

Delaware River Basin Commission

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

Ron MacGillivray, Ph.D.
Senior Environmental Toxicologist
Ron.MacGillivray@drbc.gov

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Delaware River Basin Commission

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UNITED STATES OF AMERICA

Why was the DRBC created in 1961?

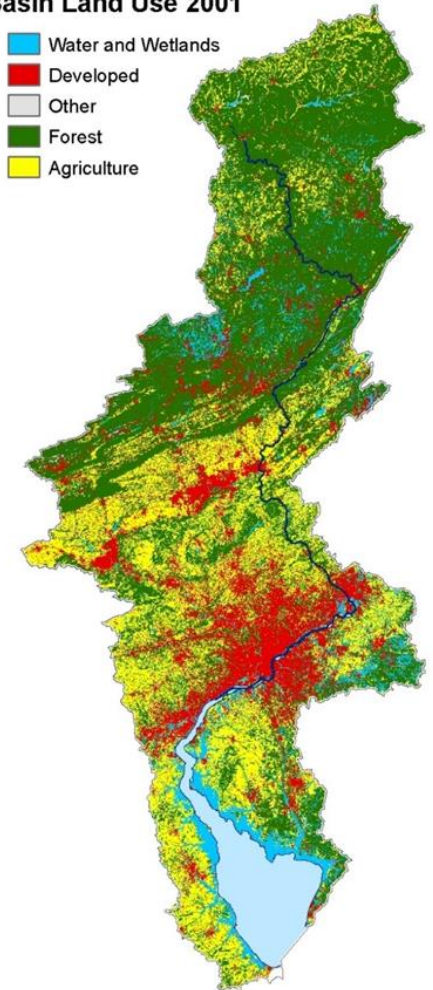


- Water supply shortages and disputes over the apportionment of the basin's waters;
- Severe pollution in the Delaware River and its major tributaries;
- Serious flooding

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

Basin Land Use 2001

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

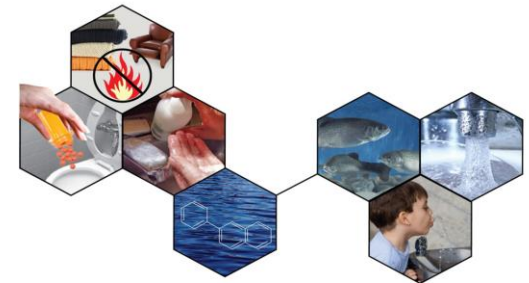


Emerging Contaminants

DRBC 2004 to 2018



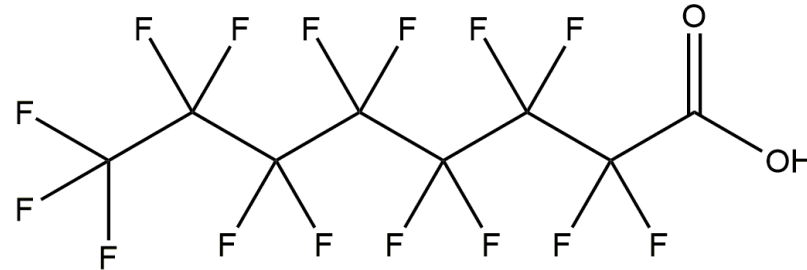
- € Pharmaceuticals and Personal Care Products (PPCP)
- € Hormones
- € Stain repellants/non-stick surfaces/fire fighting foams [PFAS]
- € Flame Retardants [PBDE]
- € Detergents [NP]
- € Plasticizers [bis-phenol A]
- € Surveys in surface water, fish and sediment



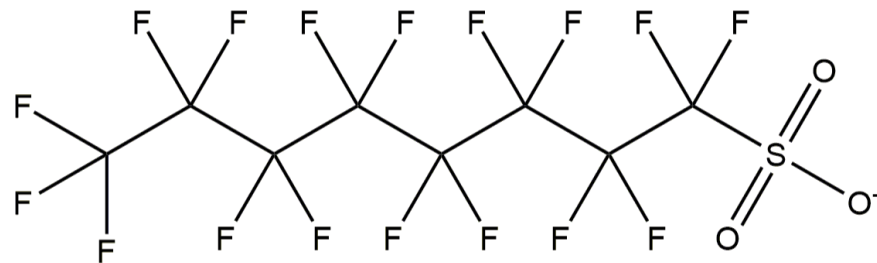
Why are Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) of Concern?



