



# **Analysis of Fish Tissue in the National Rivers and Streams Assessment**

*Focusing on*  
A National Assessment of Organo-  
halogen Compounds  
in Fish from U.S. Rivers



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# National Rivers and Streams Assessment



- Legacy organic contaminant data are:
- **Partial** (315/566)
  - **Preliminary** (Not nationally-representative)
  - **Presentation** does not represent U.S.EPA policy or that of the U.S. Government



## Organic Analytes for 566 sites

(GC-ECD)

### 22 Organochlorine pesticides

<b>Aldrin</b>	<b>Endosulfan I</b>
<b>Alpha BHC</b>	<b>Endosulfan II</b>
<b>Gamma BHC</b>	<b>Endrin</b>
<b>Alpha Chlordane</b>	<b>Heptachlor</b>
<b>Gamma</b>	<b>Heptachlor epoxide</b>
<b>Chlordane</b>	<b>Hexachlorobenzene</b>
<b>2,4'-DDD</b>	<b>Mirex</b>
<b>4,4'-DDD</b>	<b>cis-Nonachlor</b>
<b>2,4'-DDE</b>	<b>trans-Nonachlor</b>
<b>4,4'-DDE</b>	<b>Oxychlordane</b>
<b>2,4'-DDT</b>	
<b>4,4'-DDT</b>	
<b>Dieldrin</b>	

### 21 PCB Congeners PCB 8-209

### 8 PBDE Congeners PBDEs 47, 66, 99, 100, 138, 153, 154, 183



## Additional Analytes not reported here

### 566 sites (all sites)

**Mercury:** Direct mercury analyzer by Milestone  
Reporting limit: 0.005 ug/g wet wt

**Selenium:** ICP-OES

**Moisture:** Karl Fisher titration

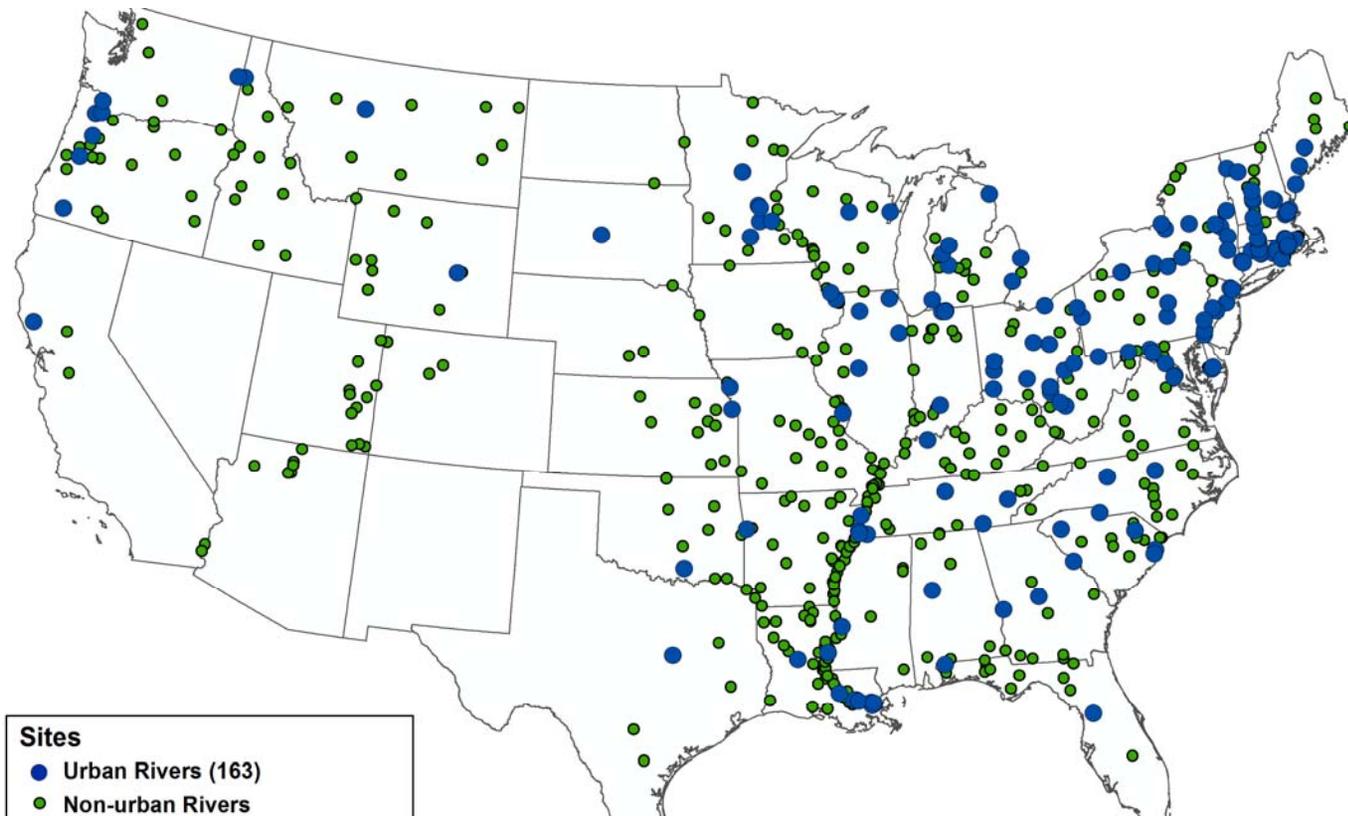
**Lipids:** Gravimetric method

### 160 urban sites

**13 PFCs**

**4 synthetic musks and two of their metabolites**

**54 pharmaceuticals**



## NRSA Sampling Locations $n = 566$

U.S. Environmental Protection Agency



## Data are Extensive

- Reporting today on 53 analytes x 315 sites = 16,695 data points
- Full set will include >30,000 data points
- Full data set will be nationally-representative and representative by ecoregion and urban (~160 sites) and non-urban locations



Focus of this presentation is Chlordane, DDT, Dieldrin, PCBs, and PBDEs (CEC entrée)

Out of the 315 valid primary samples:

