Twenty-eight Days to a Climax Community: A Succession Laboratory Using Periphyton

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Why Use Freshwater Periphyton?

- Rapid reproduction rates means succession occurs in a matter of weeks not decades
- Repeated Measures method is more intuitive for understanding succession than chronosequence
- Involves the concept of species guilds (growth forms) and conceptual models in community ecology

Lab Outcomes:

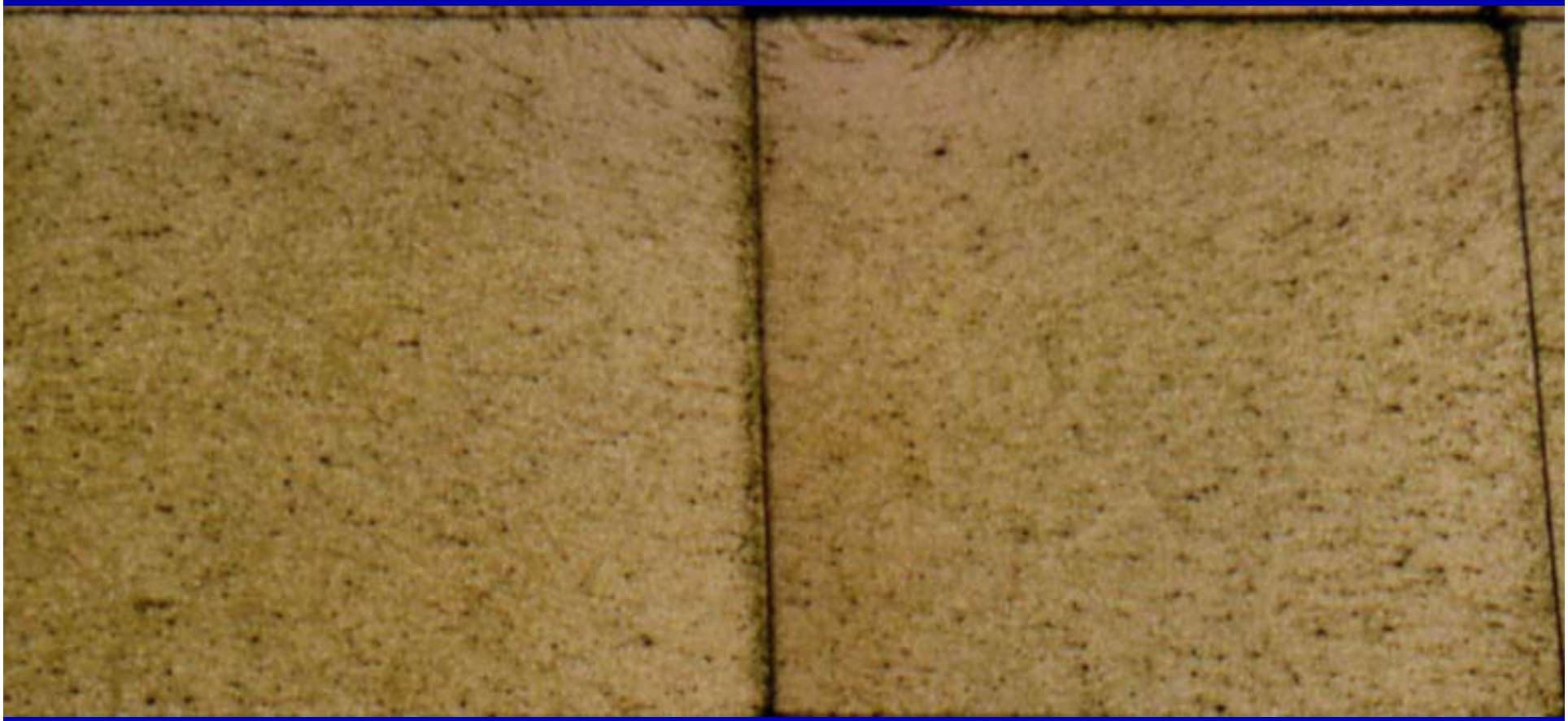
- To contrast periphyton succession in a lake and stream based on changes in taxonomic composition
- To compare successional changes in algal growth forms to published models
- To understand mechanisms of succession proposed by Connel & Slatyer and explain how they might apply to this study
- To increase awareness and become familiar with different types of algae


