



Greater Everglades Ecosystem Restoration
The Everglades: A Living Laboratory of Change
Planning, Policy and Science Meeting
Naples, Florida. July 12-16, 2010

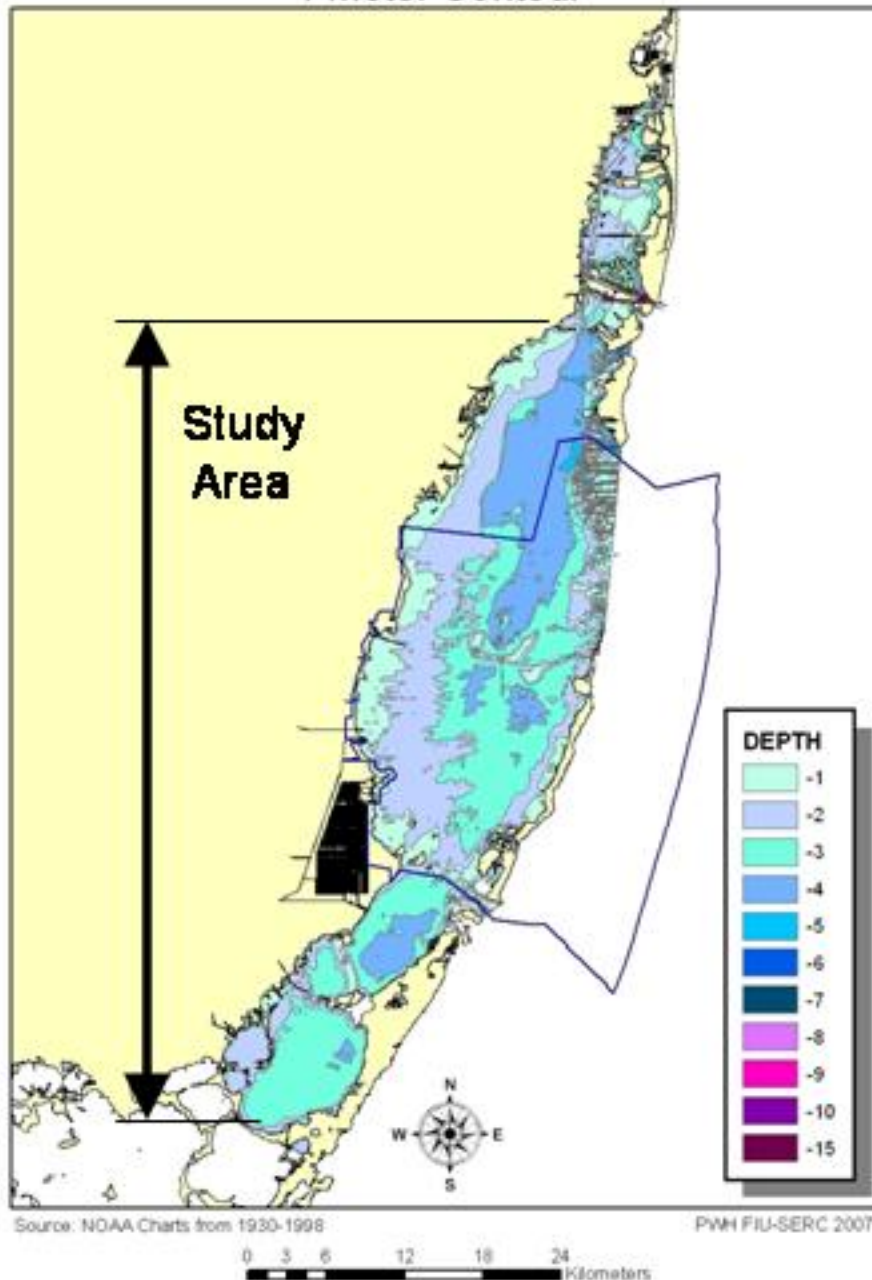
What's so Special about Biscayne Bay Waters?
An Assessment of their Properties and Trends as a
Contribution to Nutrient Criteria Development

Henry Briceño, Joseph N. Boyer, Peter Harlem,
Joffre Castro, William Nuttle, Frank Marshall and Bernard Cosby

