Long-Term Trends in South Florida Coastal Water Quality: With Potential Consequences

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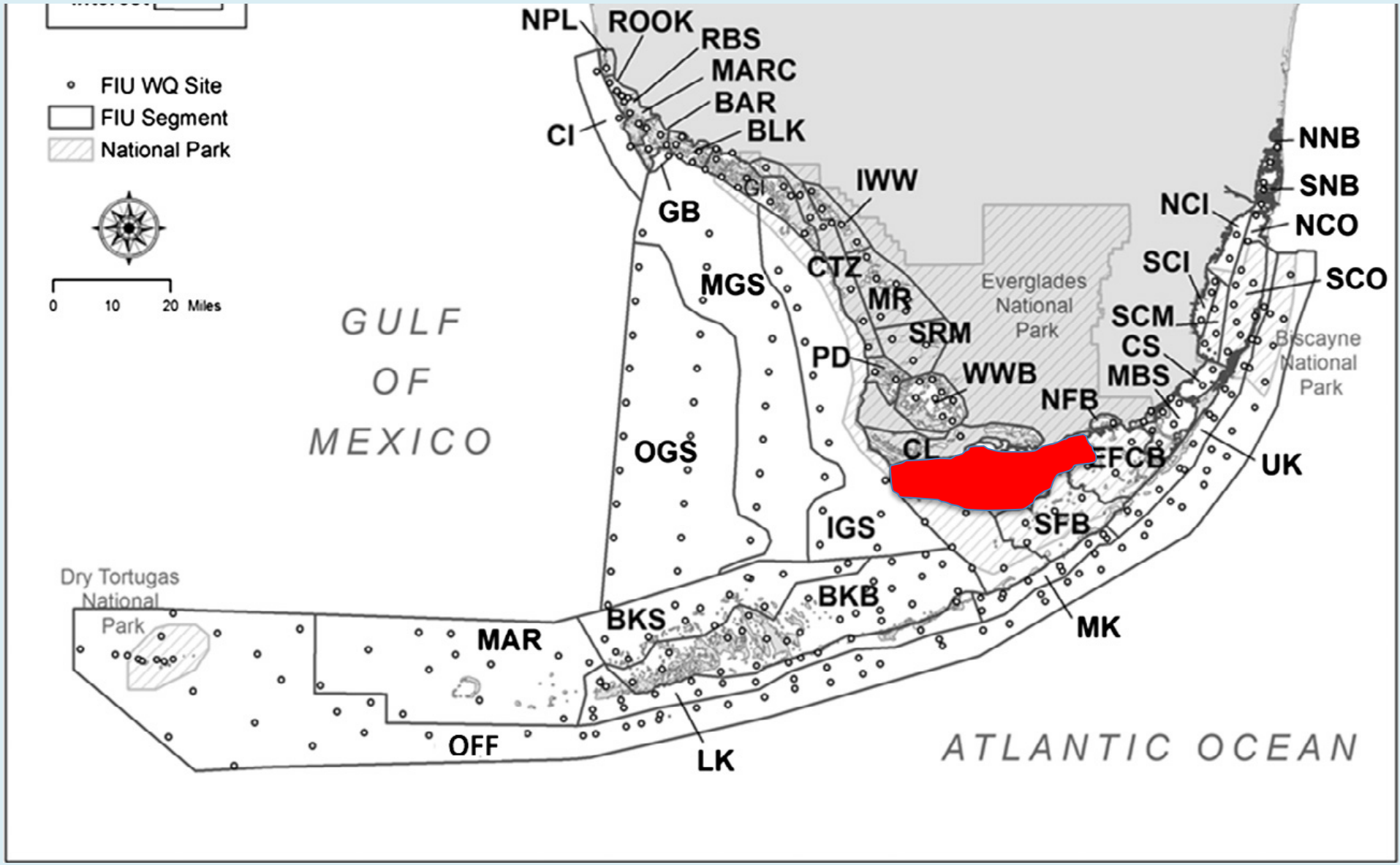
Water Quality

