

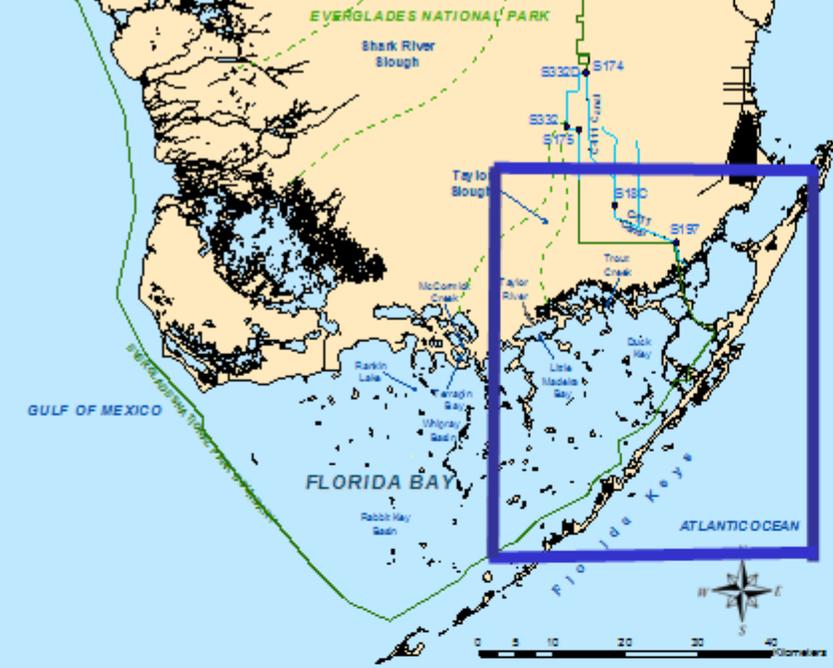
***Algal Blooms in Eastern Florida Bay and  
Southern Biscayne Bay***

***Chip Merriam***

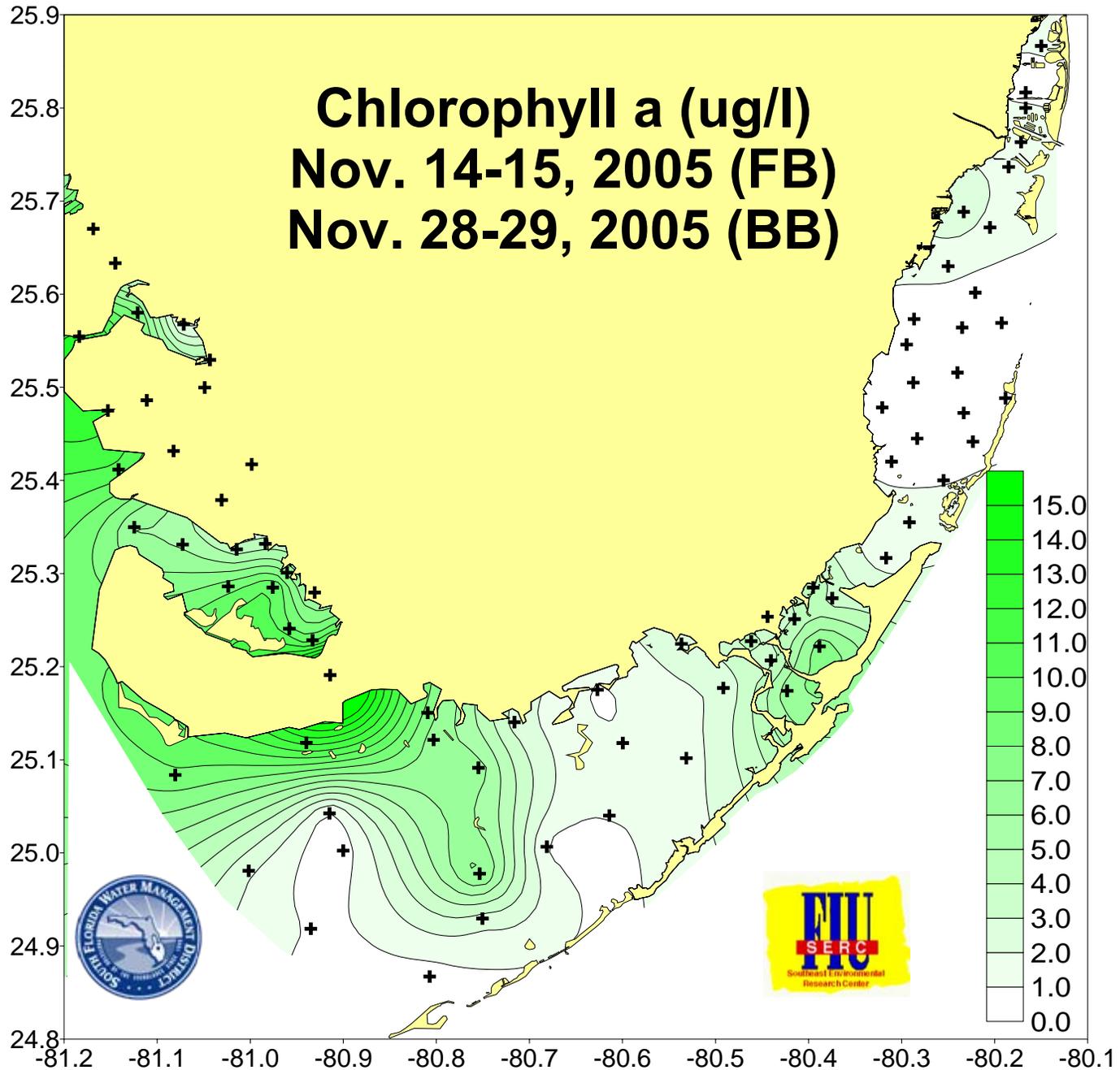
***South Florida Water Management District***