Southeast Environmental Research Center



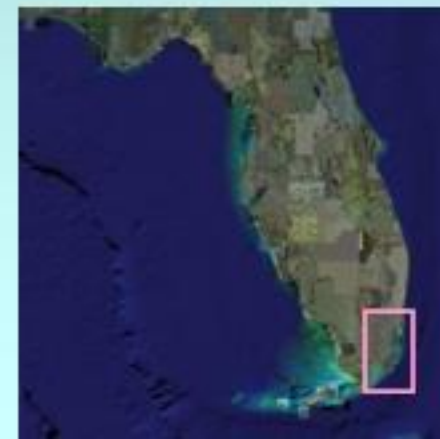
Biscayne Bay Bathymetry 1 Meter Contour



Biscayne National Park

Study Area

From Rickenbacker Causeway
To
Barnes Sound



Factor Analysis

6 Principal components

Cluster Analysis

Scores

Mean, SD
Median, MAD

NH₄

NO₂

TOC

NO₃

DO

TP

TN

SRP

TON

Tur

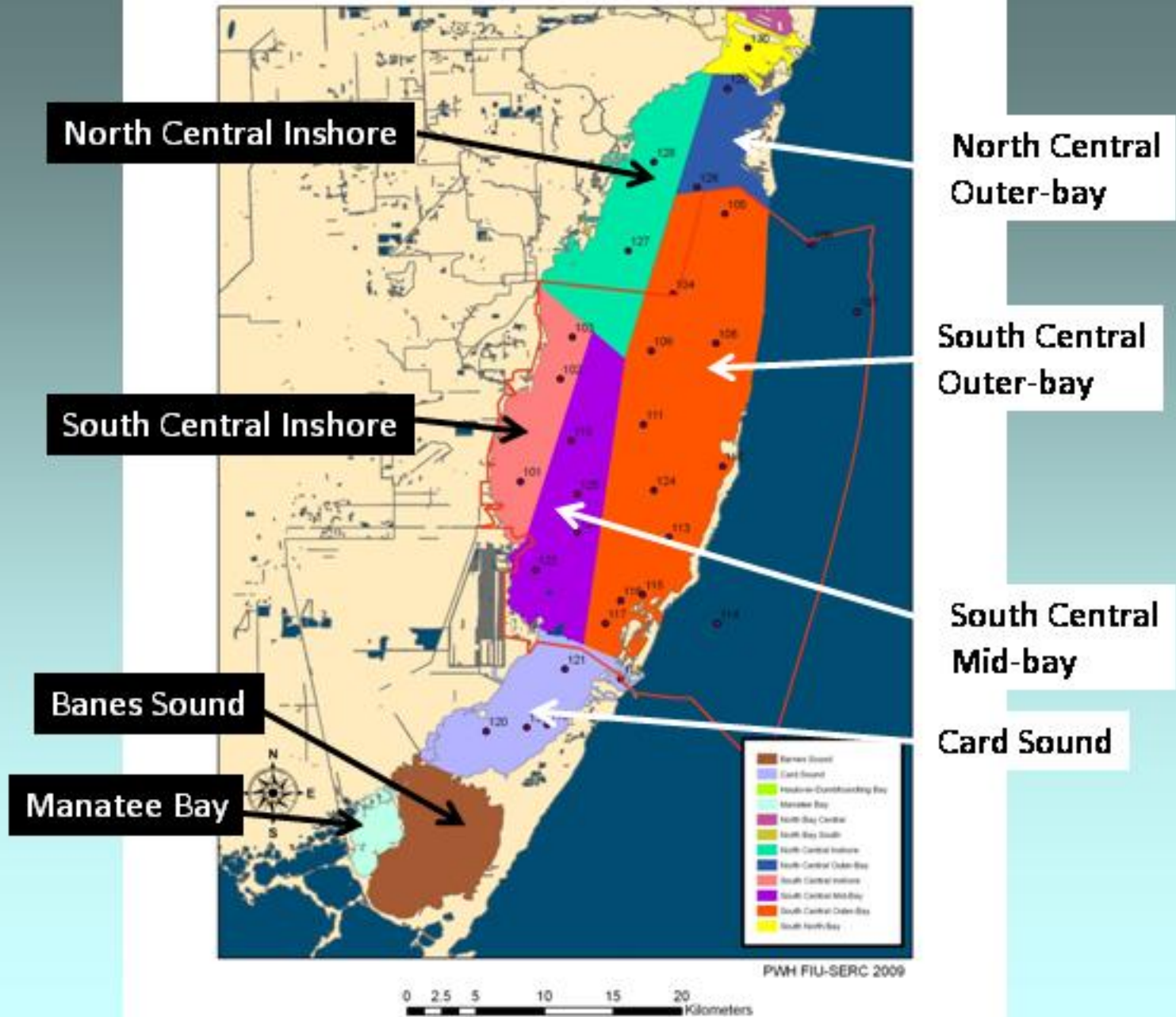
Sal

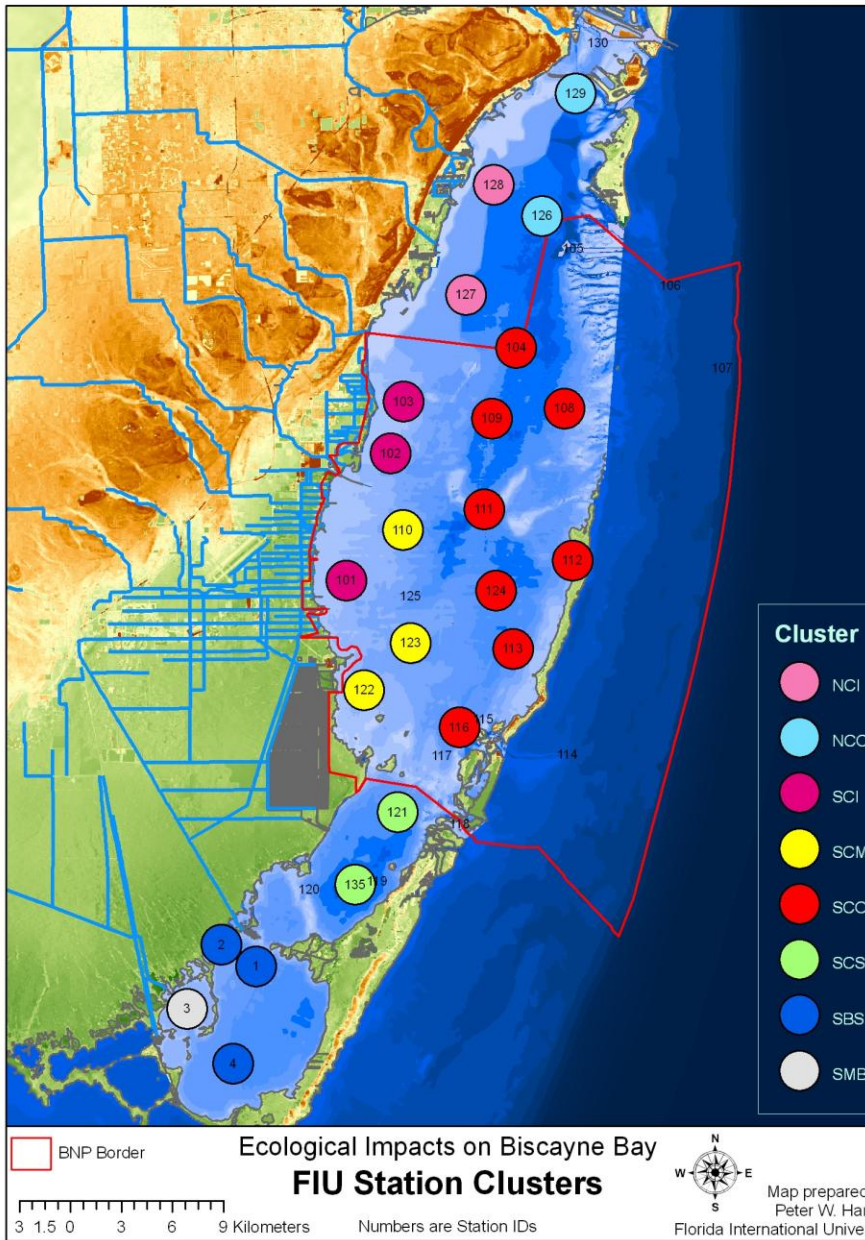
T

CHLa

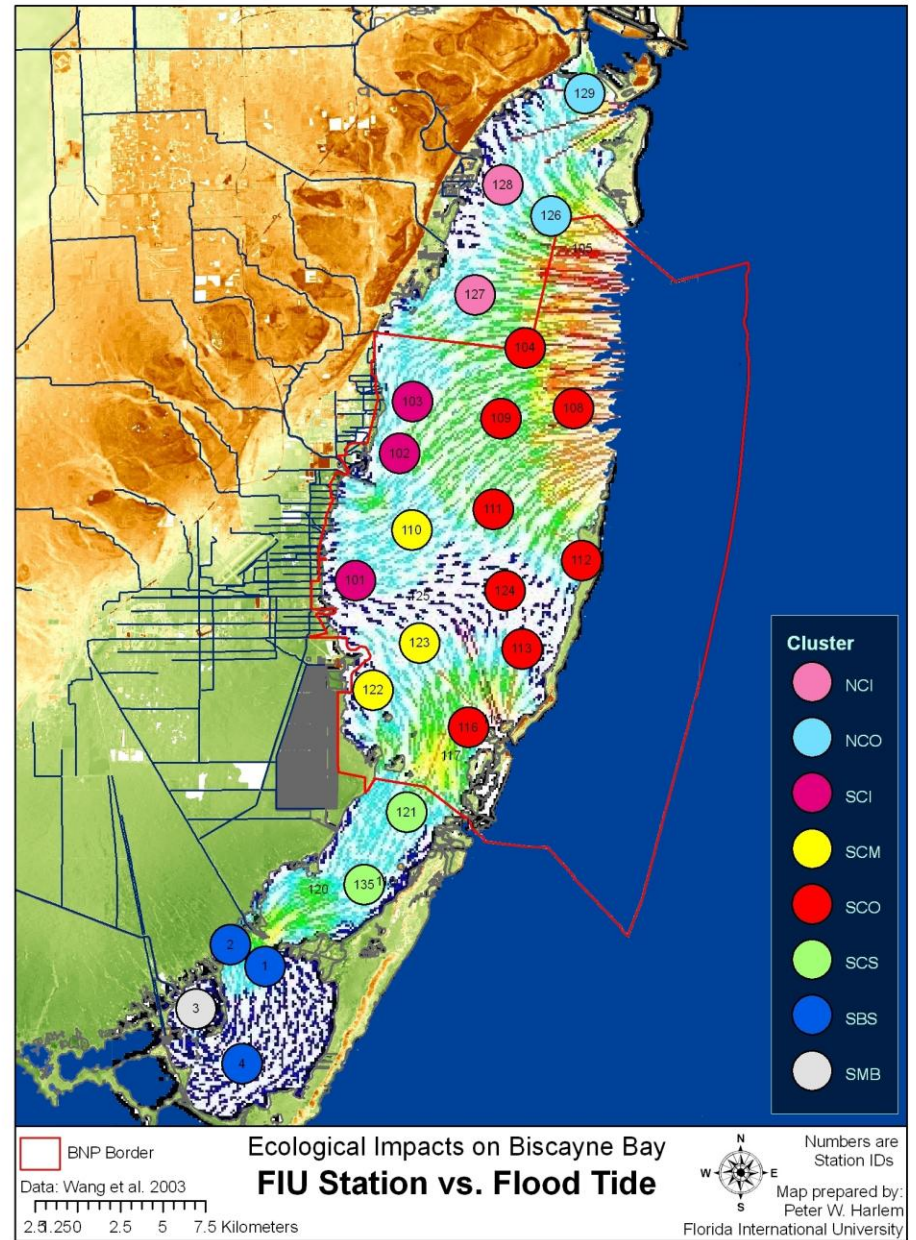
Biscayne Bay Load Boxes

Stations for Barnes Sound and Manatee Bay not shown.

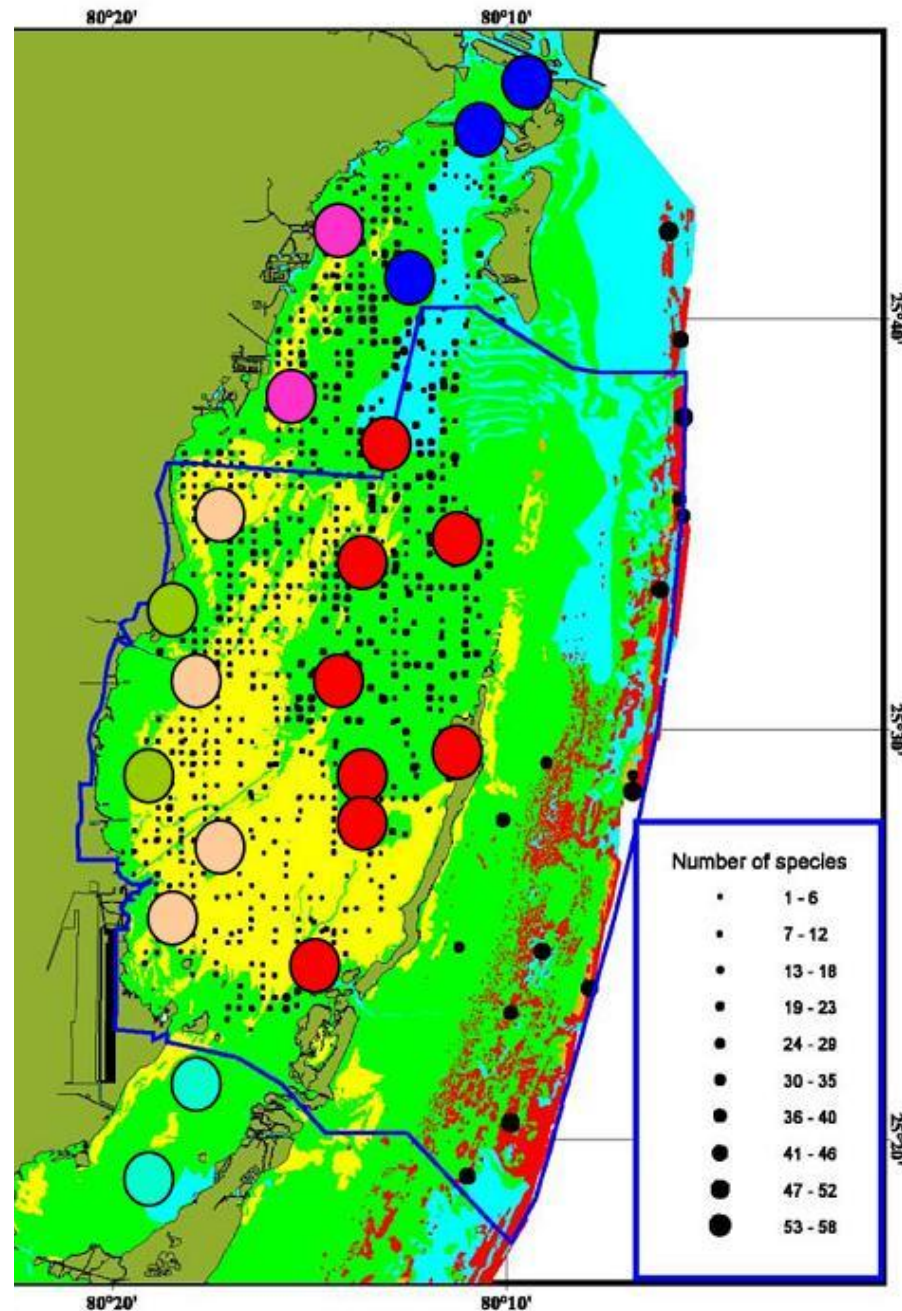
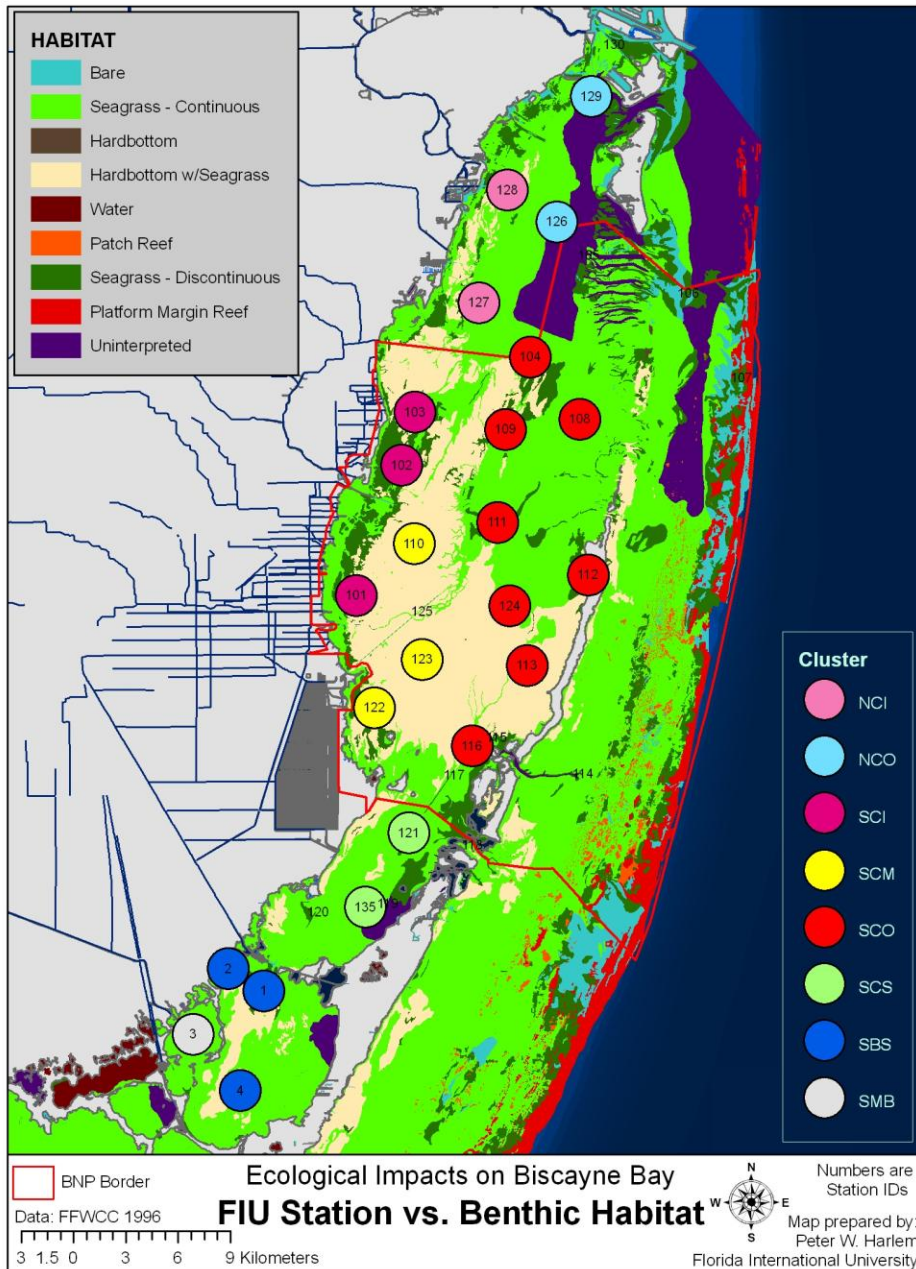




