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Freshwater Discharge and Protecting the Coastal Ecosystem in Biscayne National Park

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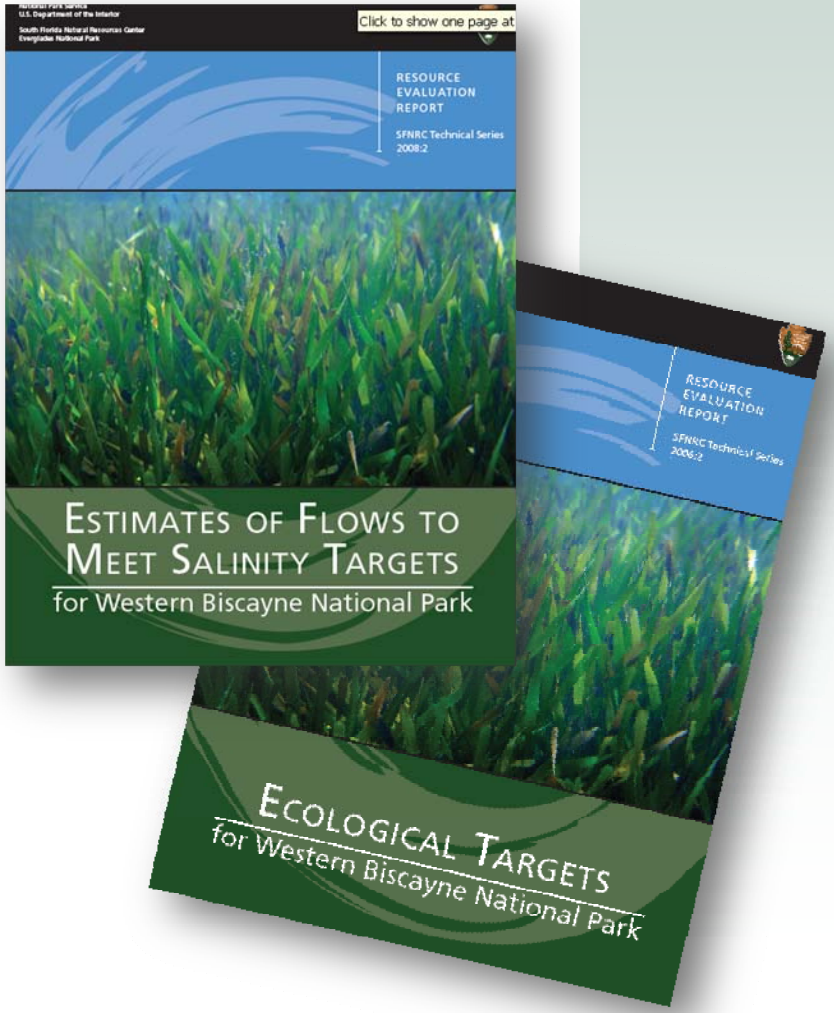
Overview

- Ecological & Hydrologic Targets for Western Biscayne National Park

- Consideration for downstream ecosystem in water management
  - Specific conditions and goals
  - Triggers for dry season flow

- Hydrodynamic Model results
  - Best use of available water
  - Quantity, timing, and distribution



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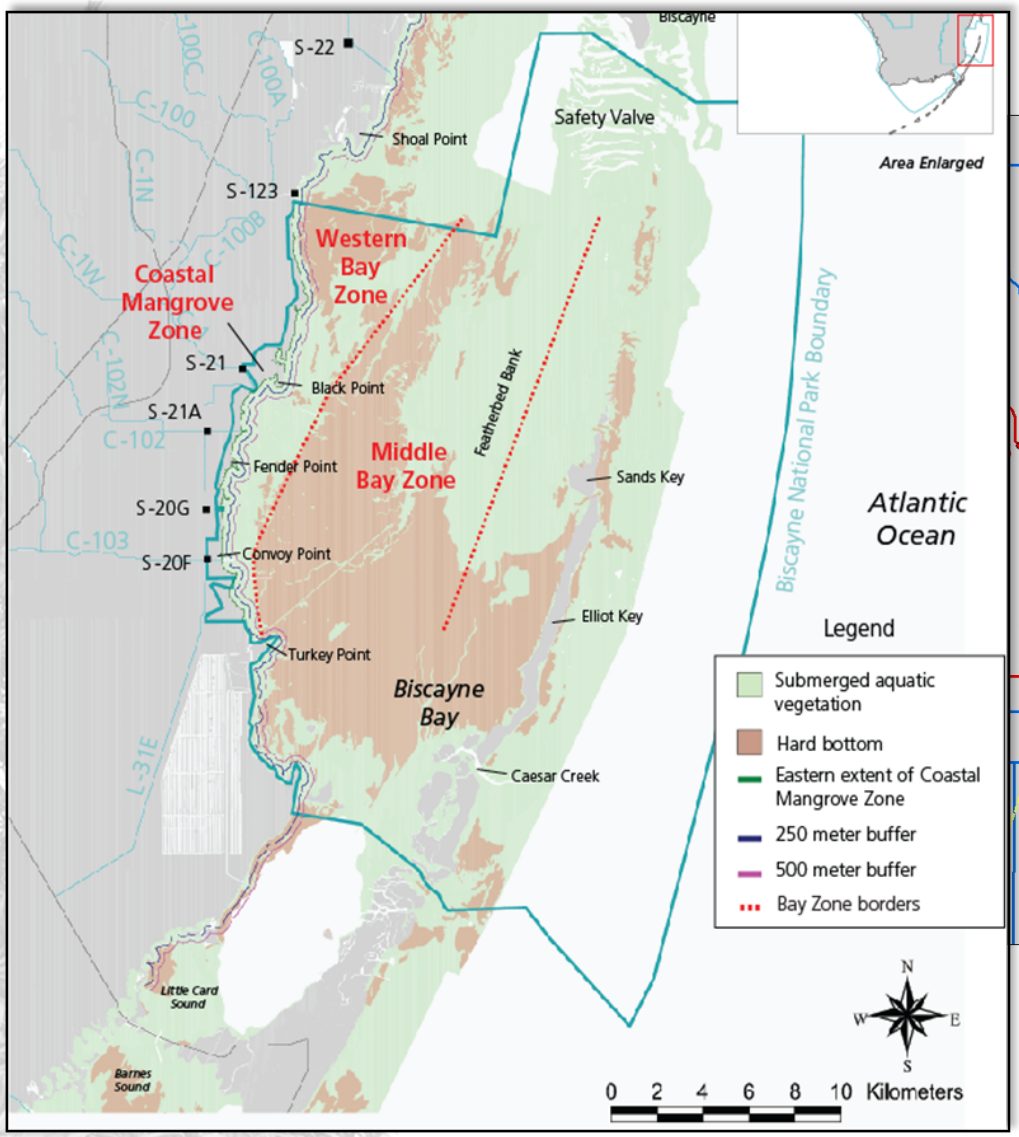

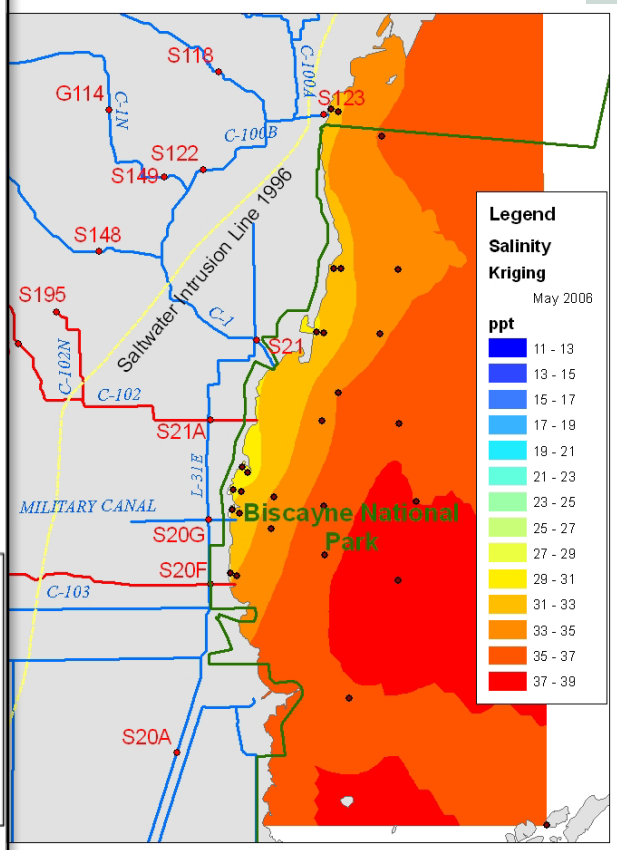

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Historical Conditions in Biscayne Bay

Collecting fresh water from a spring in Biscayne Bay approx. 1.2 km offshore from the Cutler area in 1890*

"...You could dip a tin cup in the Miami River and bring up a crystal-clear drink, and there were places in the Bay itself where fresh cold water bubbled up."

