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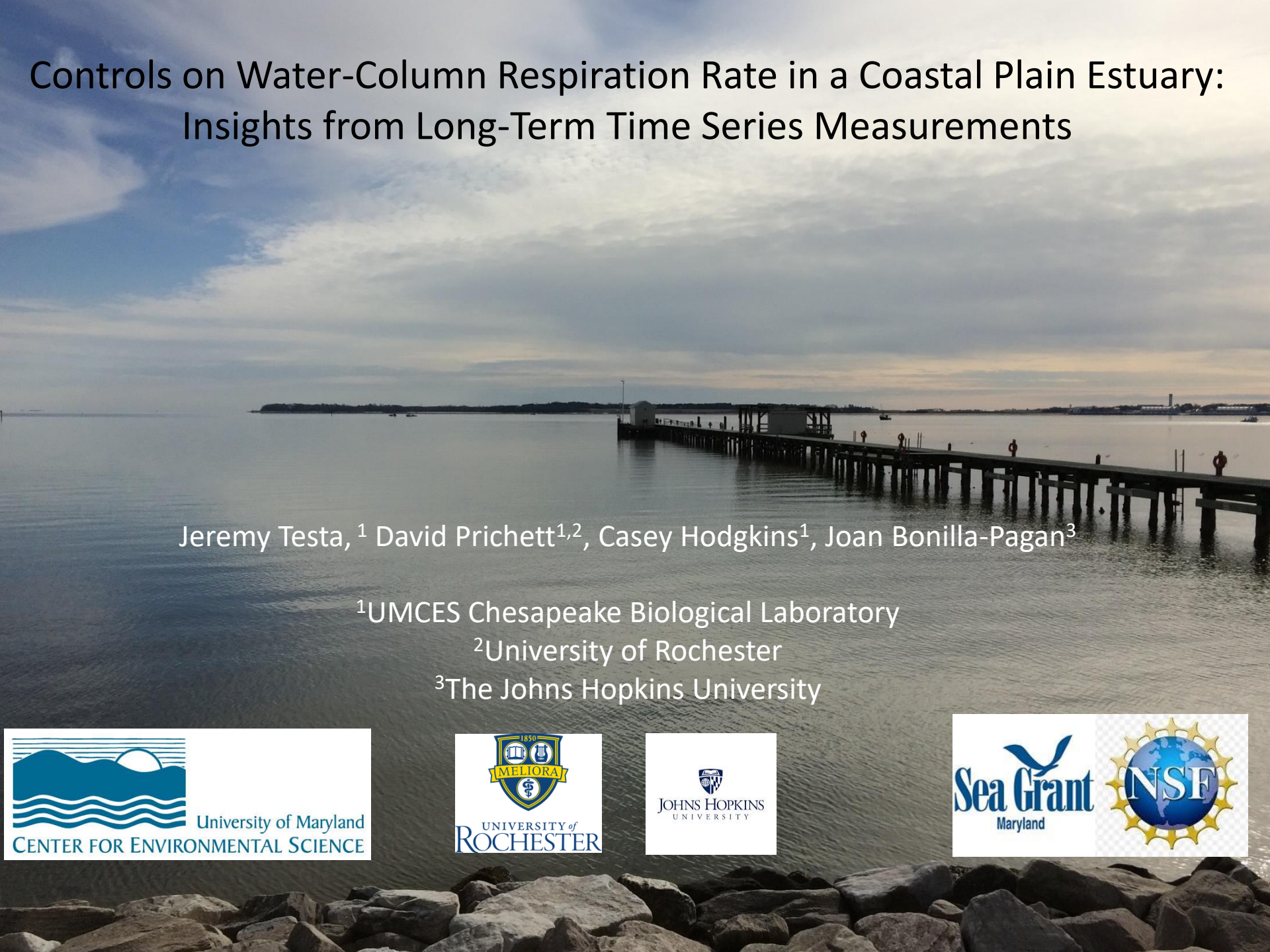

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SHORT COMMUNICATION

Controls on Water-Column Respiration Rates in a Coastal Plain Estuary: Insights from Long-Term Time-Series Measurements

