

**The Revised Florida Bay and Adjacent Marine Systems
Strategic Science Plan
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Prepared by

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I. Executive Summary

II. Introduction

The following Strategic Plan is a revision of the March 1997 *Strategic Plan for the Interagency Florida Bay Science Program*. Unlike the 1997 plan which focuses primarily on the 'science' of Florida Bay, this plan has been expanded to include more information on the Florida Bay and Adjacent Marine Systems Science Program process and the mechanisms by which the Program Management Committee (PMC) interacts with and provides timely information to South Florida Ecosystem Restoration (SFER) and Comprehensive Everglades Restoration Plan (CERP) managers. A synthesis of our knowledge about specific Florida Bay research issues will be included as an appendix to this document as will scientific information needs for adjacent marine systems e.g., Biscayne Bay.

A. Background

The Florida Bay and Adjacent Marine Systems Science Program had its beginnings in 1993 when Everglades National Park (ENP), in response to increasing local concern over changes in Florida Bay, formed the informal Florida Bay Working Group composed of interested local natural resource managers and science agency representatives. Although Florida Bay lies entirely within the jurisdiction of either ENP (ca. 85%) or NOAA/FKNMS (15%), additional agencies were involved with the Florida Bay Working Group because of their management responsibilities regarding water delivery or state fisheries, or for their role in developing and maintaining long-term monitoring of water flows into and effects upon coastal areas and living marine resources (SFWMD, FDEP, USGS, NOAA/NMFS, respectively).

Initially, at least three separate research plans were developed for Florida Bay - one each from ENP (Armentano and Robblee, 1993), NOAA (Ortner and Brown, 1993) and the SFWMD (Rudnick et al., 1993). In September 1993, those plans, along with findings from other local scientists were presented to a panel of experts convened at the specific request of the Assistant Secretary of the U.S. Department of Interior. As a result of their findings, the panel recommended a formal management framework operating under one integrated plan with outside scientific oversight (Boesch et al, 1993). As a result, in April 1994 a group of agency representatives developed the first interagency *Florida Bay Science Plan* which was later presented to and approved by both the informal Florida Bay Working Group and the congressionally appointed South Florida Ecosystem Restoration Task Force's Working Group. The plan established the Florida Bay Program Management Committee (PMC) and the South Florida Ecosystem Restoration Working Group was asked to appoint appropriate agency representatives (local science program managers).

The *Florida Bay Science Plan* of 1994 was the basis for the present program and described management responsibilities and framework, scientific goals and objectives, and research approaches and activities. Based upon the 1993 panel report, the plan listed 14 questions encompassing 72 specific associated tasks of varying urgency that needed to be addressed to further understanding of the Florida Bay ecosystem. In

addition, the plan provided the framework for the creation of a standing Florida Bay science review panel (now called the Science Oversight Panel [SOP])

Over the next several years, the PMC expanded to include representatives from the Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), and the U.S. Geologic Survey's Geologic Division (USGS/GD). Some of the ENP participants were reorganized into the National Biological Service (NBS) and, ultimately, into the U.S. Geologic Survey's Biological Research Division (USGS/BRD).

In 1997, at the urging of the PMC's Science Oversight Panel, the *Florida Bay Science Plan* was substantially revised into the *Strategic Plan for the Interagency Florida Bay Science Program*. Whereas the initial plan focused on developing and describing the program process as well as generic information/research needs, the new plan was organized around five central questions with operational hypotheses and conceptual models based upon initial research progress. The new plan also defined needed program elements, some of which were already in progress, to address each of the following five central questions and, where possible, which agency(ies) would be responsible for those elements:

CENTRAL QUESTION #1: How and at what rates do storms, changing freshwater flows, sea level rise, and local evaporation/precipitation influence circulation and salinity patterns within Florida Bay and the outflow from the Bay to adjacent waters?