J. Muir (1953)

NOAA Technical Memorandum NOS NCCOS CCMA 145

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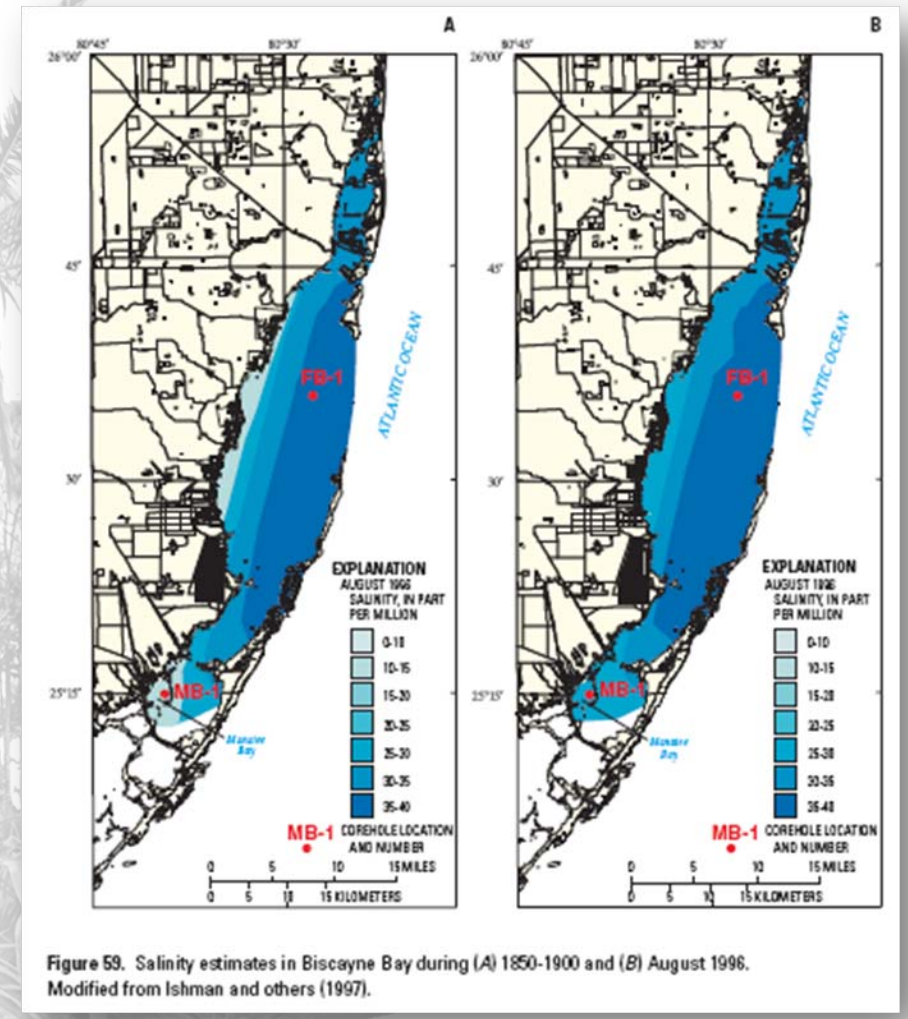

Figure 59. Salinity estimates in Biscayne Bay during (*A*) 1850-1900 and (*B*) August 1996. Modified from Ishman and others (1997).

Changes in the Nearshore Areas

Historic trend of increasing salinity in the nearshore zone

Shift from estuarine or mesohaline conditions (5 to 18 ppt) to brackish or polyhaline conditions (18-30 ppt).

USGS Circular 1275, Impact of anthropogenic development on coastal groundwater hydrology in Southeastern Florida, 1900 – 2000.

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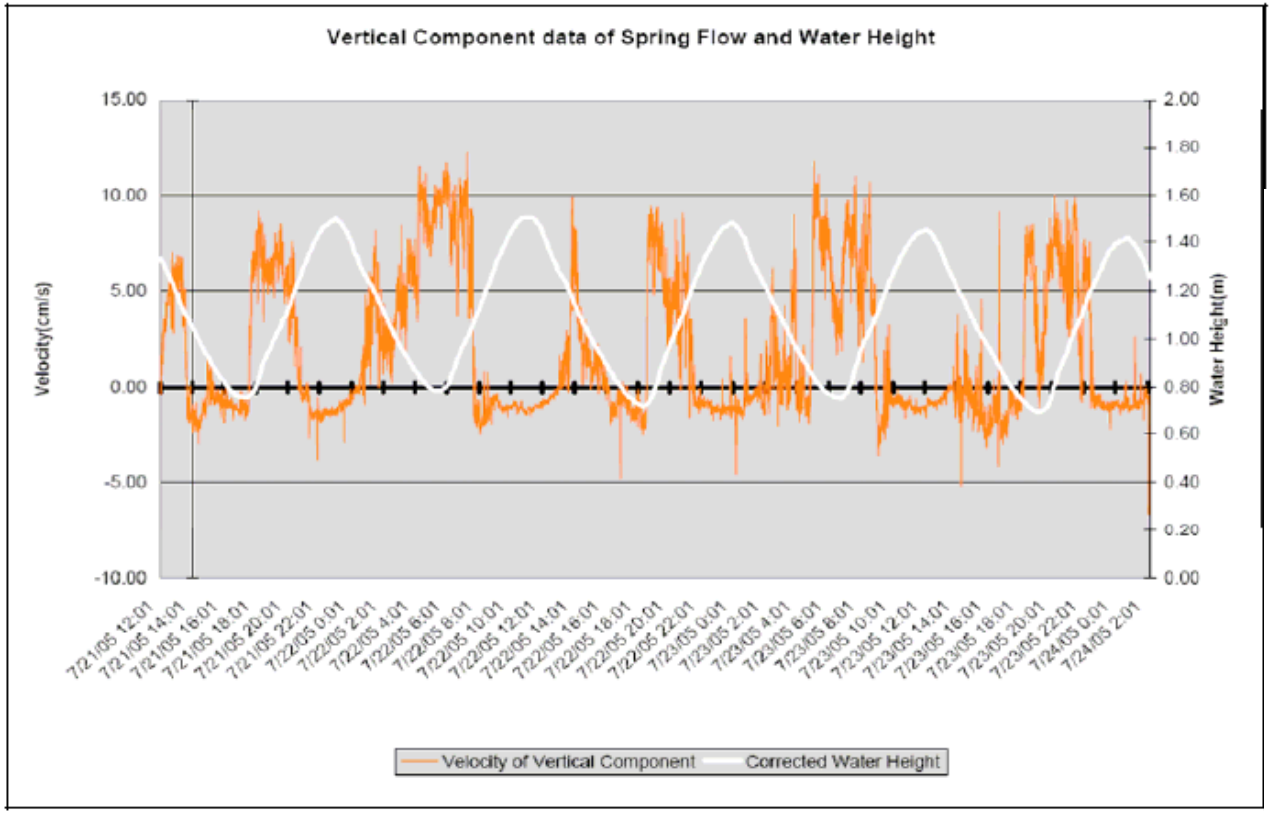

Figure 6 – Vertical component of spring flow and water height (Star-Oddi) gathered during July 21 to 24.

Modern groundwater flow is limited

Lack of freshwater head in coastal system leads to groundwater springs that stop flowing as tide falls.

