

Delaware River Basin Commission



PFAS in Surface Water, Sediment and Fish from the Delaware River

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Why was the DRBC created in 1961?

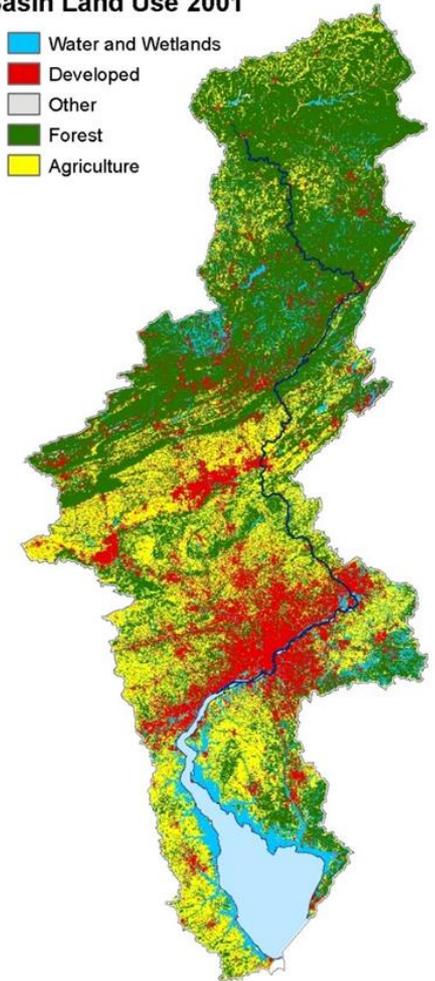


- Water supply shortages and disputes over the apportionment of the basin's waters;
- Severe pollution in the Delaware River and its major tributaries;
- Serious flooding

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

Basin Land Use 2001

- Water and Wetlands
- Developed
- Other
- Forest
- Agriculture



DRBC Strategy for Contaminants of Emerging Concern



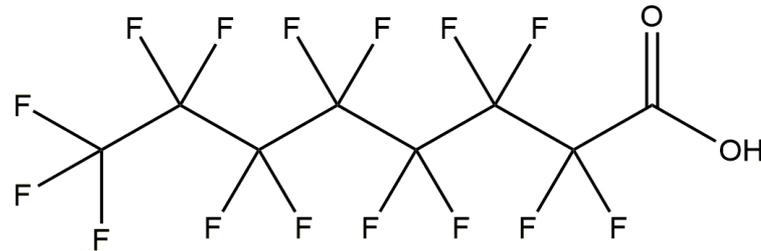
- * What are the occurrences and sources of CEC in the Delaware River and Bay?
- * What are the risks to designated uses in Delaware River and Bay from CEC?
- * What actions can be identified to minimize CEC impacts in the Delaware River and Bay?



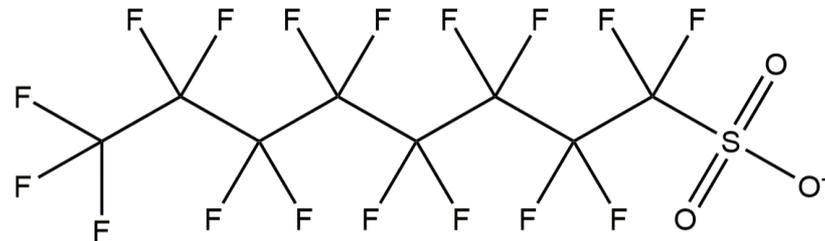
Why are Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) of Concern?



- * Properties
- * Uses
- * Sources
- * Stewardship
- * Alternatives
- * Discharges
- * Persistence
- * Toxicity
- * Bioaccumulation



Perfluorooctanoic acid (PFOA)



Perfluorooctane sulfonate (PFOS)

<https://journals.plos.org/plosbiology/article/figure?id=10.1371/journal.pbio.2002855.g001>

Human Health Effects



Association with liver damage, increased cholesterol, thyroid disease, decreased response to vaccines, asthma, decreased fertility and birth weight, pregnancy-induced hypertension