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



Perfluorooctanoic acid (PFOA)



Perfluorooctane sulfonate (PFOS)



Human Toxicity



Human Health Effects

- * Monitored in blood serum general population (bind to protein)
- * Association with liver damage, increased cholesterol, thyroid disease, decreased response to vaccines, asthma, decreased fertility and birth weight, pregnancy-induced hypertension/pre-eclampsia

Laboratory Animal

- * Primary effects in lab animals are liver, developmental and immune toxicity

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

- * Scientific understanding is evolving



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 Sites

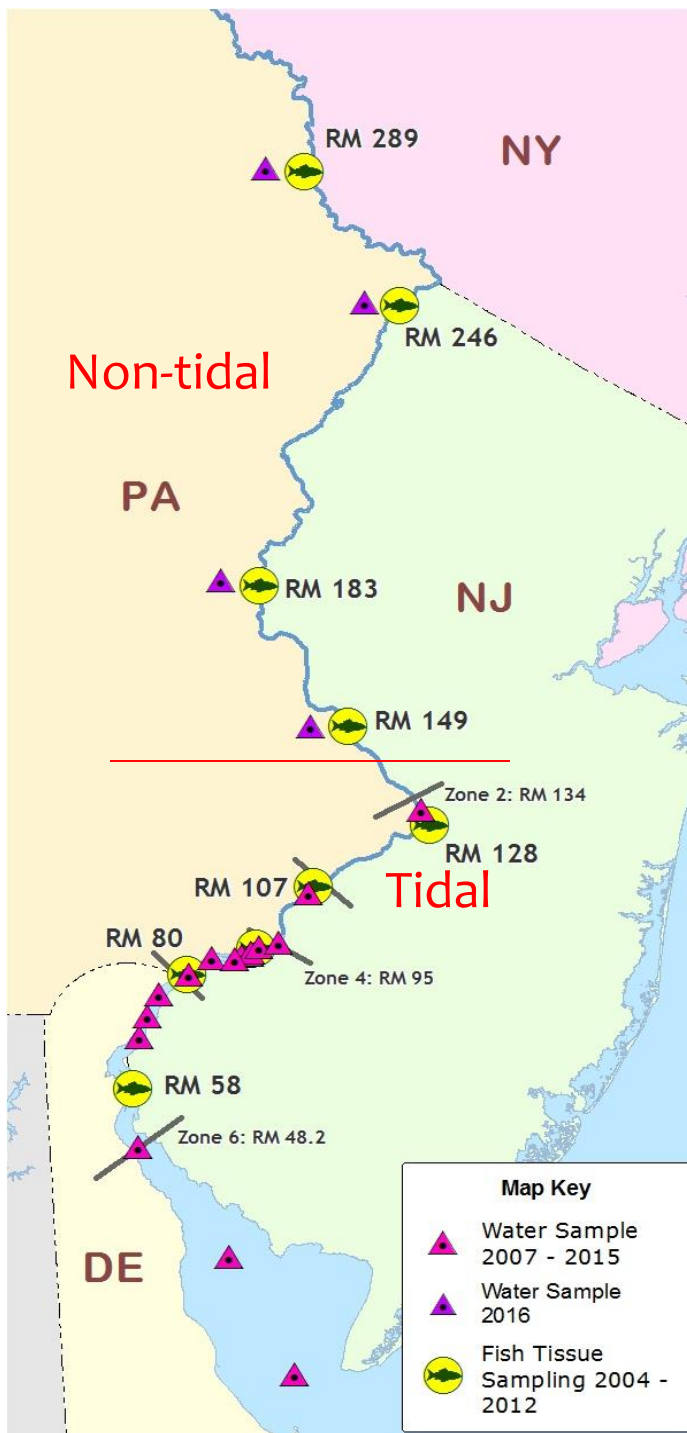


Surface Water Samples

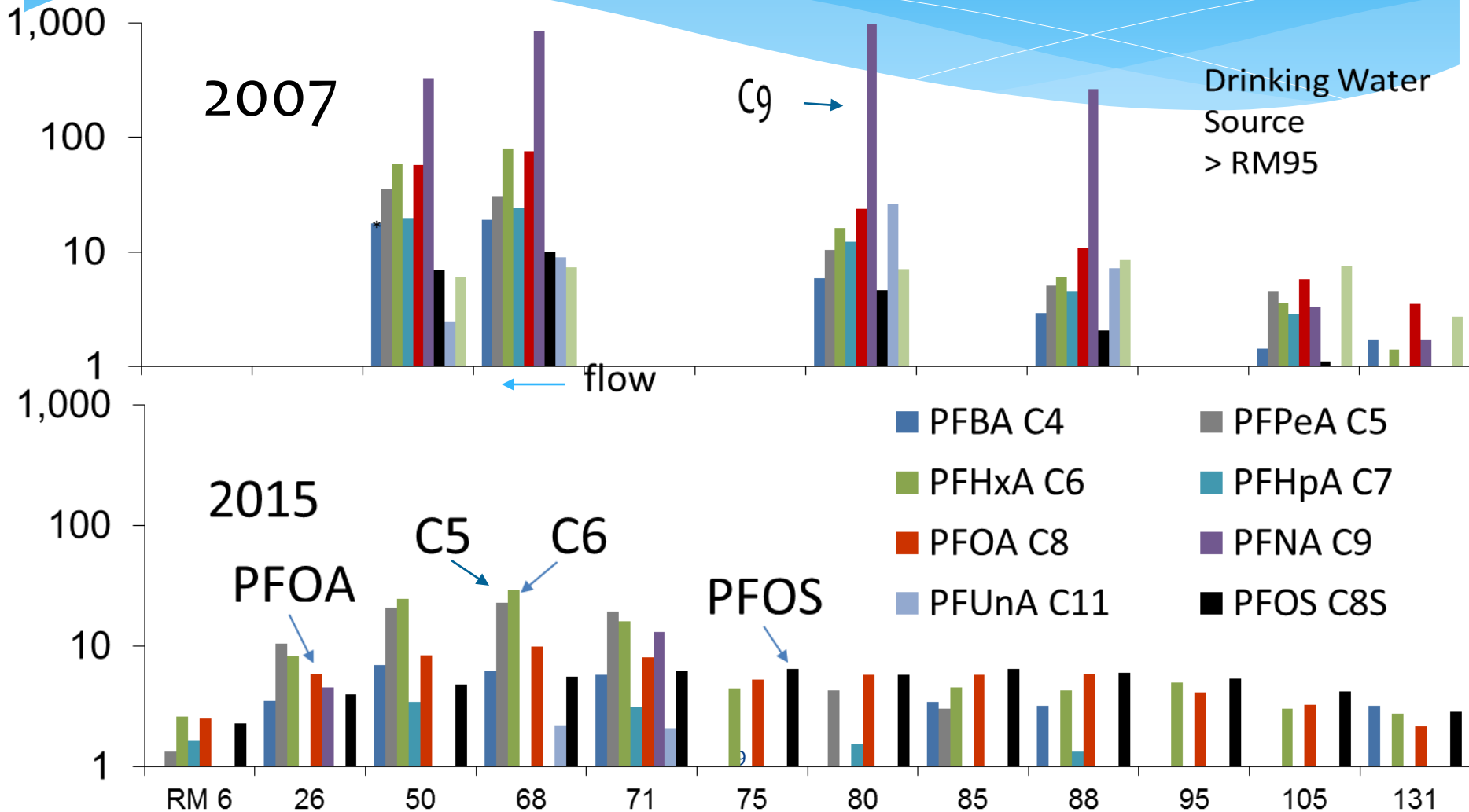
Six tidal sites in 2007, 2008,
2009

Fifteen tidal sites in 2015

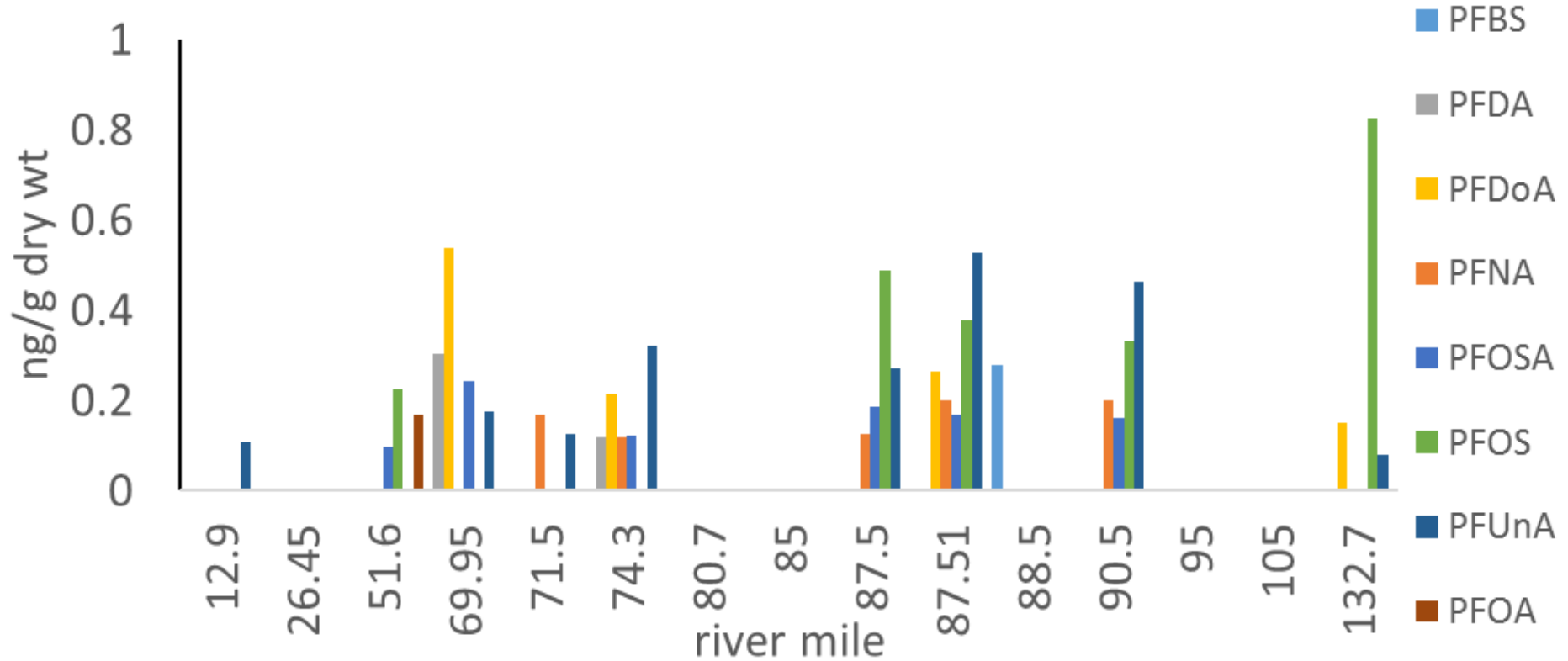
Four non-tidal sites in 2016



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



PFAS in sediment 2016 similar to other urban areas



Sampling Locations and Fish Species 2004 - 2015



Non-Tidal Locations

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

Non-Tidal Fish Species

Catostomus commersonni (white sucker)
Micropodus dolomieu (smallmouth bass)

Tidal Fish Species

Ictalurus punctatus (channel catfish)
Morone americana (white perch)