Bathymetry



Tides

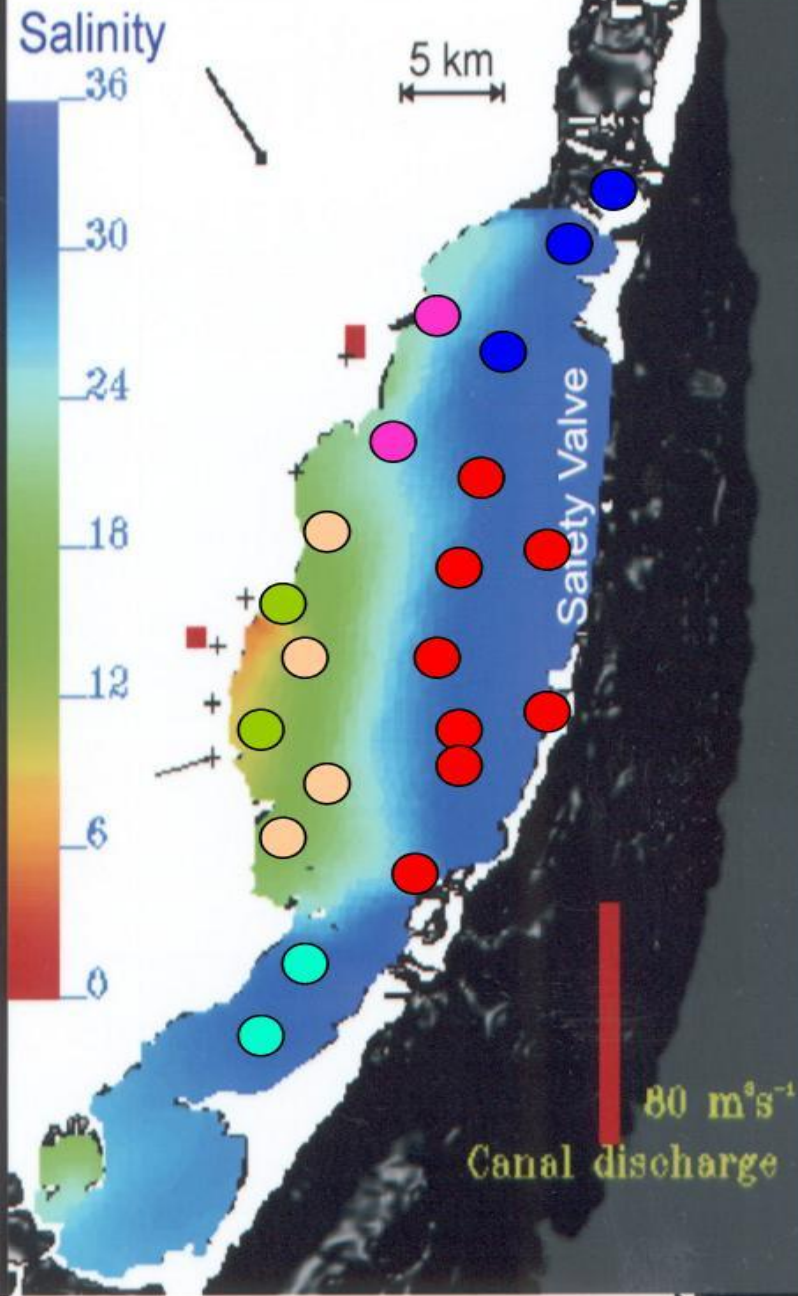


Benthic Habitats

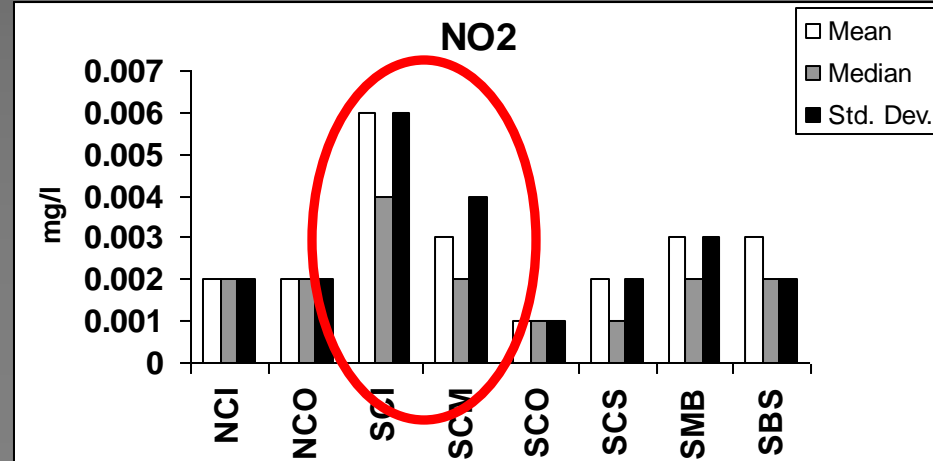
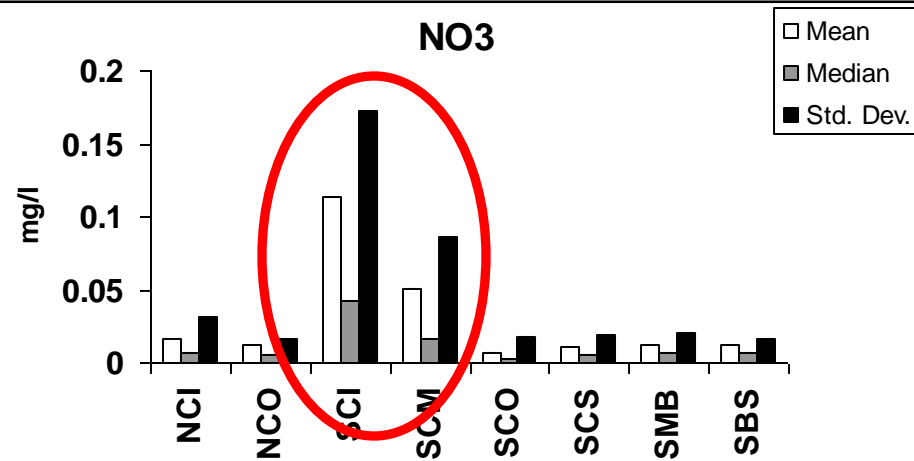
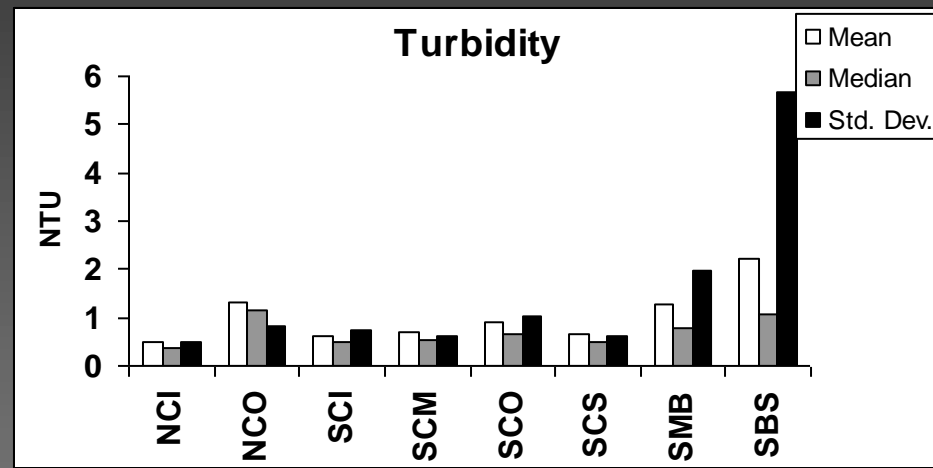
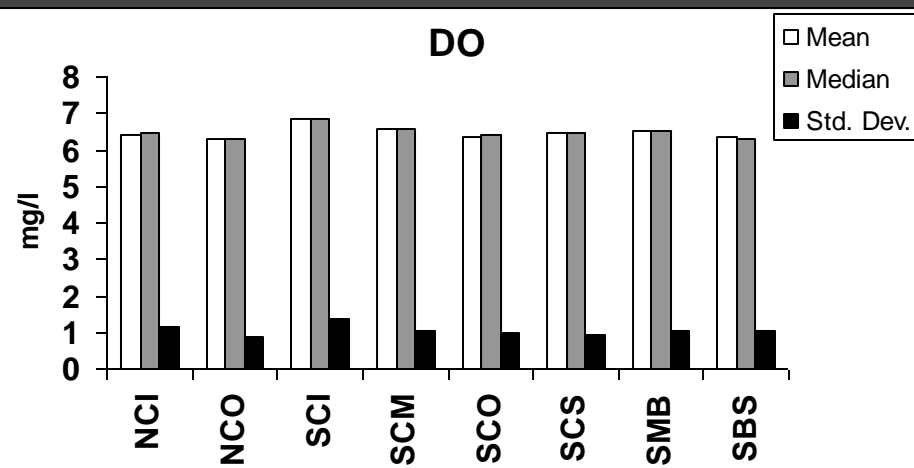
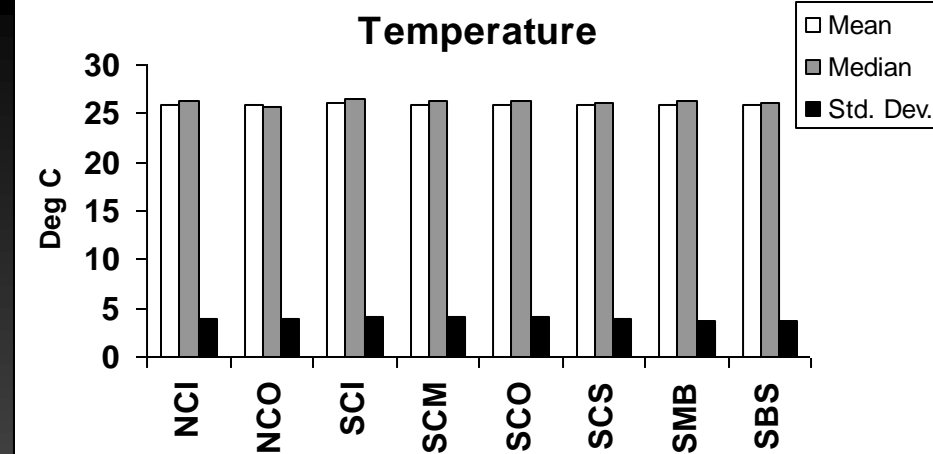
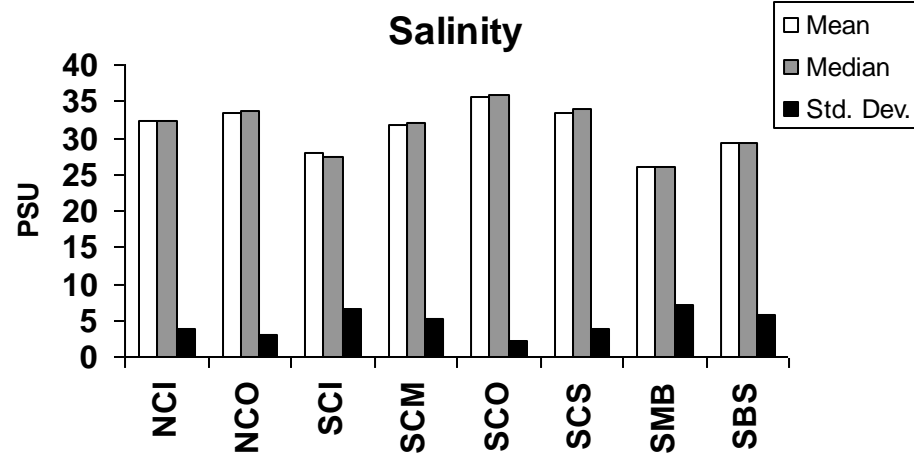
Fish Diversity

