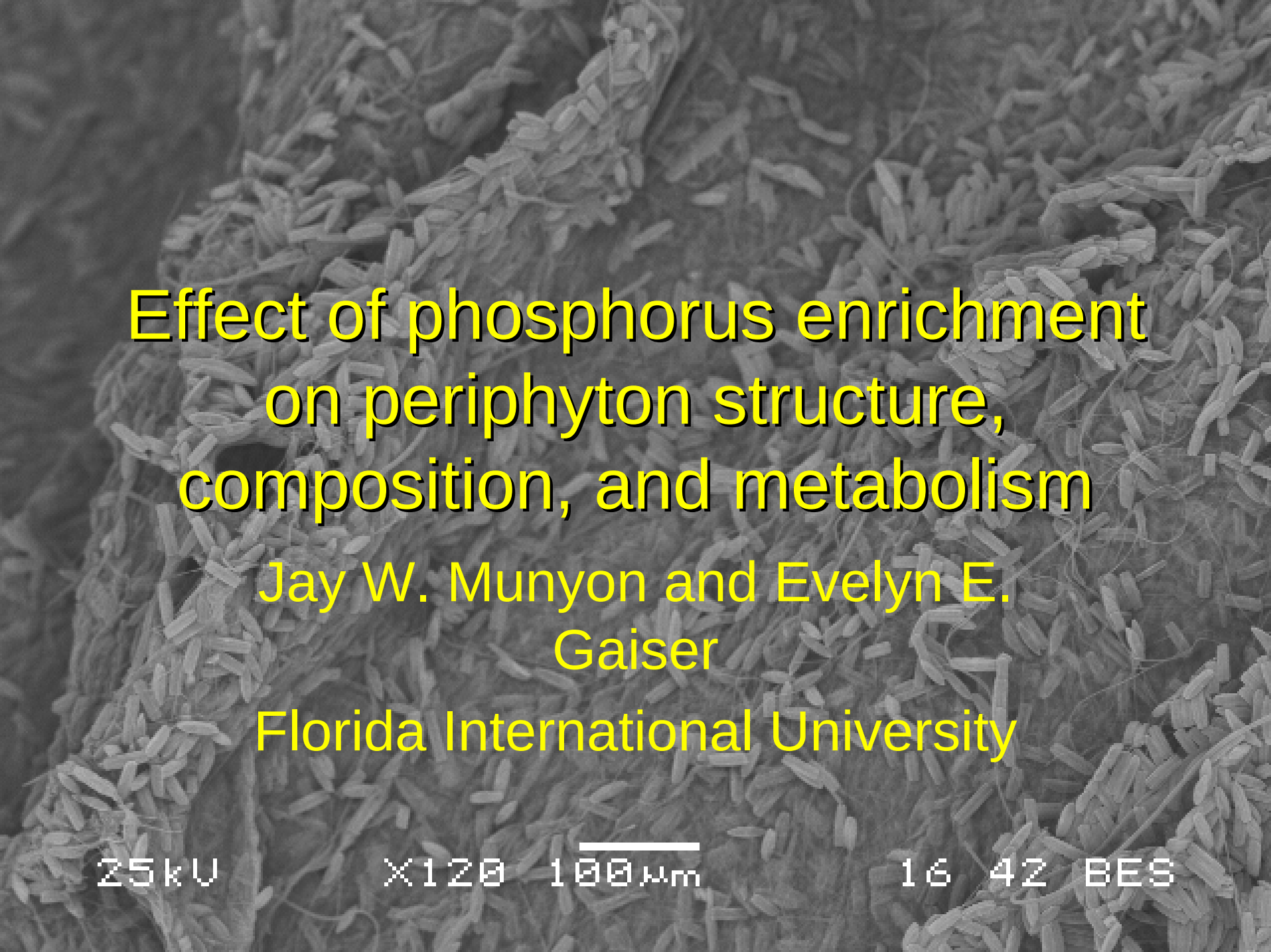
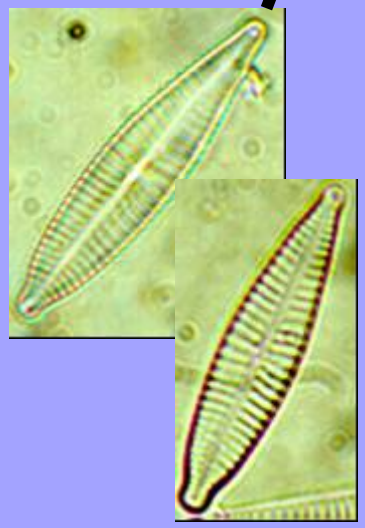
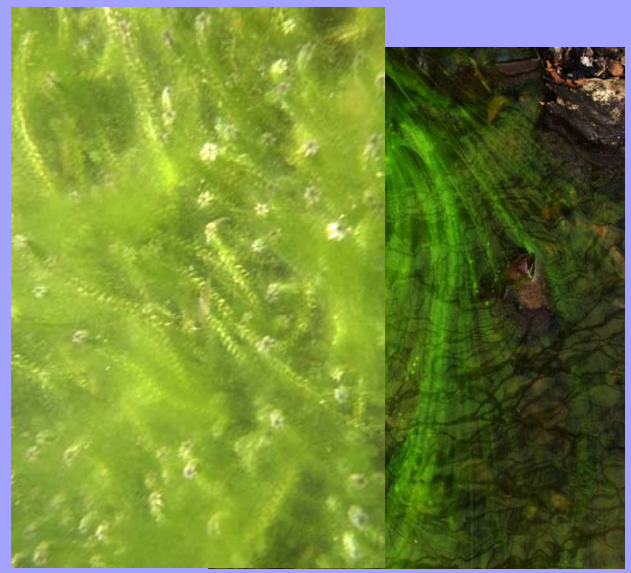


Effect of phosphorus enrichment on periphyton structure, composition, and metabolism