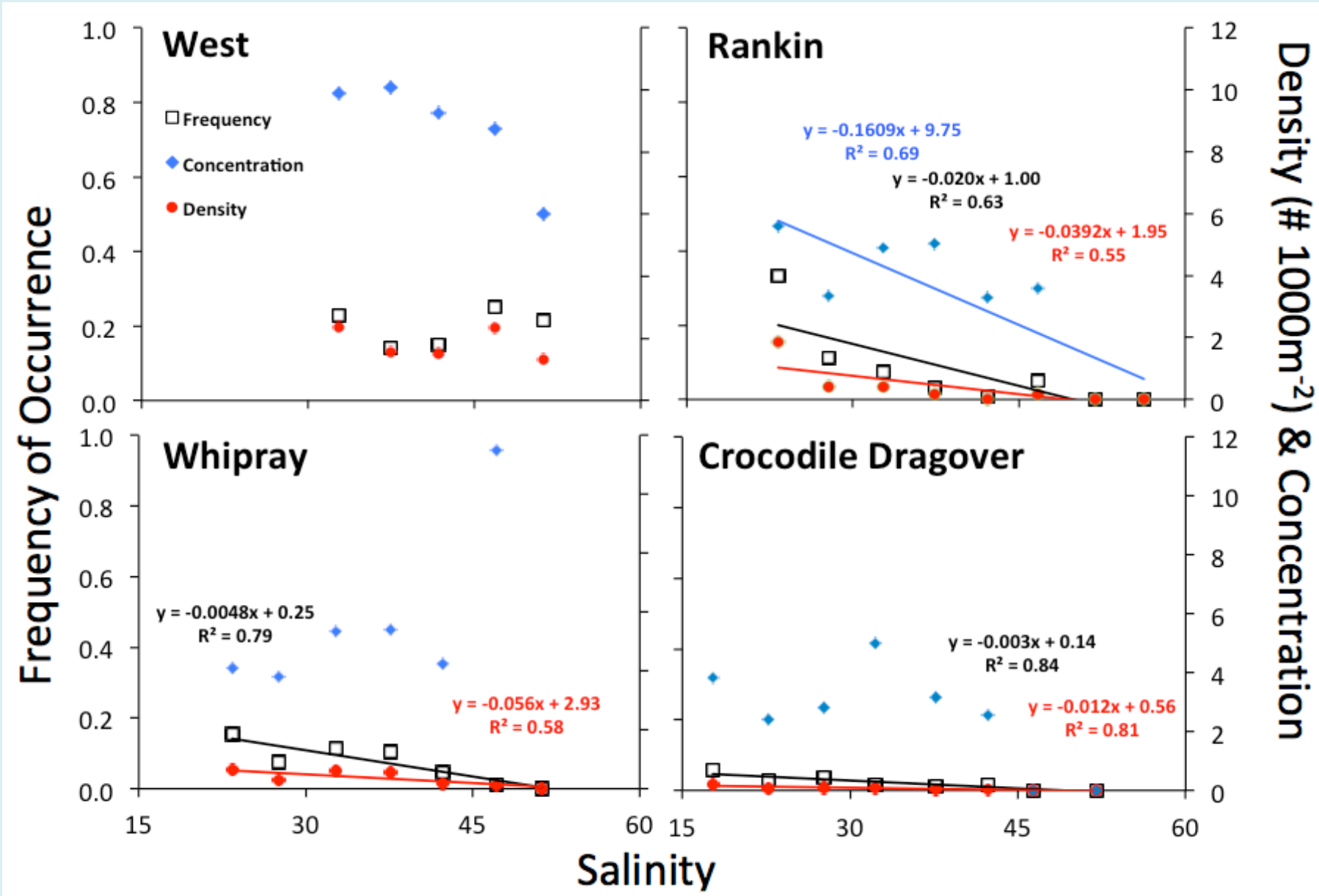
- 3 monitoring programs have operated in South Florida coastal waters with a 4th one starting
  - DERM, FIU/SFWMD, AOML, and now Biscayne Bay Water Watch
  - Measure Temperature, Salinity, pH, nutrients, chlorophyll
- Effects of water quality (salinity on upper trophic levels)
- Chlorophyll is an approved indicator for South Florida Ecosystem Restoration Task Force
- Comprehensive water column index was developed for South Florida Coastal and Marine Ecosystems by MARES that includes nutrients and temporal trends

