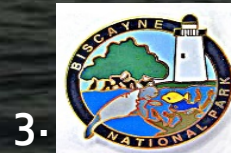
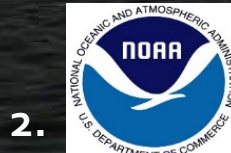


# Microalgae as a Powerful Tool in Assessment of Ecological Health of Biscayne Bay Nearshore Habitats in Support of the Biscayne Bay Coastal Wetlands Restoration Project

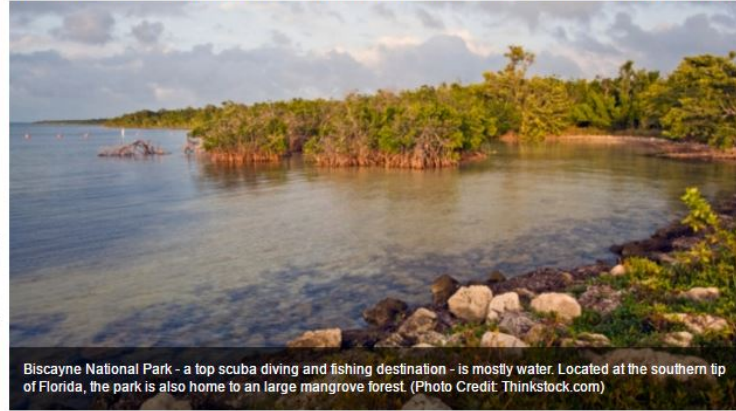
Wachnicka, A.<sup>1</sup>, Browder, J.<sup>2</sup>, Bouck, D.<sup>2</sup>, Kelble, C.<sup>2</sup>, Visser, L.<sup>2</sup>,  
Jackson, T.<sup>2</sup>, Bellmund, S.<sup>3</sup>



## Algae Bloom Leads To Smelly Biscayne Bay

July 19, 2013 9:36 PM

Filed Under: Algae Bloom, Biscayne Bay, Card Sound, Environment, Pollution, Rickenbacker Causeway, Runoff, T



Biscayne National Park - a top scuba diving and fishing destination - is mostly water. Located at the southern tip of Florida, the park is also home to an large mangrove forest. (Photo Credit: Thinkstock.com)



KEY BISCAYNE (CBS4/The Miami Herald) – An algae bloom has hit Biscayne Bay and it is possibly one of the biggest in history.

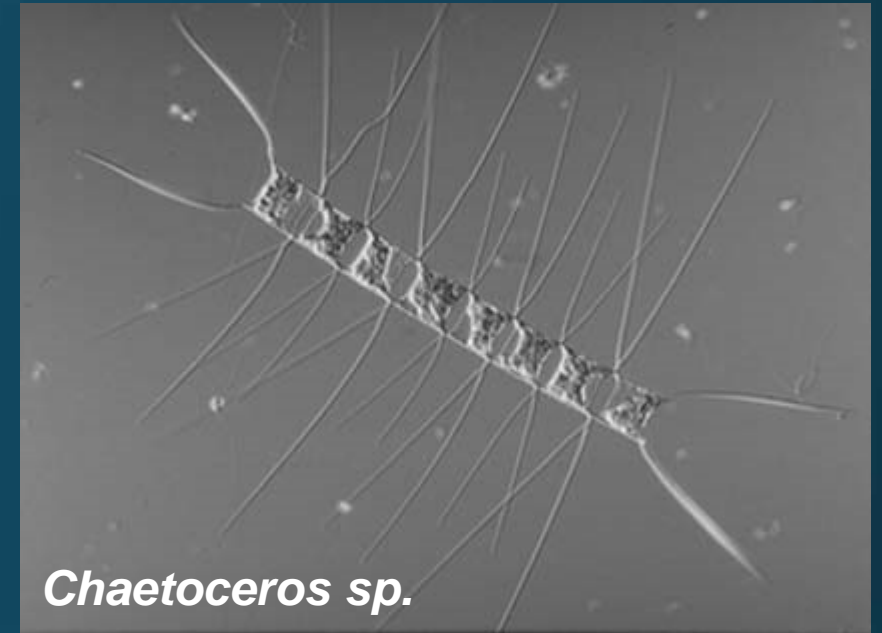


COURTESY OF NOAA



Courtesy of: Inger Hansen (FDEP)

Algal bloom North of Convoy Point,  
June 28th, 2013)



*Chaetoceros sp.*

- All the species form long chains (colonies) and have long spines (cetae)
- Can easily kill fish even at low densities and abundance!!!!
- The abundance of *Chaetoceros spp.* was absolutely staggering, especially in Card Sound & Barnes Sound!!!
- Possible impact on South Florida Economy

# Factors Affecting Biscayne Bay Ecosystem



- Habitat loss (e.g., SAV in North Biscayne Bay)
- Shift in species richness and diversity
  - Micro- & Macroalgal blooms (nearshore areas)
- Altered water quality
- Saltwater encroachment
- Altered water circulation & residence time