Jay W. Munyon and Evelyn E. Gaiser

Florida International University

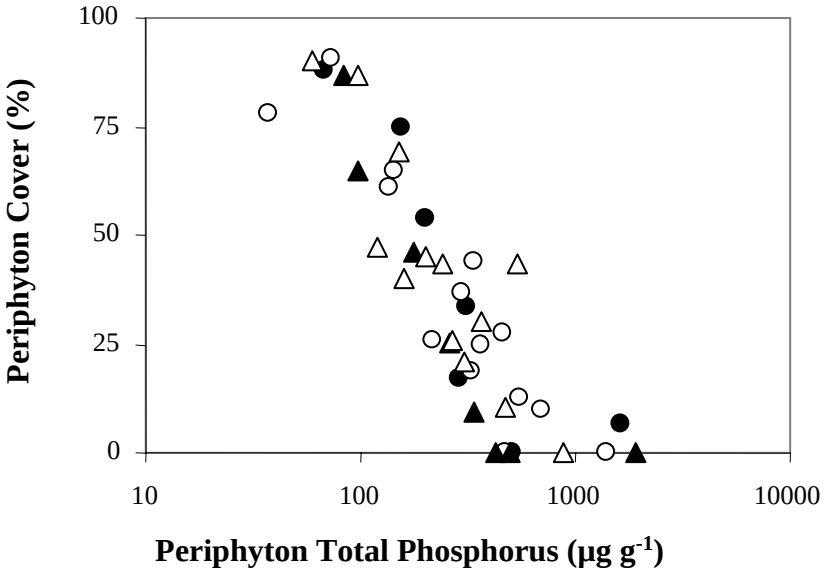


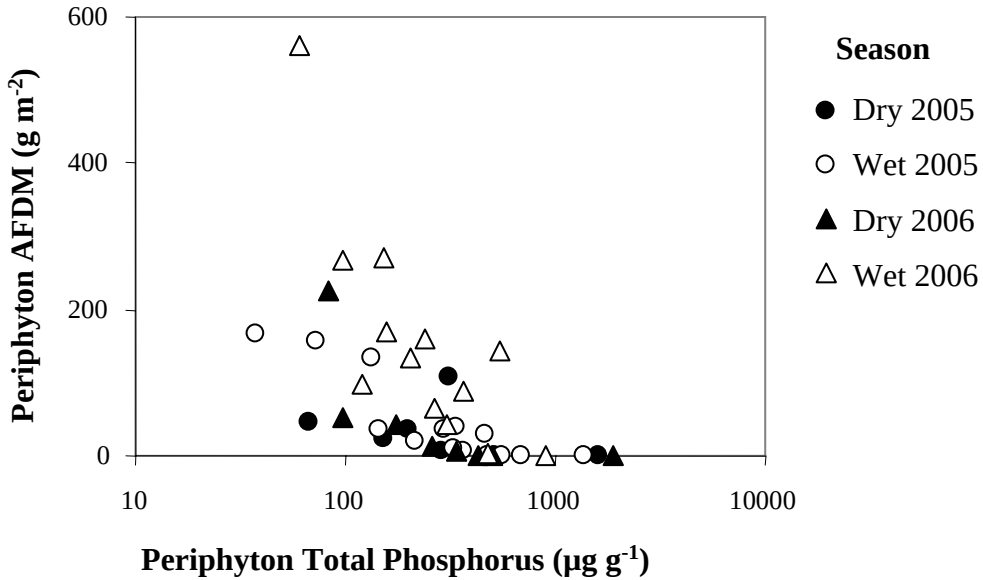


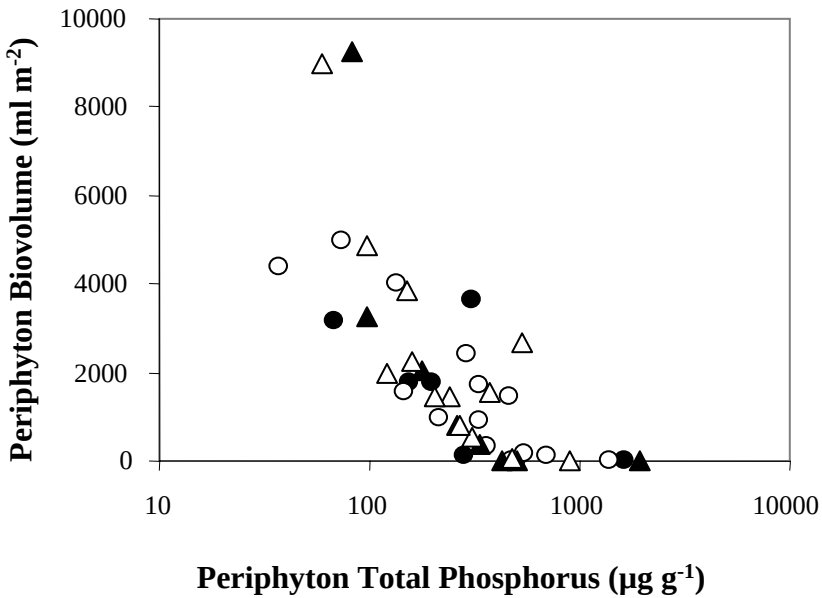
Everglades Periphyton

- Benthic calcareous mats, floating mats, and epiphytic periphyton
- Everglades periphyton varies spatially:
  - Nutrients, light, substrate, water depth
- Long term data has shown changes in biomass in response to changes in water phosphorus levels

