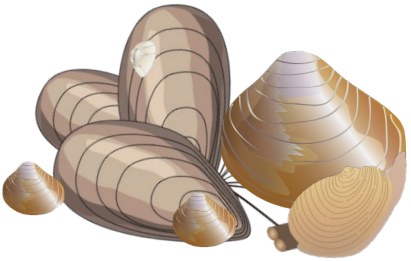
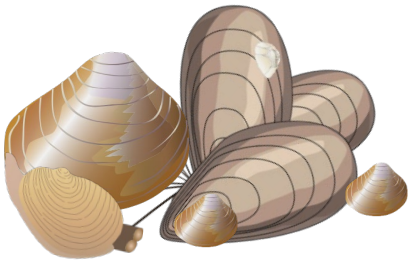
Quantifying calcifying benthic species to inform ecosystem carbon models and estimate living carbon-species flux in the Chesapeake Bay

Ryan J. Woodland, Theresa E. Murphy, Lora Harris

4/22/2026

Prepared for the Integrated Trends Analysis Team at Chesapeake Bay Program





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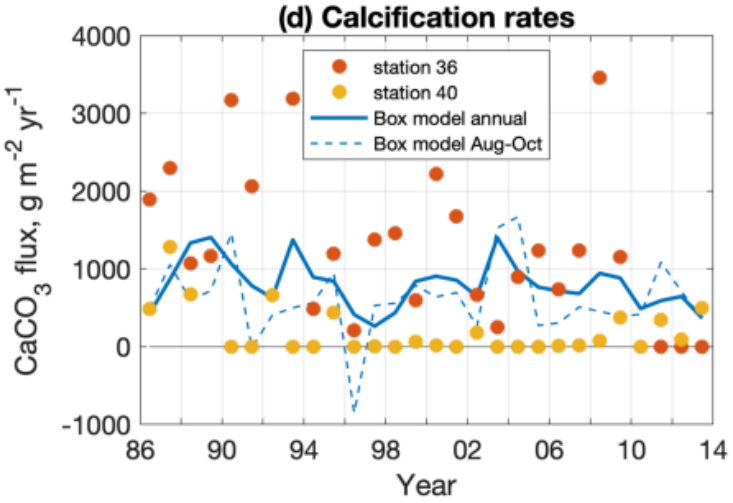
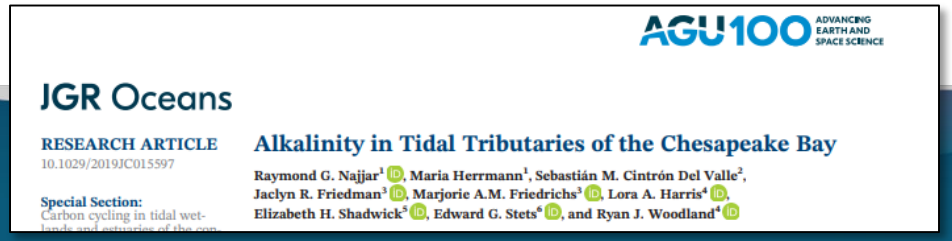
20th century paradigm: Secondary role of metazoans in system-level processes

- Primacy of physical and bottom-up drivers nutrients, light, temperature
- Influential biota limited to primary producers

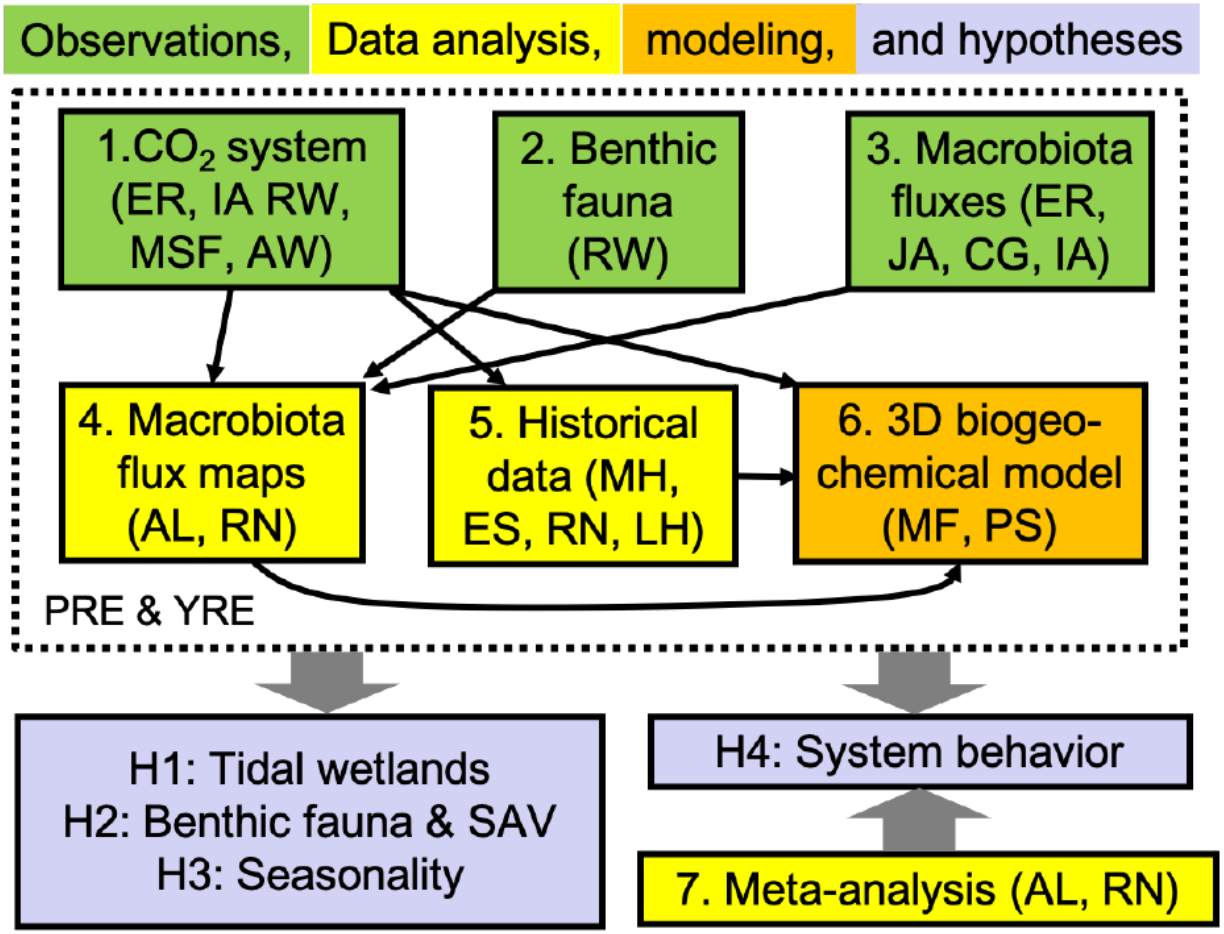
~~20th century paradigm: Secondary role of metazoans in system-level processes~~

- Primacy of physical and bottom-up drivers nutrients, light, temperature
- Influential biota limited to primary producers
- BUT! Recent work has challenged paradigm
- E.g., Najjar et al. 2019:
  - Bivalves influence alkalinity flux in Ches Bay tributary

