

# Contaminants of Emerging Concern in the Delaware River Estuary

## National Estuary Program Meeting

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Delaware River Basin  
Commission  
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# Background

- ❑ DRBC – Interstate commission created in 1961. Charged with protecting the water resources of the basin.
- ❑ Has water quality criteria and extensive monitoring programs for ambient water, sediment and fish.
- ❑ Control of Toxic Pollutants: key element in Delaware Estuary CCMP.
- ❑ Goals: collect ambient water and fish data on contaminants of emerging concern



# Basin Facts

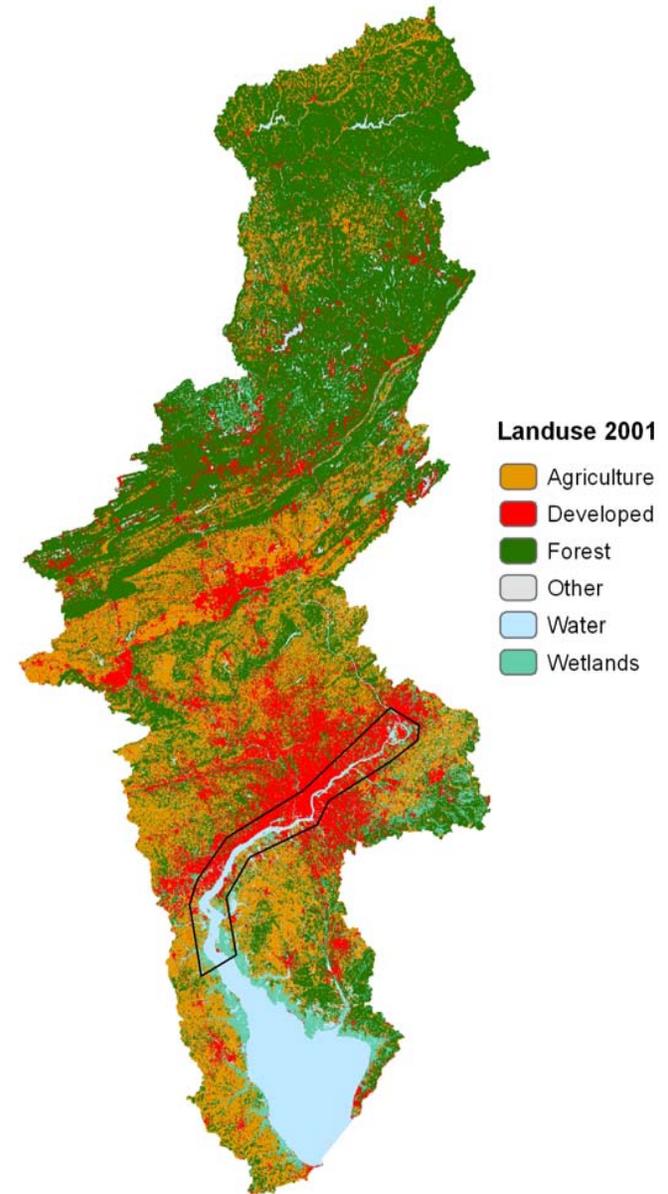
- Largest un-dammed river east of the Mississippi – 330 miles
- 13,539 square mile drainage
- 17 million water users
- 216 tributaries
- Three reaches included in National Wild and Scenic River System
- One of the world's largest freshwater tidal estuaries
- Delaware Bay- 782 sq. miles

