

Sediment Phosphorus Flux pH Interactions in the Tidal Freshwater Potomac River Estuary

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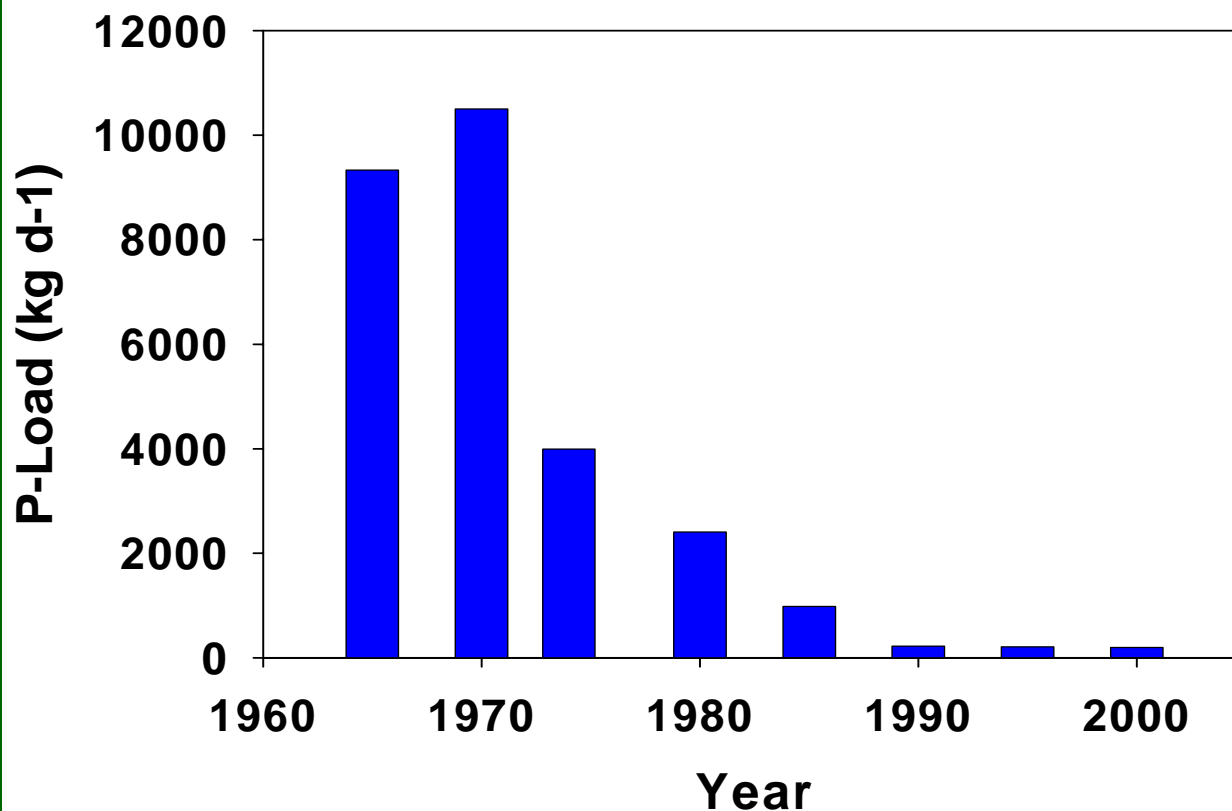


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Horn Point Laboratory**

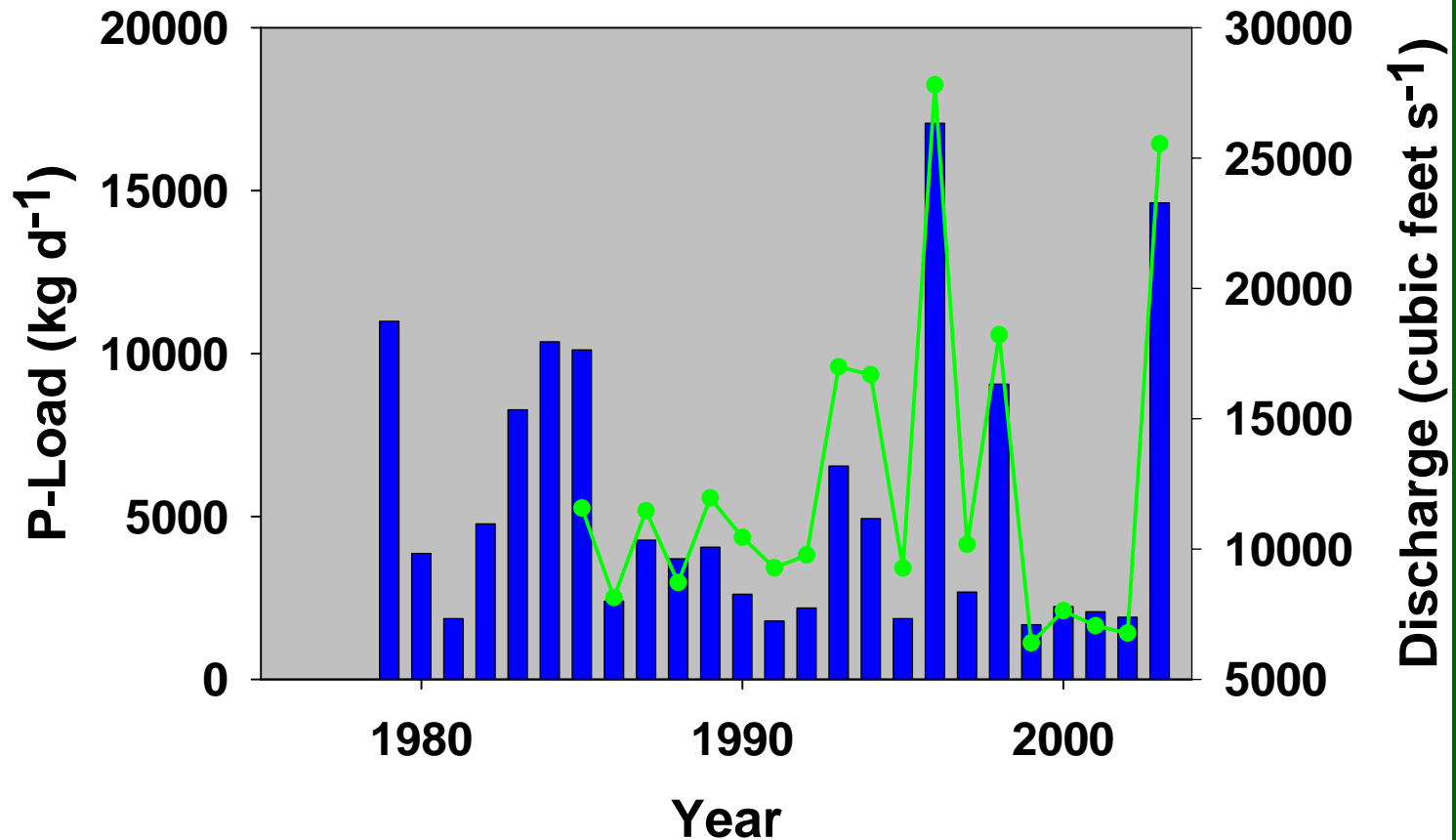
(www.potomacriver.org)

Background

Potomac River Point Source Total P Loading (Blue Plains Sewage Treatment Plant)



Potomac River Total Phosphorus Loading (Chain Bridge)