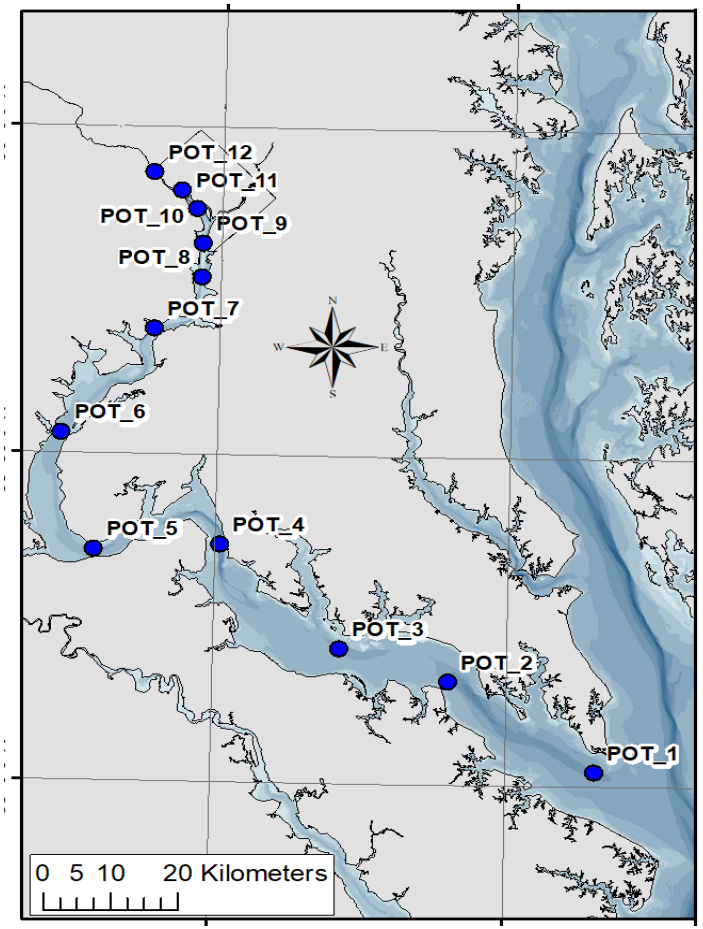




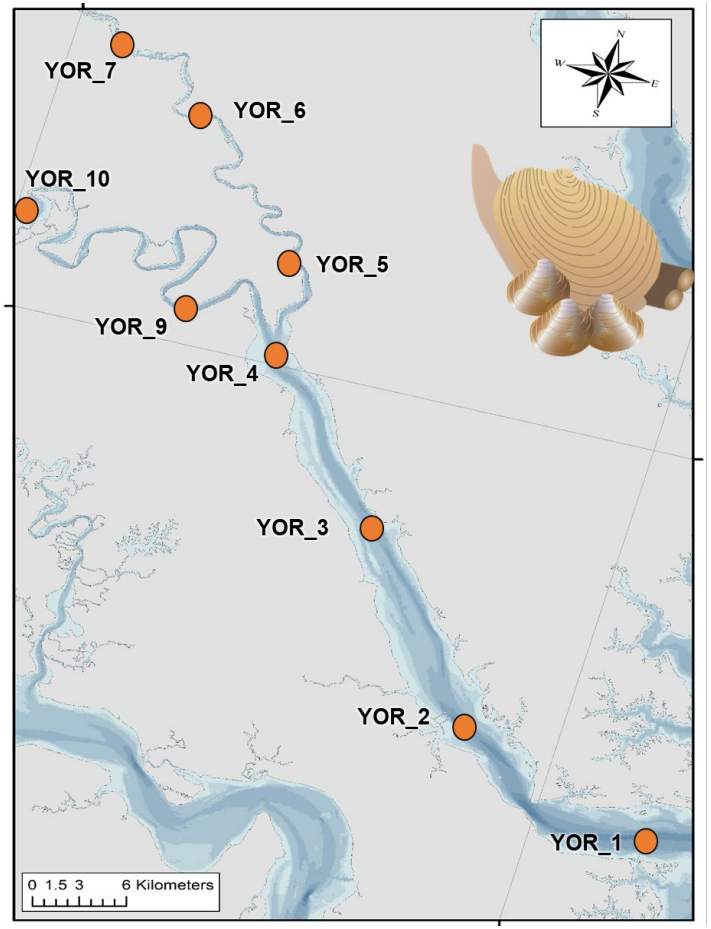
CHALK: Contribution of benthos

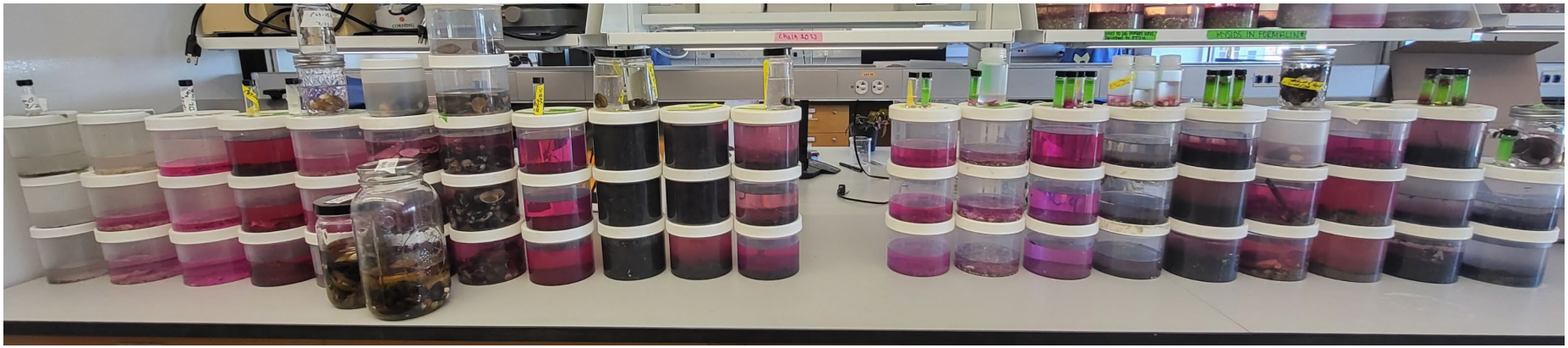


Potomac

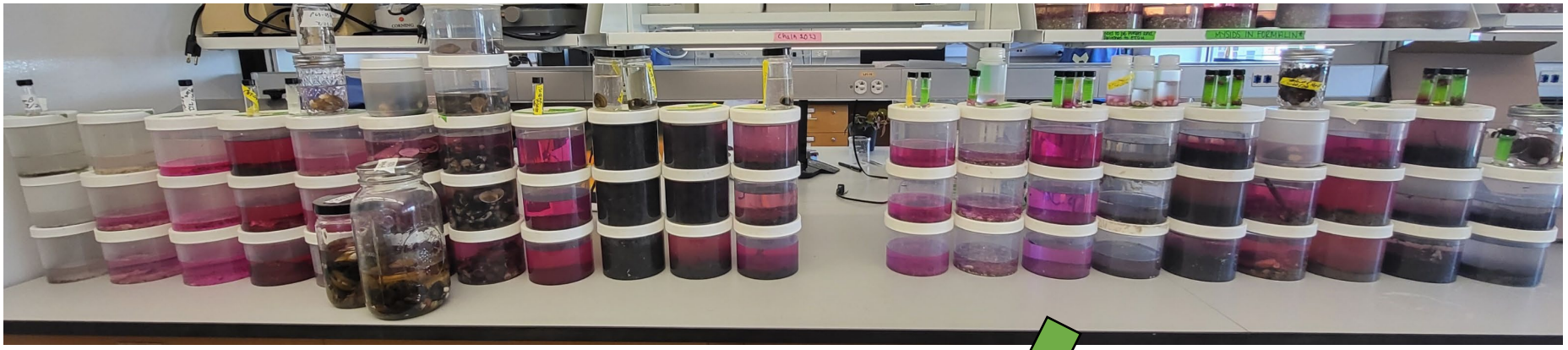


York

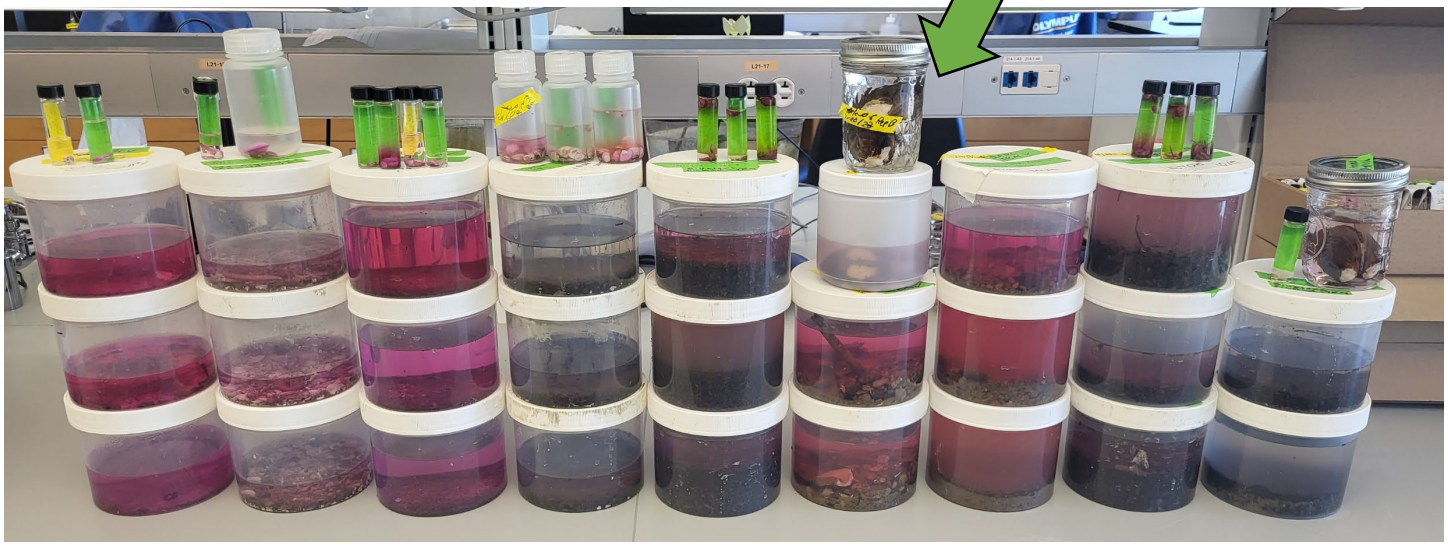


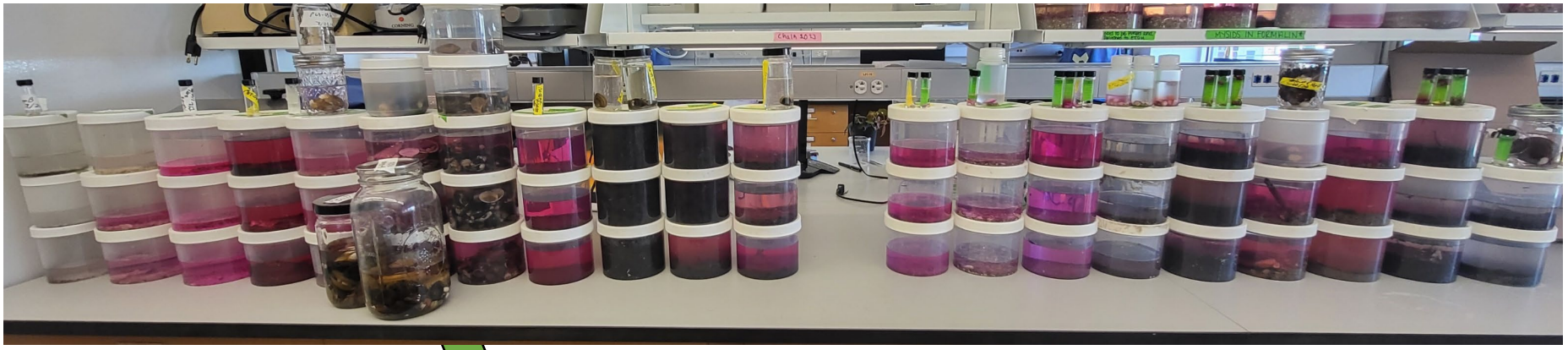


1 total season worth of samples
