Periphyton Community Dynamics in Lake George Sub-Watersheds

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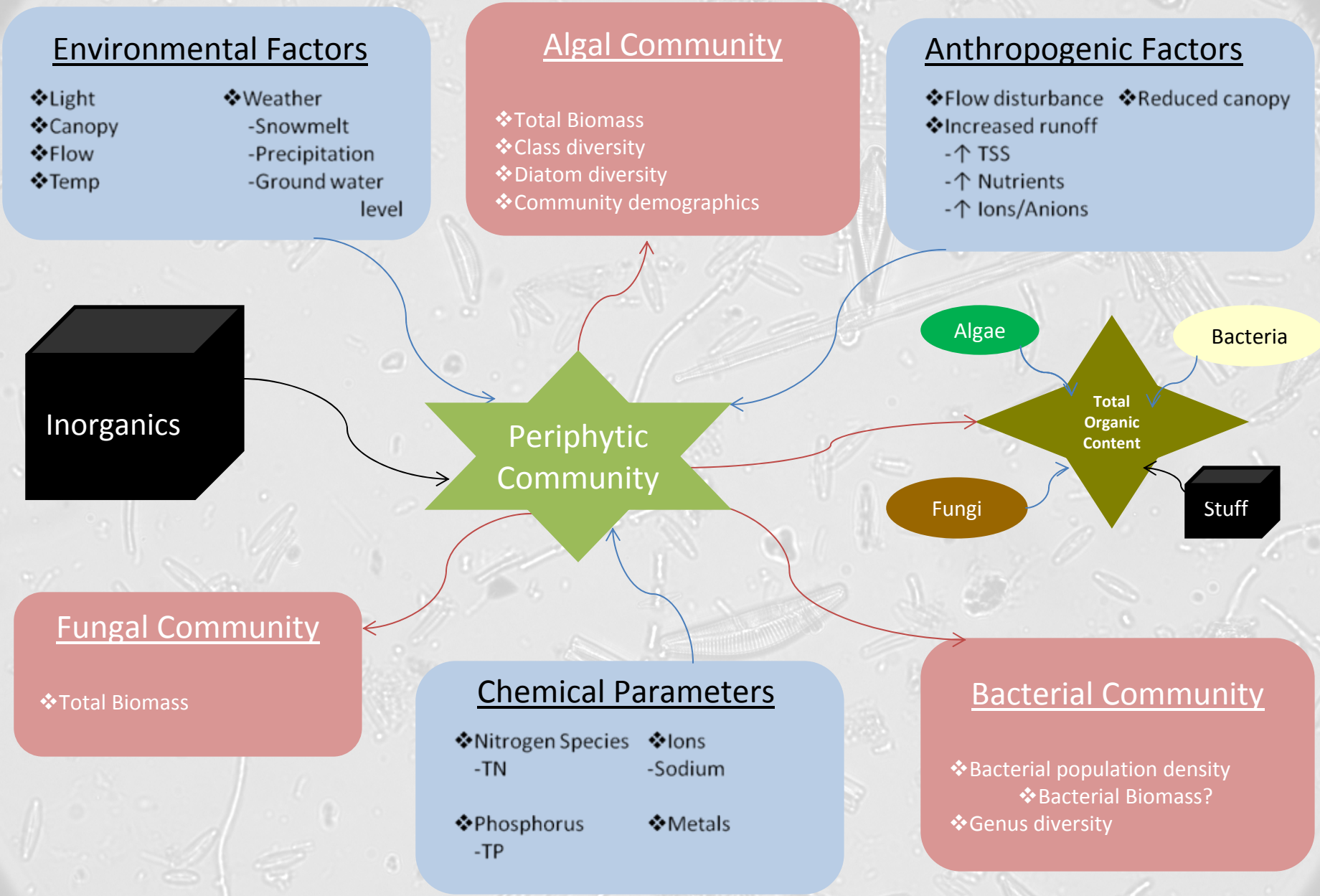
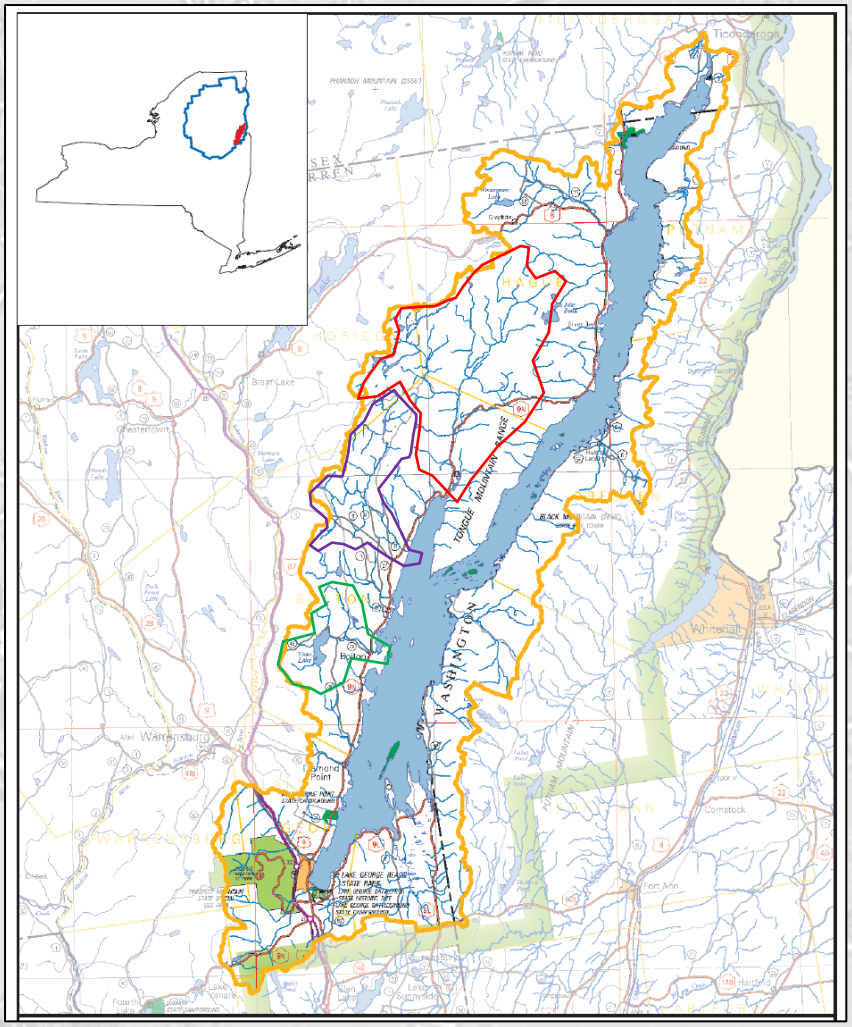
Thesis Statement

