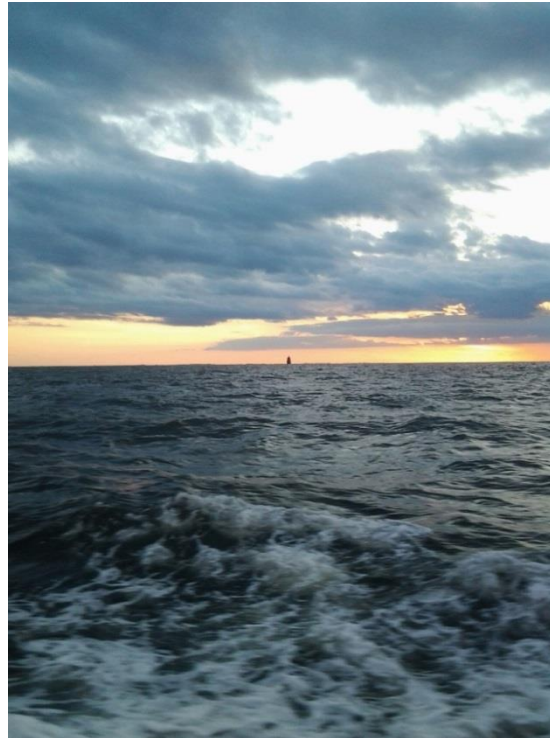


# Delaware River Basin Commission

## Emerging Contaminants in the Delaware River Basin

**Ron MacGillivray, Ph.D.**  
*Senior Environmental  
Toxicologist*

Schuylkill Action  
Network (SAN)  
*January 10, 2018*



**Delaware River Basin Commission**

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# Why was the DRBC created in 1961?

- Water supply shortages and disputes over the apportionment of the basin's waters;
- Severe pollution in the Delaware River and its major tributaries;
- Serious flooding



The 1937 *Philadelphia Record* editorial page cartoon depicts the time when the tidal Delaware was an open sewer, where pollution in some stretches robbed the river of all its oxygen needed to support fish and other aquatic life.

Five Equal Members:  
Delaware  
New Jersey  
Pennsylvania  
New York  
Federal Government



Delaware River Basin Commission

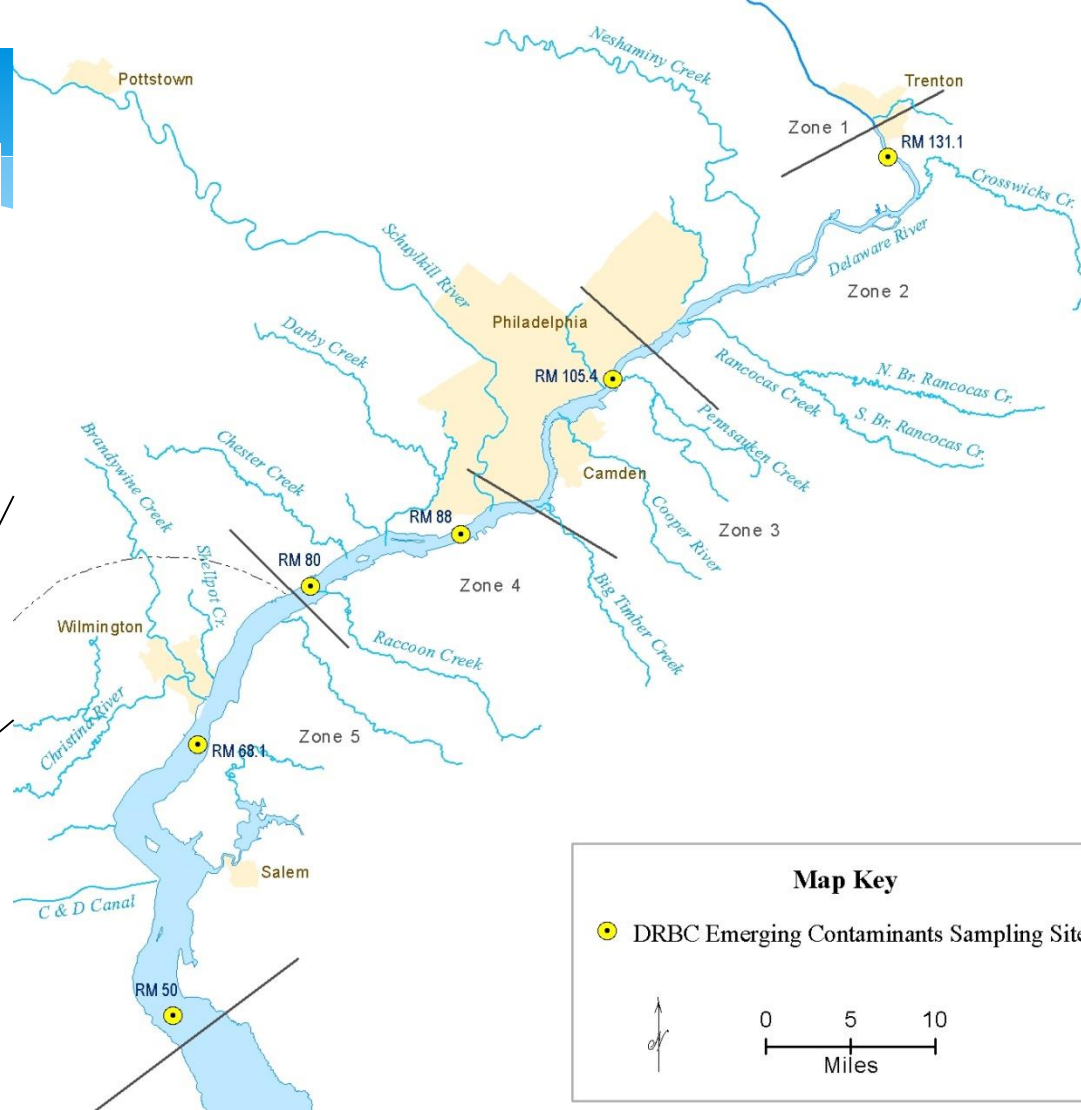
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# Current Water Quality Concerns

## Why are Pharmaceuticals and Personal Care Products (PPCP) of concern?

- \* Biological effects (diclofenac, triclocarban)
- \* Resistant to degradation (carbamazepine)
- \* Widespread and increasing use (ibuprofen, metformin)
- \* Wastewater treatment plants are not designed to remove (trimethoprim, erythromycin)
- \* Effects on aquatic life (hormone EE2)

