

**DIATOM-BASED INFERENCES OF ENVIRONMENTAL CHANGE  
IN FLORIDA BAY AND ADJACENT COASTAL WETLANDS  
OF SOUTH FLORIDA**

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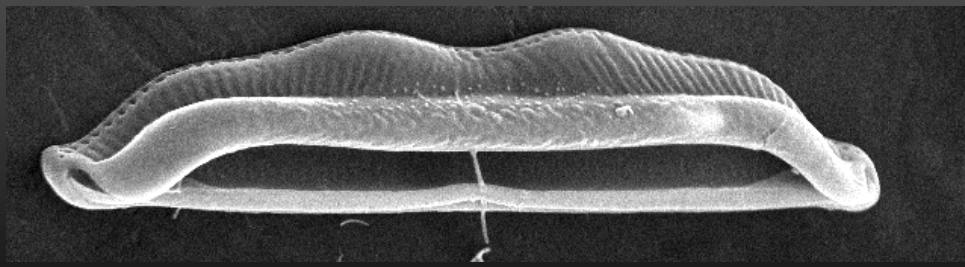
**Southeast Environmental Research Center  
Florida International University**

# STUDY OBJECTIVES

- TO DETERMINE WHETHER SPATIAL VARIABILITY IN THE COASTAL HABITAT MOSAIC IS GREATER THAN SEASONAL VARIABILITY IN DIATOM ASSEMBLAGE COMPOSITION
- TO DETERMINE THE PHYSICO-CHEMICAL CONTROLS ON SPECIES COMPOSITION IN ORDER TO PRODUCE QUANTITATIVE PREDICTION MODELS FOR SALINITY AND WATER NUTRIENTS
- TO DETERMINE WHETHER THE AVAILABILITY AND QUALITY OF COMMON SUBSTRATA (I.E., PLANKTON, UNDERWATER VEGETATION, BARE SEDIMENTS) CAN BE RELIABLY PREDICTED FROM DIATOMS
- TO RECONSTRUCT SALINITY AND WATER NUTRIENTS FROM DIATOMS IN FLORIDA BAY SEDIMENT CORES

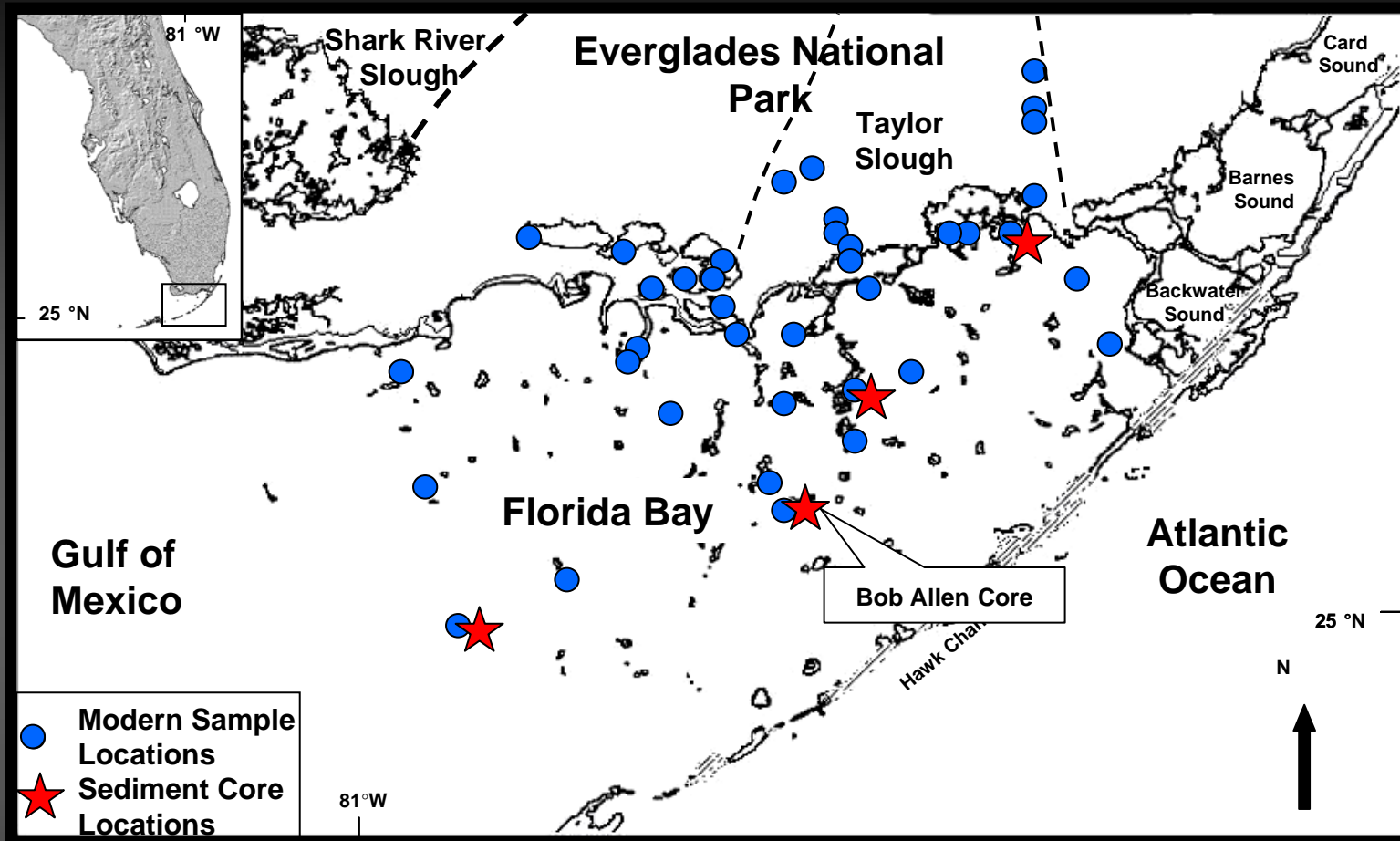
# DIATOMS - POWERFUL AND SENSITIVE PALEOECOLOGICAL INDICATORS

