SEASONAL DYNAMICS OF EPIPHYTIC ALGAE COLLECTED FROM *SPARTINA ALTERNIFLORA*

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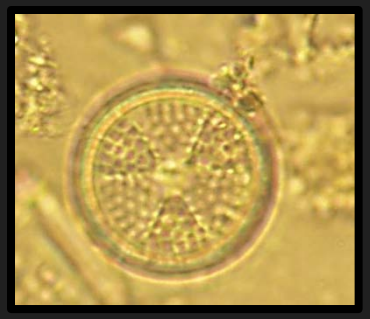
Project overview

- Epiphytic algae
- Importance of epiphytic algae to aquatic systems
- Role of eutrophication in changing natural balance
- Responses of algal growth from eutrophication

Groups of epiphytic algae

- Diatoms
  - Ex. *Navicula* sp., *Nitzschia* sp., *Achnanthes* sp.
- Greens
  - Ex. *Ulothrix* sp., *Mougeotia* sp., *Closterium* sp.
- Blue-greens (cyanobacteria)
  - Ex. *Phormidium* sp., *Oscillatoria* sp., *Leptolyngbya* sp.
- Reds
  - Ex. *Caloglossa* sp., *Polysiphonia* sp.



Importance of epiphytic algae

- Food source
  - Invertebrates, fish, grazing waterfowl
  - High C:N:P
- Production of oxygen
- Fix nitrogen
  - Cyanobacteria – converts unusable N_2 to biologically available N

Eutrophication in NE Florida

- Harmful algal blooms (HABs)
  - Industrial discharge
  - Residential runoff
- Freshwater
  - St. Johns River (FDEP, 2001)
    - 1995-2001 - 70-90% summer/spring season
- Marine/estuarine (NOAA, 2004)
  - St. Johns River high
  - Indian River Lagoon moderate

St. Johns Riverkeeper 2011

K. Spear, Orlando Sentinel, Aug 20, 2012

Impacts of eutrophication

Epiphytes

Increased biomass

Increased drag on plant

Broken leaves or stems

Decreased photosynthetic capability of plant

Study purpose and goals

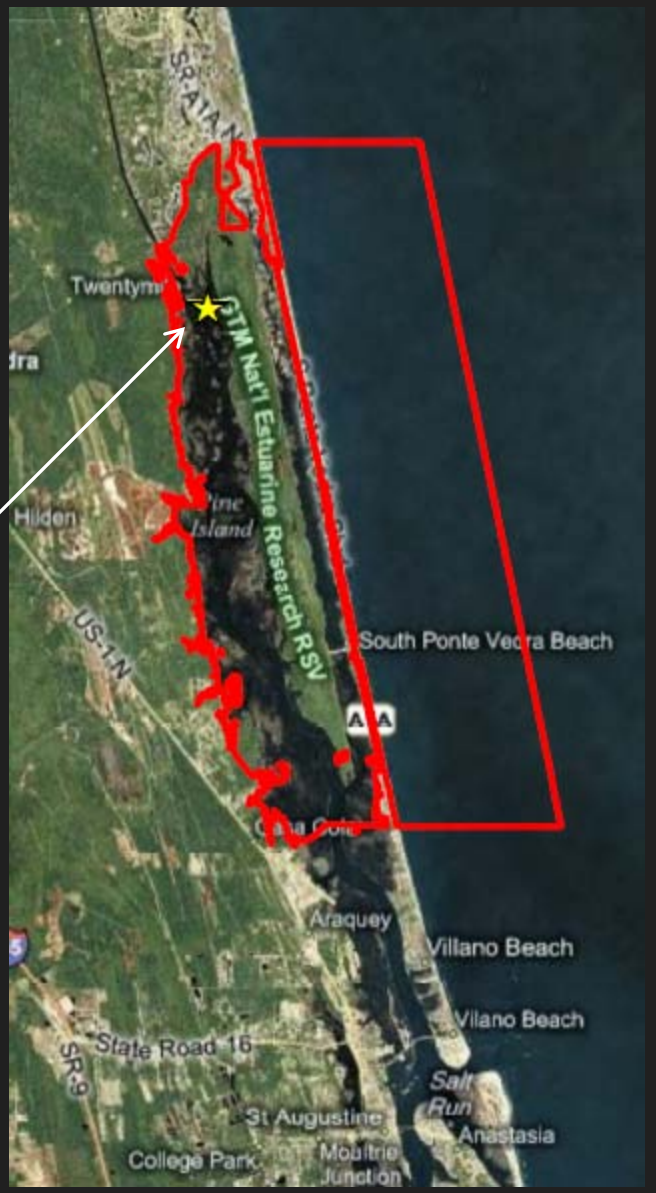
1. Limited number of studies exist that focus on the changes in the epiphytic algal community due to eutrophication.
    a. Biovolume, biomass, chlorophyll-*a* increases?
    b. Shifting community composition?

2. Little is known about the diversity of epiphytic algae in northeast Florida.
    a. What exactly is out there?
    b. Seasonal changes?

3. Elucidation of novel taxa.

Study Site: Guana Tolomato Matanzas National Estuarine Research Reserve

- Tolomato River – South of Ponte Vedra, Florida
- *Spartina* salt marsh
- Tidally influenced
  - Salinity 8-41 ppt
- Temperature
  - 19.2-30.4 C



Epiphyte Collection

Site Selection and Collection

- March – October 2011
- April – October 2012
- 3 *Spartina* salt marsh “islands”
- Monthly harvest of 1 *Spartina* stem/treatment plot
- 8 replicates/treatment

Nutrient enriched agar treatments

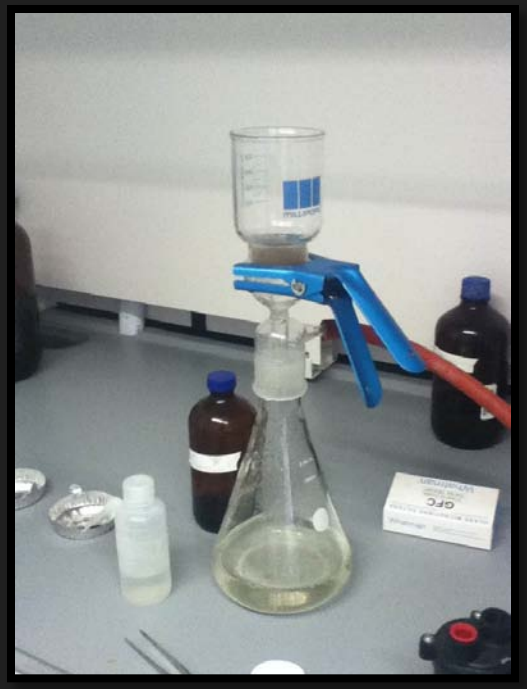
- Control (C)
- Nitrogen (N)
- Phosphorus (P)
- Combination N+P