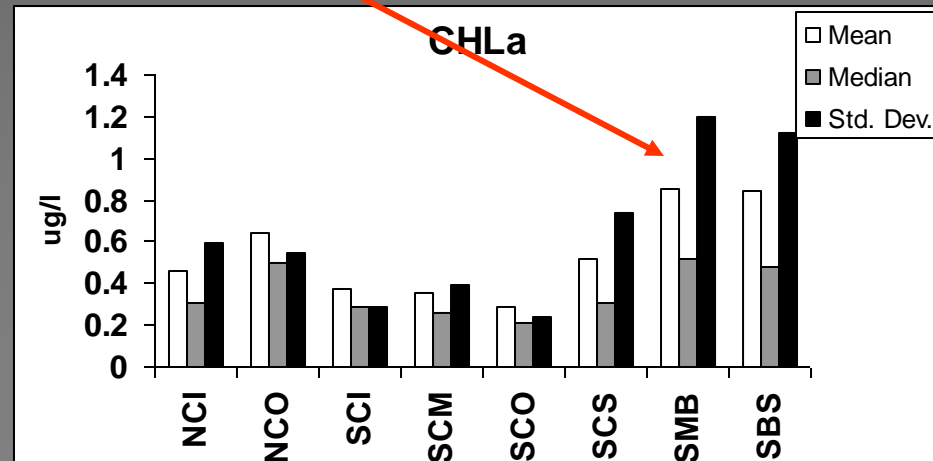
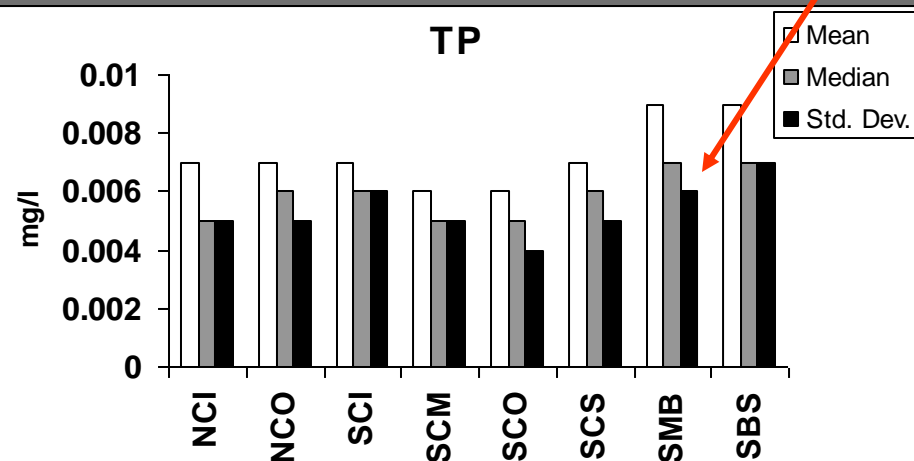
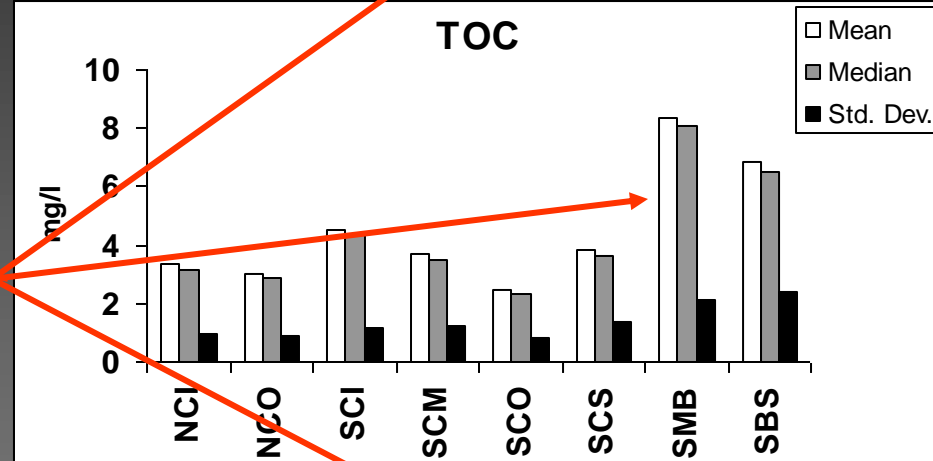
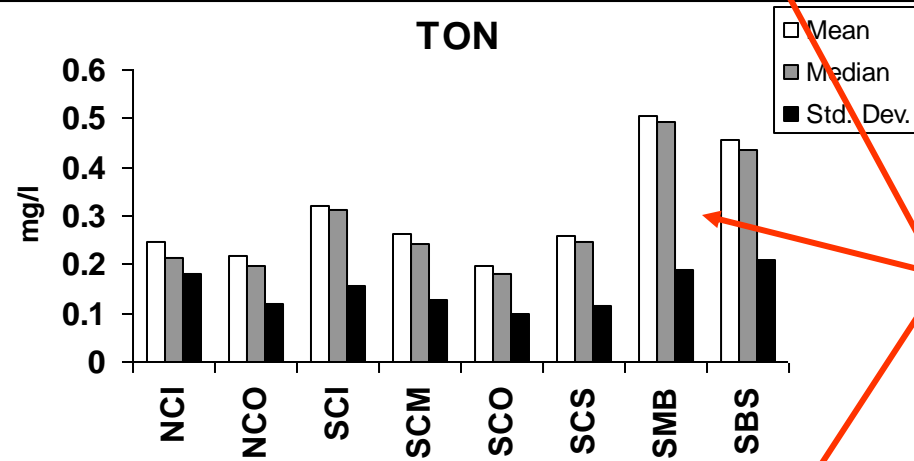
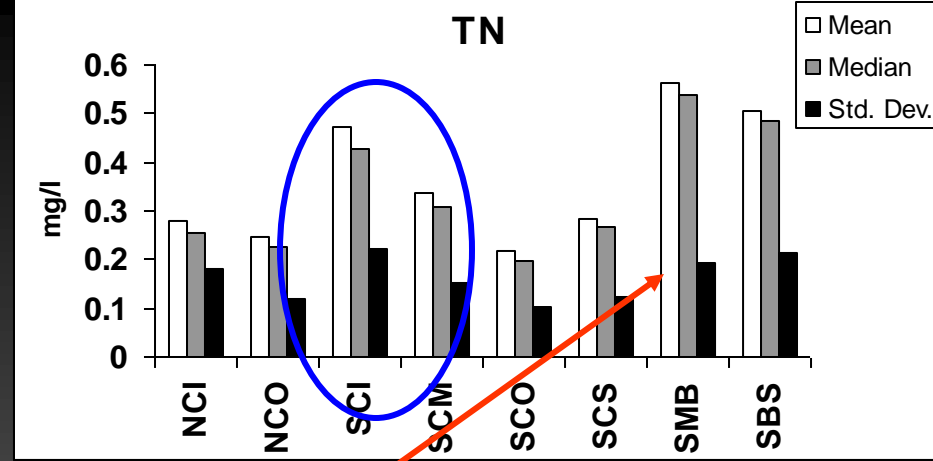
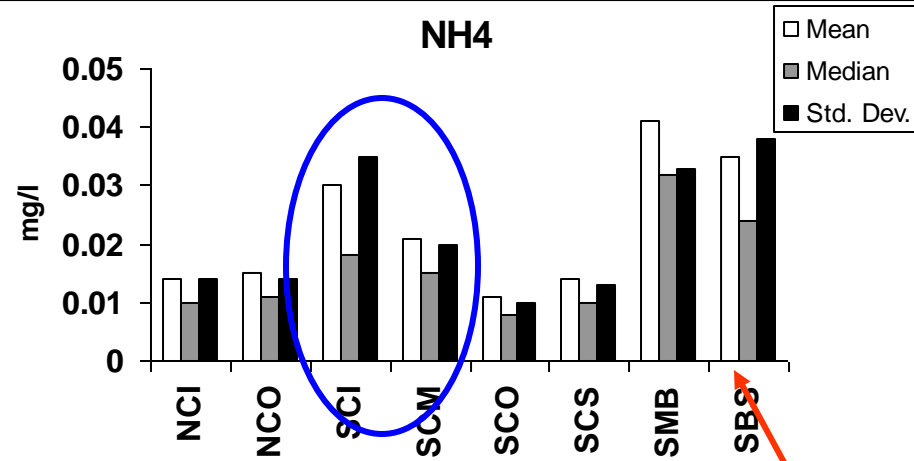
July 23, 10 am (10 hrs)

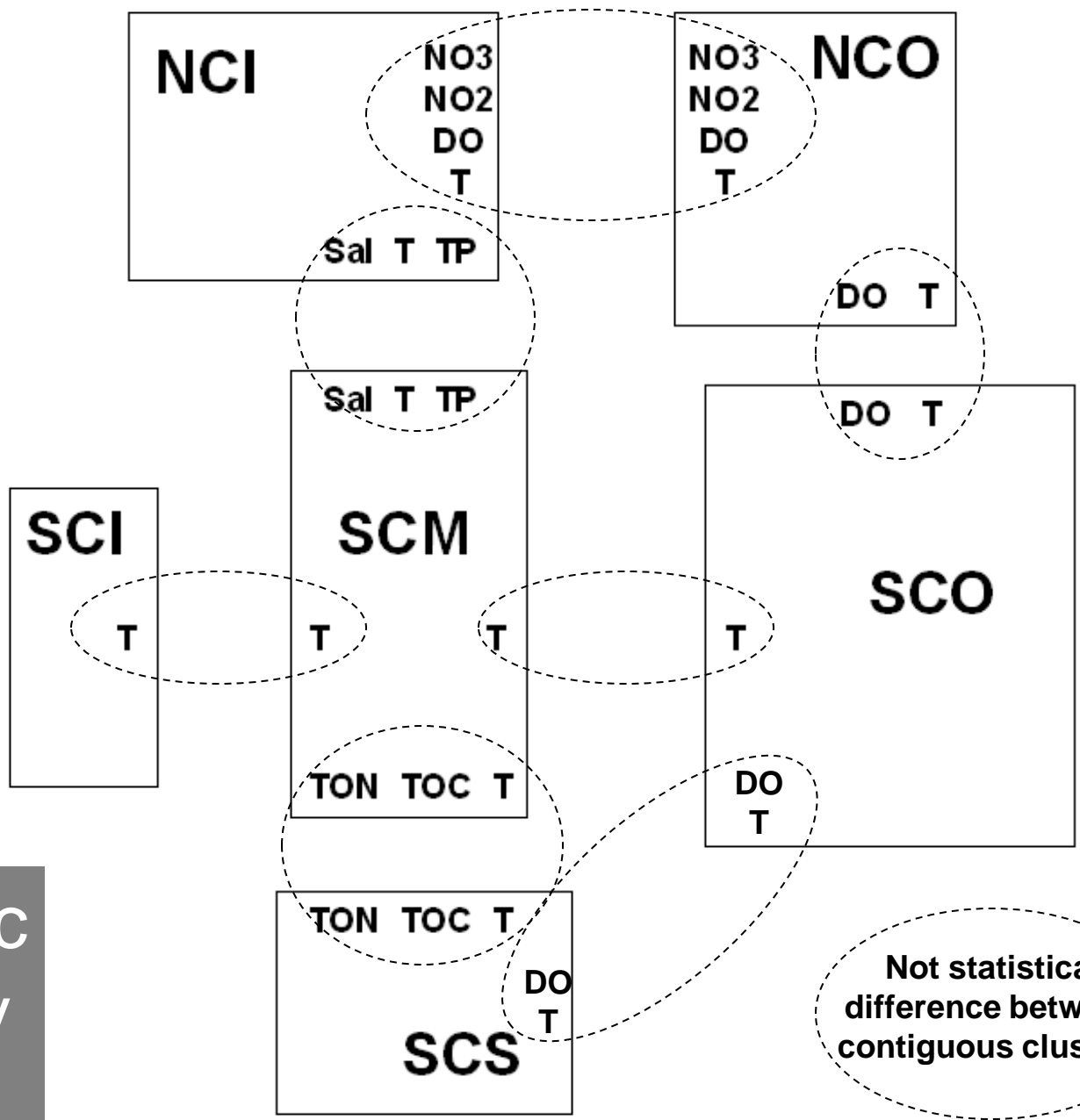
(A)