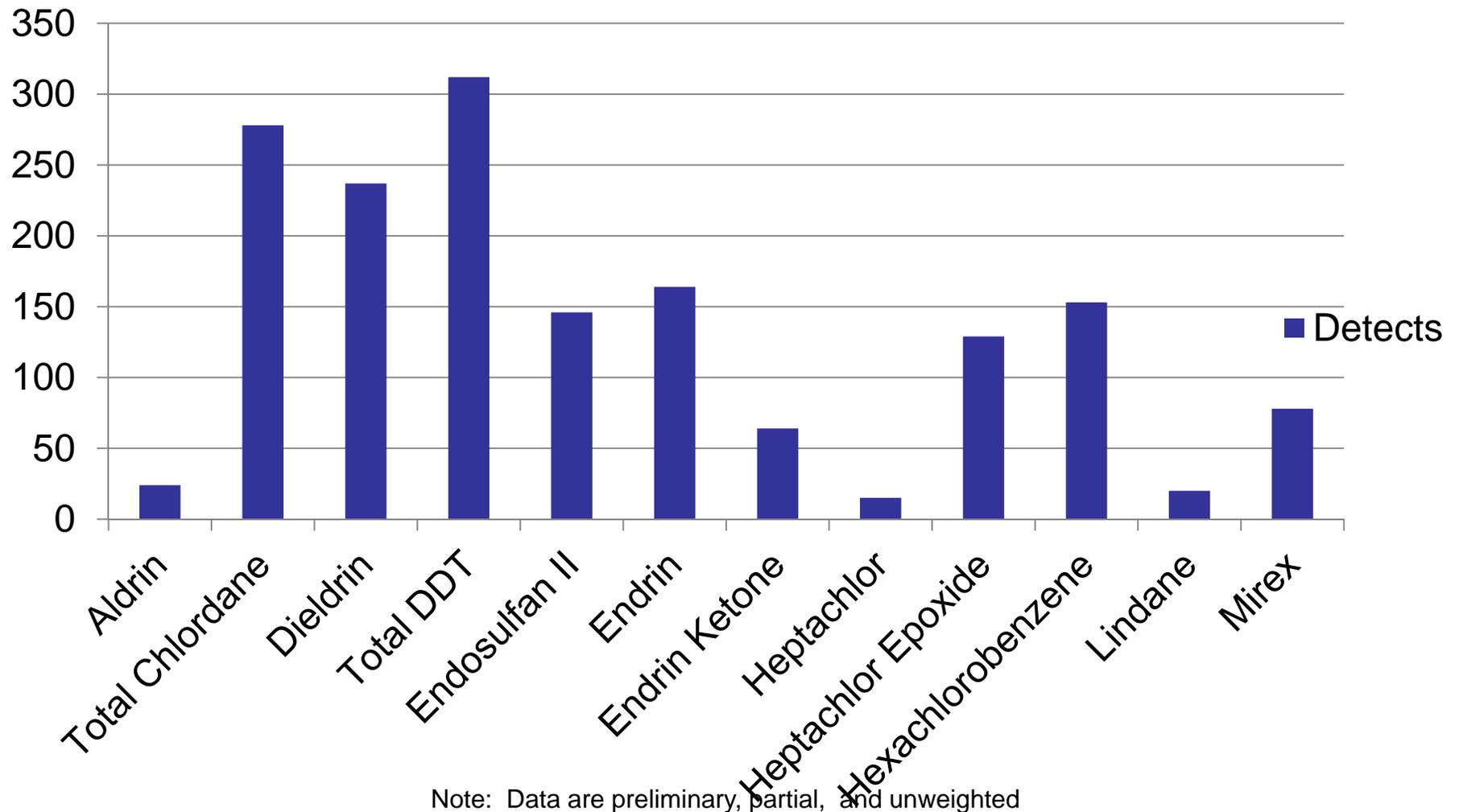
- 27 reportable detections of Aldrin
- 20 reportable detections of Lindane
- **237 reportable detections of Dieldrin**
- **278 reportable detections of Total Chlordane**
- **312 reportable detections of Total DDT**
- **PCBs Detected in 305/315 sites**
- **PBDEs Detected in 297/315 sites**

Note: Data are preliminary, partial, and unweighted

# Detects



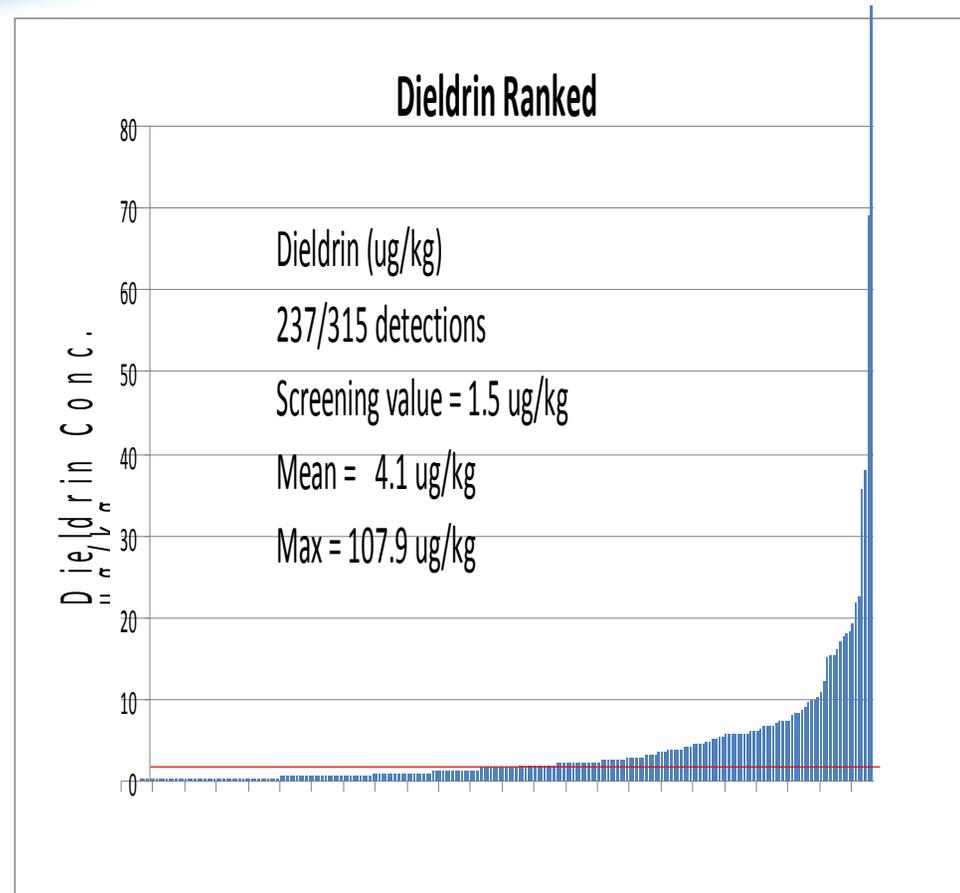
## Chlorinated insecticide detections *n*/315





