

Water Quality Monitoring in the Southern Estuaries (SE)

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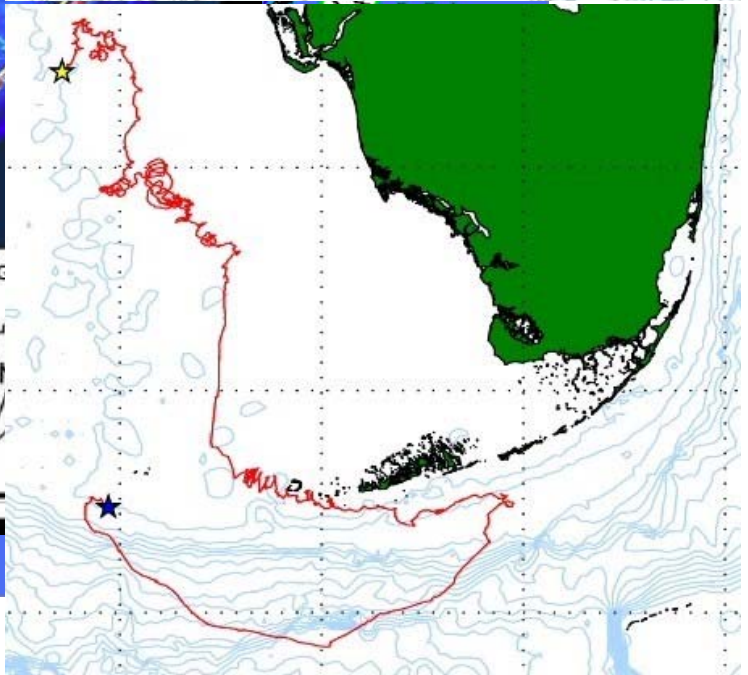
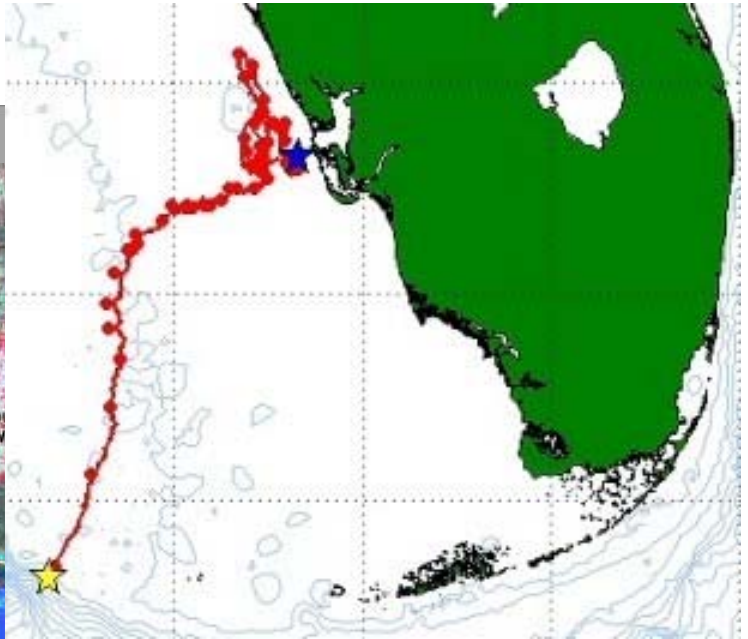
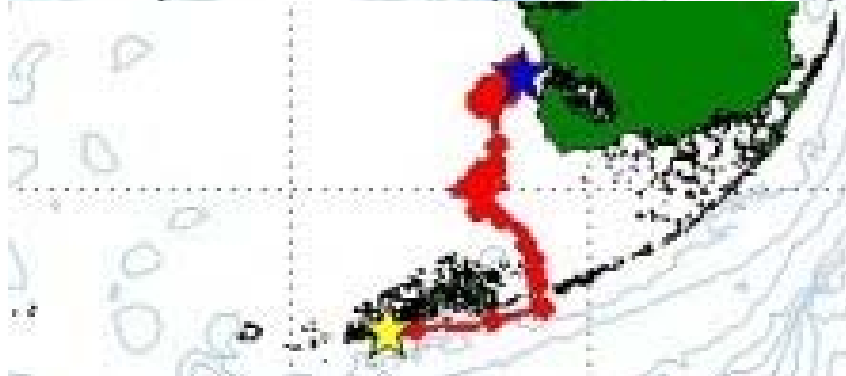
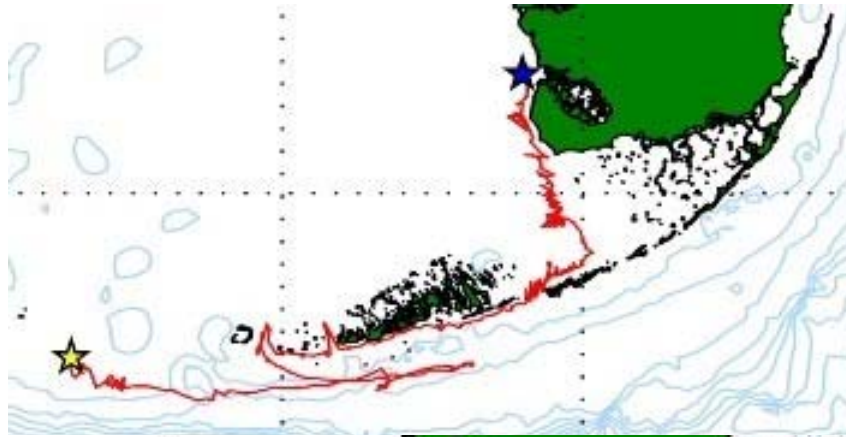




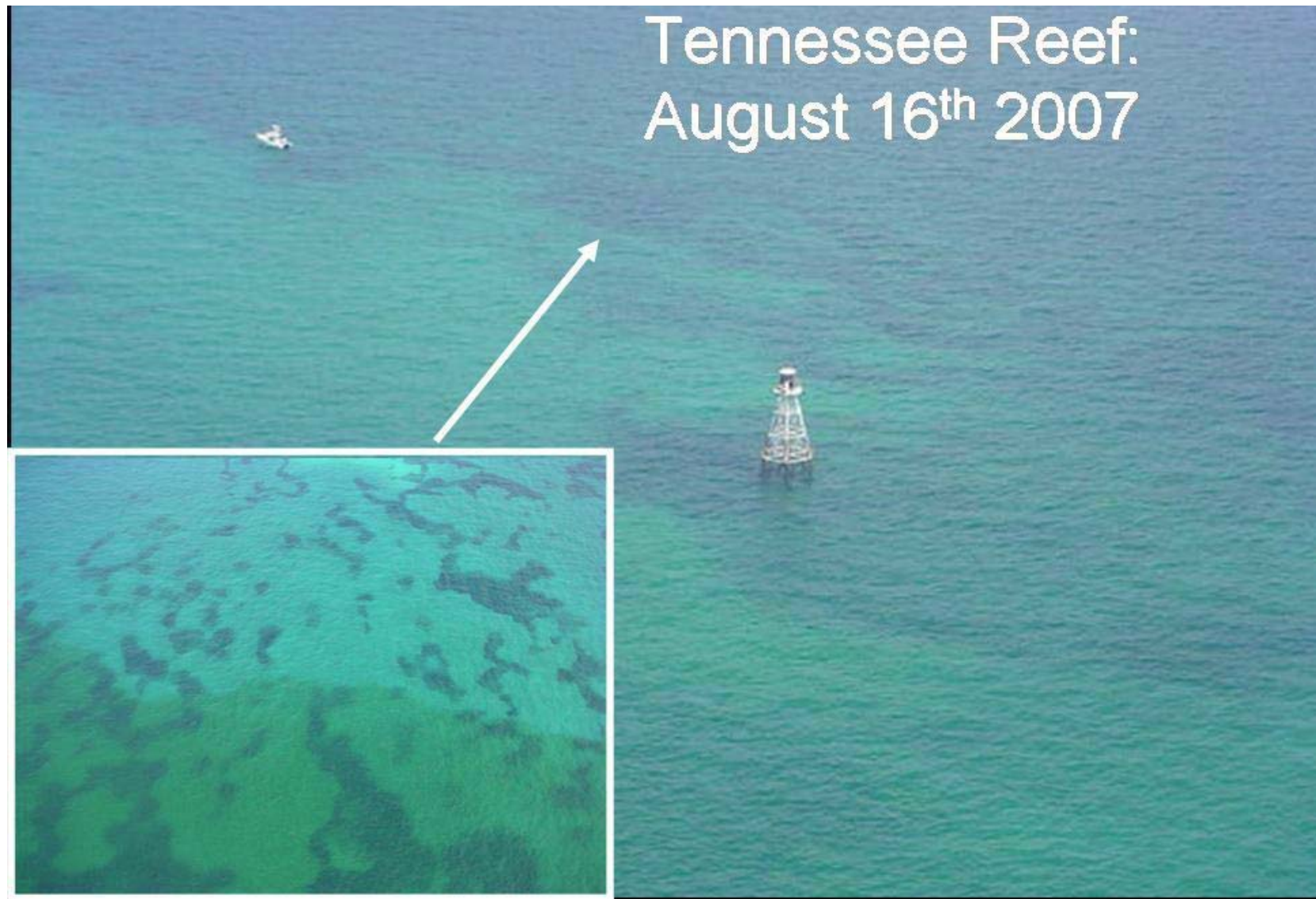
Outline

- Previous water quality monitoring in the SE
- Methodology for water quality assessment
 - Development of water quality indicator
- Status of water quality indicator in 2006
 - Is methodology appropriate?
- Future of water quality monitoring and assessment in the SE