# What are contaminants of emerging concern?

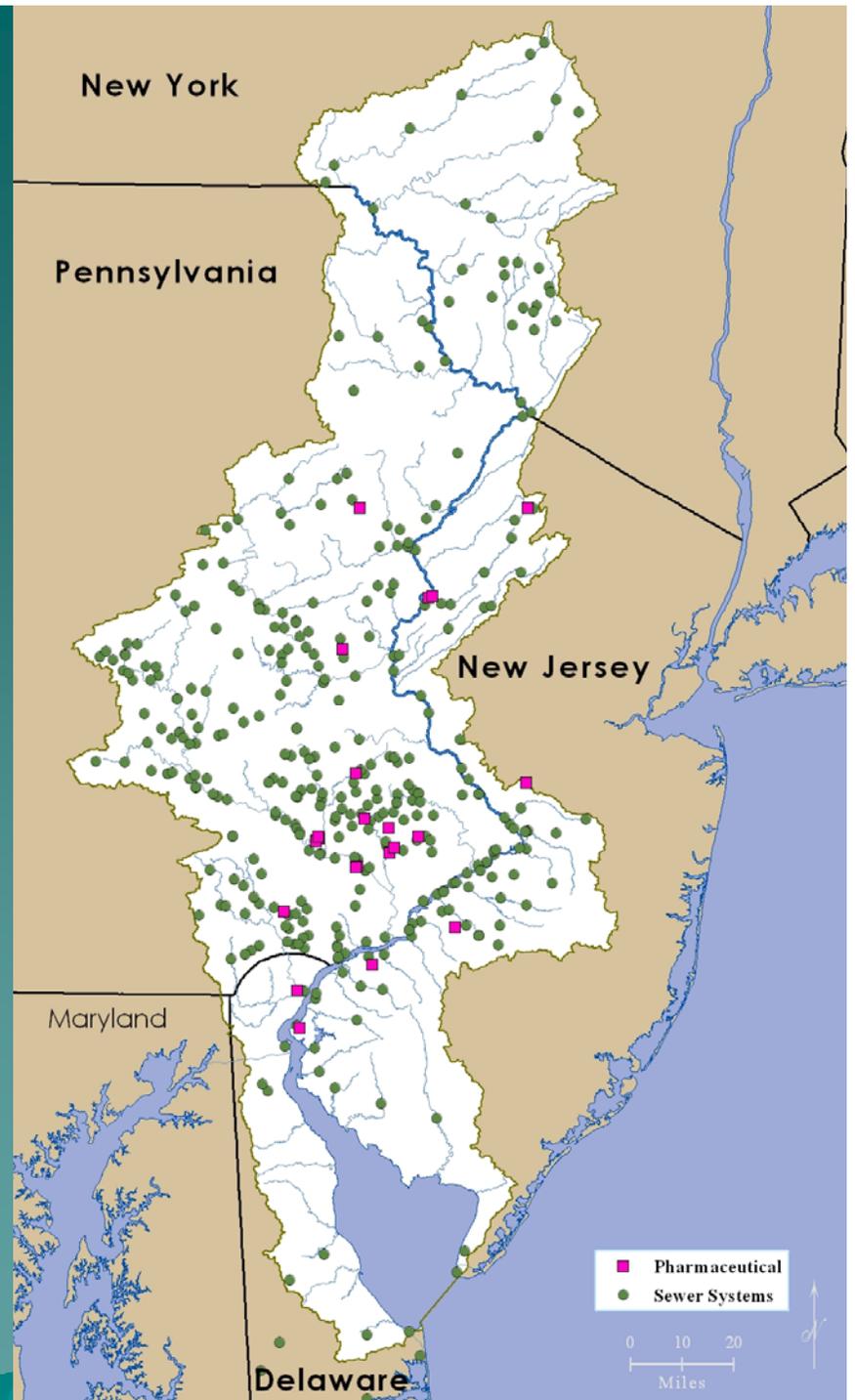
- ❑ Increased interest by scientists, the public, and regulators in substances and toxic effects not historically monitored or assessed.
- ❑ Improved analytical methods to detect compounds.
- ❑ Fate and transport not well understood.
- ❑ Growing body of information on adverse effects, but consensus has not been reached concerning the toxicity of many compounds.

## □ Map of Delaware River Basin Land Use

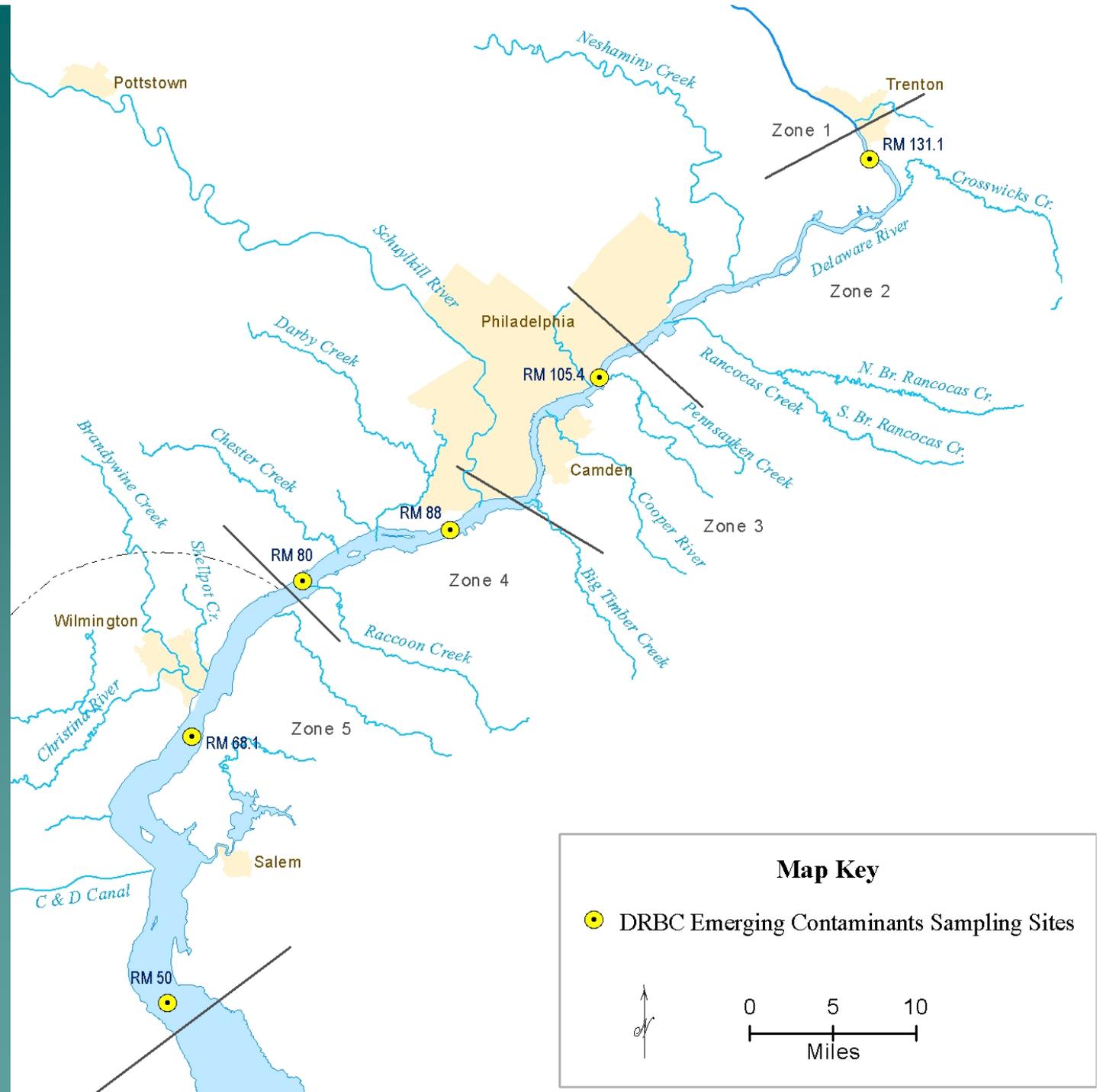
- USGS National Land Cover Database
- Ambient water survey was conducted in the tidal Delaware River (outlined in black)
- Urbanized and industrialized area
- Over 6 million residents live in contributing watersheds