Project and treatment locations

***Spartina* site**	**Treatment (=n)**			
	C	N	P	N+P
Island 1	3	2	3	2
Island 2	1	3	3	2
Island 3	4	3	2	4

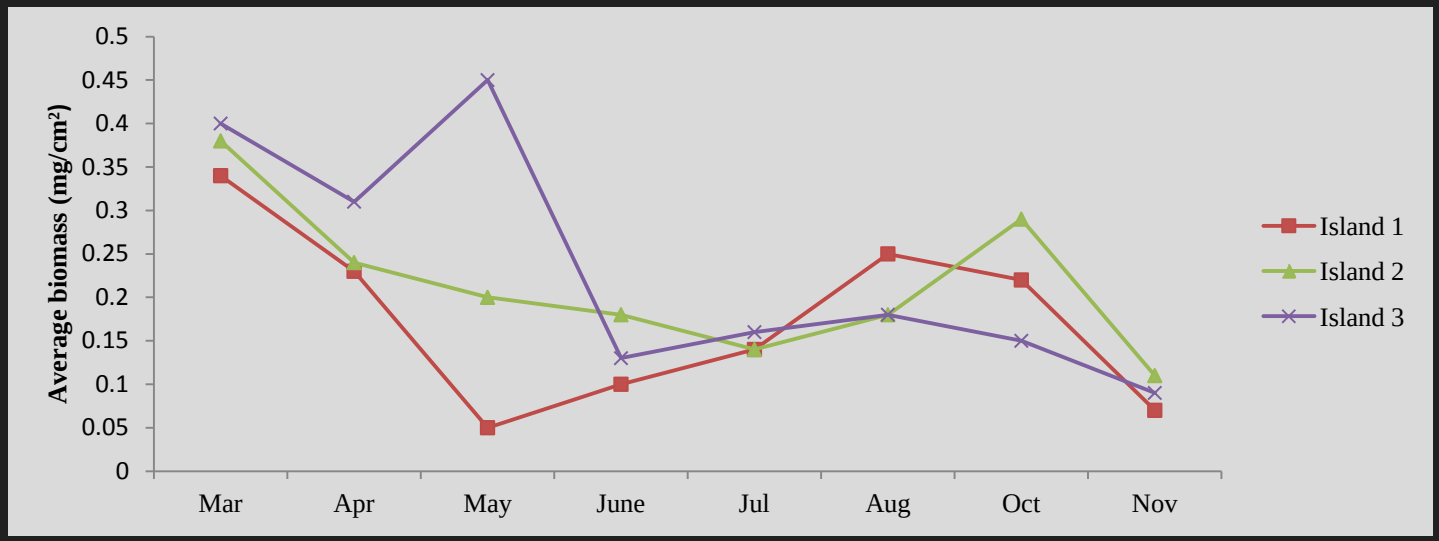
Sample Preparation

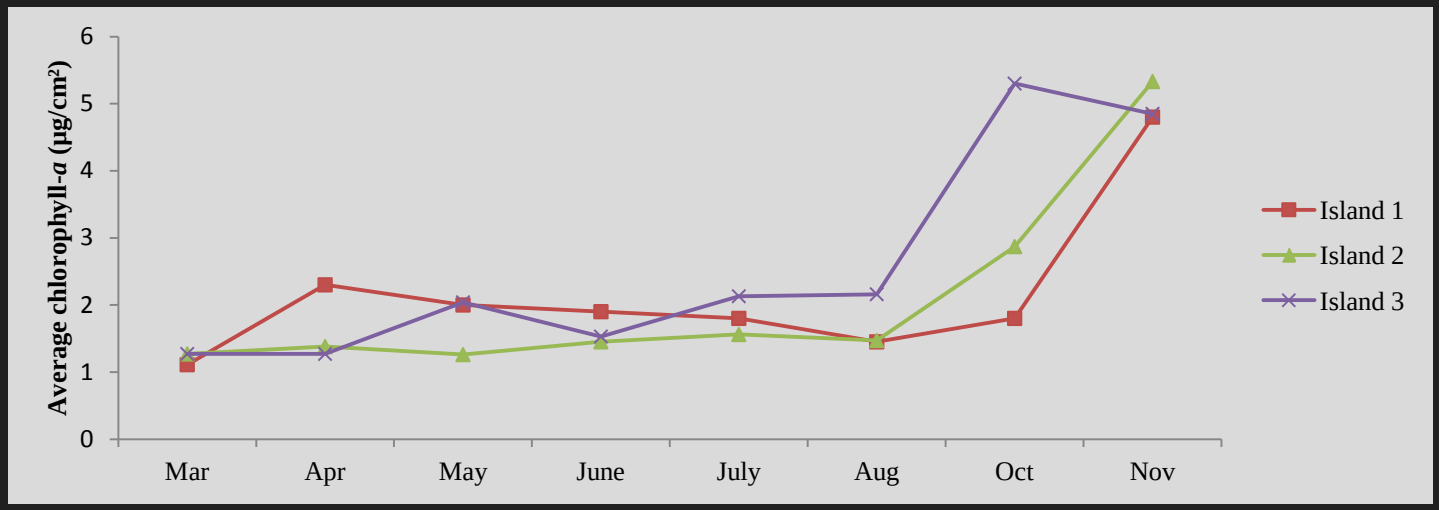
- Laboratory methods
  - Epiphyte removal from stem
  - Preservation – glutaraldahyde
  - Identification
- Data analysis
  - Cell counts for species composition – 400 cells/slide
  - Density – cells/cm^2
  - Biovolume – $\mu m^3/cm^2$
  - Biomass – mg/cm^2
  - Chlorophyll-*a* – $\mu g/cm^2$



