



Sources, Transport, Exposure & Effects of PFASs
UNIVERSITY OF RHODE ISLAND SUPERFUND RESEARCH PROGRAM

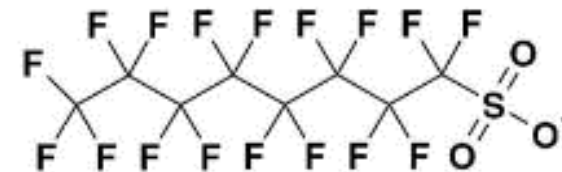
STEEP Overview

(Sources, Transport, Exposure and Effects of PFASs)

Rainer Lohmann, University of Rhode Island's Graduate School of Oceanography



Challenging compounds



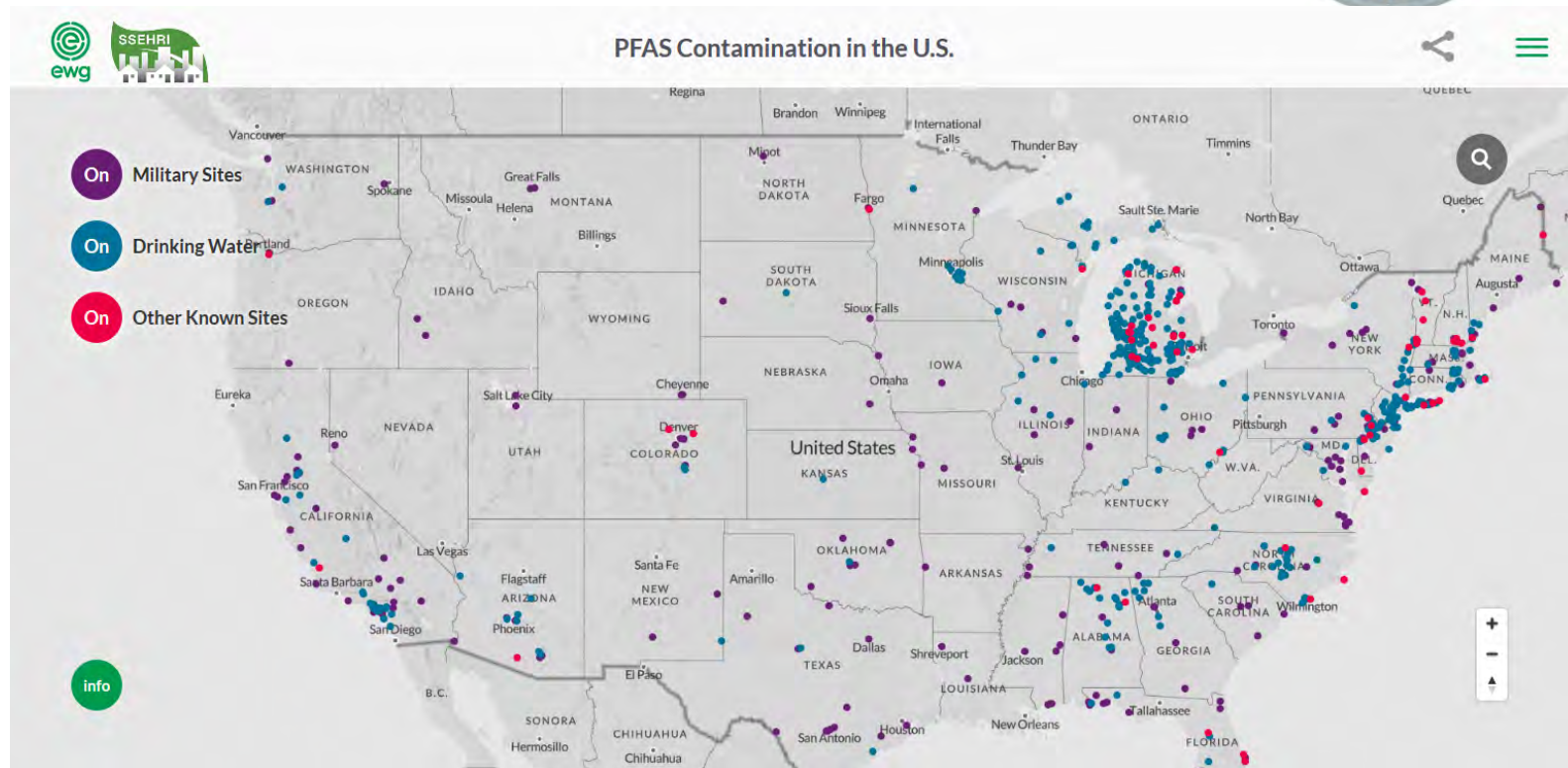
- Many contaminated sites



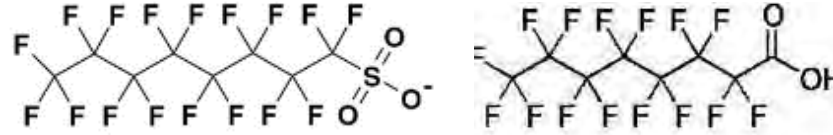
- Everyday exposure for all



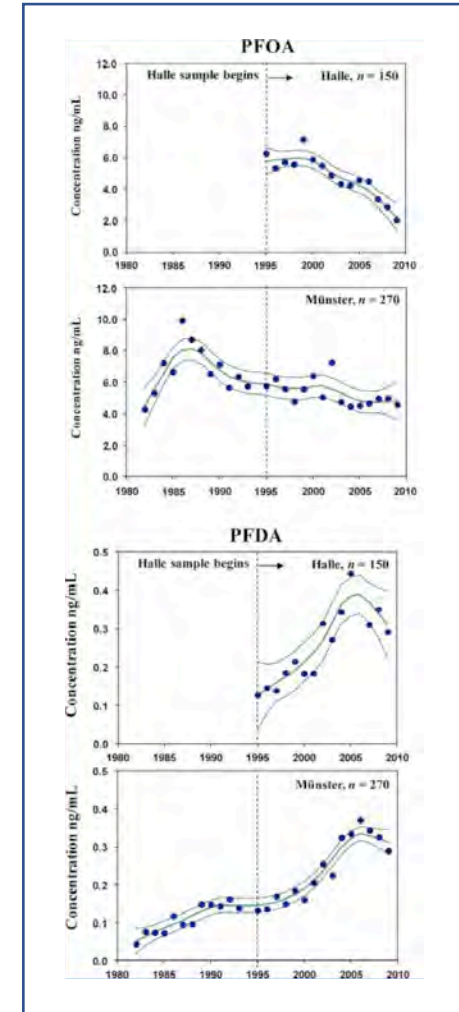
- Unique physical-chemistry, unlike traditional hydrophobic persistent organic pollutants