South Florida Water Quality Sampling

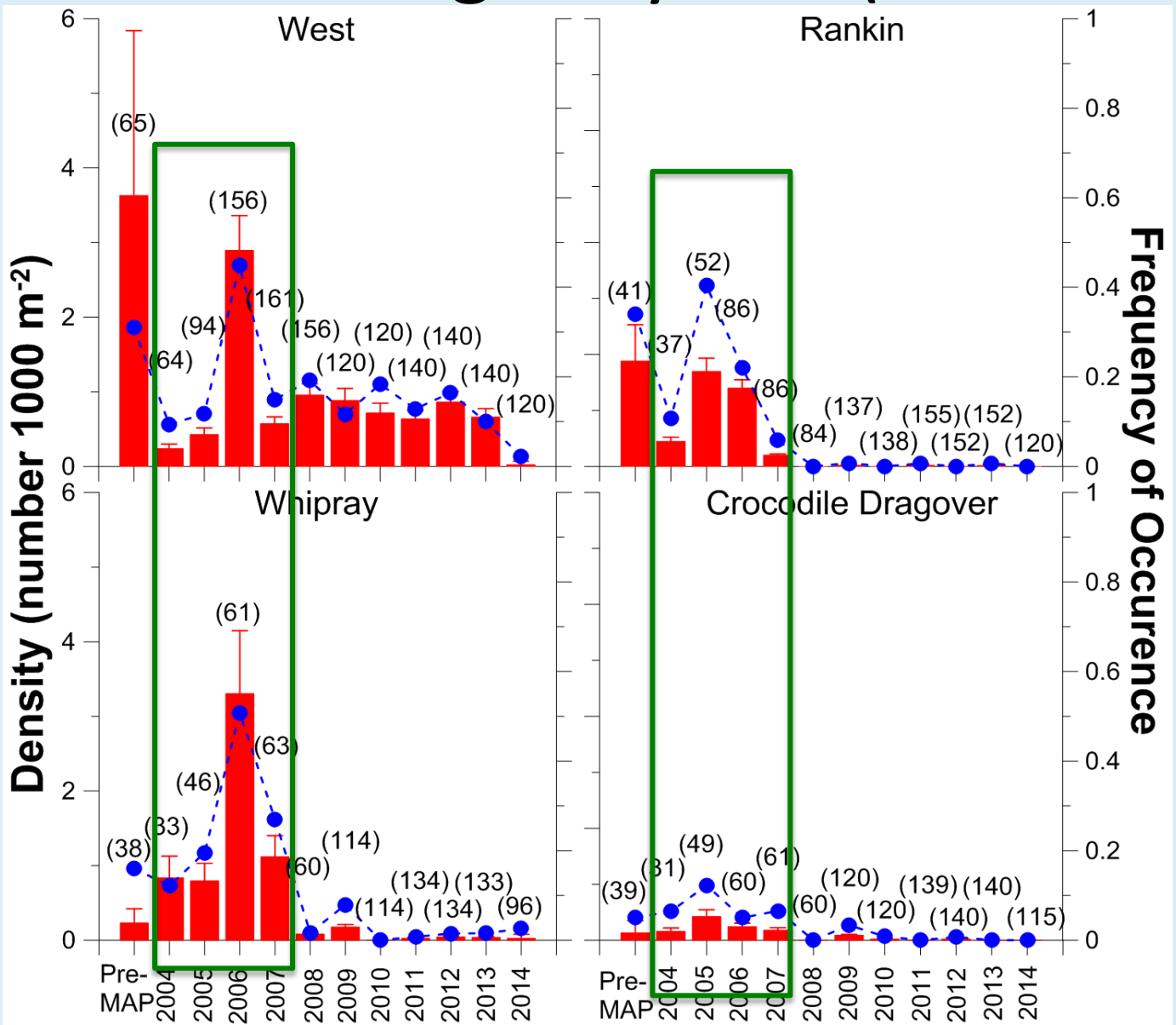


Briceno & Boyer, 2013

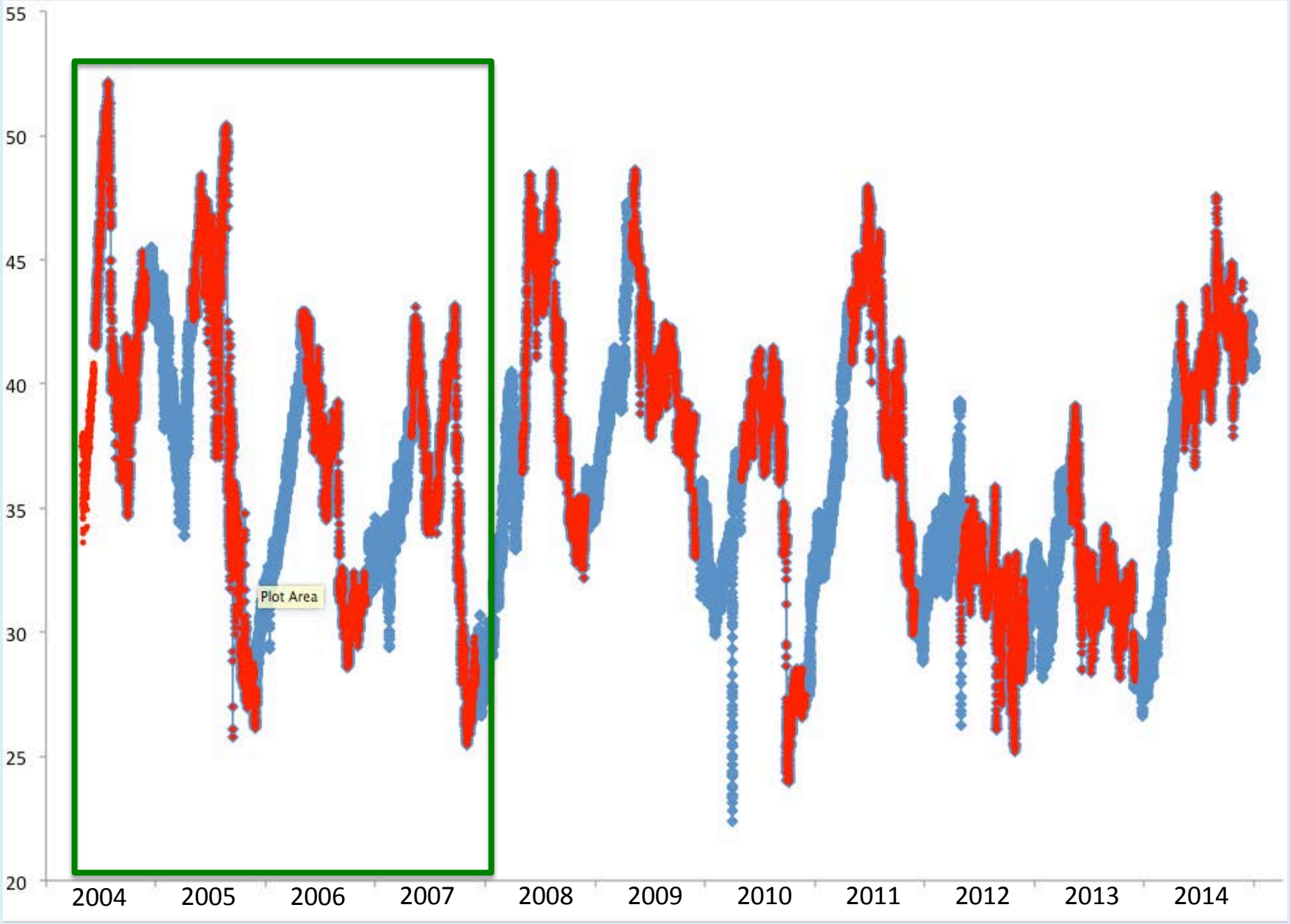