**Drivers of Change**

**Impacts**

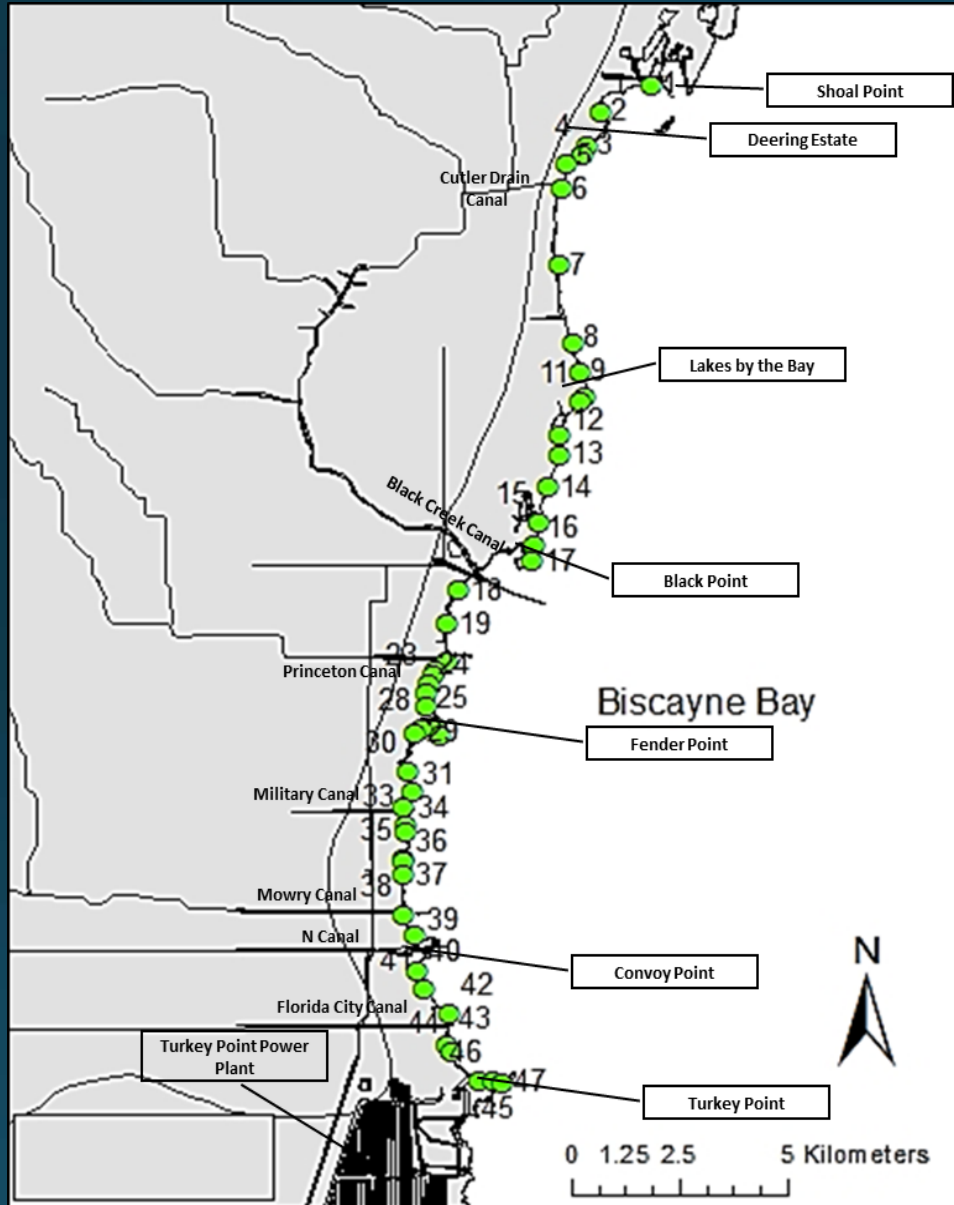
© 2012 SIO, NOAA, U.S. Navy, NGA, GEBCO

# 2014/2015 Surveys – Study Goals

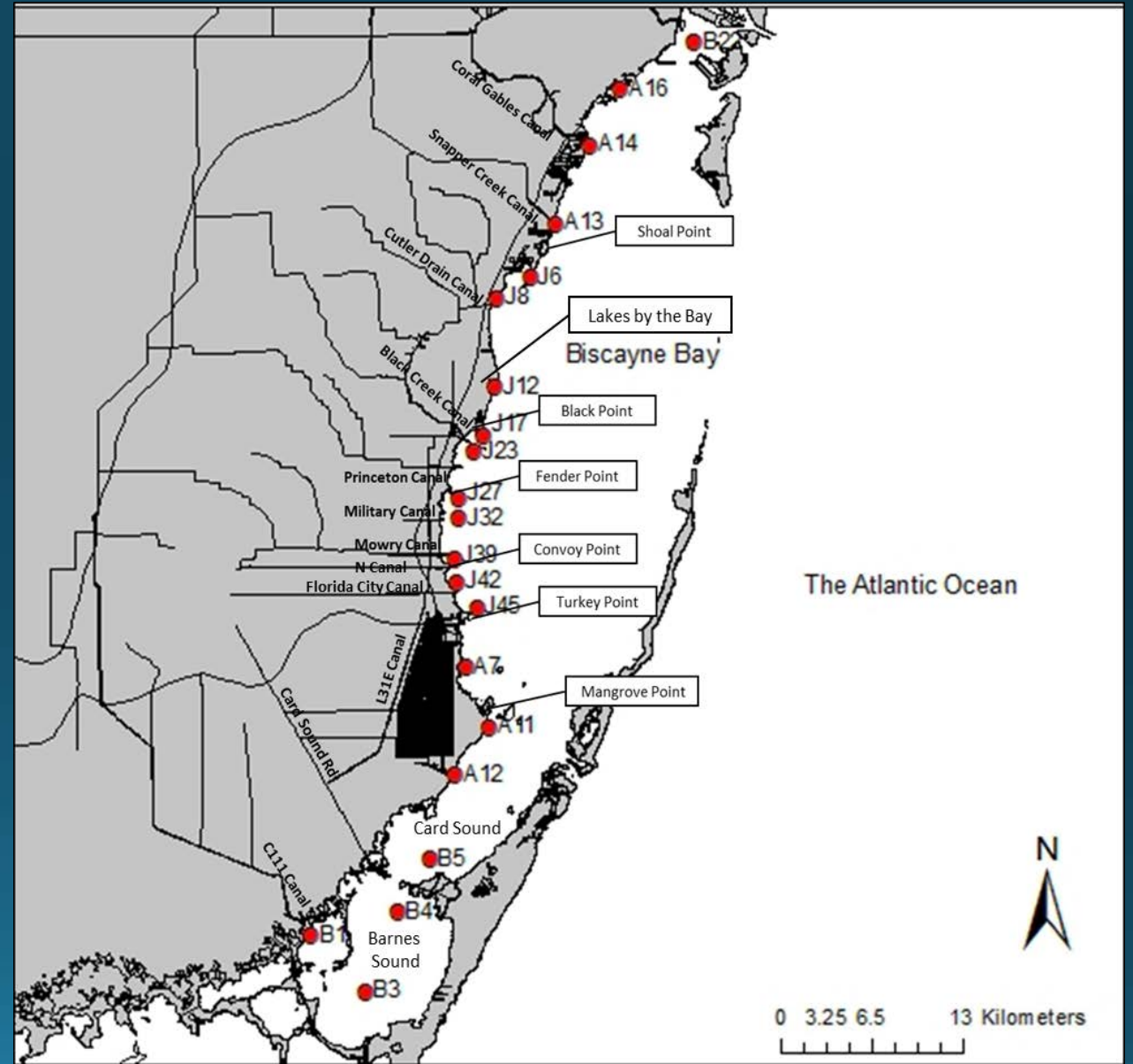
- 1. Assess hydro-ecological conditions in nearshore areas of Biscayne Bay based on spatial and temporal distribution of epiphytic and planktonic algal communities***
- 2. Identify “Hot Spots”***

# Study Area

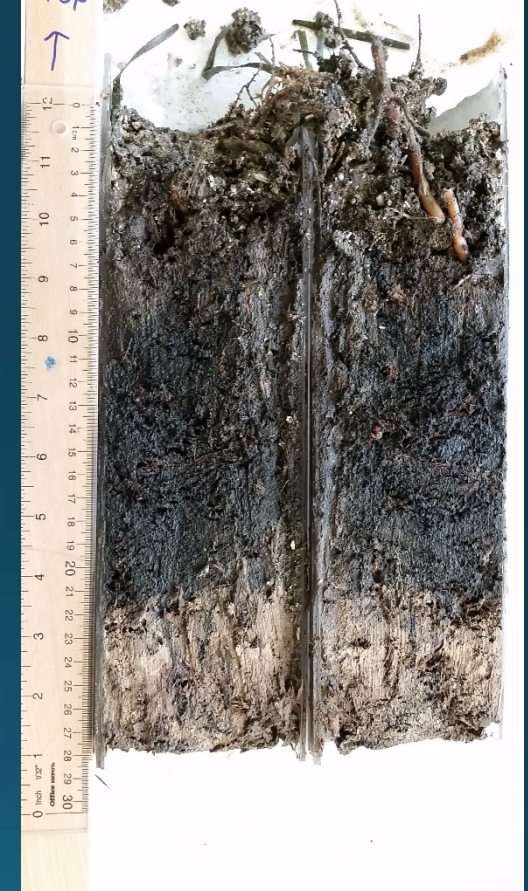
## Epiphyte Collection Sites (IBBEAM sites)



## Plankton Collection Sites

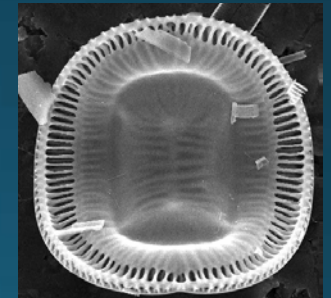
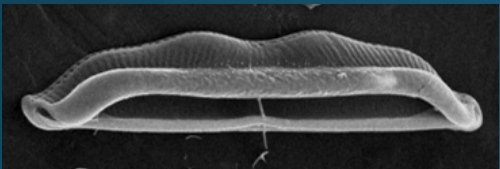
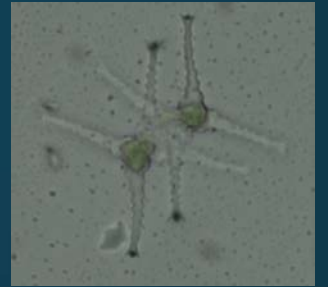
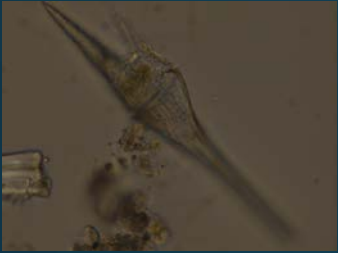