***From John Proni and Hector Casanova's NOAA-AOML study on groundwater flow study, 2008, expanded report.

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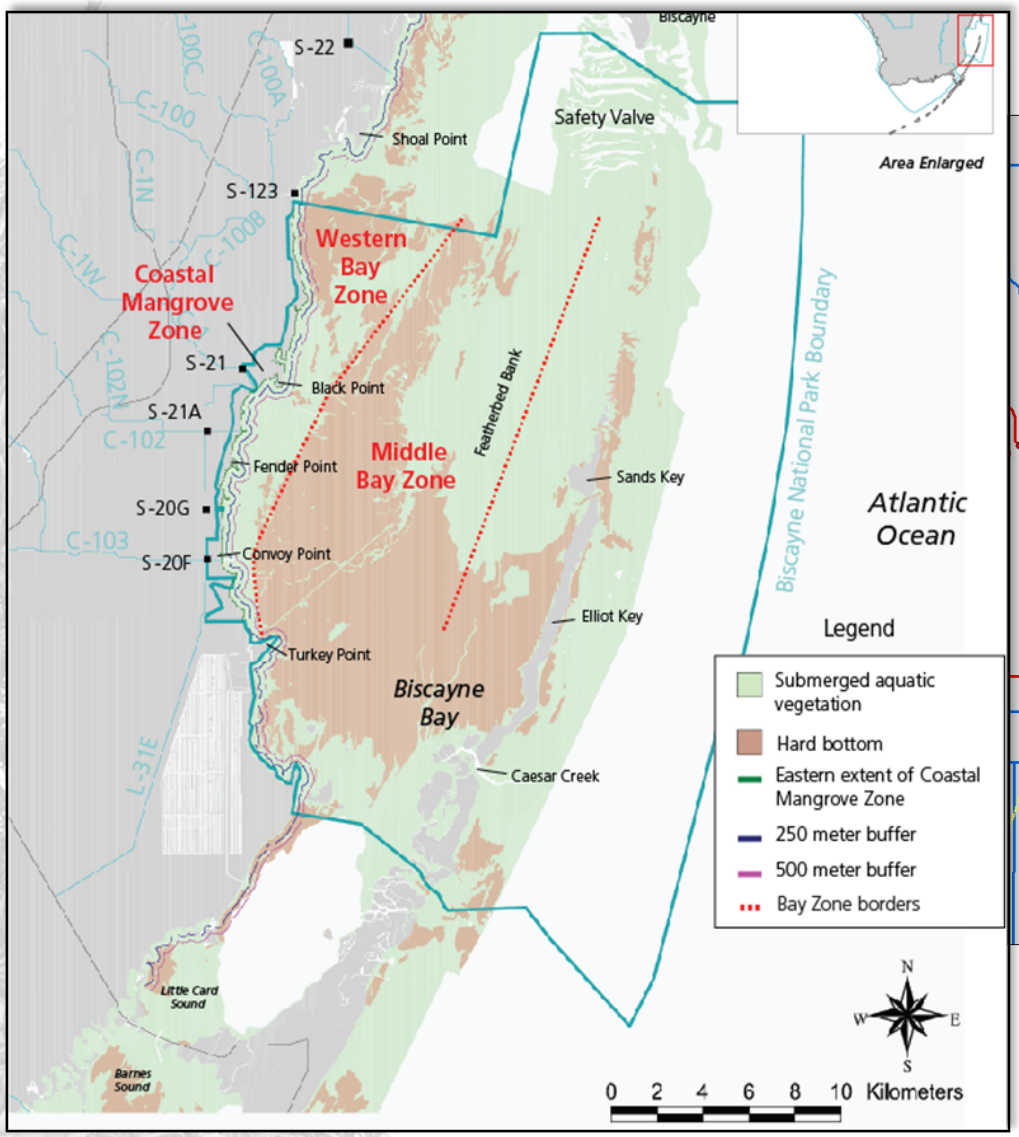

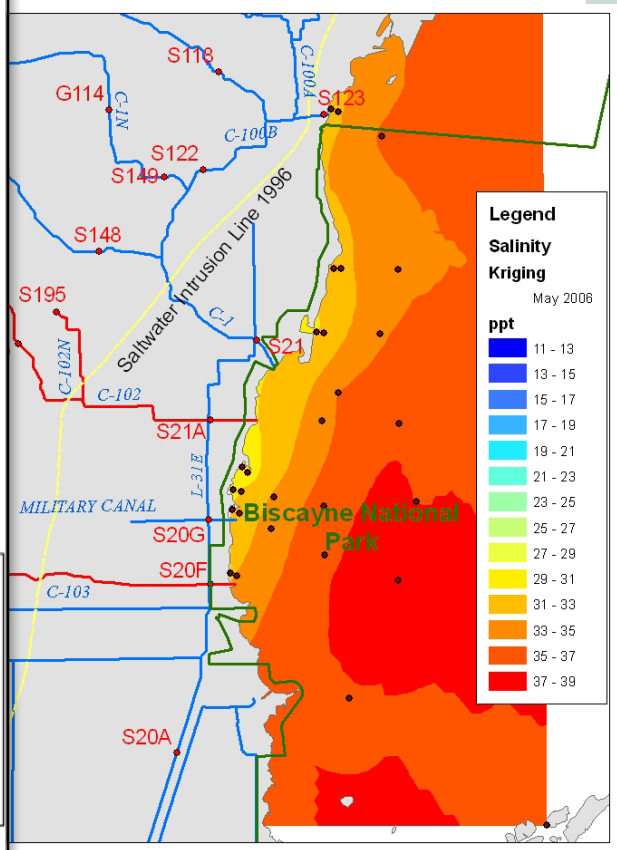

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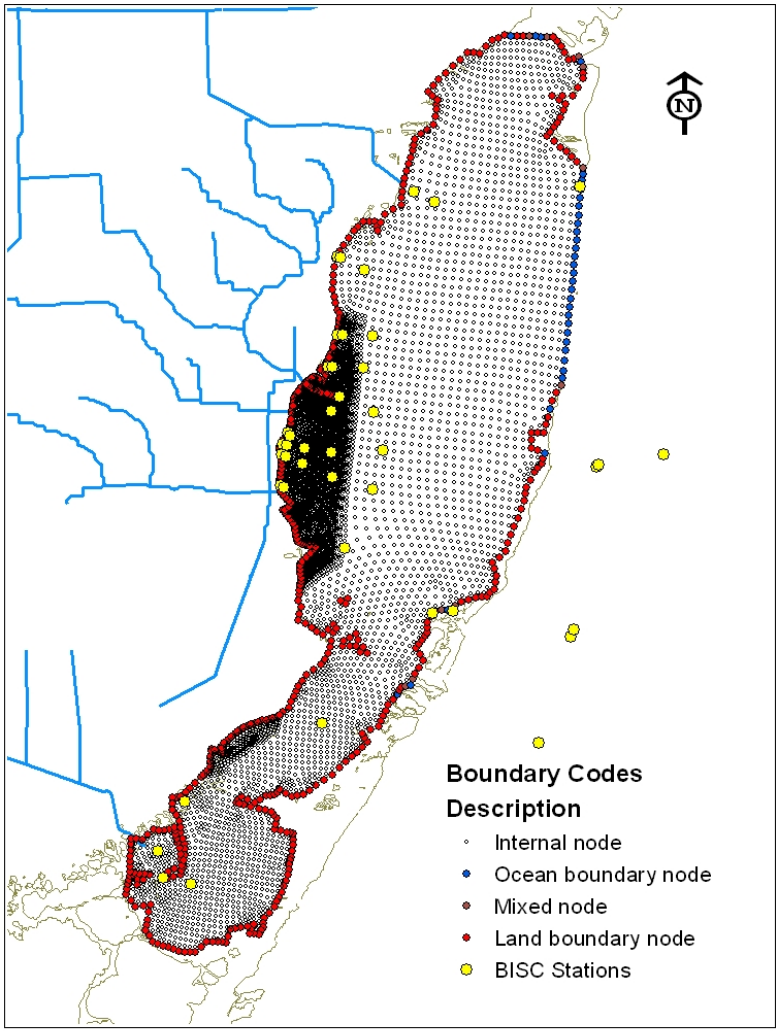
Biscayne Bay Simulation Model (BBSM)



Predicting salinity regime under alternate discharge scenarios

BBSM 2D model with:

- Advection and diffusion
- Rain and evaporation
- Wind stress
- Bottom friction
- Tidal mixing
- Surface water inflows*
- Model or observation based boundary conditions

