DRAFT BISCAYNE BAY HABITAT FOCUS AREA IMPLEMENTATION PLAN
January 16, 2016

EXECUTIVE SUMMARY

In 2011, the National Oceanic and Atmospheric Administration (NOAA) launched the NOAA Habitat Blueprint, a framework to address the growing challenge of integrating the Agency's coastal and marine habitat conservation activities as part of a long-term effort to rebuild fisheries, recover threatened and endangered species, and support resilient coastal communities nationwide. As part of the Habitat Blueprint, NOAA has selected ten Habitat Focus Areas (HFAs) in priority locations where NOAA and its partner organizations and agencies work together to restore and protect regionally important habitats. These HFAs are identified by regional experts as places where NOAA can increase the effectiveness of its science and coordination efforts to better protect highly valued natural resources and habitats at risk.

In 2014, NOAA designated Biscayne Bay and its adjacent reef tract as the Southeast region's HFA to apply the principles of the Habitat Blueprint. The Biscayne Bay HFA (BB-HFA) is located on the lower southeast coast of Florida, encompassing part of Miami and Biscayne National Park (BNP). The importance of Biscayne Bay is recognized by the State of Florida by its designation as an Outstanding Florida Water (OFW) and as the Biscayne Bay Aquatic Preserve. Biscayne Bay is subtropical by latitude (located between latitudes 25.95° N and 25.17° N), with temperatures further moderated by its close proximity to the Gulf Stream. Multiple organizations and agencies work in the area, including resource managers for Biscayne National Park, Florida Department of Environmental Protection (FDEP) Biscayne Bay Aquatic Preserves, and Miami-Dade County, as well as several NGOs that are focusing their attention on the area. Other entities with jurisdiction in the area include Florida Fish and Wildlife Conservation Commission (FFWCC), Florida Department of Agriculture and Consumer Services (FDACS), South Florida Regional Planning Council (SFRPC), South Florida Water Management District (SFWMD), the Florida Keys National Marine Sanctuary (FKNMS), U. S. Fish and Wildlife Service (USFWS), U. S. Army Corps of Engineers (ACOE), U. S. Environmental Protection Agency (USEPA), and the municipalities bordering the Bay including the City of Miami.

The BB-HFA was selected because of the valuable natural resources contained there and the immediate substantial threats to these resources. The rich resources of Biscayne Bay include a number of protected species, important recreational fishery species, and extensive mangrove shorelines, seagrass meadows, and coral reefs that nurture sea life of all types. Due to its proximity to the urban area of Miami, the Biscayne Bay HFA provides numerous recreational opportunities to the residents of this large urban area (2.66M in 2014[1]) (5.5M MSA, 2010 census), and serves as a magnet for tourism (38M visitors/yr). However, this proximity of a growing number of residents and tourists is also the main source of the threats faced by the bay, including immediate and growing threats to water quality, freshwater inflows, and continuity and function of habitat.

The goals of the Biscayne Bay HFA are to:

- Understand major sources of nutrients that contribute significantly to algal blooms in Biscayne Bay and work with resource managers to inform development and application of enhanced policies and management approaches to improve water

quality and habitat condition in the Bay ecosystem.

- Improve freshwater inflows to enhance estuarine habitat in western nearshore Biscayne Bay.
- Support and enhance recovery of protected species and sustainability of fishery species and protect and restore their habitat.
- Increase public awareness of the ecological, economic, and social benefits of the Biscayne Bay ecosystem and increase citizen involvement in bay-related conservation activities.

The impact of BB-HFA attributes on the decision process was magnified by the recognition of immediate and growing threats to water quality, freshwater inflows, and continuity and function of habitat. Selection of the BB-HFA was given further impetus by NOAA's participation in two substantive vehicles for communication about issues affecting Biscayne Bay, the Comprehensive Everglades Restoration Program (CERP) and the Biscayne Bay Regional Restoration and Coordination Team (BBRRCT). CERP is a comprehensive redesign of the South Florida water management system and will affect freshwater inflow to Biscayne Bay. BBRRCT is an advisory group to the South Florida Ecosystem Restoration Task Force (SFERTF) and is made up of representatives of local, state and federal agencies and non-governmental organizations interested in Biscayne Bay.

Figure 1. Biscayne Bay with Boca Chita Lighthouse, Biscayne National Park, in the foreground and City of Miami skyline in the background (photo by Judd Patterson, courtesy National Park Service).

INTRODUCTION

Background

Biscayne Bay is a shallow, clear water bay located on the lower southeast Florida coast. As defined for NOAA Habitat Blueprint, the BB-HFA extends from Dumfoundling Bay in the north, south to Barnes Sound and Manatee Bay. The BB-HFA also includes the coral reefs that run parallel to the bay and are a northern extension of the Florida Keys reef tract. On both the southern bay and on the reef tract, the boundaries of the BB-HFA overlap with the boundaries of the Florida Keys National Marine Sanctuary (FKNMS) and Biscayne National Park (BNP). Both the bay and reef support many federally protected species, as well as managed fishery species that support coastal and oceanic commercial and recreational fisheries. The BB-HFA is an important recreational area, used for diving, snorkeling, kayaking, and swimming. Biscayne Bay is a favorite site for community events and private parties, and much of the life of the surrounding city revolves around this spectacularly picturesque natural setting.

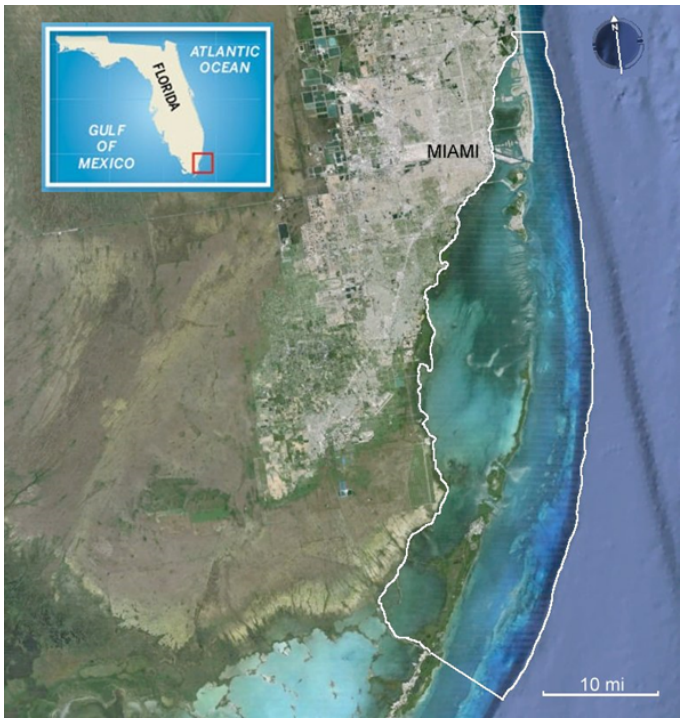

Figure 2. Google image of Biscayne Bay HFA (outlined in white), showing the bay and the reef tract, separated by the barrier islands from Miami Beach south to Upper Key Largo.

Biscayne Bay has been described as a subtropical lagoon, but the freshwater inflow it still receives creates an estuarine salinity gradient along parts of its western shoreline, resulting in nursery habitat for a estuarine dependent species, which are now limited by the reduced spatial extent of this zone. The bay habitats of the BB-HFA include extensive mangrove shorelines, seagrass meadows, and coral reefs that support such species as bottlenose dolphin, sea turtles, Acropora corals, pink shrimp, blue crab, Caribbean spiny lobster, stone crab, bonefish, groupers, and snappers. The Bay and its reef tract make an enormous economic, recreational, and esthetic contribution to the large urban area of Miami-Dade County. The recreational opportunities afforded by the BB-HFA's proximity to a city are an exceptional amenity of local living and a magnet for tourism. Industries supporting tourism are among the fastest growing components of the regional economy. The aesthetic contribution of the clear subtropical waters of the Bay and reef represent an important contribution to real estate value not only in the immediate vicinity of the Bay but beyond it. The Biscayne Bay area was selected by NOAA as a Habitat Focus Area in 2014 not only for its exceptional natural assets and its value to the surrounding area, but also because of the threats the area is facing, some of which are magnified by the very proximity to the urban system that it benefits. The purpose of this document, the BB-HFA Implementation Plan, is to describe the primary goals of the BB-HFA and the major threats to the Bay underlying those goals and to outline the ongoing and future activities related to these goals.