Exploratory analyses

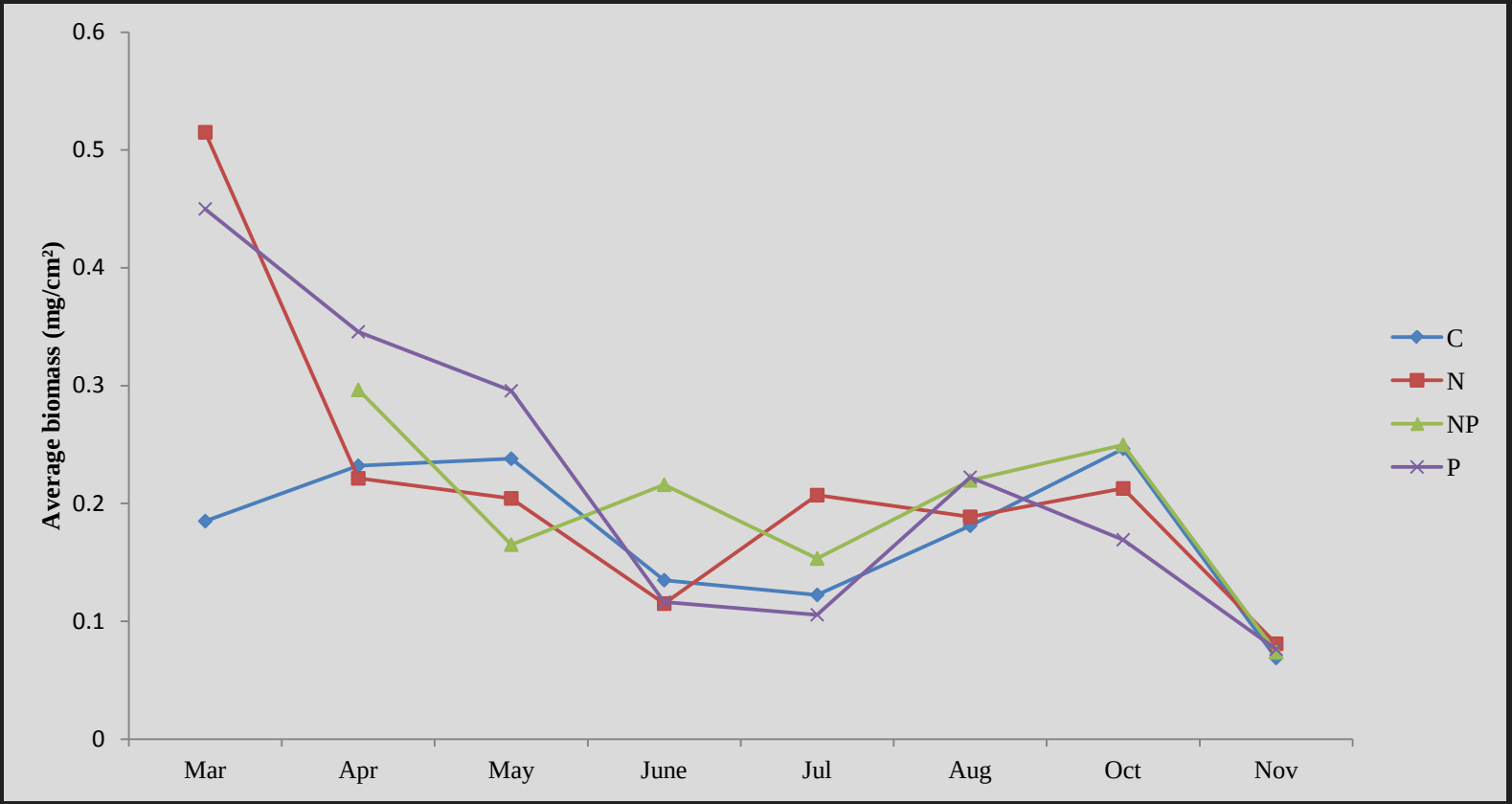
Island had no significant effect on biomass or chlorophyll *a*





Nutrient analysis:
Biomass and Chlorophyll-*a*

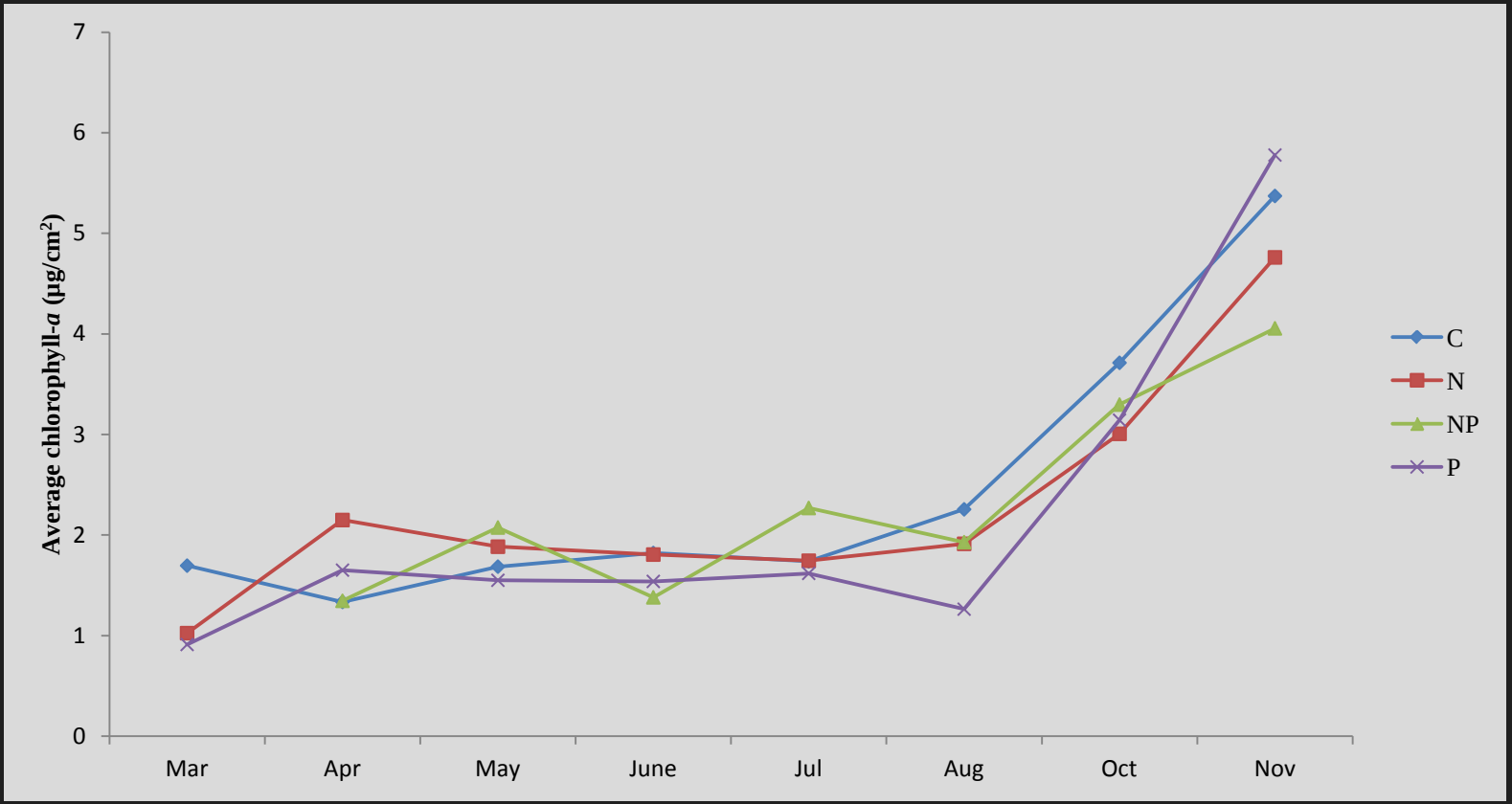
2011 Seasonal fluctuations – significant ($p<0.001$)
Nutrient treatments – not significant ($p=0.2804$)



Nutrient analysis:

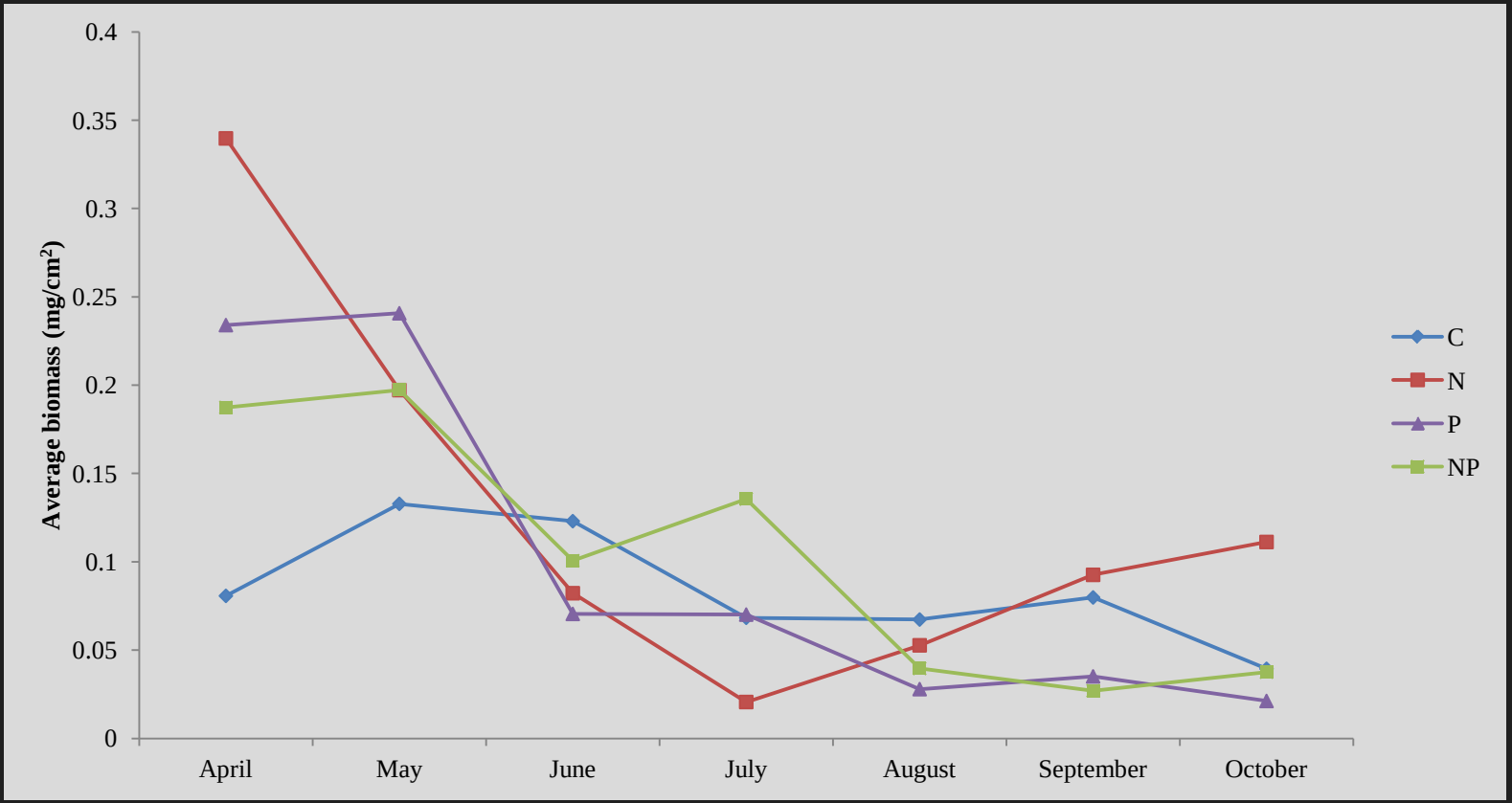
Biomass and **Chlorophyll-*a***

2011 Seasonal fluctuations – significant ($p<0.001$)
Nutrient treatments – not significant ($p=0.7521$)



Nutrient analysis:
Biomass and Chlorophyll-*a*

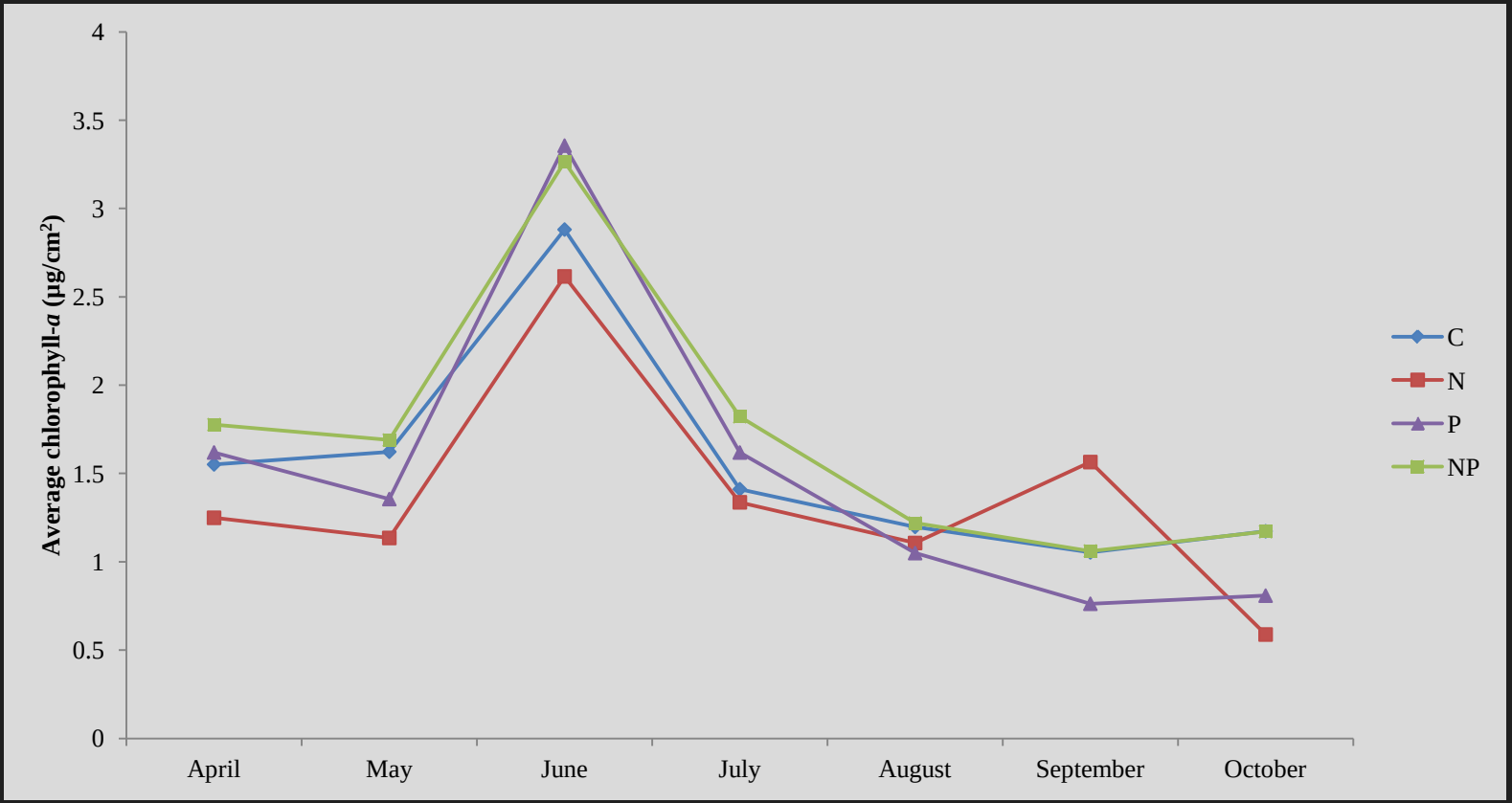
2012 Seasonal fluctuations – significant ($p<0.001$)
Nutrient treatments – not significant ($p=0.5355$)