The need for a larger picture



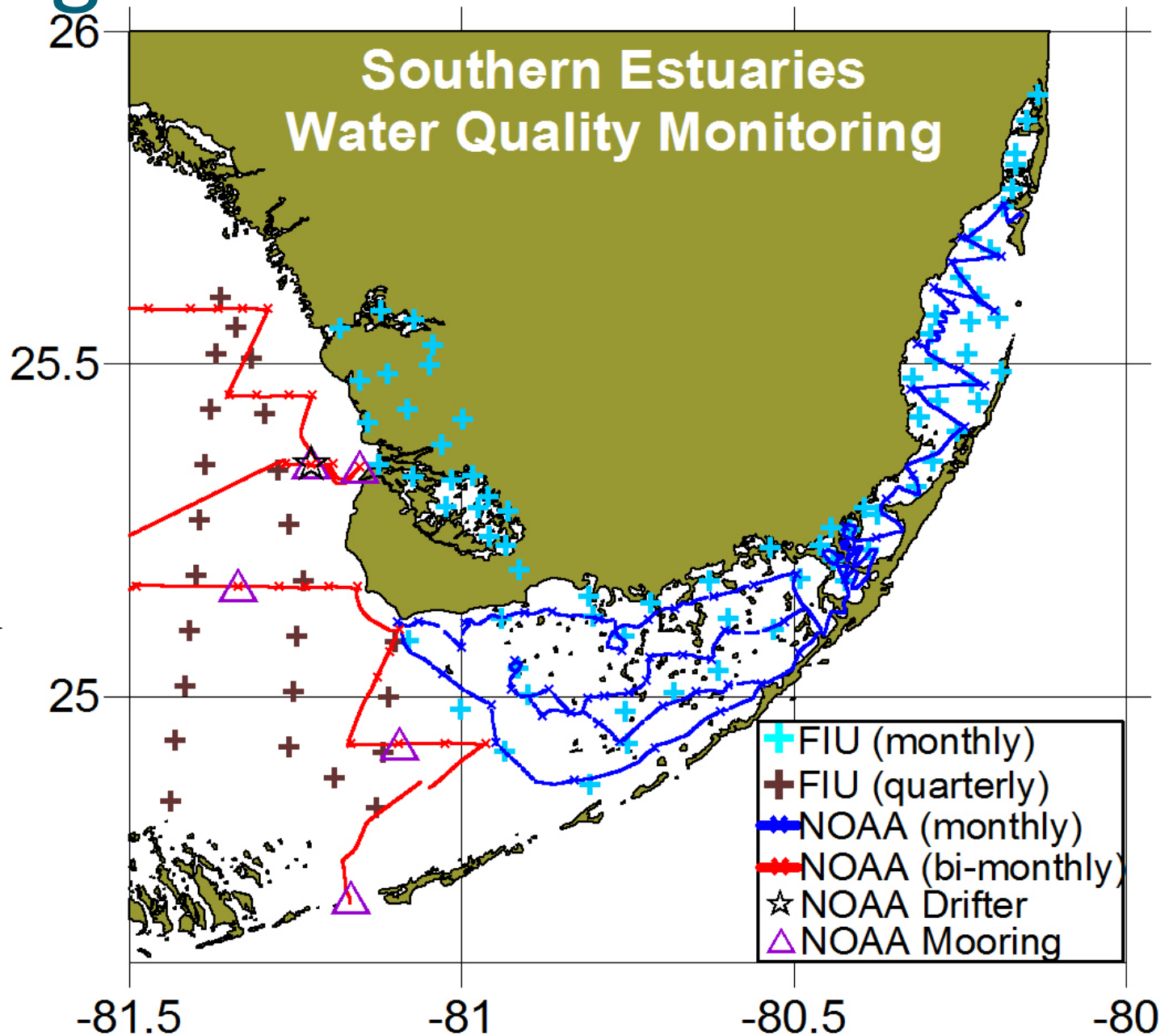
What happens in Southern Estuaries does not stay in Southern Estuaries!!!



Monitoring

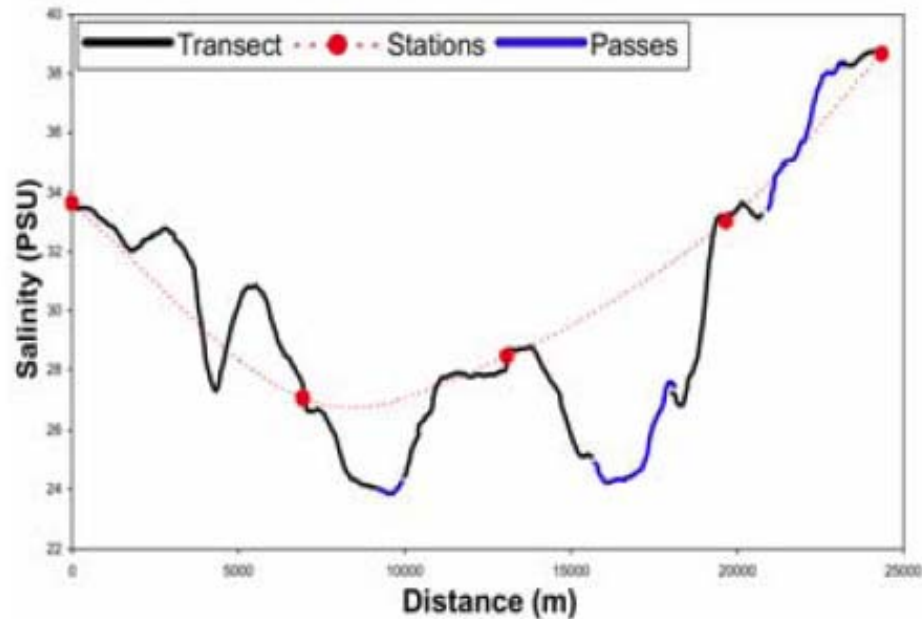
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Complementary, cooperative programs providing coverage from “event” to inter-annual time scales (except on the southwest Florida shelf)

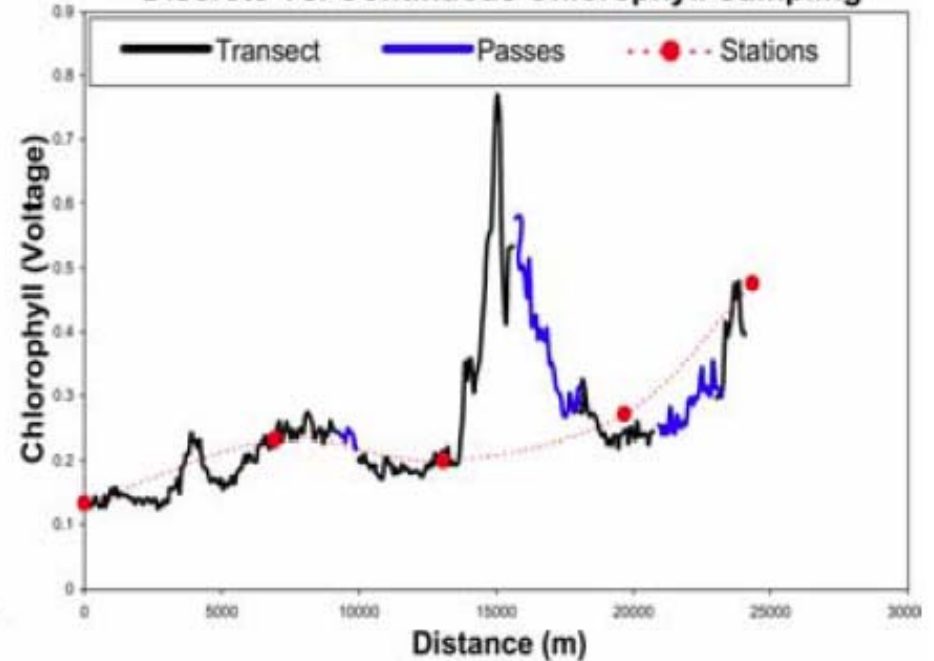


The need to complement

Discrete Vs. Continuous Salinity Sampling



Discrete Vs. Continuous Chlorophyll Sampling



However, the majority of water quality measurements (including Phosphorous) do not lend themselves to underway measurement.