- UBIQUITOUS OCCURENCE IN FRESH, BRACKISH AND MARINE ENVIRONMENTS
- NARROW TOLERANCES AROUND OPTIMA FOR MANY ENVIRONMENTAL VARIABLES
- RAPID RESPONSE OF DIATOM COMMUNITIES TO CHANGING ENVIRONMENTAL CONDITIONS
- HIGH SPECIES DIVERSITY AND NICHE SPECIFICITY
- SUBSTANTIAL VALVE PRESERVATION POTENTIAL





# STUDY AREA



# SAMPLE COLLECTION

## SEDIMENT CORING



Base of Bob Allen core



## MODERN COLLECTIONS



PLANKTON



EPIPELON



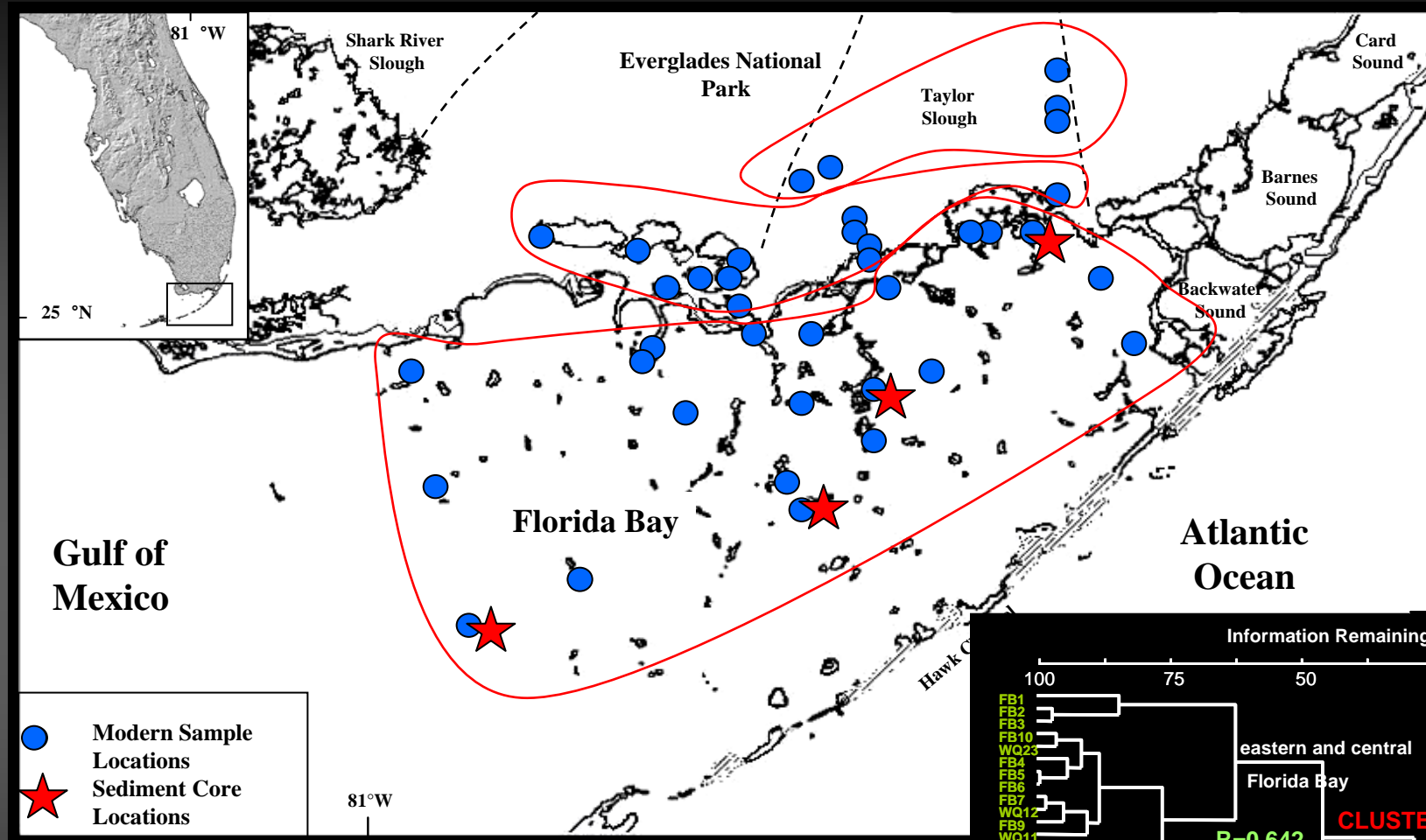
WATER QUALITY



EPIPHYTON

**CORES X-RAYED, Pb210, C14 dated**

# DIATOM ASSEMBLAGE CLUSTERS



## DIATOM ASSEMBLAGE DIFFERENCES

Spatial:

C1 vs. C3  $R=1$

C1 vs. C2  $R=0.95$

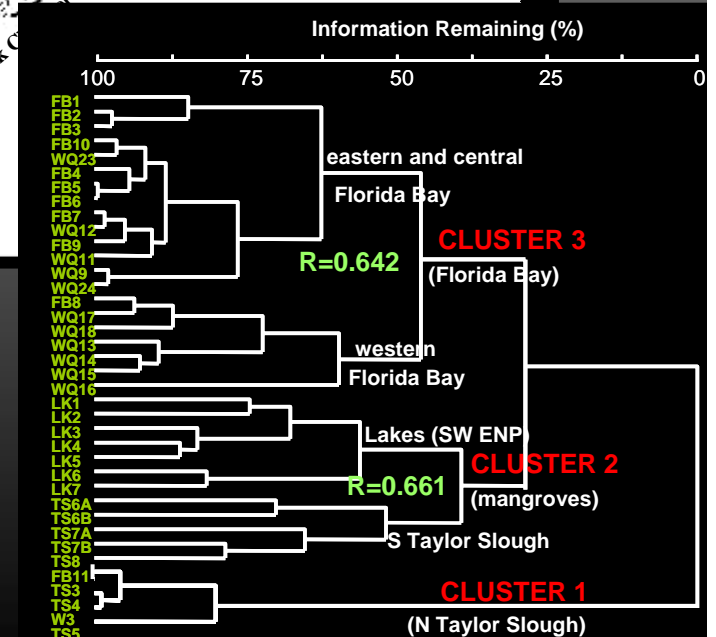
C2 vs. C3  $R=0.74$

Seasonal:

C1  $R=0.04$

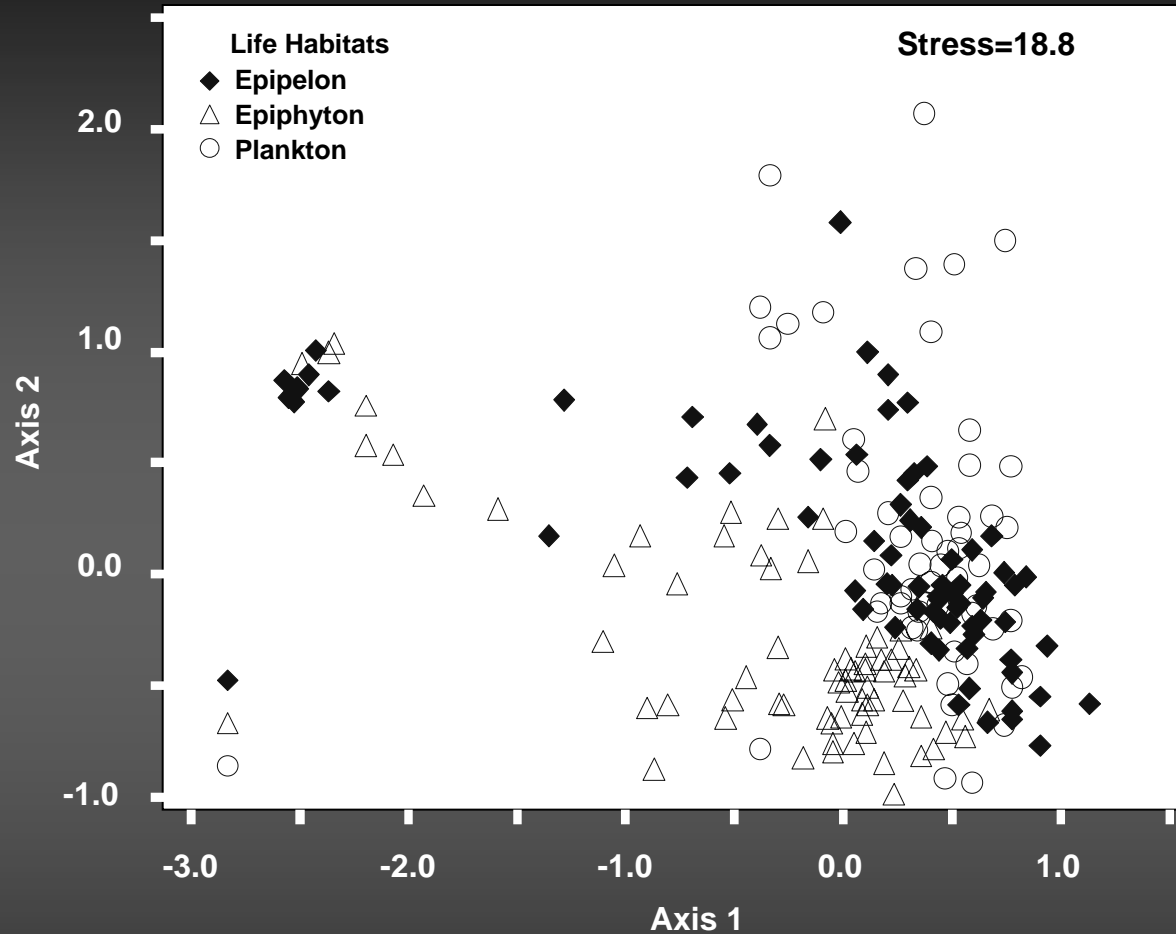
C2  $R=0.43$

C3  $R=0.44$





# NMDS ORDINATION OF DIATOM ASSEMBLAGES BY HABITAT TYPE



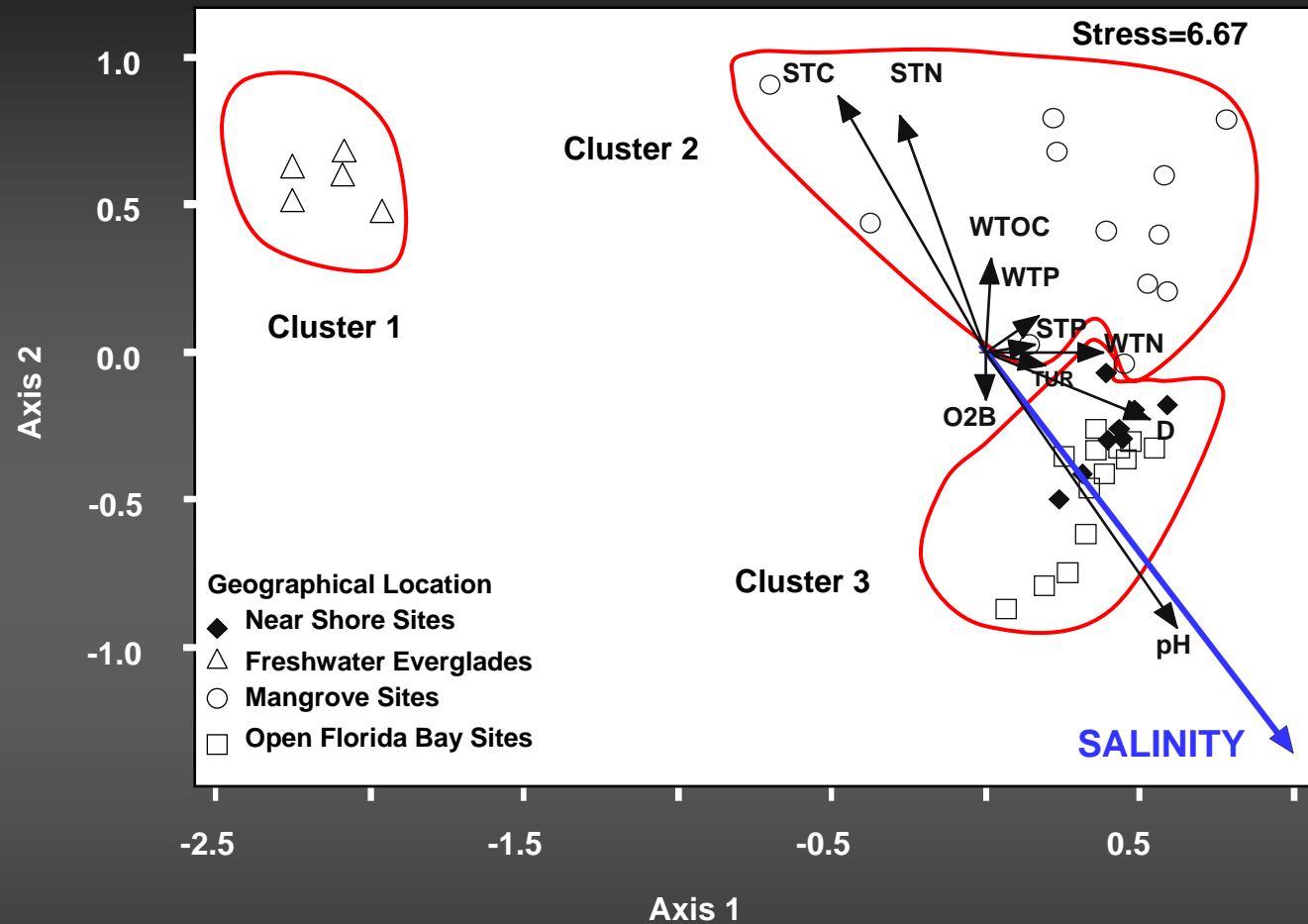
## SEASONAL DIFFERENCES:

C2 PLANKTON ONLY  $R=0.561$

C3 EPIPHYTON  $R=0.32$ , PLANKTON  $R=0.227$ , EPIPELON  $R=0.124$

C1 NO SIGNIFICAN DIFFERENCES

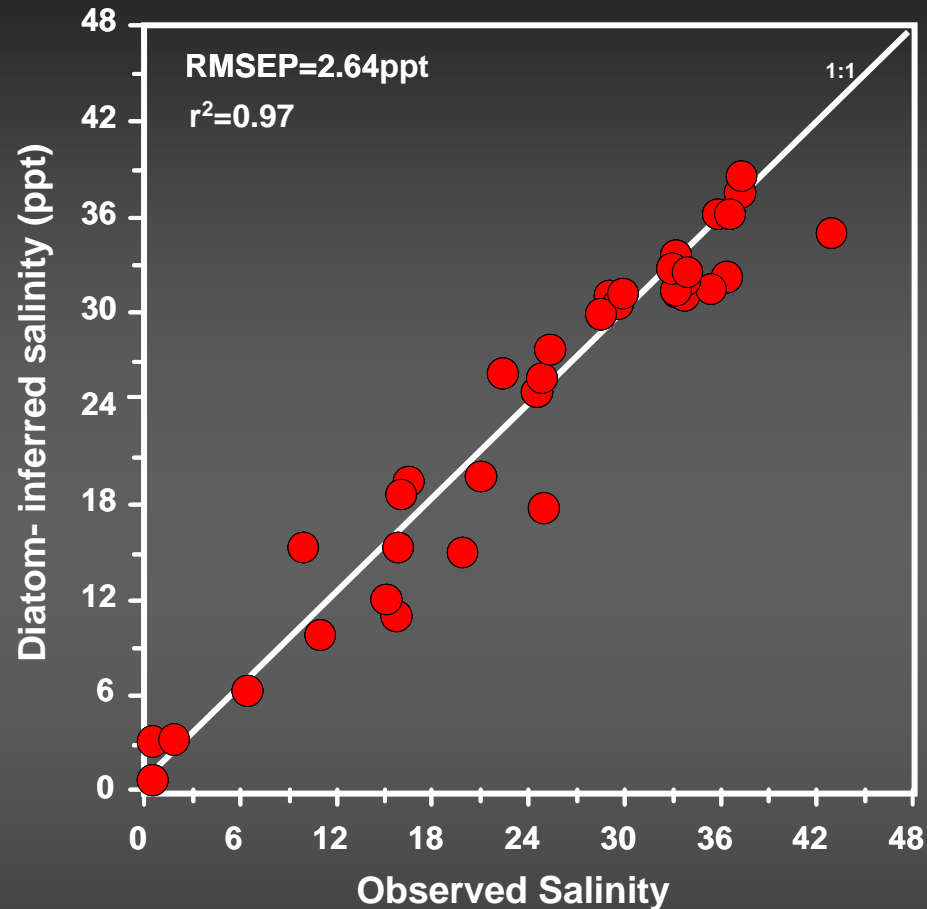
# NMDS ORDINATION SHOWING RELATIONSHIP TO ENVIRONMENTAL VARIABLES



➤ Salinity is the most influential variable and effect is independent of that of water nutrients

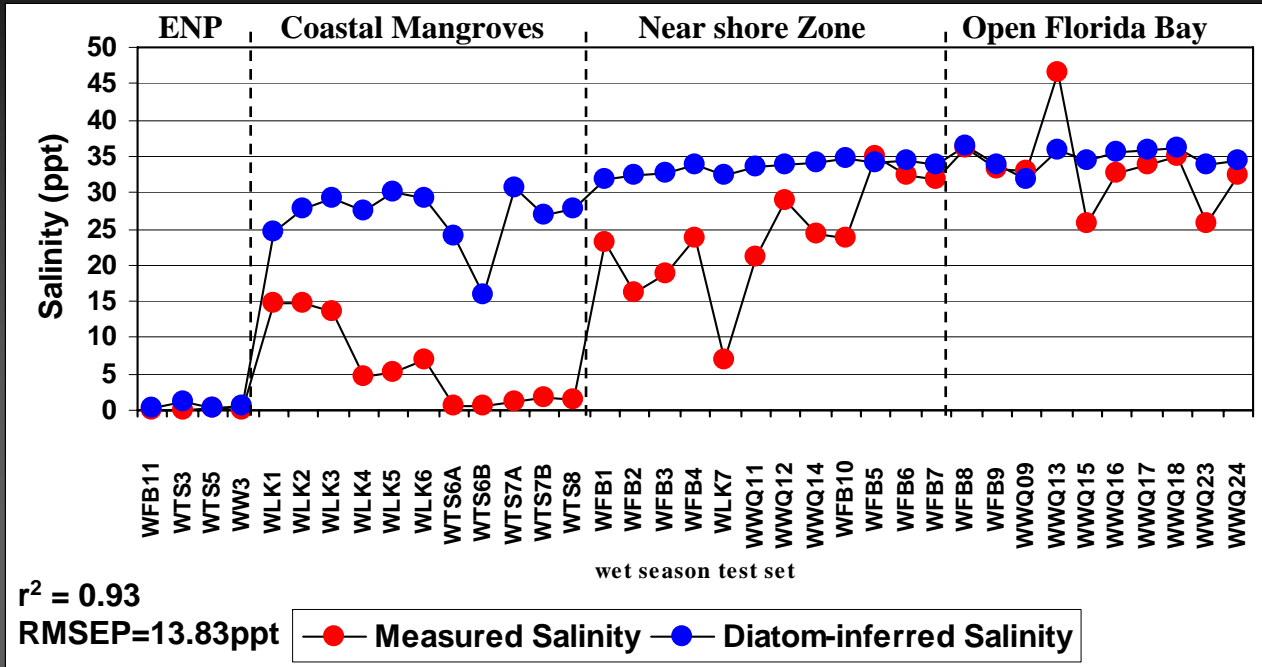


# DIATOM-BASED SALINITY PREDICTION MODEL



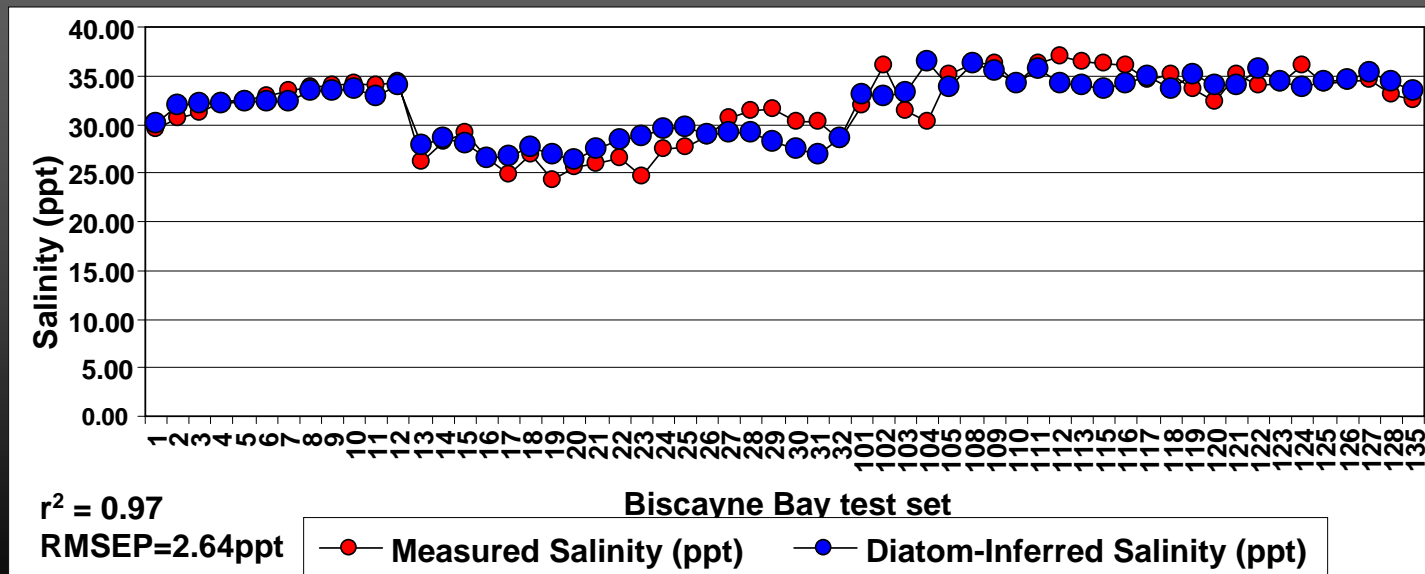
- Salinity optima and tolerances of diatoms calculated from modern dataset
- WA-PLS with leave-one out cross-validation to infer salinity from optima of each taxon weighted by its abundance
- Model explains 97% of variability in species composition and predicts salinity within 2.64 ppt

