Review of Recent PCB in the Tidal Potomac River

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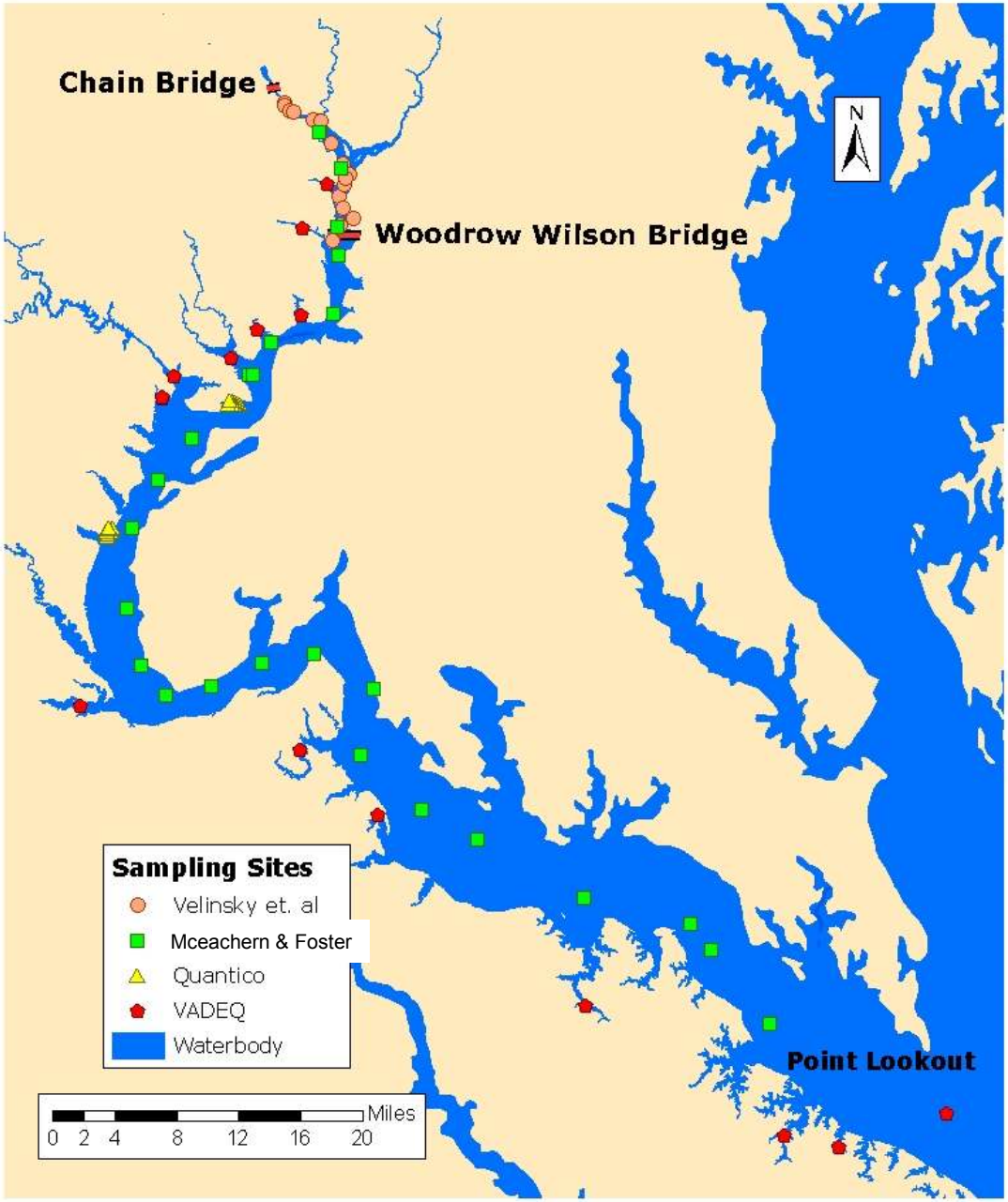
PCB Sediment Data (>2000)

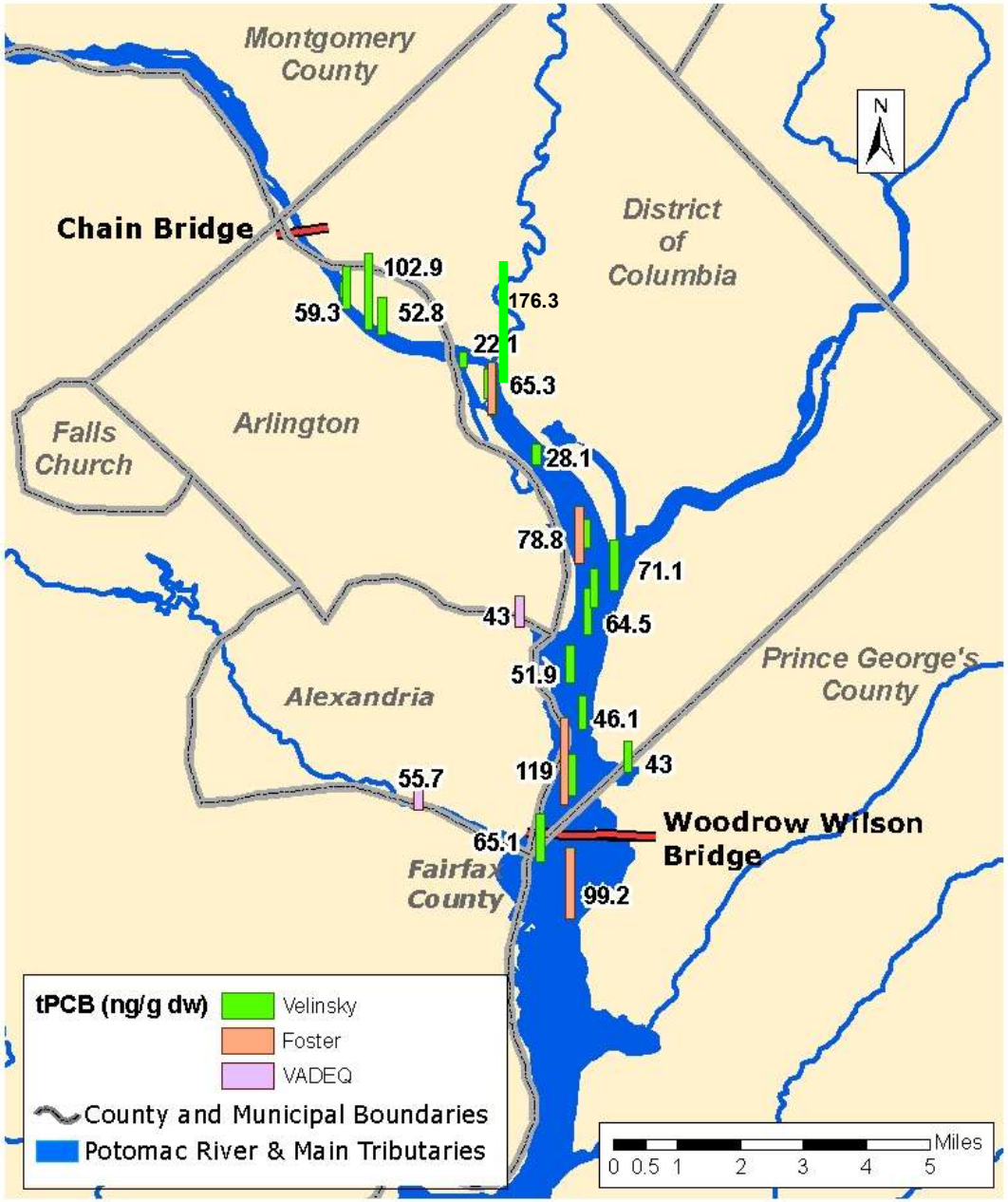
- *Surficial Sediments:*
  - 2000 Anacostia (110 samples)/Potomac River (5) (Velinsky et al.)
  - 2001-200? Lower Tidal Anacostia River (?): LSU
  - 2000 VA Tribs/Embayment (15): (VADEQ)
  - 2000 Mainstem Potomac River (25) (Mceachern and Foster)
  - 2002 Quantico Embayment (23) (Battelle)
  - 2005 VA Trib/Embayments (25): VA DEQ
  - 2005 Mainstem Upper Tidal Potomac River (19) (Velinsky et al.)
  - 2005 Mainstem Lower Tidal Potomac River (XX) (Baker)*
- *Core Sediments*
  - 2003 Lower Tidal Anacostia River (5 cores) (Velinsky et al.)
  - 2005 Mainstem Upper Tidal Potomac River (5) Velinsky et al.)

*** Not analyzed as of yet.** **Red - # of Samples or Cores**

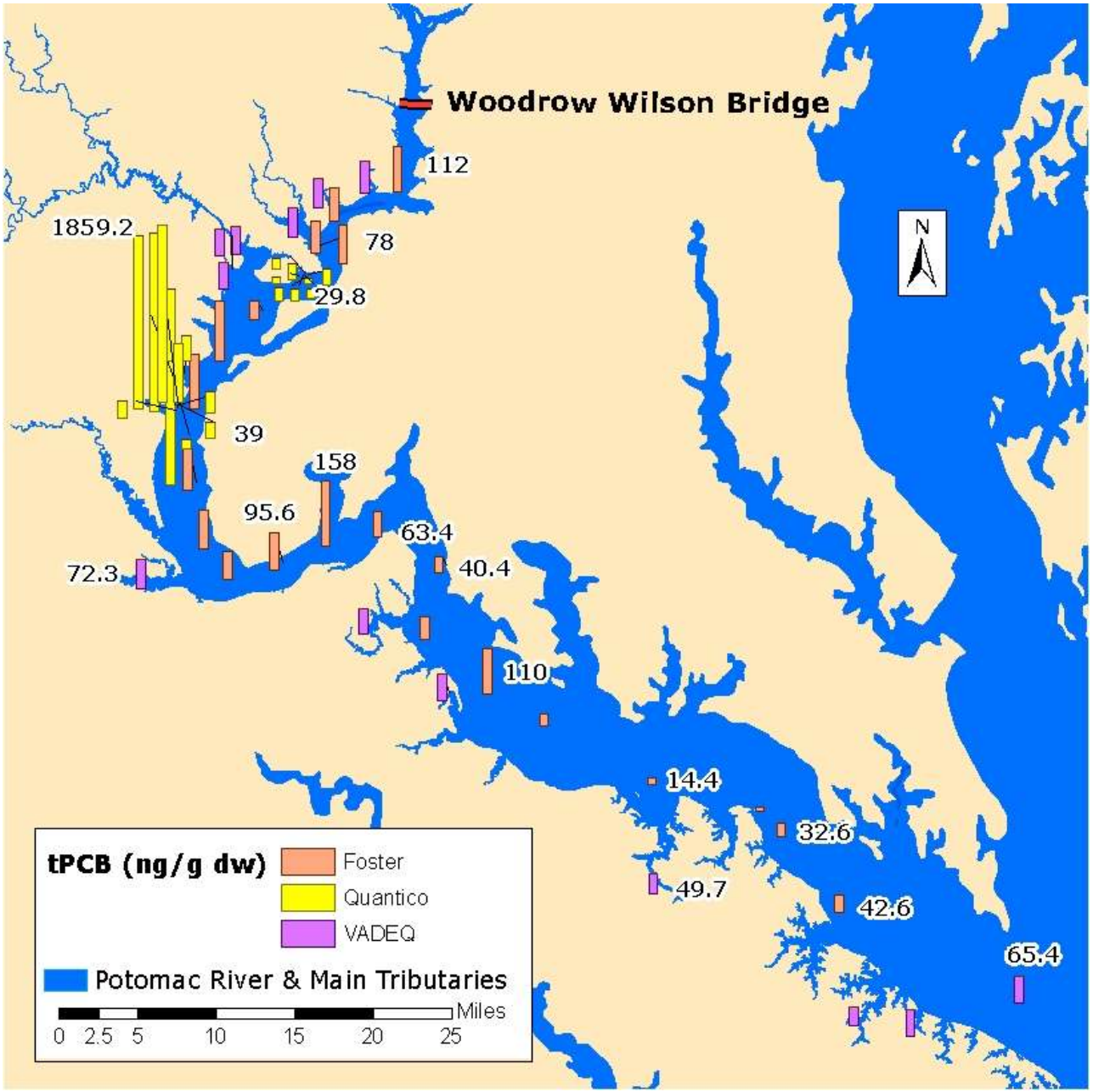
Mainstem Tidal Potomac River: Sampling Locations



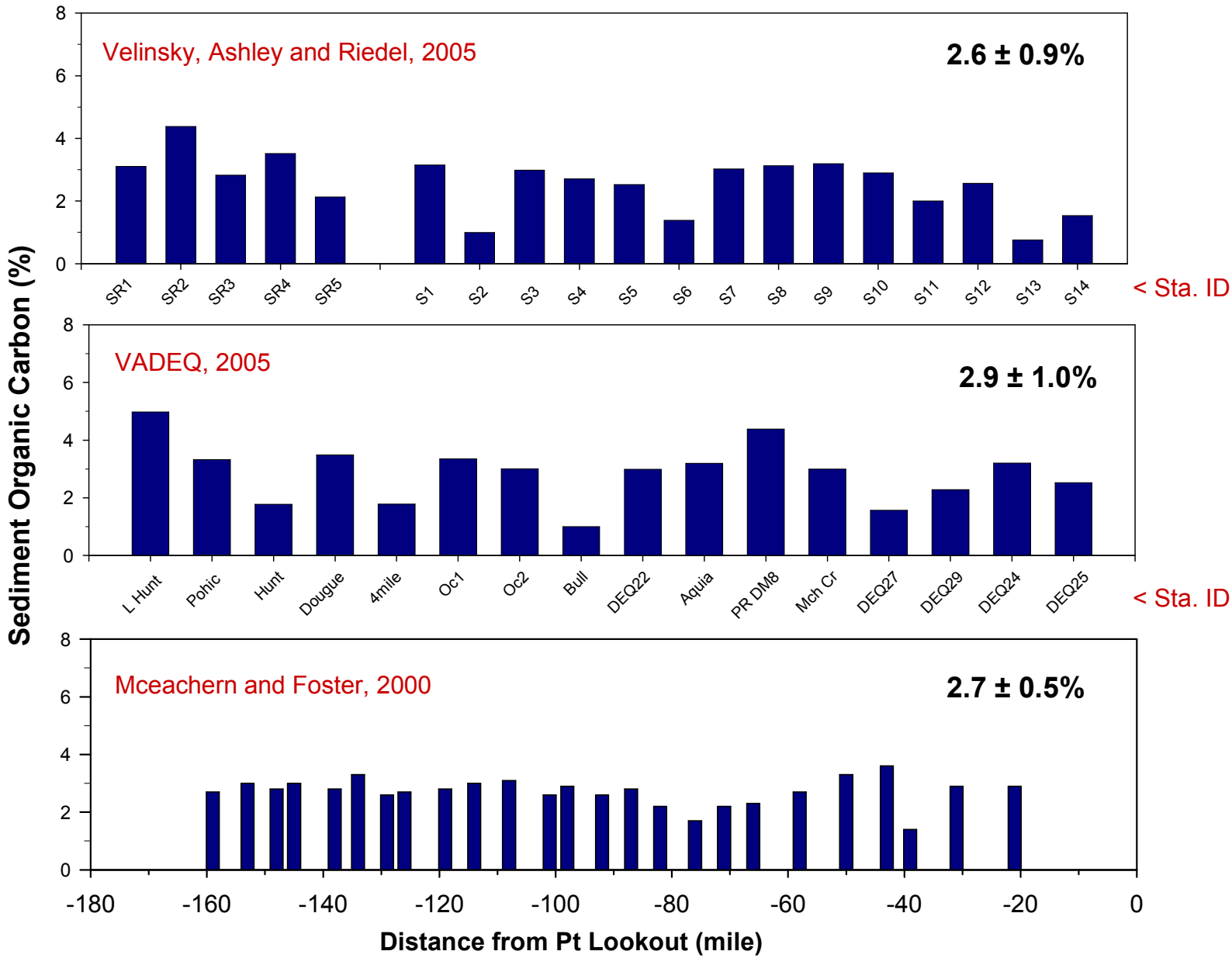
Mainstem Tidal Potomac River: Overview of TPCBs