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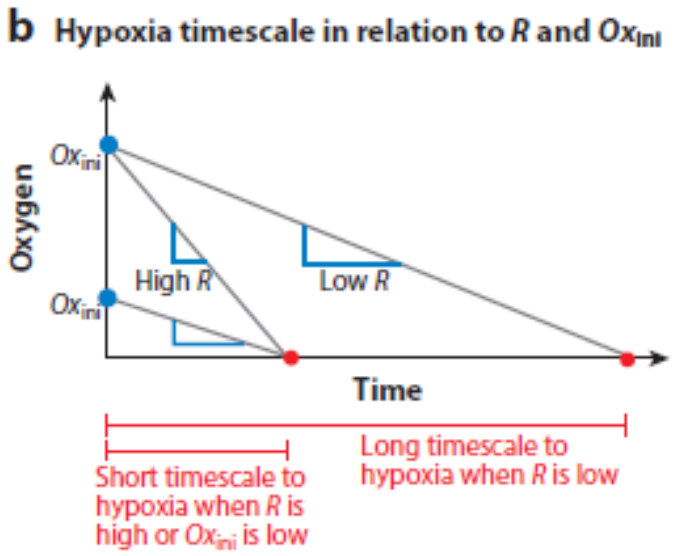
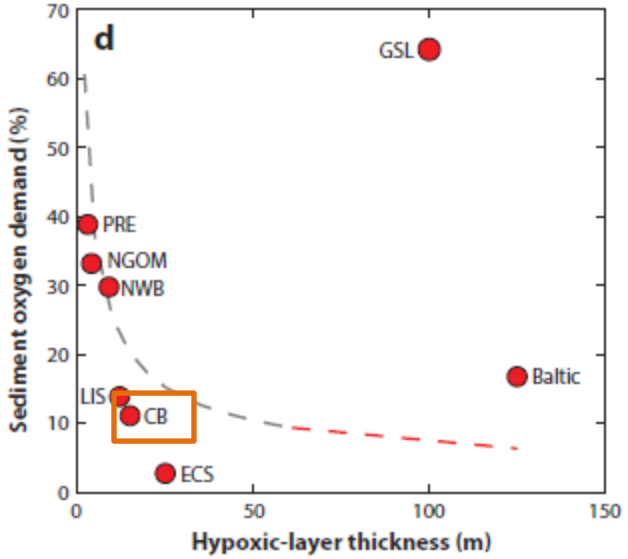
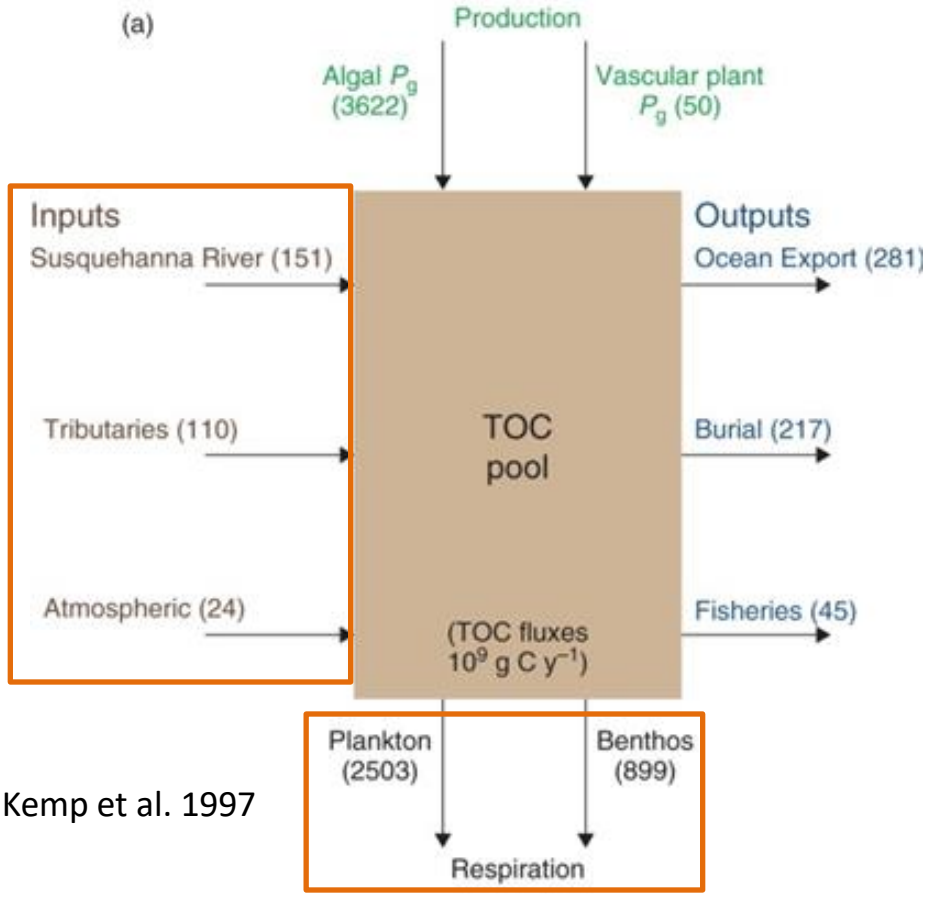
Oxygen Depletion (R) is Primarily Driven by Water-Column Respiration



