



# **Florida Department of Environmental Protection**

## **Water Quality Standards Program**

# **Updates from South Florida Canal Aquatic Life Study**

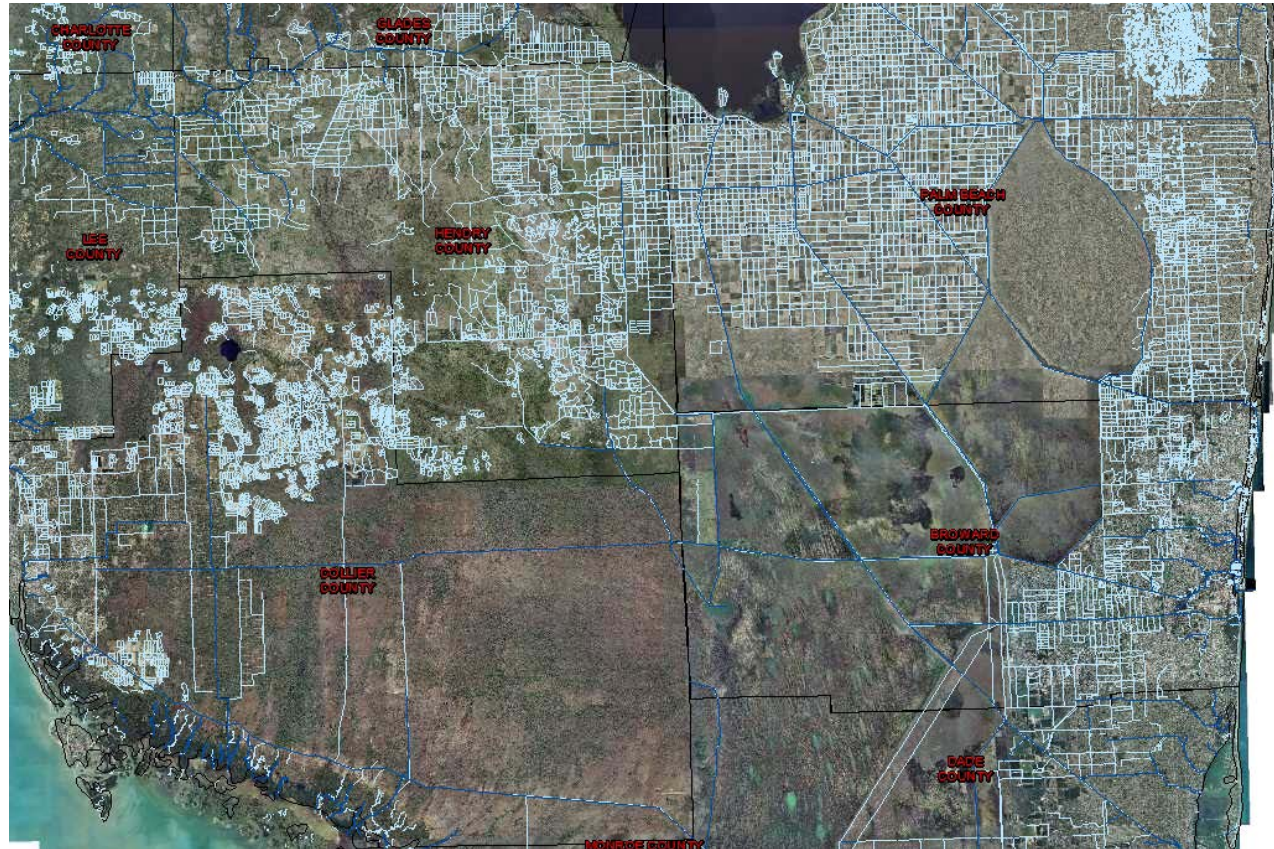
**FDEP Biocriteria Meeting**  
**May 16, 2017**



# Canals are South Florida

Other than the Everglades and Lake Okeechobee, Canals are the predominant freshwater features in South Florida

- Built as part of the Central and Southern Florida Flood control project by the USACOE
- Designed and constructed from 1940s to 1970s
- 70 pump stations and more than 650 water control structures and 700 culverts
- Managed by SFWMD and USACOE

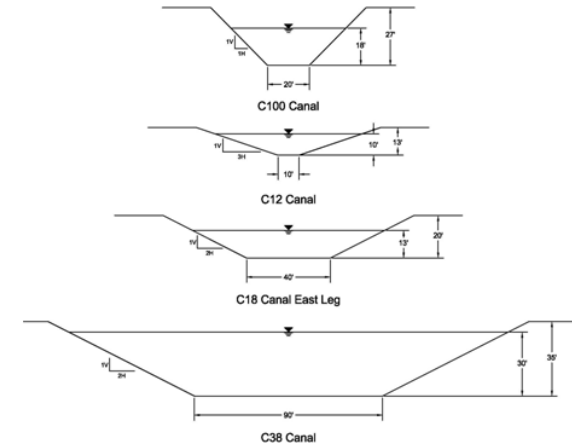




# Canals are Different

Canals are generally man-made waterbodies with the primary purpose of moving water (stressful habitat for biological communities)

- Generally very deep with steep banks
- Usually highly managed
- Flow highly variable
- Can act as streams or lakes or ?



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# Study Objective: Perform a Comprehensive Assessment of South Florida Canals and Their Aquatic Life

The objectives of the study are:

- Assess aquatic life in South Florida canals;
- Evaluate the differences in conditions for South Florida canals;
- Determine interrelationships between aquatic life in canals and other physical, chemical, hydrologic, etc. variables;
- Collect information that can be used to guide management decisions.