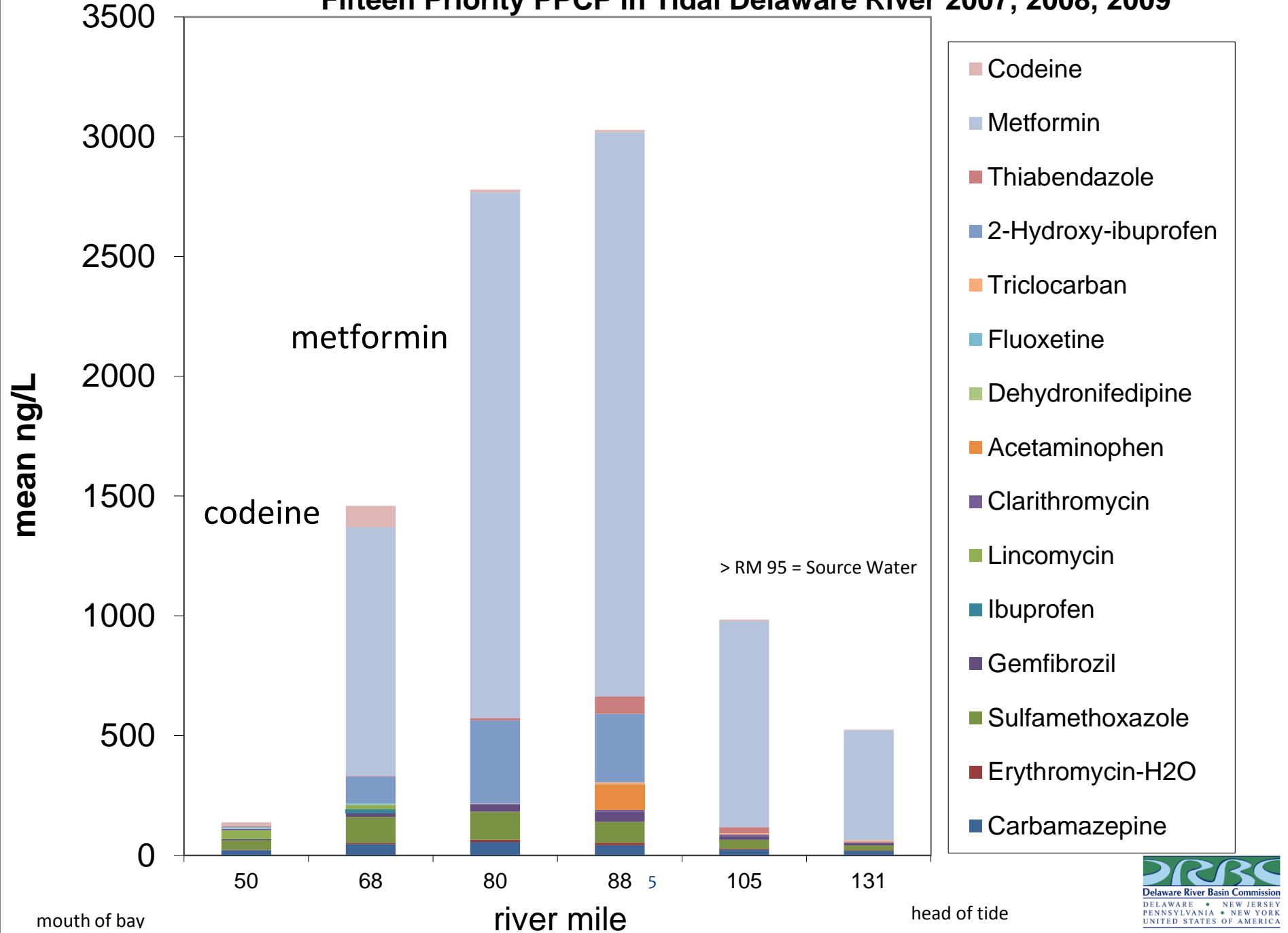
# Delaware River Basin



PPCP surveys  
2007, 2008, 2009, 2017



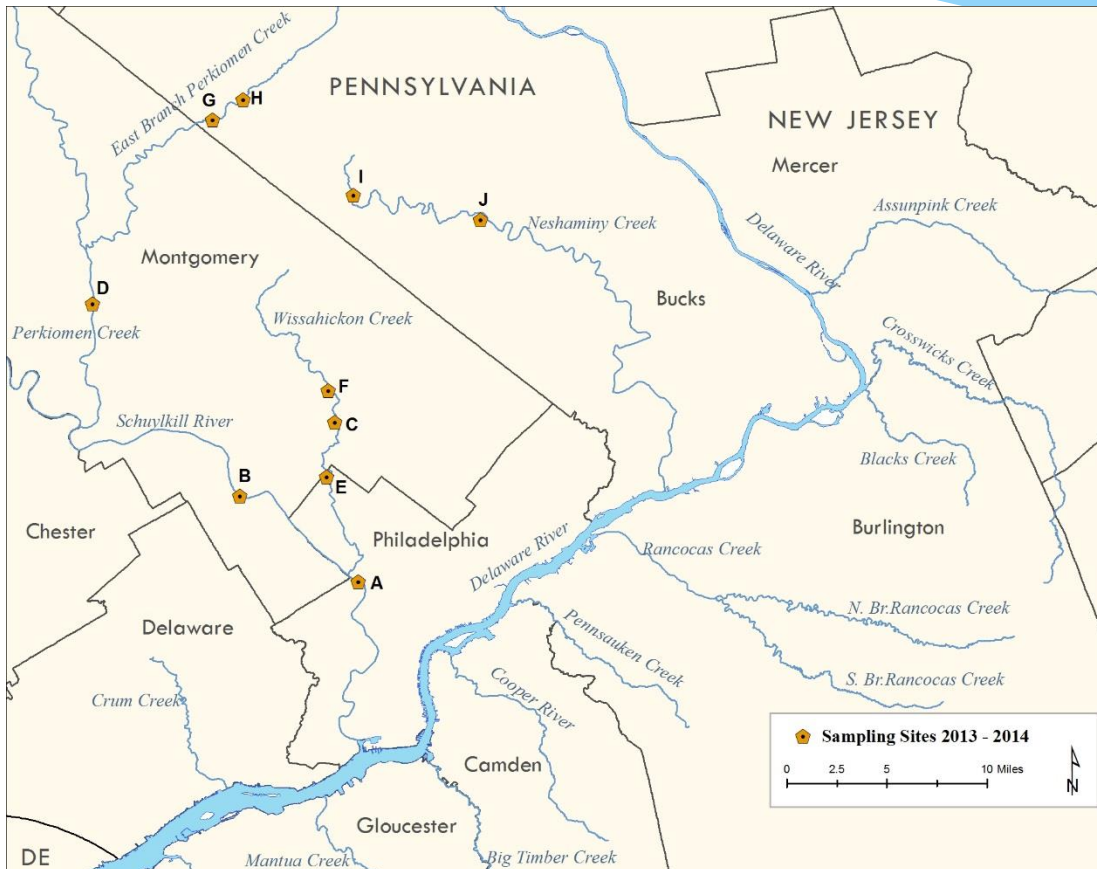
# Fifteen Priority PPCP in Tidal Delaware River 2007, 2008, 2009