CENTRAL QUESTION #2: What is the relative importance of the influx of external nutrients and of internal nutrient cycling in determining the nutrient budget of Florida Bay? What mechanisms control the sources and sinks of the Bay's nutrients?

CENTRAL QUESTION #3: What regulates the onset, persistence and fate of planktonic algal blooms in Florida Bay?

CENTRAL QUESTION #4: What are the causes and mechanisms for the observed changes in the seagrass community of Florida Bay? What is the effect of changing salinity, light, and nutrient regimes on these communities?

CENTRAL QUESTION # 5: What is the relationship between environmental and habitat change and the recruitment, growth and survivorship of animals in Florida Bay?

As noted earlier, progress to date in answering these central questions will be included in an appendix based upon draft central question syntheses prepared in April 2001.

Shortly after the Florida Bay Science Plan was revised and at the specific request of the Science Coordination Team and the South Florida Ecosystem Restoration Working Group, the PMC expanded its geographic scope and the program became the Interagency Science Program for Florida Bay and Adjacent Marine Systems. As a result, members were added representing the SW Florida shelf (i.e., Rookery Bay National Estuaries Program), the Florida Keys National Marine Sanctuary, Biscayne National Park and Miami-Dade Department of Resource Management.

B. Program Components: Description and Evaluation

Management and Oversight:

Program Management Committee. Guiding the science program is a committee of science managers (Program Management Committee [PMC]) from the 9 federal and state agencies (see Appendix __) with regulatory, management, or other responsibilities in Florida Bay and the surrounding marine ecosystems e.g., Biscayne Bay, Southwest Florida Shelf. The PMC provides information needed by its respective partners to coordinate the research programs of each agency in pursuit of the goal of understanding the major factors driving change in the coastal marine ecosystems of South Florida. Under the general umbrella of the South Florida Ecosystem Restoration Task Force, the PMC has assumed responsibility for managing a program of research, monitoring, and modeling activities in the South Florida coastal marine environment.

The continued viability of the PMC with its many federal and state agencies working together to ensure the best and most efficient use of limited resources (both financial and other) while continuing to deliver quality science is one of the program's biggest accomplishments. Given each agency's unique mandates and very different internal procedures and budget processes, working together has not always been easy. Nevertheless, the Florida Bay and Adjacent Marine Systems Science Program and its PMC have become the model for how to organize science in other parts of the South Florida Ecosystem Restoration effort.

Implementation plans (a Science Oversight Panel recommendation) for Florida Bay research programs are one mechanism to ensure that agency mandates are being met and that funds are being used appropriately while still ensuring consistency with *Interagency Florida Bay Strategic Science Plan*. The PMC purportedly receives and reviews individual agency implementation plans for scientific activities conducted under program auspices. However, individual agencies have markedly differed in the degree to which they have been able to adhere to this general guideline.

Do we need to say anything about, "it's not in the PMC's domain (as a committee) to recommend regulatory targets" ?

Science Oversight Panel. Integral to the implementation of the Florida Bay Research Program is independent expert review. This need has been served by the Science Oversight Panel (SOP) whose role is to provide regular technical and management review of the quality of research, modeling and monitoring activities and the scientific results and inferences from those activities. The SOP also provides guidance to the PMC on strategies for program development. The present SOP consists of six senior scientists with significant experience in major estuarine restoration programs but without involvement in Florida Bay projects. They participate in annual conferences by formally leading question and answer sessions and by providing written reports to the PMC presenting critical review and recommendations for advancing the program (most recently, Hobbie et al., 2001). Additionally, at the request of the PMC, the SOP has helped to arrange and participate in *ad hoc* advisory panels of experts for specialized technical workshops e.g., circulation modeling.

The Standing Oversight Panel has specifically declined the opportunity to expand its role to address any of the present or planned scientific activities in marine systems adjacent to Florida Bay (e.g. Biscayne Bay or the FKNMS).