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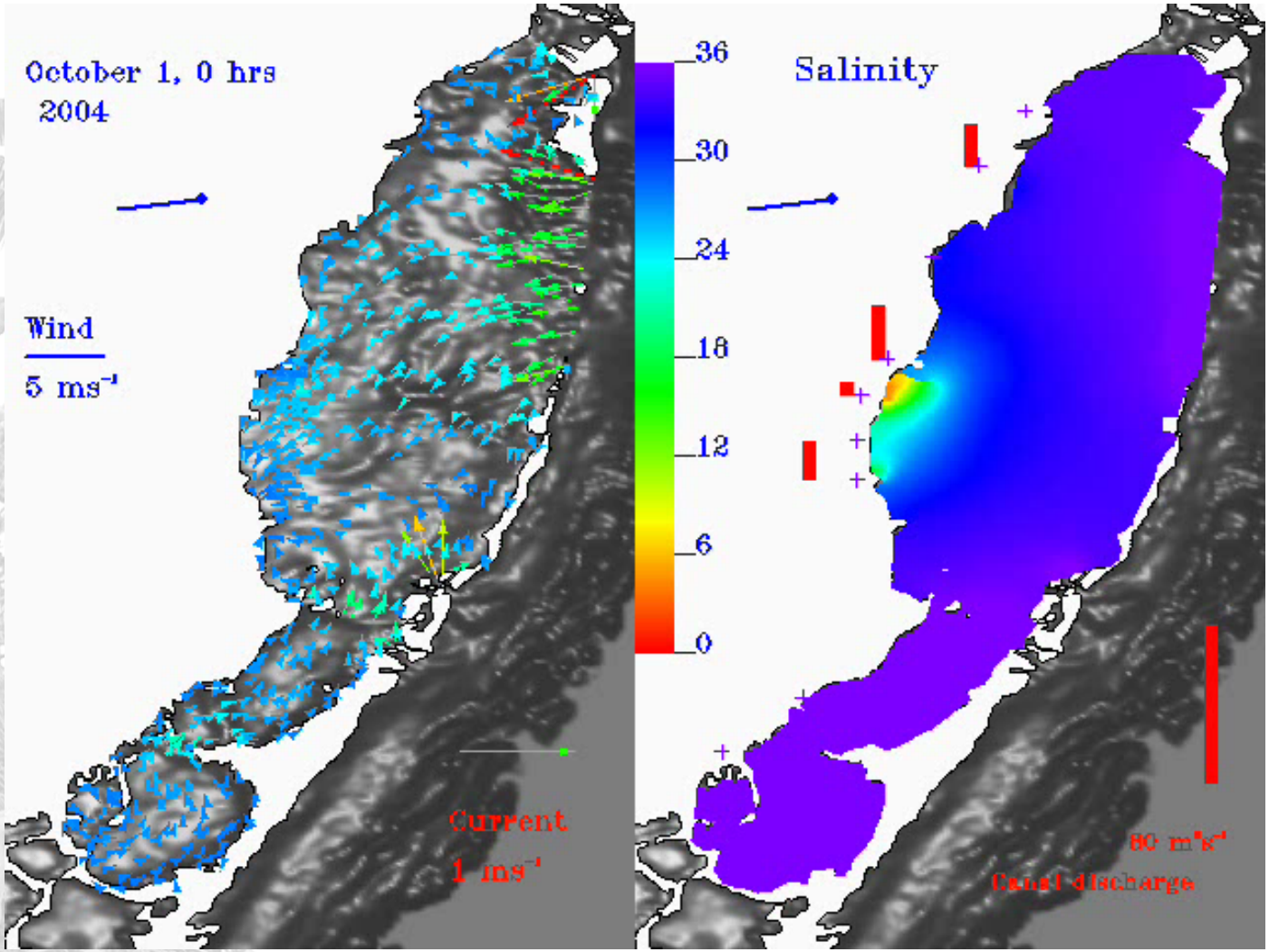
Model Output



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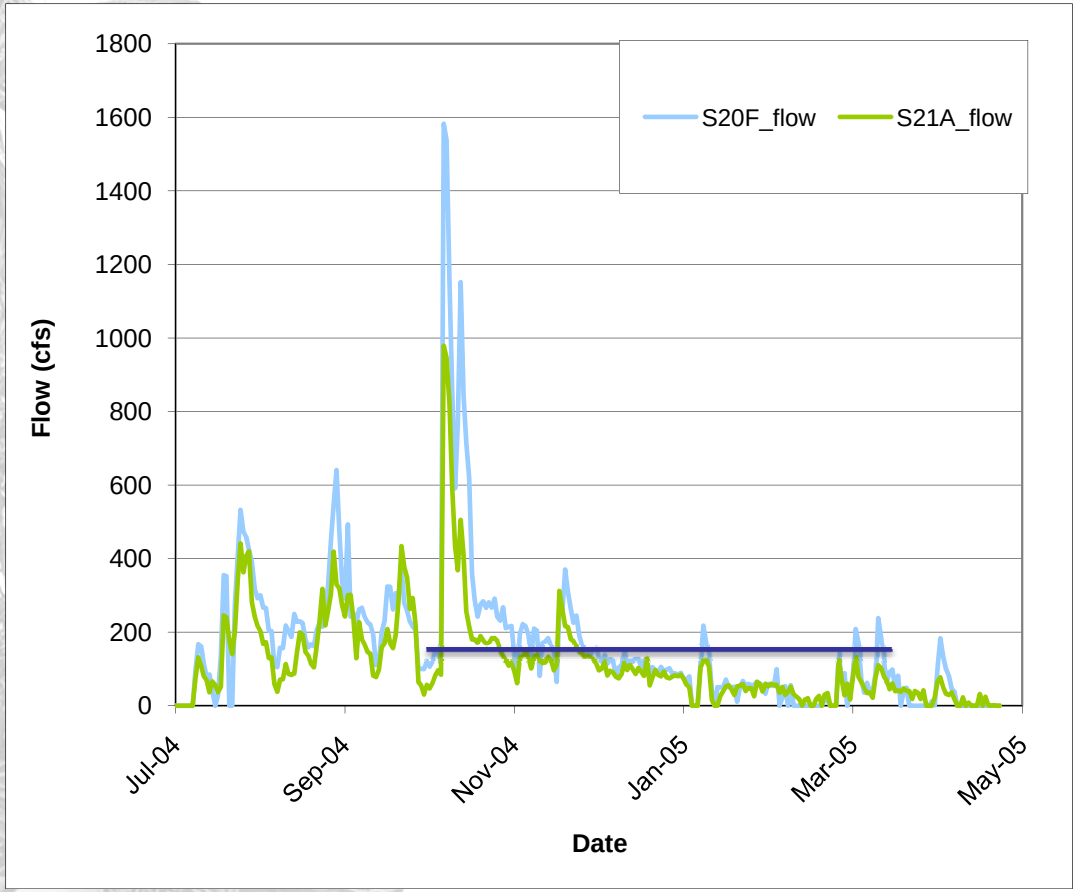
Alterative flow options using existing water



Constant temporal distribution

- Steady flow rate Oct. 15 to March 30
- Limitation: stage in canal will show steady decrease through dry season

Changing spatial distribution

- 3 different model scenarios split the constant flow across different areas

Goals:

- Hypersalinity prevention
- Reduce variation in salinity

Modeled Scenarios:
What is the best way to use 63 kaf freshwater to benefit Biscayne National Park?

- Slow_ag
  - Release 63 kaf, split between two canals (S21A, S20F), over the period from Oct. 15 to March 30th
- Culverts_ag
  - Release 63 kaf at Slow-Ag rate through coastal region via planned culverts in L31E
- Redistributed_ag
  - Release 63 kaf at Slow-Ag rate through the above culverts and three canal structures (S20F, S21A, and Military Canal)