## Dieldrin-low SV

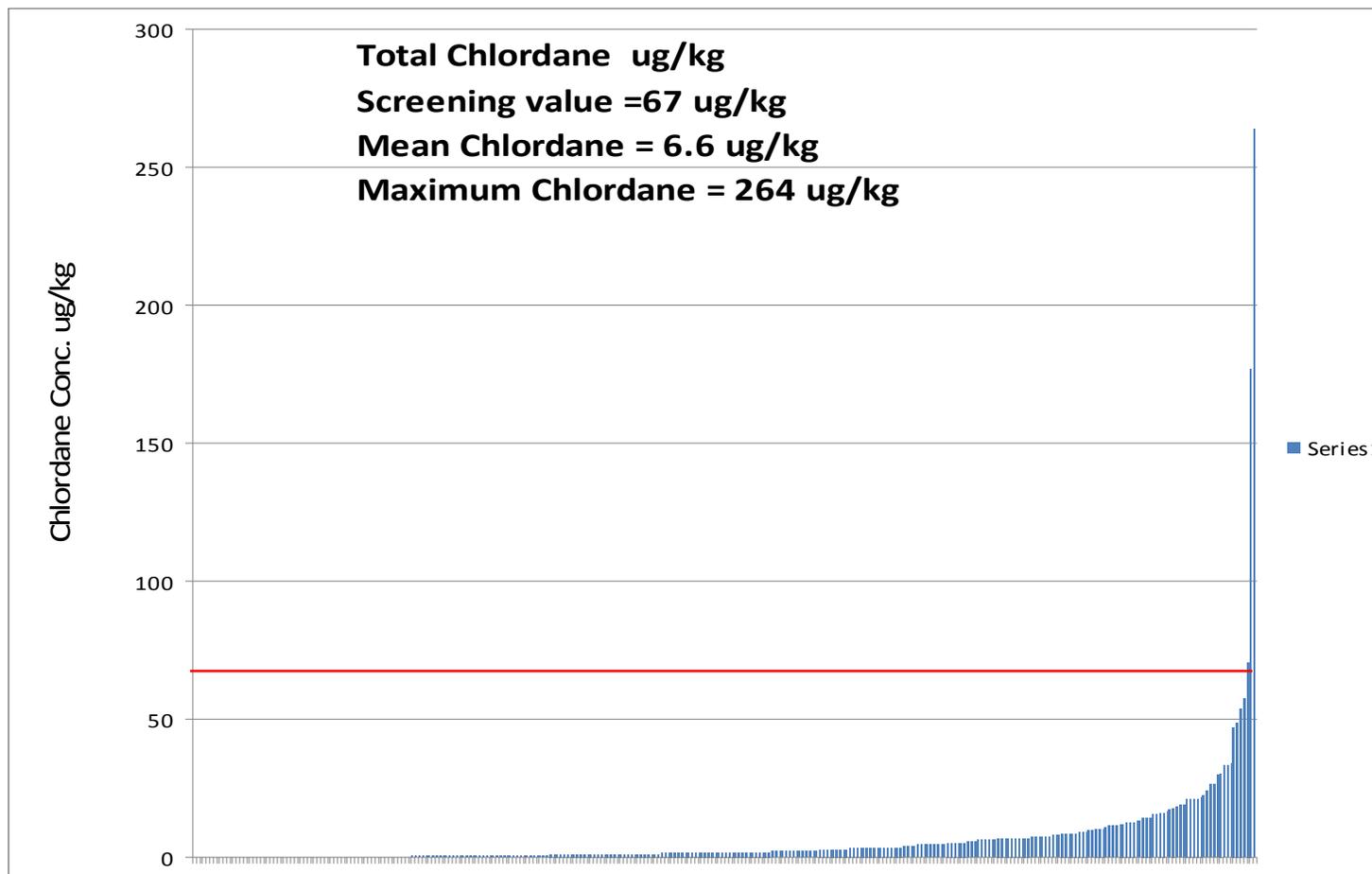
- Dieldrin
- 238/315 detections
- Screening value = 1.5 ug/kg
- Mean = 4.1 ug/kg
- Max = 107.9 ug/kg



Note: Data are preliminary, partial, and unweighted



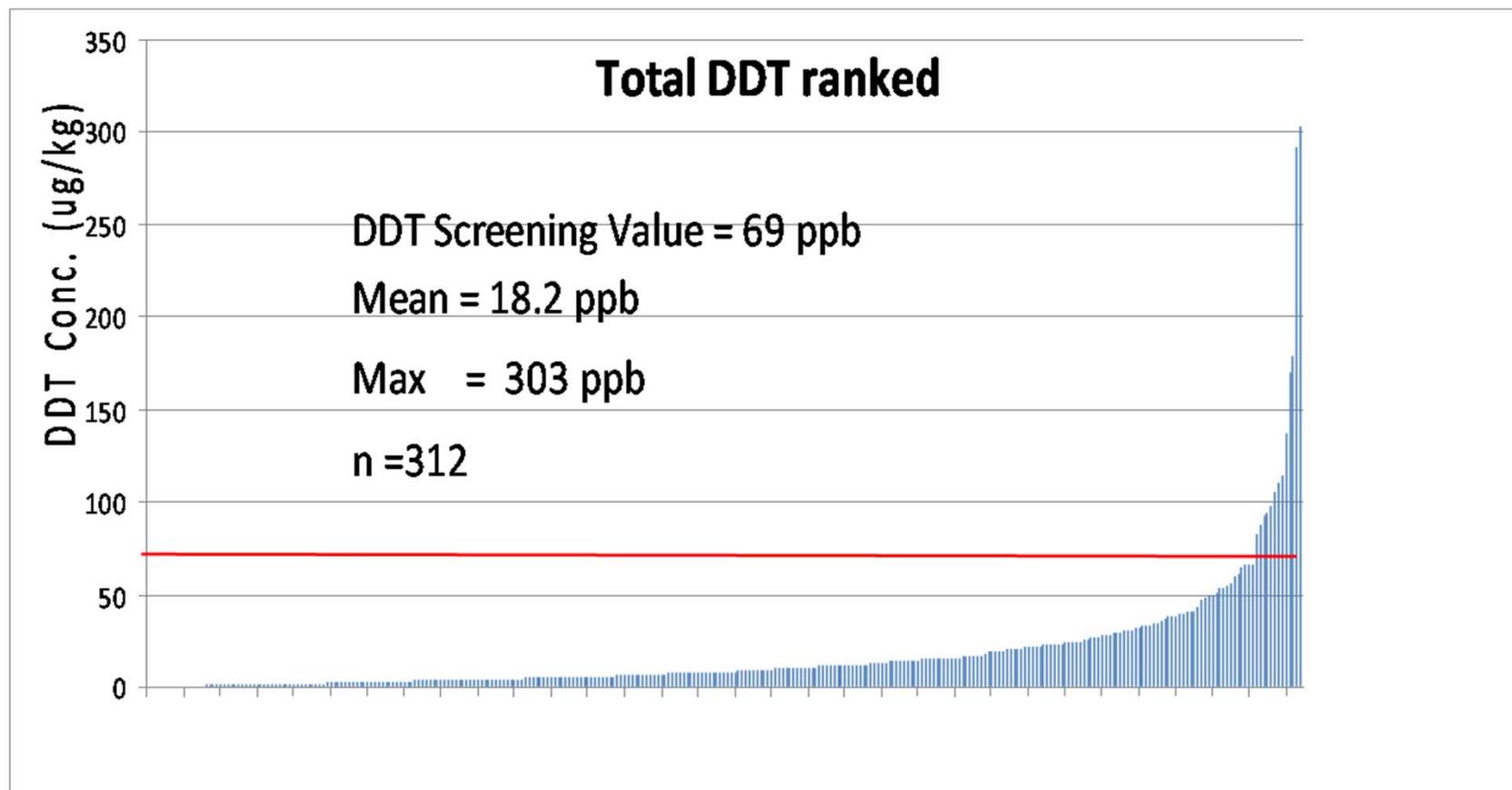
# Chlordane-pervasive, low concentrations, below SV



