

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

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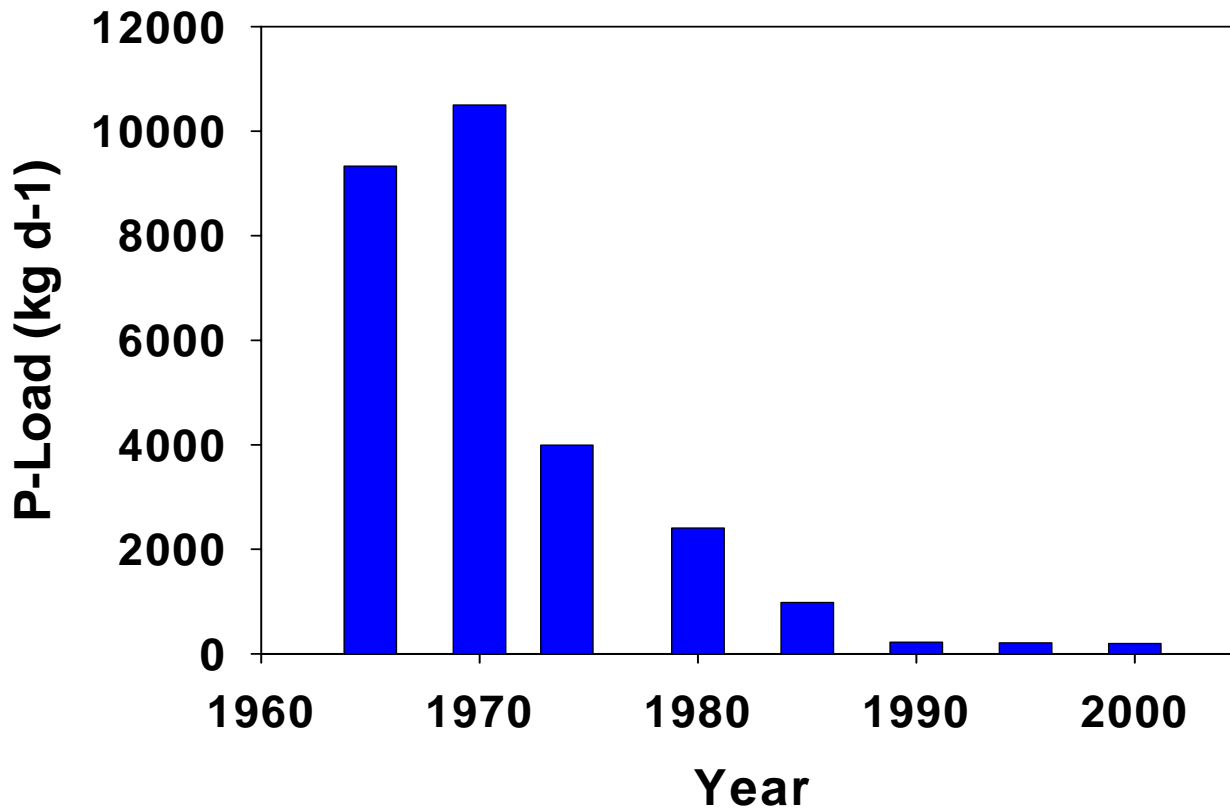


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Horn Point Laboratory**

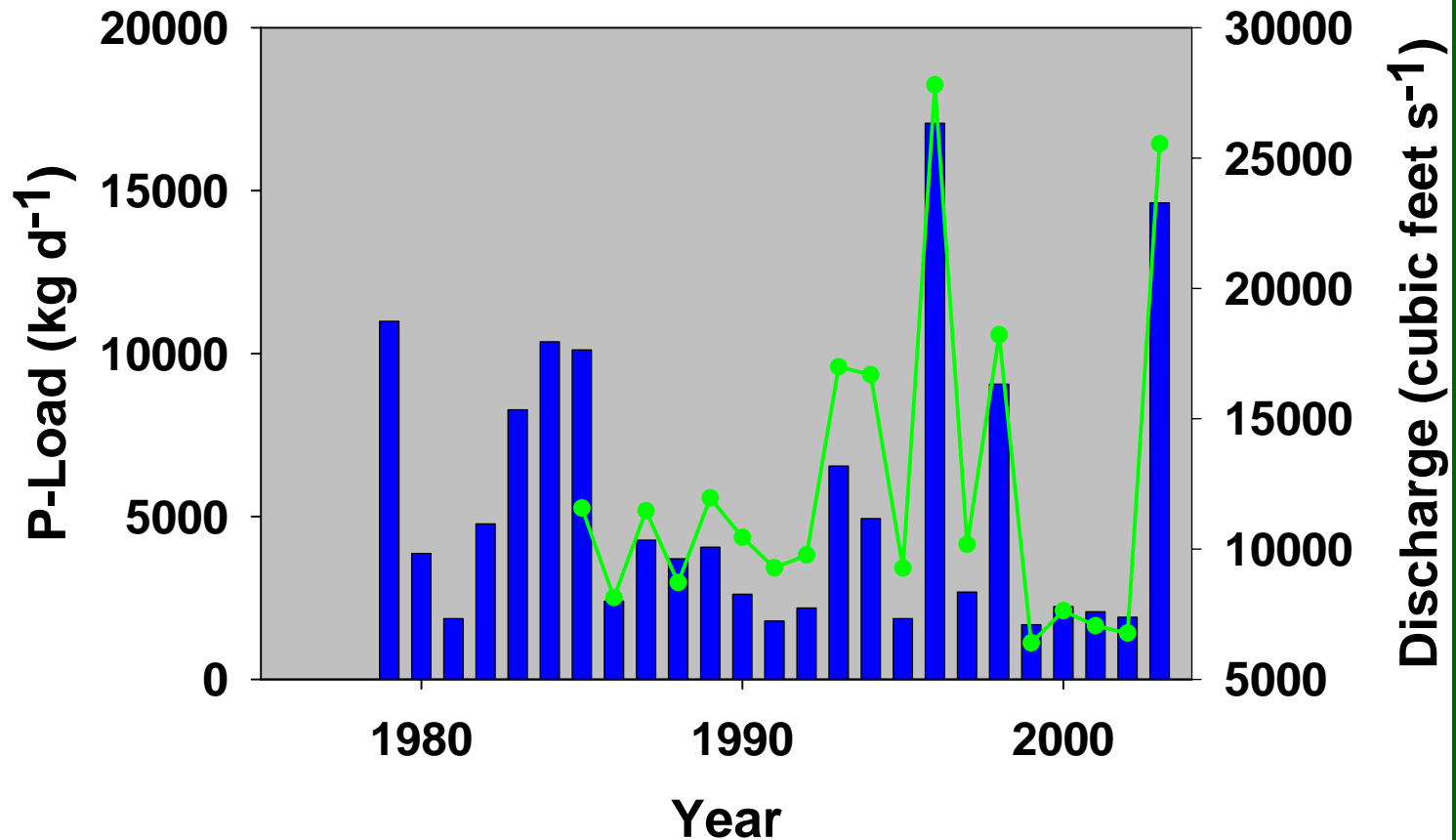
([www.potomacriver.org](http://www.potomacriver.org))