Summer 2024

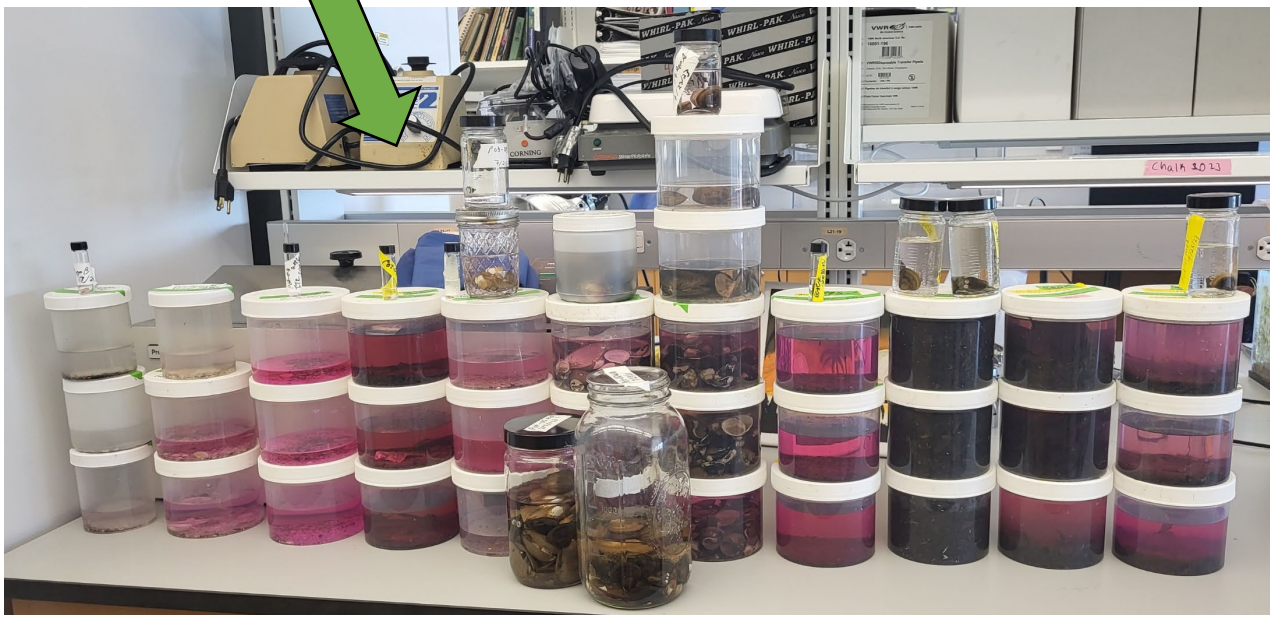


York Samples



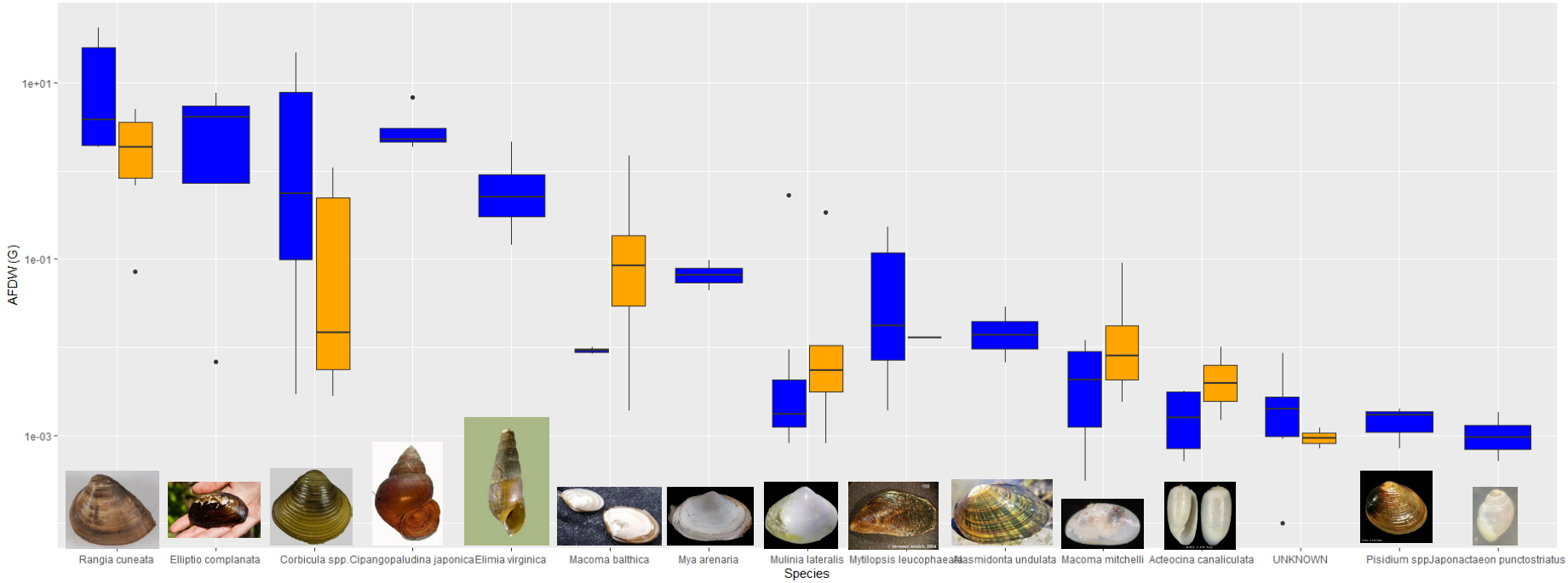


Potomac Samples

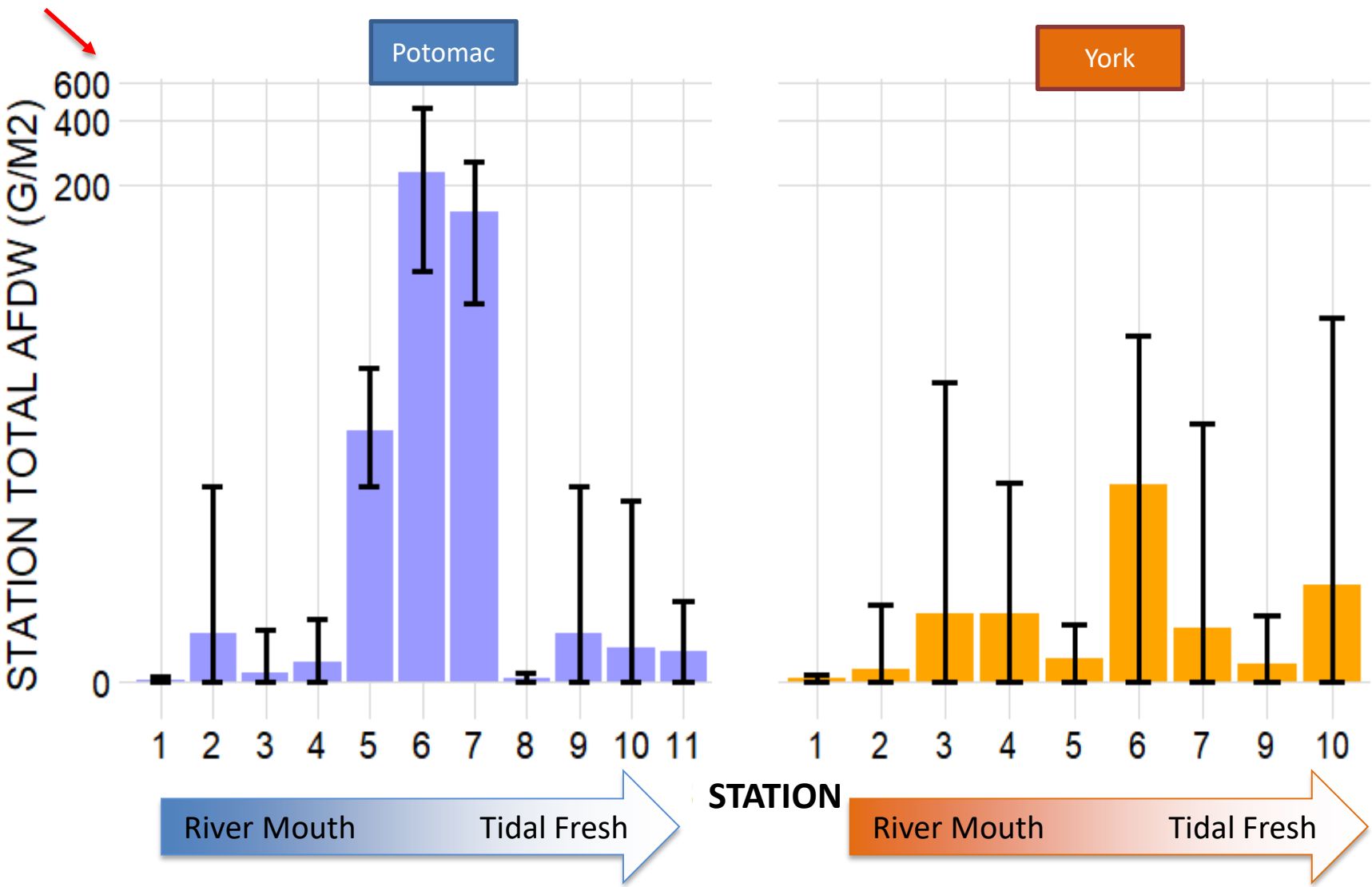


Biomass quantified as ash free dry weight (g /m^2)

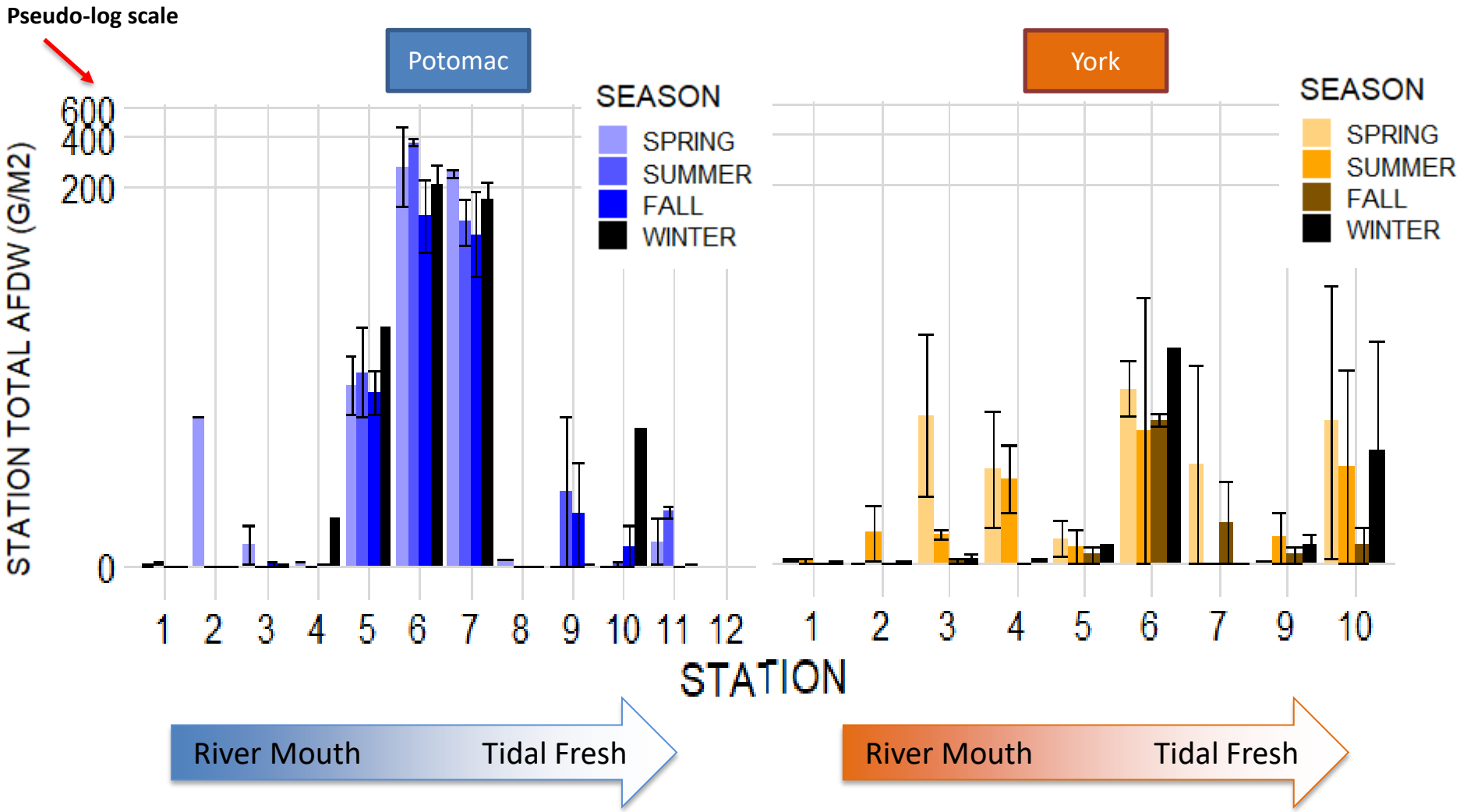
Main Taxa
by weight and river



Biomass, over space



Station biomass, seasonally



Living biota flux calculations:

- **Secondary production**
- **Calcification**
- **Respiration**

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Research article

Benthic macrofaunal carbon fluxes and environmental drivers of spatial variability in a large coastal-plain estuary