***December 6, 2006***



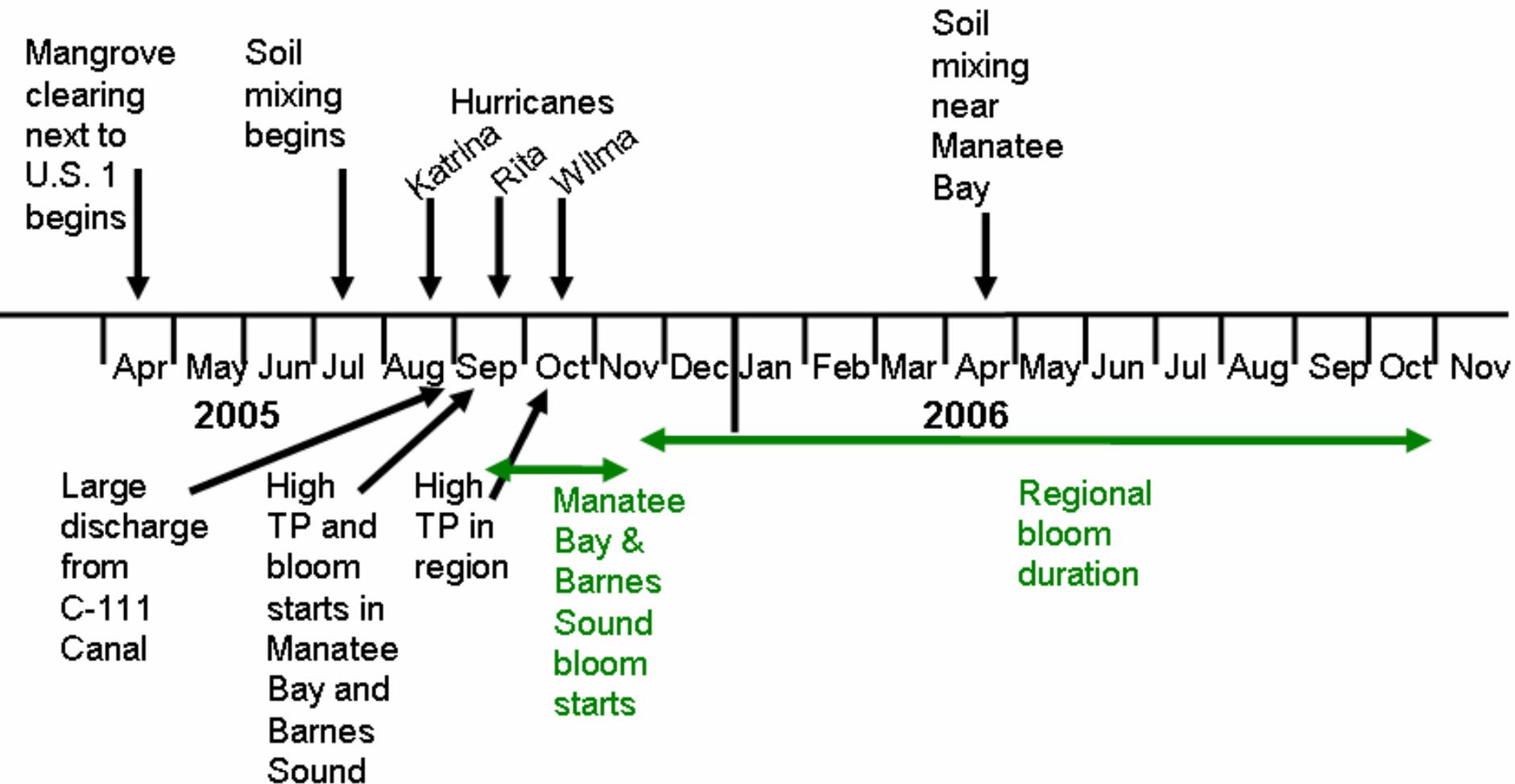


# Algal bloom initiated by November 2005



from:  
J. Boyer

# Timeline of Eastern Florida Bay – Southern Biscayne Bay Algae Blooms and Potentially Related Events

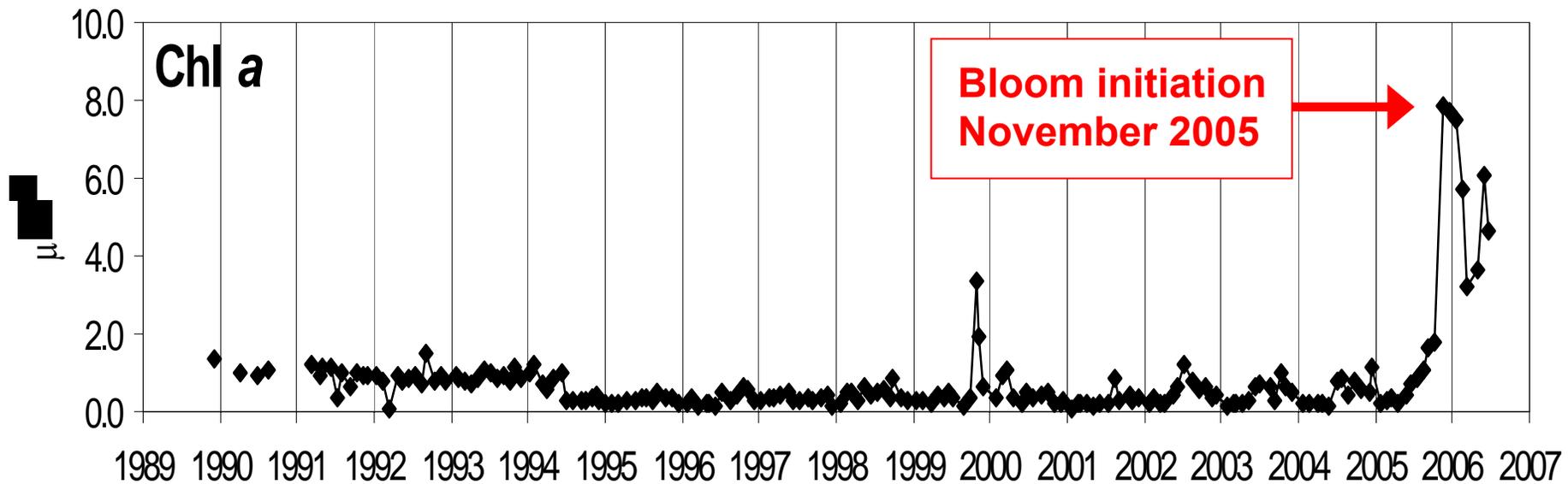
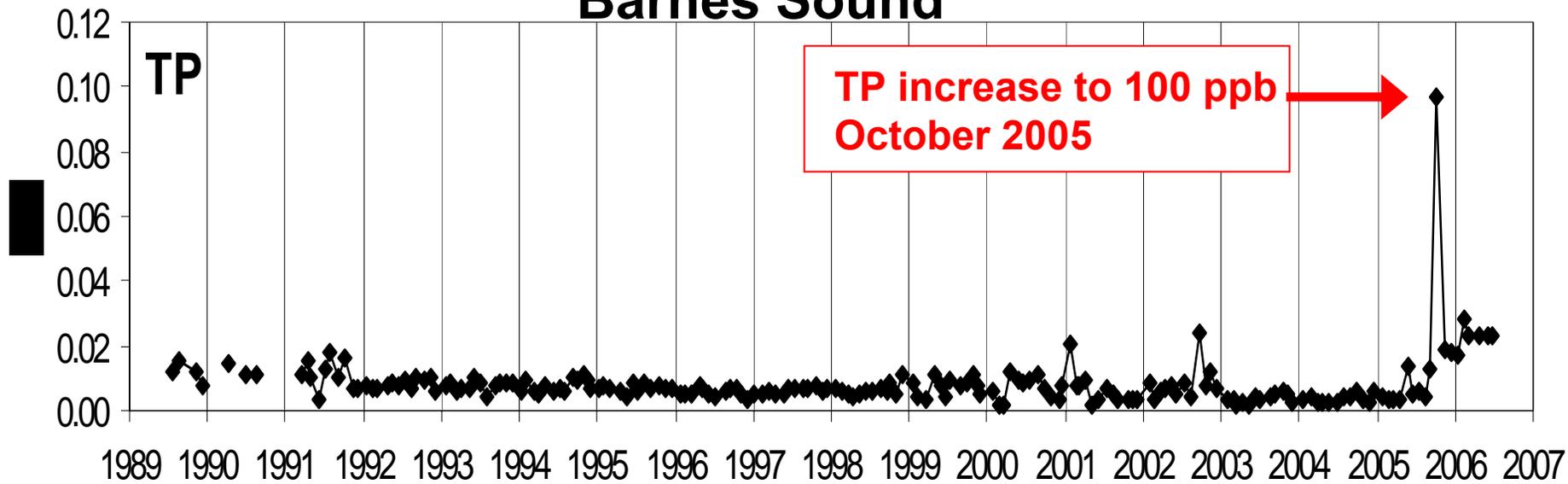


