Home-Raised Chicken Egg PFAS Testing and Exploratory Evaluation Exposure Pathways

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NEWMOA Northeast Conference on the Science of PFAS

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PFAS Contamination of the Agriculture Ecosystem

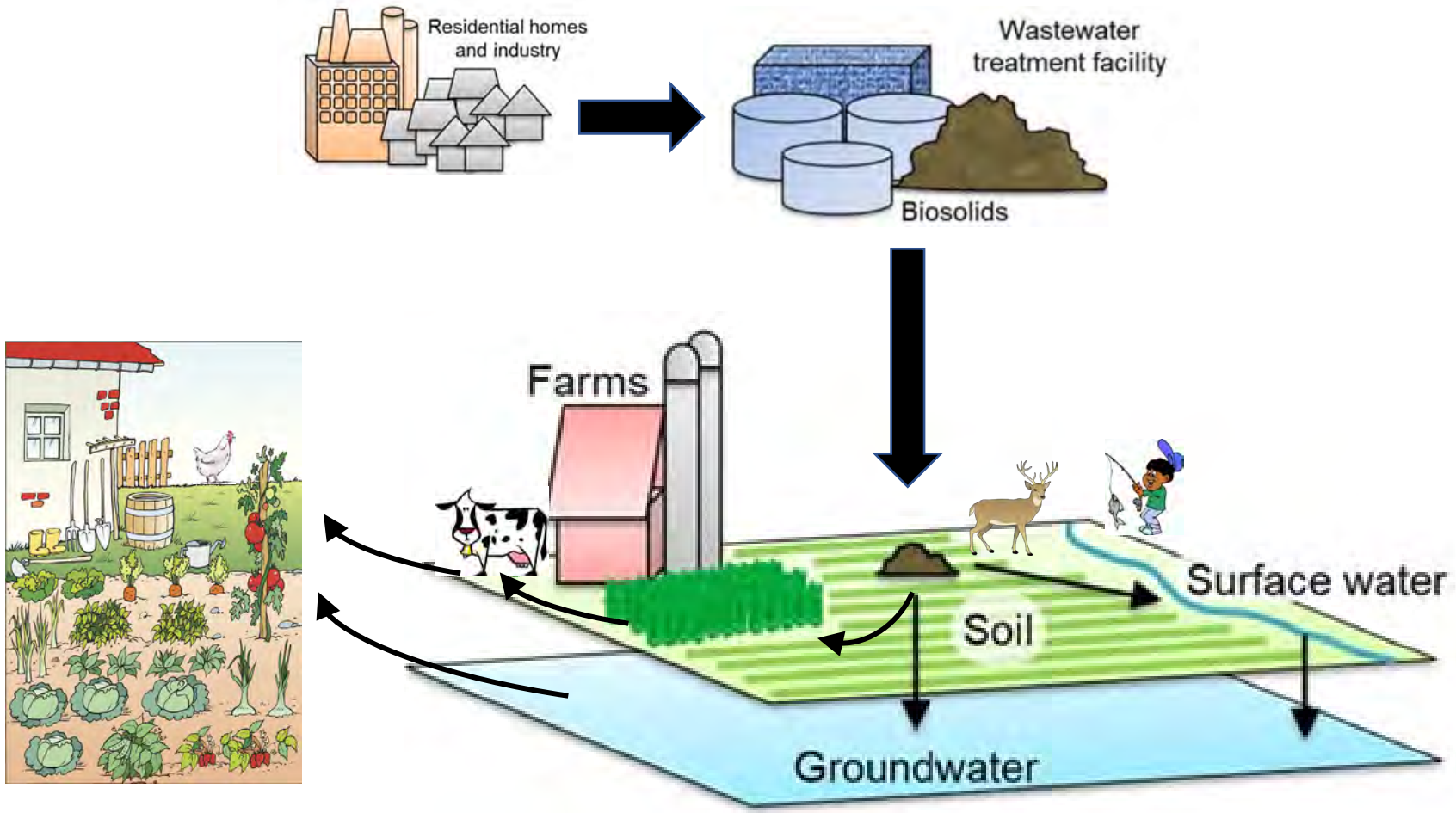
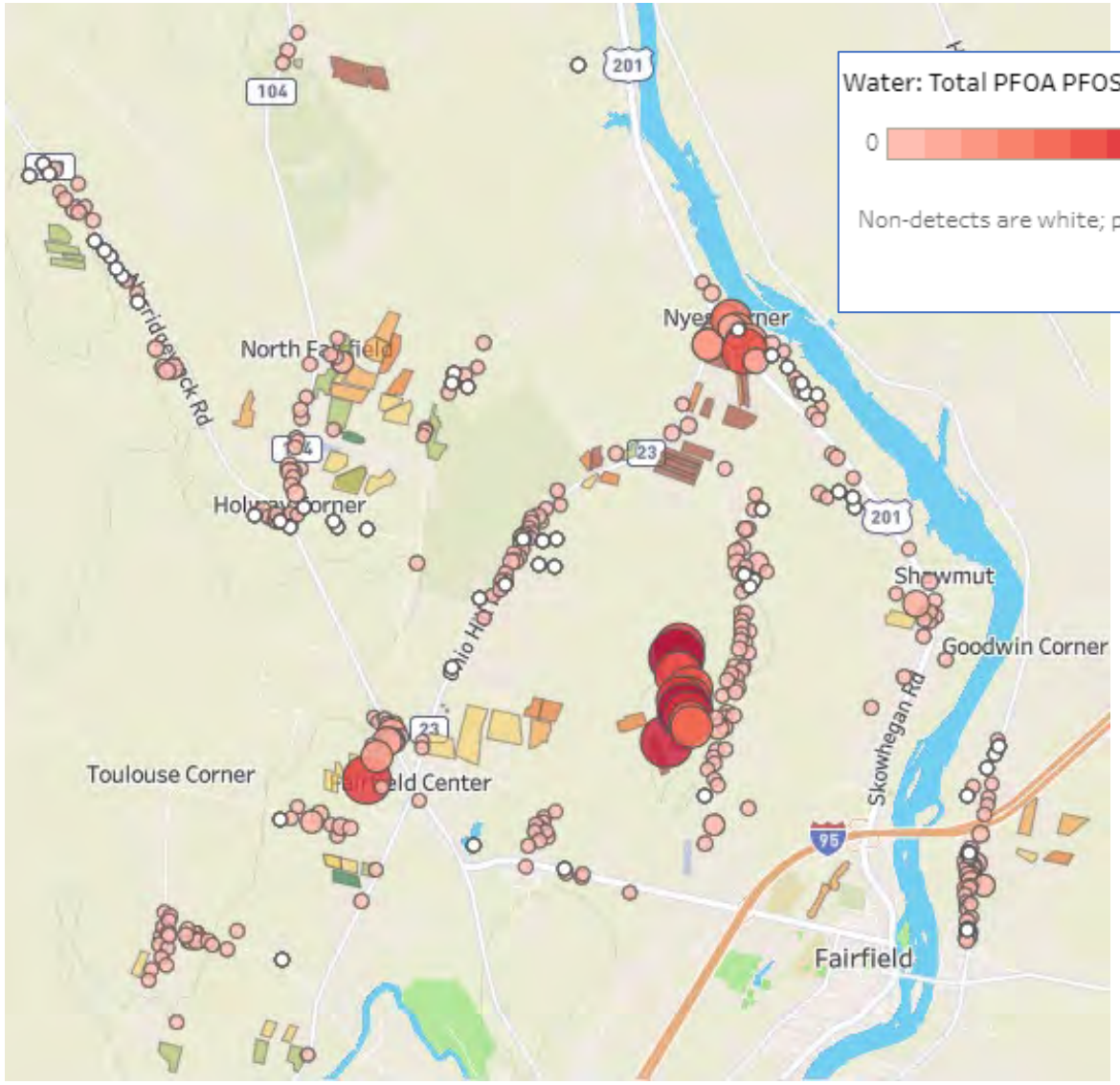
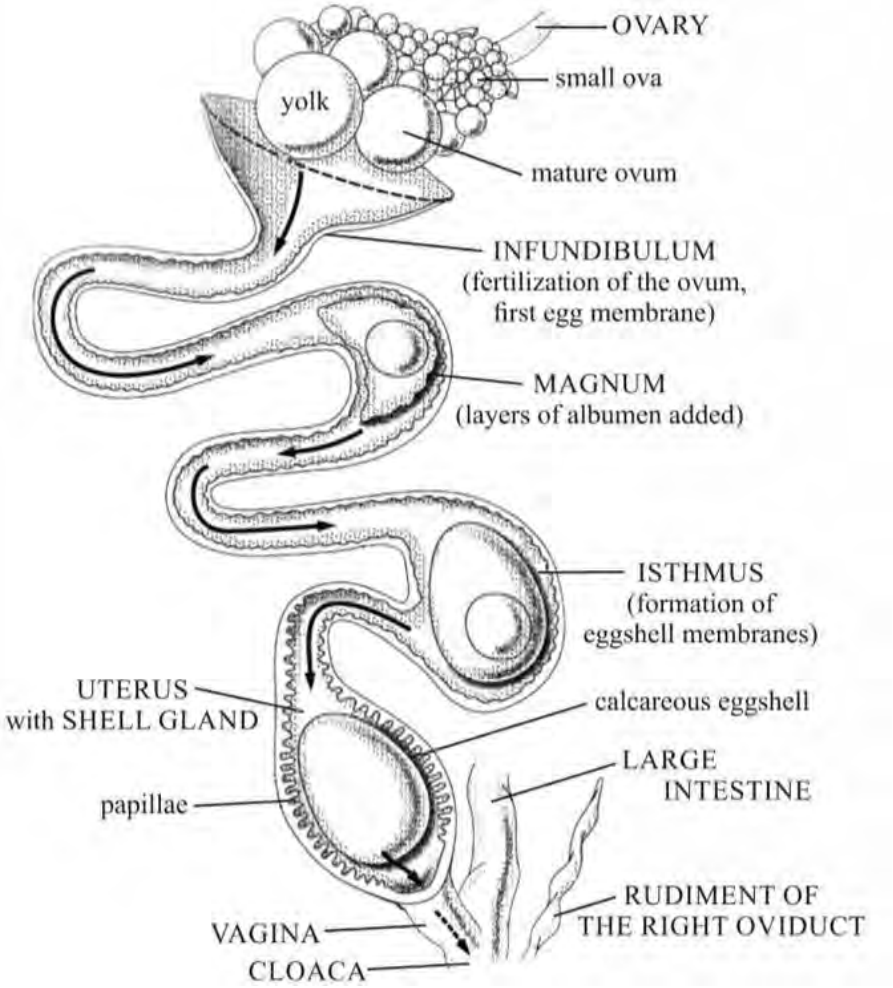


