Impact on Phytoplankton Community from Oyster Biodeposit Resuspension in Shear Turbulence Resuspension Mesocosms.

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Presentation Outline

1. Background
2. Methods
3. Hypothesis
4. Results
5. Discussion
6. Conclusion
7. Acknowledgements
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Background: STURM System

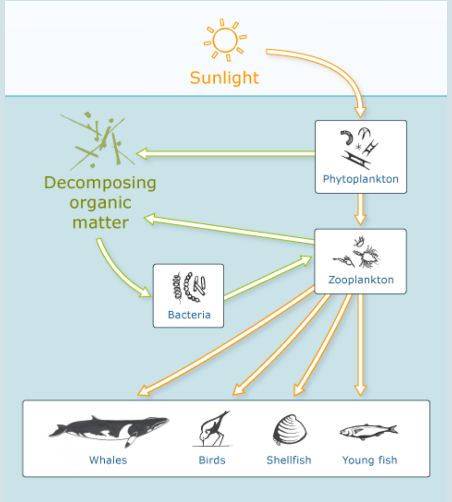
- This research required the use of the STURM system
  - Shear Turbulence Resuspension Mesocosm
- Systems useful in studying benthic-pelagic coupling processes
  - Cycling of nutrients
  - Cycling of particulates
  - Resuspension of sediments
  - Regeneration of solutes
- Systems have been used by Dr. Porter for a variety of studies

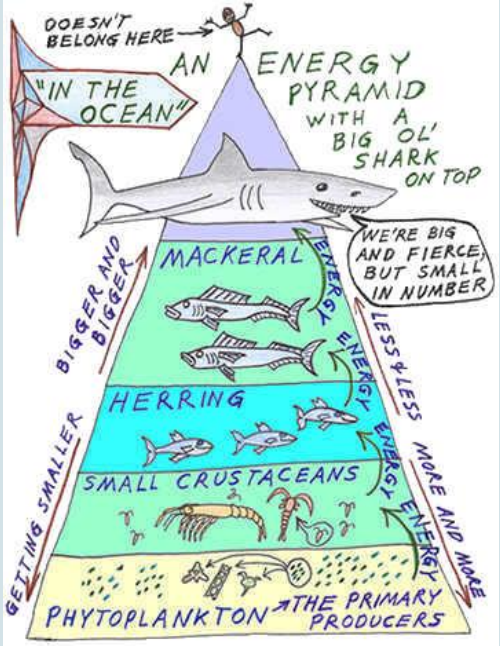
Background: Oysters

- The Eastern Oyster, *Crassostrea virginica*
  - Once abundant in the Chesapeake Bay
  - Overfishing and disease declined population
  - Increase population suggested method to improve water quality
- Filtration
  - Assimilate 70% of organic material filtered
  - Left over material becomes bonded with mucus and deposited
- Importance of biodeposits
  - Transfer particles and nutrients to sediments
  - Possible phytoplankton control
  - Food source for benthic organisms

Background: Phytoplankton

- Bottom of the food chain
  - Population changes impact various species
- Populations affected by nutrient fluxes, temperature, dissolved oxygen, salinity, etc
  - Nutrients: silicate, nitrogen, and phosphate
- Top down and bottom up control





Methods

- 4-week experiment
  - Sampling performed daily
  - June 27 to July 25
- Mesocosms
  - 1000 L tanks
  - 1 M water column
  - Resuspension paddles
  - Mixing: 8s, 1.5s, 9s, 1.5s
  - Sediment taken from Patuxent River
- Biodeposits added daily to 3, 4, and 5
  - None added to 1, 2, and 6
- Water exchanges performed daily
  - Filtered seawater used to re-fill tanks
  - 10% of water exchanged

