9th INTECOL INTERNATIONAL WETLANDS CONFERENCE
WETLANDS IN A COMPLEX WORLD
JUNE 3-8, 2012
ORLANDO FLORIDA, USA

Interrelationships among hydrological, biodiversity and Land Use Features of the Pantanal and Everglades

Biogeochemical Segmentation and Derivation of Numeric Nutrient Criteria for Coastal Everglades waters.

FIU
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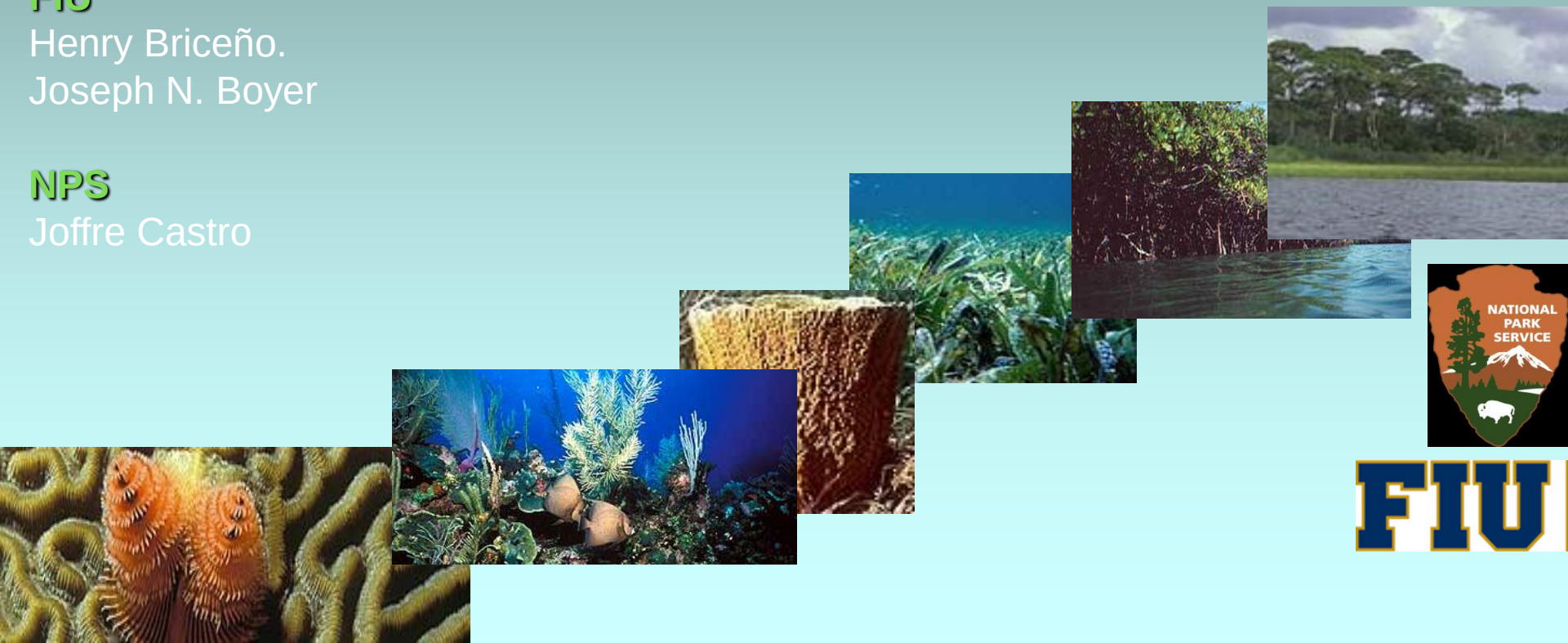
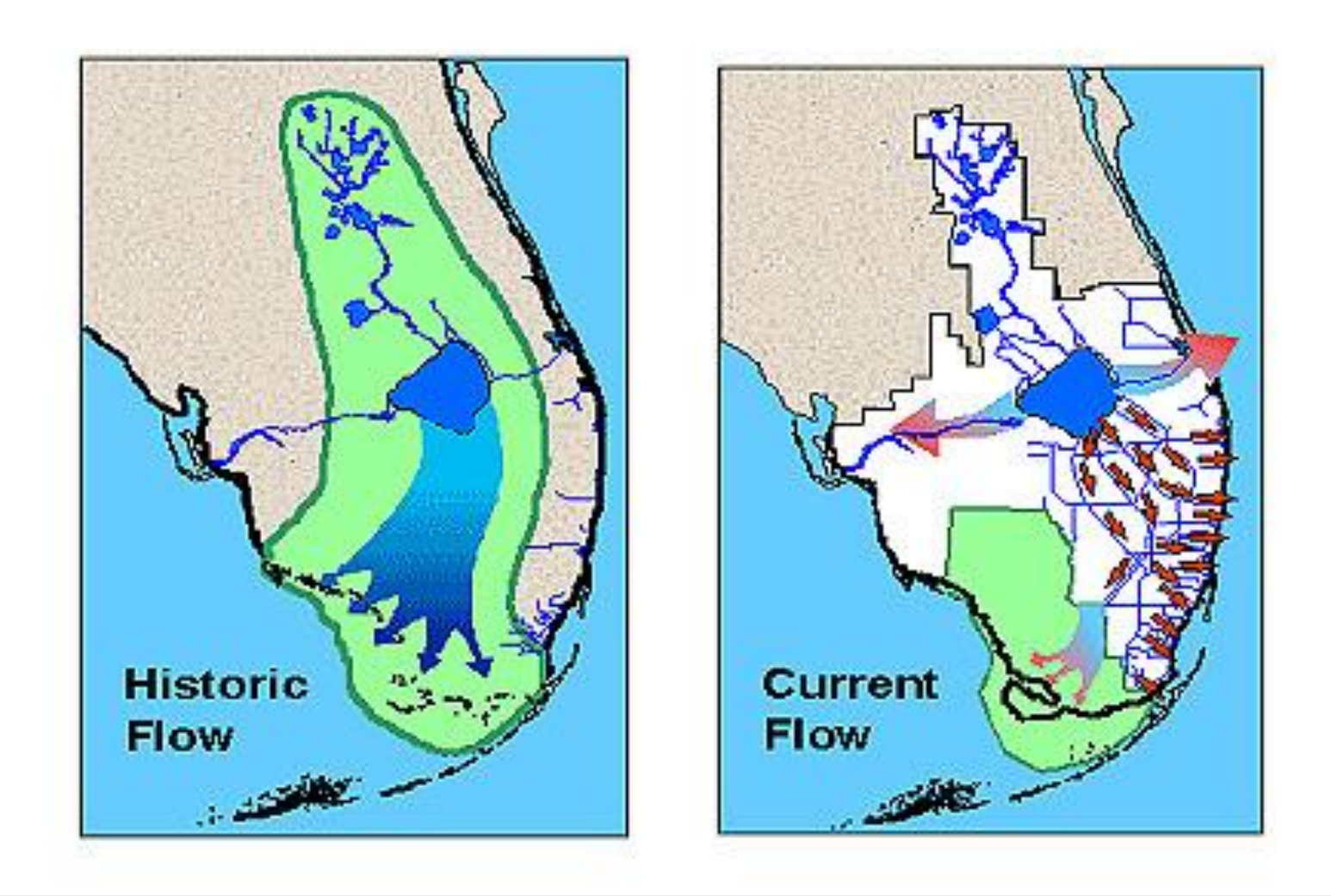
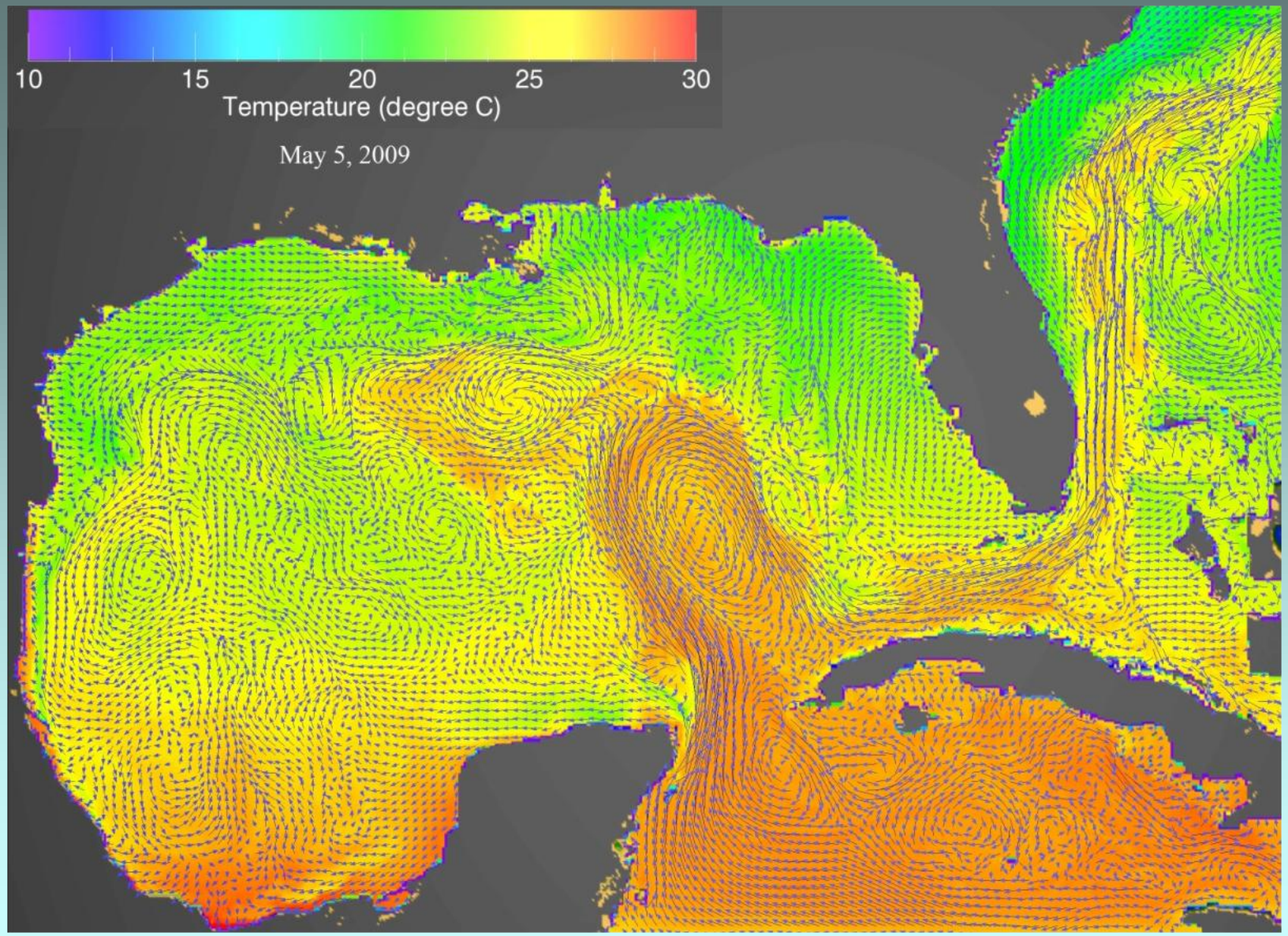


