SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Everglades National Park--Seagrass Workshop
March 29, 2010

A Synthesis of Models for Analysis of Everglades Impacts and Restoration

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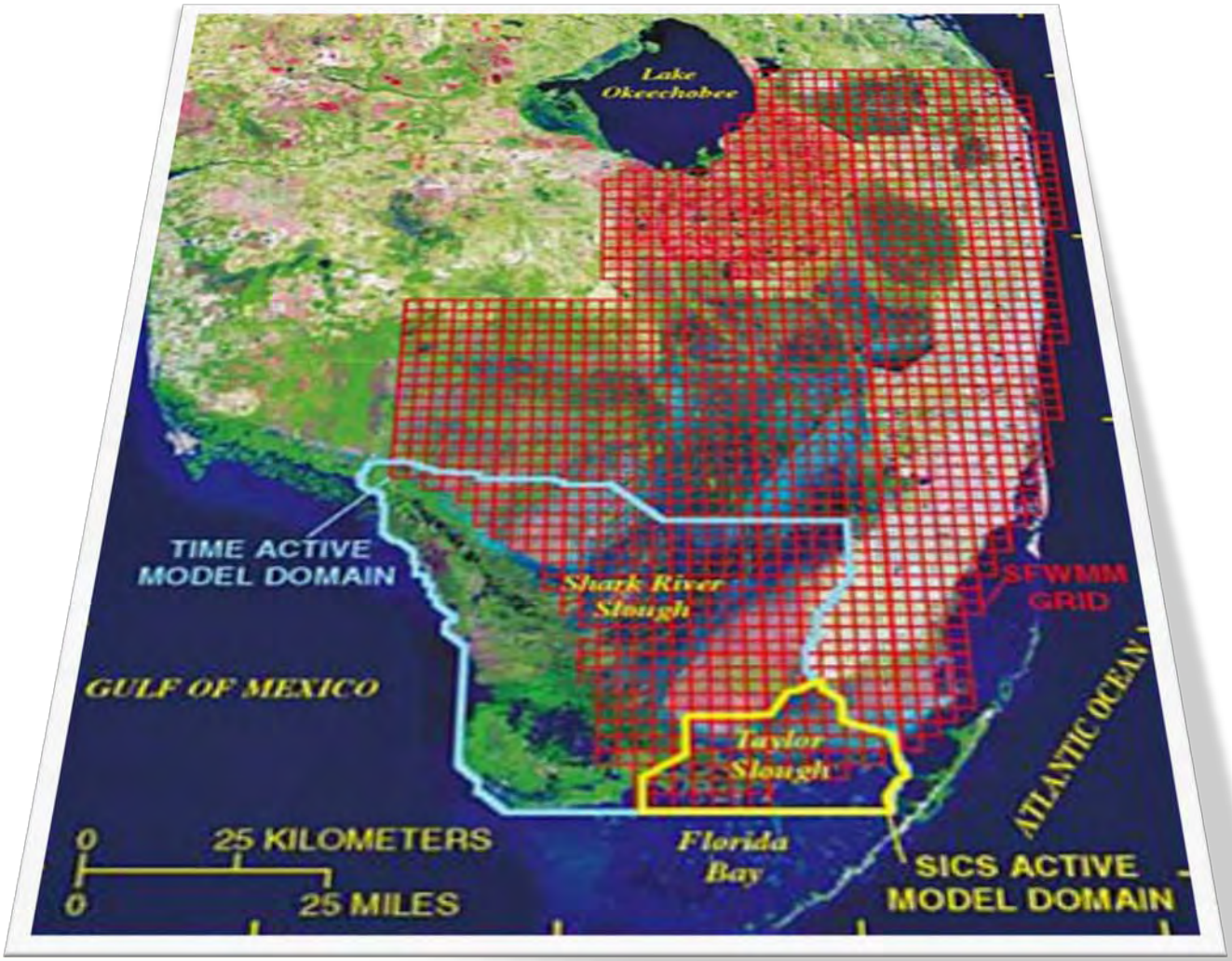
Presented at:

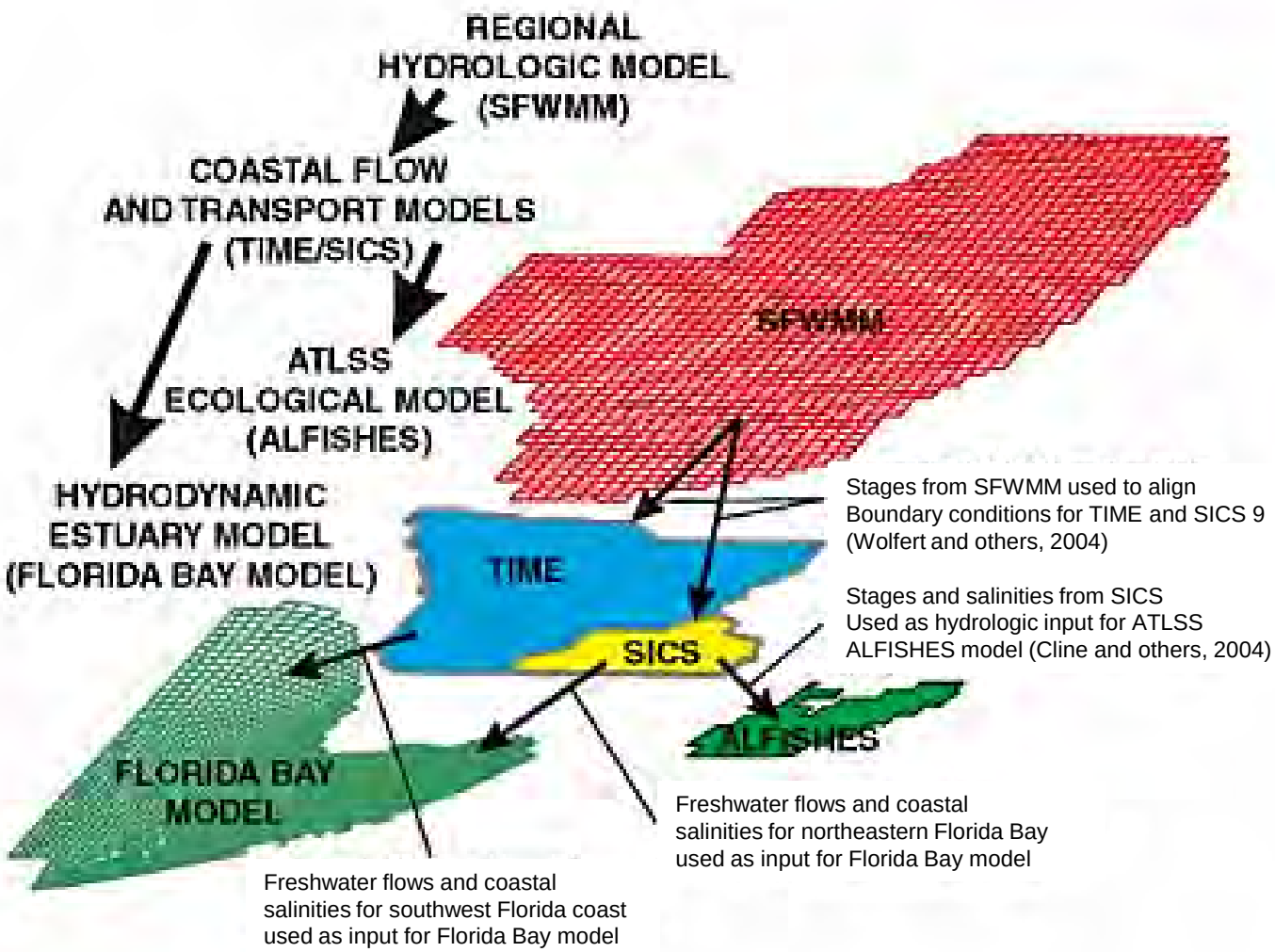
Krome Center
Everglades National Park

sfwmd.gov

Florida Bay and the Everglades Watershed: Hydrologic Model Domains

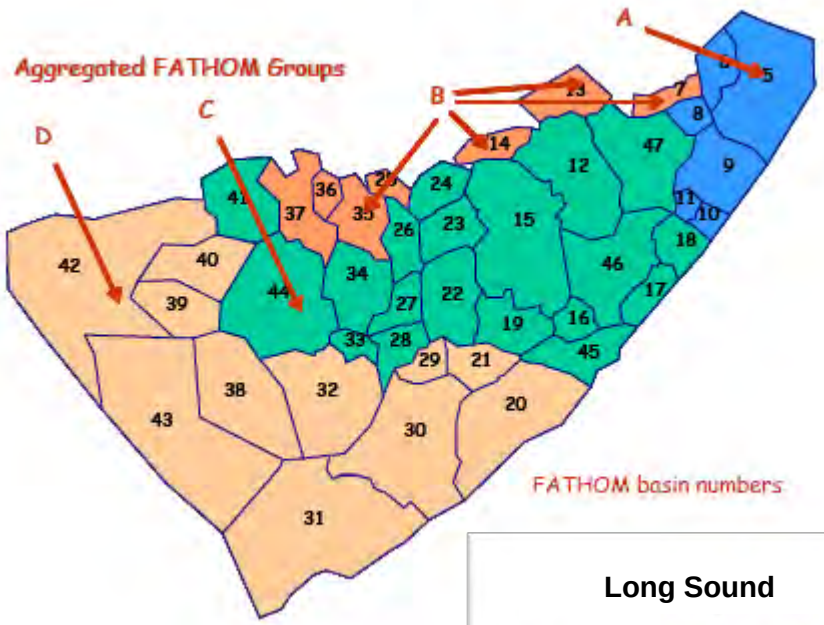


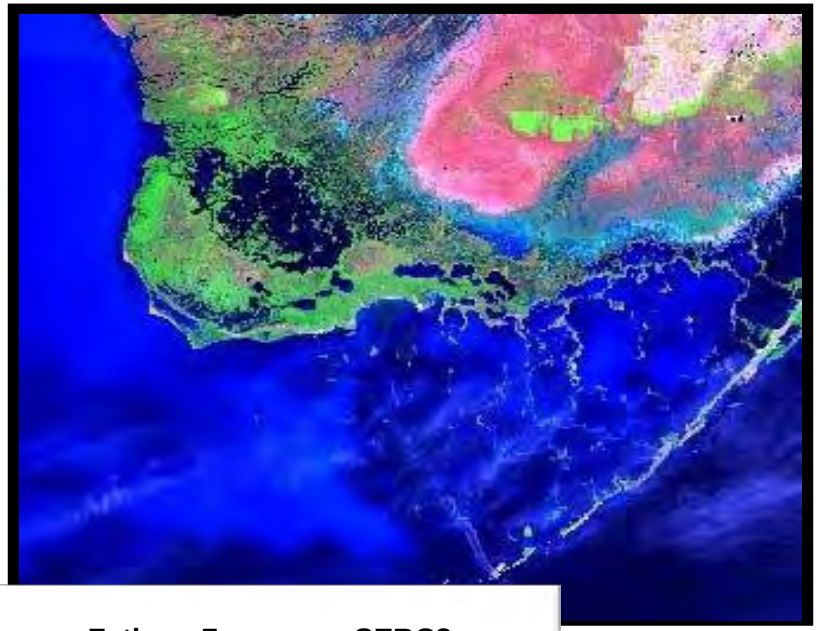
Integration of Watershed Hydrologic Models



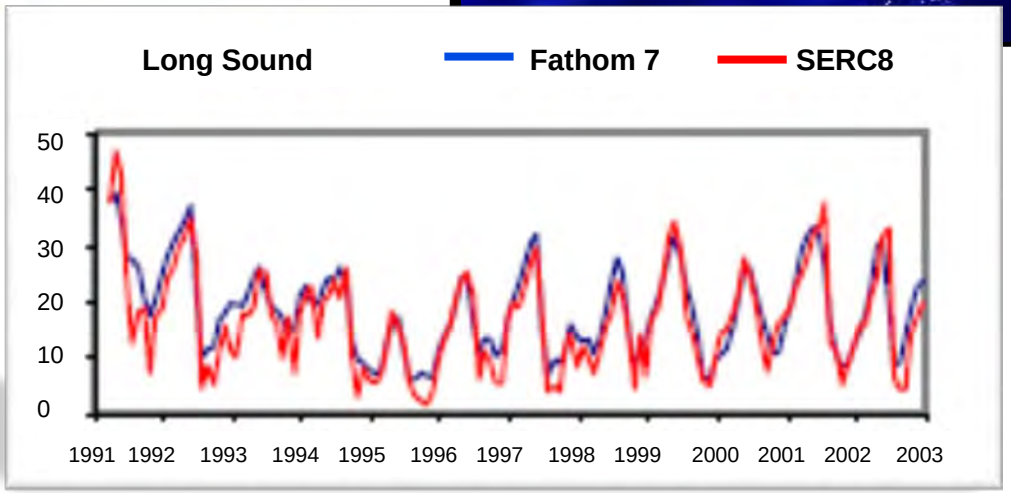
Langevin et al. (2004)

FATHOM
(Flux Accounting and Tidal Hydrology Ocean Model)



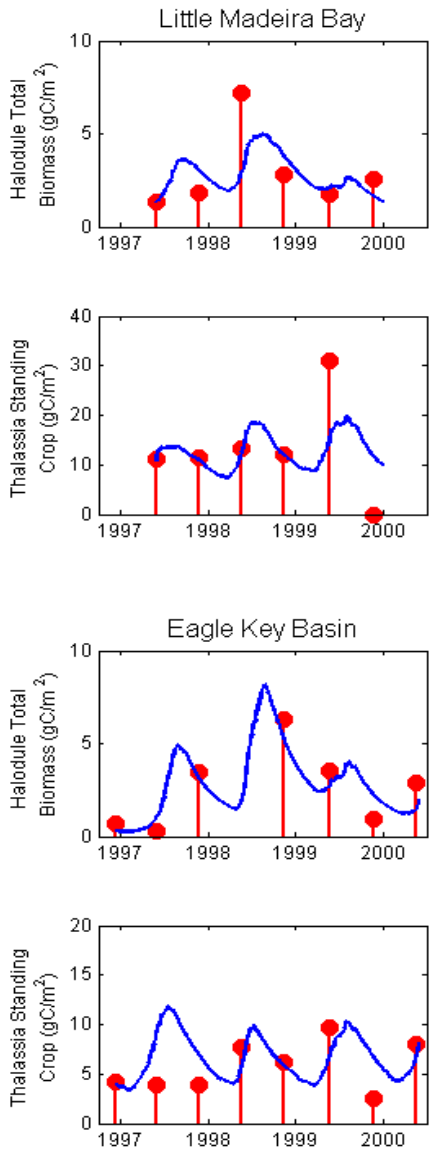


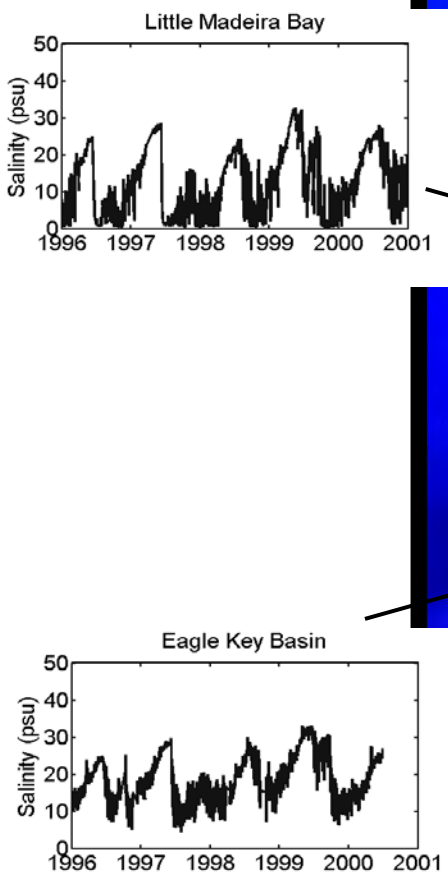
Cosby et al. (2005)