Unglazed clay tiles attached with silicone adhesive to cement blocks

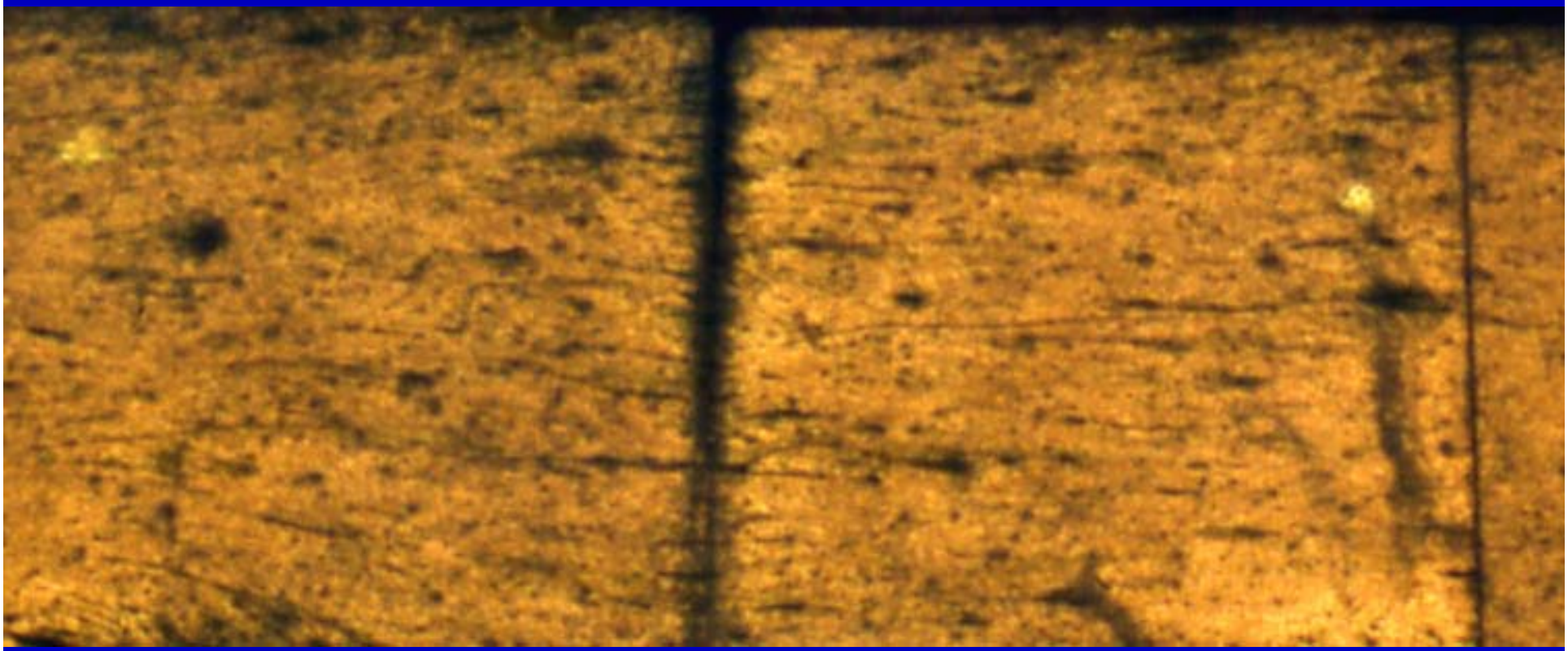
Students (or you) place blocks in high irradiance areas in a stream and in a pond or lake about 0.25 m deep