# PPCP in SEPA Tributaries of the Delaware River

## Temple University / DRBC

### PA Water Resources Research Center and PA Sea Grant



# Why are Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) of Concern?

- \* Properties
- \* Uses
- \* Sources
- \* Stewardship
- \* Alternatives
- \* Discharges
- \* Persistence
- \* Toxicity
- \* Bioaccumulation
- \* Transport and Sinks



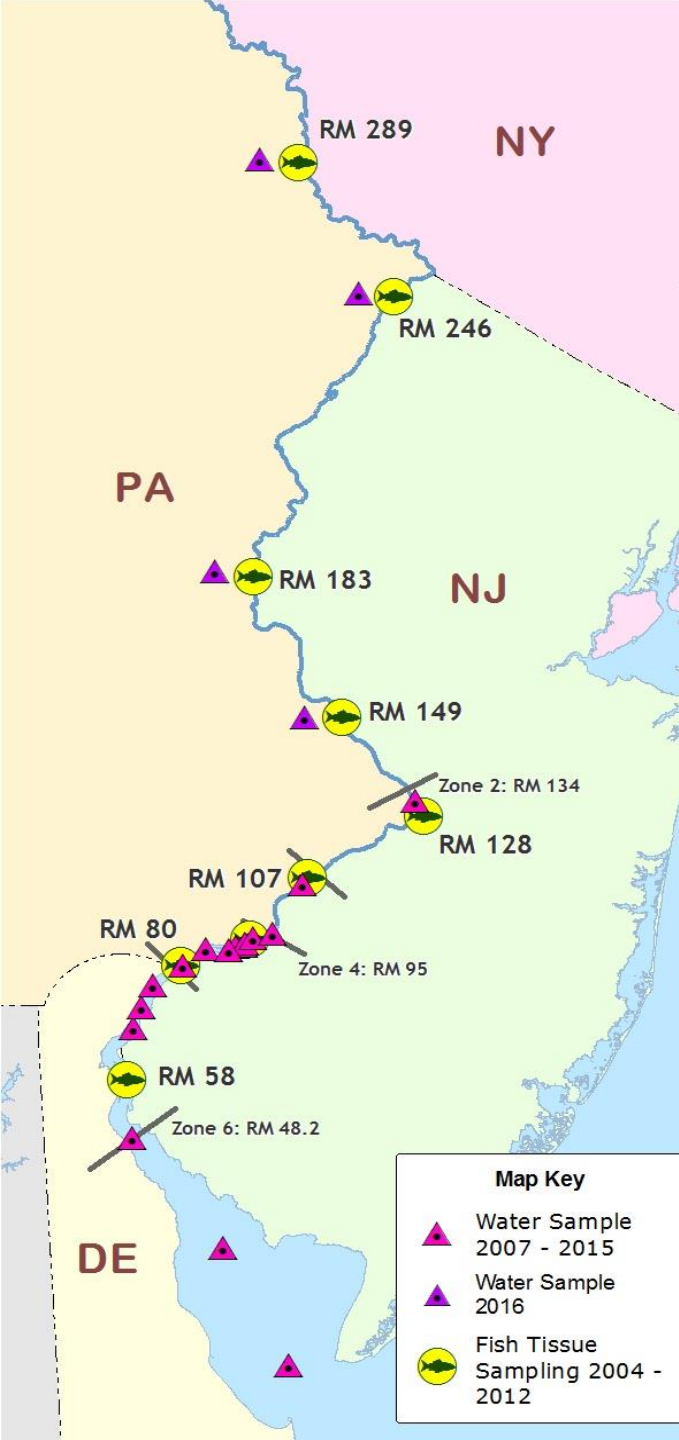
