Science Supporting Water Needs of Biscayne Bay

Sarah Bellmund

Biscayne National Park -NPS

Joe Serafy

National Marine Fisheries Service –NOAA

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SFWMD West Palm Beach

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Messages

Biscayne ***is not*** an estuary

Biscayne Bay ***was*** an estuary

Three conditions combine to detract from the Bay's ecological integrity and function.

1. Freshwater delivery pattern (FW entering the Bay in abrupt, localized pulses).

2. Hypersalinity (due to reduced quantities of FW).

3. Reduced water quality (contaminants, etc.)

Fish studies and other observations represent an important source of insight into the Bay's present, past and future.

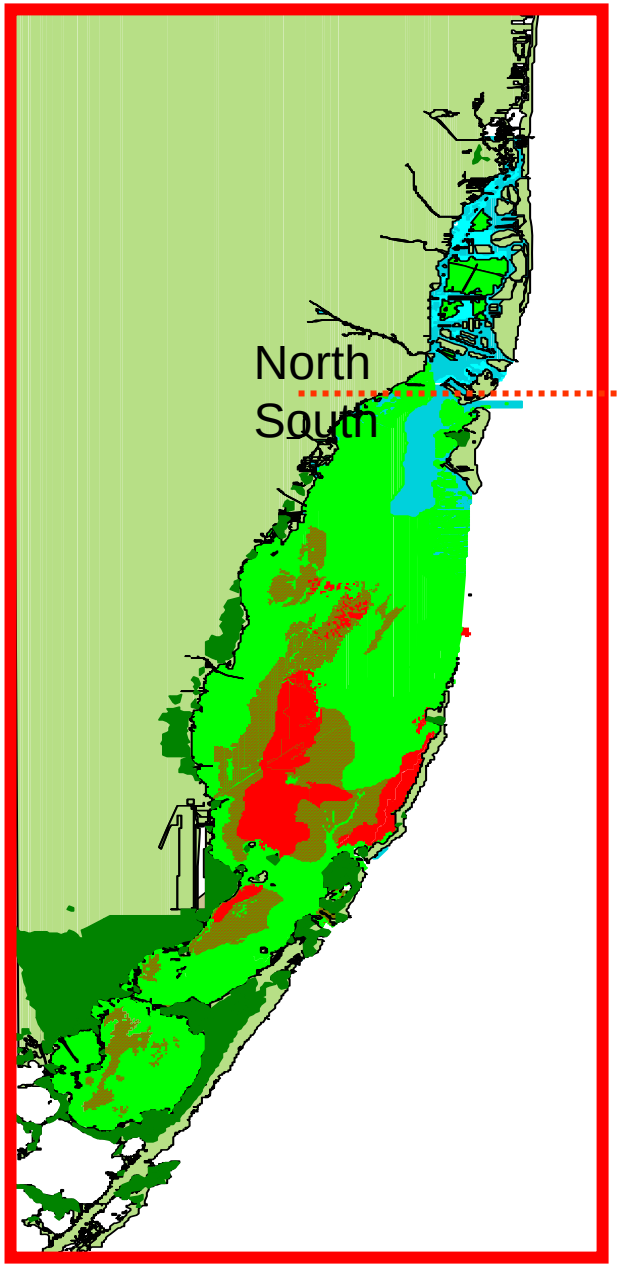
Present Day Biscayne Bay

Barebottom
Silt-sand sediments devoid of large floral or sessile invertebrate forms.

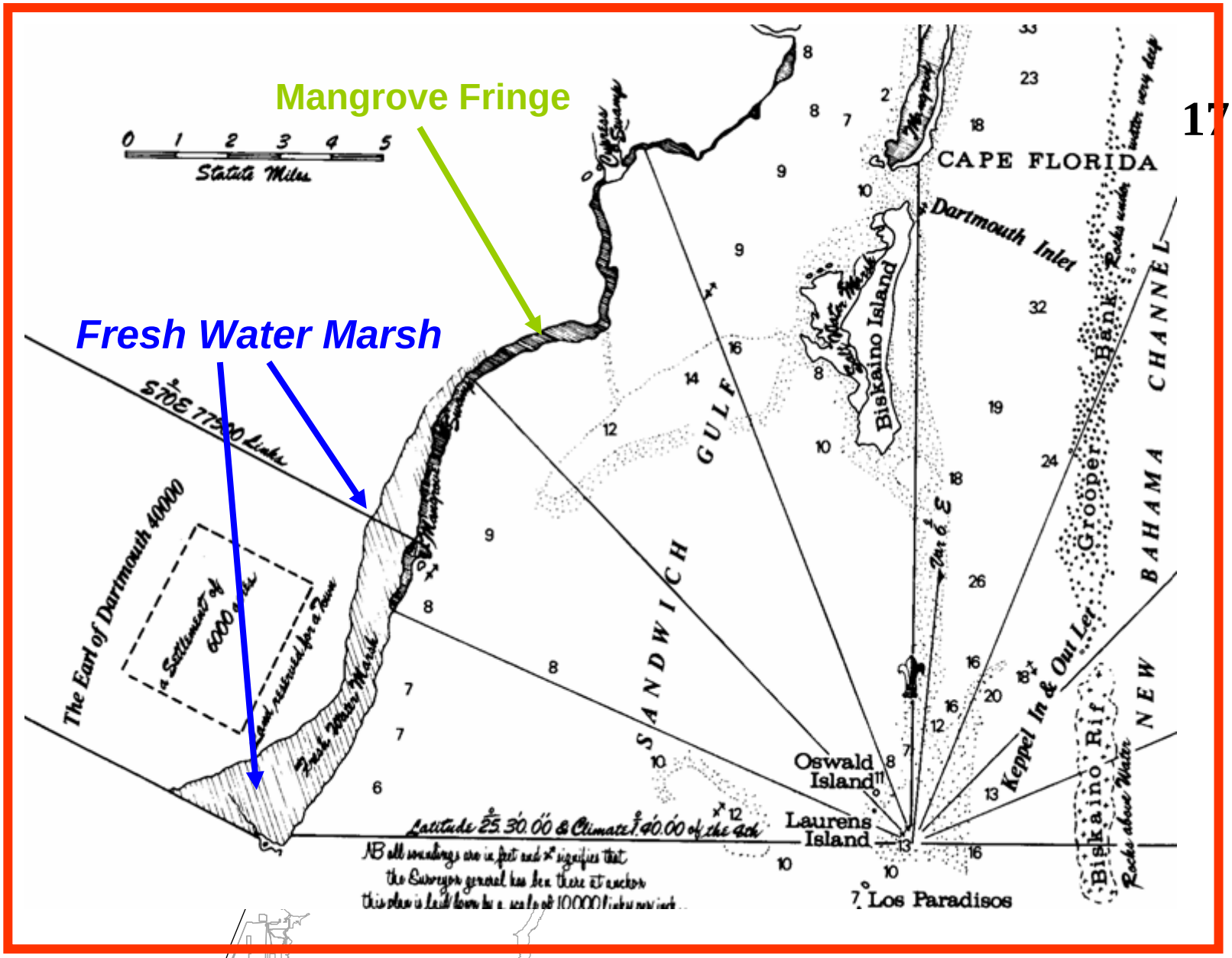
Seagrass & Algal
Thalassia testudinum (turtle grass),
Syringodium filiforme (manatee grass),
Halodule wrightti (shoal grass).
Laurencia, *Dictyota*, *Caulerpa*, *Halimeda*