***Spatial distribution of bloom consistent with road disturbance hypothesis and .....***

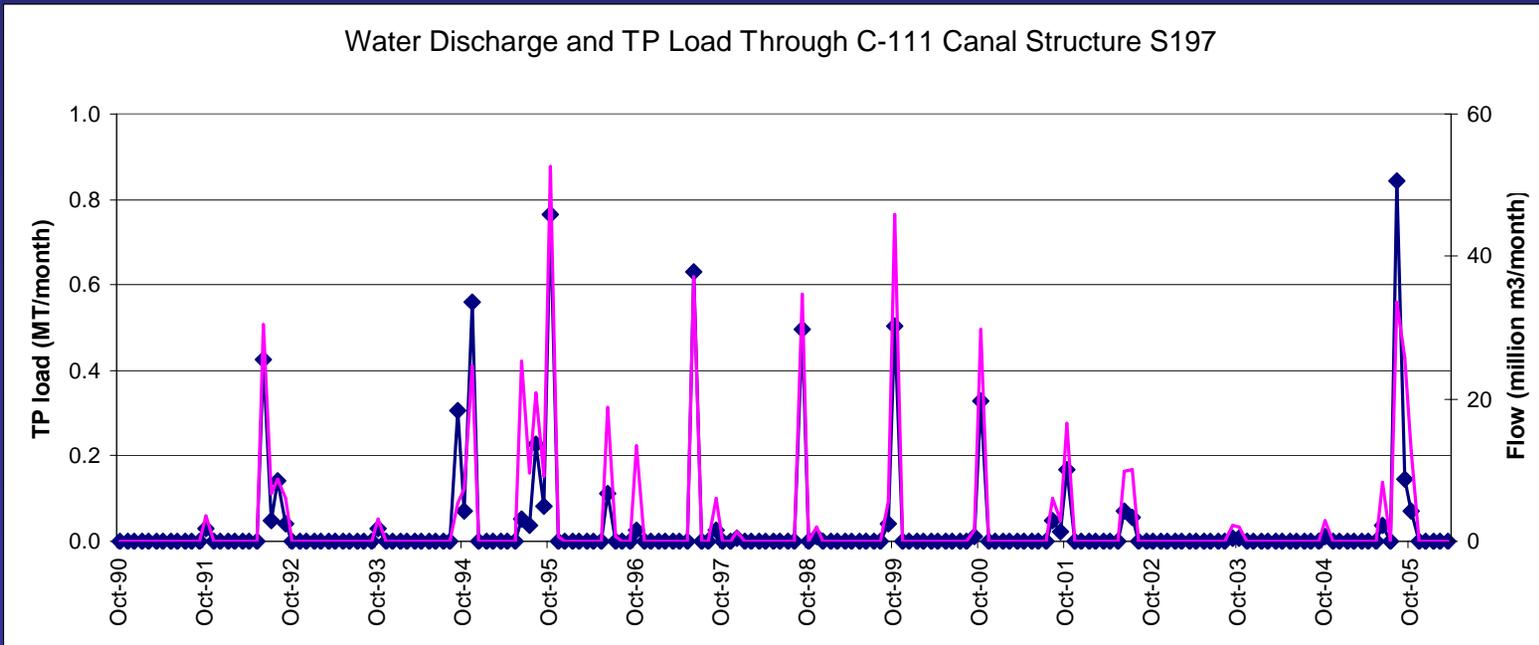
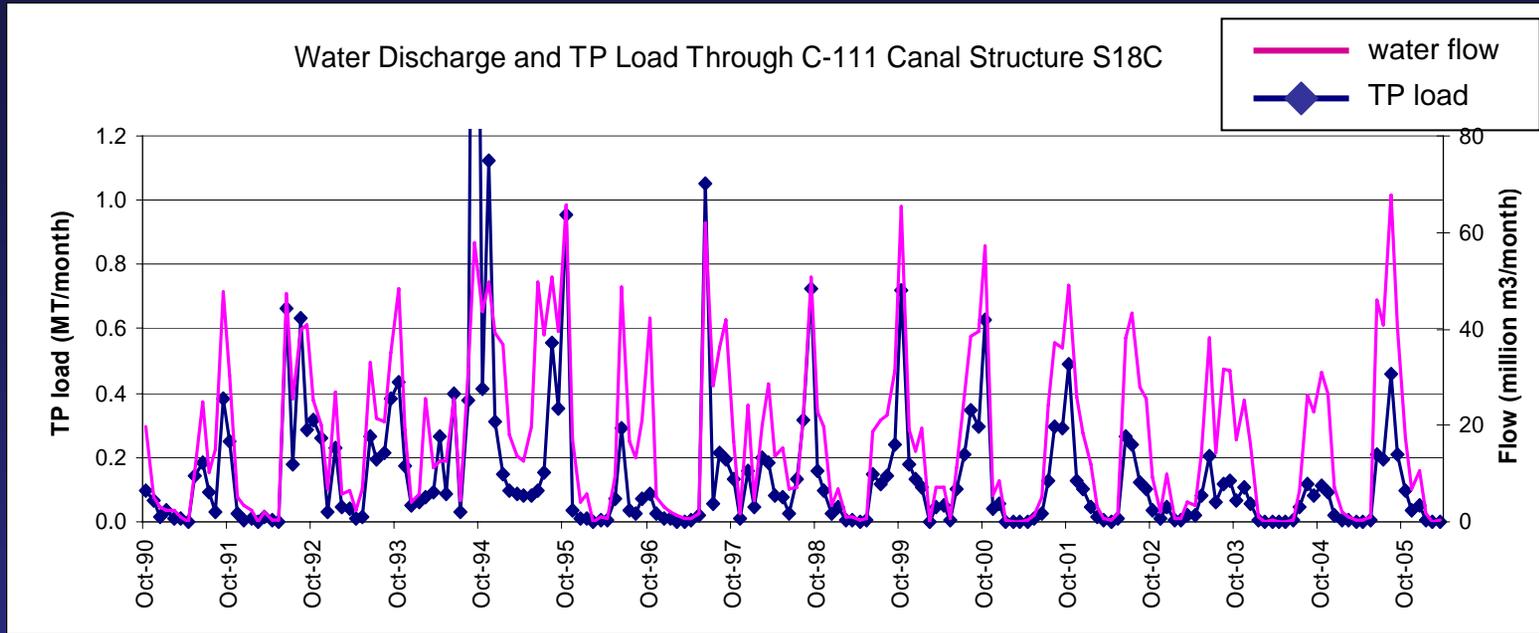