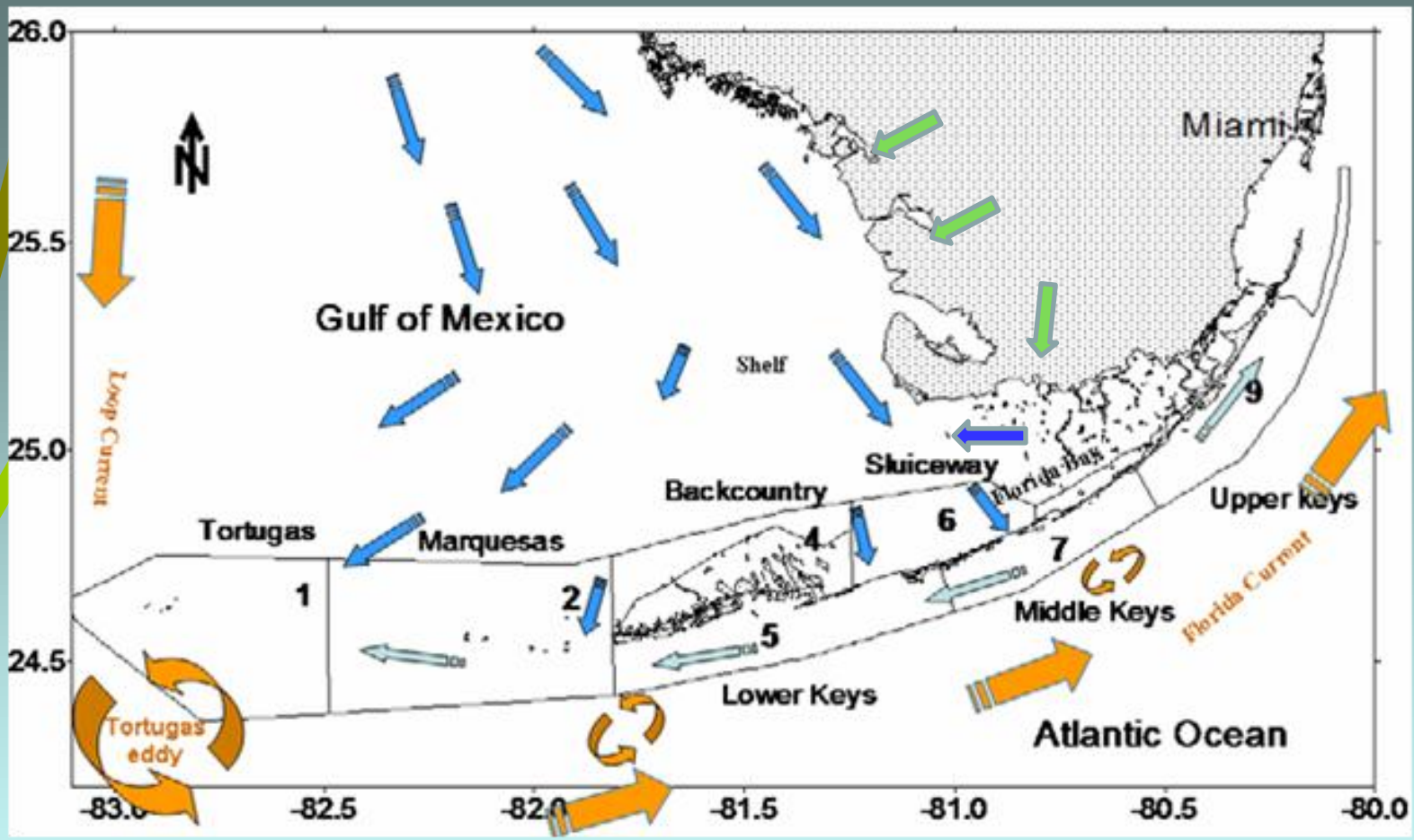
100 years of hydrology intervention

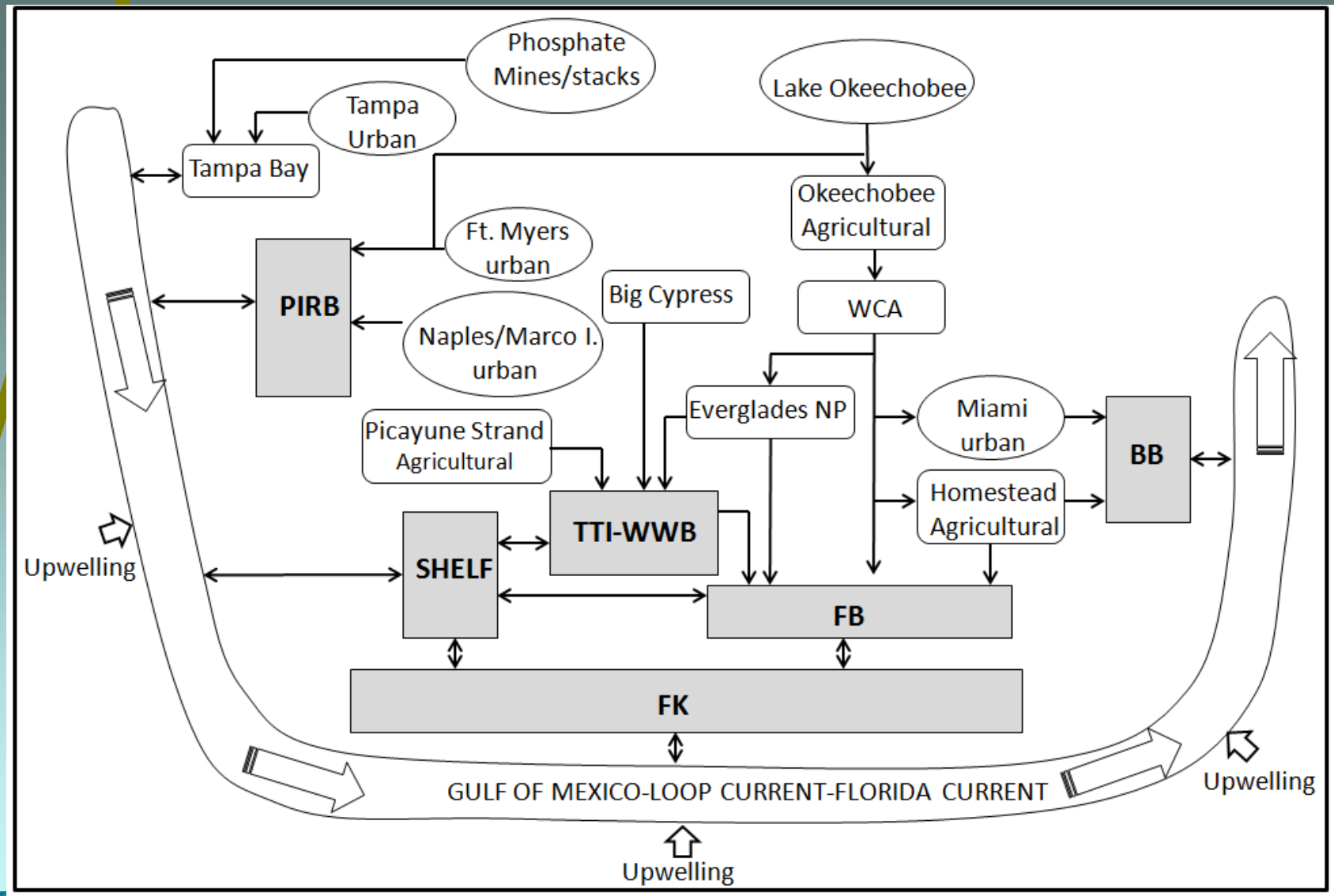


…urban development

Naples Bay
impacted by drainage, channelization, and urban development


10
15
20
25
30
Temperature (degree C)
May 5, 2009


26.0
25.5
25.0
24.5
-83.0
-82.5
-82.0
-81.5
-81.0
-80.5
-80.0
N
Miami
Gulf of Mexico
Shelf
Loop Current
Sluiceway
Florida Bay
Backcountry
Upper keys
Tortugas
Marquesas
1
2
4
5
6
7
9
Middle Keys
Florida Current