Salinity & Juvenile Spotted Seatrout



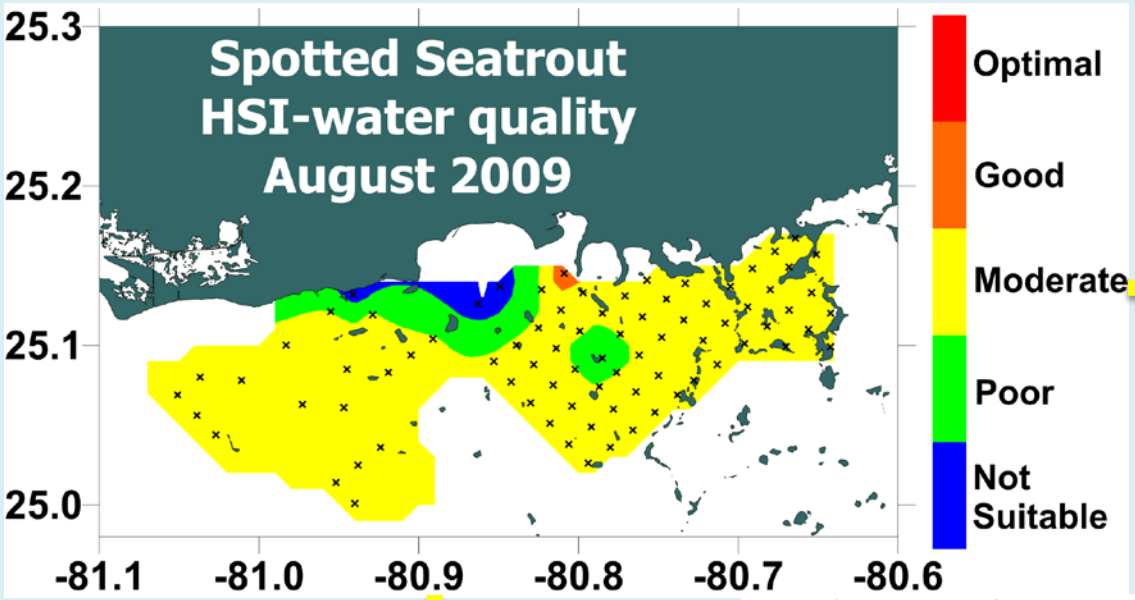
Florida Bay collapsed last year, but it has been declining for years (decades)