# Map of Pharmaceutical Sources in the Delaware River Basin



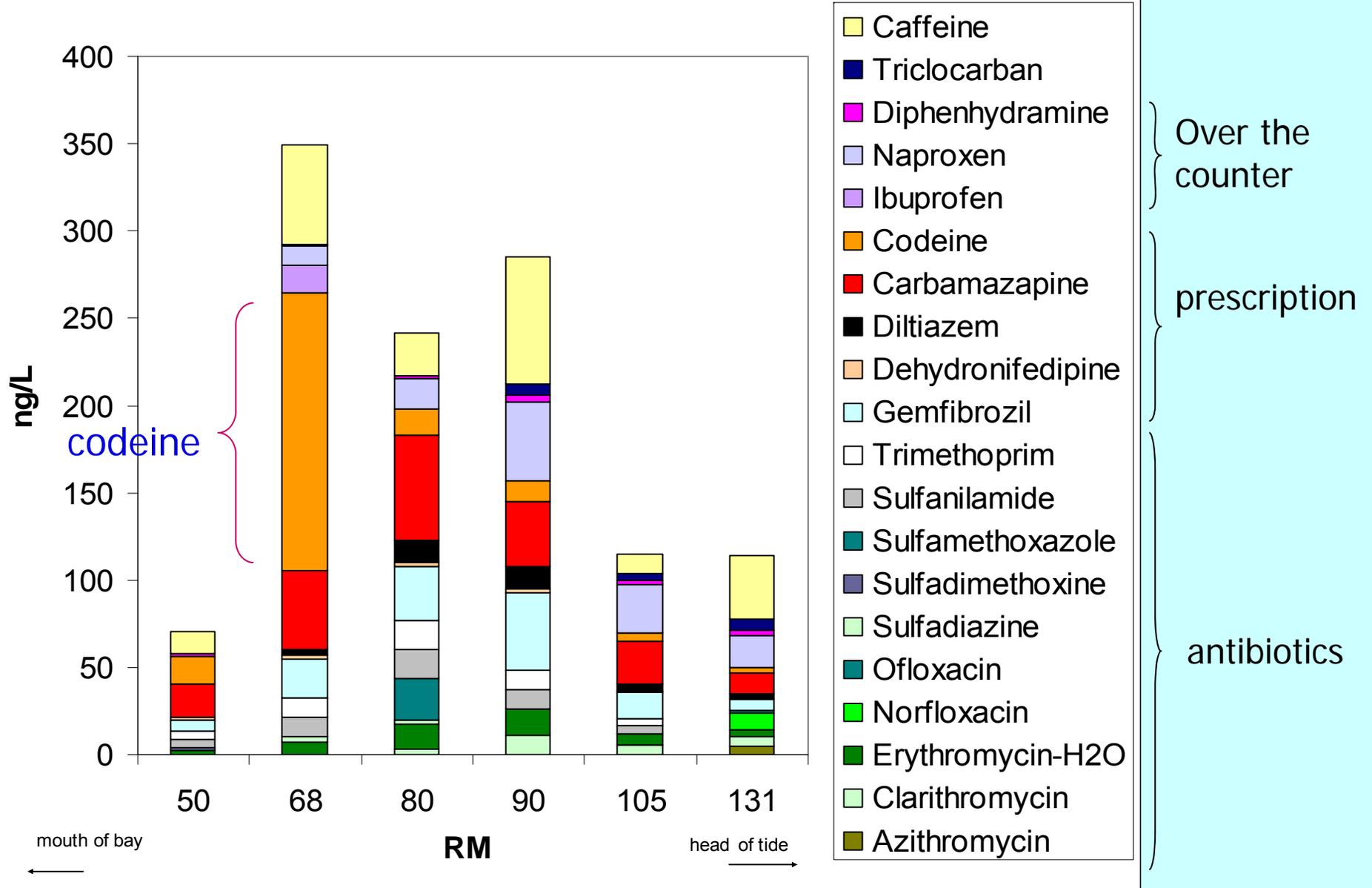
# Ambient Water Sampling Locations



# Emerging Contaminants Surveys Delaware Estuary

	2007 # of analytes / # detected	2008 # of analytes / # detected	2009 # of analytes / # detected
PFC LC/MS/MS	13/11	13/11	13/NA
PPCP LC/MS/MS	54/21	72/49	119/NA
Hormones GC/LRMS	24/6	27/11	17/NA
NP and NPE GC/MS	3/2	3/1	3/NA
bisphenol-A LC/MS/MS		1/0	1/NA

# PPCP in Tidal Delaware River



# Summary – PPCP

- ❑ Analyzed for 72 compounds.
- ❑ Detected 21 compounds.
- ❑ Concentrations in the ng/L (ppb) range
  - Individual compound conc. max. - Codeine at 169 ng/L at RM 68
  - Combined pharmaceuticals conc. max. - 353 ng/L at RM 68
- ❑ Similar contaminants present in surface waters near other urban areas.