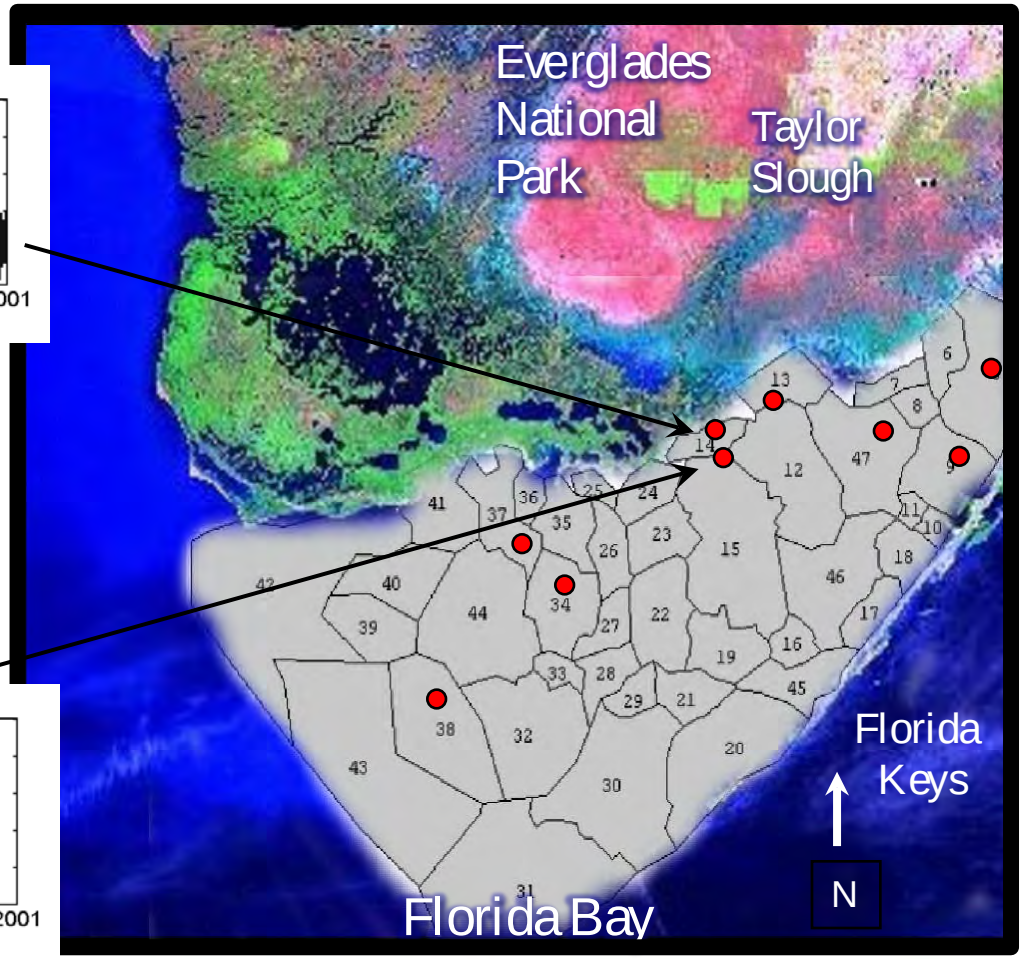


Hunt et al. (2006)

Florida Bay Ecological Model Calibration Sites

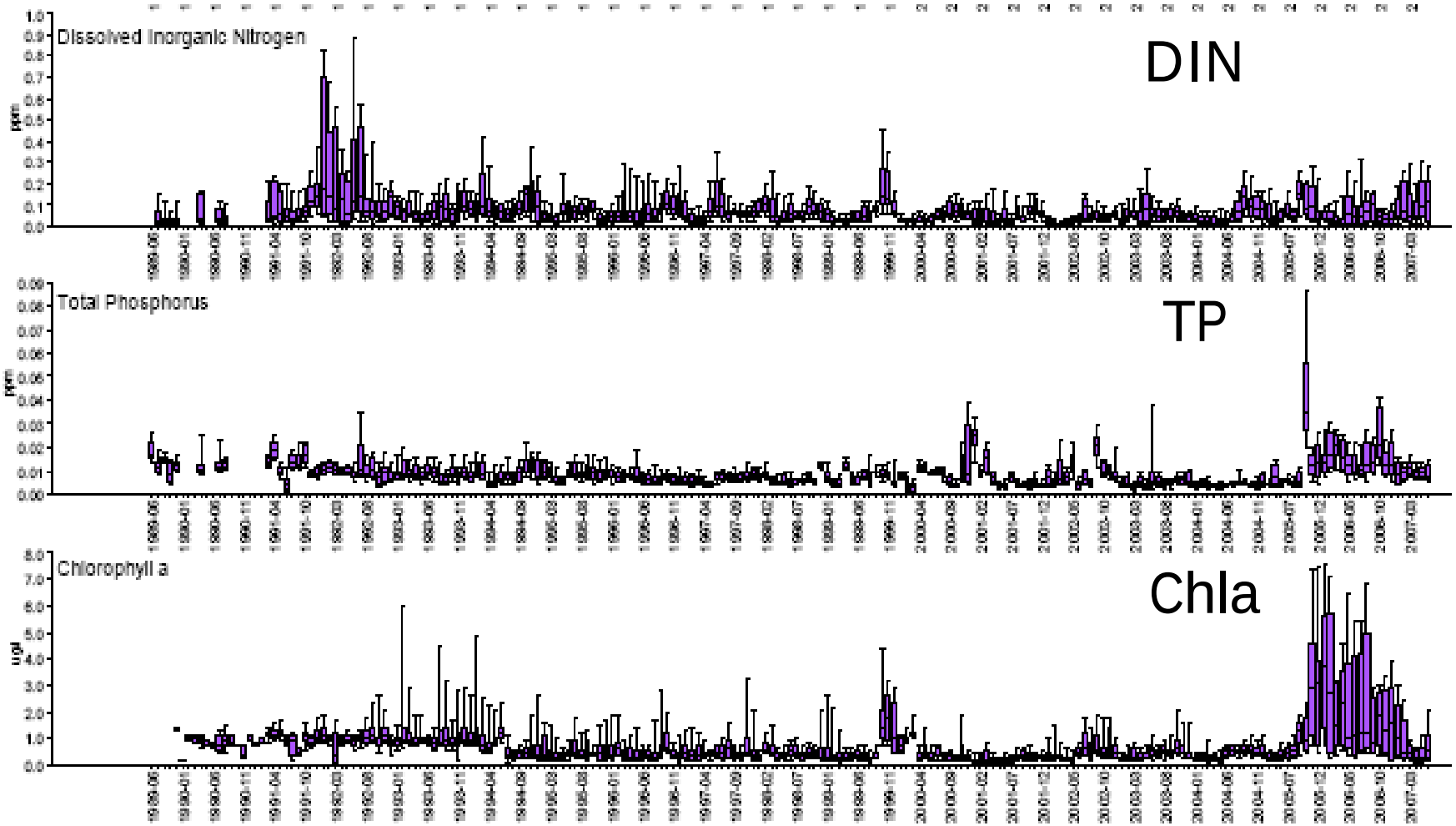




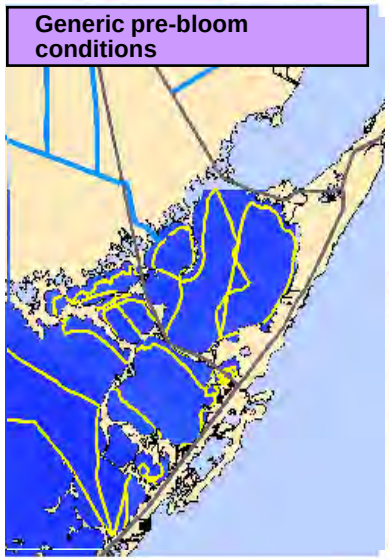


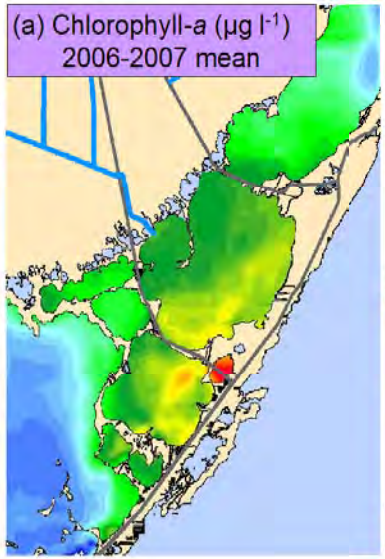
Nuttle et al. (2005) Madden et al. (2007)

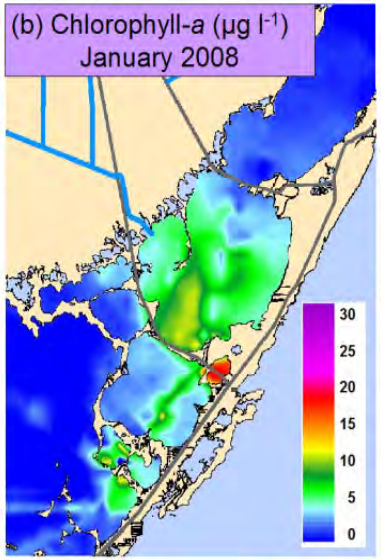
Water Quality in Eastern Florida Bay
1999-2007 (Boyer et al. 2008)