The primary goals of the Biscayne Bay HFA Implementation Plan are to, by 2020:

1. Understand major sources of nutrients that contribute significantly to algal blooms in Biscayne Bay and work with resource managers to inform development and application of enhanced policies and management approaches to improve water quality and habitat condition in the Bay ecosystem.
2. Improve freshwater inflows to enhance estuarine habitat conditions in western nearshore Biscayne Bay.
3. Support and enhance recovery of protected species and sustainability of fishery species and protect and restore their habitat.
4. Increase public awareness of the ecological, economic, and social benefits of the Biscayne Bay ecosystem and increase citizen involvement in Bay-related conservation activities.

These goals are interrelated and address threats to the bay related to three major issues: ***water quality***, ***water quantity***, and ***physical/biological habitat***. Policy makers, resource managers, and the public need to know the value of the services the Bay provides in order to better appreciate a healthy bay ecosystem and ensure its future. The value of Biscayne Bay to the regional economy and the ***socioeconomic services*** of the bay have not been evaluated since 2004; thus, the lack of updated socioeconomic data is a fourth major issue.

Key issues threatening the Biscayne Bay HFA

Water quality

Collaborative water quality monitoring conducted by investigators from NOAA, Florida International University (FIU), and the Miami-Dade County Department of Regulatory and Economic Resources, Environmental Resources Management (MD-DERM) led to the discovery that chlorophyll-*a* concentrations in all parts of the bay, including the more pristine central and southern areas, have been increasing for the past 20 years. Since 2005, two unprecedented large scale algal blooms have occurred in the central and southern parts of the bay. Blooms of microscopic algae in the water column depress dissolved oxygen levels in bottom waters, reduce water clarity, and shade out seagrass, causing seagrass loss. Blooms of macroscopic algae growing on the bay bottom overgrow or crowd out existing benthic communities resulting in the loss of healthy benthic habitat and often leaving bare bottom in place of existing seagrass beds. A bloom of the macroalgae, *Anadyomene*, that peaked in 2011-2012 killed approximately 12 square miles of seagrass (Miami Dade County Department of Regulatory and Economic Resources Environmental Resource Management, unpublished data).

A dolphin-mortality event in Biscayne Bay during the summer of 2015 (Litz, NOAA NMFS SEFSC unpublished), suggests that bay habitat quality continues to decline. Five dead dolphin were found in the northern part of the Bay within a 4-month period. This is the first time in over 20 years of study that so many Bay dolphin have died within such a short period. The Biscayne Bay group, consisting mainly of photo-identified individuals, numbers only about 100 (Litz, unpublished).

Water quantity

Biscayne Bay is near the downstream end of a hydrologic system managed primarily for water supply and flood control. As a result of upstream control structures, canals, and operations, freshwater flow to Biscayne Bay has substantially changed in quantity, quality, timing, and distribution. The Comprehensive Everglades Restoration Plan (CERP) seeks to correct damaging influences of this managed system on remaining natural systems. CERP is, however, constrained by commitments to the "built" system for water supply and existing levels of flood control, which affect freshwater inflow to Biscayne Bay from both local and regional sources, and trade offs with other upstream components of the natural system. One CERP project, Biscayne Bay Coastal Wetlands (BBCW), is designed to capture canal water otherwise routed directly into the Bay as point discharge and distribute it broadly along the coastline in a semblance of natural flow pathways, restoring at least a fraction of the bay's former coastal wetlands and improving nursery function along the shoreline. However, upstream CERP projects and accommodations for agriculture in southeastern Miami-Dade County may further reduce annual freshwater flows to Biscayne Bay and change their seasonality. A net loss of water to Biscayne Bay in CERP was recognized in the original CERP planning process (USACE 1999), and a wastewater reuse project and a review of other sources of "makeup" water were proposed to replace the deficit, but the wastewater reuse project was never funded and there was no local sponsor for a project garnering additional water from the built system. Subsequent events and decisions have further threatened Biscayne Bay's freshwater supply. A State "reservation" of fresh water for Biscayne Bay guaranteed only the amount of freshwater specifically required for Phase I of BBCW, not protecting the total volume of water flowing into the Bay currently despite a significant deficit in the dry season. Planning for Phase II, and related reservation of additional water for Biscayne Bay, is not scheduled to start until 2020, and the land footprint and fresh water needed for Phase II may have become unavailable by then.

Physical/Biological Habitat

The well-being of protected and fishery species in the BB-HFA depends upon the spatial extent and quality of habitat, and the major ecologically supportive habitat types are all under siege by a variety of threats. The threat of direct physical damage or destruction is imposed on the already mentioned decline in water quality and losses of freshwater inflow. The prime supportive types of habitat in the BB-HFA, in addition to the water column itself, are seagrass, coral reef, and mangrove. For most of the HFA, primary productivity is concentrated in the benthic communities, which provide food and structure to support higher trophic levels of the Bay and reef tract. Seagrass meadows occur in both the Bay and on the reef tract. Seagrass beds in Biscayne Bay support many species of small forage fish and invertebrates and are a feeding ground for reef fish. Various species of fish and invertebrates, including game and commercial species, use the bay as a nursery habitat or shelter in the mangroves prior to migrating to the reef and other offshore habitats. There once were many recreationally and commercially important estuarine dependant organisms that spent their entire lives in the bay. The epiphytic algae that form communities on seagrass blades are an important part of the base of a food web that leads from amphipods to shrimp and small fish. This food web leads to larger fish that support bottlenose dolphin, sawfish, and sharks. Seagrasses are fed upon directly by sea turtles and manatees. Coral reefs are especially noted for their high biological diversity. The productivity of mangroves is focused not only in leaf, stem, and root biomass but also in the community of epiphytic organisms, including oysters that colonize submerged mangrove prop roots.

Seagrass and corals are especially vulnerable to water quality degradation. Seagrass and mangroves are affected by past and future changes in the quantity of fresh water Biscayne Bay receives from the upstream managed hydrologic system. All three types of habitat are vulnerable to physical threats. These threats include shoreline and marine construction and damage from boats and anchors. Physical threats to Biscayne Bay habitat have been accelerating with increased population, economic development, and increased boat-based recreational activities.

Socioeconomics

Up to date socio-economic information is needed for use with ecological information to help policy makers, resource managers, and the public better evaluate the services that Biscayne Bay provides and better appreciate a healthy bay ecosystem. New data and approaches are available to build on and expand the work performed most recently in 2004.

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BB-HFA GOAL SUPPORTING ONGOING ACTIVITIES OF NOAA AND KEY PARTNERS

Ongoing activities of NOAA and our resource management partners that support BB-HFA goals are listed in Table 1, and many of these are included as key activities in our Implementation Plan. Ongoing activities of the NOAA laboratories support their mandates of providing sustainable fisheries, protecting marine mammals and endangered and threatened marine species, conserving coral reef, and, implied, ecosystem management. The listed ongoing activities of Biscayne Bay resource management entities are taking place independently of BB-HFA implementation plan development and were not specifically designed to support BB-HFA goals and yet, they do, because BB-HFA goals are so well aligned with the goals of these resource management entities. Including these activities in our planning and working together with our resource management partners will enable a more effective overall effort to restore and protect Biscayne Bay and its adjacent reef tract.

The two NOAA Labs at the shore of Biscayne Bay, the Southeast Fisheries Science Center (SEFSC) of the National Marine Fisheries Service (NMFS) and the Atlantic Oceanographic and Meteorological Laboratory (AOML) of the Office of Oceanic and Atmospheric Research, are the lead NOAA entities supporting the BB-HFA. These NOAA labs have several ongoing projects that support the BB-HFA goals, all of which are included in this Plan. The Coral Reef Conservation Program (NOAA/NOS/CRCP) also has activities relevant to this Implementation Plan for BB-HFA.

