Effects of Oyster Biodeposit Resuspension on Phytoplankton Community Structure

Sabrina Tolbert

Mentors: Elka T Porter; Richard Lacouture

Background – Oyster Biodeposits

- Oysters are filter feeders
  - Adult oysters can filter 50 gal daily
- Biodeposits are nutrient rich
  - Transfer nutrients to the sediment
- Oysters have been considered as a method to reduce phytoplankton biomass

Background - Phytoplankton

- Microscopic plants Primary producers
- Populations are influenced by nutrients
  - Nitrite, nitrate, ammonium, phosphate
- Dominant phytoplankton in the Chesapeake Bay Estuary include: Diatoms, Dinoflagellates, Phytoflagellates, and Cyanobacteria

Background – STURM System

- STURM (Shear Turbulence Resuspension Mesocosm)
- Gives a more realistic model of shallow water ecosystem
  - Accurate shear bottom turbulence and water column mixing
- Allows for data collection involving:
  - Nutrient cycling, particle suspension, plankton communities

Hypotheses

Phytoplankton samples from 2018 were analyzed to draw further conclusions

- ❖ Resuspension tanks were found to be water column dominated
- ❖ Chlorophyll *a* data showed no significant difference between tanks

- Higher levels of nitrate, nitrite, and dissolved inorganic nitrogen in resuspension tanks will have impacts on phytoplankton community structures
  - Increased nutrient levels will cause an increase in phytoplankton biomass
  - Resuspension tanks will be diatom dominant
- Tanks with increased phytoplankton biomass will also have increased zooplankton biomass