PFASs



- **Widespread human and environmental exposure**
 - Particularly perfluorinated C₈ compounds – PFOS and PFOA
- **Wide range of adverse effects (humans/animals)**
 - Immunosuppression (Grandjean et al., 2013)
 - More PFOA, higher risk of being overweight (Haldersson et al., 2012)
 - Link between [PFOA] in blood and insulin resistance (Timmermann et al., 2014)
 - Several cancers at high exposure (C8 Science panel)
- **Regulatory action**
 - PFOS withdrawal and PFOA action plan
- **Replacement with other fluorinated compounds**
 - Shorter, polyfluorinated; more complex molecules - precursors



(Yeung et al., 2013)

It's been a busy time for PFASs

- No recent action by EPA...
- But at state level
 - NJ also issued for PFOS at 13 ng/L
 - NY, MI, NH, CA, VT...
- MA proposed sum of 6 at 20 ng/L
- General consensus that EPA Advisory of 70 ng/L not sufficient

PERSPECTIVE

Key scientific issues in developing drinking water guidelines for perfluoroalkyl acids: Contaminants of emerging concern

Gloria B. Post^{1*}, Jessie A. Gleason², Keith R. Cooper³

¹ New Jersey Department of Environmental Protection, Trenton, New Jersey, United States of America, ² New Jersey Department of Health, Trenton, New Jersey, United States of America, ³ Rutgers University, New Brunswick, New Jersey, United States of America

Table 1. EPA and state health-based drinking water guidelines for long-chain PFAAs^a.

PFAA	Source	Year	Guideline (ng/L)
PFOA	EPA [33]	2016	70 ^b
	Minnesota [54]	2017	35
	New Jersey [31]	2017	14 ^c
	North Carolina [55]	2006	2,000
	Texas [56]	2016	290
	Vermont [57]	2016	20 ^b
PFOS	EPA [33]	2016	70 ^b
	Minnesota [54]	2017	27
	Texas [56]	2016	560
	Vermont [57]	2016	20 ^b
PFNA	New Jersey [39]	2015	13 ^c
	Texas [56]	2016	290
PFHxS	Texas [56]	2016	93

Grounding some numbers

- We typically measure in the ng/L range
- about 10 grains of table salt ...
- ~ dissolved in an Olympic pool



Who will foot the bill(s)?

AP

Chemours sues DuPont over environmental liabilities

Company says former owner soft-pedaled costs at time of spin off

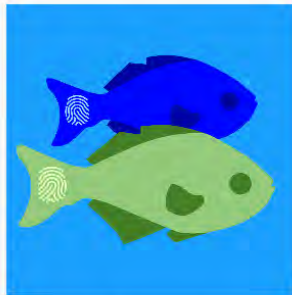
by *Alexander H. Tullo*

JULY 2, 2019 | APPEARED IN **VOLUME 97, ISSUE 27**

STEEP

Sources, Transport, Exposure & Effects of PFASs
UNIVERSITY OF RHODE ISLAND SUPERFUND RESEARCH PROGRAM

Connecting science and people



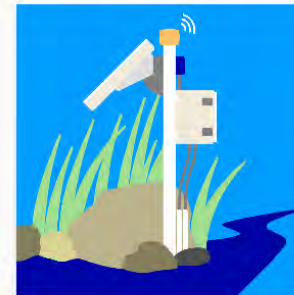
STEEP Research:
Environmental Fate
& Transport