# PFAS Sites

## Surface Water Samples

Six tidal sites in 2007, 2008, 2009

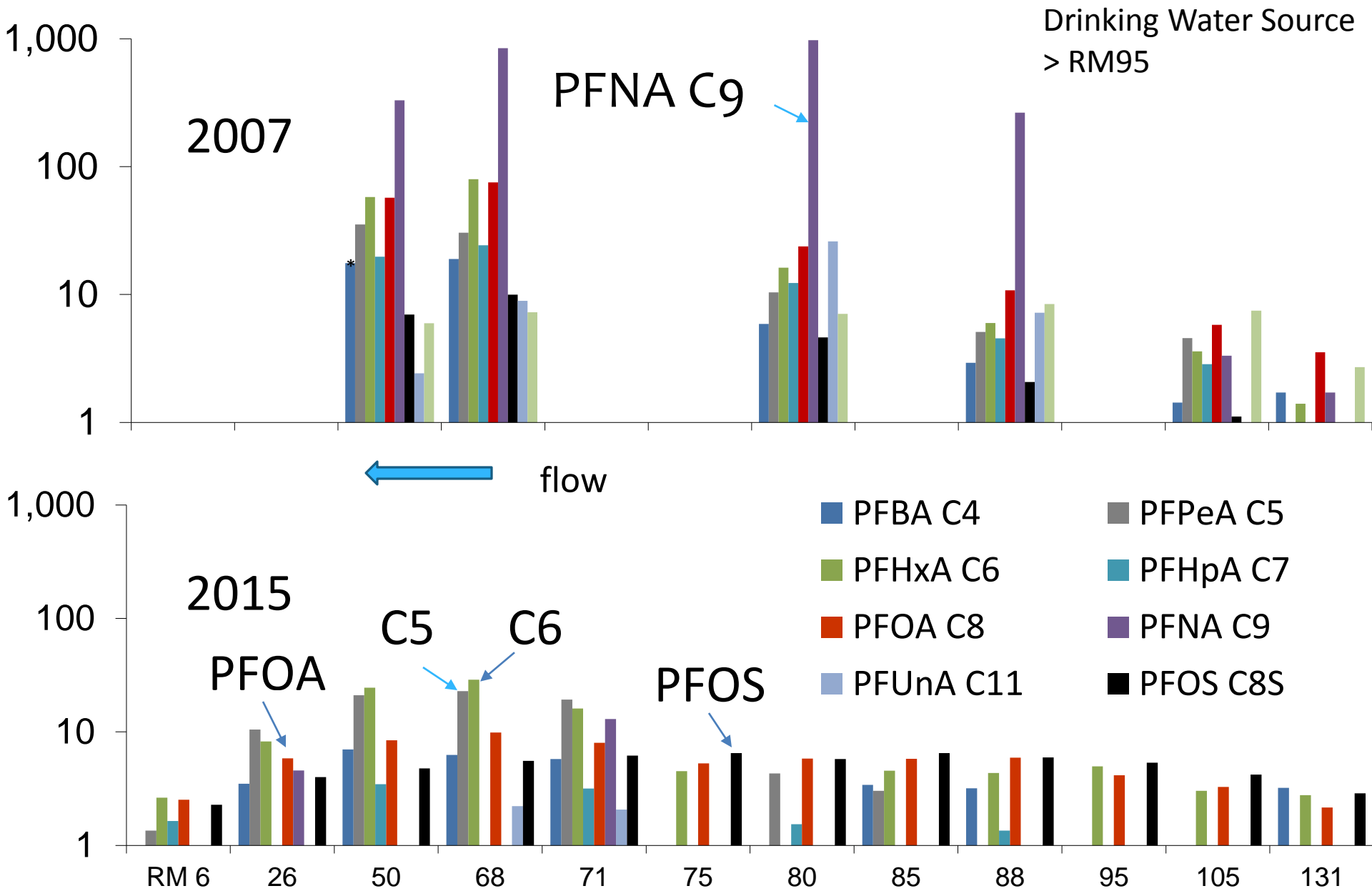
Fifteen tidal sites in 2015

Four non-tidal sites in 2016

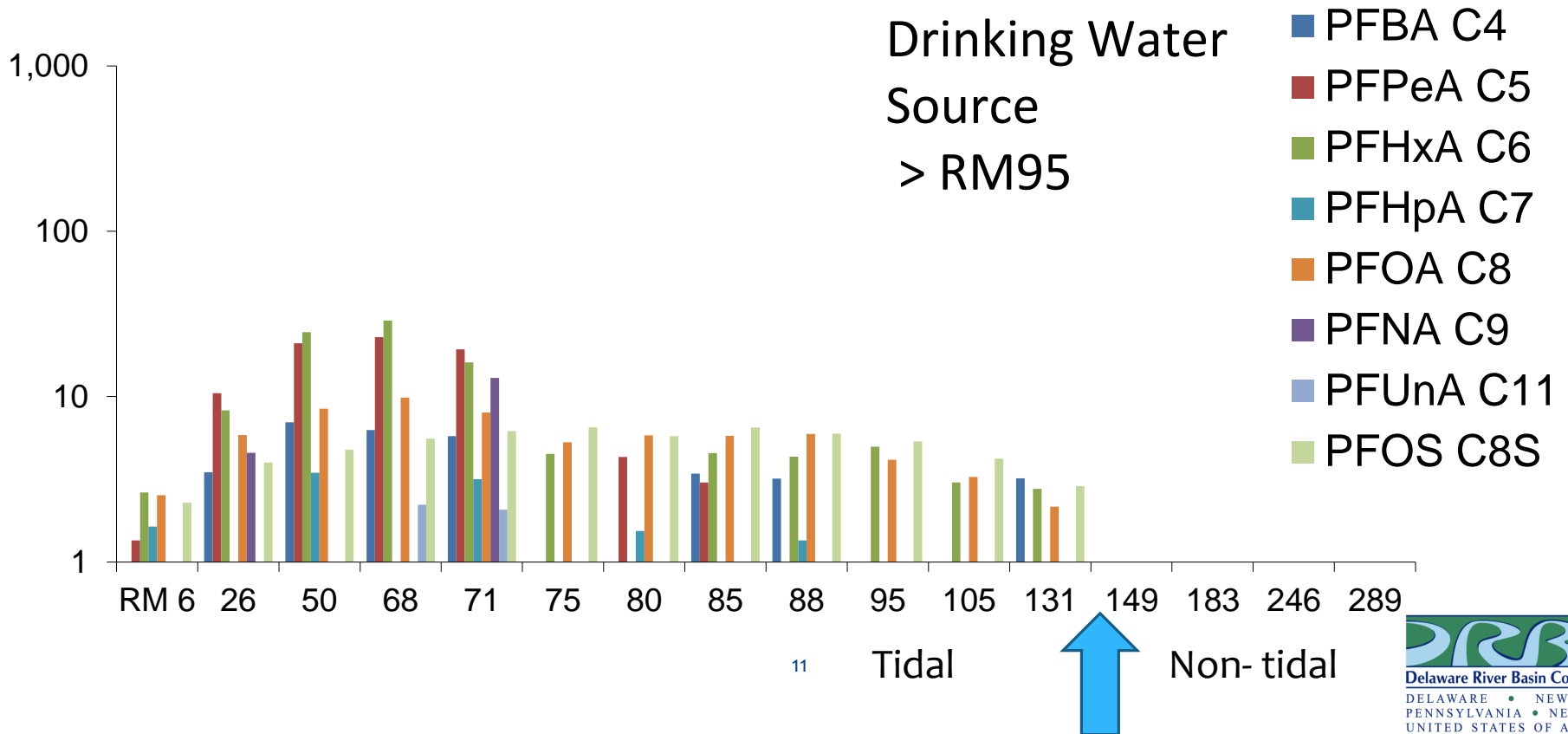




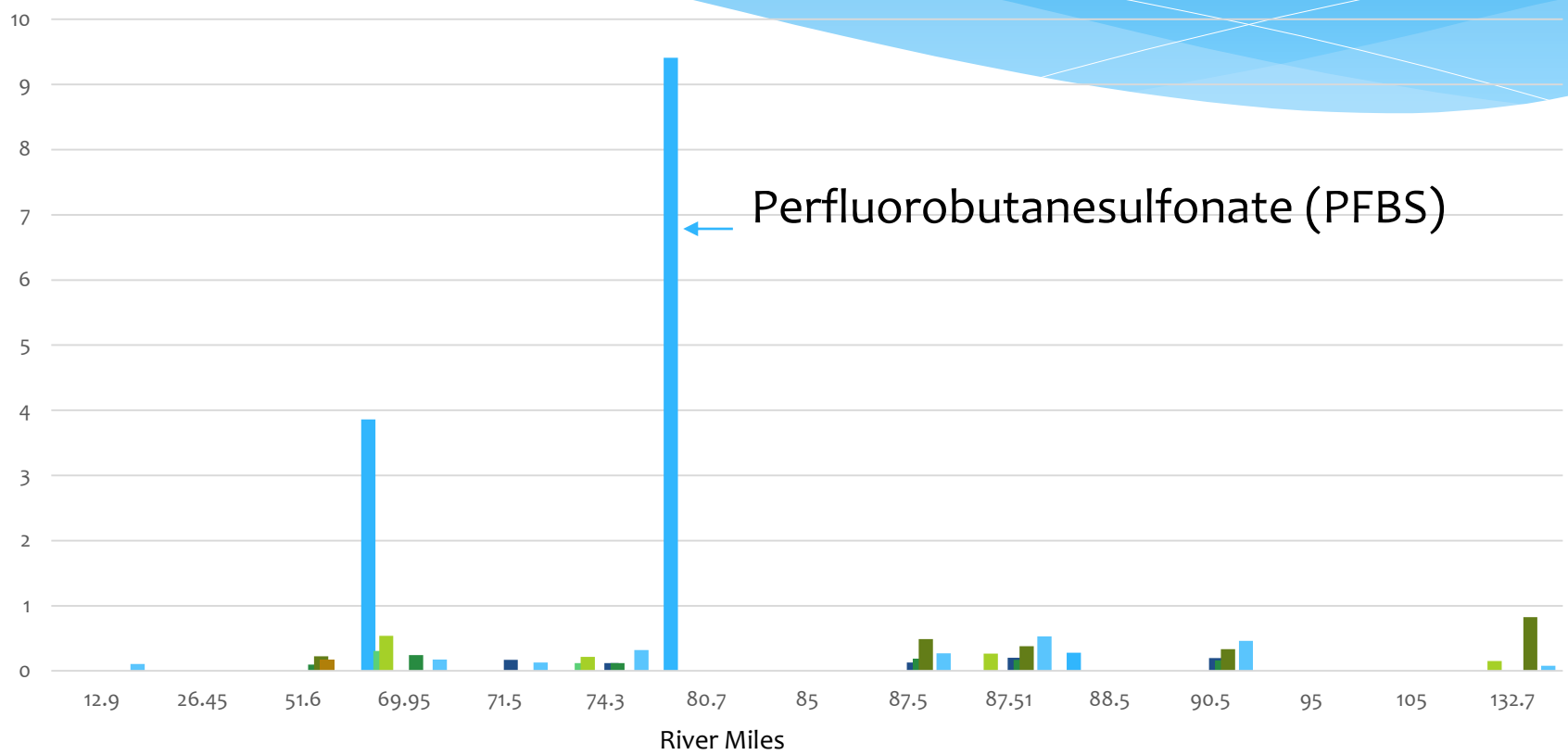
# PFAS (ng/L) decreases in surface water vary by compound



# PFAS (ng/L) in tidal (2015) and non-tidal (2016) surface water of Delaware River



# PFAS (ng/g dry) in surface sediment (2016)



- Perfluorobutanesulfonate (PFBS)