Lower Keys
Tortugas eddy
Atlantic Ocean


Phosphate Mines/stacks
Tampa Urban
Lake Okeechobee
Tampa Bay
Okeechobee Agricultural
Ft. Myers urban
PIRB
Big Cypress
WCA
Naples/Marco I. urban
Everglades NP
Miami urban
BB
Picayune Strand Agricultural
Homestead Agricultural
TTI-WWB
Upwelling
SHELF
FB
FK
GULF OF MEXICO-LOOP CURRENT-FLORIDA CURRENT
Upwelling
Upwelling

SEGMENTATION METHOD

Six basins, 350 stations

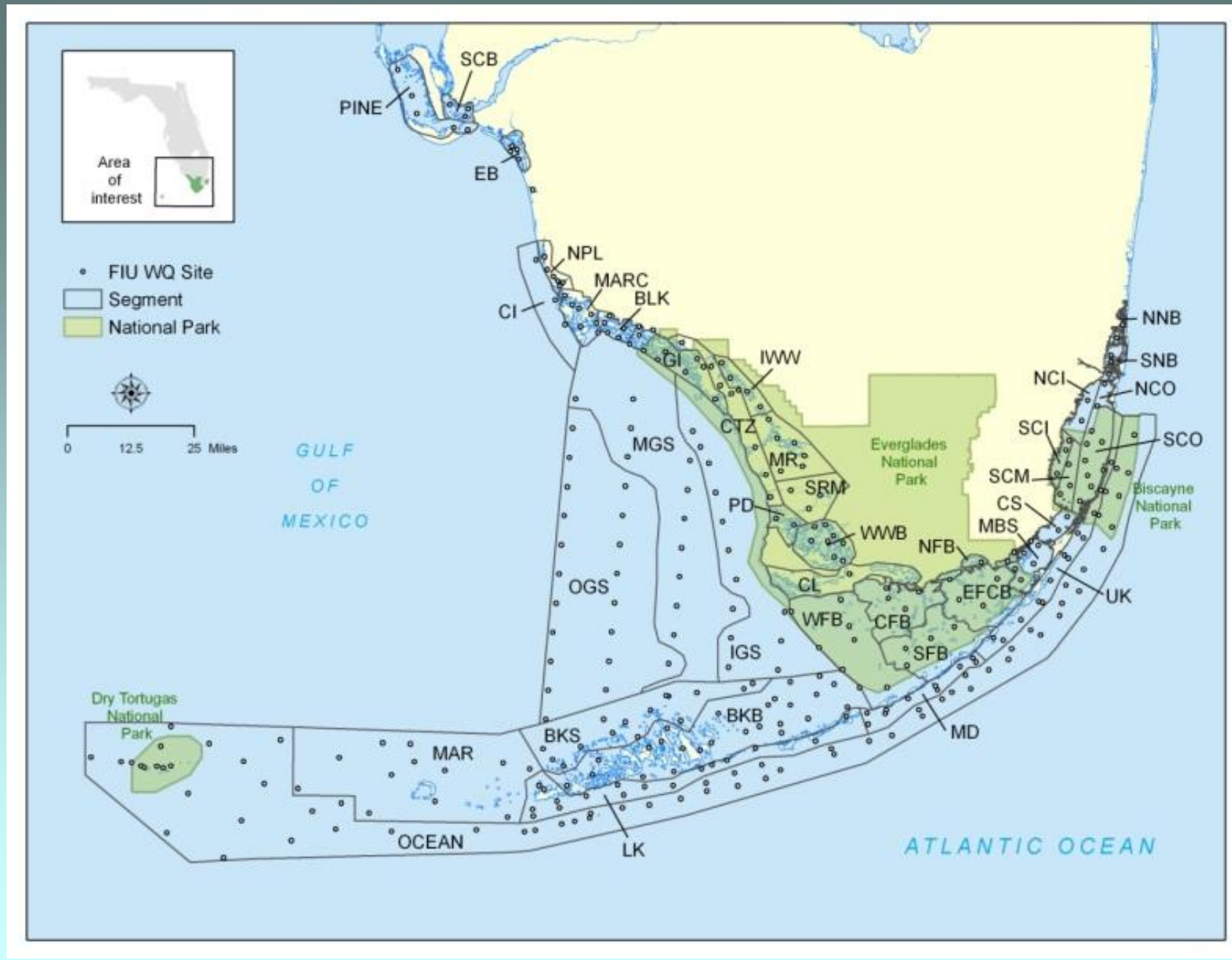
POR 1991 (1995)-1998.

