# Emerging Contaminants In the Delaware Estuary

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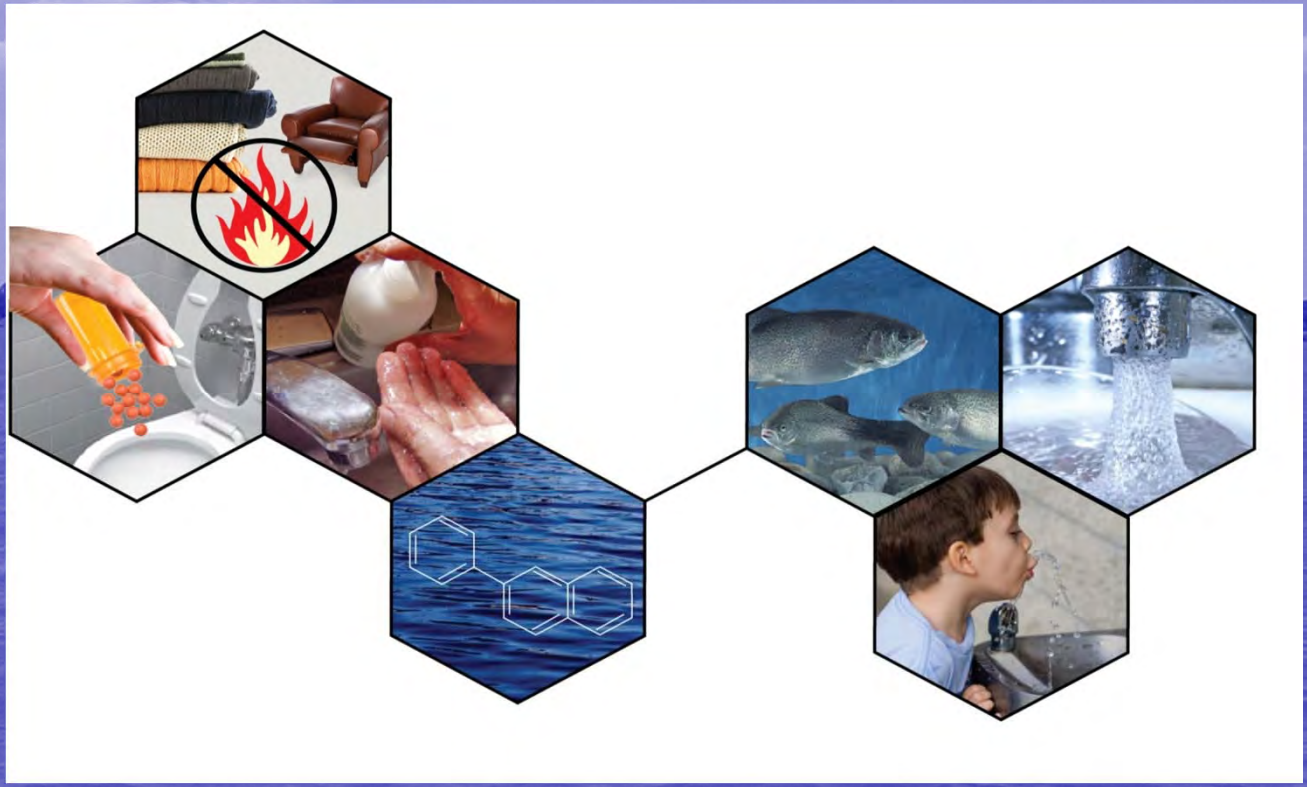
Delaware River Basin Commission
DELAWARE · NEW JERSEY
PENNSYLVANIA · NEW YORK
UNITED STATES OF AMERICA