# Water Quality Sampling



- Sampling initiated Nov. 2012 and was completed Oct. 2016
- Monthly collections for TKN, TP, NO<sub>x</sub>, TOC, Color, Turbidity, and Chlorophyll *a*
- Quarterly sonde deployments to collect diurnal DO data, with vertical profile data taken before and after deployment
- Information on physical attributes of canals, canal management, flow and other canal disturbance factors was also collected





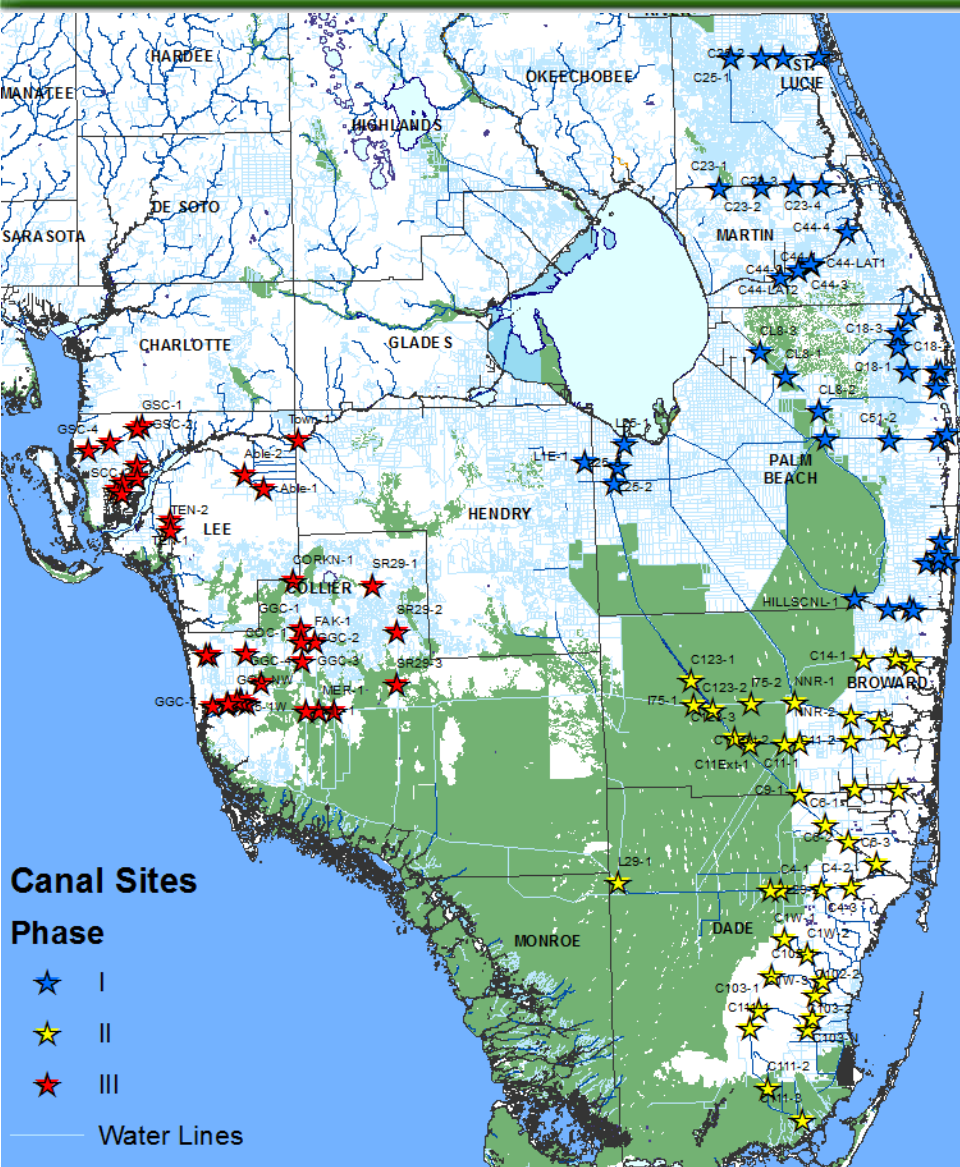
# Biological Sampling

- Habitat Assessment
- Stream Condition Index (SCI)
- Linear Vegetation Survey (LVS)
- Rapid Periphyton Survey (RPS)
- Phytoplankton
- Zooplankton (specific method for this study)
- Fish presence/absence (subset of sites)