- Perfluorobutanoate (PFBA)
- Perfluorodecanoate (PFDA)
- Perfluorododecanoate (PFDoA)
- Perfluoroheptanoate (PFHpA)
- Perfluorohexanesulfonate (PFHxS)
- Perfluorohexanoate (PFHxA)
- Perfluorononanoate (PFNA)
- Perfluorooctane sulfonamide (PFOSA)
- Perfluorooctanesulfonate (PFOS)
- Perfluorooctanoate (PFOA)
- Perfluoropentanoate (PFPeA)
- Perfluoroundecanoate (PFUnA)

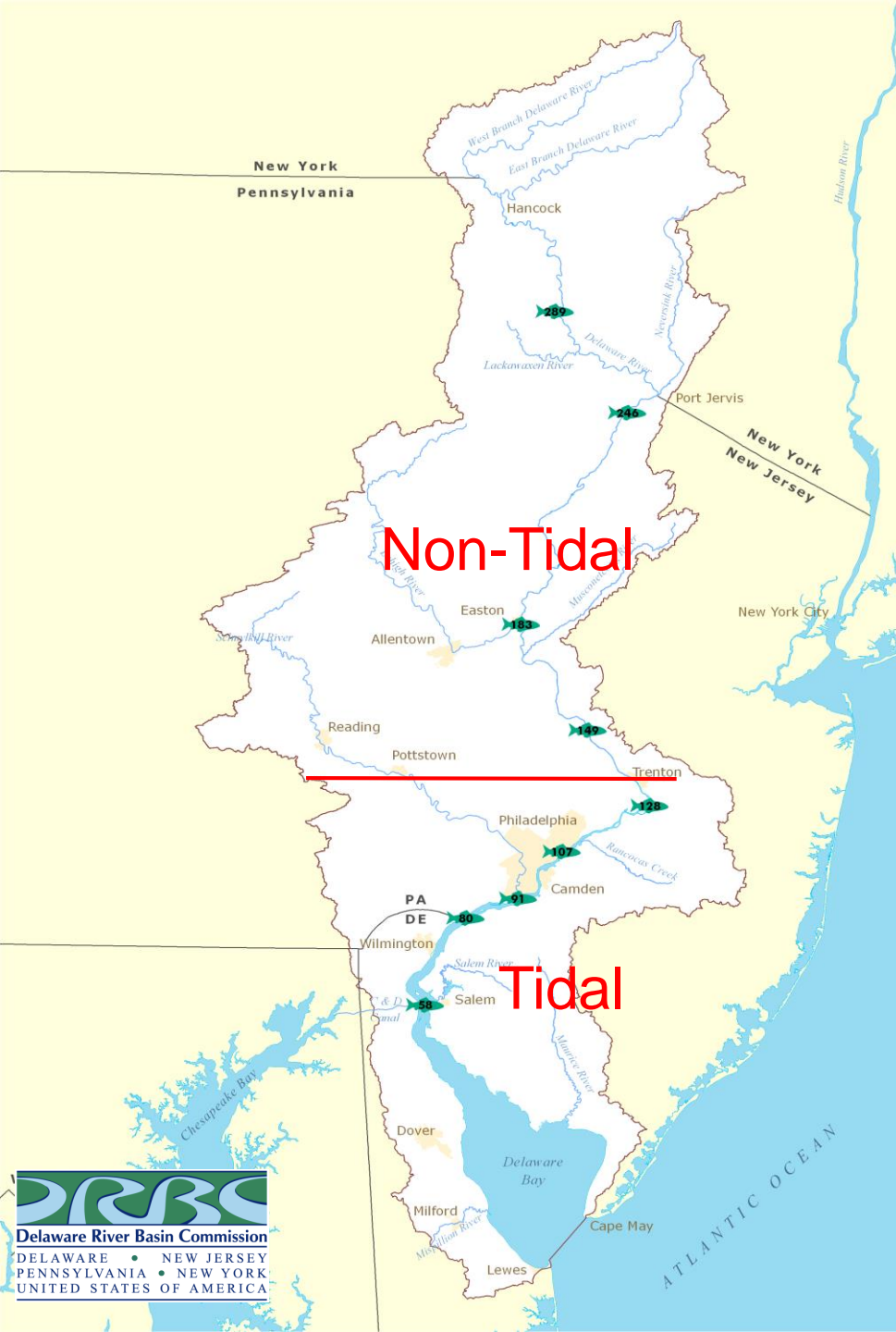
# Fish Sampling Locations PFAS 2004 - 2015