STEEP Research:
Childhood Risk



STEEP Research:
Metabolic Effects



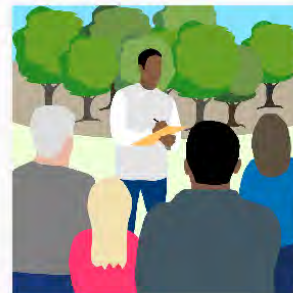
STEEP Research:
Detection Tools



STEEP Core:
Next
Generation



STEEP Core:
Research
Translation



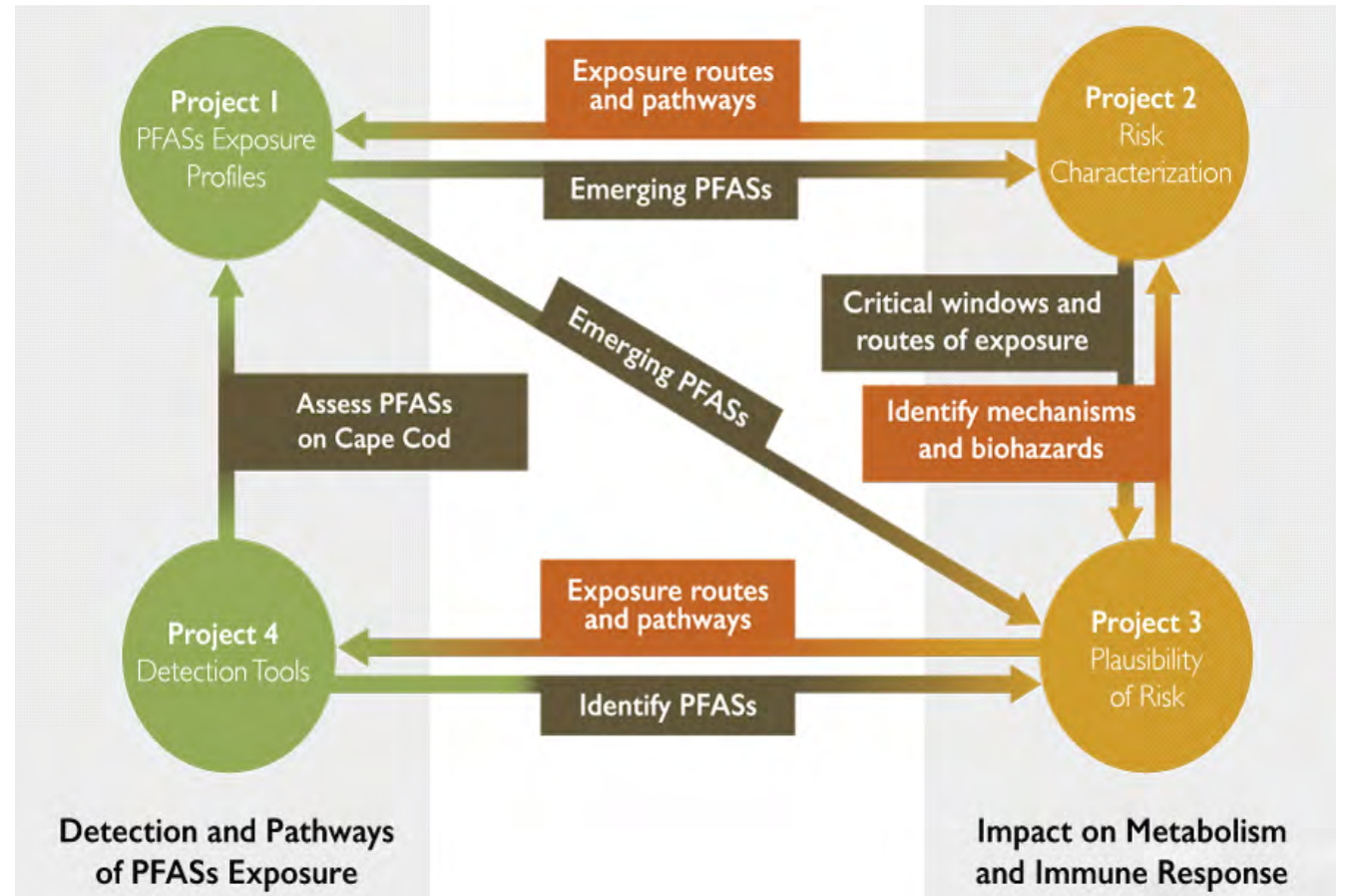
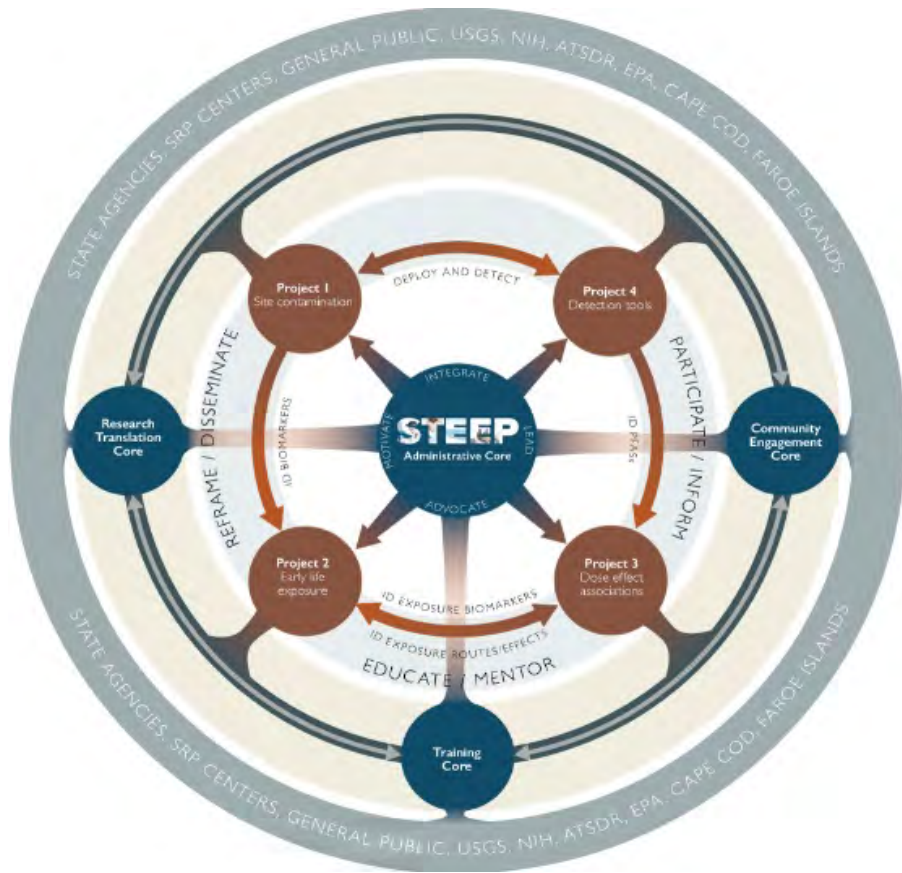
STEEP Core:
Community
Engagement



STEEP Core:
Administrative

www.uri.edu/stEEP

So what do we actually do?



The STEEP family?