Remove tiles and scrape with brush ca. Days, 4, 8, 16, and 28

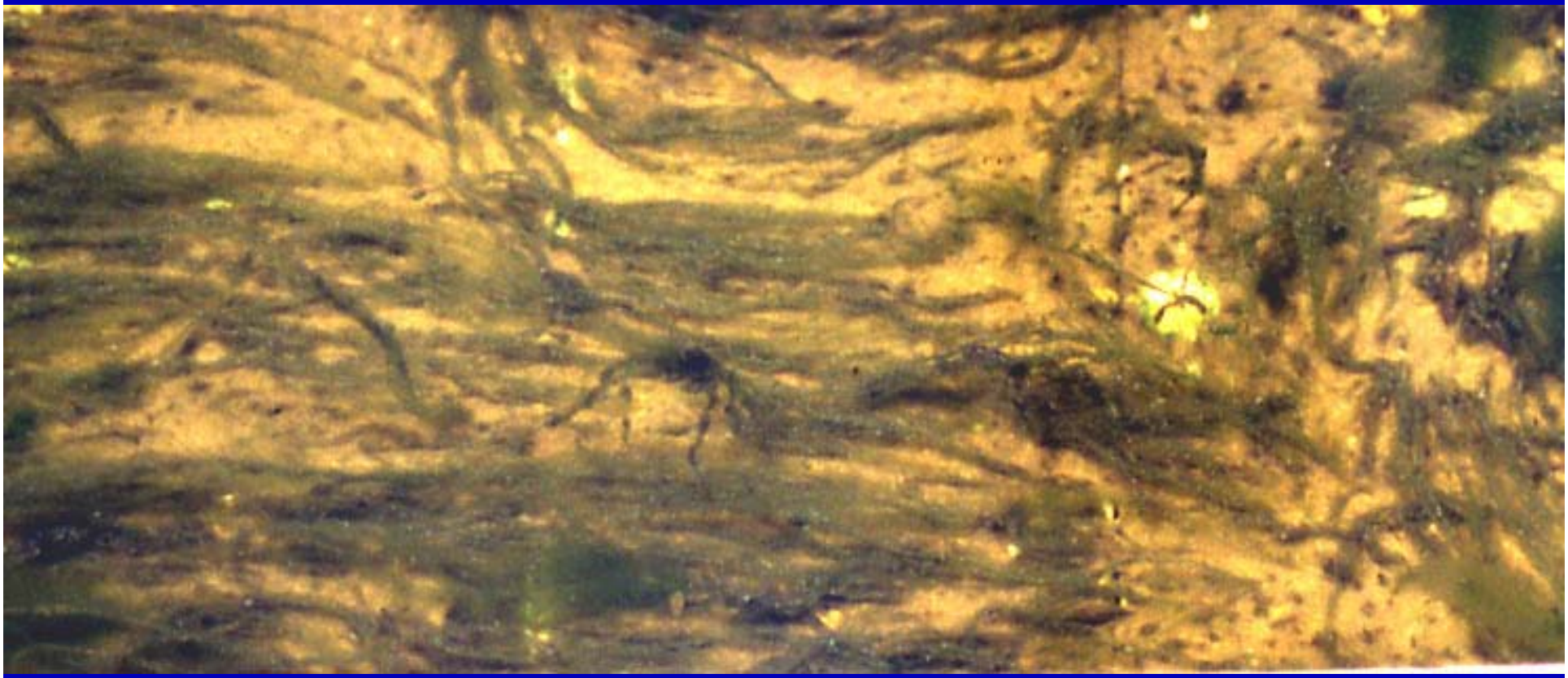
Day 8



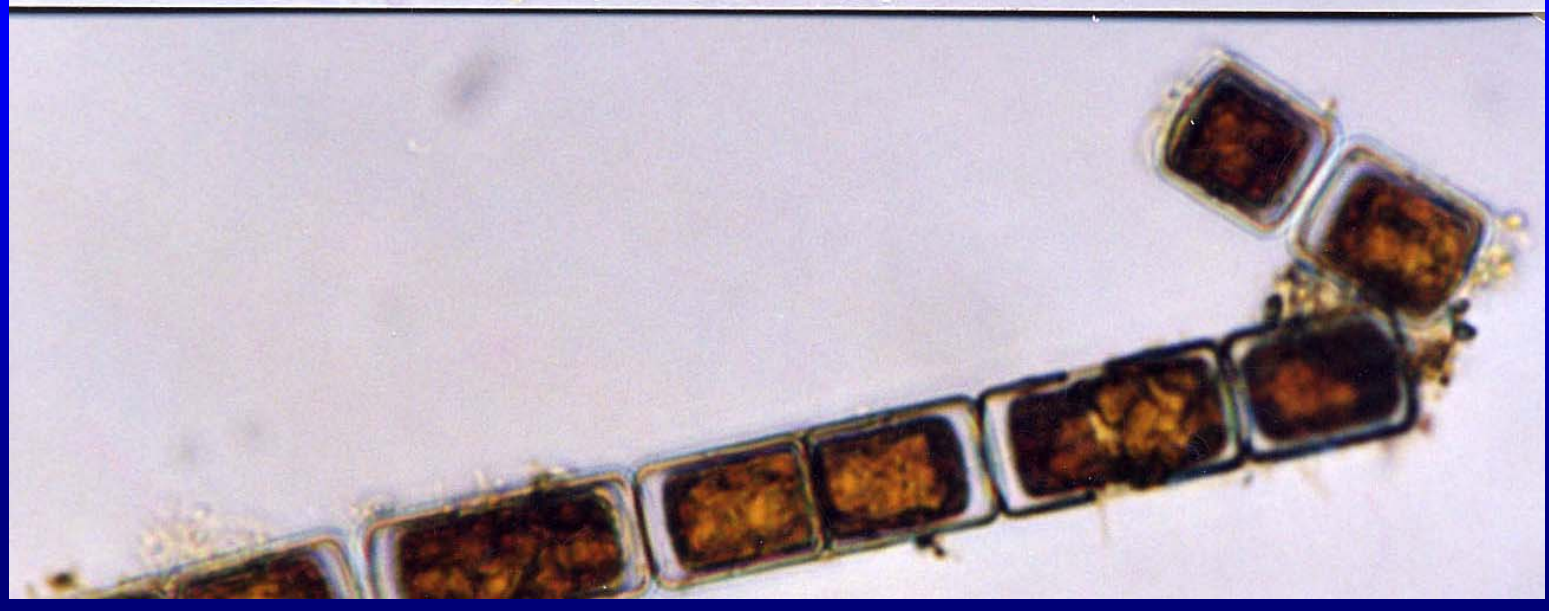
Day 16



Day 28



Students count and ID about 200 taxa (genus and growth form) from wet mounts at 400X