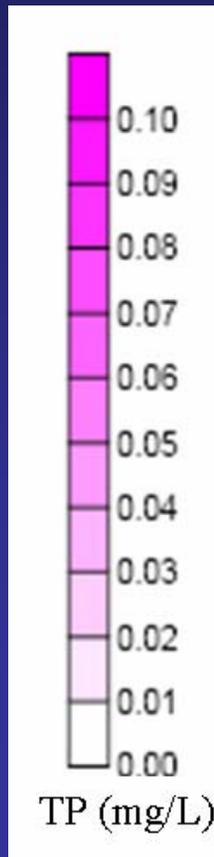
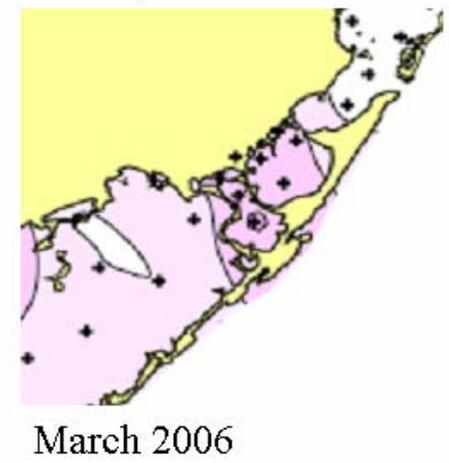
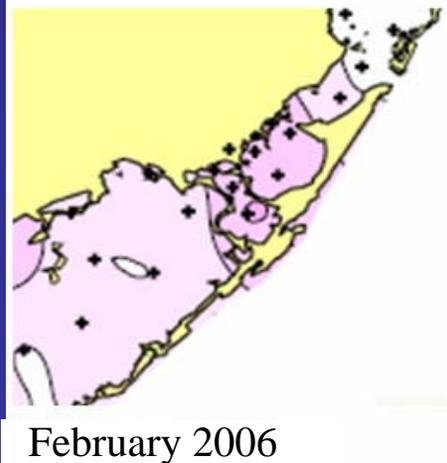
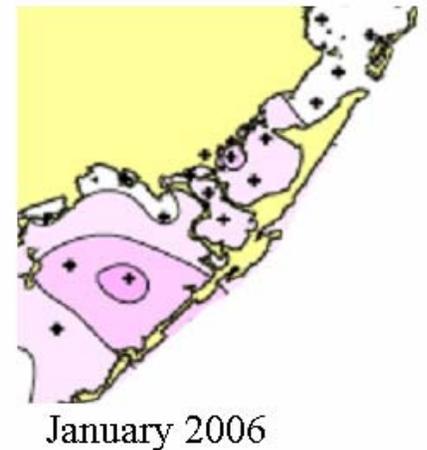
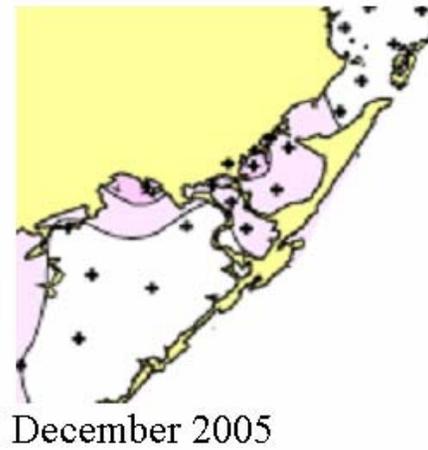
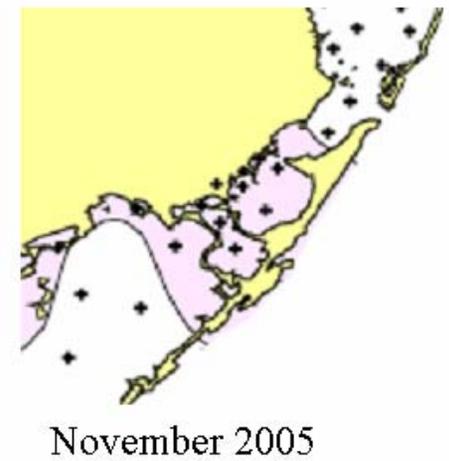
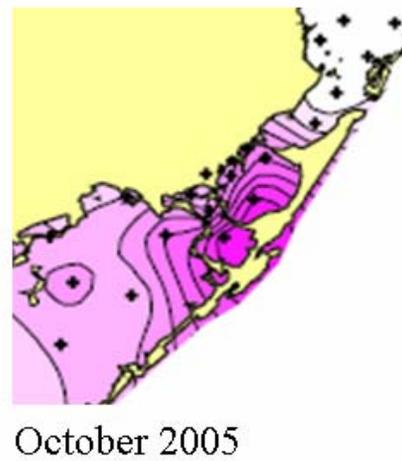
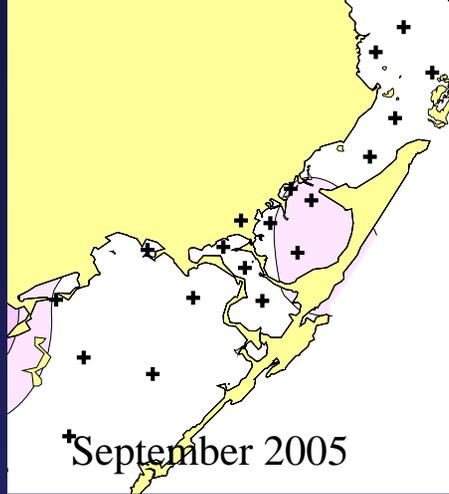
***.... timing of bloom initiation consistent with hurricane disturbance hypothesis.***