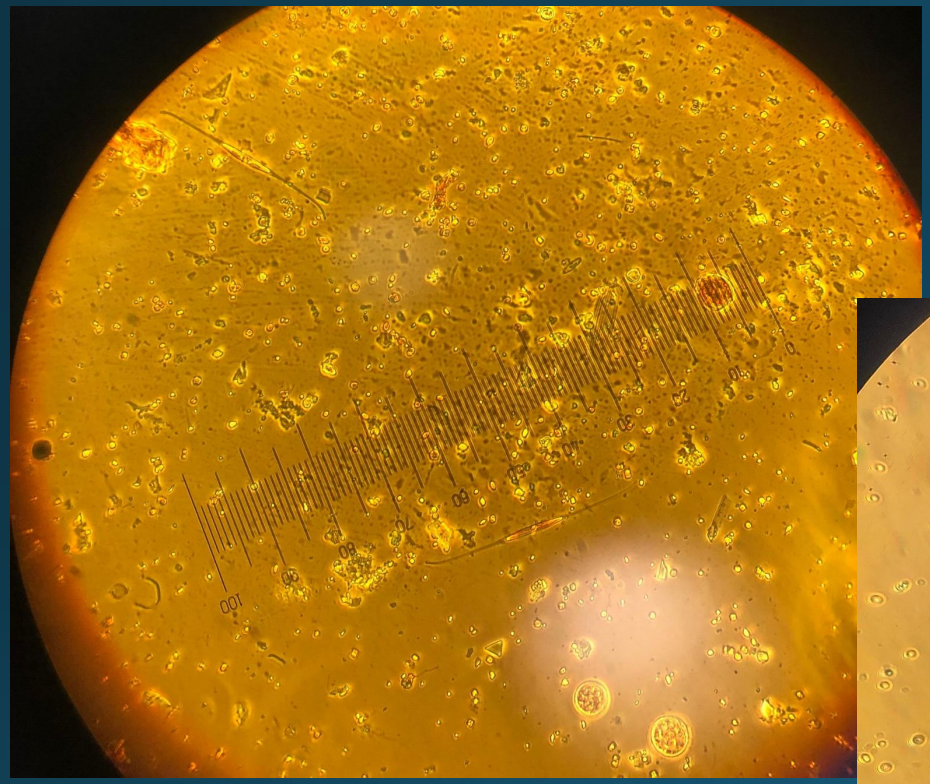
Methods – Mesocosm Set-up

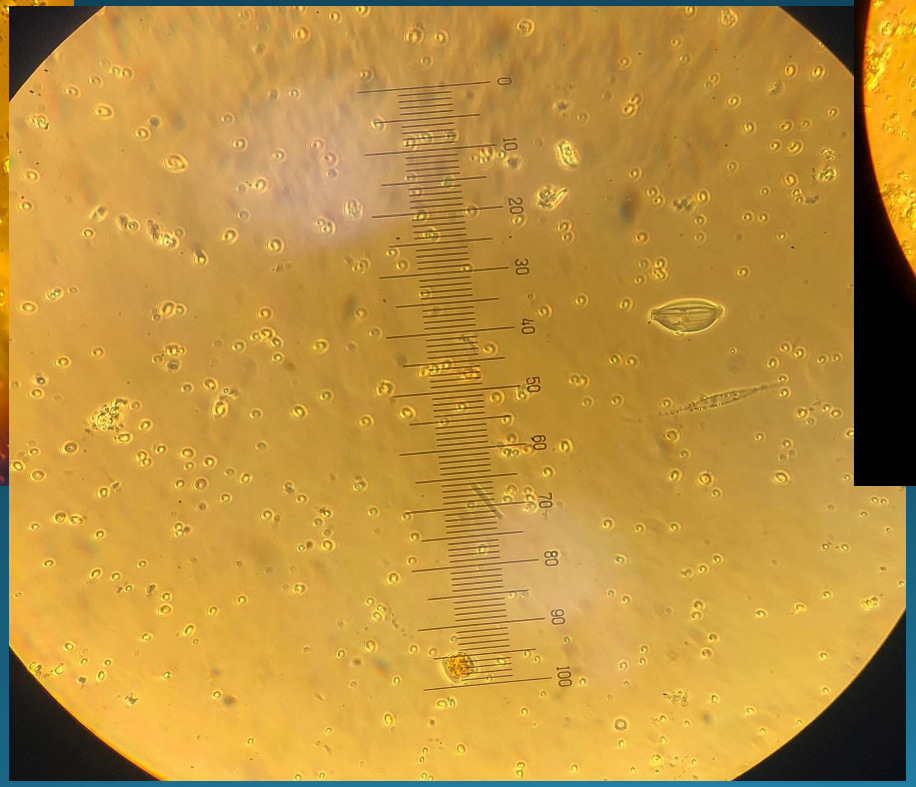
- **6 tanks total** – 3 STURM (**R**) and 3 Non-Resuspension (**NR**)
- **All tanks received**:
  - 1000L seawater, 10cm sediment, mixing paddles (paddles differ between R and NR tanks)
- **Daily Procedures**:
  - 10% water exchange, biodeposits added, water quality measurements
- **Twice Weekly** :
  - Water sampling, plankton sampling, light profile

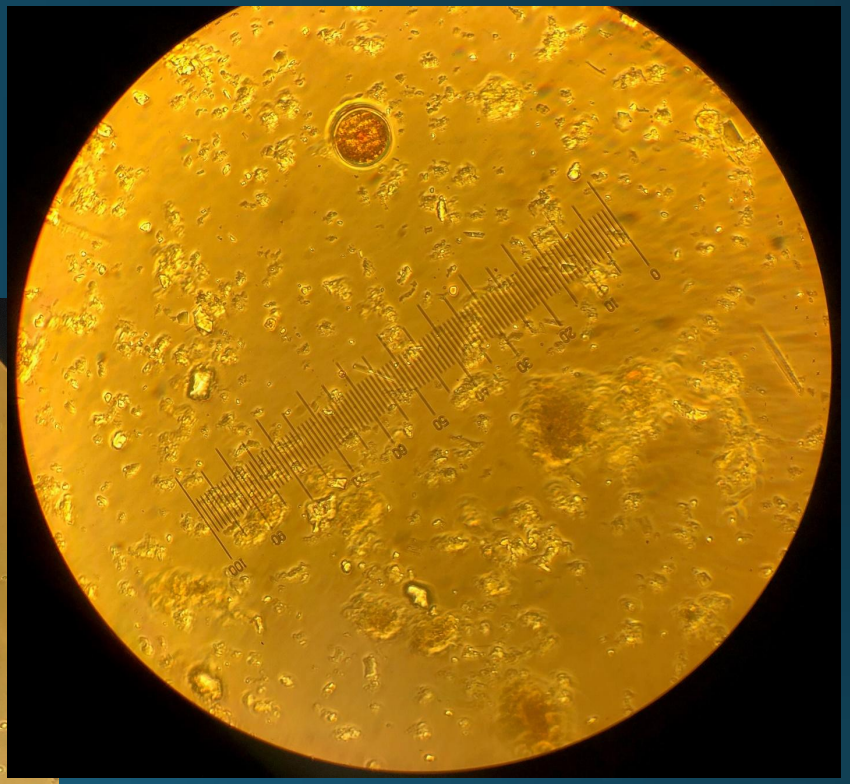
Methods - Phytoplankton

- **Microscopy Techniques :**
  - Utermohl settling technique – uses an inverted microscope
  - 500x magnification used
  - Min of 100 cells counted per sample
  - Min 10, Max 50 fields looked at per sample
- Species ID and carbon conversion to calculate biomass
- Phytoplankton biomass compared to zooplankton and nutrients