# WA-PLS INTRA-SET CROSS VALIDATION



➤ MODEL BASED ON ONE-TIME SAMPLING EVENT HAD BIGGER PREDICTION ERROR

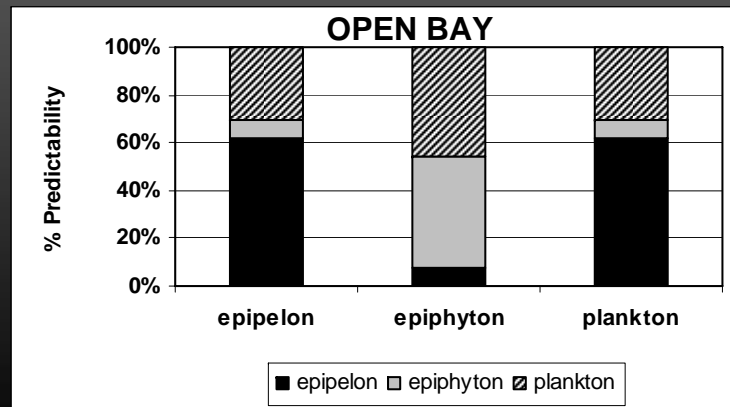
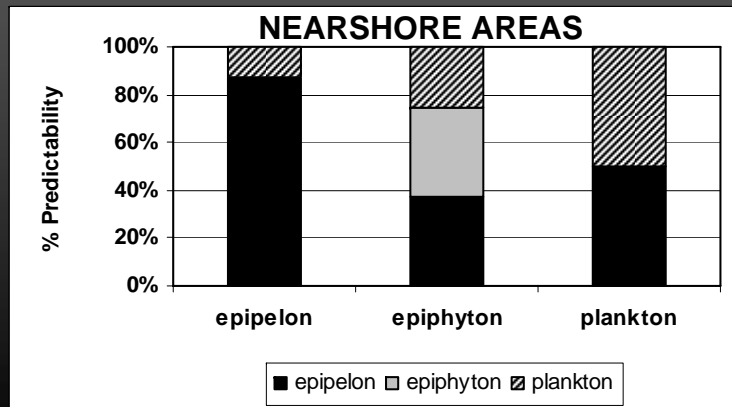
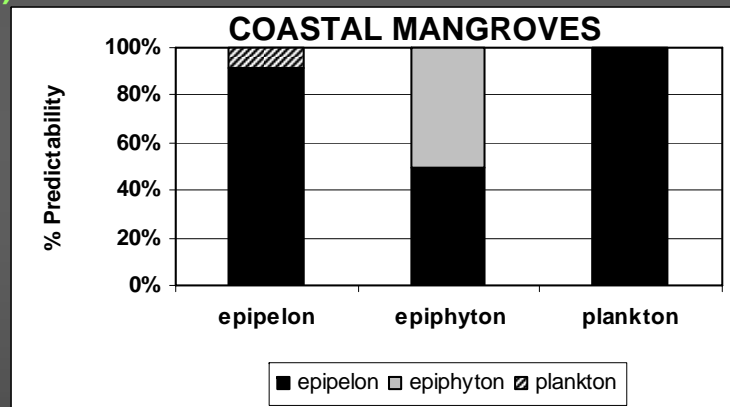
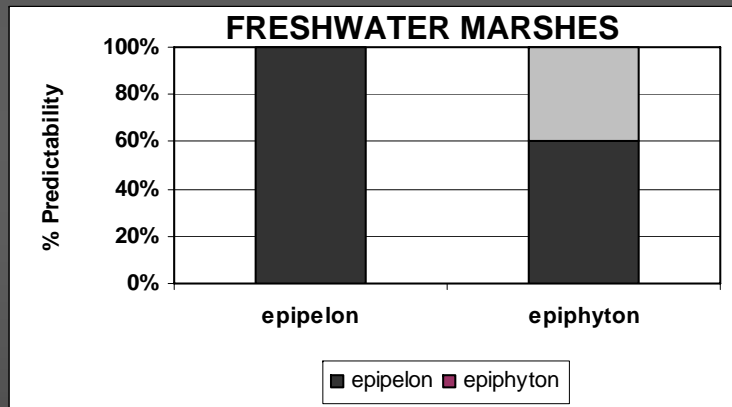
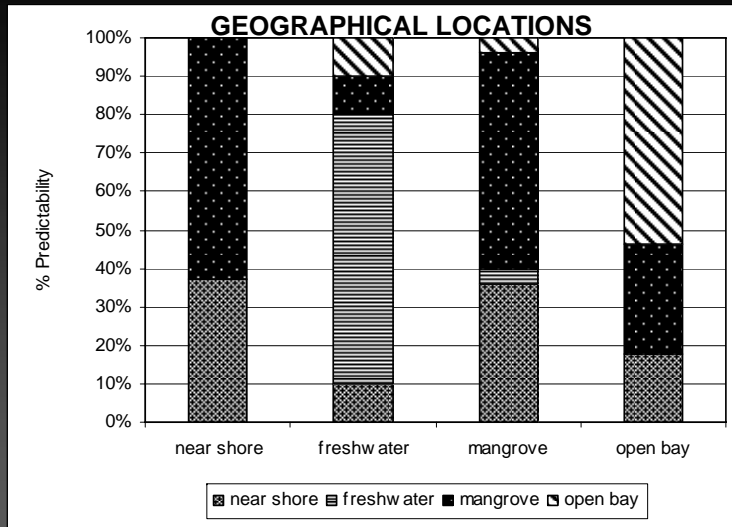
➤ ACCURATE SALINITY ESTIMATION POSSIBLE ONLY FOR LOCATIONS WITH LOW ANNUAL VARIABILITY