# Methods



# Algae – Powerful Ecological Indicators

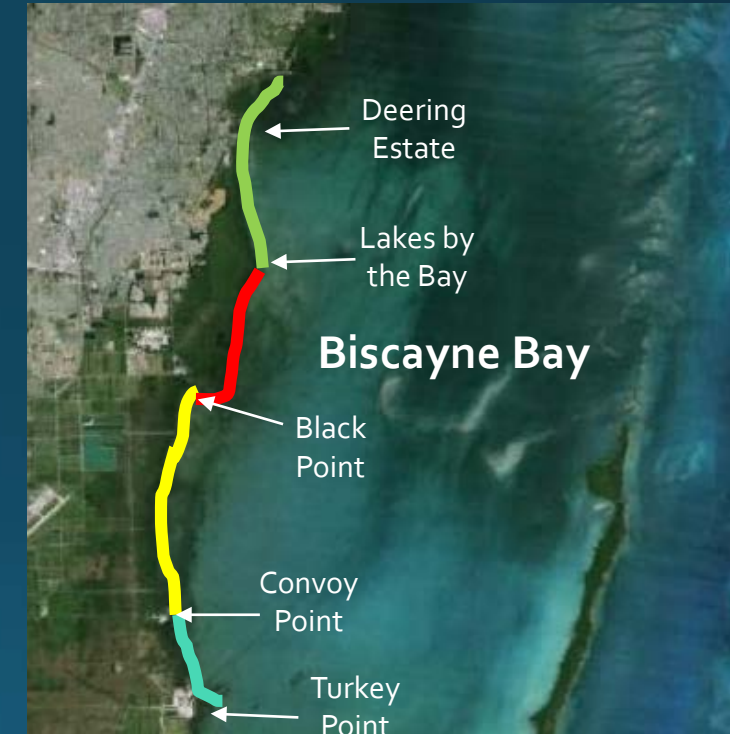
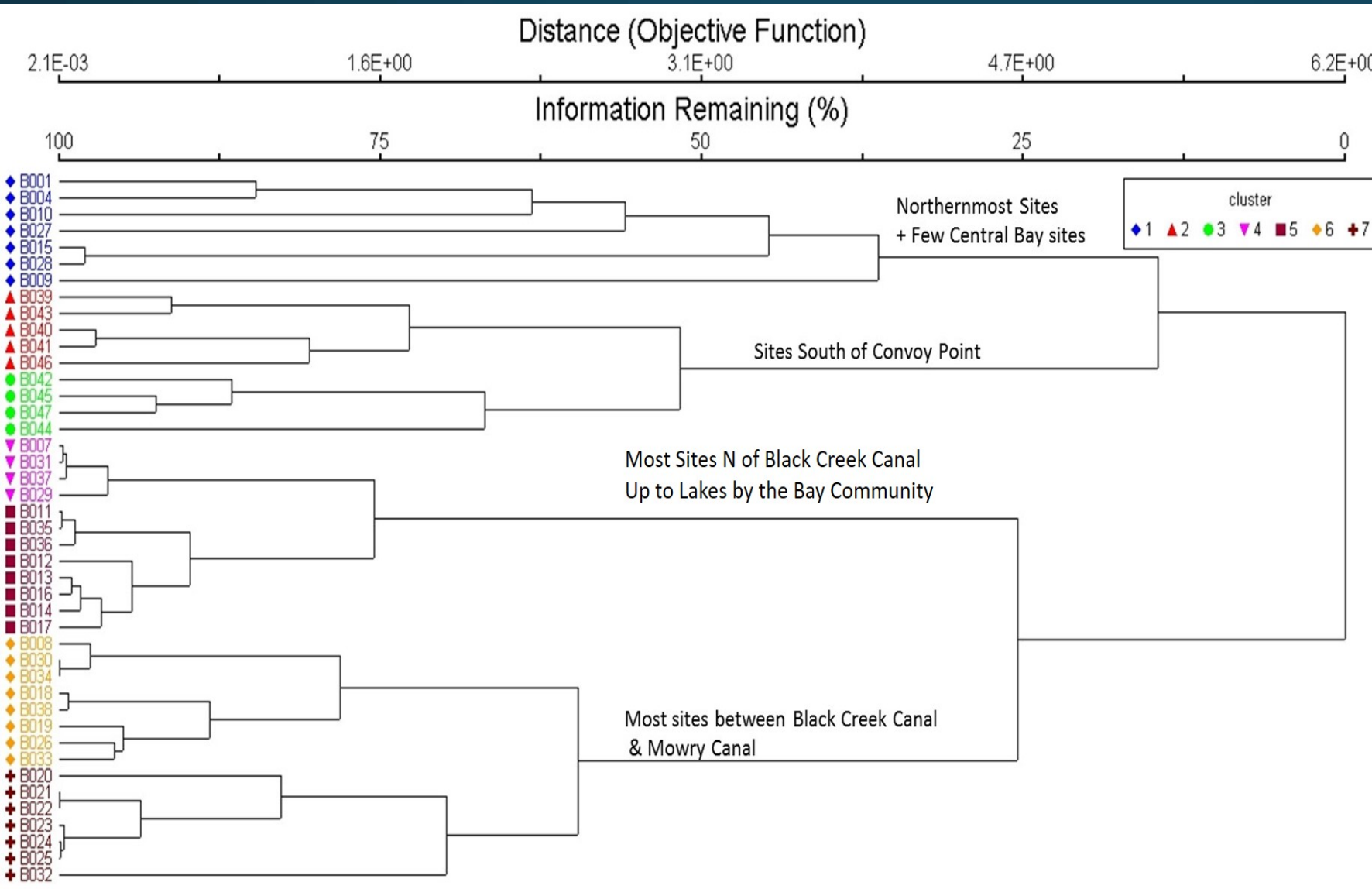
- Ubiquitous distribution (most)
- Relevant to ecosystem – form the base of food web
  - Easy to identify
- Diverse and species rich – provide large amount of ecological information and statistical power in analyses
- Strong relationships between algae & water quality
  - Respond quickly to environmental changes