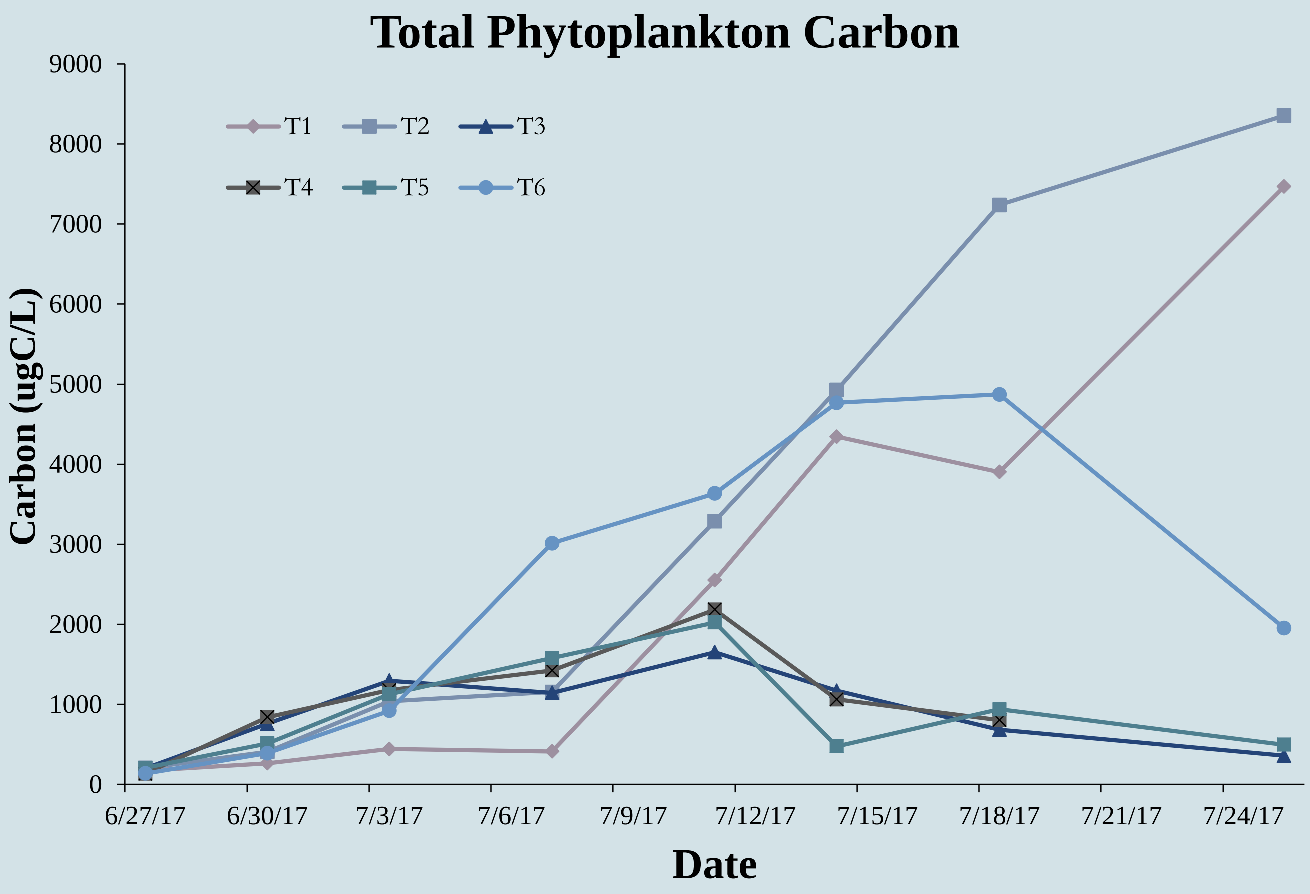
Methods Continued

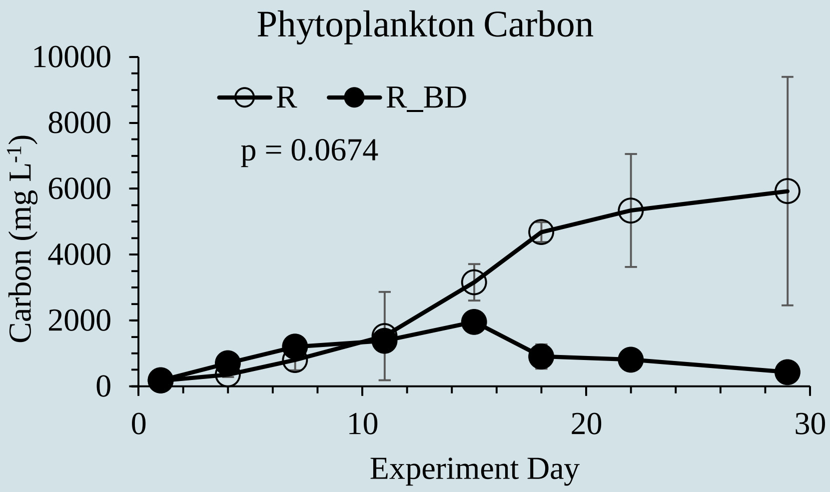
- Various parameters assessed
  - Temperature, salinity, absorbance, particulate concentrations, nutrient concentrations, etc.
- Water samples acquired for:
  - Phytoplankton and zooplankton research
- Phytoplankton counted using microscopy
  - Species carbon constants referenced to determine total carbon
- Analysis using excel
  - Comparisons with T-test assuming unequal variances
  - Tanks with biodeposits vs. tanks without biodeposits
  - Assessed carbon, biomass, and density

Hypotheses

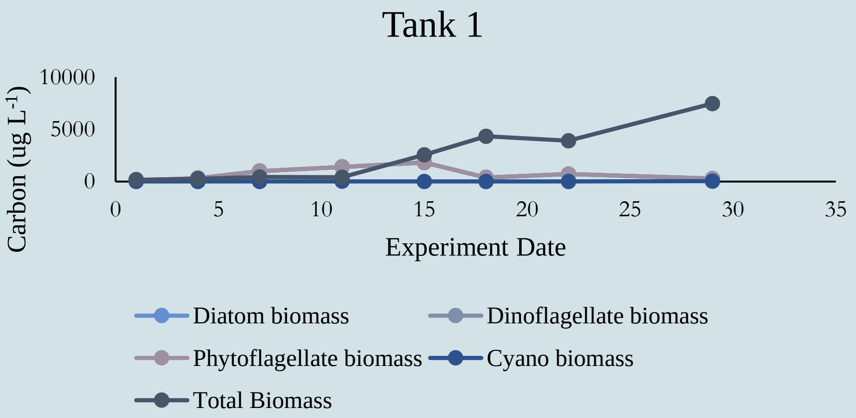
1. In the tanks 3, 4, and 5, with biodeposits added daily, we will observe an increase in diversity.
2. The phytoplankton biomass observed in the tanks with biodeposits added, will be significantly higher than that of the tanks with no biodeposits added.

