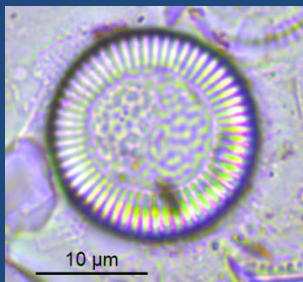
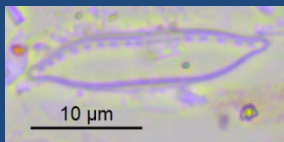


# Preliminary Analysis Of Historical Water Quality In The Tidal Christina River, Delaware

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# Introduction

## **Purpose**

- Determine how water quality varied over the last 1000 years in a tidal river
- Increase understanding of changes in water quality before European settlement
- Determine continuing impacts of land-use on water quality

## **Hypotheses**

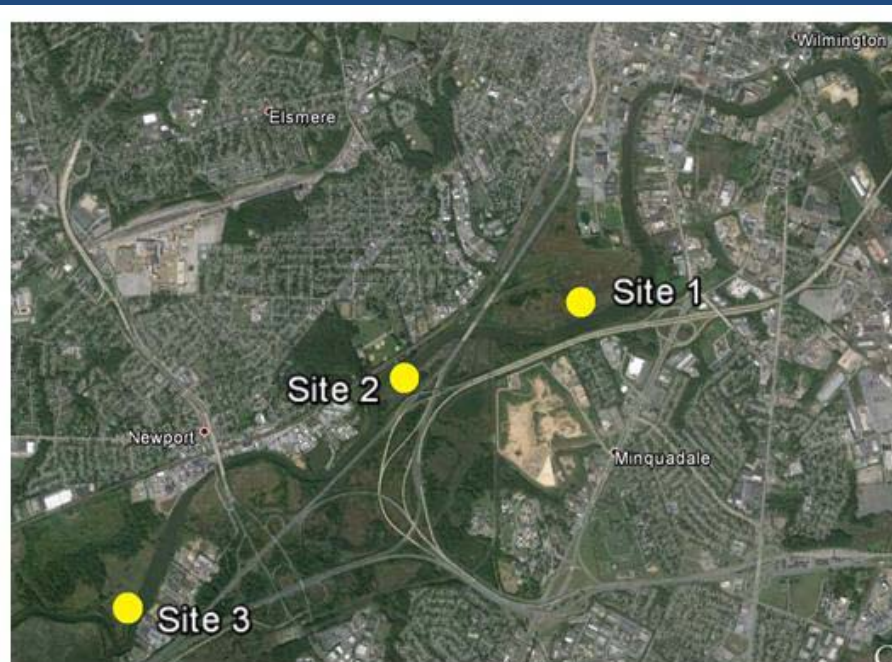
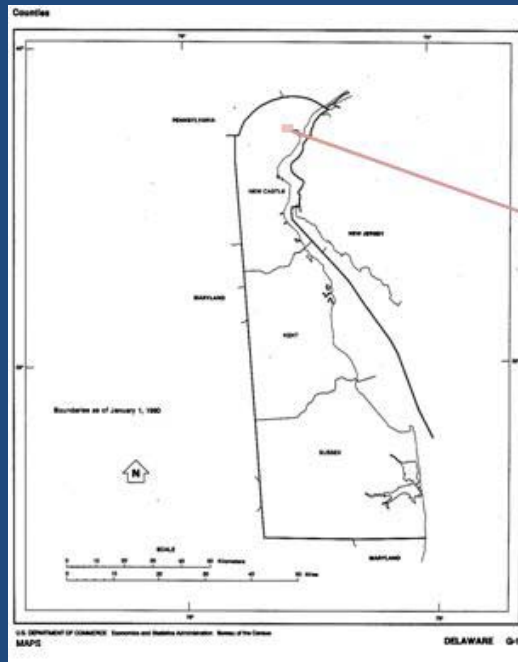
- Post-settlement water quality will degrade due to land use changes, which increase sediments and nutrient loads
- 20<sup>th</sup> century perturbations to water quality include input of heavy metals and further inputs of nutrients and sediments

# Background

- European settlement in the Mid-Atlantic US began in the late 1600s, land use changes continue into the present
- Commonly noted impacts include: increased sedimentation, vegetation changes, increased nutrient levels, changes in carbon storage, and increased heavy metals (Boesch *et al.*, 2001; Bratton *et al.*, 2003; Cooper & Brush, 1991)
- Christina River is also influenced by “natural” processes
- This research is significant because a tidal river system, an environment likely to be impacted by sea level change, is studied