## Non-Tidal Locations

Narrowsburg, NY	RM 290
Milford, PA	RM 246
Easton, PA	RM 183
Lambertville, NJ	RM 149

## Tidal Locations

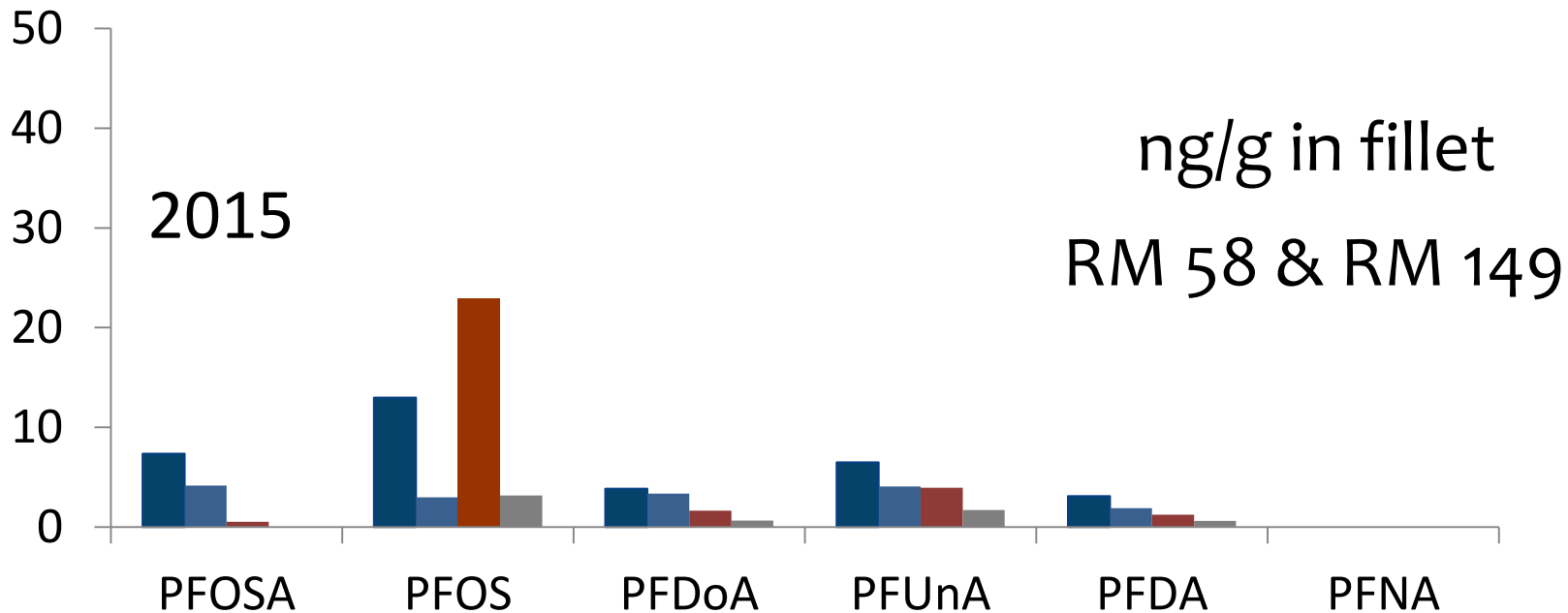
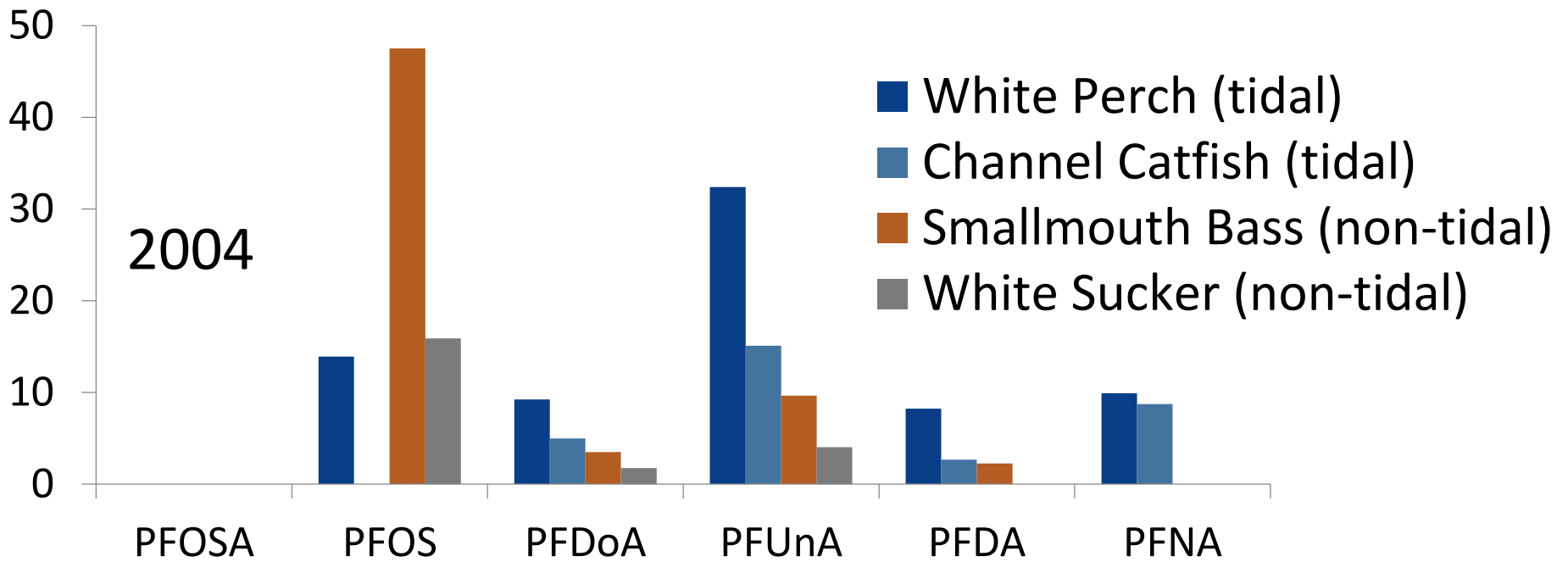
Crosswicks Creek	RM 128
Tacony-Palymra Br.	RM 107
Woodbury Creek	RM 91
Raccoon Creek	RM 80
Salem River	RM 58