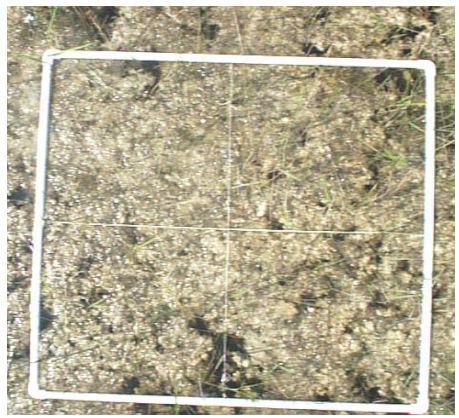
Sweater periphyton in the water column

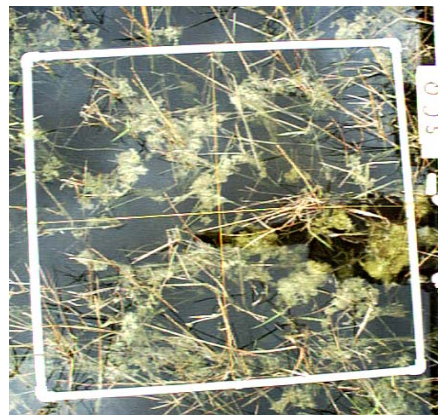






30 ppb Treatment

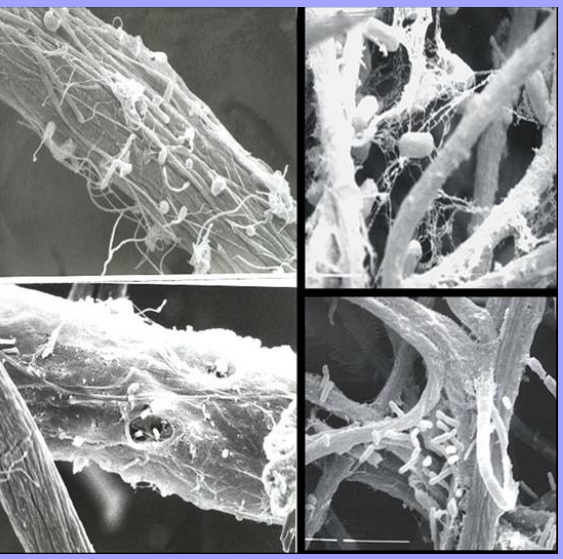




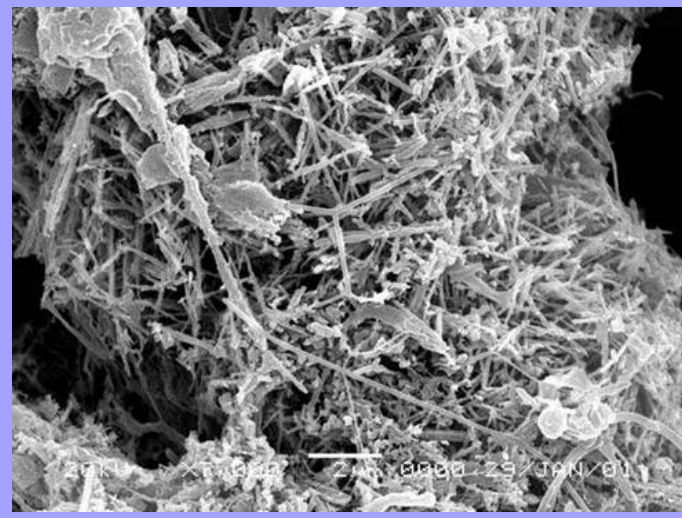
Day 1 **Day 180**

Gaiser et al. 2006 L&O

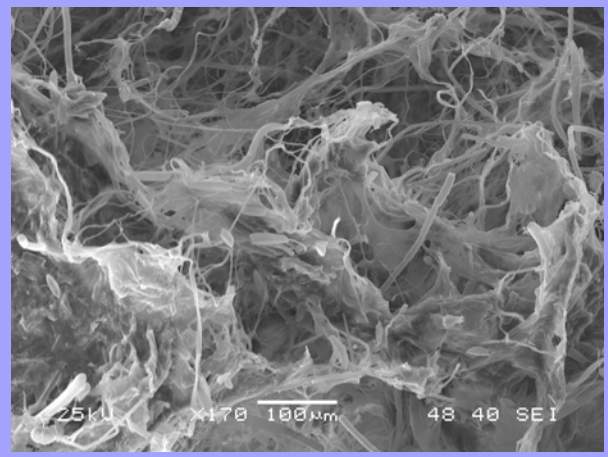
Periphyton Matrix



Blue greens with filaments of EPS (courtesy M. Gantar)

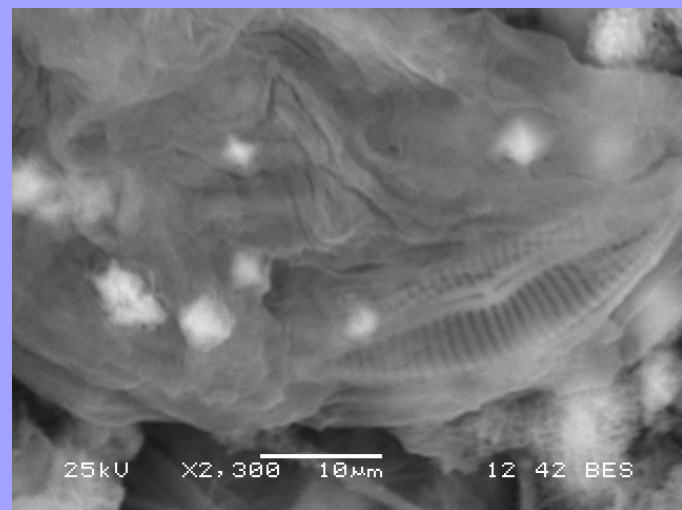


$CaCO_3$ crystals in periphyton mat (courtesy M. Gantar)

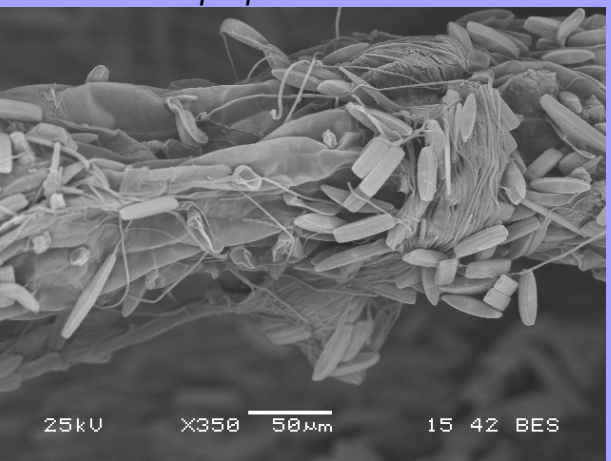


EPS in periphyton mat

Encyonema with sheath/trail of EPS



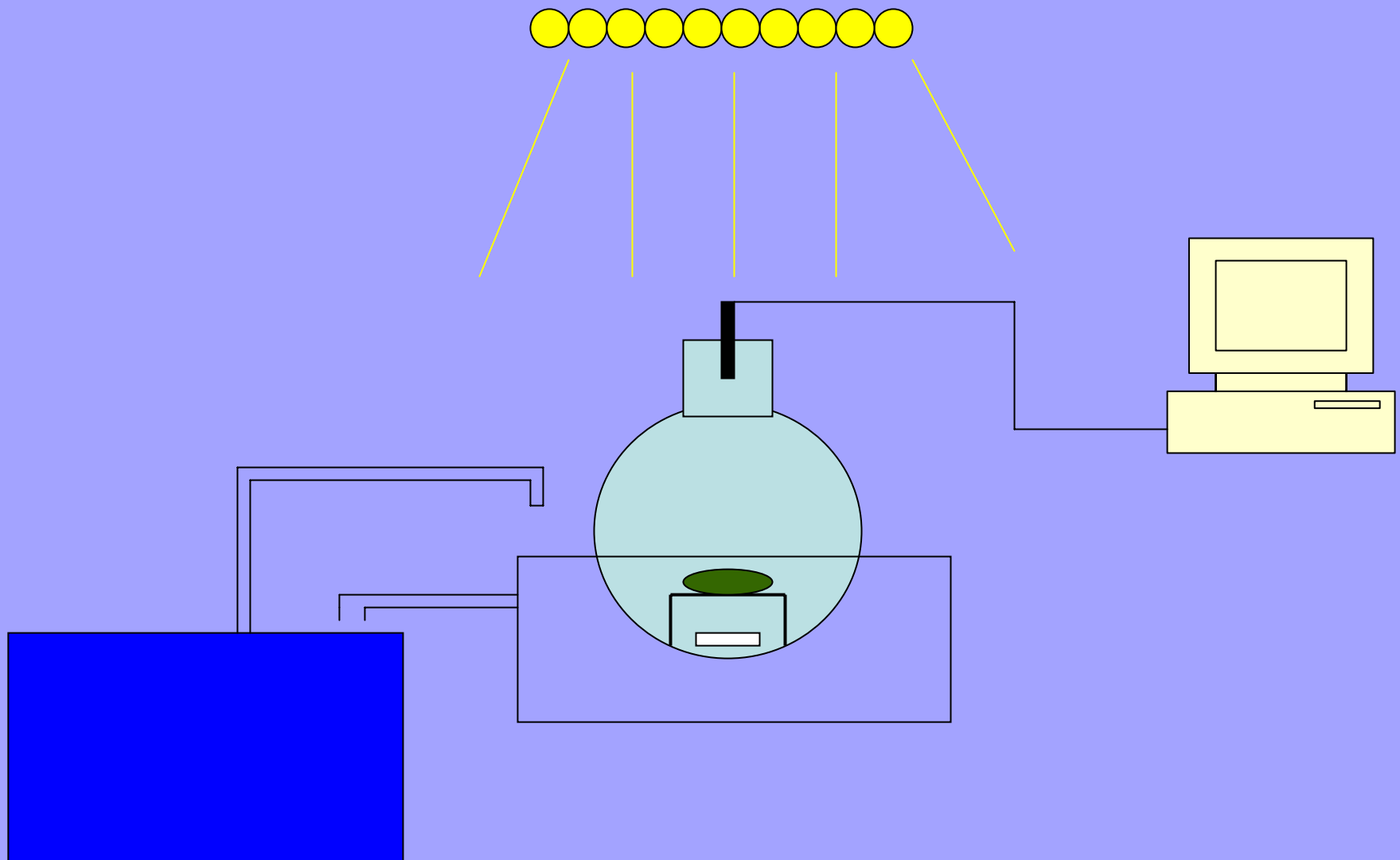
Diatoms leaving EPS trail on *Utricularia purpurea*



