Sediment Composition and Diagenesis

Jeffrey Cornwell

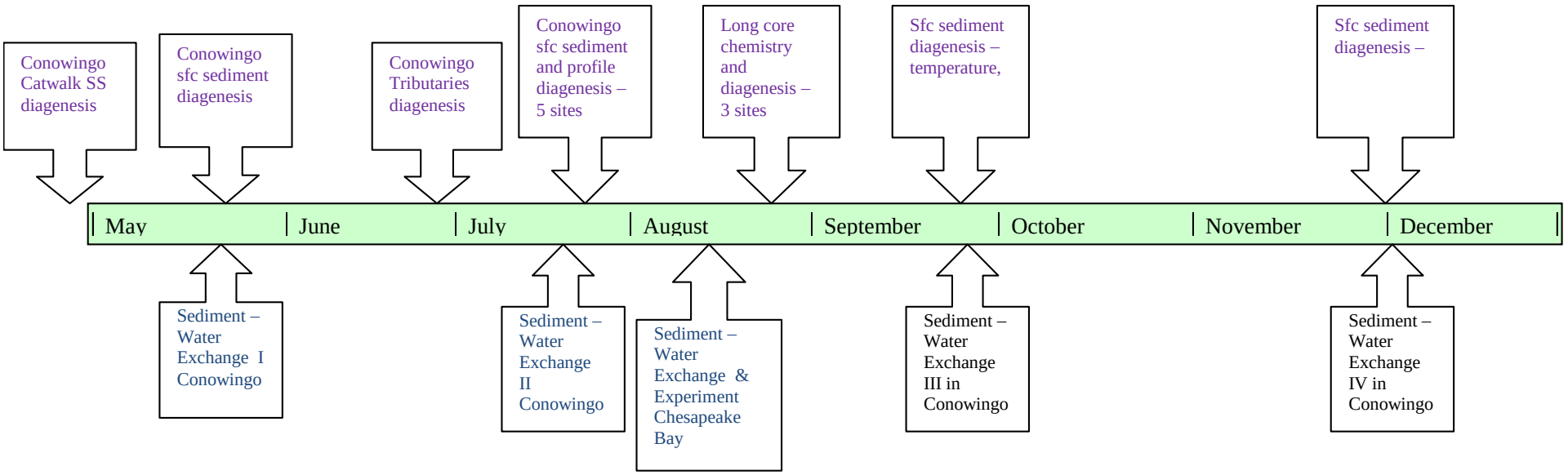
Hamlet Perez, Michael Owens, Alison Sanford, Kabrena Owens, Rose Geranio

Zoe Vulgaropulos

Central Questions

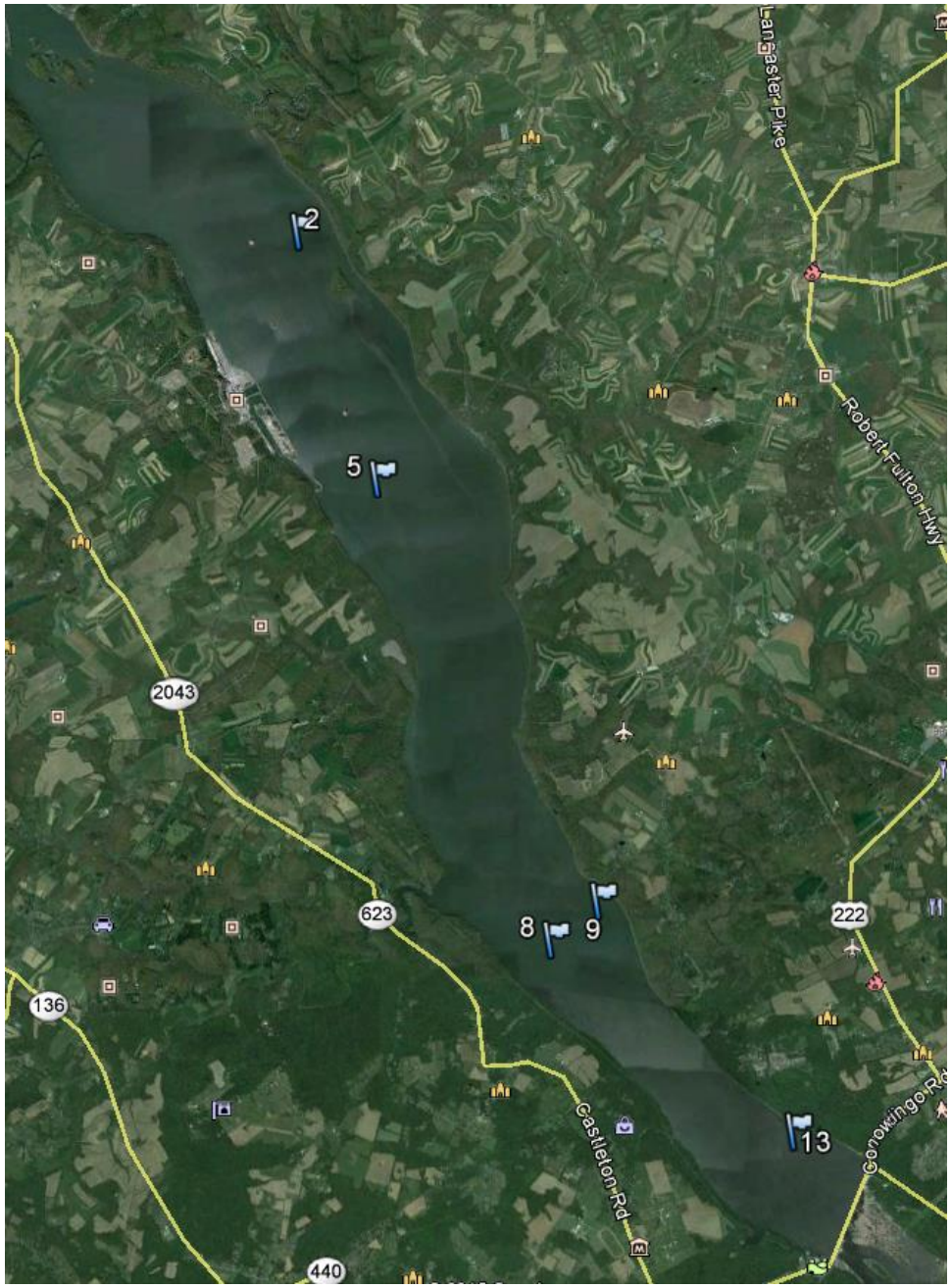
- What is the bioavailability of N and P in particulate material entering and leaving the Conowingo Reservoir?
- How biogeochemically reactive are Conowingo sediment deposits within the reservoir?
- Are scoured Conowingo sediments a new source of nitrogen?