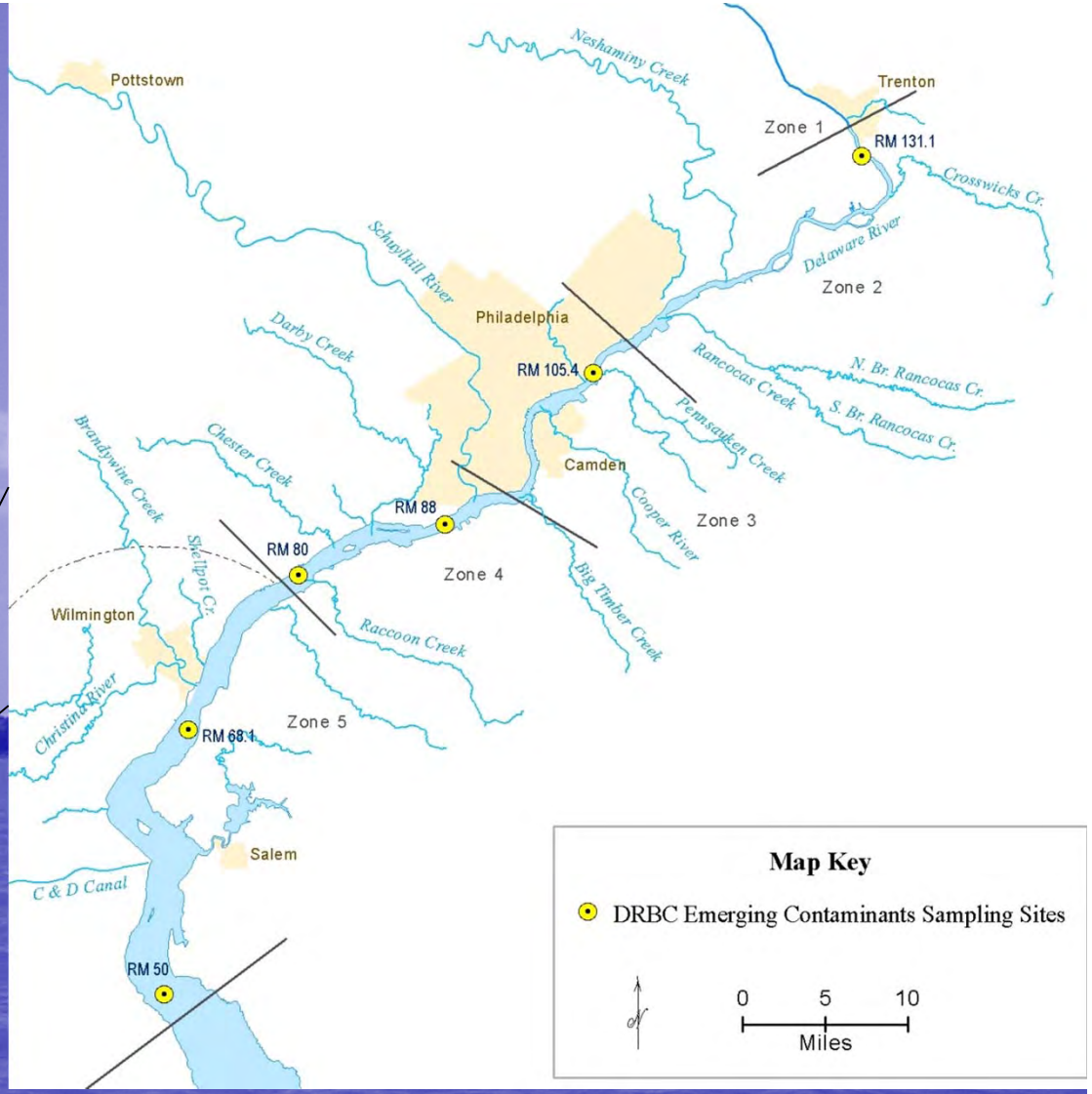
- Program: Water Quality
- Goals: Evaluate ambient water for unregulated contaminants of increasing environmental and human health concern
- Participants: DRBC and Axys Analytical Laboratories

# Contaminants of Emerging Concern

- Pharmaceuticals and Personal Care Products (PPCP)
- Hormones
- Stain repellants/non-stick surfaces [PFC]
- Flame Retardants [PBDE]
- Surfactants [NP]
- Plasticizers [bis-phenol A]