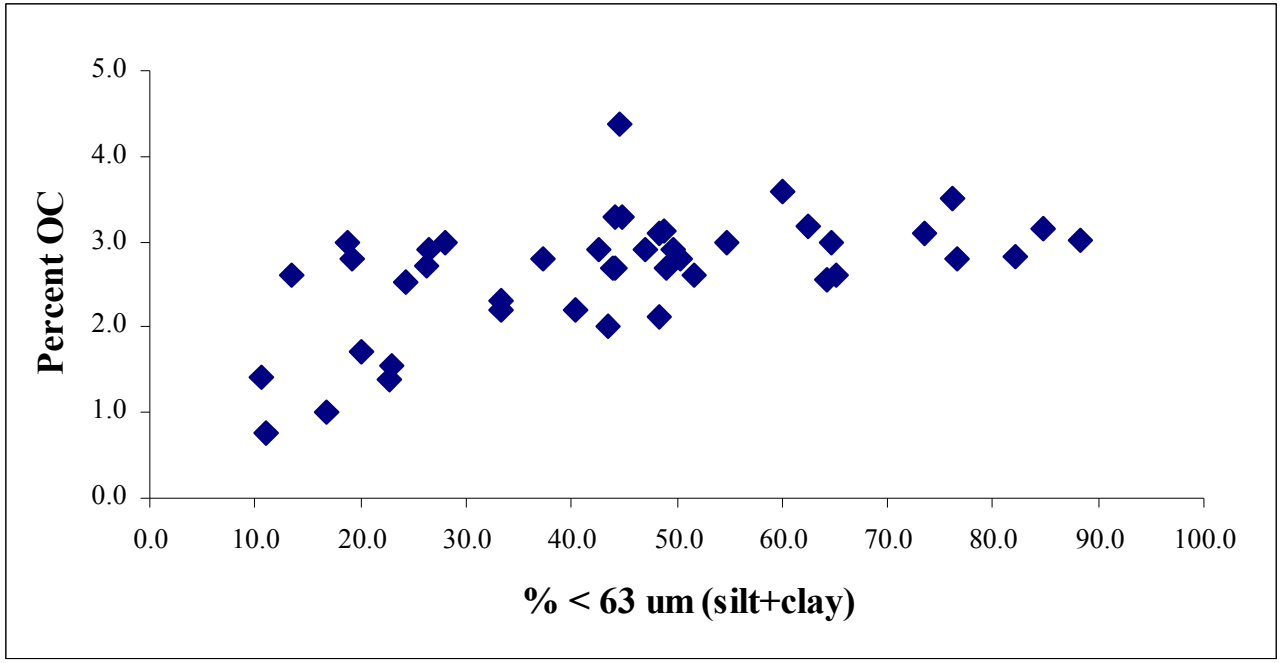
Mainstem Tidal Potomac River: Overview of TPCBs



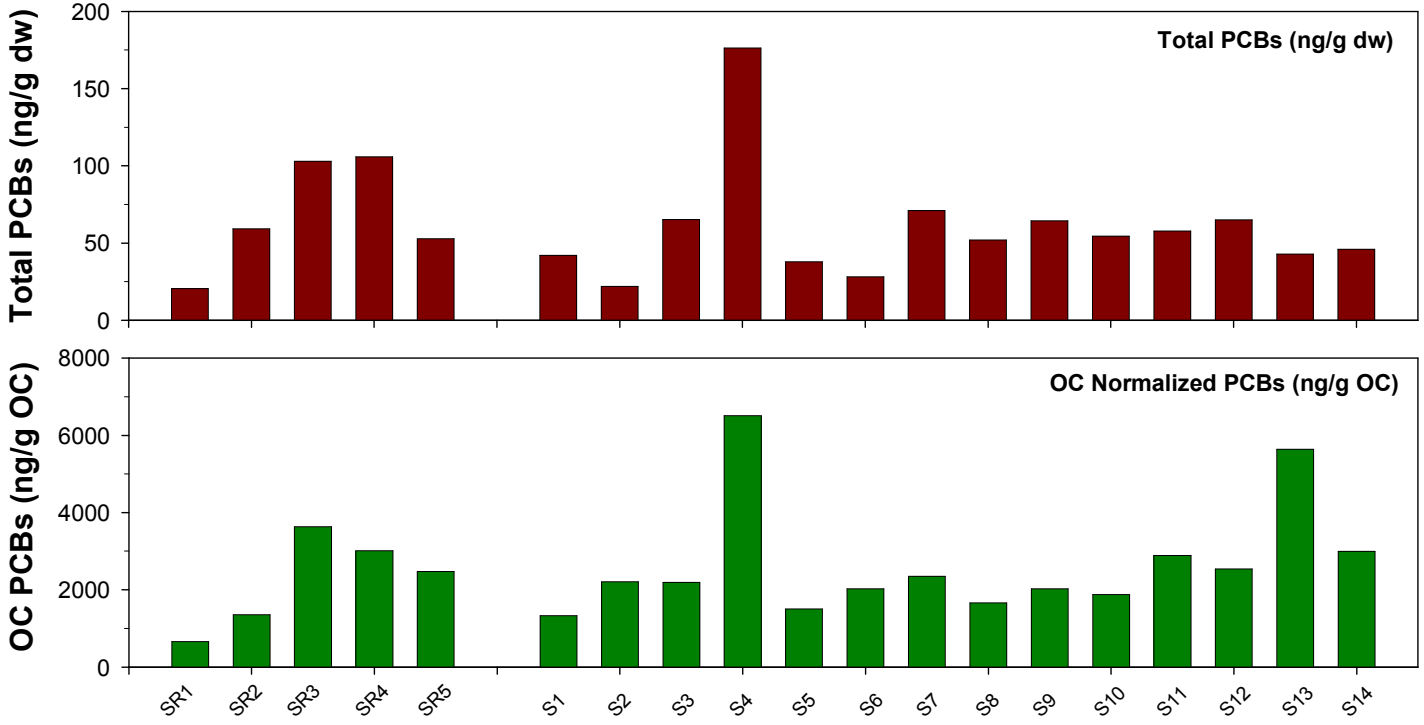
Mainstem Tidal Potomac River: Organic Carbon Distributions



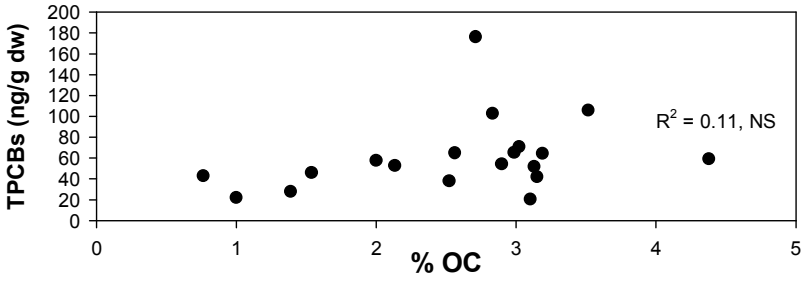
Relationships of Grain Size and Organic Carbon



Mainstem Upper Tidal Potomac River (Velinsky et al, 2005)

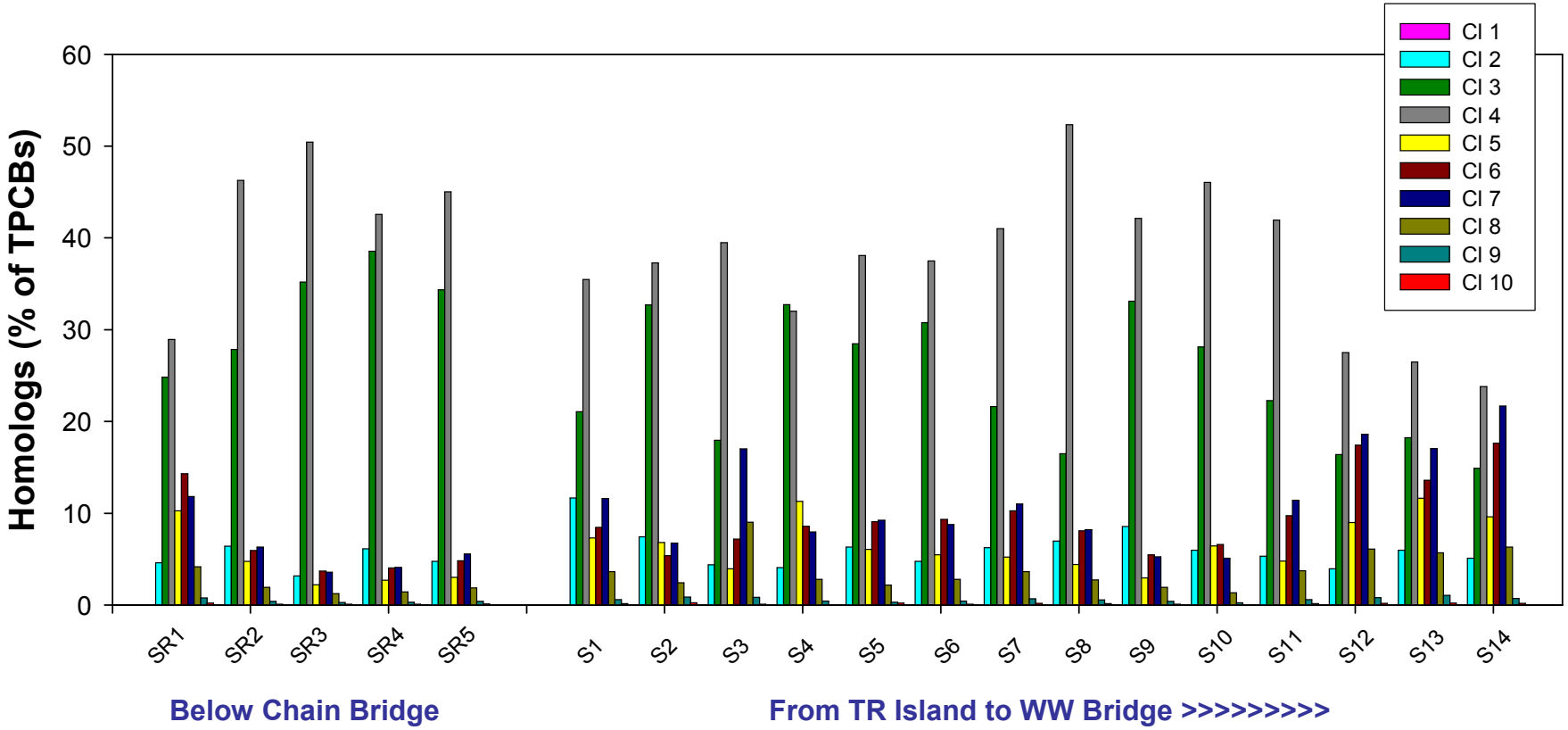


Below Chain Bridge **From TR Island to WW Bridge >>>>>>>>>>**



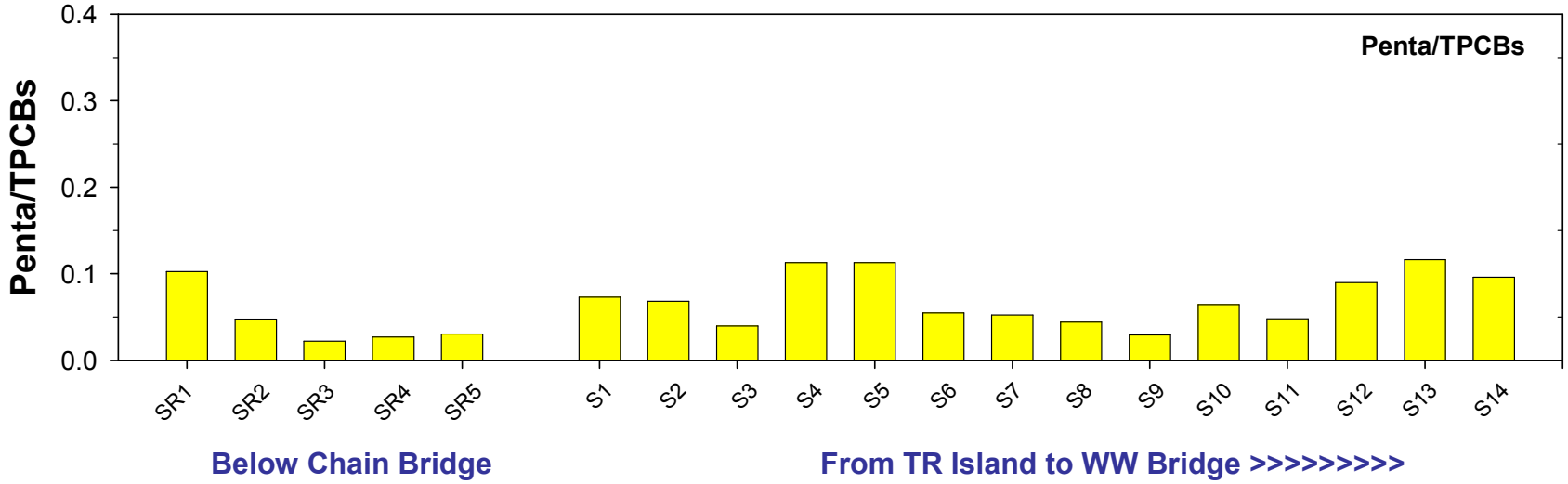
Velinsky, Ashley and Riedel, 2005

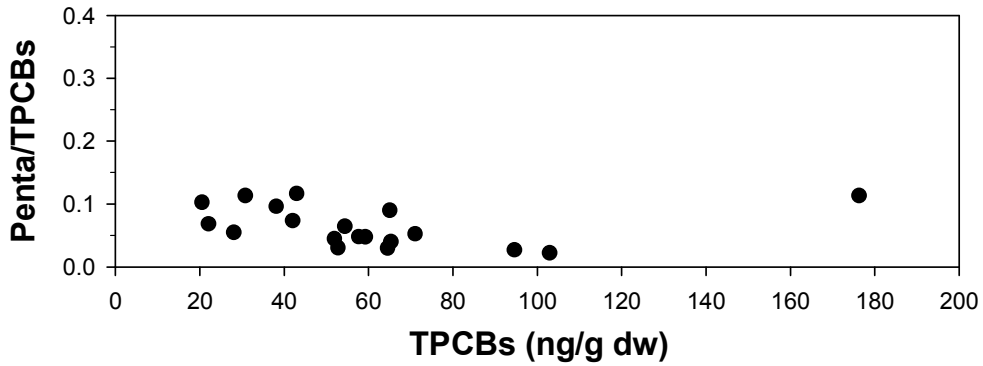
Mainstem Upper Tidal Potomac River: Homolog Distribution