Periphytic communities of the Lake George Watershed change in composition when exposed to either anthropogenic or environmental factors

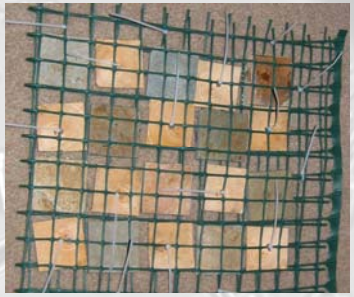

Environmental Factors
❖Light
❖Canopy
❖Flow
❖Temp
❖Weather
-Snowmelt
-Precipitation
-Ground water level
Algal Community
❖Total Biomass
❖Class diversity
❖Diatom diversity
❖Community demographics
Anthropogenic Factors
❖Flow disturbance
❖Reduced canopy
❖Increased runoff
-↑ TSS
-↑ Nutrients
-↑ Ions/Anions
Inorganics
Periphytic Community
Algae
Bacteria
Total Organic Content
Fungi
Stuff
Fungal Community
❖Total Biomass
Chemical Parameters
❖Nitrogen Species
-TN
❖Ions
-Sodium
❖Phosphorus
-TP
❖Metals
Bacterial Community
❖Bacterial population density
❖Bacterial Biomass?
❖Genus diversity

Lake George

- Watershed- 149,760 acres
- Lake area- 28,160 acres
- Approximately 190 tributaries
- 40% of the watershed is forever wild
- Lake George Village, Ticonderoga, and Bolton Landing are the larger towns surrounding the lake



Experiments



Experiment Number	Experiment Name	Initial question asked
1	Nutrient amended substrates	Does increased nutrients (N,P, N+P) change periphyton dynamics in three streams of varying stages of development?
2	Gradient of development within one stream	How do communities differ at 3 sites along one stream on a gradient of development?
3	Gradient of development within three streams	Are community trends along a gradient of development repeatable in other streams?
4	Intact community habitat shift	How do periphyton communities change when introduced to new environments?
5	Light/Shade manipulations	How does shade impact different members of the periphytic community?

Methods for periphyton analysis

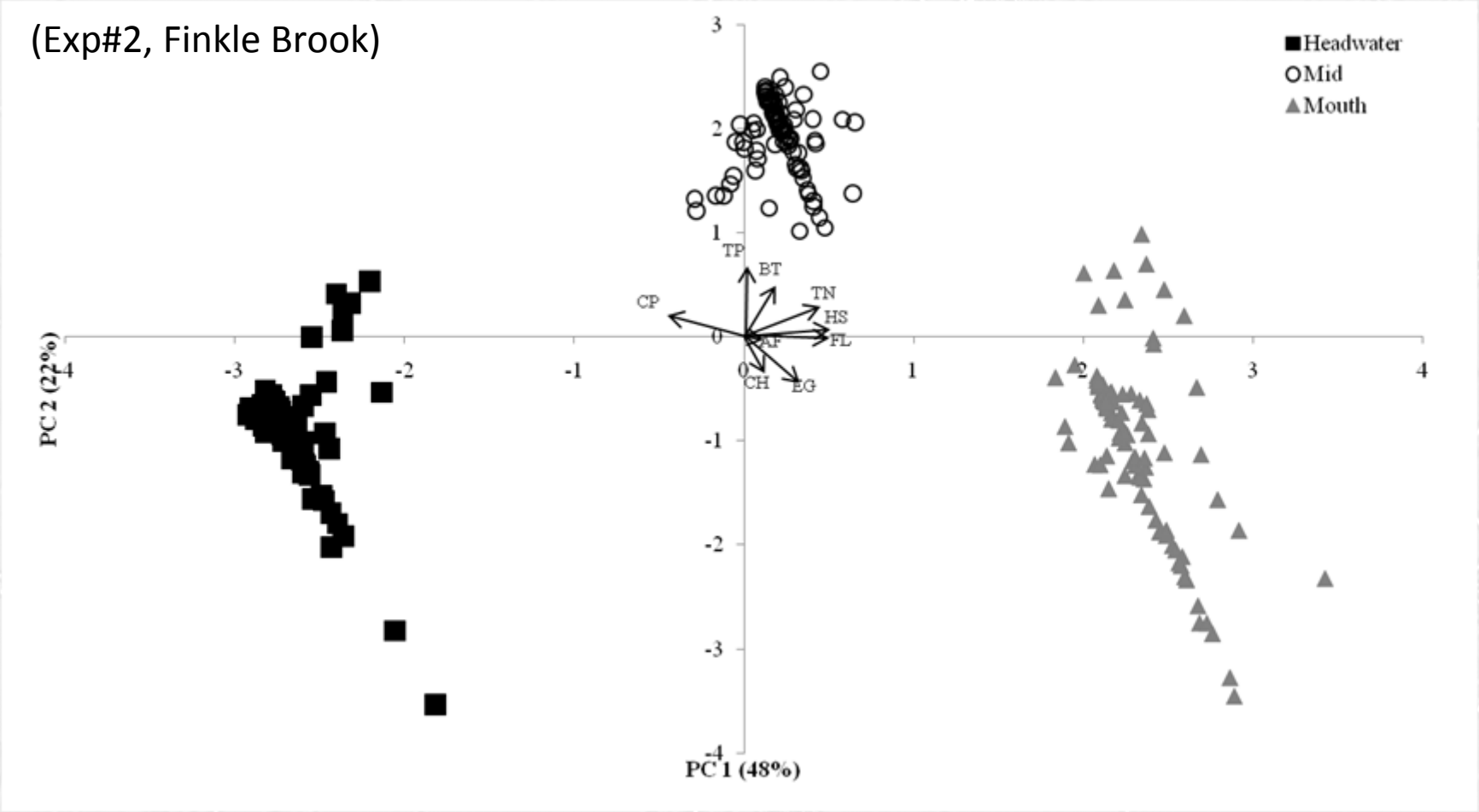
Periphyton	Method of analysis
Total Organic Matter	Ash Free Dry Mass(AFDM)
Algae	Chlorophyll *a,* fluorometric analysis
Bacteria	Acridine Orange stain w/ fluorescence microscopy
Fungi	Ergosterol extraction with HPLC analysis and quantification
Diatom	Taxonomy

What affects periphyton growth?