# South Florida Canal Aquatic Life Study, Sampling Sites



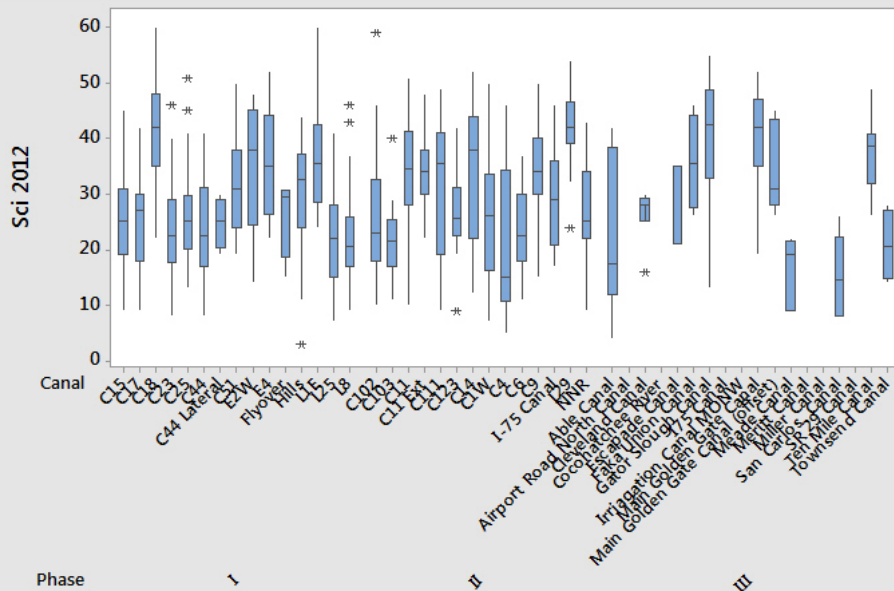
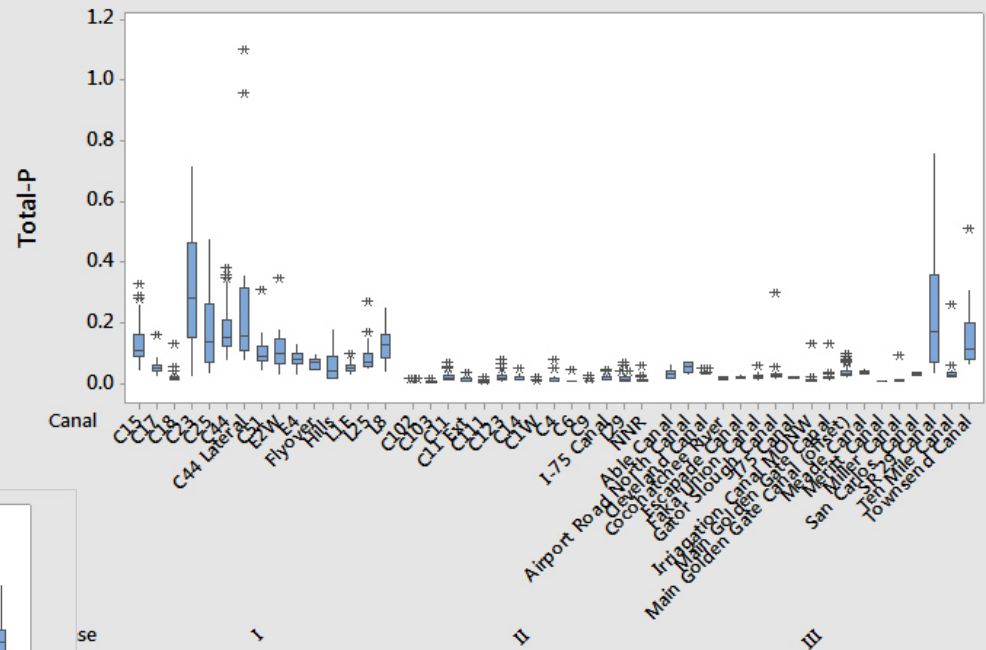
- **Phase I:** 42 sites in 15 canals located in St. Lucie, Martin, and Palm Beach Counties sampled in 2013
  - Less frequent sampling continued at 25 sites in 2014 -16 to build longer period of record
- **Phase II:** 38 sites in 14 canals located in Broward and Miami-Dade Counties sampled in 2014
  - Less frequent sampling continued at 28 sites in 2015 -16
- **Phase III:** 35 sites in 17 canals located in Lee, Collier, and Hendry Counties sampled in 2016



# Preliminary Results

Differences observed between canals with respect to water quality

- DO Conductivity
- Nutrients Chlorophyll
- Color TOC



Biological differences also apparent

- SCI Scores
- HA Scores



# More Preliminary Results

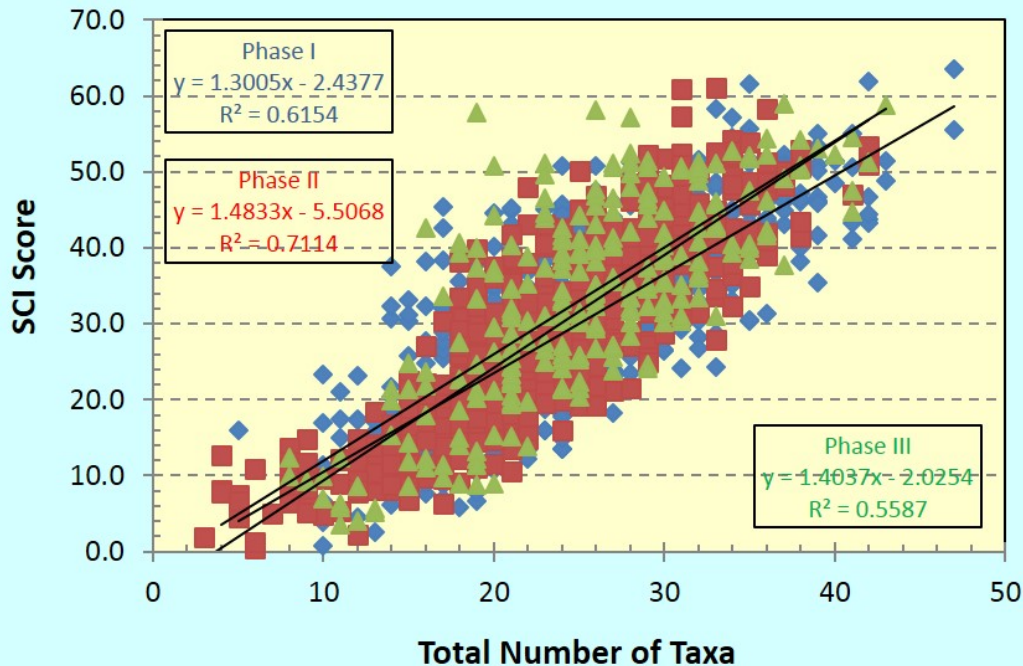
**Canals often do not meet WQ criteria (DO, pH, Specific Conductance, Chlorophyll (assessment target), and SCI**

| Parameter            | Percent of Canals with > 10% Exceedance | Exceedances by Phase |
|----------------------|-----------------------------------------|----------------------|
| DO Sat               | 53.2                                    | II > III > I         |
| pH                   | 27.7                                    | I > III > II         |
| Specific Conductance | 6.4                                     | I                    |
| Chlorophyll          | 36.2                                    | I > III > II         |
| SCI (based on sites) | 83.5                                    | I = II > III         |