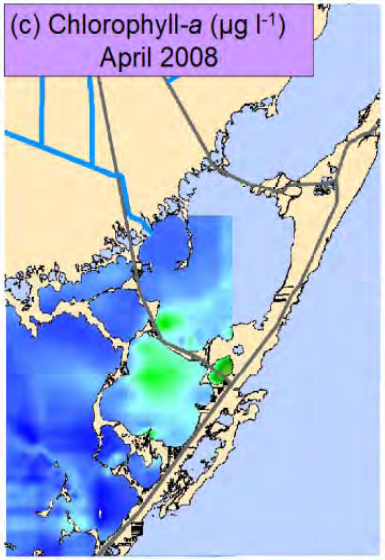


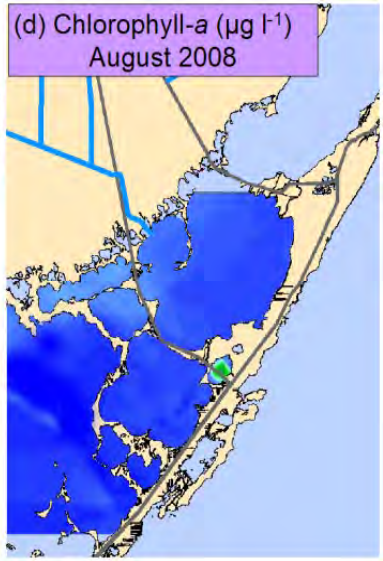
Dataflow Bloom Mapping 2005-2008

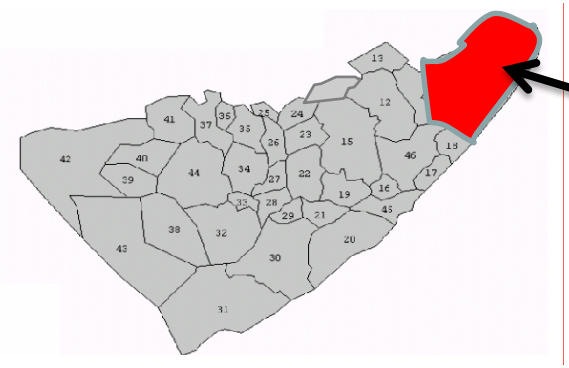






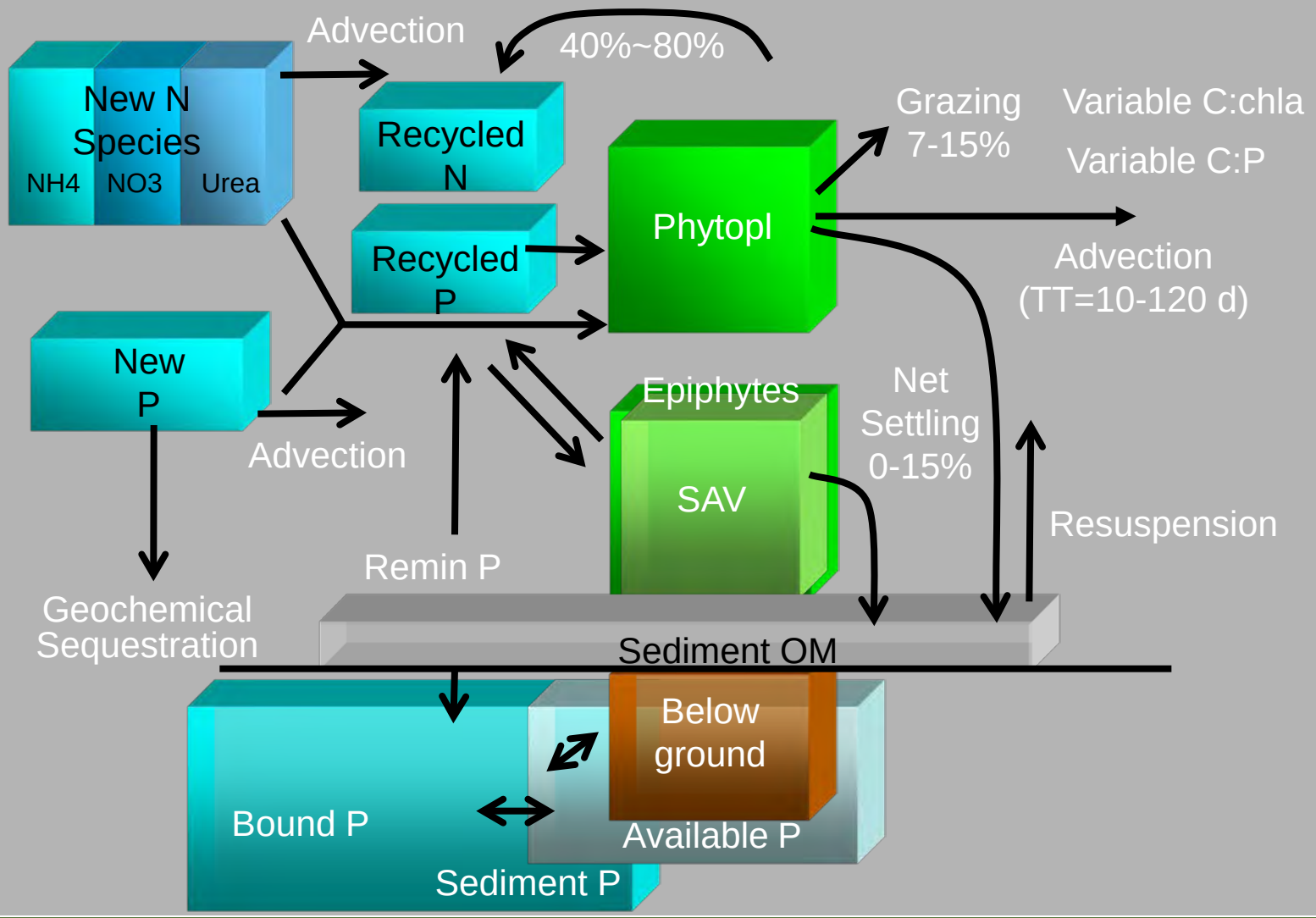




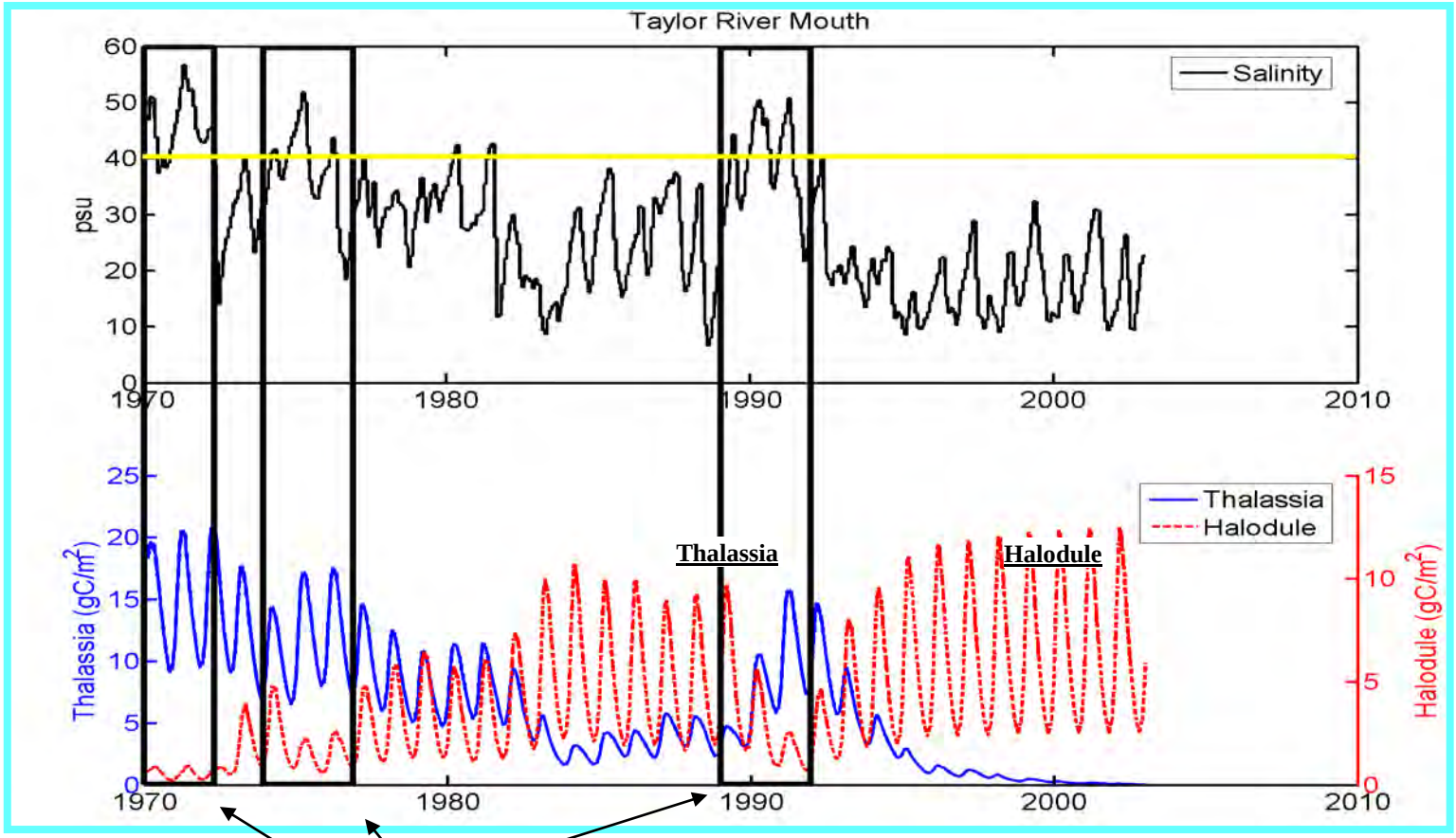


FATHOM basin where bloom is mapped

SAV-Phytoplankton Model Interactions



Integrating FATHOM and SEACOM to Guide Minimum Flows and Levels Thresholds for Florida Bay