Hypotheses

- As water TP increases:
  - System metabolism will change
  - EPS concentration will decrease
  - Abundance of mat-forming species will decrease
  - Periphyton biomass will decrease

Microcosm Experimental Setup

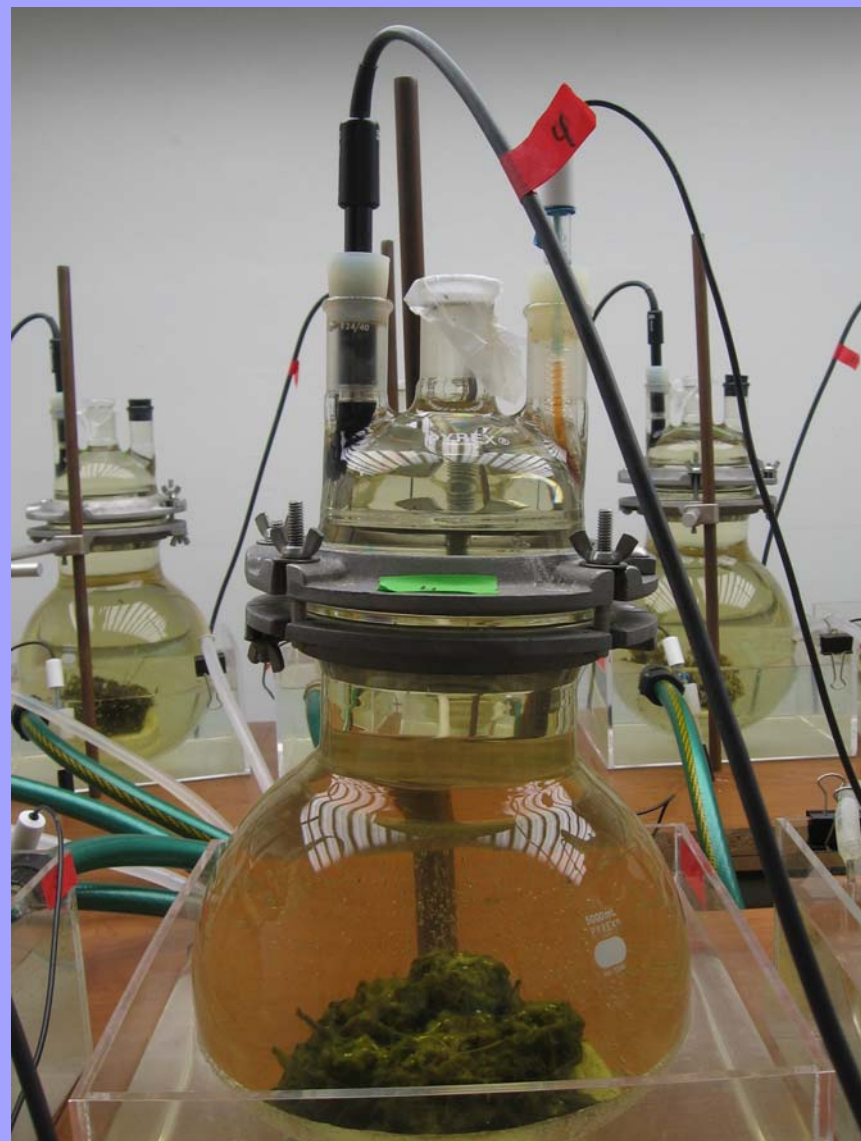


Methods

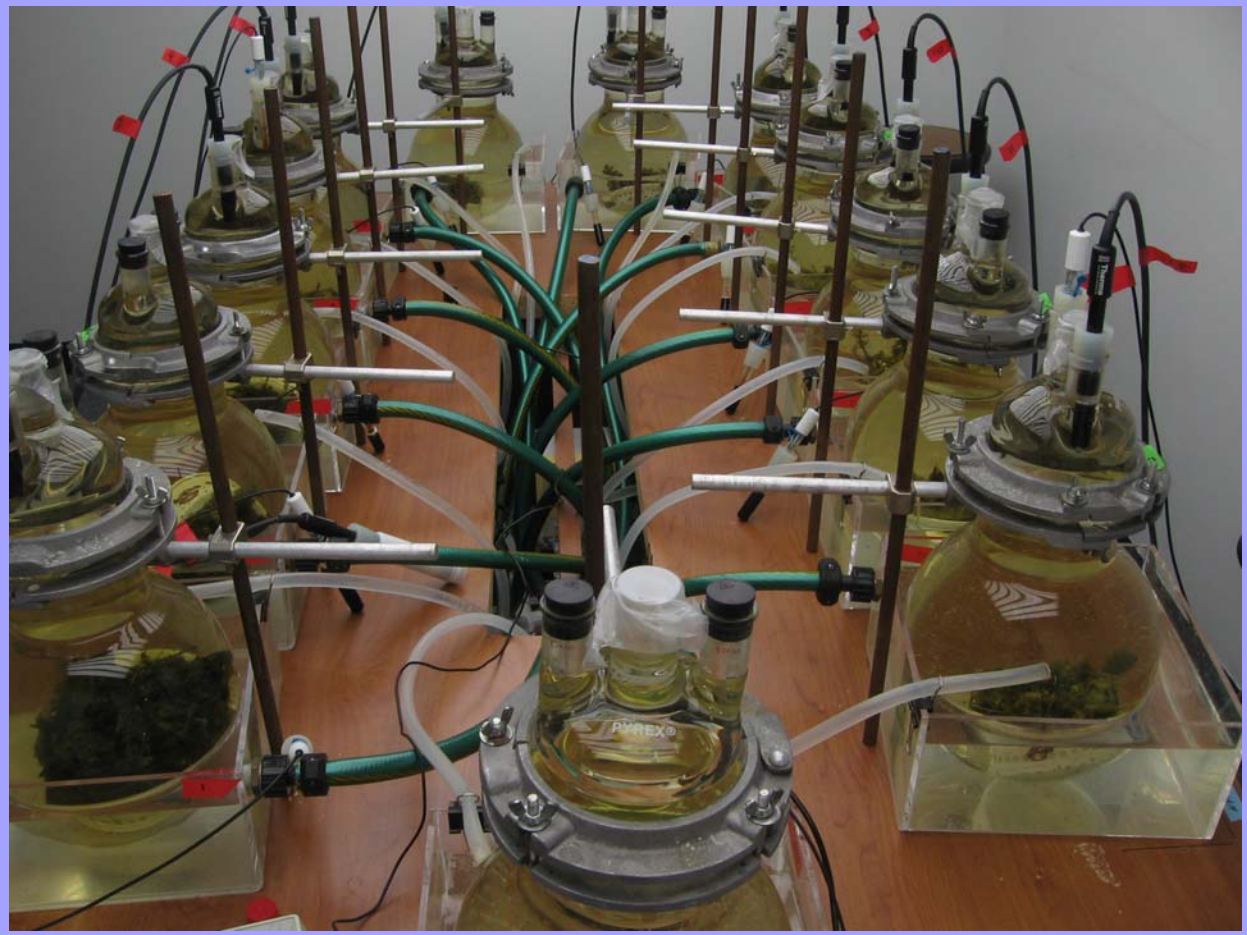
- Treatments
  - Control
    Periphyton with filtered Everglades water
  - +P
    Periphyton with P-enriched filtered Everglades water
  - +A
    Periphyton pre-incubated in antimicrobial solution and filtered Everglades water
  - +P+A
    Periphyton pre-incubated in antimicrobial solution and P-enriched filtered Everglades water

- +P = added ~2 µM (30ppb) P using Na_2HPO_4