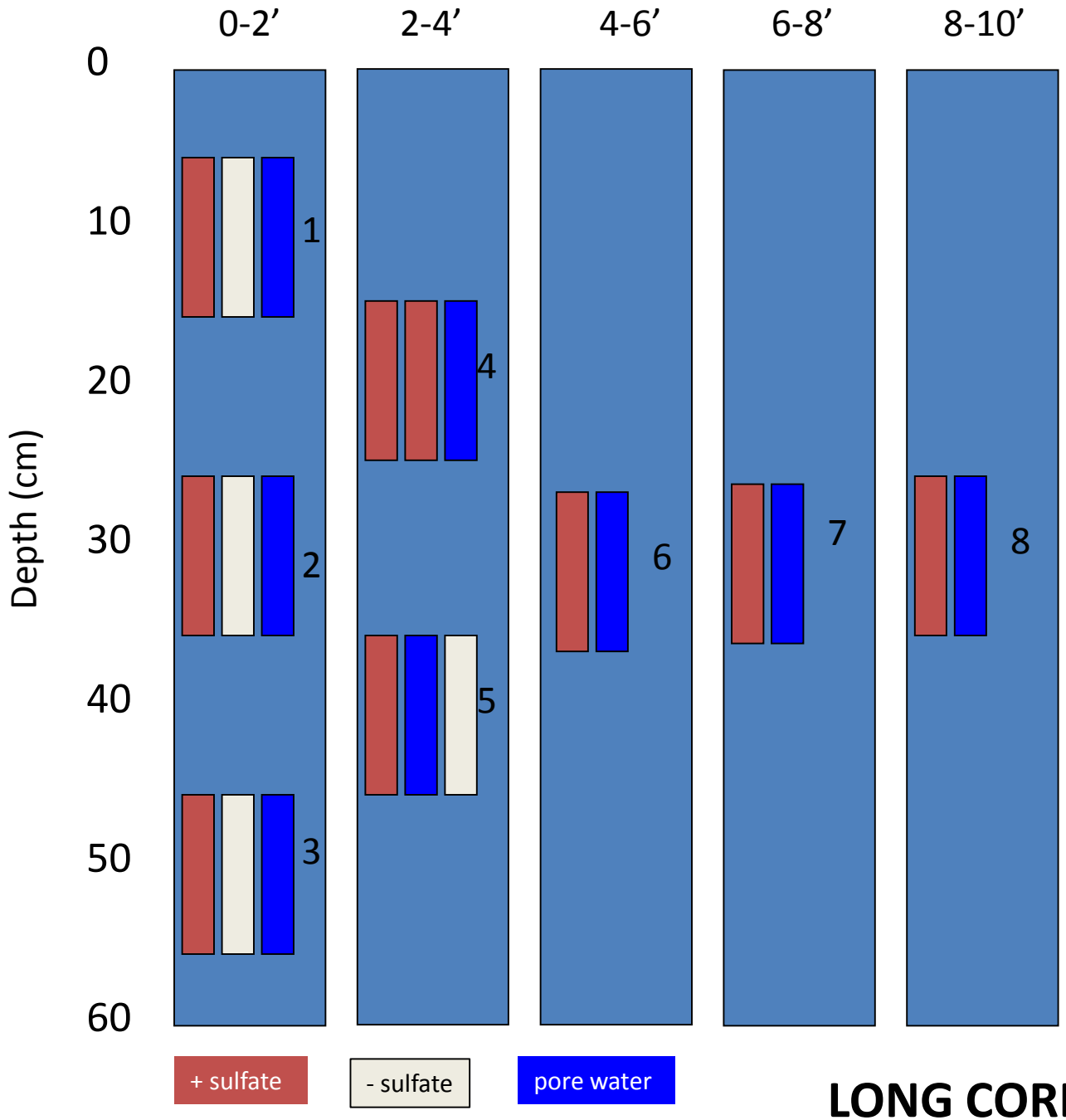
Conowingo Biogeochemistry Timeline



Next Sediment Sampling – Post Freshet Sampling in Reservoir and in Chesapeake Bay

Long Cores


2
5
2043
623
8
9
222
136