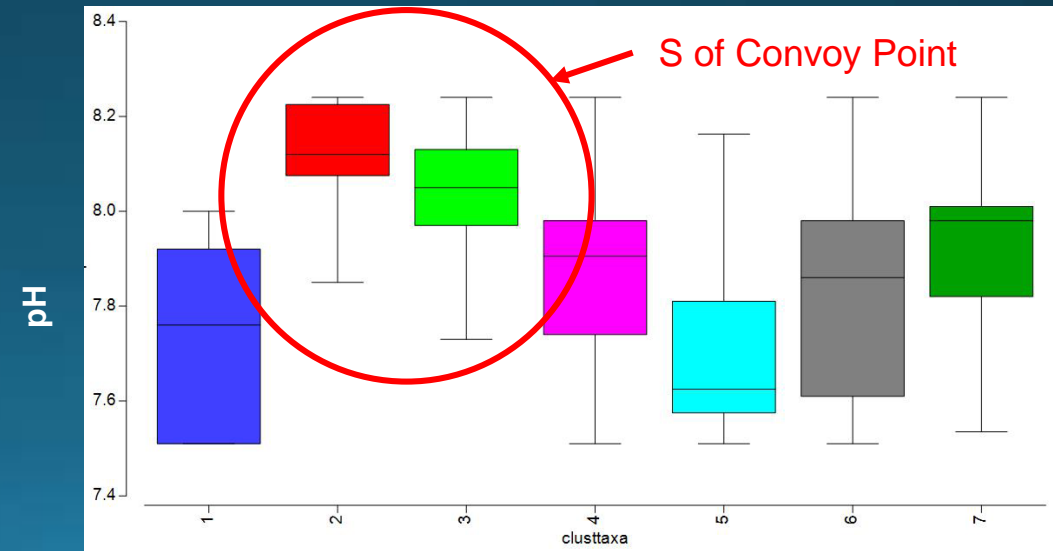
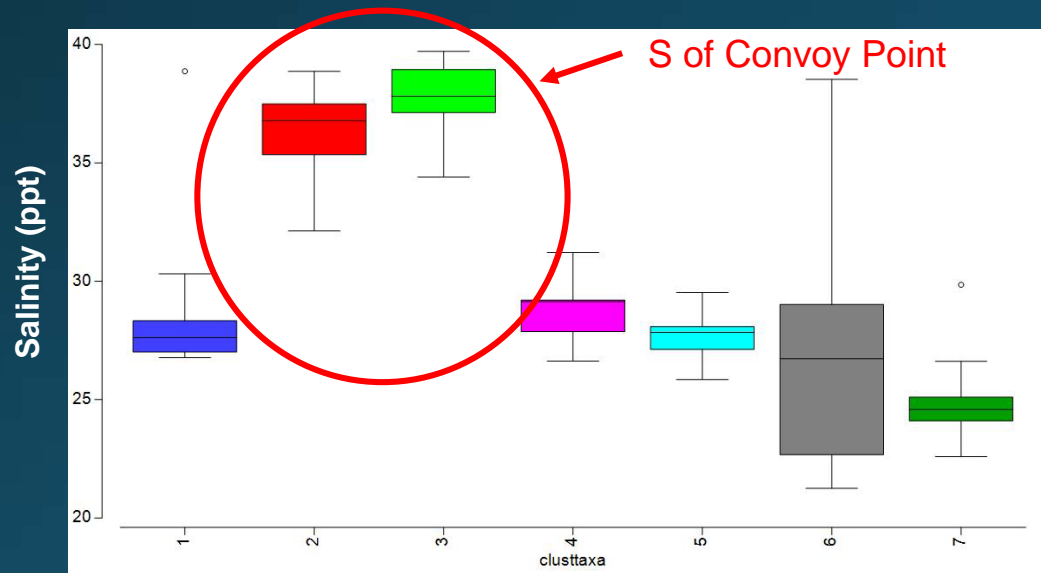
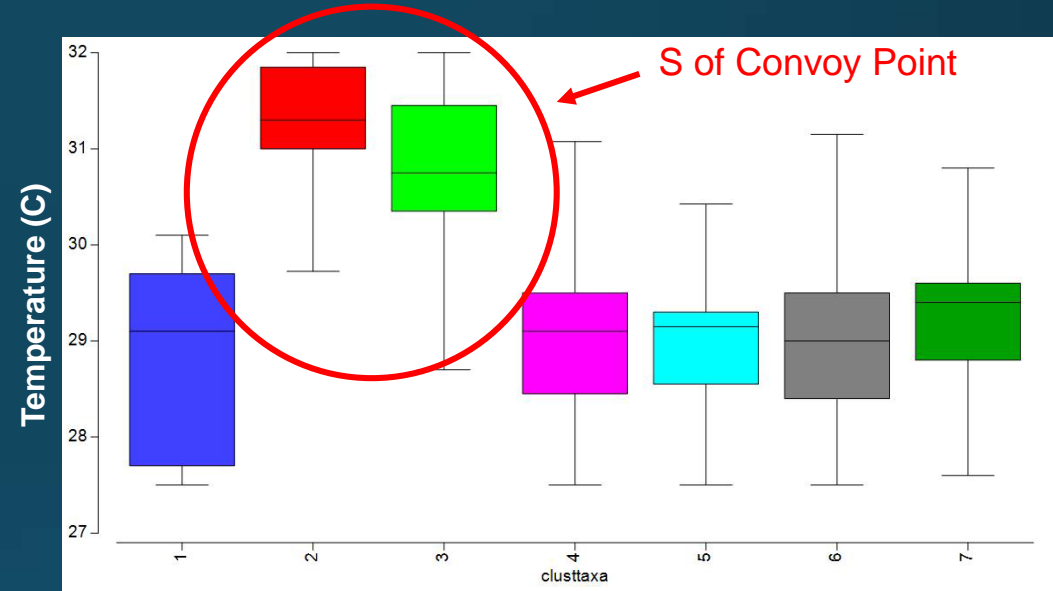
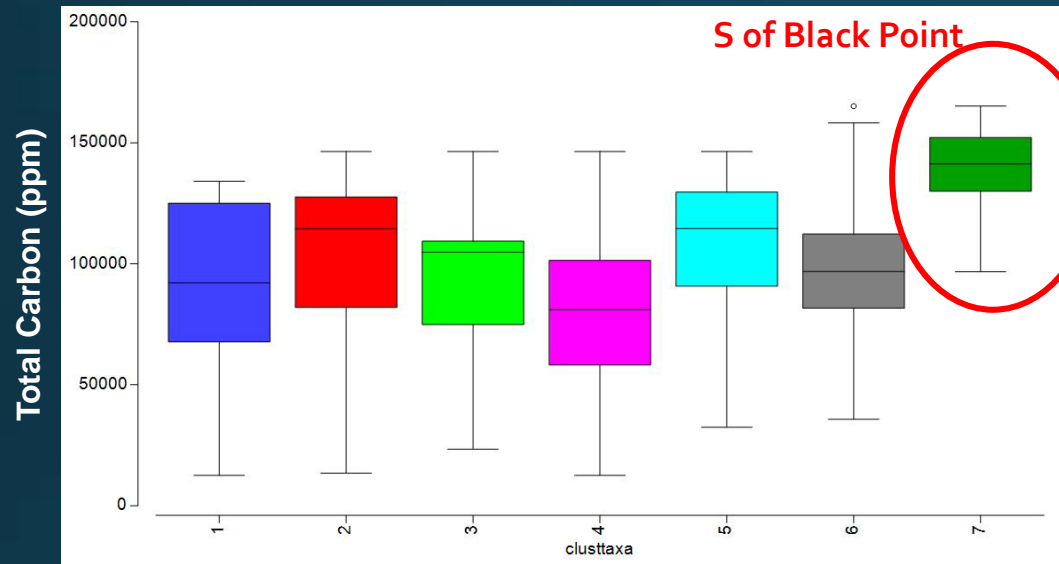




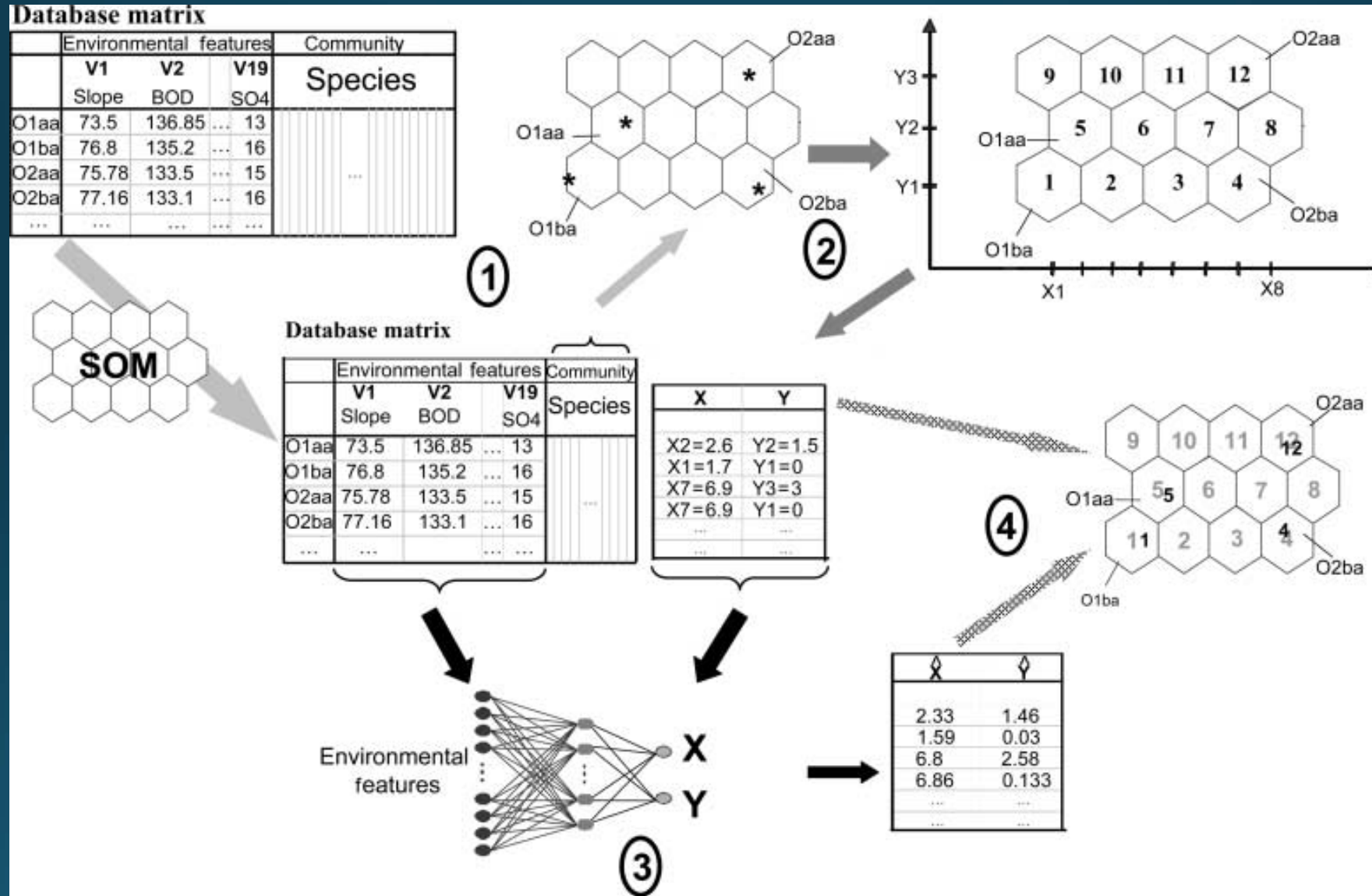
# Spatial Difference In Epiphytic Communities Along The Biscayne Bay Coast In Wet Season 2014