Hardbottom
Thin veneer of sediment over limestone.
Sponges (e.g., *Spongia*)
Sea fans/whips (e.g., *Gorgonia*)
Stony corals (e.g., *Siderastrea*)
Soft corals (e.g., *Plexaura*)

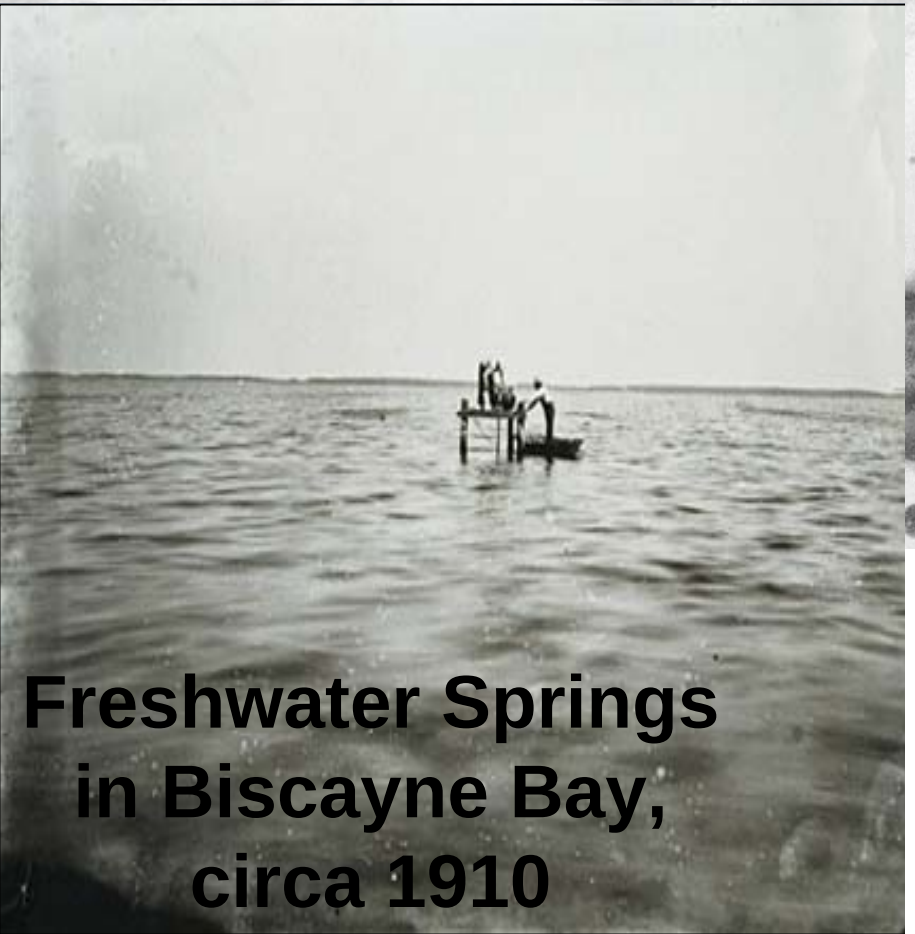
Mangrove
Rhizophora mangle (red mangrove)
Avicennia germinans (black mangrove)
Laguncularia racemosa (white mangrove)