EPA HA PFOS & PFOA 70 ng/L, NJDEP MCL PFNA 13 ng/L



Ecotoxicity



Ecological Effects

- * National WQC for aquatic life not derived
- * Long chain PFAS bioaccumulate
- * Many PFAS are persistent (short and long chain)
- * Moderately acute and slightly chronically toxic to aquatic organisms (survival, growth and reproduction)
 - * PNEC for PFOS 0.6 to 6.6 ug/L (Qi et al. 2011)
 - * PNEC for PFOA 1,250 ug/L (Hoke et al. 2015)
 - * PNEC for PFHxA (C6) 199 ug/L (Hoke et al. 2015)
- * Sublethal effects observed (e.g., histopathology, neurological and immune effects) non-standard tests

- ❑ Water grab samples in HDPE bottles
- ❑ Fish samples are composites of five standard fillets.
- ❑ Sediment surficial grab with Ponar.
- ❑ Analytical Parameters & Methods: 13 compounds using LC/MS/MS Method
- ❑ Analysis by SGS-Axys Analytical LTD



Sulfonates and Sulfonamide

- 4 Perfluorobutanesulfonate (PFBS)
- 6 Perfluorohexanesulfonate (PFHxS)
- 8 Perfluorooctanesulfonate (PFOS)
- Perfluorooctane sulfonamide (PFOSA)

of carbons

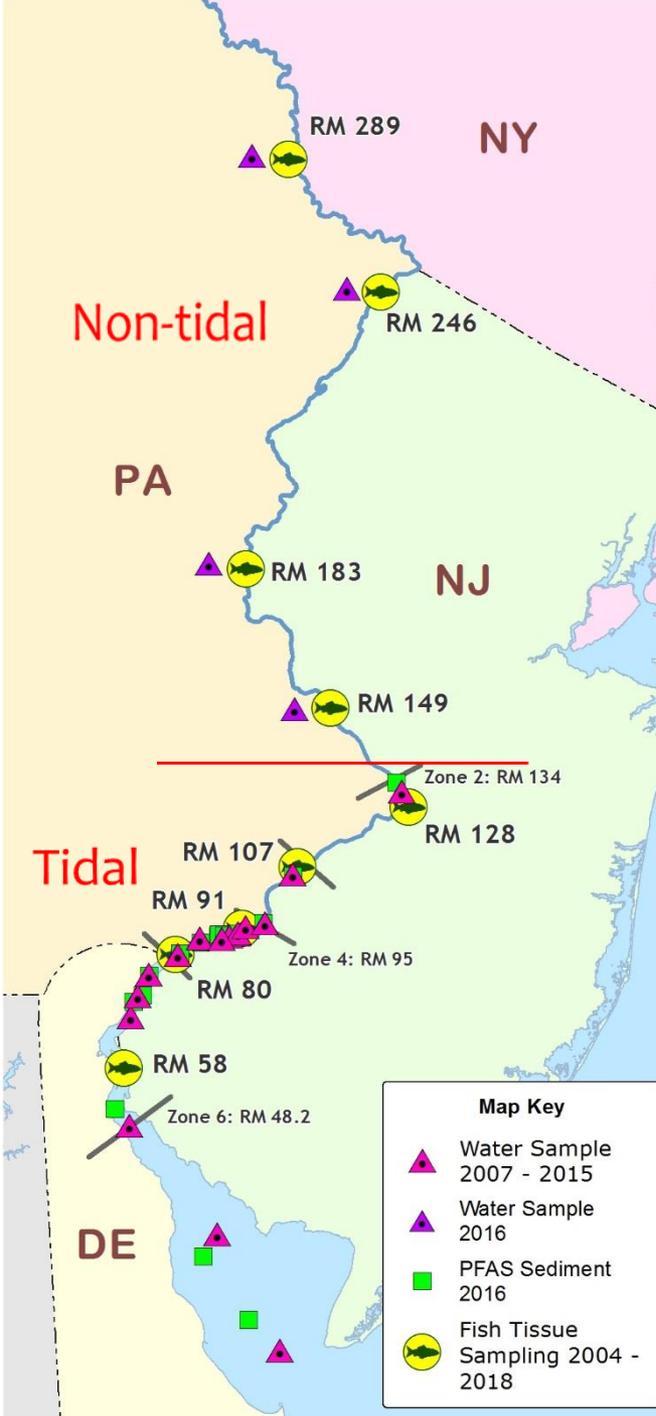


Carboxylates

- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12

- Perfluorobutanoate (PFBA)
- Perfluoropentanoate (PFPeA)
- Perfluorohexanoate (PFHxA)
- Perfluoroheptanoate (PFHpA)
- Perfluorooctanoate (PFOA)
- Perfluorononanoate (PFNA)
- Perfluorodecanoate (PFDA)
- Perfluoroundecanoate (PFUnA)
- Perfluorododecanoate (PFDoA)