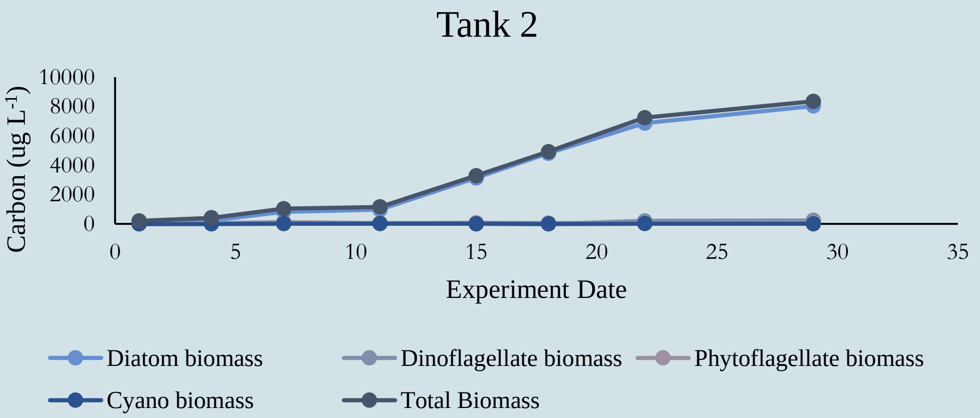
Results Carbon

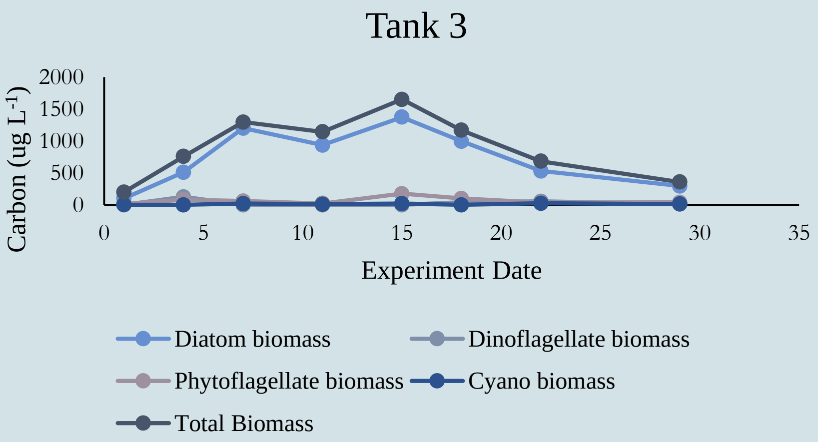


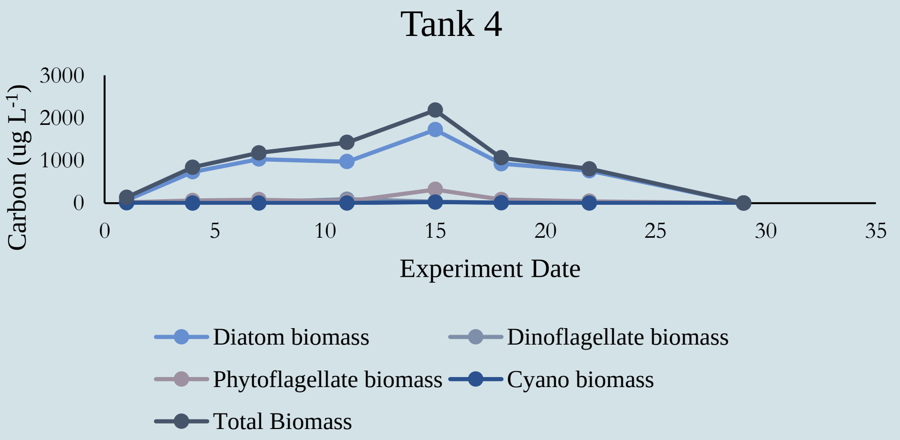


Results: Biomass per Tank

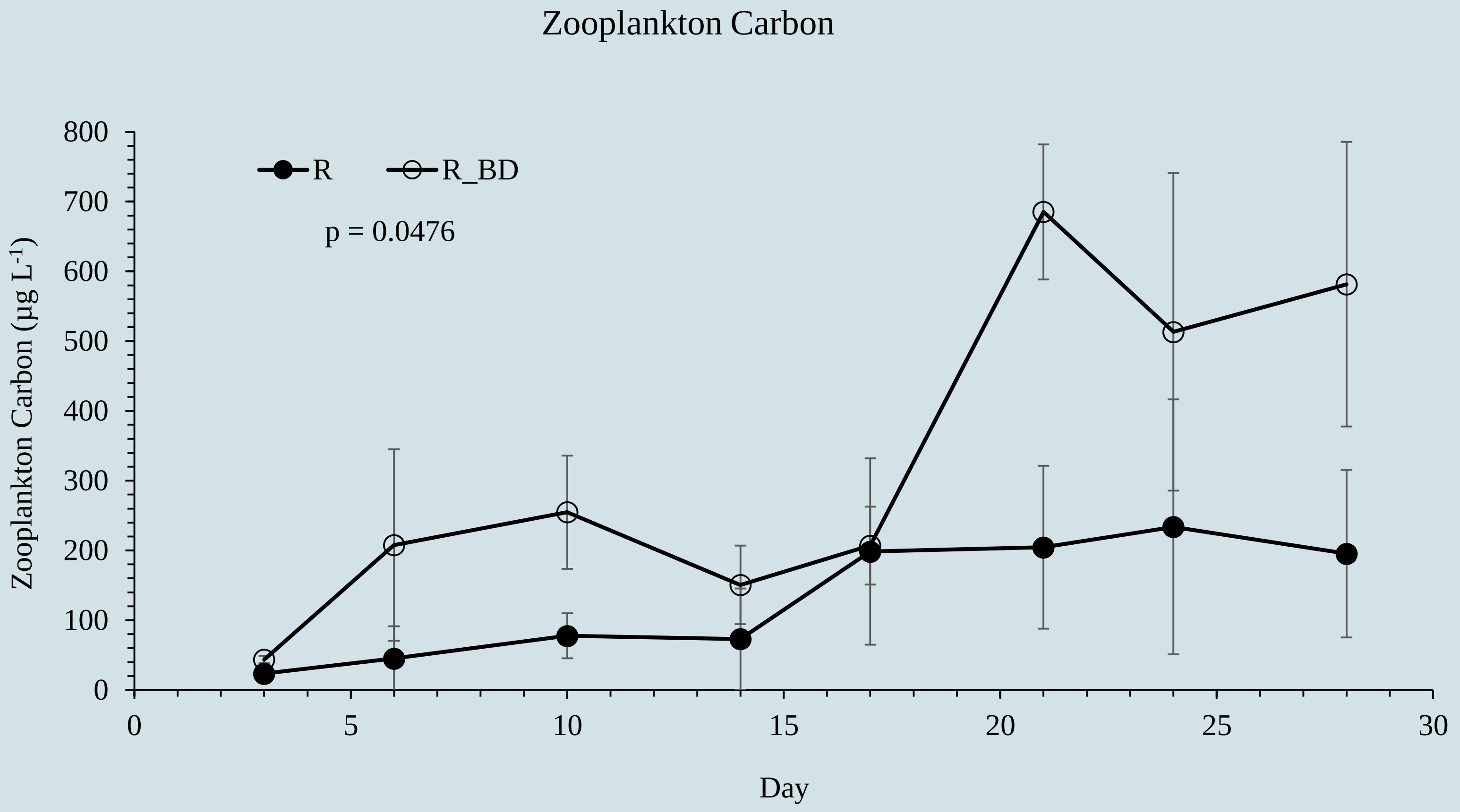




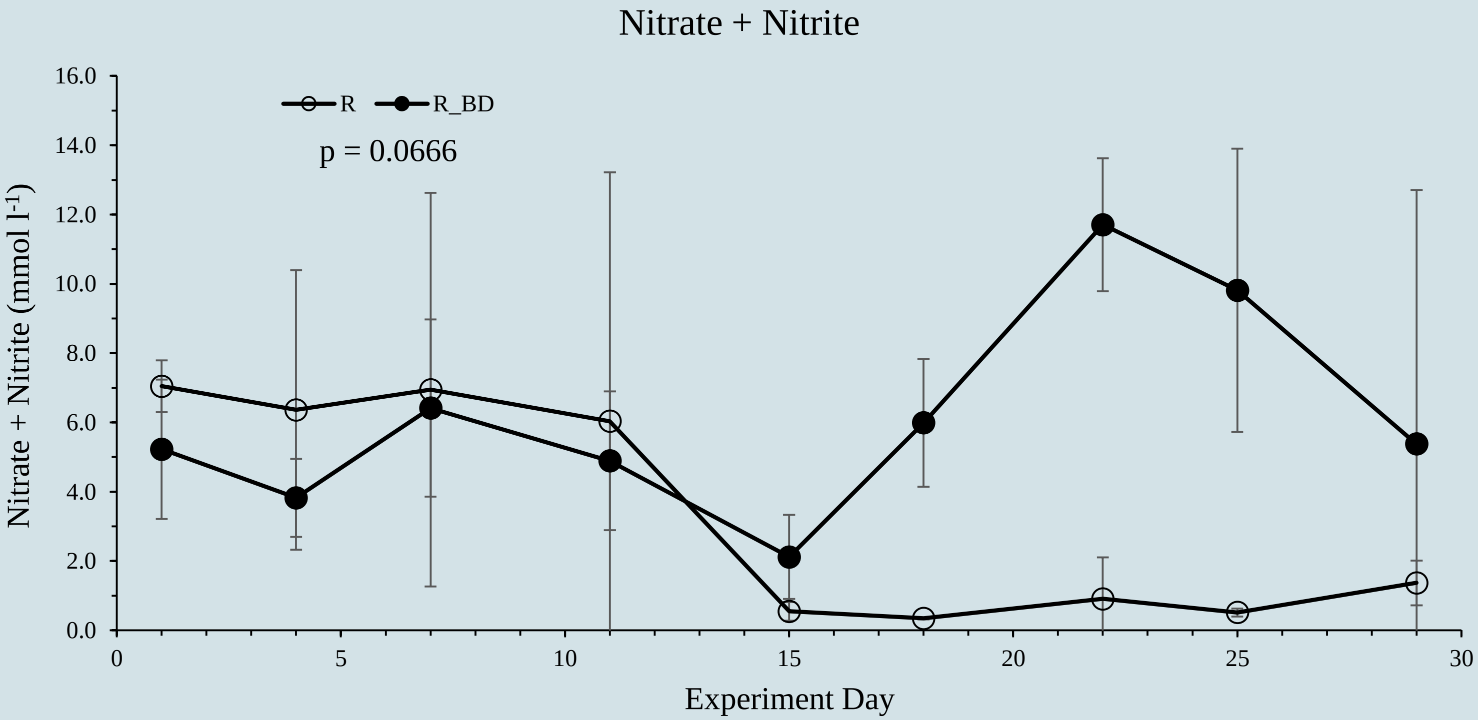




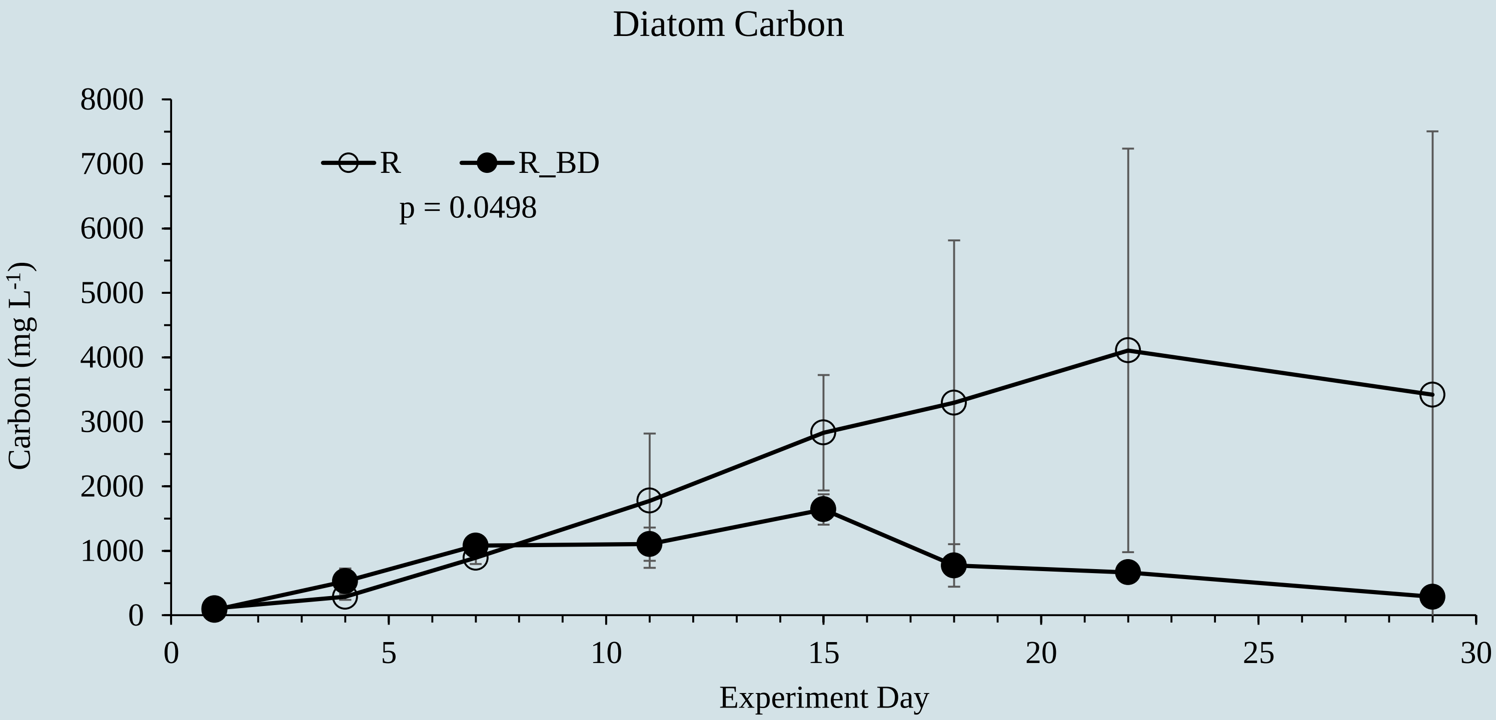
Results: Zooplankton Carbon



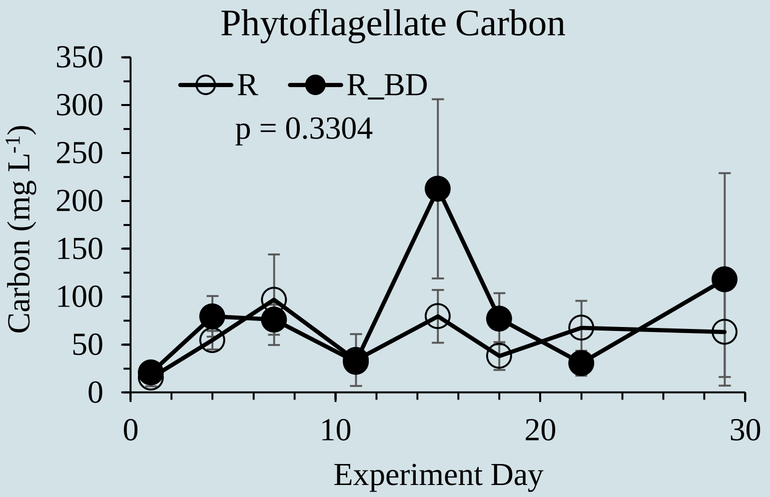
Results: Nitrate and Nitrite