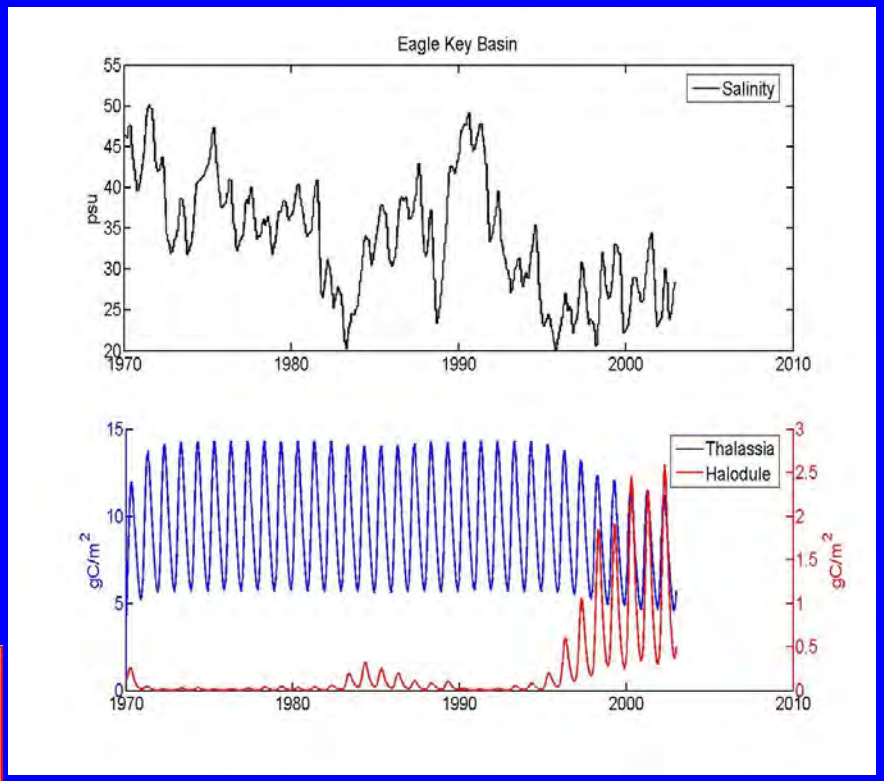


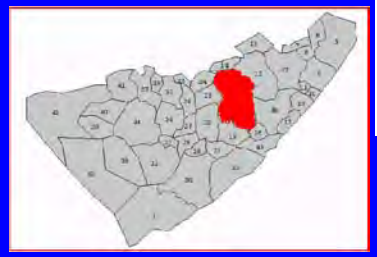
High Salinity

Salinity output from FATHOM Cosby et al. (2005)

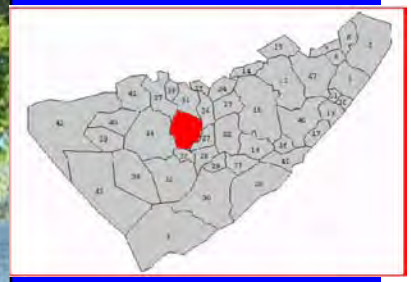
SAV from Madden et al. (2006)

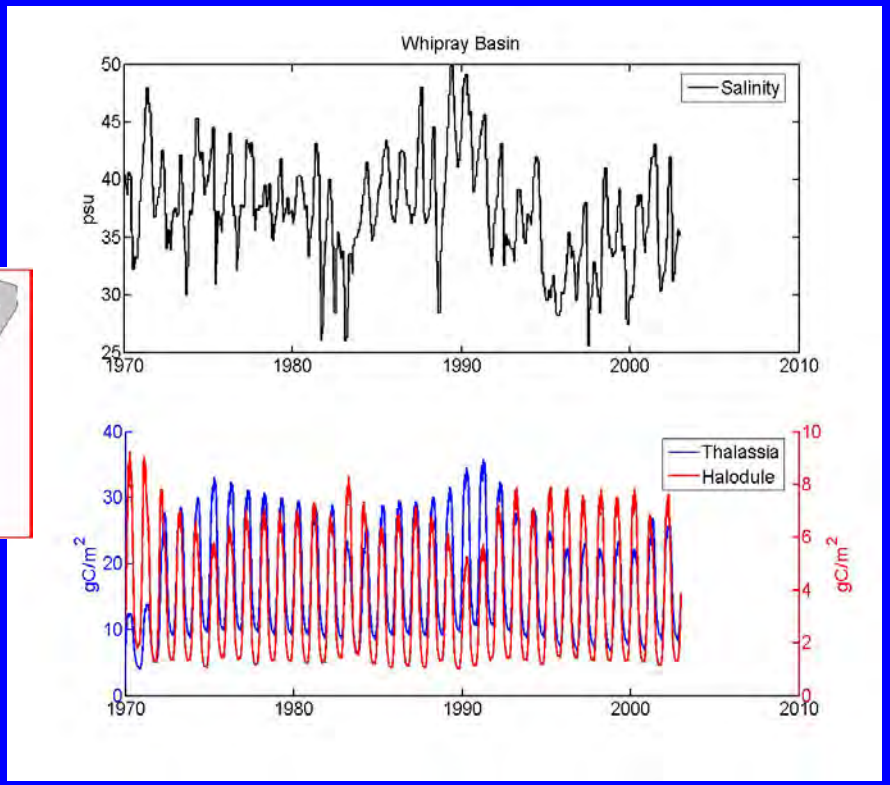
Differential Response to Salinity and Nutrient Regimes- Eagle Key Basin