Velinsky, Ashley and Riedel, 2005

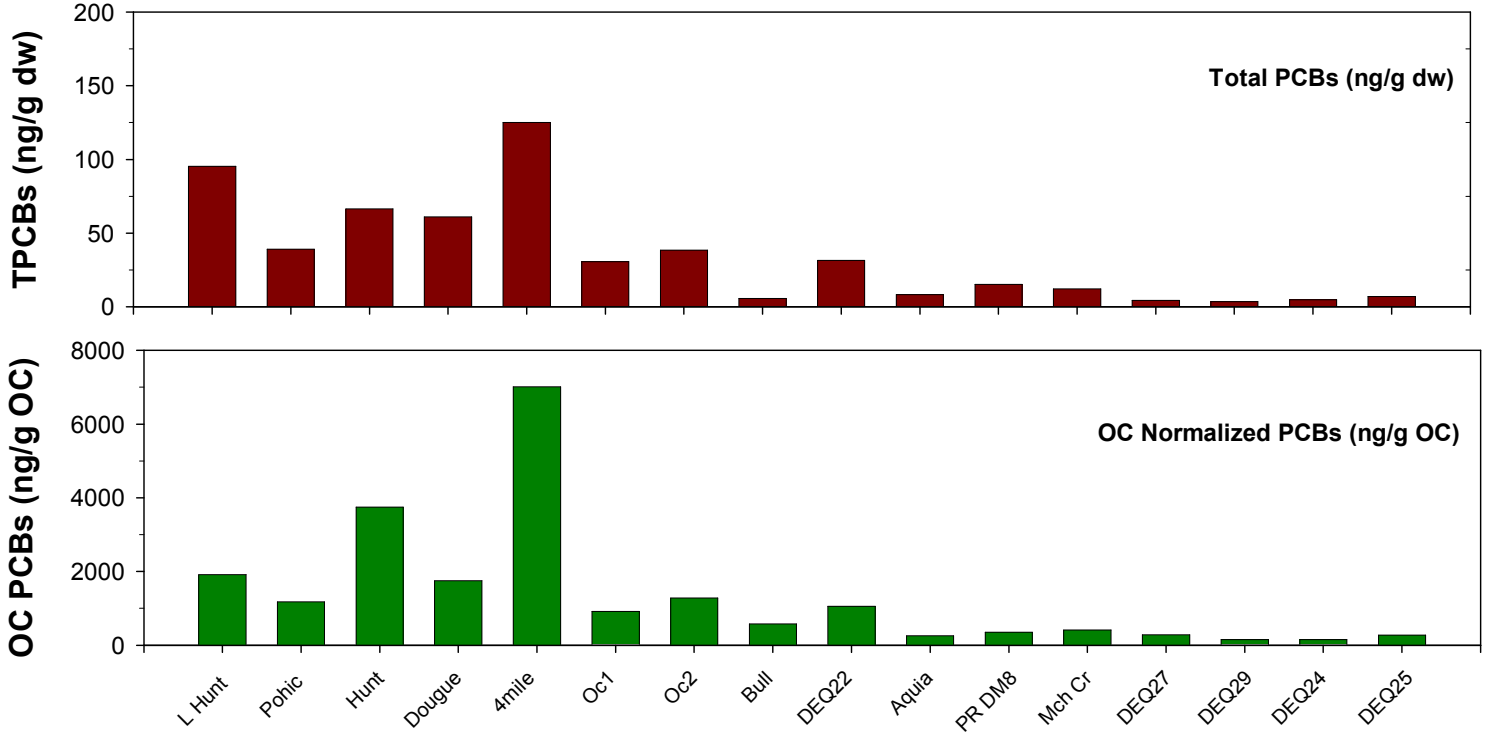
Mainstem Upper Tidal Potomac River: Penta PCBs to TPCBs



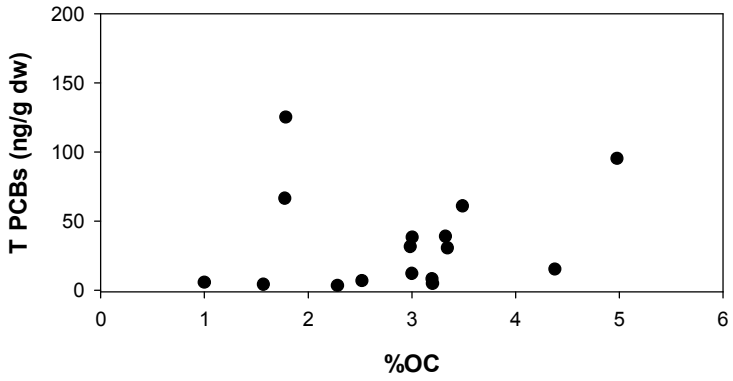


Velinsky, Ashley and Riedel, 2005

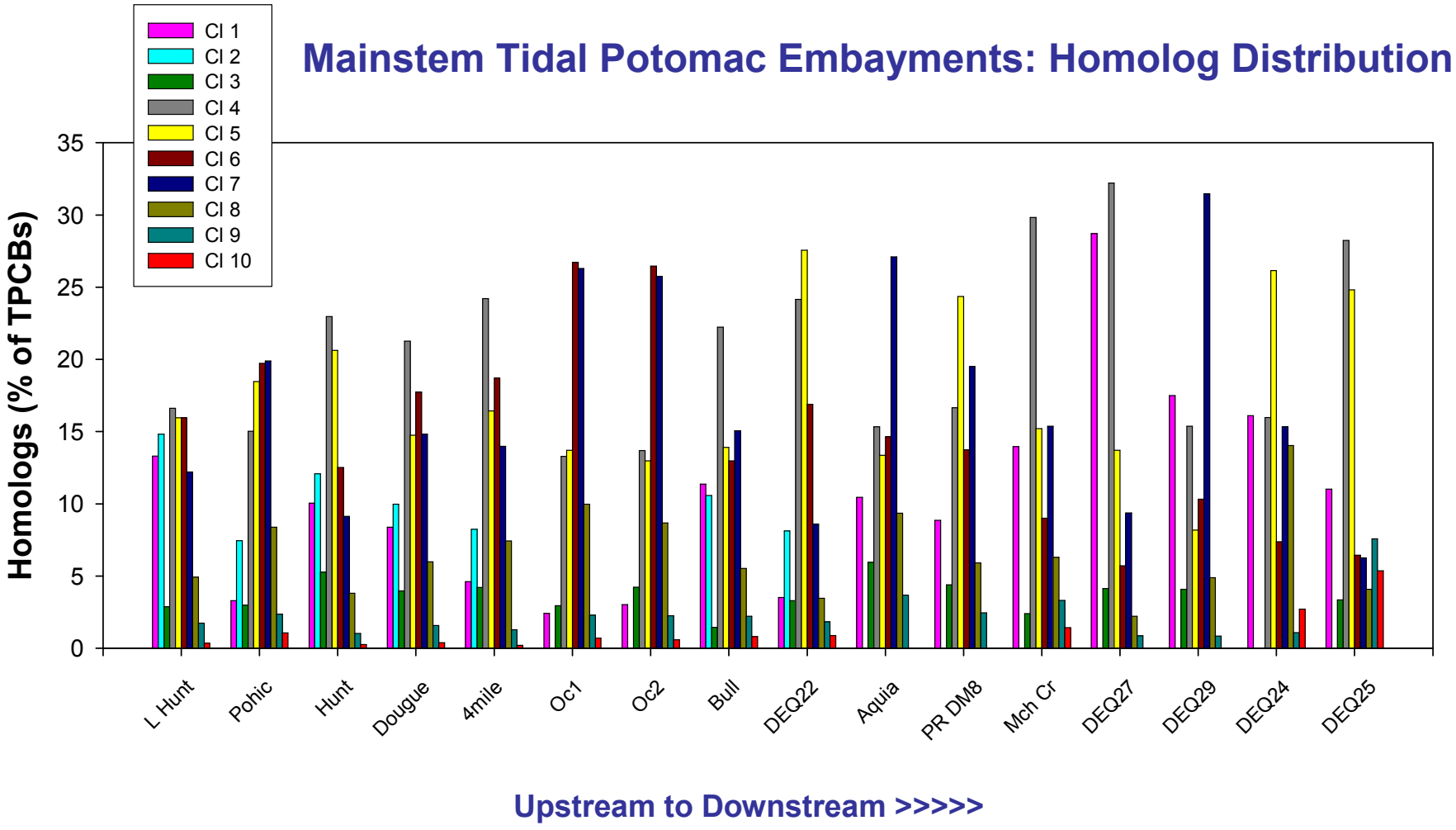
Mainstem Tidal Potomac Embayments (VA DEQ, 2005)



Upstream to Downstream (approx) >>>>>

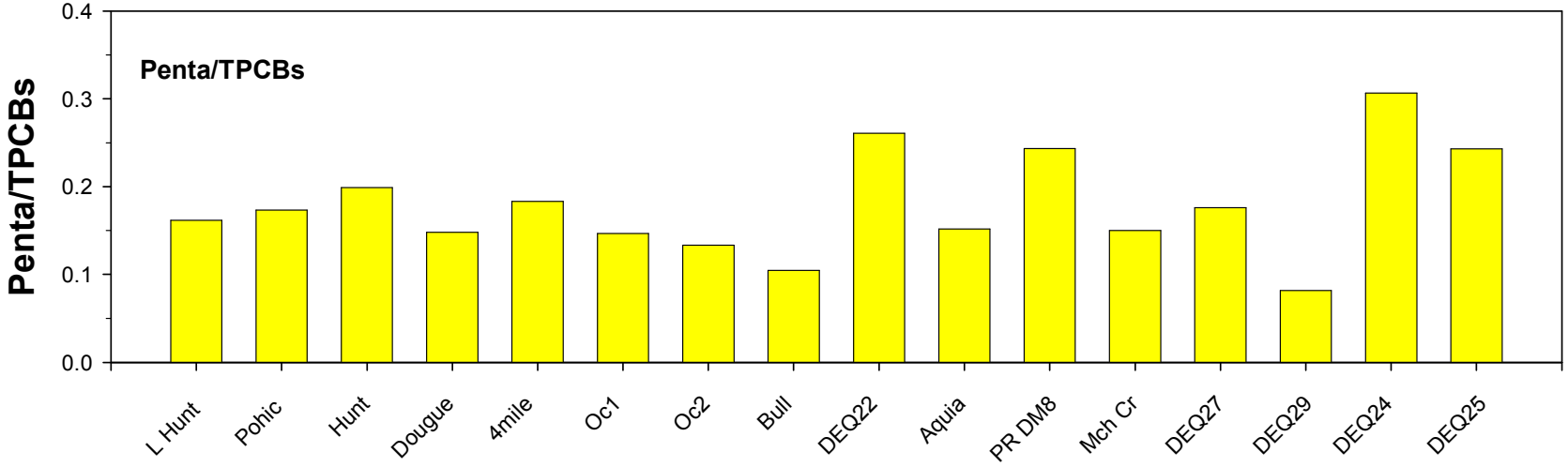


VADEQ, 2005

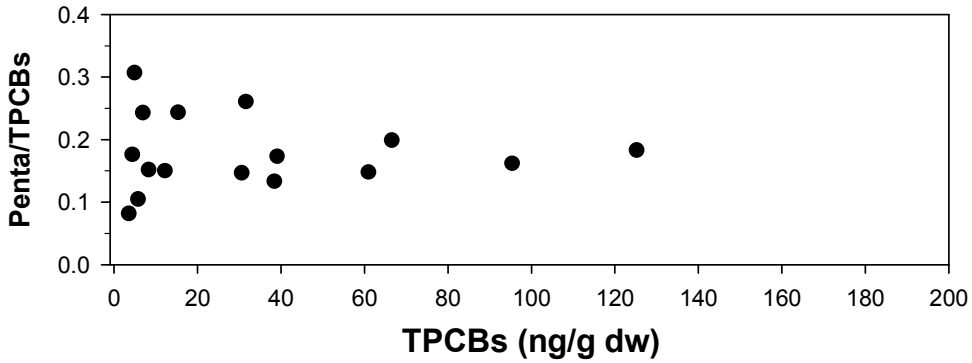

Mainstem Tidal Potomac Embayments: Homolog Distribution
Cl 1
Cl 2
Cl 3
Cl 4
Cl 5
Cl 6
Cl 7
Cl 8
Cl 9
Cl 10
Homologs (% of TPCBs)
0
5
10
15
20
25
30
35
L Hunt
Pohic
Hunt
Dougue
4mile
Oc1
Oc2
Bull
DEQ22
Aquia
PR DM8
Mch Cr
DEQ27
DEQ29
DEQ24
DEQ25
Upstream to Downstream >>>>>