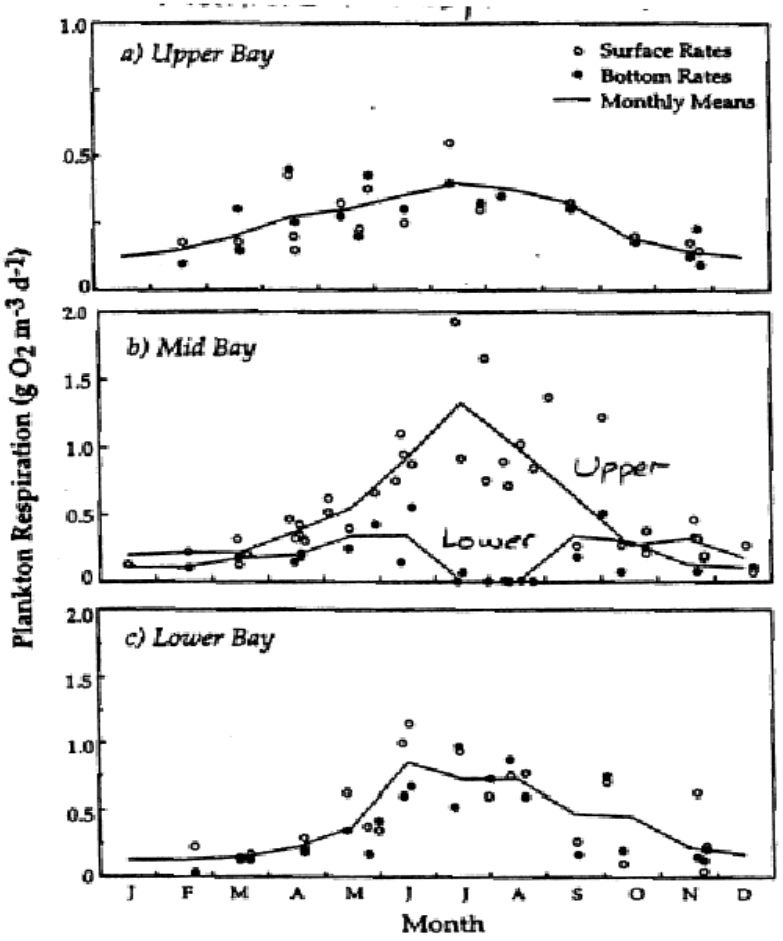


Fennel and Testa 2019

Plankton Respiration Rate is a BIG Part of Bay Oxygen Budget, and *varies over space and time*