- **SCI scores are generally low and range from <1 to 64 with an average of 29.7 and few passing scores.**
  - **Only 16% (17 of 103) of canal sites pass SCI (average  $\geq 40$ ).**
  - **Highest site average SCI score was only 46.**
- **Habitat Assessment scores range from 14 to 111 with an average of 49.**
- **Low taxa richness in zooplankton results.**
- **Some phytoplankton samples contain surprisingly few cells.**



# Preliminary Results

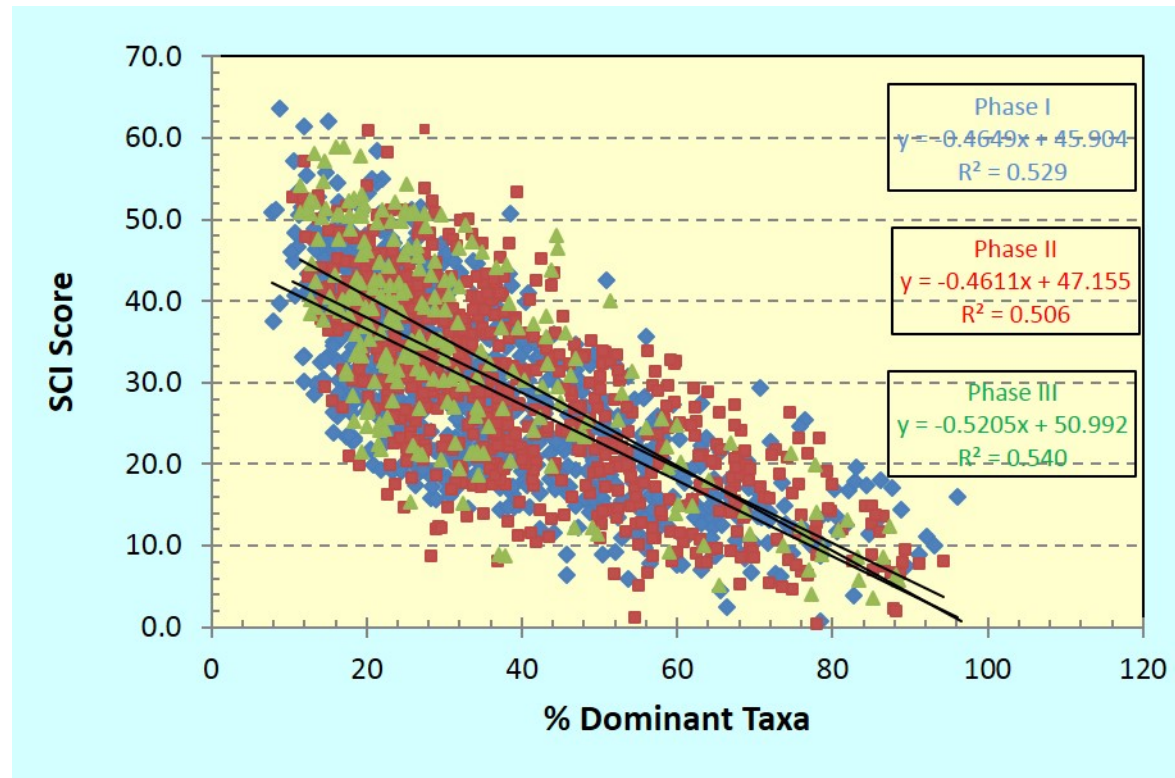


- Of the ten SCI metrics, SCI scores most highly driven by:
  - Total # Taxa
  - % Dominant
- SCI also correlated to # of chironimide taxa
- Similar results for canals in all areas
- Phase III biological data limited due to lag time between collection and analyses



# Preliminary Results

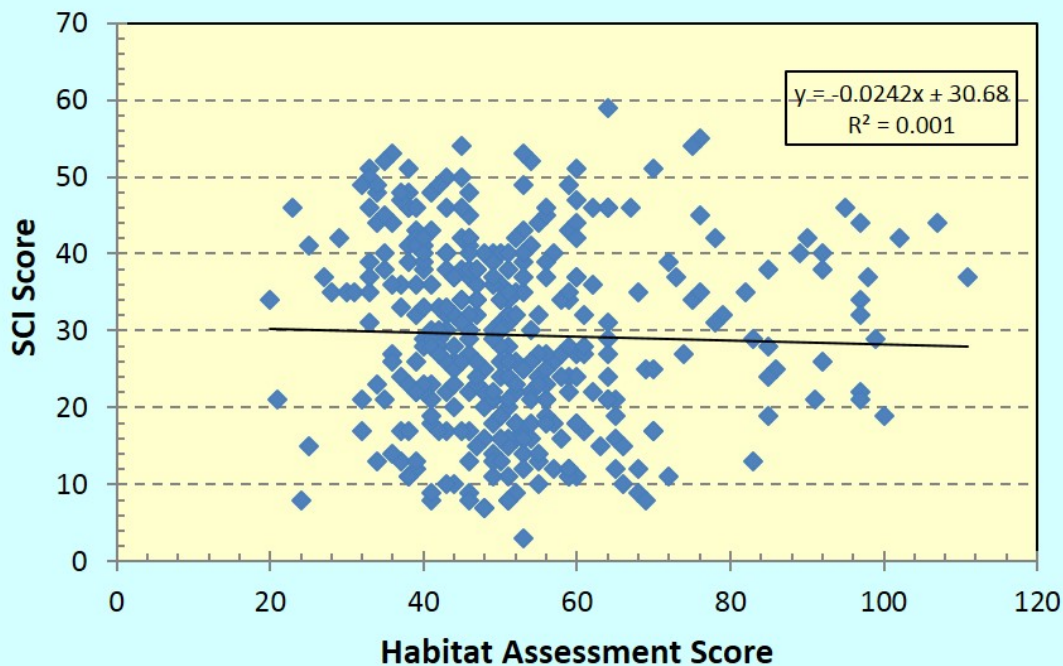
- Of the ten SCI metrics, SCI scores least influenced by:
  - # Sensitive taxa
  - # Long-lived taxa
  - # Clinger taxa
  - # Ephemeroptera taxa
- Lack of correlation due to limited number of organisms in these groups, except very tolerant