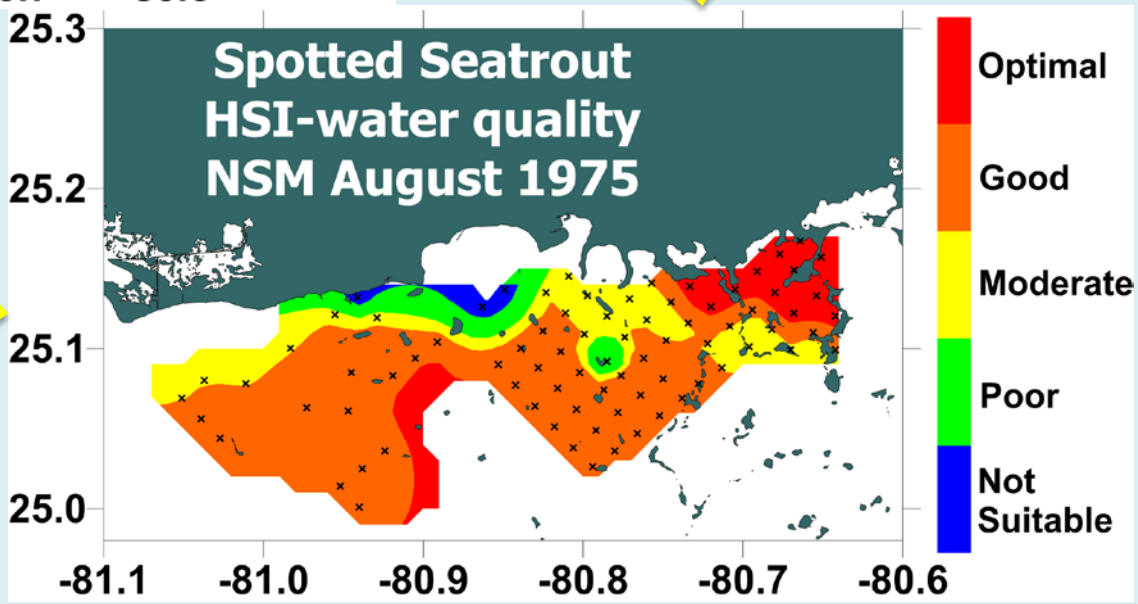


Central Florida Bay Salinity Time Series

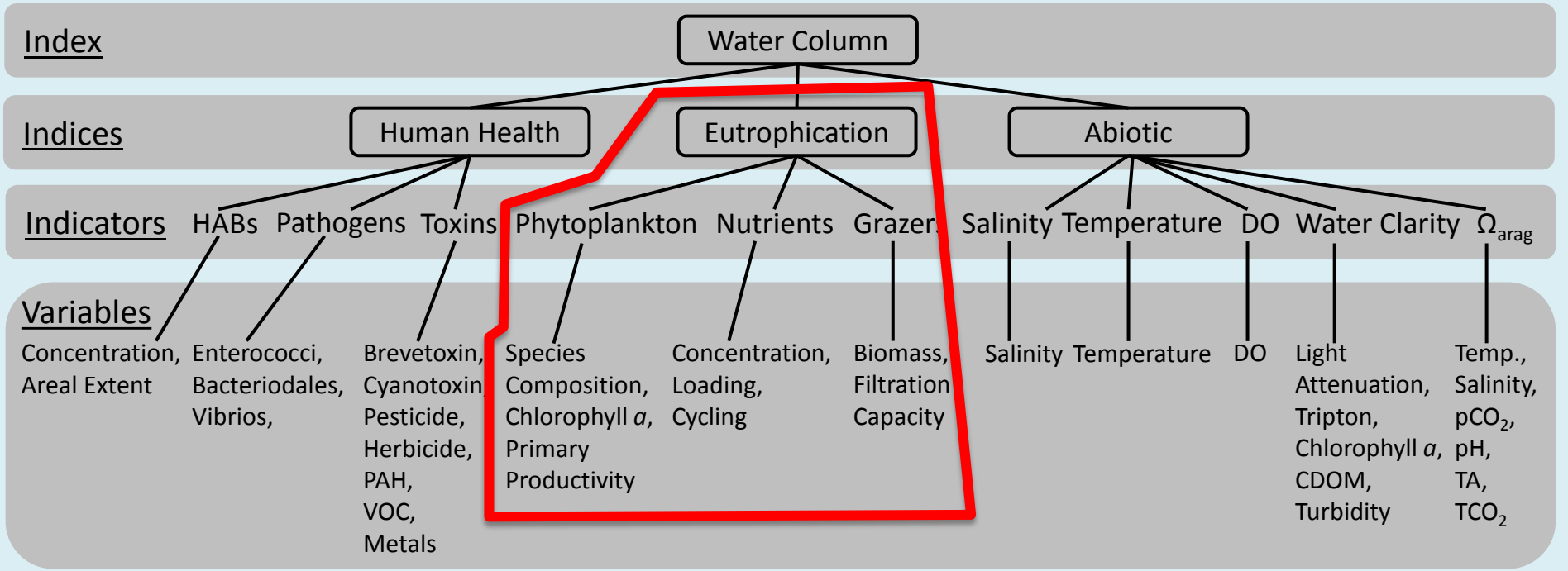


How can we improve this situation?
Everglades Restoration