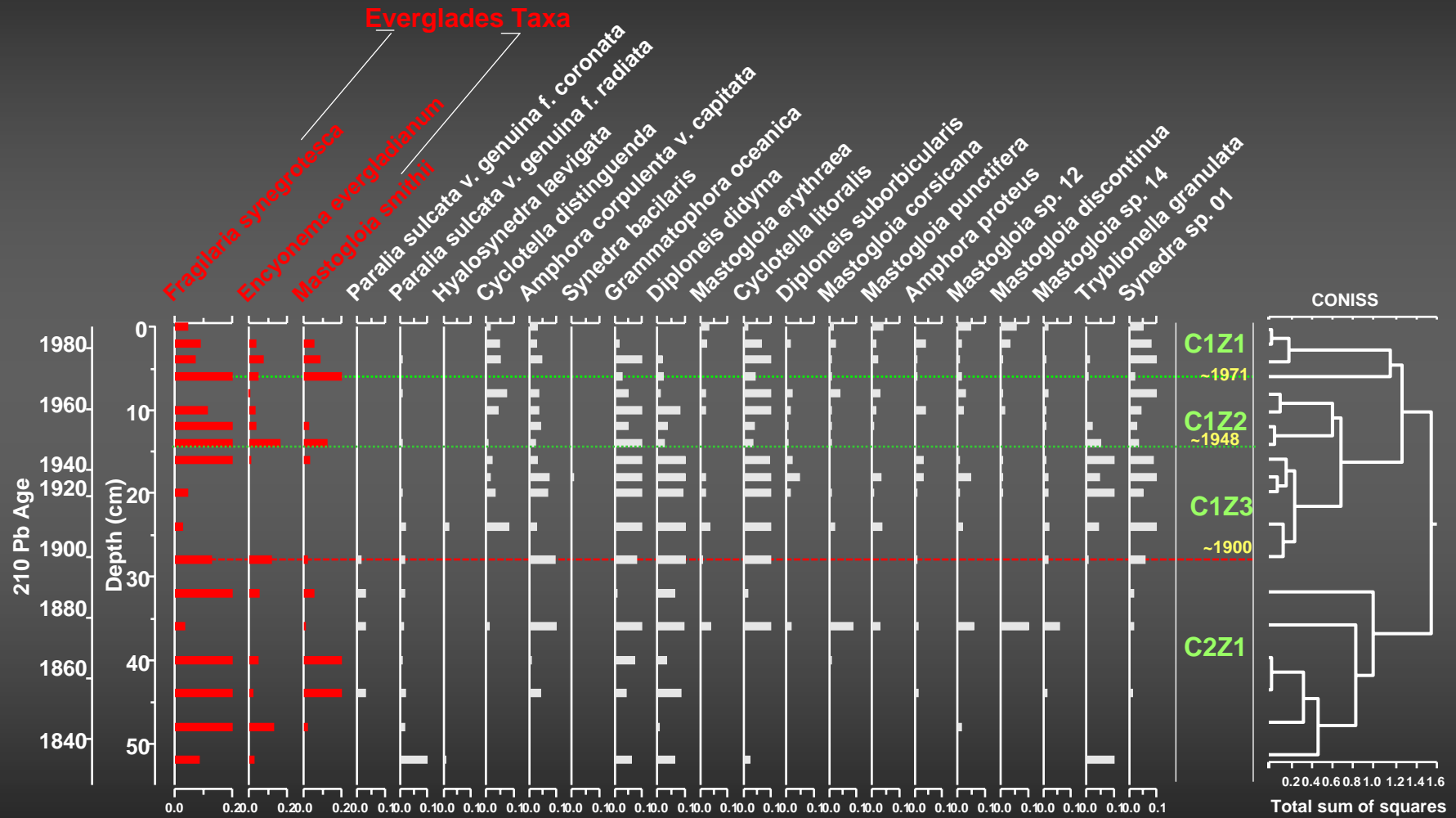
# DIATOM-BASED PREDICTIONS OF GEO-LOCATIONS AND LIFE HABITAT BASED ON DISCRIMINANT FUNCTION ANALYSIS

➤ FRESHWATER MARSHES SHOWED THE HIGHEST PREDICTABILITY FOLLOWED BY MANGROVES, OPEN BAY AND NEAR SHORE HABITATS

➤ LIFE HABITAT PREDICTABILITY WAS THE HIGHEST IN FRESHWATER MARSHES (70%), FOLLOWED BY NEARSHORE (58%), MANGROVE (47%) AND OPEN BAY (46.2%) LOCATIONS