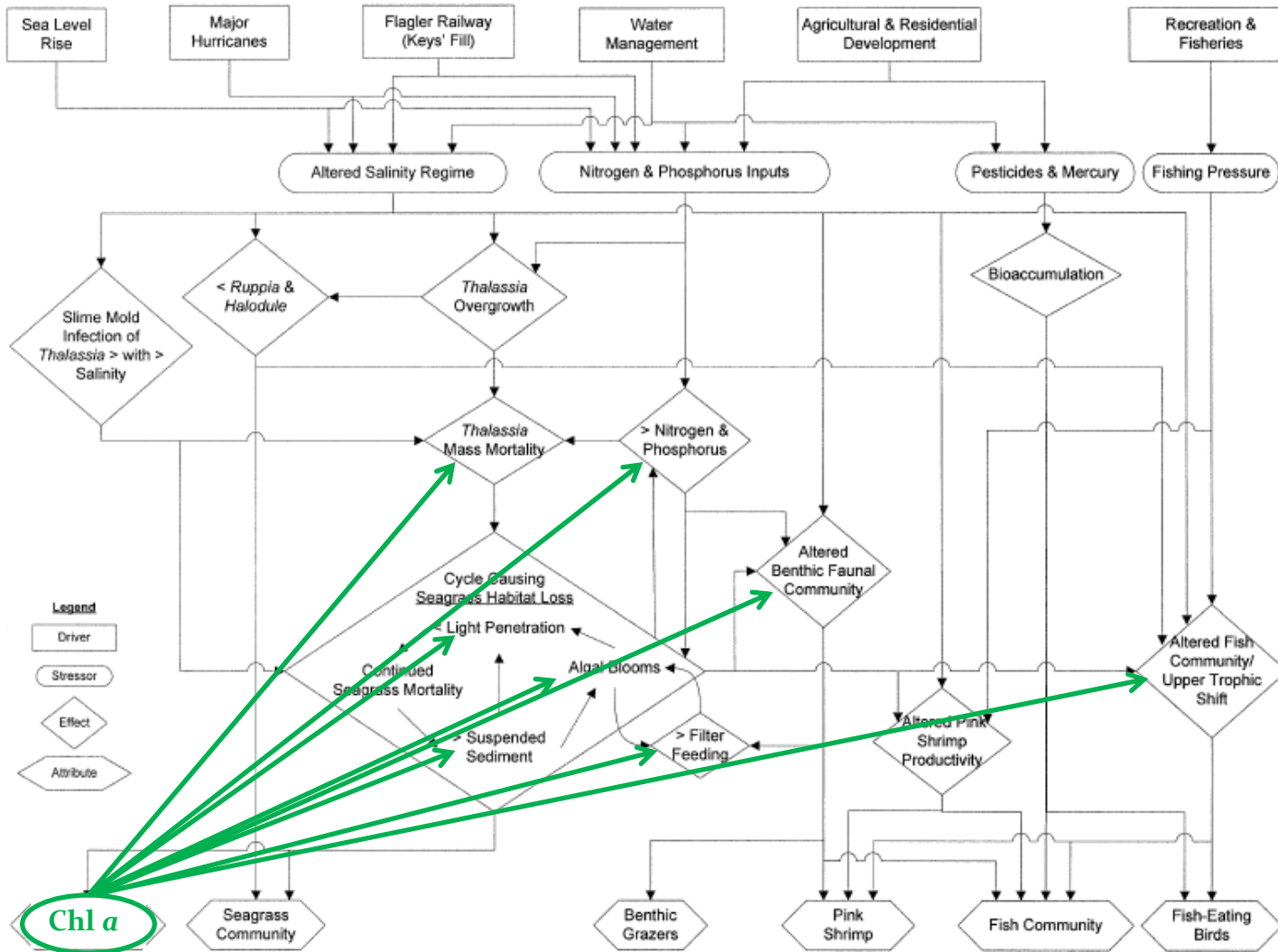


Methodology

- Identify an ecological indicator that integrates the majority of water quality conditions (Florida Bay Algal Blooms expanded to Southern Estuaries Phytoplankton Blooms)
- Assess the status of this indicator
- Develop a predictive capability for the indicator with respect to restoration activities
 - used to determine natural variability from management
 - Not yet complete

Indicator Selection

Florida Bay Conceptual Ecological Model



Consensus-building with partners to develop the Conceptual Ecological Model (CEM)

Identify indicators of ecosystem health from CEM

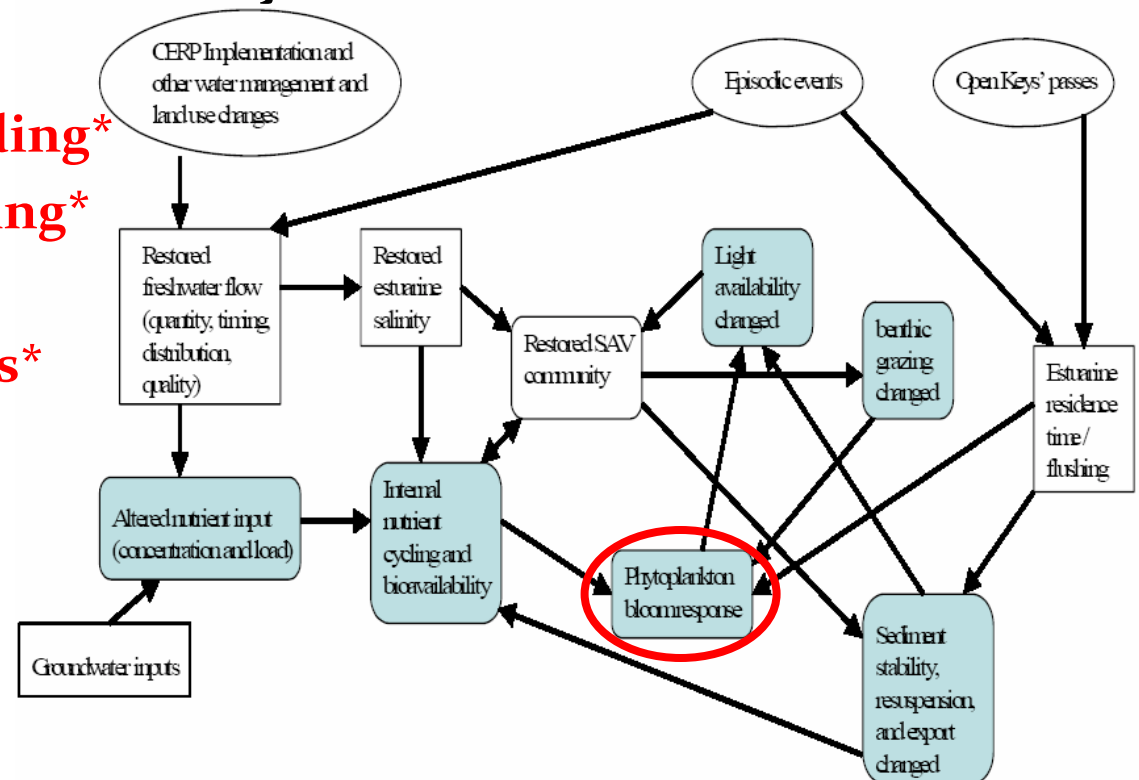
Assess status of indicators

Develop models of indicator response to conduct scenario testing

Indicator Selection

- The spatial extent, duration, density, and composition of phytoplankton blooms are controlled by several factors that will be influenced by CERP. These include:

- External Nutrient Loading***
- Internal Nutrient Cycling***
- Light Availability
- Water Residence Times***
- Biomass of Grazers



For more info.:

Doren here tomorrow @ 2:20



Interim Goal

**Prevent any increase in the intensity,
duration, or spatial extent of
phytoplankton blooms in Florida Bay
or adjacent waters**