We also have a potential problem with nutrient pollution

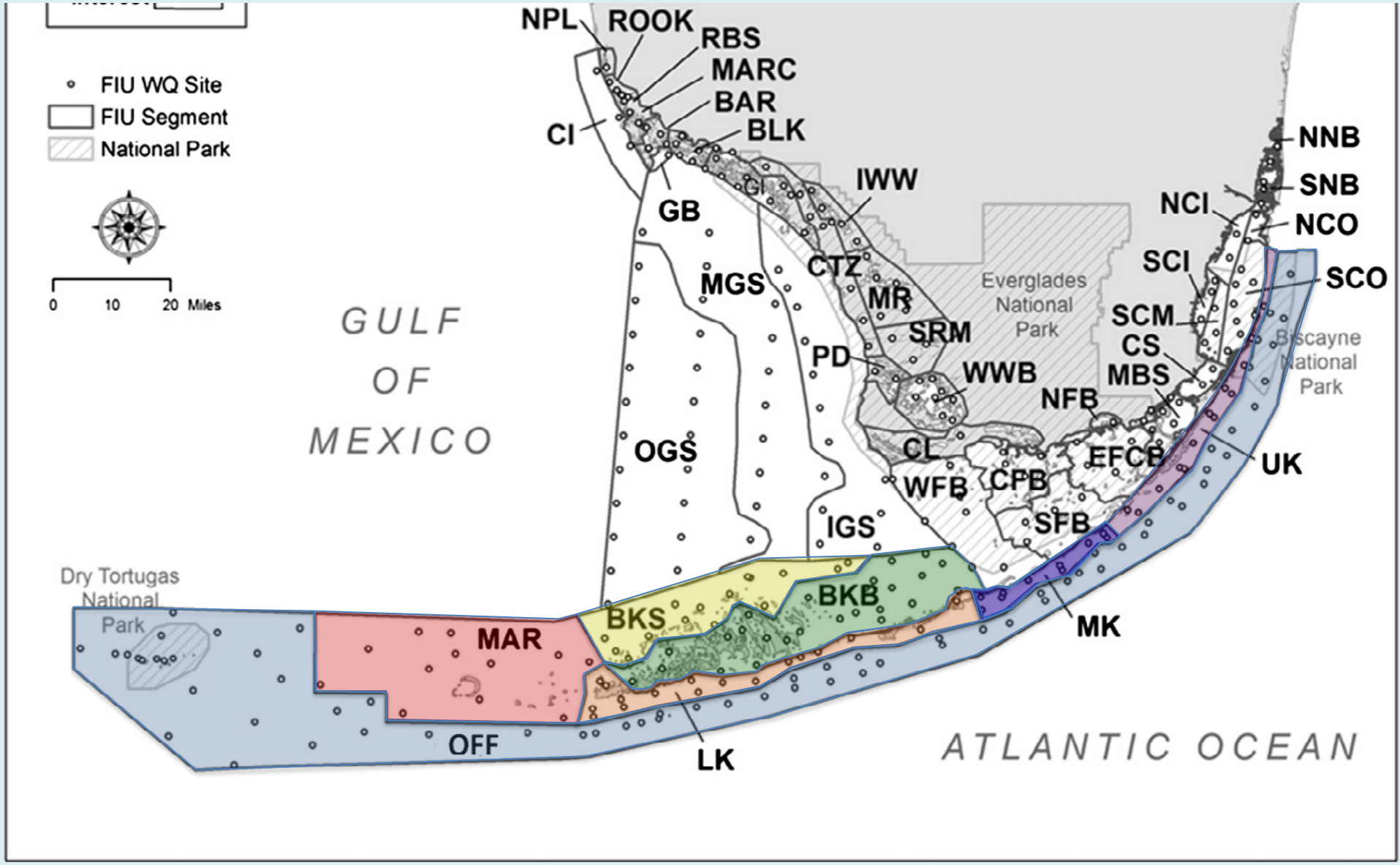


Loomis et al., 2014
Kelble et al., submitted

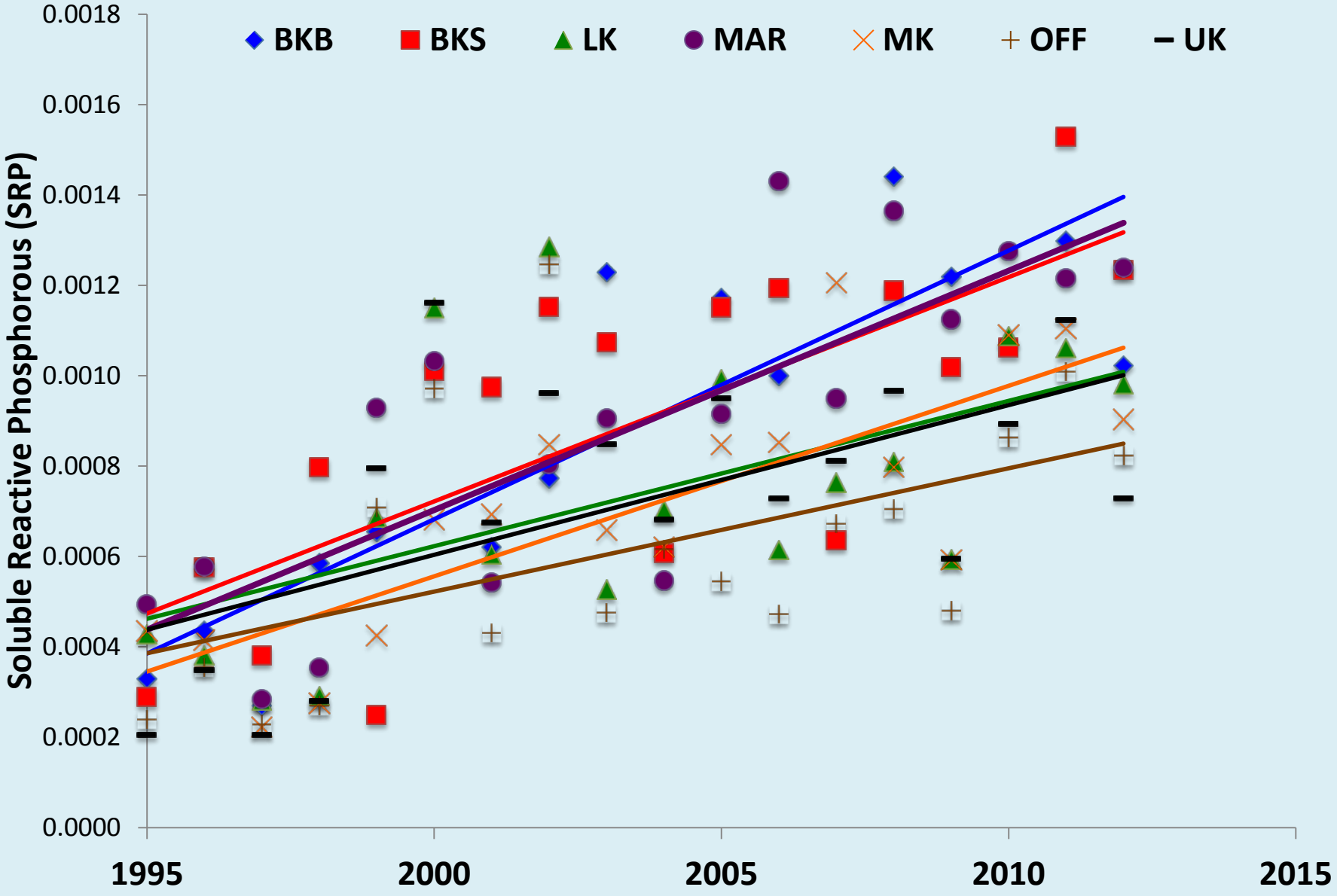
Assessing Eutrophic in south Florida coastal waters