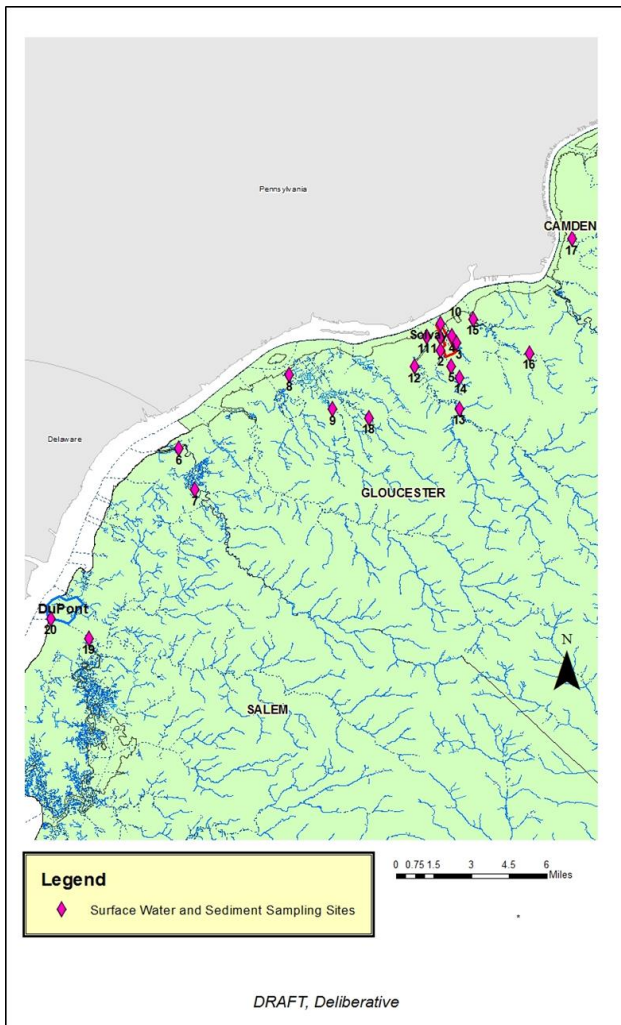
Non-Tidal

Tidal



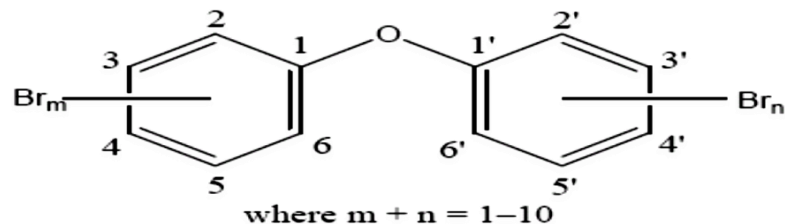


# NJDEP / USEPA-NERL / DRBC 2017 PFAS surface water and sediment NJ tidal tributaries



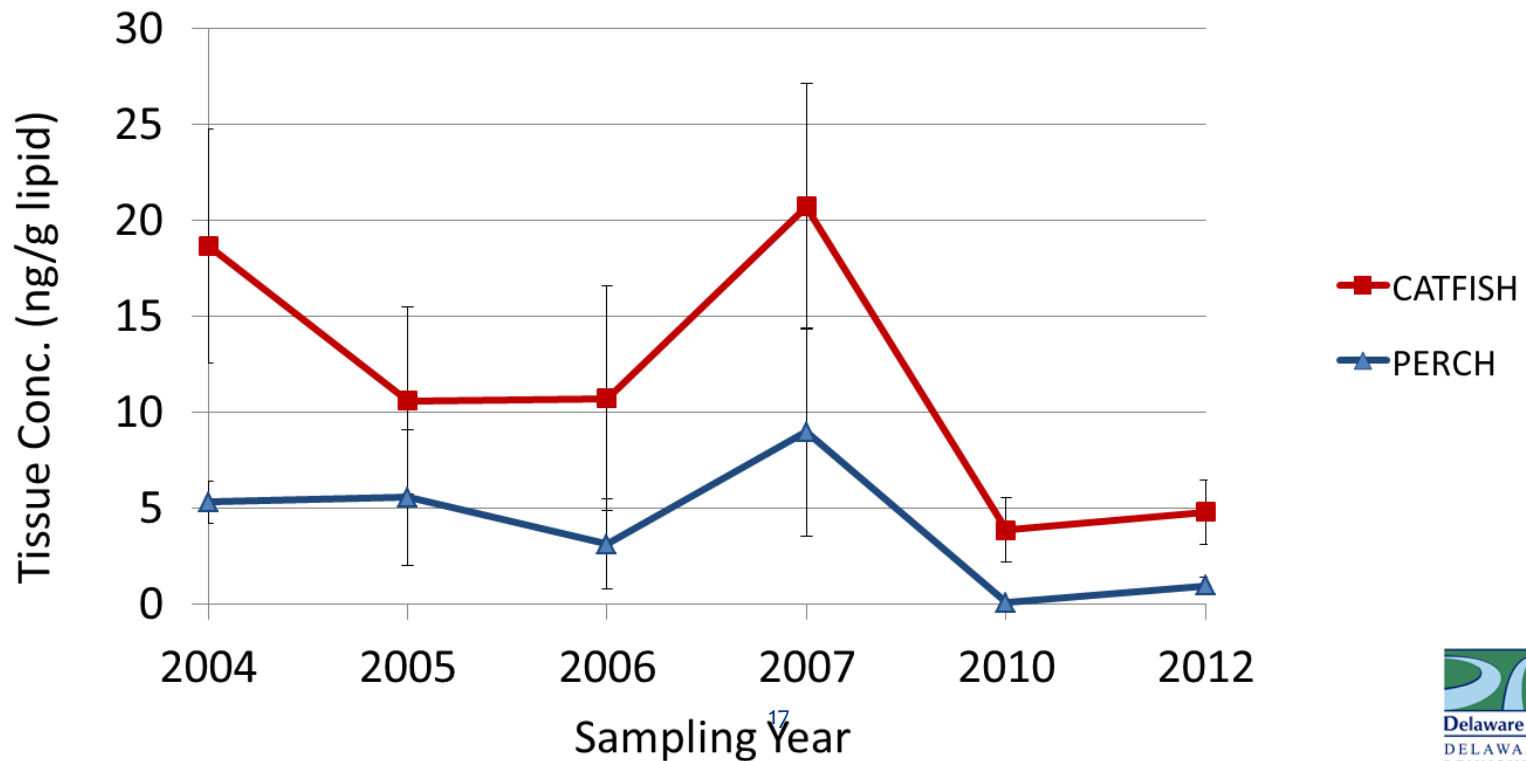
# Why are Polybrominated Diphenyl Ethers (PBDE) Flame Retardants of Concern?