Salinity gradient





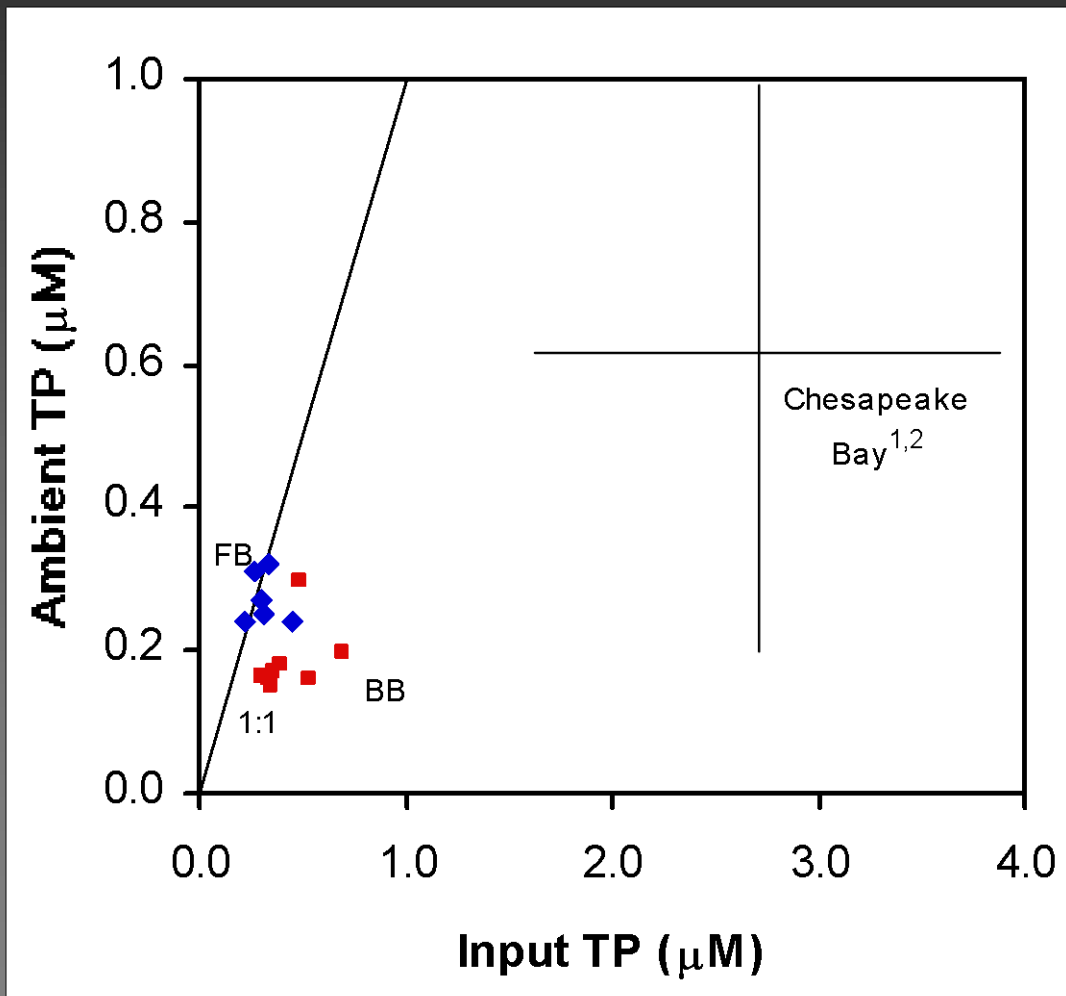


Not statistical difference between contiguous clusters

Non-parametric Mann-Whitney test

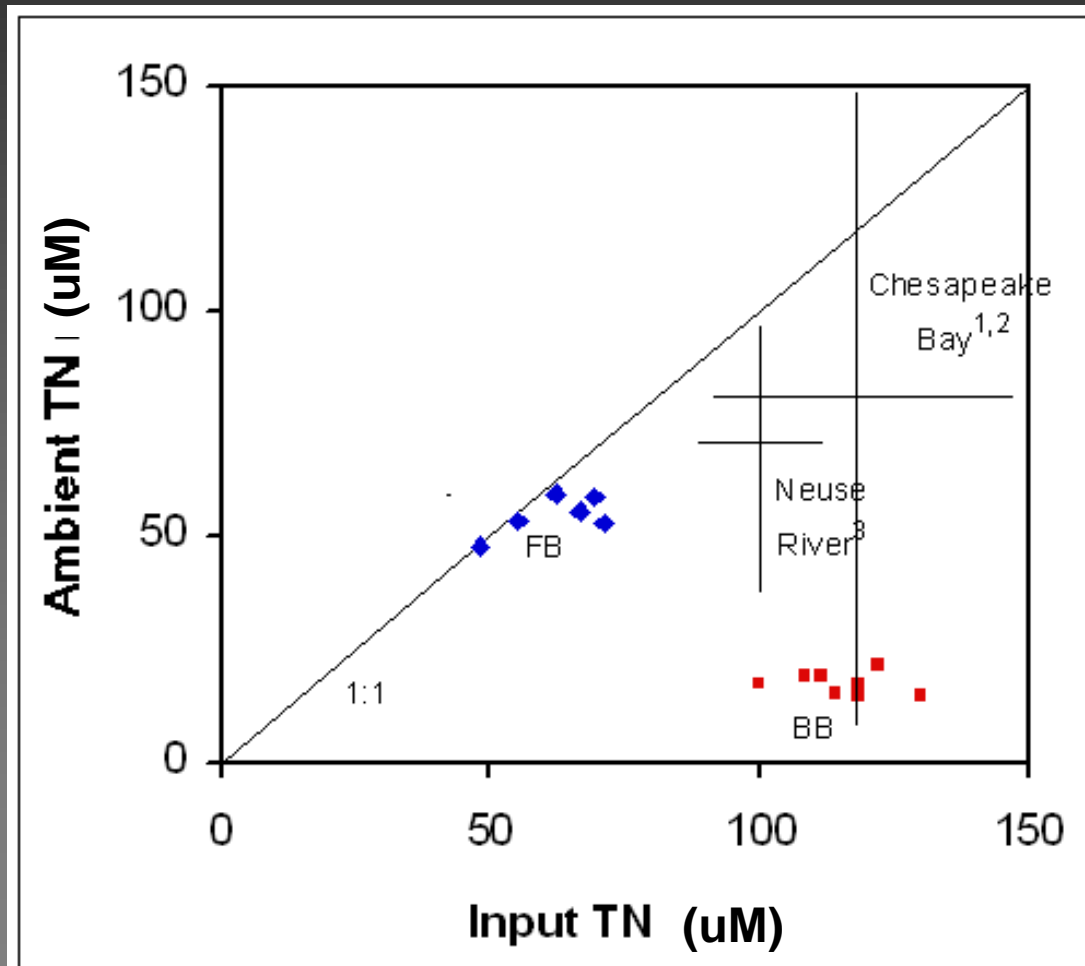


Annual Input [TP] vs Ambient [TP]





Annual Input [TN] vs Ambient [TN]



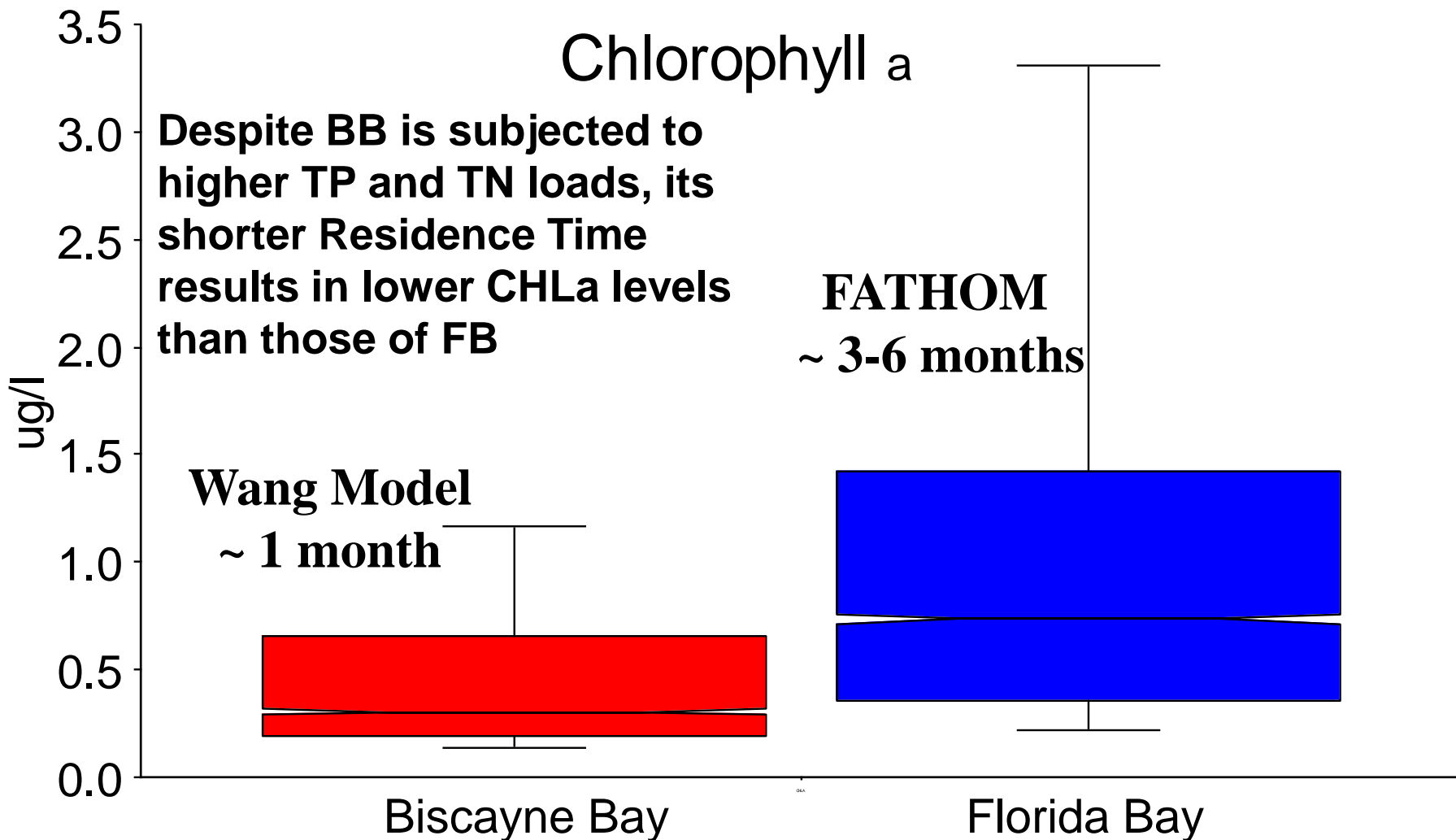


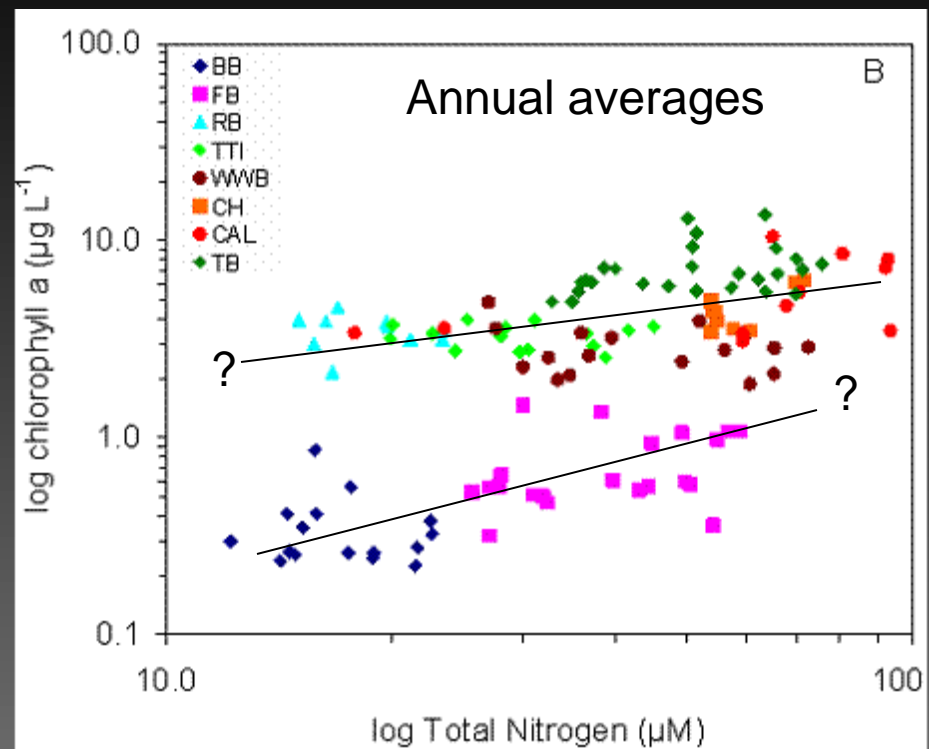
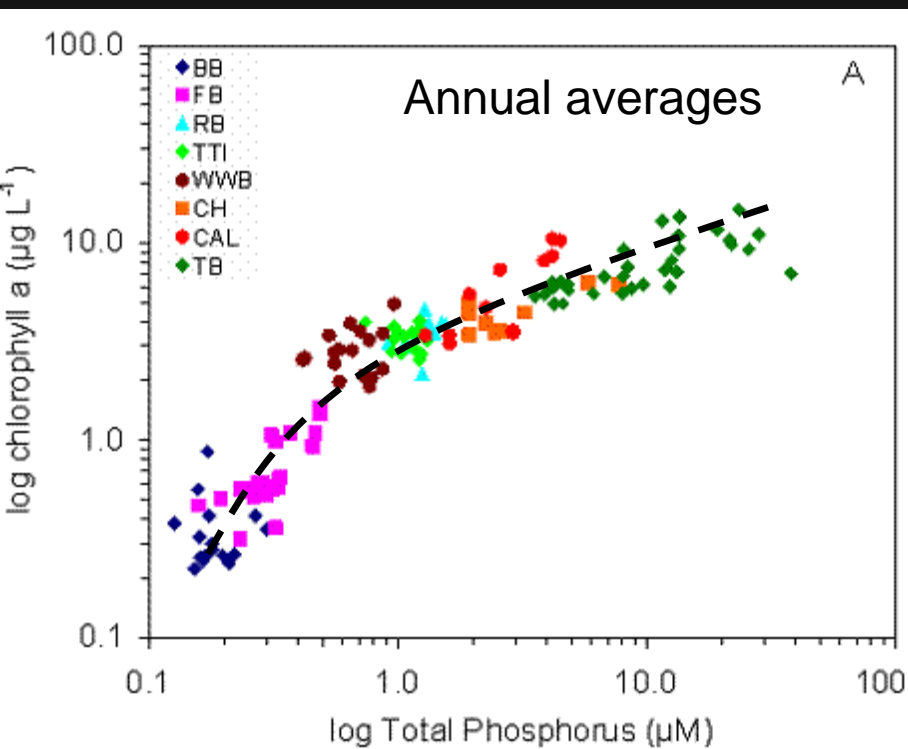
Chlorophyll a