Key partners of NOAA in the BB-HFA are Biscayne National Park (BNP), Miami Dade County (mainly Division of Environmental Resources Management (MD-DERM) in the Department of Regulatory and Economic Resources, and the Florida Department of Environmental Protection's (FDEP) Biscayne Bay Aquatic Preserves (BBAP). Each of these organizations follows a management plan. A long-term Biscayne Bay Management Plan for Biscayne Bay was developed by Miami-Dade County in 1981 and reviewed in 2001 (http://www.miamidade.gov/environment/library/reports/biscayne-bay-mgt-plan.pdf) as part of the Biscayne Bay Partnership Initiative, a state-sponsored review and planning effort to bring attention and resources to the Bay (http://www.discoverbiscaynebay.org/documents/website/BBPI-Final_Report.pdf). The General Management Plan for Biscayne National Park was approved by the Regional Director August 31, 2015, and contains provisions for a no-take marine reserve in part of the

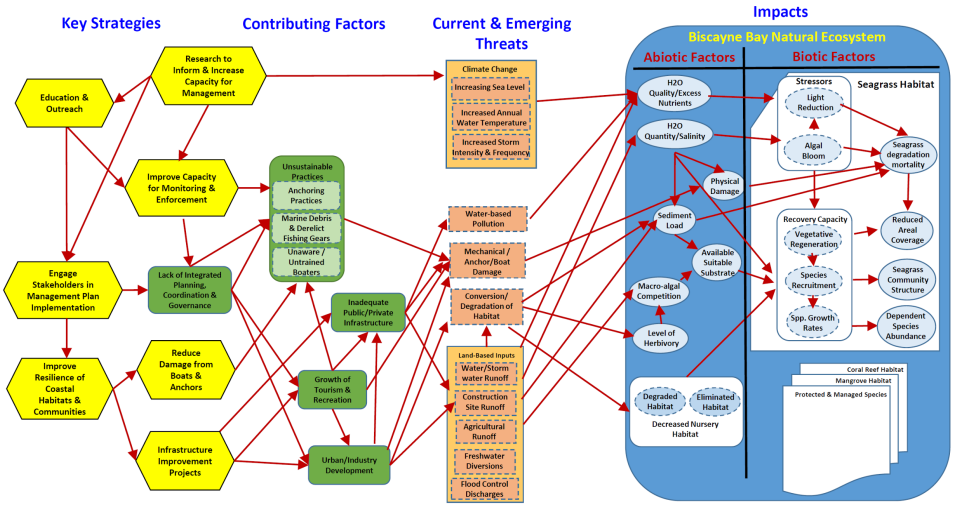
reef tract area of the Park and other zones with special protections inside the Bay (plan accessible at http://parkplanning.nps.gov/document.cfm?parkID=353&projectID=11168&documentID=65801).
The draft management plan for Biscayne Bay Aquatic Preserves is nearing completion of the approval process at the Florida Department of Environmental Protection in Tallahassee and is available on line at http://publicfiles.dep.state.fl.us/cama/plans/aquatic/Biscayne_Bay_Aquatic_Preserves_Management_Plan_2012.pdf.

BB-HFA IMPLEMENTATION PLAN KEY ACTIVITIES, BY GOAL AND OBJECTIVE

The overarching goal of the BB-HFA is to protect and enhance Biscayne Bay's support value for protected and fishery species and the human environment and economy. Water quality and quantity issues and physical damage or destruction are the main threats to BB-HFA habitats supporting protected and fishery species. These same issues jeopardize the underpinnings of the regional human environment and economy. Goal 1 of this plan addresses water quality issues and Goal 2 addresses water quantity issues. Much of the habitat in the BB-HFA is biologically based and exceptionally fragile Use of this habitat by protected and fishery species and habitat damage or destruction are addressed in Goal 3. Helping partners accomplish their habitat-protection goals is critical to making progress toward protecting and restoring habitat.

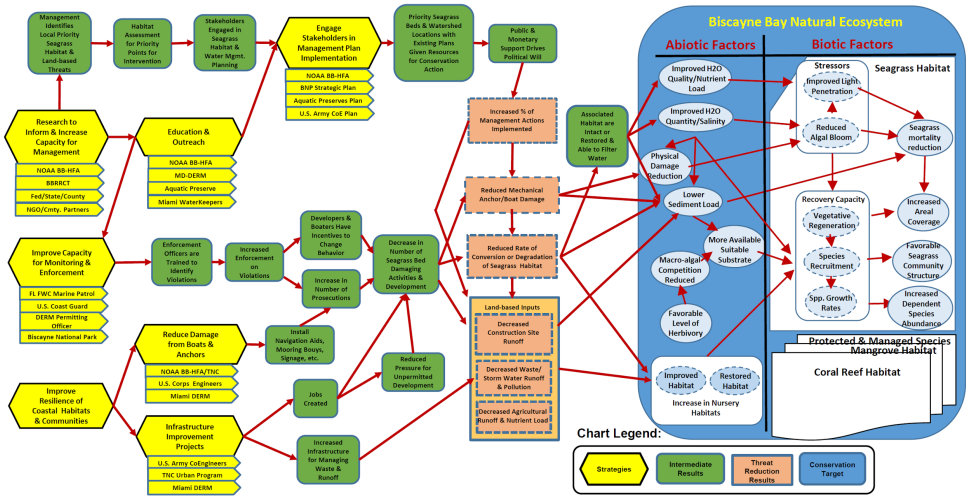
The Logic Framework Model (for the Seagrass Habitat component) shown in Figure 3 provides a graphic representation of the complex interactions among the different elements of the Biscayne Bay Habitat Focus Area. As a planning guide, the Log Frame model provides a systematic approach to problem solving by enabling the BB-HFA team to identify: (1) the major current and emerging threats to the ecosystem, (2) the factors contributing to these threats, and (3) their specific impacts on both the biotic and abiotic components of the system, which in turn (4) determine the overall health of the Biscayne Bay and the well-being of the people that benefit from the Bay's ecosystem services. Disaggregating the major, long-term threats into more specific, "bite sized" contributing factors enables the BB-HFA team to identify short- as well as medium-term strategies to effectively address Biscayne Bay issues at the local community, Bay-wide, and regional levels.

Figure 3. Logic Framework for Biscayne Bay (Seagrass Habitat component)



Following from the Logic Frame Model, the Results Chain Model (for example, the seagrass habitat component of the Biscayne Bay Ecosystem) shown in Figure 4 provides a framework for translating Biscayne Bay HFA goals into implementation strategies and action programs that specifically address the key contributing factors impacting the overall health and long-term sustainability of the Bay. The Results Chain model also functions as a communication tool for resource managers and education/outreach professionals as it allows stakeholders and local communities to see the linkages between policies, programs and regulations with expected improvements in ecosystem services and outcomes. It also shows how and where their individual as well as collective actions, no matter how small, can make a difference in bringing about a healthy Biscayne Bay HFA.

Figure 4. Results Chain Model for Biscayne Bay (Seagrass Habitat component)



Goal 1. By 2020, understand major sources of nutrients that contribute significantly to algal blooms in Biscayne Bay and work with resource managers to inform development and application of enhanced policies and management approaches to improve water quality and habitat condition in the Bay ecosystem.

Biscayne Bay has been experiencing warning signs that it could be approaching a tipping point for eutrophication. Biscayne Bay is a naturally clear water system that contains the majority of primary production in benthic communities and shoreline mangrove communities (Brand, 1988). Increasing nutrients in the water column shifted portions of North Biscayne Bay to a more water column dominated primary production system while southern Biscayne Bay remains a primarily benthic primary production dominated system. Many estuaries around the world have exceeded the tipping point toward eutrophication, resulting in a significant loss of seagrass and benthic primary production as pelagic phytoplankton shade out benthic plants (REF). Phytoplankton blooms can damage sponges and cause a cascade of ecological disturbance that affects important commercial fishery species, such as spiny lobster, *Panulirus argus* (Butler et al., 1995).

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The warning signs in Biscayne Bay include:

1) 20-year increases in chlorophyll *a* and soluble reactive phosphorus, the limiting nutrient in Biscayne Bay
2) unprecedented macroalgal bloom of *Anadyomene* sp. from 2009 until present that is causing seagrass mortality (estimated 12 mi^2 loss, MD-DERM), leaving unvegetated bottom, and thus reducing habitat quality
3) unprecedented phytoplankton blooms in 2013

Depending on the nutrient source, mitigation strategies to reduce nutrient inputs can often be expensive. Targeted approaches to determine and reduce the most influential sources of nutrients are the preferred method. To help protect the vital seagrass habitats of Biscayne Bay, the Habitat Focus Area aims to develop scientific understanding necessary to advise managers and regulators on the most effective and efficient methods to reduce the nutrient sources to Biscayne Bay.

OBJECTIVE A – Understand the major sources of nutrients that contribute to algal blooms and the long-term increase in SRP and chlorophyll a in Biscayne Bay.

Strategy: Improve Capacity for Monitoring and Enforcement

The first step to achieving nutrient controls necessary to protect Biscayne Bay's habitats is quantifying the nutrient sources contributing to algal blooms and increases in nutrients and chlorophyll *a* over the past 20-years. Analyzing existing water quality monitoring data that has been and continues to be collected in Biscayne Bay will allow us to begin quantifying the relative importance of different nutrient sources. Because nutrient reduction measures can be expensive, the existing monitoring data should be supplemented with data aimed at determining the source of different land-based types of pollution that could be targeted with management actions. This source should then be coupled with the impacts to natural communities. Funding for water quality monitoring programs has been cut significantly in recent years at all levels of government. In response to this recent dearth of water quality monitoring in Biscayne Bay, Florida Sea Grant has launched a citizen water quality monitoring program called Biscayne WaterWatch. The hope is that Biscayne WaterWatch will be a model for supplemental, scientifically-sound water quality monitoring.