# Background

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



# Potomac River Total Phosphorus Loading (Chain Bridge)

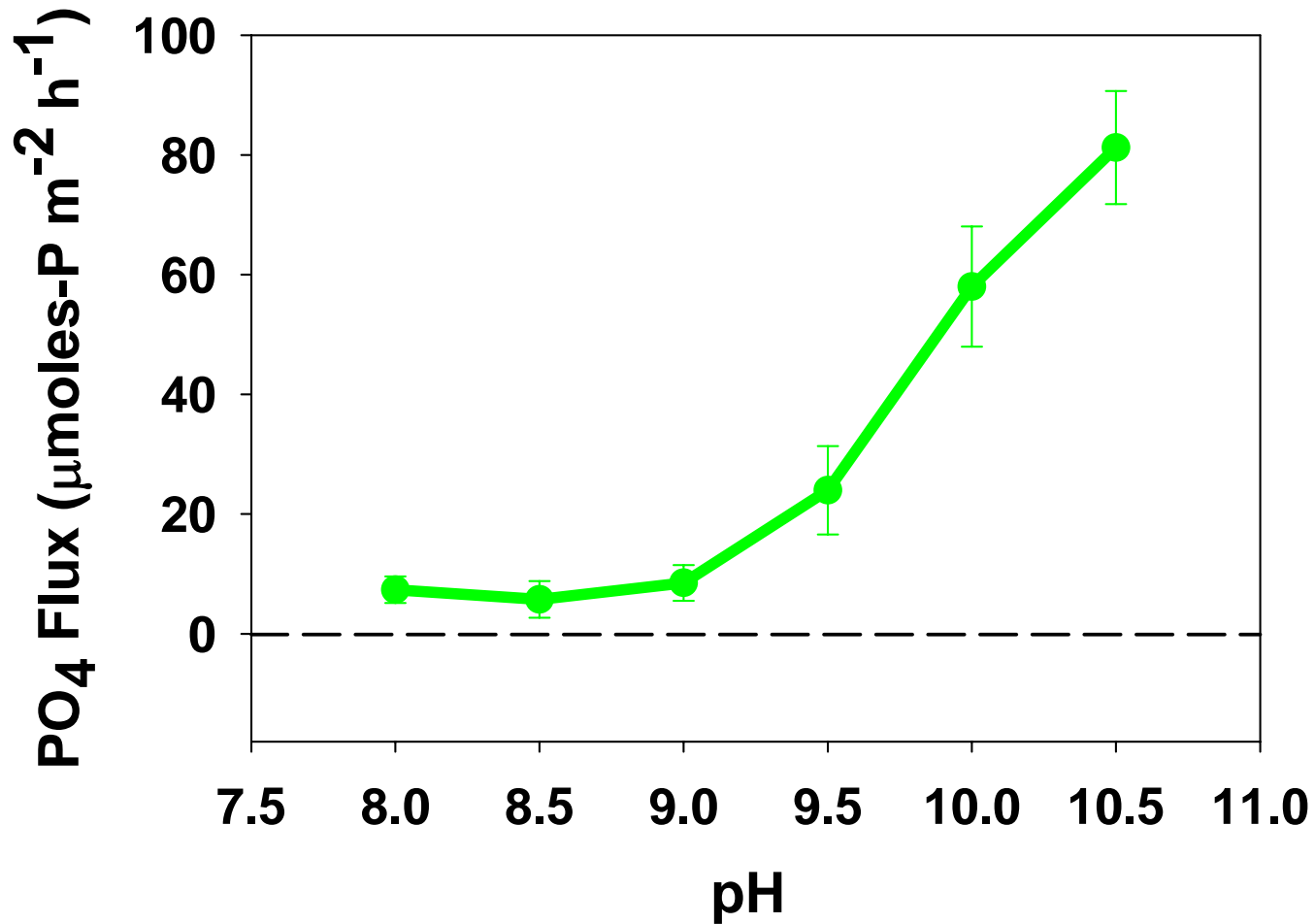




(MDDNR)

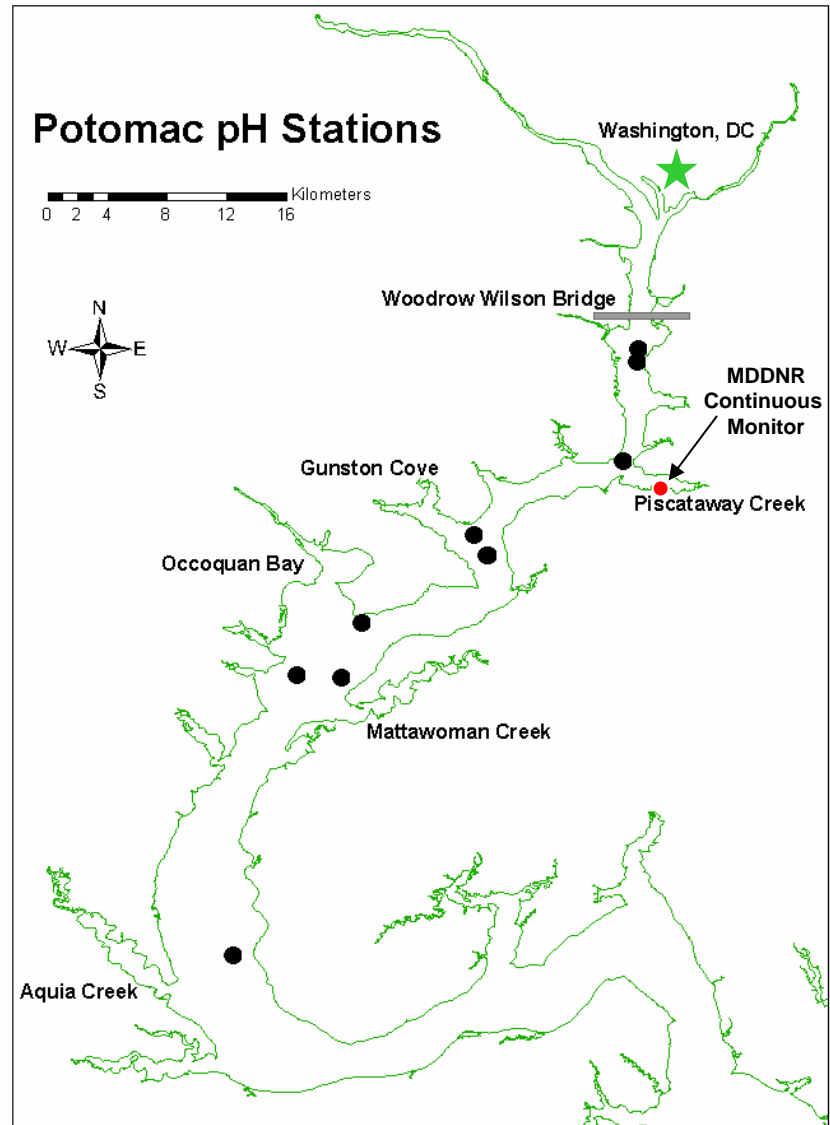


# Potomac River Sediment $\text{PO}_4$ Flux



(Data from Seitzinger 1991)