# Delaware River Basin


## Ambient Water Sampling

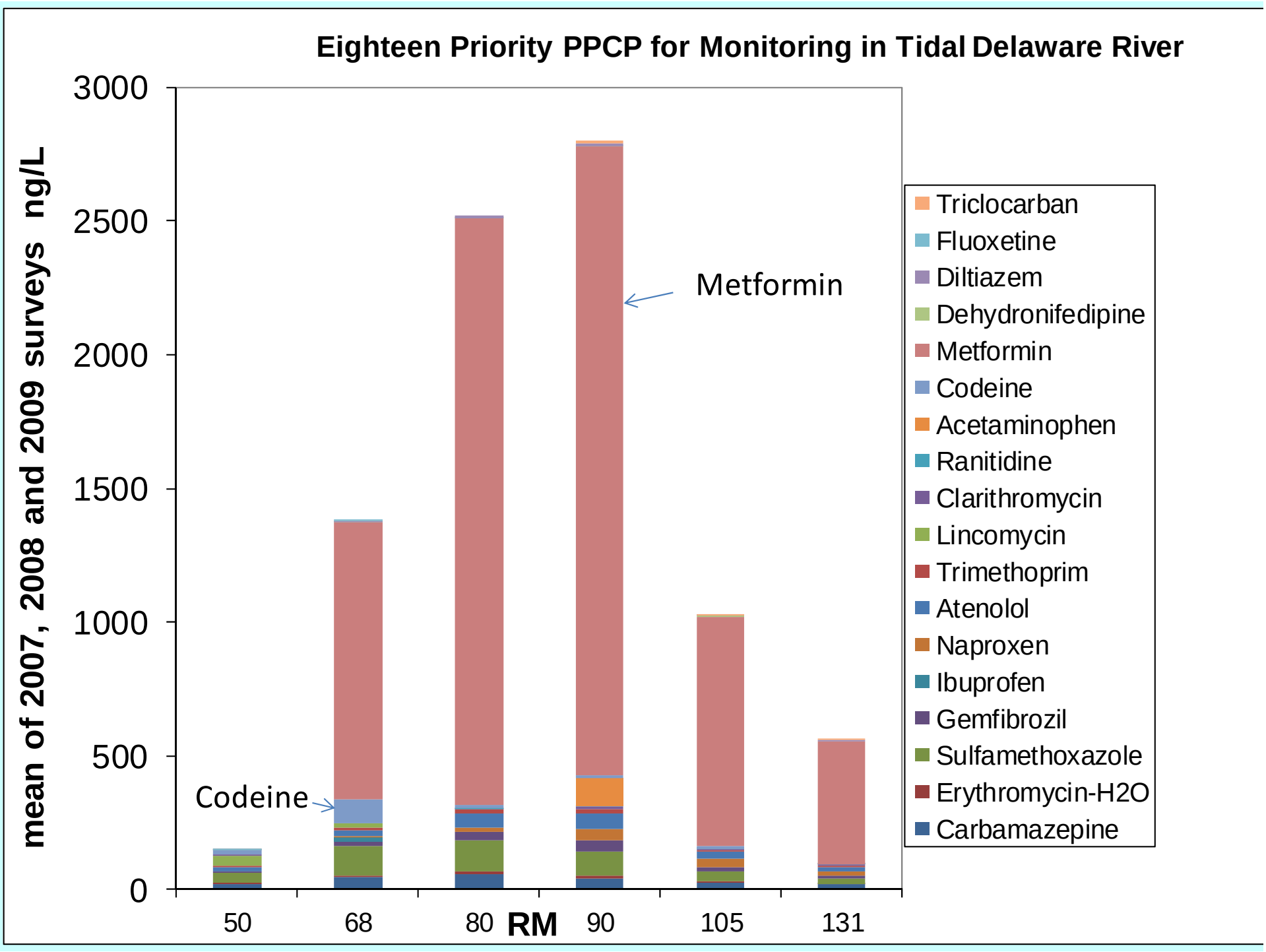
## Ambient Water Surveys in the Tidal Main Stem Delaware River

| | 2007<br># of analytes / # detected | 2008<br># of analytes / # detected | 2009<br># of analytes / # detected |
|---|---|---|---|
| PFC<br>LC/MS/MS | 13/11<br>MLA060 – Rev03 | 13/11<br>MLA060 – Rev04 | 13/11<br>MLA060 – Rev07 |
| PPCP<br>LC/MS/MS<br>USEPA 1694 plus extended list of analytes | 54/21<br>MLA052 – Rev04 | 72/49<br>MLA052 – Rev04 | 119/46<br>MLA075 – Rev04 |
| Sterols and Hormones | 24/6<br>MLA055 – Rev02<br>GC/LRMS | 27/11<br>MLA068 – Rev01<br>GC/LRMS | 17/2 Hormones only<br>MLA072 – Rev02<br>LC/MS/MS |
| NP and NPE<br>GC/MS | 3/2<br>MLA004 – Rev04 | 4/1<br>MLA004 – Rev05 | 4/2<br>MLA004 – Rev05 |
| bis-phenol-A<br>LC/MS/MS | Not monitored | 1/0<br>MLA059 – Rev03 | 1/0<br>MLA059 – Rev04 |
| PBDE<br>HRGC/HRMS<br>USEPA 1614 | 46/24<br>MLA033-Rev03 | Not monitored | Not monitored |
| Carbamate Pesticides<br>LC/MS/MS | 21/7<br>MLA-047 Draft | Not monitored | Not monitored |