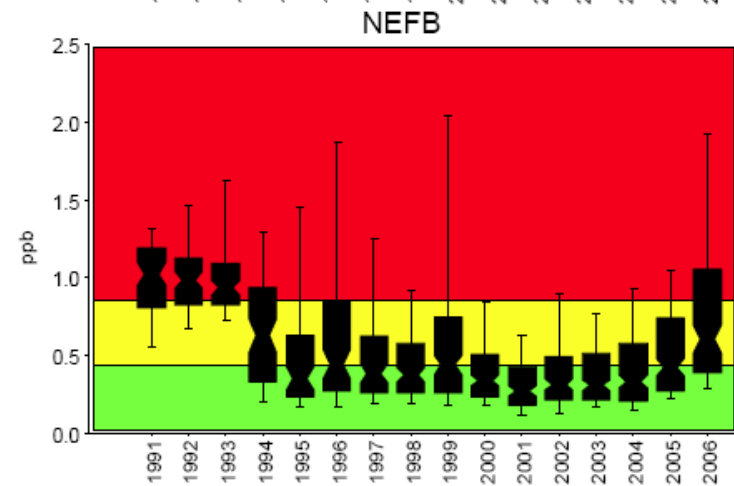
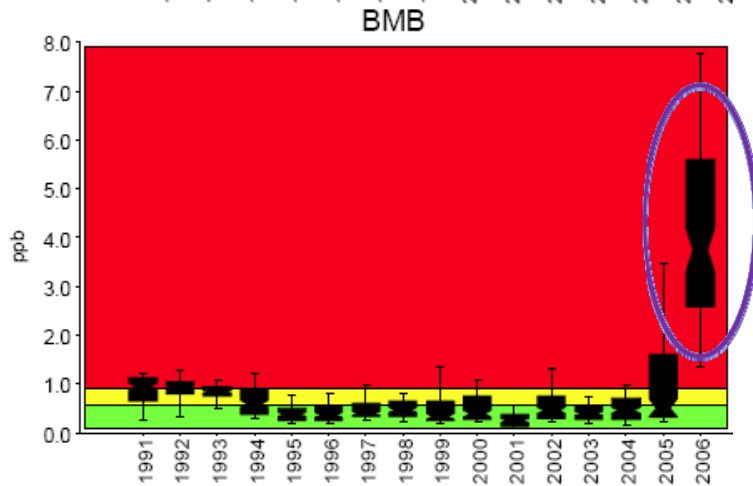
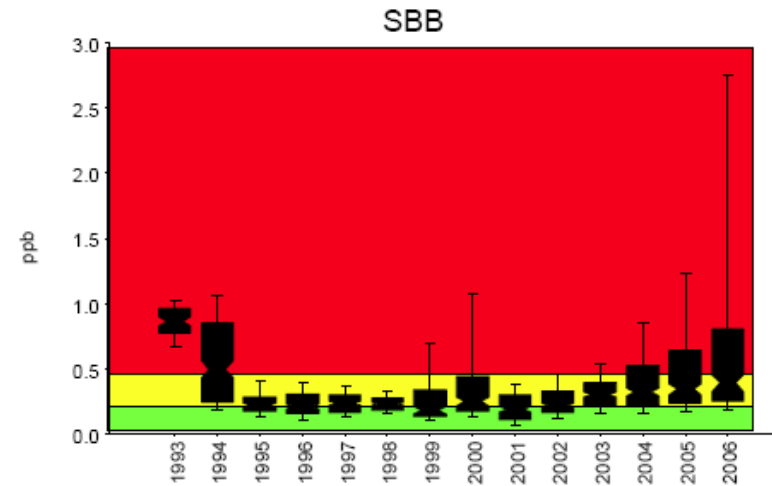
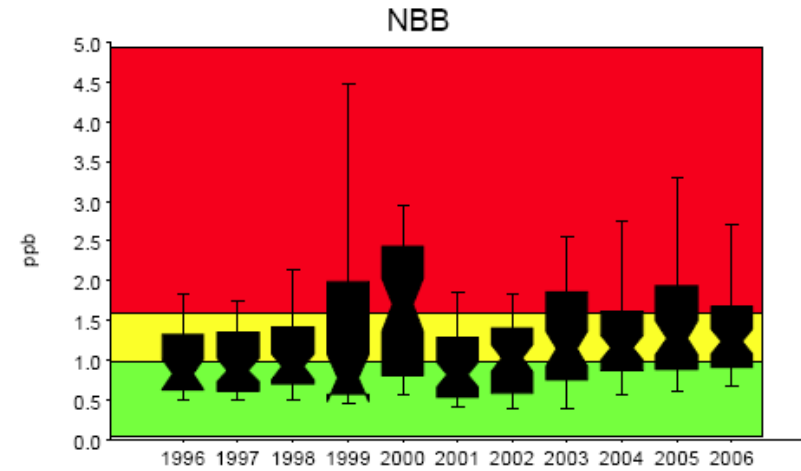
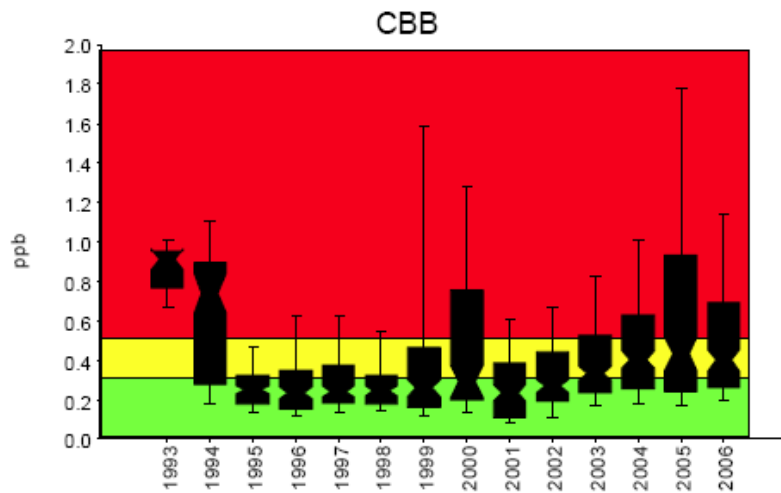
Indicator Assessment

- Lacked an effective mathematical model to delineate natural variability from management effects
- Given Interim Goal, EPA methodology was applied to assess the status of chlorophyll *a* (*EPA 2001*)
- Spatial heterogeneity in many water quality processes necessitated the division of the Southern Estuaries into 10 sub-regions

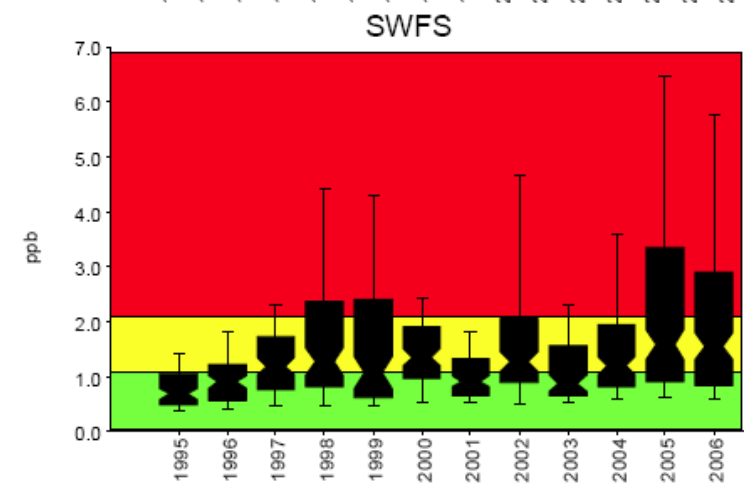
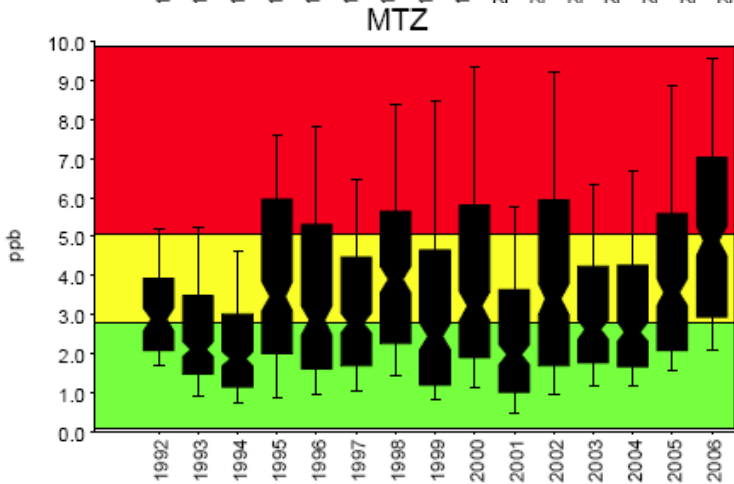
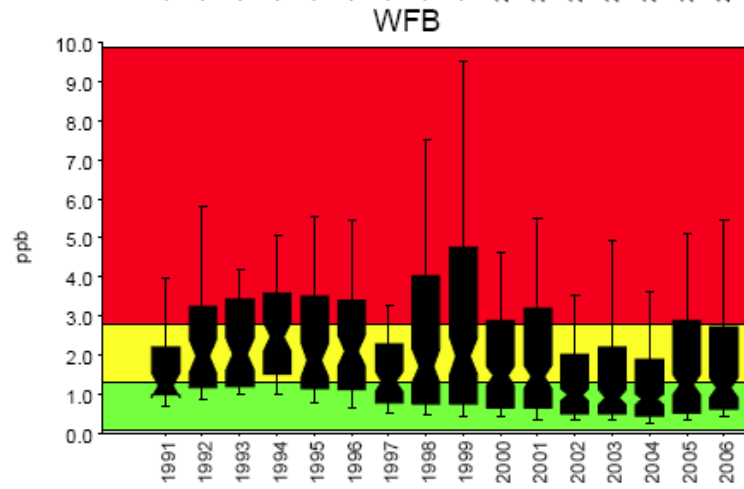
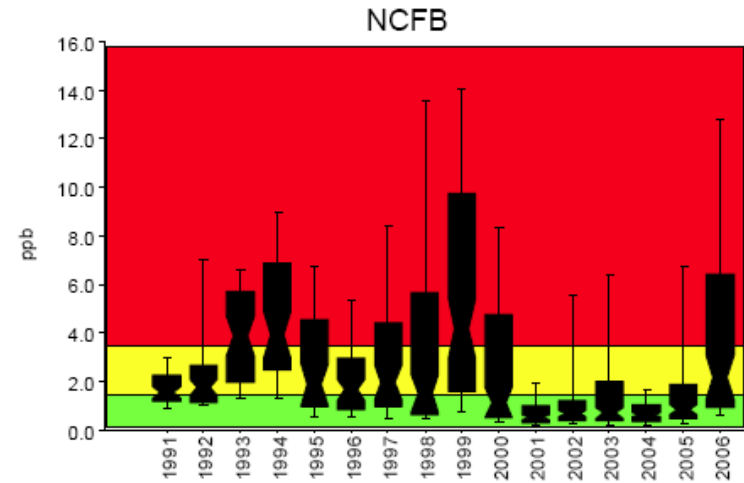
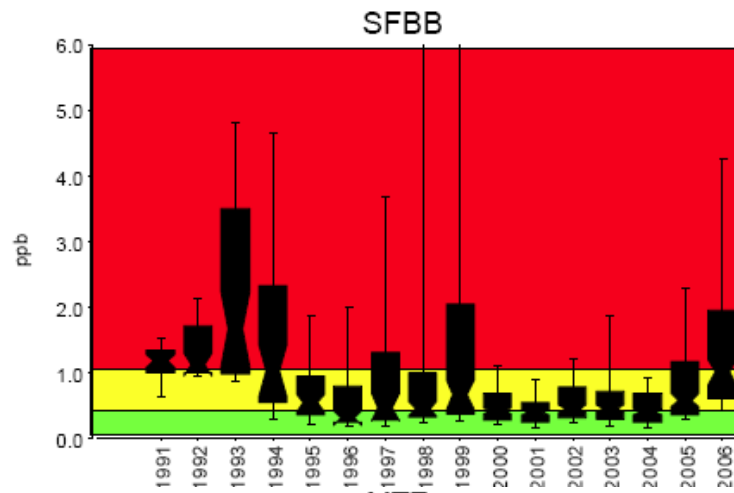
Reference Condition