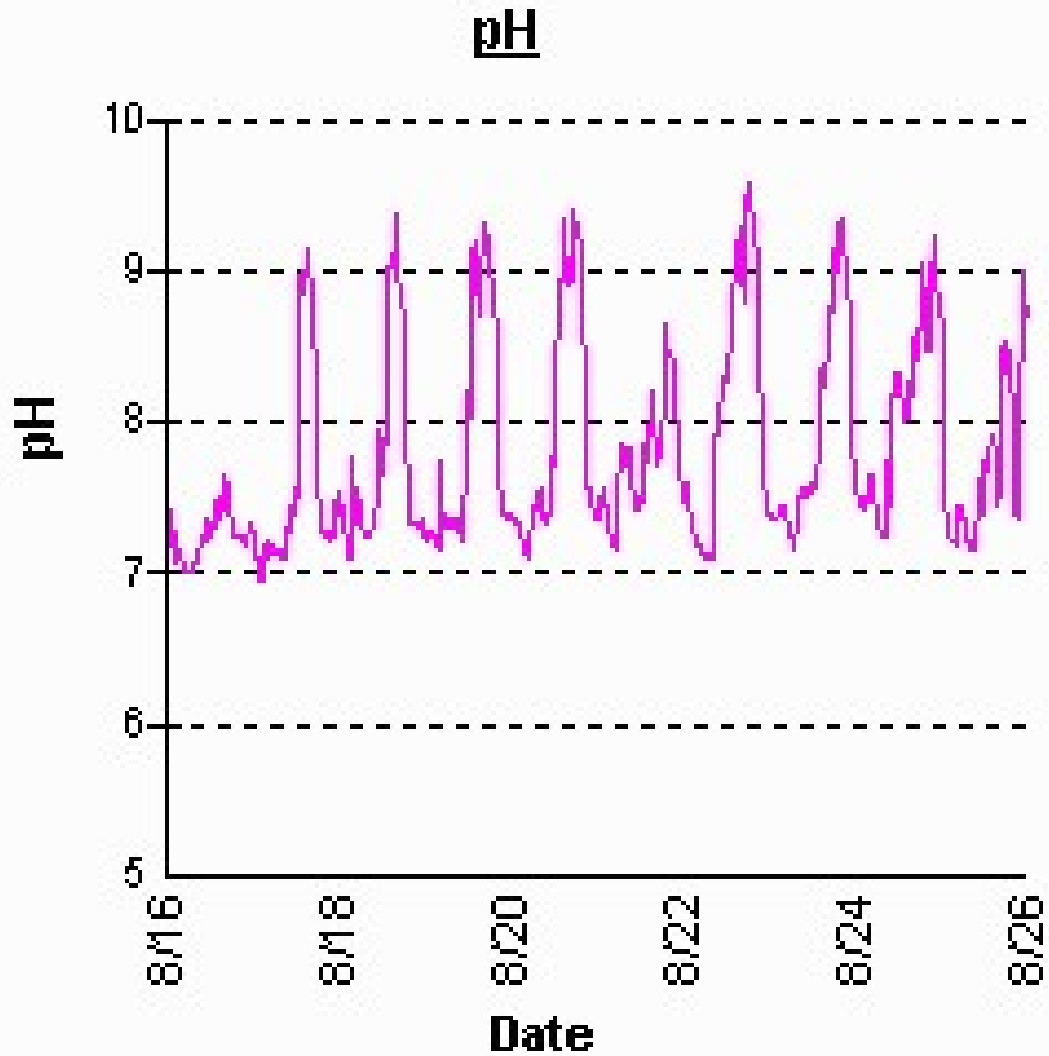
# Site Locations



# Site Characteristics

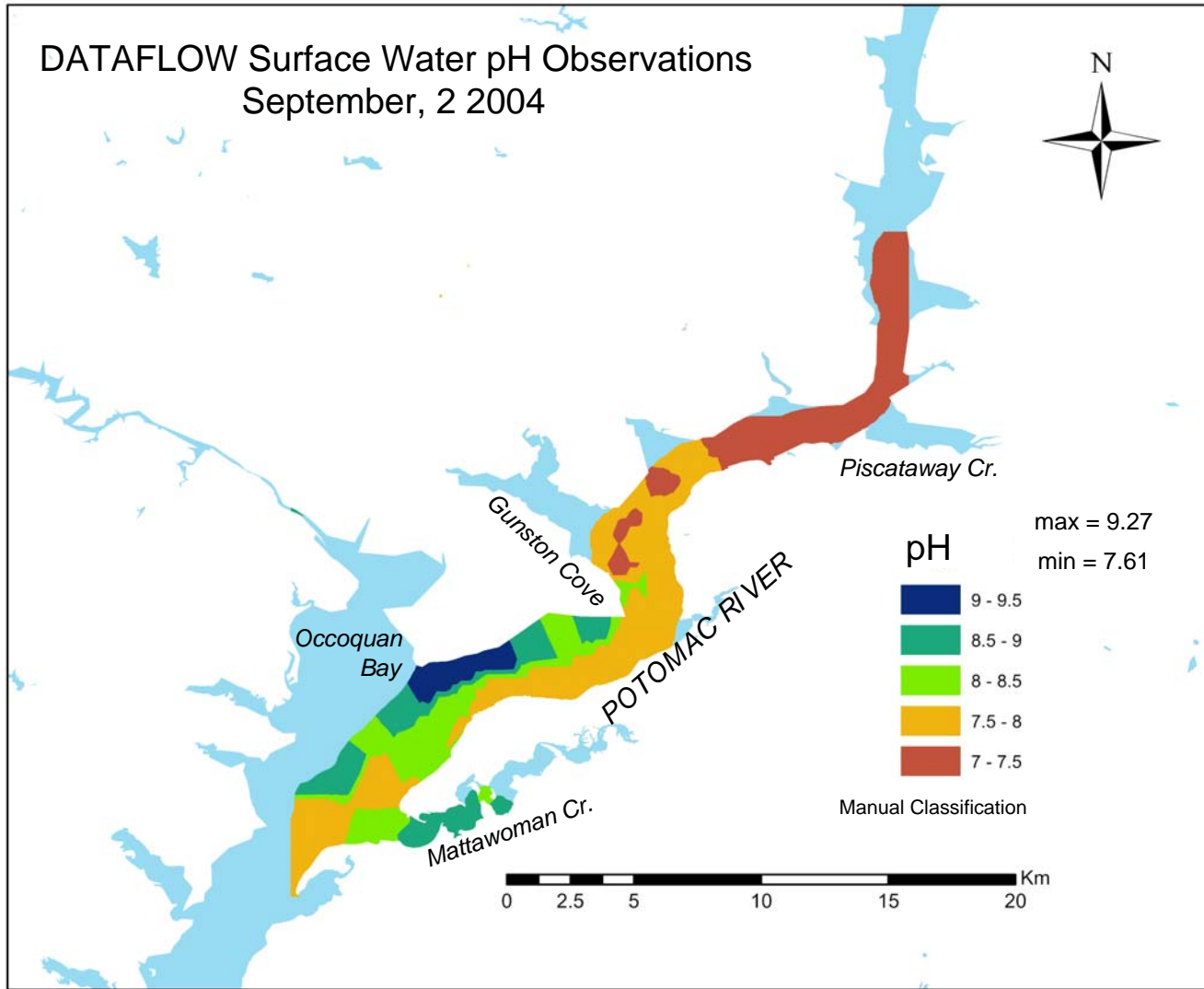
<u>Bottom Water Variable</u>	<u>Range</u>
Depth (m)	3 – 7
Salinity	0.1 - 0.7
Water Temperature (°C)	24 – 26
pH	7.6 - 8.4
Dissolved Oxygen (mg L <sup>-1</sup> )	6 – 8
PO <sub>4</sub> (μM)	0.4 – 1.0