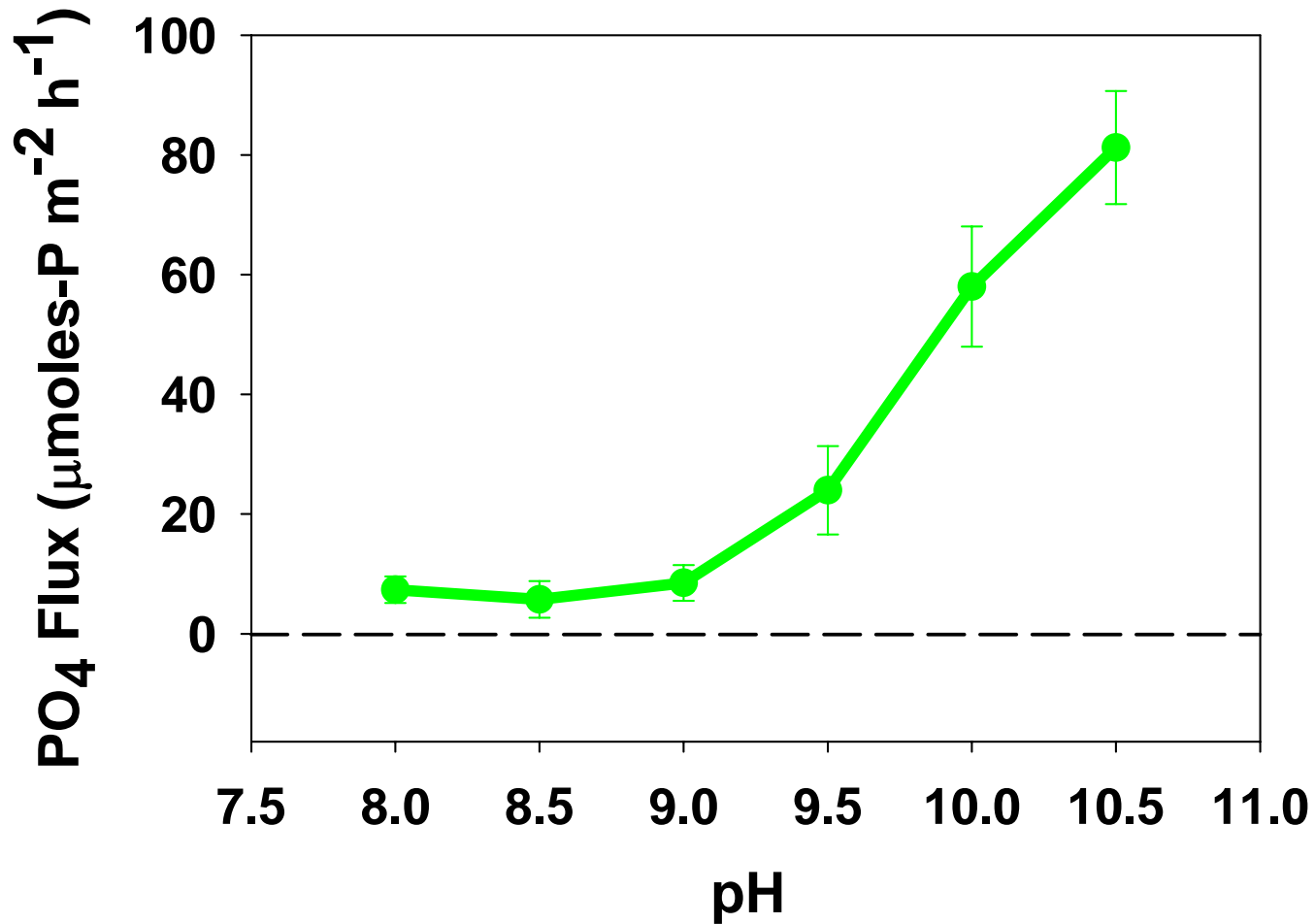




(MDDNR)

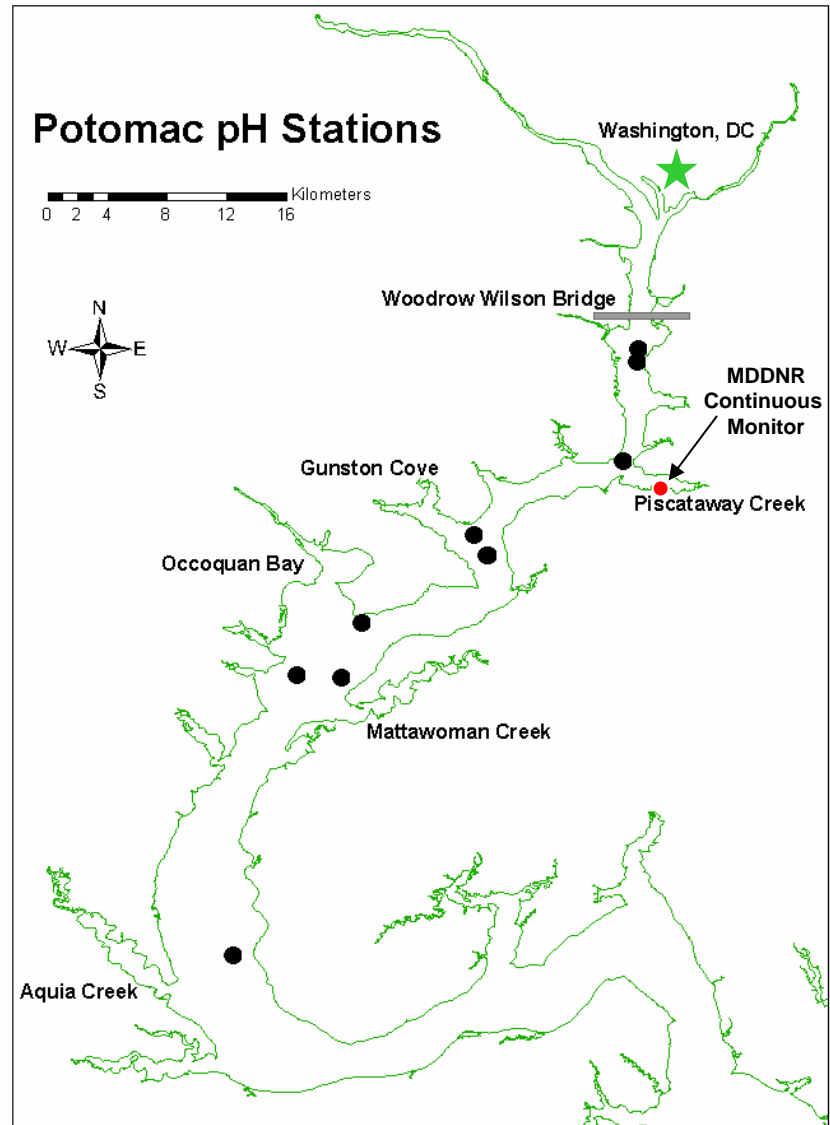
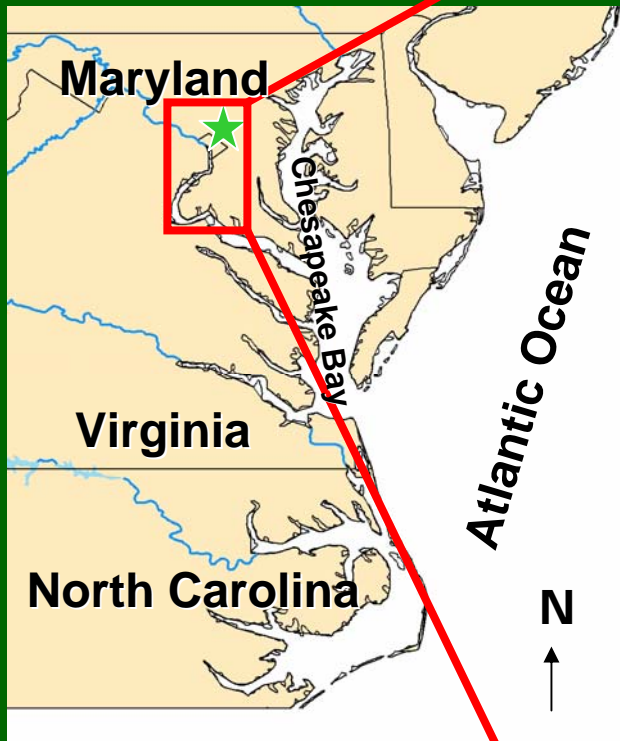


Potomac River Sediment PO_4 Flux



(Data from Seitzinger 1991)