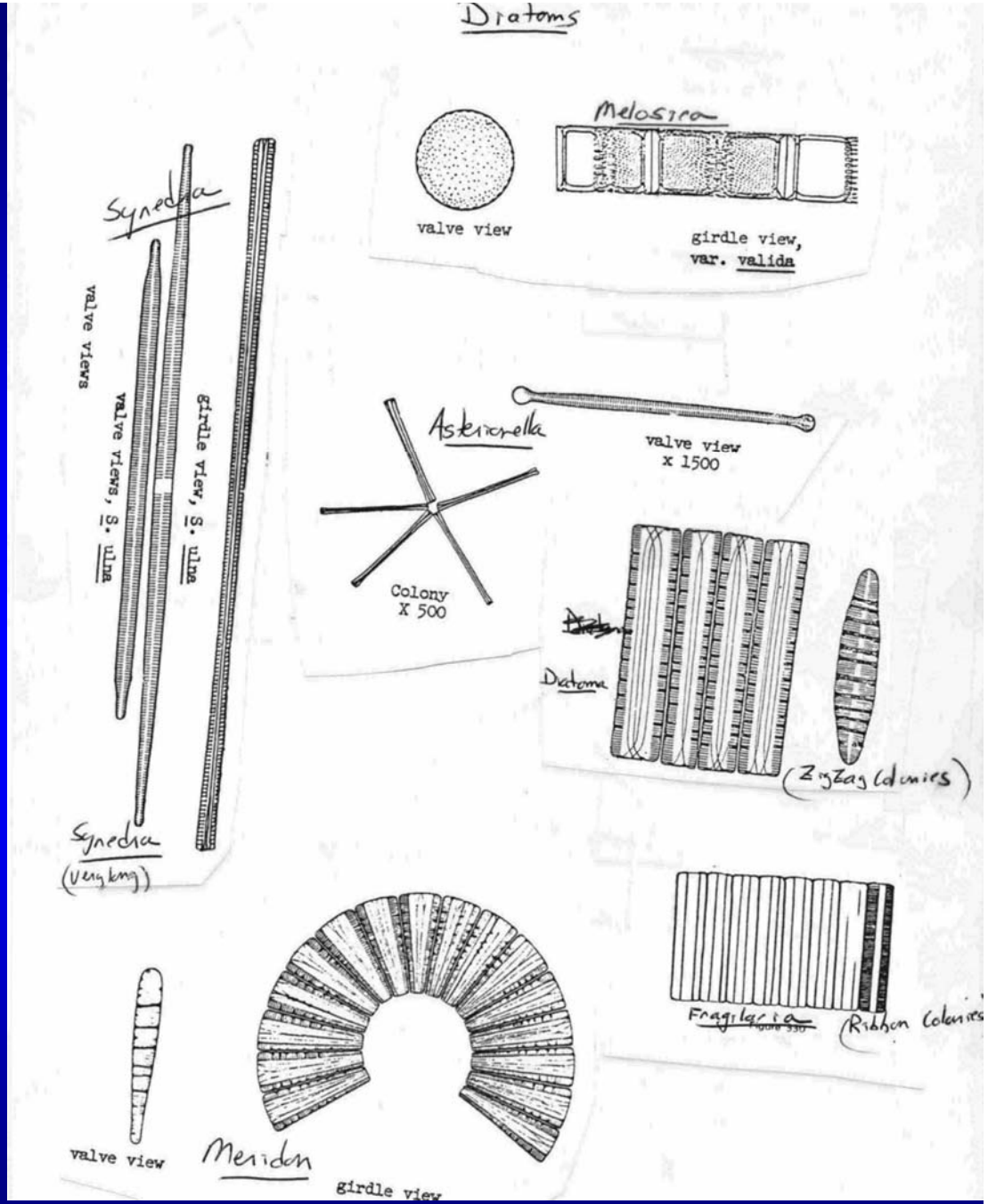


Useful Taxonomic References To Make Up Your Own Picture Key

- **1971. C.I. Weber.** ***A guide to the common diatoms at water pollution surveillance system stations*****. EPA.**
- **1988. J. Needham.** ***A guide to the study of freshwater biology*****. McGraw Hill.**
- **1996. E. Cox.** ***Identification of freshwater diatoms from live material*****. Chapman & Hall.**
- **1997. T.J. Entwisle et. al.** ***Freshwater Algae in Australia*****. Sainty and Assoc.**
- **2000. M. Kelly.** ***Identification of common benthic diatoms in rivers*****. Field Studies Council.**

Other ID Aids:

- Photos of common taxa
- Power Point presentation with images from the web



Growth Forms:

*Prostrate
*Erect immobile
*Stalked
*Motile
*Chain
*Colonial
  prostate greens
    and BG's
*Filamentous
    greens
*BG filaments

Lake growth form model (Hoagland et al. 1982)

KEY TO LABELING:

a = Attached bacteria,
b = *Navicula menisculus* var. *upsaliensis*—prostrate attachment, mucilage coat,
c = *Gomphonema parvulum*—short stalks,
d = *Gomphonema olivaceum*—long stalks,
e = *Fragilaria vaucheriae*—rosette, mucilage pads,
f = *Synedra acus*—large rosette, mucilage pads,
g = *Nitzschia* sp.—rosette, mucilage pads,
h = *Stigeoclonium* sp.—upright filaments.