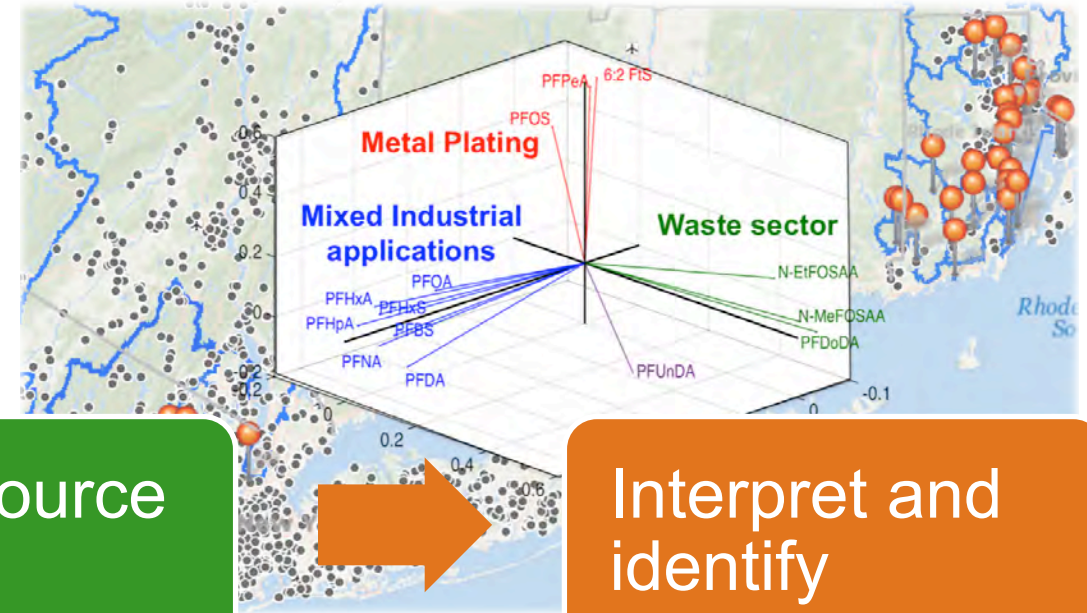
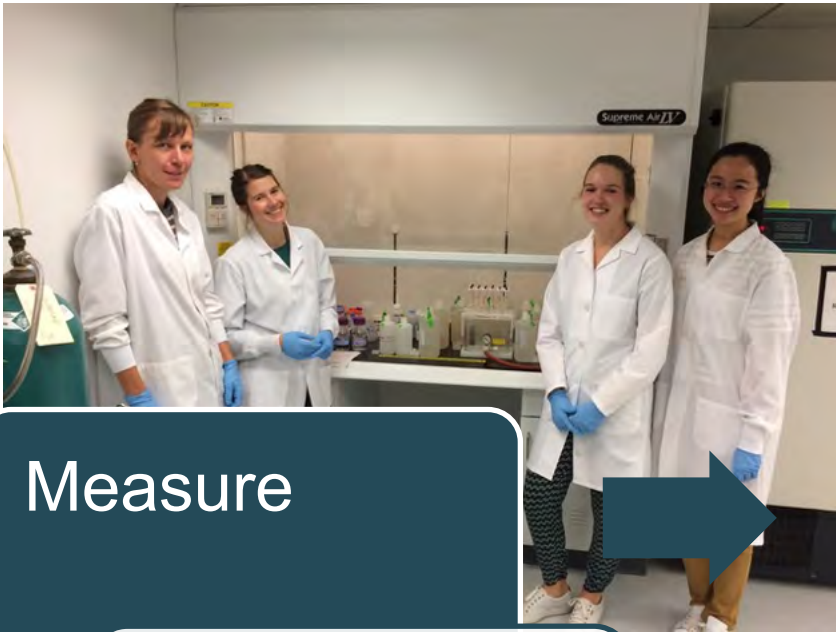
The STEEP team !



Project 1: Sources, fate and transport

PI: Elsie Sunderland (HU)

Collab: Denis LeBlanc (USGS); Alan Vajda (CU)



Measure

- Quantify a broad suite of PFASs

Derive source profile

- Principal Component Analysis (PCA) and Hierarchical Clustering

Interpret and identify

- Geospatial analysis
- Source information
- Environmental transformation and toxicokinetics

Bioassessment of PFAS Contaminated Groundwater

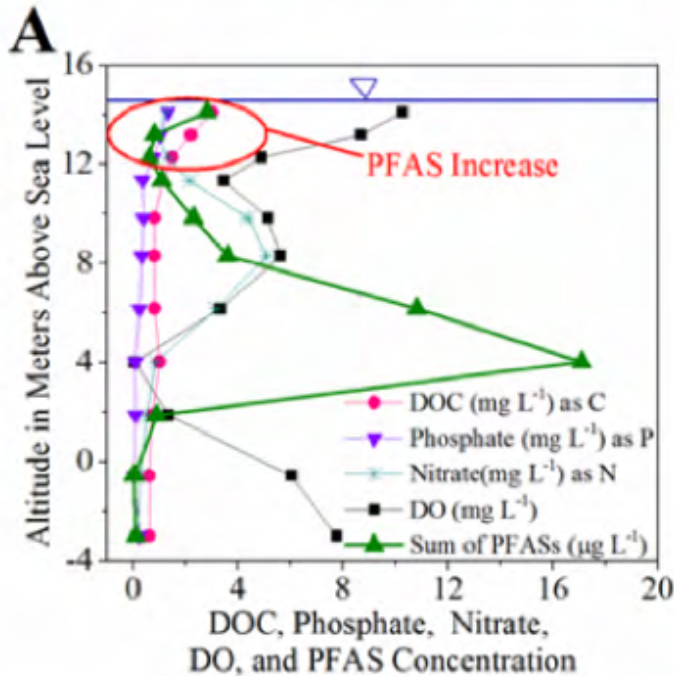
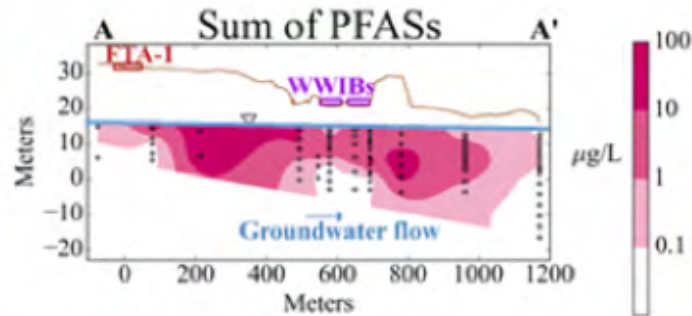