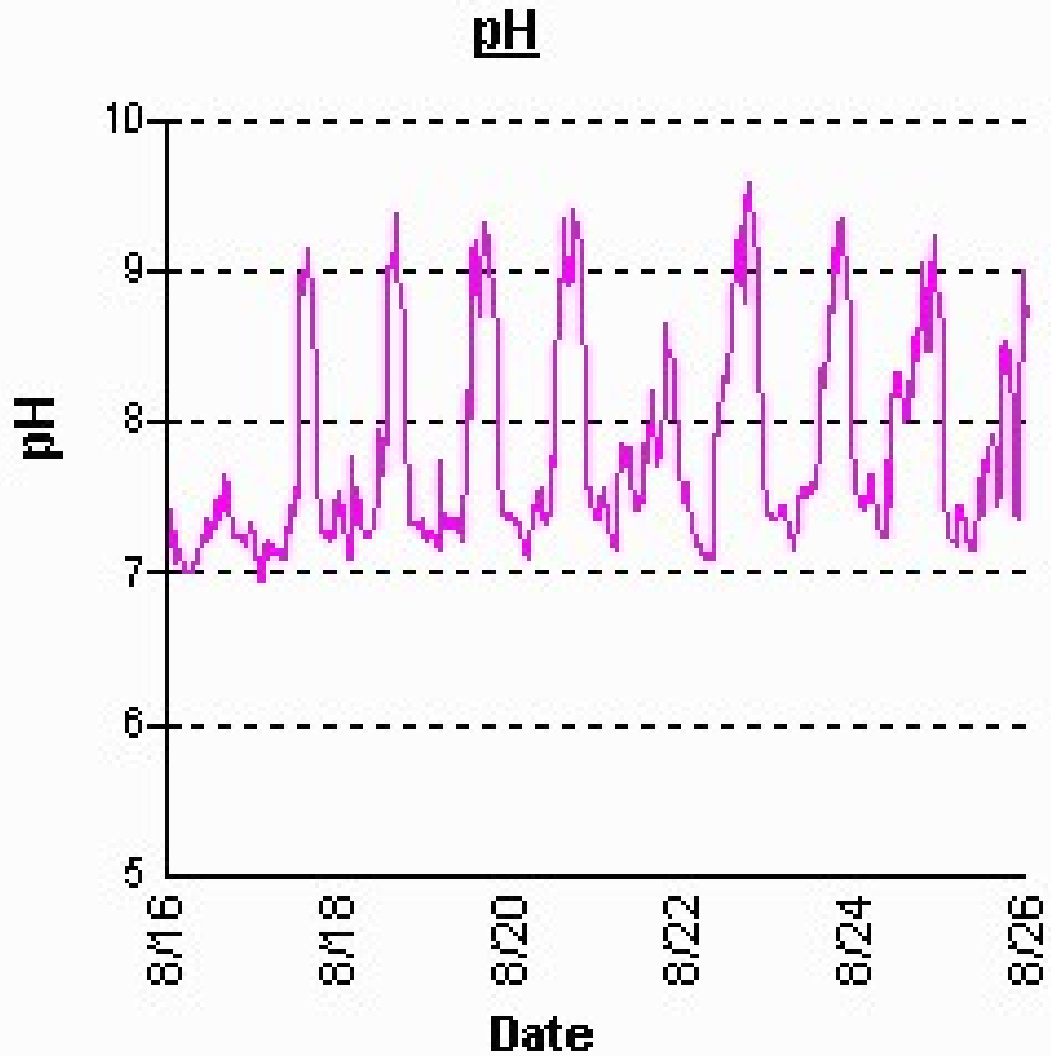
Site Locations



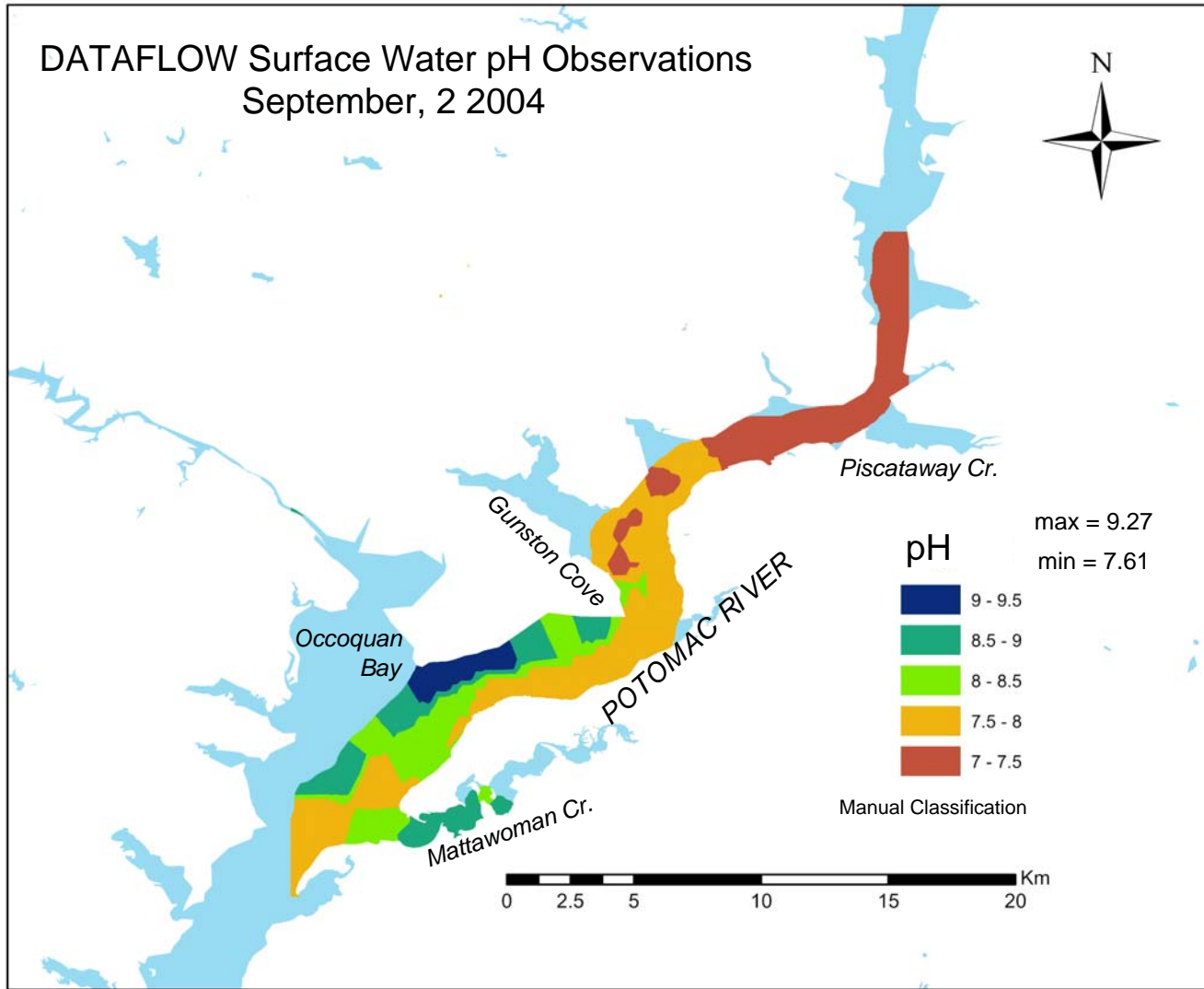
Site Characteristics

<u>Bottom Water Variable</u>	<u>Range</u>
Depth (m)	3 – 7
Salinity	0.1 - 0.7
Water Temperature (°C)	24 – 26
pH	7.6 - 8.4
Dissolved Oxygen (mg L ⁻¹)	6 – 8
PO ₄ (μM)	0.4 – 1.0