13
Lancaster Pike
Robert Fulton Hwy
Castleton Rd
Conowingo Rd
440



Plus sulfate simulates estuarine conditions

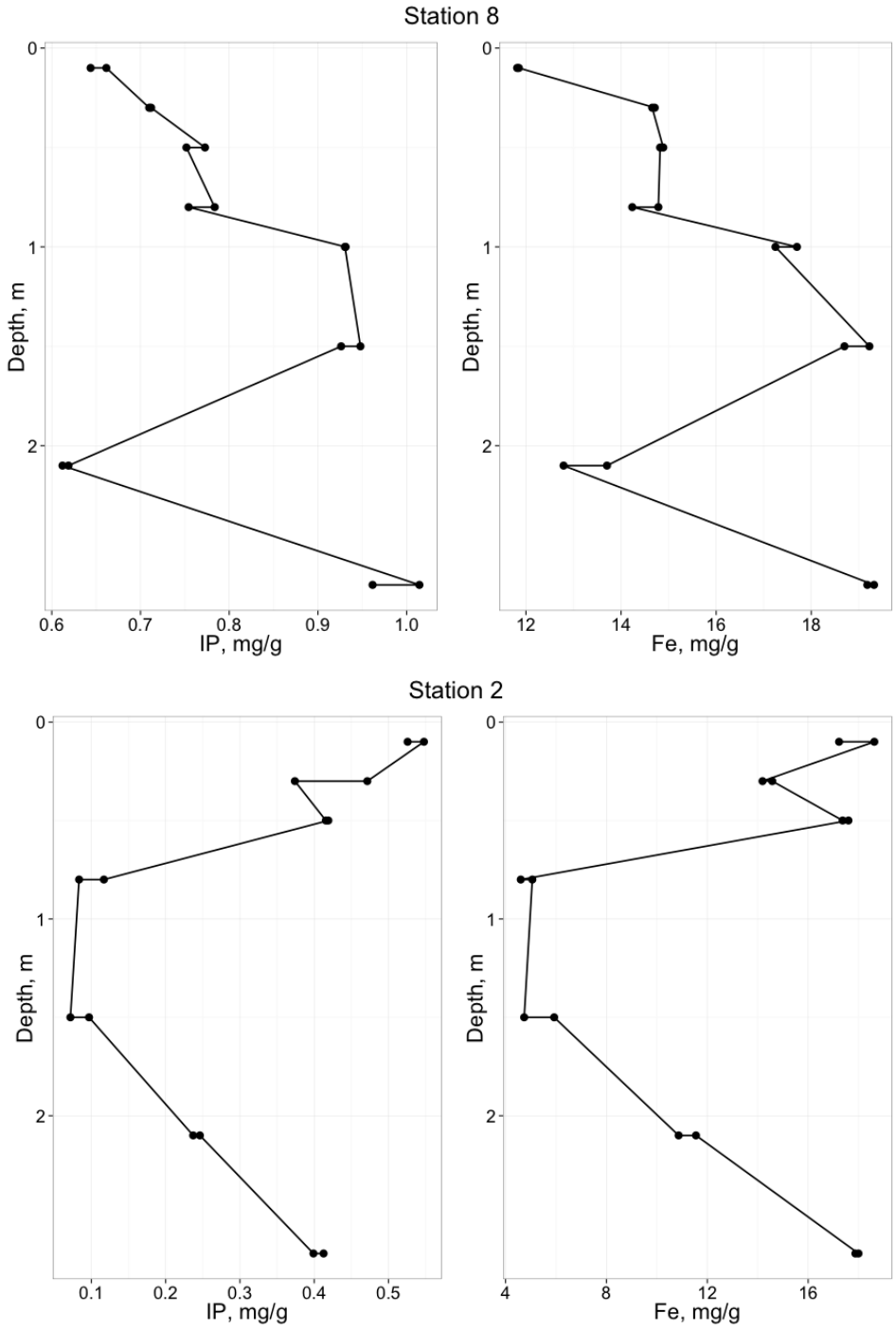
Minus sulfate simulates reservoir conditions