Glimpses of Biscayne Bay Past

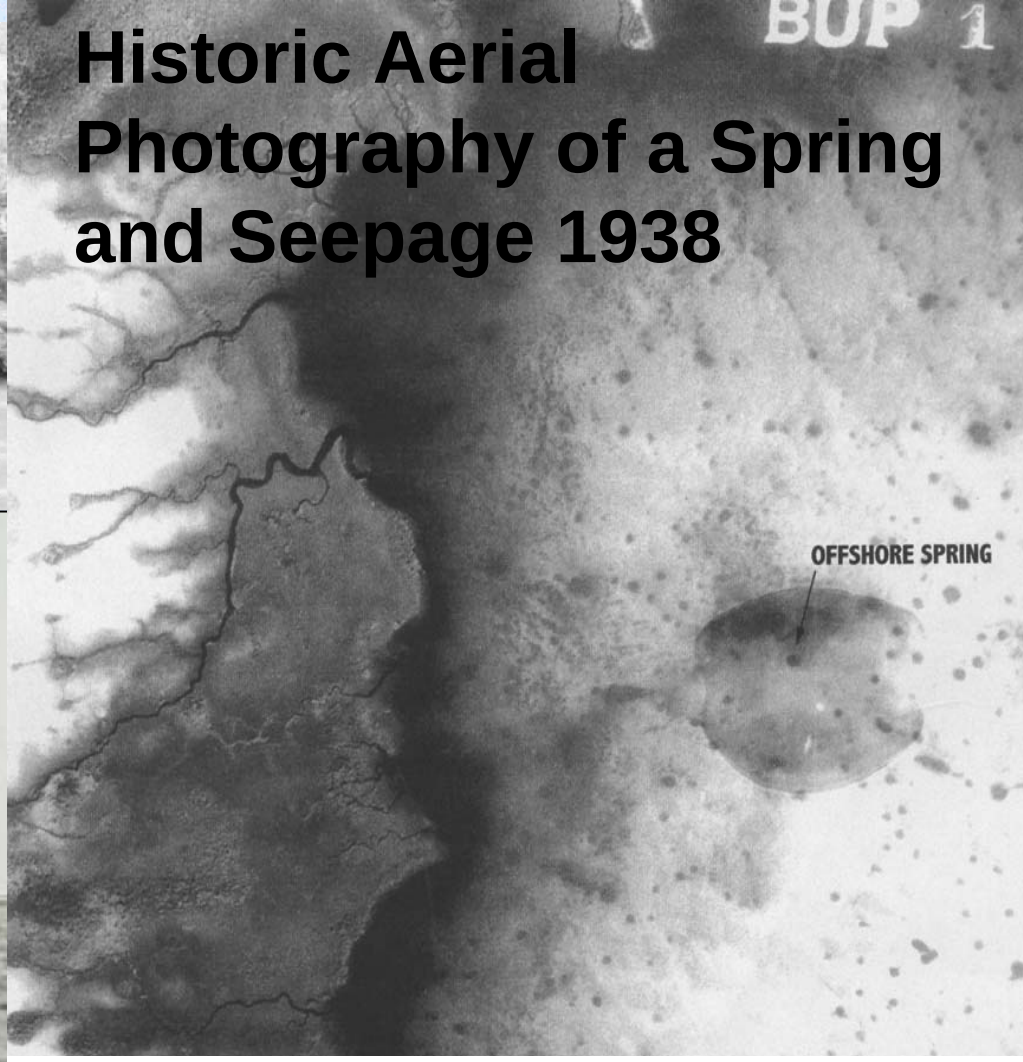


Karst Features



Freshwater Springs in Biscayne Bay, circa 1910

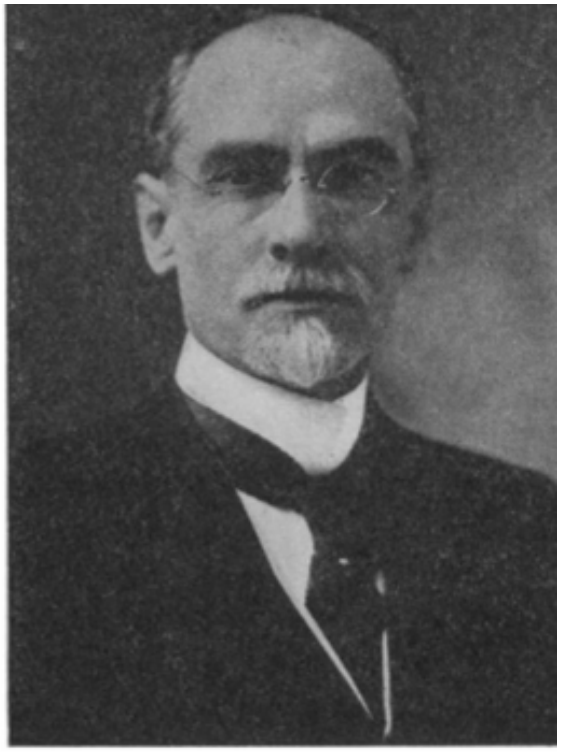
Historic Aerial Photography of a Spring and Seepage 1938



"Springs of good water are common and wells are to be had by a comparatively small amount of digging. Many springs burst up through the bottom of the bay, and we see fresh water boiling up through the salt." J. Buck, 1877 (Buck, reprinted 1979)

Glimpses of Biscayne Bay Past

Smith, H. M. 1896. Notes on Biscayne Bay, Florida, with references to its adaptability as the site of a marine hatching and experimental station. p. 169–186. In Report to the U.S. Commissioner of Fish and Fisheries for 1896, Government Printing Office, Washington, DC, USA.



Dr. Hugh M. Smith as Commissioner Fisheries, 1914

"Redfish (*Sciaena ocellata*) – Abundant at all seasons."

"There is a luxuriant growth of oysters in parts of Biscayne Bay."

"At a depth of a few feet, fresh water may be found at almost any point on the shore of the mainland."

"The mainland below Cocoanut [*sic*] Grove is an almost unbroken wilderness…"

"Miami has become an important town with over 2,000 inhabitants". [Miami-Dade Metro Area: 5.59 million (2008)]

Glimpses of Biscayne Bay Past

Dole, R.B. 1914. Some chemical characteristics of seawater at Tortugas and around Biscayne Bay, Florida. Papers from Tortugas Laboratory, Carnegie Institute, Washington, D. C. 5(182):69-78.

Dole (1914)

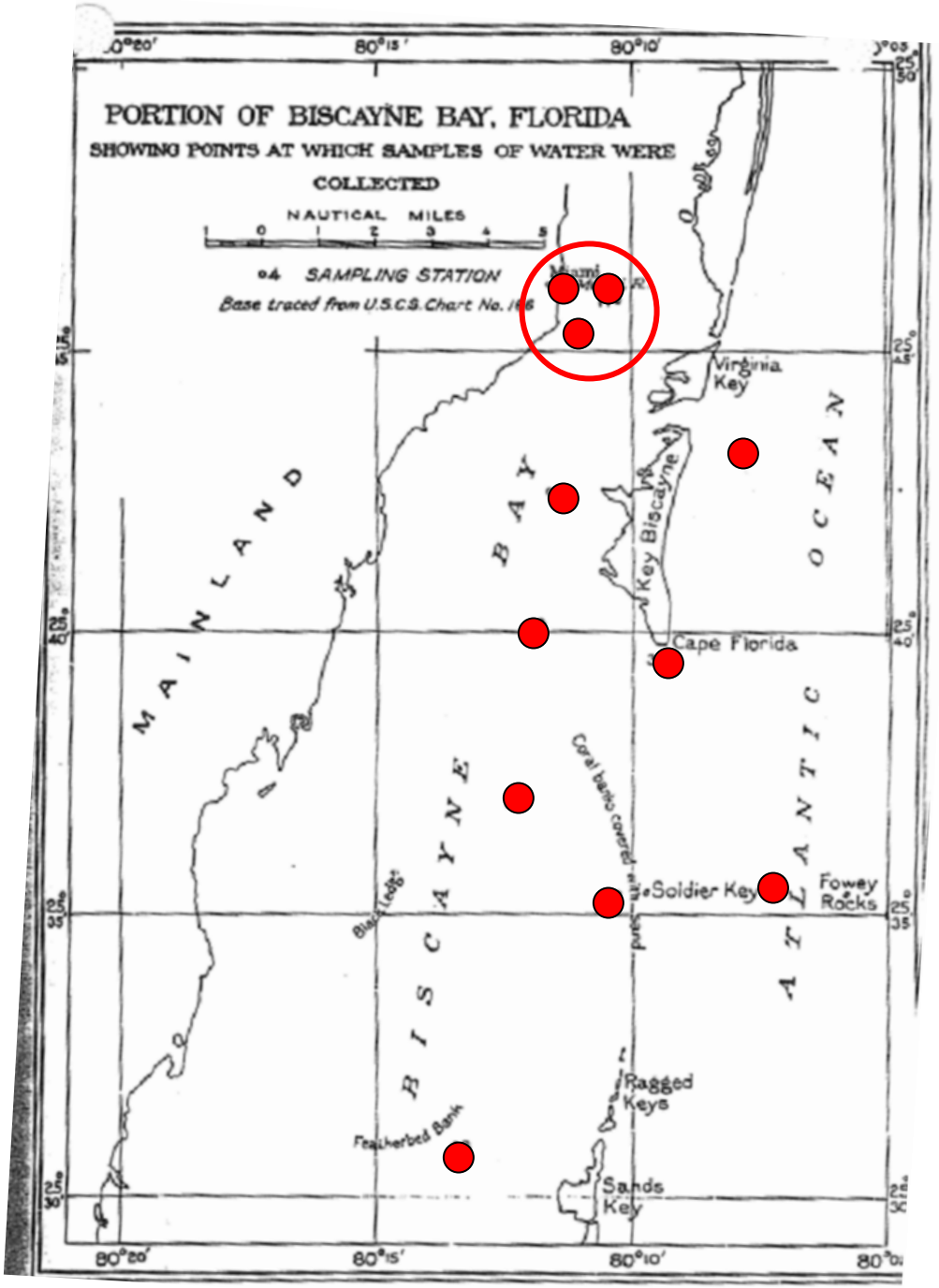
Site I: 2.6
Site II: 26.6
Site 7: 24.1
June 13, 1913