# MDDNR Con Mon Station Piscataway August 2004



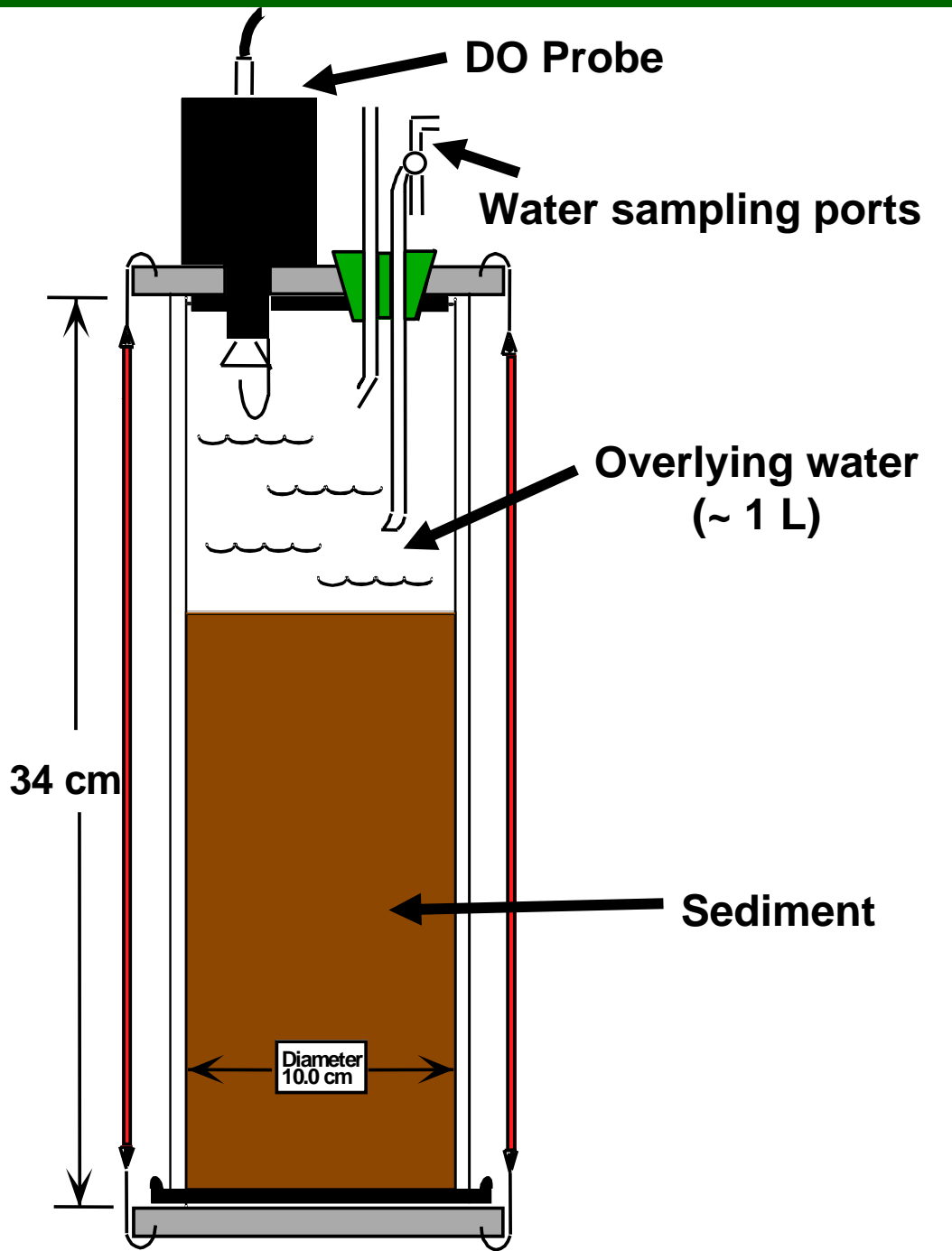


# DATAFLOW Surface Water pH Observations September, 2 2004



# Methods

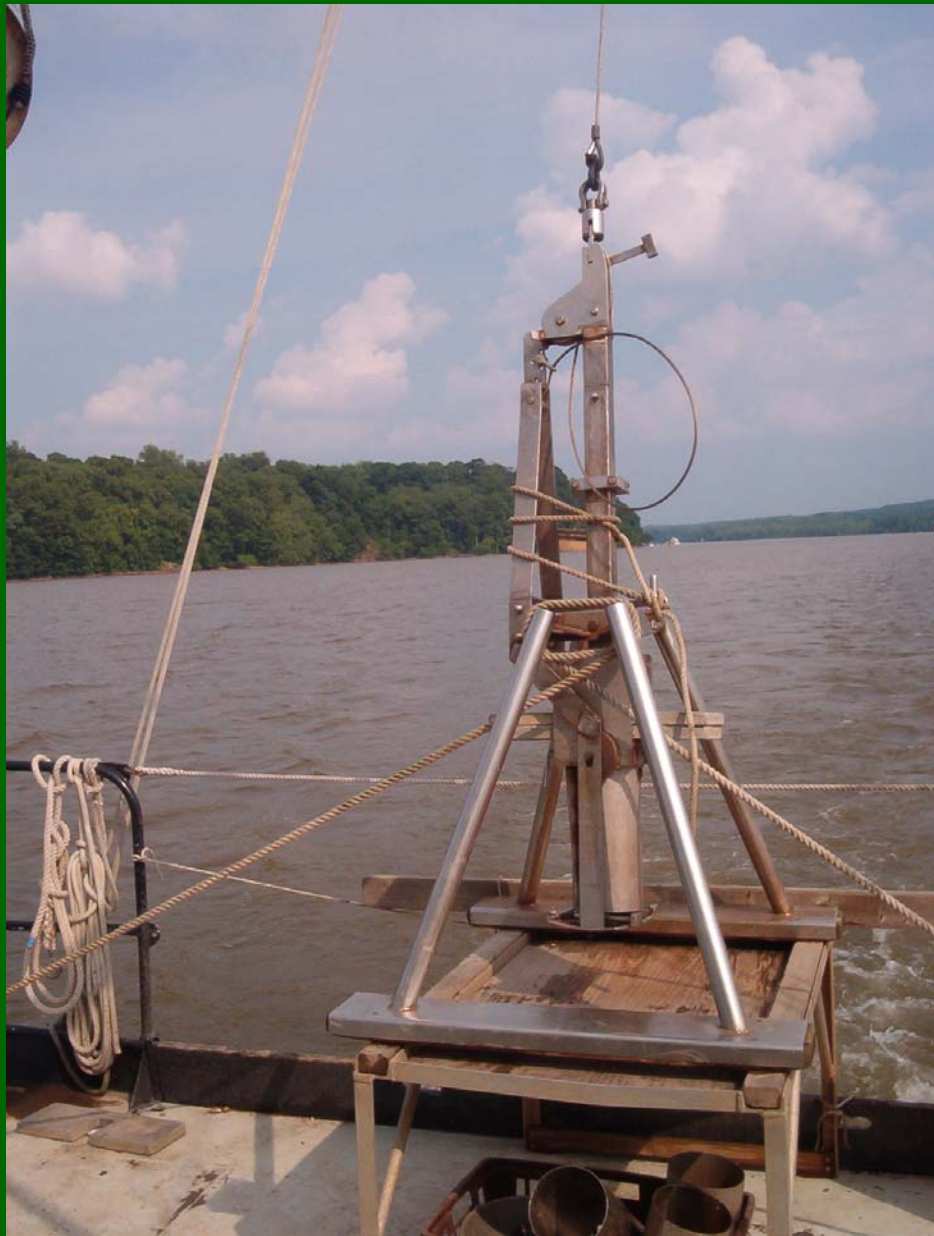
- **Sampling from April – September, 2004**
- ***In-Situ* Sediment Flux Measurements**
- ***In-Situ* Sediment Pore Water Profiles**
  
- **pH Response Sediment Flux Experiments**
- **pH Response in Pore Water Profiles**
  
- **Surficial Sediment Samples**
- **Water Column Profiles**
- **High Resolution Water Quality Mapping**