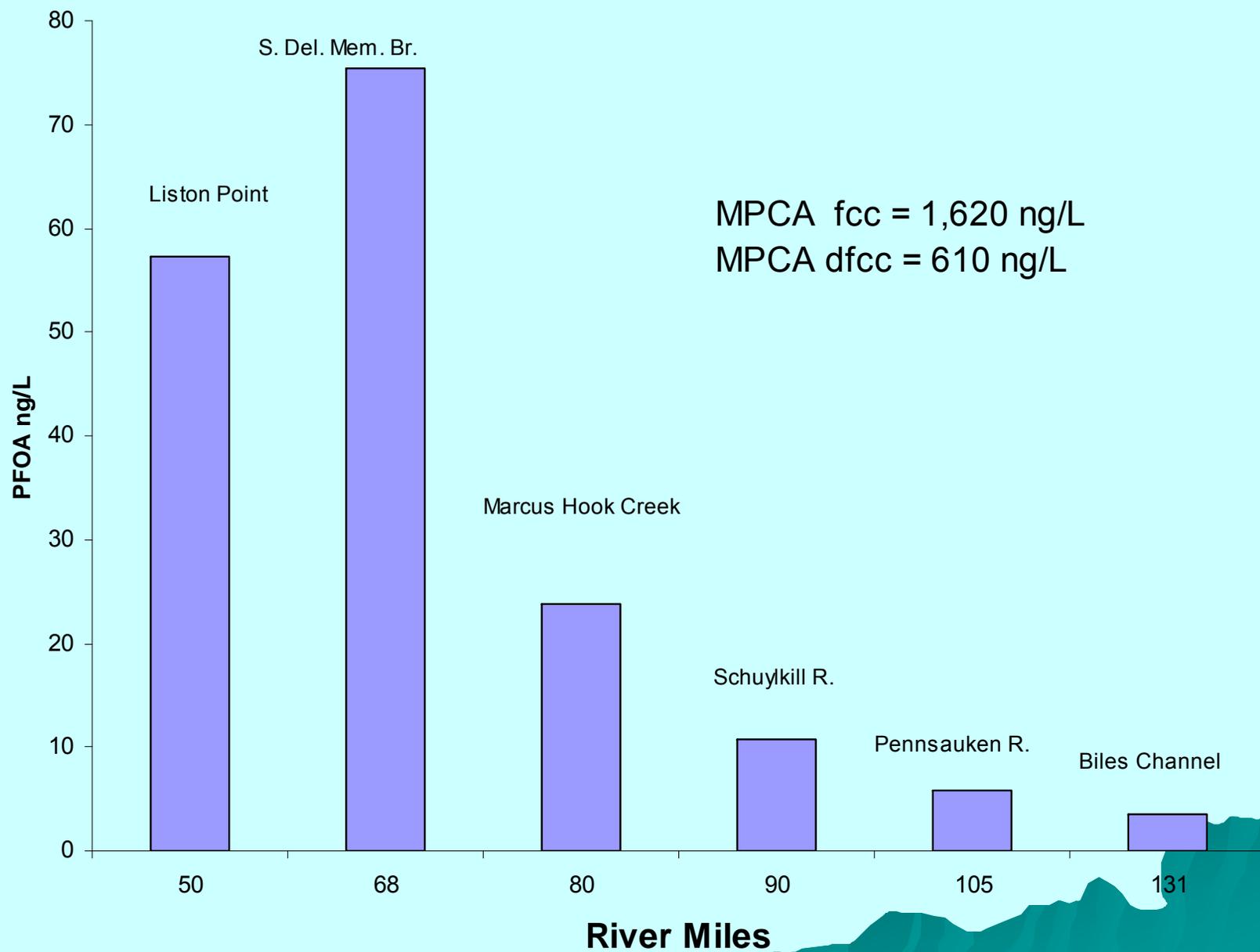
- ❑ Aquatic ecotoxicity data, primarily based on individual compounds and single species tests, are readily available for only 16 out of the 21 PPCP analytes detected limiting assessment of risk to aquatic life.
- ❑ Tier One screening for prioritization of future assessment and characterization
- ❑ Risk Index =  $PEC/PNEC$ 
  - Risk Index > 1.0 (clarithromycin effect on algal growth)
  - Risk Index > 0.1 (carbamazapine effect on *Ceriodaphnia dubia*, ibuprofen effect on *Hydra*, erythromycin effect on *Pseudokirchneriella subcapitata*, sulfamethoxazole effect on cyanobacteria)