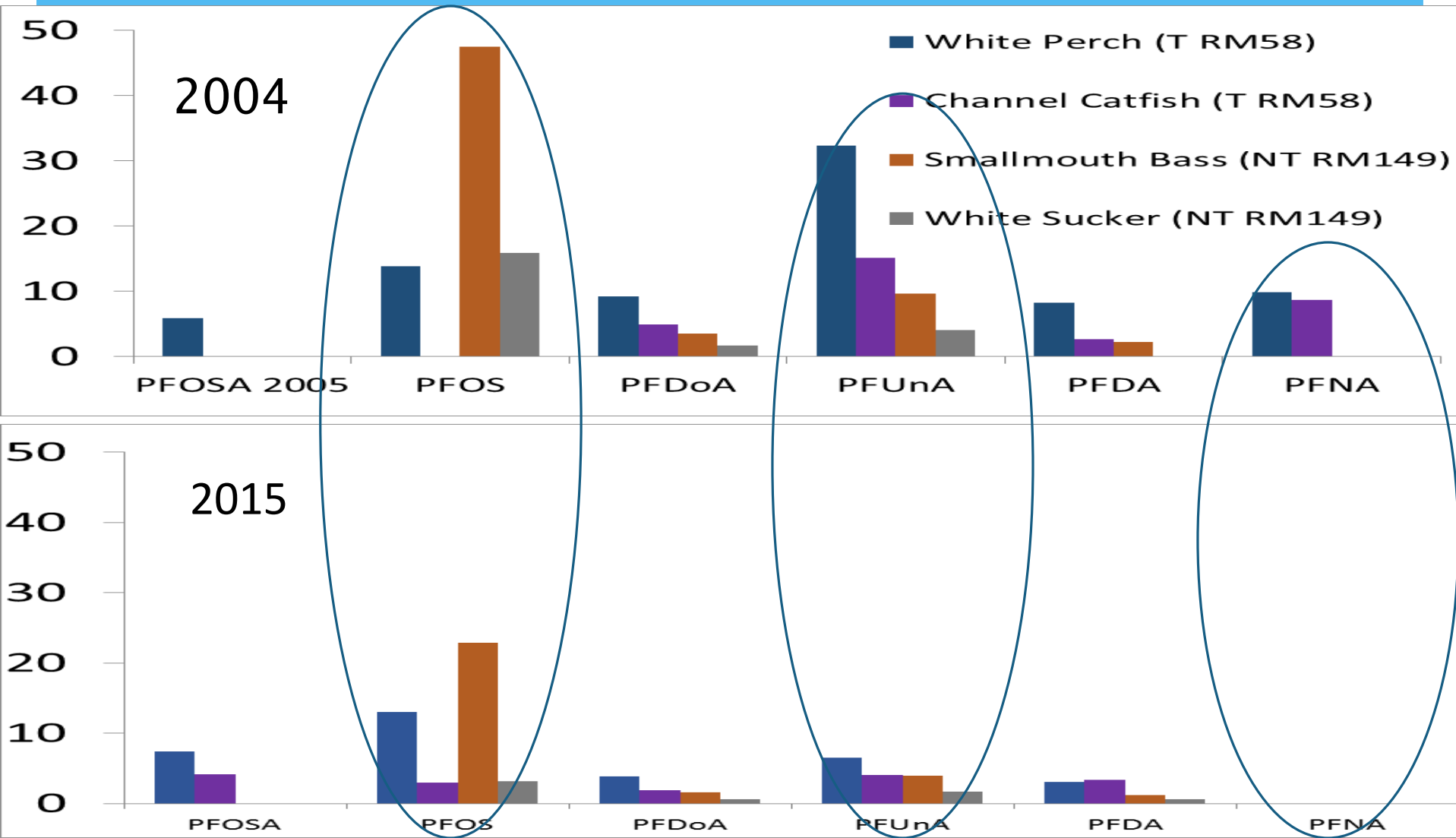
Tidal Location

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

Sample Design

Collected periodically by electrofishing or hook & line
 Composite of five (5) fish of similar size of each species collected at each location (fillet)

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





Next Steps



Ongoing

Fish – 2018 collection with PFAS analysis

Recommended

Extend list of PFAS analytes (e.g., replacement compounds)

Surface Water

- * Compile data from non-DRBC surveys in tidal river when available
- * Deploy passive samplers in non-tidal river (seeking external funds),

Sediment

- * Sample targeted non-tidal sites (seeking external funds)

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Questions?

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