Methods – Phytoplankton ID

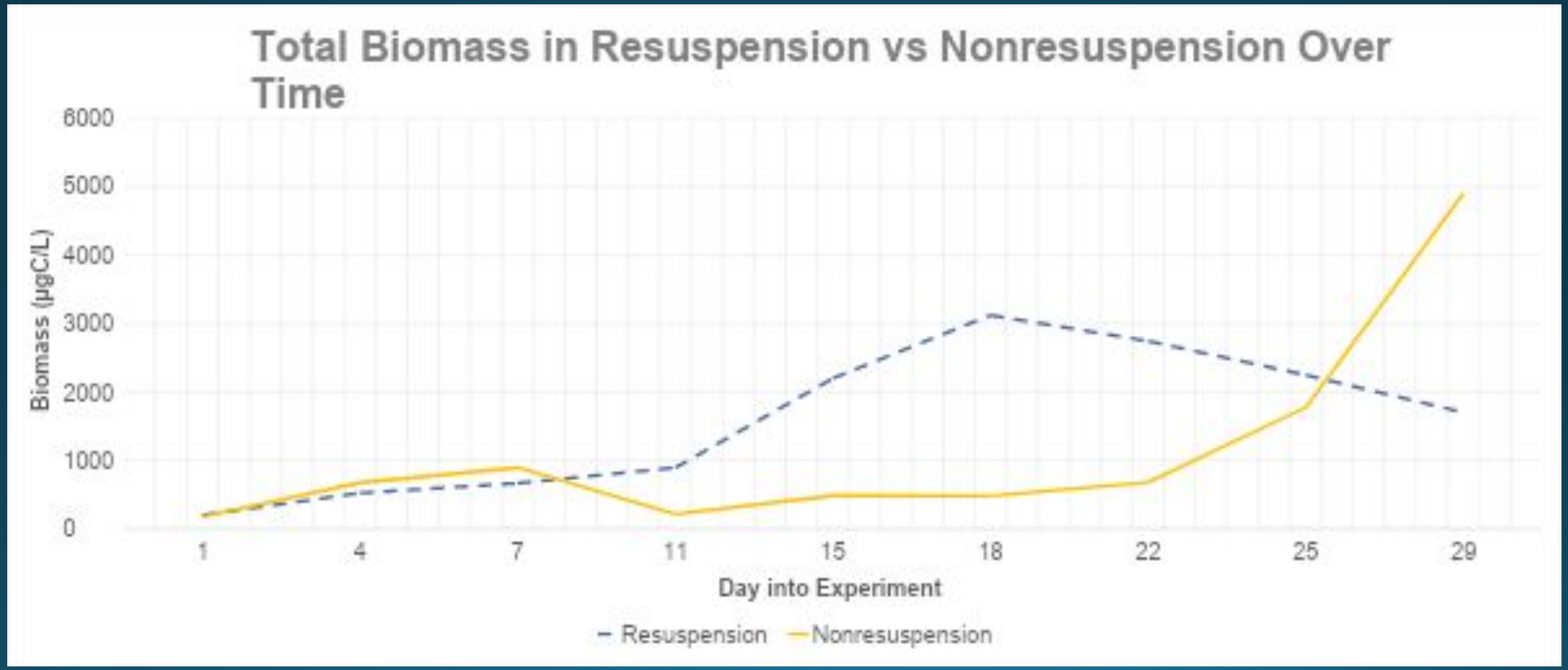




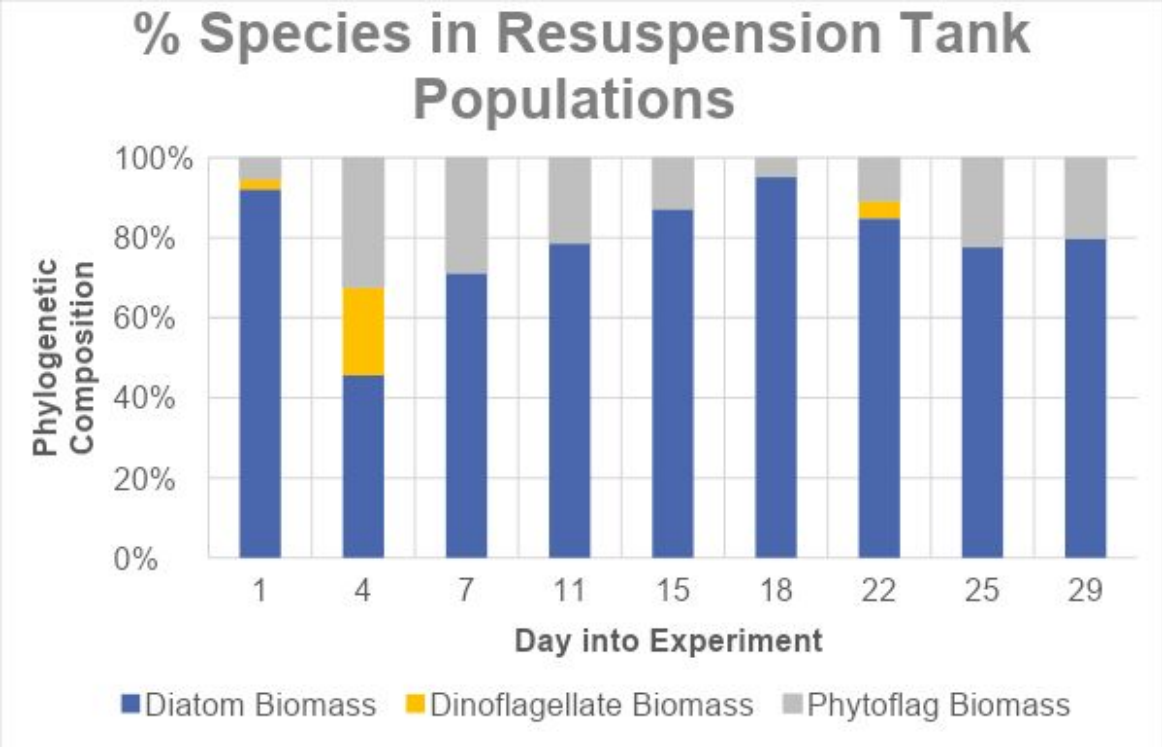


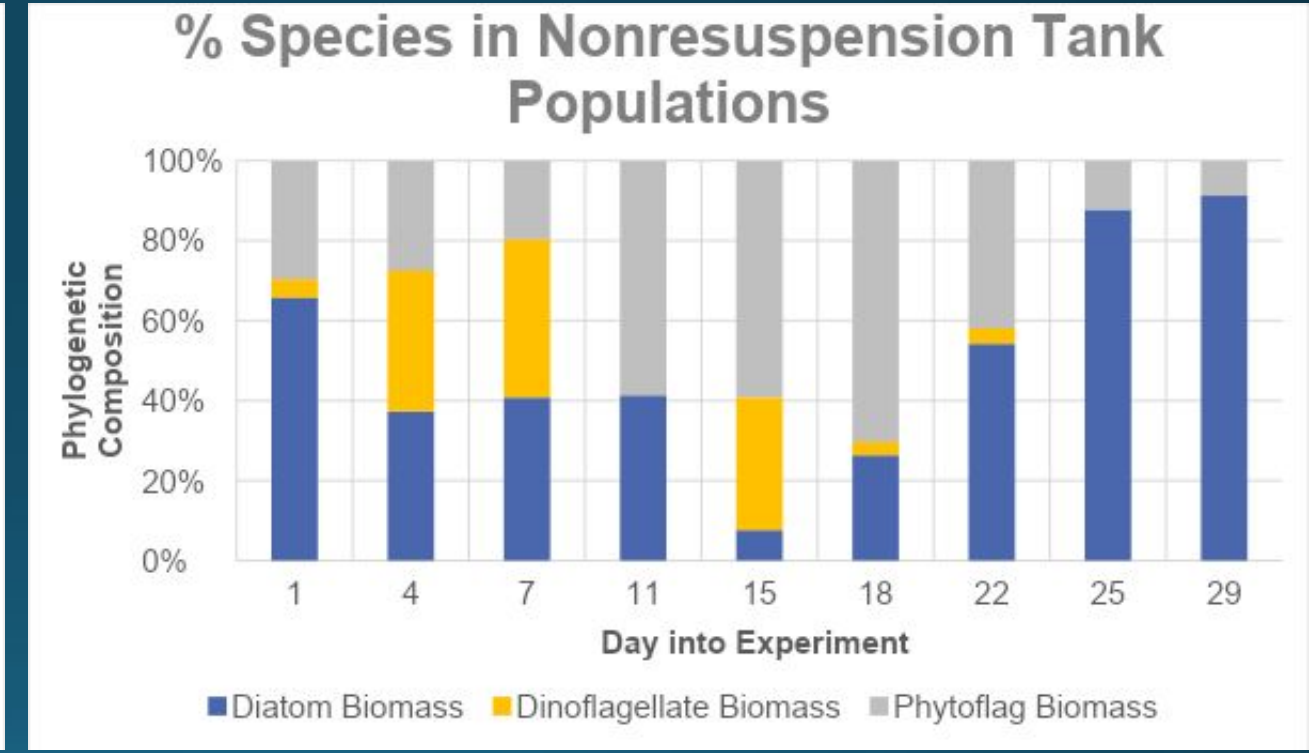