# Perfluorochemicals

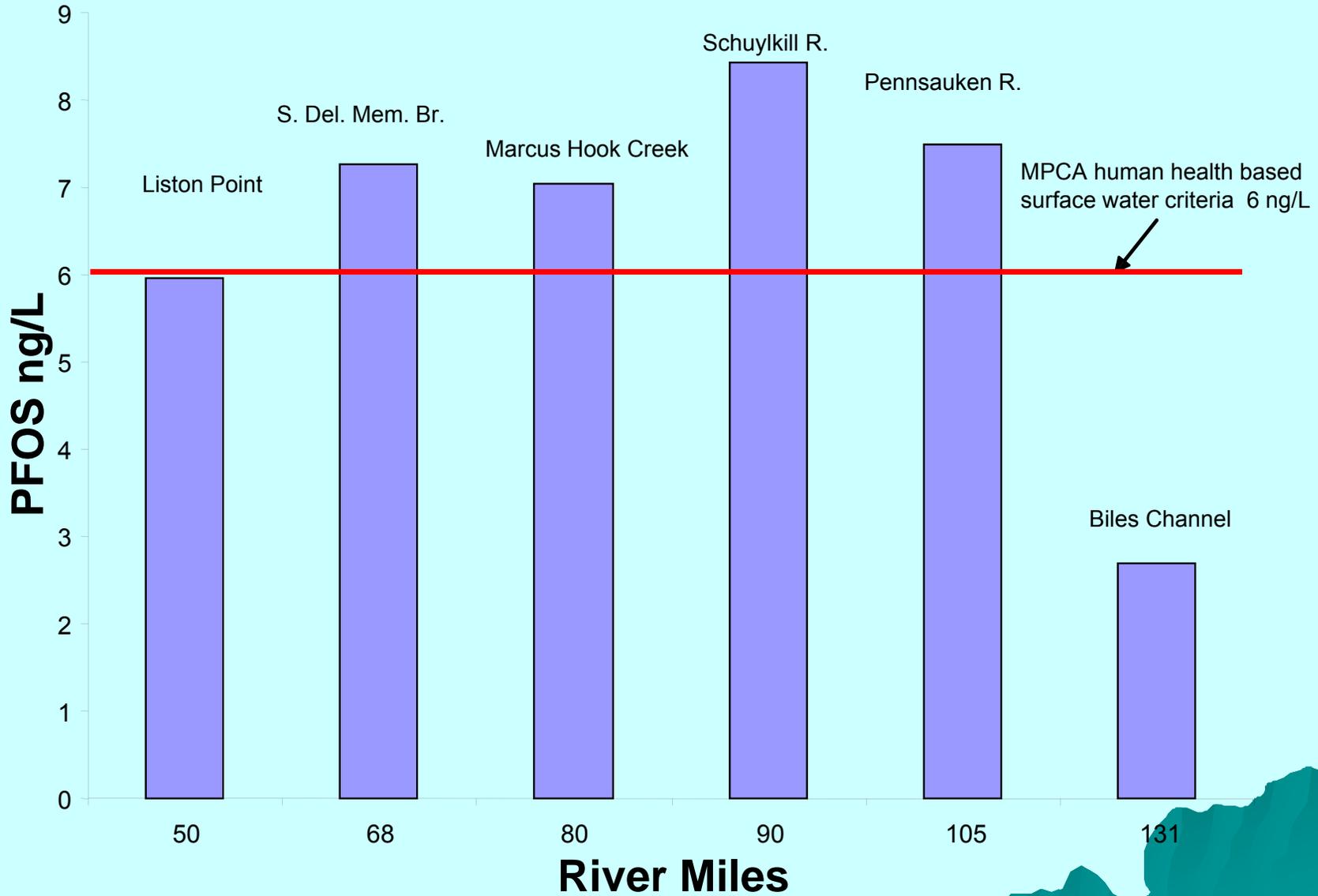
- ❑ Possess unique properties that make them ideal for use in products that resist heat, oil, stains, grease and water.
- ❑ They are commonly used in nonstick cookware, stain-resistant carpet and fabrics, fire-fighting foam and other industrial applications.
- ❑ Their chemical structure make them extremely resistant to degradation in the environment.