Indicator	Variable	Optimal	Good	Fair	Poor	Critical
Phytoplankton	Chlorophyll a	At or below baseline values and trend is stable or decreasing	At or below baseline values, but trend is increasing	Significantly above baseline, but trend is decreasing	Significantly above baseline and trend is stable	Significantly above baseline and trend is increasing
	Species Composition	Dominance by non-harmful phytoplankton species with no harmful species present		Dominance by non-harmful phytoplankton species with harmful species present at non-threatening concentrations	Dominance by non-harmful phytoplankton species with harmful species present at damaging concentrations	Dominance by harmful phytoplankon species
	Primary Production	********** *Not Enough Data To Set Targets* **********				
Nutrients	Concentrations & Loading	Below Baseline	Equal to baseline	Significantly above baseline, but trend is decreasing	Significantly above baseline, with no trend	Significantly elevated from baseline with increasing trend
	Cycling	********** *Not Enough Data To Set Targets* **********				
Grazers	BiomassZ Filtration Capacity	Intact Grazer Community with no loss in biomass or filtration capacity	Loss in the Grazer Community, but significantly increasing trend	Loss in the Grazer Community, with no significant trend	Loss in the Grazer Community and significantly decreasing trend	Complete loss of either benthic or pelagic historical grazing community

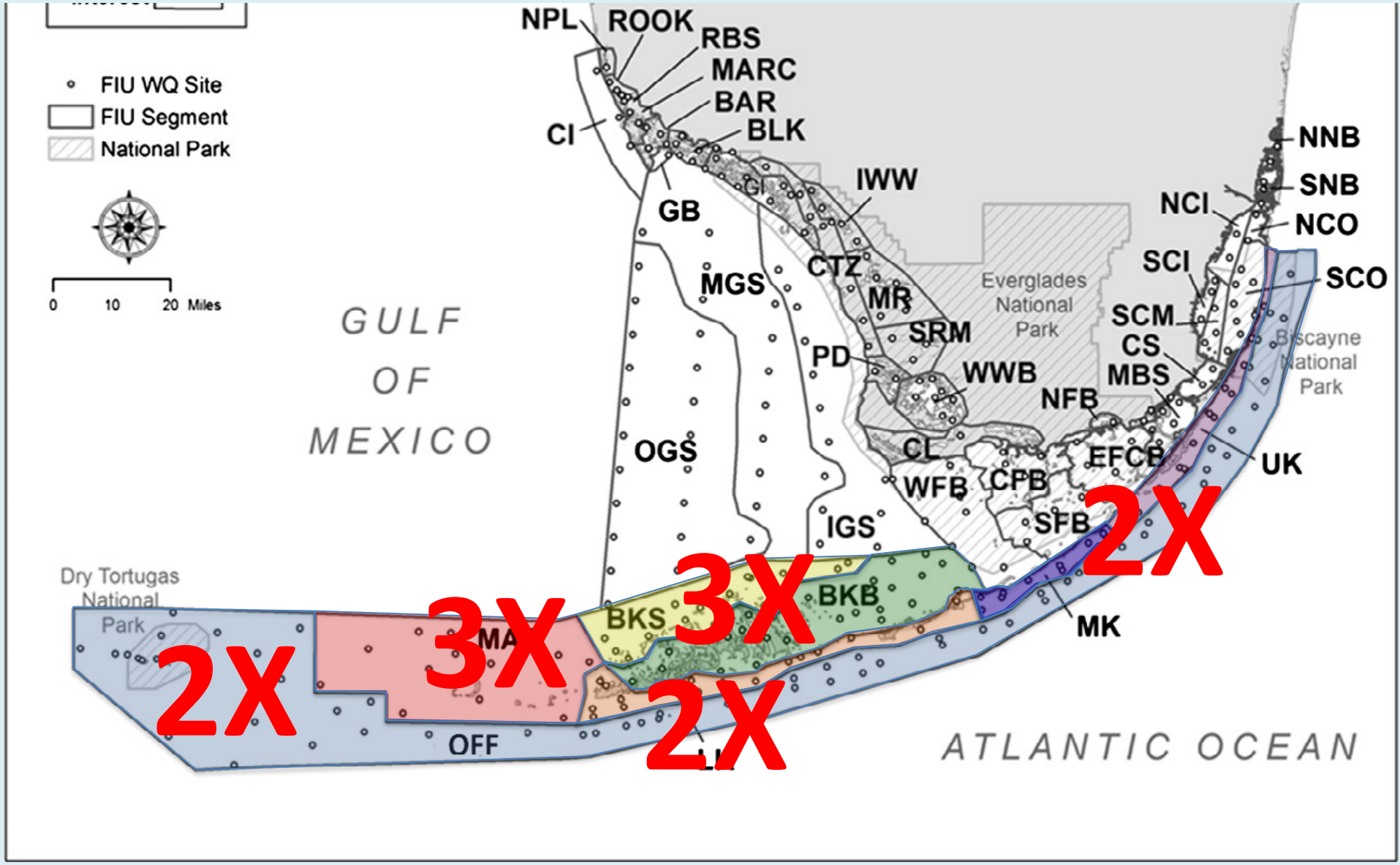
FKNMS Water Quality



The Increasing Trend In The Keys



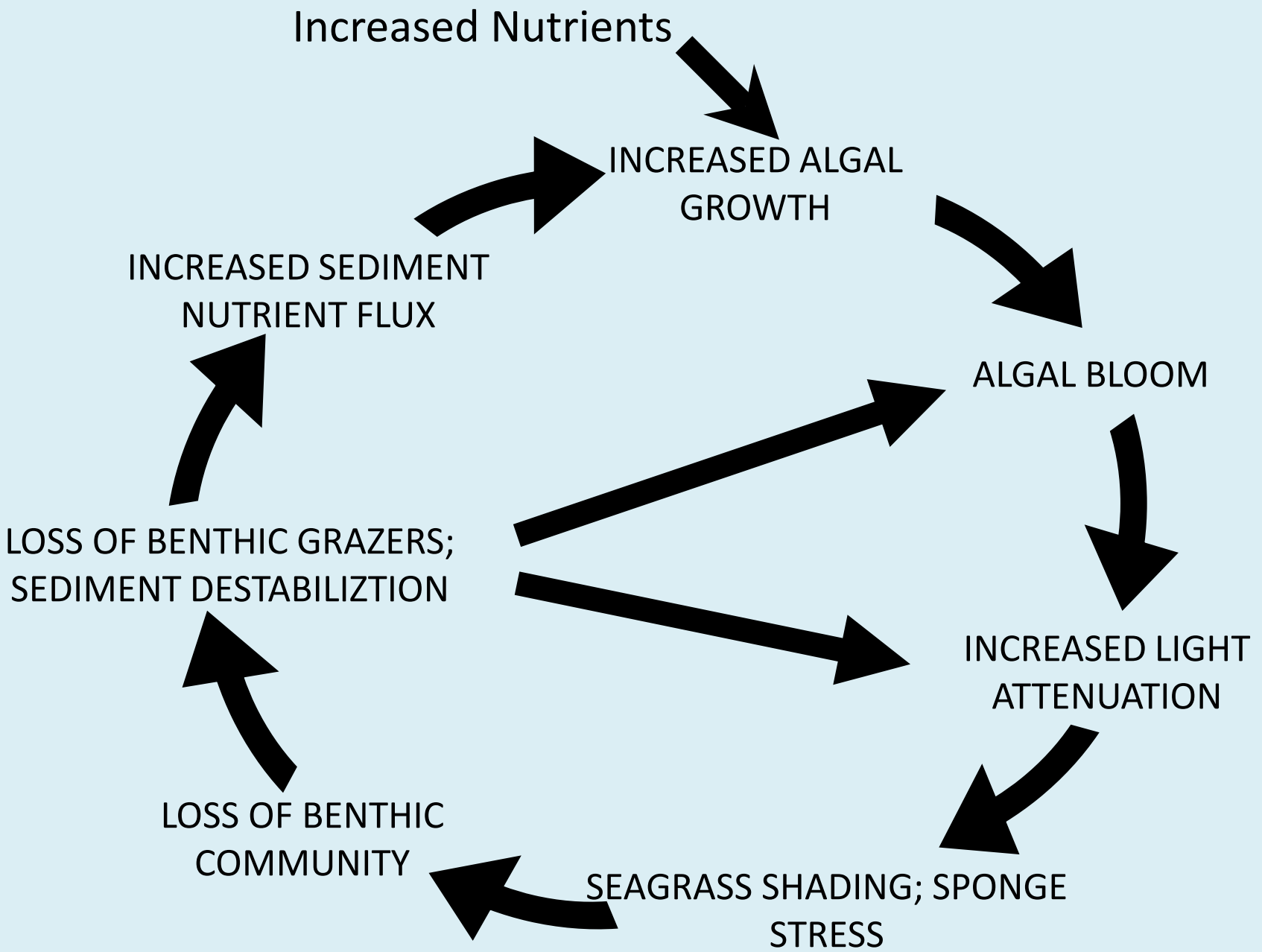
FKNMS Water Quality



Eutrophication Index Summary

- TP and TN did not have elevated concentrations