Time course underway for 8-9 months

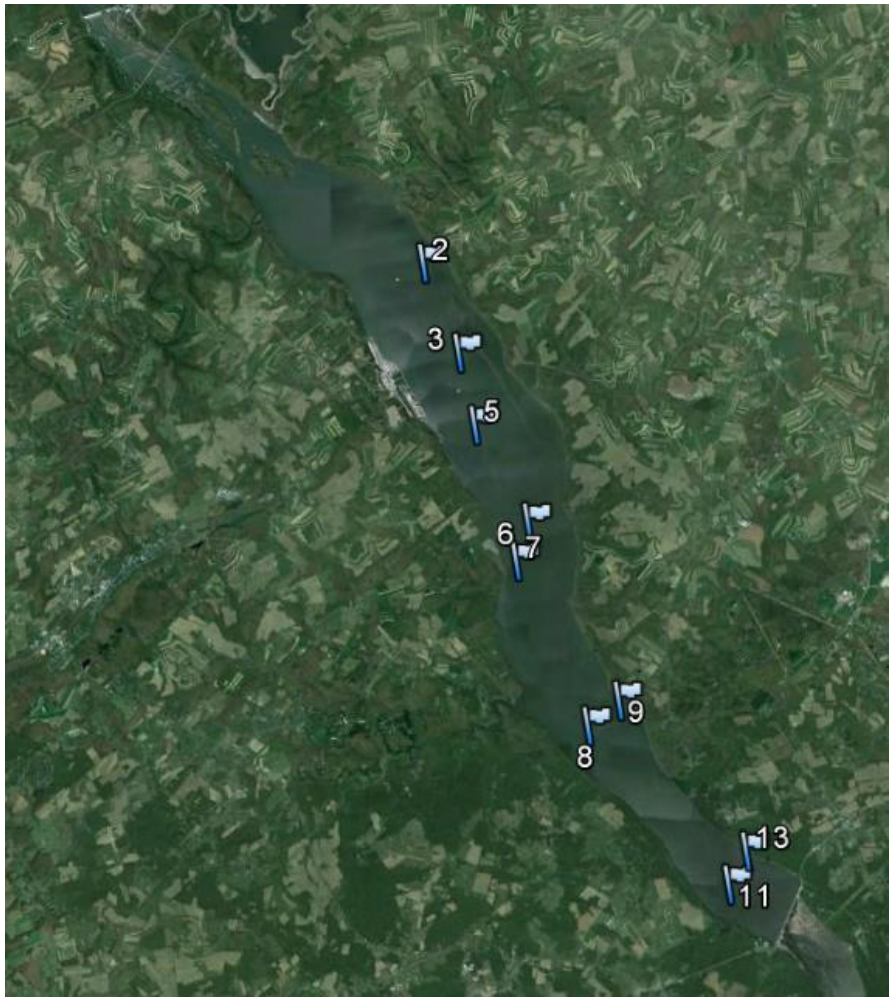
LONG CORE SEGMENTATION

Vertical profiles of HCl-extractable inorganic P and Fe

- Concentrations similar to previous Conowingo sediment data
- The strong correlation between Fe and IP is expected, it is likely that down core grain size differences account for some of the highs and lows.
- Highest iron concentrations approach 2%
- Data from Zoe Vulgaropulos