Differential Response to Salinity and Nutrient Regimes- Whipray Basin

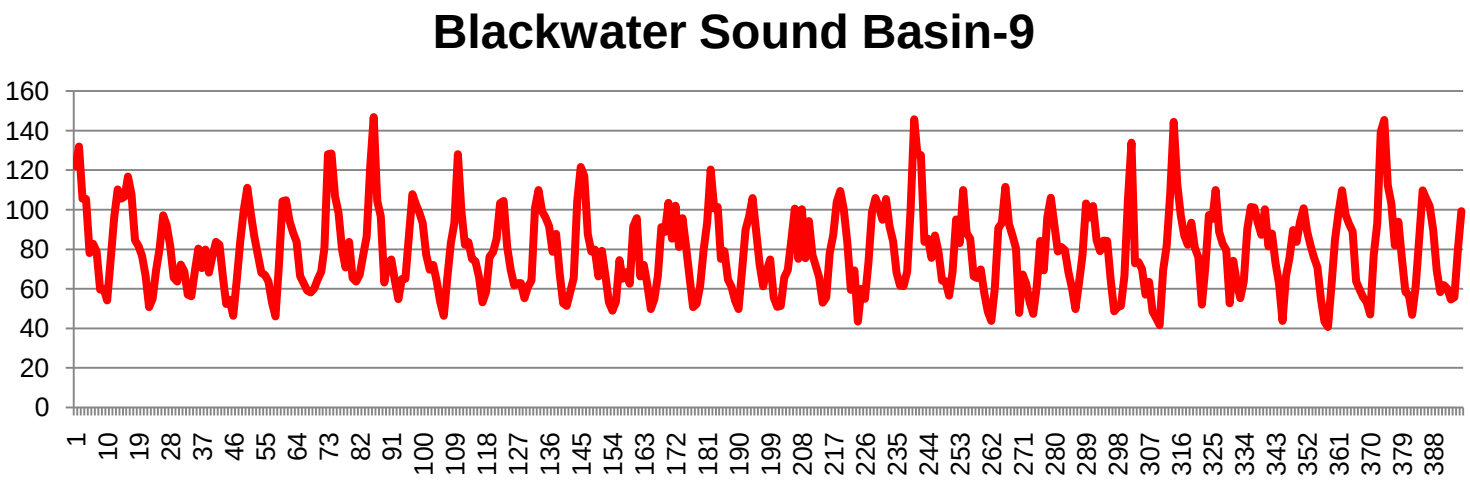


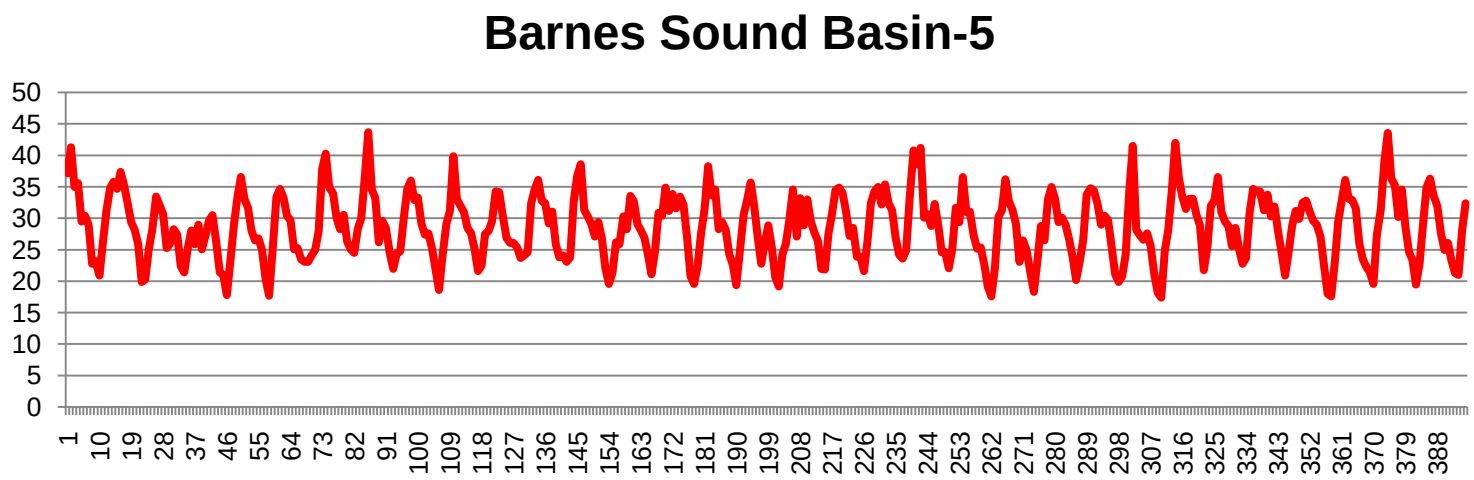


Characteristics of the Phytoplankton Model

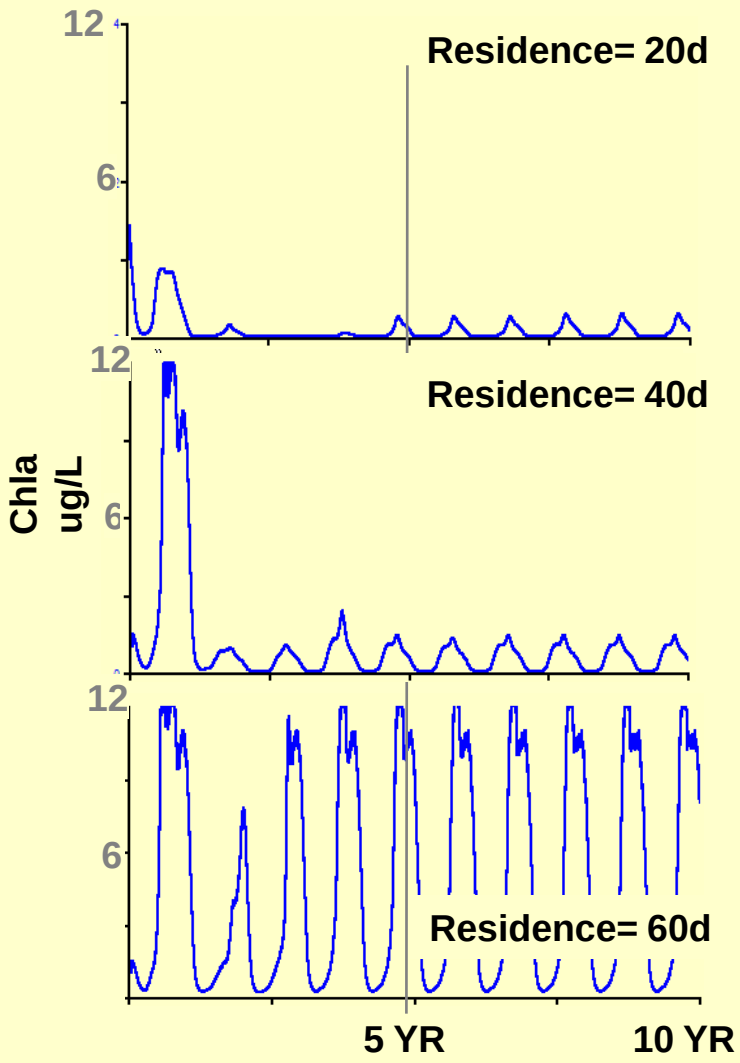
- Single generic species
- High dependency on Recycling (40-80%)
- Strong dependency on Water Residence Time (20-120 d)
- Dependency on Grazing Rate (7-15%)
- P Limitation/pulse and bloom
- N Substrate preference function
- Mechanistically incorporates variables sensitive to climate change: depth, light, temperature, salinity response

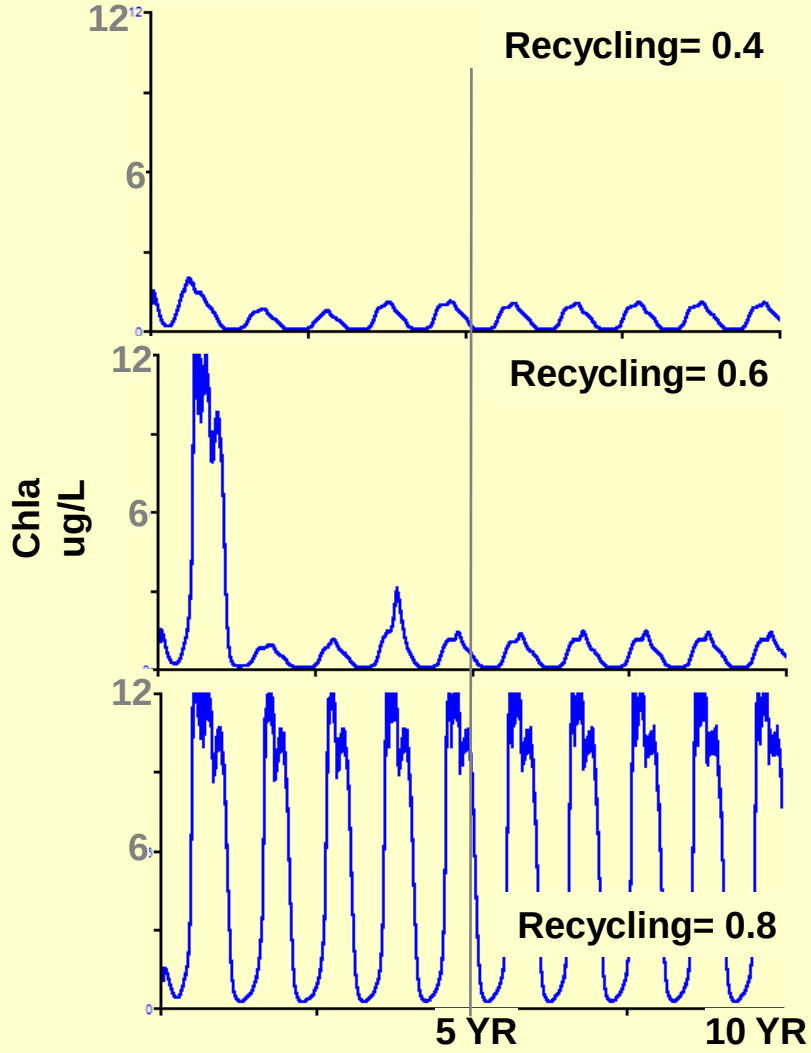
Flushing Times (days) Calculated by FATHOM