  - Only increasing trend was TP in Manatee and Barnes sounds
- DIN only elevated in 2 Biscayne Bay and 1 Florida Bay zone
  - Only increasing trend in Central Biscayne Bay
- 14 of 21 zones had elevated SRP
  - Increasing trend in 14 of 21 zones
- 9 of 21 zones had elevated chlorophyll *a*
  - Increasing trend in 7of 21 zones

Why take preventive action?



Chlorophyll *a* increase: What is the cause?

- **Two Hypotheses :**

1. Bottom-up (i.e. nutrients, in particular loading, is increasing) --

All evidence to date suggests P-limitation in Florida Keys, so knowing about N is useful, but my not provide the needed information

a. Land-Based Sources
  - Canals
  - Groundwater

b. Atmospheric sources have been estimated for DIN and TP from deposition experiments – unknown if data exists for inorganic P or Si

c. Internal sources (seagrass beds, etc.)

2.Top-Down (i.e. grazers have decreased allowing phytoplankton and macroalgae to increase)

- Zooplankton have been collected but not analyzed since 2003
- Sponge estimates to-date are not as comprehensive as necessary
- Manatees, sea turtles, and herbivorous fish

Conclusions

- Upstream areas are starved for FW and showing decreased nursery habitat function that effects FKNMS conditions

- Data shows increasing Chlorophyll a, SRP, and in some cases DIN; but, decreasing TP and TN
  - Need to identify source of increasing nutrients

- Preventing further increases in inorganic nutrient loading is essential to maintain the health of south Florida coastal waters

- Continuing ongoing monitoring is essential to effectively maintain the oligotrophic nature of south Florida coastal waters

Discussion and Questions

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