Sediment-Water Exchange

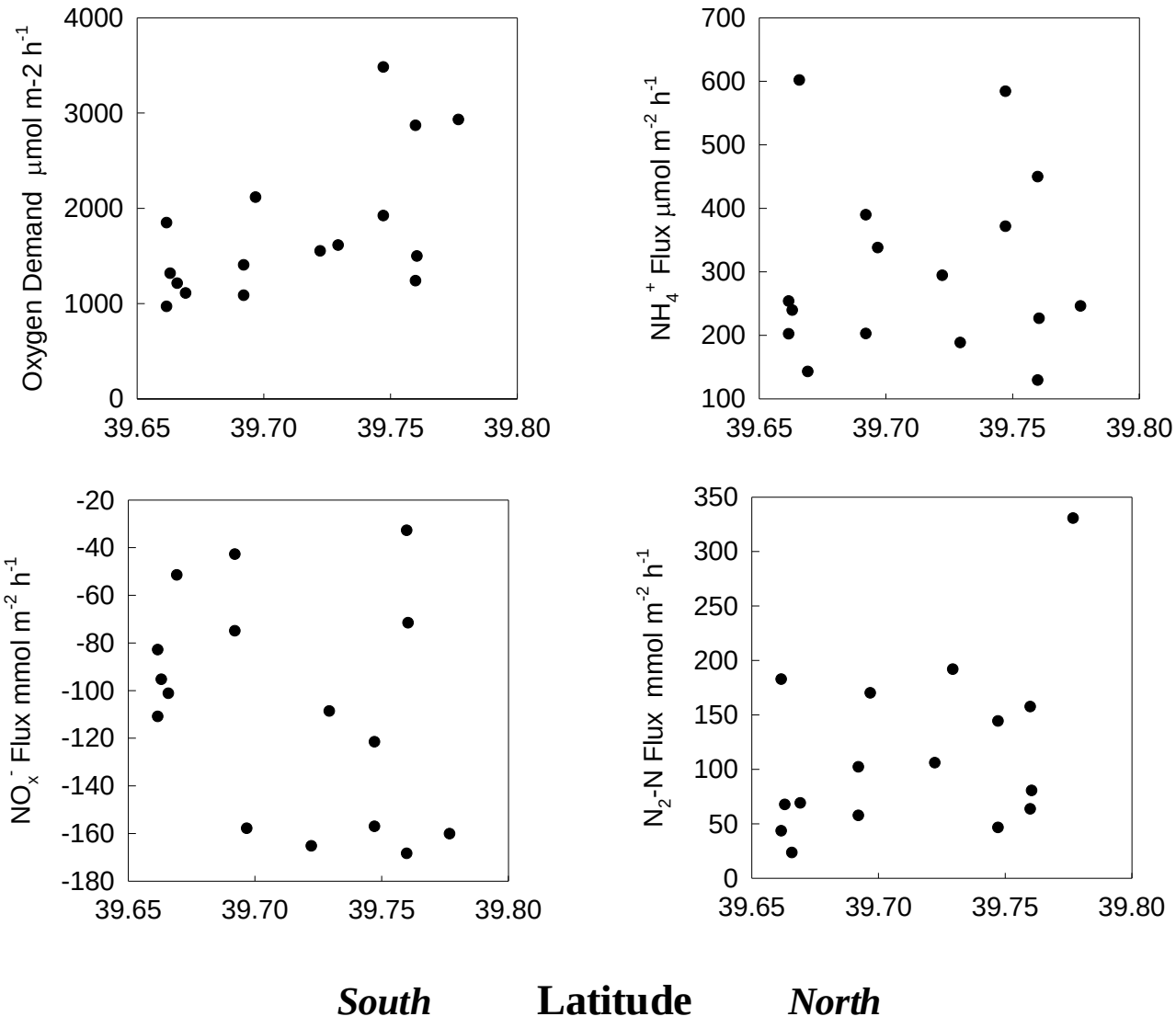


Sampled in May, July, September and December 2015

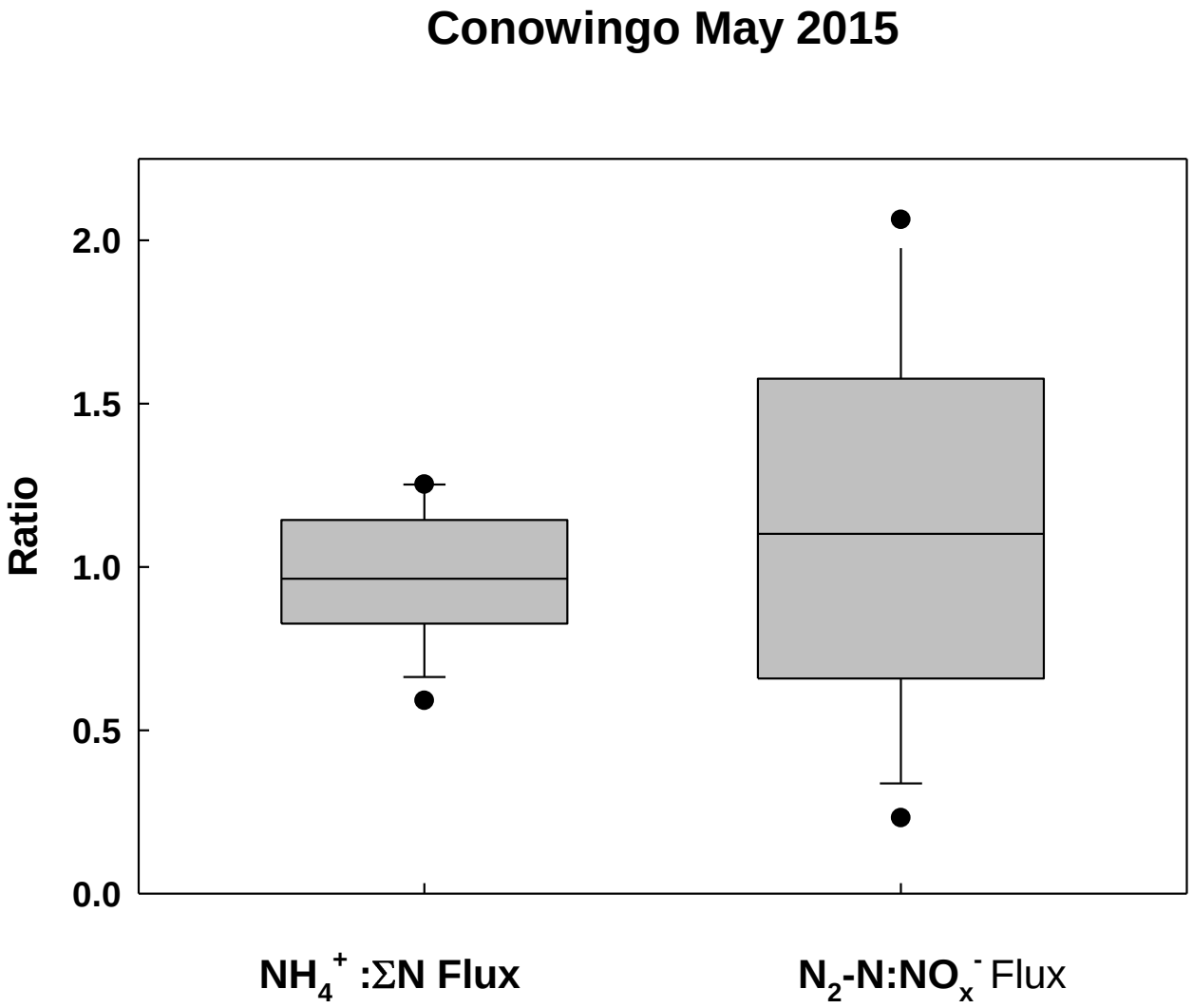
Sediment-Water Exchange

- We collected cores from 13 sites in May with some replication
- Subsequent fluxes used fewer sites and duplicate cores in all cases
- Fluxes of soluble reactive P, ammonium, nitrate, oxygen and di-nitrogen (denitrification)
- Rates from the Conowingo Reservoir in May, July, September, and December
- Bay cruise in August from 4 stations