NH4, NO2, TOC, TP, TN, NO3, TON, SRP, DO, Turbidity, Salinity, CHLa, Temperature

Factor Analysis (PC extraction)

Scores Mean, SD, Median, MAD

Hierarchical Clustering


Area of interest
FIU WQ Site
Segment
National Park
0 12.5 25 Miles
GULF OF MEXICO
ATLANTIC OCEAN
Everglades National Park
Biscayne National Park
Dry Tortugas National Park
PINE
SCB
EB
NPL
MARC
BLK
CI
GI
IWW
CTZ
MR
SRM
PD
MGS
OGS
IGS
WWB
NFB
CL
EFCB
WFB
CFB
SFB
UK
MD
BKB
BKS
MAR
OCEAN
LK
NNB
SNB
NCI
NCO
SCI
SCO
SCM
CS
MBS

NUMERIC NUTRIENT CRITERIA

The USEPA recommends three types of approaches for setting numeric nutrient criteria:

- reference condition approach

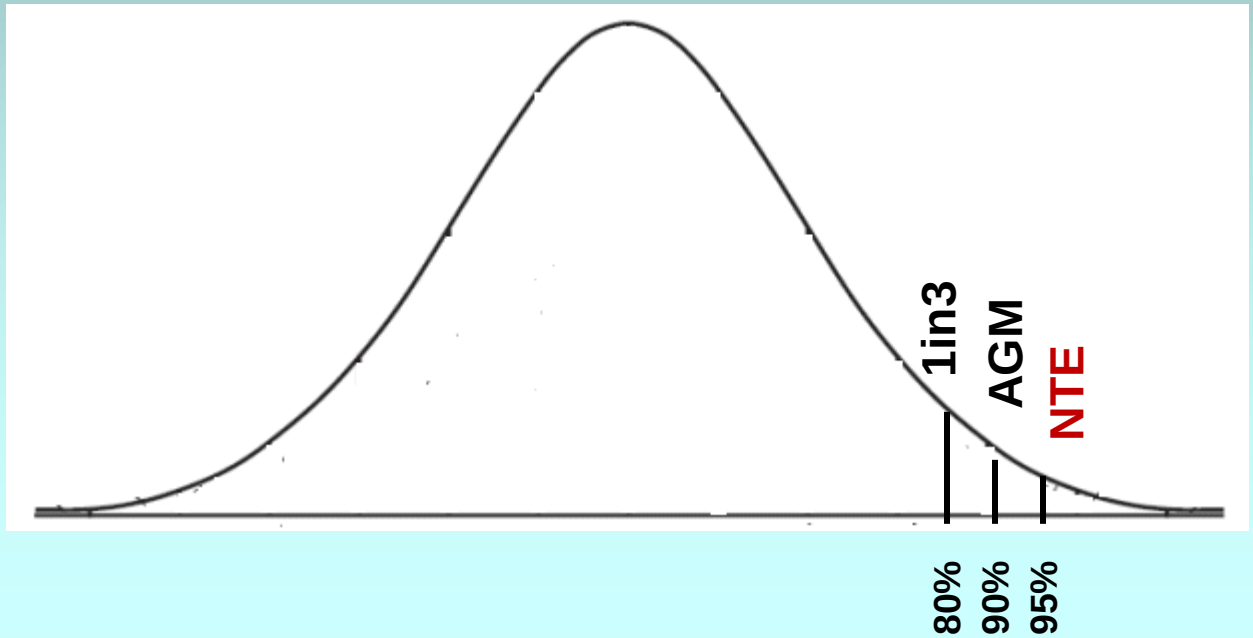
- stressor-response analysis

- mechanistic modeling.

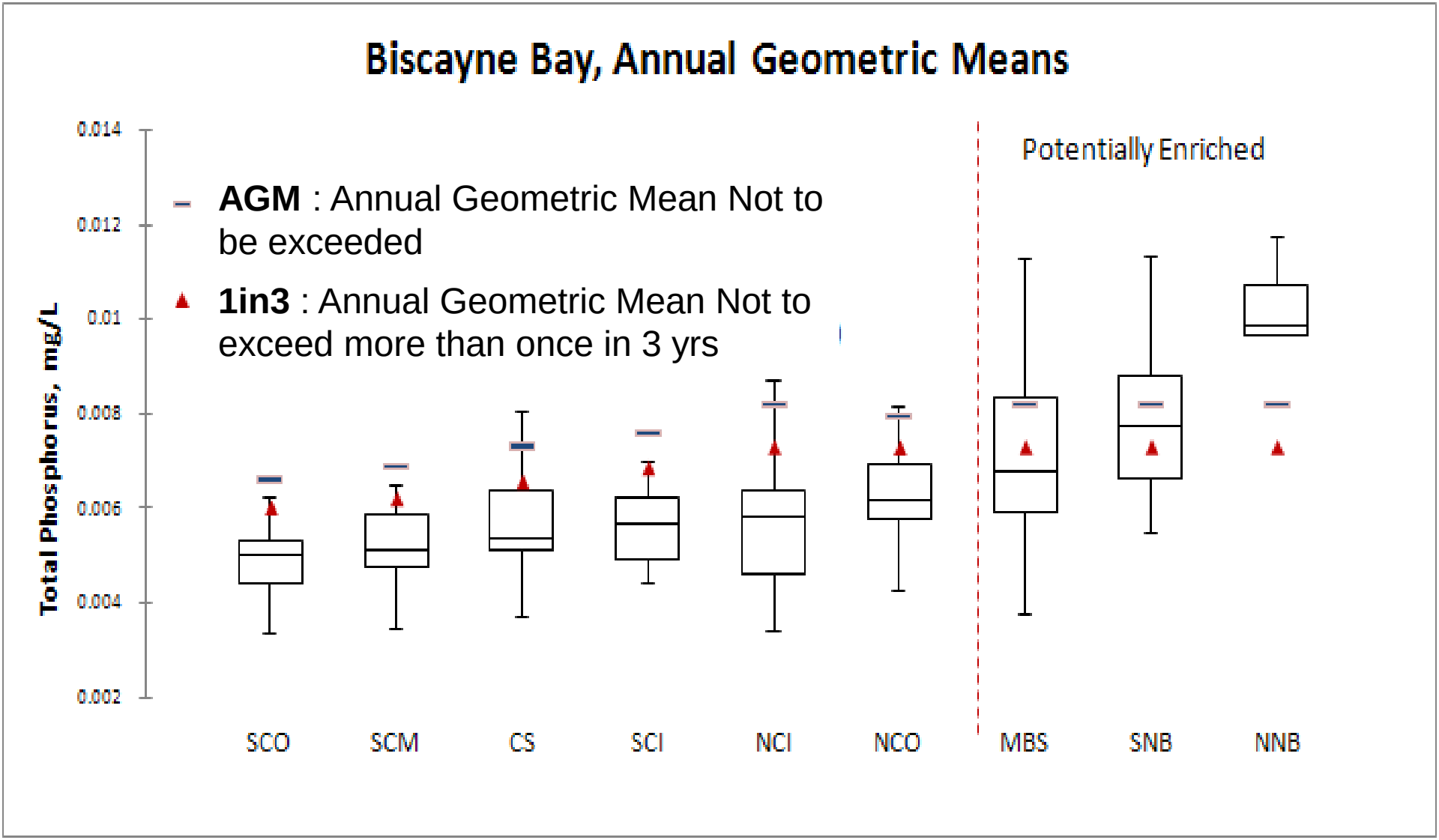
A Station's Never to Exceed (NTE) Limit. This limit is the highest possible level that a station concentration can reach at any time