# Preliminary Results

**SCI doesn't appear to be highly correlated to any hydrologic, chemical, or habitat measures**

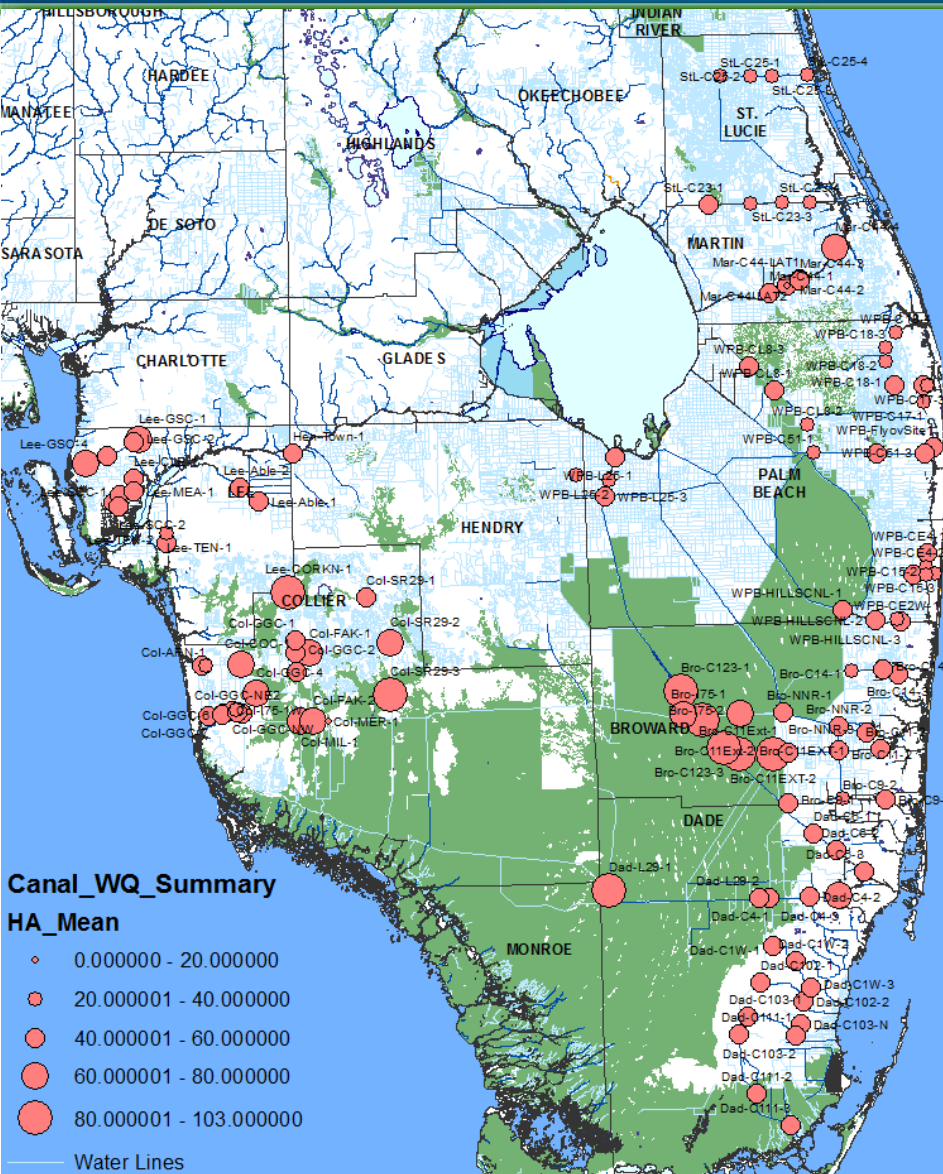


**Examined other factors to help explain differences observed**

- Types of habitat available (inverts)
- Canal morphology
  - Width and depth
  - Presence of littoral area or ledge
- Vegetation maintenance activities
  - Frequency and days since last treatment
- Flow
- Connection to wetlands (Everglades marsh)
  - Wetland adjacent to site
  - Wetland adjacent to canal away from site
  - Wetland adjacent to connected canal
  - Adjacent wetland > 1 mile away