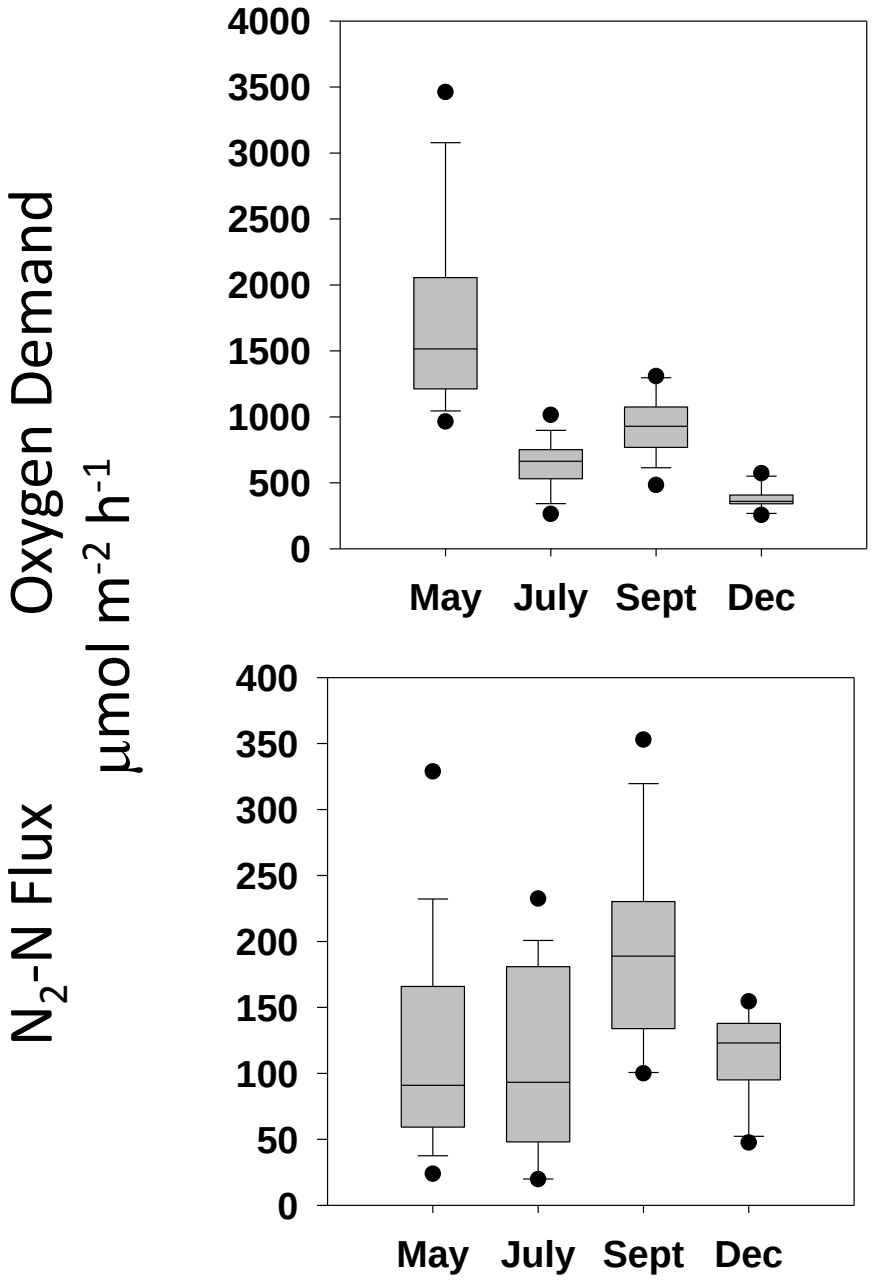
May 2015


Oxygen Demand µmol m-2 h-1
4000
3000
2000
1000
0
39.65
39.70
39.75
39.80
NH4+ Flux µmol m-2 h-1
700
600
500
400
300
200
100
NOx- Flux mmol m-2 h-1
-20
-40
-60
-80
-100
-120
-140
-160
-180
N2-N Flux mmol m-2 h-1
350
300
250
200
150
100
50
0
South
Latitude
North

Most denitrification from water column nitrate, most net N flux as ammonium

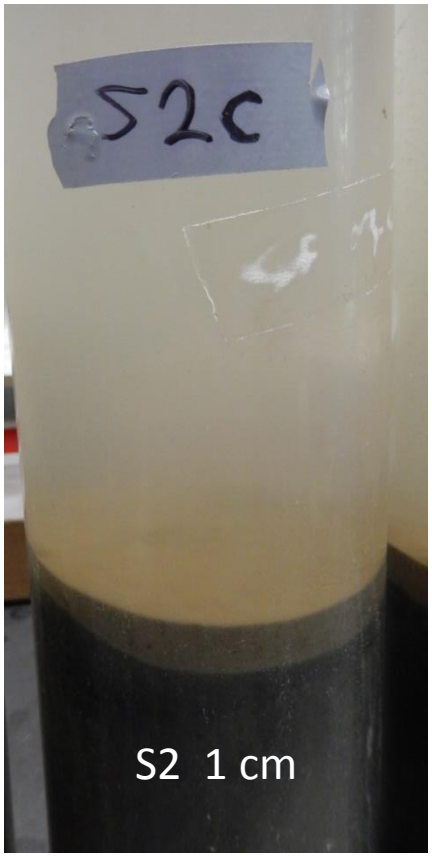


- Strong rate of oxygen uptake and nutrient regeneration in May
- Denitrification has a spike in September, but always fairly high