A Segment's Annual Geometric Mean (AGM) Limit. This limit is the highest possible level a segment's average concentration of annual geometric means can reach in year

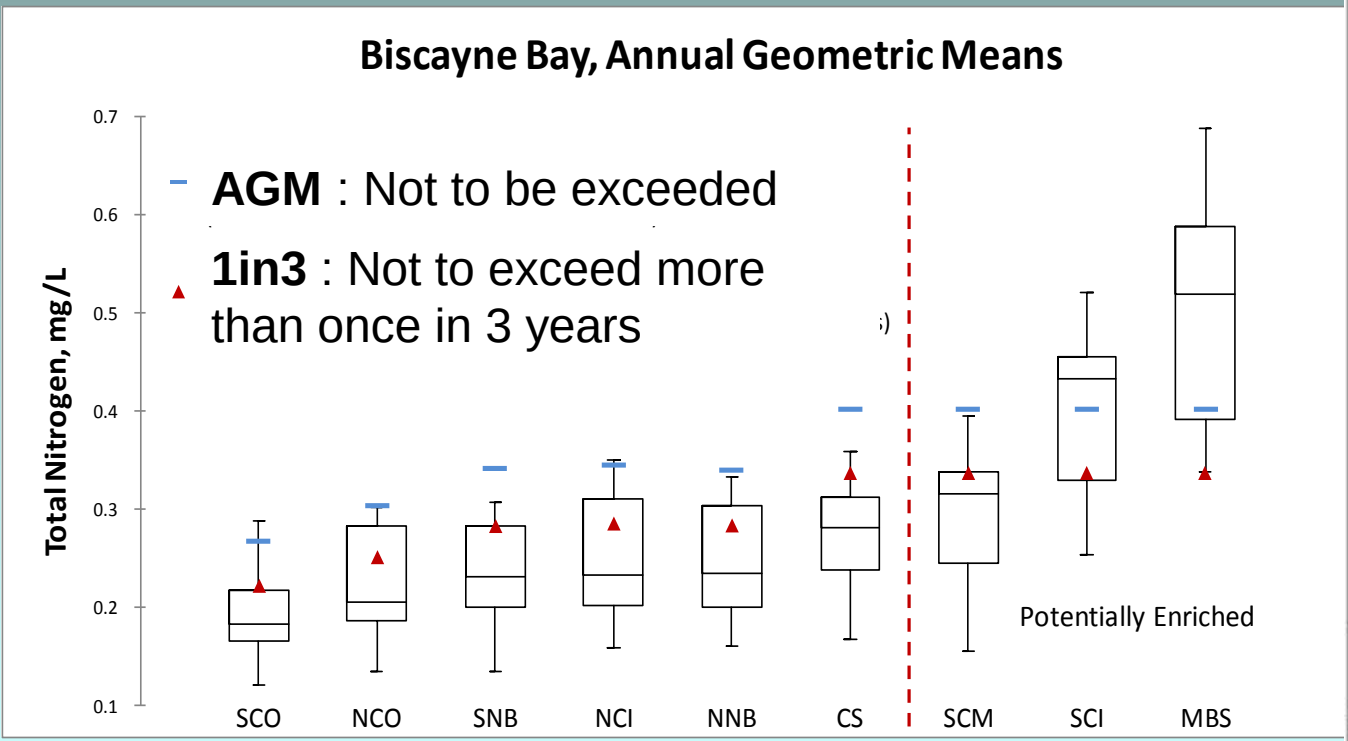
A Segment's 1-in-3 Years (1in3) Limit. This limit is the level that a segment average concentration of annual geometric means should be less than or equal to, at least, twice in three consecutive years.

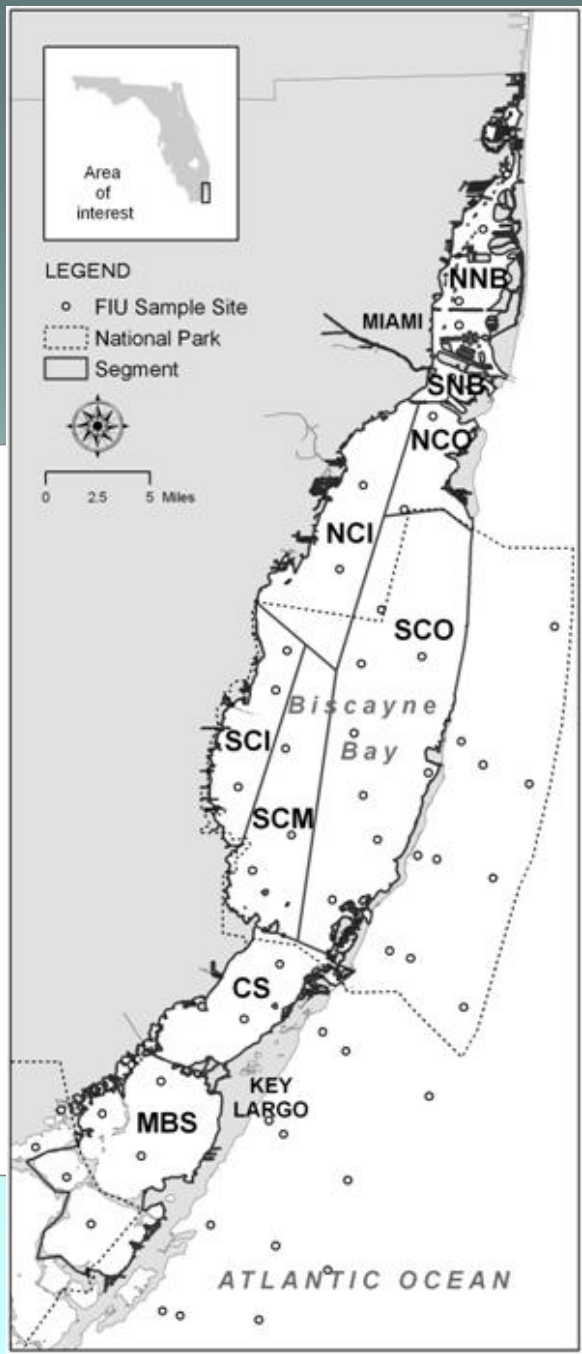


	Total phosphorus, in mg/L								
Limit	SCO	SCM	CS	SCI	NCI	NCO	MBS	SNB	NNB
AGM	0.007	0.007	0.007	0.008	0.008	0.008	0.008	0.008	0.008
1in3	0.006	0.006	0.007	0.007	0.007	0.007	0.007	0.007	0.007