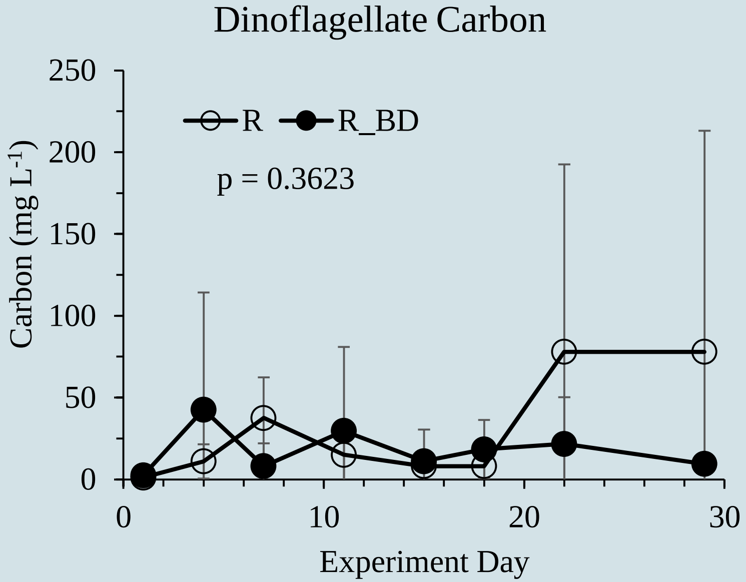


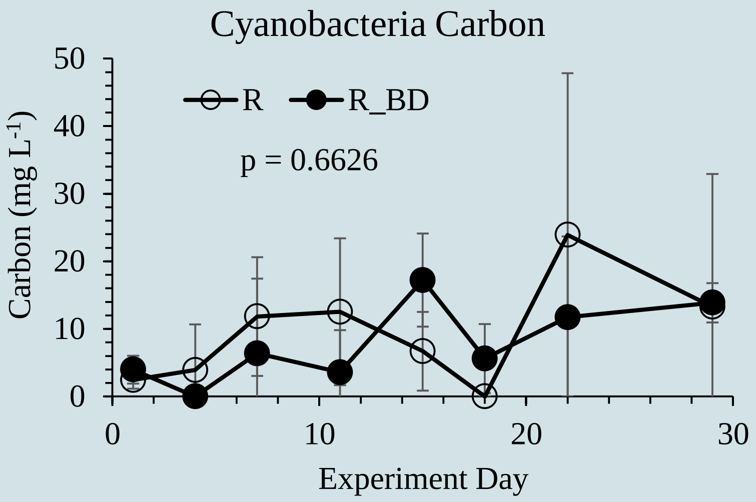
Results: Total Diatom Carbon



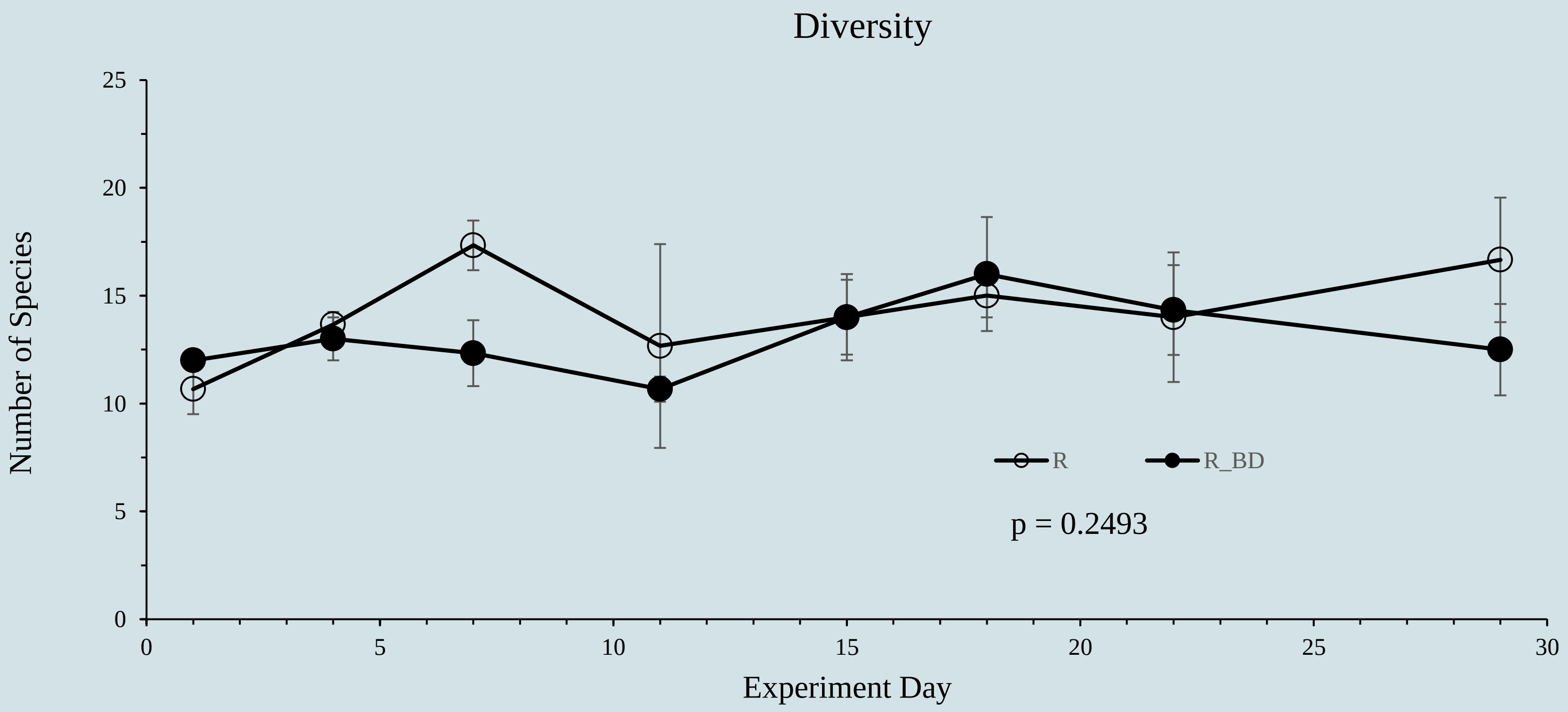
Results: Total Carbon by Group



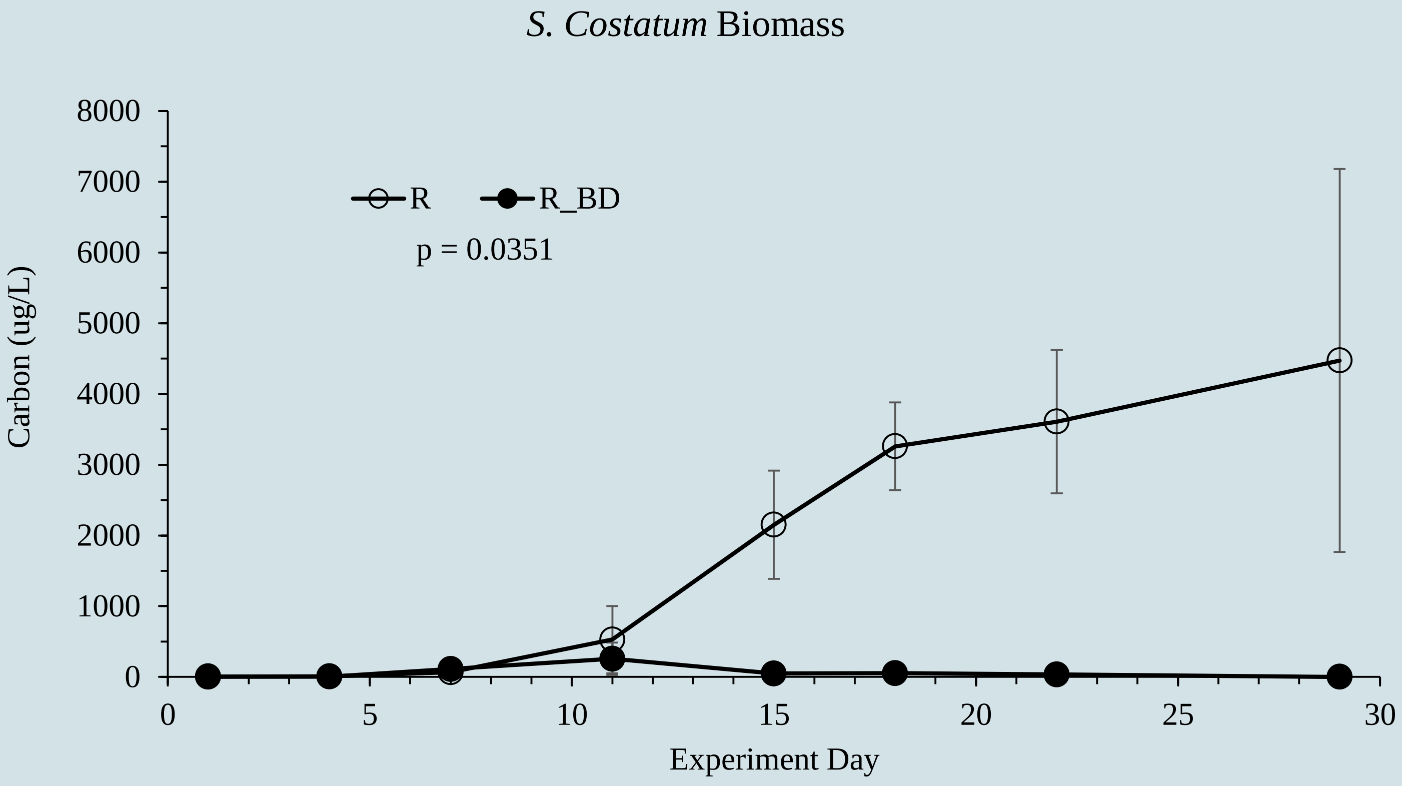




Results: Diversity



Results: *S. Costatum* Biomass



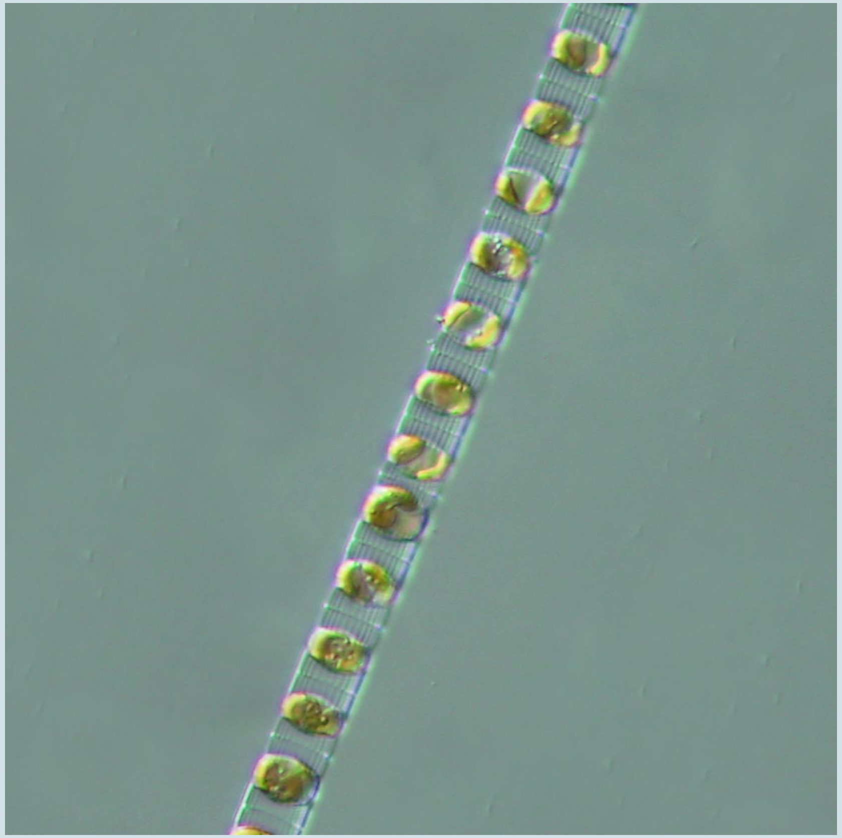
- Average non- BD chain length = 10.45 cell/chain
- Average BD chain length= 4.70 cell/chain