- \* Used in consumer products such as television casings and polyurethane foam inside furniture cushions.
- \* **Indoor dust** is believed to be the primary source of human exposure (~ 90%) but **dietary exposure** is also a concern
- \* PBDEs are characterized as persistent, bioaccumulative, toxic compounds.
- \* High PBDE levels in serum alter steroid hormones levels and thyroid function, motor and cognitive deficits in children
- \* Voluntary phase-outs, EPA action plan and SNUR, state bans including NY



# Polybrominated Diphenyl Ethers (PBDE) Flame Retardants

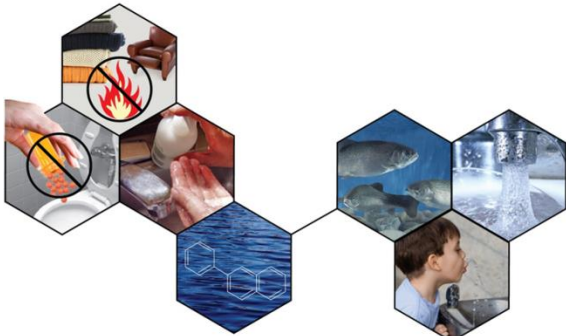
Lipid normalized tissue concentrations of BDE 209 in catfish and perch by year sampled





# Summation

- \* Current assessment and regulatory approaches are inadequate for many compounds detected in waters and biota.
- \* Some CEC may require regulation under the SDWA and CWA.
- \* Are replacement alternatives safer?
- \* Additional ecotoxicology information is needed for assessment of aquatic life and wildlife protection.

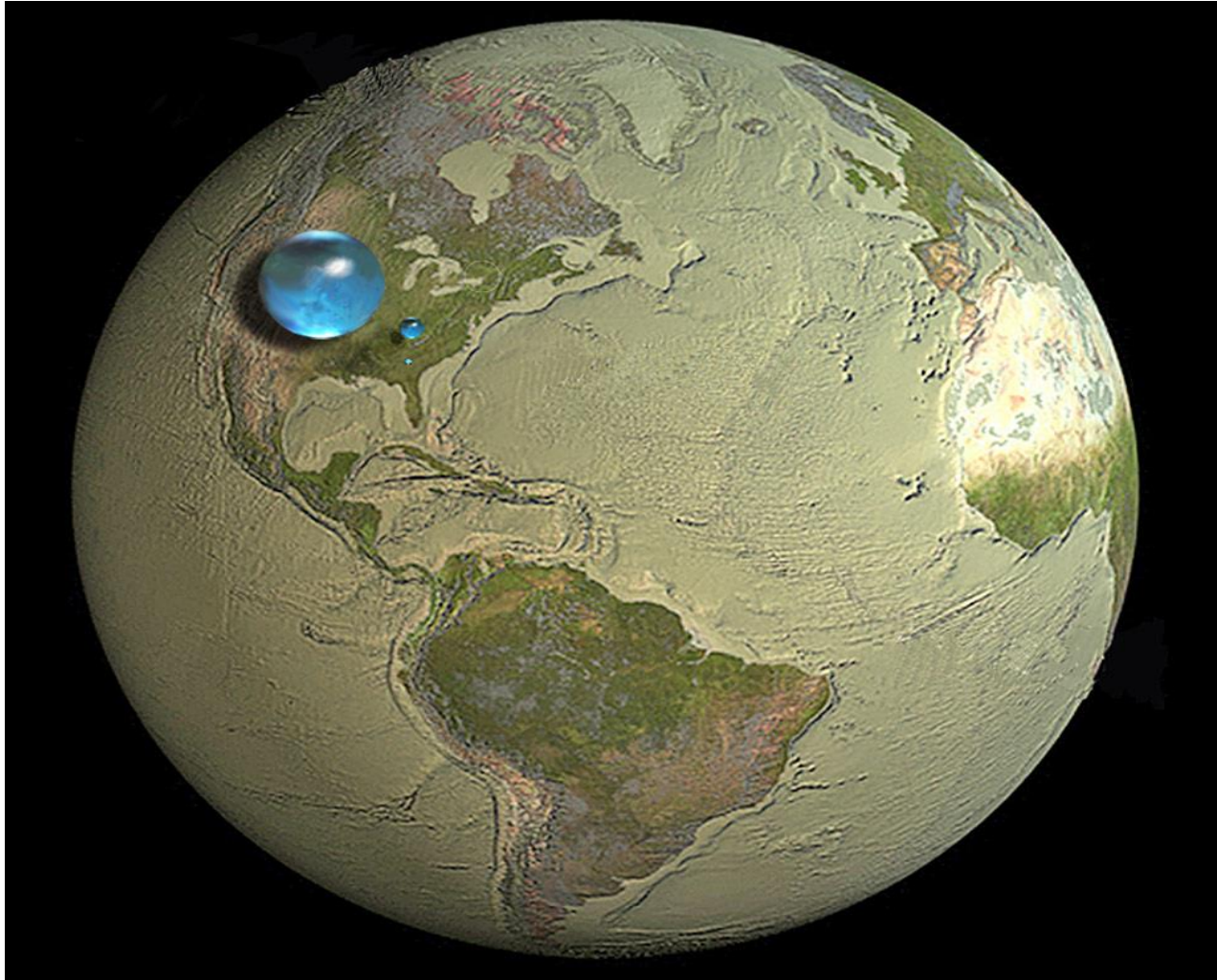


# Questions?

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Spheres representing all of Earth's water, Earth's liquid fresh water,<sup>19</sup> and water in lakes and rivers  
Credit: Howard Perlman, USGS; globe illustration by Jack Cook, Woods Hole Oceanographic Institution