Results – Phytoplankton Biomass

P=0.0728



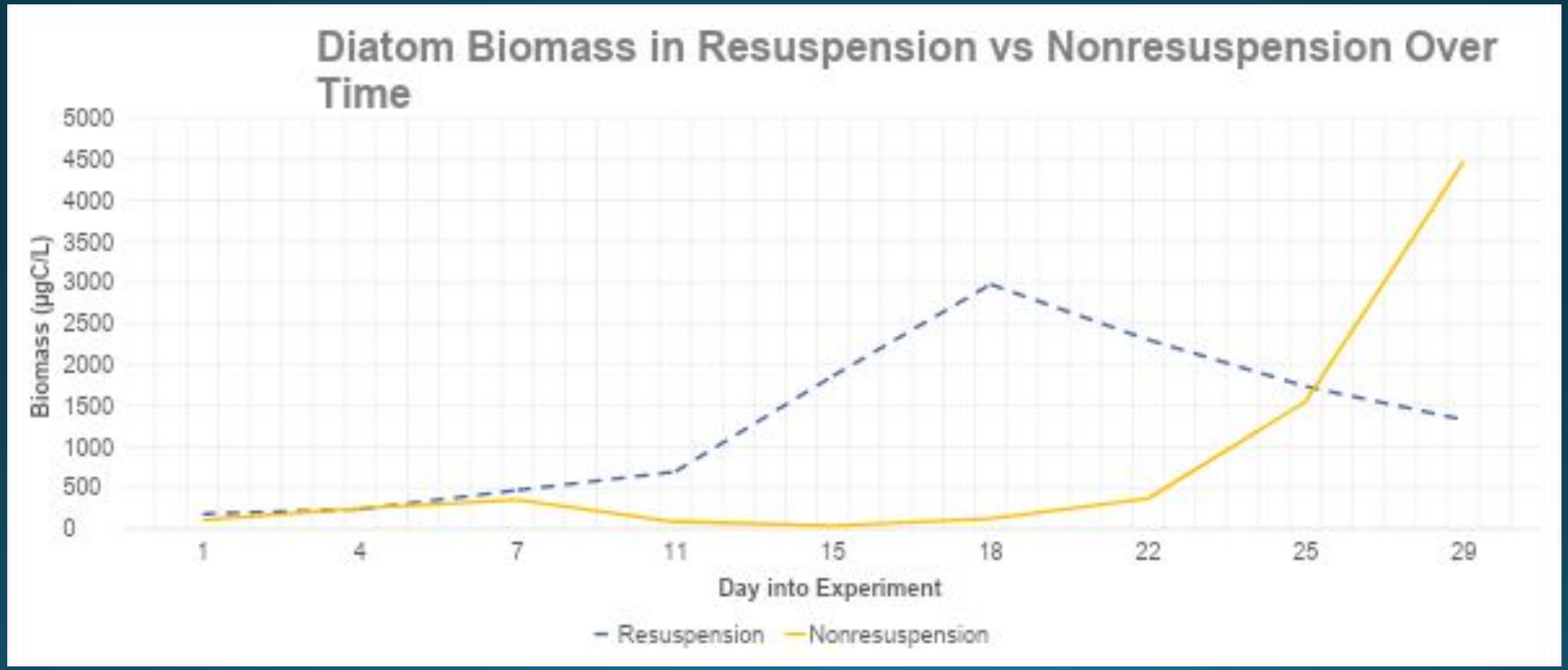
Results – Population Compositions as Biomass