Environmental Factors

Communities are affected most by different environmental factors

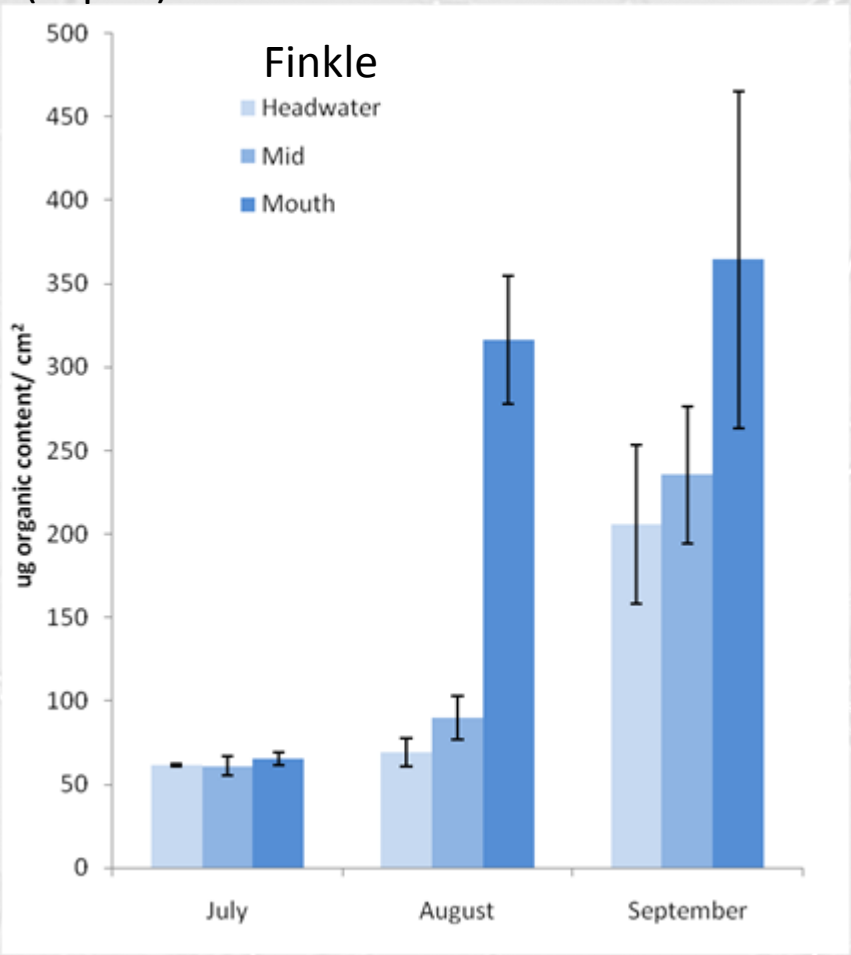
(Exp#2, Finkle Brook)



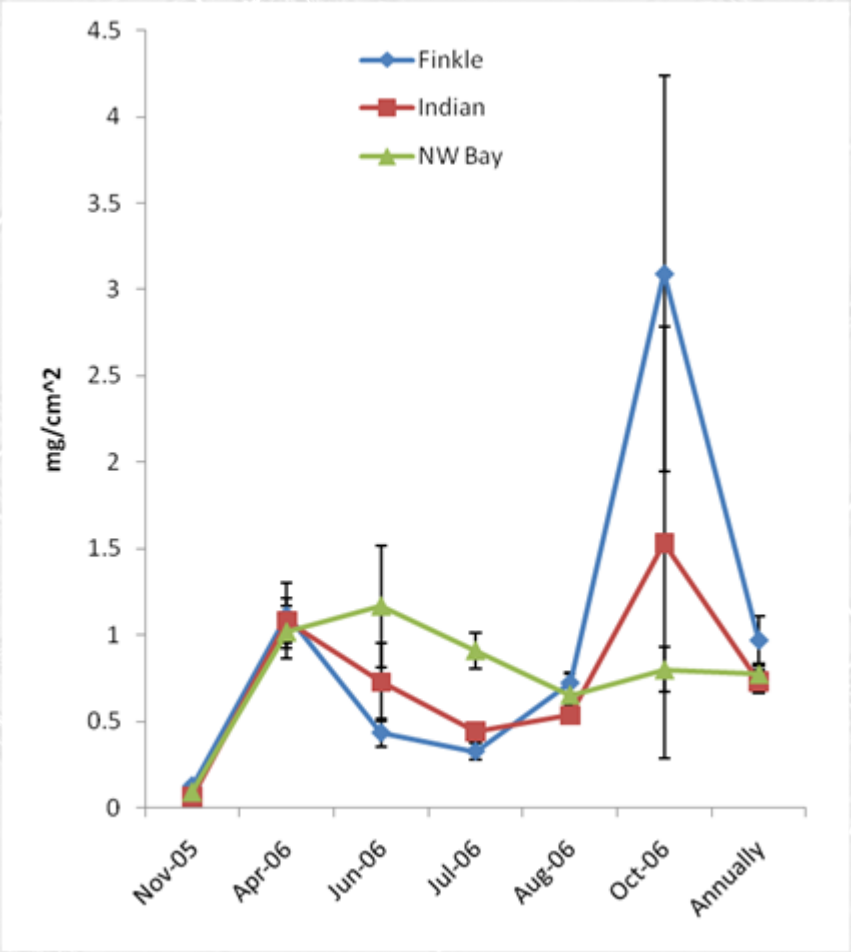
Biplot of Principle Component Analysis factors

Total Organic Matter fluctuates throughout the year and is highest in the fall

(Exp#2)