MDDNR Con Mon Station Piscataway August 2004



DATAFLOW Surface Water pH Observations
September, 2 2004

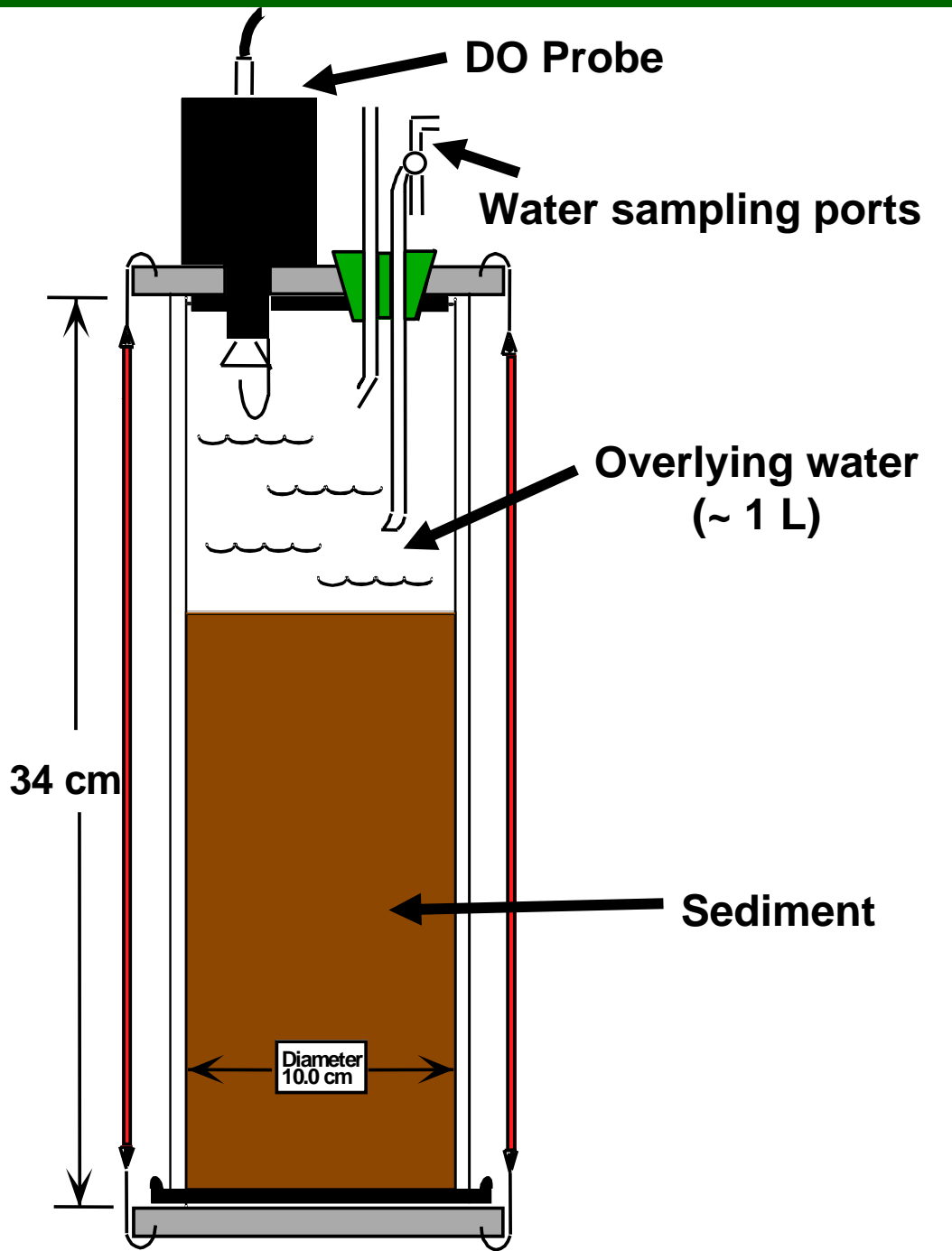


Methods

- **Sampling from April – September, 2004**
- ***In-Situ* Sediment Flux Measurements**
- ***In-Situ* Sediment Pore Water Profiles**

- **pH Response Sediment Flux Experiments**
- **pH Response in Pore Water Profiles**

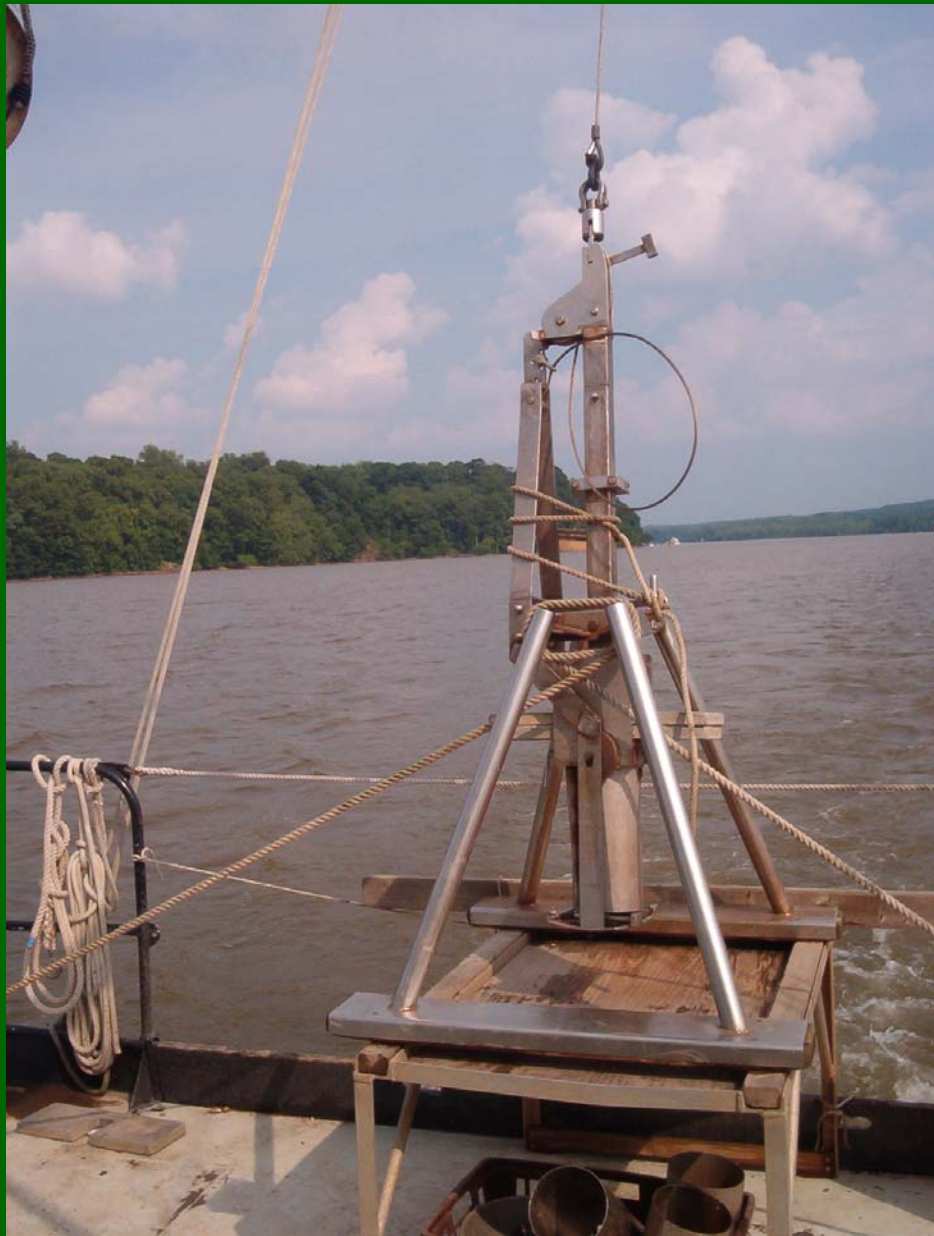
- **Surficial Sediment Samples**
- **Water Column Profiles**
- **High Resolution Water Quality Mapping**