The activities and data listed below have been identified as necessary to understand nutrient distributions in Biscayne Bay and quantify the sources of these nutrients especially with regards to potential land-based or aquifer sources of pollution. The collection and analysis of this data should be of the highest priority.

Major activities to support this work include:

- Collect monthly samples on the distribution of nutrients (TP, TN, NH_4, NO_x, Silica, and SRP) and chlorophyll *a* in Biscayne Bay (ONGOING; LEADS: Miami-Dade County; Miami Waterwatch/Florida SeaGrant; NOAA/AOML; BNP)
- Collect data on flow and nutrients at canal gates to calculate monthly loading estimates for nutrients (TP, TN, NH_4, NO_x, Silica, and SRP) entering Biscayne Bay canals from upstream locations (ONGOING; LEADS: SFWMD, Miami-Dade County)
- Conduct surveys of canal waters to better understand nutrient distributions (TP, TN, NH_4, NO_x, Silica, and SRP) and chlorophyll *a* from canal gates to the Bay. This will quantify how far into Biscayne Bay specific canals influence nutrient distributions and identify canals with the greatest nutrient inputs into the Bay. (ONGOING: HFA funded FY15 and unknown status for FY16; LEAD: NOAA/AOML)
- Conduct intensive temporal monitoring at canal structures to determine the representativeness of monthly loading measurements (NOT CURRENTLY FUNDED; LEAD: NOAA/AOML)
- Collect samples of markers to identify potential nutrient sources from wastewater treatment plants, septic tanks, agriculture, and grass fertilizers (NOT CURRENTLY FUNDED; LEADS: NOS/NCCOS & FLORIDA DEP)

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• Nutrient and chlorophyll-a sampling at 47 alongshore sites between Shoal Point and Turkey Point biannually in conjunction with an ongoing epifaunal sampling project (IBBEAM); collateral sampling at 27 additional sites slightly offshore (HFA FY15 FUNDING; LEAD: NOAA/SEFSC)

Outcome:
• Better understanding and ability to control nutrients that impact the health of Biscayne Bay.
• Adoption and continued operation of Biscayne WaterWatch's citizen science program as a viable supplement to the current Miami-Dade DERM water quality monitoring program.

Performance Measure:
• Acceptable number and quality of monthly water samples from designated sites provided to partner laboratories for nutrient analysis.
• Acceptable quality of biannual nutrient and chlorophyll-a samples collected at 47 alongshore sites in conjunction with IBBEAM epifaunal sampling.
• Samples collected by Biscayne Waterwatch Citizen Science program comparable with Miami-Dade DERM collections.

OBJECTIVE B – Develop Scenario Evaluation Tools to Develop Effective Nutrient Reduction Strategies

Strategy: Research to Inform and Increase Capacity for Management

Analytical results will be used to develop an ecological forecasting capability for scenario evaluations that predict the effectiveness of different nutrient reduction approaches. These scenario evaluations would then provide the scientific basis for implementing effective nutrient controls for Biscayne Bay. The scenario evaluations still need to be effectively communicated to managers.

Major activities to support this work include:
• Conduct a 20-year trend analysis of the water quality data.
• Develop an ecological forecasting model
• Predict the effectiveness of various nutrient reduction approaches.
Evaluate ….
• Communicate results to resource managers directly and through the BB-HFA education/outreach programs.

Outcome:
• Reliable ecological forecasting tool; effective reduction in nutrients.

Performance Measure:
• Percent reduction in nutrient inputs
• Reduction in frequency and extent of algal blooms.

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OBJECTIVE C – Educate Decision-Makers on the Importance of Biscayne Bay, the Issues in Biscayne Bay Regarding Nutrients, and Effective Nutrient Controls

Strategy: Engage Stakeholders in Management Plan Implementation

The third strategy will be to communicate this information to decision-makers in such a way that effective nutrient mitigation measures are enacted. The Biscayne Bay HFA will work with partners at Miami WaterKeepers to conduct on the water education for elected officials that focuses on communicating: 1) Biscayne Bay's ecological and economic importance, 2) the nutrient pollution issues facing Biscayne Bay, and 3) effective, potential mitigation strategies for reducing nutrient loading to Biscayne Bay and protecting its vital seagrass and sponge habitats. (See Goal 4 for details).

OBJECTIVE D – Reduce the quantity of sewage entering the bay directly or, indirectly, in groundwater or canal water.

Strategy: Conduct infrastructure improvements.
Major activities to support this work include:
• Replace old infrastructure to reduce future sewage spills, based on historic data on spill locations and volumes. (ONGOING, MD-WASD)
• Replace septic tanks, converting these areas for connection to sewage treatment plants (planned for 10 commercial corridors based on 2013 study; will take 10-15 yrs to complete). (ONGOING, MD-WASD)
• Work with Miami Dade County and the Miami-Dade County Water and Sewer Department to ensure new areas of development in the county are directly connected to sewage treatment plants.

Outcome:
• Significant reduction in sewage/land-based pollution inputs going into Biscayne Bay

Performance Measure:
• Number of septic tanks replaced
• Percentage reduction in sewage spills and related pollution entering Biscayne Bay waters

GOAL 2. Improve freshwater inflows to enhance estuarine habitat conditions in western nearshore Biscayne Bay.

Biscayne Bay is almost continuously subjected to new threats to its freshwater inflows and lacks a specific guaranteed allotment other than a minimal amount that is a "reservation" associated with the Phase I Biscayne Bay Coastal Wetlands (BBCW) project of CERP. Phase II will bring another increment of reserved flow for Biscayne Bay, but the full reservation still will not be as much as the bay is receiving now, and even the planning stage of Phase II is years away. Although monitoring is underway to establish pre-CERP conditions and follow changes associated with CERP implementation, no capability has been identified to address these threats preemptively. Two strategies we will pursue are 1) modeling to relate change in flow to change in habitat area and 2) direct communication water

management and operations staff to take advantage of ad hoc opportunities to improve the quantity, timing, and distribution of freshwater inflow to Biscayne Bay.

The Deering Estate Environmental, Archaeological and Historic Preserve (Deering Estate), a key partner of BB-HFA, is entering the final phase of the development of an education wetland as part of the South Florida Water Management District's (SFWMD) Comprehensive Everglades Restoration Plan (CERP) on their property located in the southern section of Biscayne Bay. This project is part of a larger project to restore freshwater flows into Biscayne Bay as part of the Biscayne Bay Coastal Wetlands Project and CERP. Deering Estate is also engaged in the Deering Flow-way/Cutler Slough Rehydration project, a site specific reconciliation ecology effort to help restore seasonal water flow into an historic slough (a freshwater wetland habitat) that once existed within the Estate boundaries. The Deering Flow-way redistributes water from the SFWM flood protection canals via spur canal and pumping station. The slow moving water is then naturally filtered as it travels through the Estate's habitat and out to Biscayne Bay in a more ecologically beneficial sheet flow manner.

Objective A – Acquire information that can show water managers and others the effects of water management actions on area of bay habitat for estuarine-associated organisms.

Strategy: Research to Inform and Increase Capacity for Management
Major activities to support this work include:
• Use a hydrodynamic model for Biscayne Bay now in the public domain (Stabenau et al. 2015) to predict area of favorable nearshore habitat, as defined for an estuarine fish and invertebrate community (i.e., mesohaline, 5-18 salinity range; polyhaline, 19-30 salinity range), with incremental changes (decreases or increases) in freshwater inflow.
    • Use the same freshwater inflow record from 1996 through 2011 used in Stabenau et al. (2015).
    • Vary freshwater input across the shoreline incrementally, and determine the area within each salinity band with each incremental change in flow.
    • Determine area lost or gained with each incremental flow change.
NOAA/SEFSC and AOML, NPS (UNFUNDED)

• Monitoring in IBBEAM
    • Monitor salinity and temperature and record at 15-sec intervals along the western Biscayne Bay shoreline and develop indices.
    • Monitor submerged aquatic vegetation (SAV) along the western Biscayne Bay shoreline
    • Monitor mangrove fish and epifauna and relate abundance to salinity and seagrass.
BNP, NOAA/SEFSC, UM-RSMAS (ONGOING, FUNDED BY USACE)

• Wetland/groundwater monitoring
    • Monitor SAV downstream from culverts in the L31E canal created to redistribute water to the Bay in BBCW.
    • Monitor physicochemical parameters in groundwater wells at the Deering Estate.
    • Monitor salinity in Deering Estate in groundwater wells in creeks feeding into Biscayne Bay
MD-DERM and MD-PROS (ONGOING, FUNDED BY SFWMD)

Outcome:
15

• Increased freshwater inflow to Biscayne Bay with safeguards to prevent its future loss.