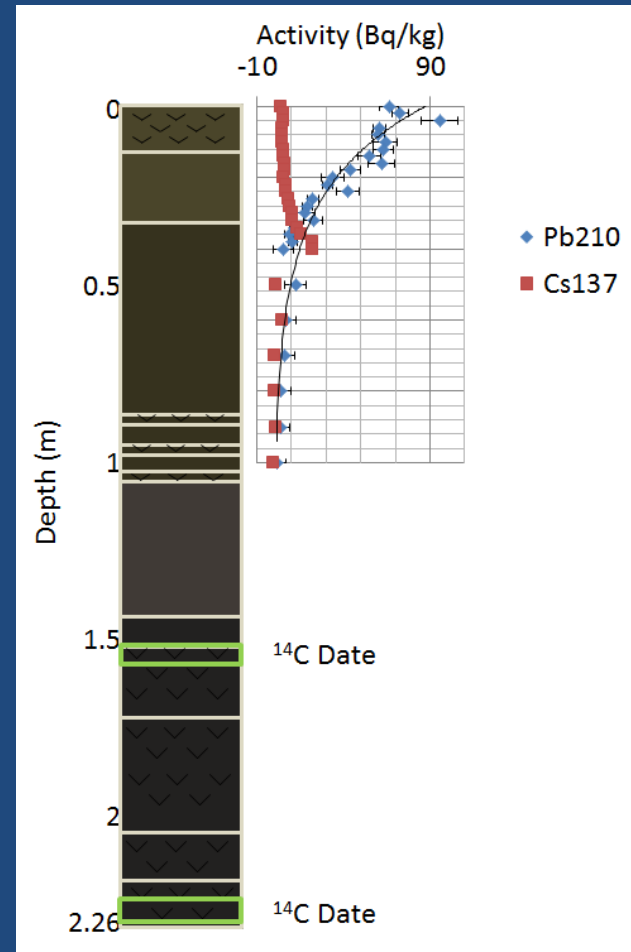
# Study Site

- Samples collected from tidal marshes of Christina River, DE using vibracore
  - Focus on Site 1 ( $N39^{\circ}43.173'$   $W75^{\circ}34.059'$ )