VADEQ, 2005

Mainstem Tidal Potomac Embayments: Penta to Total PCBs

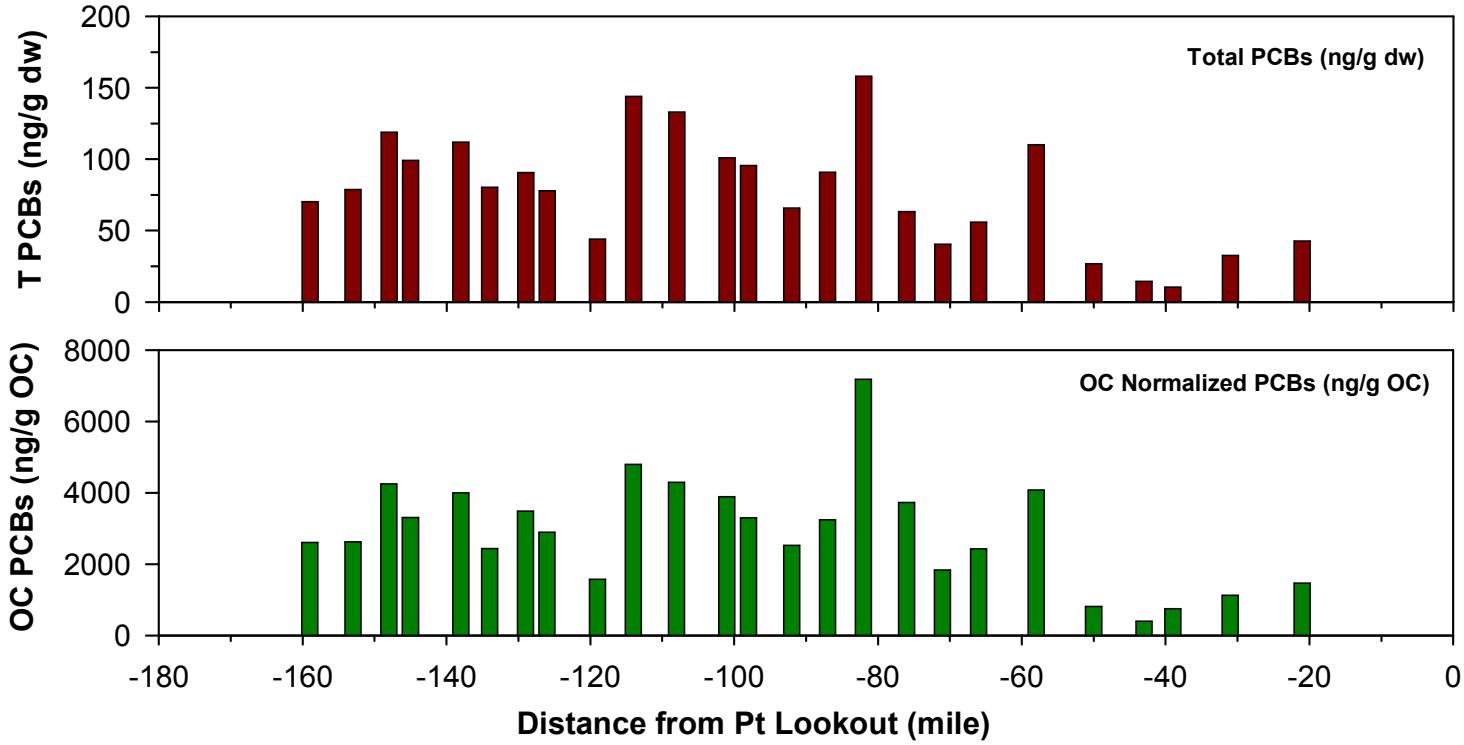


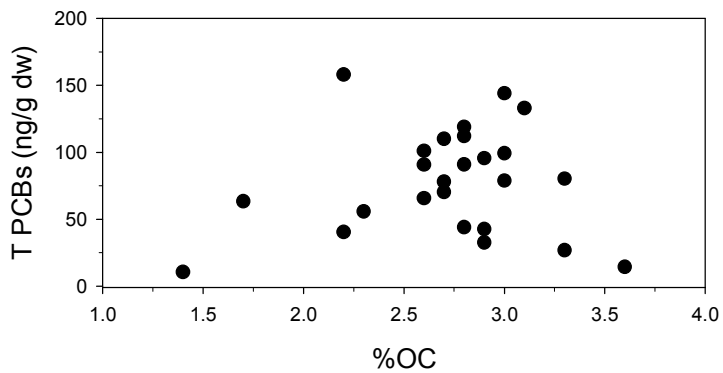
Upstream to Downstream >>>>>



VADEQ, 2005

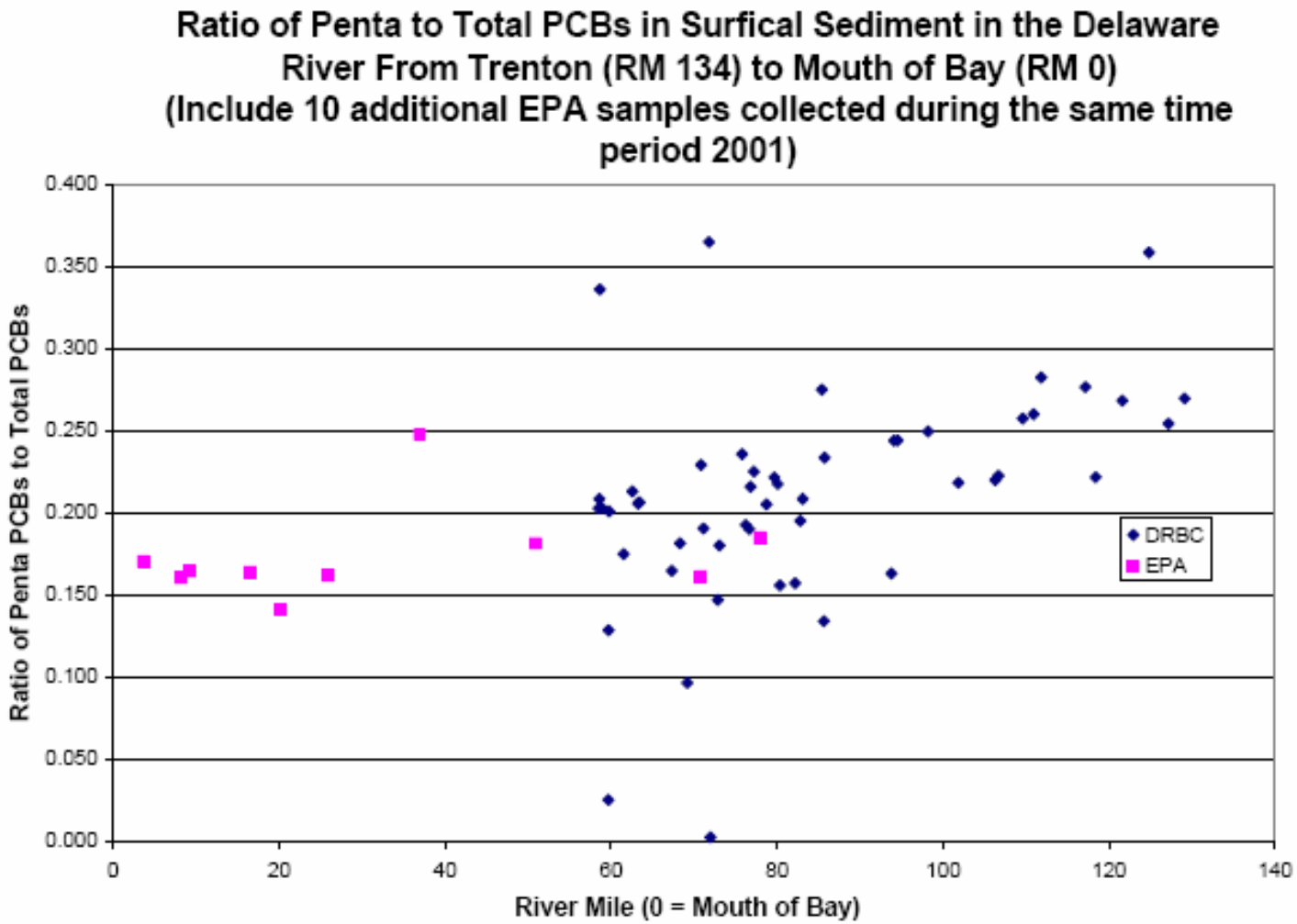
Mainstem Tidal Potomac River (Mceachern and Foster, 2000)