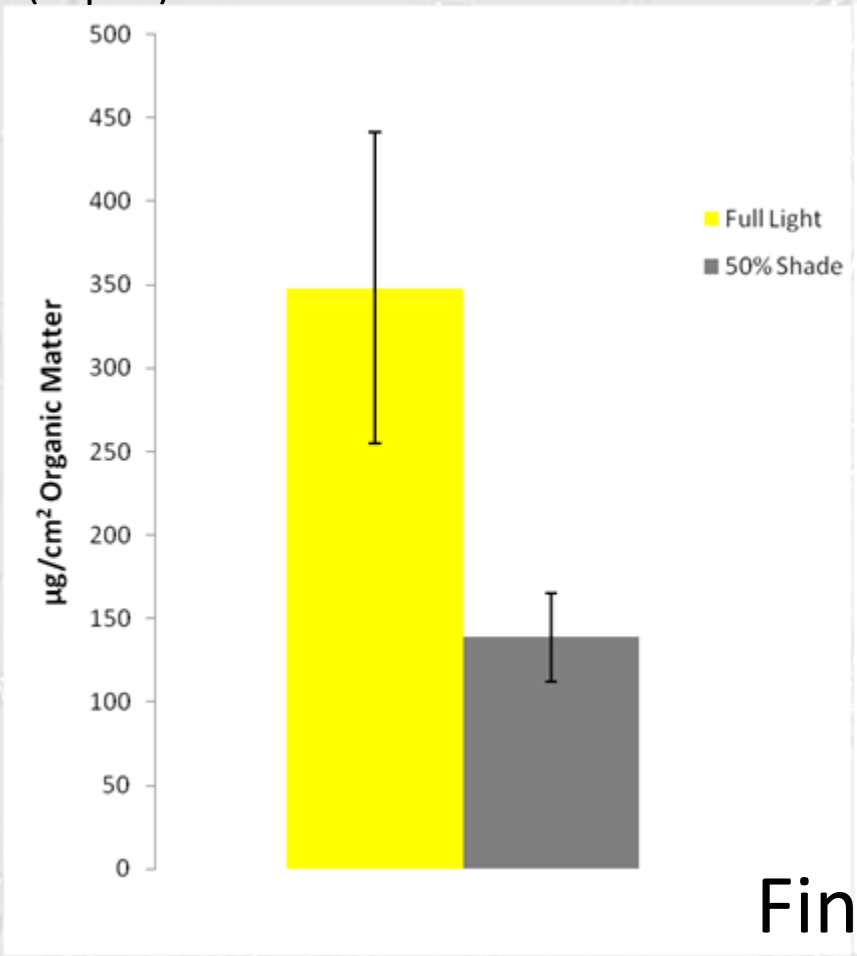


(Exp#1)

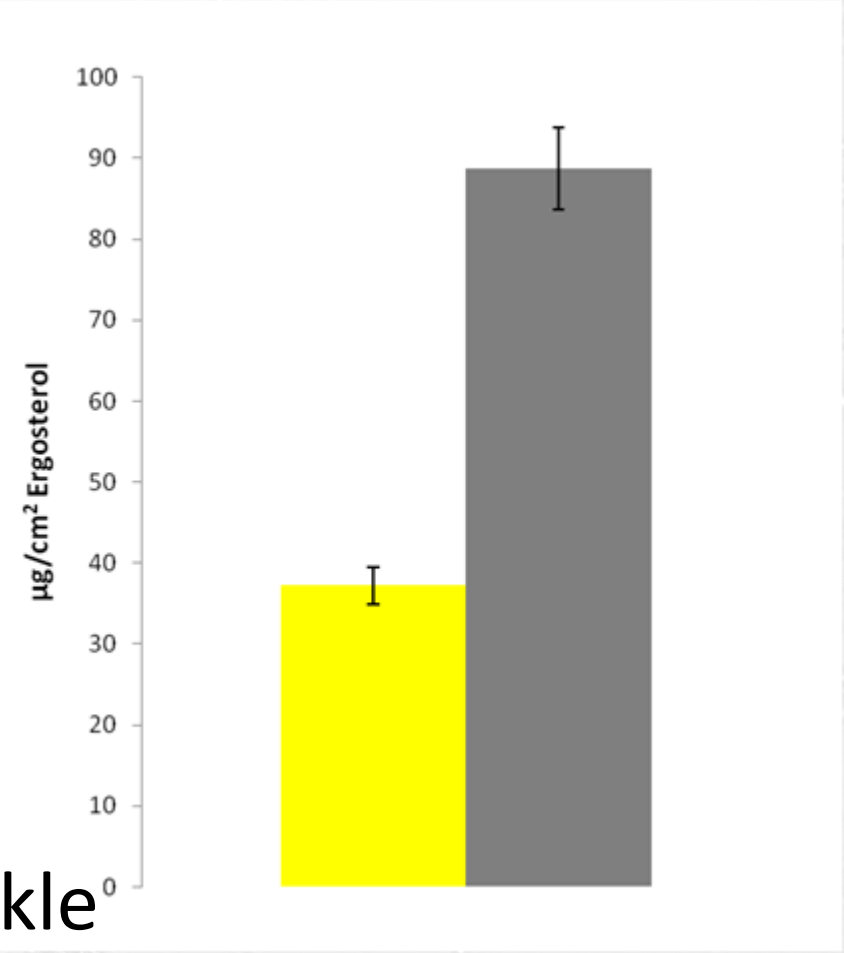


Light is a major factor controlling the periphyton community

(Exp#5)



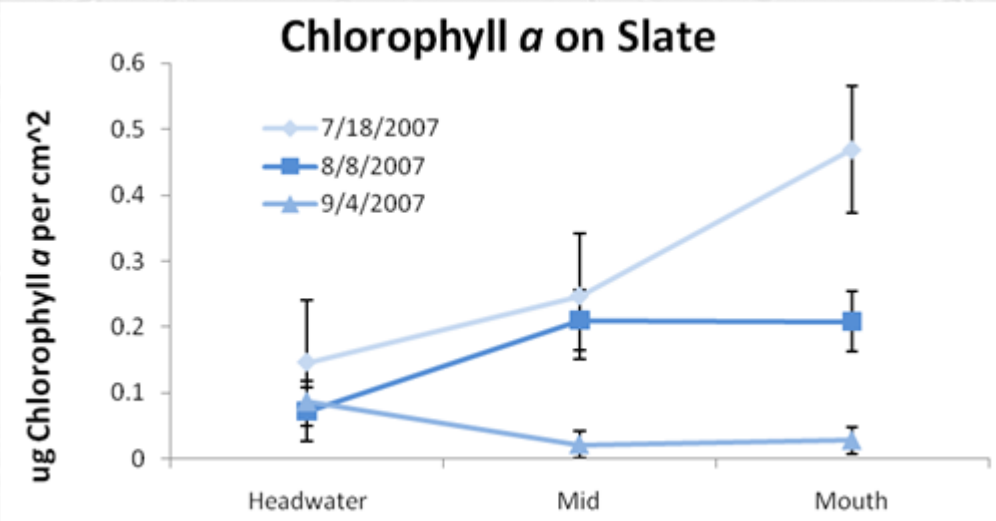
(Exp#5)