Nutrient analysis:

Biomass and **Chlorophyll-*a***

2012 Seasonal fluctuations – significant ($p<0.001$)
Nutrient treatments – not significant ($p=0.4432$)



Yearly analysis:
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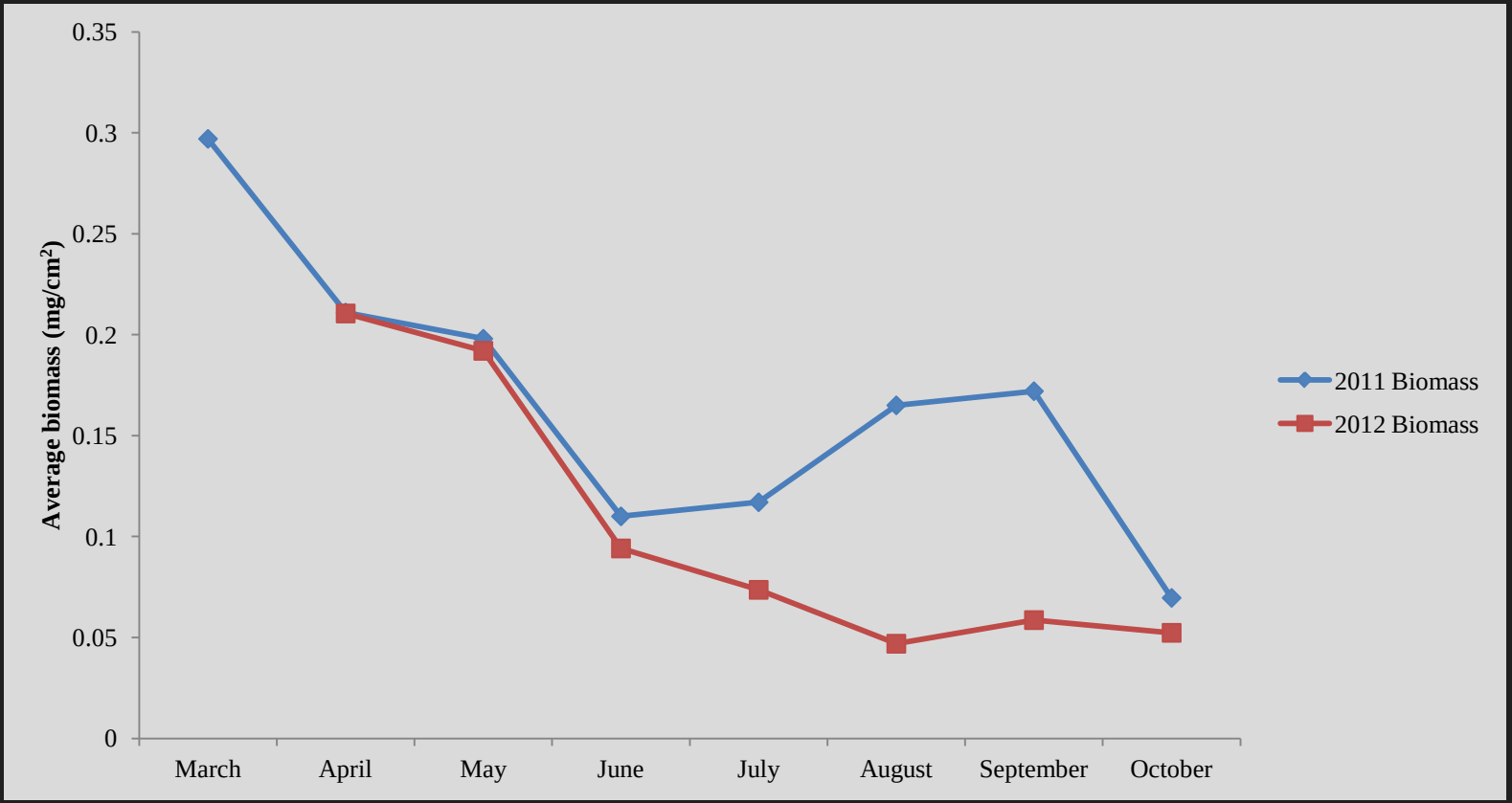