# Criteria for Prioritization of PPCP

- Environmental Concentration
- Toxicity (ecological and human)
- Physicochemical properties
- Analytical feasibility (all but Atenolol listed in EPA Method 1694)
- Consumption/sales
- Degradation/persistence

de Voogt *et al.*, 2009, Water Sci & Technol
Kostich and Lazorchak, 2008, Sci Total Environ
Ottmar *et al.*, 2010, Bull Environ Contam Toxicol

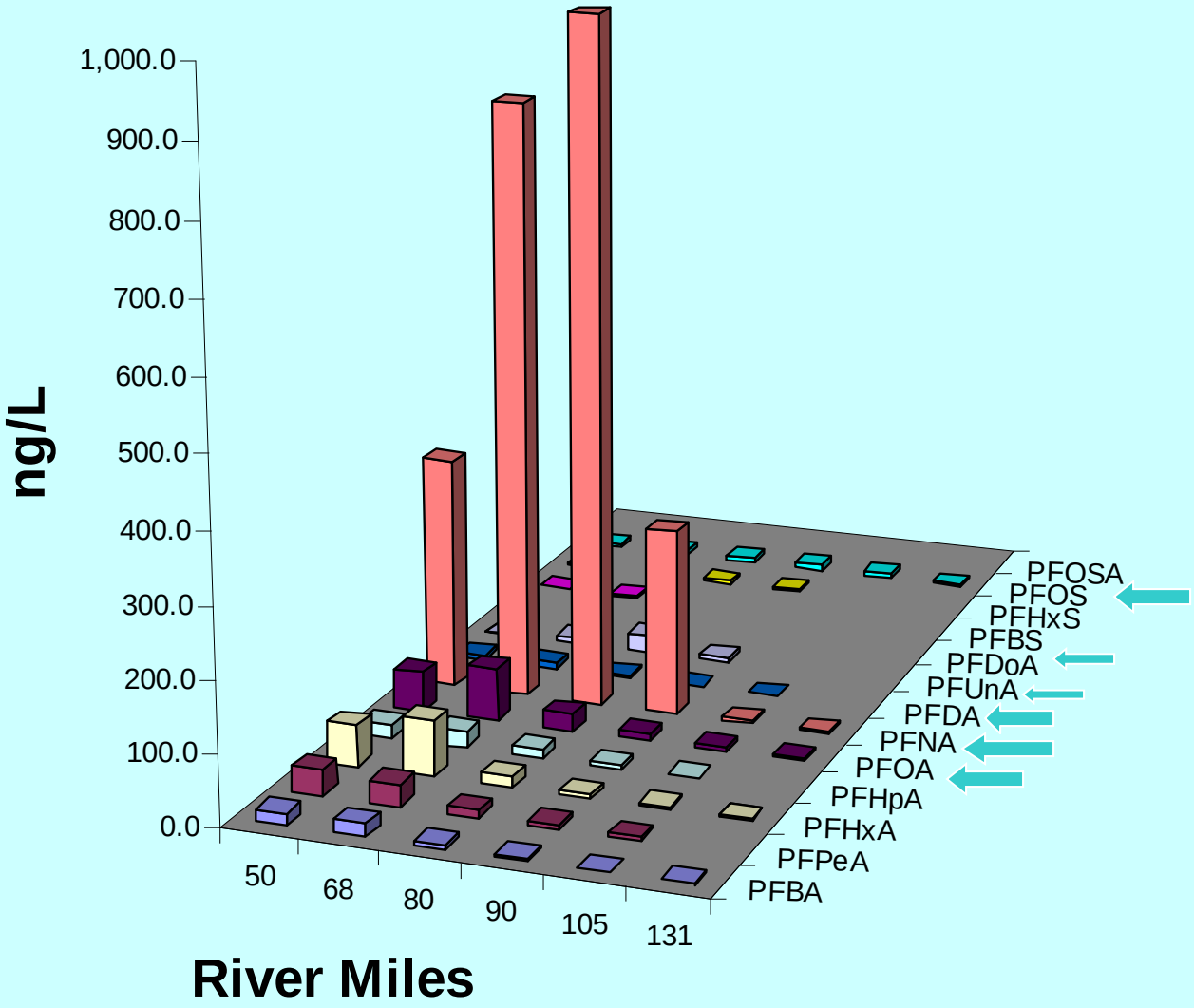

Eighteen Priority PPCP for Monitoring in Tidal Delaware River
mean of 2007, 2008 and 2009 surveys ng/L
3000
2500
2000
1500
1000
500
0
Metformin
Codeine
50
68
80
RM
90
105
131
Triclocarban
Fluoxetine
Diltiazem
Dehydronifedipine
Metformin
Codeine
Acetaminophen
Ranitidine
Clarithromycin
Lincomycin
Trimethoprim
Atenolol
Naproxen
Ibuprofen
Gemfibrozil
Sulfamethoxazole
Erythromycin-H2O
Carbamazepine