Executive Officer. The program was significantly enhanced by the appointment of an Executive Officer (EO) from (month) 1998 through (month) 2000. The EO worked with the PMC and research teams to implement the activities of the Florida Bay and Adjacent Marine Systems Science Program and communicate scientific results to South Florida restoration managers. Specifically, the EO was charged with : 1) initiating the development of Florida Bay restoration performance measures, 2) facilitating syntheses activities, 3) facilitating the development and application of predictive models, and 4) improving the lines of communication between the PMC and the restoration and resource managers. The Executive Officer made progress in other areas as well including the compilation of important documents e.g., a *Draft Implementation Plan*, *Summary of Research on Florida Bay*, all of which are available on the 'Important Documents' page of the program's web site at <http://www.aoml.noaa.gov/ocd/sferpm/oid.html>. Unfortunately, this position has currently lapsed which has markedly slowed recent PMC progress.

Science Activities:

Research Activities. *Include highlights from SOP report for each question*

Monitoring. Greatly enhanced monitoring within and around the Bay and kept alive, etc. (*Good section for Rudnick*)

Predictive Models. Florida Bay is a unique and complex system affected by a myriad of factors making it essential to develop a suite of models that can be used by restoration managers to predict, with confidence, the various outcomes of upstream restoration alternatives. The success of these models depends, to a large degree, on the adoption of hydrodynamic and water quality models.

Considerable effort has been applied towards the development of these models yet the PMC, to date, has no useable hydrodynamic or water quality models. Based on the Physical Science Team's review of the two existing hydrodynamic models i.e., USACE's RMA10 and ENP's FATHOM in early 1999, the Science Oversight Panel recommended that FATHOM be dropped altogether and RMA10 be "put on hold until a satisfactory linkage with finite difference water quality models are worked out (SOP, 1999)." (*Refer to and included results of modeling workshop leading to Terms of Reference. More input from Dave re: Feasibility Study*).

Where does this leave us now? Granted other models are moving forward such as seagrass growth model and carbon model (SOP, 2001) but we can't do much without hydro- and WQ models. Need a lot more in this section.[ABSOLUTELY I AGREE]

Performance Measures. *What is on the table for Florida Bay and what did the PMC say officially about CERP choice (on website)?*

Standard Data Set. The assessment of benefits to Florida Bay from restoring the hydrology of the Everglades depends absolutely on salinity projections obtained from validated, predictive models. To validate these models requires a standard data set for runoff, climate, sea level and salinity that characterizes both the forcing and the response of the Bay during a period in which significant variation occurred in salinity.

A standard data set for Florida Bay is in the final stages of development and, when fully assembled, will be used to support verification of and make comparisons between predictive models. This data set will also be available to users via the World Wide Web.

Research Teams. Functioning research teams, one for each of the five Central Questions, are an essential component of the overall science program. One objective of these teams is to assist in the development of performance measures and conceptual and predictive models and provide coordination of field work. While some teams are well established and have been meeting on a regular basis to exchange information and identify existing gaps in data (see <http://www.aoml.noaa.gov/flbay/pmcrschtms2.html> for reports), others continue to have difficulty getting organized.

Most recently each research team was charged with presenting a draft synthesis to the SOP at the April 2001 conference. Unfortunately, the syntheses fell markedly short of the SOP's expectations. While the SOP acknowledges the challenges involved in synthesizing information, panel members agree that this exercise is critical to bridge the gap between science and restoration managers.

Topical Workshops. Numerous workshops focusing on specific topics e.g., Florida Bay Nutrients, Circulation Modeling, Seagrass Modeling have been held (see Appendix E). As mentioned earlier, some of these workshops included *ad hoc* advisory panels e.g., subcommittees of the SOP, which have led to written recommendations that the PMC accepts as guidance in coordinating the interagency program. Nearly all of these workshops have some form of documentation available on the program's web site at <http://www.aoml.noaa.gov/flbay/pmcrschtms.html>.