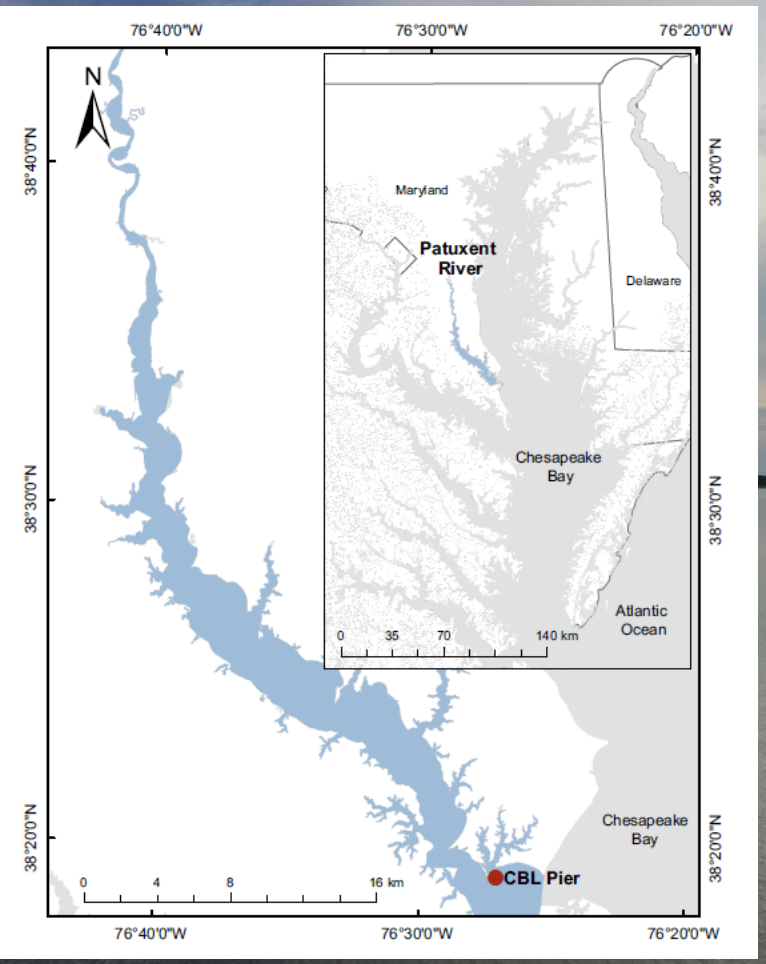


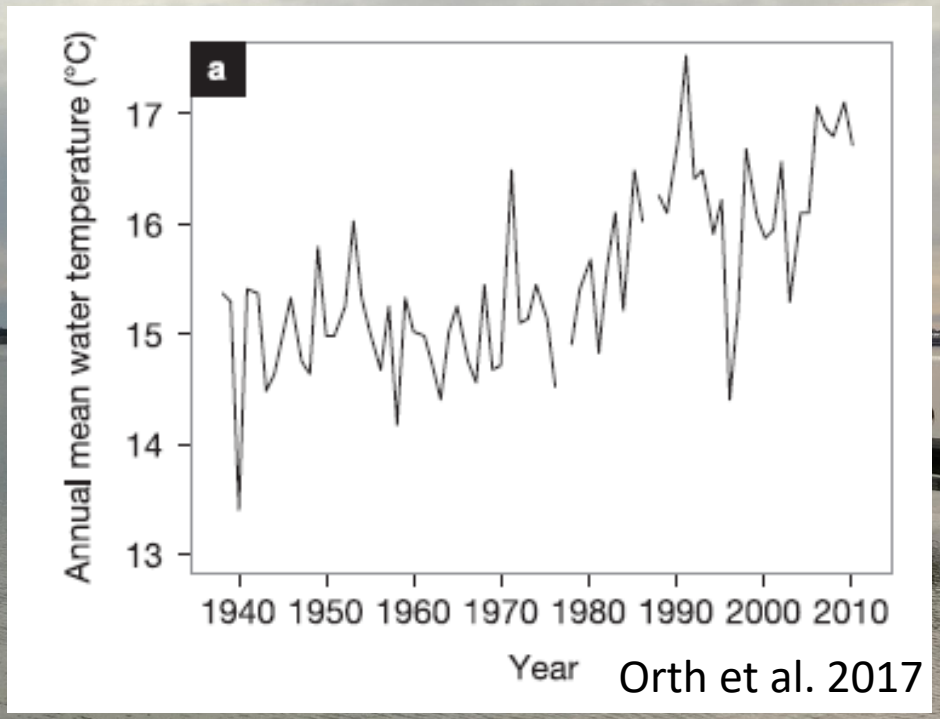
Kemp et al. 1997



We have taken tens of thousands of DO, chl-a measurements, *100s of respiration measurements*

