marinas as opposed to creation of new facilities that would introduce new impacts.	2013-2014	$200
Habitat Loss	Conduct training for and coordinate on-site field surveys with staff of DEP's Southeast and South District offices.	2012-2013	$1,000

2020-2021 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Habitat Loss	Partner with local, state (non-DEP) and federal agencies on applications for proposed construction projects to offer biological survey information or public interest projects.	2012-2013	$200
Habitat Loss	Partner with local, state and federal agencies to secure funding and conduct marine habitat restoration projects and employ non-regulatory methodologies to reduce marine habitat impacts.	2015-2016	$10,000
Obstacles in Natural Resource Management	Work with other agencies to respond to vessel groundings and quantify injuries through the use of surveys and Trimble™ GPS technology to map location, size, and volume of injury.	2014-2015	$3,000
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2014-2015	$20,000
Obstacles in Natural Resource Management	Coordinate with other resource agencies and law enforcement to support efforts to address derelict and/or illegal fisheries gear and harvesting activities.	2013-2014	$20,000
Obstacles in Natural Resource Management	Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff.	2013-2014	$500
Obstacles in Natural Resource Management	Continue to partner with the USCG and local and state agencies to participate in oil disaster Area Contingency Planning.	2012-2013	$1,000
Obstacles in Natural Resource Management	Work with law enforcement to encourage enforcement of the seagrass law prohibiting destruction of seagrasses in aquatic preserves.	2012-2013	$1,000
Obstacles in Natural Resource Management	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Obstacles in Natural Resource Management	Work with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.	2012-2013	$500
Obstacles in Natural Resource Management	Facilitate a greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.	2012-2013	$1,000
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2015-2016	$10,000
Public Awareness, Access, and Use	Partner with other agencies and organizations to identify funding sources to conduct greater or targeted marine law enforcement.	2014-2015	$2,000
Public Awareness, Access, and Use	Work with regulatory staff, law enforcement, legal staff and resource management staff from other agencies to address uses of BBAP that are not water-dependent, are potentially illegal, or harm resources.	2013-2014	$500
Sustainable Economic Use and Viability	Coordinate with local, state, and federal resource managers and law enforcement, namely FWC, to ensure that commercial fishing vessels' equipment is functioning properly to ensure protection of the benthic habitat and water quality.	2013-2014	$250
Sustainable Economic Use and Viability	Work with local and municipal governments on finding appropriate locations and types of activities for the filming industry and other on-water activities related to entertainment.	2012-2013	$500

2020-2021 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Sustainable Economic Use and Viability	Work more closely with DEP's Clean Marina, Boatyard, and Boater programs to advertise location of pumpout facilities, existence of Clean programs and access to guidelines.	2017-2018	$5,000
	Resource Management Subtotal		$128,150
Education & Outreach			
Water Quality and Quantity	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$1,000
Water Quality and Quantity	Continue to develop curriculum for teachers as well as presentations and activities for the public of all ages to learn about the ecosystem services provided by Biscayne Bay resources and the natural history of Biscayne Bay.	2012-2013	$5,000
Water Quality and Quantity	Coordinate and/or participate in three public presentations per year, including outreach events where staff can provide information to the public regarding how reduce negative impacts on water quality.	2012-2013	$2,000
Habitat Loss	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$2,000
Habitat Loss	Convey knowledge gained regarding the function of ecosystem services provided by coastal habitats to the public and students, from grade school through university.	2012-2013	$2,000
Public Awareness, Access, and Use	Continue to conduct formal and informal outreach activities in counties BBAP serves, with particular focus on underserved communities, to promote awareness and appreciation of BBAP's natural resources to foster stewardship and appreciation.	2012-2013	$4,000
Public Awareness, Access, and Use	Develop an awareness and access guide to be used by paddlers and other passive recreational users to be disseminated by concessionaires, businesses, and leaders of organizations.	2012-2013	$5,000
Public Awareness, Access, and Use	Participate and assist in the coordination of informal teaching opportunities.	2012-2013	$3,000
	Education & Outreach Subtotal		$24,000
2020-2021 Total			**$258,150**