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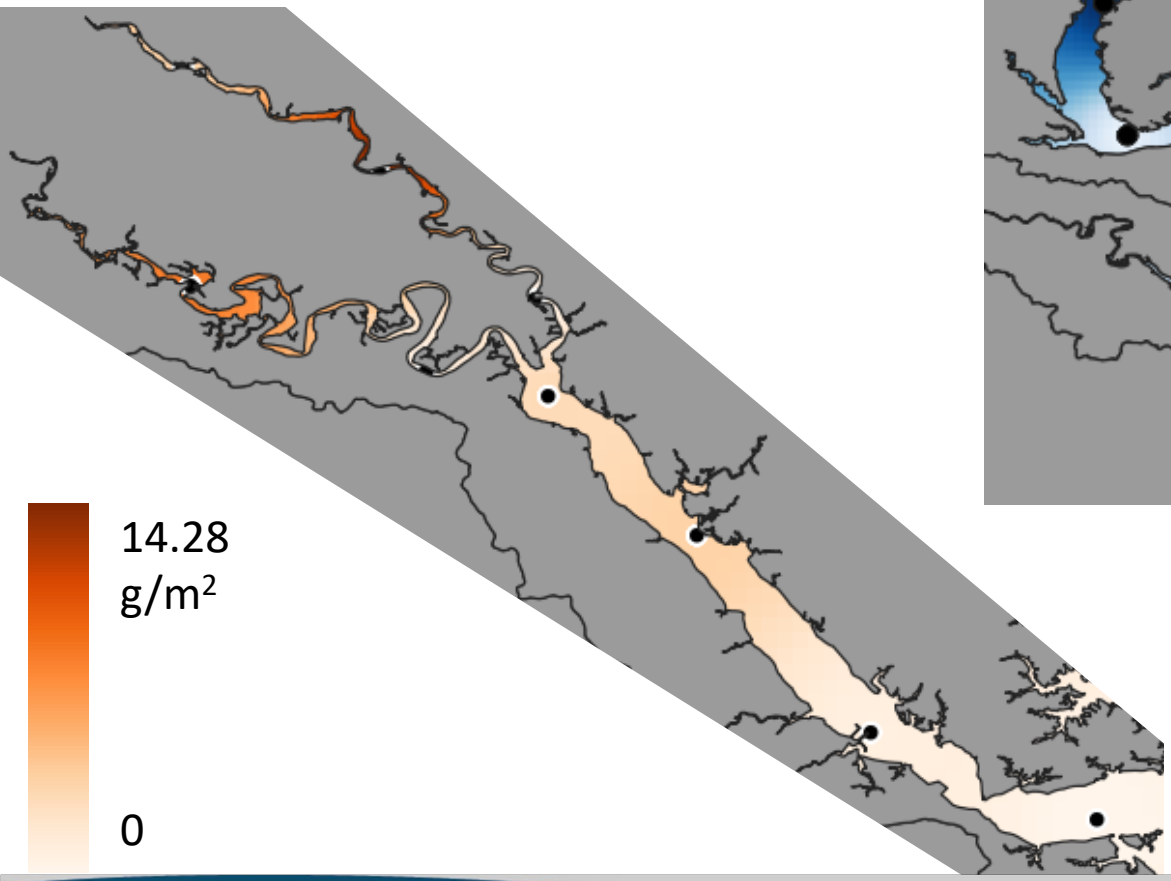
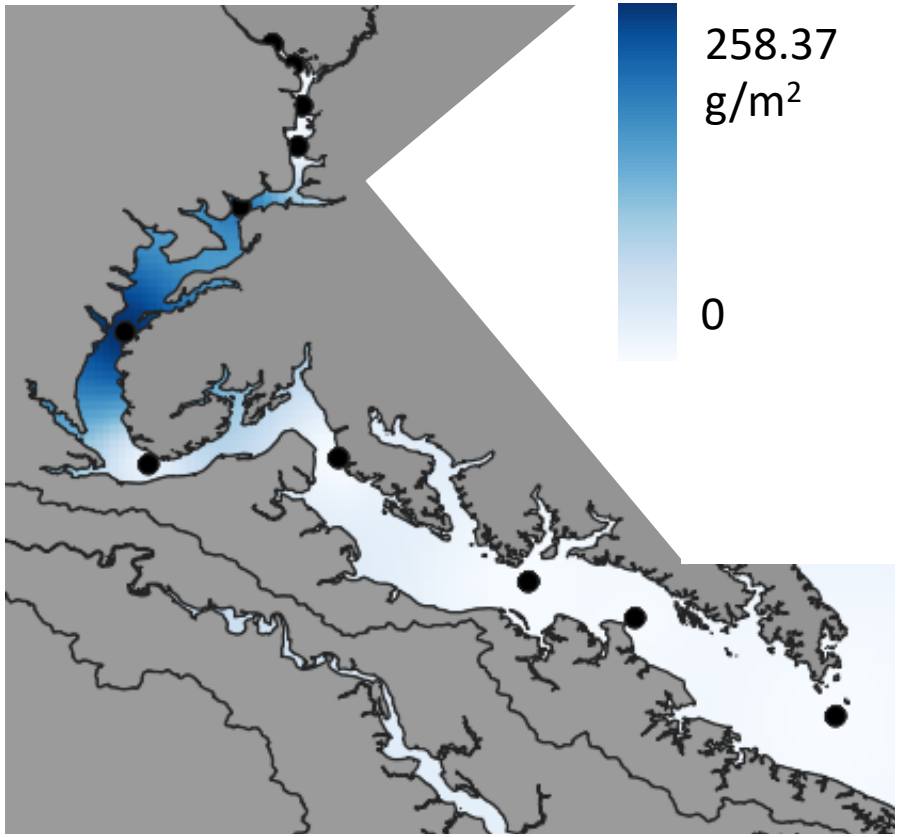
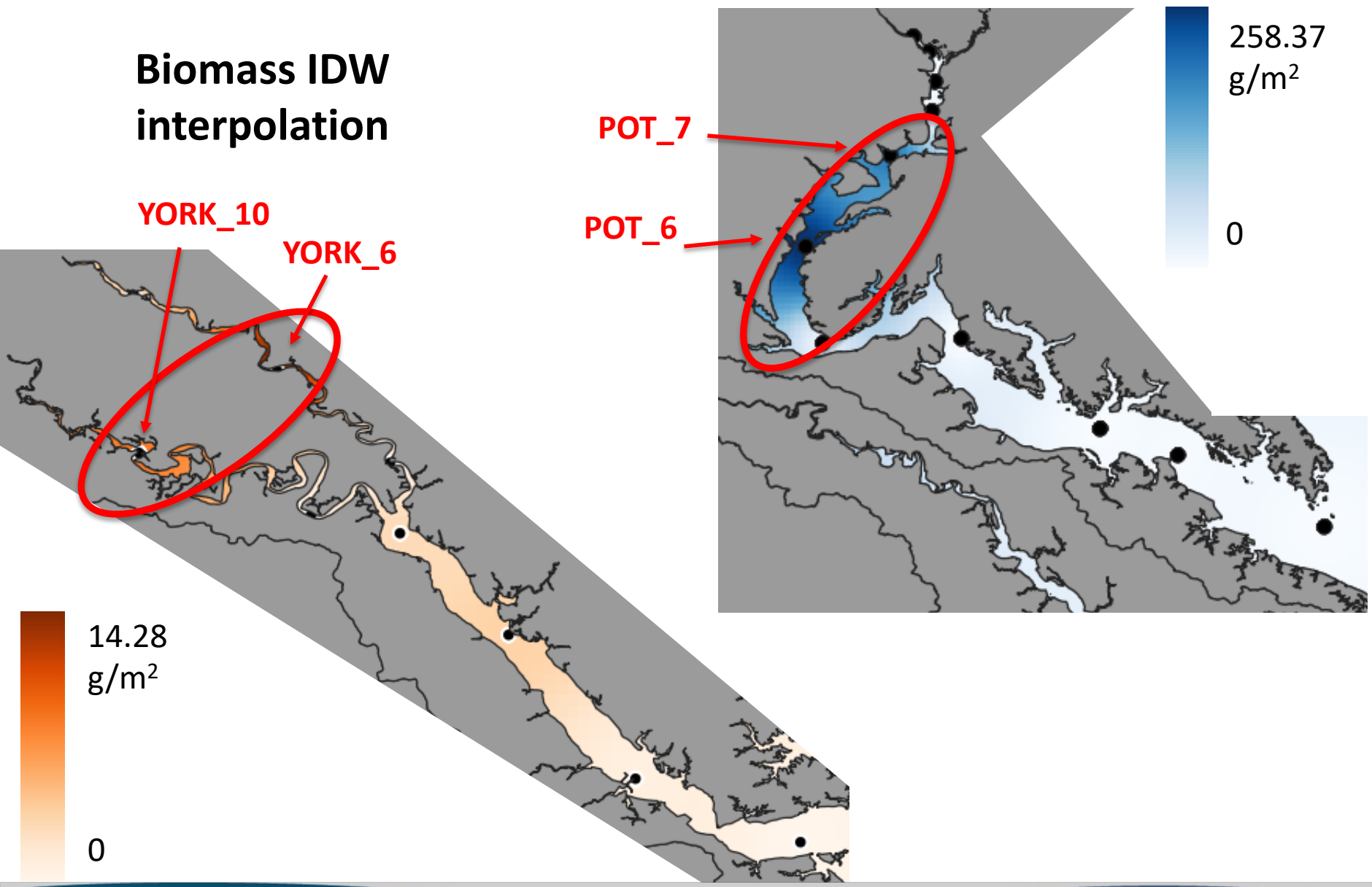
[1]The Pennsylvania State University, University Park, PA, USA
[2]Virginia Institute of Marine Science, William & Mary, Gloucester Point, VA, USA
[3]University of Maryland Center for Environmental Sciences, Cambridge, MD, USA