Chesapeake Biological Laboratory Pier

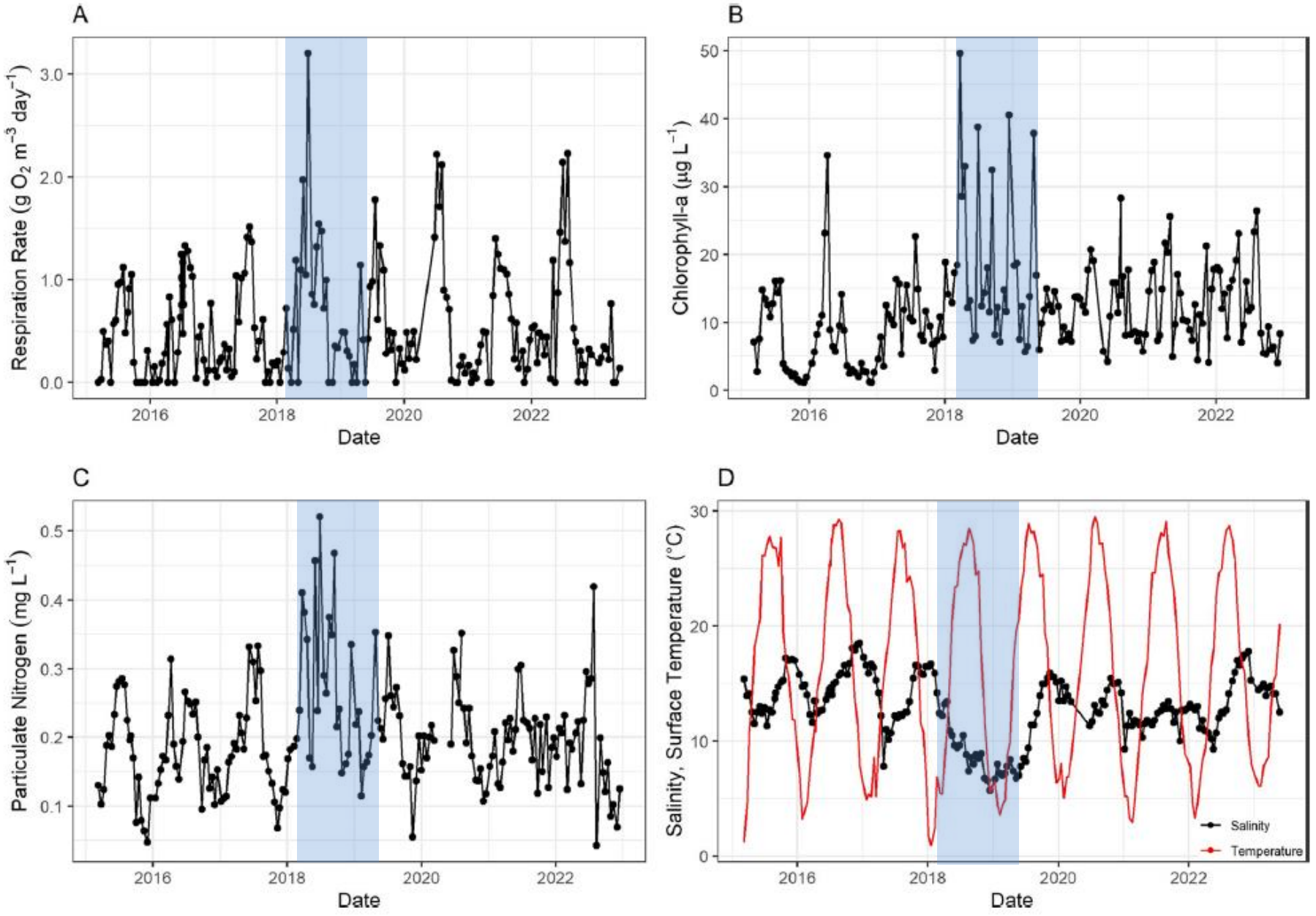


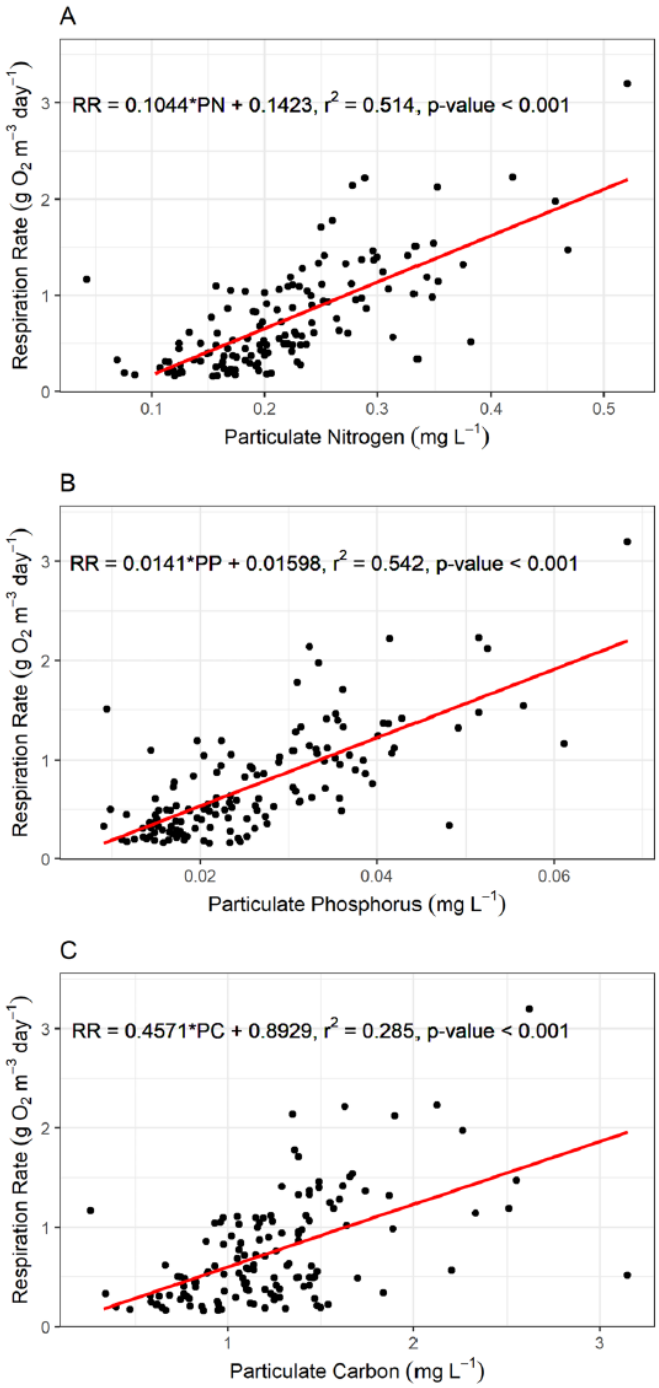


Orth et al. 2017


PROBE Y1
TESTA
YSI

Time-Series Reveals Seasonal and Inter-annual Variability

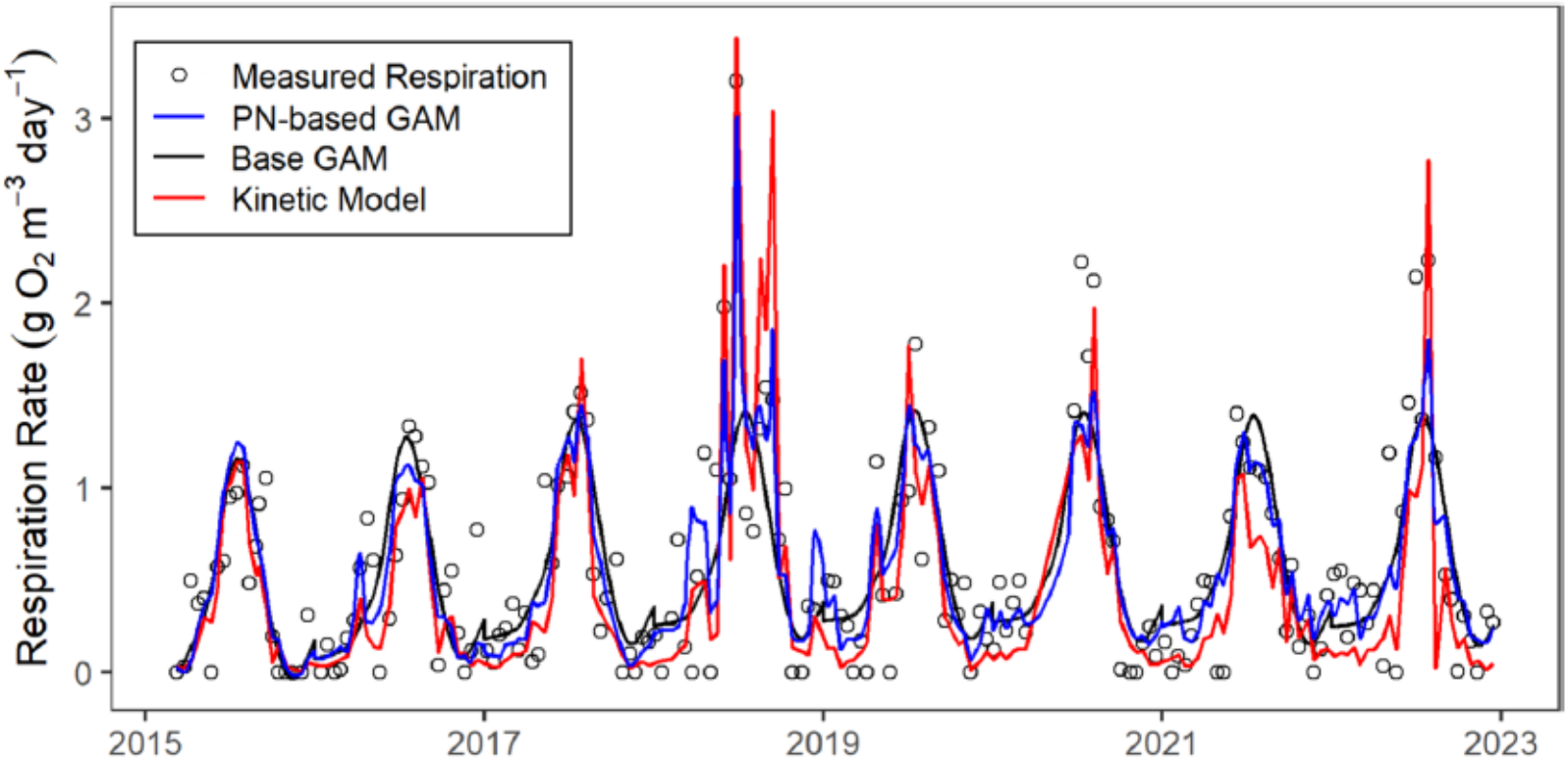




Particulate Matter Pools are Important Co-Variates with Respiration Rate

- Reflects substrate control of respiration
- Can reflect both algal material and detritus
- Particulate nutrients better correlated than PC, reflecting role of higher nutritional material

Models to help test hypotheses