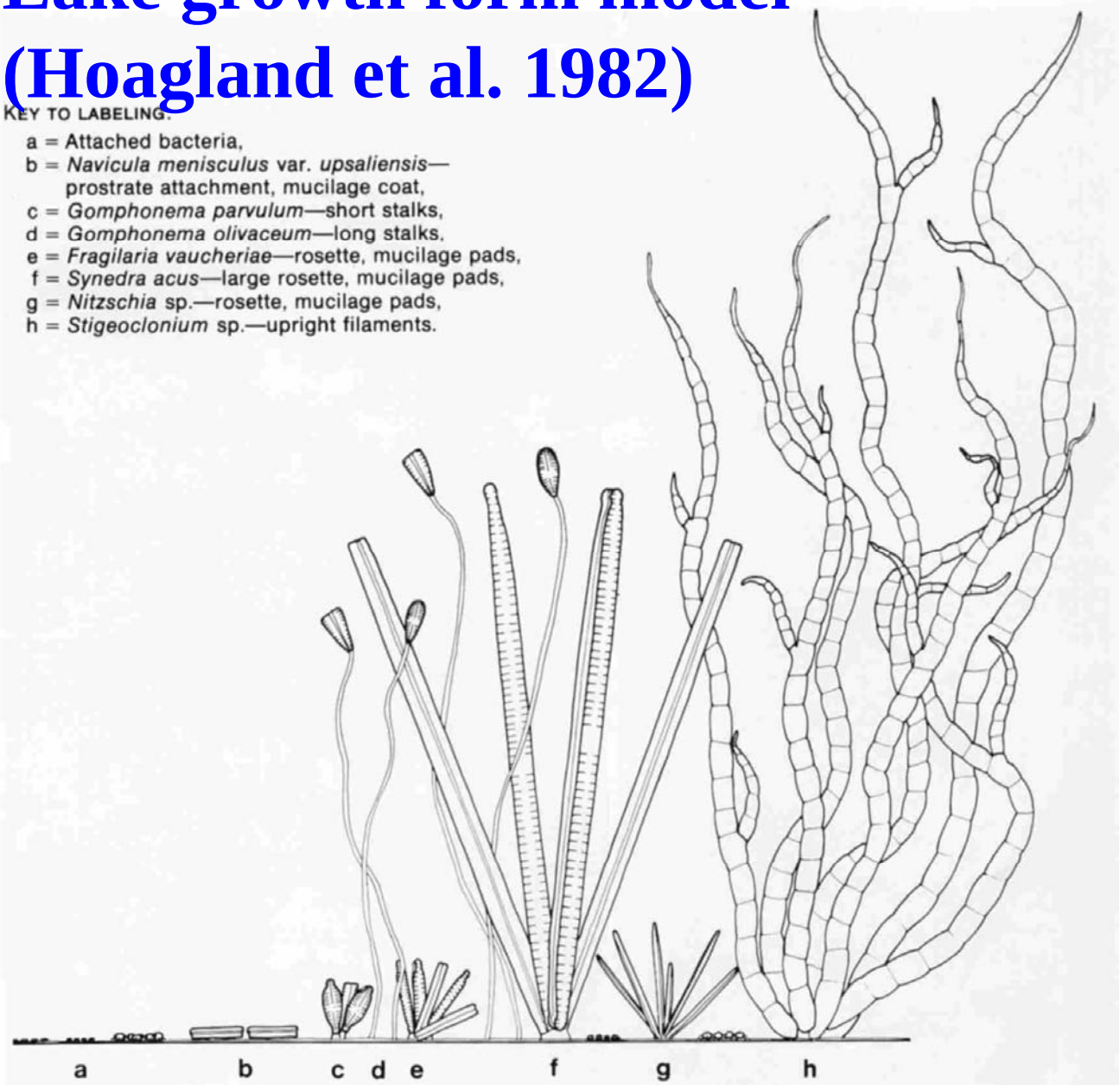


Fig. 47. Range of vertical stature in the periphyton community. Drawn to scale, ×400.

Early succession:
Long upright diatoms,
loosely attached algae

Middle succession:
motile diatoms mixed
with some stalked

Late succession:
thick mat with motile
diatoms, filamentous
diatoms and green
algal filaments

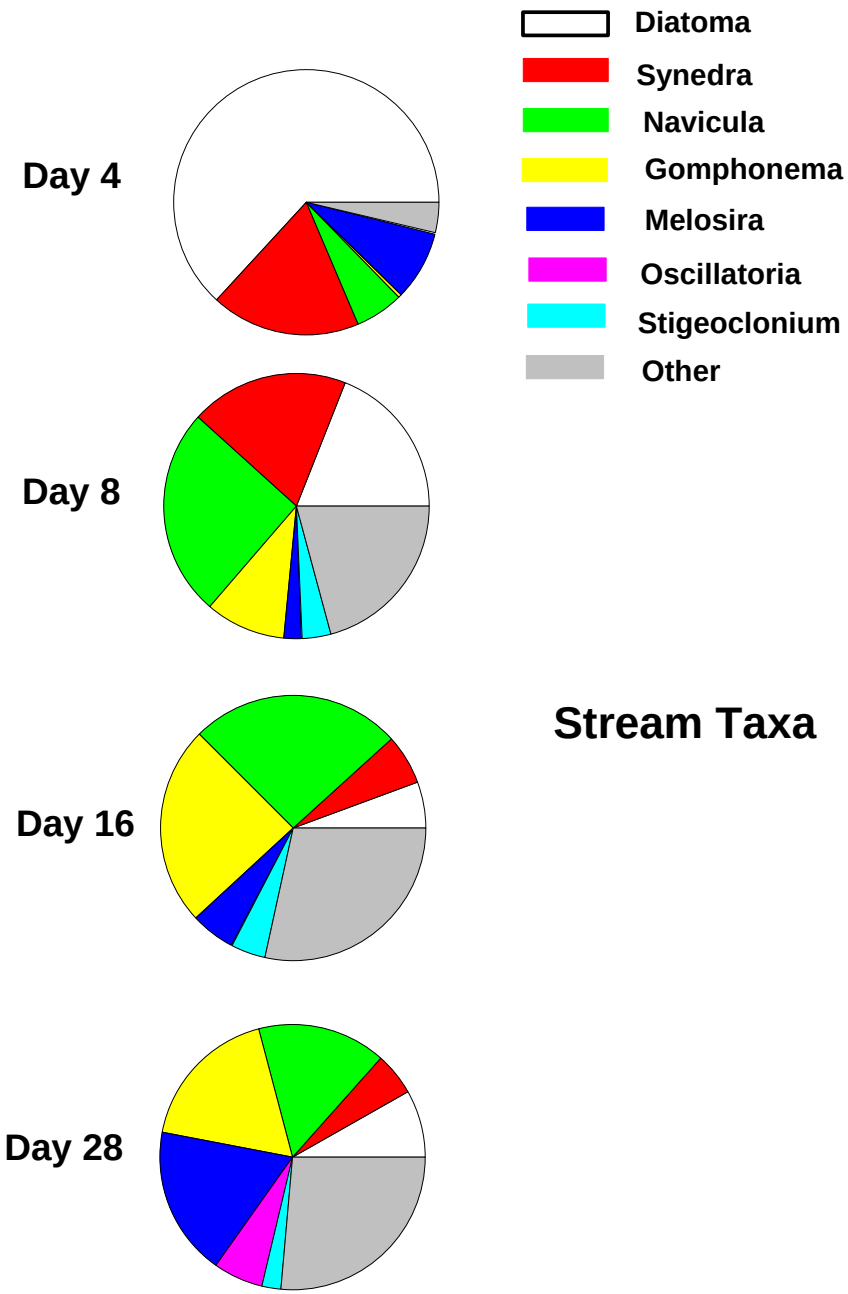
Stream growth form model based on (Hudon and Bourget 1983)