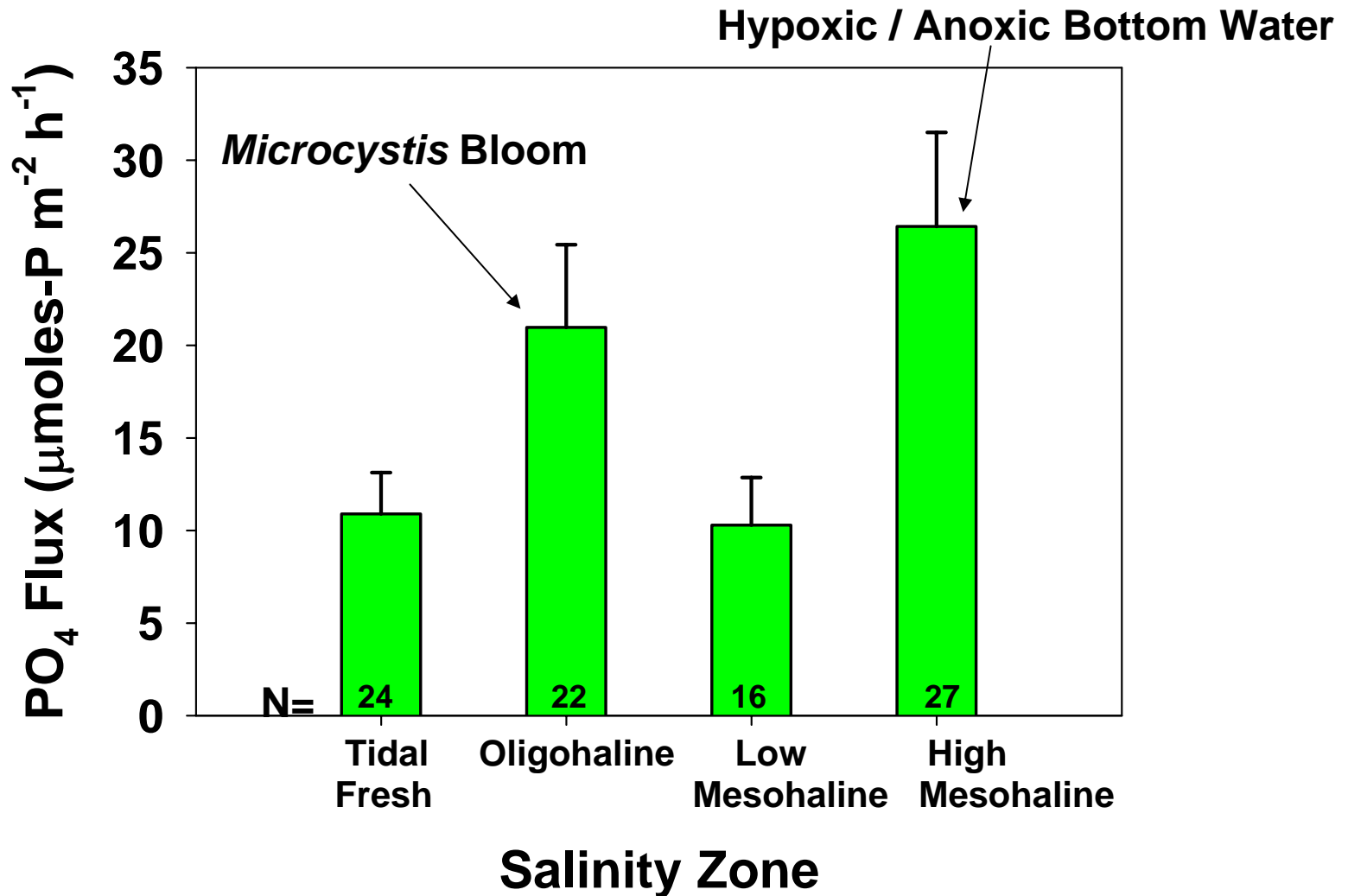
# Methods

## Flux Measurements

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



# Potomac River *In-Situ* Sediment PO<sub>4</sub> Flux

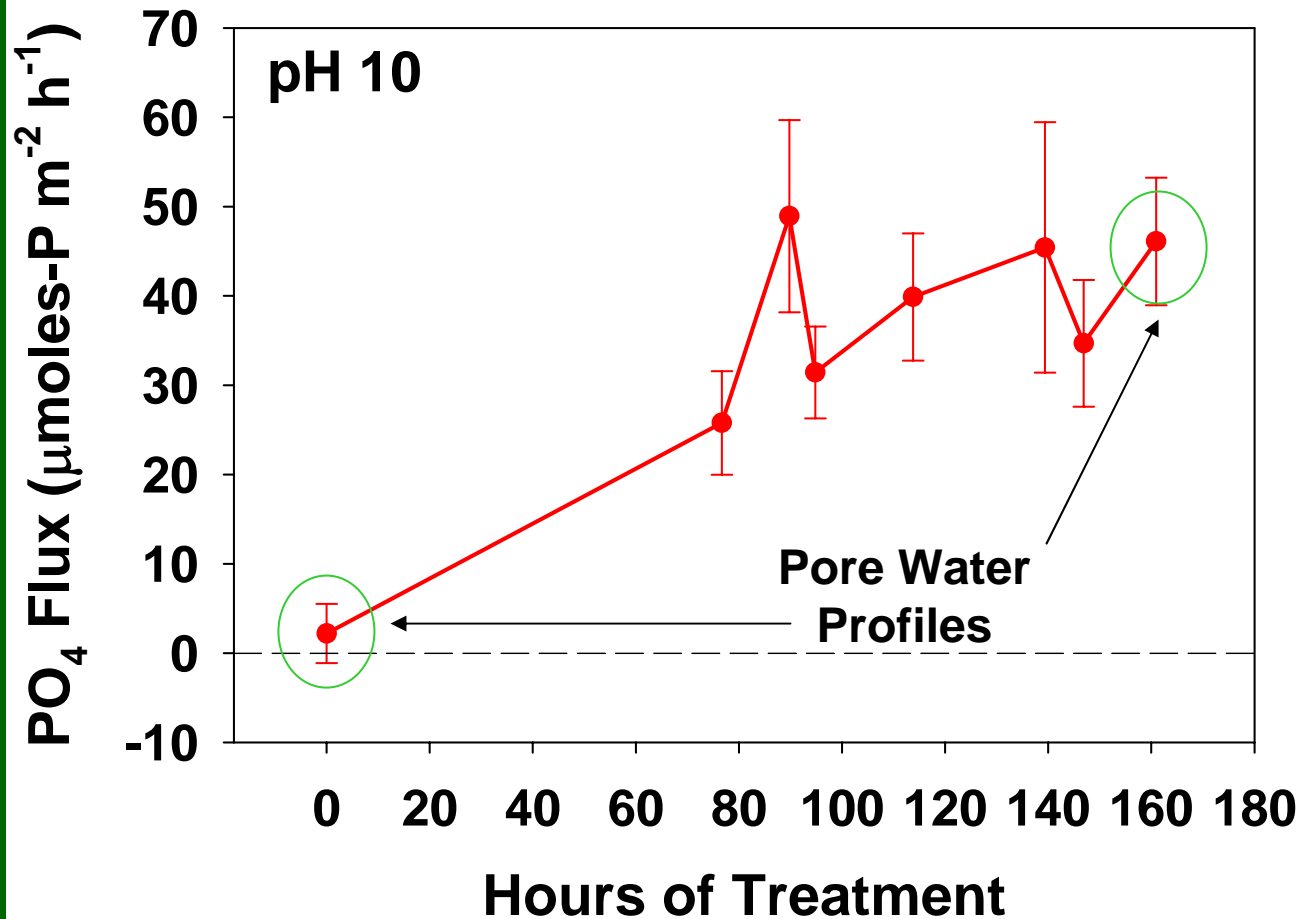


(Data from Callender 1982, Potomac TMDL 2002 and this study)