Limit	Total Nitrogen, in mg/L								
	SCO	NCO	SNB	NCI	NNB	CS	SCM	SCI	MBS
AGM	0.27	0.30	0.34	0.35	0.34	0.40	0.40	0.40	0.40
1in3	0.22	0.25	0.28	0.29	0.28	0.34	0.34	0.34	0.34

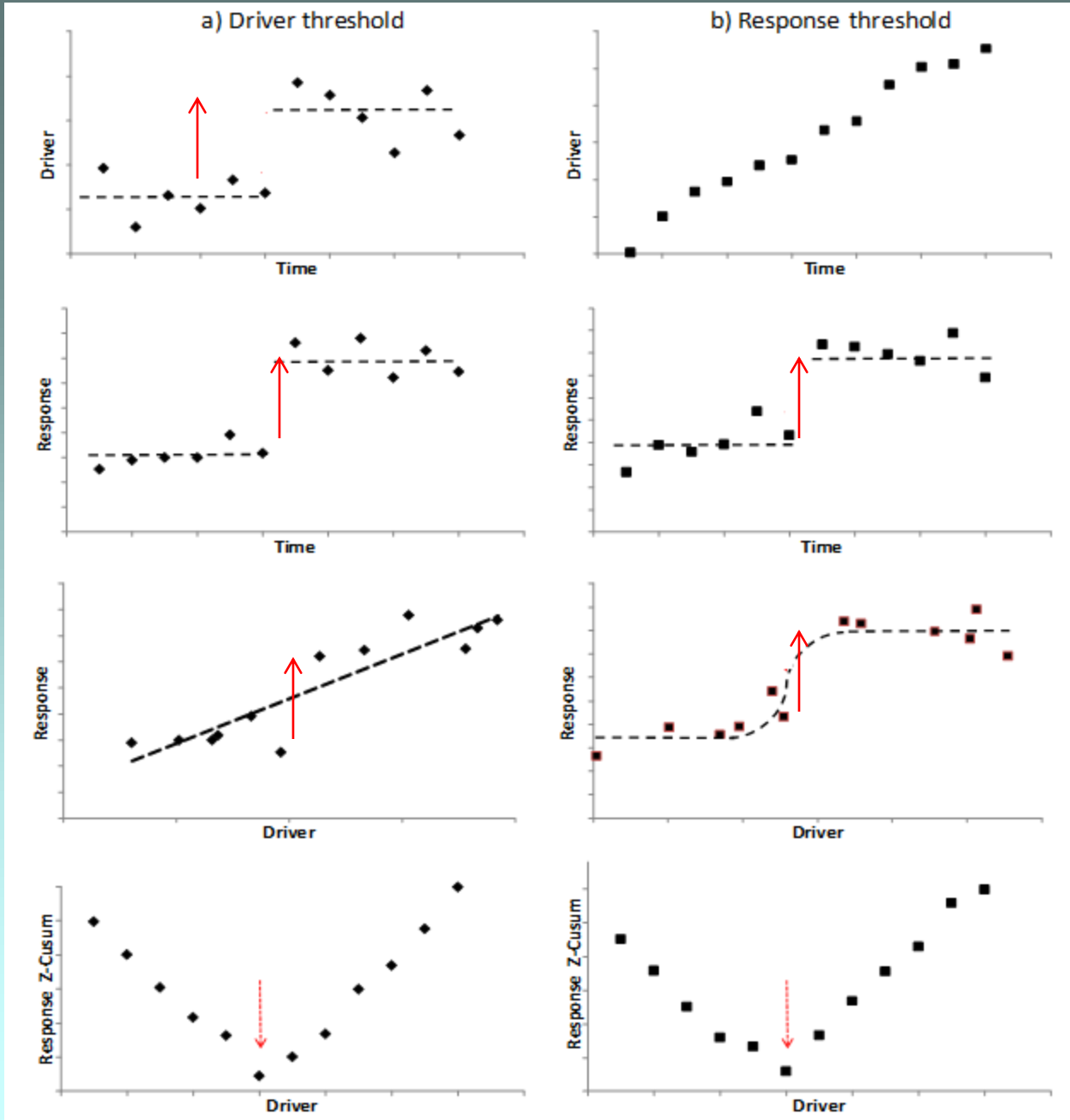




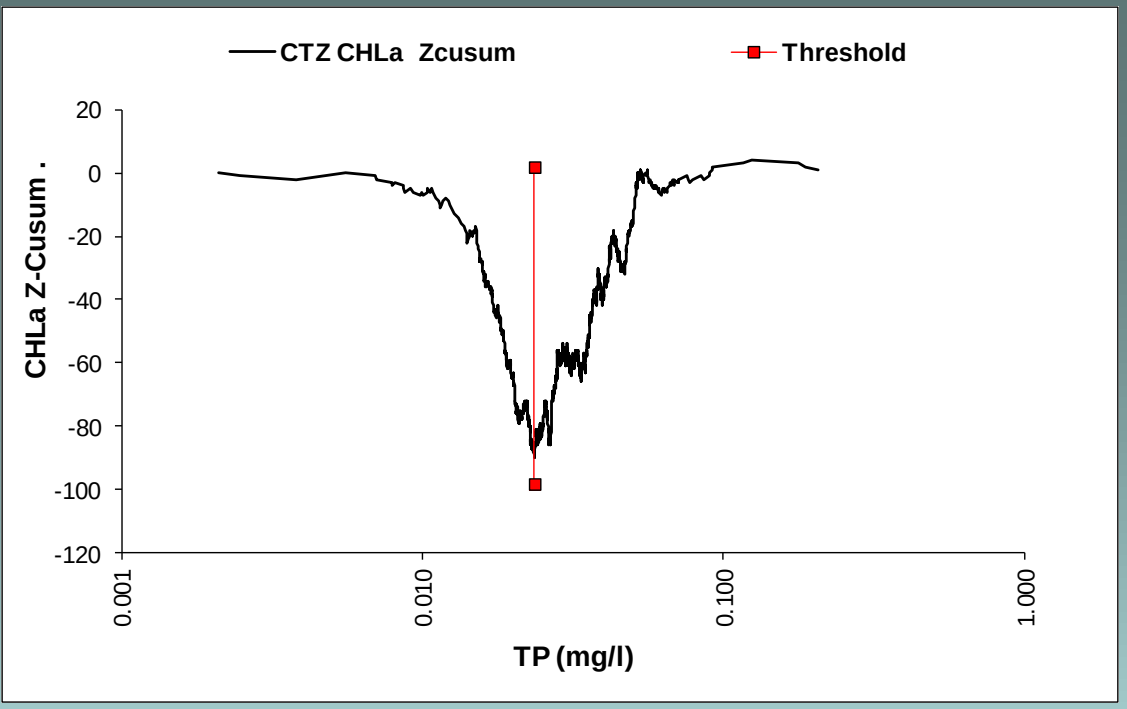
THRESHOLD ANALYSIS

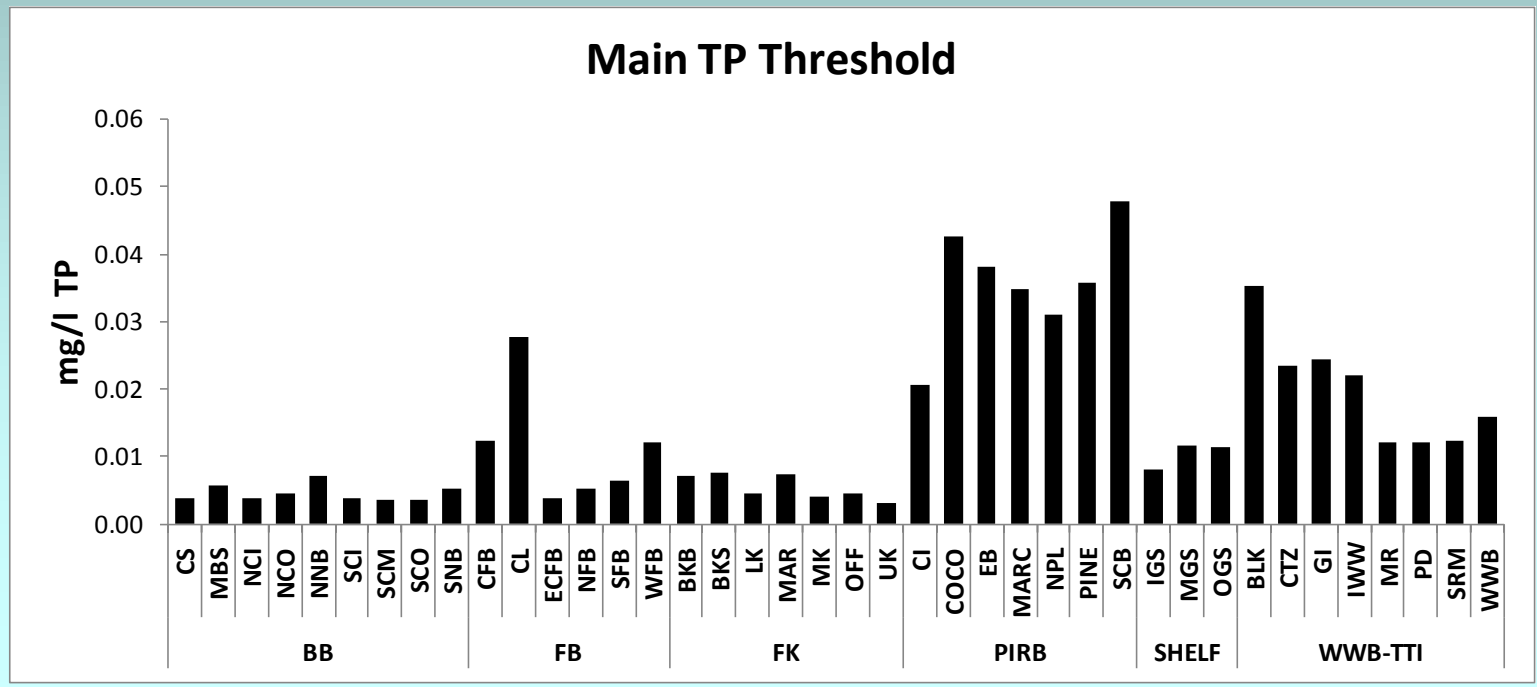
Regime Shift Detection methods (Rodionov 2004)

Cumulative deviations from mean method



Modified after Andersen et al 2008