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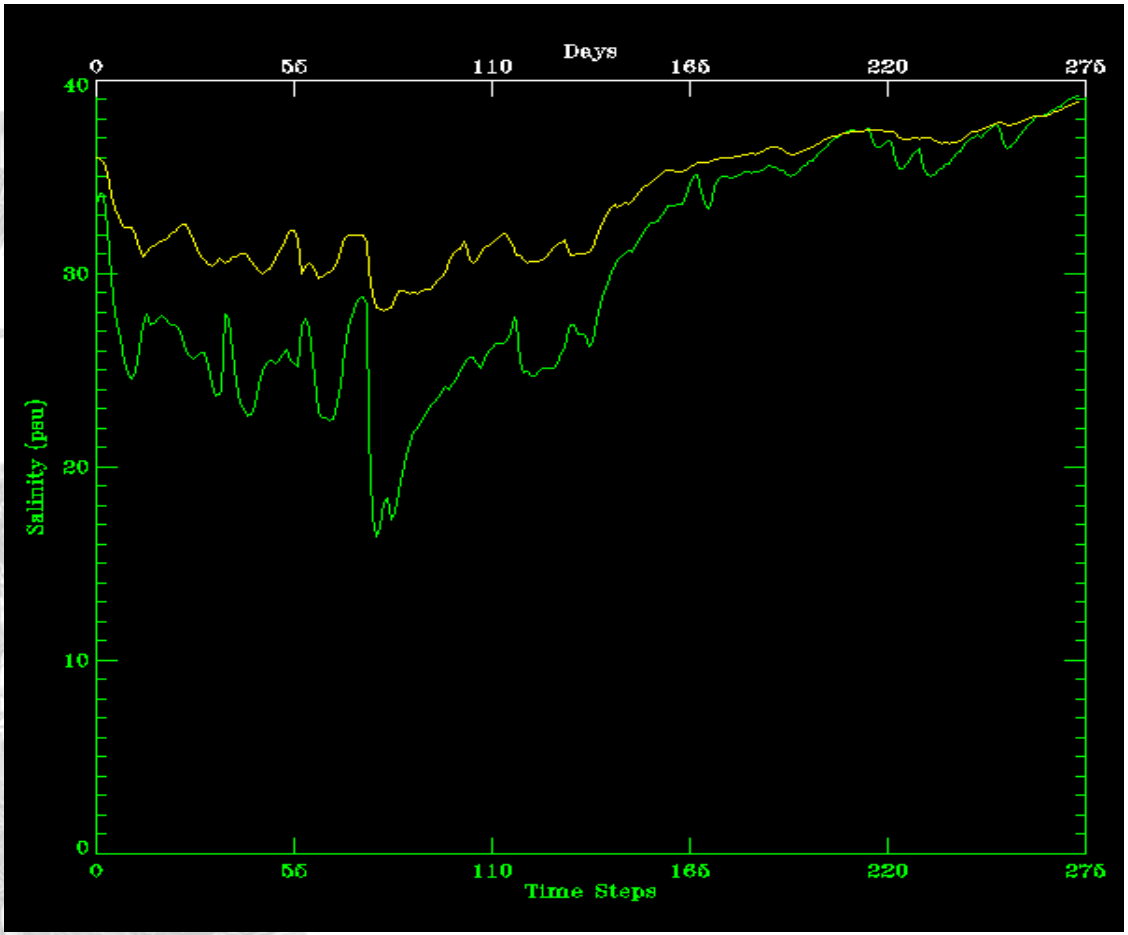
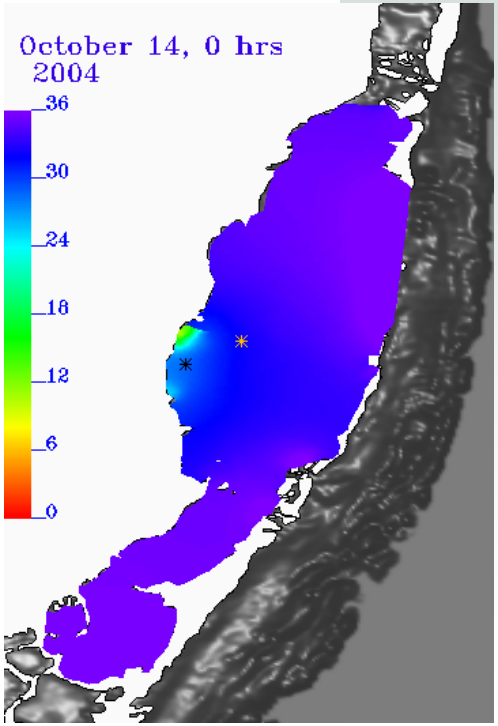
Modeled Results – Base Conditions





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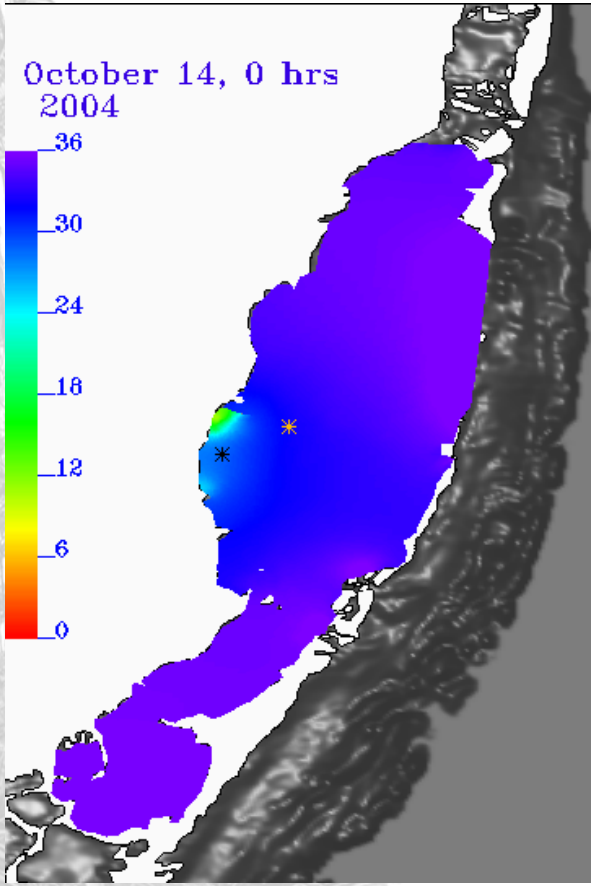
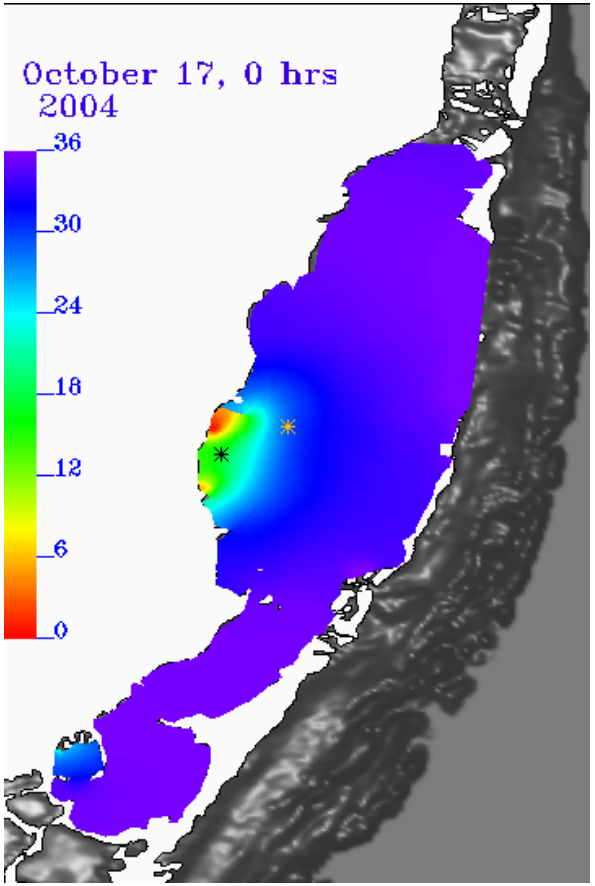
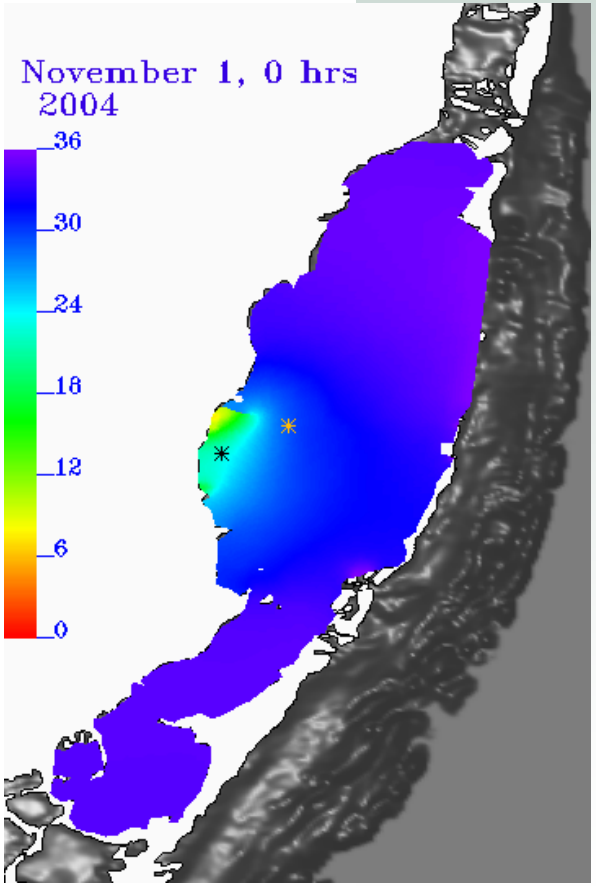
Modeled Results – Base Conditions







Plot shows reduction in salinity from release of fresh water from agricultural drawdown

