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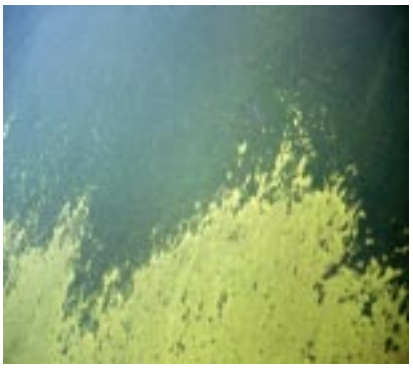
Empirical and Modeling Studies in Support of Florida Bay Ecosystem Restoration

The USGS Florida Caribbean Science Center's Restoration Ecology Branch at Florida International University is conducting research in coastal marine waters of South Florida. Understanding the responses of seagrasses and their fauna to changes in habitat and in the quality, quantity, timing and distribution of freshwater inflows is critical to linking upstream water management to salinity and biotic structure and function in Florida Bay and other coastal waters.



Aerial view of seagrass die-off in the dense grass beds of Johnson Key Basin, Western Florida Bay, 1989

In 1987, a widespread, rapid die-off of turtle grass, *Thalassia testudinum*, began in Florida Bay (Figure 1). Rapid loss of seagrass on the scale observed in Florida Bay (4,000 hectares lost, 60,000 hectares damaged) was unprecedented in tropical waters and hypothesized to threaten the Bay's water quality, sport fishery, and nursery function (Robblee et al.,1991). Linked to the loss of seagrass was a dramatic shift in 1991 from the clear water, *Thalassia*-dominated system characteristic of the Bay, to a system characterized today by extensive and persistent turbidity and algal blooms.

There were also changes in the structure of biotic communities. Seagrass associated fish and shrimp declined in western Florida Bay (Figure 2). Species composition changed; the abundance of the dominant fish, the rainwater killifish, *Lucania parva*, and the dominant caridean shrimp, *Thor floridanus*, declined by over 90%. These changes were still evident in 1997, ten years after the seagrass die-off. In contrast, bay anchovy, *Anchoa mitchilli* were found in dramatically greater numbers in the mid-1990's.

The appearance of the bay anchovy and the Spanish sardine, *Sardinella aurita*, is thought to be a response to the algal blooms which now characterize the formerly clear water Johnson Key Basin.

Dramatic changes in Florida Bay and declines in both the pink shrimp and lobster fisheries, the largest commercial fisheries in Florida, drew attention to the Bay's problems and resulted in calls to restore the Florida Bay ecosystem. An interagency Florida Bay Program Management Committee was formed to develop and coordinate a science program for the Bay (Armentano et al., 1994; FBPMC, 1997).

Florida Bay Research Program Objectives

1. Provide an idealized restoration target by developing an understanding of Florida Bay prior to significant alteration by man.

2. Within the context of natural system variation develop a basic understanding of anthropogenic processes affecting Florida Bay.

3. Develop as management tools an integrated package of landscape-level simulation models predicting the response of the Florida Bay ecosystem and key consumer populations to upstream water management and abiotic forcing.

Florida Bay Research Program Participants

- U.S. Environmental Protection Agency
- Florida Department of Environmental Protection
- U.S. Geological Survey
- U.S. Fish and Wildlife Service
- National Oceanic and Atmospheric Administration
- National Park Service
- South Florida Water Management District
- U.S. Army Corps of Engineers