2021-2022 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Ecosystem Science			
Water Quality and Quantity	Support and assist in the improvement of the existing water quality monitoring network to ensure that monitoring provides sufficient quality and quantity of data.	2012-2013	$30,000
Water Quality and Quantity	Identify sources of pollutants and sources of turbidity impacting BBAP and its tributaries, with specific focus on the Miami River.	2012-2013	$10,000
Water Quality and Quantity	Support the identification of gaps in current sediment testing programs with particular focus on identifying loads of PCB concentrations, heavy metals, petroleum hydrocarbons, and other insecticides, pesticides, and contaminants that may be present.	2014-2015	$10,000

2021-2022 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Habitat Loss	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2014-2015	$5,000
Habitat Loss	Continue to partner with agencies and/or secure funding for research aimed at understanding the direct impacts of coastal construction projects and to develop effective avoidance and minimization criteria.	2017-2018	$500
Obstacles in Natural Resource Management	When feasible, based on staffing and funding levels, BBAP will partner with other resource agencies to confirm the success or failure of restoration techniques used in current and previously completed projects.	2015-2016	$12,000
Obstacles in Natural Resource Management	Work with other agencies to respond to vessel groundings and quantify injuries through the use of surveys and Trimble™ GPS technology to map location, size, and volume of injury.	2014-2015	$3,000
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2014-2015	$20,000
Obstacles in Natural Resource Management	Increase the number of epibenthic monitoring sites within the preserves' boundaries.	2014-2015	$25,000
Obstacles in Natural Resource Management	Conduct wildlife and groundtruthing surveys of seagrass areas, particularly those areas that have not been evaluated in over ten years.	2012-2013	$10,000
Public Awareness, Access, and Use	Coordinate increasing or replacing regulatory signage and buoys so they are correct, legible and enforceable.	2018-2019	$1,500
Public Awareness, Access, and Use	Promote awareness of proper boating practices to reduce propeller scarring in seagrasses and other benthic communities.	2014-2015	$2,000
	Ecosystem Science Subtotal		$129,000

Resource Management			
Water Quality and Quantity	Partner with the DEP Coral Reef Conservation Program's watershed management project to target stormwater management issues and relevant best management practices.	2012-2013	$500
Water Quality and Quantity	Partner with DEP's Coral Reef Conservation Program to support and promote marine debris and land based sources of pollution projects	2012-2013	$500
Water Quality and Quantity	Support the Biscayne Bay Coastal Wetlands portion of the Comprehensive Everglades Restoration Plan, with particular attention paid to source of water slated for use in flooding coastal wetlands.	2012-2013	$1,000
Water Quality and Quantity	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Water Quality and Quantity	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2013-2014	$3,000
Water Quality and Quantity	Continue to coordinate with law enforcement through training opportunities, monthly meetings and other venues where natural resource information and roadblocks to effective enforcement against environmental violations can be discussed and better understood.	2013-2014	$6,000