Delta = 24

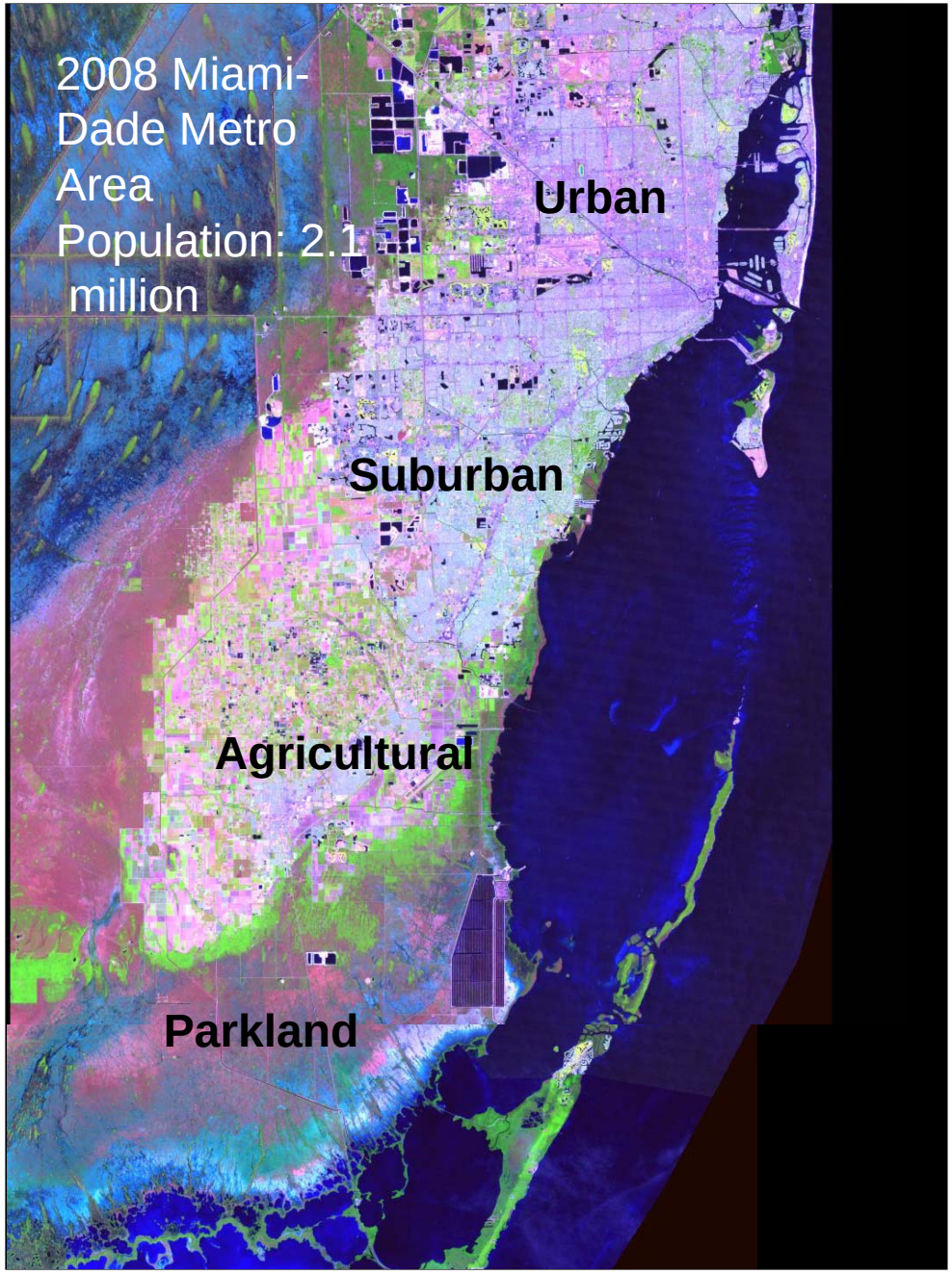
DERM (1995)

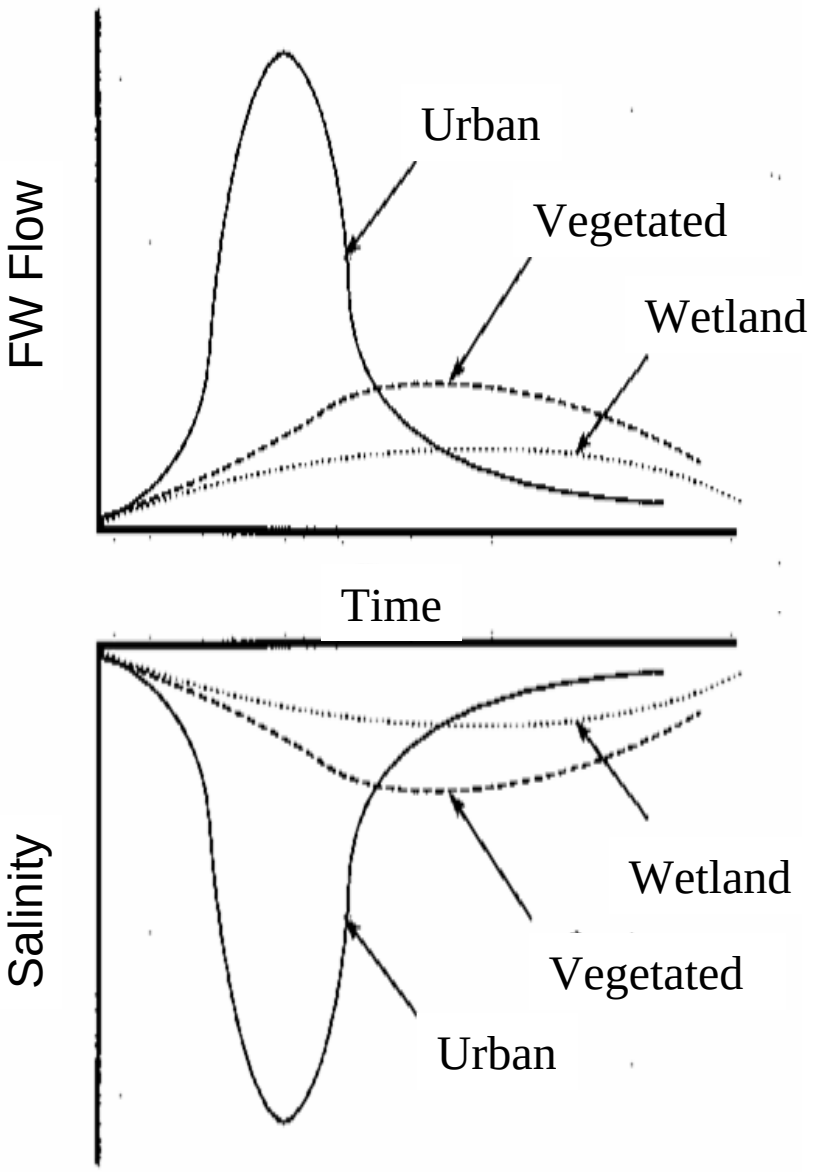
MR01: 33.5 (4.6)
BB23: 34.9 (3.7)
BB22: 34.9 (3.9)
20-yr June mean (SD)