# Spatial Analyses

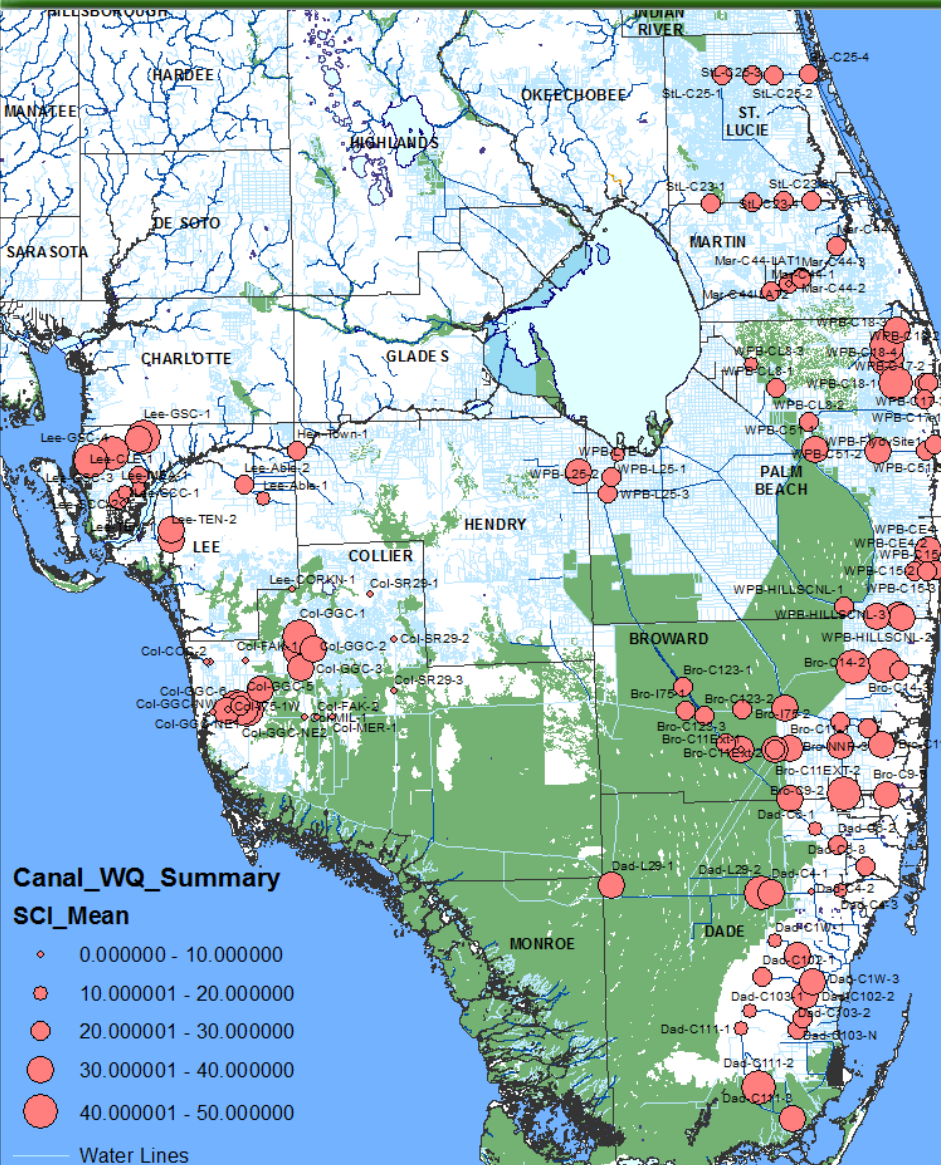


## Habitat Assessment

- Highest HA scores found in Everglades canals (as expected)
  - Open to marsh = recruitment source
  - More plants
  - Better WQ (lower TP)
  - Less surrounding anthropogenic influence
- Lowest HA scores for northeastern sites



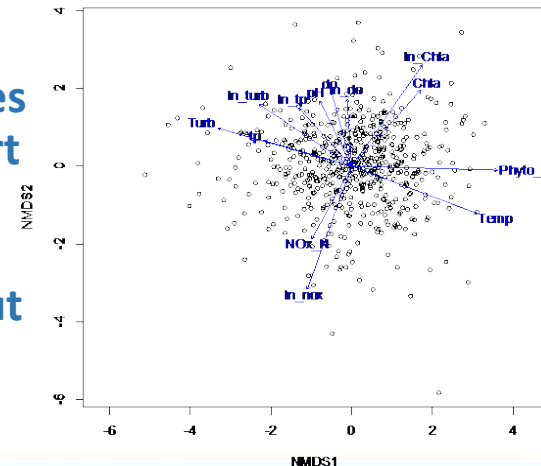
# Spatial Analyses



## SCI Scores

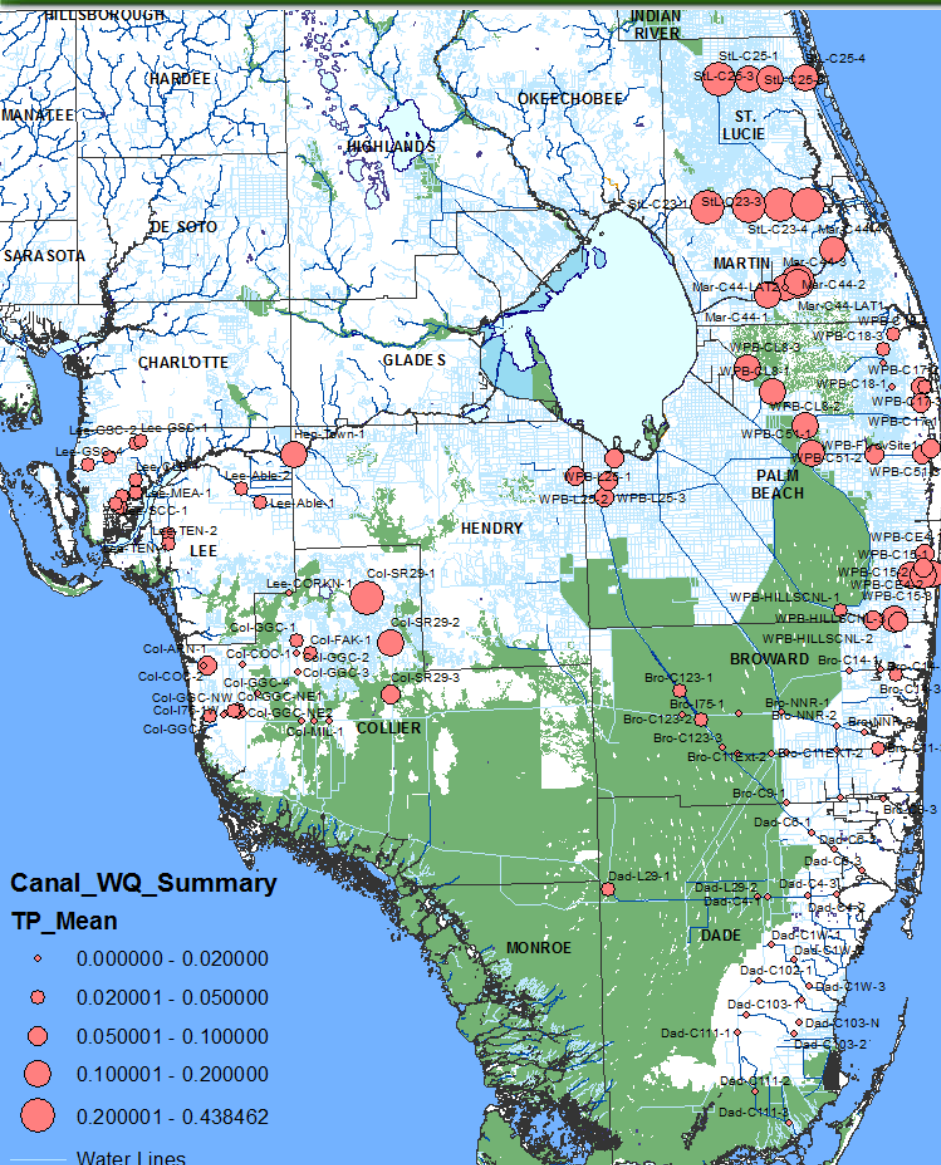
- Low SCI scores found in Everglades canals (not expected)
  - Why???
- Low SCI scores also found for northeastern sites