PFAS Sample Sites



Surface water

Six tidal sites in 2007, 2008, 2009

Fifteen tidal sites in 2015

Four non-tidal sites in 2016

Fish

Four non-tidal and five tidal sites

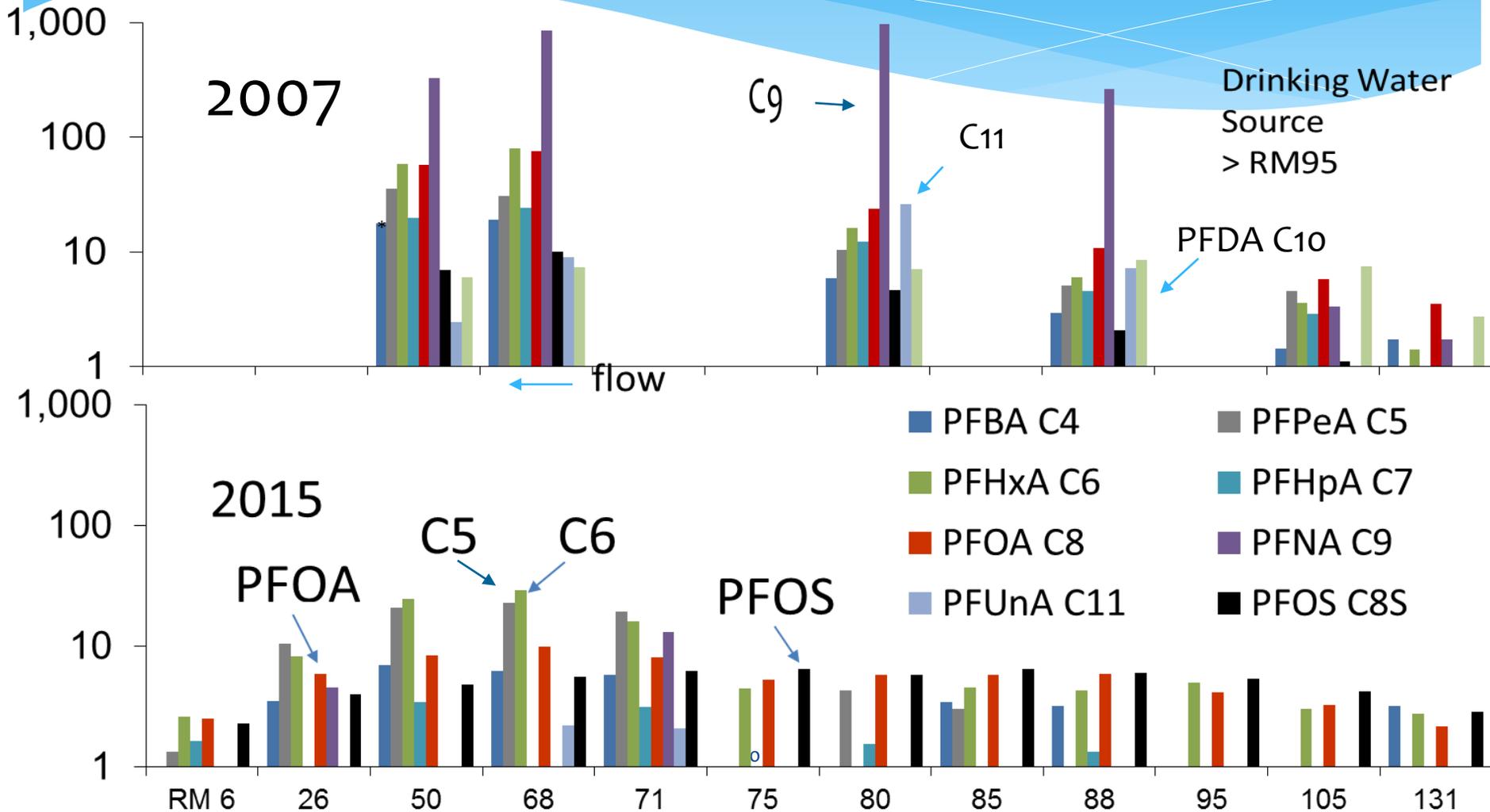
in 2004, 2005, 2006, 2007, 2010,

2012, 2015 and 2018

Sediment

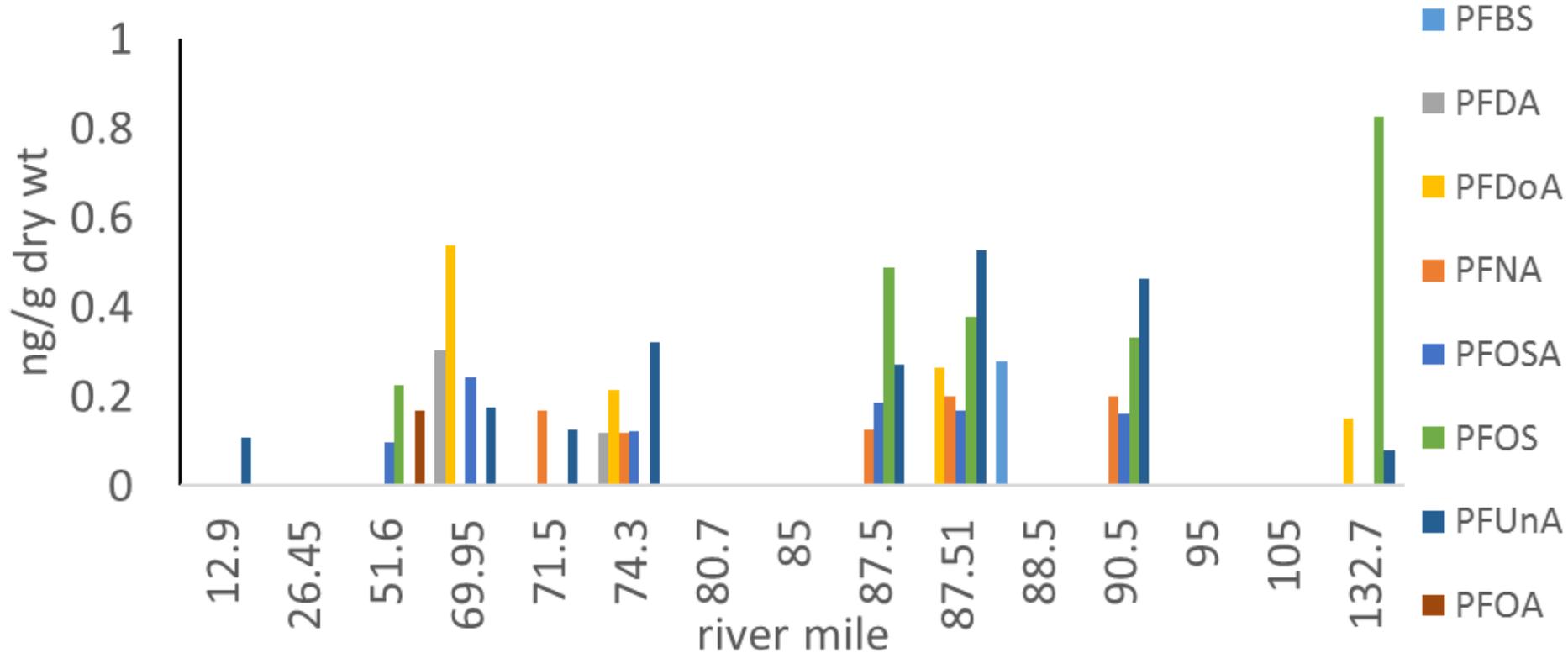
Fifteen tidal sites in 2016