Despite BB is subjected to higher TP and TN loads, its shorter Residence Time results in lower CHLa levels than those of FB

FATHOM
~ 3-6 months

Wang Model
~ 1 month

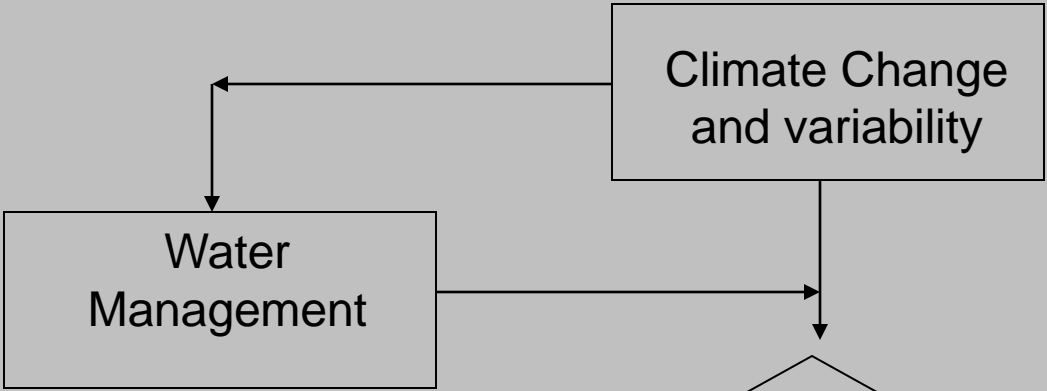




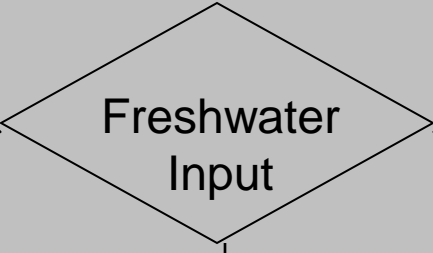
These results strongly suggest that TP is the main driver for phytoplankton biomass, coinciding with results from Hoyer et al (2002) for 300 shallow water coastal water bodies in Florida:

Florida Sites	Hoyer et al. (2002) Accounted Variance of CHLa	
	TP	TN
300	81%	46%

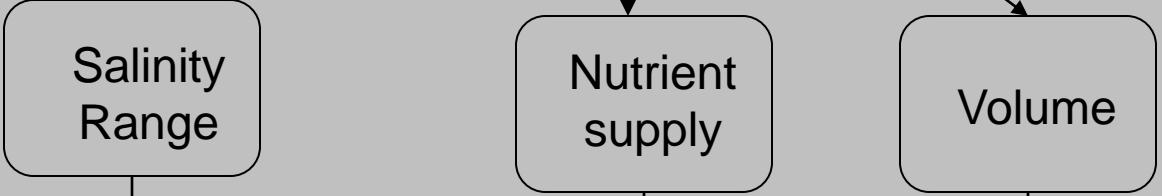
Forcing



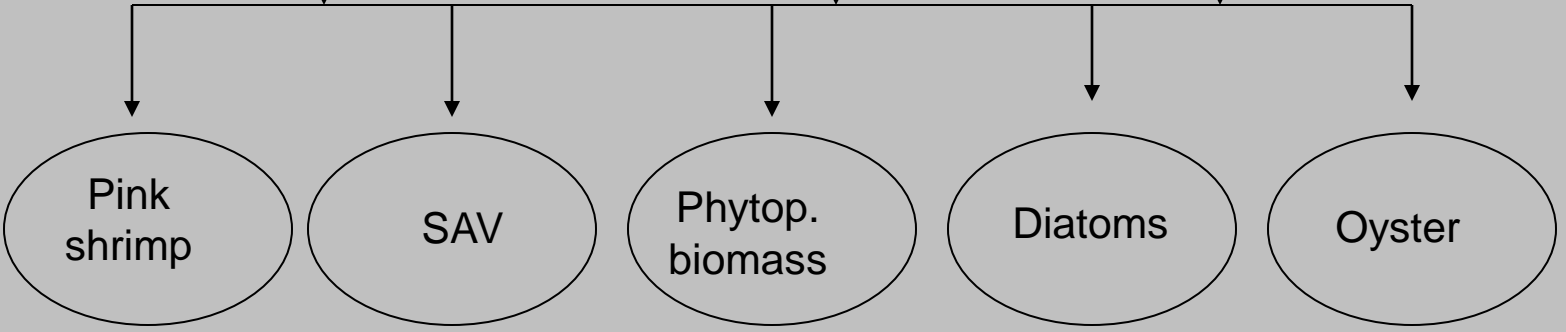
Driver



Stressor

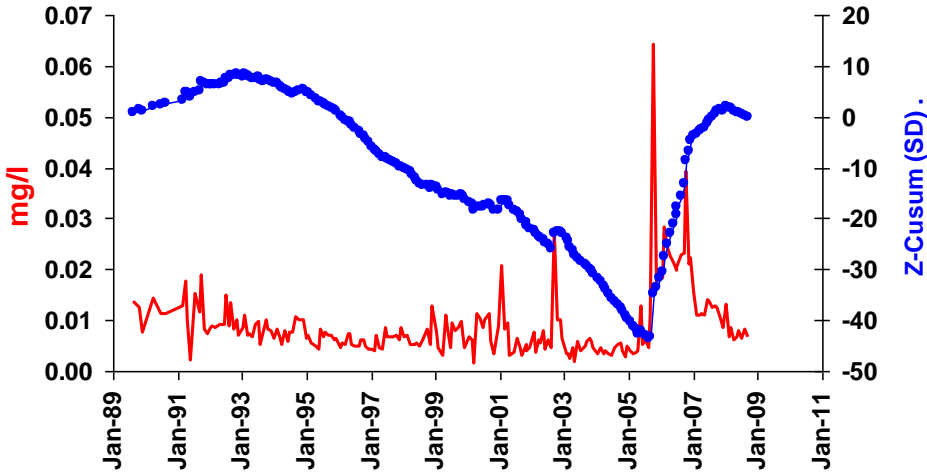


Indicator

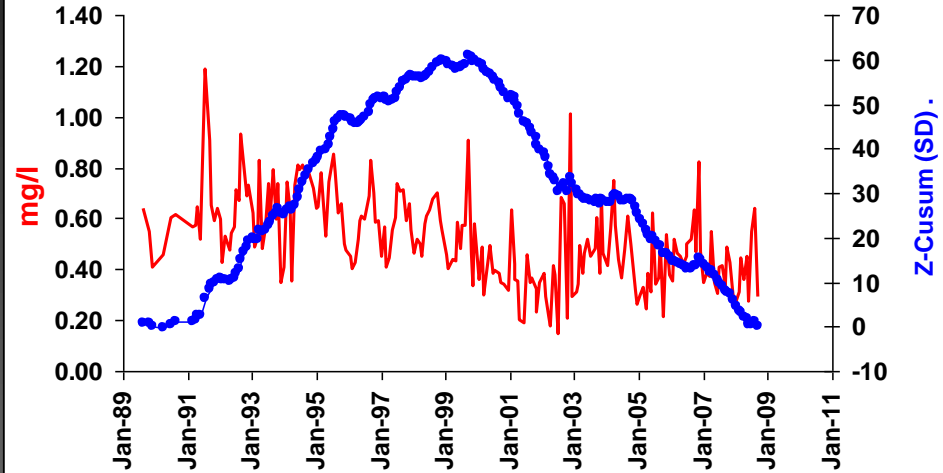


TRENDS

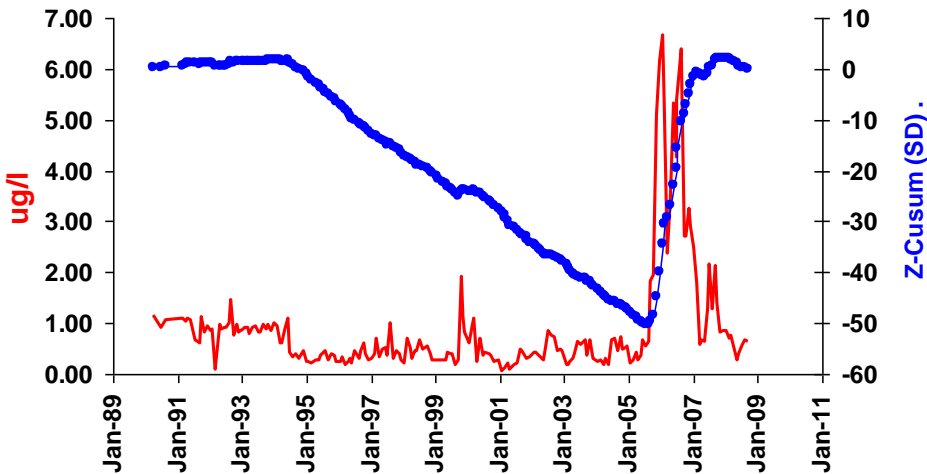
TP Manatee-Barnes



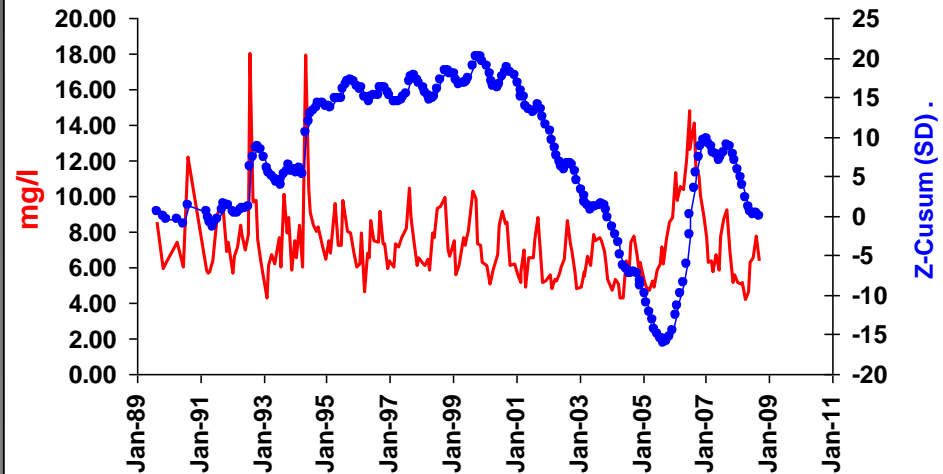
TN Manatee-Barnes



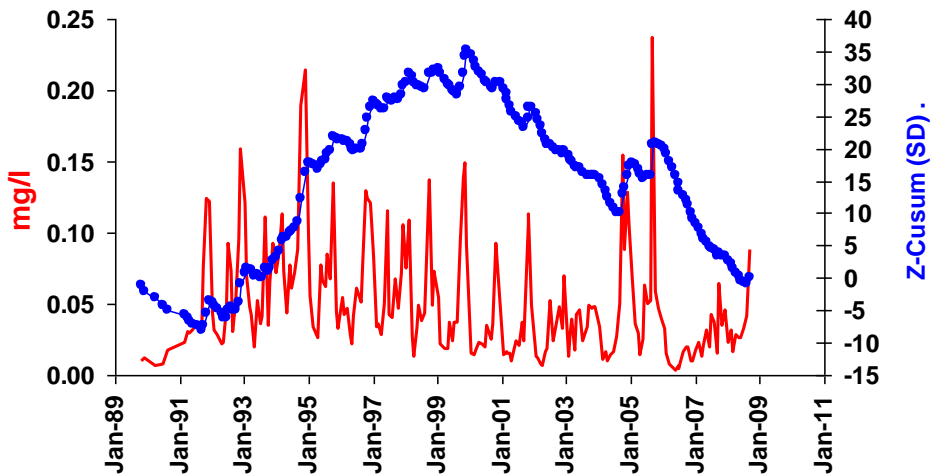
CHLa Manatee-Barnes



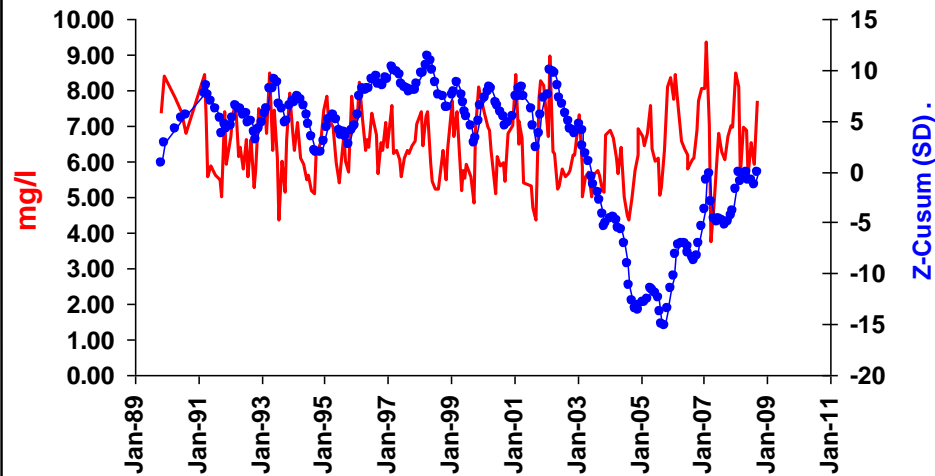
TOC Manatee-Barnes



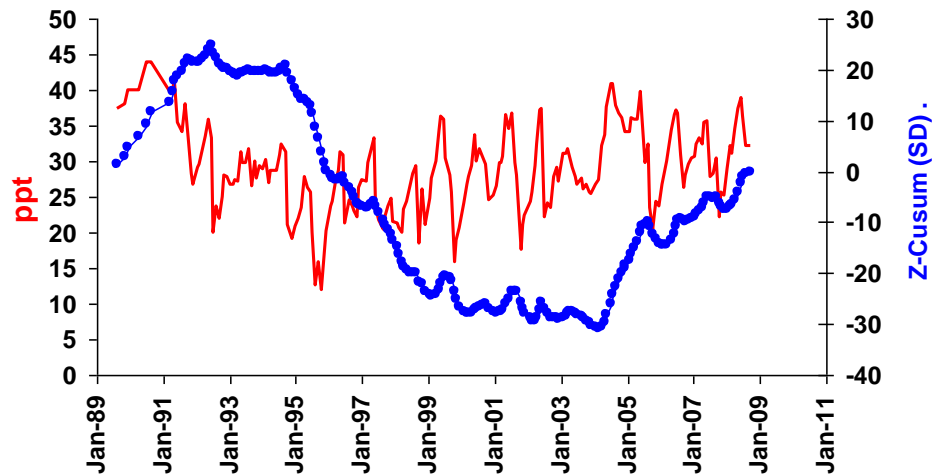
DIN Manatee-Barnes

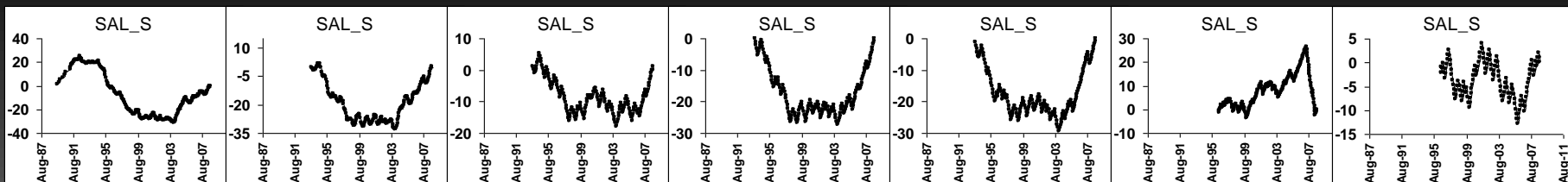
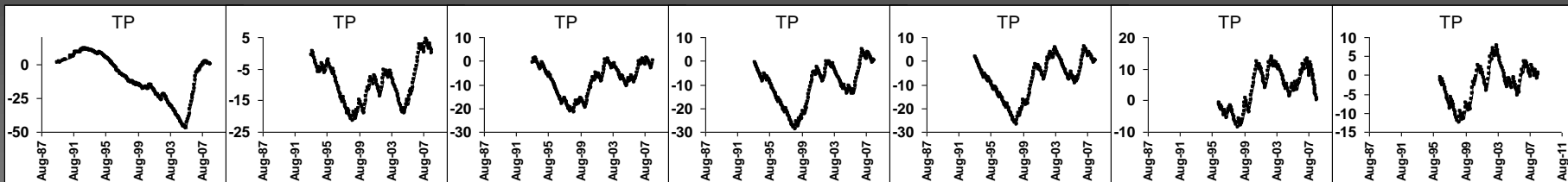
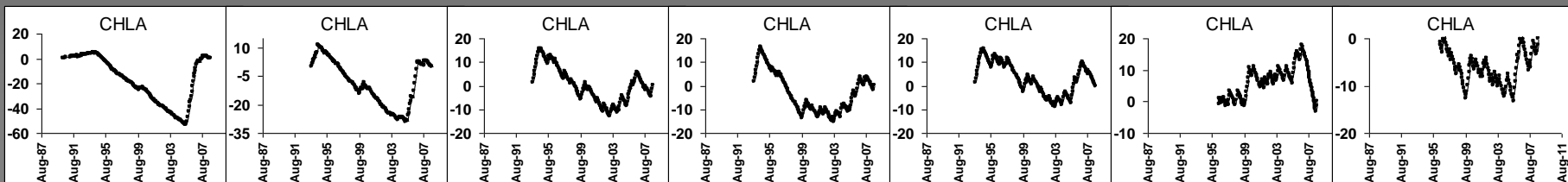
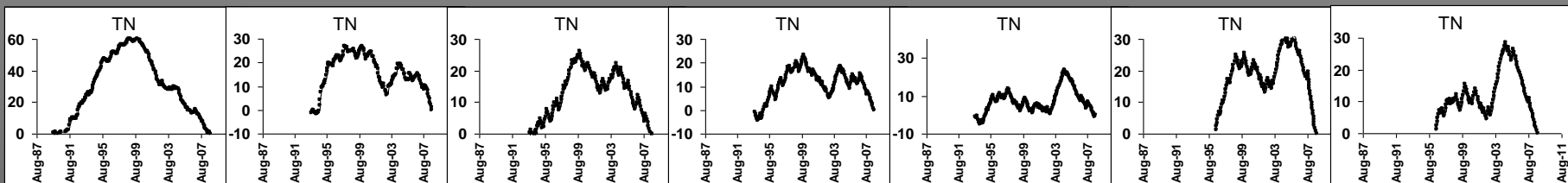
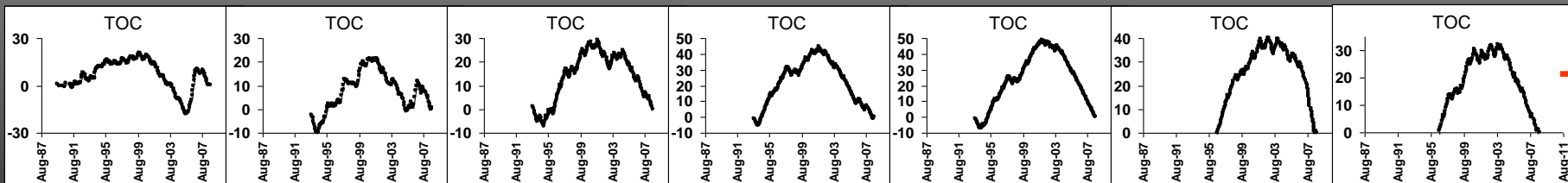
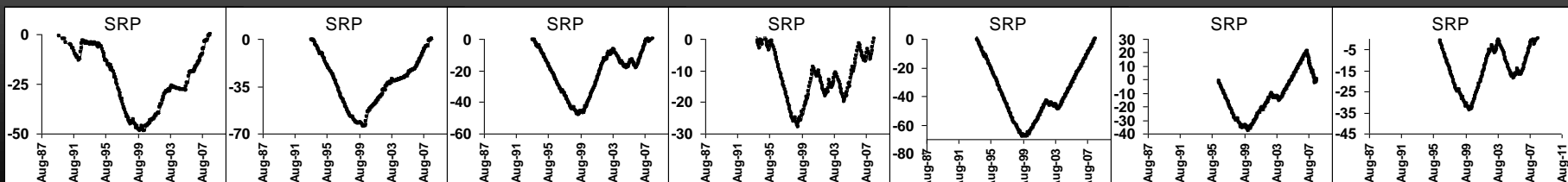