CTZ CHLa Zcusum
Threshold
CHLa Z-Cusum .
20
0
-20
-40
-60
-80
-100
-120
0.001
0.010
0.100
1.000
TP (mg/l)


Main TP Threshold
mg/l TP
0.06
0.05
0.04
0.03
0.02
0.01
0.00
CS
MBS
NCI
NCO
NNB
SCI
SCM
SCO
SNB
CFB
CL
ECFB
NFB
SFB
WFB
BKB
BKS
LK
MAR
MK
OFF
UK
CI
COCO
EB
MARC
NPL
PINE
SCB
IGS
MGS
OGS
BLK
CTZ
GI
IWW
MR
PD
SRM
WWB
BB
FB
FK
PIRB
SHELF
WWB-TTI

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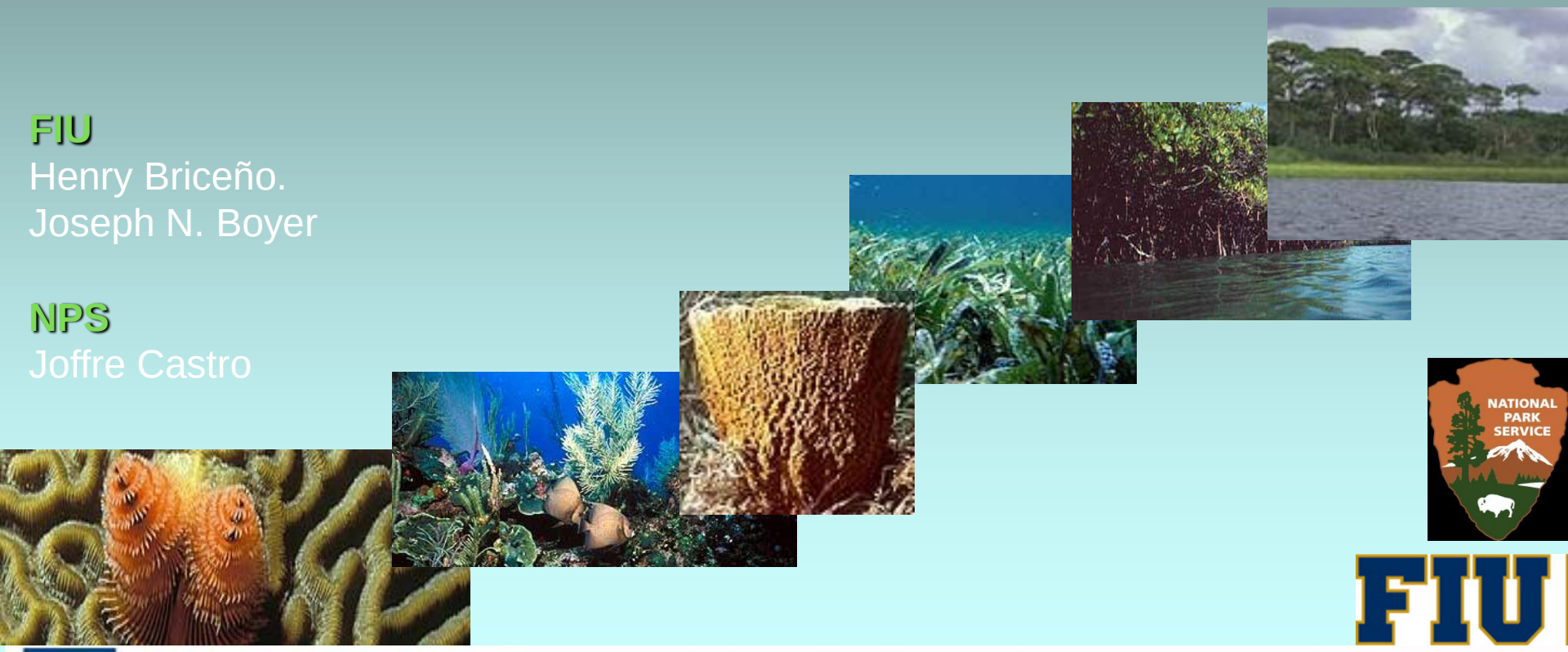