Fig 2) Periphyton succession in a stream based on algal growth forms.

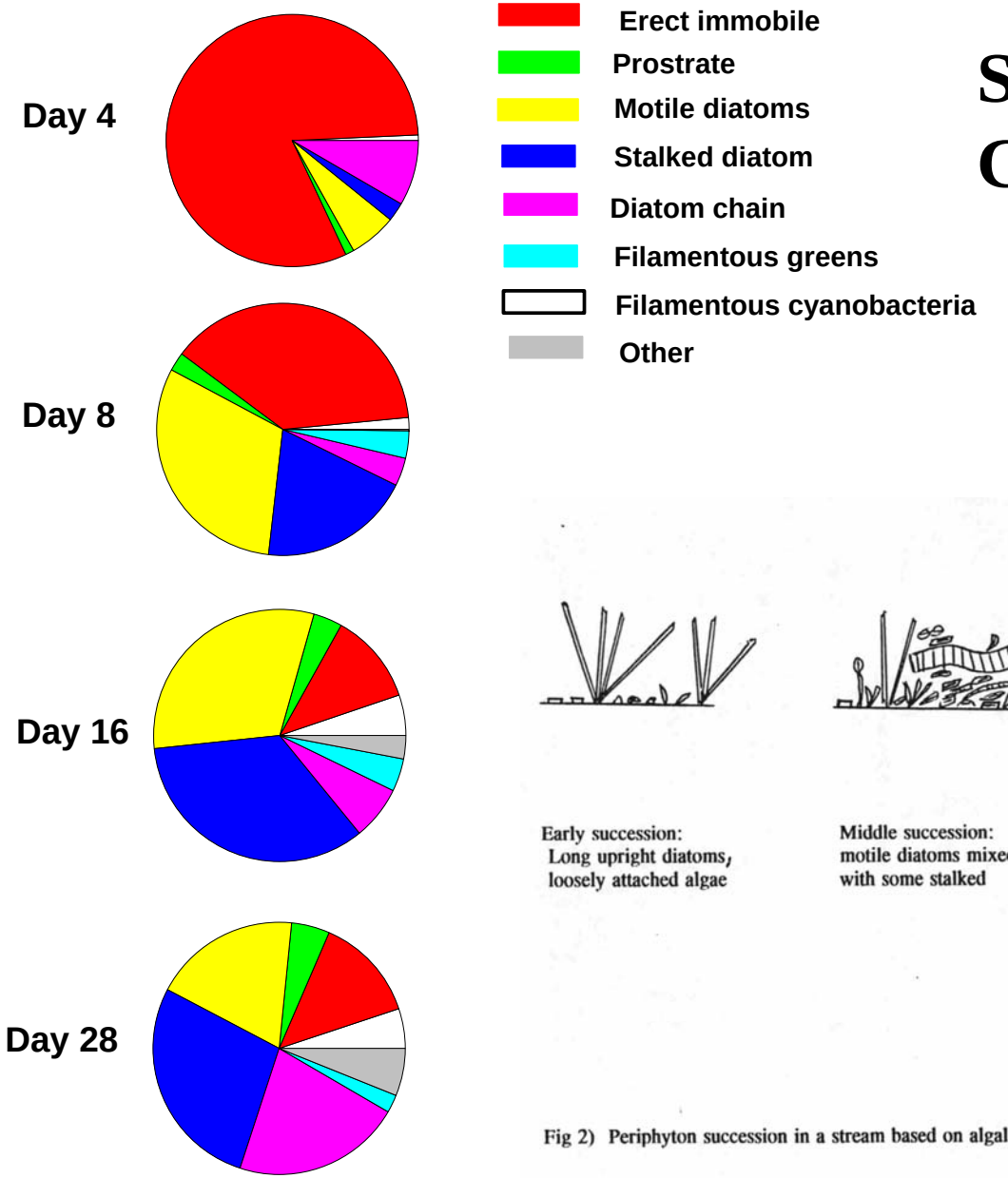
Students enter their counts into a Excel file and the data is pooled for the class