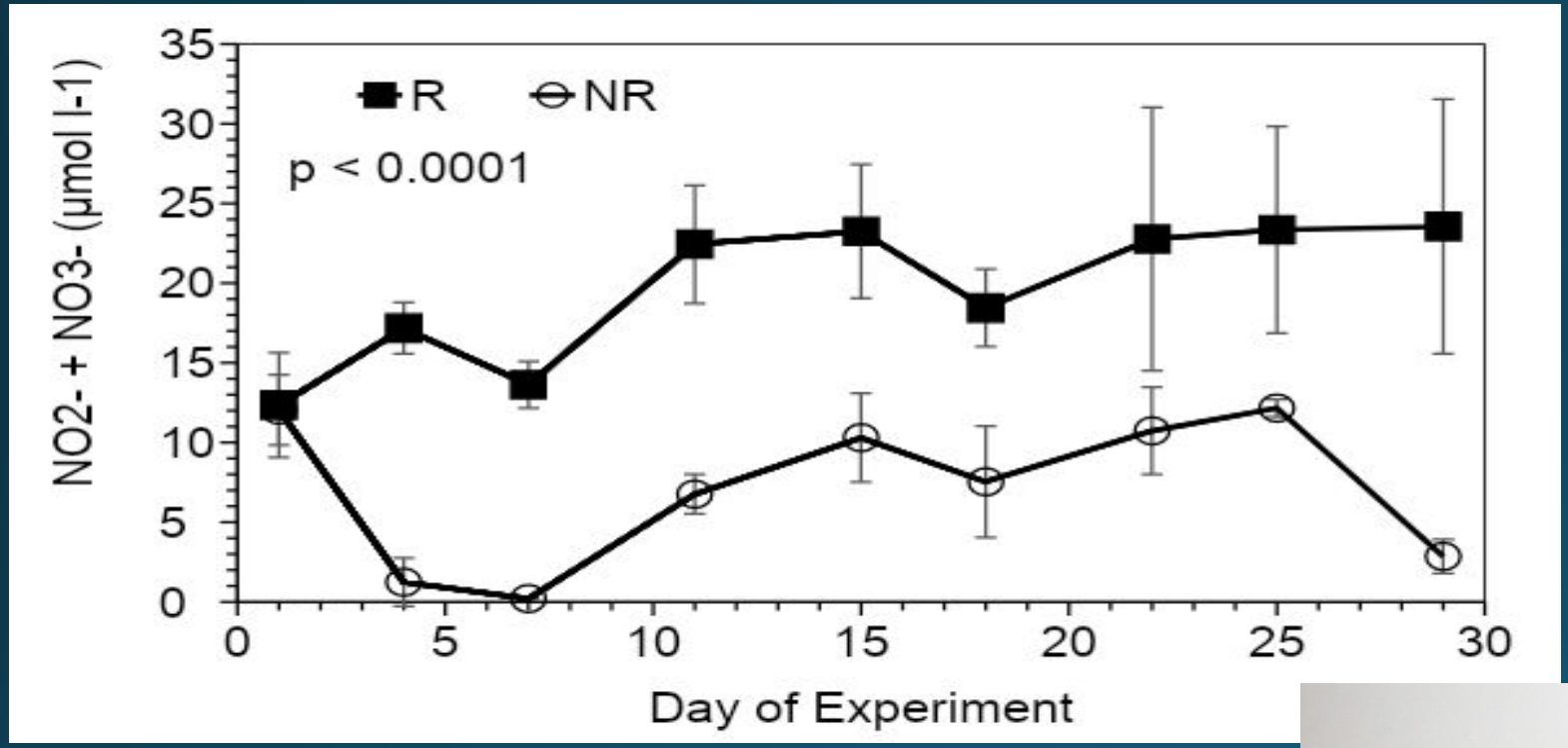


Results – Diatom Biomass

P= 0.0481



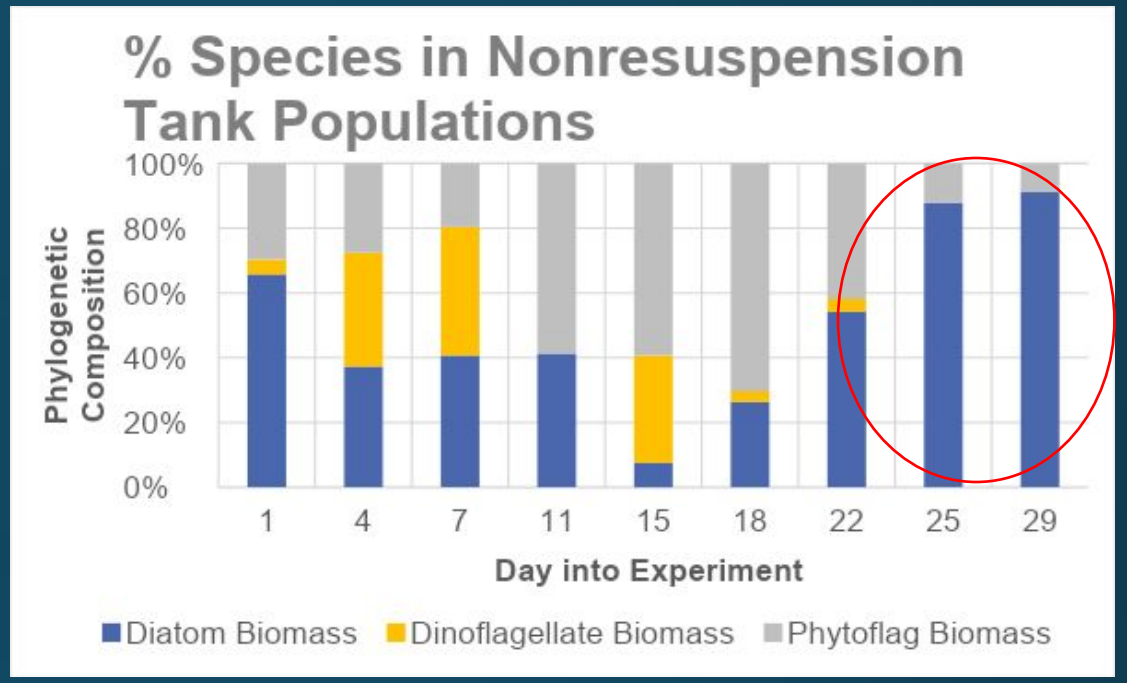