Biomass IDW interpolation

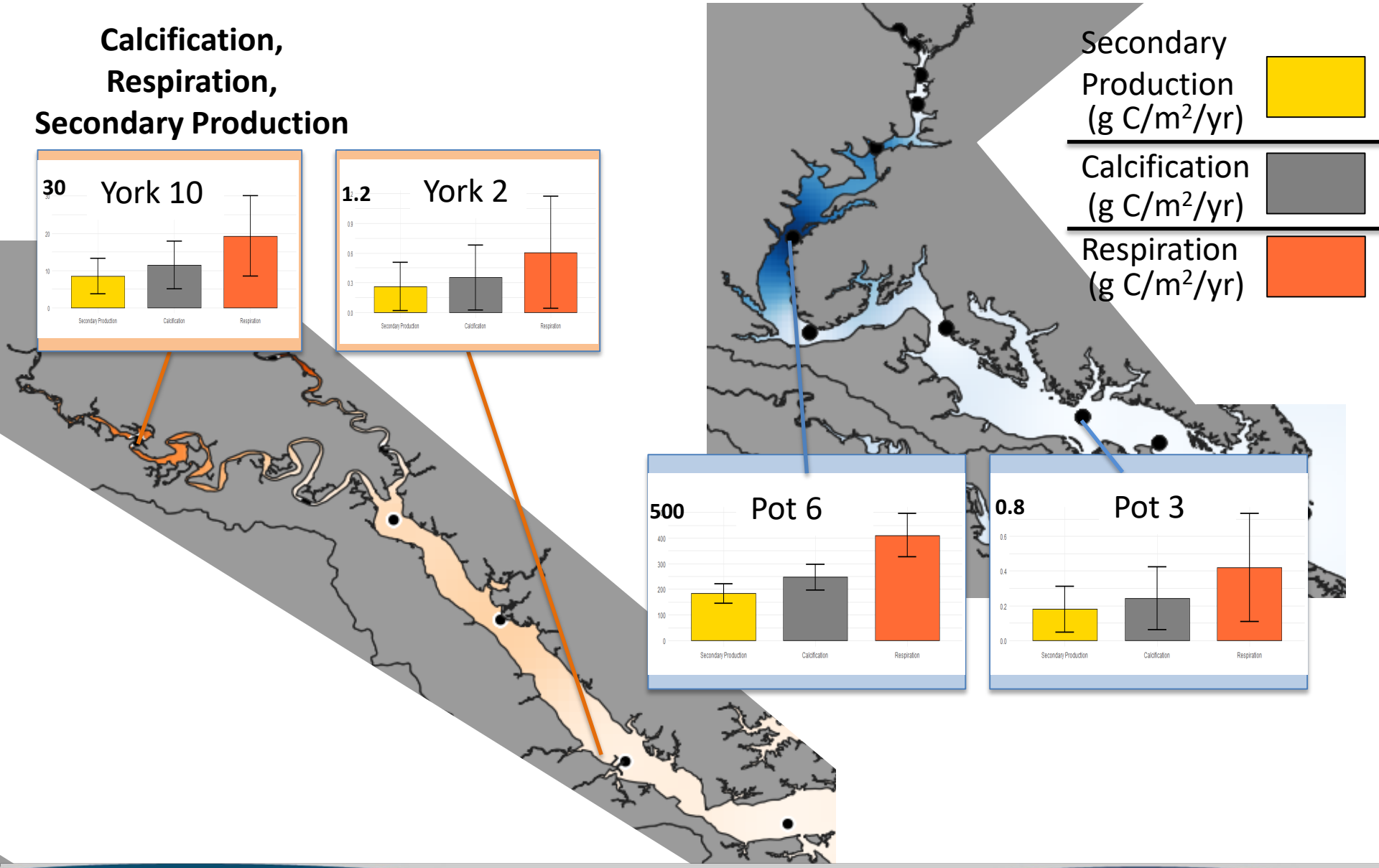




Biomass IDW interpolation



Calcification, Respiration, Secondary Production



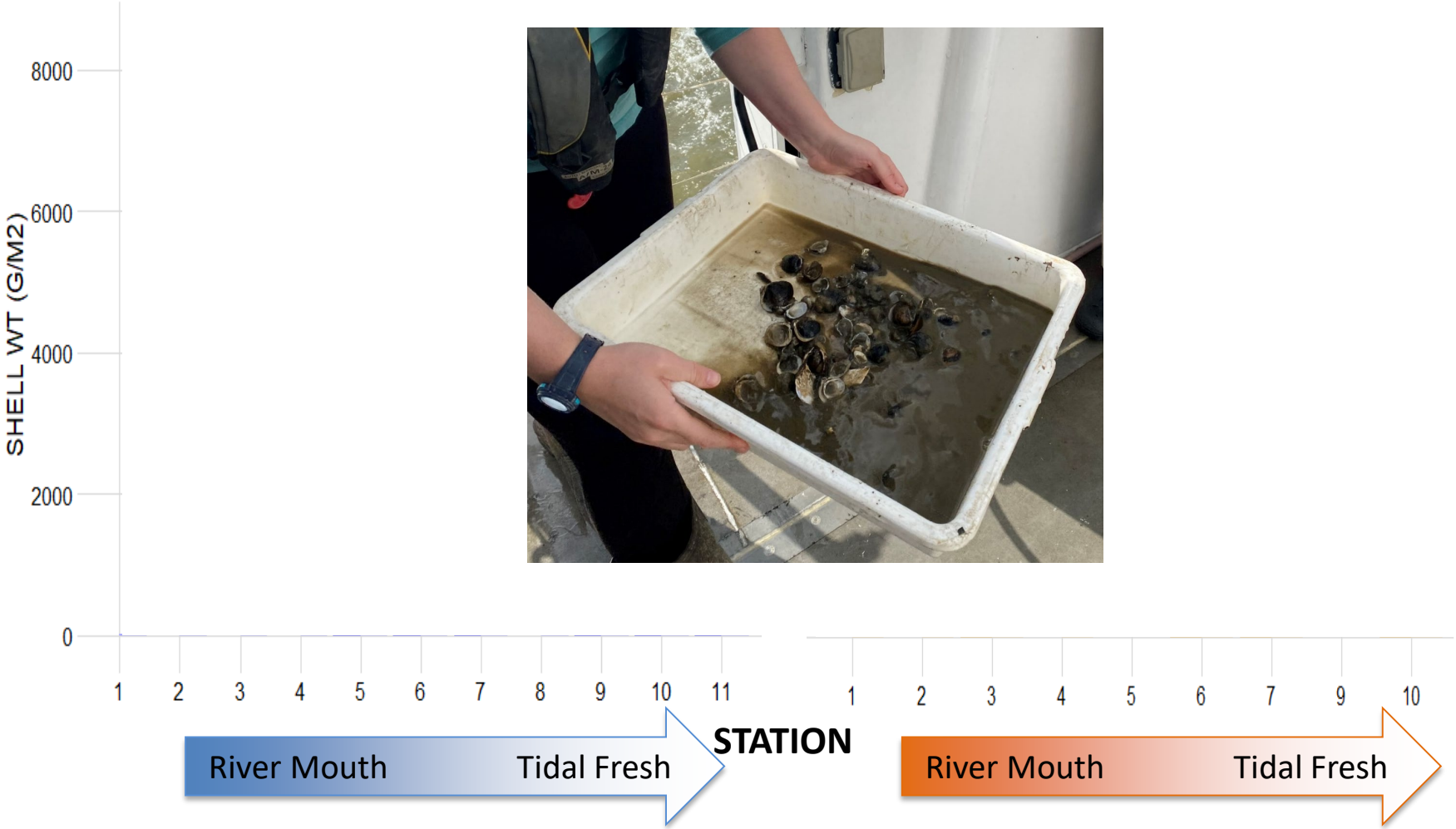
SHELL

Potomac

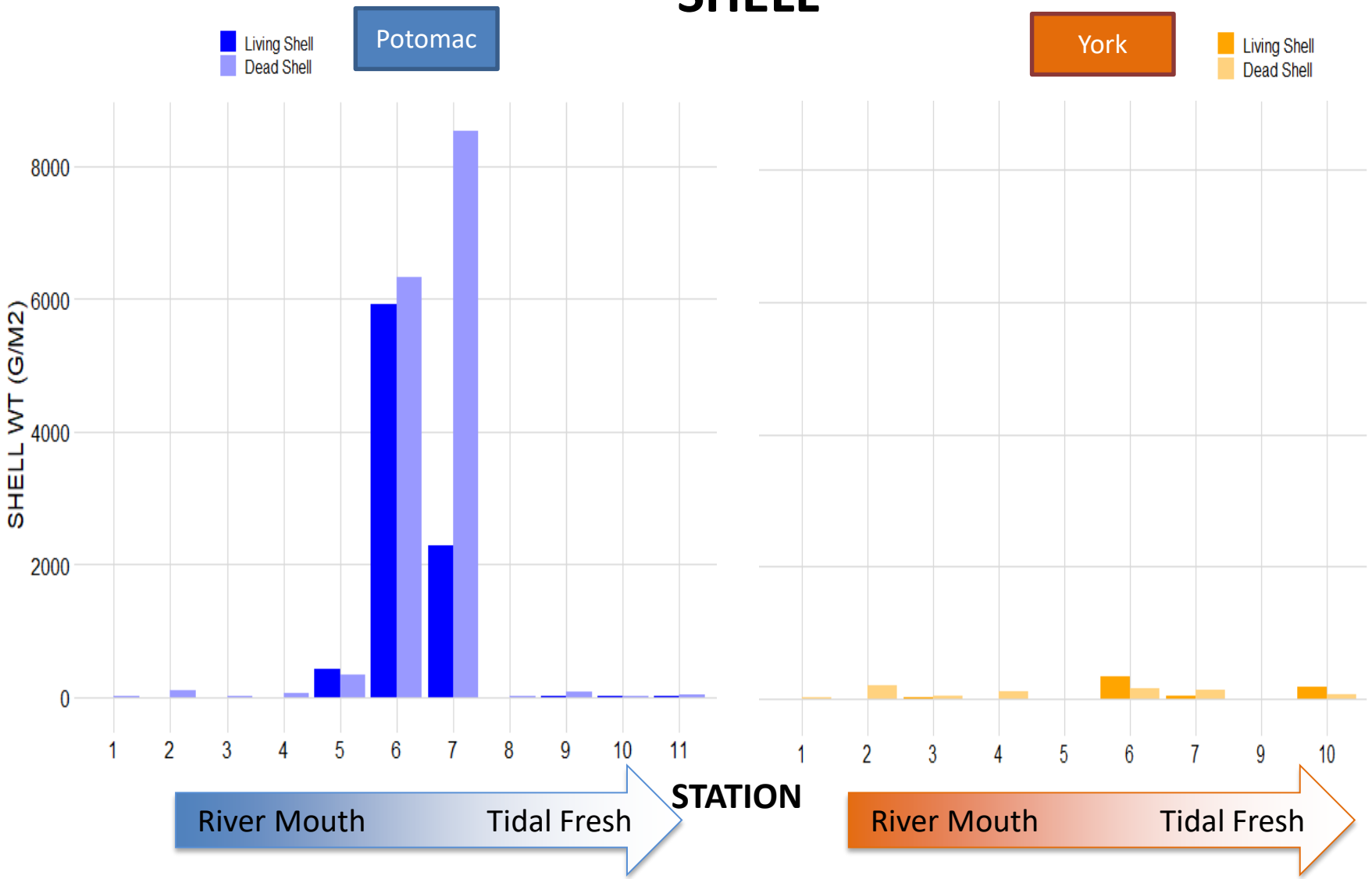
Living Shell
Dead Shell

York

Living Shell
Dead Shell

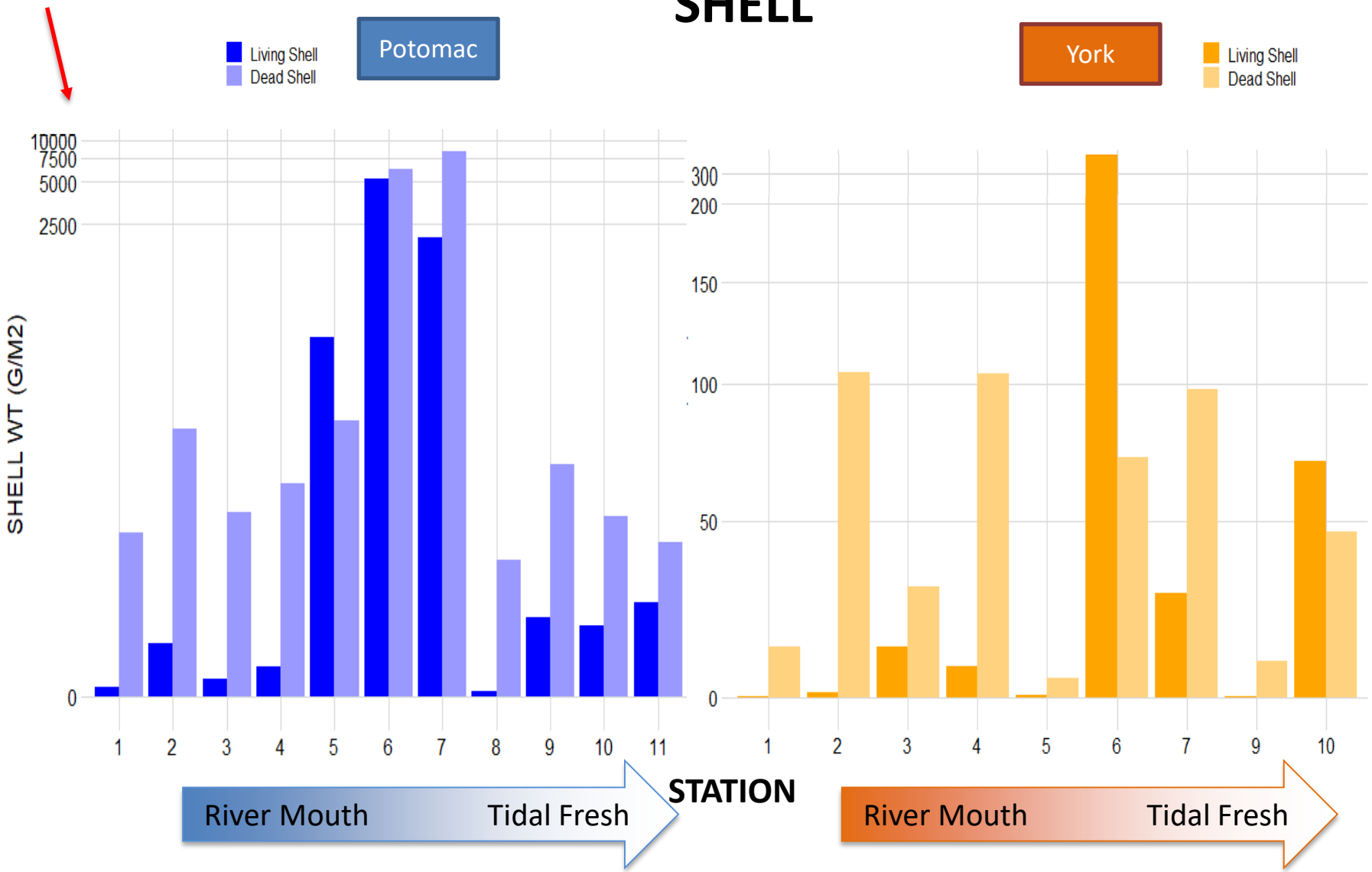


SHELL


Potomac
Living Shell
Dead Shell
York
Living Shell
Dead Shell
SHELL WT (G/M2)
8000
6000
4000
2000
0
1
2
3
4
5
6
7
8
9
10
11
1
2
3
4
5
6
7
9
10
STATION
River Mouth
Tidal Fresh
River Mouth
Tidal Fresh

SHELL

Pseudo-log scale, NOT the same scale per river

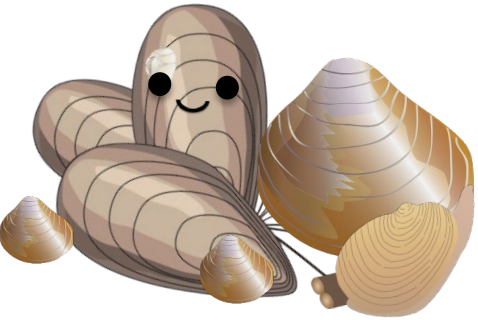


Why does this matter?