- +A = 250 mg D-cycloserine, 10 mg ampicillin, 10 mg tetracycline, 100 mg benomyl brought to 1 L with DI H_2O



Methods



Methods

- System was run for 7 days
- Analyses
  - Metabolism
  - Extracellular Polysaccharide concentration (EPS)
  - Diatom abundances
  - Dry Weight
  - AFDM
  - Chl a
  - Water column TOC, TN, TP
  - Tissue C, N, P
  - Soft algae abundances
  - Bacteria

Methods

- System was run for 7 days
- Analyses
  - **Metabolism**
  - **Extracellular Polysaccharide concentration (EPS)**
  - **Diatom abundances**
  - **Dry Weight**
  - AFDM
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  - Water column TOC, TN, TP
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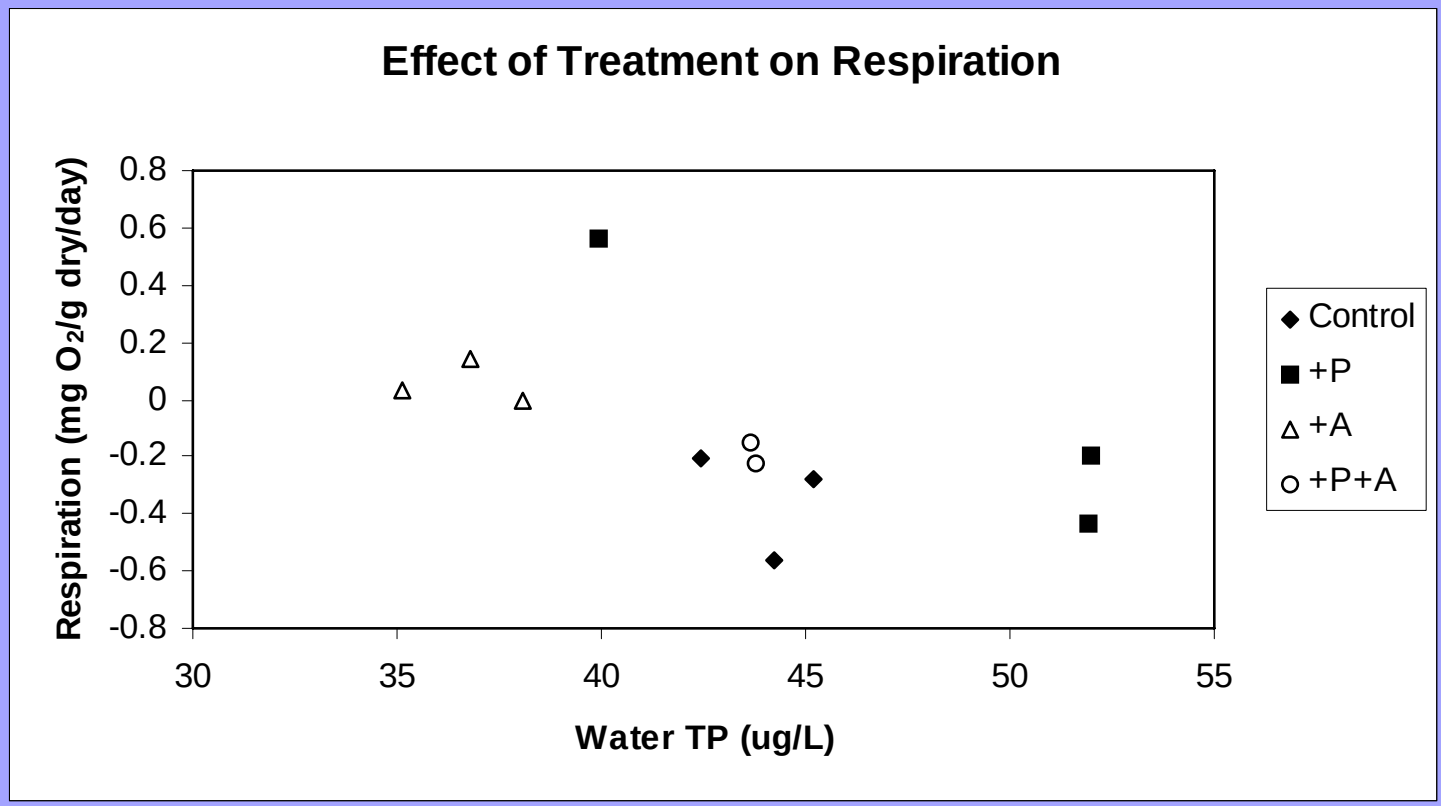
  - Soft algae abundances
  - Bacteria