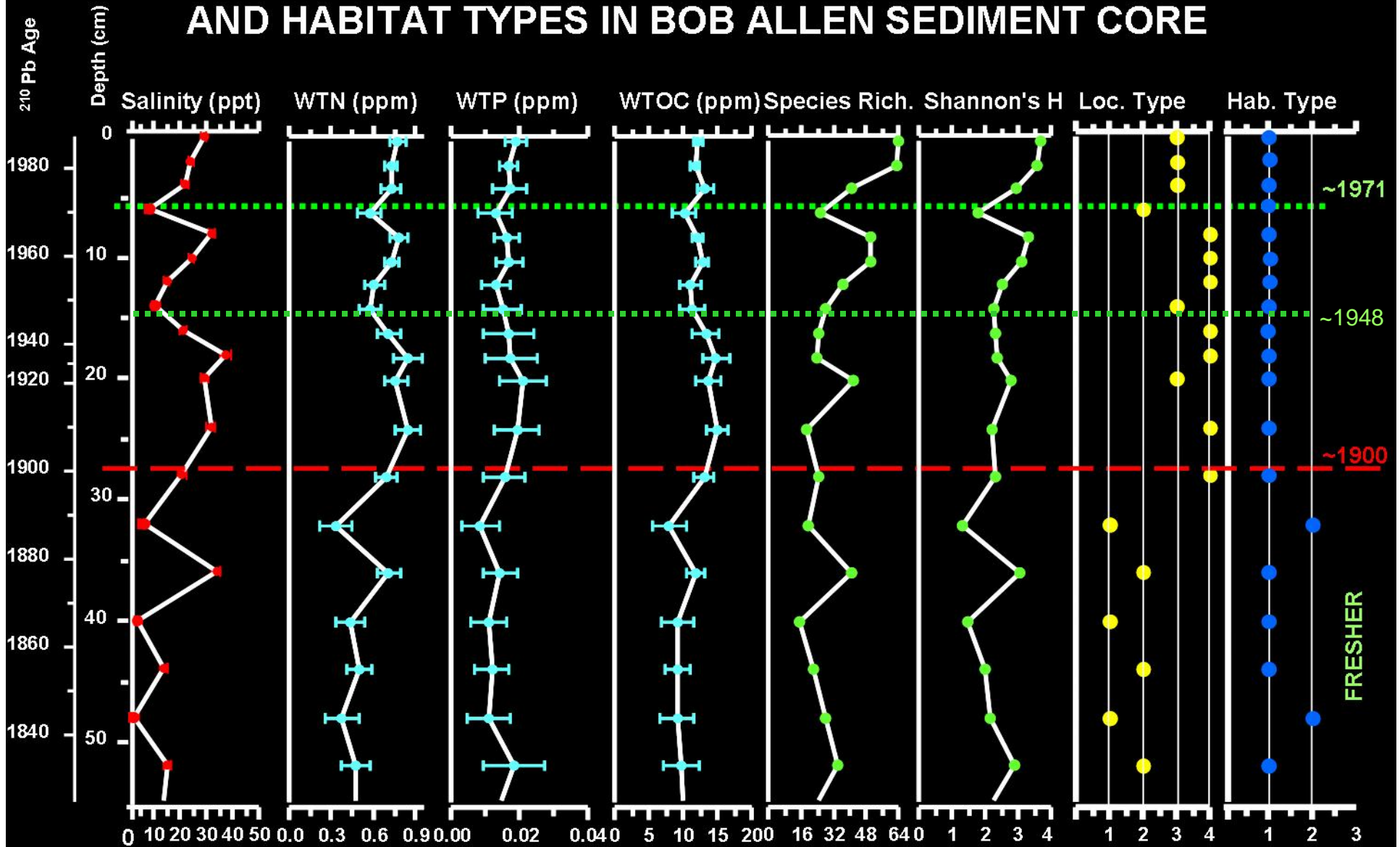


# STRATIGRAPHIC RECORD – BOB ALLEN





# DIATOM-BASED ESTIMATION OF SALINITY, NUTRIENTS GEO-LOCATION AND HABITAT TYPES IN BOB ALLEN SEDIMENT CORE



1 = FRESHWATER MARSHES  
 2 = COASTAL MANGROVES  
 3 = NEARSHORE SITES  
 4 = OPEN FLORIDA BAY  
 1 = EPIPELON  
 2 = EPIPHYTON  
 3 = PLANKTON

FRESHER

# CONCLUSIONS

- SALINITY WAS THE MOST INFLUENTIAL VARIABLE TO DIATOM ASSEMBLAGES RESULTING IN VERY STRONG PREDICTION MODEL
- DIATOMS PROVIDE RELIABLE TOOL IN PREDICTING HABITAT TYPE
- DIATOMS PROVIDE GOOD ESTIMATES OF PAST ENVIRONMENTAL CONDITIONS IN FLORIDA BAY AT SUFFICIENT RESOLUTION TO DETECT THE ONSET AND MAGNITUDE OF HUMAN- AND CLIMATE-CAUSED CHANGE
- DIATOM-BASED RECONSTRUCTIONS SHOULD BE SUPPORTED BY RESULTS OBTAINED FROM OTHER PALEOENVIRONMENTAL PROXIES IN ORDER TO PROVIDE THE BEST INTERPRETATION OF PAST ENVIRONMENTAL CONDITIONS

**“ALL RECONSTRUCTIONS ARE WRONG, BUT SOME RECONSTRUCTIONS ARE USEFUL” G.P.E. BOX**

# ACKNOWLEDGEMENTS

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