Delta = 1.4

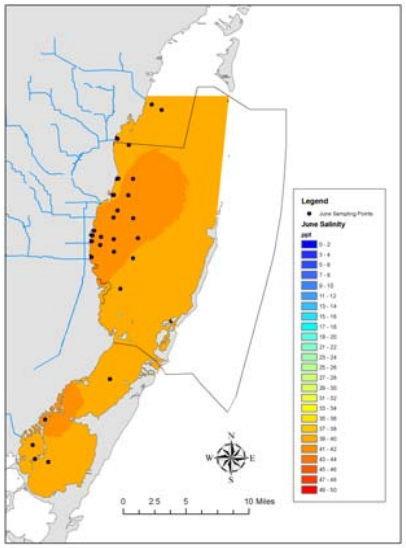


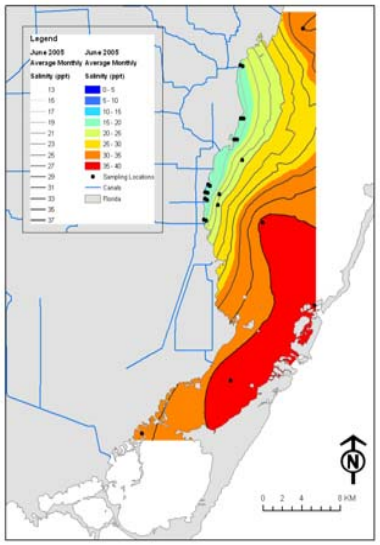
Present Day Biscayne Bay

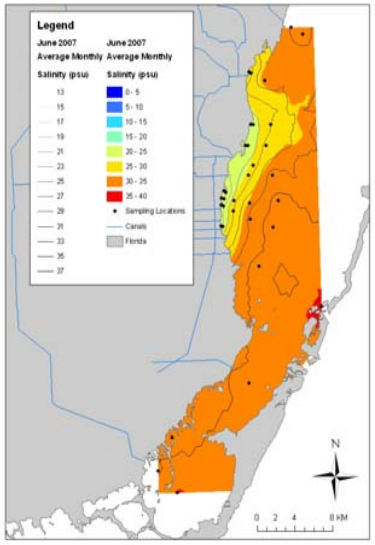


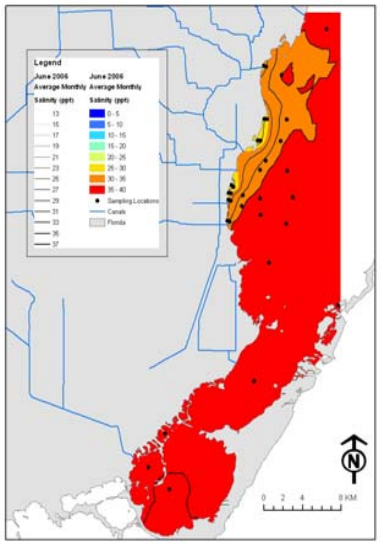


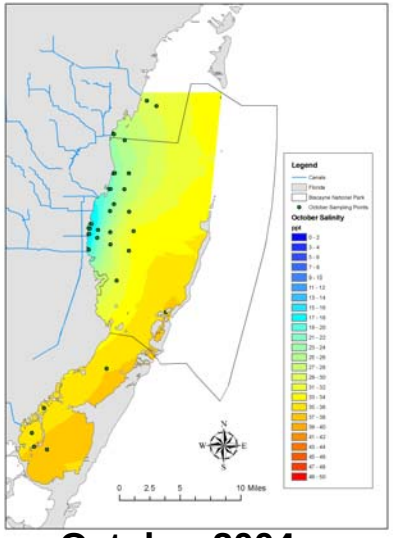
Salinity Early Wet Season Compared to Peak Wet Season and October Drawdown

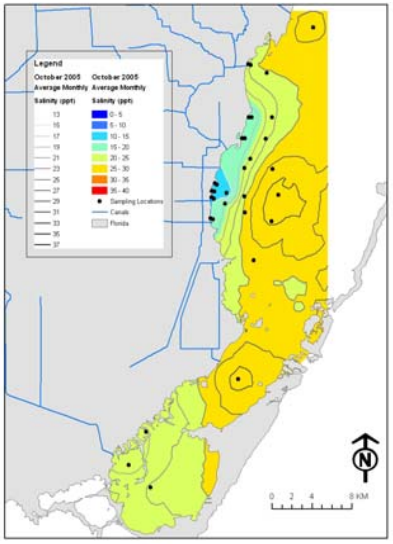

June 2004


June 2005


June 2006


June 2007


October 2004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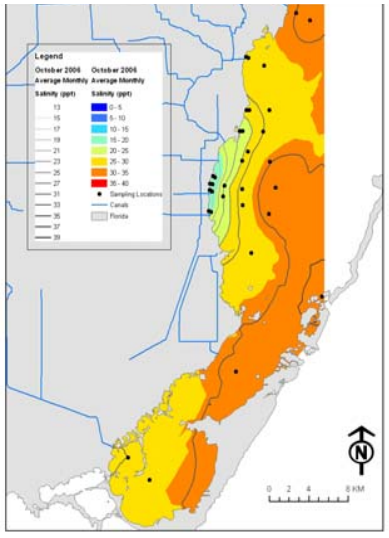
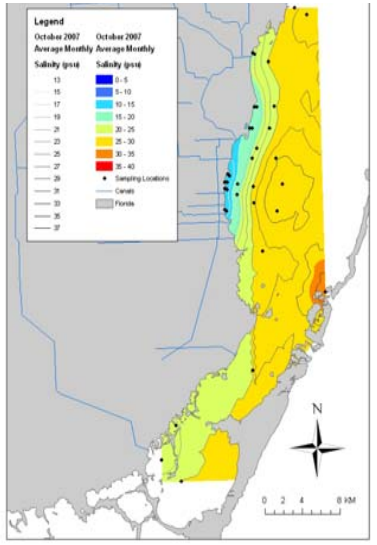
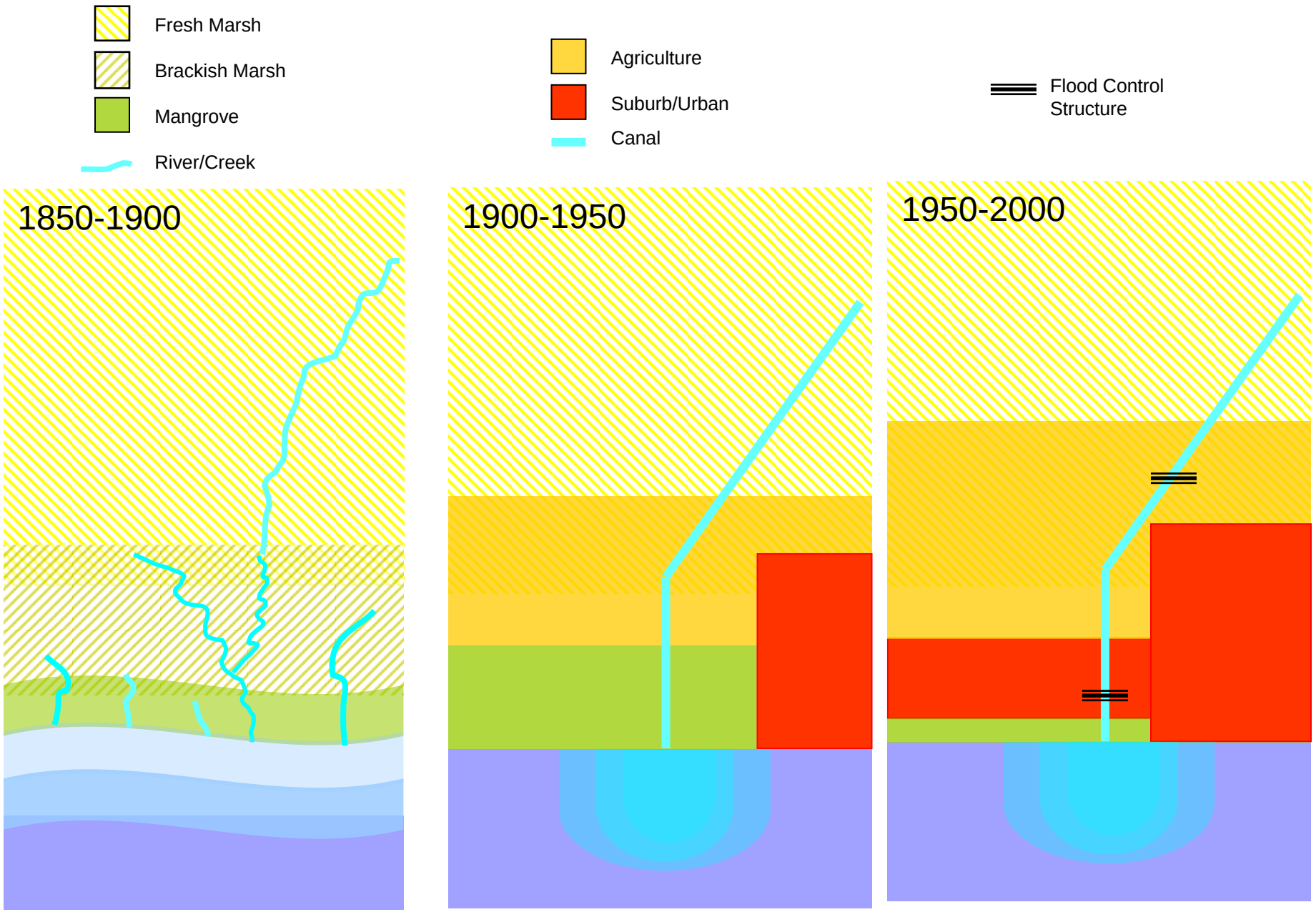
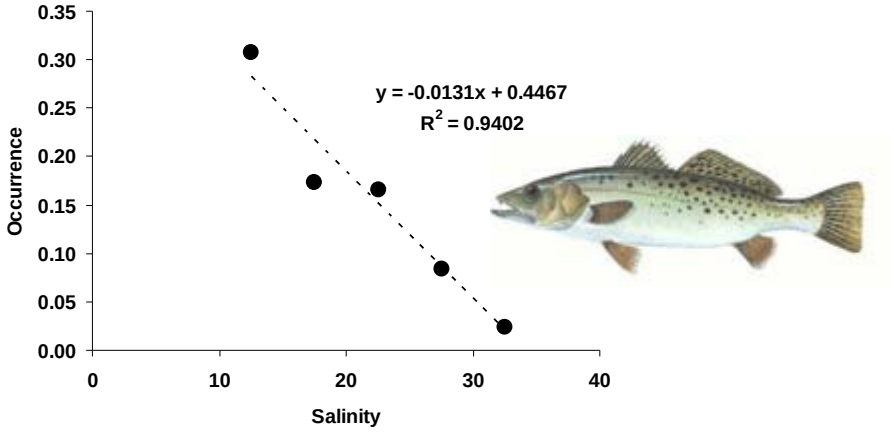