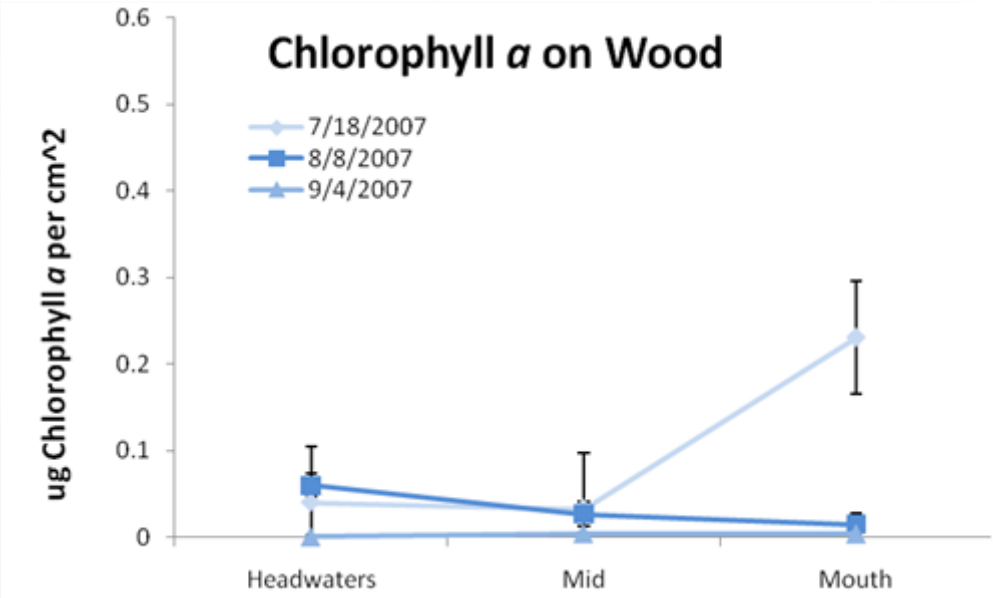


Finkle

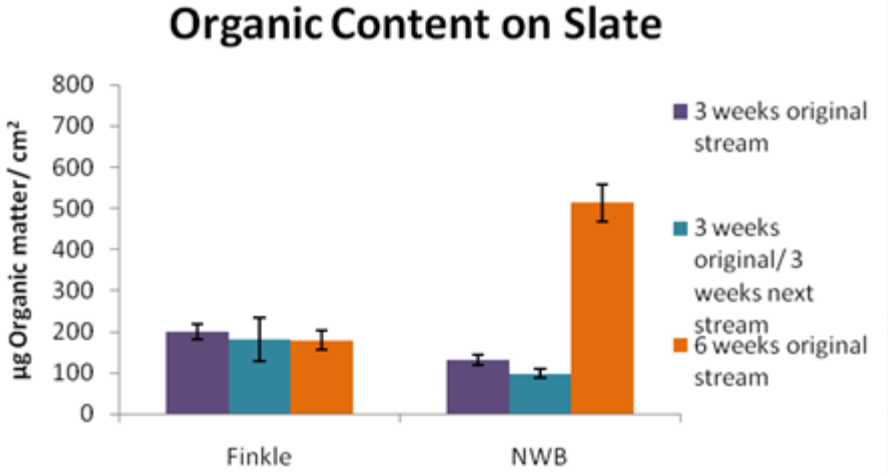
Different substrates are preferred by different community members

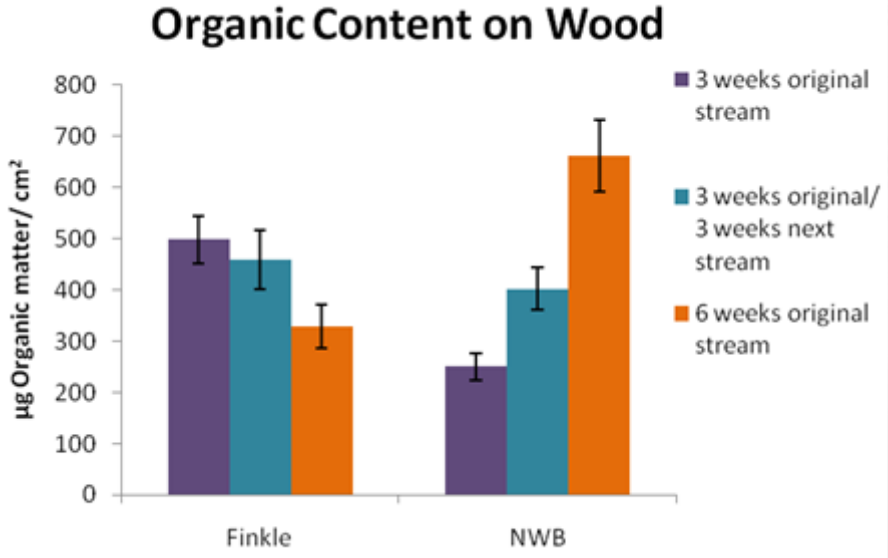
(Exp#2)





(Exp#4)

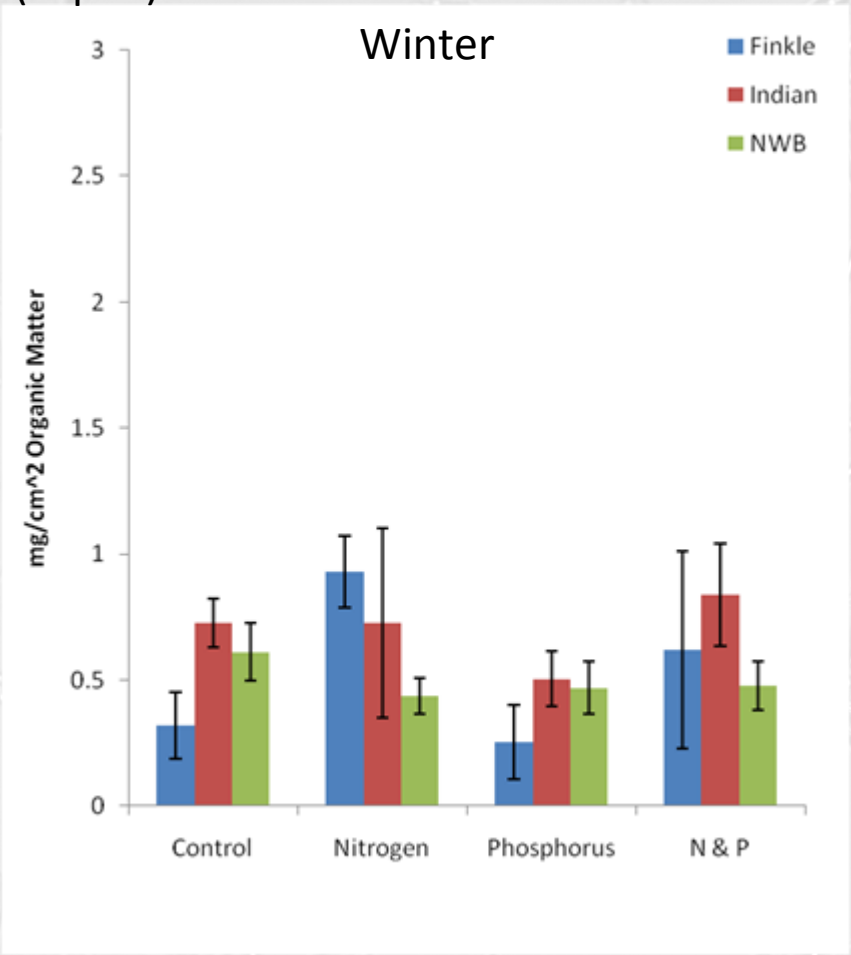




Anthropogenic Factors

Nitrogen and phosphorus are not a critical limiting factor in periphyton growth

(Exp#1)