# Barnes Sound



# Discharge and TP load through the C-111 canal since 1991

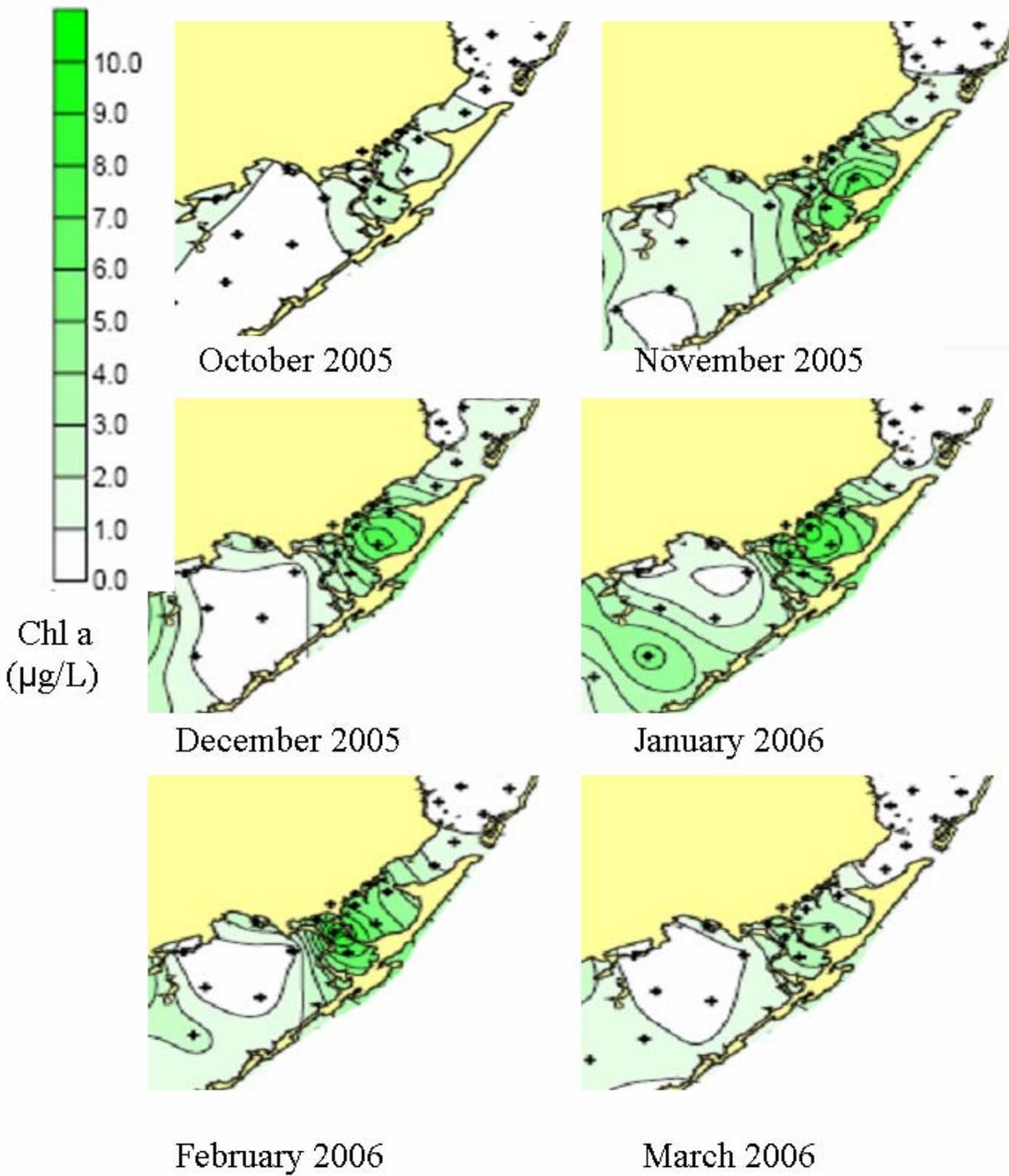




**Total phosphorus concentrations in eastern Florida Bay and southern Biscayne Bay.**

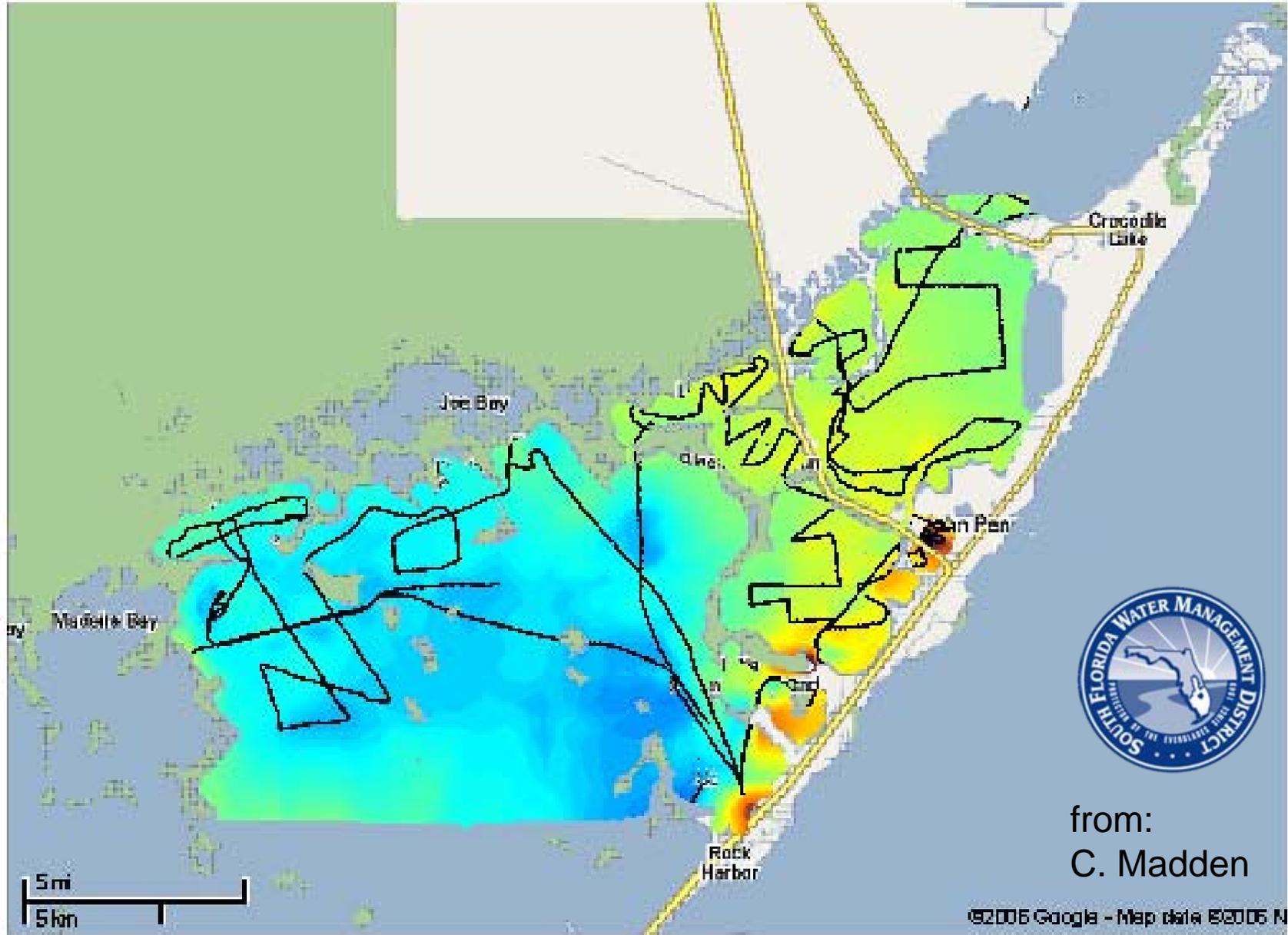
Concentration contours calculated by J. Boyer.

***Chlorophyll-a concentrations in eastern Florida Bay and southern Biscayne Bay***



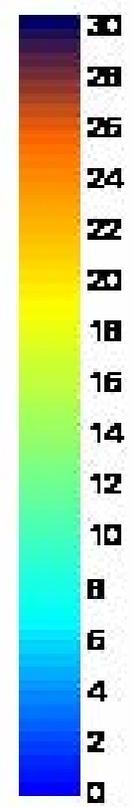
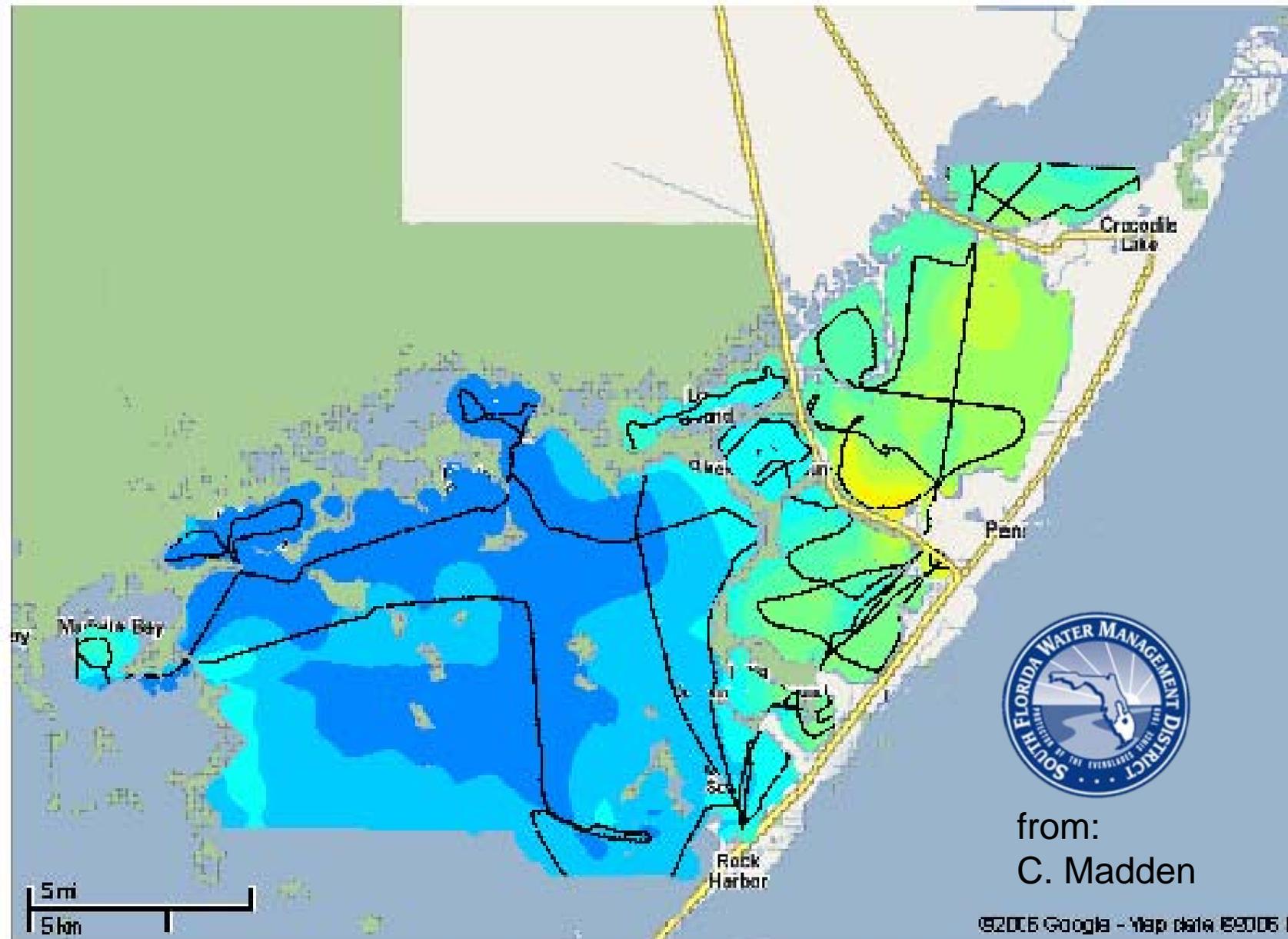
Concentration contours calculated by J. Boyer.