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



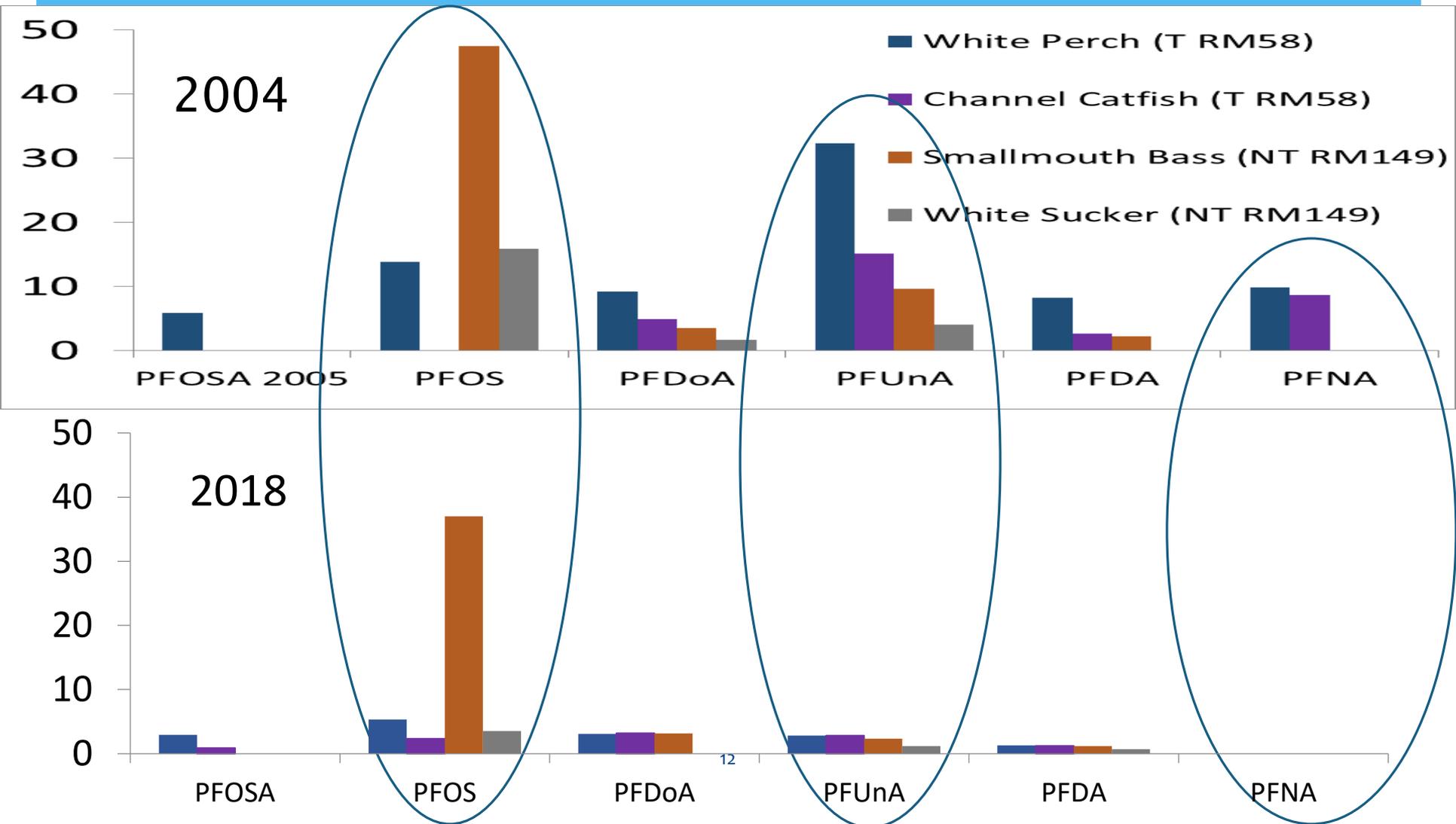
PFAS in sediment 2016

low concentrations similar to other urban areas



Sediment surficial grab with Ponar.