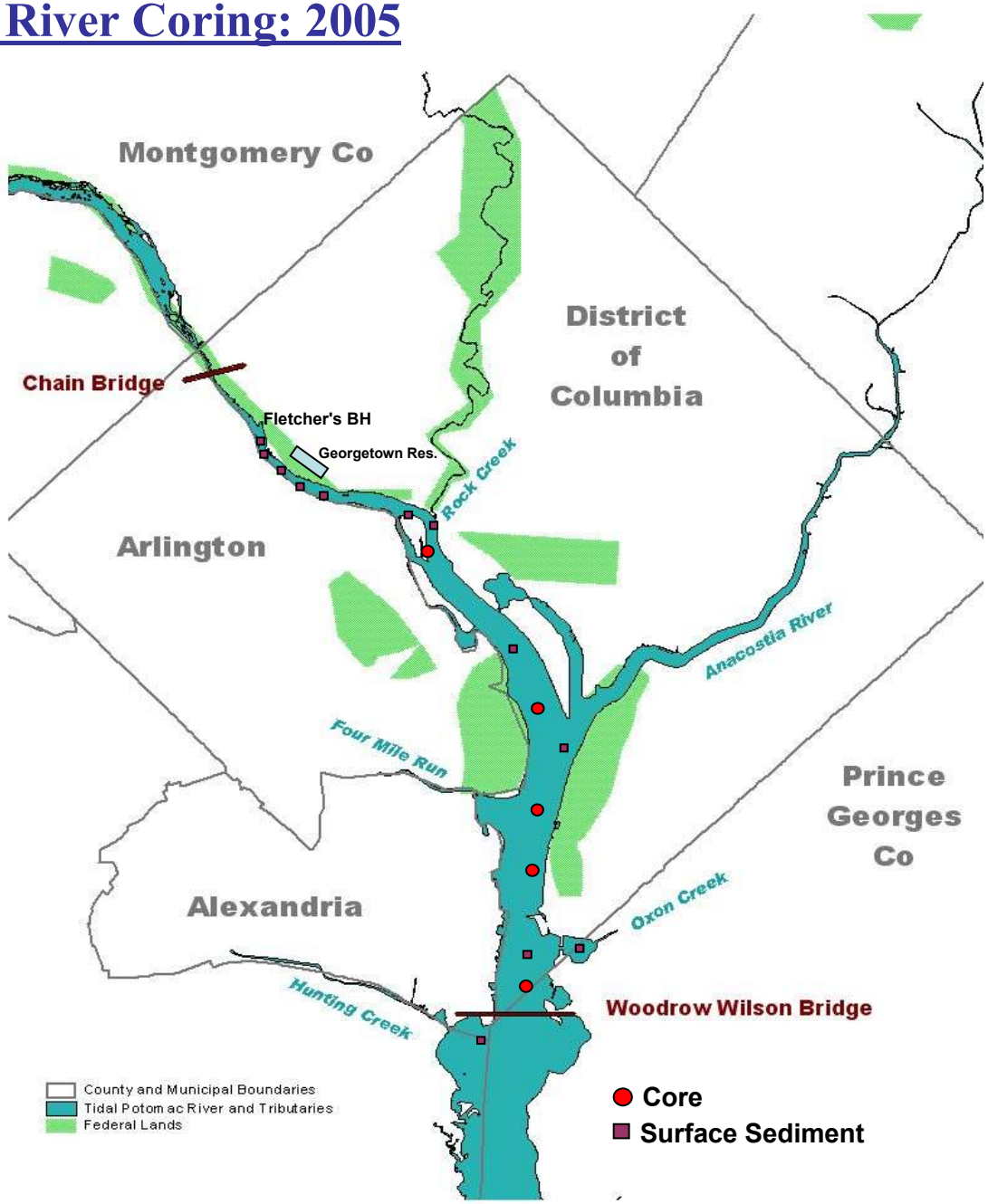


Mceachern and Foster, 2000

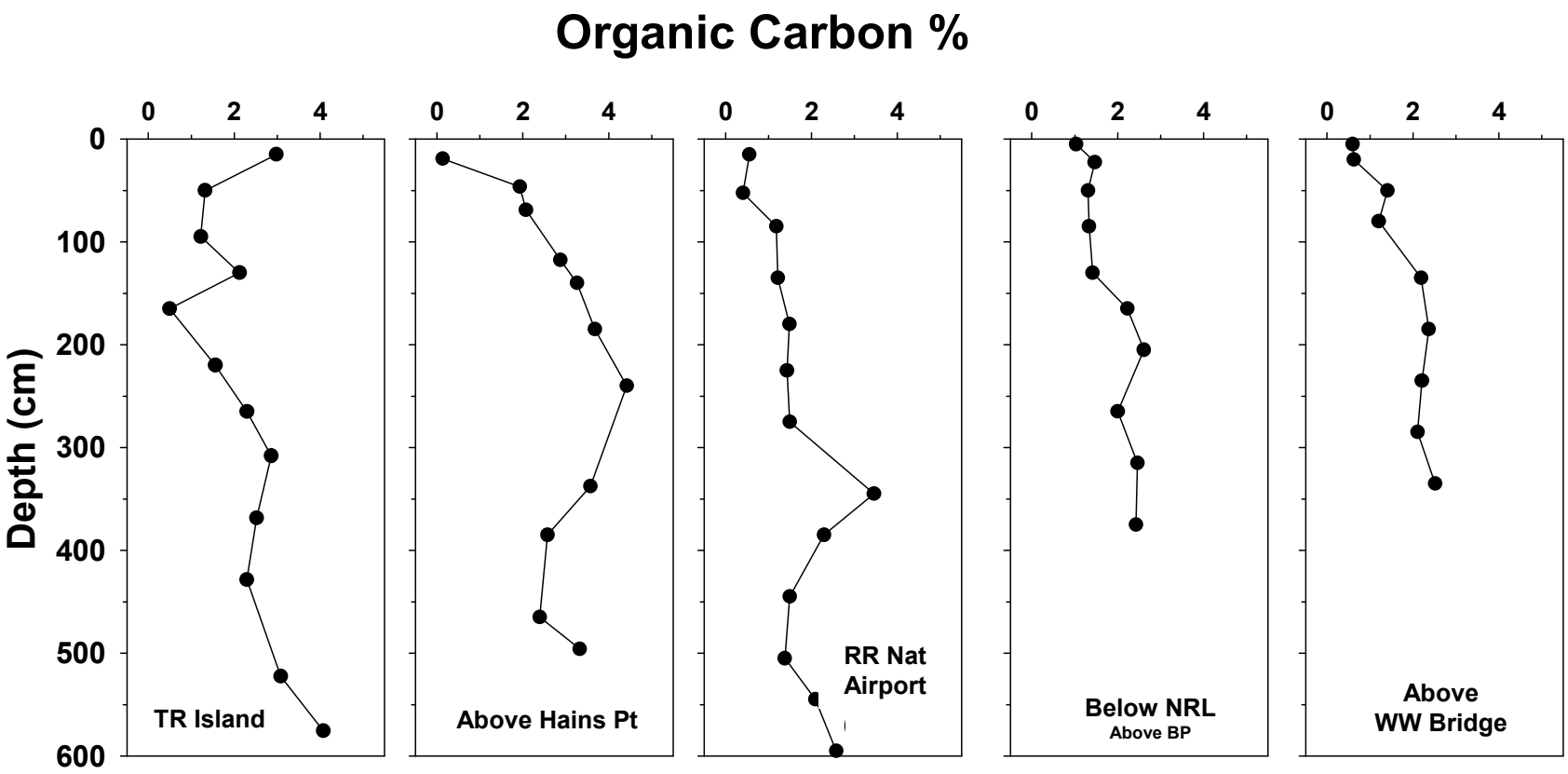
Data from the Delaware Estuary TMDL



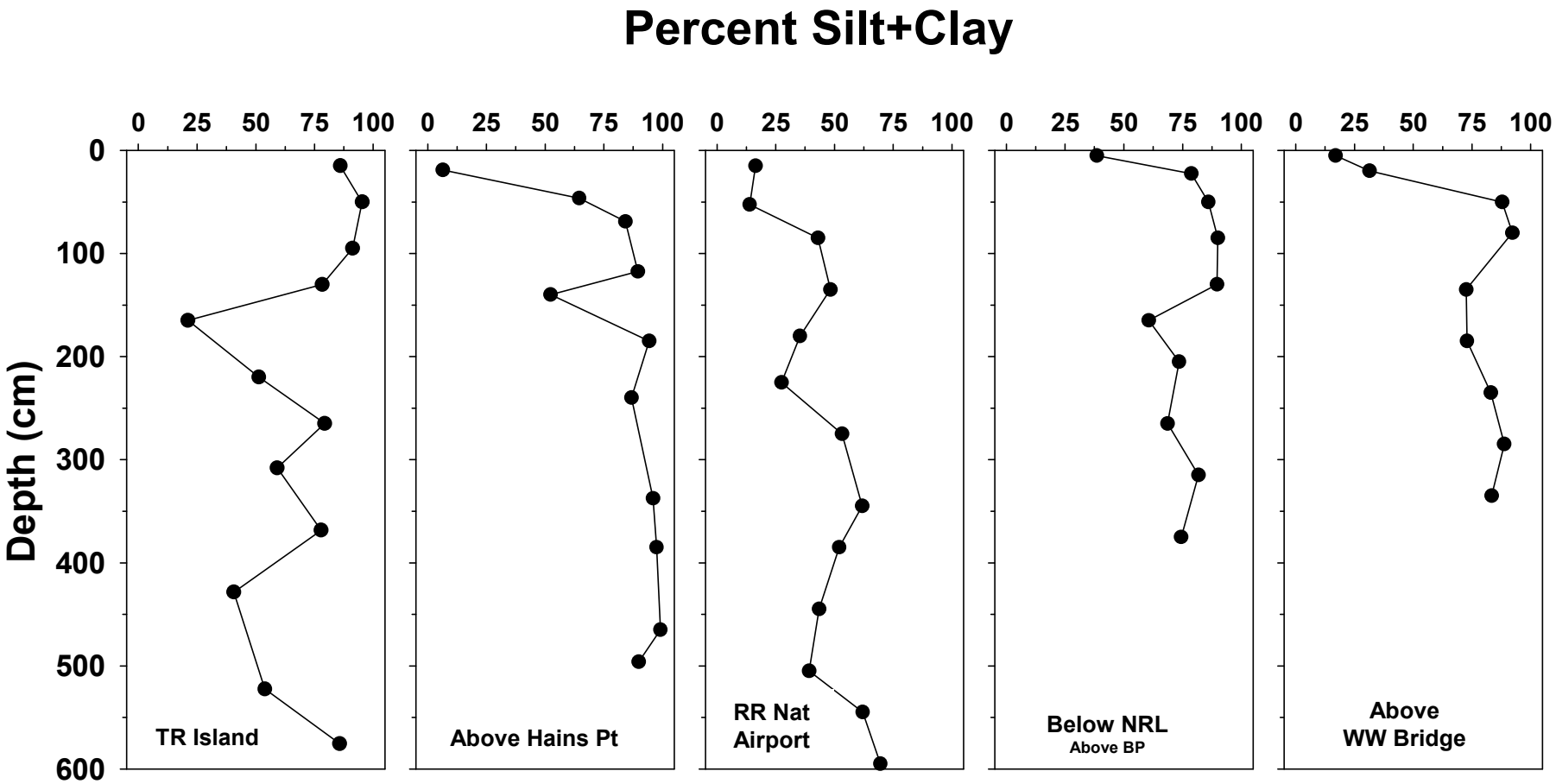
Potomac River Coring: 2005



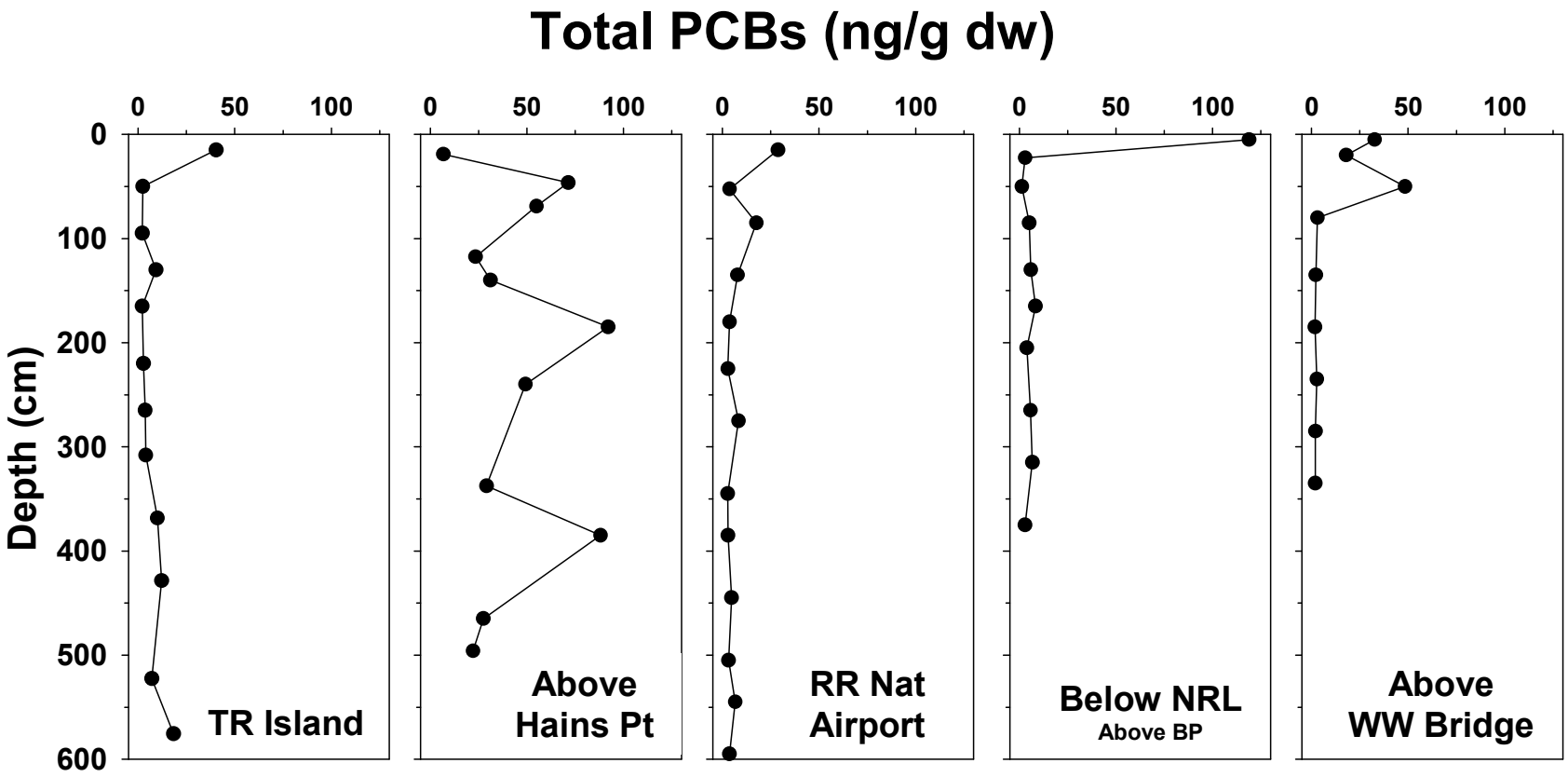
Potomac River Coring: 2005

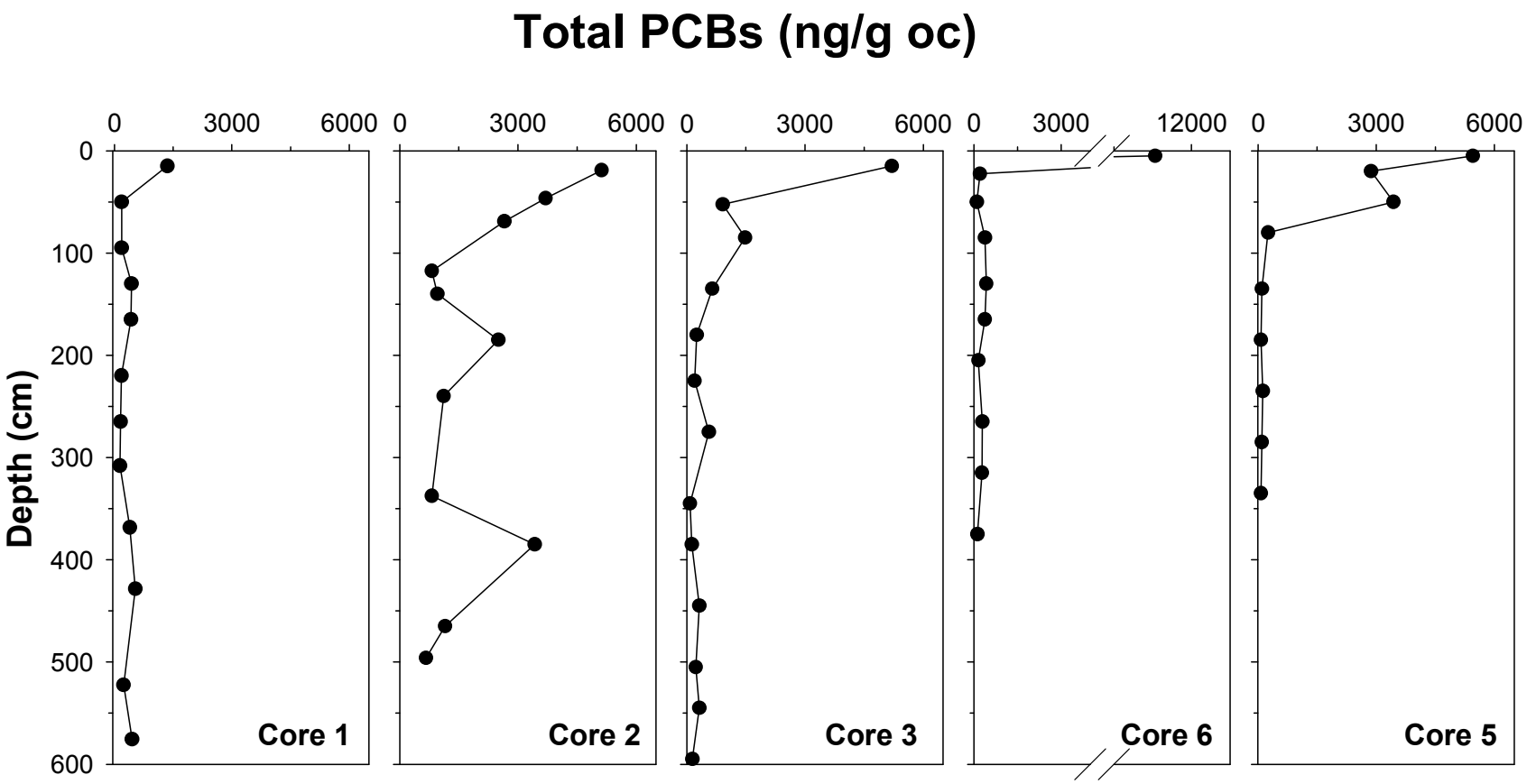


Potomac River Coring: 2005

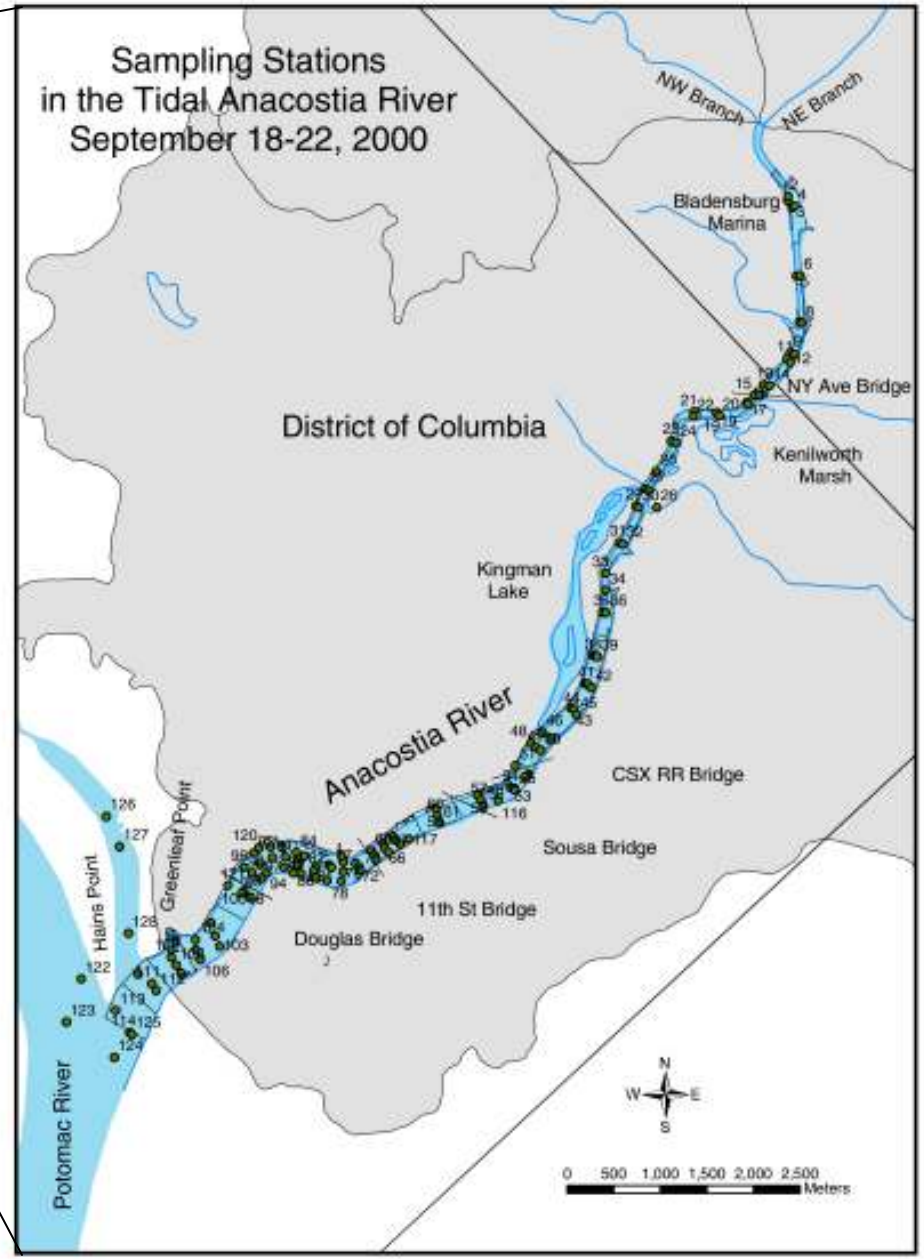


Potomac River Coring: 2005




Total PCBs (ng/g oc)
Depth (cm)
0
100
200
300
400
500
600
0
3000
6000
12000
Core 1
Core 2
Core 3
Core 6
Core 5