Performance Measure:
• Percent of time that salinity is within the target range window.

Objective B – Improve communications with water managers

Strategy: Engage Stakeholders in Management Plan Implementation
Major activities to support this work include:
• Take part in science planning and science presentation meetings of CERP and the South Florida Ecosystem Restoration Task Force (SFERTF) BNP, MD-DERM, SEFSC (ONGOING)
• Attend and help support the BBRRCT, whose priority activity is to advise the SFERTF Working Group on issues affecting freshwater inflow to Biscayne Bay. BNP, MD-DERM, SEFSC, BBAP, NPCA (ONGOING)

Outcome: Increased attention to Biscayne Bay's water needs by Working Group and participating agencies.

Performance Measure: Number of BBRRCT letters or reports to the SFERTF Working Group with recommendations on issues affecting quantity, quality, or distribution of water flow to Biscayne Bay.

Objective C – Seek ad hoc opportunities to augment flows and improve timing and distribution.

Strategy: Engage Stakeholders in Management Plan Implementation
Major activities to support this work include:
• Improve communications with SFWMD management and operations staff about Biscayne Bay's freshwater inflow needs. MD-DERM, BNP, NPS (ONGOING)
• Keep up-to-date on flows and weather. MD-DERM, NPS (ONGOING)
• Use opportunities to modify operations temporarily to improve the quantity, timing, and distribution of freshwater flow to Biscayne Bay within present management constraints. NPS, MD-DERM (ONGOING)

Outcome: More water to Biscayne Bay, delivered with ecologically supportive timing and distribution.

Performance Measures: Number of opportunistic modified release events.

Objective D – Decrease urban water demand

Strategy: Engage Stakeholders in Management Plan Implementation
Major activities to support this work include:
• Continue Water Conservation Program implemented in 2006 with incentives for switching to high efficiency toilets and fixtures.

• Survey landscaped components of single and multi-residential homes and provide one-time-only $2,800 toward retrofit irrigation systems on owner-acceptance of recommended irrigation improvement.
(ONGOING, MD-WASD)

Outcome:
• More water available for the Bay

Performance Measure:
• Number of gallons reduced

GOAL 3. Support and enhance recovery of protected species and sustainability of fishery species and protect and restore their habitat.

Objective A – Improve knowledge of the habitat requirements of BB-HFA protected species and managed fishery species.

Strategy: Research to Inform and Increase Capacity for Management

Many protected species occur in the BB-HFA. Under NOAA's mandate are the bottlenose dolphin, five sea turtles (green, loggerhead, hawksbill, Kemp Ridley, and leatherback), the smalltooth sawfish, and nine Endangered Species Act (ESA)-listed coral species, including two *Acropora* and five newly listed species. SEFSC has ongoing projects related to improving our knowledge of habitat use and habitat needs of bottlenose dolphin, the sea turtles, and the Acropora corals. SEFSC has been studying the bottlenose dolphin groups in Biscayne Bay since 1990, starting with a photo-identification effort that has provided the underpinnings of other studies. This work has become particularly relevant to BB-HFA because five dolphin mortalities have been reported in Biscayne Bay since the BB-HFA habitat designation, all within the 4-mo period from late April to late August, 2015. The first investigation of living sea turtles in Biscayne Bay was started by SEFSC turtle scientists in 2014.

The West Indian Manatee is an important marine mammal living in Biscayne Bay that is federally protected under both the ESA and the Marine Mammal Protection Act, but its protection is the mandate of the U.S. Fish and Wildlife Service rather than NOAA. A previous major cause of manatee deaths in Miami-Dade County was entrapment in SFWMD water control structures, but this problem was resolved with the installation of new gates specially designed to prevent manatee entrapment. Collision with boats is presently the main cause of manatee deaths in Miami-Dade County. Miami Dade County has a Manatee Protection Plan that is coordinated with the regional U.S. Fish and Wildlife Service Manatee Recovery Plan and the Florida Fish and Wildlife Manatee Management Plan.

The smalltooth sawfish is an endangered species known to use mangrove areas as nursery habitat. NOAA-designated Essential Fish Habitat (EFH) for smalltooth sawfish includes Southwest Florida in the Charlotte Harbor-Peace River area and from Cape Romano south through the Ten Thousand Islands and Florida Bay to U.S. Highway 1, the boundary between Florida Bay and Biscayne Bay. With this plan, we introduce new BB-HFA efforts to consolidate and improve the knowledge base on smalltooth sawfish presence in Biscayne Bay.

Major activities to support this work include:
• Study population structure, movements, health, and group interactions of bottlenose dolphin in the BB-HFA, characterize habitat use, and investigate potential causes and contributory factors for the recent bottlenose dolphin deaths in the Bay. NOAA/SEFSC (ONGOING)
• Initial emphasis is on identifying who (species and size groups) is using the Bay and the parts of the bay and characteristics of habitat where found. SEFSC has participated for many years in the regional stranding network for sea turtles, covering beaches on Virginia Key routinely and responding to citizen alerts on stranded turtle sightings. Stranding results reveal the past presence not only of loggerhead and green turtles, but also Kemp's Ridleys, Hawksbills, and Leatherbacks, in the BB-HFA. NOAA/SEFSC (ONGOING)
• MD-DERM administers the Miami-Dade County Manatee Protection Plan with its regulatory, enforcement, and education and outreach components. MD-DERM, FFWCC, USFWS, SFWMD (ONGOING)
• Presence and Potential Habitat of Smalltooth Sawfish in Biscayne Bay.
This new BB-HFA project will
- Use existing data to document the presence of smalltooth sawfish in Biscayne Bay and the type of habitat where found
- Communicate with SEFSC scientists studying sawfish in the EFH to learn more about the characteristics of habitat frequented there
- Collaborate with University of Miami scientists studying lemon sharks in Biscayne Bay to take advantage of acoustical arrays
- Discuss sawfish imperiled state and potential for restoring juvenile habitat in CERP-BBCW footprint with project managers to increase the potential benefits of restoring sheet flow.
- Collaborate with citizen scientists, local schools, and the Deering Estate on the deployment and monitoring of smalltooth sawfish in Biscayne Bay based on acoustic arrays within their properties.
- BB_HFA involvement may help enhance communication among the many groups working on smalltooth sawfish and sharks.

NEW HFA PROJECT, NOAA/SEFSC (UNFUNDED)

Outcome:
• Improved scientific information on the use of Biscayne Bay by protected species

Performance Measure:
• Improved protection through scientific information gained and its use in education and outreach.

Objective B – Determine the condition of fishery species and their use of habitat in the BB-HFA.

Strategy: Research to Inform and Increase Capacity for Management

The Reeffish Visual Census is a well-established diver-based method of monitoring reef fish species that was developed by SEFSC and UM-RSMAS on the Florida Keys Reef Tract and has been refined over time and extended north to the reef tract of Biscayne National Park and beyond. In a multispecies assessment of exploited fish species in Biscayne National Park that was based on RVC and other data,

Ault et al. (2001) determined that 77% of the 35 species that could be analyzed were overfished. In response to this report and other information, a no-take marine reserve was designated in the reef tract part of the Park. Continued application of the RVC is needed to follow change over time in abundance of reef fish species in the BB-HFA and to determine the effectiveness of the new BNP no-take marine reserve.

Major activities to support this work include:
• Coordinate with UM-RSMAS, BNP and FFWCC to conduct RVC of Biscayne National Park and Miami-Dade County area and compare fish densities and size distributions to previously collected (2014) data to evaluate the effectiveness of the newly designated no-take marine reserve in BNP after at least 1 yr of enforced operation and biennially thereafter. NOAA/SEFSC (ONGOING).
• Prepare a user-friendly data portal to improve access to RVC data. NOAA/SEFSC (ONGOING)
• Modify the new RVC data portal to allow RVC data for the BB-HFA to be analyzed as a distinct body (under consideration) NOAA/SEFSC (UNFUNDED).

Outcome:
• Evaluation of effectiveness of no-take marine reserve.

Performance Measure:
• Expanded use of RVC data.