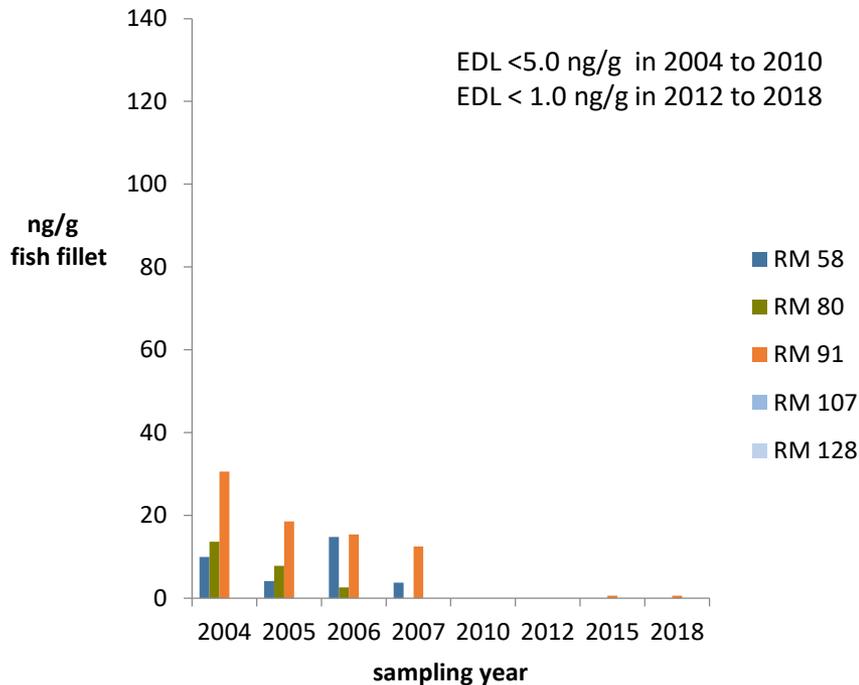
PFAS (ng/g) in fish fillet vary by species, location and year



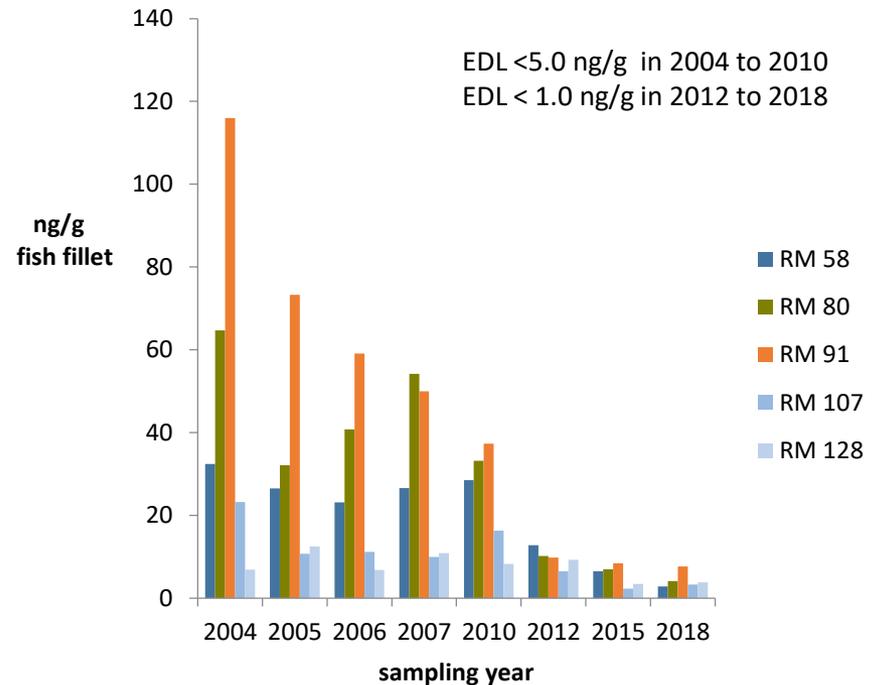
Statistically significant decreases for PFNA and PFUnA concentrations in fish