## PFOA In Ambient Water Of The Tidal Delaware River



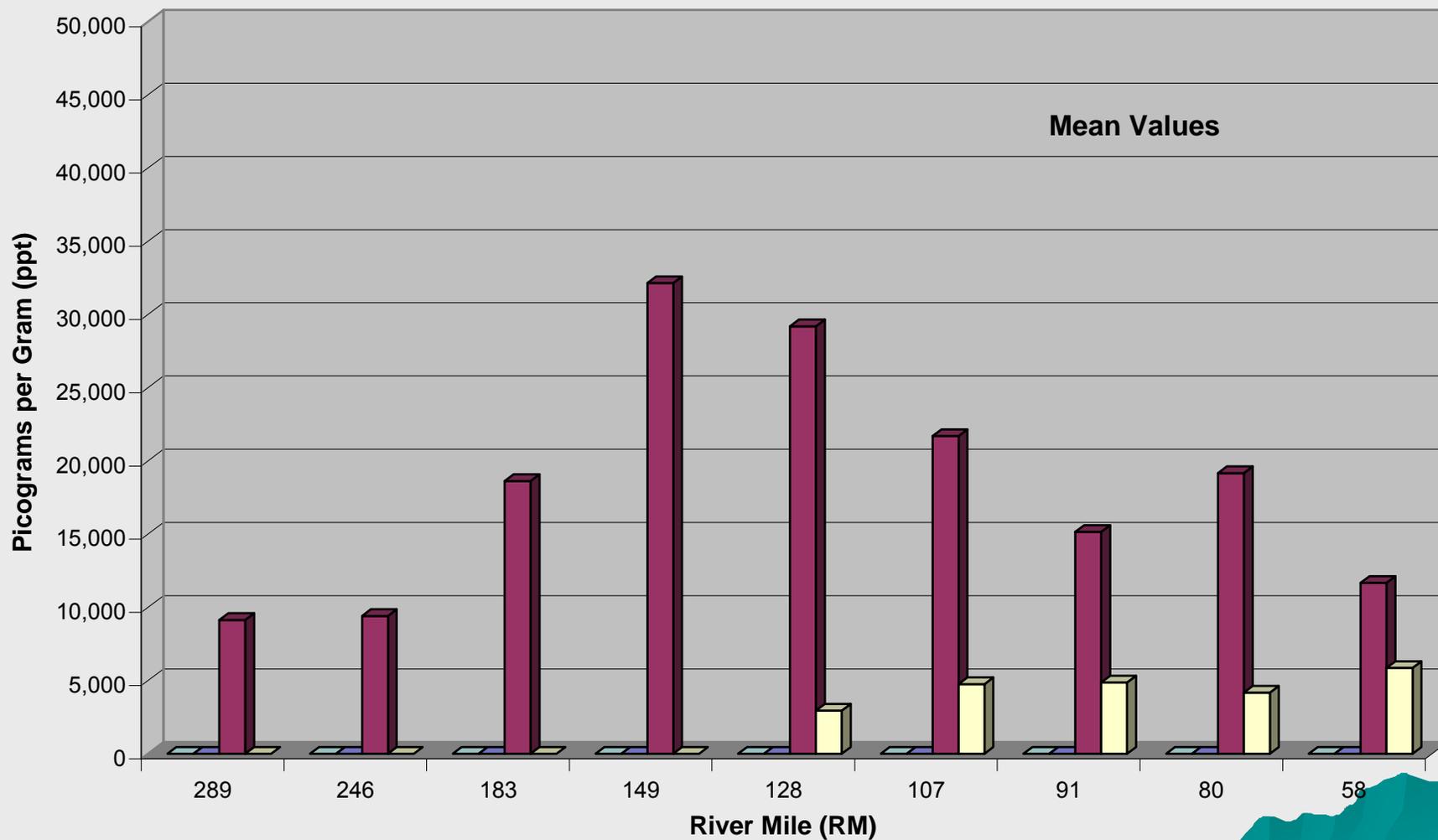
# PFOS In Ambient Waters Of The Tidal Delaware River