Objective C – Protect and restore habitat used by protected and fishery species

Strategy: Improve Capacity for Monitoring and Enforcement

Up-to-date navigational aids are fundamental to protecting bottom habitat in the BB-HFA and can also be invaluable to resource managers**.** Seagrass and coral, essential habitat for fishery and protected species and their prey, are highly vulnerable to physical damage from boats, and boats can experience damage, as well, for lack of good navigation information. NOAA nautical charts are the basis for most navigational information, including GPS software describing the bay, but bathymetric data for some parts of the BB-HFA need updating. While bathymetric survey data from as recently as 2008 were used in the NOAA nautical chart for some large parts of the BB-HFA, other substantial parts, located both inshore and offshore, are depicted on the NOAA chart using pre 1940 or even pre 1900 survey data.

Major activities to support this work include:
• Compile and develop information that could contribute to creating navigation aids based on GIS overlays.
    • To meet the need for more up to date information, compile existing spatial datasets of benthic cover and bathymetry (e.g., including lidar, aerial imagery, habitat cover) into a set of GIS layers that can be used to create maps useful for nearshore navigation, plan future updates of the official NOAA chart, contribute to commercial navigation applications, site navigational/resource protection signage, and inform resource managers on a range of issues.
    • Where new bathymetry is available or can be inferred, compare to existing bathymetry on the NOAA chart, and departures will be quantified in a separate product. Departures from original bathymetry or shoreline location, along with existing information from recreational boating and

marina use studies, will help NOAA prioritize areas for future surveys to provide bathymetric detail suitable for updating the NOAA chart.

Noted sources of georeferenced digital materials include the Florida Fish and Wildlife Research Institute, the South Atlantic Fishery Management Council, NOAA Ocean Service, NOAA Coast Survey, the National Park Service, and Miami-Dade County. This work will be performed in collaboration with local resource managers and the University of Miami and with advice from the NOAA Coast Survey. Providing up-to-date supplementary maps to help navigation in the short term and facilitating updates of the official NOAA nautical charts in the long term will enable safer boating and better protection of the bay's benthic resources. HFA NOAA/SEFSC, UM-RSMAS (LIMITED FUNDING, HFA FY16 FUNDING REQUESTED)

Outcome:
• GIS products useful to navigation to supplement outdated parts of NOAA charts.

Performance Measure:
• Number of requests/downloads of these products

Strategy: Reduce Damage from Boats and Anchors

Additional permanent physical navigational signage is needed to help boaters avoid certain valuable and vulnerable habitat. This need was expressed by the Bay's three major management agencies. Planning and placing physical signage will require coordination with the U.S. Coast Guard.

Major activities to support this work include:
• Boaters' Guide to Biscayne Bay https://www.flseagrant.org/wp-content/uploads/SGEB_73_web.pdf COMPLETED, FLORIDA SEAGRANT
• Plan and implement placement of new navigational and informational signage to protect seagrass. ONGOING, MD-DERM, MITIGATION FUNDS, BBAP)
• Develop an integrated proposal to obtain funding for navigational signage for the BB-HFA from the Florida Inland Navigation District.
• Help Biscayne National Park install navigation signage to delineate new protective zones along the Bay's western shoreline.
• Help BBAP install navigation/information signage to delineate and protect the state-designated Bill Sadowski Critical Wildlife Area (CWA), which lies immediately adjacent to the water route to the Boat Show planned for Virginia Key. A marina of several hundred boat slips also is planned for the immediate vicinity.

NOAA/SEFSC, BNP, BBAP, FWC (UNFUNDED HFA)

Outcome: Reduction in area of seagrass and coral damaged by boats.

Performance Measure: Number of environmentally sensitive areas identified for recreational boaters; acreage of areas receiving additional protection through added signage.

Strategy: Reduce Damage from Boats and Anchors

Cumulative injury to corals and seagrasses is an inevitable outcome of boat anchoring. A network of strategically-placed mooring buoys could reduce anchor damage substantially and be a convenience to

boaters engaged in many activities. Three recent reports funded by NOAA/NOS/CRCP, as well as other available reports and consultation with local managers, could provide the basis of a planning guidance document.

Major activities to support this work include:
• Collect and analyze data about vessel use patterns, coral reef impacts of boat anchoring and user activity, and effectiveness of mooring buoys to reduce reef damage; prepare reports (COMPLETED, NOAA/NOS/CRCP)
• Develop a mooring buoy planning guidance document, using information from the CRCP reports and discussions with MD DERM, BBAP, BNP, and FKNMS representatives. This would be a planning guidance document and not a plan itself. NOAA/SEFSC (UNFUNDED HFA)

Outcome:
• A mooring buoy planning guidance document for the BB-HFA that resource managers could use to develop or refine mooring buoy plans.

Performance Measure:
• Acceptance of the guidance document by resource managers and effective mooring buoy plans resulting from the guidance.

Objective D – Restore or mitigate for damaged or lost habitat

Strategy: Research to Inform and Increase Capacity for Management
Major activities to support this work include:
• Refine scientific techniques for coral nursery culture, restocking, and reef restoration approaches and their evaluation. (ONGOING, NOAA/SEFSC, /SERO, NOS/CRCP)
• Characterize the trait of disease resistance in elkhorn and staghorn corals using pairwise field transmission assays and targeting genotypes in Tavernier and Middle Keys nursery and wild genets in Key Largo region. (NEW, NOAA/SEFSC, NOS/CRCP)
• Survey damage to seagrass beds from propeller scarring or groundings and plan restoration projects and associated protective signage. (ONGOING, MD-DERM, BBAP)
• Review permit applications and participate in conservation, restoration, and monitoring of seagrass habitat. (ONGOING, BBAP)
• Stock and maintain coral nursery in Biscayne National Park. (ONGOING, UM-RSMAS, UNFUNDED)

Outcome:

Performance Measure:

Strategy: Engage Stakeholders in Management Plan Implementation
Major activities to support this work include:
Conduct/lead restoration projects with volunteers
- Create and maintain native plant communities on Virginia Key. (ONGOING, MD-DERM)
- Create native plant communities on spoil islands in Biscayne National Park. (ONGOING, BNP)

Outcome:

Performance Measure:

Objective E – Increase the length of living shoreline and shoreline otherwise protected with coastal resiliency improvements in the BB-HFA

Strategy: Facilitate Infrastructure Improvement Projects

The mangrove shoreline is an important sea life supporting habitat in Biscayne Bay that has lost ground to development of the shoreline area. With most of the northern bay bulk-headed and seawalls also found in parts of the southern bay, Biscayne Bay is an ideal candidate for implementation of living shorelines using a combination of mangrove and other materials, chosen in combinations depending on the geomorphology and hydraulics of the specific location. Living shorelines provide better habitat for marine organisms than seawalls and their beneficial effects extend into nearby bottom habitat, which is less exposed to bottom scour by proximity to the more natural shoreline. Vegetated shorelines or a combination of plant communities and stabilization materials can attenuate wave action, dissipate wave energy, and mitigate erosional forces. Miami-Dade County has pioneered the establishment of living shoreline on many shoreside tracts of public land. Despite vocal encouragement of the concept, some difficult issues stand in the way of advancement onto commercial and private lands. One issue is the necessary use of either bay area or land area to create a sloping shoreline or to add structure bayward of a seawall. Permitting entities resist the loss of any bay bottom area, especially if seagrass is present; similarly, homeowners, who often have postage-stamp properties, do not want to give up any area of lawn. It may not be easy to work around this problem, but special opportunities (e.g., where there is no seagrass) may exist, and compromises may be possible. Concerted group effort and a good knowledge base will be needed to develop viable approaches and generate the support of permitting agencies and willing landowners.

Major activities to support this work include:
• Restore coastal wetlands and create living shorelines. (ONGOING, MD-DERM)
• Join The Nature Conservancy (TNC) and other living shoreline-coastal resiliency proponents in development of a plan to broaden the use of shoreline restoration, enhancement, and stabilization projects. Successful, large scale implementation of such projects is particularly important in areas already experiencing observable impacts of sea level rise. (TNC, MD-DERM, BBAP, HFA NOAA/SEFSC, UNFUNDED)
• Investigate (in terms of feasibility, design alternatives, and funding) the opportunity to establish a living shoreline/coastal resiliency demonstration project on SEFSC property. The Bear Cut shoreline of Virginia Key, where the SEFSC is located, is seriously eroding, and action is needed to prevent property loss and the likely inability to use the land for a new facility or even sell it. Bear Cut is a tidal channel between Biscayne Bay and the Atlantic Ocean that separates Virginia Key from Key Biscayne. A living shoreline with boulder stabilization would integrate well with a natural barrier island habitat, called Bear Cut Preserve, located on opposite shore (the Key Biscayne side) of Bear Cut. Miami Dade County has previously conducted wetlands restoration, subtropical hammock restoration, and dune restoration on the side of Virginia Key near the SEFSC. NOAA/SEFSC, TNC, (HFA UNFUNDED)

Outcome:
• New projects growing out of this collaborative effort.