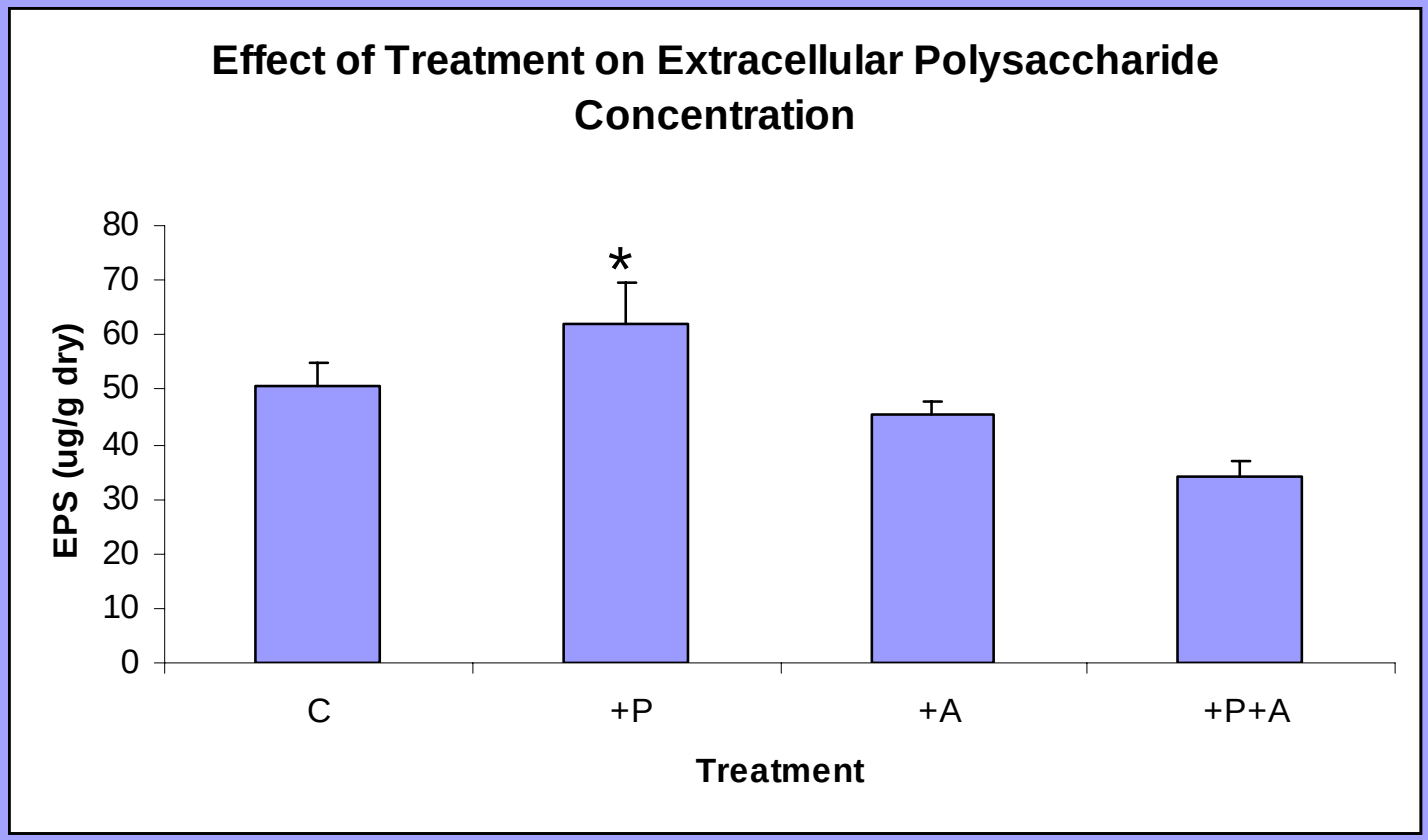
Hypothesis 1: System metabolism will change with increases in water TP



Respiration rates increased with increasing water TP

+A respiration rates differed significantly from control rates

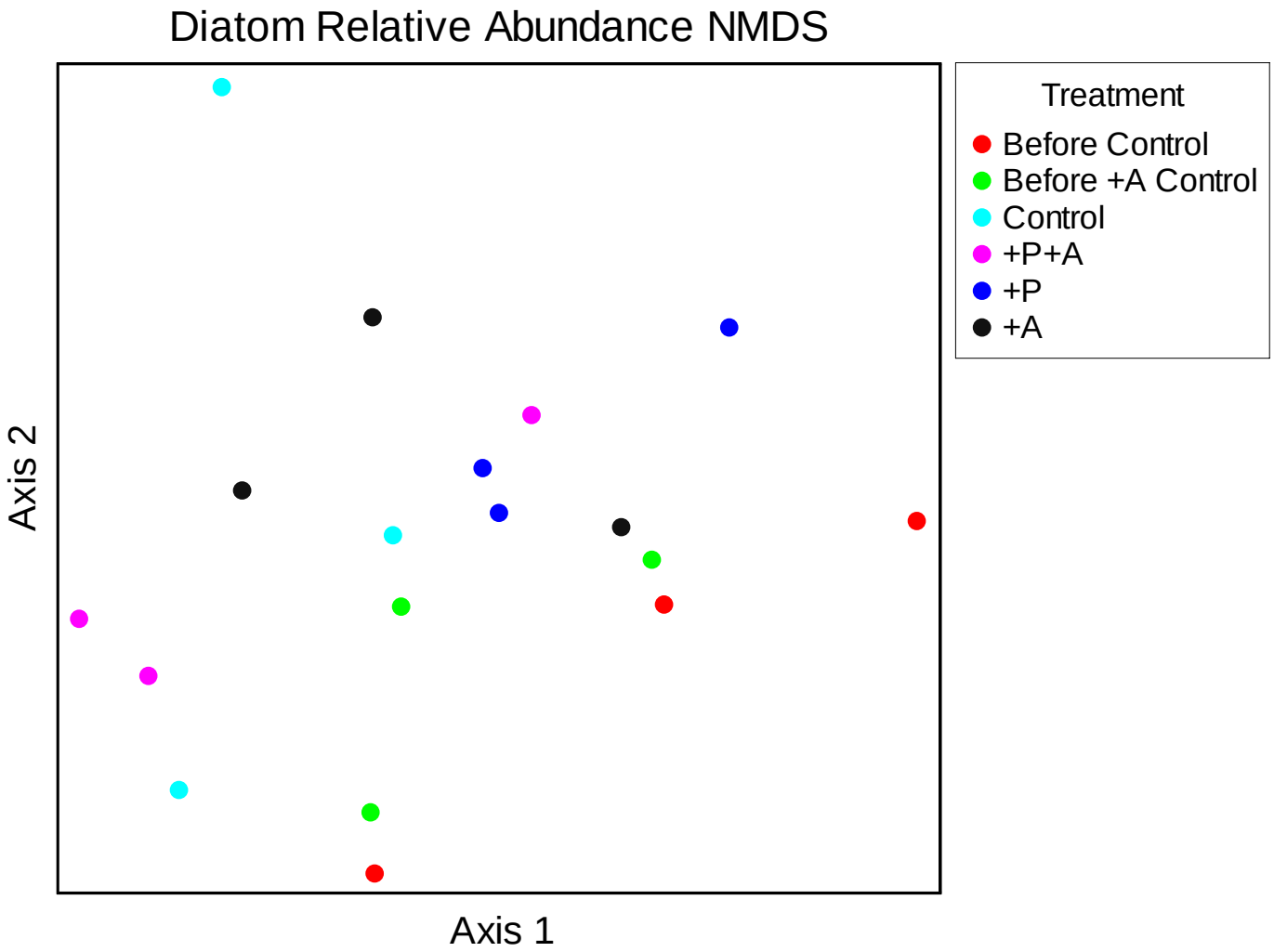
Hypothesis 2: EPS concentration will decrease with increasing water TP