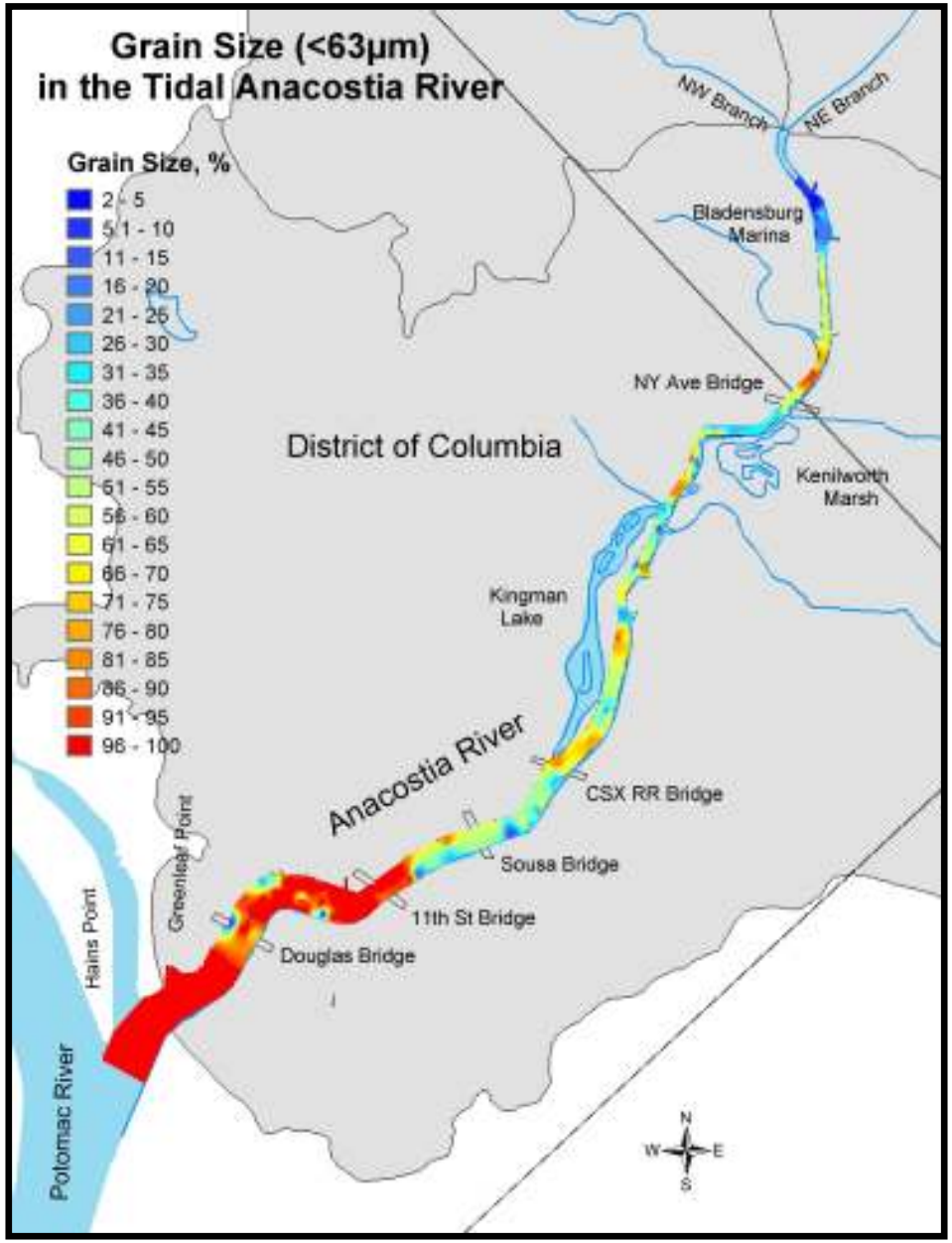
Tidal Anacostia Sediment Studies

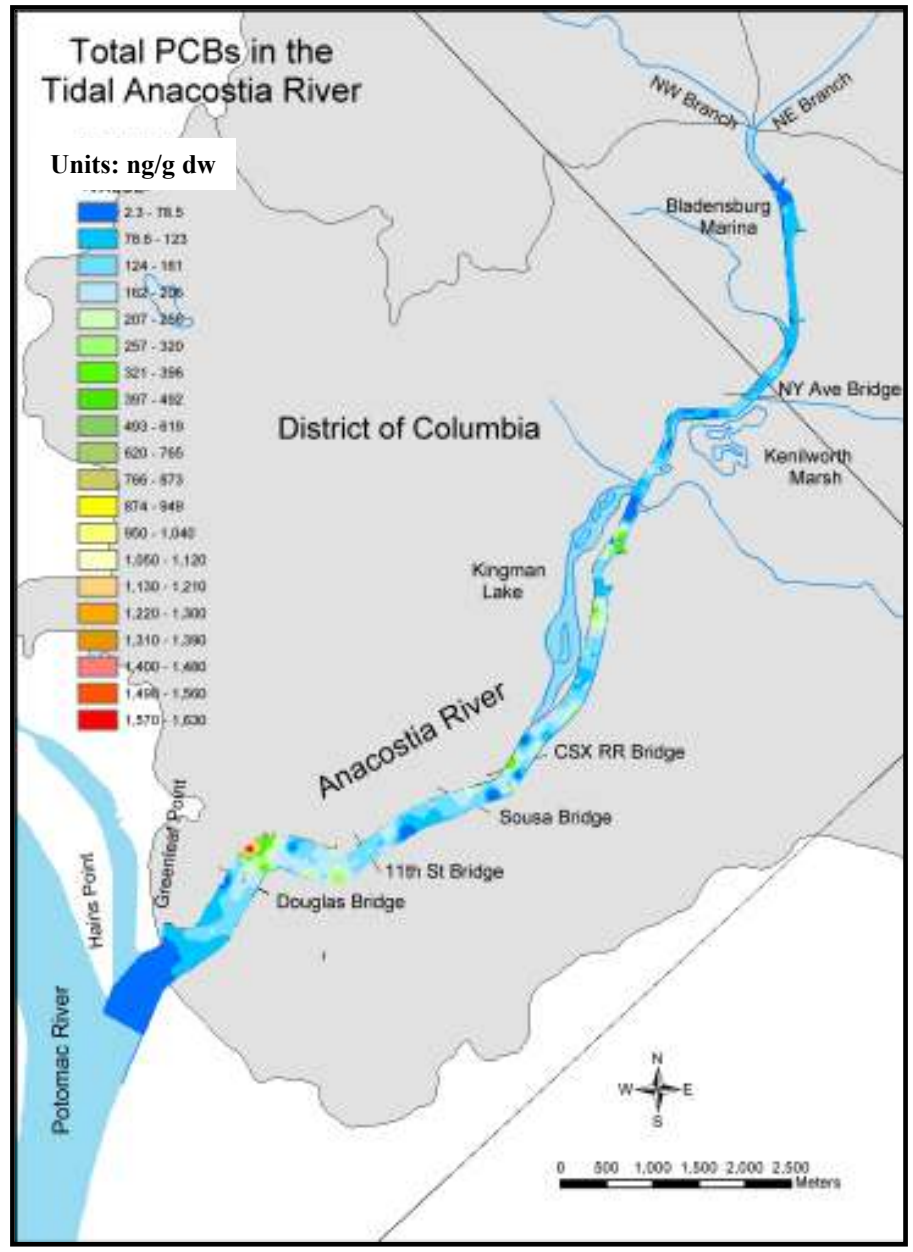


- Surface Sediment Surveys
  - -1989
  - -1992
  - -2000

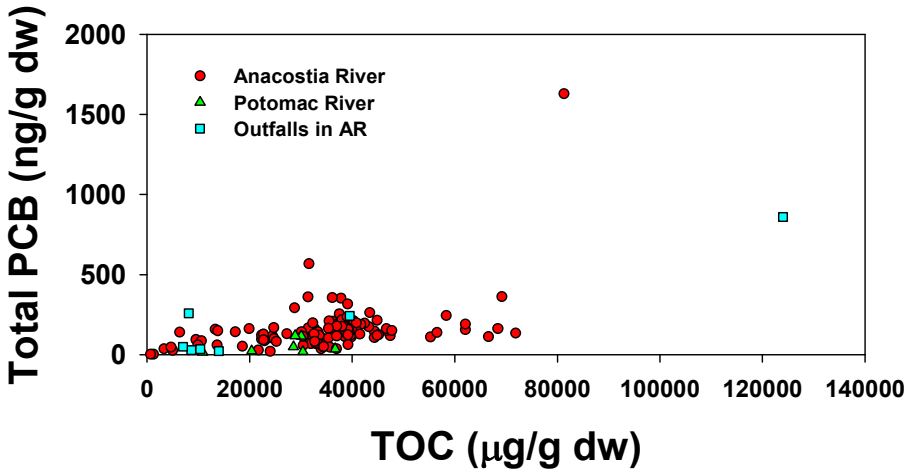
- Sediment Core Collections
  - -1994
  - -2003

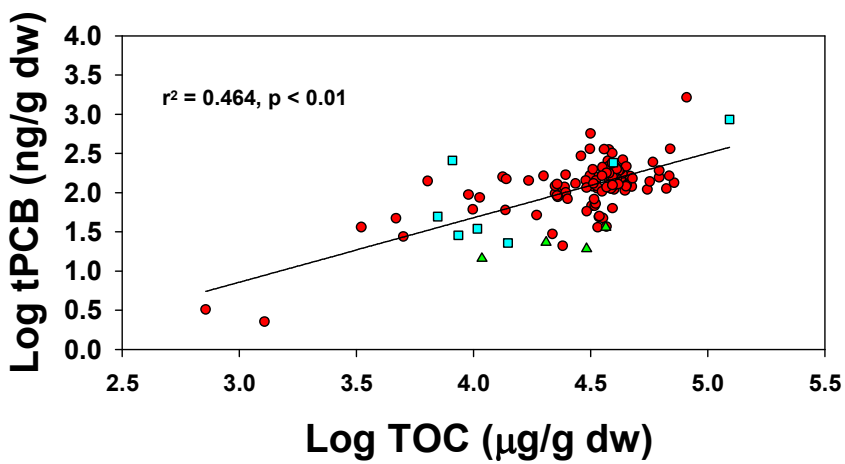
Anacostia Surface Sediment: 2000





Relationship between OC and tPCBs in Anacostia sediments

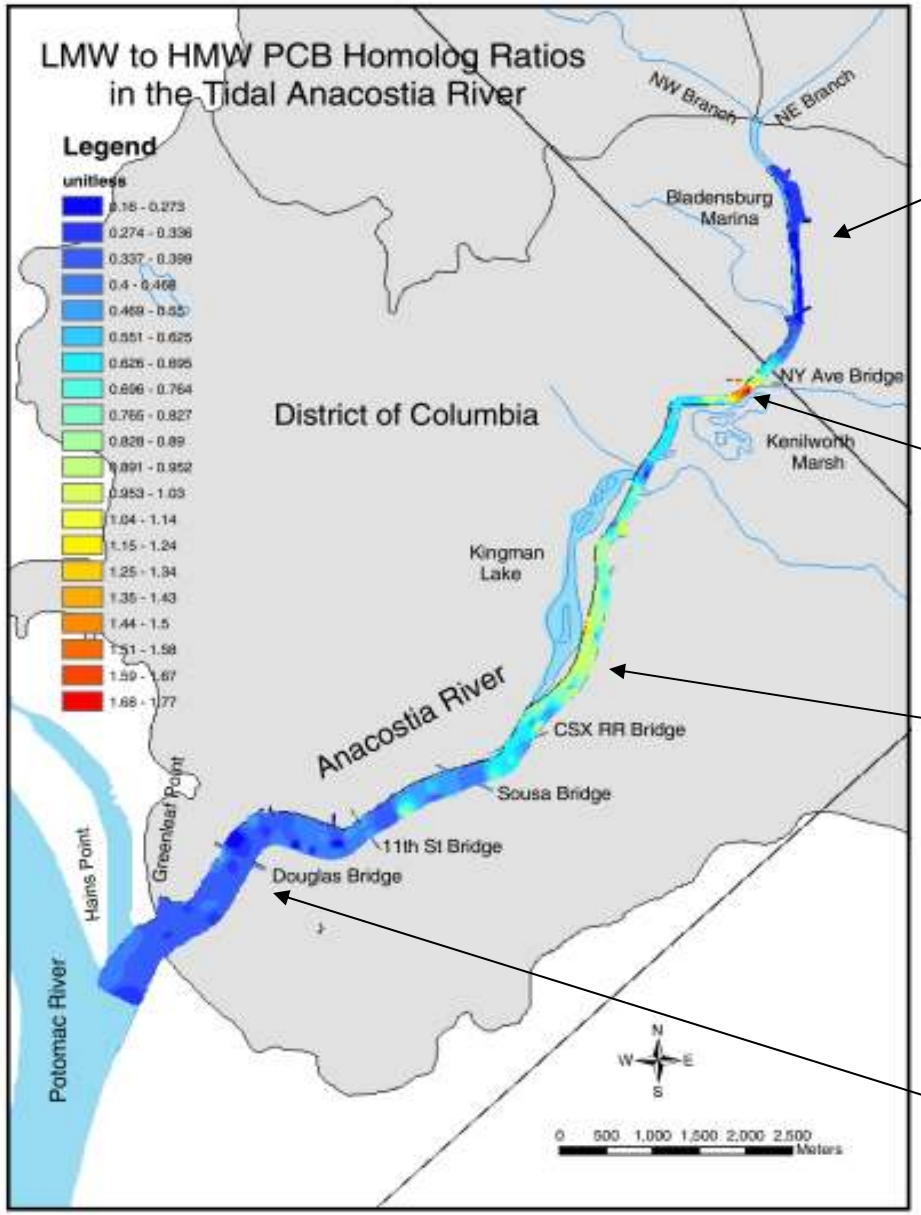


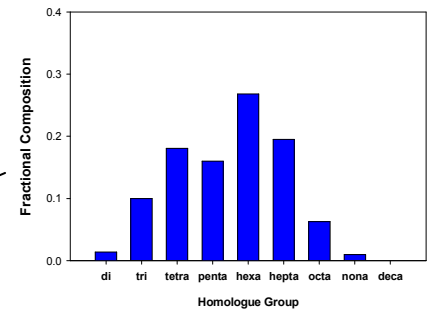


- OC appears to be controlling the distribution of PCBs in tidal river (sources are fairly well-mixed within system)

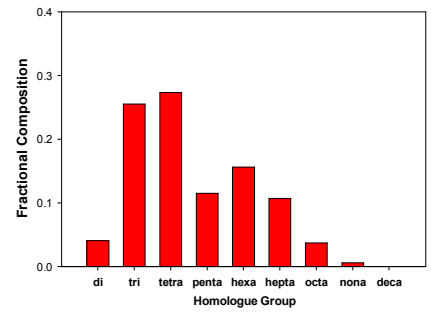
- A few outliers (normality test) suggesting 2 "hot spots" in river; Wash. Navy Yard, and near PEPCO power plant area.