Monitoring wells



Different Source Waters

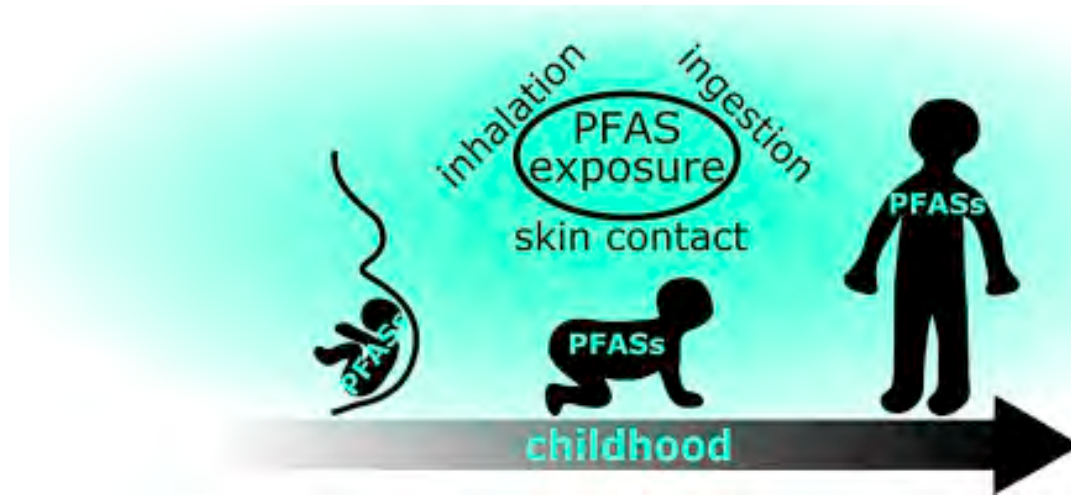
- FTA Plume
- Uncontaminated Groundwater



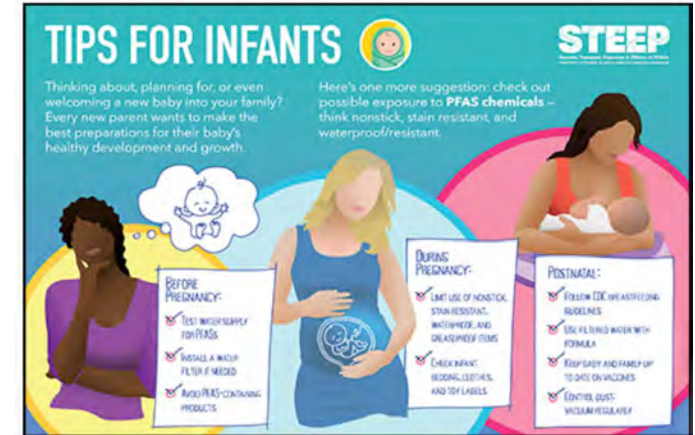


Project 2: Inflammation and metabolic changes in children developmentally exposed to PFASs

PI: Dr. Philippe Grandjean (Harvard T.H. Chan School of Public Health)



- Immunotoxicity
- Response to vaccine
- Increased risk for obesity
- *Changes hormones related to obesity, diabetes, hunger*



Project 3: PFAS effects on metabolic abnormalities in rodents and human cells

PI: Drs. Angela Slitt and Geoff Bothun (URI)

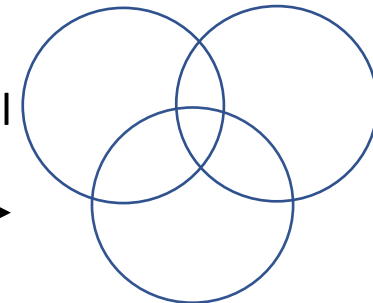
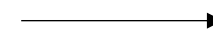