October 2006

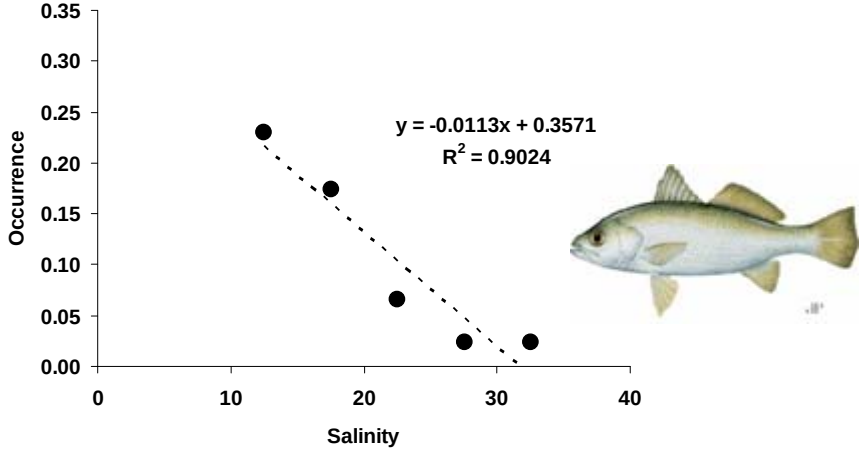

October 2007

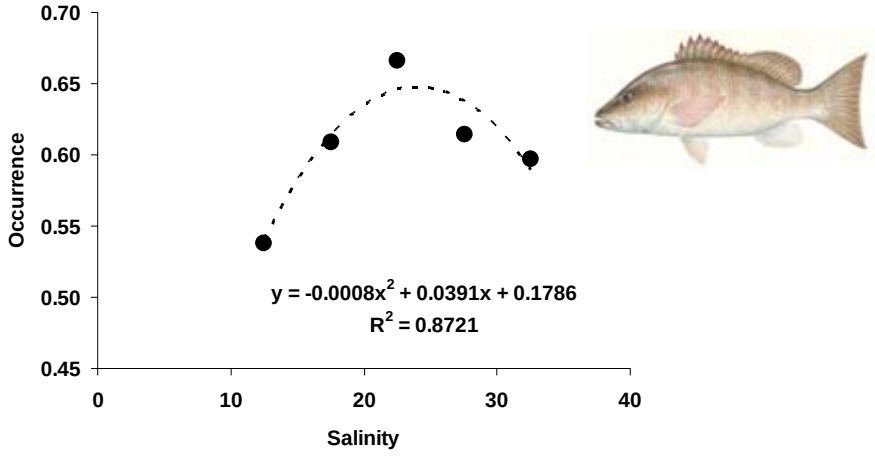
Bay Changes: overview



Biscayne Bay Seagrass Fishes

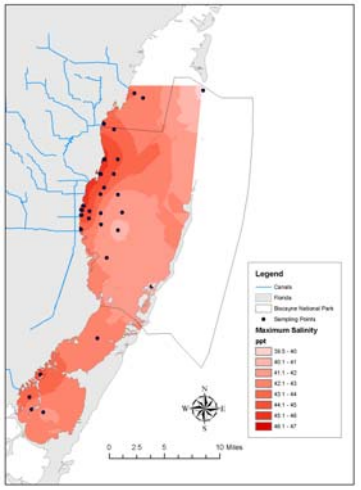






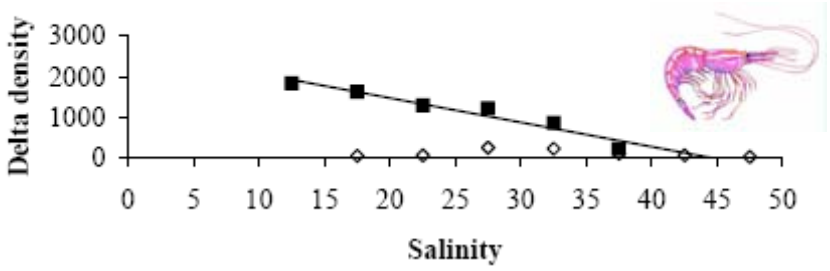
Hypersalinity (> 36 psu)

Reduced abundance of several critical forage fishes and invertebrates: pink shrimp, yellowfin mojarra, pinfish, gulf toadfish.