Standing Subcommittees. As noted earlier in 1998 the responsibilities of the PMC were expanded to include marine ecosystems in adjoining waters including Biscayne Bay. Specifically, the PMC assumed responsibility for producing a strategic plan for Biscayne Bay much like the existing plan for Florida Bay. The plan identifies the scientific information needs in Biscayne Bay and defines an appropriate organizational model setting the stage for a more cohesive, integrated program of research.

Communication:

Annual Science Conference. The annual science conference has been an integral part of the interagency Florida Bay Science Program since it began in 1994. The conference is intended for three primary purposes: 1) to provide scientists in different agencies or institutions who work on different projects information on the progress being made by their peers thereby facilitating collaboration and cross-

fertilization amongst each other, 2) to regularly update the Florida Bay Science Oversight Panel so they can recommend necessary programmatic changes to the PMC, and 3) to publicize preliminary research results prior to publication since some are relevant to ongoing restoration management decisions. Conferences have been held in October of 1995, December of 1996, May of 1998, November of 1999, and April of 2001.

The format of the April 2001 conference differed significantly from past conferences in that syntheses were given for the major topical areas instead of presentations by individual researchers. Unfortunately, this change in format, intended to facilitate review of the program by the SOP, did not meet the expectations of the either the SOP or the PMC. Recommendations to eliminate the same shortcomings during the next conference can be found in Hobbie et al. (2001) *Report of the Florida Bay Science Conference Science Oversight Panel*.

Outreach and Education. The Florida Bay Education Project is the outreach and education component of the Florida Bay and Adjacent Marine Systems Science Program. It is sponsored by the Florida Sea Grant College Program and the University of Florida Cooperative Extension Service and supported by grants from NOAA/NOS and NOAA/NMFS. The project distributes program generated scientific information via newspaper articles, brochures, presentations and workshops to the various user groups in South Florida and provides support to the PMC during PMC sponsored conferences and workshops. Although the Florida Bay Education Project has produced a number of valuable tools to educate the public e.g., Florida BayWatch Reports, and the PMC agrees that outreach and education are important to the science program, competition (with research) for limited funds has derailed the Florida Bay Education Project. At present, the project is scheduled to terminate in December of 2001. While there is a good possibility that National Sea Grant (through NOAA) may be willing to provide a limited amount of interim funding, this is likely to occur only if the PMC can make a firm commitment for future funding of the Florida Bay Education Project.

Web Site.

C. Rationale for a Revised Plan

Since 1995 the primary program emphasis has been to gain basic understanding of the physical, biological, and chemical environment of Florida Bay and its environs and the processes regulating change and stability within that environment. Another emphasis has been to gain sufficient understanding of the historical Bay to be in a position to define restoration goals. By setting strategic research goals, initiating projects necessary to meet those goals, and maintaining continuity within the program, these goals have by and large been accomplished (see Appendix C), but there is now an additional driving force.

With congressional authorization of WRDA 1996 and WRDA 2000 South Florida Ecosystem Restoration (SFER) is now underway. The three primary goals of SFER are to: 1) restore a more natural hydrology to the region while still meeting the water needs

of growth, development, and agriculture, 2) restore native habitats, and 3) balance environmental needs with social and economic needs

One of the principal components of SFER is the Central Everglades Restoration Plan (CERP) which authorizes a set of actual construction projects that will replumb the upstream system as well as several pilot studies and feasibility studies that are intended to yield the specifics of additional necessary projects. CERP purports to be based upon the best available scientific information and to represent adaptive scientific management. If so, the understanding developed by the interagency Florida Bay and Adjacent Marine Systems Science Program must be incorporated into this ongoing process. We must assure the results of our scientific studies be delivered to restoration managers in a timely and consistent manner and in a form that will effectively benefit restoration decision-making (see Linking Science with Management).