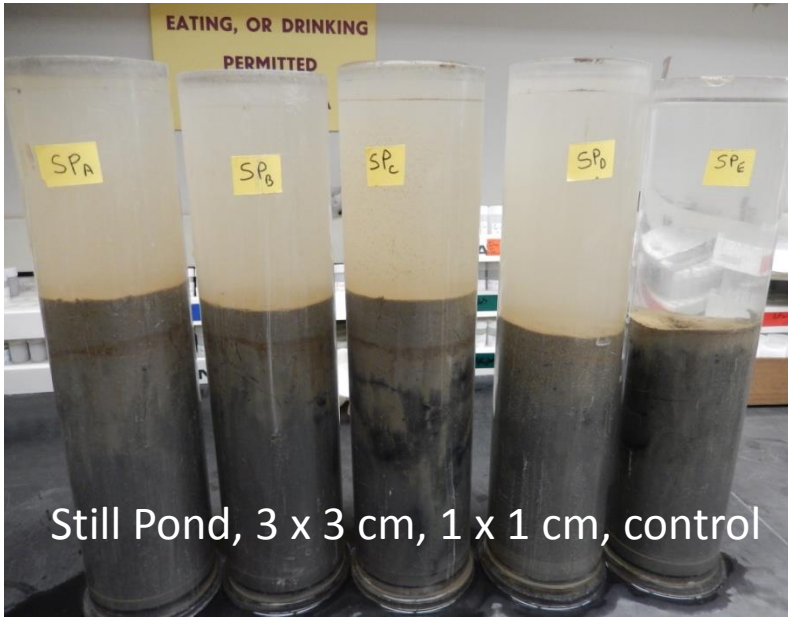
Sites for August Cruise Sampling

Sediment Additions



S2 1 cm

Still Pond 3 cm
Worm Activity



Still Pond, 3 x 3 cm, 1 x 1 cm, control

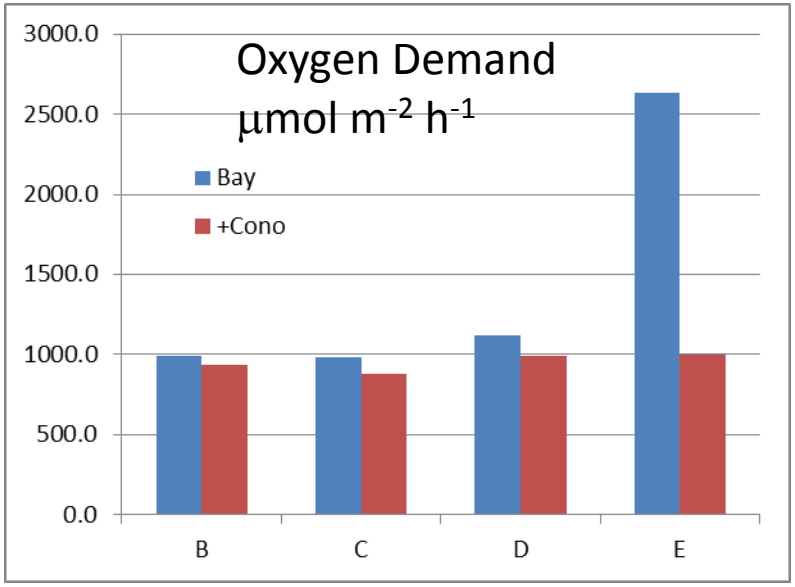
Still Pond Experiments – Upper Bay

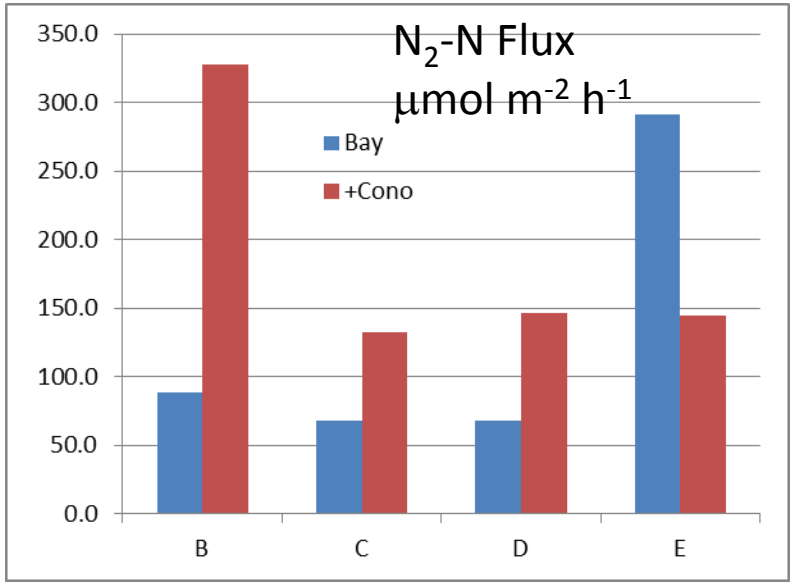
4 Cores

10 Day Incubation With 0.5-1.0 cm Of Conowingo Sediments

Core E Appears Different Than the Others

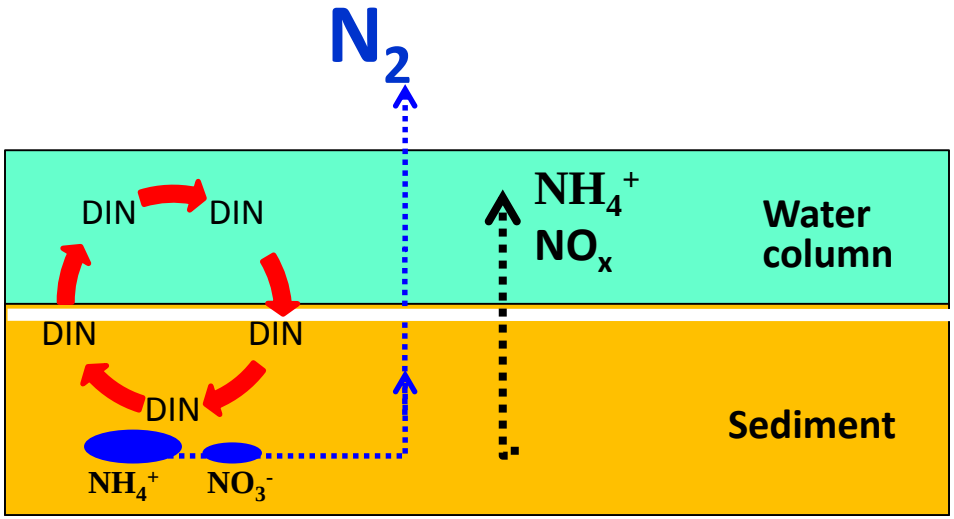
3 ouat of 4 show enhanced denitrification – need final ammonium flux calculations….





Core ID

Conowingo Versus Bay Data



Denitrification efficiency

Half is denitrified, the rest (mostly) returned as ammonium

Denitrification Efficiency (%)	
Cono	CBay
49	47

Conclusions

- Conowingo sediments appear highly reactive for N cycling, not for P cycling
- The return of inorganic N as ammonium is equally efficient in Conowingo as in Bay sediments
- We have a lot of completed analyses, about 1-2 months of data analysis
- The water column work is small, we need higher flows with lots of suspended sediment!