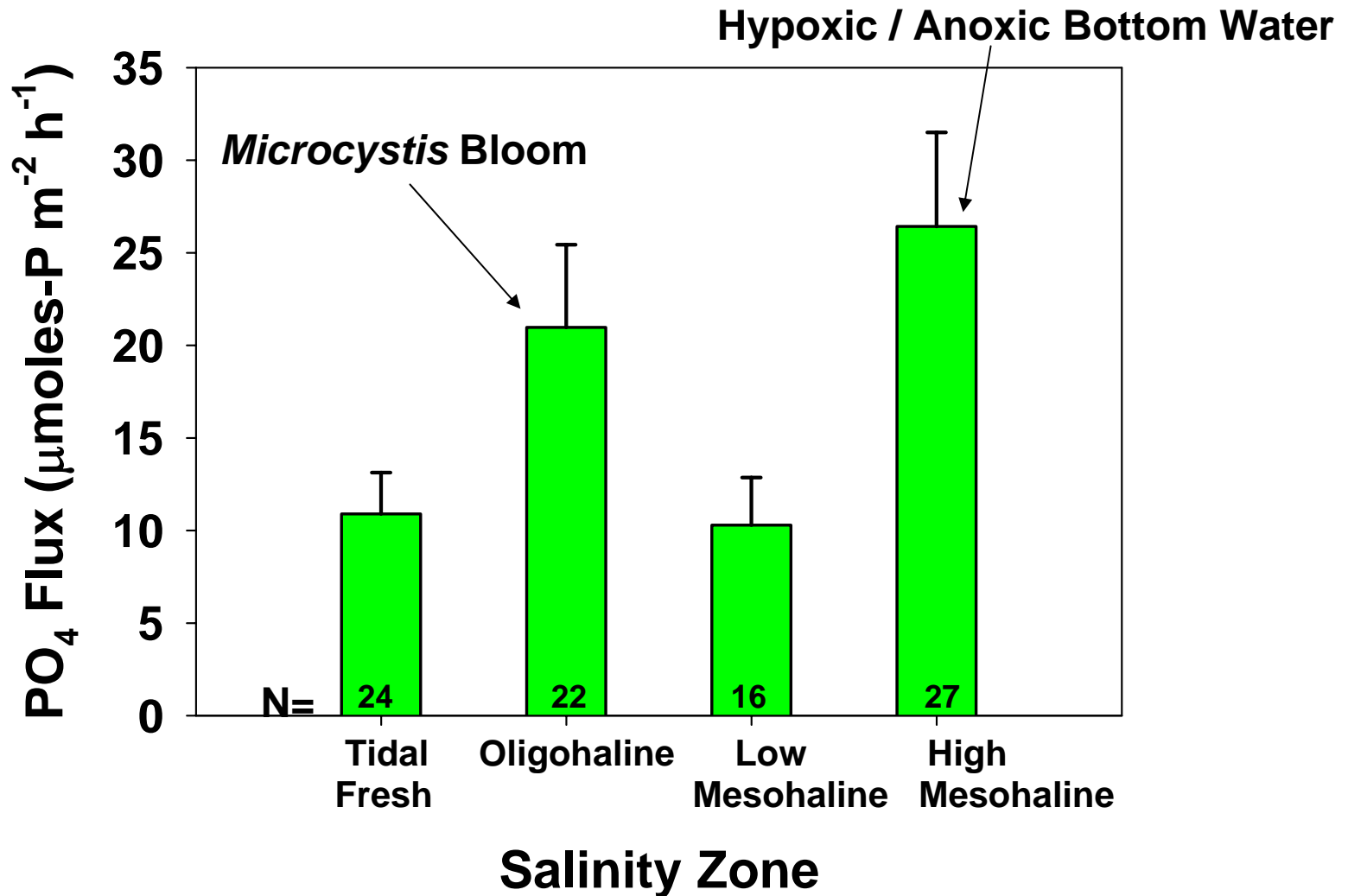
Methods

Flux Measurements

- Dark
- *In-situ* temperature
- Continuously stirred
- 3 hour incubations
- Hourly samples :
 - Dissolved Oxygen
 - Water Temperature
 - DIN
 - DIP



Potomac River *In-Situ* Sediment PO₄ Flux

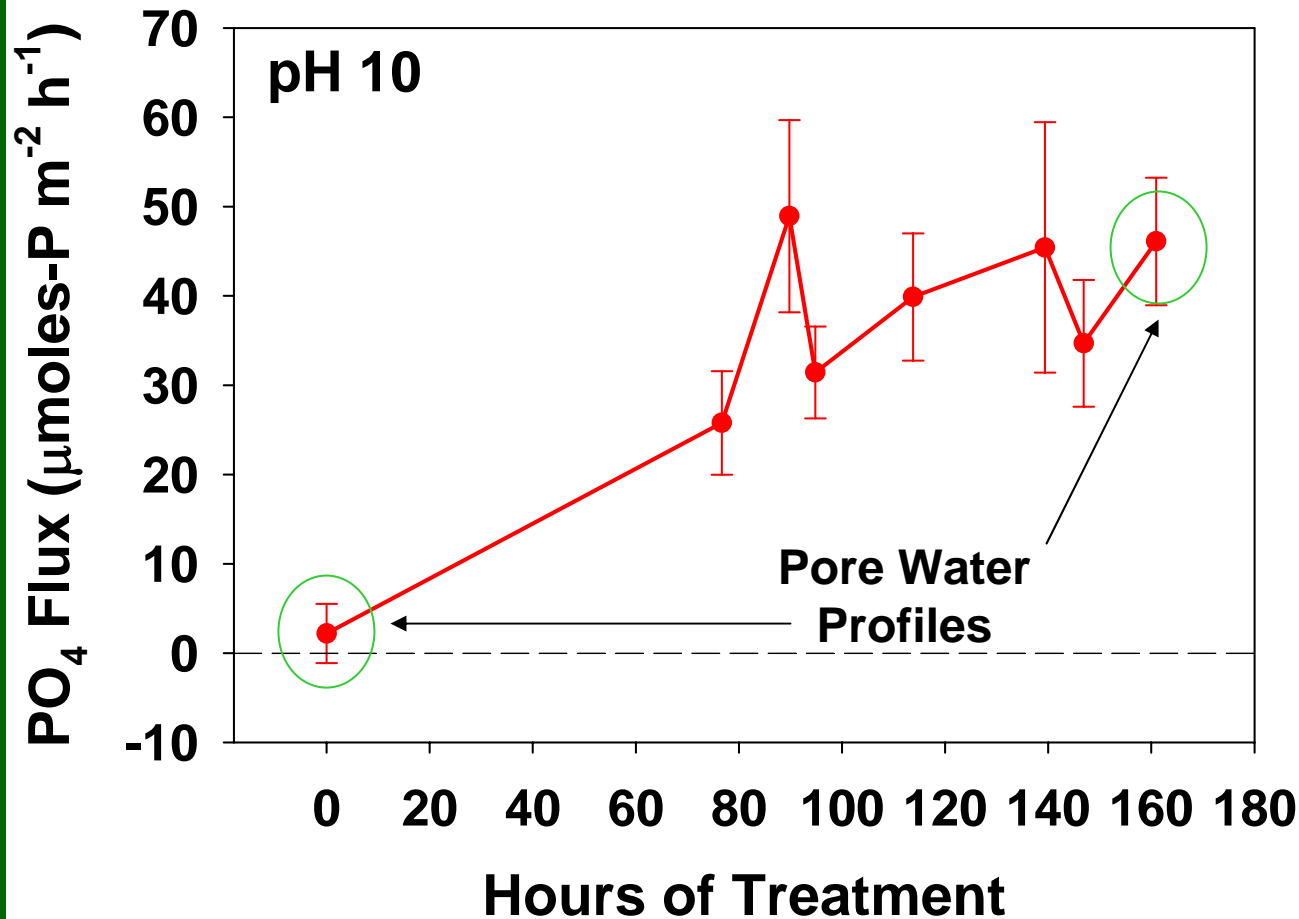


(Data from Callender 1982, Potomac TMDL 2002 and this study)