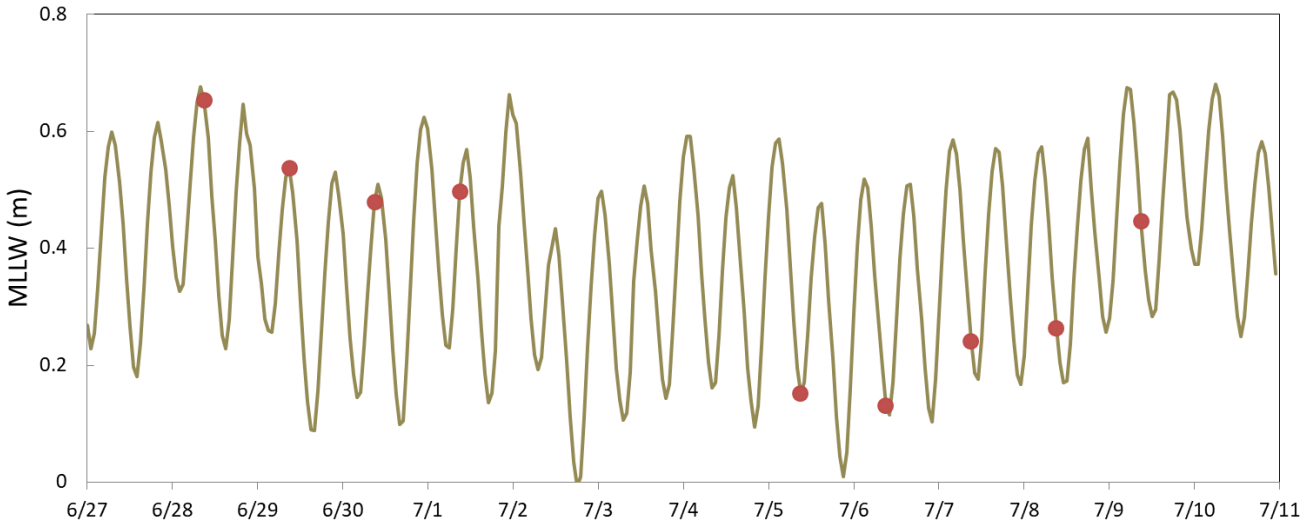


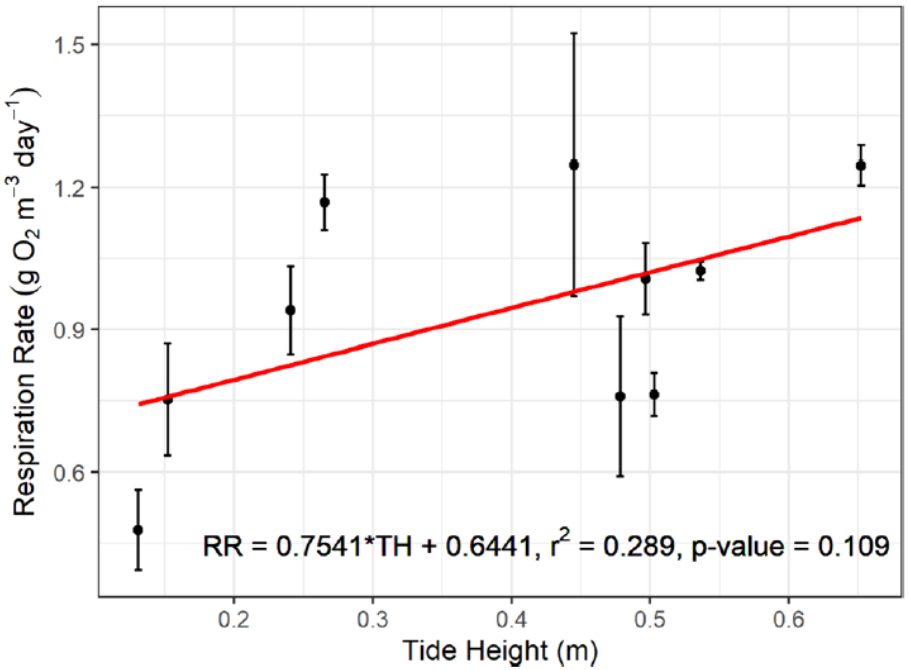
Model type	SSE	r^2	RMSE
GAM with time and PN	*14.64*	*0.741*	*0.282*
GAM with time and C:N ratio	*14.56*	*0.742*	*0.281*
GAM with time and chlorophyll-a	*18.23*	*0.678*	*0.315*
Kinetic model	*20.49*	*0.669*	*0.334*
GAM with time and temperature	*20.48*	*0.637*	*0.334*
GAM with time and C:P ratio	*22.78*	*0.597*	*0.352*
Base GAM with time	*22.92*	*0.594*	*0.353*
GAM with time and discharge	*22.90*	*0.593*	*0.353*
GAM with time and salinity	*22.89*	*0.595*	*0.352*