DO Manatee-Barnes



Salinity-B Manatee-Barnes

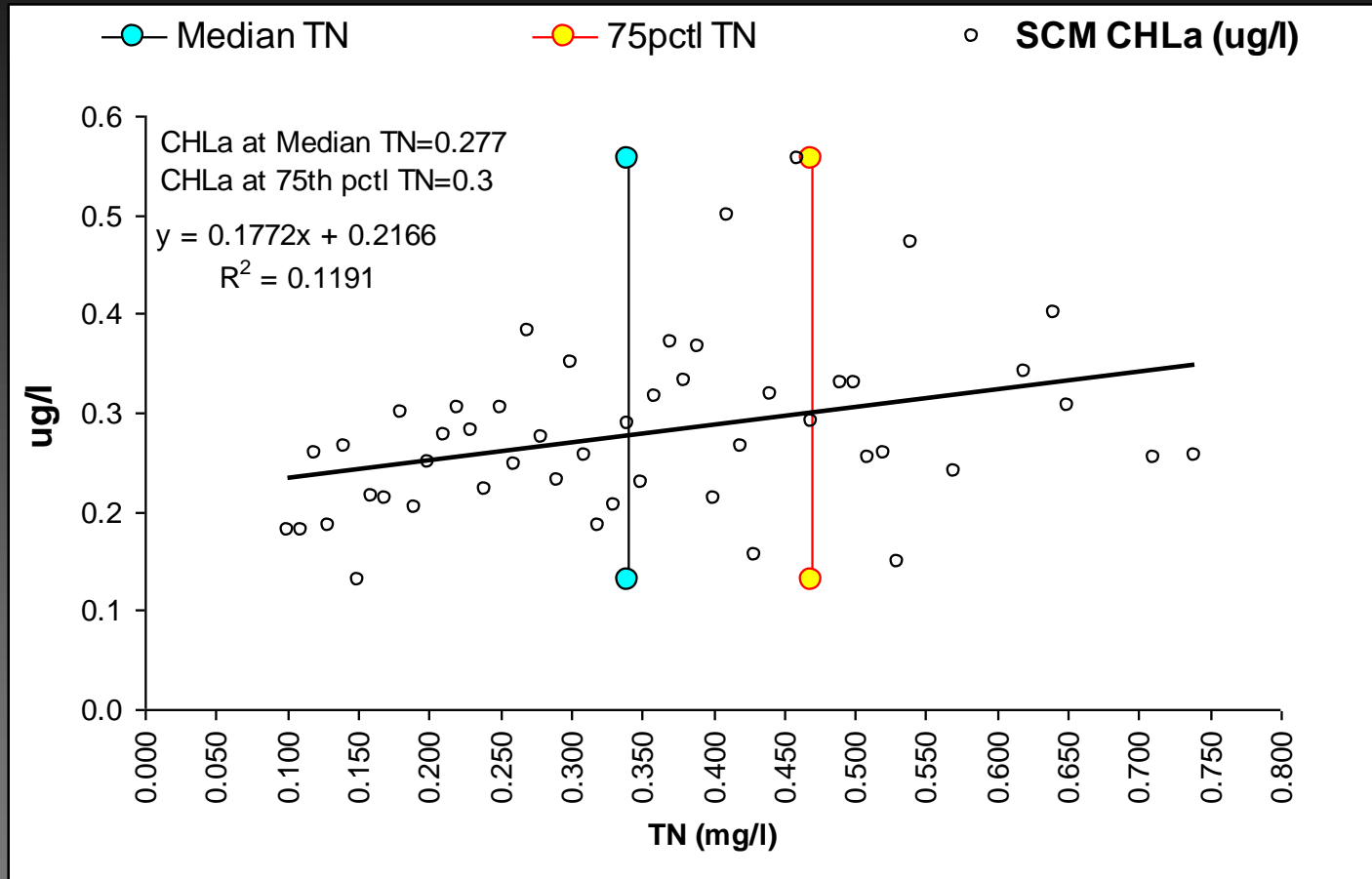


MBS**CARD****SCI****SCM****SCO****NCI****NCO****SAL****TP****CHLa****TN****TOC****SRP**

NUMERIC NUTRIENT CRITERIA DEVELOPMENT

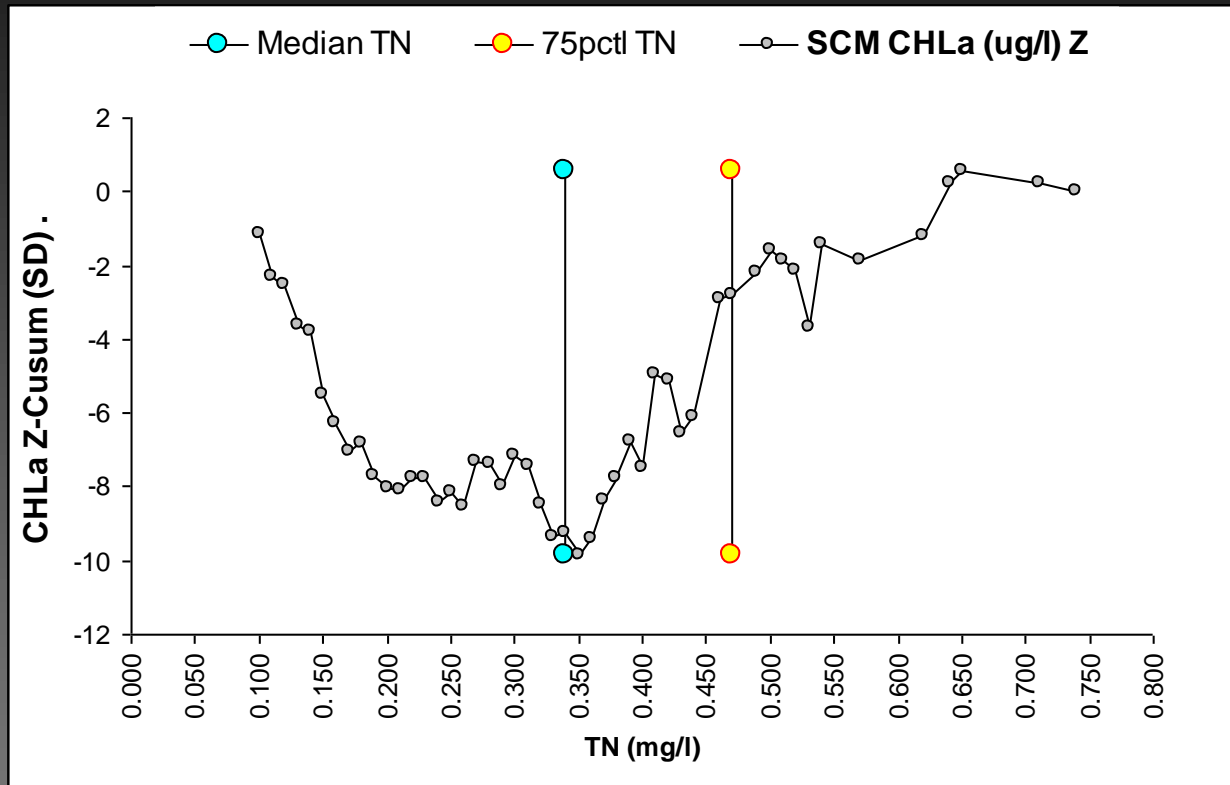
- Numeric criteria exclusively derived from statistics may fail to comply with its fundamental objective of being protective.
- Hence, we sought for assurance by studying the behavior of phytoplankton biomass (CHLa) along a nutrient gradients at each previously derived segment of BB

NUMERIC NUTRIENT CRITERIA DEVELOPMENT



Little can be obtained from a scatter plot like this one

NUMERIC NUTRIENT CRITERIA DEVELOPMENT



CHLa Z-cusum data plotted along the TN gradient readily indicate where below average CHLa values (segment of curve with negative slope) shift to predominantly above average CHLa concentrations (positive slopes). In this case, for South Central Mid BB the threshold is about 0.35 mg/l TN

	TN Threshold (mg/l)	Average CHLa below threshold (ug/l)	Average CHLa above threshold (ug/l)
CS	0.190	0.241	0.319
MBS	0.480	0.348	0.451
NCI	0.250	0.335	0.463
NCO	NT	NT	NT
NNB	0.250	1.359	1.700
SCI	0.480	0.287	0.350
SCM	0.350	0.247	0.316
SCO	0.190	0.195	0.242
SNB	0.240	0.848	1.079

NT= no trend

	TP Threshold (mg/l)	Average CHLa below threshold (ug/l)	Average CHLa above threshold (ug/l)
CS	DT	DT	DT
MBS	0.004	0.303	0.415
NCI	0.003	0.238	0.407
NCO	NT	NT	NT
NNB	0.007	1.418	1.604
SCI	0.006	0.287	0.313
SCM	0.007	0.257	0.297
SCO	DT	DT	DT
SNB	NT	NT	NT

NT= no trend

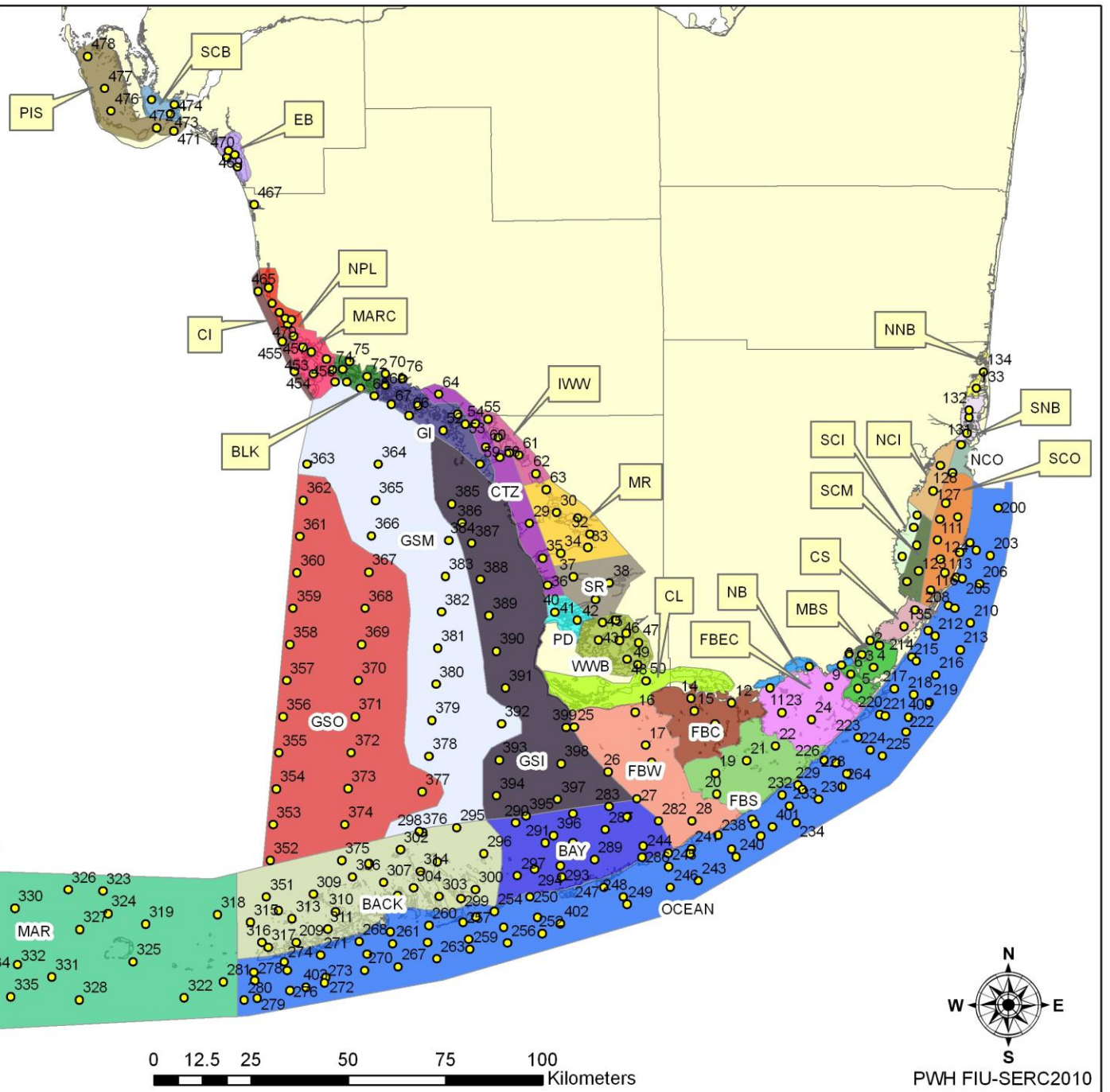
DT= declining trend

NUMERIC NUTRIENT CRITERIA DEVELOPMENT

- Similar procedure consisting of:
 - Subdivision of basins using Factor and Cluster analyses.
 - Exclusion of data points affected by storms or obvious impact.
 - Derivation of TN and TP thresholds using Z-Cusum data for CHLa along nutrient gradients has been performed for all 37 sub-basins in South Florida.

NUTRIENT CRITERIA SUBBASINS

BACK	MARC
BAY	MBS
BLK	MR
CI	NB
CL	NCI
CS	NCO
CTZ	NNB
DRTO	NPL
EB	OCEAN
FBC	PD
FBEC	PIS
FBS	SCB
FBW	SCI
GI	SCM
GSI	SCO
GSM	SNB
GSO	SR
IWW	WWB
MAR	





Greater Everglades Ecosystem Restoration

The Everglades: A Living Laboratory of Change
Planning, Policy and Science Meeting
Naples, Florida. July 12-16, 2010

Thank You!!!



FIU



Henry Briceño, Joseph N. Boyer, Peter Harlem,
Joffre Castro, William Nuttle, Frank Marshall and Bernard Cosby

Southeast Environmental Research Center