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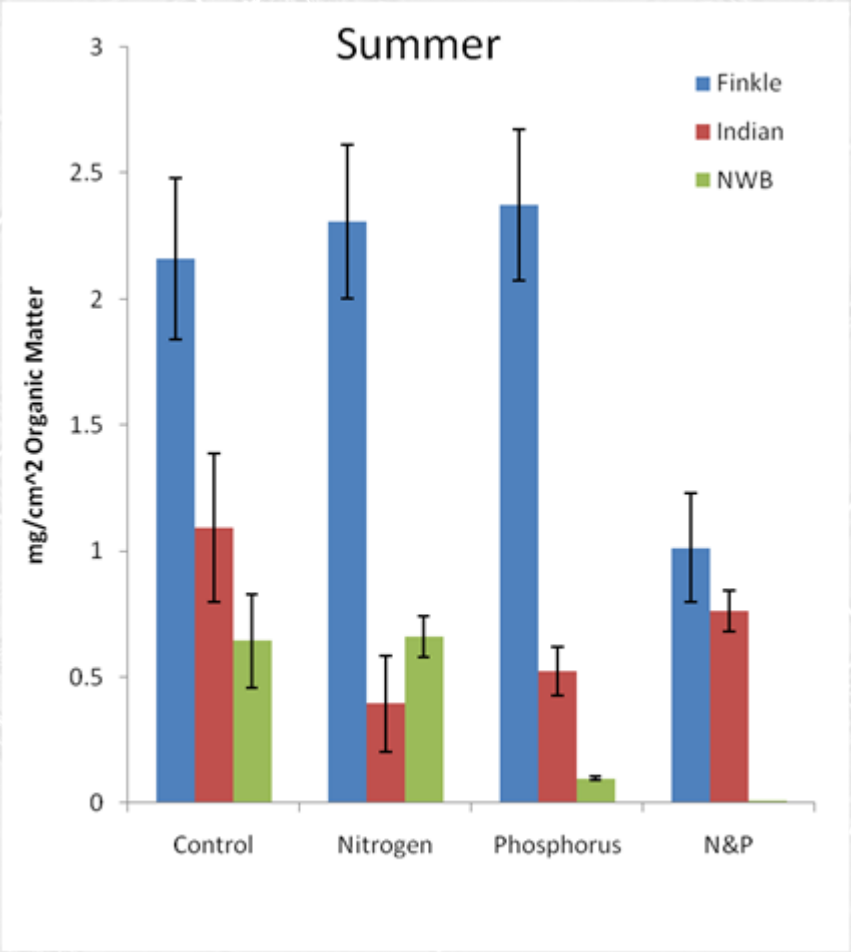
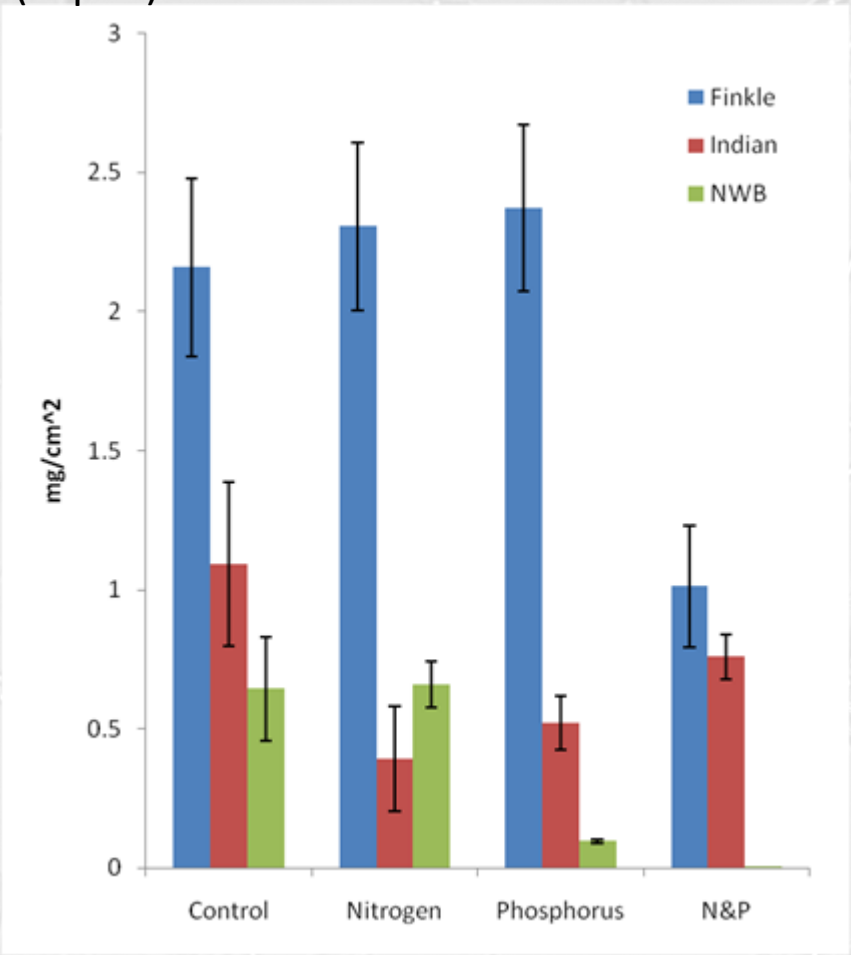
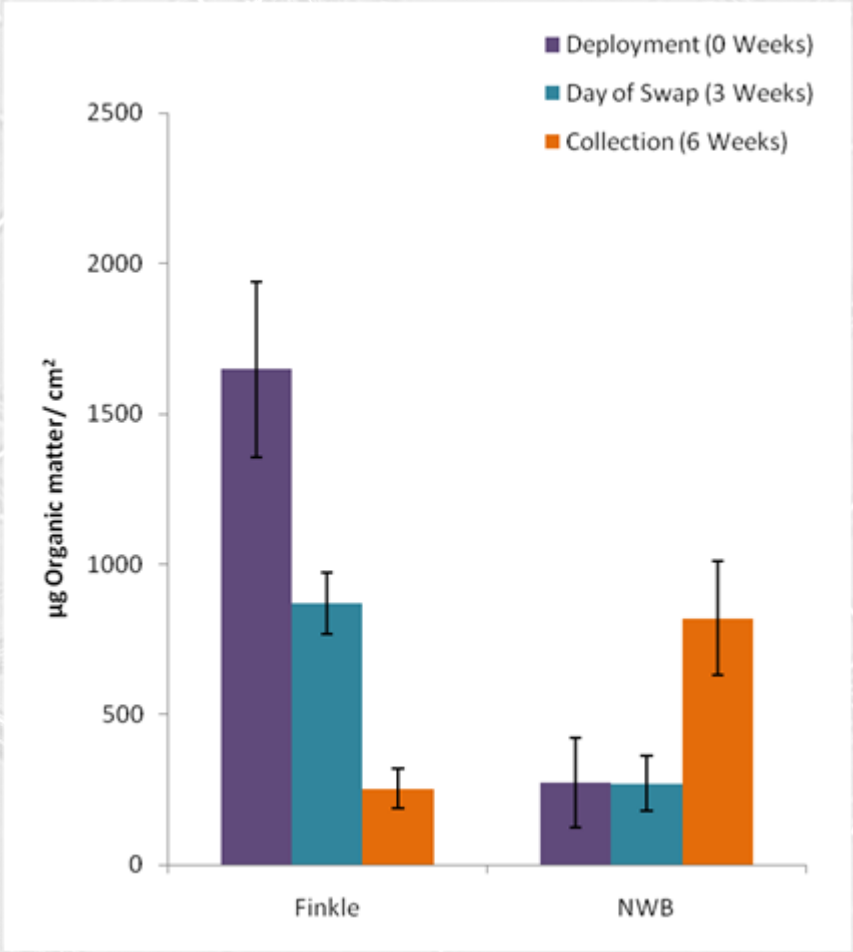