Performance Measure:
• Length of shoreline covered by new living shoreline or coastal resiliency projects.

Objective F – Remove derelict or abandoned fishing gear, vessels, and other marine debris from the BB-HFA.

Strategy: Engage Stakeholders in Management Plan Implementation

Blue crab and stone crab traps become lost or abandoned in the bay. The best time for agencies and volunteers to remove them is during the two-week closure of the blue crab fishery every other year, when commercial trappers are required to remove their traps from the water. Then those removing derelict traps do not have to worry about illegally removing active traps by mistake. NOAA/SEFSC has joined this effort, representing the HFA. Vessels become derelict in the bay when they sink or become disabled and are abandoned. MD-DERM makes a herculean effort to remove these vessels from the Bay and is sometimes helped by FIND or the U.S. Coast Guard.

Major activities to support this work include:
• Organize biennial volunteer crab trap removal efforts in Biscayne Bay. (ONGOING, MD-DERM, Florida SeaGrant, BNP, Florida Audubon, NOAA/SEFSC HFA (UNFUNDED)
• Collaborate with other agencies and volunteers to remove derelict vessels from Biscayne Bay (ONGOING, MD-DERM, FIND, US Coast Guard)
• Organize BAYNANZA Community Bayshore Clean-up Day and associated educational activities(MD-DERM)
• Biscayne Bay Litter Prevention Summit (ECOMB, BBAP)

Outcome:
• Removal of gear, vessels, and trash that damage and degrade Biscayne Bay habitat

Performance Measure:
• A clean bay

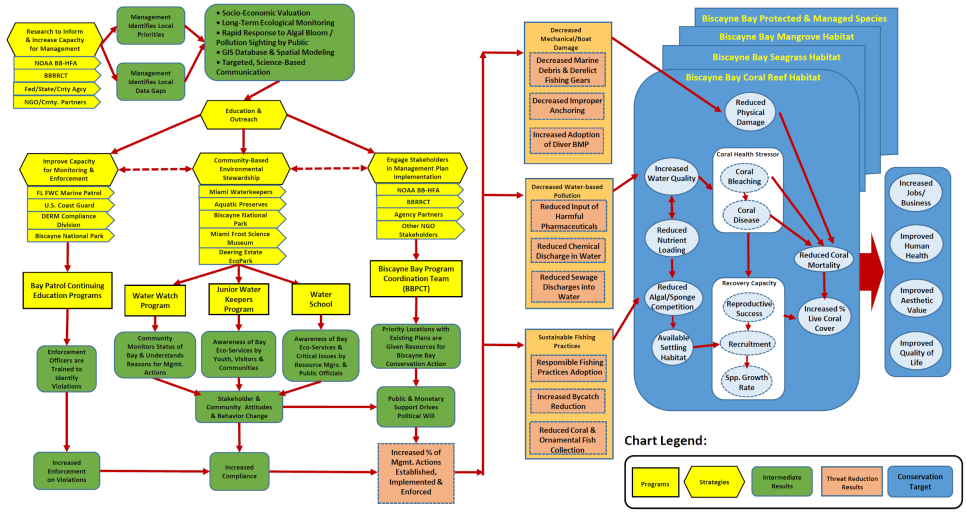
GOAL 4. Increase public awareness of the ecological, economic, and social benefits of the Biscayne Bay ecosystem and increase citizen involvement in conservation activities.

The long-term success of the Biscayne Bay Habitat Focus Area hinges on getting scientists, managers, industry, environmental groups, citizens and other stakeholders working together towards the common goal of balancing the needs of resource conservation with the enjoyment of the many ecological, economic and social benefits that the Bay provides. Key to this is getting citizens and communities engaged in conservation activities based on sound science and best practices. Raising people's awareness can lead to changes in attitude that eventually manifests into responsible individual behavior and practices. Collectively, this translates into active citizen engagement in resource management,

policy development, research, enforcement, and education/outreach programs that result in better stewardship of their environment and resources.

The implementation strategies to achieve Goal 4 of the Biscayne Bay Habitat Focus Area will focus primarily on: (1) ***Research to Inform and Increase Capacity for Management***, and (2) ***Education and Outreach***. The Biscayne Bay Results Chain Model (Figure 5) shows how these strategies and associated programs will be implemented to achieve Goal 4 of the Biscayne Bay HFA.

Figure 5. Results Chain Model for Goal 4 of the Biscayne Bay HFA.



Data Acquisition and Integration:

This component aims at contributing relevant and timely scientific information to help responsible government agencies better manage and protect the resources of Biscayne Bay. Adding to the habitat science (water quality, quantity, and habitat protection) research contributions of Goals 1 through 3, Goal 4 will data mine relevant archival information pertaining to the Bay, update past socio-economic valuation studies, conduct rapid response samplings of reported algal blooms and Bay pollution, and supplement/complement local management agency's long-term water quality monitoring programs in the Bay. In cooperation with Federal, State, and local partners, the Biscayne Bay HFA will make this information available to the public using various media, including a publicly accessible, GIS-enabled, single point-of-contact BB-HFA website.

Objective A – Acquire and synthesize available socioeconomic information relating to Biscayne Bay.

Geno Olmi - NOAA …, 1/16/2016 2:36 AM
Comment [3]: Formatting. Other Goals have Objectives labeled by letter (alpha) rather than numeric.

Much of the Information about Biscayne Bay is dispersed and hard to find. A means is needed to disseminate current knowledge about the bay ecosystem in education and outreach efforts and to advance development of new scientific knowledge about living resources and their habitat.

Strategy: Research to Inform and Increase Capacity for Management
Major activities to support this work include:
• Conduct literature search and review of all referenced and grey literature relevant to socio-economic issues related to Biscayne Bay, including web linkages to all relevant information and a catalog of all ongoing and historical projects within Biscayne Bay that we can access
• Develop Biscayne Bay literature and stakeholder database in Endnote
• Compile stakeholder contact list
• Conduct local stakeholders/key informant Interviews
• Develop a Biscayne Bay-focused and web-enabled GIS database (including projects currently not web-linked) that allow downloading of the GIDAS database (created by the University of Miami to hold some Biscayne Bay scientific information) and encourage other scientists to upload their data to this database
• Provide a single-point-of-entry Biscayne Bay website to facilitate access to and dissemination of scientific and management information regarding Biscayne Bay
• Migrate socio-economic literature, results of Goals 1 through 3 research, and other relevant information into the Biscayne Bay HFA GIS database and website.

Outcome:
• Informed citizenry actively engaged in the science-based management of Biscayne Bay. BB-HFA website and database routinely updated and consulted by citizens, NGOs, communities and government agencies for best available scientific data/information when formulating resource management policies.

Performance Measure:
• Number of decision makers and citizens knowledgeable of the BB-HFA database
• Percent of agencies using BB-HFA database as a reliable source of information when drafting or evaluating management actions
• Number of visits to BB-HFA web portal

Objective B – Integrate socioeconomic and ecological information into messages that help spread realization of the Bay's importance and its need for active support and protection.

Strategy: Research to Inform and Increase Capacity for Management
Major activities to support this work include:
• Develop effective Bay-wide science-based communication strategies in support of local conservation activities:
• Economic valuation studies to update 2005 Hazen and Sawyer; quantify Bay-dependent uses
• Integrate socio-economic, ecological and geographic data into communication strategy/materials for targeted dissemination including web access that allow use of exploratory statistical techniques to examine ecosystem linkages followed by more detailed statistical tests to quantify these linkages (NEW HFA PROJECT, NOAA-AOML-OCED, FUNDED IN FY15)
• Conduct SCUBA, satellite and aerial habitat monitoring surveys
• Conduct ecosystem services calculation and risk analysis associated with algal blooms (On-Going - NOAA/AOML)

Outcome:
• Citizen's stewardship efforts for continued recovery/improvement in the long-term resilience and sustainability of the ecosystem services provided by Biscayne Bay to Southeastern Florida.