PFNA (C9) in White Perch from Delaware Estuary



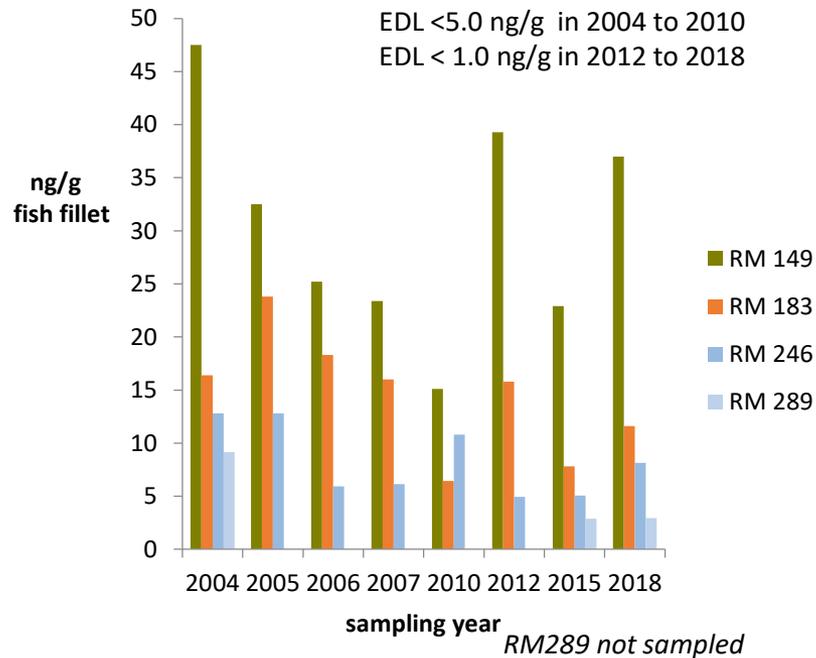
PFUnA (C11) in White Perch from Delaware Estuary



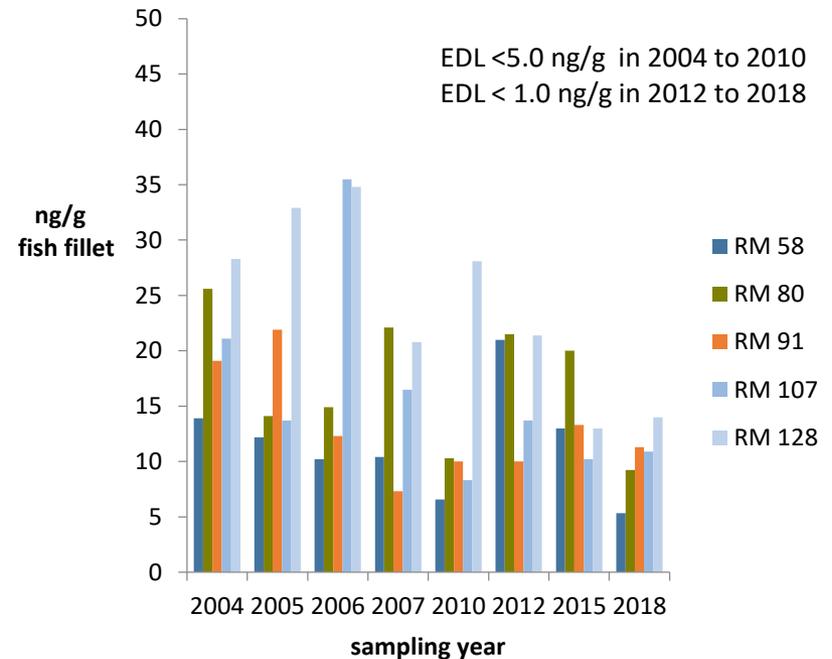
PFOS bioaccumulation in fish with limited declines in concentrations



PFOS (C8) in Smallmouth Bass from Delaware River



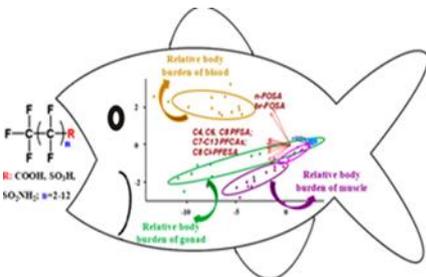
PFOS (C8) in White Perch from Delaware Estuary



Data Needs



- PFAS have been detected in surface water, sediment and fish from the main stem Delaware River
- Data needs:
 - for fish consumption advisories (more main stem data and advisory triggers)
 - for source water protection (occurrence of other PFAS , precursors and alternative cpds e.g., GenX and Solvay replacement product)
 - for protection of aquatic life (measured environmental concentrations and predicted no effect concentrations, bioaccumulation factors (BAF))



Questions



Shi et al, 2018 ES&T

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DRBC Contaminants of Emerging Concern

<https://www.state.nj.us/drbc/quality/reports/cecs.html>