# High resolution map of chlorophyll-a ( $\mu\text{g} / \text{L}$ ) – January 24-26, 2006



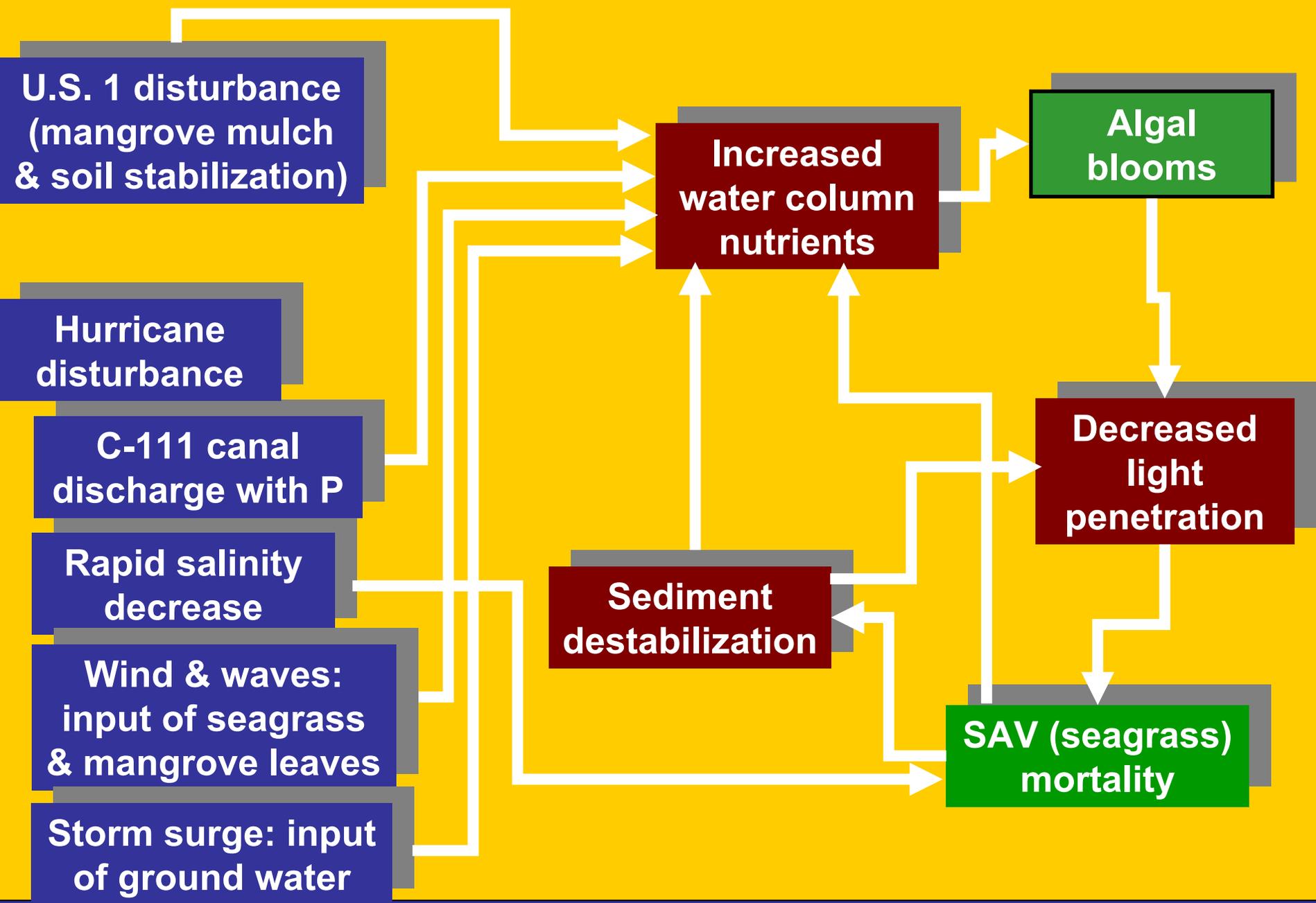
from:  
C. Madden

# High resolution map of chlorophyll-a ( $\mu\text{g} / \text{L}$ ) – July 19-20, 2006



from:  
C. Madden

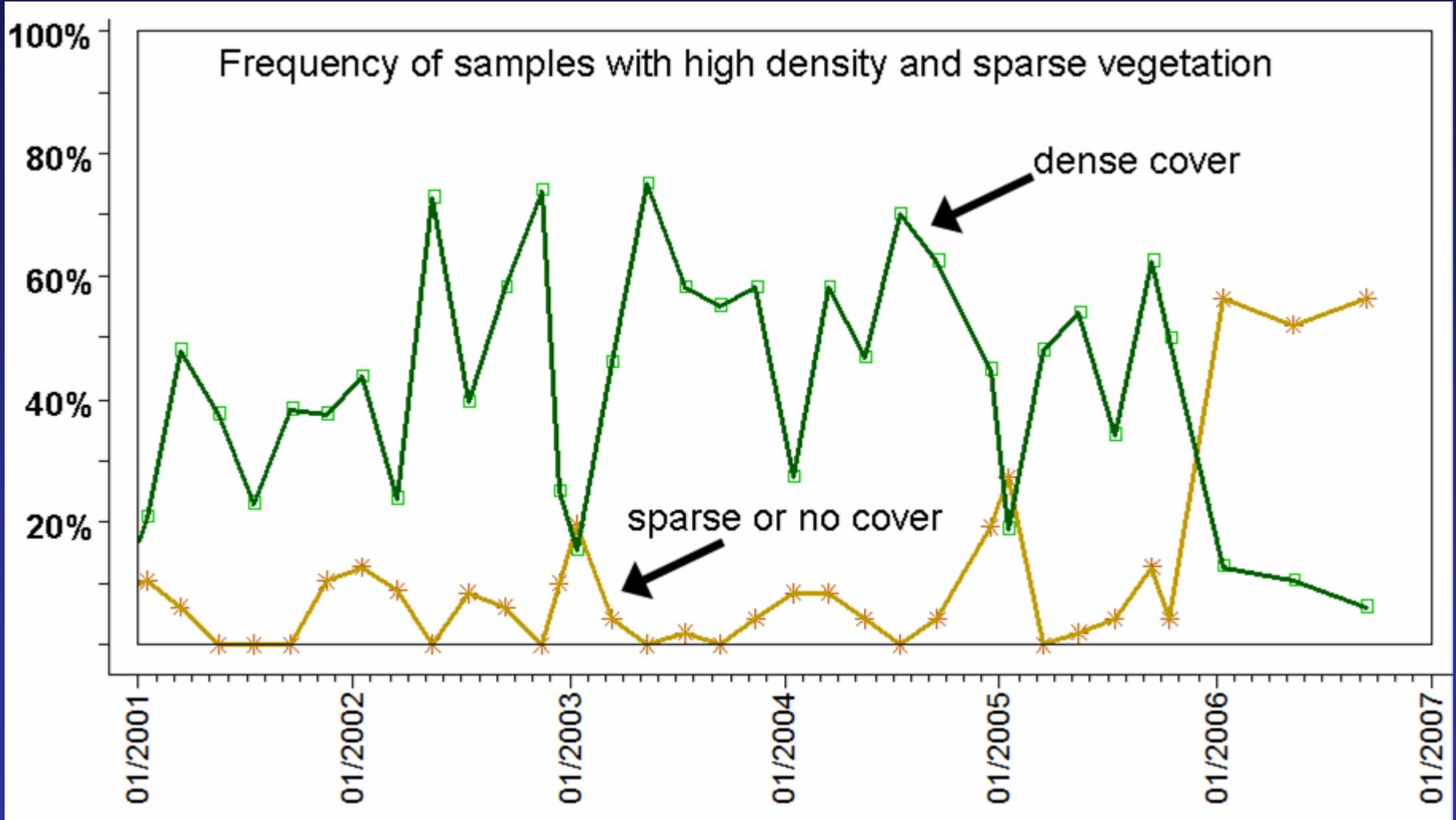
# *Algal blooms: hypothesized cause and effect*



## *Estimated phosphorus budget for the bloom*

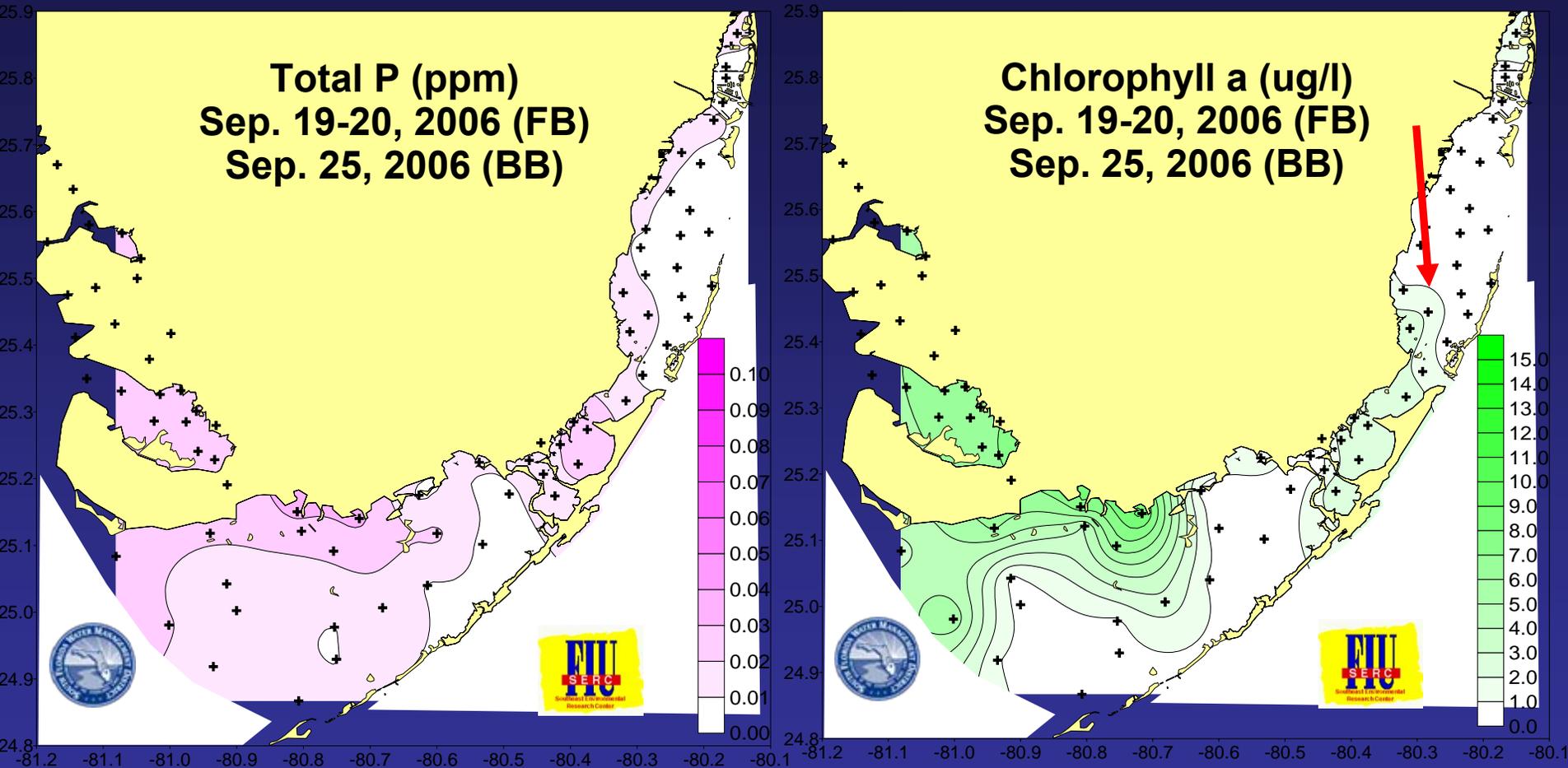
	Metric tons P
Bloom P requirement (biomass over 65 sq. miles)	3
C-111 Canal discharge (2005 hurricane season)	2.6
Decomposing mangrove & seagrass leaves (from hurricane wind & waves)	?
Ground water nutrients (from Keys and Florida Bay)	?
Seagrass mortality (storm salinity stress, post-bloom light stress)	?
US 1 mulched mangroves (maximum above-ground through November 2005)	0.9
US 1 below-ground nutrients (mangrove roots, soils, sediments)	?