- Extensive statistical analyses conducted by Curt Pollman yielded little explanatory information about SCI response





# Spatial Analyses



## Total Phosphorus

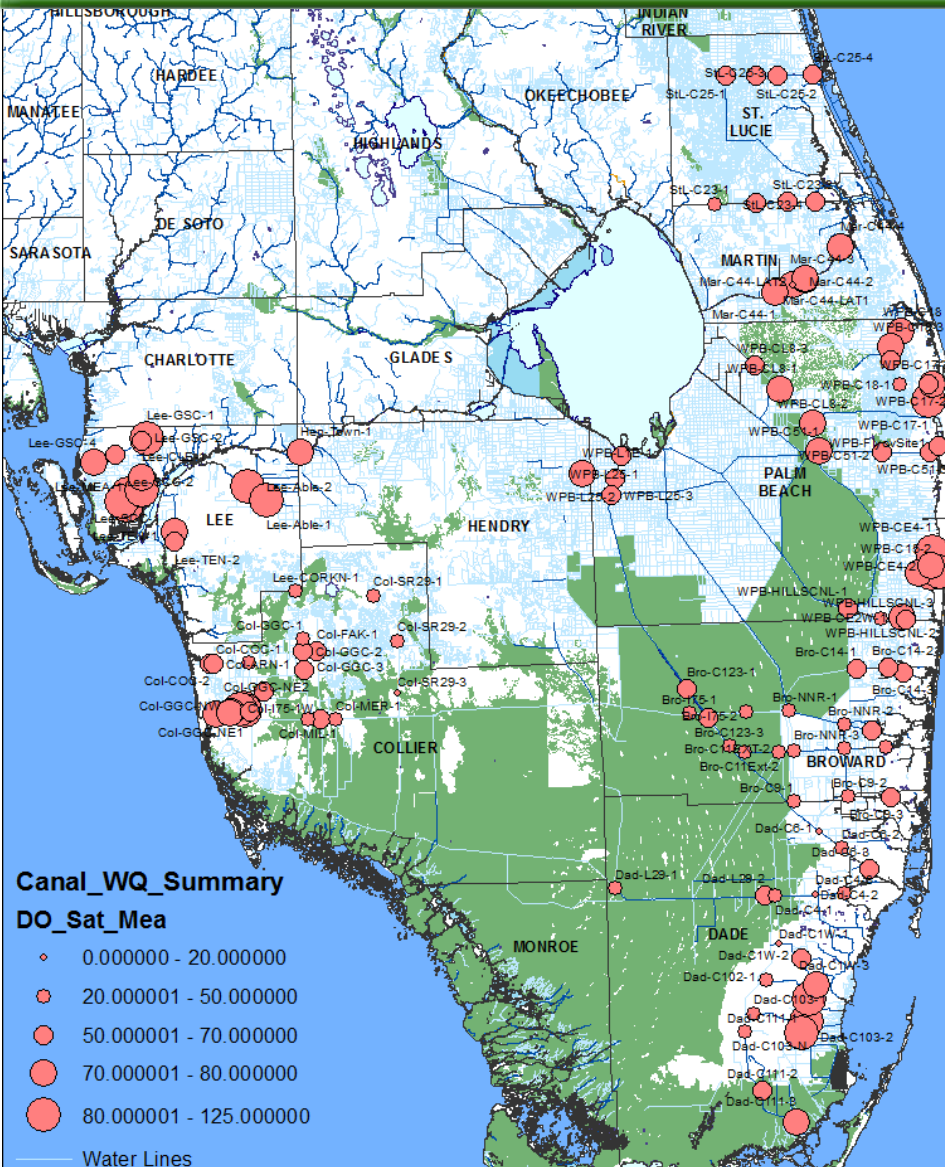
- General north to south gradient
  - Lake Okeechobee
  - EAA
- Low TP in Everglades Canals
- Also low TP in SE Phase II canals
  - Groundwater influence

## Total Nitrogen

- No distinct spatial pattern
  - High near Lake Okeechobee
  - Also high in some SE canals
    - NOx



# Spatial Analyses



## Dissolved Oxygen (duh!)

- Lowest DO levels in Everglades Canals
  - Bugs need oxygen to survive
  - Wetlands (Everglades) known for low DO (DO SSAC)
  - Explains low SCI in Everglades canals?