Department of the Interior
U.S. Geological Survey
Biological Resources Division
Florida Caribbean Science Center
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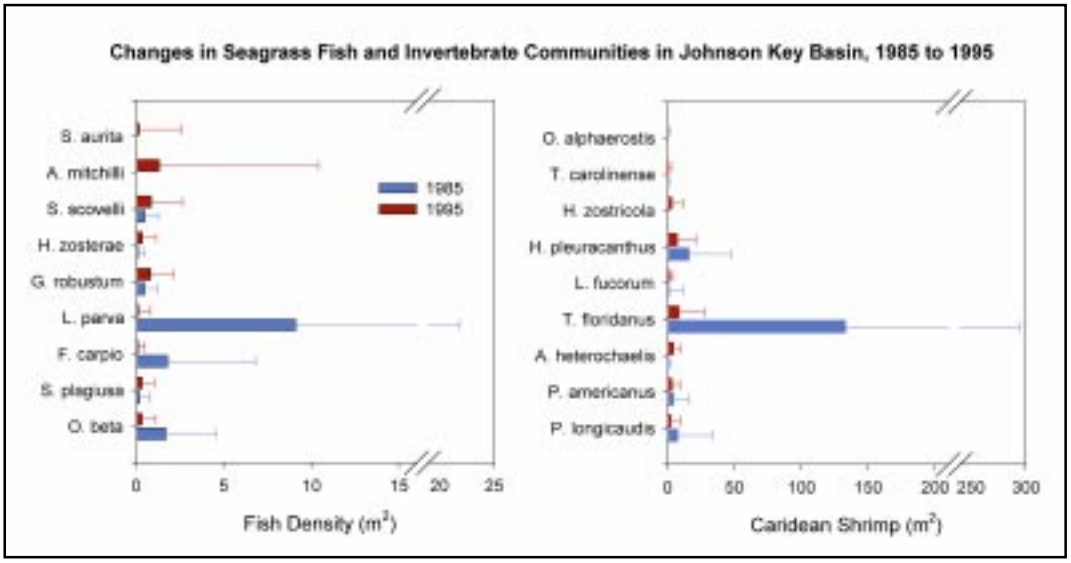

The Florida Bay Research Program addresses five critical research areas: 1) circulation and hydrology; 2) water quality and nutrient dynamics; 3) phytoplankton bloom dynamics; 4) seagrass ecology; and 5) consumer dynamics. Our contributions to this interagency program are listed below. Priorities have emerged from workshops, annual science conferences and scientific oversight panel reviews, coupled with close coordination among participating agencies.

References

Armentano, T. V., M. Robblee, P. Ortner, N. Thompson, D. Rudnick and J. Hunt. 1994. *Interagency Science Plan for Florida Bay*. 43 p.

FBPMC. 1997. *Strategic Plan for the Interagency Florida Bay Science Plan*. 37 p.

Robblee, M. B., T. R. Barber, P. R. Carlson, Jr., M. J. Durako, J. W. Fourqurean, L. K. Muehlstein, D. Porter, L. A. Yarbro, R. T.Zieman, J. C. Zieman. 1991. Mass mortality of the tropical seagrass Thalassia testudinum in Florida Bay (USA). *Marine Ecology Progress Series* 71:297-299.

Ongoing Research and Collaborations

Proposal for an Issue of the Journal Estuaries to be Dedicated to Long-term Studies in Florida Bay. James W. Fourqurean, Florida International University; and M.B. Robblee, USGS-BRD.

Florida Bay Fish-Habitat Assessment Program (FHAP). Michael J. Durako, University of North Carolina at Wilmington; and Margaret O. Hall, Florida Institute of Marine Science.

Temporal and Spatial Variation in Seagrass Associated Fish and Invertebrates in Western Florida Bay: a Comparison with and without Seagrass Die-Off in Johnson Key Basin. M. B. Robblee, USGS BRD.

Relationships among Inshore Sources of the Pink Shrimp, Penaeus duorarum, and the Offshore Tortugas and Sanibel Fisheries. Brian Fry, Louisiana State University; M. B. Robblee, USGS BRD; and James W. Fourqurean, Florida International University.

Fish Recruitment, Growth and Habitat Use in Florida Bay: an Integrated Team Approach. Donald Hoss, William Hettler, David Peters, Allyn Powell, Gordon Thayer, NOAA/NMFS; M.B. Robblee. USGS-BRD; Richard Matheson, David Camp, FDEP/Florida Marine Research

High Resolution Bathymetry of Florida Bay. Mark Hansen, USGS-GD (St. Petersburg).

Estuarine Fish Community Structure - Patterns of Stability, Change and Succession in Relation to C-111 Hydrology Modification. Kenneth Sulak, USGS-BRD.

Salinity Patterns in Florida Bay: A Synthesis.
Gail Clement, Florida International University; M. B. Robblee, USGS BRD; Robert B. Halley, USGS GD (St. Petersburg); DeWitt T. Smith, NPS-Everglades National Park.

A Seagrass Light Monitoring Network for Florida Bay.
Paul Carlson, FDEP/Florida Marine Research Institute.

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