# Summary – PPCP

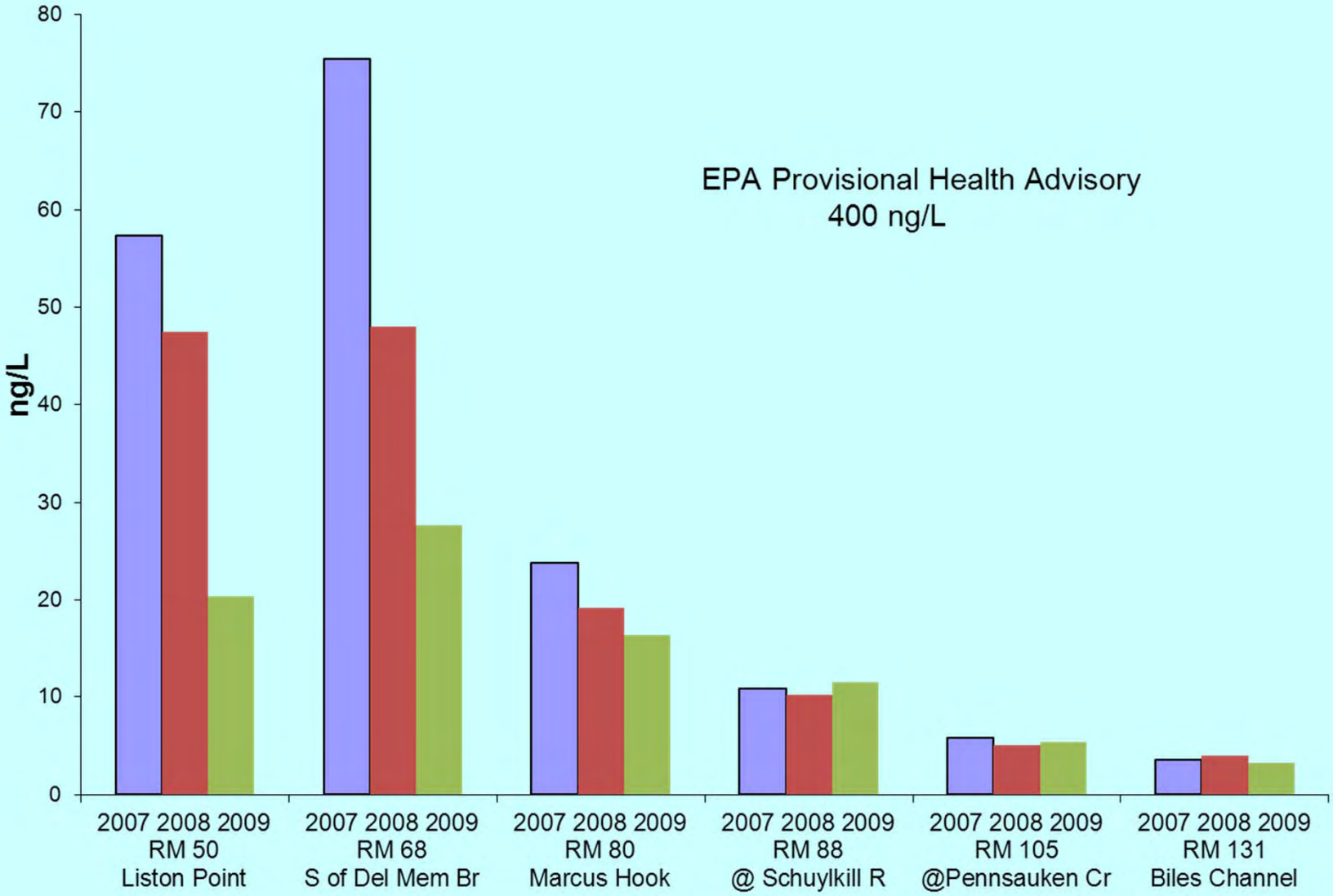
- Similar contaminants present in other fresh and estuarine surface waters with exception of codeine and metformin.
- Recommend monitoring of all parameters feasible.
- Eighteen priority PPCP proposed for study in Delaware Estuary.