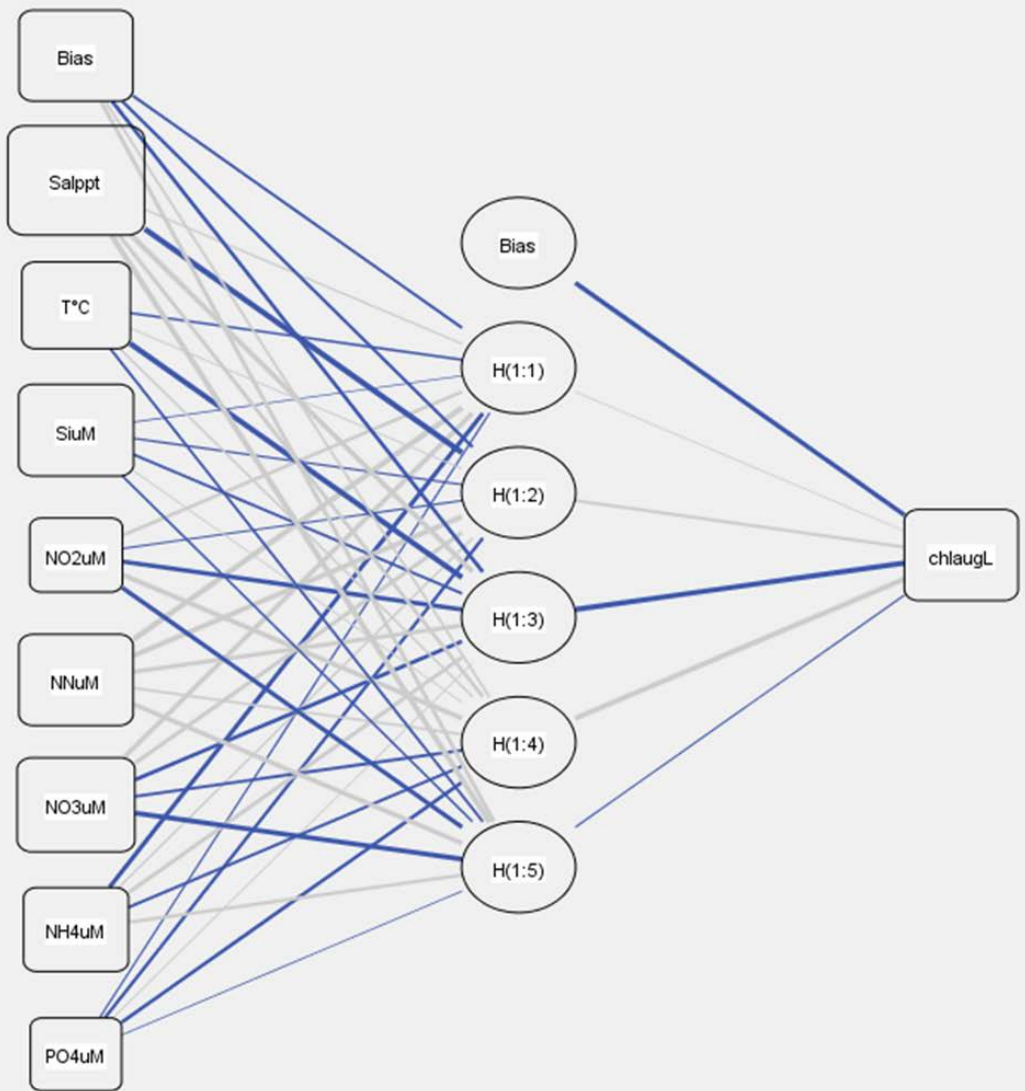
# Significant Differences In Water Quality Variables Among Wet Season 2014 Clusters