More developed sites/streams support more Total Organic Matter

(Exp#1)

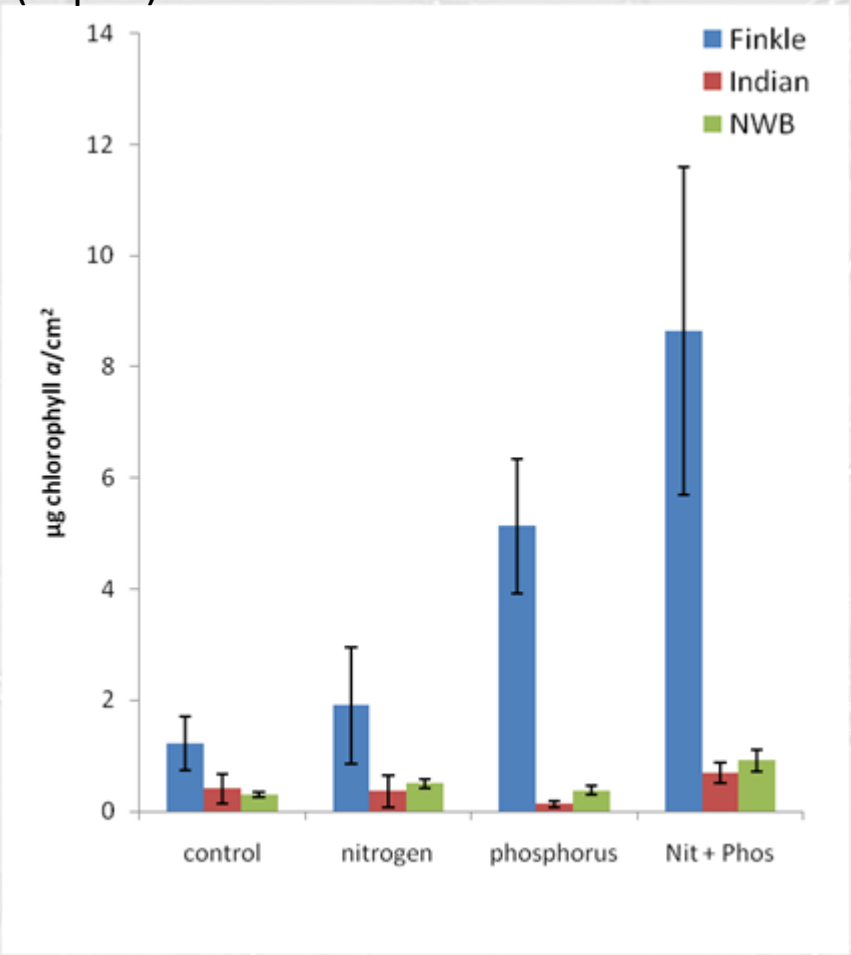


(Exp#4)



More developed sites/streams support more Chlorophyll *a*

(Exp#1)