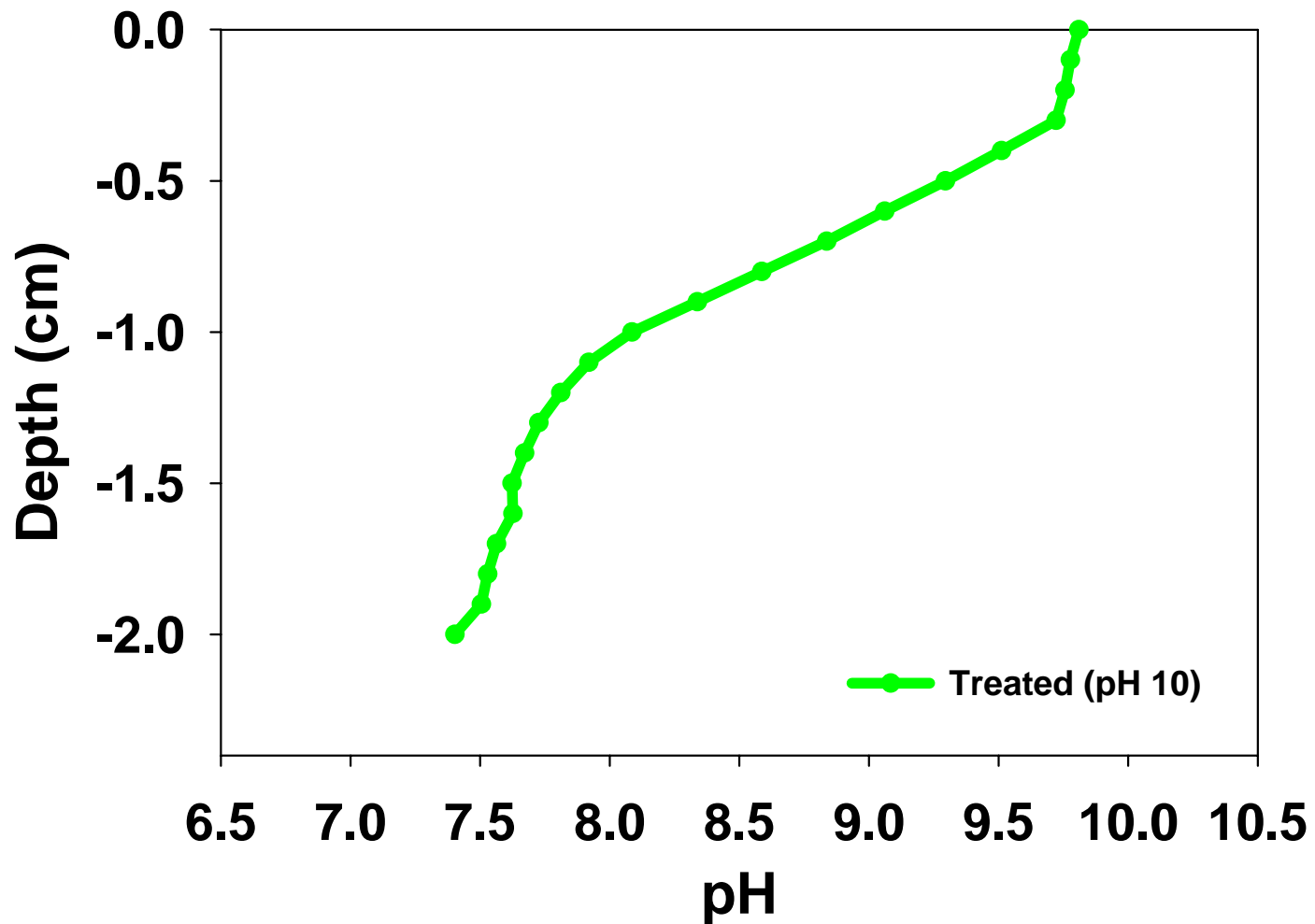


Results

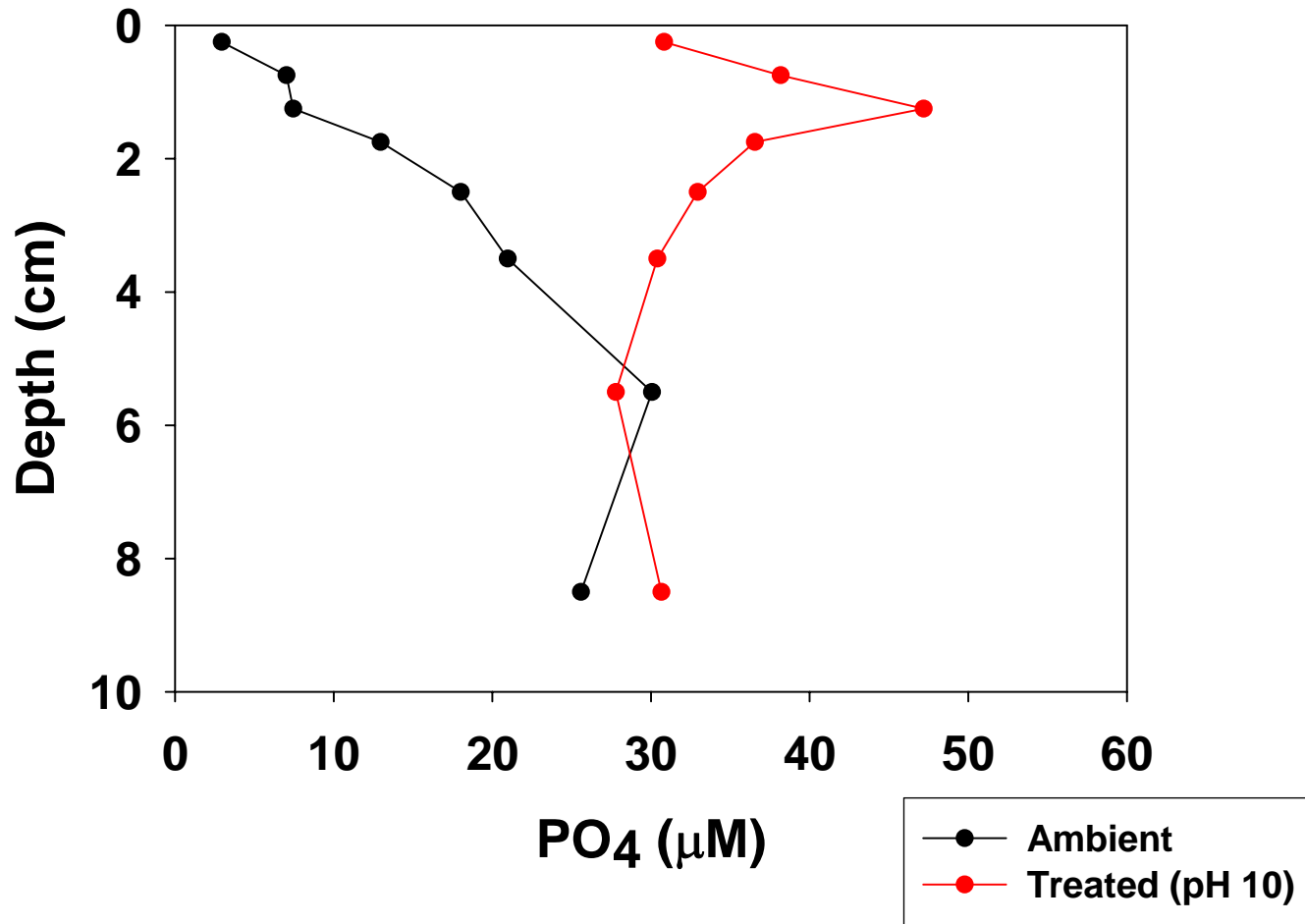
May 2004 Potomac River pH Response Sediment PO_4 Flux