# Modeling The Structure Of Diatom Assemblages Using Artificial Neural Networking (ANN) Algorithms



— Synaptic Weight > 0  
— Synaptic Weight < 0

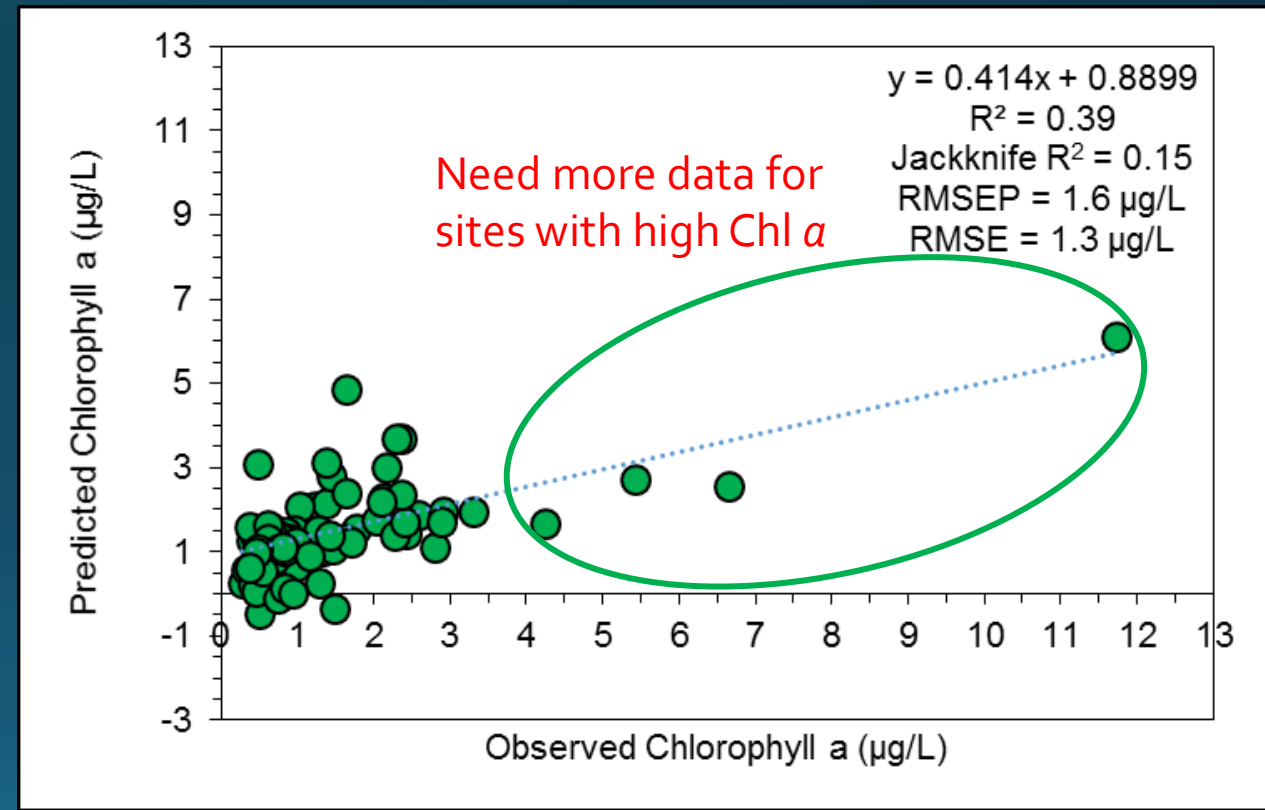
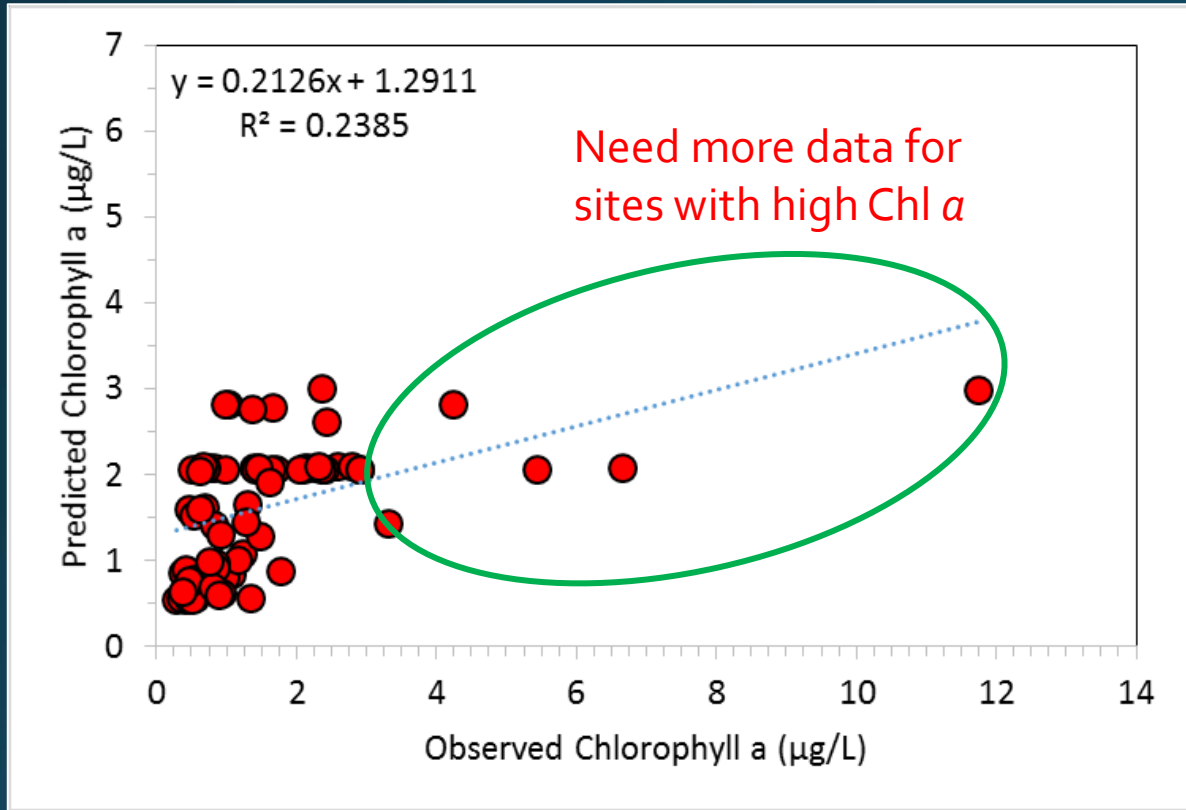


Hidden layer activation function: Hyperbolic tangent

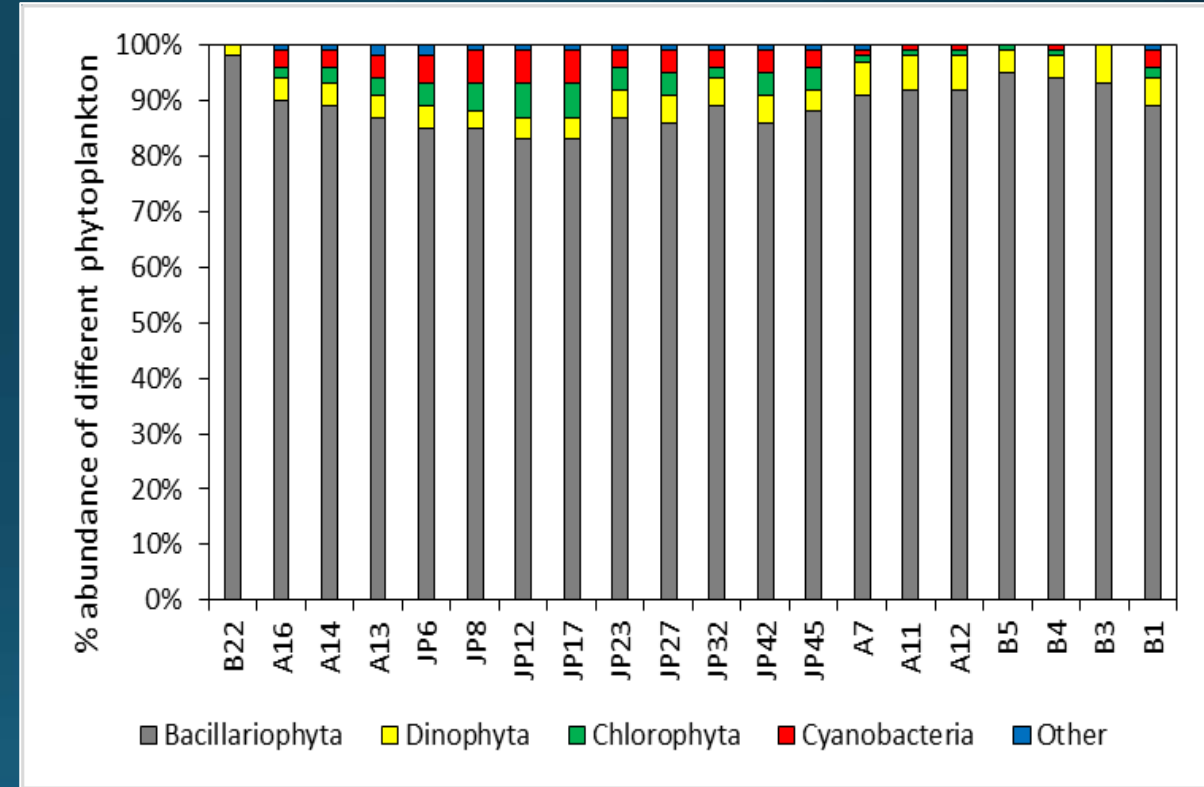
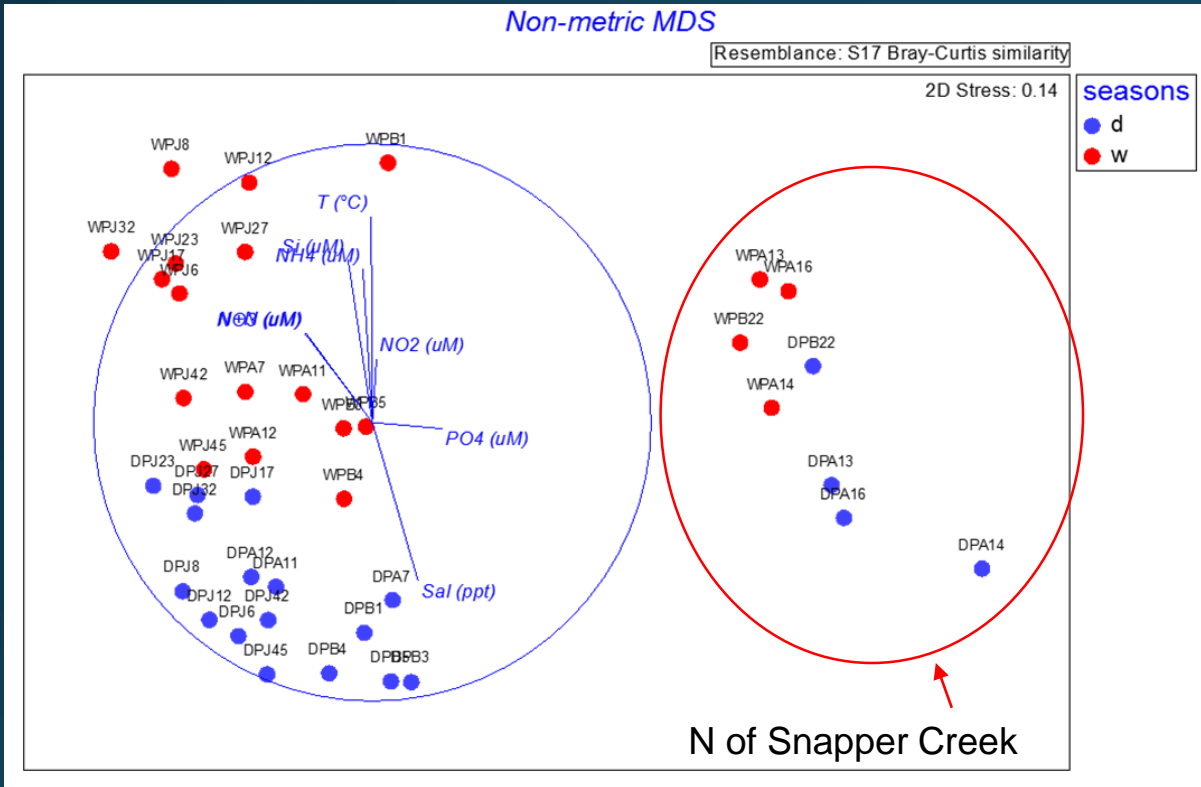
Output layer activation function: Identity