- *time* represents temperature cycle in GAM
- Kinetic model similar to formulation in ICM

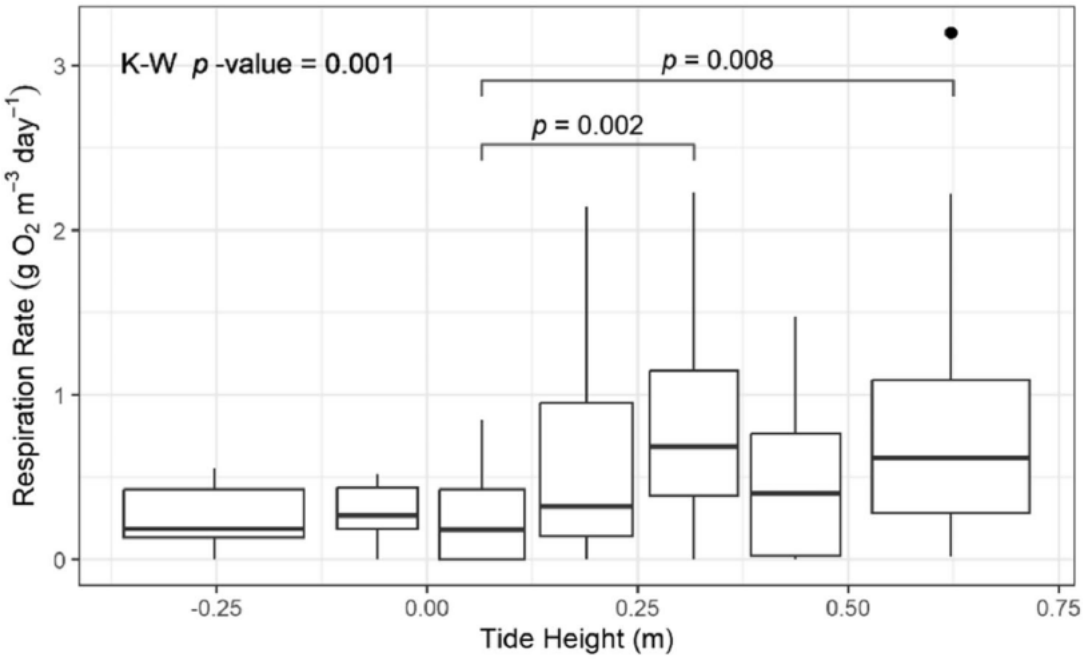
$$Respiration\ rate = k \times \theta^{(Temp-20)} \times [PN]^2$$