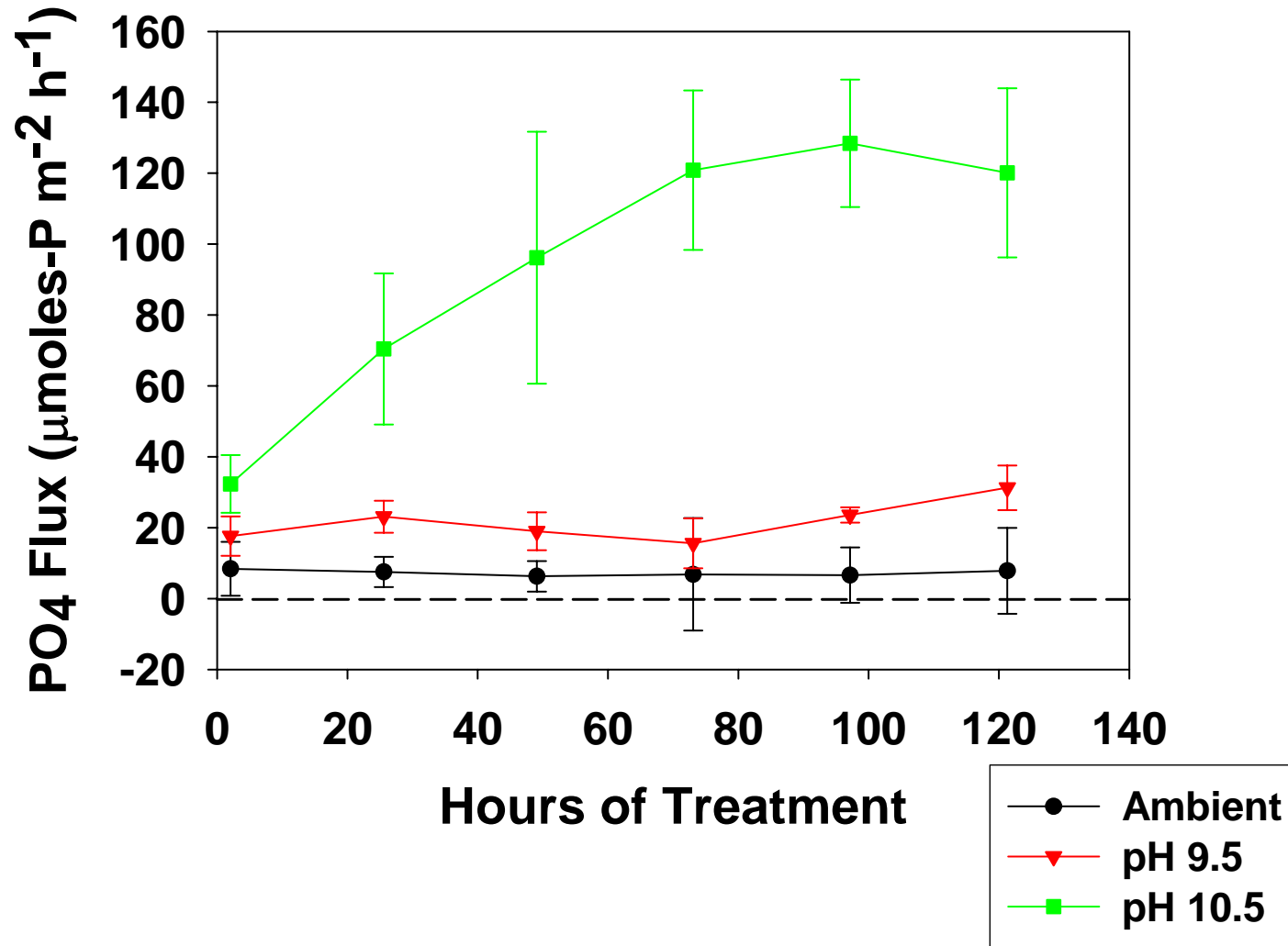
May 2004 Potomac Sediment Microelectrode Profiles



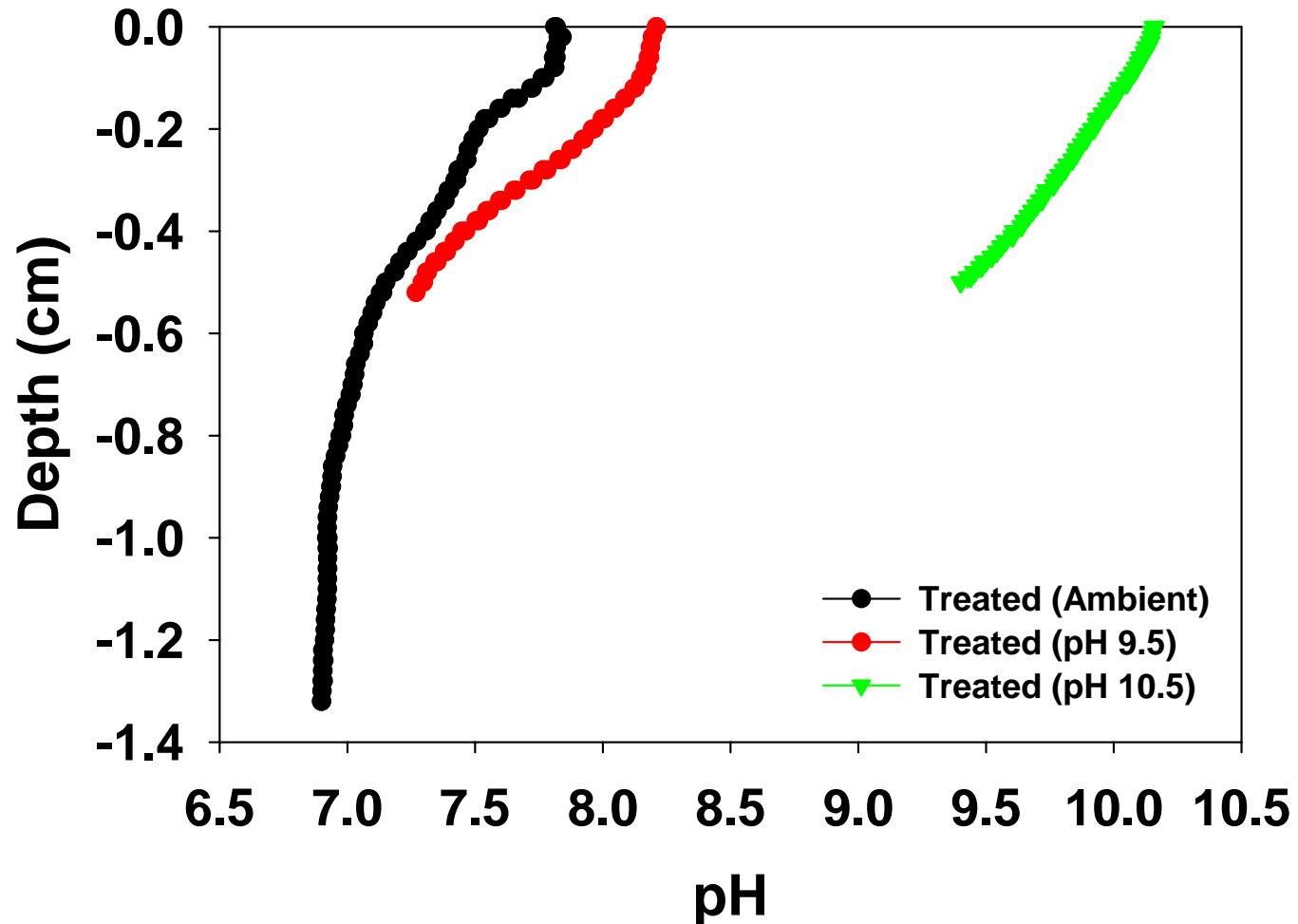
May 2004 Potomac Sediment Pore Water Profiles