Note: Data are preliminary, partial, and unweighted



## DDT-toxic, pervasive, moderate concentrations



Note: Data are preliminary, partial, and unweighted



## PCBs and PBDEs

### PCBs

- $n = 305/315$
- Mean = 52 ug/kg
- Max = 856 ug/kg
- SV = 47 ug/kg

### PBDEs

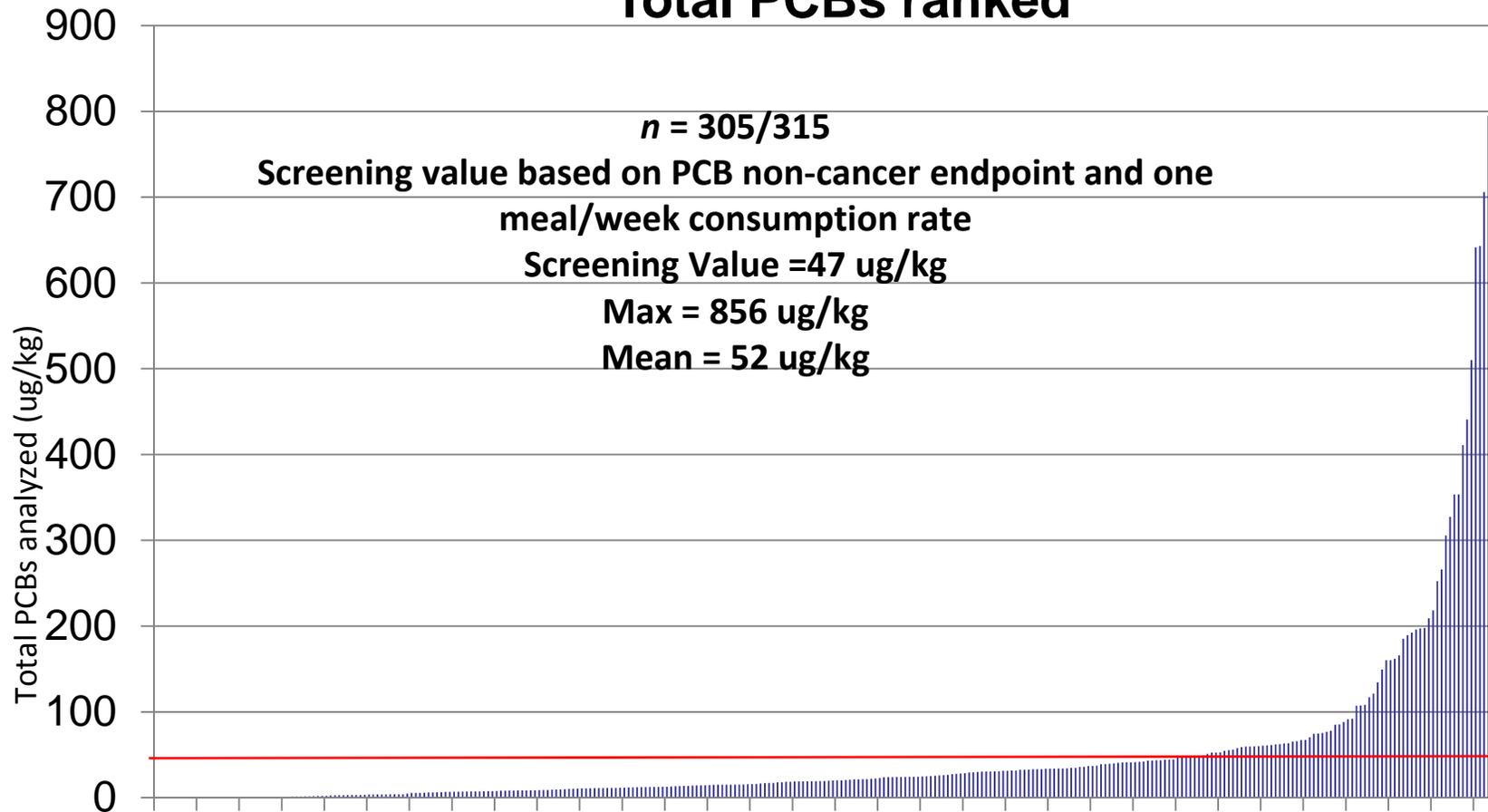
- $n = 298/315$
- Mean = 15 ug/kg
- Max = 311 ug/kg
- SV = 310 ug/kg