Sub-region		Valid N	25th Percentile	Median	75th Percentile
Blackwater, Manatee, Barnes	BMB	1704	0.306	0.526	0.910
Central Biscayne Bay	CBB	1673	0.200	0.313	0.566
Mangrove Transition Zone	MTZ	3803	1.690	2.863	4.903
North Biscayne Bay	NBB	635	0.670	1.048	1.648
North-central Florida Bay	NCFB	1399	0.585	1.216	3.710
Northeast Florida Bay	NEFB	1979	0.254	0.417	0.790
South Biscayne Bay	SBB	2257	0.181	0.264	0.426
South Florida Bay	SFB	1695	0.327	0.533	1.059
Southwest Florida Shelf	SWFS	1297	0.739	1.180	1.976
West Florida Bay	WFB	2304	0.653	1.345	2.845

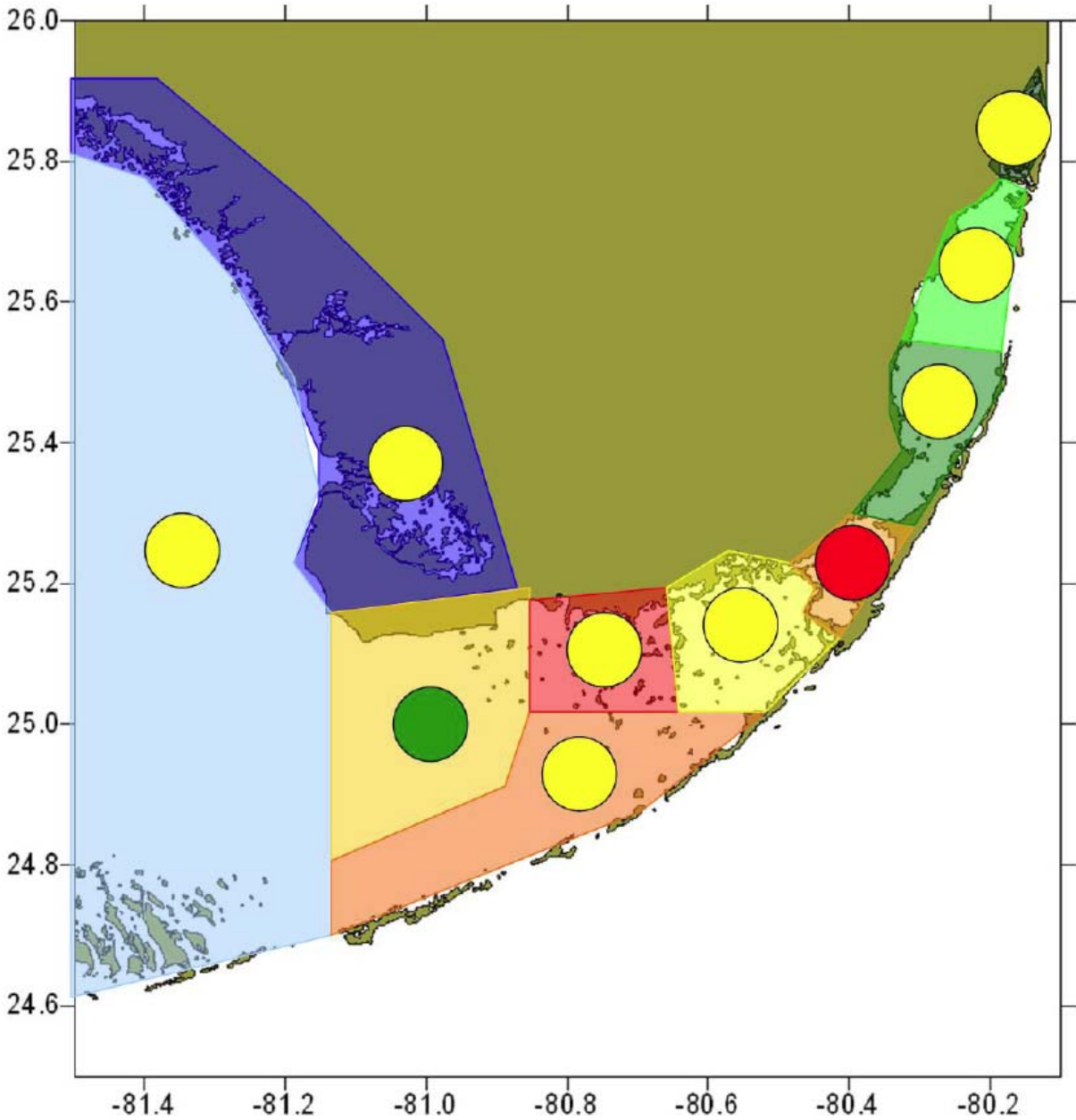
Status & Trends



Status & Trends



Indicator Assessment



Restoration Stoplight Report Card

Florida Bay Algal Blooms

KEY FINDINGS – SOUTHERN ESTUARIES

SUMMARY FINDING: Re-suspension of nutrients from the 2005 hurricane season resulted in algal blooms in many regions of the southern estuaries and may cause continued algal blooms in the bay for some time. However, this is expected to subside within a few additional years in lieu of further significant hurricane activity and should return to predominantly green for all regions with the possible exception of BMB.

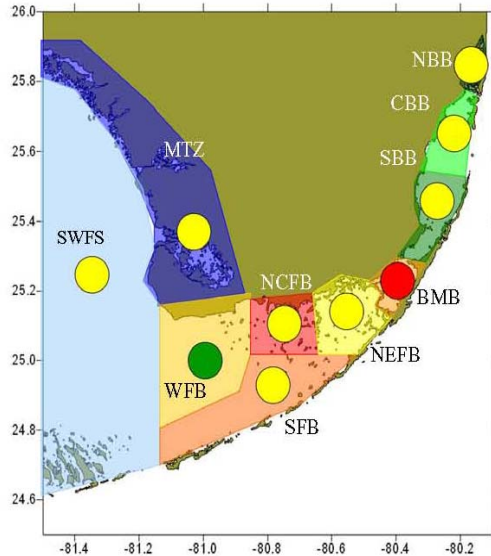


Figure 1. Map of Florida Bay regions with stoplight ratings by region

KEY FINDINGS:

1. The majority of regions assessed had significant algal bloom activity that appears to have been predominantly influenced by the heavy 2005 hurricane season aggravated for the eastern bay by road construction on US 1.
2. The majority of regions assessed had chlorophyll-*a* and algal blooms rated as moderate (yellow).
3. The majority of regions assessed where the chlorophyll-*a* was higher than the median do not appear to be indicative of long-term negative trends.
4. The most commonly occurring condition was large spatial coverage of algal blooms and elevated chlorophyll-*a* concentrations.
5. Overall eutrophic symptom expressions were geographically variable and appear to be explainable from existing phenomenological conditions of hurricane activity overall exacerbated by

road construction along US 1 in the eastern areas of the bay.

6. Continue monitoring water quality throughout the bay and the SW coastal shelf particularly as a result of the post 2005 hurricane season.
7. Monitoring of Barnes, Manatee and Blackwater Sounds is critical while road construction along US 1 continues.
8. Monitoring long term consequences of nutrient releases into the bay from both natural (e.g. hurricanes) and human causes (e.g. road construction) and the interactions of hydrological restoration (e.g. more fresh water flow into Florida Bay) is critical to evaluating Florida Bay restoration.