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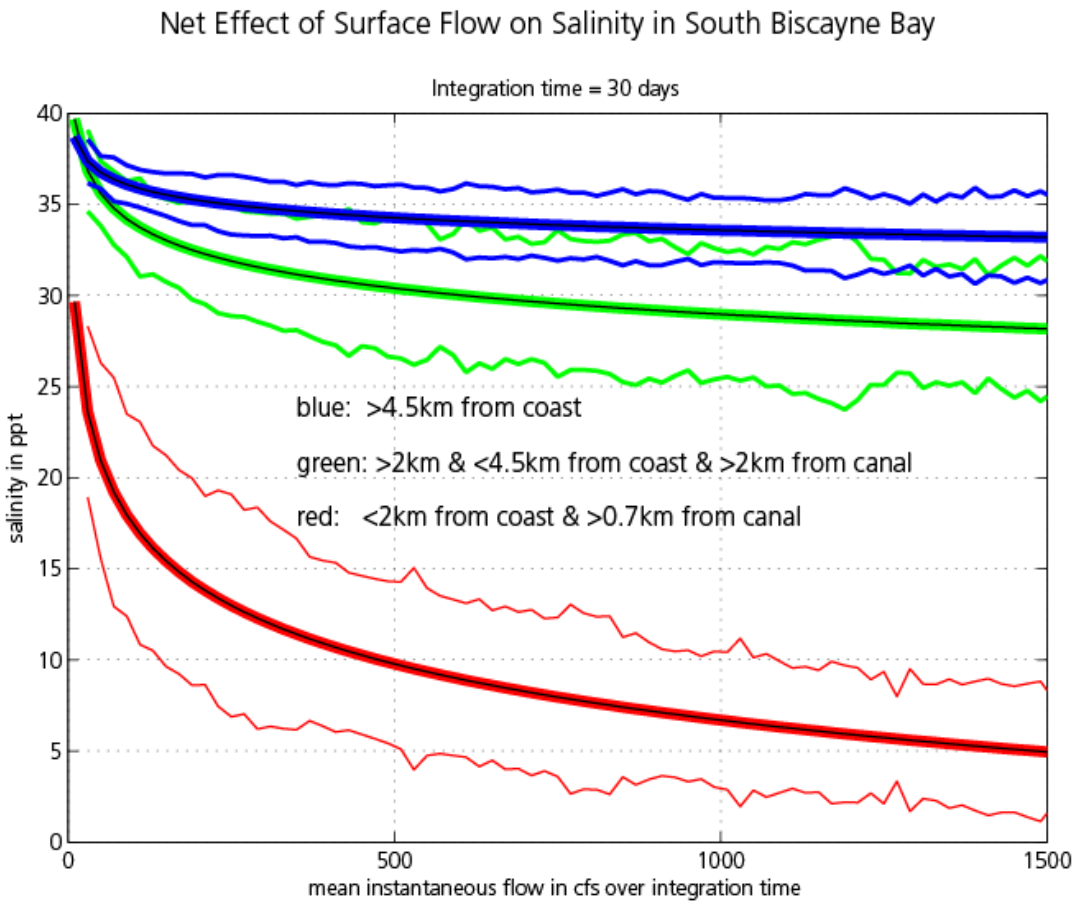
Assessing Environmental Impact



- Diminishing returns with increasing flow rate
- Driven by mixing dynamics

Suggests, through observations, there is an optimum flow rate for salinity reduction

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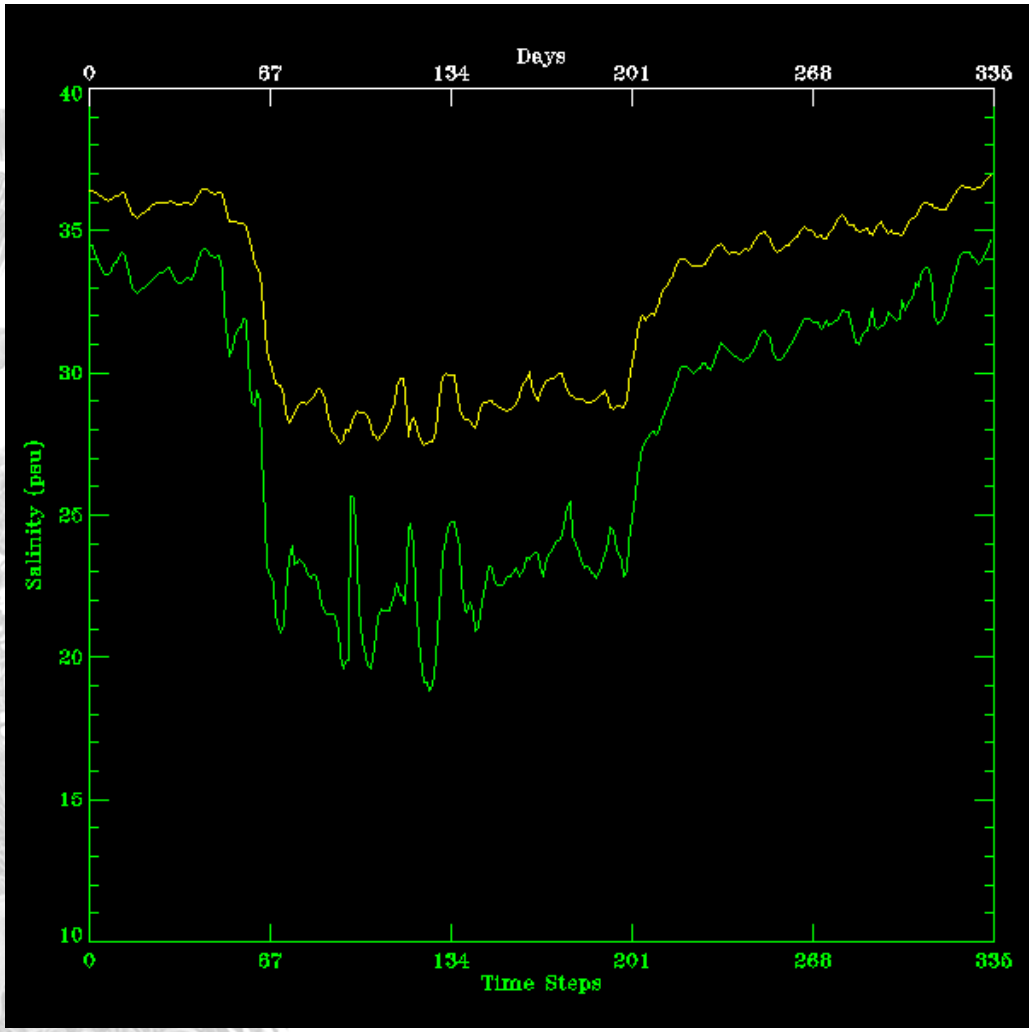
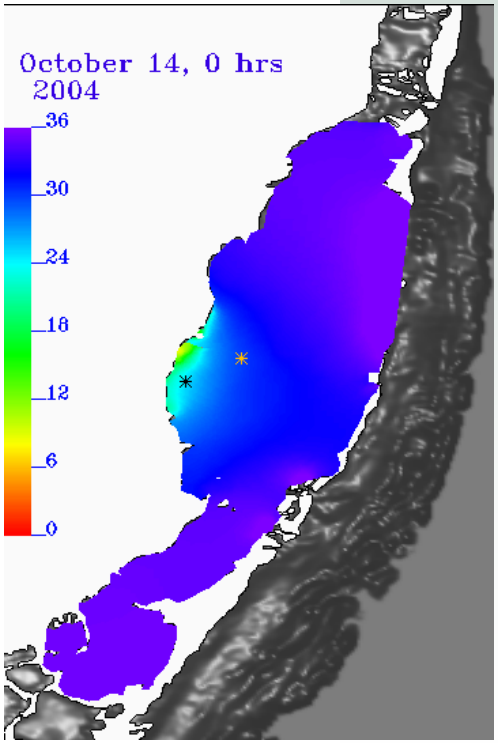
Modeled Results – Slow_ag