Results – Diatom Biomass in R tanks

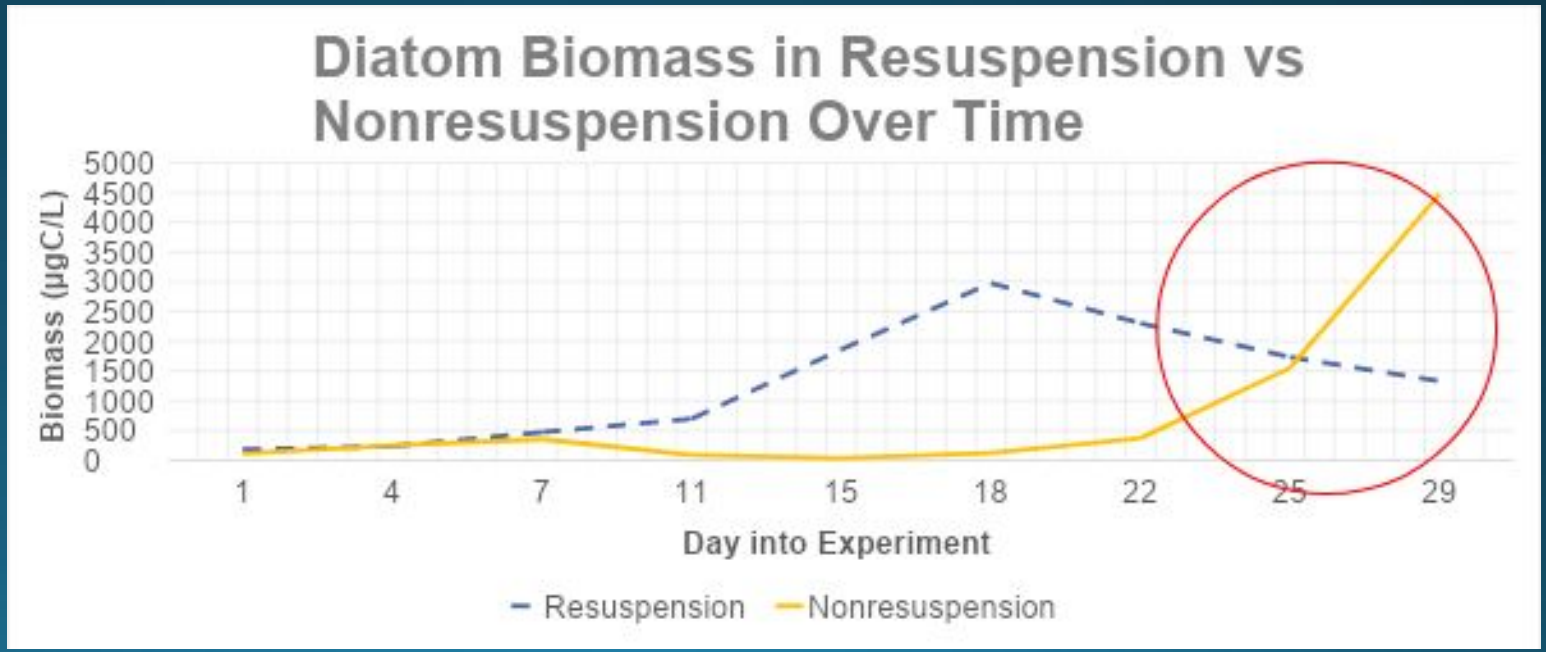


STURM Paddle

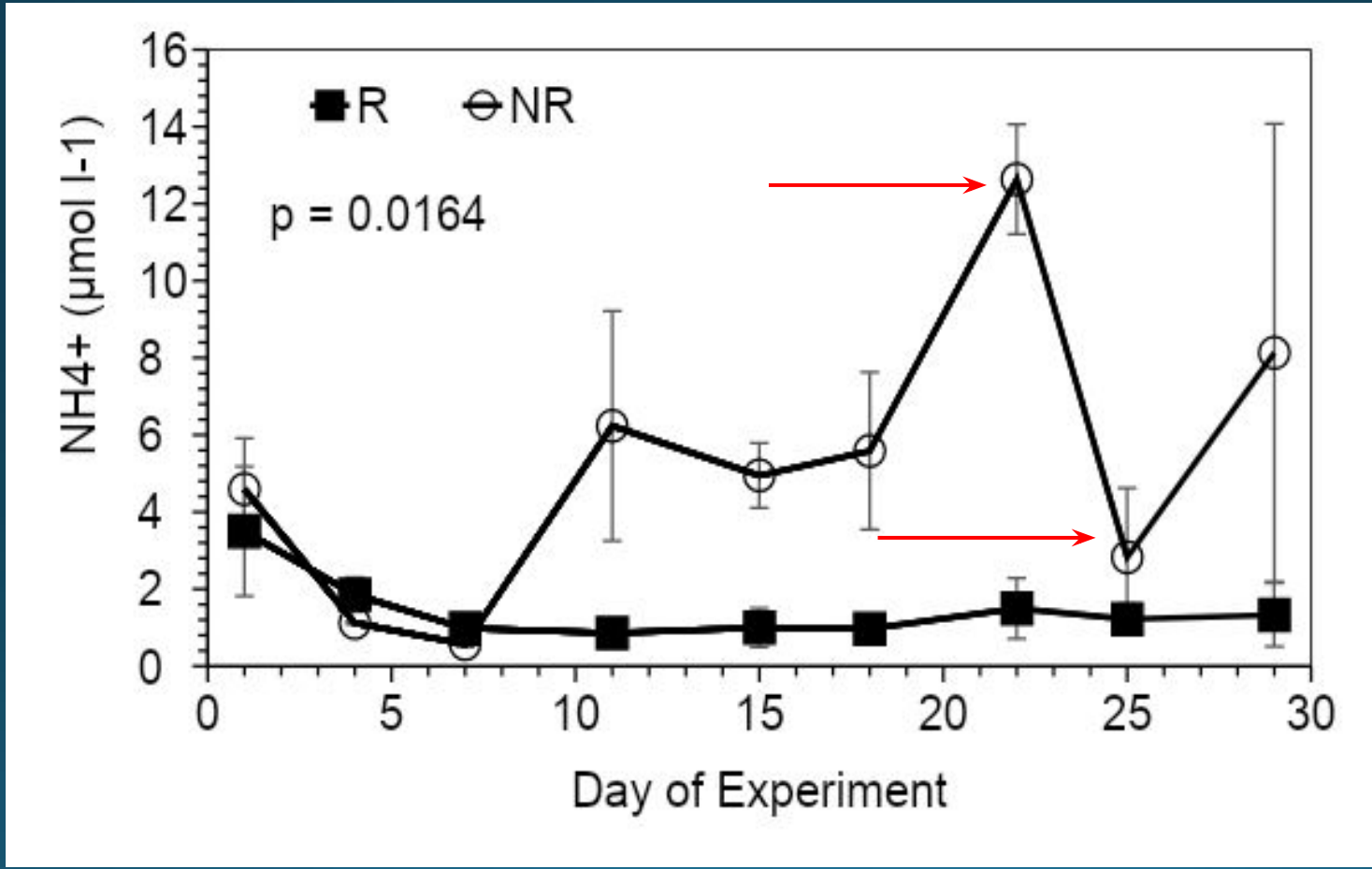
Results - Diatom Biomass in NR tanks

There is a sudden jump in diatom biomass in the NR tanks in the last days of the experiment