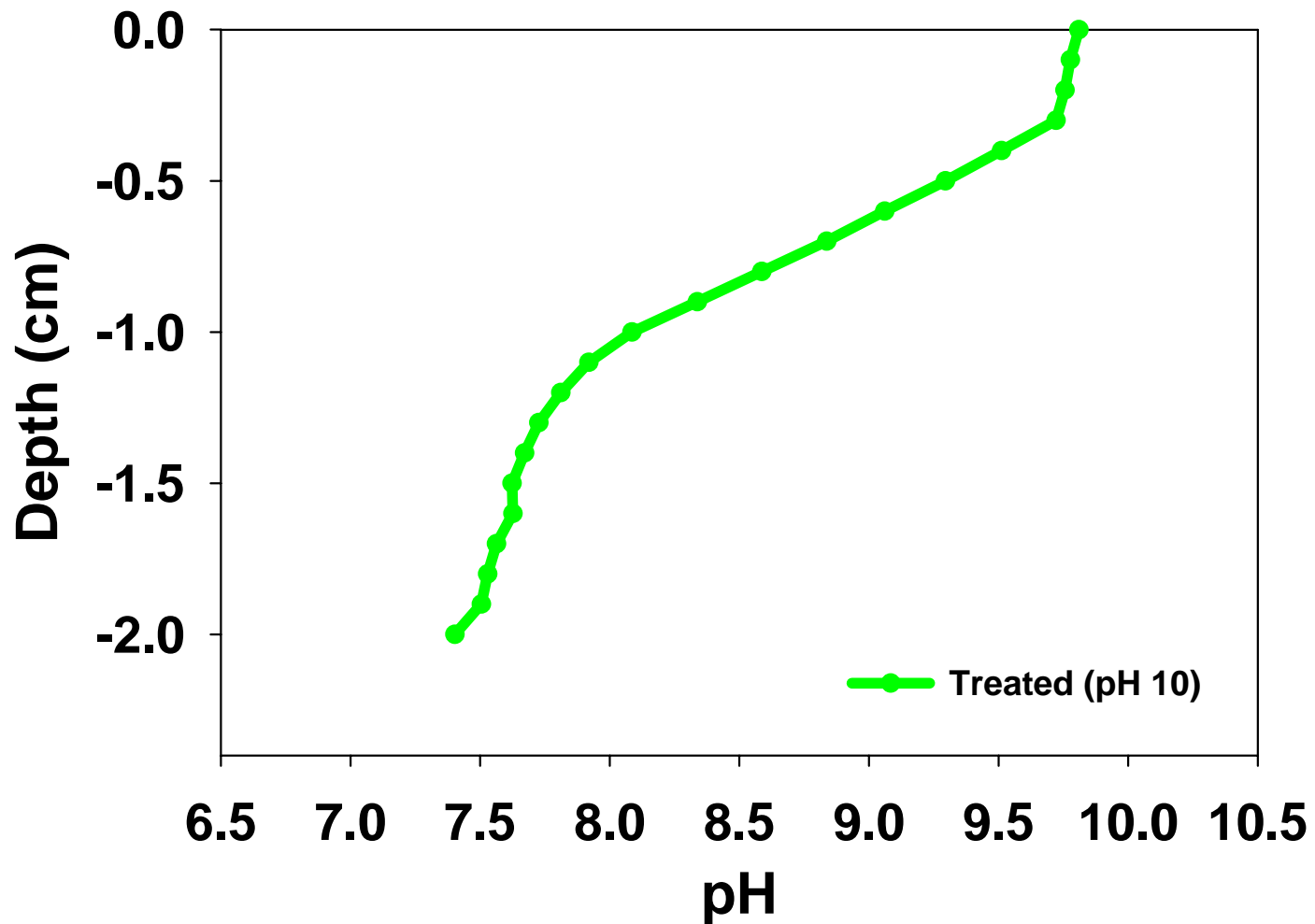


# Results

## May 2004 Potomac River pH Response Sediment $\text{PO}_4$ Flux

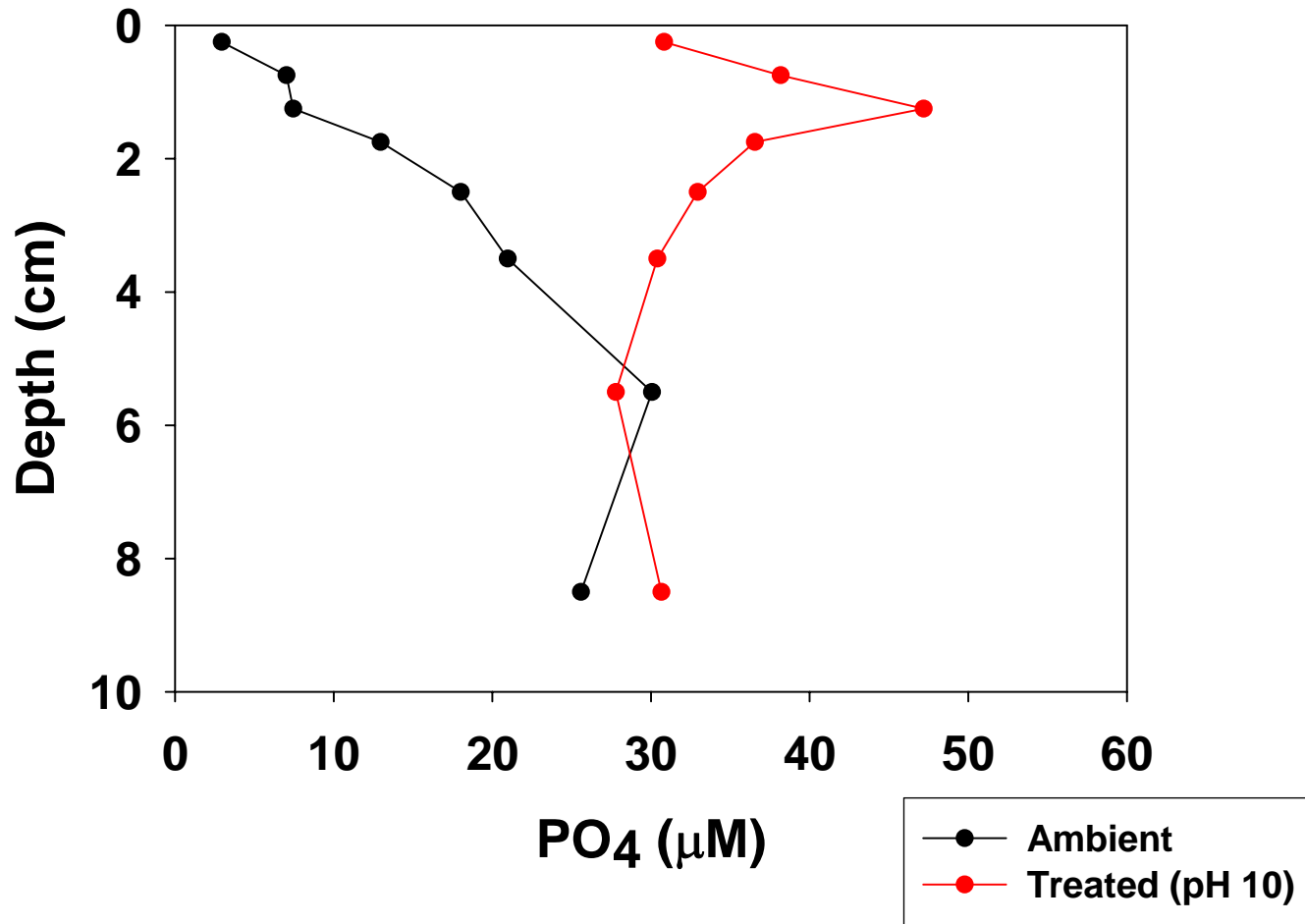


# May 2004 Potomac Sediment Microelectrode Profiles

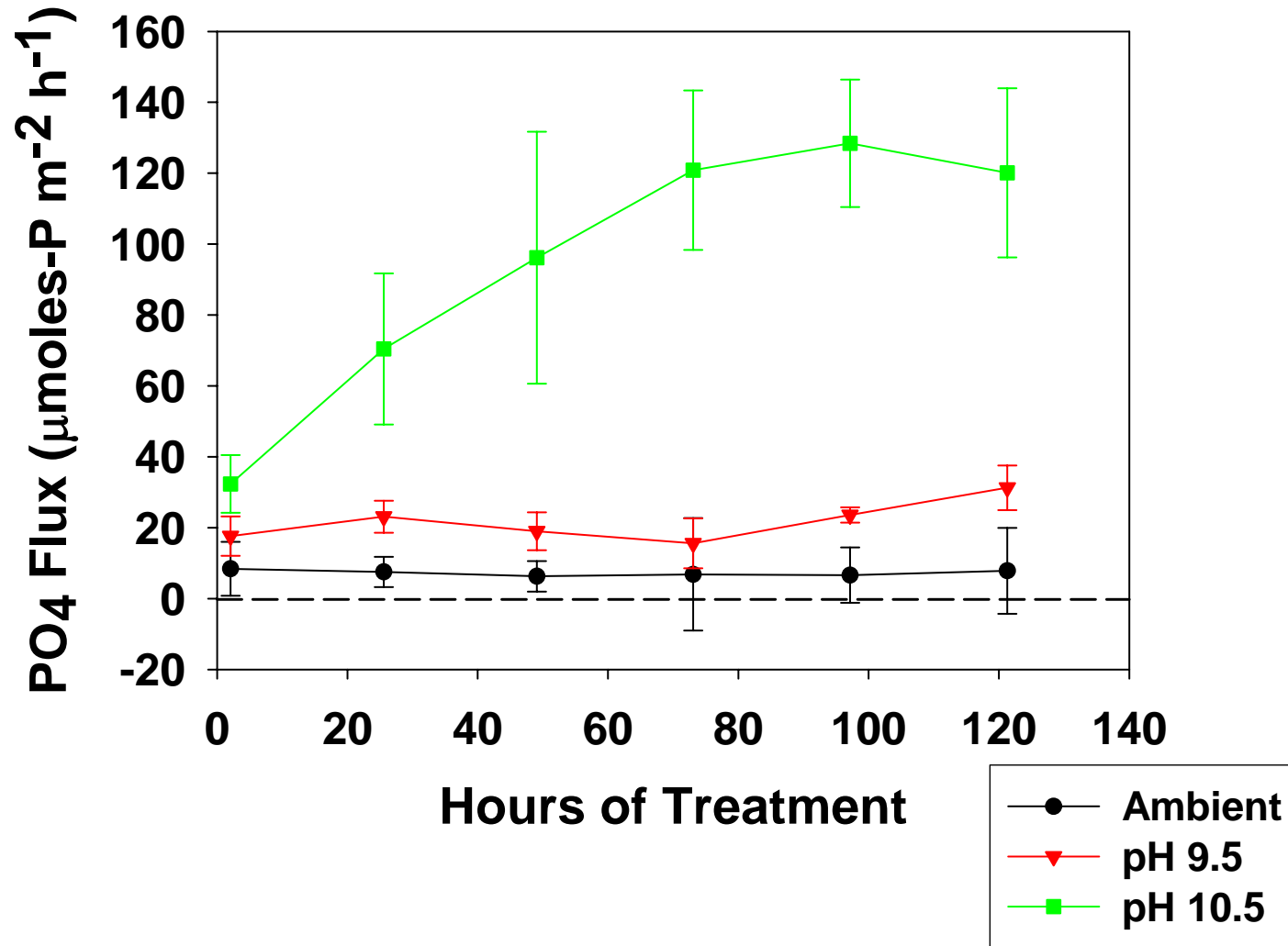