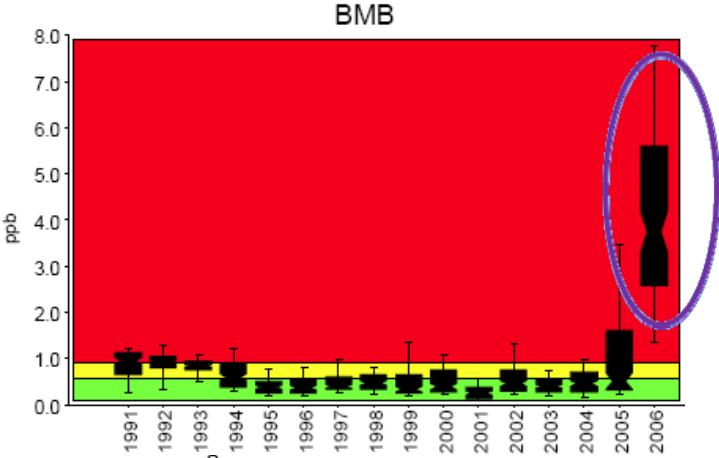
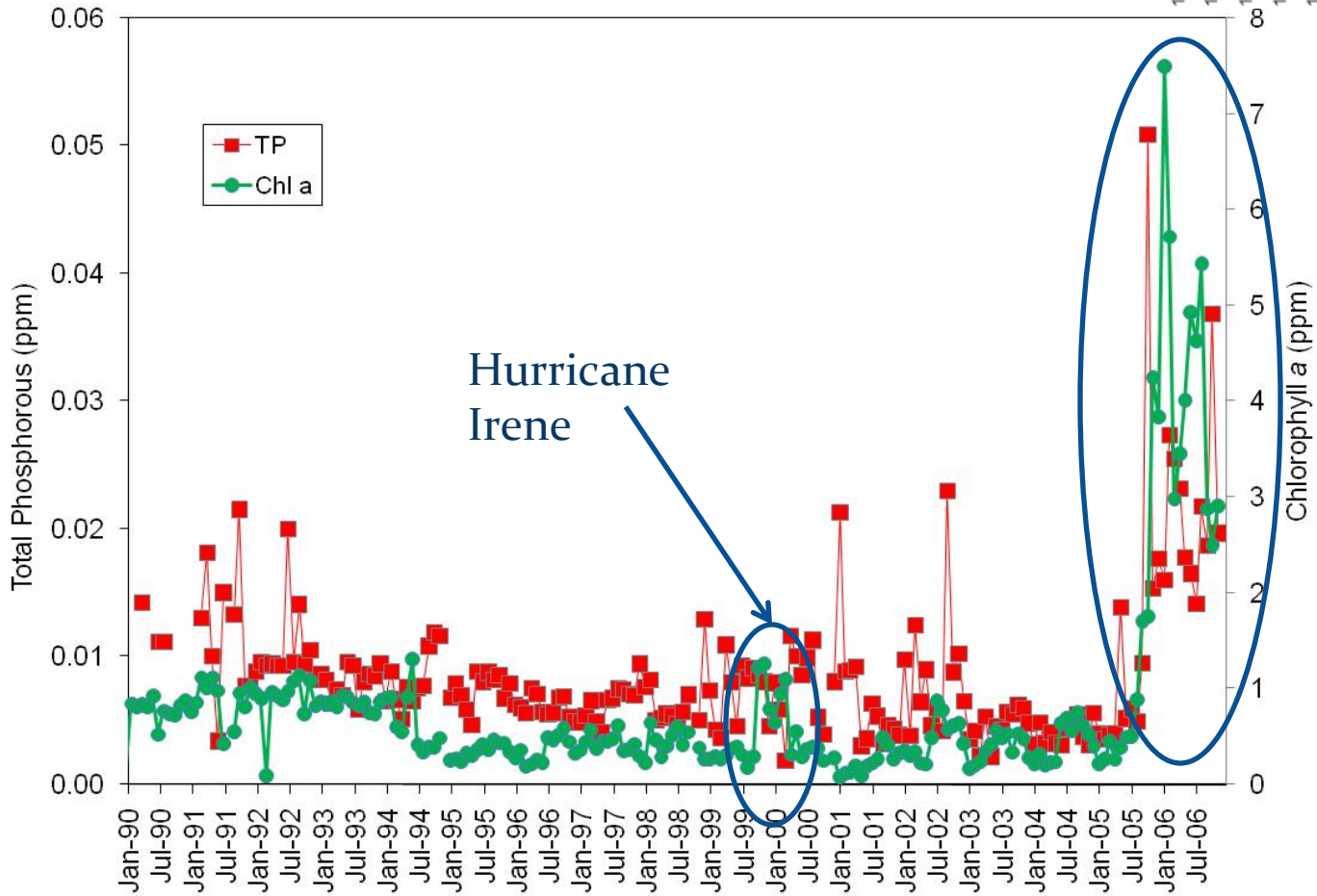
ALGAL BLOOMS – SOUTHERN ESTUARIES

PERFORMANCE MEASURE	LAST STATUS	CURRENT STATUS ^a	2-YEAR PROSPECTS ^b	CURRENT STATUS ^a	2-YEAR PROSPECTS ^b
Chlorophyll <i>a</i> BARNES, MANATEE & BLACKWATER SOUNDS (BMB)	Red	Red	Yellow	This region of the bay experienced an unusual cyanobacterial bloom in 2006. The bloom was initiated by a large spike in phosphorus from a combination of canal releases and highway construction in response to the active hurricane season. The bloom has abated somewhat but chlorophyll concentrations have not returned to previous levels.	When road construction is completed, we expect that this area will return to its green condition that existed from 1995 until 2006.
Chlorophyll <i>a</i> NORTHEAST FLORIDA BAY (NEFB)	Yellow	Yellow	Yellow	The current status is due to influence of the cyanobacterial bloom from Barnes, Manatee and Blackwater Sounds periodic expansion into this region.	The return to a green condition for this region of the bay depends on water management activities improving flows into the C-111 basin and Taylor Slough.
Chlorophyll <i>a</i> NORTH-CENTRAL FLORIDA BAY (NCFB)	Green	Yellow	Yellow	The current status is due to the presence of a seasonal cyanobacterial bloom in both early and late 2006. These blooms do not appear every year, but have occurred intermittently over the past 15 years.	Without improvements in freshwater flows to Florida Bay the area will probably remain yellow.
Chlorophyll <i>a</i> SOUTH FLORIDA BAY (SFB)	Yellow	Yellow	Yellow	The current status is due to the extension of the cyanobacterial bloom from the north-central region of the bay during both years. This has occurred intermittently over the past 15 years and it is unlikely that this signifies a long-term negative trend.	Since blooms in this area are driven by external forces, it is expected that such periodic events may occur.
Chlorophyll <i>a</i> WEST FLORIDA BAY (WFB)	Green	Green	Green	The seasonal diatom blooms in this region for both 2006 and current were not as dense or widespread as in the past.	This region is influenced primarily by Shark Slough outputs and southerly transport of Gulf of Mexico water along the SW Florida Shelf. Conditions are therefore dependent on external forcing.
Chlorophyll <i>a</i> MANGROVE TRANSITION ZONE (MTZ)	Yellow	Yellow	Yellow	The chlorophyll concentrations were slightly higher in this region for 2006. This may have been due to the active 2005 hurricane season and is unlikely to indicate a negative long-term trend.	The return to a green condition for this region of the bay depends on water management activities improving flows into the C-111 basin and Taylor Slough.
Chlorophyll <i>a</i> SOUTHWEST FLORIDA SHELF (SWFS)	Yellow	Yellow	Yellow	The chlorophyll concentrations were slightly higher in this region for both 2006 & 2007. This may have been due to the active 2005 hurricane season and is unlikely to indicate a negative long-term trend.	This region is influenced primarily by Shark Slough outputs and southerly transport of Gulf of Mexico water. Conditions are therefore dependent on external forcing.
Chlorophyll <i>a</i> NORTH BISCAYNE BAY (NBB)	Yellow	Yellow	Yellow	The chlorophyll concentrations were higher than the baseline for the past four years.	Without any major hurricanes or changes in water flows to this region it is expected that this region will remain yellow. Significant inputs from canals will continue to affect this area until sheet-flow is restored.
Chlorophyll <i>a</i> CENTRAL BISCAYNE BAY (CBB)	Yellow	Yellow	Yellow	The chlorophyll concentrations were higher than the baseline for the past four years.	Without any major hurricanes or changes in water flows to this region it is expected that this region will remain yellow.
Chlorophyll <i>a</i> SOUTH BISCAYNE BAY (SBB)	Yellow	Yellow	Yellow	The chlorophyll concentrations were higher in this region for 2006. This area was also influenced by periodic expansion of the cyanobacterial bloom from Barnes, Manatee and Blackwater Sounds into this region.	Without any major hurricanes or changes in water flows to this region it is expected that this region will remain yellow.

^a Data in the Current Status column for the algal bloom indicator reflect data inclusive of calendar year 2006.