## ANN Architecture Applied To Water Quality Data And Chlorophyll a Concentration

# Observed Vs. ANN (Left) & WAPLS (Right) Model-predicted Chlorophyll a Concentration Values

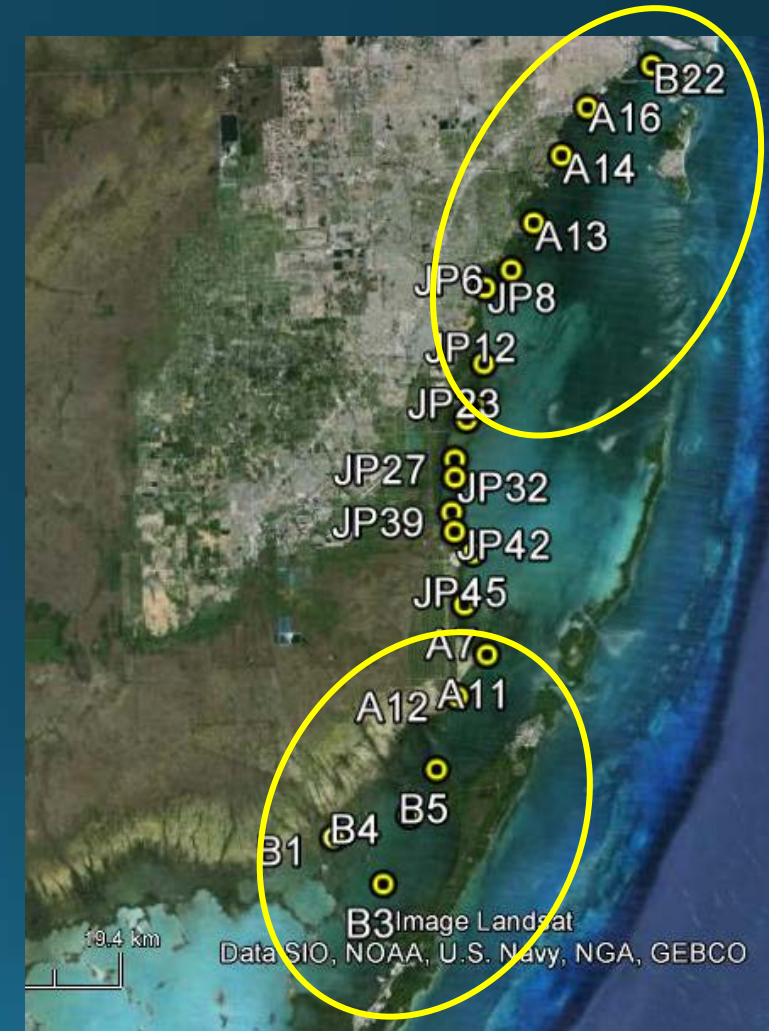
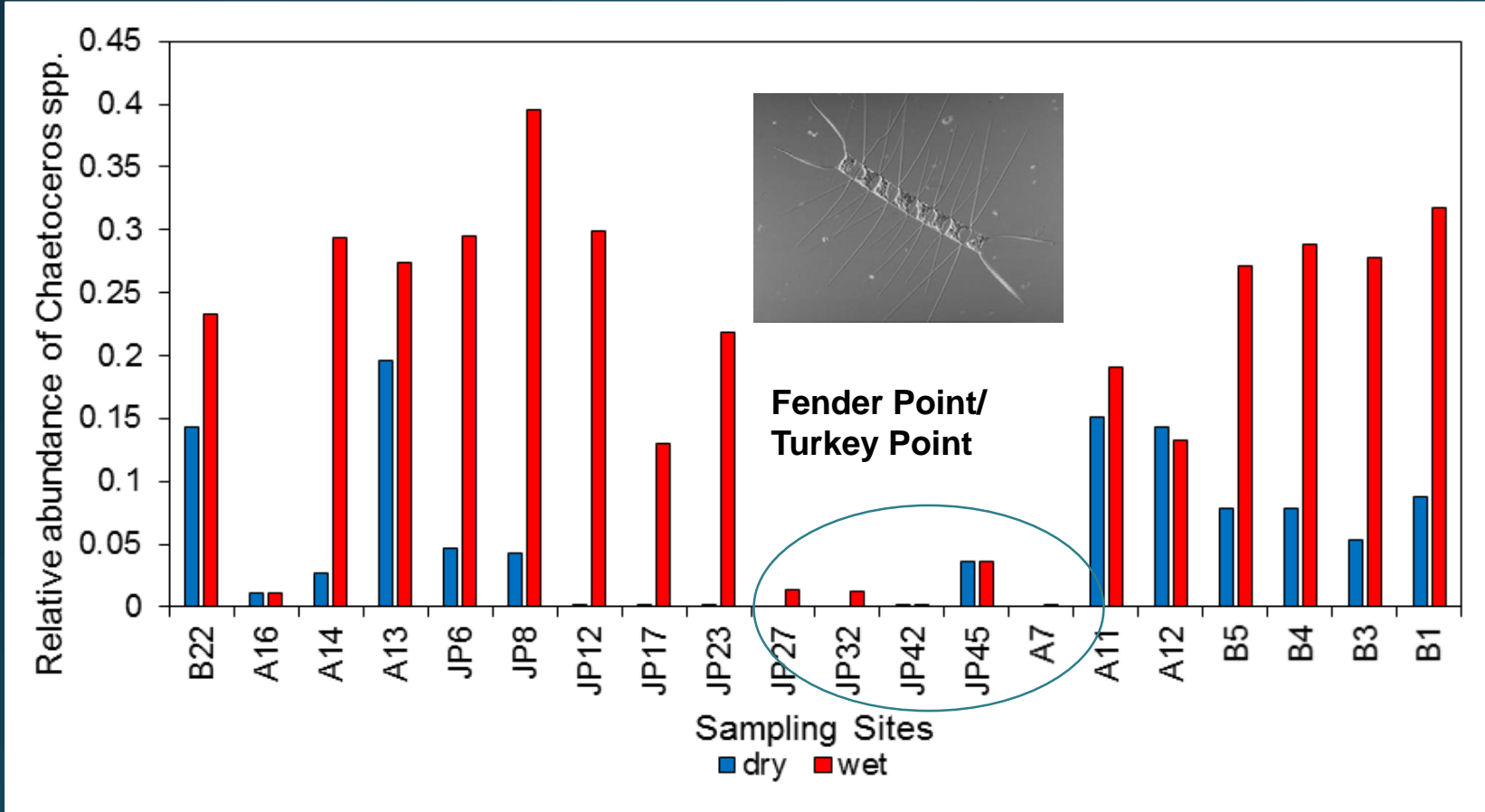