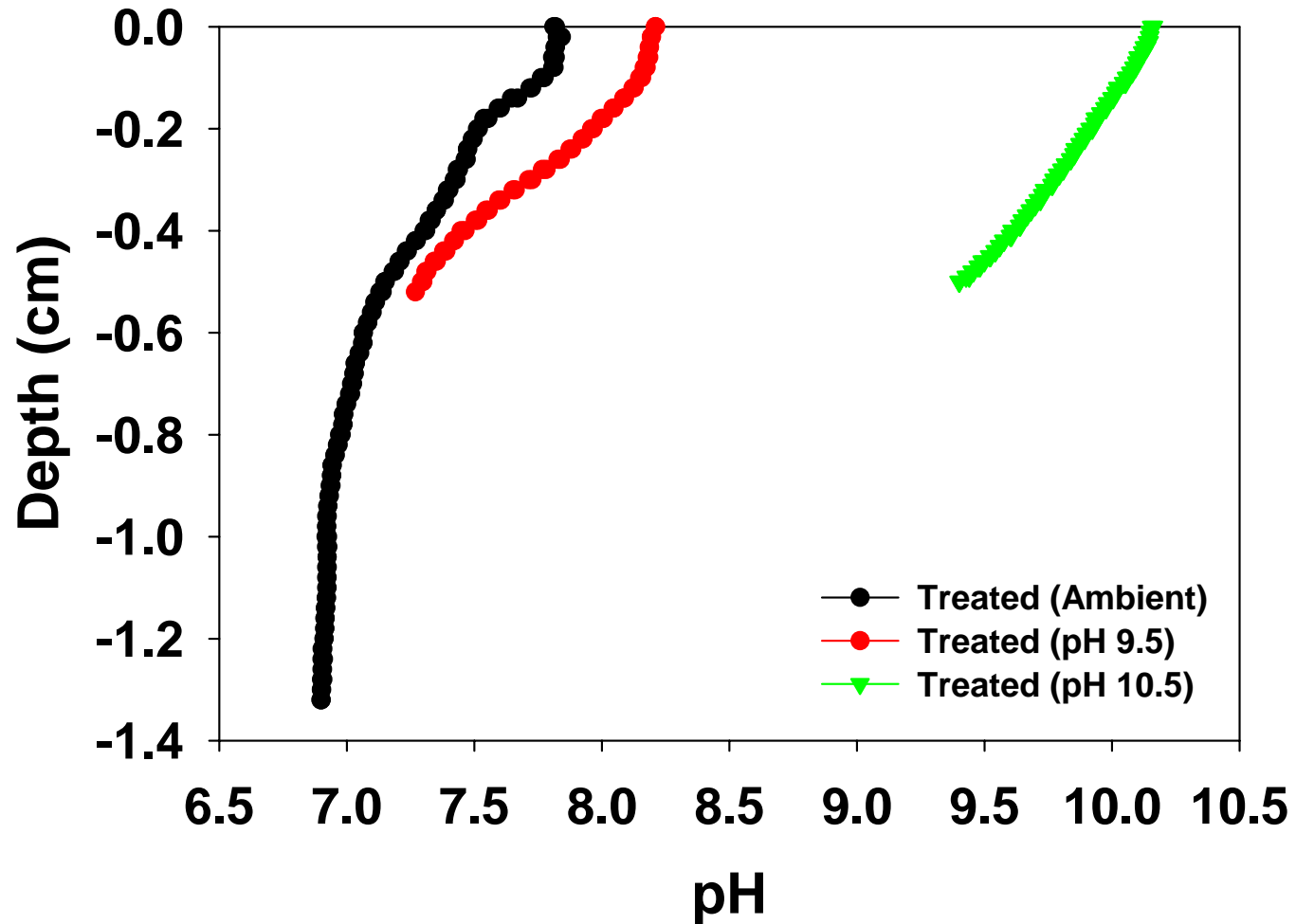
# May 2004 Potomac Sediment Pore Water Profiles



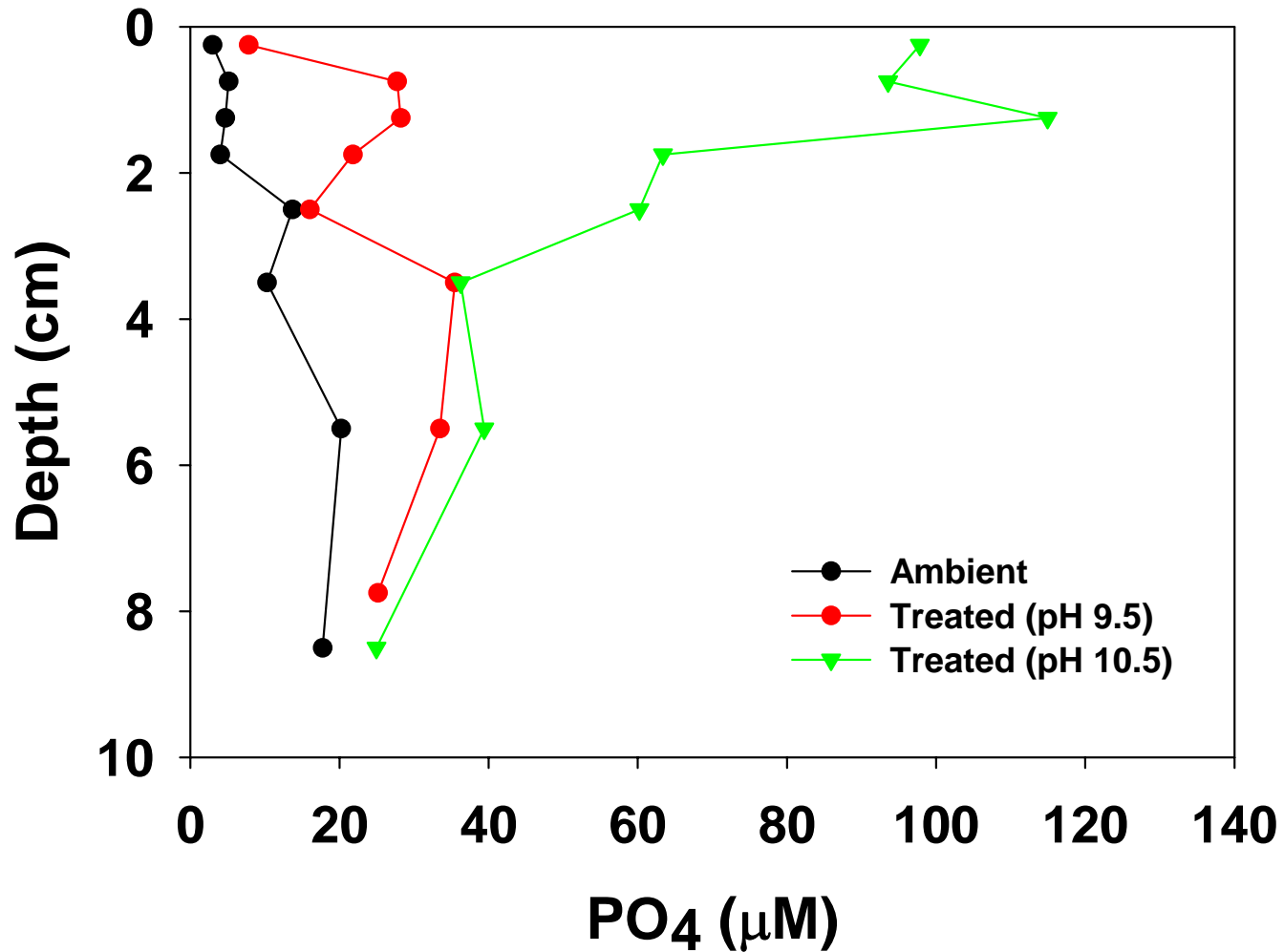
# July 2004 Potomac River pH Response Sediment $\text{PO}_4$ Flux