Count Sheet.
Succession data, taxa and growth forms-Stream

Taxon	Day ___	Day ___
Diatoma (long-immobile)		
Synedra (long-immobile)		
Cocconeis (prostrate)		
Achnanthes (prostrate)		
Cyclotella (prostrate)		
Gomphonema (stalked)		
Cymbella (stalked)		
Navicula (motile)		
Pinnularia (motile)		
Nitzschia (motile)		
Suriella (motile)		
Fragilaria (chain)		
Melosira (chain)		
Oscillatoria/Phormidium (cyanobacteria)		
Unicellular greens (don't attach)		
Filamentous greens		


Day 4
Day 8
Day 16
Day 28
Diatoma
Synedra
Navicula
Gomphonema
Melosira
Oscillatoria
Stigeoclonium
Other
Stream Taxa

Stream Growth Forms



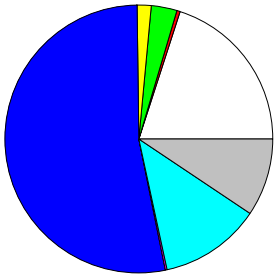
Early succession: Long upright diatoms, loosely attached algae

Middle succession: motile diatoms mixed with some stalked

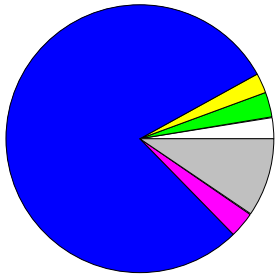
Late succession: thick mat with motile diatoms, filamentous diatoms and green algal filaments

Fig 2) Periphyton succession in a stream based on algal growth forms.

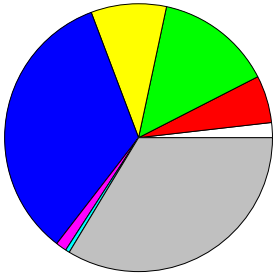
Day 4



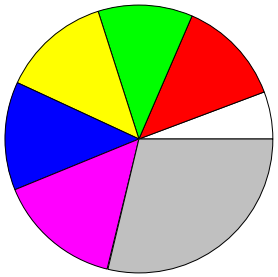
Day 8



Day 16



Day 28



Scenedesmus/Ankistro.
Oedogonium
Unicellular greens
Melosira
Navicula
Cymbella
Synedra
Other

Pond Taxa

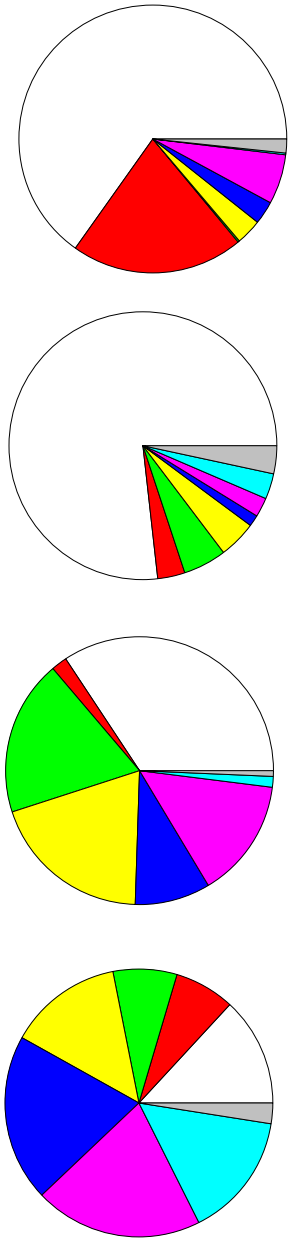
Pond Growth Forms

Day 4

Day 8

Day 16

Day 28



- Unicellular/col. greens
- Erect immobile
- Prostrate
- Motile diatoms
- Stalked diatom
- Diatom chain
- Filamentous greens
- Other

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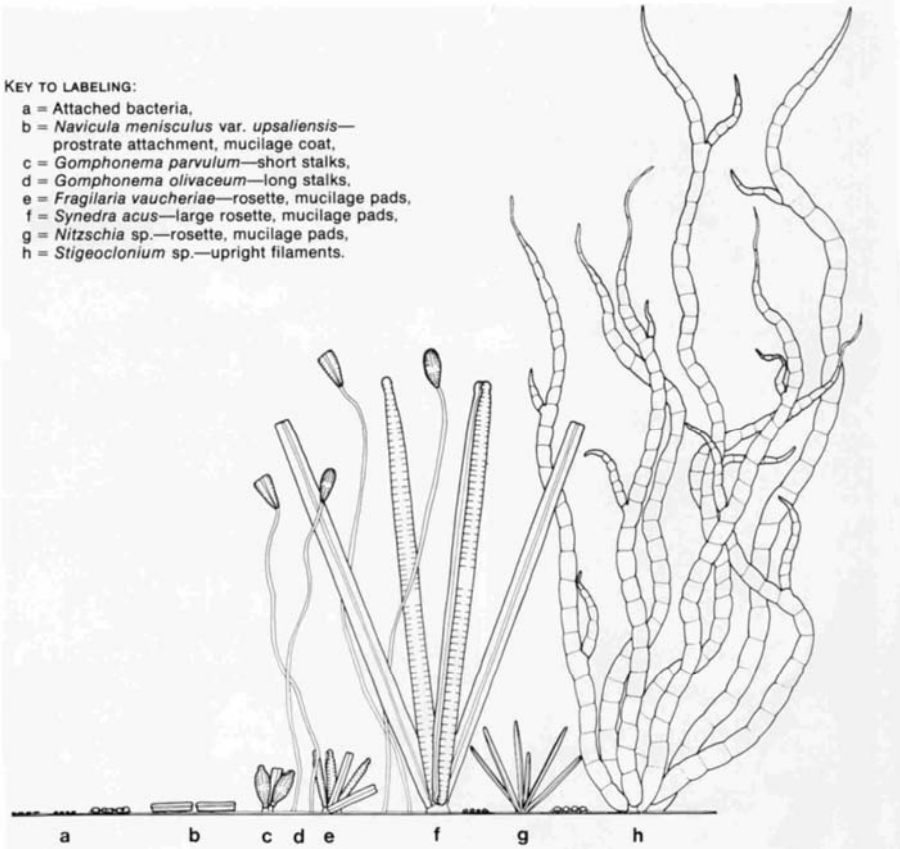