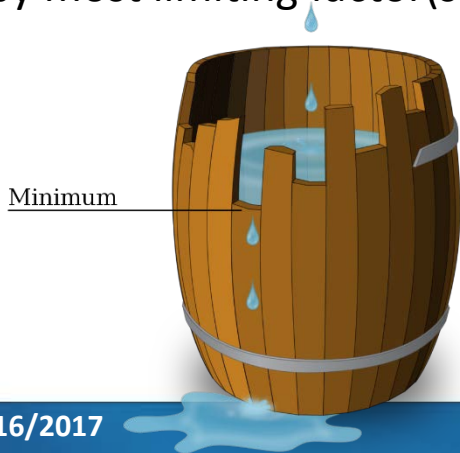




# Summary

## Canals are Complex Waterbodies

- Largely man-made
- Complicated mix of natural and anthropogenic influences
- Biological communities are not responding to the same factors in all of the canals (multiple factors)
- Biological responses are probably not linear
  - Liebig's Law of the minimum
  - Bug community controlled by most limiting factor(s)





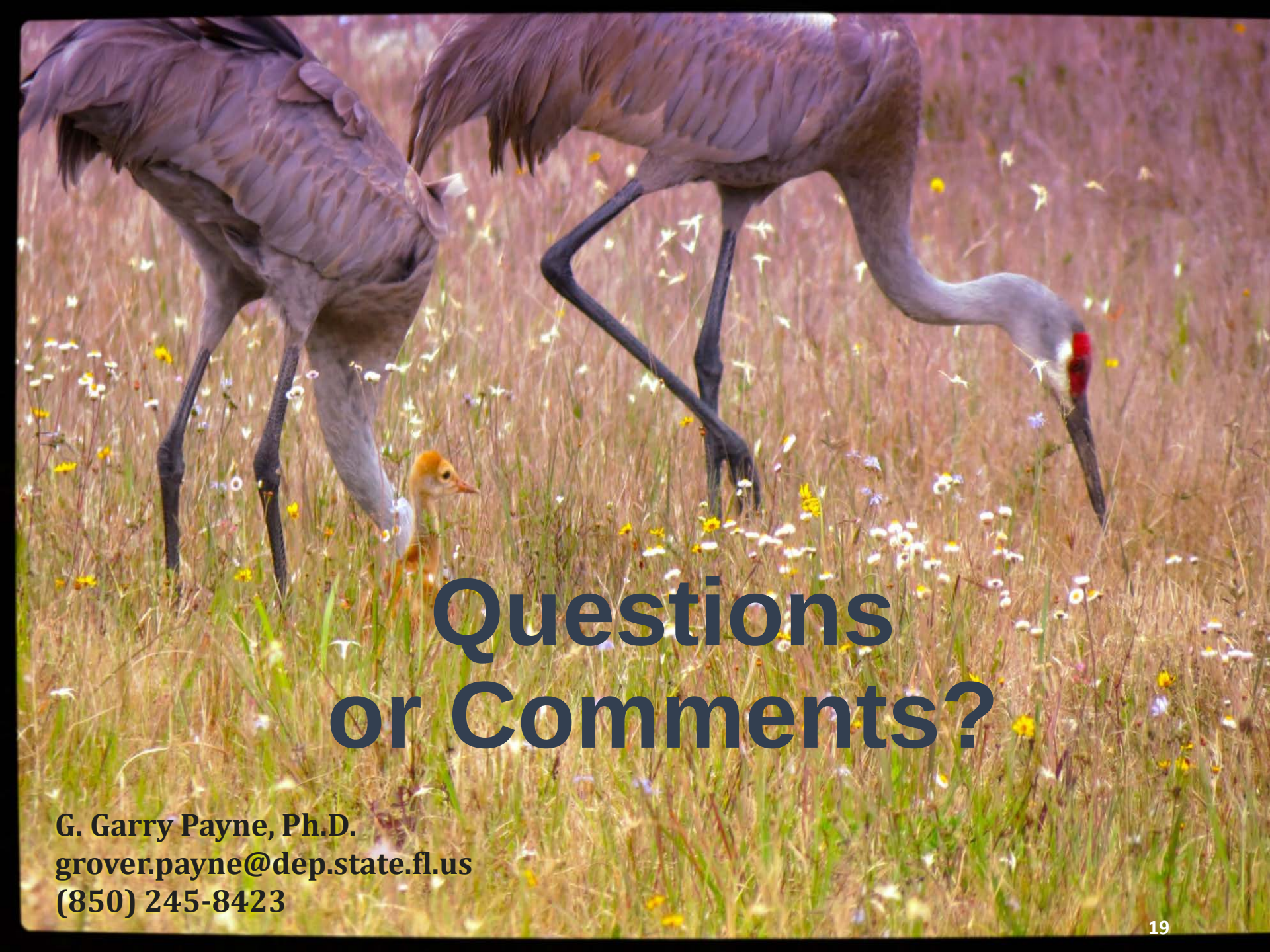
# What is Ahead?

- **Additional Analyses**

- Look at SCI (and individual metrics) relationship with multiple parameters using additional techniques
- Modify SCI to be more appropriate for SF Canals
  - SCI and metrics for peninsula likely not appropriate for canals
- Examine data for other biological communities; fish, plants, algae
- Prepare draft report

- **Make regulatory recommendations**

- Revised regional criteria (nutrients, DO)
- Reclassification and/or SSACs

A photograph of two adult sandhill cranes and a small chick in a field of tall grass and wildflowers. The cranes are leaning over, possibly foraging. The chick is standing between them. The background is a soft-focus field of yellow and white wildflowers.

# Questions or Comments?

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