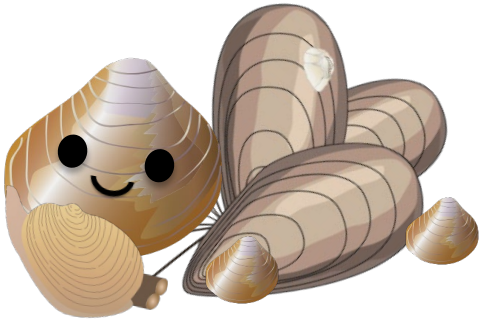
Macrofauna can influence ecosystem-scale processes often attributed primarily to abiotic conditions or 1^0

Next steps:

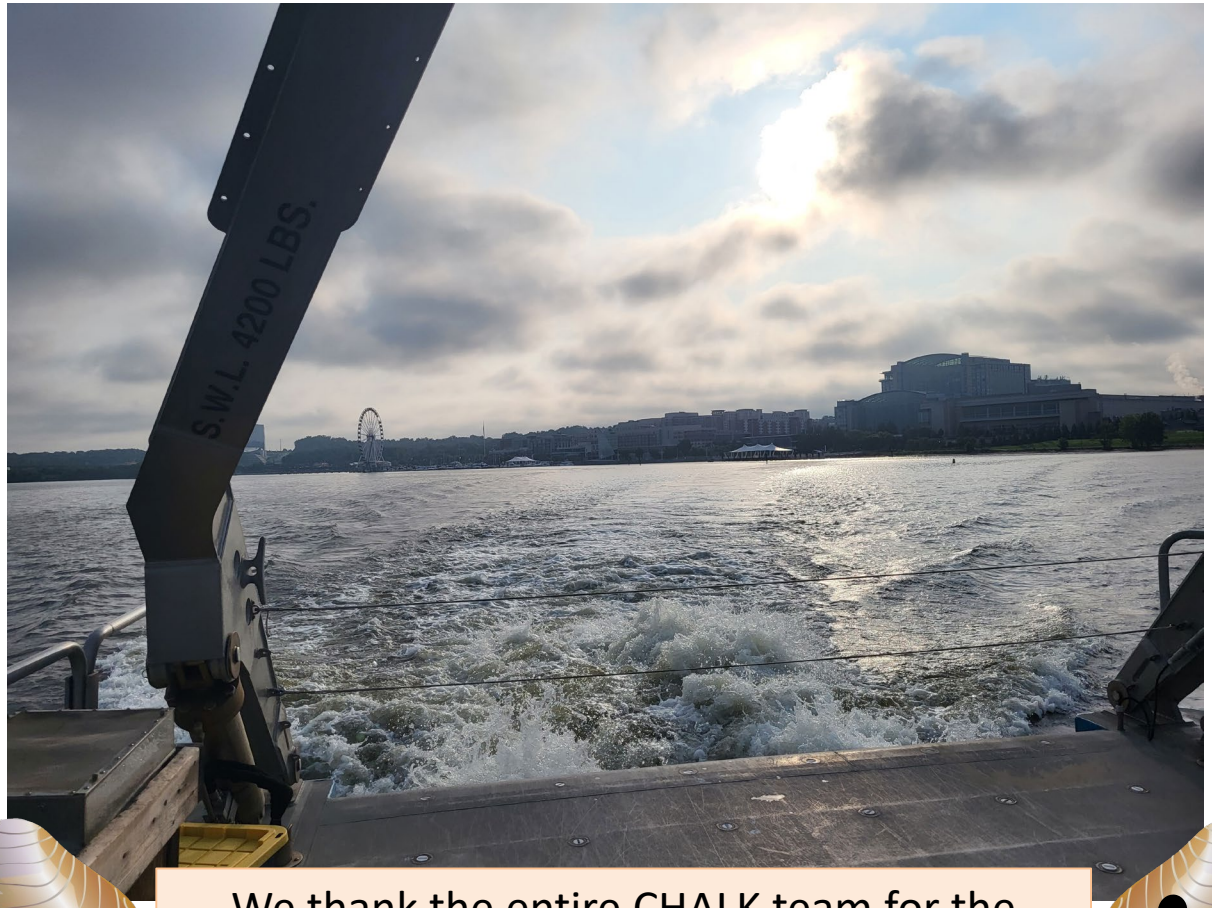
- **Ecosystem-scale integration of biomass, secondary production, respiration, & calcification**
- **Estimate contribution of shell hash to C budget and flux calculations**

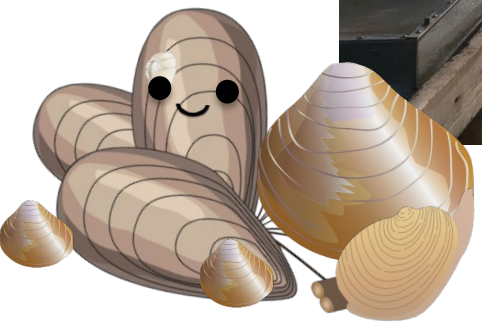


We thank ITAT for this opportunity, the entire CHALK team for all their hard work in the field, and NSF for funding this research.

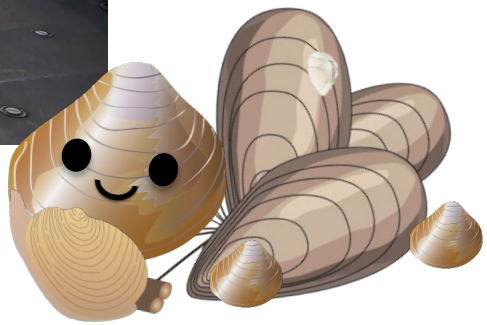


Questions?

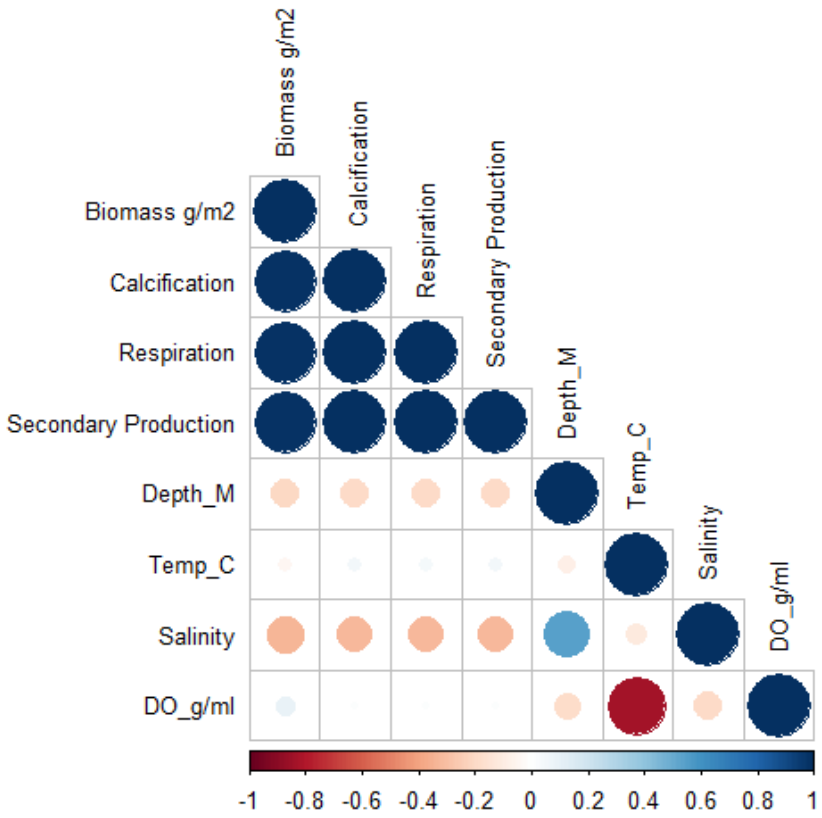




We thank the entire CHALK team for the endless hard work and NSF for the incredible funding opportunity!



Potomac



York