Homolog Pattern Change in Tidal River

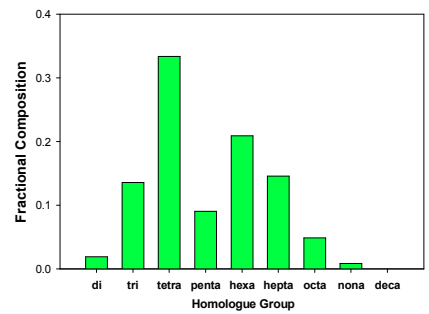


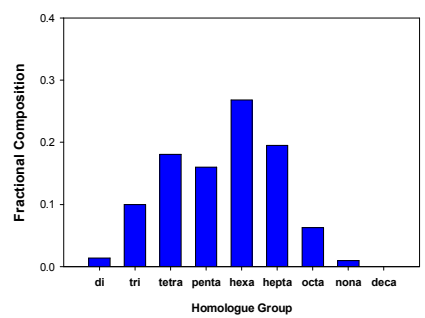


Upper watershed

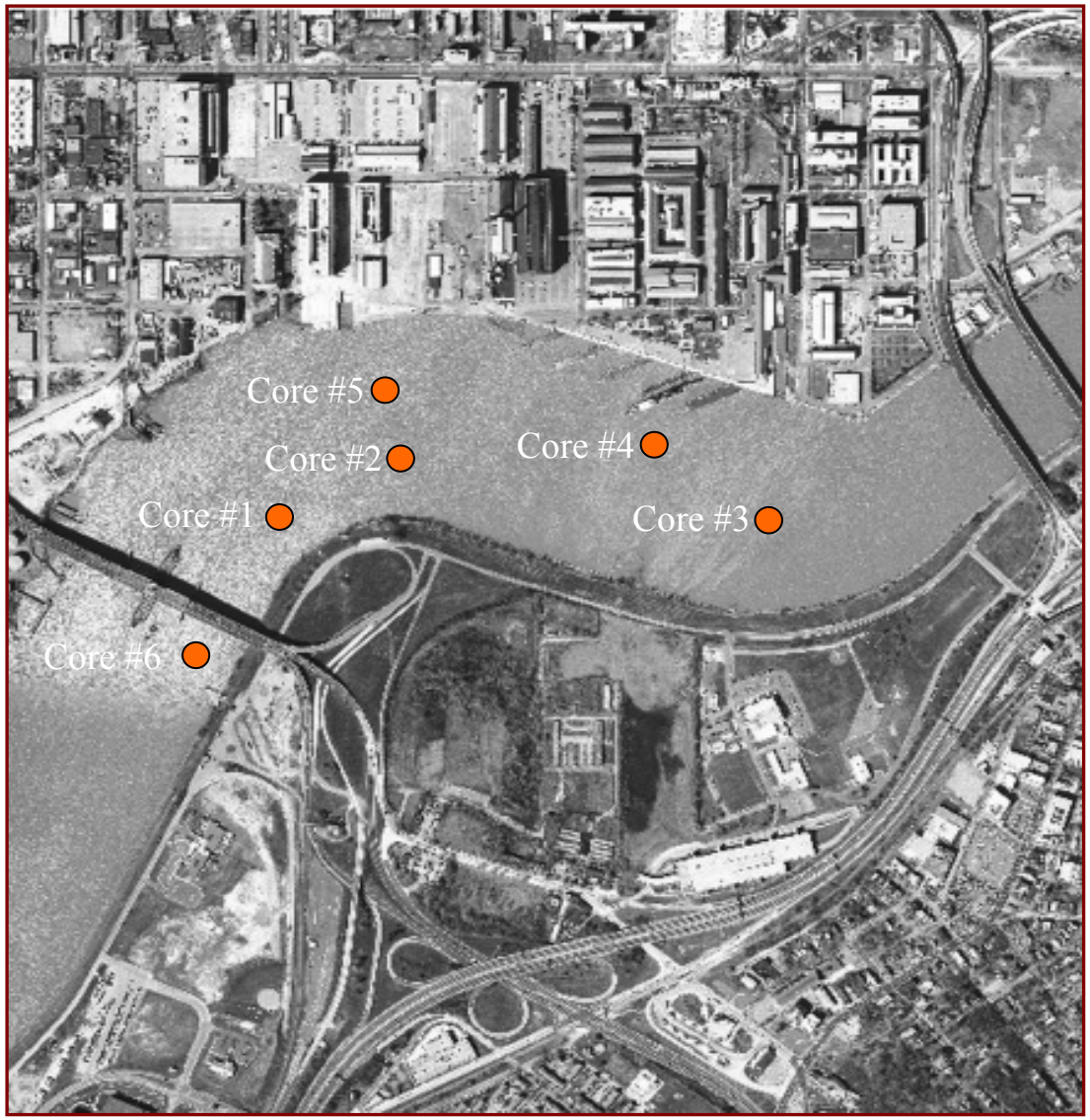


Additional Sources/Mixing





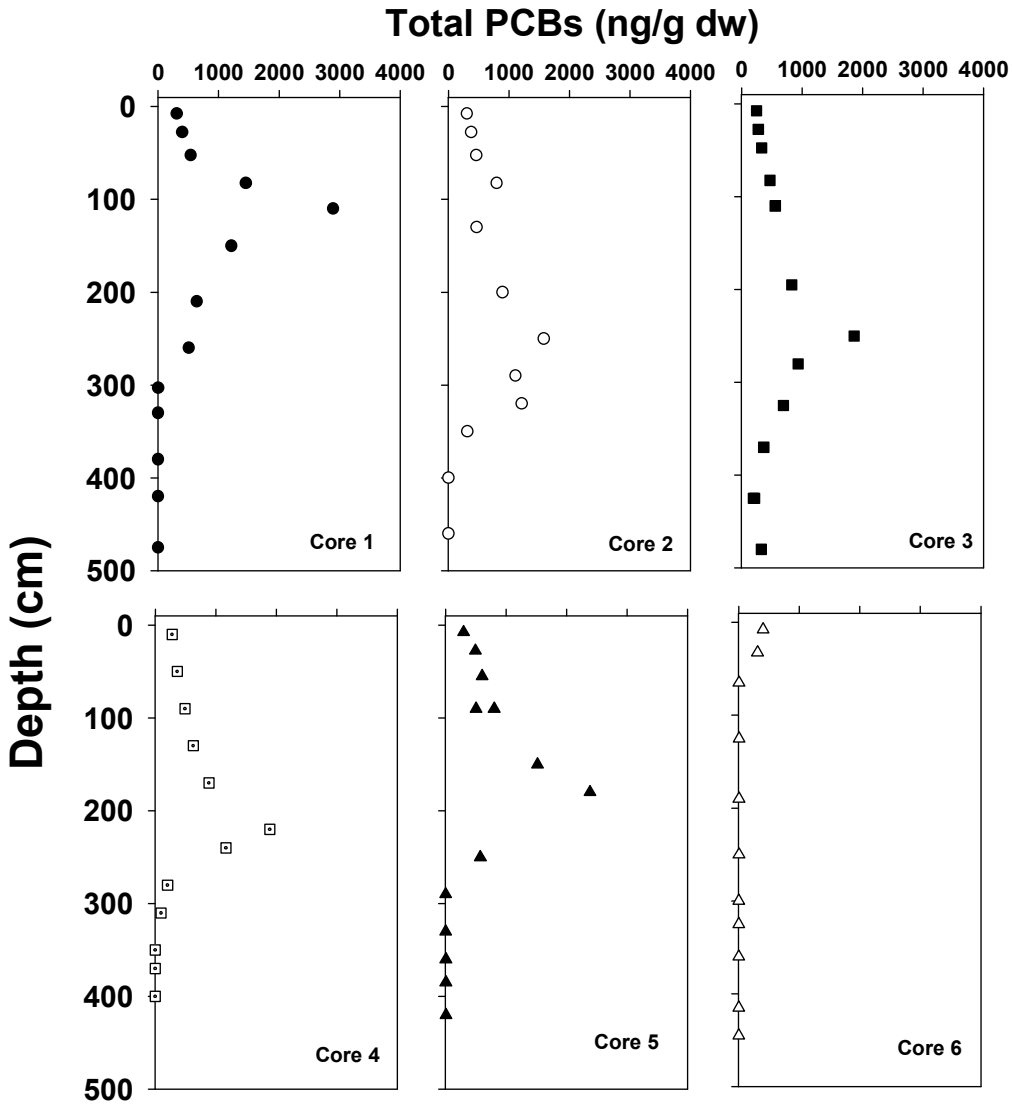
Well Mixed pattern



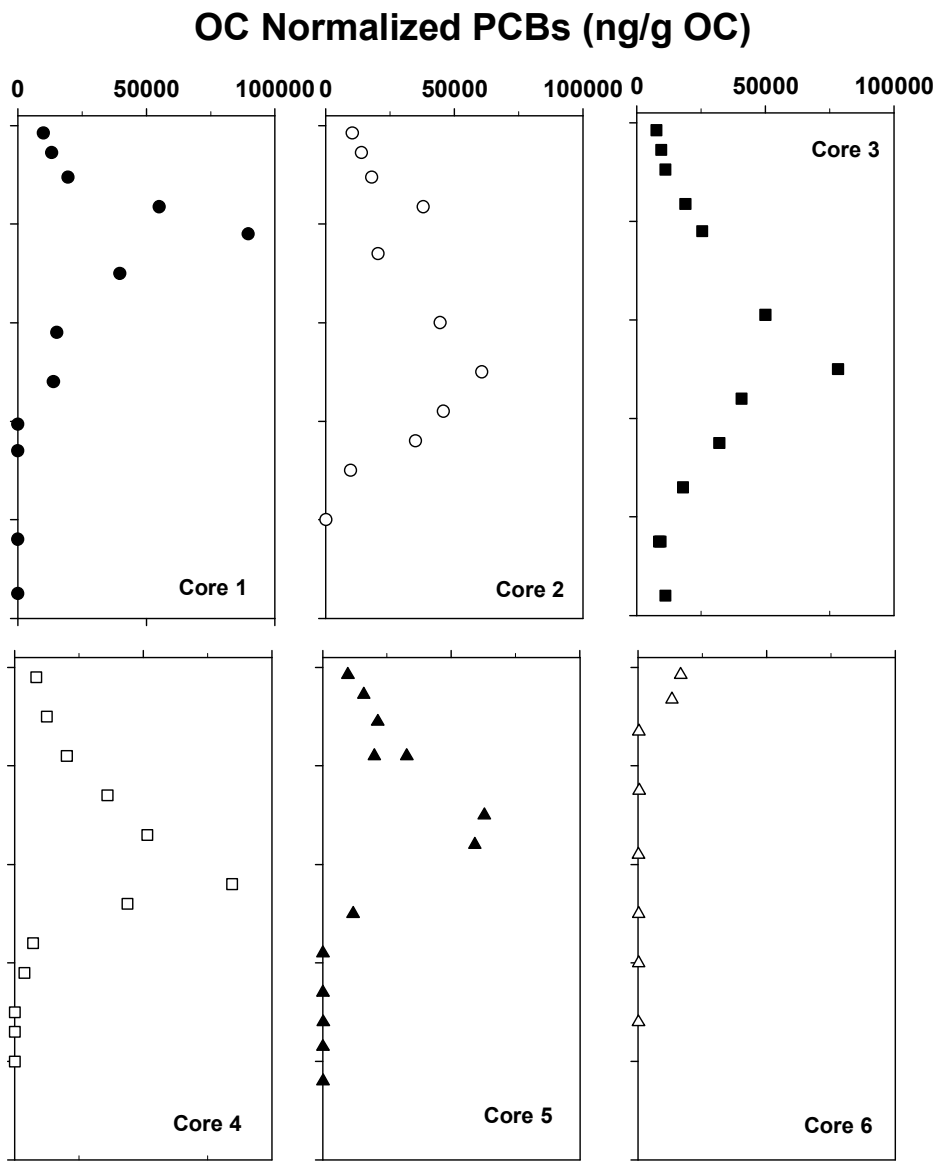
Poplar Point Sediment Cores

Collected in June 2003

Sediment PCB with Depth



Sediment PCB normalized to OC with depth



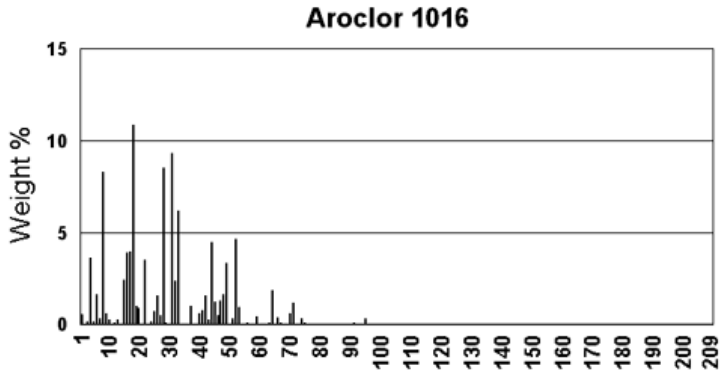
Sediment Collections and Analysis: Data Needs

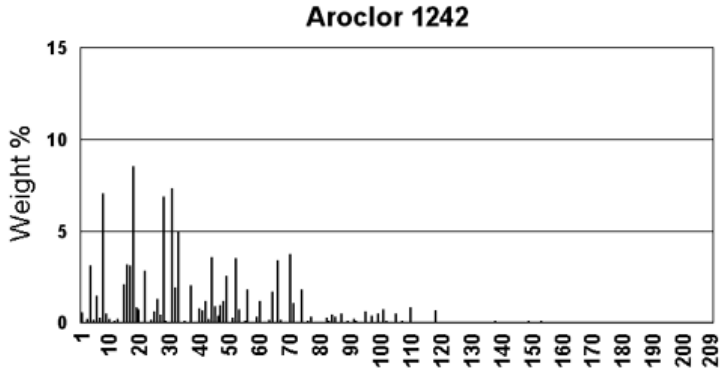
- Congener list needs to have similar set of compounds for each investigation.
- Multiple PIs need to have comparable methods: accuracy and precision (i.e., recoveries of specific chemicals and congeners)
- Ancillary parameters (organic C, grain size)
  - These parameters could be at different spatial scale (more dense sampling grid)
- Sediment mix layer needs to be defined (radiogenic elements)

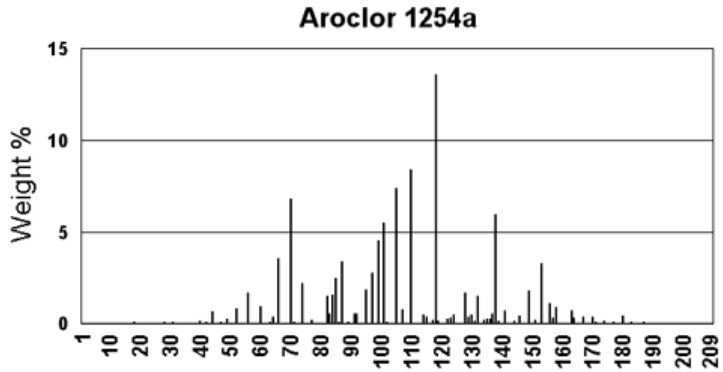
End

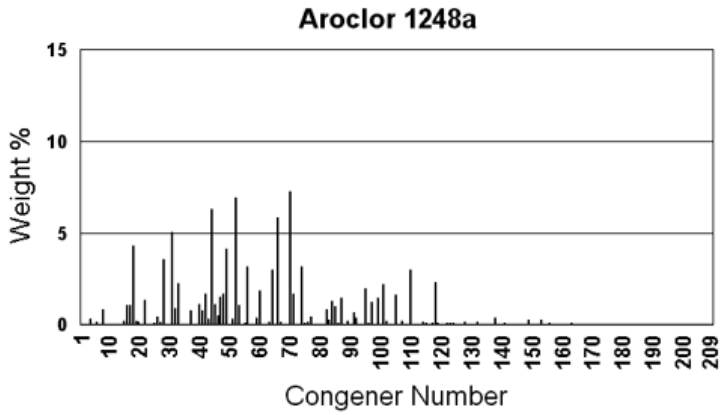
(supplemental information follows)