# Perfluorochemicals

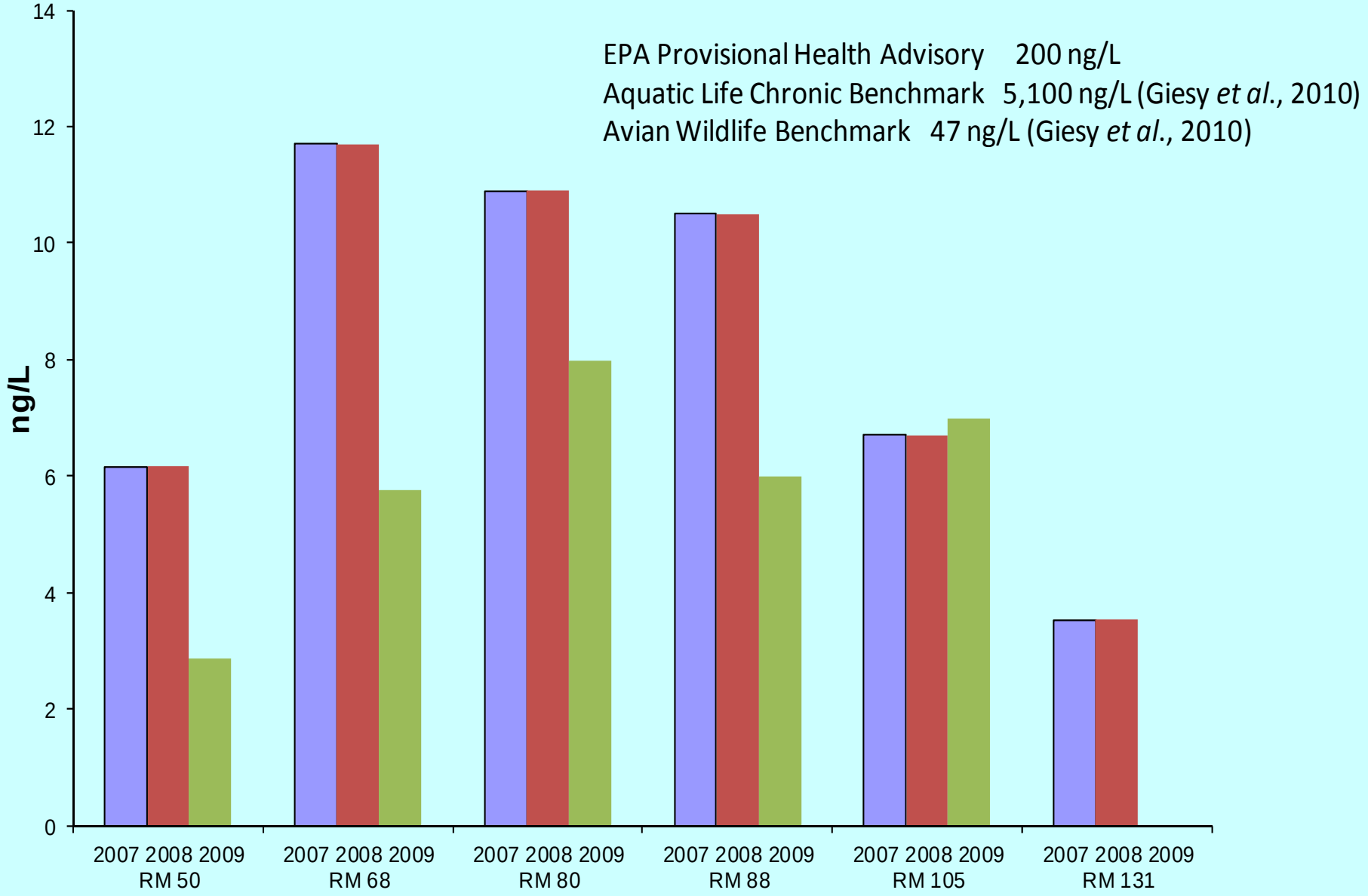
# PFC In Ambient Waters Of TheTidal Delaware River