# *Submerged Aquatic Vegetation Status: Barnes Sound (recent loss - mostly macroalgae)*



data from: Miami-Dade DERM

# Current Bloom Conditions: decreased intensity, but expansion in Biscayne Bay



from: J. Boyer

# *Summary of Algal Bloom Information*

## **Bloom Description: Structure, Distribution, Timing**

- **Bloom mostly blue-green algae (bacteria)**
- **Bloom has covered 45 to 95 sq. miles in east Florida Bay & south Biscayne Bay**
- **Sustained since November 2005**
- **No similar bloom previously observed in region**
- **Bloom was first in Manatee Bay and Barnes Sound after Hurricane Katrina**
- **Bloom density (chlorophyll *a*) highly correlated with TP - likely P limited**
- **Bloom spread (with lower chl-*a*) as far as Turkey Point in late summer 2006.**

# *Summary of Algal Bloom Information*

## **Bloom Causation: Hypotheses and Evidence**

**Multiple factors probably caused the initiation and sustenance of the bloom**

- Spatial pattern of algae & P consistent with possible road construction effect**
- Timing of bloom initiation & P peak consistent with possible hurricane effect**
- TP load from C-111 Canal discharge very large – P transport and fate uncertain**
- Bloom sustained by long water residence time (poor flushing) + efficient P retention (regardless of the nutrient source).**

# *Ongoing Scientific Activities*

## **Multi-agency cooperation:**

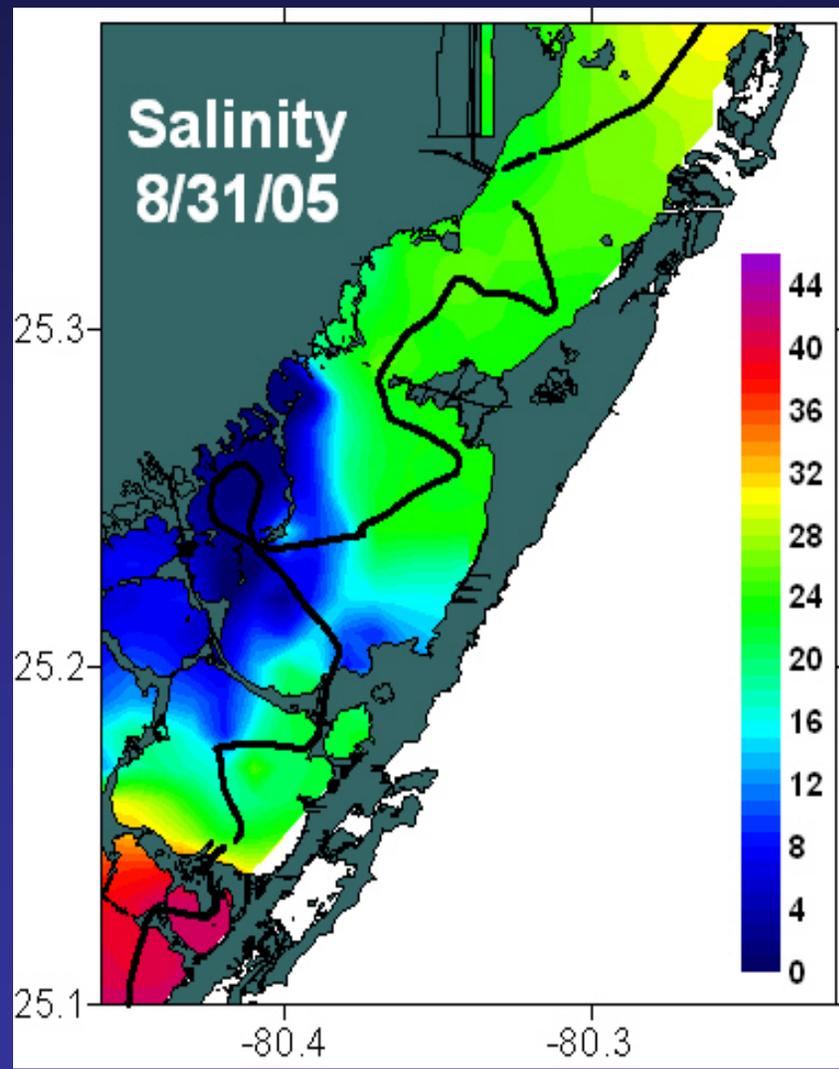
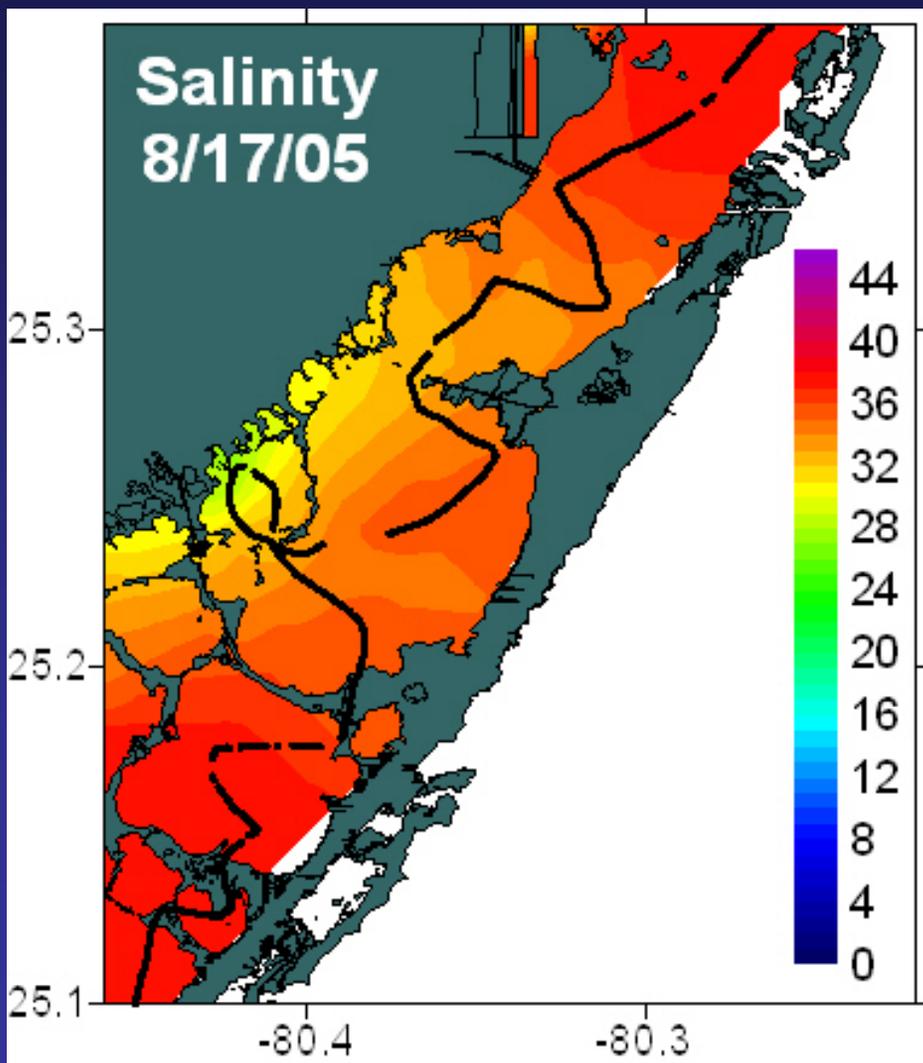
**SFWMD, FIU, FDOT, Miami-Dade DERM, FFWCC, NOAA, NPS, USGS**

- **Chemical analysis of cement and slag additives (FDOT contractors)**
- **Soil coring and analysis of soil nutrient content (FDOT contractors)**
- **Analysis of nutrient loss from soil/mulch samples (FDOT contractors)**
- **Water quality sampling near and away from US 1 (SFWMD, FIU, DERM, NOAA)**
- **Baseline water quality sampling for Phase II construction (Manatee Bay to C-111 bridge) (FDOT, DERM, SFWMD)**
- **Bloom mapping about every three weeks (SFWMD, NOAA)**
- **Effects of soil extracts and cement/slag additives on algae (FFWCC, U. MD/NOAA)**
- **Dissolved oxygen monitoring (SFWMD)**
- **SAV monitoring (Miami-Dade DERM, FFWCC, SFWMD, FDOT)**

Hurricane Rita



# Salinity immediately before and after Hurricane Katrina (August 26, 2005)



From: C. Kelble and P. Ortner (NOAA)

# Wind Speed During 2005 Hurricane Season