PFOA and PFOS

- Liver damage
- Increased cholesterol



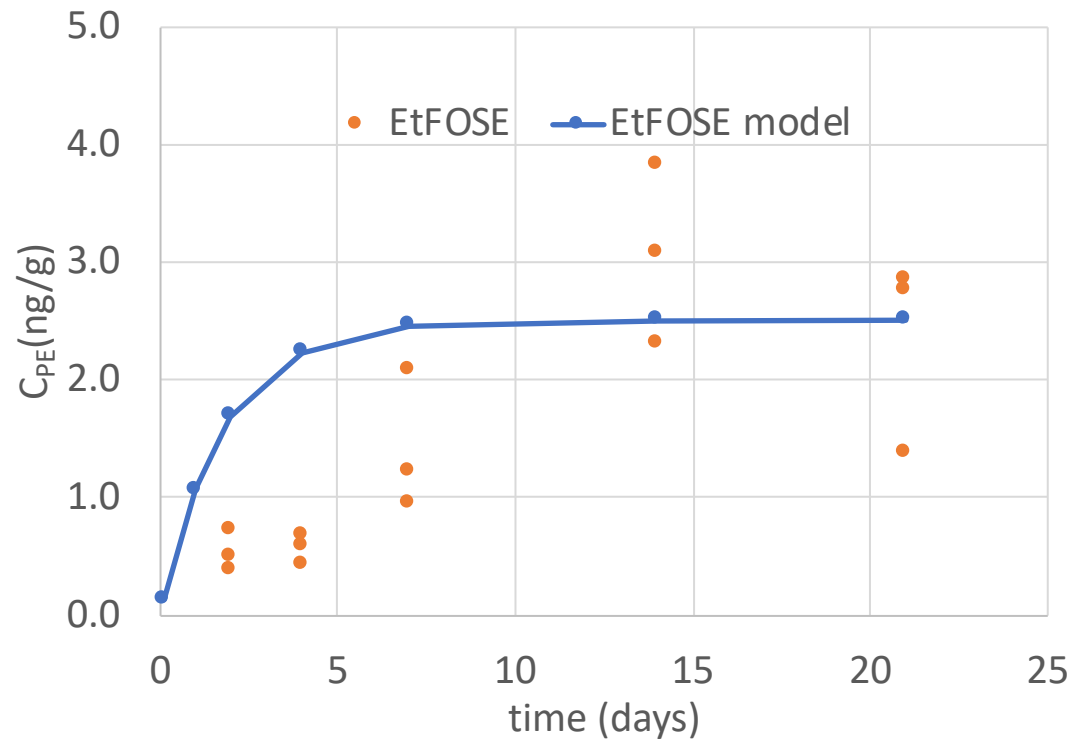
Assess cell
response



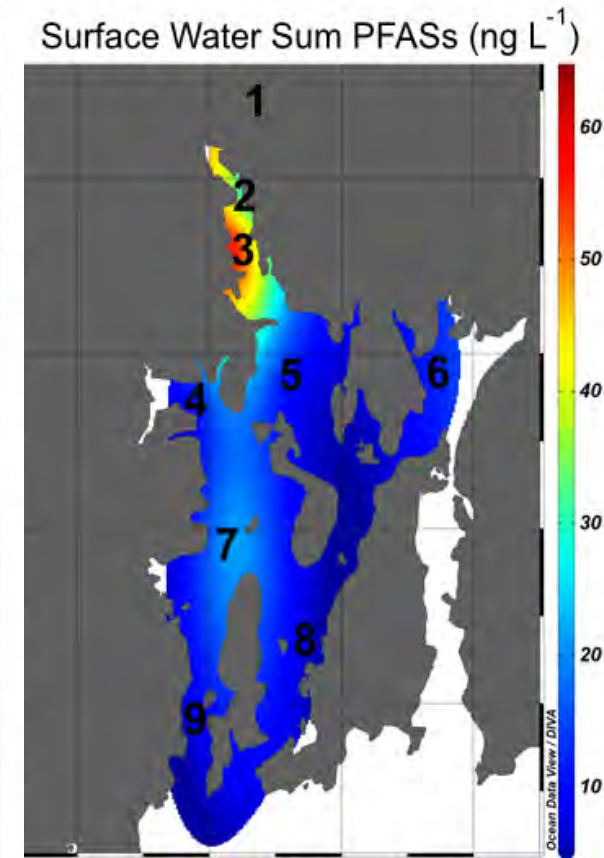
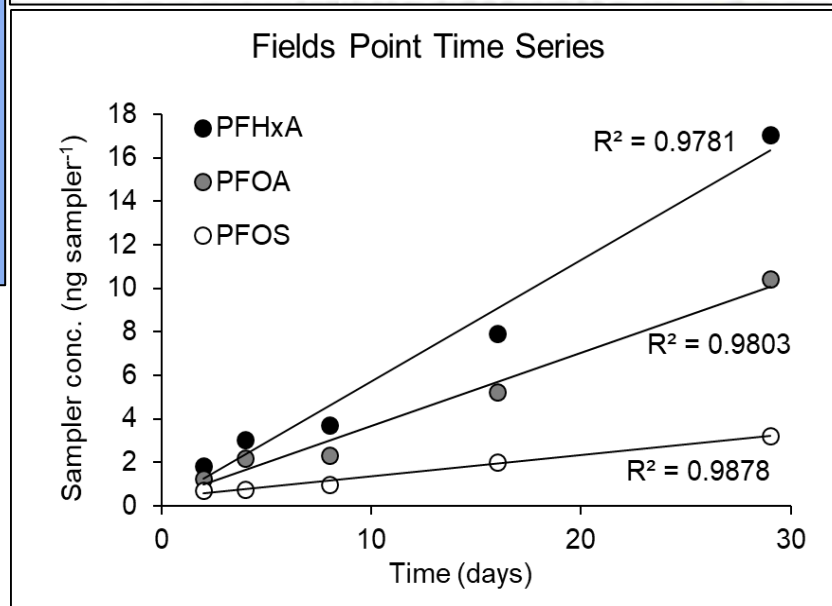
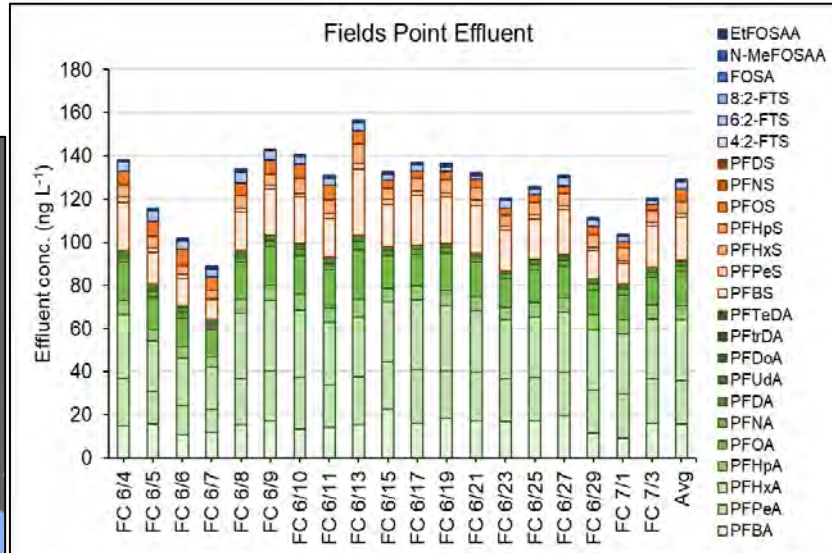
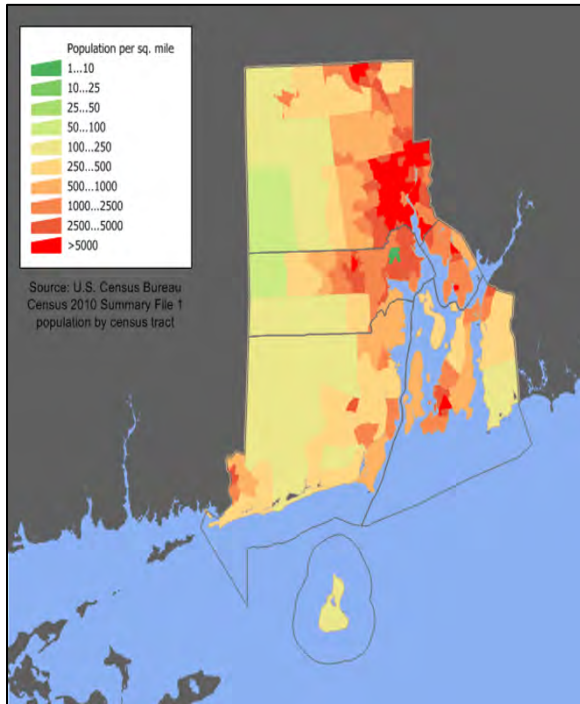
**Understand
similarities and
differences of newer
PFASs to legacy PFASs**