# PFNA In Ambient Waters Of The Tidal Delaware River

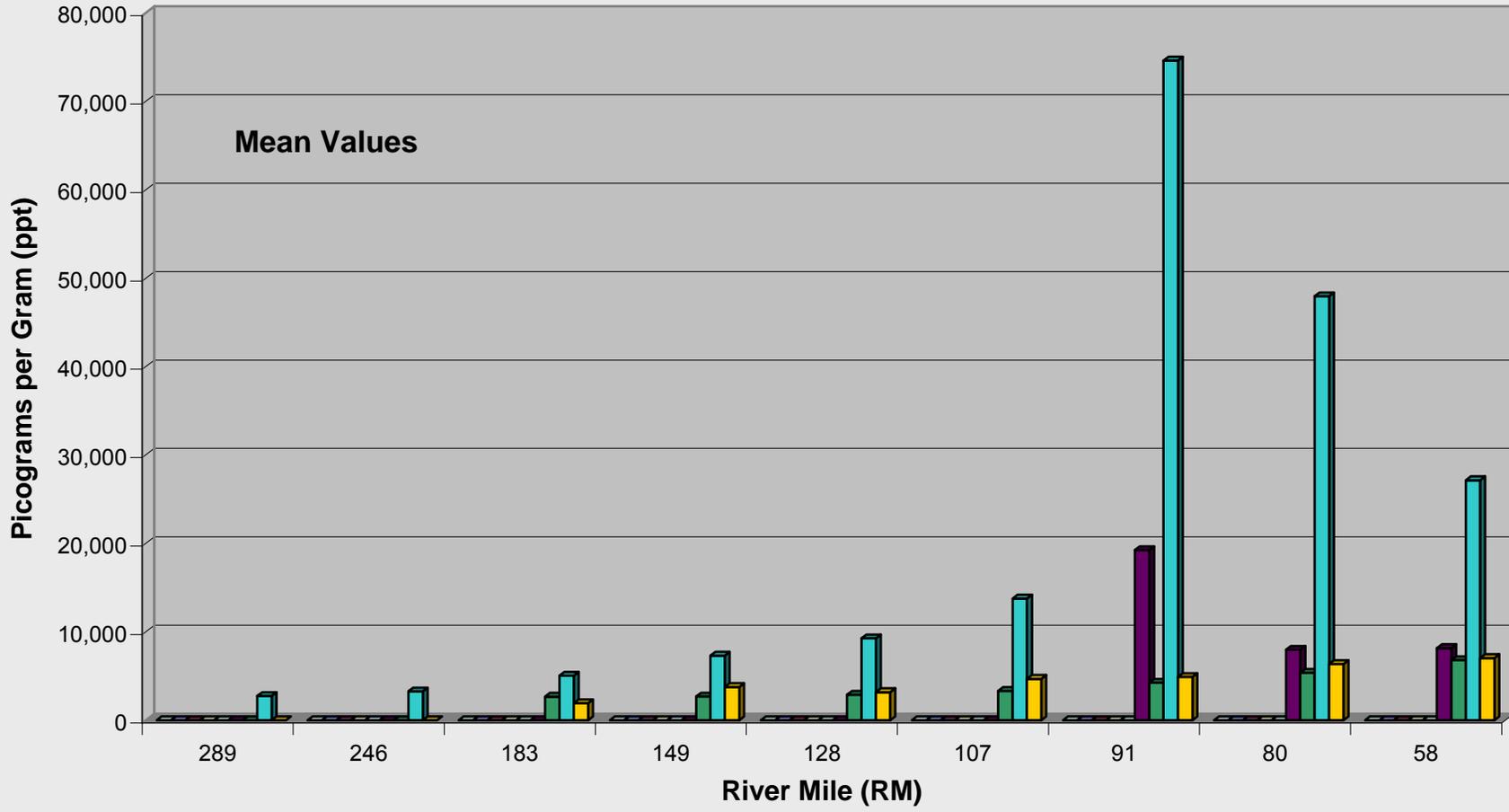


## Perfluorinated Alkyl Sulfonate Results for Pelagic Species Delaware River - 2004 - 2007



PFBS PFHxS PFOS PFOSA

# Perfluorinated Carboxylate Results for Pelagic Species Delaware River - 2004 - 2007



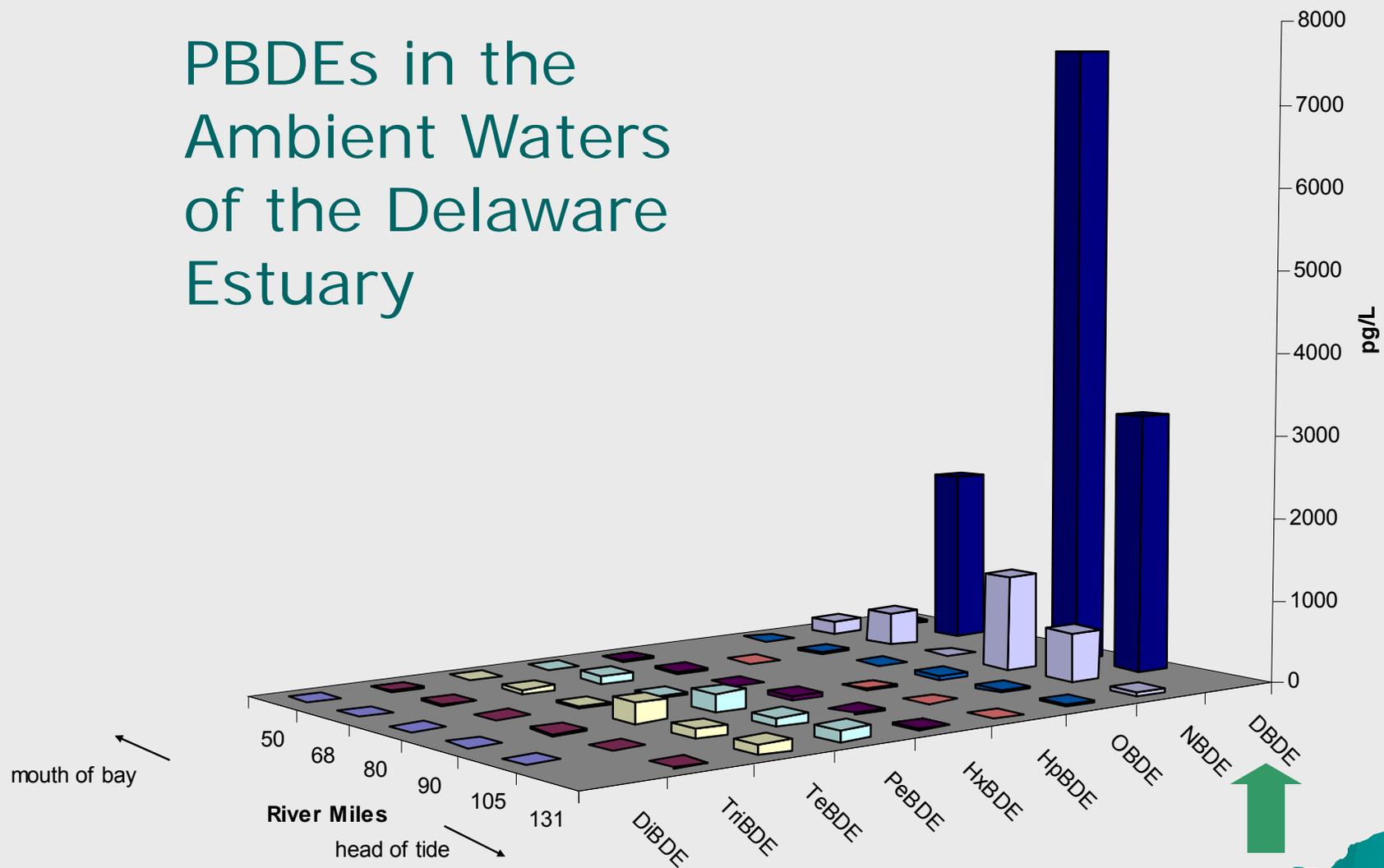
# Summary – PFCs

- PFC detected at ng/L levels
  - PFNA highest PFC concentrations
  - PFOA levels do not exceed MN surface water criteria of 610 ng/L
  - PFOS levels exceed MN surface water criteria of 6 ng/L
- Additional information needed especially on longer chain and sulfonated compounds.