2021-2022 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Water Quality and Quantity	Support stormwater system retrofitting at the municipal, county and state levels and facilitate dialog to encourage this to happen.	2014-2015	$500
Water Quality and Quantity	Work with law enforcement and partnering resource agencies to minimize the number of derelict vessels within BBAP boundaries.	2014-2015	$10,000
Water Quality and Quantity	Facilitate logistical, financial, and/or staff support that would allow Miami-Dade County, Biscayne National Park, the South Florida Water Management District, Florida International University, and other institutions to expand their water quality monitoring efforts.	2015-2016	$10,000
Habitat Loss	Encourage, when possible, maintenance of existing boat ramps and marinas as opposed to creation of new facilities that would introduce new impacts.	2013-2014	$200
Habitat Loss	Conduct training for and coordinate on-site field surveys with staff of DEP's Southeast and South District offices.	2012-2013	$1,000
Habitat Loss	Partner with local, state (non-DEP) and federal agencies on applications for proposed construction projects to offer biological survey information or public interest projects.	2012-2013	$200
Habitat Loss	Partner with local, state and federal agencies to secure funding and conduct marine habitat restoration projects and employ non-regulatory methodologies to reduce marine habitat impacts.	2015-2016	$10,000
Obstacles in Natural Resource Management	Coordinate with other resource agencies and law enforcement to support efforts to address derelict and/or illegal fisheries gear and harvesting activities.	2013-2014	$20,000
Obstacles in Natural Resource Management	Work with law enforcement and governmental agencies to facilitate an agreement between tow boat operators and DEP and/or relevant agencies to report grounded vessels to BBAP staff.	2013-2014	$500
Obstacles in Natural Resource Management	Continue to partner with the USCG and local and state agencies to participate in oil disaster Area Contingency Planning.	2012-2013	$1,000
Obstacles in Natural Resource Management	Work with law enforcement to encourage enforcement of the seagrass law prohibiting destruction of seagrasses in aquatic preserves.	2012-2013	$1,000
Obstacles in Natural Resource Management	Involve the community in the management of natural resources by developing and implementing an adopt-an-island and/or an adopt-a-shoreline program.	2012-2013	$10,000
Obstacles in Natural Resource Management	Work with law enforcement and government agencies' regulatory staff to reduce the incidence of non-compliant or illegitimate businesses operating in or on Biscayne Bay.	2012-2013	$500
Obstacles in Natural Resource Management	Facilitate a greater presence at municipal and county waterfront-related committees that address alterations to Biscayne Bay shorelines.	2012-2013	$1,000
Obstacles in Natural Resource Management	Develop partnerships with other governmental agencies and non-governmental organizations to procure funding to design and conduct habitat restoration and enhancement projects within BBAP.	2015-2016	$10,000
Public Awareness, Access, and Use	Partner with other agencies and organizations to identify funding sources to conduct greater or targeted marine law enforcement.	2014-2015	$2,000
Public Awareness, Access, and Use	Work with regulatory staff, law enforcement, legal staff and resource management staff from other agencies to address uses of BBAP that are not water-dependent, are potentially illegal, or harm resources.	2013-2014	$500

2021-2022 Cost Estimate			
Issue	**Strategy**	**Project Initiation**	**Estimated Yearly Cost**
Sustainable Economic Use and Viability	Coordinate with local, state, and federal resource managers and law enforcement, namely FWC, to ensure that commercial fishing vessels' equipment is functioning properly to ensure protection of the benthic habitat and water quality.	2013-2014	$250
Sustainable Economic Use and Viability	Work with local and municipal governments on finding appropriate locations and types of activities for the filming industry and other on-water activities related to entertainment.	2012-2013	$500
Sustainable Economic Use and Viability	Work more closely with DEP's Clean Marina, Boatyard, and Boater programs to advertise location of pumpout facilities, existence of Clean programs and access to guidelines.	2017-2018	$5,000
	Resource Management Subtotal		$105,150
Education & Outreach			
Water Quality and Quantity	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$1,000
Water Quality and Quantity	Continue to develop curriculum for teachers as well as presentations and activities for the public of all ages to learn about the ecosystem services provided by Biscayne Bay resources and the natural history of Biscayne Bay.	2012-2013	$5,000
Water Quality and Quantity	Coordinate and/or participate in three public presentations per year, including outreach events where staff can provide information to the public regarding how reduce negative impacts on water quality.	2012-2013	$2,000
Habitat Loss	Engage in dialog with environmental consultants, bayfront homeowners, and environmental regulatory staff, and the United Stated Fish and Wildlife Service to promote the Living Shorelines program.	2012-2013	$2,000
Habitat Loss	Convey knowledge gained regarding the function of ecosystem services provided by coastal habitats to the public and students, from grade school through university.	2012-2013	$2,000
Public Awareness, Access, and Use	Continue to conduct formal and informal outreach activities in counties BBAP serves, with particular focus on underserved communities, to promote awareness and appreciation of BBAP's natural resources to foster stewardship and appreciation.	2012-2013	$4,000
Public Awareness, Access, and Use	Develop an awareness and access guide to be used by paddlers and other passive recreational users to be disseminated by concessionaires, businesses, and leaders of organizations.	2012-2013	$5,000
Public Awareness, Access, and Use	Participate and assist in the coordination of informal teaching opportunities.	2012-2013	$3,000
	Education & Outreach Subtotal		$24,000
2021-2022 Total			**$258,150**

*D.3 / **Budget Summary Table***

The following table provides a summary of cost estimates for conducting the management activities identified in this plan.