Performance Measure:
• Number of informed citizens/community groups engaged in conservation activities in support of common Bay agenda

Education and Outreach

On-Going Education and Outreach Programs of Partners in Biscayne Bay:

Education and Outreach Program at Biscayne Bay Aquatic Preserves (BBAP) includes
• Public presentation forums for academic and public groups
• Train-the-Trainer Program for educators (presently focused on Miami-Dade College staff)
• Environmental Immersion Day program with introduction to water quality and/or weather instruments and biological sampling
• Eco-Experience Tours guided tours by kayak and powered catamaran
• Eco-Experience Bayologist camps and after-school programs for children
  - Baynanza annual county-wide educational activities and shoreline cleanup
  - Law Enforcement natural resource training presentations and programs

Nancy Diersing - N…, 1/26/2016 3:06 AM
Comment [4]: Do you mean only BBAP activities or other partners, too? BNP, Deering estate, Miami Dade Parks Department, Marjory Stoneman Douglas Nature Center all provide BB education related activities, too.

Eric Buck 1/23/2016 2:32 AM
Deleted: adults

Eric Buck 1/23/2016 2:23 AM
Comment [5]: these programs are not current

Education and Outreach Program at BNP includes
• Insert here…

As part of the Biscayne Bay Coastal Wetlands Project and the Cutler Slough Rehydration Project, the Deering Estate is currently engaged in the following research and education activities
• Citizen science program in habitat monitoring and data collection to encourage greater understanding, support, and advocacy of natural areas and restoration projects (with emphasis on understanding wetland habitats and water conservation in a local/regional context)
• In partnership with Florida International University/Florida Coastal Everglades Long-Term Ecological Research, and SFWMD, all professional field research and citizen science data collected is being incorporated into a new K-12 STEM curriculum and a special environmental stewardship training program

NOAA will also work directly with Miami Water Keepers, an NGO actively involved in local environmental issues, to better implement targeted Biscayne Bay HFA social science research, education and outreach programs. We also envision the Miami Water Keepers to serve as the core of a citizen-based stewardship network that will continue to implement and expand on the NOAA Habitat Blueprint beyond its initial five-year project period. One major feature of the Biscayne Bay HFA Education and Outreach strategy is its focus on identifying target audience/stakeholders to better design, develop and implement effective programs and activities that address their specific needs while at the same time minimizing program delivery costs. The following community outreach programs will be implemented through Miami Water Keepers: (1) ***Junior Water Keepers*** targeted at Biscayne Bay elementary through

high school students who will also serve as educational ambassadors to the community, (2) ***Water School*** programs tailored to educate elected officials and their staff about the Biscayne Bay watershed issues and ecological services, and (3) ***Water Watch*** designed to train cohorts of citizen-scientists to conduct water sampling as part of a collaborative Biscayne Bay water quality monitoring network.

Objective C – Increase citizen involvement in conservation activities.

Strategy: Education and Outreach
Major activities to support this work include:

Community-Based Environmental Stewardship Program:
Engage Citizens Panel & partners to develop and implement the curricula for the following Biscayne Bay HFA education/outreach programs:

1. Water Watch - water quality monitoring by trained Citizen Scientists to supplement under-represented/ sampled sites as well as complement existing FL DERM field sampling stations and monitoring program
Major activities to support this work includes:
• Recruit, train, and equip citizen scientists to collect scientifically-rigorous water quality data for processing in Miami-Dade County Laboratories
• Provide water quality data for public use and management decisions

Performance Measure:
• Percent of local community residents aware of Biscayne Bay water quality issues
• Number of Citizen Scientists participating in the cooperative water sampling program
• Percent of policies and management decisions that incorporated Water Watch data

2. Water School - Bay-orientated half day educational tours specifically tailored to public officials and their aides to make them aware and educated on Biscayne Bay's critical water quality, habitat/resource management issues.

Major activities to support this work includes:
• Conduct annual educational workshops about Biscayne Bay for 20 elected officials/aides
• Communicate findings of economic, water quality, and GIS studies directly to elected officials

Performance Measure:
• Reaction time of officials to act on algal bloom events
• Percent of policies and management programs based on best science
• Increase in funding for BB conservation programs

3. Junior Waterkeepers - Bay-related curriculum to educate children about the bay in schools across the county; groom young Junior Waterkeepers Ambassadors to promote the health and importance of critical Biscayne Bay habitats and organisms to the local communities
Major activities to support this work includes:
• Develop curricula about Biscayne Bay
• Recruit and train student educators and potential Biscayne Bay JW Ambassadors to the community

• Recruit, train and organize a core network of Junior Waterkeepers and teachers among participating Biscayne Bay elementary and high schools
• Administer/organize Junior Waterkeepers/Ambassadors Outreach presentations and events at various participating schools and communities
• Incorporate education/outreach activities into partner school's and community's Junior Waterkeepers programs (e.g., smalltooth sawfish monitoring, adopt-a-water quality station, etc.)

Performance Measure:
• Percent of JW qualifying as BB local JW Ambassadors
• Number of school districts participating in JW programs
• Number of teachers who incorporated BB-HFA issues in their courses

Overall Outcome:
• Active citizen involvement in Biscayne Bay conservation programs and activities together with local community groups and government agencies.

Objective D – Establish a collaboration with the County and other enforcement agencies to enhance enforcement of regulations and increase user compliance.

Strategy: Improve Capacity for Monitoring and Enforcement
Major activities to support this work include:
Establish and maintain partnerships with Federal, State, and Local resource management and enforcement agencies to devise better outreach efforts that increase compliance through:
• BBRRCT Seminar Series
• Coordinate with DERM, Aquatic Preserve, Biscayne National Park, Miami Waterkeepers to establish the curricula and jointly implement the "Bay Patrol Continuing Education Program" targeted at improving the capability of enforcement officers in recognizing, coordinating, and enforcing multi-agency resource regulations pertaining to Biscayne Bay
• FDEP's Southeast Florida Coral Reef Initiative - Our Florida Reefs process: Community Working Groups composed 68 Recommended Management Actions (RMA) to improve coral health, water quality, and education programs
• Miami-Dade County Manatee Plan includes education/outreach and compliance/enforcement component
• Virginia Key North Point (VKNP) volunteer planting to restore 15 acres of wetlands
• Fishery Awareness Course offered preferentially to those who have received fishing citations, who can take the course in lieu of fines or other penalties; others can also take the course (On-Going - BNP)
• Cell phone application shows boaters where they are located in the bay in relation to jurisdictional boundaries and rules specific to management area (Completed - BBAP, Friends of Biscayne Bay)

Outcome:
• Improved protection of critical Biscayne Bay habitats, managed stocks, and protected species through enhanced enforcement and increased compliance with regulations.

Performance Measure:
• Number of citations for resource use violations
• Ratio of citations issued between users who received instructions and those who did not

Objective E – Engage other Federal, State, and Local government agencies and Non-Governmental Organization (NGO) stakeholders in Bay Conservation programs.

Strategy: Engage Stakeholders in Management Plan Implementation
Major activities to support this work include:
Re-enforce effectiveness of other stakeholders/partners through:
• Establish a local BB Program Coordination Team (BBPCT) that includes major resource management partners in the region
• Continue to support the operations & stakeholder outreach activities of the Biscayne Bay Regional Restoration Coordinating Team (BBRRCT)
• Reach out to other government agency partners (e.g., South Florida Water Management District, U.S. Army Corps of Engineers, U.S. Fish & Wildlife Service, U.S. Department of Agriculture)
• Engage many other NGOs to find out how BB-HFA can better support their conservation efforts on behalf of the Bay

Outcome:
• Maintain and improve the sustainability and health of Biscayne Bay habitats and residents through responsible citizen engagement and stewardship.

Performance Measure:
• Number of priority BBPCT projects approved & slated for funding
• Number of Bay management plans achieving cross-agency consistency
• Number of BBPCT joint projects planned or completed

Summary of Resource Needs (staff and funding), highlighting gaps

Plan for monitoring and measuring progress

Partner and Stakeholder Engagement Strategy

Our partner and stakeholder engagement strategy will have, at minimum, five major components:

- Continued support and involvement in BBRRCT.
- Continued involvement in CERP, with increased participation in workshops and project planning activities most directly related to Biscayne Bay.
- Inclusion of representatives of Miami-Dade DERM, Florida Aquatic Preserves/FDEP Coastal, and Biscayne National Park on our BB-HFA Plan Implementation Coordination Team.
- Expanded communication and collaboration with NGOs directly involved in Biscayne Bay.
- Seek opportunities to engage municipalities.

Communications Strategy

- BBRRCT (local conservation community)
- Storyboard
- Local (AOML and SEFSC) websites
- Media opportunities
- Public speaking engagements
- Single-point-of-entry website