Note: Data are preliminary, partial, and unweighted

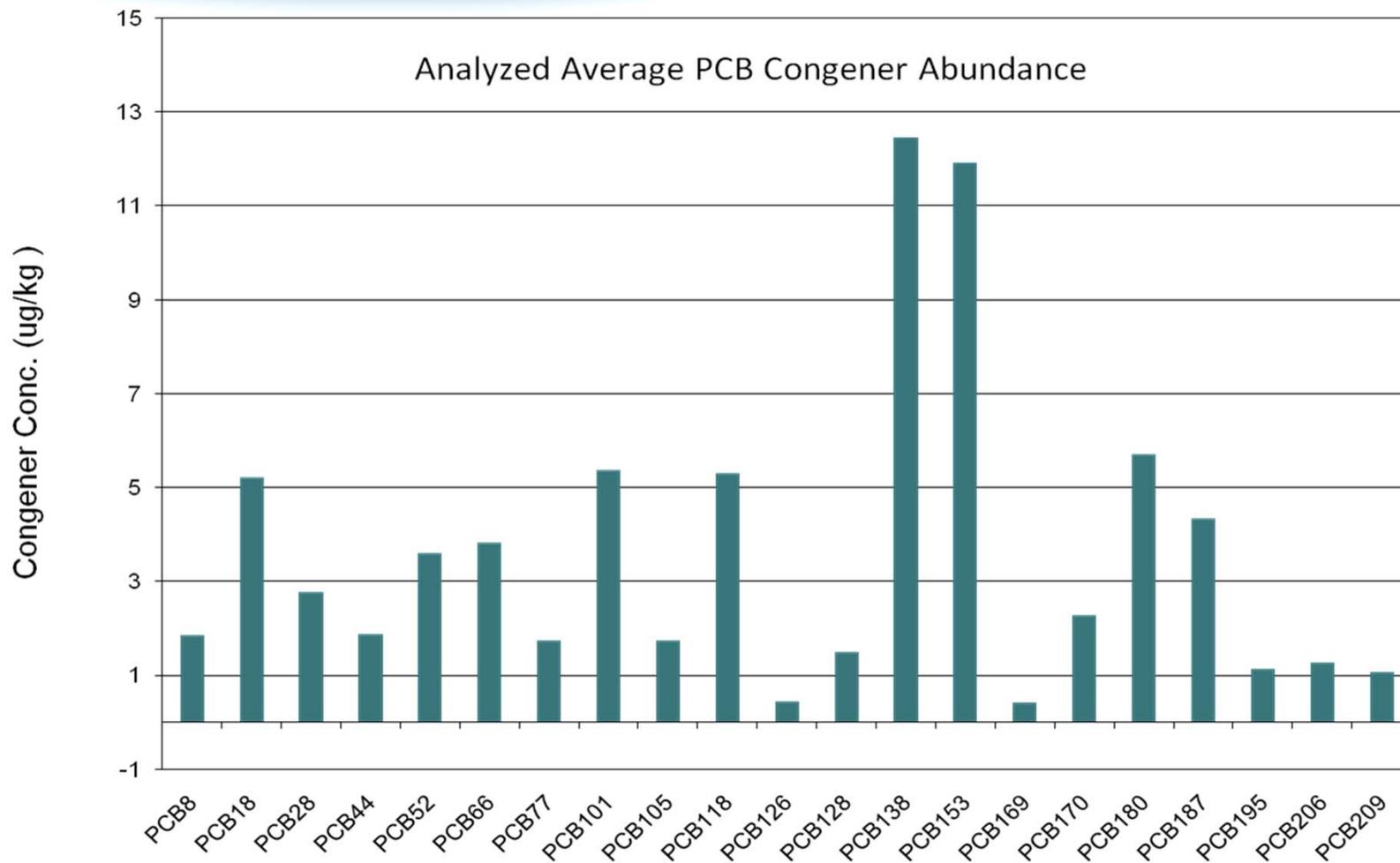


## Summed PCBs (21/209 congeners)

### Total PCBs ranked



Note: Data are preliminary, partial, and unweighted



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## Human health screening values (SVs)- I meal/week

<u>Compound (ug/kg)</u>	<u>Non-cancer SV</u>	<u>Cancer SV</u>
Chlordane	1200	67
Dieldrin	120	1.5
DDT (total)	120	69
PCBs (total)	47	12
PBDEs (total)	310	NA

- U.S. EPA (2000) Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories; Volume 2 Risk Assessment and Fish Consumption Limits; Third Edition EPA 823-B-00-008 Office of Water, Washington DC