2012-2013 Cost Estimate	
Ecosystem Science Subtotal	$80,500
Resource Management Subtotal	$20,200
Education and Outreach Subtotal	$26,500
2012-2013 Total	***$127,200***

2013-2014 Cost Estimate	
Ecosystem Science Subtotal	$83,500
Resource Management Subtotal	$66,650
Education and Outreach Subtotal	$50,000
2013-2014 Total	***$200,150***

2014-2015 Cost Estimate	
Ecosystem Science Subtotal	$142,000
Resource Management Subtotal	$151,900
Education and Outreach Subtotal	$34,000
2014-2015 Total	***$327,900***

2015-2016 Cost Estimate	
Ecosystem Science Subtotal	$226,500
Resource Management Subtotal	$135,150
Education and Outreach Subtotal	$83,500
2015-2016 Total	***$445,150***

2016-2017 Cost Estimate	
Ecosystem Science Subtotal	$212,500
Resource Management Subtotal	$189,150
Education and Outreach Subtotal	$128,000
2016-2017 Total	***$529,650***

2017-2018 Cost Estimate	
Ecosystem Science Subtotal	$183,500
Resource Management Subtotal	$141,650
Education and Outreach Subtotal	$31,500
2017-2018 Total	***$356,650***

2018-2019 Cost Estimate	
Ecosystem Science Subtotal	$147,000
Resource Management Subtotal	$151,650
Education and Outreach Subtotal	$24,000
2018-2019 Total	***$322,650***

2019-2020 Cost Estimate	
Ecosystem Science Subtotal	$119,000
Resource Management Subtotal	$139,150
Education and Outreach Subtotal	$24,000
2019-2020 Total	***$282,150***

2020-2021 Cost Estimate	
Ecosystem Science Subtotal	$106,000
Resource Management Subtotal	$128,150
Education and Outreach Subtotal	$24,000
2020-2021 Total	***$258,150***

2021-2022 Cost Estimate	
Ecosystem Science Subtotal	$129,000
Resource Management Subtotal	$105,150
Education and Outreach Subtotal	$24,000
2021-2022 Total	***$258,150***

*D.4 / **Major Accomplishments Since the Approval of the Previous Plan***

Despite several attempts made jointly by Miami-Dade County and the Florida Department of Environmental Protection (DEP) to draft a management plan for the Biscayne Bay Aquatic Preserves (including a separate draft plan that was composed), to date no document had been accepted by the state of Florida as the site's official management plan. In fact, in the late 1990s Miami-Dade County's Department of Environmental Resources Management (reorganized and renamed in 2011 to Permitting, Environment, and Regulatory Affair [PERA]) hosted a DEP staff person out of their office who would serve as manager for the aquatic preserves. In the early 2000s with substantial support of the Friends of Biscayne Bay Inc., DEP was able to secure a building on the John F. Kennedy Causeway that had once been the offices of the Florida Marine Patrol. Active management of the aquatic preserves began, and management initiatives were decided upon by the manager and his or her senior staff and laid out in annual work plans.

Since this time, and in addition to acquiring office space for the Biscayne Bay Aquatic Preserves (BBAP) (the eventual home of DEP's Coral Reef Conservation Program as well), there have been several notable accomplishments that have significantly contributed to enhanced management and protection of Biscayne Bay. These accomplishments are the direct result of preserve staff working collaboratively to facilitate and/or implement management tools that serve to preserve and enhance Biscayne Bay in an essentially natural condition for the enjoyment of future generations (of both human and non-human inhabitants alike).