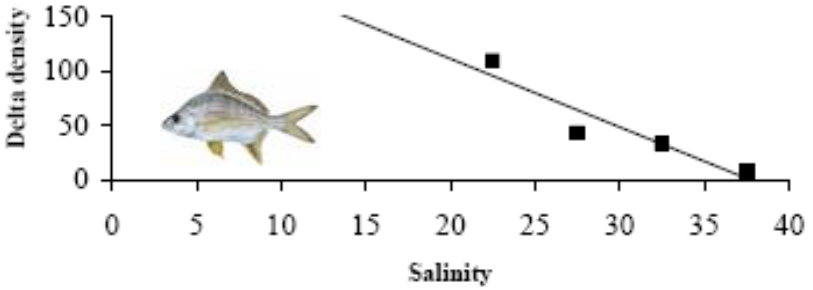
Farfantepenaeus duorarum trawl

BB y = -59.923x + 2661.3
R^2 = 0.94, p=0.002

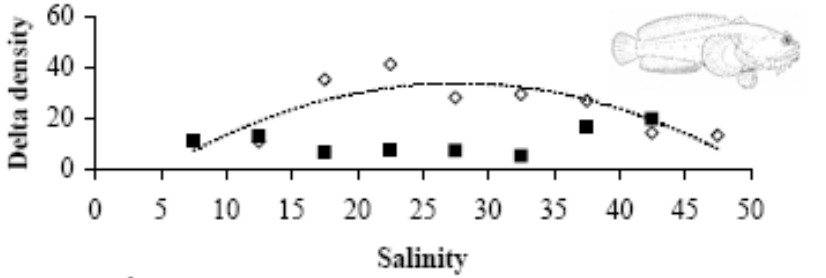


Gerres cinereus trawl

BB y = -6.2773x + 236.27
R^2 = 0.88, p=0.06



Opsanus beta trawl

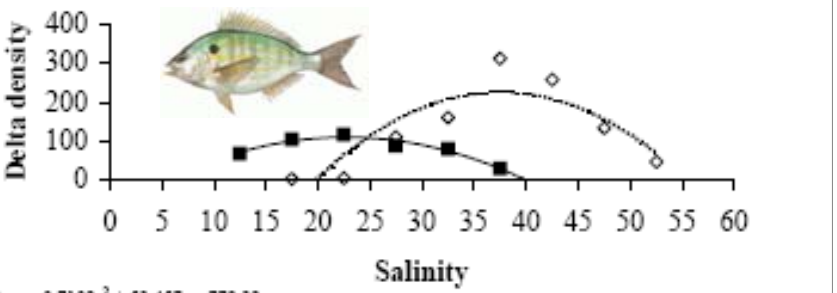


FB y = -0.0651x² + 3.5999x - 15.81
R^2 = 0.64, p=0.08

◇FB ■BB

Lagodon rhomboides trawl

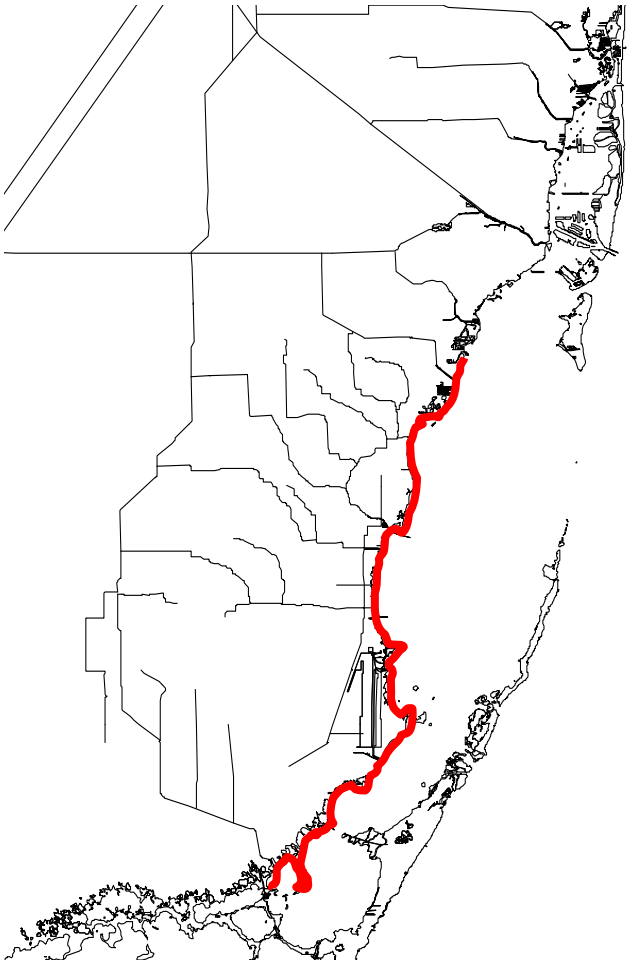
BB y = -0.3686x² + 16.716x - 80.725
R^2 = 0.94, p=0.02