## Wildlife risk values (WVs)

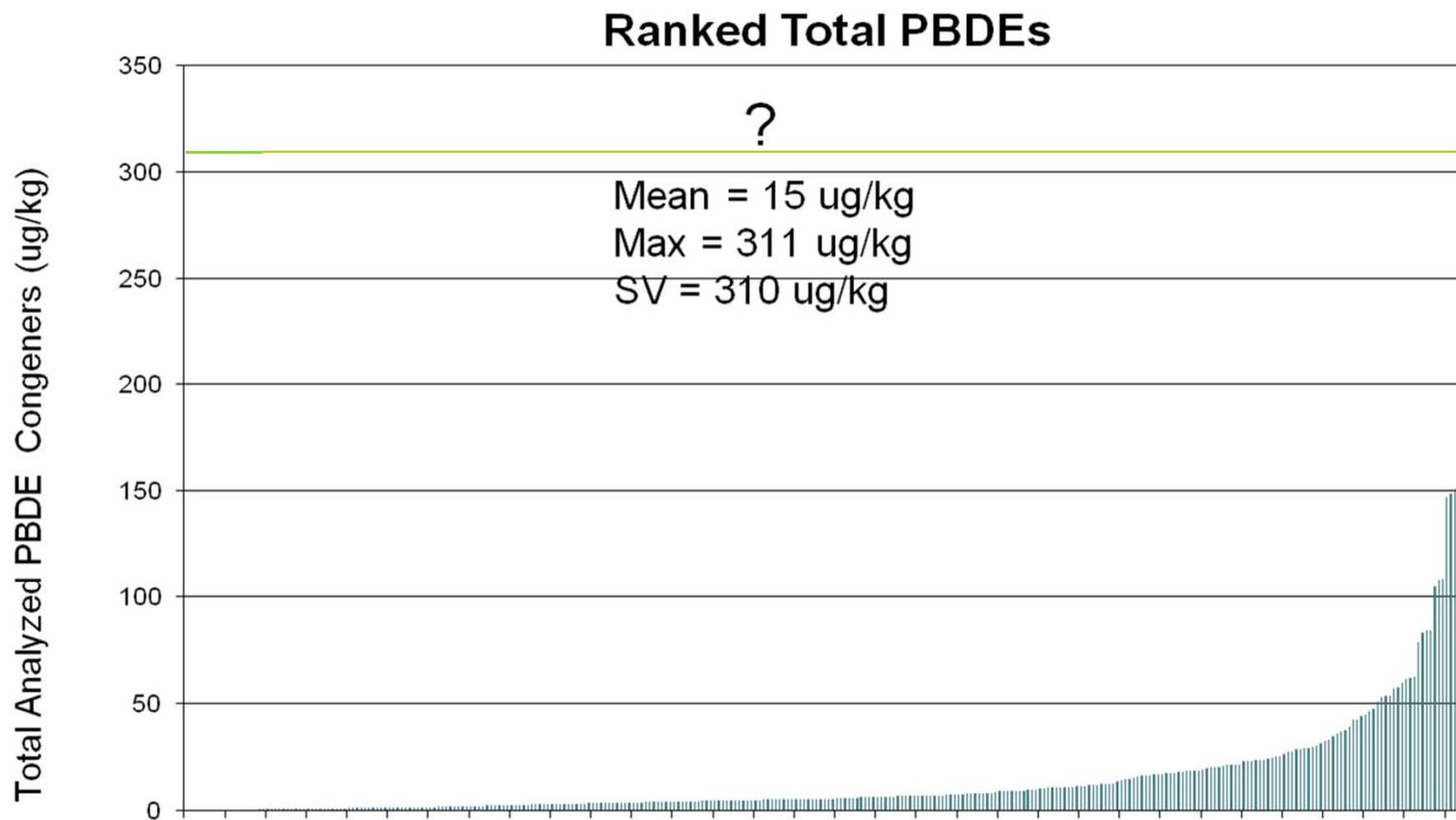
<u>Compound*</u>	<u>Mink WV</u>	<u>Kingfisher WV</u>
Chlordane	830	4.5
Dieldrin	20	360
DDT (total)	360	155
PCBs (total)	130	440

(\*ug/kg wet weight)

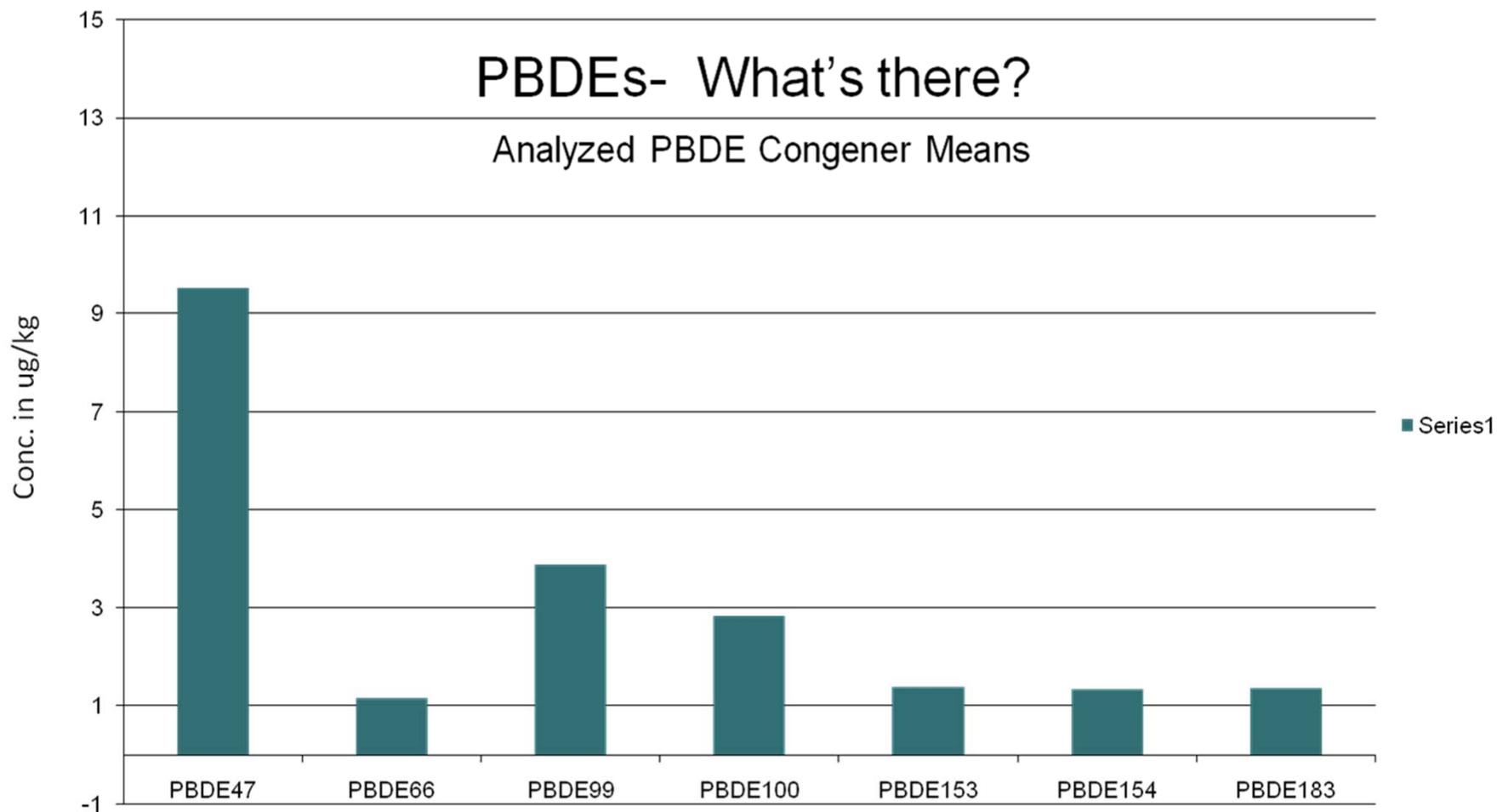
*\*Lazorchak, J.M.et al. 2003. CONTAMINATION OF FISH IN STREAMS OF THE MID-ATLANTIC REGION: AN APPROACH TO REGIONAL INDICATOR SELECTION AND WILDLIFE ASSESSMENT. Environ Tox Chem.\_22,3*



# PBDEs-pervasive, lower concentrations, lower toxicity



Note: Data are preliminary, partial, and unweighted



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## About PBDEs

- Non-legacy organo-halogen
- Neither as abundant in the environment nor as toxic as PCBs
- Similar in shape, size, and binding site to PCBs.
- Predominant exposure pathway is ingestion of dust- only 17 % from food (U.S. EPA-IRIS)
- Penta and octaPBDE not produced after 2004
- Deca phasing out by 2013.