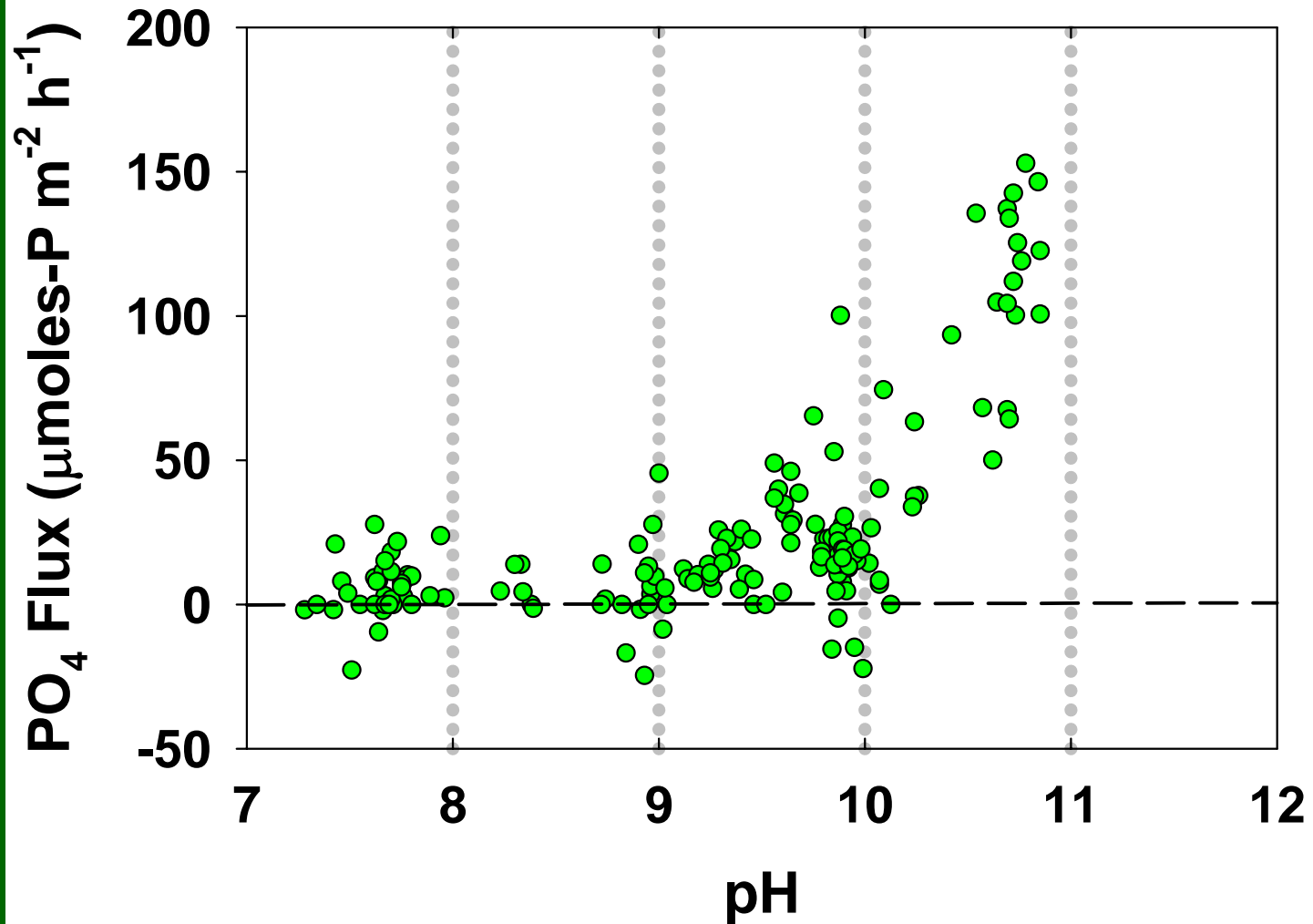
# July 2004 Potomac River pH Response Sediment Microelectrode Profiles



# July 2004 Potomac Sediment Pore Water Profiles



# Potomac Sediment $\text{PO}_4$ Flux



# Conclusions

- Sediment  $\text{PO}_4$  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  $\text{PO}_4$  concentrations responded to elevated pH; large concentrations observed at sediment surface

# Conclusions

- **Concerned about extreme pH (>10) needed to achieve large increases in sediment PO<sub>4</sub> releases**
  - **These very high pH values rarely observed in the field**
- **Other potential mechanisms of PO<sub>4</sub> release need exploration**
  - **Prime candidate is PO<sub>4</sub> release from tide / wave re-suspended bottom sediments**

## Acknowledgements

**CBL NASL**

**CBL RFO**

**Paul Smail**

**Maria Ceballos**

**Eric Buck**

**Heather Soulen**

**Sarah Greene**

**Erica Kiss**

**Jennifer O'Keefe**

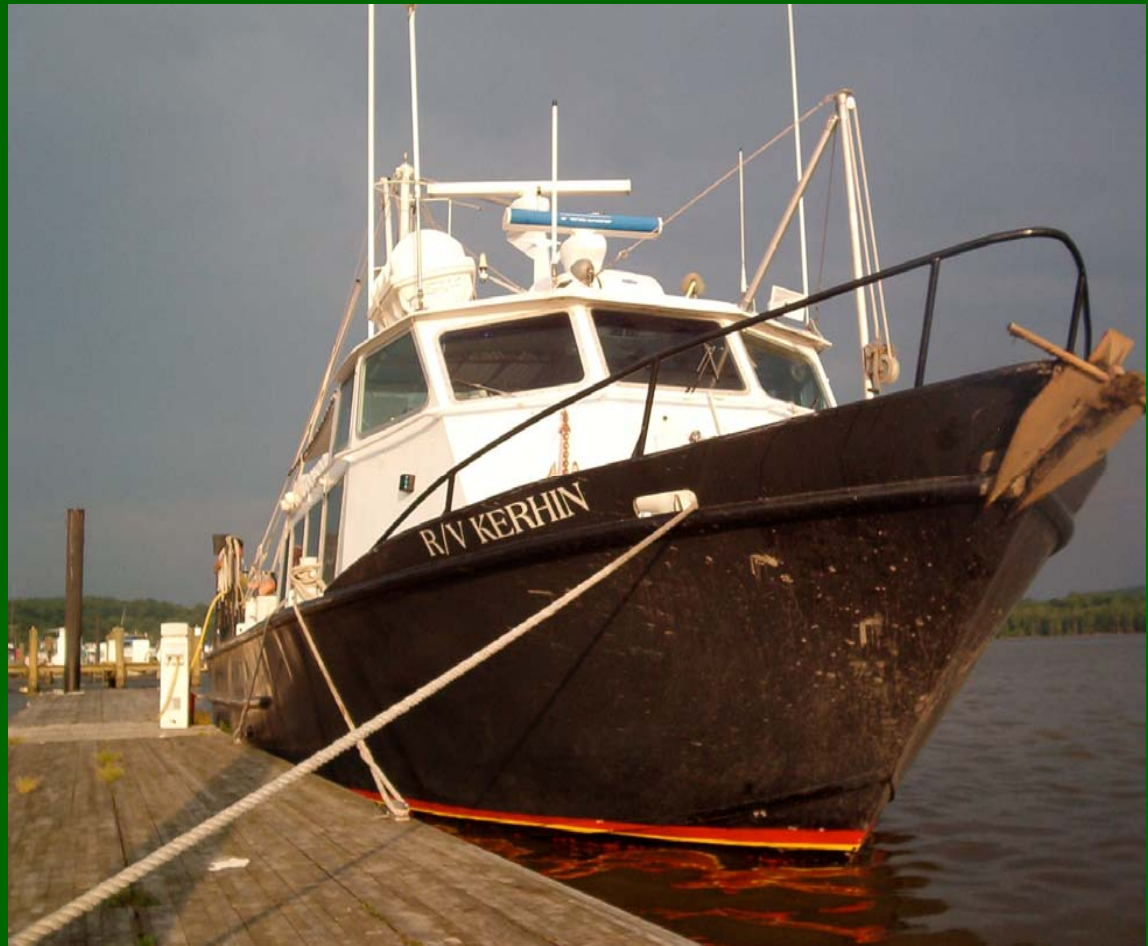
**Jessica Burton**

**Becky Holyoke**

**Capt. Rick Younger (MDDNR)**

**Carlton Haywood (ICPRB)**

**Nauth Panday (MDE)**



## Funding

**ICPRB (Interstate Commission on the Potomac River Basin**

**MDE (Maryland Department of the Environment)**