Discussion

- Tanks with biodeposits have different community structures
  - More single cells
  - Difference in biomass
    - Especially after 15 days ($p = 0.0026$)
- All tanks were diatom dominated
  - Comparable to the Chesapeake Bay environment
  - Large populations of *S. costatum* and centrics
    - Aligning with literature
  - Influenced by turbidity
- Phytoplankton biomass higher in tank 3, 4, and 5
  - Opposite to zooplankton community

Discussion Continued

- Nitrate and Nitrite
  - Enriched in Tank 1, 2, and 6
    - Suggested: increased grazing, less phytoplankton, greater concentration
- Total carbon by group
  - Only significant with diatom carbon
- Diversity
  - No significant difference
- *Skeletonema costatum*
  - Greater volume and longer chains in tank 1, 2, and 6
  - Nitrate and nitrite connection
  - Lack of grazing ability
  - Difference in average chain length



Conclusion and Further Research

- Hypotheses rejected
  - Findings were contrary to predicted outcomes
- Resuspension of biodeposits changes the phytoplankton community
- Resuspension of sediment may cause diatom dominance
- Zooplankton and phytoplankton association
  - Probable correlation between populations in both settings
- No change in diversity
  - Via these results and based on technology used
- *Skeletonema costatum*
  - Nutrient and grazing relationships
  - Continued research necessary

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Photos from:

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- https://teara.govt.nz/en/diagram/5137/marine-food-chain
- http://nordicmicroalgae.org/taxon/Skeletonema%20marinoi

Questions?