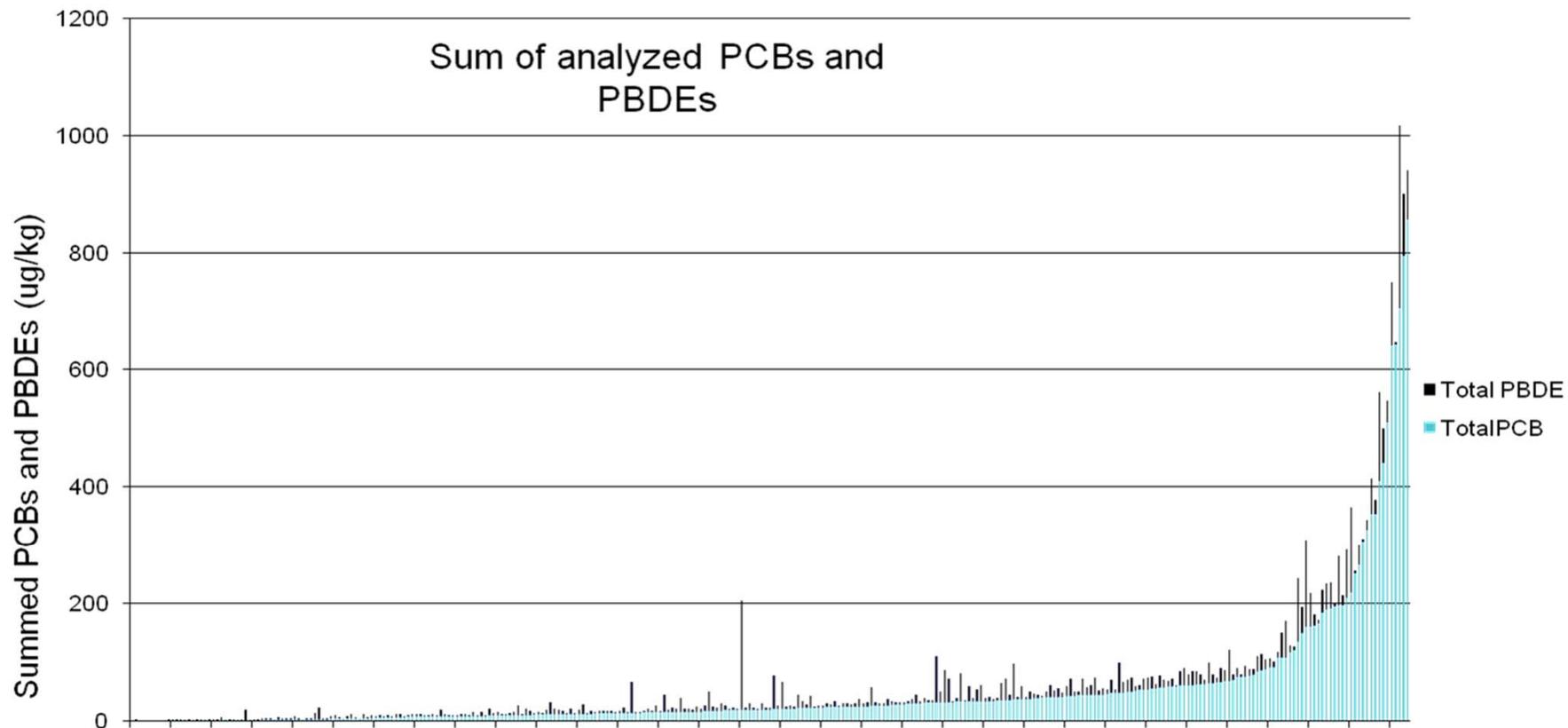


## PBDEs- further considerations:

- Primary toxic effect is neurodevelopmental
- Combinant additive effects have been documented:
  - PCB-52 & PBDE-99 (Eriksson et al., 2006)
  - PCB-153 & PBDE-47 (He, 2010)
  - PBDE-99 & MeHg (Fisher, 2008)
- Variability in 1/2 life ( in humans) among congeners:
  - Penta long, Deca (current production) short
- Window of developmental susceptibility (Eriksson, 2002)