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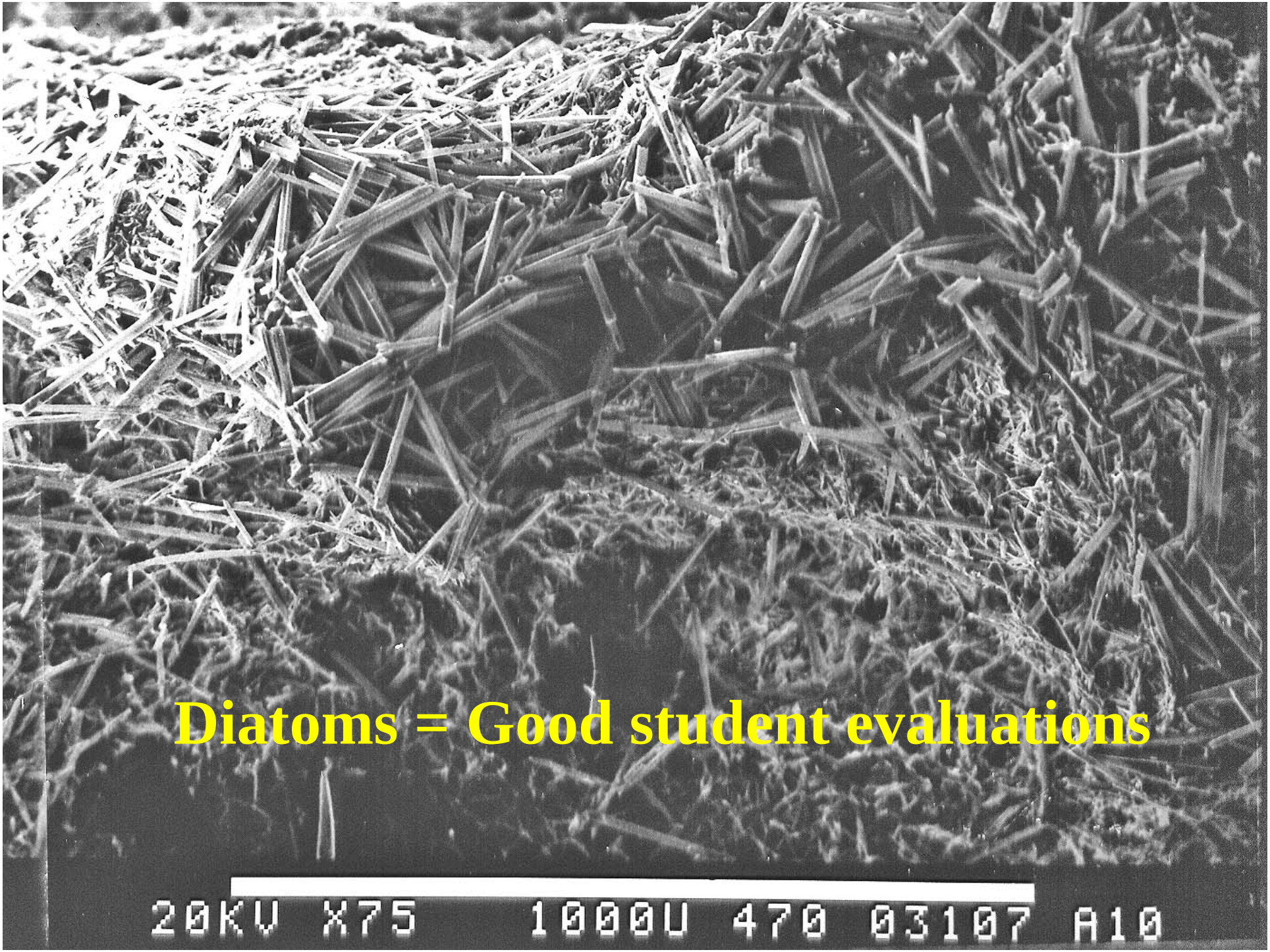
Lab Report

- Presentation of changes in taxonomic structure and growth forms in properly constructed figures
- Discussion of successional sequence, contrasting differences in the lake and stream
- Do the changes in growth form fit the generalized models for lakes and streams?
- Discuss how Connel and Slatyer models may apply, and how you would test the models

Possible Modifications

- Compare succession in areas of different light or current speed
- Compare succession with and without grazers using an exclosure
- Determine relative changes in cell density during succession by scraping the same area & bringing samples up to the same volume. Students pipette a known volume onto their slide and count a given number of transects on the slide


Diatoms = Good student evaluations
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