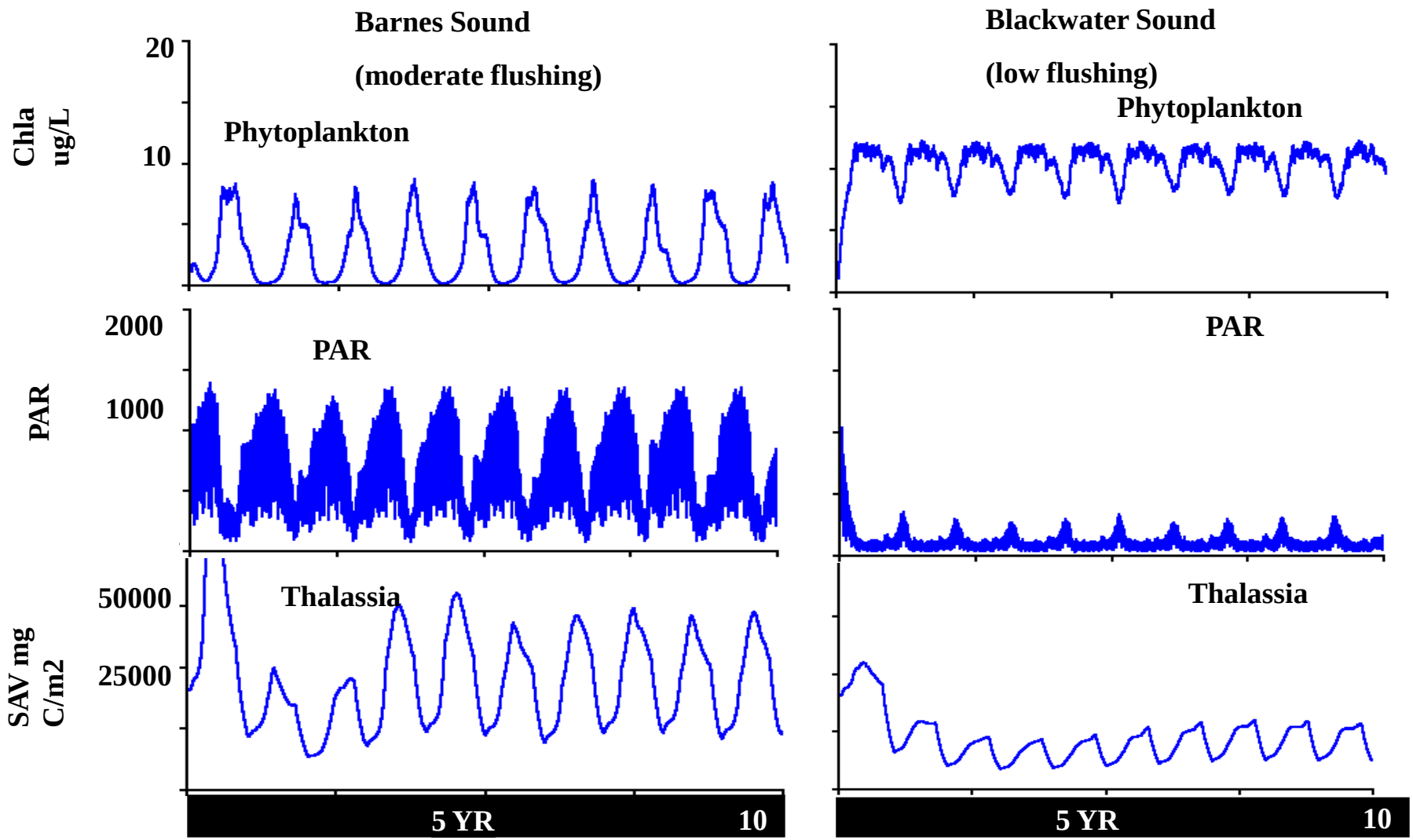


Phytoplankton:
Basin Residence Time and P Recycling Efficiency



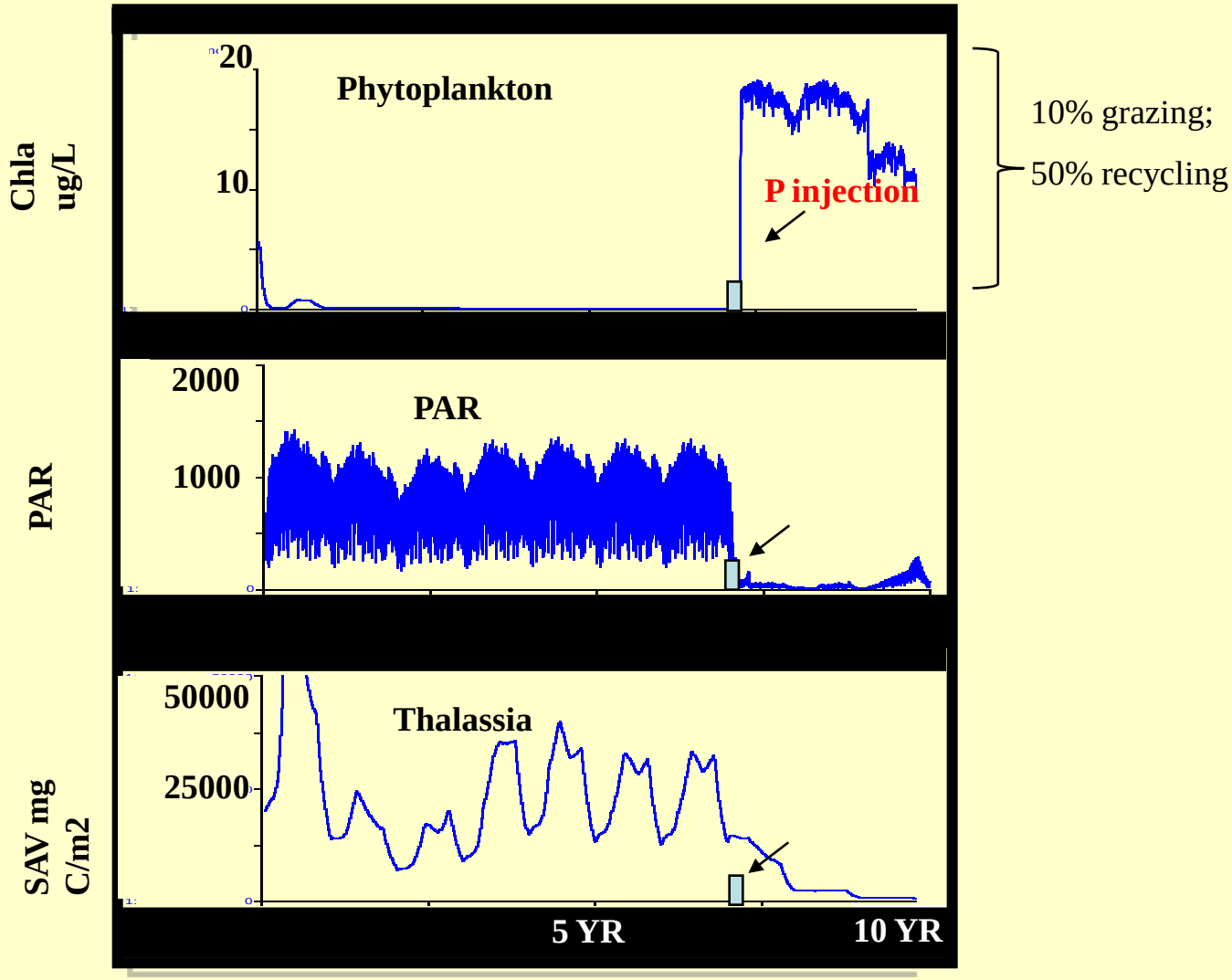


A Tale of Two Basins-
Differential Flushing Rates Affects System Architecture

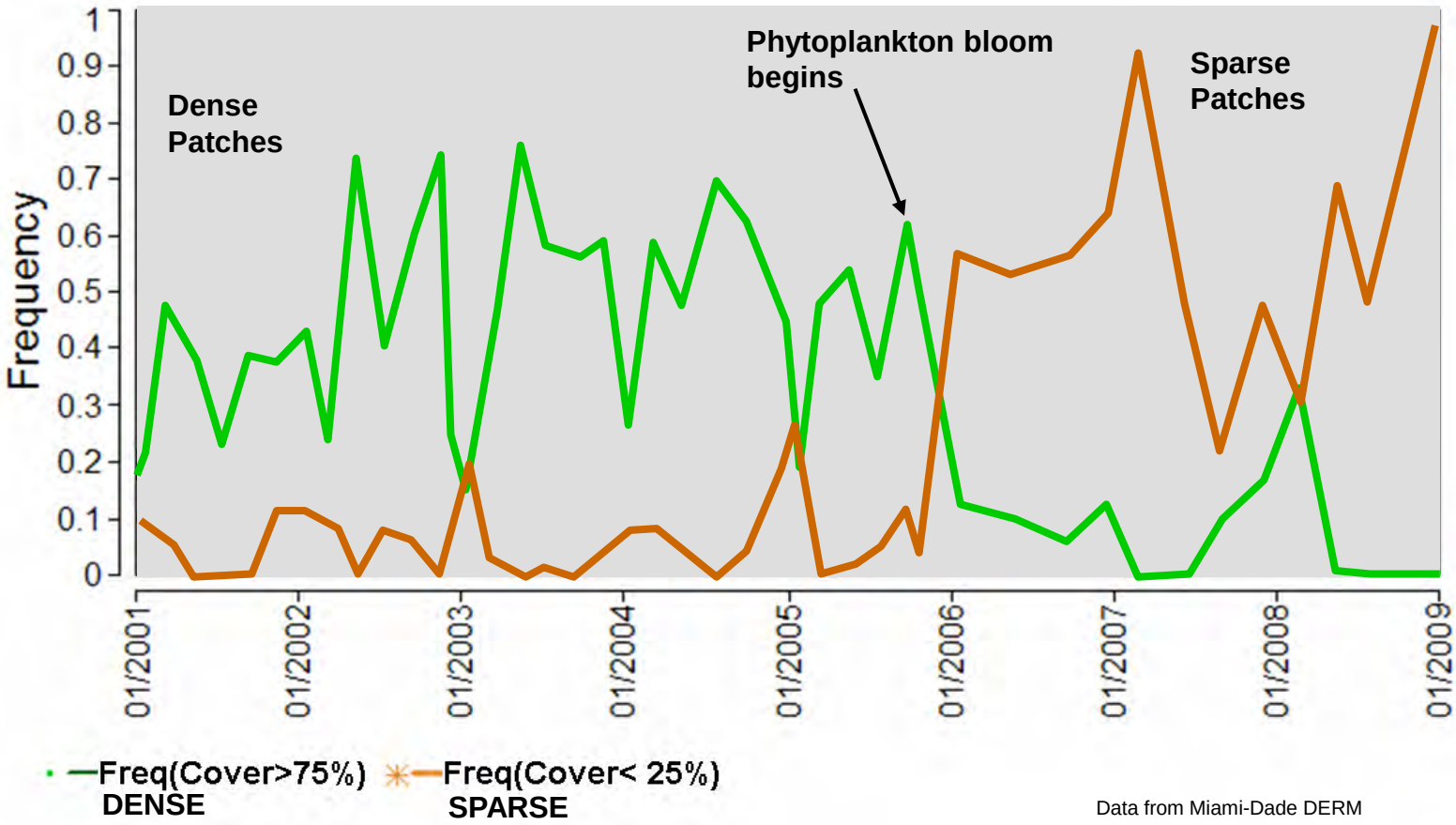


Bloom Simulation and SAV: P injection in Yr 7

Increased P Loading Degrades Photic Regime

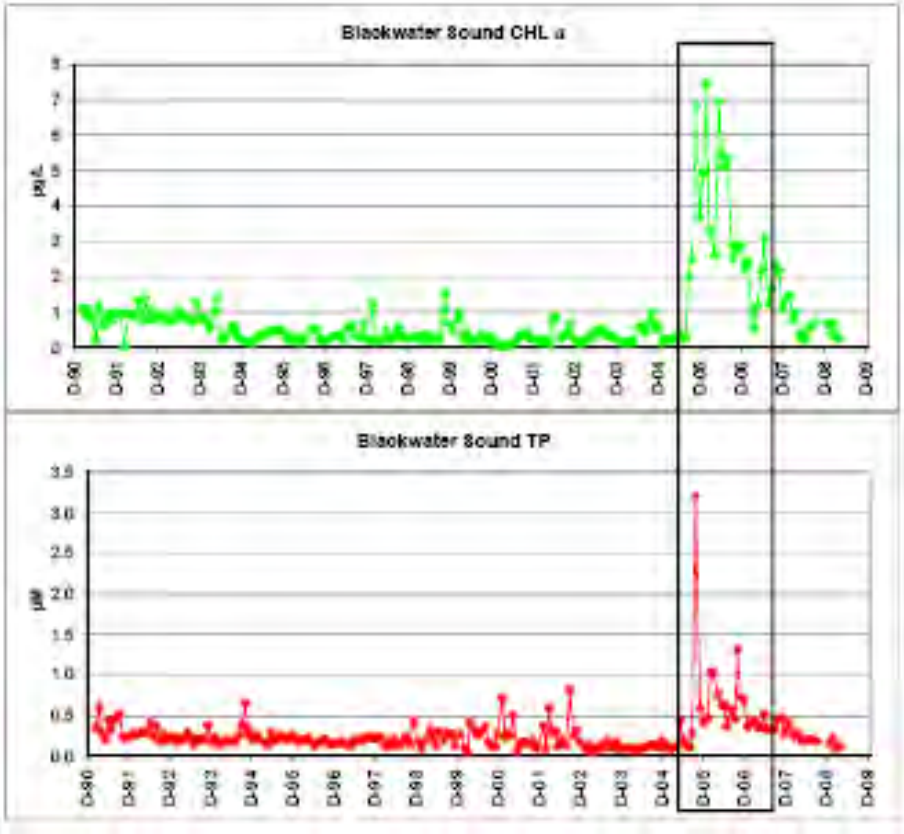


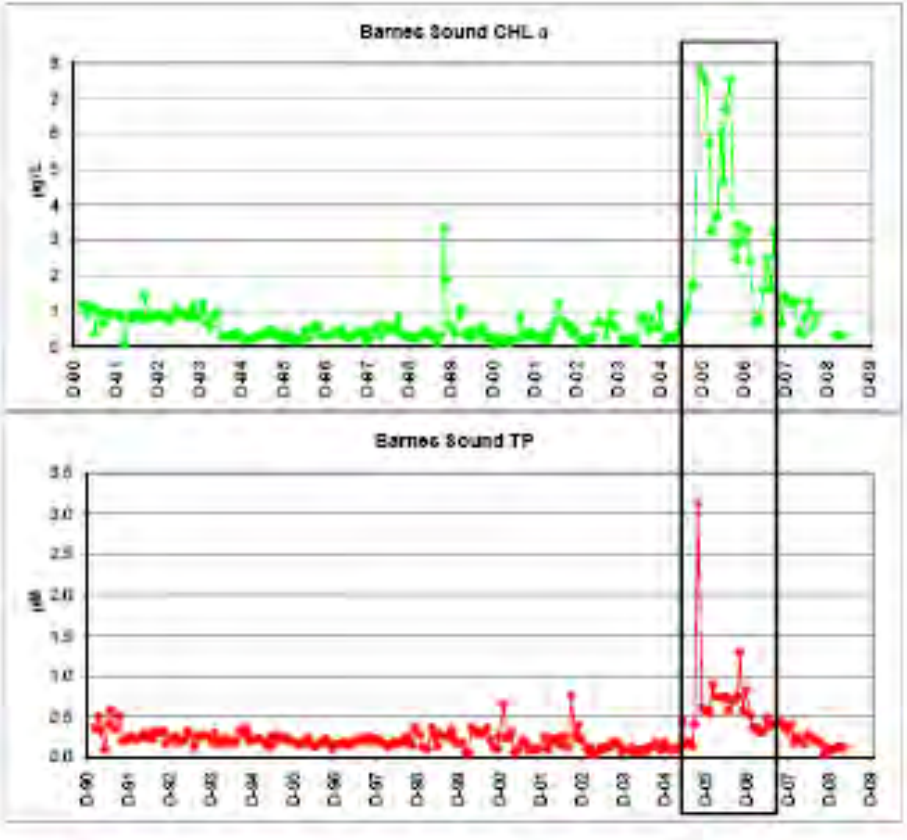
Density of SAV in Barnes Sound (2001– 2008)



Data from Miami-Dade DERM

Phosphorus and Chla Concentrations in Eastern Florida Bay





Conclusions

- Integrated watershed, hydrologic transport models and ecological models allow us to understand consequences of perturbations to phytoplankton and seagrass communities
- Models evaluate inflection or tipping points where there is a potential to undergo system state changes
- Combined factors of nutrient loading, flushing rate and grazing rate can create sustained bloom conditions
- SAV feedbacks can prolong blooms and create a negative feedback loop
- Model synthesis framework now being used to evaluate regulatory freshwater requirements and restoration designs in the context of global climate change

A Synthesis of Models for Analysis of Everglades Impacts and Restoration

THANK YOU

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