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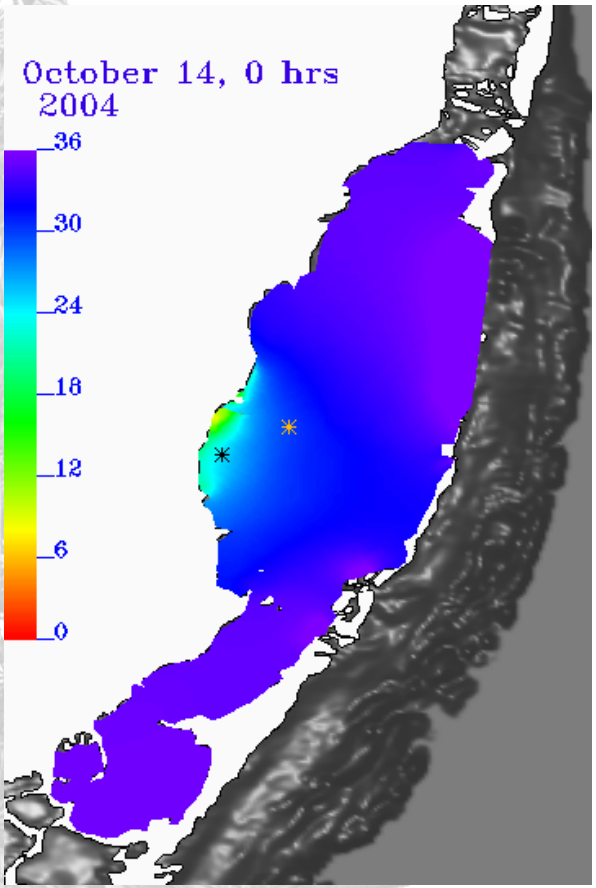
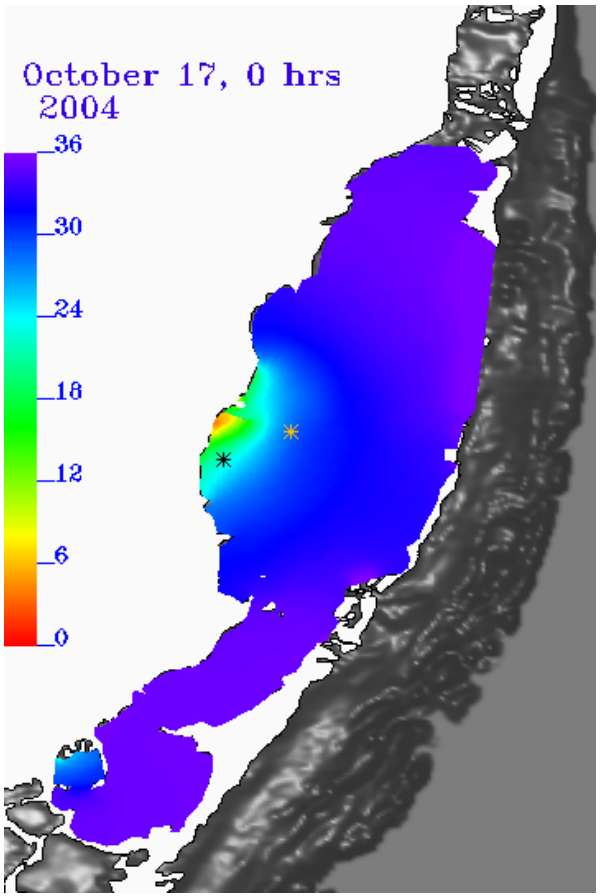
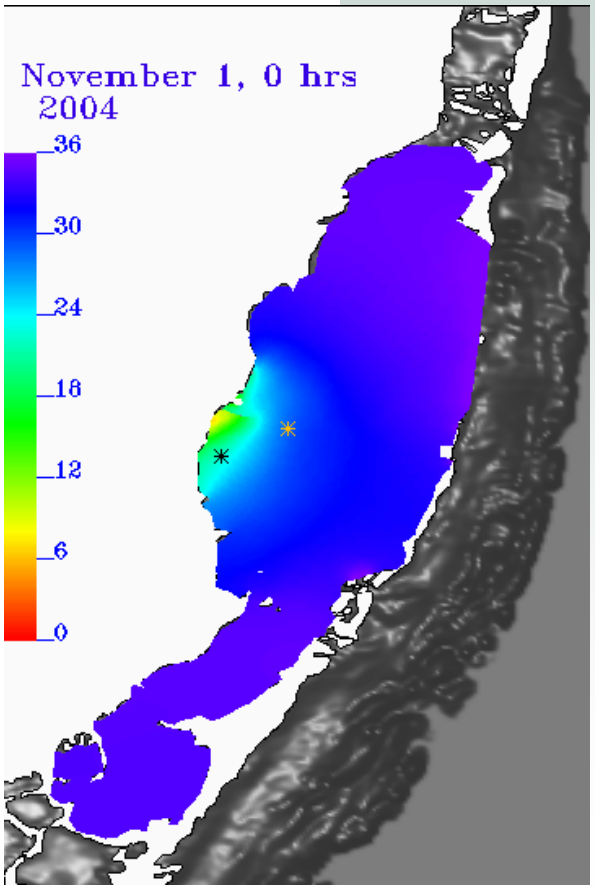
Modeled Results – Slow_ag







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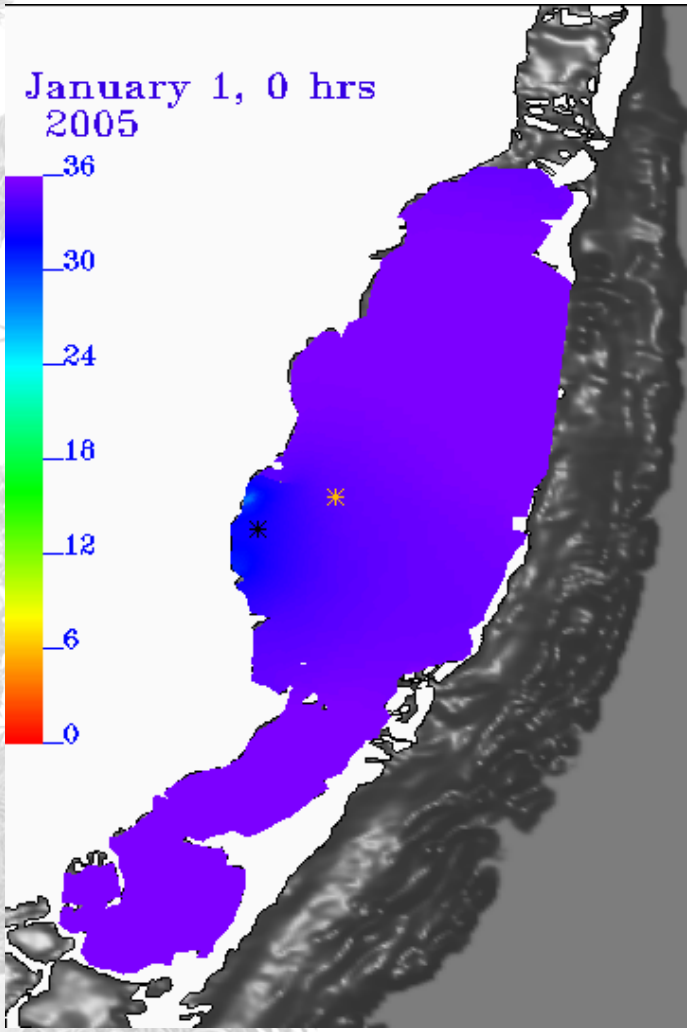
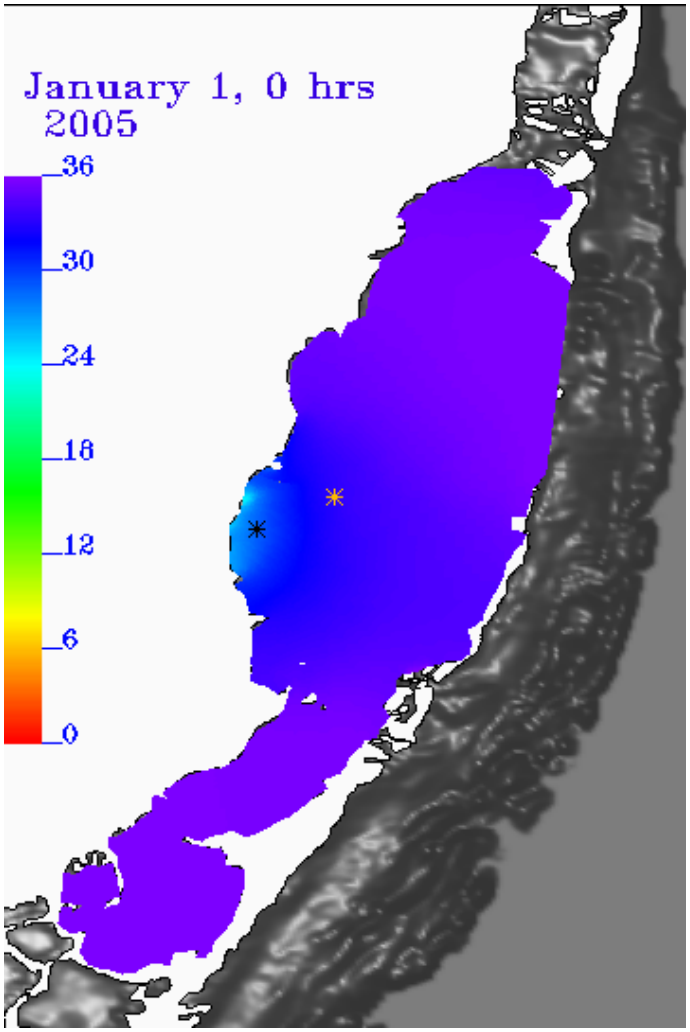
Modeled Results - Base v Slow_ag