P enrichment significantly increased EPS concentration

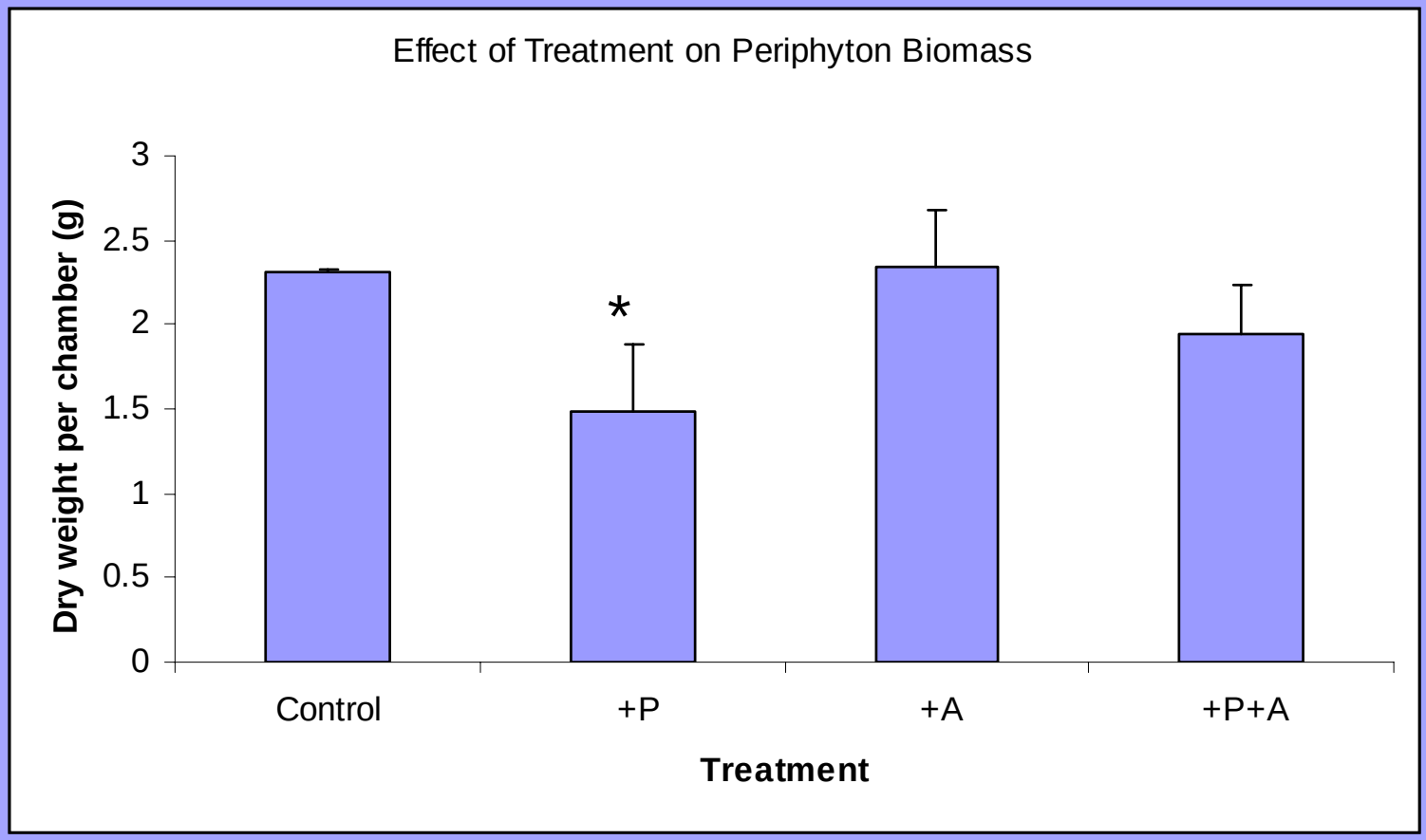
+A and +P+A showed no significant change

Hypothesis 3: Abundance of mat forming diatoms will decrease



- There were chamber effects as shown by the before run controls grouping out from the rest.
- After running an indicator species analysis, we find that *Nitzschia amphibia* was an indicator P-enrichment

Hypothesis 4: Periphyton biomass would decrease with increasing water TP



Periphyton biomass decreased significantly with increased P

+A and +P+A showed no significant changes

Conclusions

- As water TP increases:
  - Metabolism changed with increasing water TP
  - EPS concentration did not decrease in response to P-enrichment
  - *Nitzschia amphibia* abundance did increase as a result of enrichment, however running the experiment for longer may have elicited a stronger response
  - Periphyton biomass did decrease in response to phosphorus, however this decrease was ameliorated by addition of antimicrobials