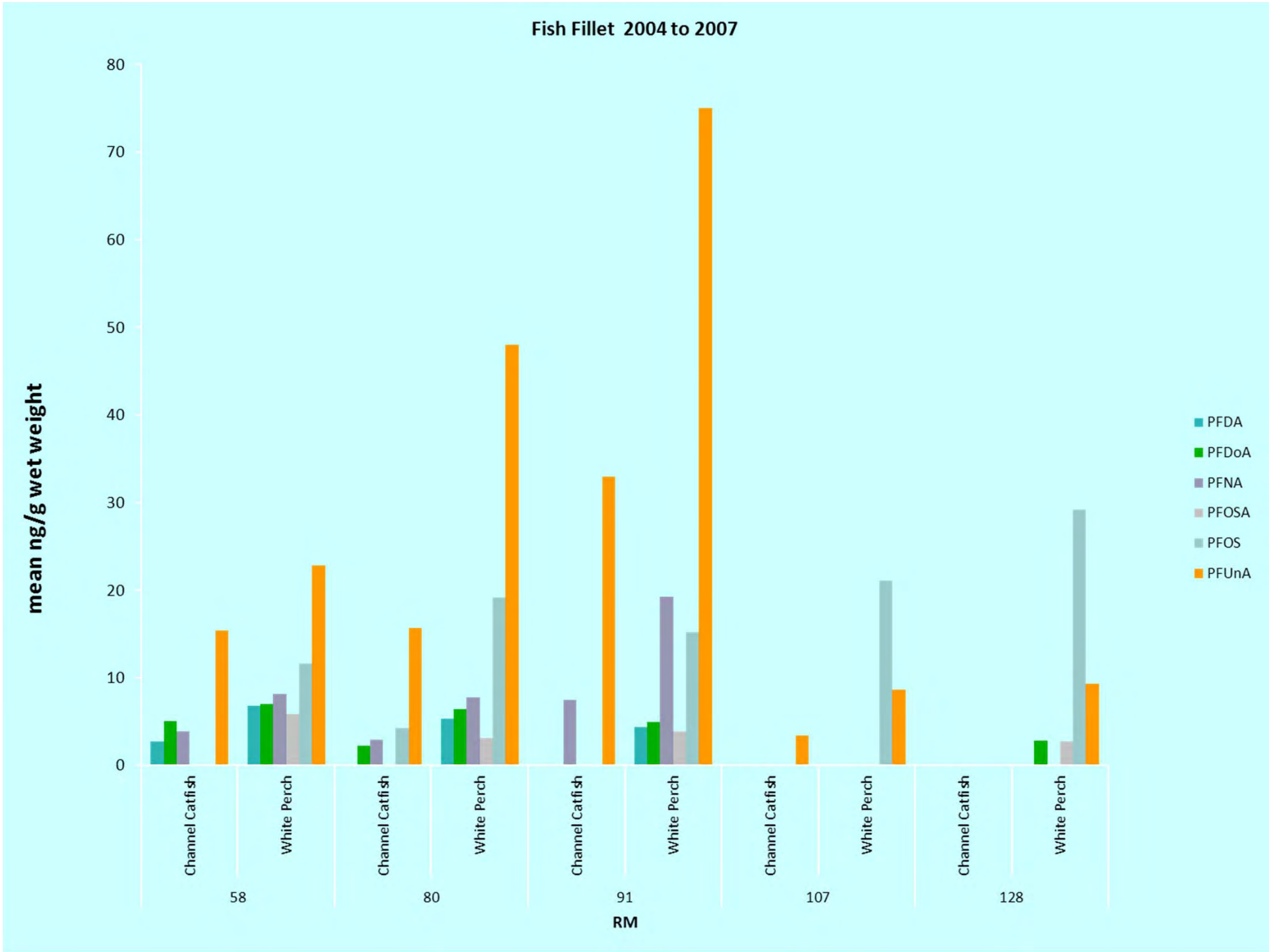


## PFOA In Ambient Water Of TheTidal Delaware River

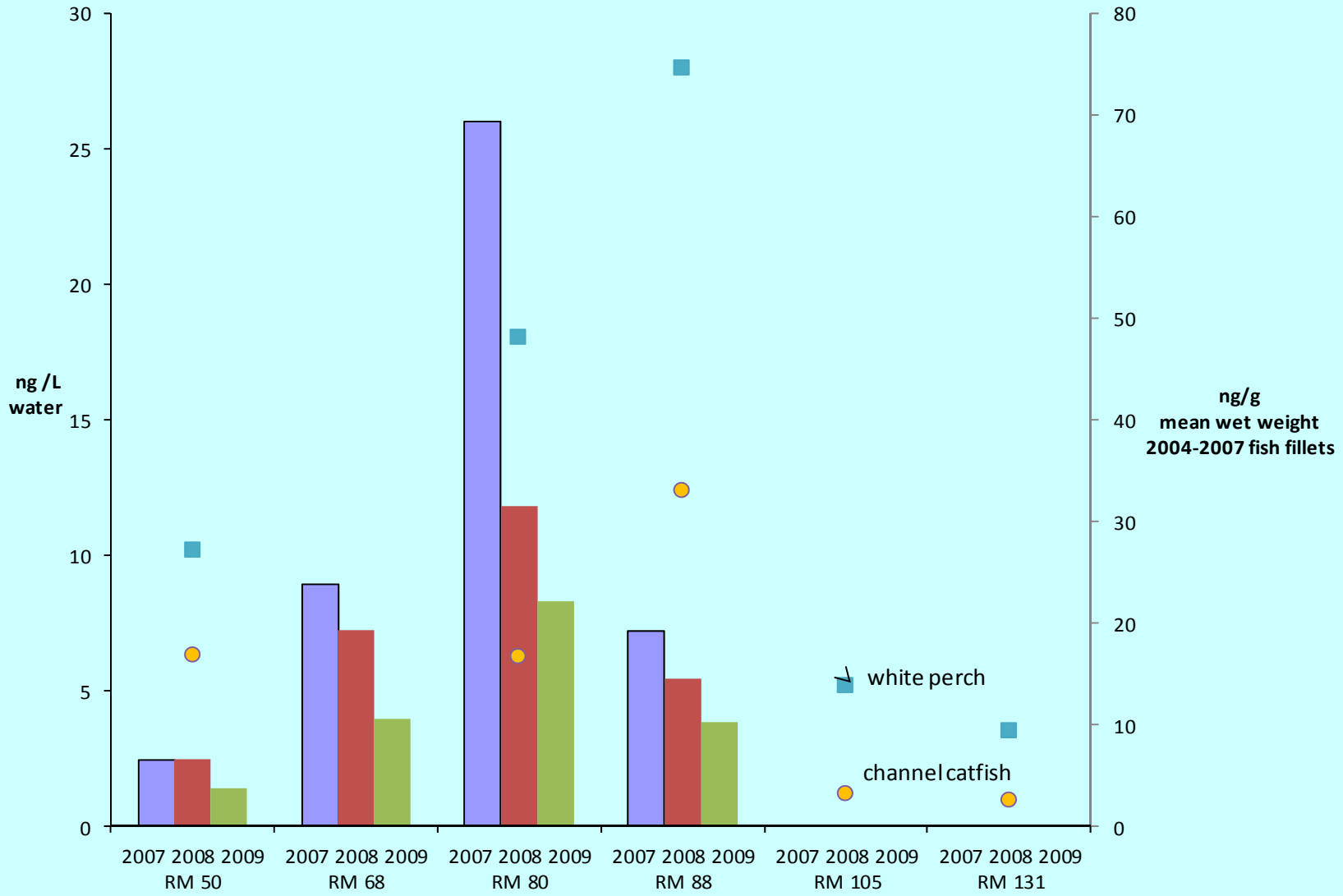


## PFOS In Ambient Water Of The Tidal Delaware River




Fish Fillet 2004 to 2007
mean ng/g wet weight
80
70
60
50
40
30
20
10
0
Channel Catfish
White Perch
58
80
91
107
128
RM
PFDA
PFDoA
PFNA
PFOSA
PFOS
PFUnA

# PFUnA (C11) In TheTidal Delaware River



# Summary – Perfluorinated Compounds

- PFC detected at ng/L (pptr) levels in water
  - PFNA (C9) highest PFC concentrations in water
  - Concentrations in water appear to be going down
- PFC in Delaware River fish fillets at ng/g (ppb) levels
  - PFUnA(C11) > PFOS(C8) > PFNA(C9) > PFDoA(C12) > PFDA(C10)
- Additional ecotoxicology information needed especially on the bioaccumulative and persistent longer chain and sulfonated compounds

# Summation

- Current assessment and regulatory approaches are inadequate for many compounds detected in waters of the estuary.
- Eighteen PPCP are prioritized for focused study.
- Additional ecotoxicology information is needed especially on longer chain and sulfonated PFC.

# Acknowlegements


- Tom Fikslin and DRBC MMA staff for support and advice throughout the project
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**http://www.state.nj.us/drbc/emc.htm**