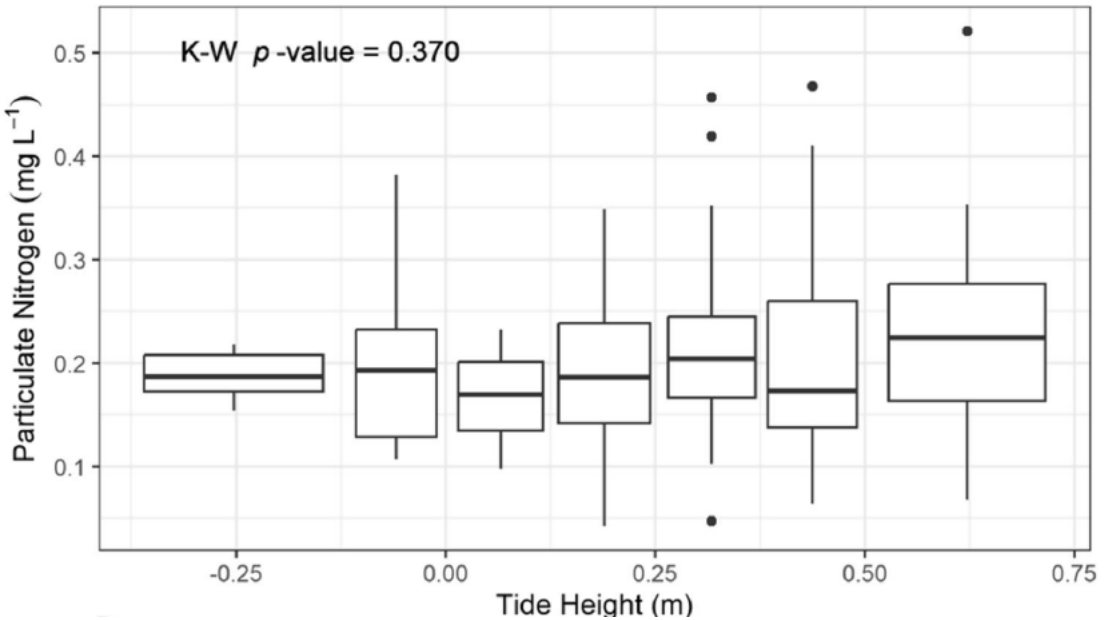
Going Back in Time: 2016





Joan Bonilla-Pagan
REU Project
2016
10 *near* consecutive days
of measurements





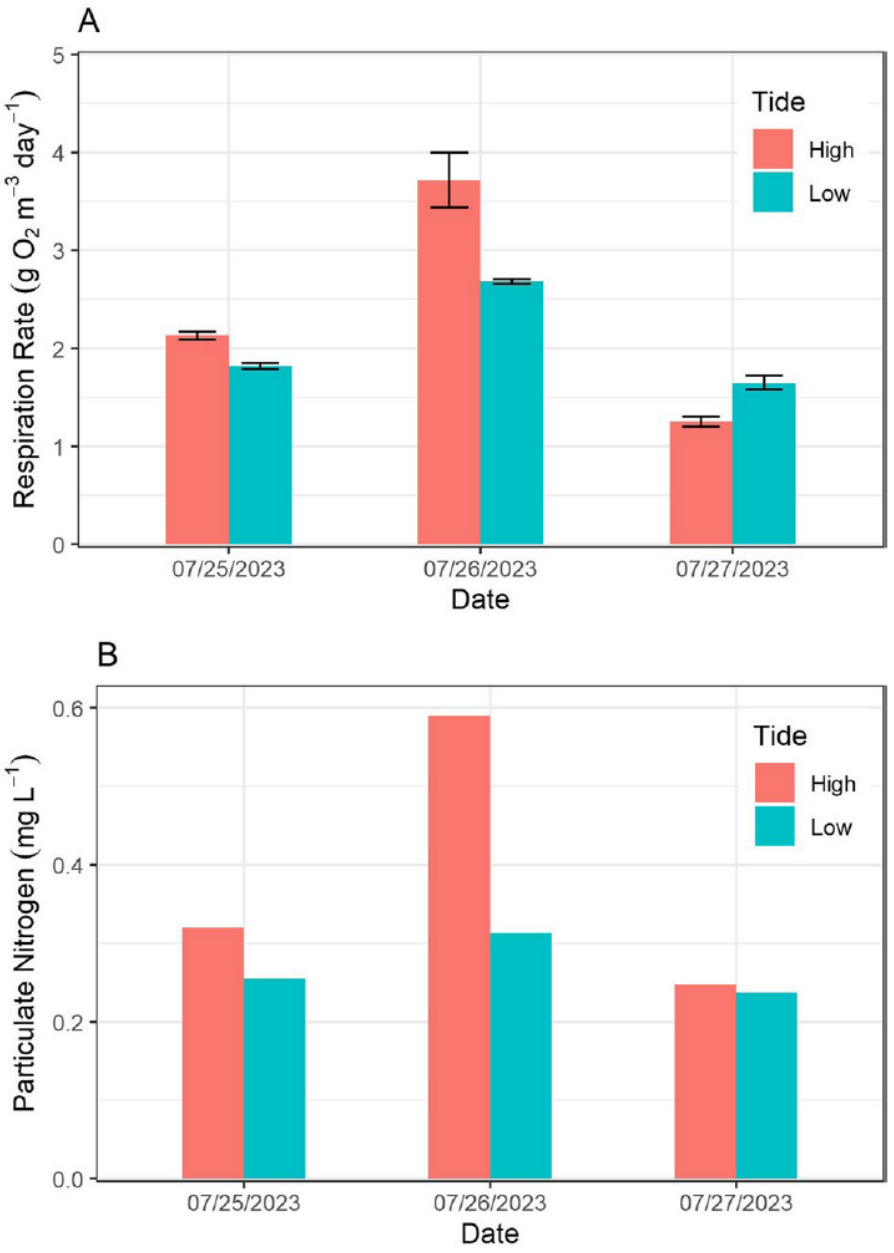
Tidal Effects on Respiration Rate and Particulate N Across Entire Record

- Significantly higher respiration at high tide
- Smaller effect on particulate nitrogen

Effect of Tide: Comparison of respiration rate measured at high and low tide *on the same day*

- Higher respiration rate and PN on 2 of the 3 days at high tide

- Opposite effect of tide on 3rd day, but PN also not different



Summary

- Few long-term time series of rate processes exist, despite their importance
- Respiration record at CBL pier reinforces prior assumptions about temperature, OM quality effects on respiration
- Some limited evidence that respiration is higher at high tide, suggesting an influence of mainstem Bay water
- Findings reinforce notion of time-of-sampling effect