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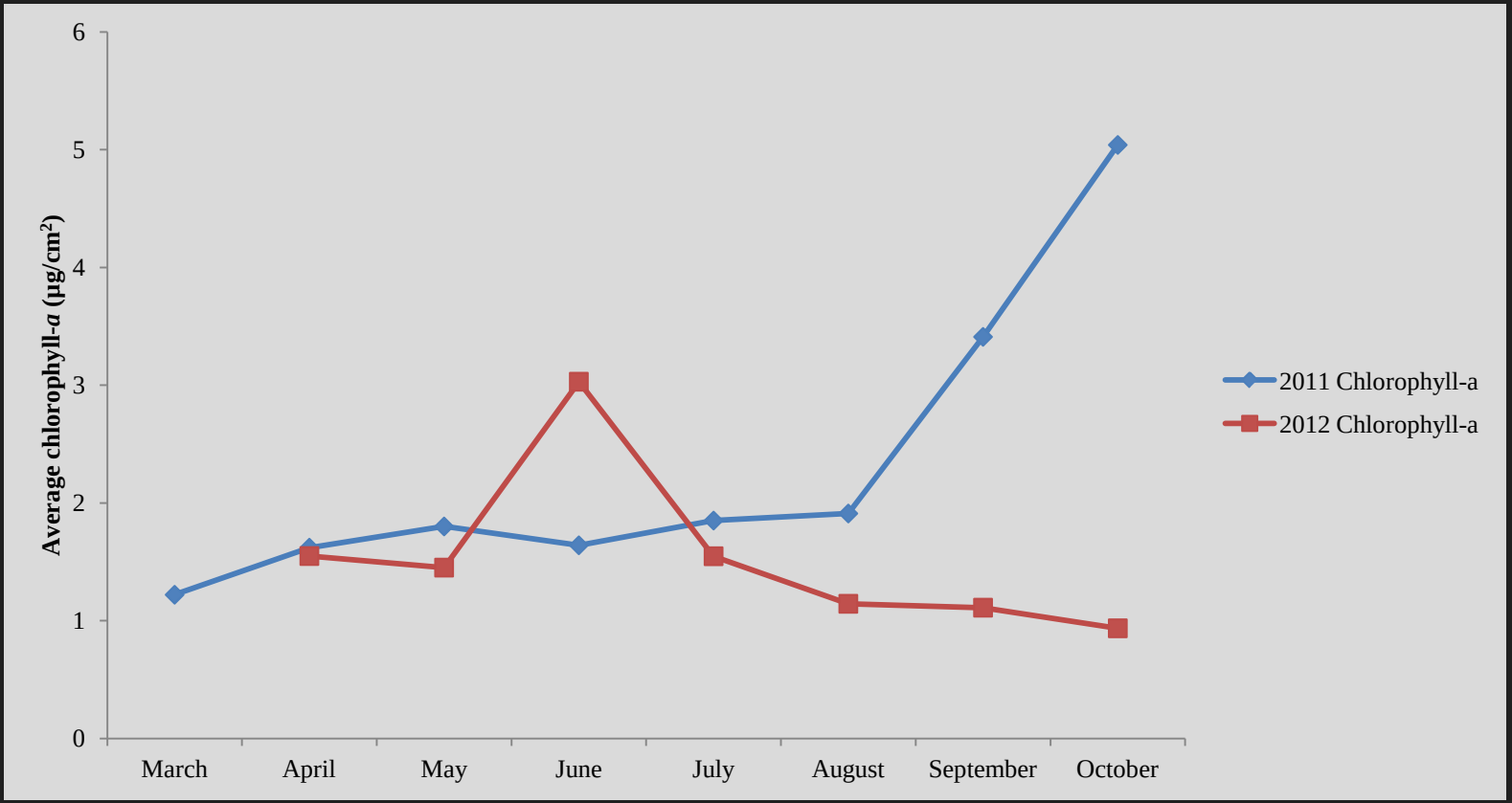
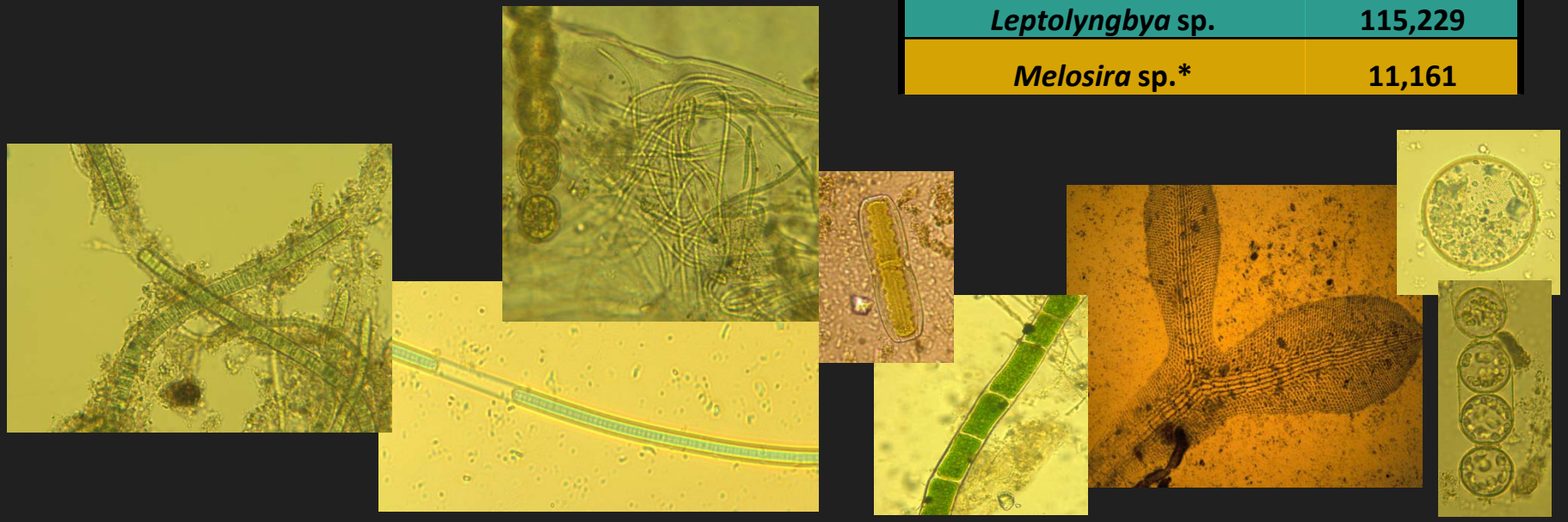


Epiphytic algal community composition

- 156 infra-generic taxa identified
  - 77 Diatoms
  - 17 Greens
  - 54 Cyanobacteria
  - 7 Reds
- 8 dominant genera (>5%) accounting for 85% of cells

GENUS	Abundance
Caloglossa leprierii	29,537
Polysiphonia sp.	42,069
Phormidium sp.	44,934
Coleofasciculatus sp.	45,097
Oscillatoria sp.	46,168
Lyngbya sp.	54,397
Microcoleus sp.	95,900
Leptolyngbya sp.	115,229
Melosira sp.*	11,161



Epiphytic algal community composition: Biodiversity

Species Richness = number of species observed each month

- Showed significant monthly fluctuations

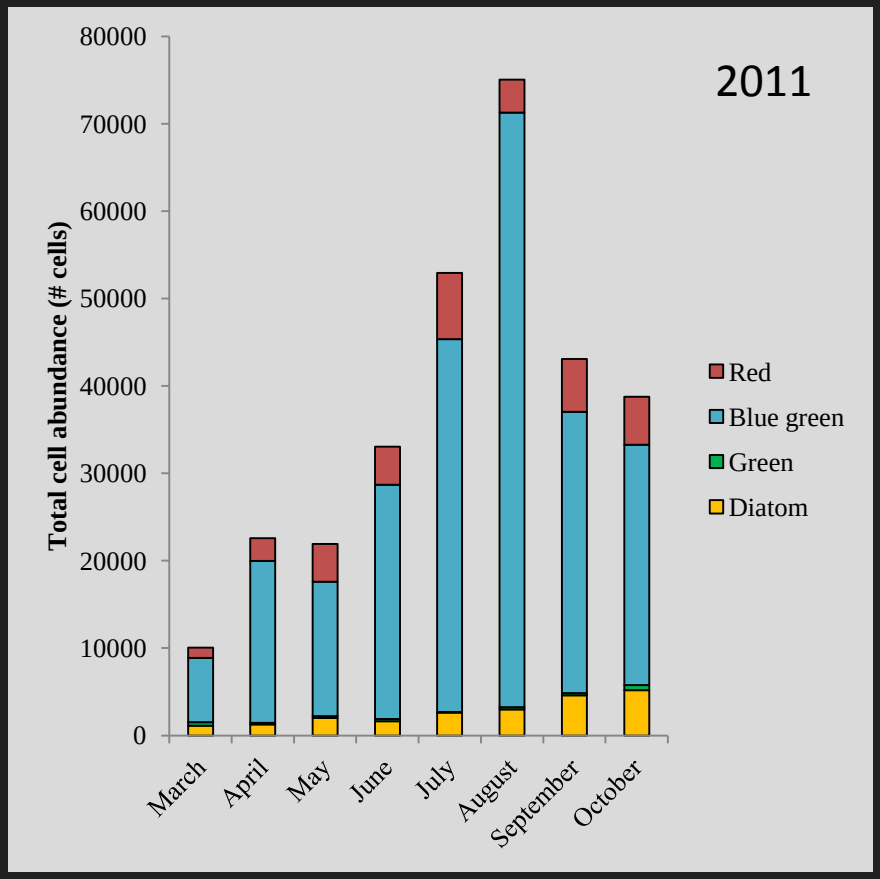
Shannon-Wiener Biodiversity Index (H´) takes into account species richness and relative abundance