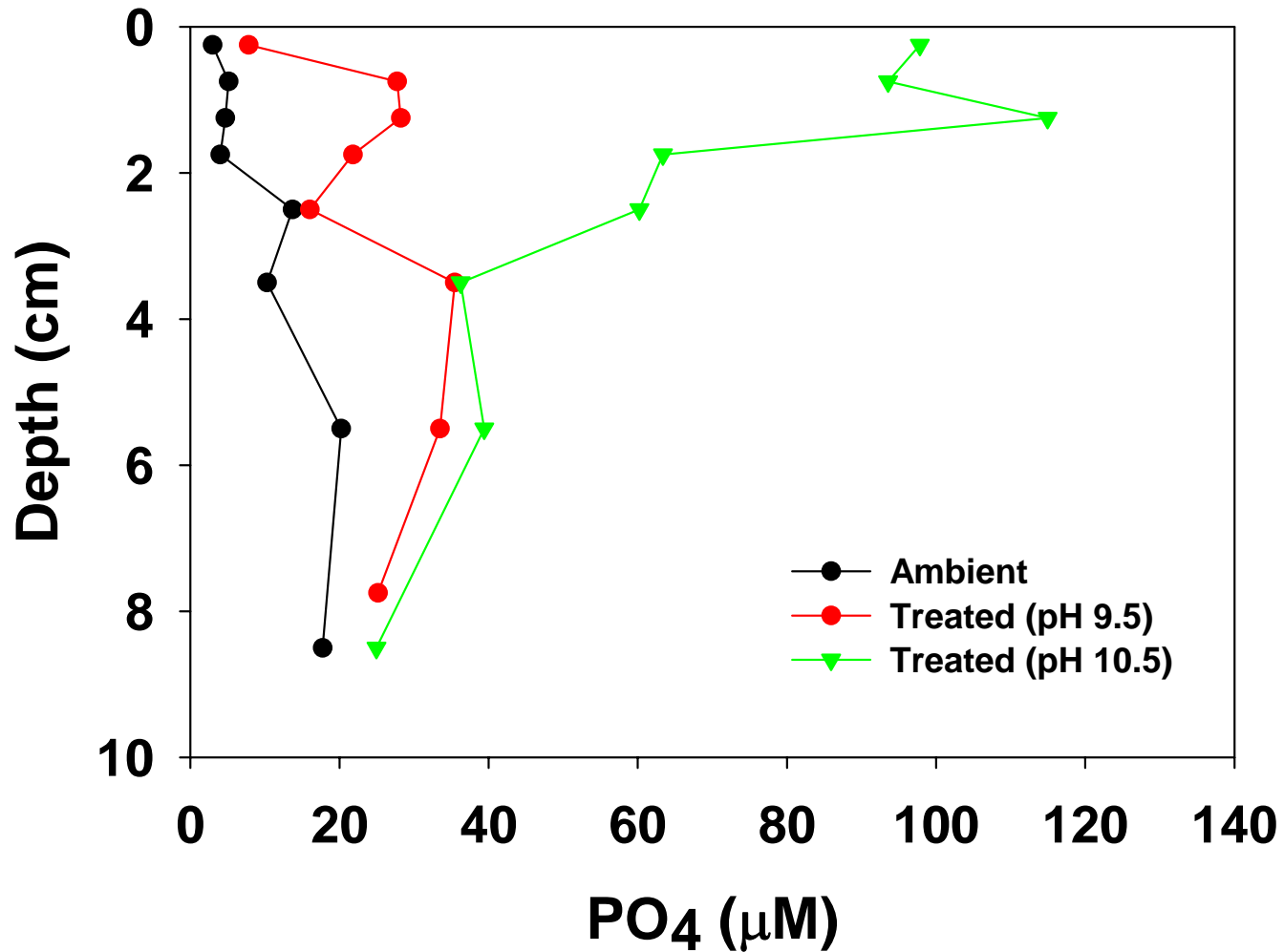
July 2004 Potomac River pH Response Sediment PO_4 Flux



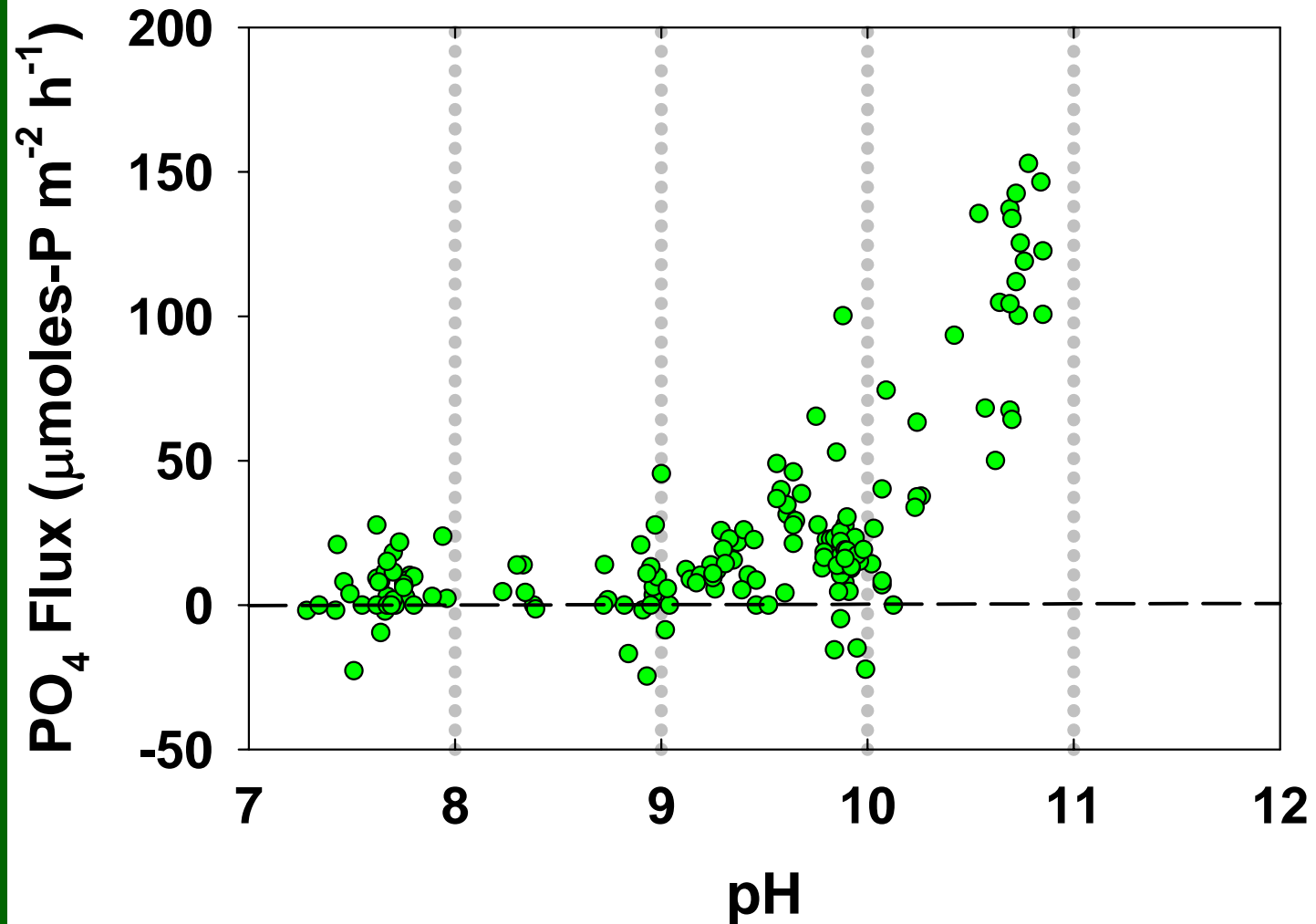
July 2004 Potomac River pH Response Sediment Microelectrode Profiles



July 2004 Potomac Sediment Pore Water Profiles



Potomac Sediment PO_4 Flux



Conclusions

- Sediment PO_4 fluxes increased under elevated pH conditions
 - Response on same time scales (hrs) as *in-situ* pH elevation
 - Response large and persistent enough to influence algal bloom formation (hrs - days)
- Pore water PO_4 concentrations responded to elevated pH; large concentrations observed at sediment surface

Conclusions

- **Concerned about extreme pH (>10) needed to achieve large increases in sediment PO₄ releases**
 - **These very high pH values rarely observed in the field**
- **Other potential mechanisms of PO₄ release need exploration**
 - **Prime candidate is PO₄ release from tide / wave re-suspended bottom sediments**

Acknowledgements

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