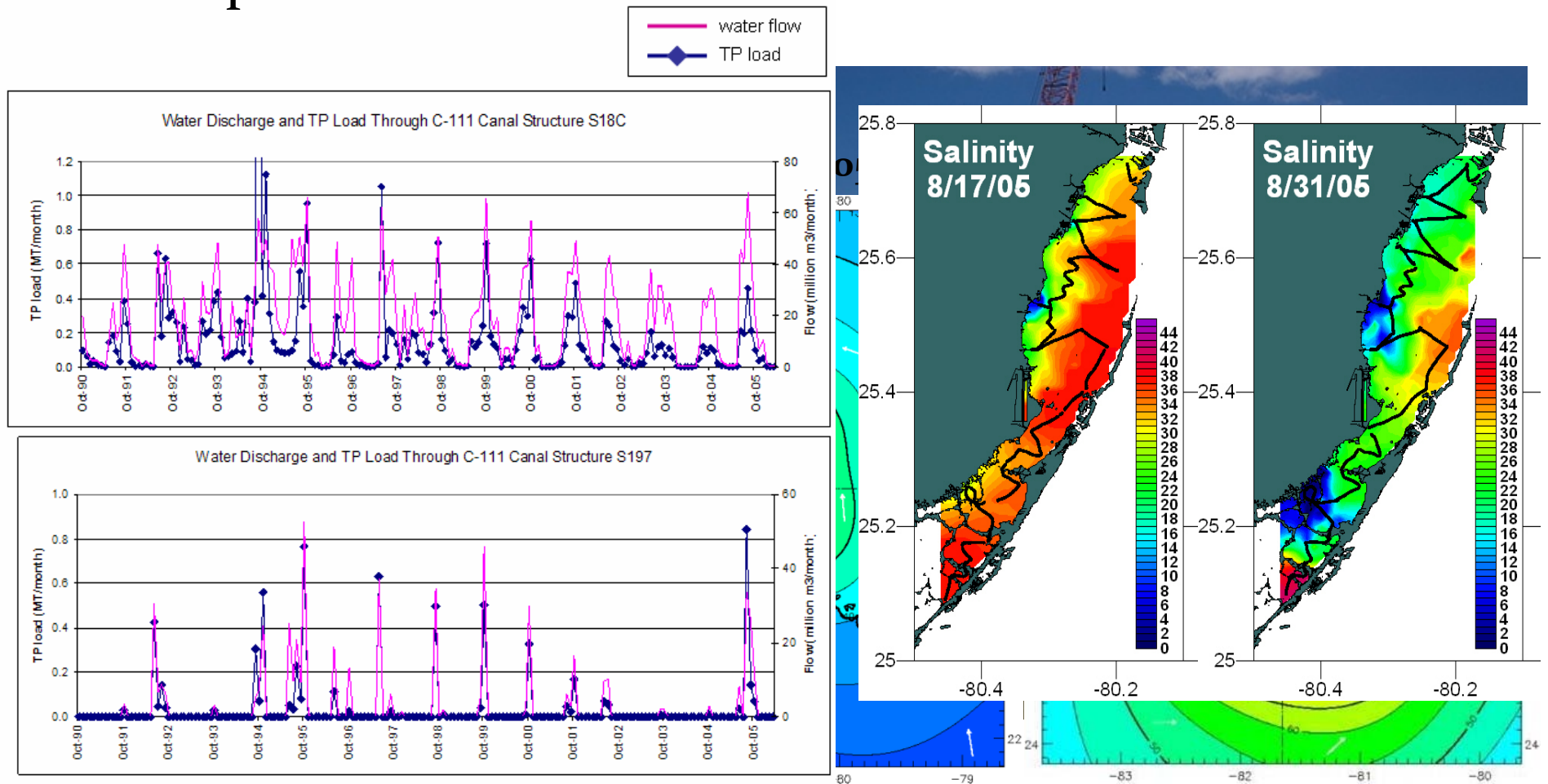
^b The assumption being used for the 2-Year Prospects Column is: *There will be no changes in water management from the date of the current status assessment.*

A Closer Look



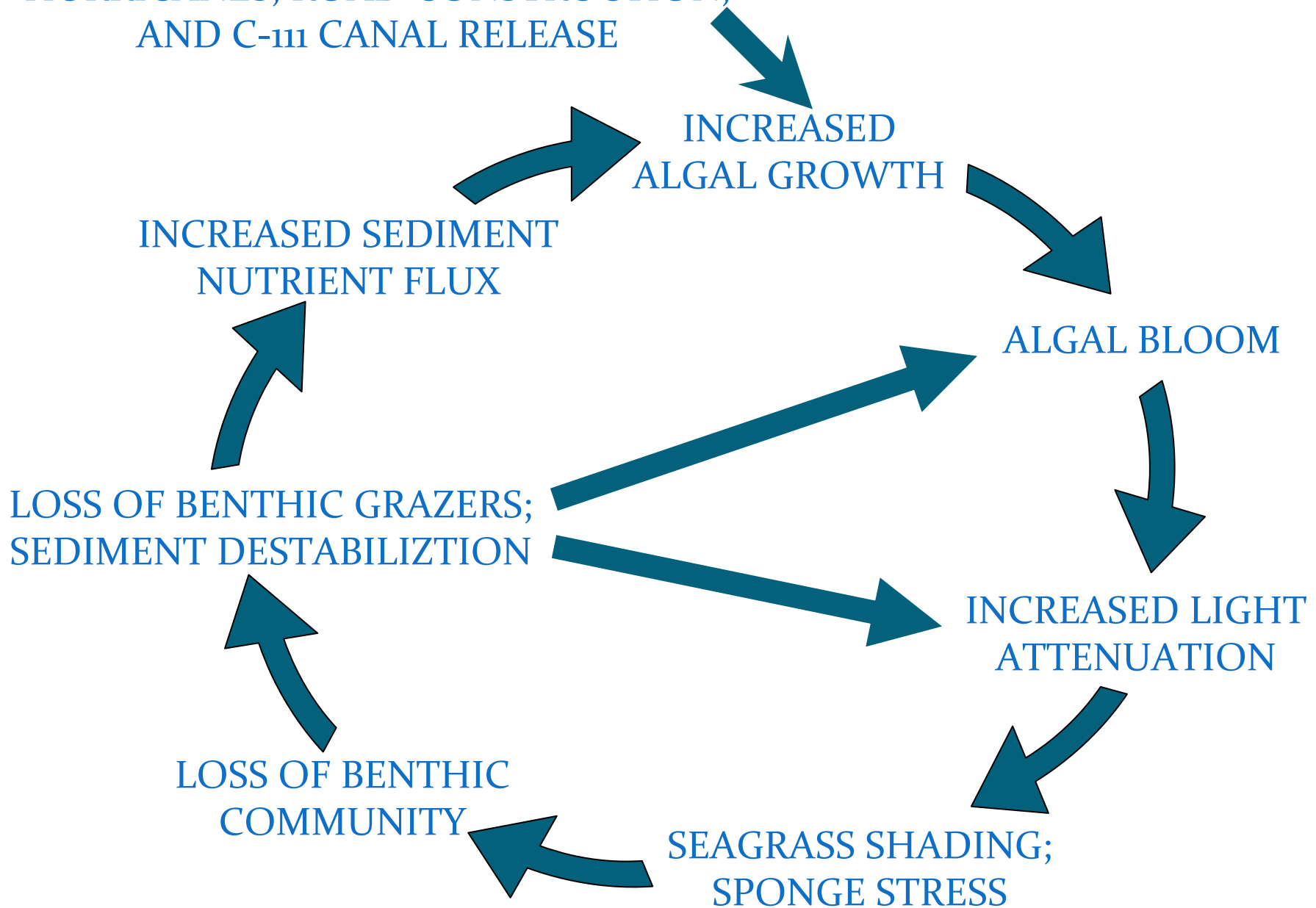
Probable Initiation Cause(s)

- Spatial Distribution = road construction
- Temporal Distribution = Hurricanes



Long-term Ecological Issue

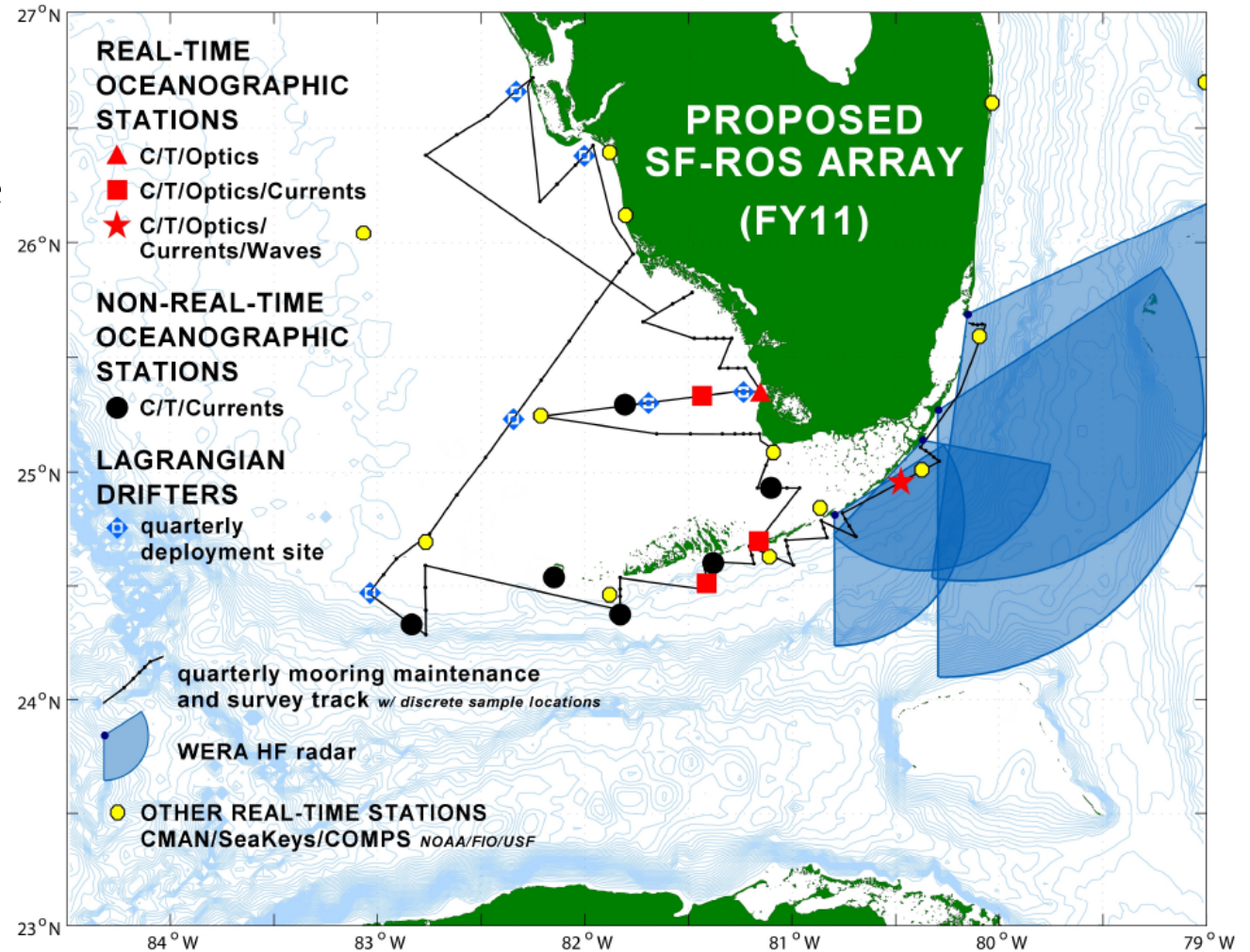
HURRICANES, ROAD CONSTRUCTION,
AND C-111 CANAL RELEASE