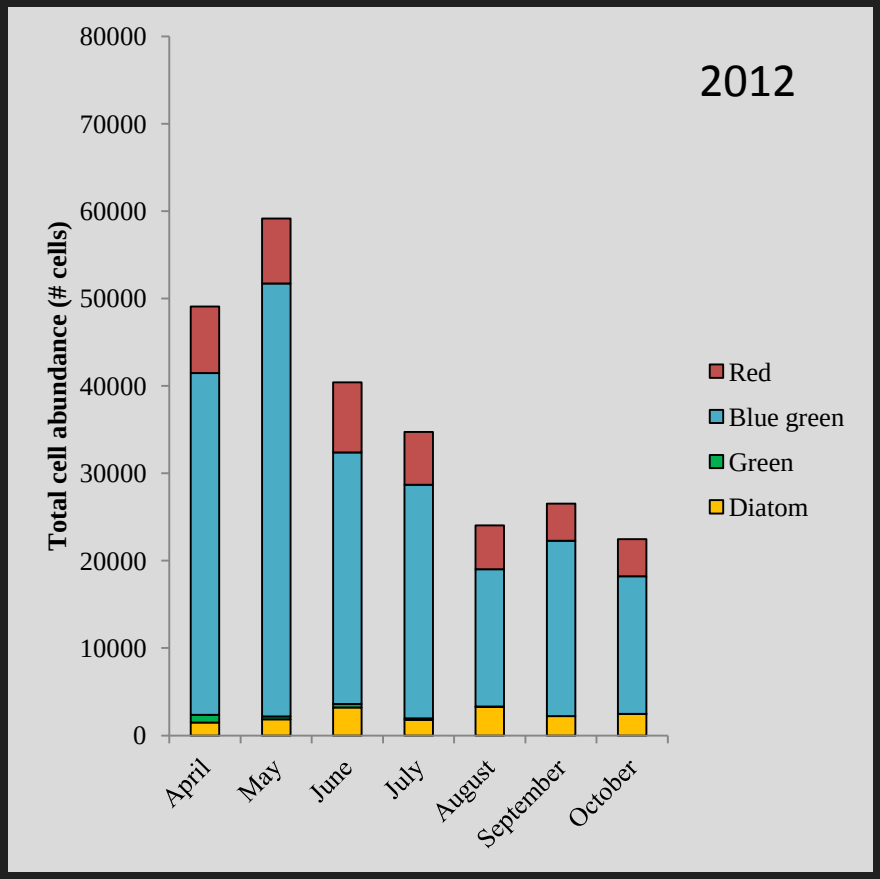
- Typical ecological range 0-4
  - 0 low diversity
  - 4 high diversity
- Showed significant monthly fluctuations

	2011		2012	
Month	Species Richness	H´	Species Richness	H´
March	56	2.15	-	-
April	61	2.25	90	2.86
May	72	2.62	87	2.86
June	66	2.30	78	2.86
July	79	2.56	76	2.77
August	87	2.81	67	2.67
September	84	2.96	66	2.24
October	80	3.00	64	2.58

Epiphytic algal community composition: Cell abundance

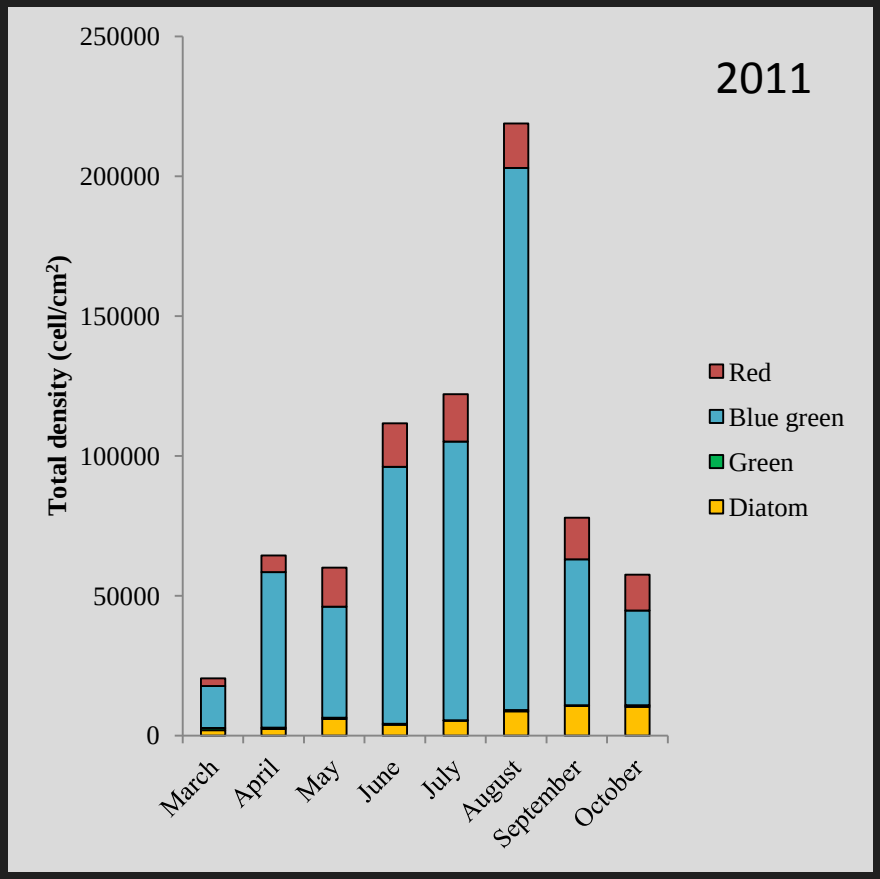
2011 and 2012 algal divisions had significant seasonal fluctuations