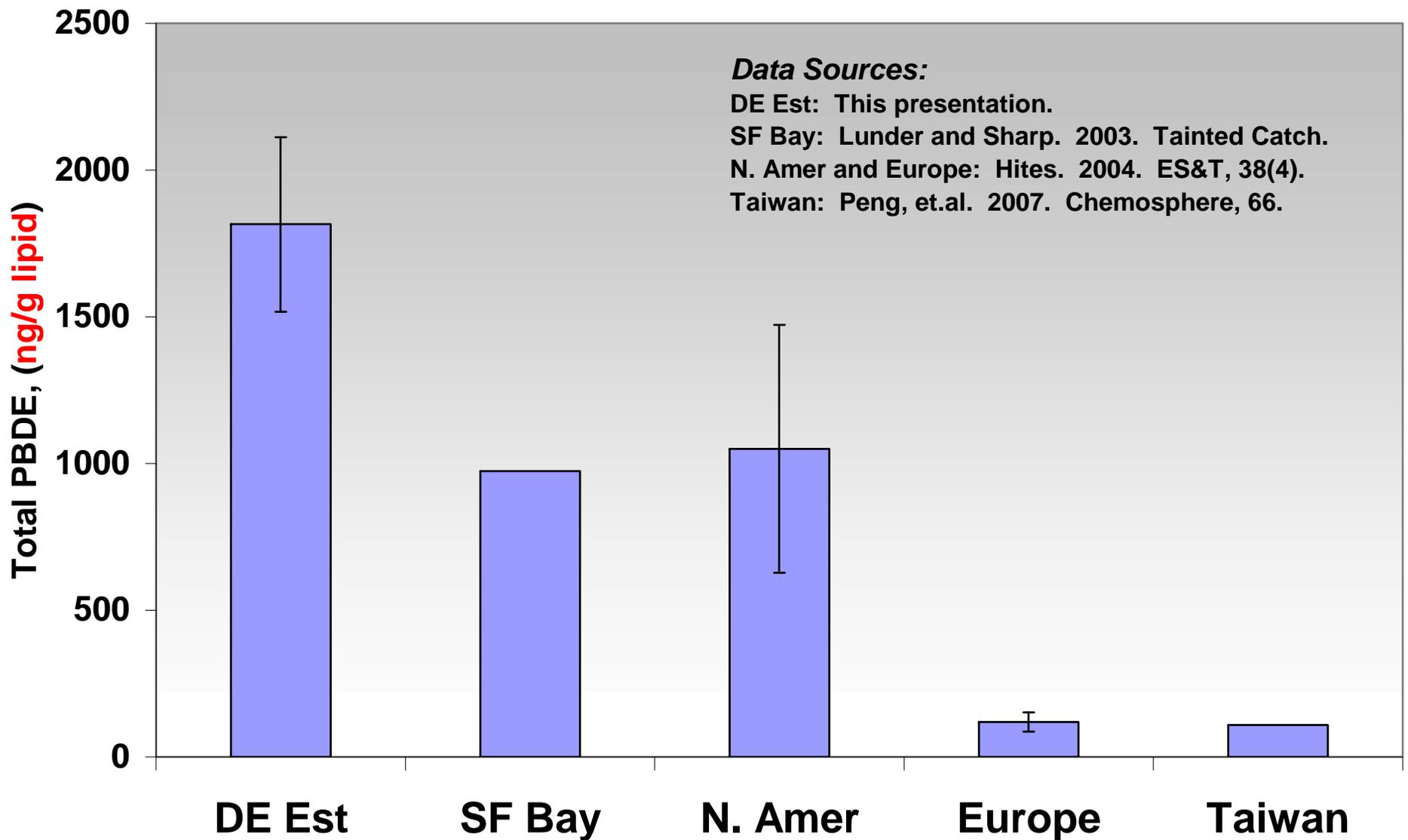
# Brominated Flame Retardants

- ❑ Penta-BDE: used in foam products such as seat cushions and other household upholstered furniture; rigid insulation
- ❑ Octa-BDE: used in high-impact plastic products (e.g., computers, automobile trim).
- ❑ Deca-BDE: plastics (e.g., wire and cable insulation, adhesives, coatings and textile coatings) & fabric/carpet/drapery treatment

# PBDEs in the Ambient Waters of the Delaware Estuary



## Mean PBDE in DE Estuary Fish vs. Fish Elsewhere



from presentation by Rick Greene, DNREC

# Summary – PBDE

- ❑ Total PBDE detected at concentrations between 246 to 9,376 pg/L.
- ❑ DecaBDE predominant homolog at three sites (2,090 to 7,630 pg/L).
- ❑ NonaBDE, PeBDE and TeBDE each predominant at different sites (29 to 161 pg/L).
- ❑ PeBDE and OBDE have low potential for direct toxicity, can bioaccumulate.
- ❑ DecaBDE concern is persistence and potential for transformation to bioaccumulative forms.

# Next Steps

DRBC plans to continue the assessment of sources, fate and effect of emerging contaminants in the Delaware Estuary through:

- Periodic ambient water and fish tissue surveys in mainstem of Delaware River.
- Limited POTW effluent sampling.
- Ambient surveys in tributaries for PFC.
- Collaborative studies on the effects:
  - ◆ Continue comparisons to effects levels – need to develop criteria for priority chemicals.
  - ◆ Exploring the use of alternative bioassays and other measures of impacts on aquatic health.

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