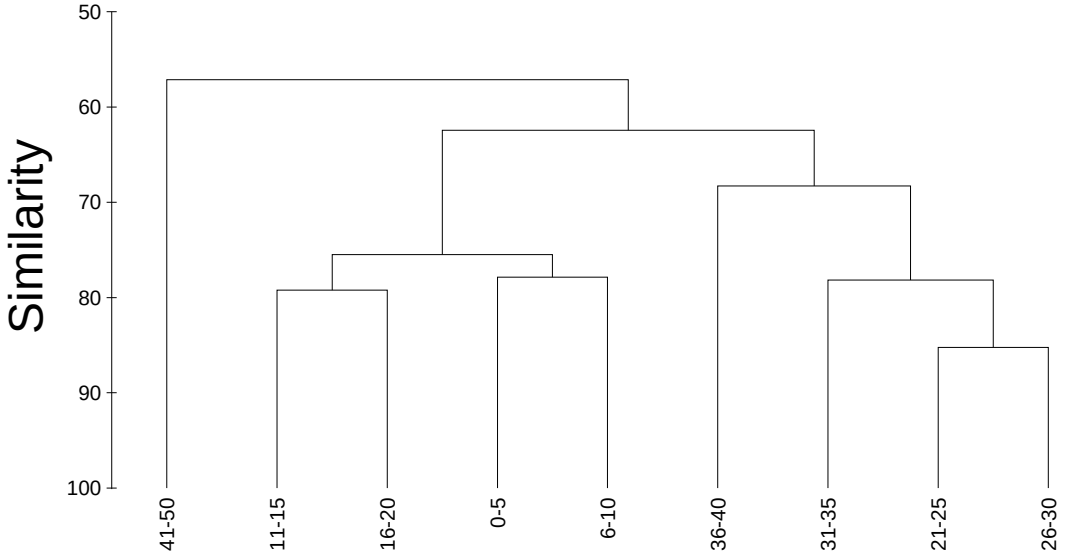


FB y = -0.7109x² + 53.457x - 779.32
R^2 = 0.75, p=0.03

■BB ◇FB

Mangrove Fishes



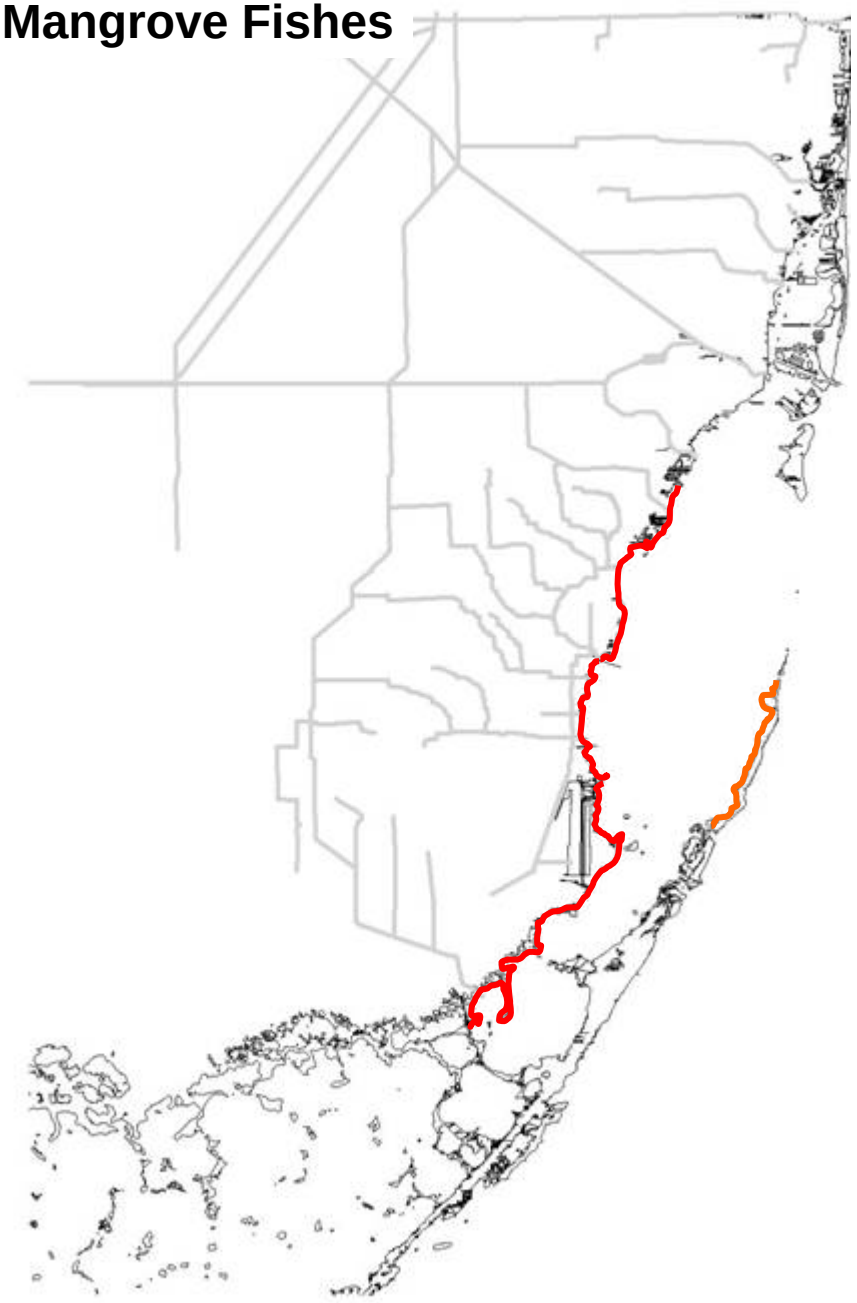


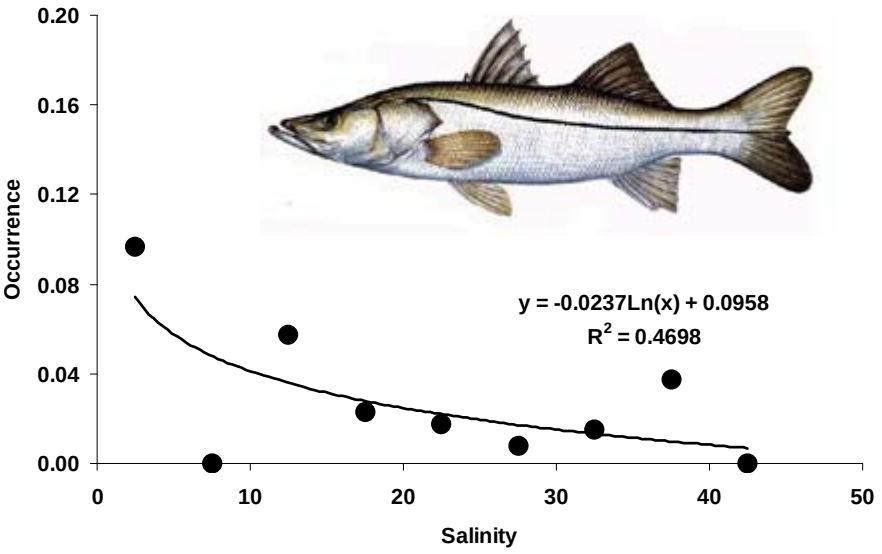
> 40 psu

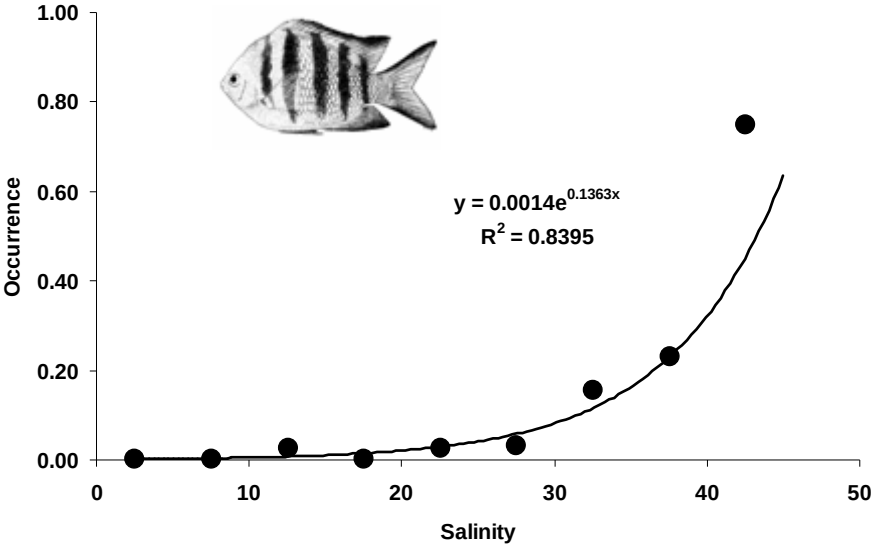
0 - 20 psu

20 - 40 psu

Mangrove Fishes







Summary

Biscayne ***is barely*** an estuary
(freshwater-pulsed lagoon)

Biscayne Bay ***was*** an estuary
(historical papers, data and maps)

Detracting from the Bay's ecological integrity and function are:

1. **Freshwater delivery pattern (FW entering the Bay in abrupt, localized pulses).**

2. **Hypersalinity (due to reduced quantities of FW).**

Conclusions

Increase or maintain current levels of freshwater flow into Biscayne Bay

Strive to reduce the point-source, pulsing nature of freshwater delivery (*via* wetland creation and other sheetflow enhancement devices, e.g., BBCWP).