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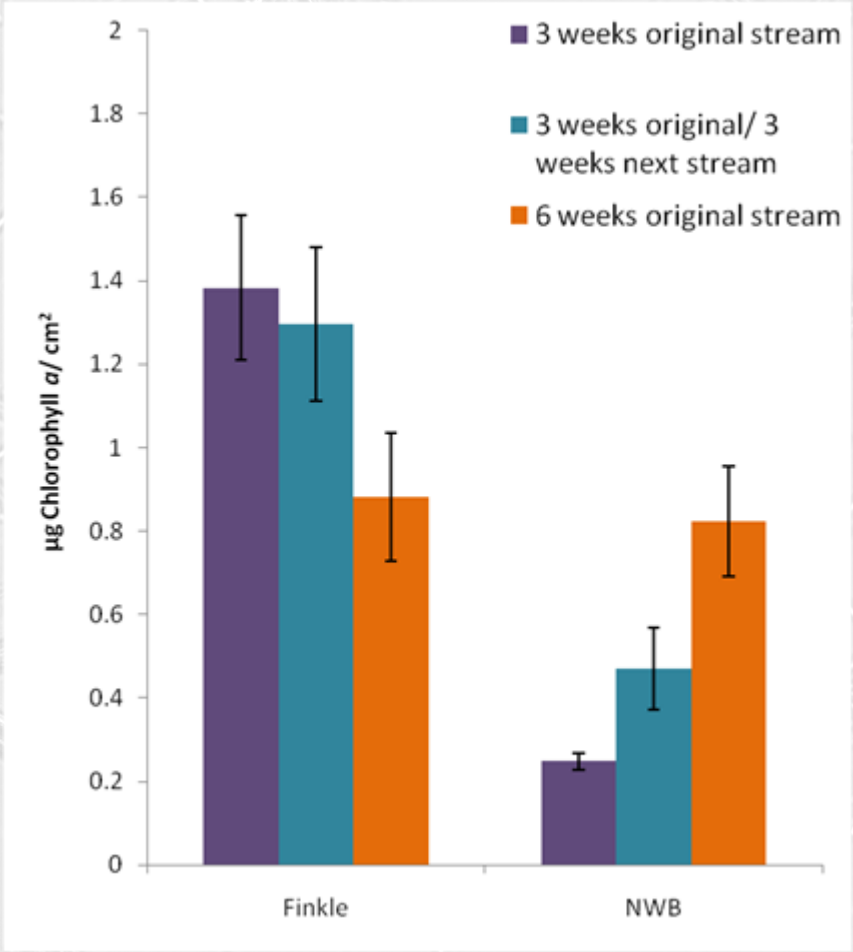
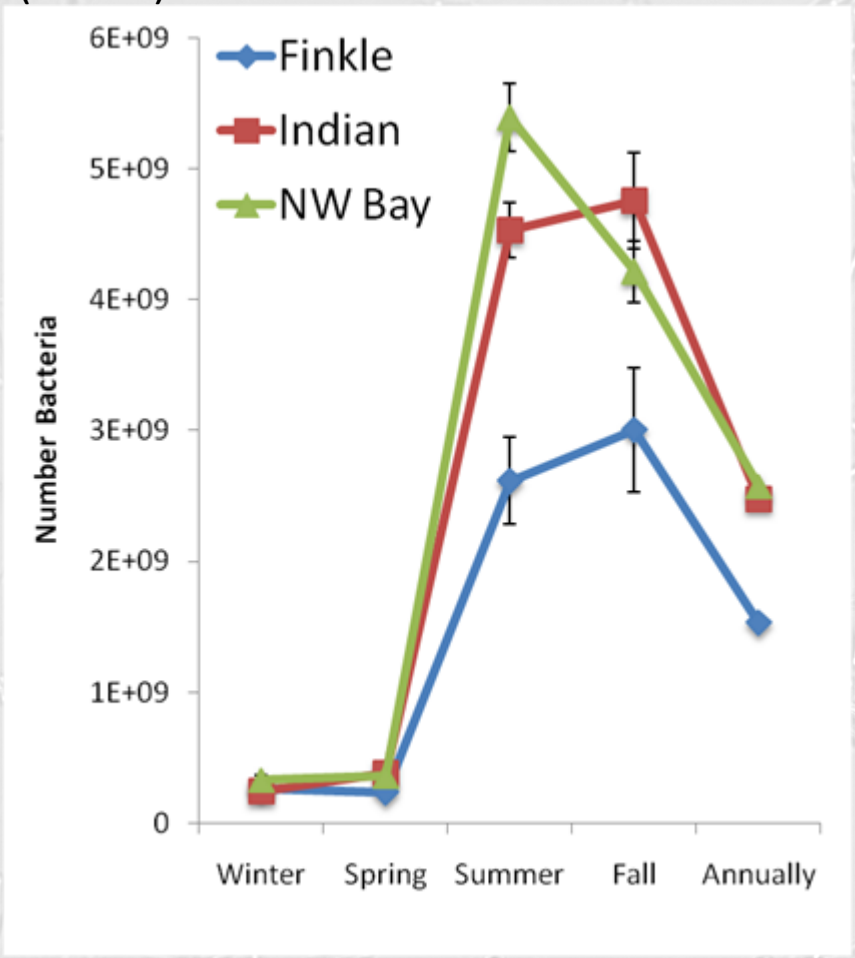
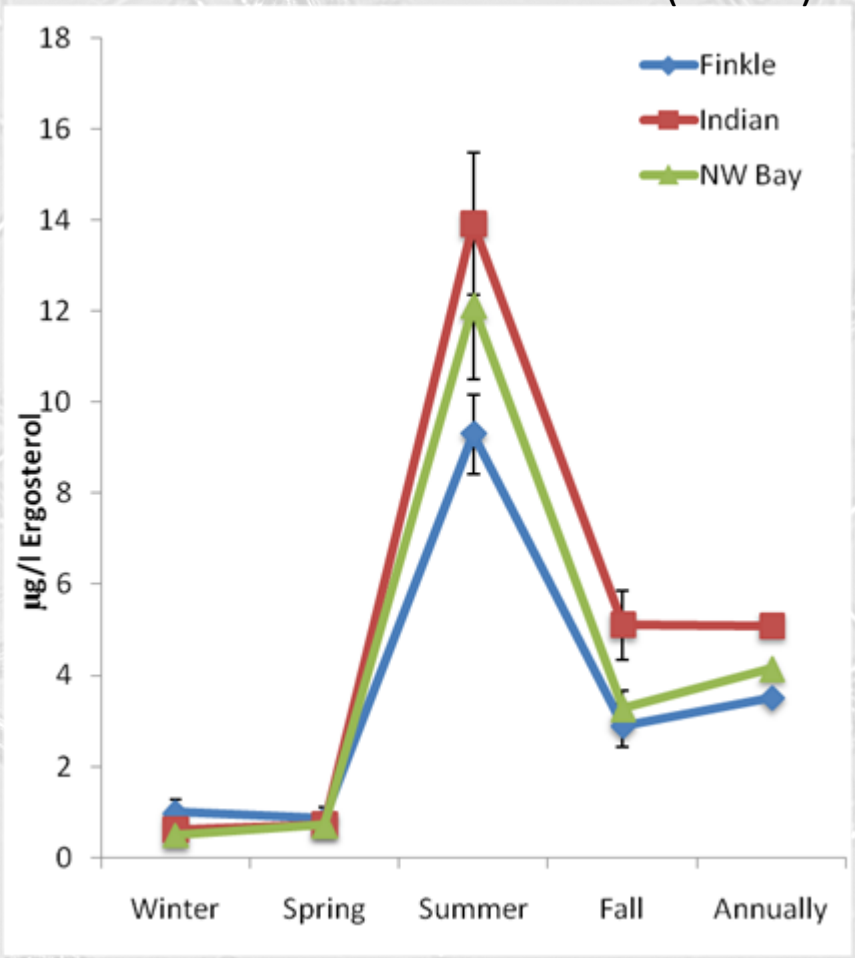


Less developed sites/streams support more Bacteria and fungus

(EXP#1)



(EXP#1)

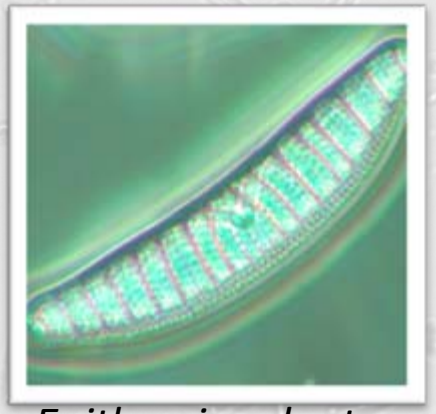


Diatom communities are less diverse and sensitive in developed streams

(Exp#4)

- Preliminary data shows:
  - There is less diversity in the more developed stream
    - Most species are found on all substrates
  - There is more diversity in less developed streams
    - Different substrates support more unique communities, indicating sensitivity

- 77 Species so far
- 32% common to both streams



Epithemia adnata

Gomphonema acuminatum var. coronatum

Conclusions

1. Periphyton communities are a complex and dynamic system which can not be understood by considering only some of the community members

2. Each community's composition of algae, fungus and bacteria is a signature, which is unique to each site

3. Periphyton is ideal for biomonitoring impacted streams, due to its sensitivity to chemical and physical environmental factors

Thank you for your attention

Thanks to

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  - Charles Boylen
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