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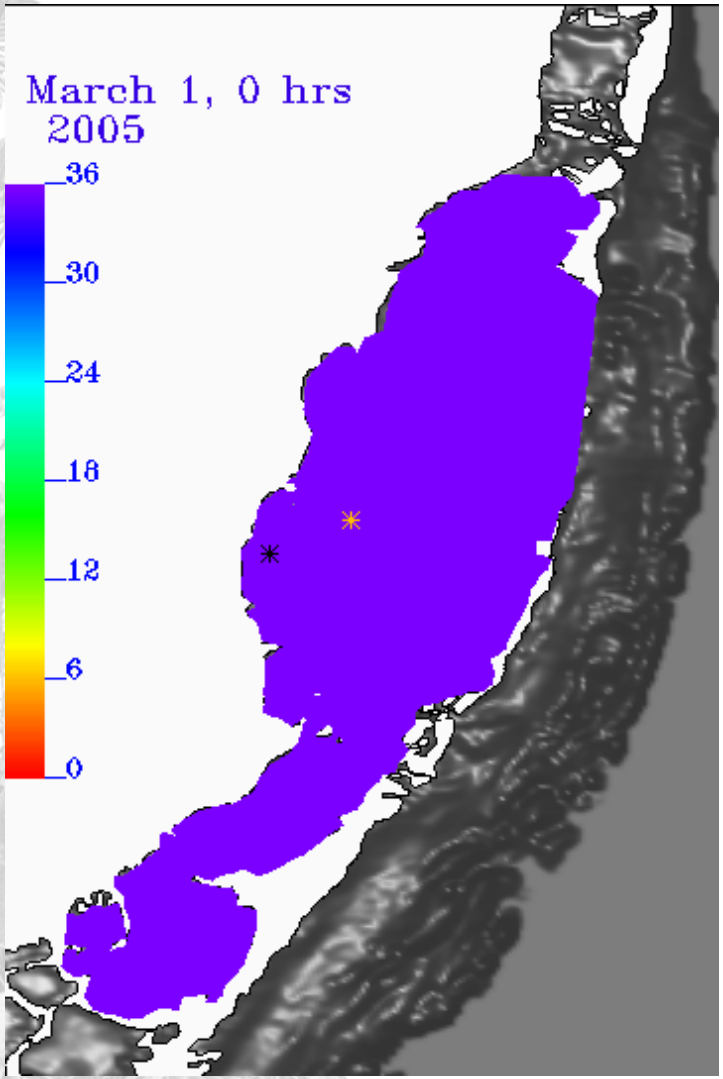
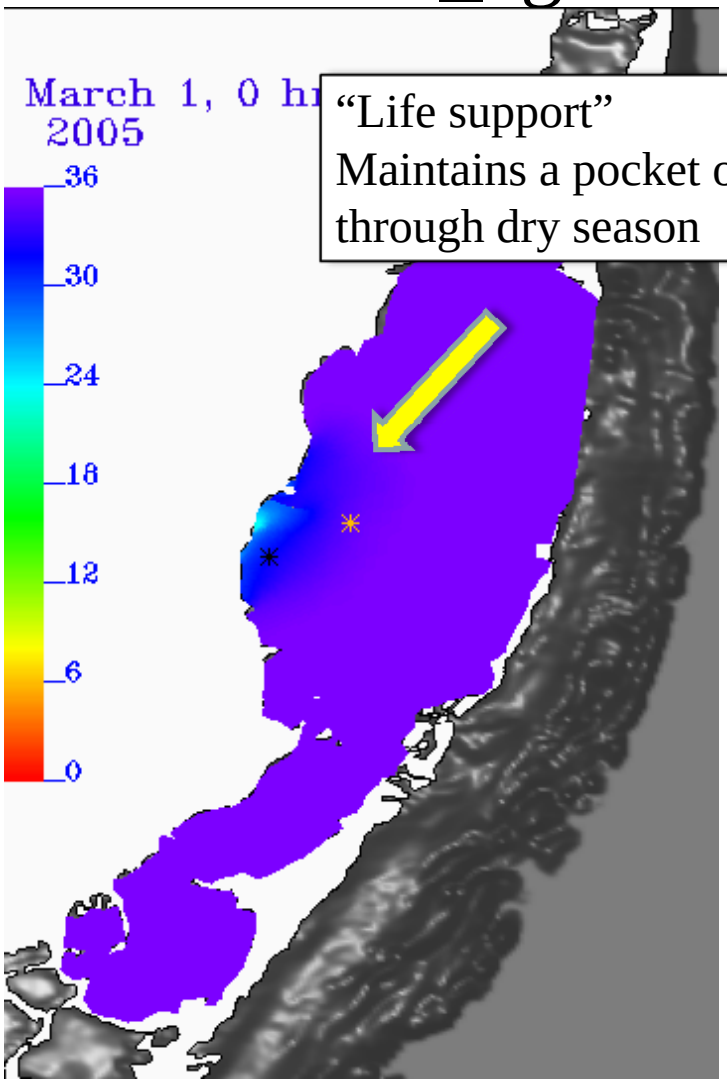
Modeled Results - Base v Slow_ag





"Life support"
Maintains a pocket of productivity through dry season

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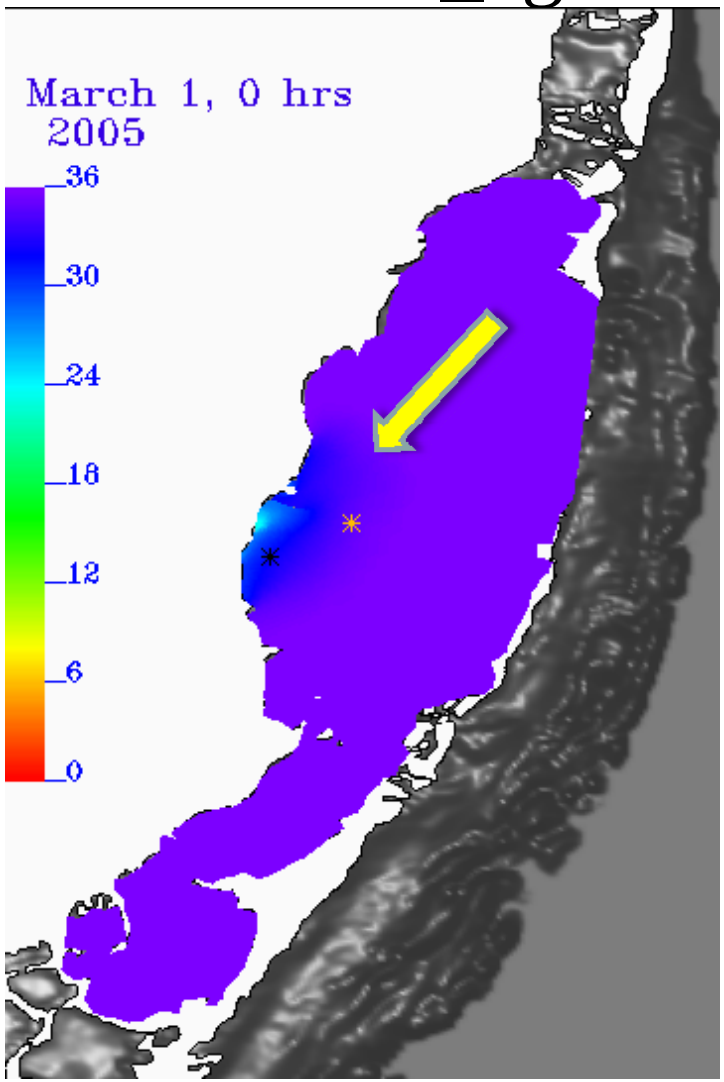
Modeled Results - Base v Slow_ag

Alternative approach to protecting the bay:

Suggest minimum flow rate of 82 cfs if salinity is above *mesohaline conditions* at BISC14 *late in the dry season*[*]



Q & A Session

- Model related
- Storage, seasonality
- Acreage and bottom types
- Total flow to Biscayne Bay

- Other comments or concerns

References

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