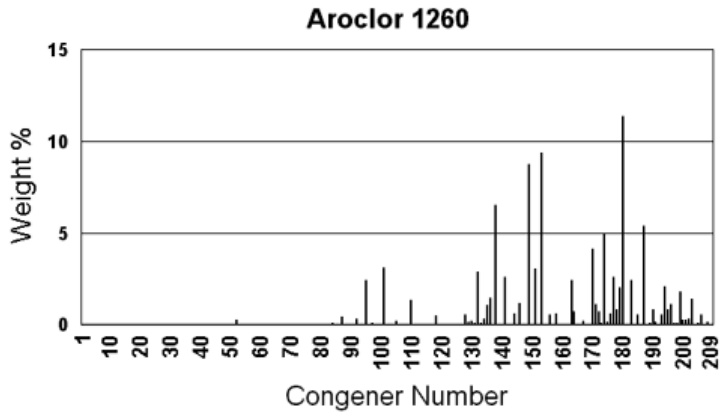
Congener Distributions in Aroclors









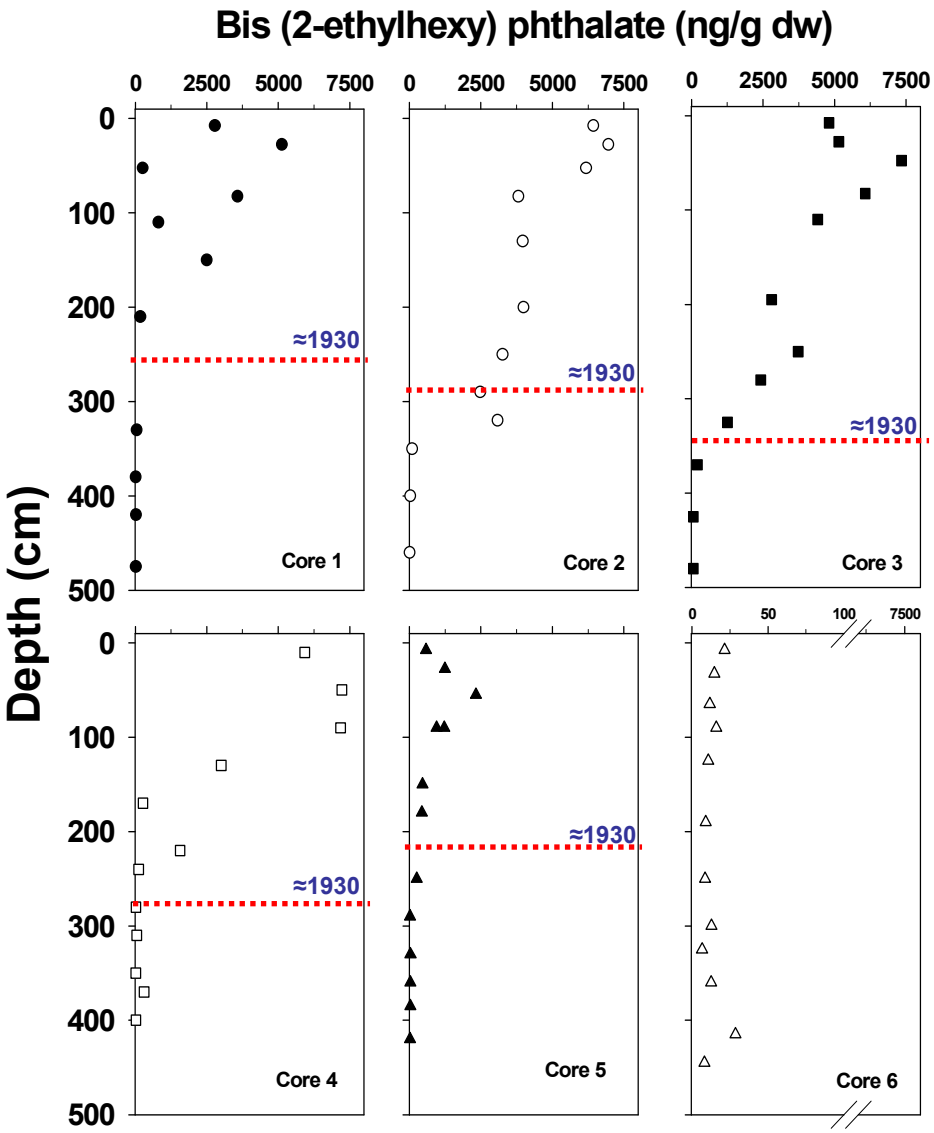


Ref: http://www.epa.gov/toxteam/pcbid/aroclor_plots.htm

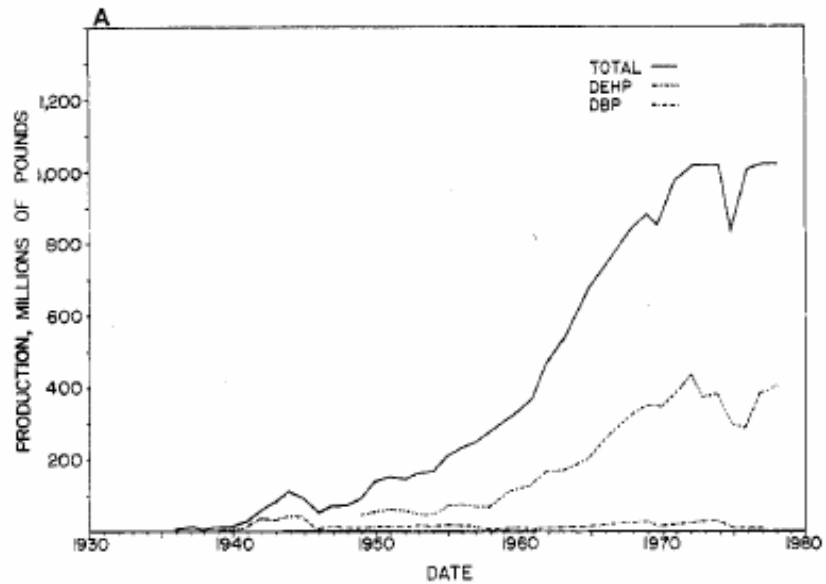
The following slides show dating analysis for Anacostia cores

- The assigned times in red are independently derived from Pb210 dating.
- Pb concentrations are augmented by sources independent of leaded gasoline usage.
- PCB concentrations by depth in core 1 agrees with expected PCB usage over time, but PCB concentrations in the other cores peak at depths (times) deeper (earlier) than expected.

Historical changes in DEHP concentration levels



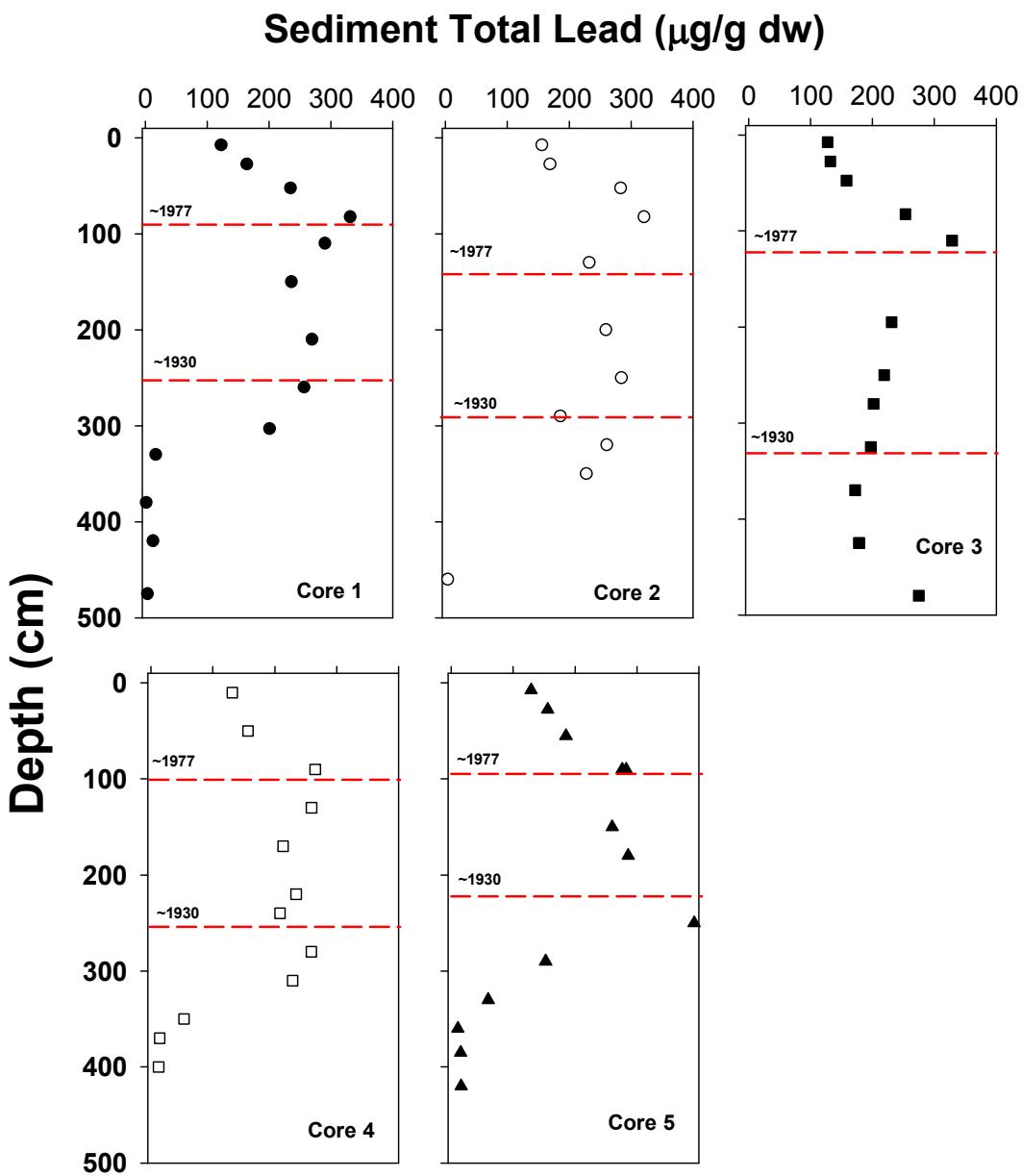
- Phthalate esters first used in polymer market in 1920s
- DEHP first produced in 1933



US production rate in X10^6 lb/yr

Peterson and Freeman 1982; EST 16

Historical changes in Pb concentration levels



- Pb added to gasoline in 1923 as tetraethyl Pb
- CWA banned Pb in gasoline in 1972

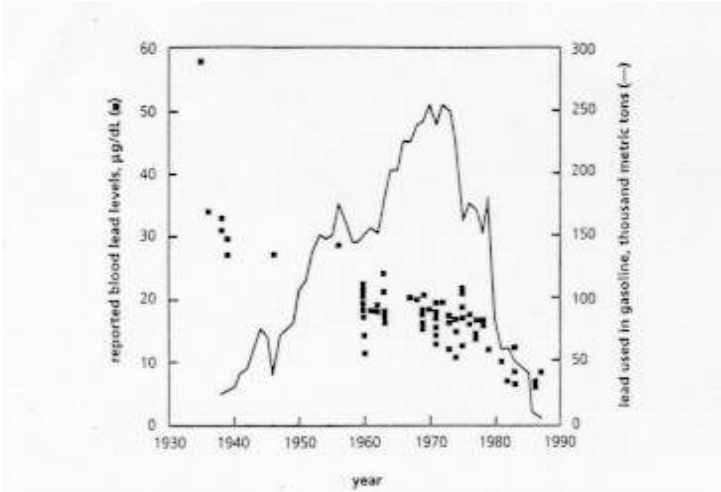
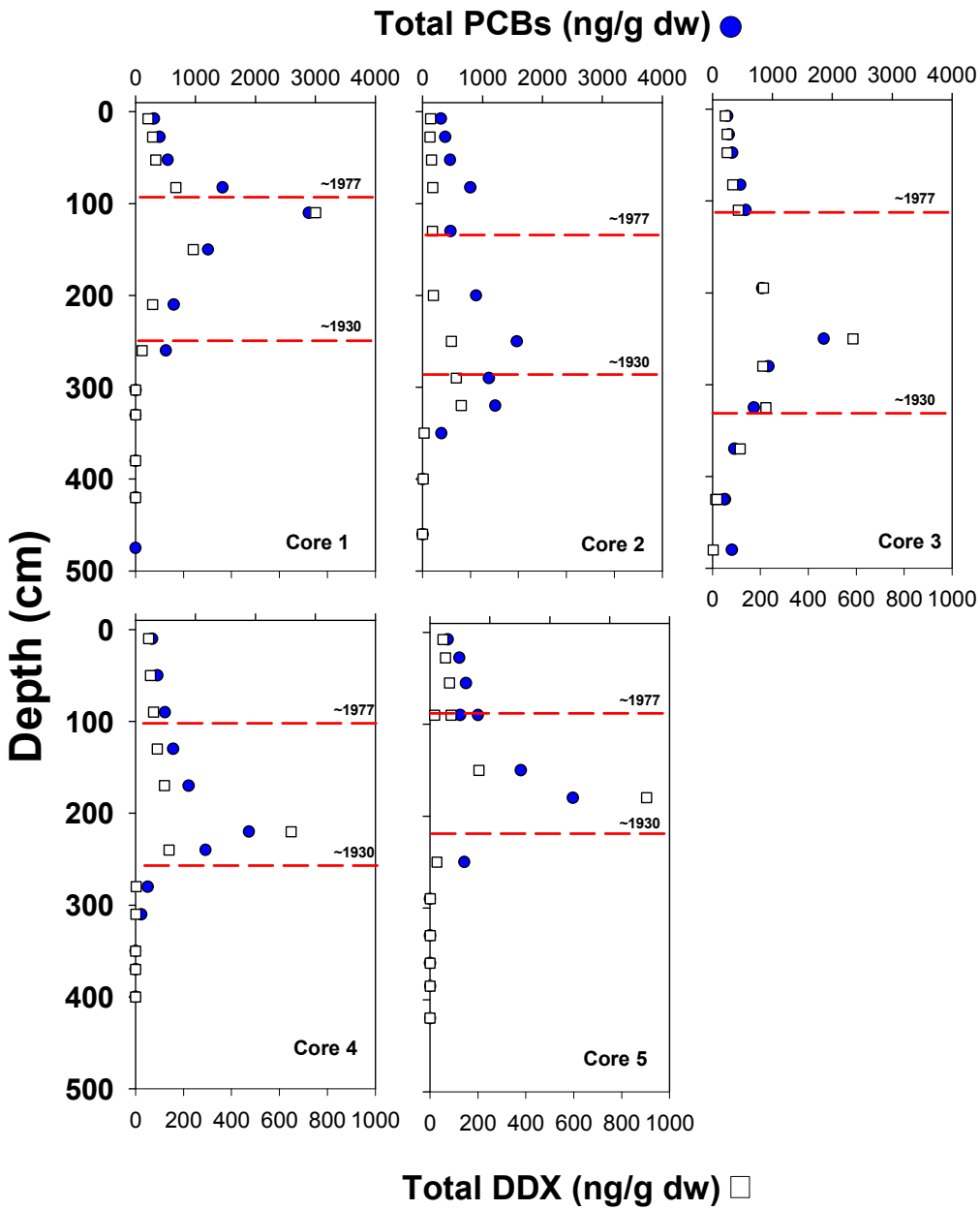


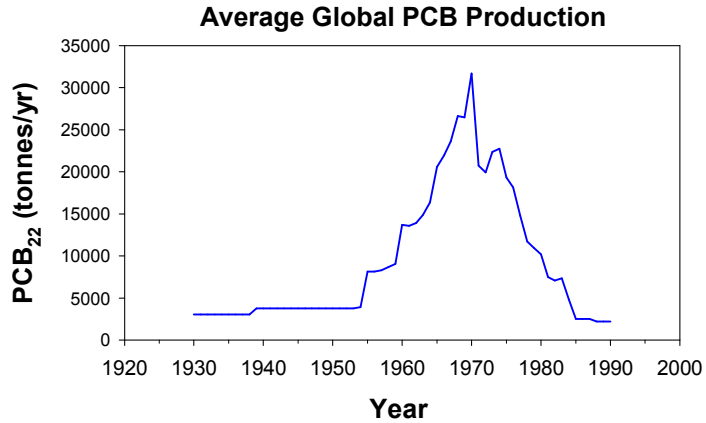
Figure 3 Amount of lead used in gasoline (*solid line*) and published reports of blood levels for the United States (34).

Thomas. 1995. Annu. Rev. Energy Environ. 20:301-24 (http://www.princeton.edu/~vmthomas/pb_elim/pb-elimination.html)

Historical changes in DDX and PCBs concentration levels



- PCBs first produced in 1920s
- PCBs phased ban in 1970s



Brevik, K., A. Sweetman, J.M. Pacyna and K.C. Jones: 2001 Science of the Total Environment. Vol. 290, No. 1-3, 181-198

- DDT synthesized in 1874, pesticide use started in 1940; ban started in mid/late 1950s.
- DDT fully banned in 1972
- Both are still in use today; worldwide transport via air