# Seasonal Differences In The Abundance Of Phytoplanktonic Communities - Dry vs. Wet Seasons 2015



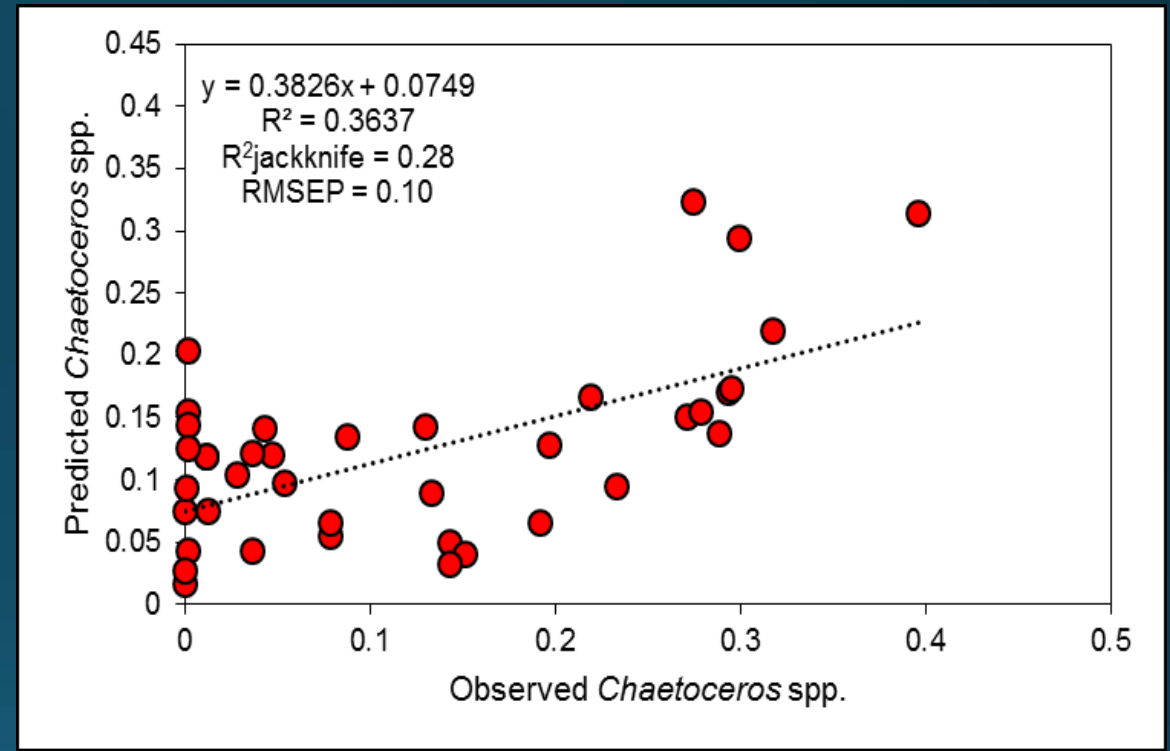
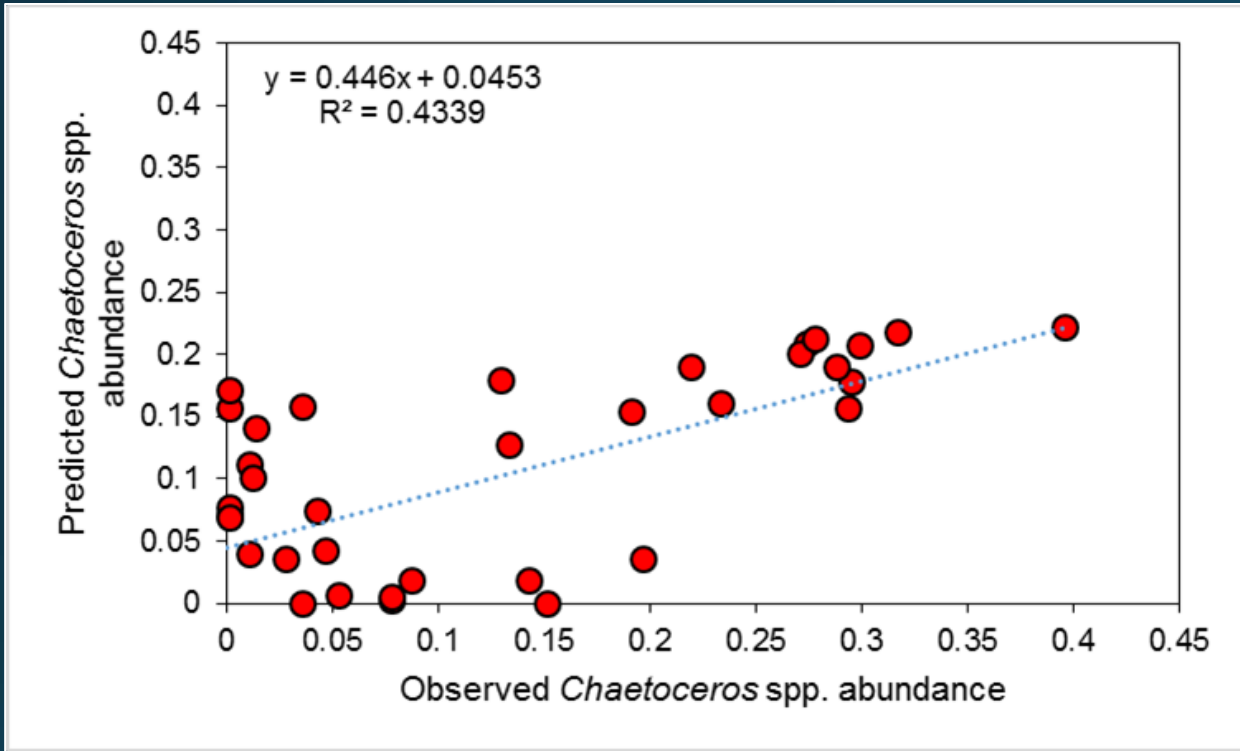
Wet Season Phytoplankton Community Abundance

# Seasonal Changes In Relative Abundance Of Chaetoceros Spp. At Plankton Sampling Locations (Dry And Wet Seasons 2015).



- In Dry Season: abundance significantly higher at saltier sites with lower Si concentration
- In Wet Season: abundance significantly higher at sites with higher Si concentration

# Observed Vs. ANN & WAPLS - Predicted *Chaetoceros* Spp. Abundance





# Final Recommendations

- Taxonomic studies of algal communities should be added to the already existing water quality and habitat monitoring programs in the Bay in order to better understand the extent, origin and possible harmful effects of algal blooms & effects of restoration on the Bay's nearshore biota
- Appropriate numeric nutrient criteria should be adopted for water bodies flowing into Biscayne Bay to prevent excess nutrients in nearshore waters, which increases the probability of occurrence of algal blooms
- Well-designed ecological models should be developed for the nearshore areas of the Bay in order to evaluate current and predict future effects of different water management scenarios on the nearshore habitats and biota
- The potential effects of warming climate, extreme weather events, and large-scale climate oscillation patterns (e.g., El Niño) should be investigated and taken into account during development of a well-crafted water management plan for the Bay.

# Acknowledgments