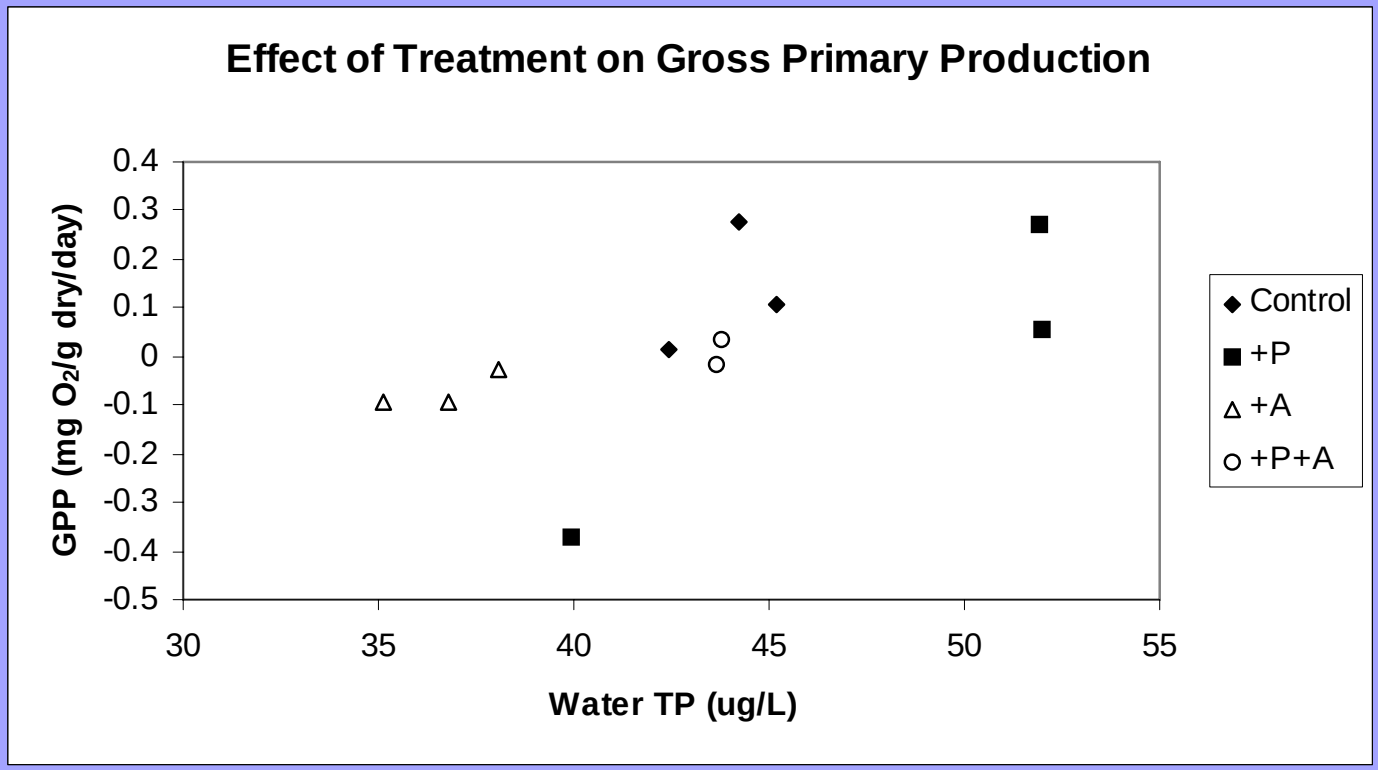
Future Directions

- More microcosm research needs to be performed with greater number of replicates for each treatment
- Periphyton mats need to be collected from areas with known low phosphorus levels
- We need to find a method to quantify bacteria in Everglades periphyton mat

Acknowledgements

- Everglades National Park
- Everglades Foundation Fellowship
- SERC Christina Menendez Fellowship
- FCE-LTER
- Committee – Evelyn Gaiser, Joe Boyer, and Steve Oberbauer
- Miro Gantar
- The Periphyton Group
- The countless people who helped me with this project

Hypothesis 1: System metabolism will change with increases in water TP



Water column TP of controls did not differ significantly from +P

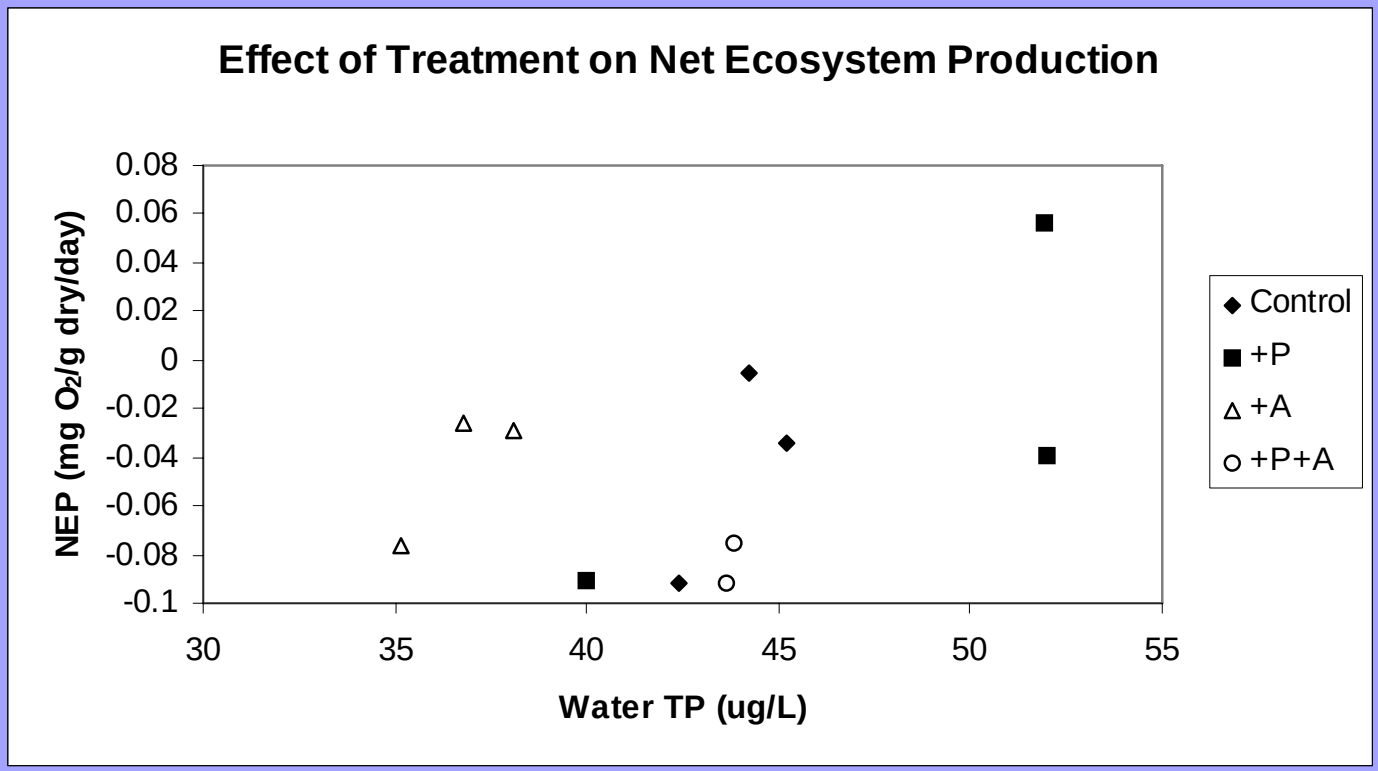
Control GPP did not differ significantly from +P

+A had lower TP than control indicating uptake from water column

+P+A had lower TP than +P indicating that antimicrobials treatment increased P uptake

GPP increased significantly with increasing TP

Hypothesis 1: System metabolism will change with increases in water TP



NEP increased with increasing water TP

+A and +P NEP did not differ significantly from control NEP