Project 4: Simple tools for complex chemistry

- Uptake of compounds by PE sheets



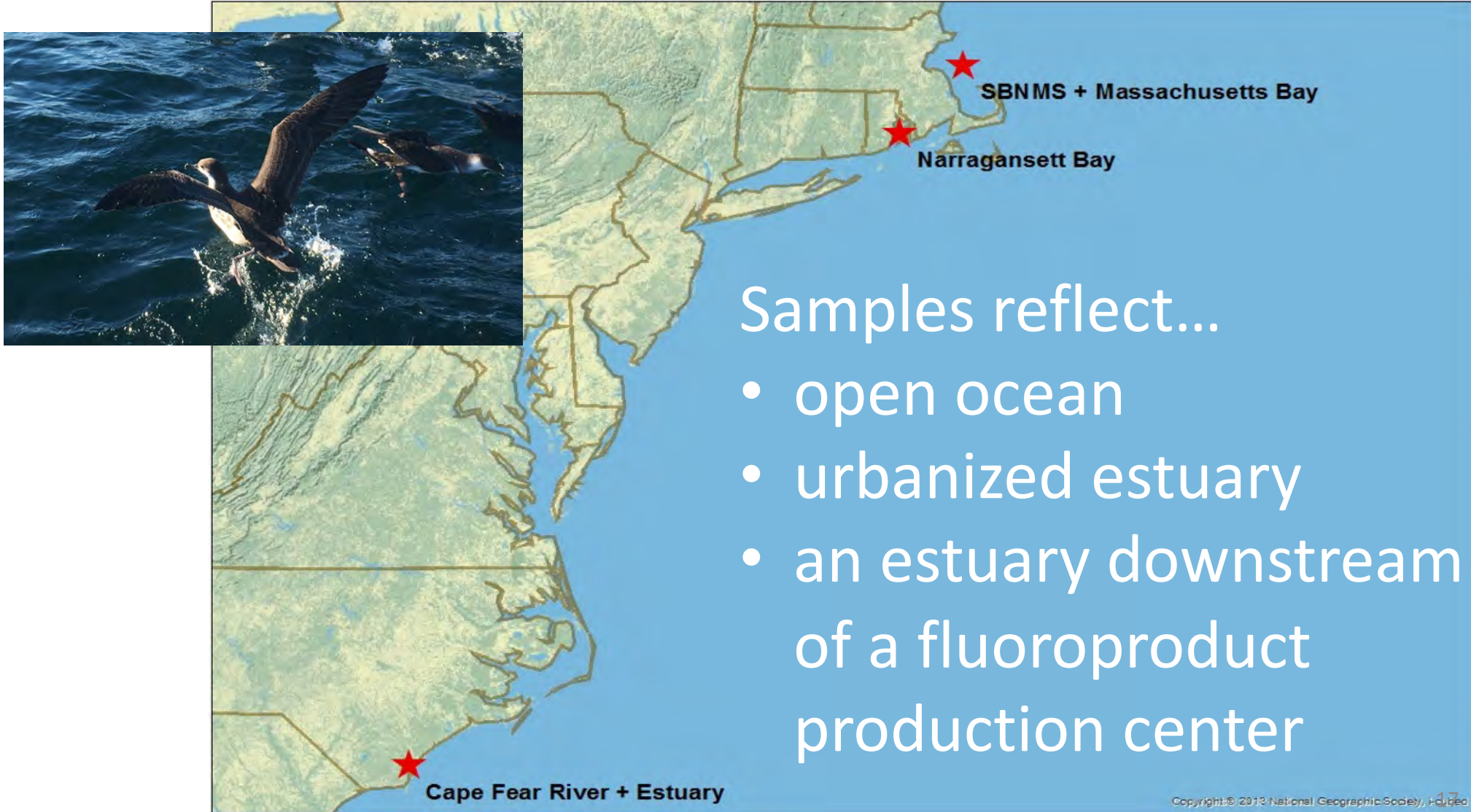
Tube spotters aware – soon here, too



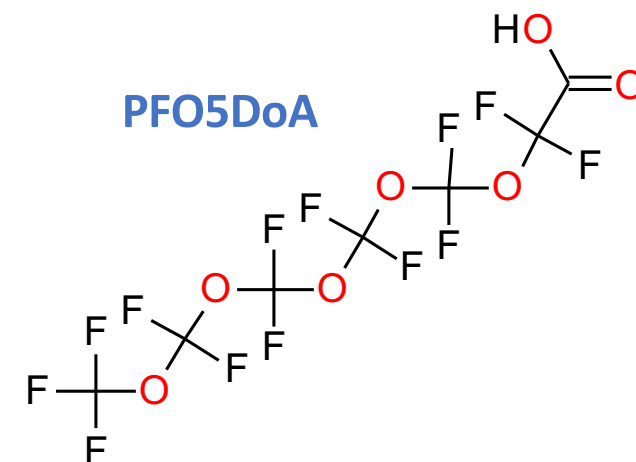
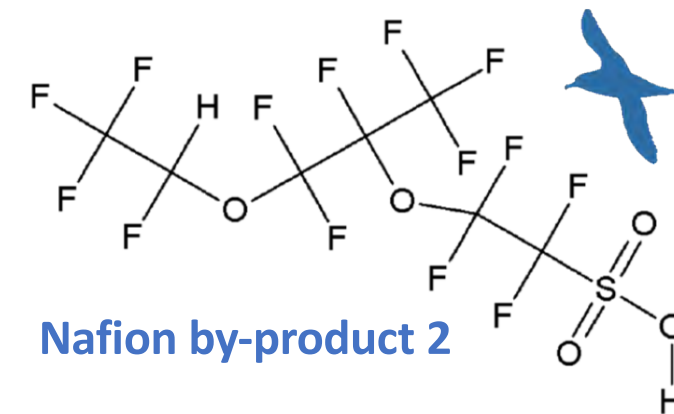
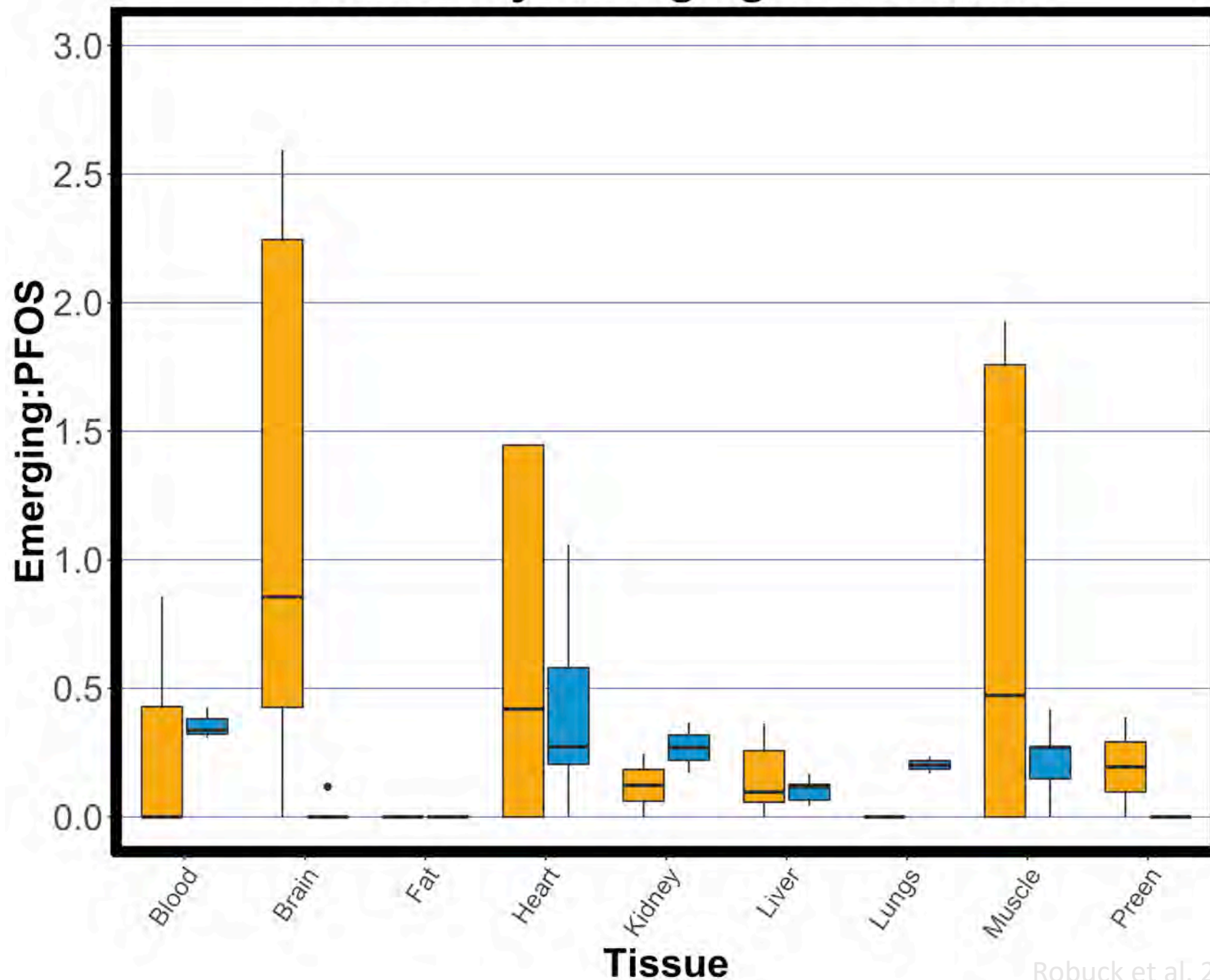
PFASs take to the air: trends in seabirds



Image credit: Anna Robuck, URI-GSO

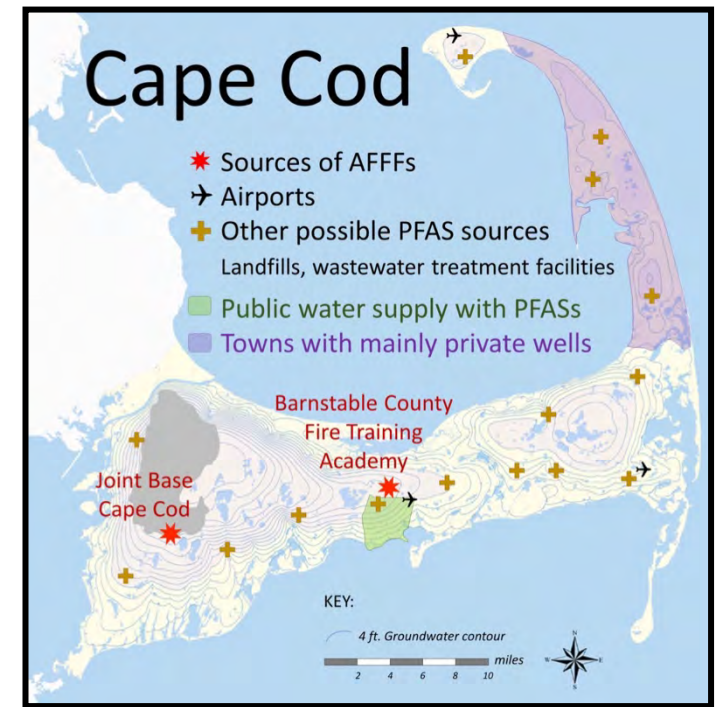


Preliminary Emerging:PFOS ratios



STEEP's focus on Cape Cod

- Vulnerable sole-source aquifer
- AFFF contamination of public and private drinking water wells
- Prior studies of septic systems as PFAS sources
- Community concerns about water quality and health



Community engagement Core

PIs: Alyson McCann (URI)

Laurel Schaidler (SSI)



Private well testing



Community events and presentations

- The STEEP team for spending years together
- To NIEHS, **5P42ES027706**
- To Michelle Heacock, Bill Suk, the NIEHS team and reviewers
- All of you...

THE
UNIVERSITY
OF RHODE ISLAND



SCHOOL OF PUBLIC HEALTH
Department of Environmental Health



STEPP is funded under award number P42ES027726.
More information about STEPP is available at: <https://web.uri.edu/steep/>



So how does this affect you?

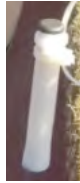
- Air

- Outdoor
- Indoor



- Water

- Stream/po



- Soil/sediment



[123RF.com](https://www.123RF.com)