Concurrently, individual agency mandates now require a predictive understanding which necessitates continuing basic process research albeit in a more focused and targeted manner. This would be true regardless of SFER but is, perhaps, all the more necessary to assure that SFER does not proceed at the expense of mandates such as the Endangered Species Act (ESA). Participating agencies with such resource management mandates include *inter alia* NOAA (both NMFS and FKNMS), ENP, and FDEP. *Do we want to say anything about monitoring and modeling?*

III. Revised Mission Statement

IV. Program Goals

A. Physical Sciences

Vision

Challenge (e.g., lack of good hydrodynamic models)

Implementation Strategy (how are we going to accomplish)

Benefits/Links to Restoration

B. Nutrients

V. Integrating Science with Management

One of the problems in any restoration effort is that of integrating the results of quality science with the management decisions being made.

How to use what we learn from research to make effective management decisions
Scientists and managers speak a different language, operate on different timelines, etc.
Is goal of PMC to be this conduit i.e., bridge this gap (how are we going to do it?)

PMC has opportunity with FB/FK Feasibility Study, etc.

Linkages to CERP

*RECOVER (Restoration Coordination and Verification)

organize and apply scientific and technical information to support objectives of CERP
PMC linked through representation on RECOVER committees i.e., Rudnick, Traxler, Ortner, Alleman (specific responsibility for FB and BB conceptual models/programs/monitoring plans e.g., AAT and RET)

Other projects and their PDTs

*Florida Bay/Florida Keys Feasibility Study and its PDT

Evaluate FB and its connections to the Everglades, Gulf of Mexico, and the Florida Keys to determine types of modifications needed to restore water quality and ecological conditions of the Bay

Quantity, timing, and distribution

Nutrient sources and load, impacts to reef, restoration targets

Establish water quality and ecological performance measures

Evaluate potential benefits of restoring connectivity between Bay and Atlantic Ocean

Evaluate problems in holistic manner through employment of hydrodynamic and water quality models

Linkage is that program managers of Feasibility Study i.e., SFWMD and USACE, are now PMC members and have agreed to jointly sponsor a physical modeling scoping workshop based upon the PST's terms of reference

What about SFER i.e., Working Group... The relationship between the PMC of the Florida Bay and Adjacent Marine Systems Science Program and the SFER Working Group (WG) (via the Science Coordination Team [SCT]) of the SFERTF has been hampered by the WG's lack of knowledge of the PMC's program and undefined lines of authority and accountability.

Fundamental challenge for PMC will be to protect quality science while evolving with CERP and SFER.

VI. Timeline

VII. References

Food for thought i.e., things that should likely be addressed in revised plan...

1. SOP's recommendations re: strategic plan
 - central questions need modification and redirection
 - specific objectives and schedules to enhance interdisciplinary collaboration
 - re-examine PMC membership i.e., mix of environmental scientists and those skilled in the application of science and engineering
2. SOP's suggested elements
 - ecological history of Bay (syntheses)
 - holistic interaction between FB and adjoining waters (syntheses)
 - circulation and fate transport w/i FB to define habitat and water quality (syntheses)
 - simulation and development of forecast models
 - definition of current and future resources
3. How to encourage managers to ask for science information
4. Specifics on how we're to engage with CERP e.g., Feasibility
5. Mechanism for regular reporting (to show what PMC is/is not doing)
6. Geographic expansion... what exactly are we willing to do or not do and what problems might we encounter in doing so
7. Evaluate the role of SOP in light of PMC's new relations to CERP, CROGREE i.e., revise charge, discontinue, formalize relation to CROGREE or subcommittee thereof
8. What are we going to do about outreach and education
9. Need some way to evaluate whether we're meeting our goals (report card sufficient for research? but what about other components)
10. Should include list of different agencies and their responsibilities (as part of document or as appendix)
 - *Should define our funding strategies e.g., AOs or subcontracts
 - *Prioritize
11. Are we going to re-engage MEG?
12. What about data management?