Future of water quality – The Good

NOAA/IOOS

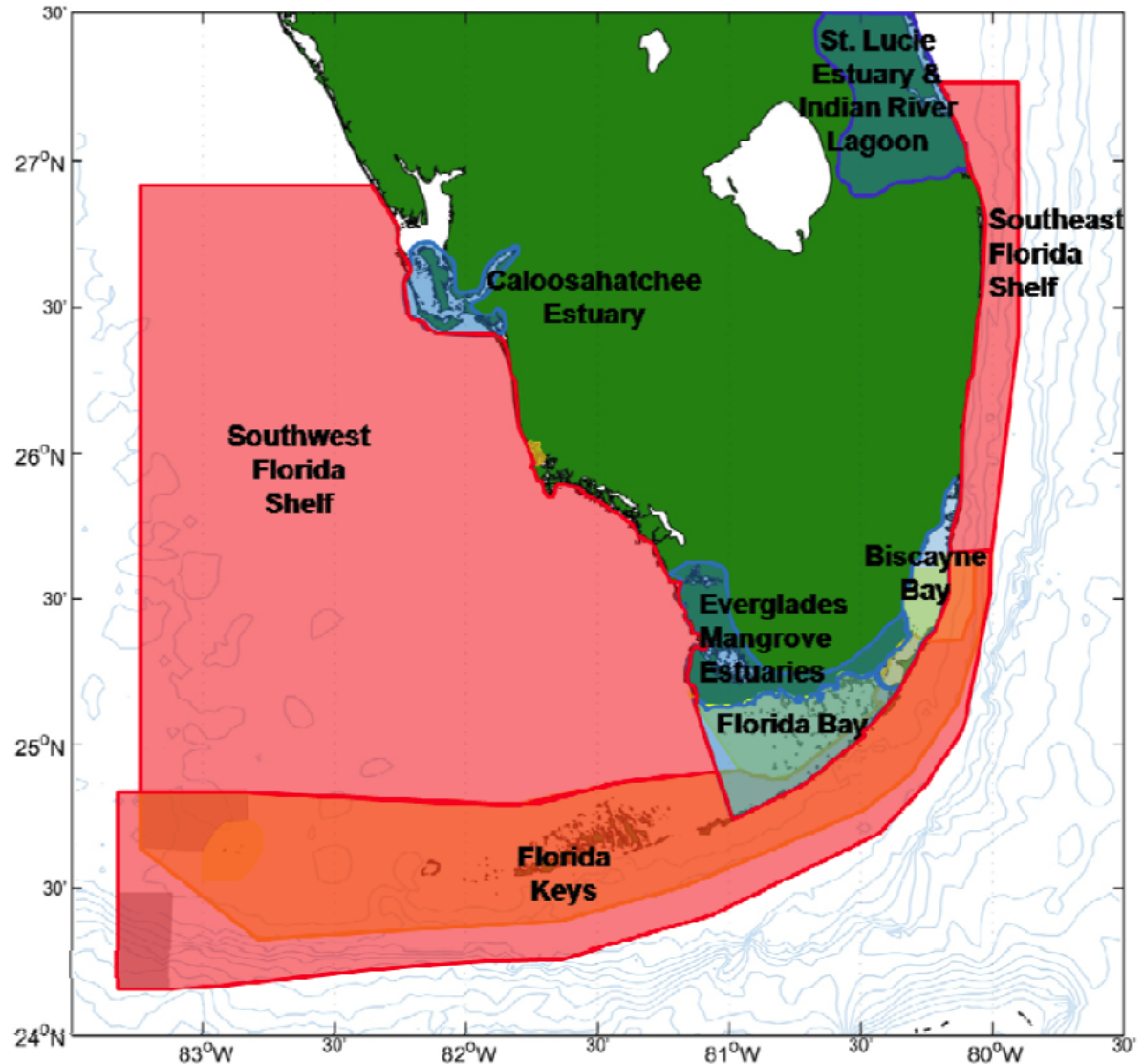
1. Expansion of real-time moorings
2. Development of particle tracking/NPZ capabilities in SoFla-HyCOM
3. Expansion of drifter program
4. Develop ecological forecast



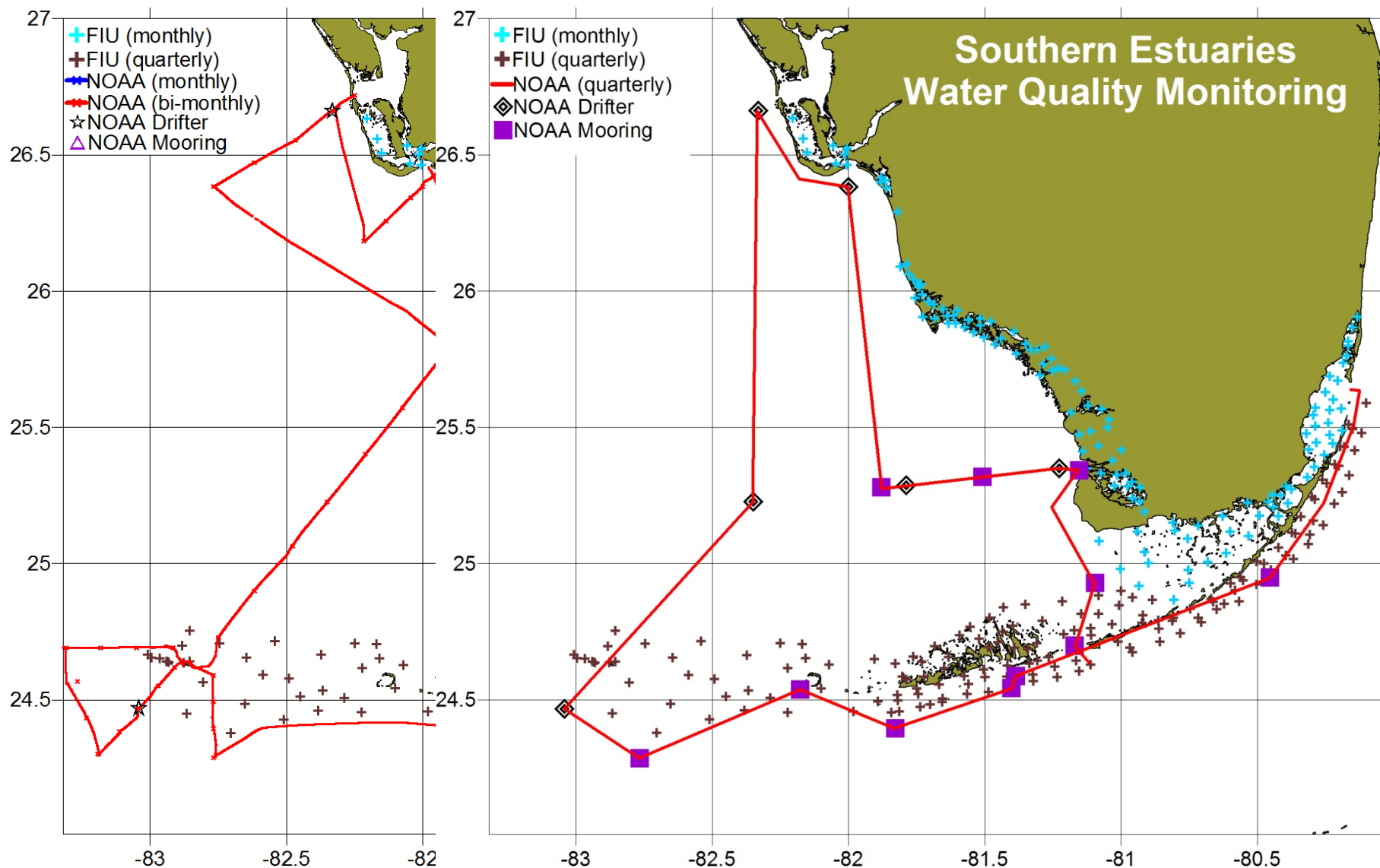
Future of water quality – The Good

NOAA/CSCOR MARES

1. Large, consensus building effort (managers, scientists, NGOs, public)
2. Expansion to incorporate critical downstream habitats
3. Ecosystem goal setting/indicator development
4. Identification and prioritization of the critical uncertainties and information gaps



Future of water quality – The Ugly??





Conclusions

- The pre-restoration water quality condition has been established in Biscayne Bay and Florida Bay, but is not adequately quantified on the southwest Florida shelf
- The current water quality indicator and assessment methodology is sufficient, but needs improvement (model)
- A small increase in TP loading resulted in a large, persistent algal bloom
- The future is murky
 - The potential loss of what was already insufficient water quality monitoring on the southwest Florida shelf is of grave concern

A sunset over the ocean with the text "Questions???" overlaid. The sky is filled with wispy clouds in shades of orange, yellow, and red, with the sun low on the horizon. The ocean is dark blue in the foreground. The text is white with a blue outline and is positioned in the upper half of the image.

Questions???