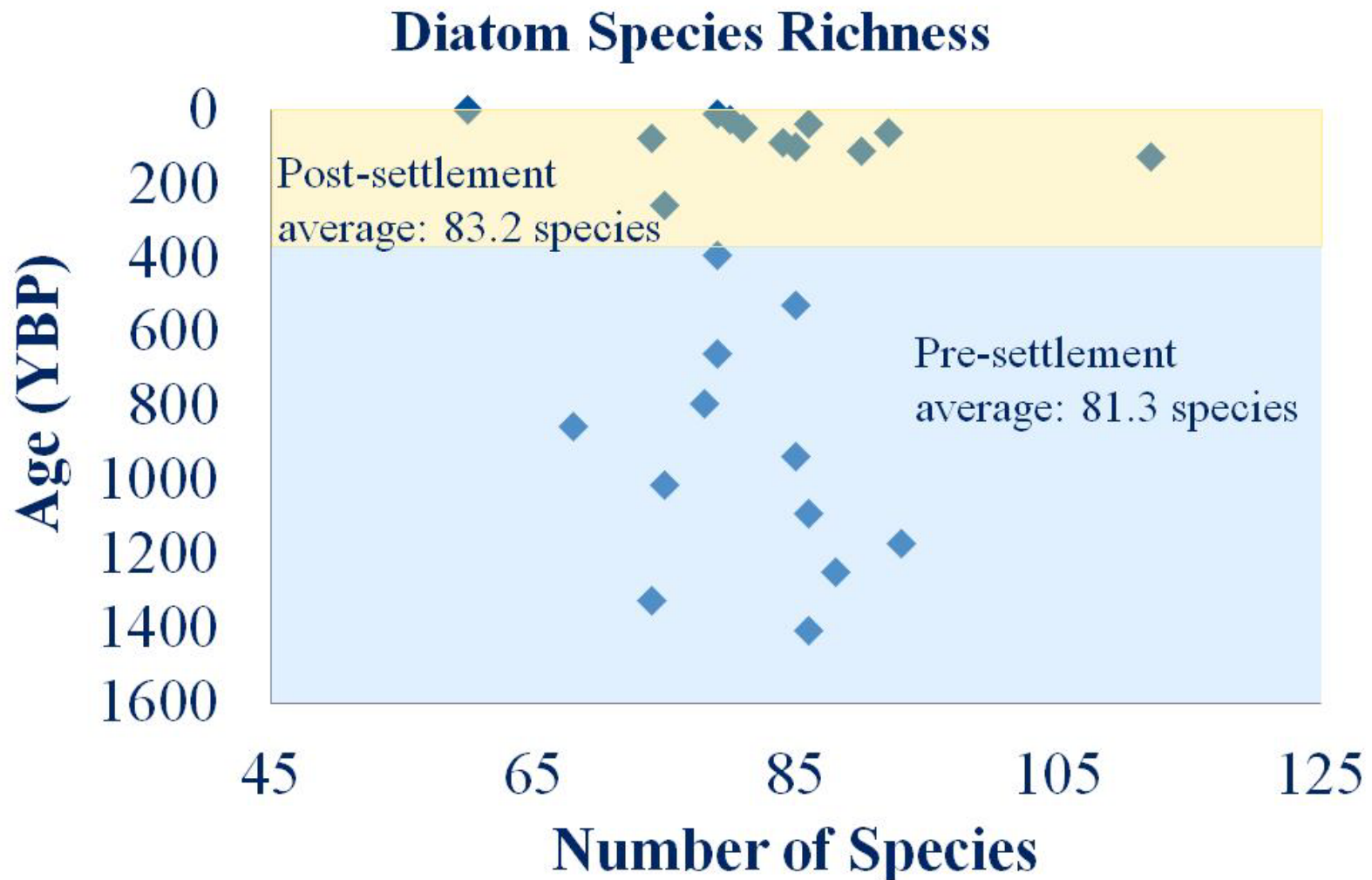


# Methods

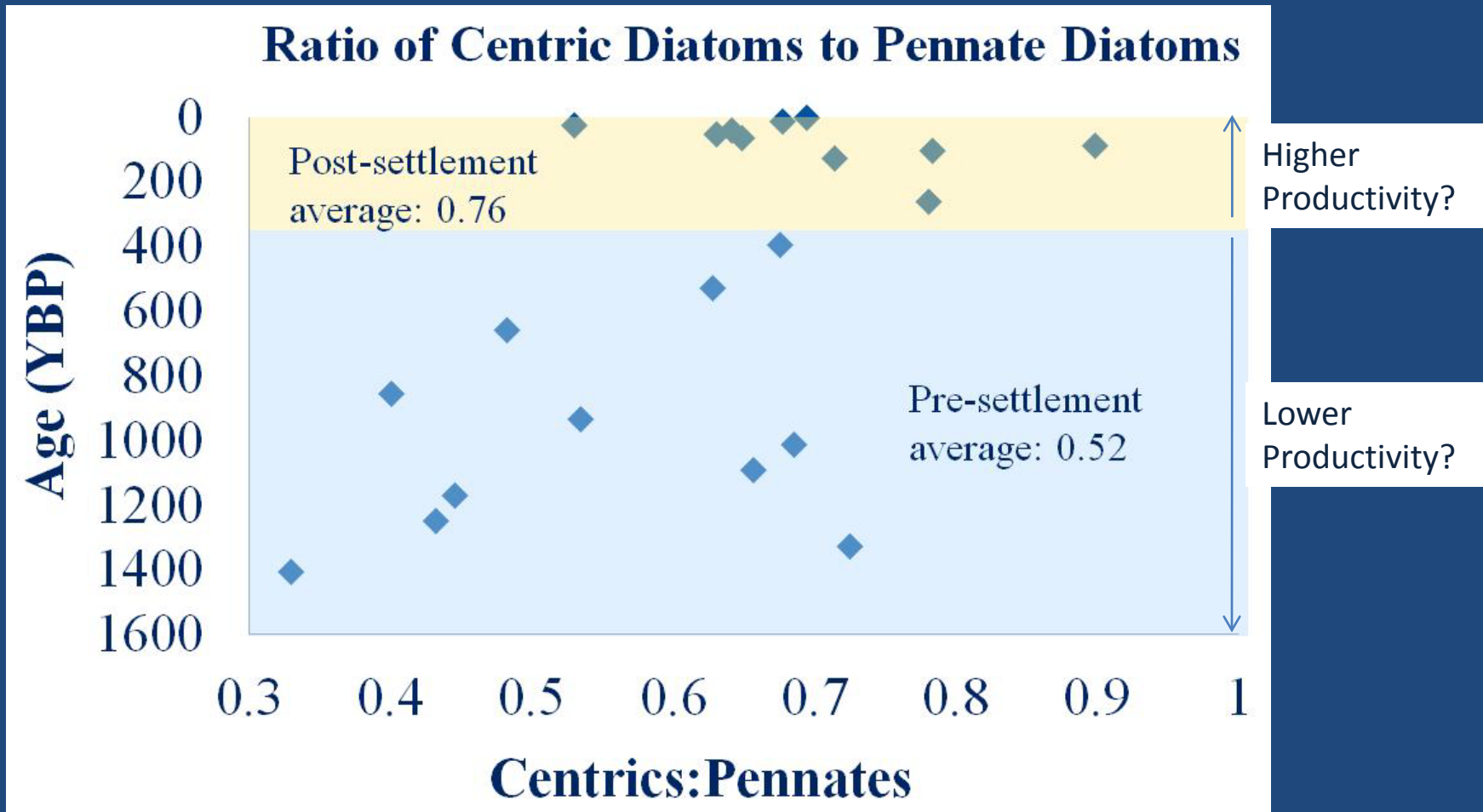
- Diatom samples taken every 10 cm
  - Diatoms extracted and analyzed under 100x
  - 500+ diatoms per slide counted
- Chronology from gamma counting ( $^{210}\text{Pb}$ ,  $^{137}\text{Cs}$ ) the top 1 m and two  $^{14}\text{C}$  dates (152 cm, 226 cm)