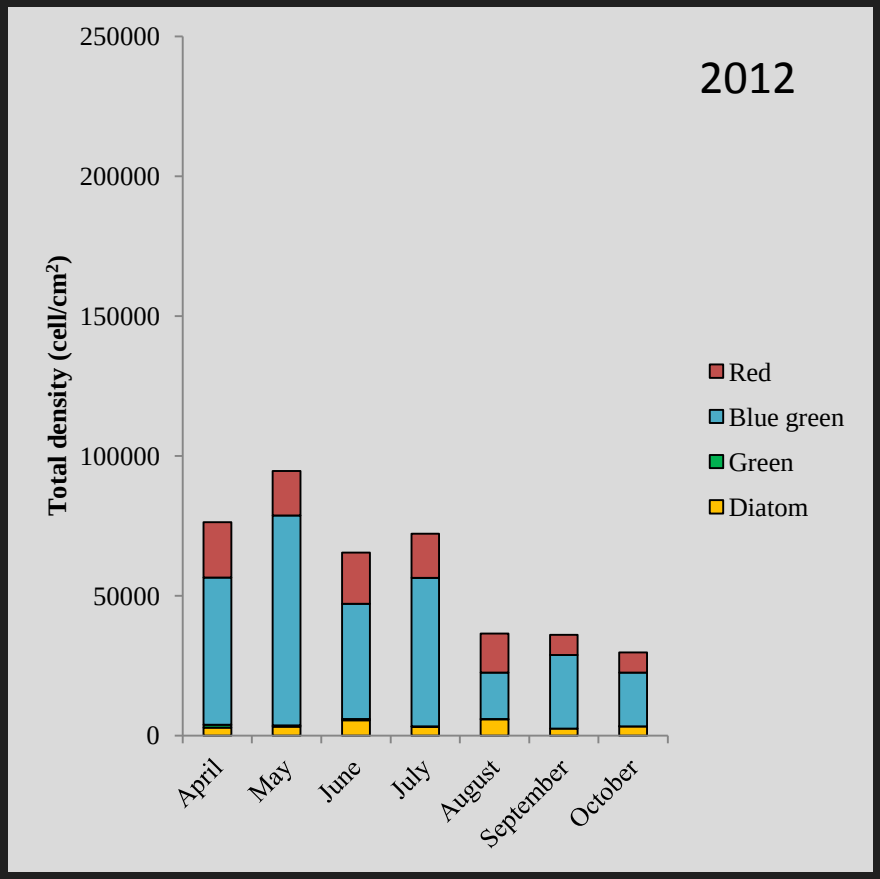




Epiphytic algal community composition: Density

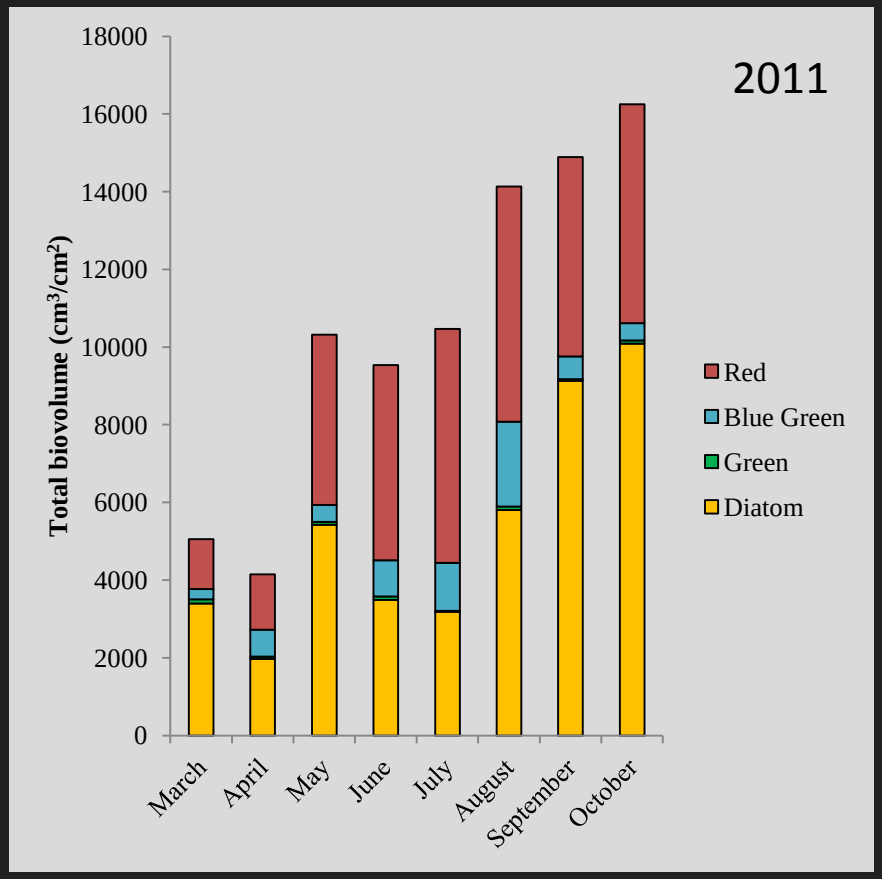
2011 and 2012 algal divisions had significant seasonal fluctuations

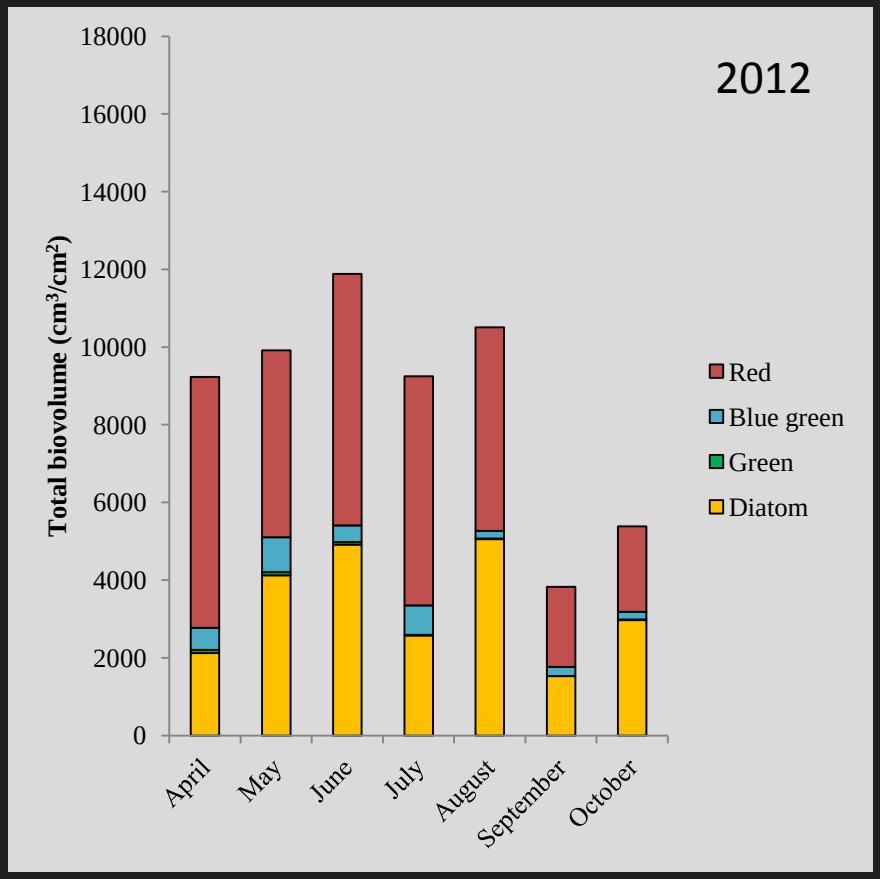




Epiphytic algal community composition: Biovolume

2011 and 2012 algal divisions had significant seasonal fluctuations





Summary of results

- Seasonal patterns significantly influence algal growth
  - Biomass
  - Chlorophyll-*a*
  - Density
- Simulation of eutrophication did not show significant effects to algal community
  - Biomass
  - Biovolume
  - Chl. *a*
  - Species composition
- Why?
  - Biotic factors
    - Tasty morsels of algae consumed by herbivores?
    - Emergent vegetation escape eutrophic waters
  - Abiotic factors
    - Ambient nutrient levels exceed treatment levels
    - Tidal currents shearing algal growth

Future studies

- Culturing various epiphytic cyanobacteria from *Spartina* to further differentiate morphovars and the phylogenetic placement

- Lab study to remove environmental variables

  e.g. herbivory/shearing effects/abscission of macrophyte leaves

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- Scott Eastman

COASTAL BIOLOGY
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