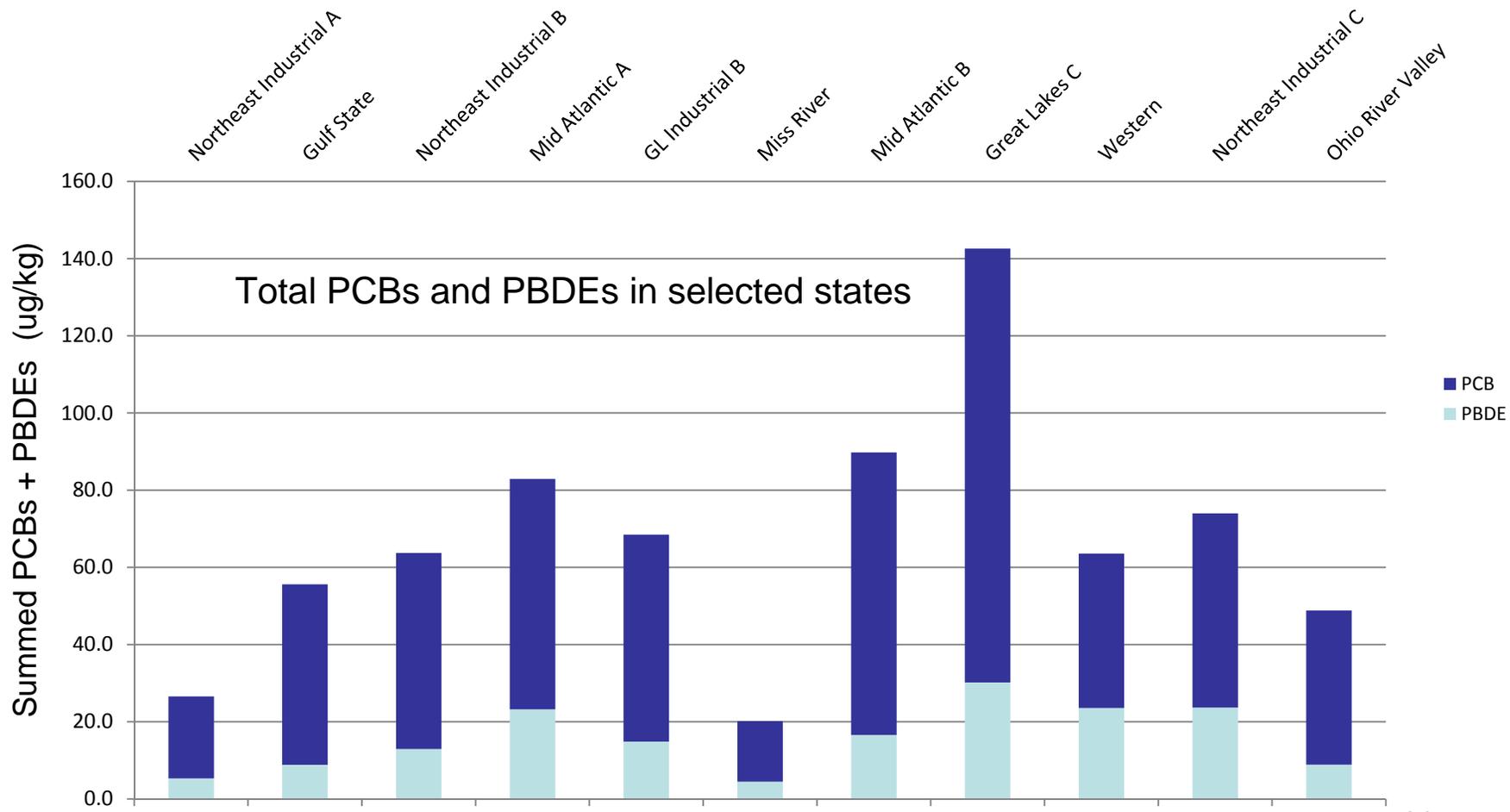
## Should we be looking at this?



Note: Data are preliminary, partial, and unweighted



## What's where? (Fish tissue from Selected states)

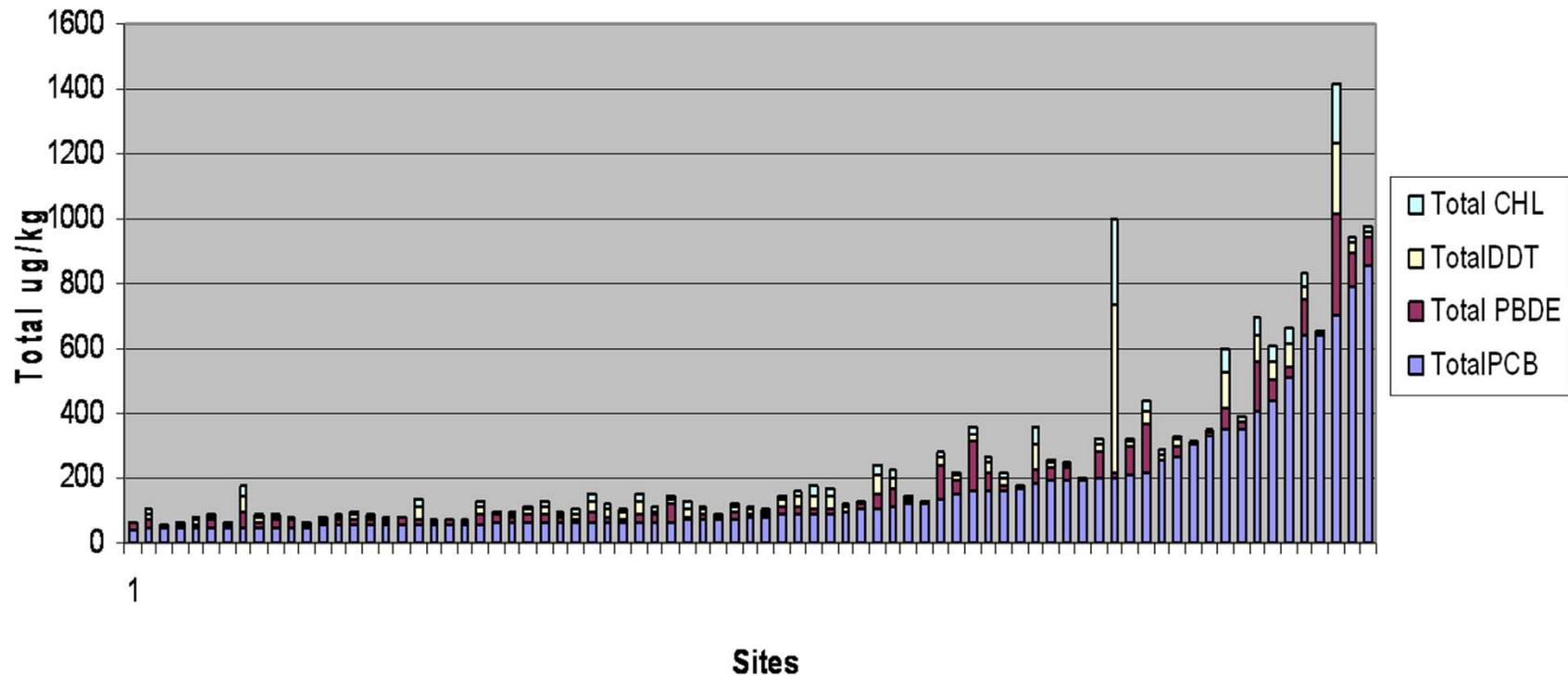


Note: Data are preliminary, partial, and unweighted



Or should we be looking at this?

**Total PCB, PBDE, DDT & Chlordane in Fish Tissue  
4th Quartile Data**



Note: Data are preliminary, partial, and unweighted



## Synthesis

- Dieldrin, chlordane, DDT, PCBs and PBDEs are pervasive in fish tissue samples collected from U.S. rivers
- Chlordane, DDT, PCBs and PBDEs co-occur in fish tissue at 88.6% of locations sampled
- The presence and effects of individual contaminants must be viewed in the context of co-occurring compounds
- Monitoring of fish tissue for assessment and for fish consumption advisories continues to be important for organic compounds as well as Hg
- New persistent organic compounds add to the overall organo-halogen burden.

Note: Data are preliminary, partial, and unweighted



U.S. EPA Office of Water