# Results: Species Richness

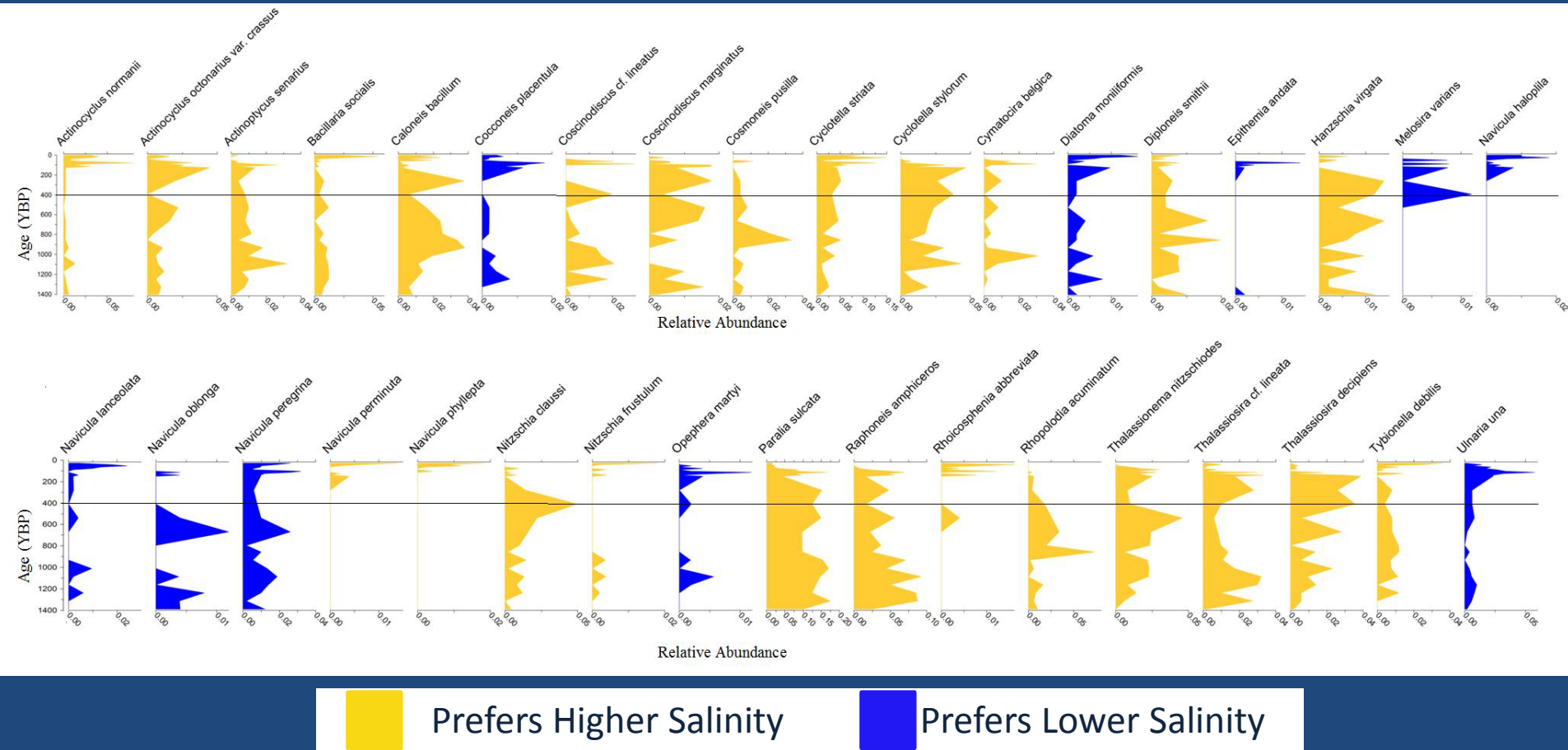


# Results: Centric:Pennate Ratio





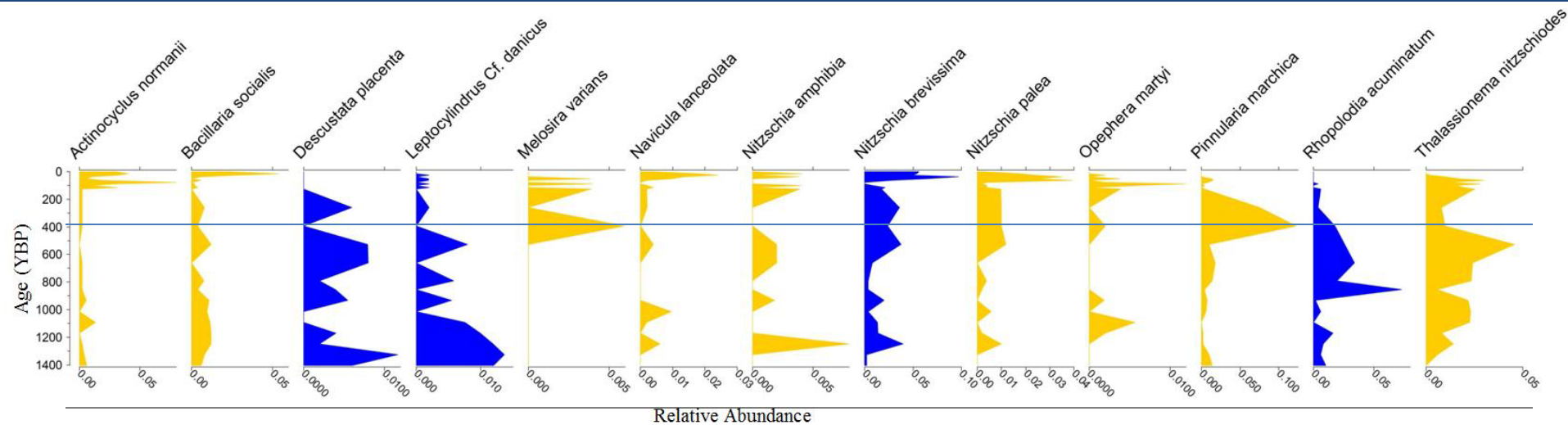
# Results: Salinity



- Salinity seems to have varied through time, but tended to be higher in the past
- Recent spike in high salinity diatoms may be related to increased nutrients and conductivity



# Results: Nutrients & Eutrophication



Tolerant/Prefers high nutrients



Sensitive/Prefers low nutrients

- In general, low nutrient species begin to decline about 300 years before present and most are gone by 200 years ago
- Most tolerant species mostly increase during this time, with several species showing their highest abundances in the last 100 years

# Conclusions

- 310 diatom taxa identified
- Species richness (number of species per sample) appears variable through time
  - Not impacted by settlement
- Centrics to pennates ratio generally higher in post-European settlement samples
  - More productivity due to higher nutrient input?

# Conclusions

- Salinity seems higher in the past
  - Some taxa that prefer high salinity increase in more recent samples
    - Related to transport of diatoms or increased nutrients or conductivity rather than salinity?
- Diatoms that prefer lower nutrient conditions decreased 200-300 YBP; more tolerant species increased in abundance around this time
  - Coincides with increased P from fertilizers and detergents

# Future Work

- Complete diatom counts for sites 2 and 3, continue research on autecology
  - Focus on nutrients, dissolved solids, and other pollutants
- Measure total carbon, total nitrogen and total phosphorous, and heavy metals in core 3
- Complete radiocarbon dating and gamma counting for all three cores
- Analyze pollen to locate the deforestation horizon

# Acknowledgements

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- Thank you to my committee members: Don Charles, Pete McLaughlin, and Chris Sommerfield for their advice and guidance.
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Thank You!

Any Questions?