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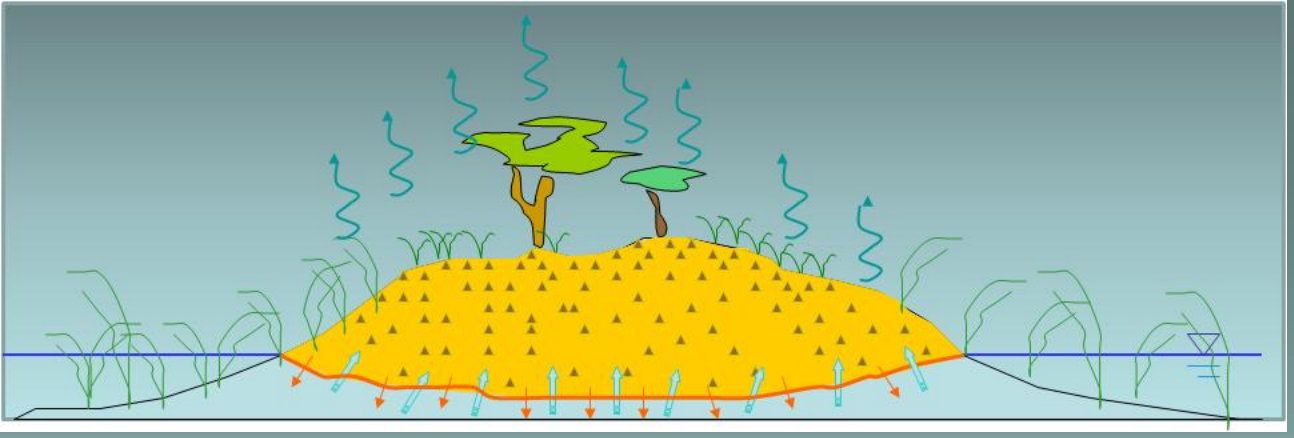
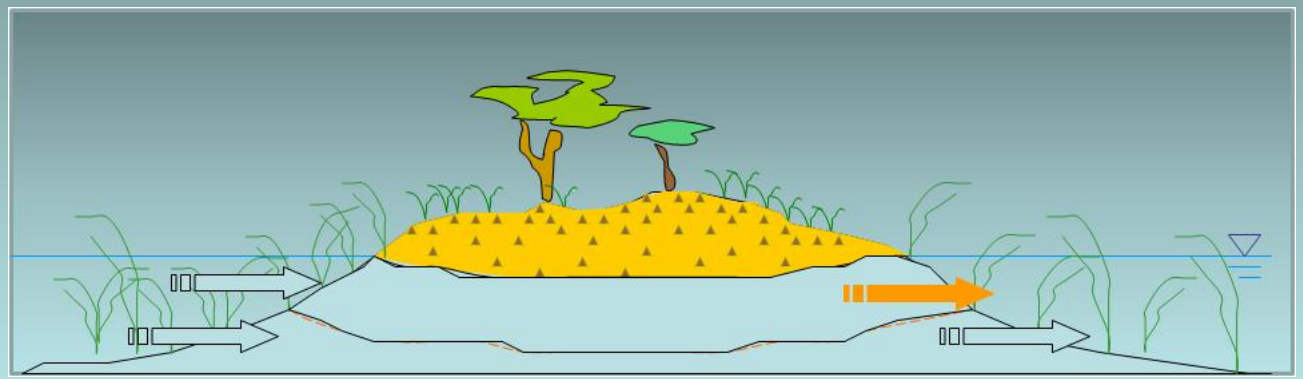
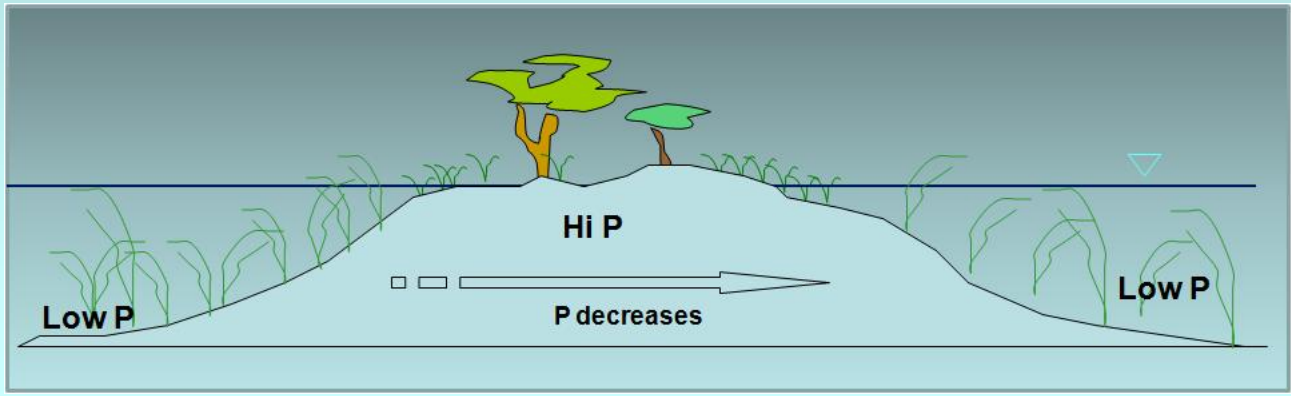
Hydroperiod







	Biscayne Bay	Florida Bay	Florida Keys	Whitewater Bay-10,000 Islands	Shelf	Pine Island-Rookery Bay
POR	Jun/96 to Sep/08	Mar/91 to Dec/07	Mar/95-Oct/09	Sep/92-Sep/08	May/95-Sep/07	Jan/99-Sep/09
Input Variables for Factor Analysis	TN TP CHLA TOC SAL_S DO_S TURB NOX NO2 NH4 SRP	TN TP CHLA TOC SAL DO TURB TON NO3 NO2 NH4 SRP TEMP	TN TP CHLA TOC SAL DO TURB TEMP	TN TP CHLA TOC SAL DO TURB NH4	TP TN CHLA NOX NH4 TOC SAL_S DO_S TURB	TN TP CHLA TOC SAL_S DO_S TURB NO3 NO2 NH4 SRP
Stations	30	28	155	47	49	29
Factors	5	6	4	4	4	5
Acct Variance	73%	79%	66%	75%	63%	81%
Clusters	n=9 Card Sound (CS) North Central Inshore (NCI) North Central Outter (NCO) Northern North Bay (NNB) South Central Inshore (SCI) South Central Mid Bay (SCM) South Central Outter (SCO) Southern North Bay (SNB) Manatee-Barnes Sound (MBS)	n=6 Central Florida B. (CFB) Eastern-Central (ECFB) North Florida B. (NFB) Coastal Lakes (CL) South Florida B. (SFB) West Florida B. (WFB)	n=7 Back Bay (BKB) Back Shelf (BKS) Lower Keys (LK) Middle Keys (MK) Upper Keys (UK) Marquesas (MAR) Offshore (OFF)	n=8 Black River (BR) Coastal Transition Z. (CTZ) Gulf Islands (GI) Internal Waterways (IWW) Mangrove Rivers (MR) Ponce de Leon (PD) Shark River Mouth (SRM) Whitewater Bay (WWB)	n=3 Inner (IGS) Mid (MGS) Outter (OGS)	n=7 Collier Inshore (CI) Estero Bay (EB) Marco Island (MARC) Naples Bay (NB) Pine Island S. (PINE) San Carlos B. (SCB) Cocohatchee (COCO)