- Marine Law Enforcement Workshops: Staff work collaboratively with the Florida Fish and Wildlife Conservation Commission (FWC) and the Marine Animal Rescue Society (MARS) to develop curriculum and execute a biannual series of workshops aimed at providing natural resource information to marine law enforcement,

lifeguards, resource managers, and parks staff. Issues covered in class include marine mammal protection and stranding response protocols; coral reef and seagrass protection; increased awareness about the natural resources nearshore and offshore and the role law enforcement plays in protecting natural resources. Hundreds of officers have been trained around the state including Miami-Dade, Broward, Palm Beach, Martin, St. Lucie, Brevard, and Duval counties.

- Coordination of the Manatee Awareness Group: A quarterly meeting of agency staff, educators, marine industries, law enforcement, and non-profit organizations coordinated by BBAP and held alternately in Miami-Dade, Broward, and Palm Beach counties has allowed for greater awareness of relevant manatee protection issues and has served as a forum for information exchange directly resulting in increased protection for manatees and their habitat. Between 2010 and 2012, BBAP facilitated meetings between FWC's Boating and Waterways Section and the Manatee Awareness Group to solicit feedback on a plan to improve all on-water regulatory signage. While there are a few unresolved issues, by and large all regulatory signage in the three counties is current, accurate, legible and enforceable, including reinstallation of downed buoys in the Bill Sadowski Critical Wildlife Area.
- Management of the Bill Sadowski Critical Wildlife Area: In partnership with FWC and the Tropical Audubon Society, formal habitat surveys have commenced although they are not yet regularly scheduled. These surveys of birds, seagrasses, water quality, and other wildlife will help to maintain this area's designation as a regional jewel deserving of additional resource protection.
- Re-establishing the annual Christmas Bird Count in Biscayne Bay: In coordination with the Tropical Audubon Society, annual Christmas Bird Count surveys have been reinstated in Biscayne Bay after they were discontinued several years ago. This information will contribute to a long-standing collection of data to demonstrate shifts in species presence over time.
- Coordination with area universities and colleges: Increased coordination with Florida International University, University of Miami, Barry University, and Miami-Dade College has not only provided the support for BBAP's successful internship program, but through these institutions BBAP has collaborated on numerous projects and has been offered numerous opportunities to raise awareness about the aquatic preserves for students and faculty and to encourage that BBAP be considered in their research as a possible study site. Professors of various disciplines have brought the natural resources and story of BBAP into their curriculum—from environmental journalism to archaeology, biology and foreign language. Students and faculty of all backgrounds and interests have been exposed to and made aware of this regional treasure and its meaning to the community.
- Participation in the Biscayne Bay Regional Restoration Coordination Team: Maintaining an active role as a voting member and, most recently, serving as Vice-Chair, has allowed BBAP the opportunity to stay involved and active in discussion of activities that might take place in or have an impact on Biscayne Bay.
- Participation in the Comprehensive Everglades Restoration Plan (CERP) process: Staff have participated in project delivery team meetings, been a part of water protection and habitat monitoring discussions, and have been involved in other topics and issues related to CERP with a specific focus on the Biscayne Bay Coastal Wetlands component of CERP.
- Development of a geodatabase: With support from the regional office, Rookery Bay National Estuarine Research Reserve, and through funding from the Coastal Zone Management Program, one full-time staffer over the course of one year will develop a geodatabase that will serve to not only help staff organize and easily reference important data in a meaningful way, but also make information about natural resources available to other agencies and to some extent the public.
- Obtaining DEP diver status for BBAP staff: Some of the field work carried out by staff is made more efficient through the use of SCUBA. With support from DEP's Southeast District office and/or Coral Reef Conservation Program staff, BBAP can meet staffing requirements to use SCUBA as a tool to obtain resource information.
- Supportive, reciprocal relationship with DEP regulatory staff: BBAP staff have continued to work collaboratively as needed by DEP Southeast and South District staff in an effort to make more efficient the permitting process while protecting important natural resources and navigating through BBAP's unique rule and statute.

Biscayne Bay Aquatic Preserves
Management Plan

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