Results – Diatom Biomass in NR tanks

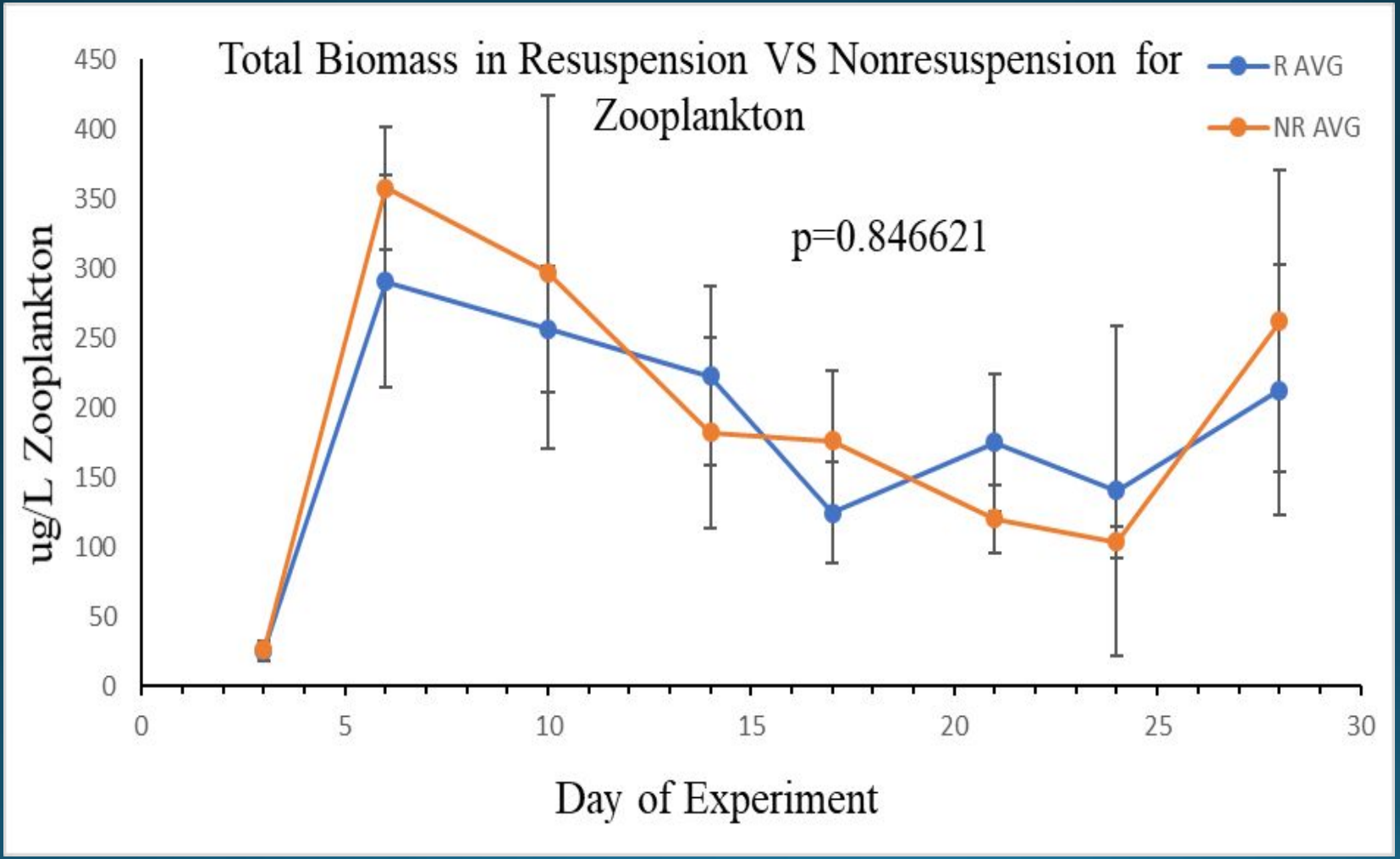


Synthesis NR vs R with Biodeposit Additions

NR

R

Results - Zooplankton



Discussion

- Biomass was not different between tanks, but population structure did vary
  - Diatom biomass was higher in the resuspension tanks (R)
- There was bottom up population control impacting the phytoplankton populations
  - Nutrient levels were controlling populations as opposed to zooplankton

❖ Research attempts to complete the picture when discussing oyster restoration to control nutrient overloads

Acknowledgments

Elka T. Porter – Mentor

Erin and Habibah - Peers working on the STURM project

Richard Lacouture – Mentor

University of Baltimore and PEARL