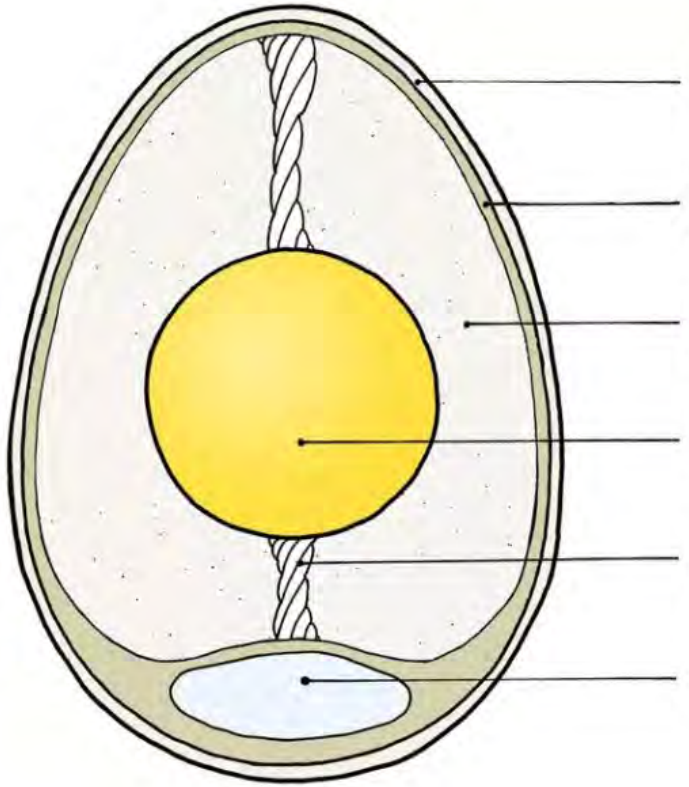
Image: Diana Oviedo-Vargas, Ph.D., Stroud Water Research Center

PFAS Exposure and Backyard Chicken Eggs



The Egg





Colin McDonald/CNET

SHELL

MEMBRANES

ALBUMEN EGG WHITE
(90% water, 10% protein)

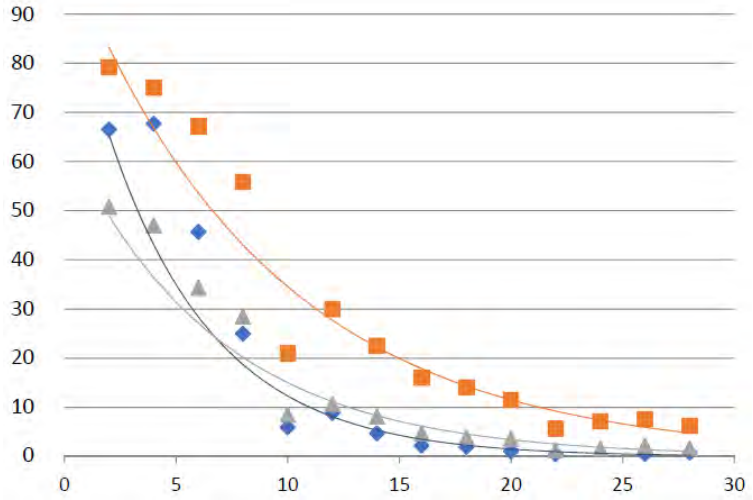
YOLK
(53% water, 16% protein, 26% fat)

CHALAZA

AIR CHAMBER

PFAS and Eggs

Australian PFAS water chicken egg study



	Half-life
PFOS	3.5 days
PFOA	5.4 days

Source: AECOM. 2017. Off-Site Human Health Risk Assessment
https://www.defence.gov.au/environment/pfas/williamtown/publications.asp

German PFAS feed chicken egg study

	Liver (ng/g)	Kidney (ng/g)	Muscle (ng/g)	Plasma (ug/L)	Yolk (ng/g)
PFOS	1.5	2.9	6.2	70.8	560.7
PFOA	3.7	19.7	0.3	6.6	18.6

Source:
Kowalczyk et al. 2020-
https://pubs.acs.org/doi/10.1021/acs.jafc.0c04485

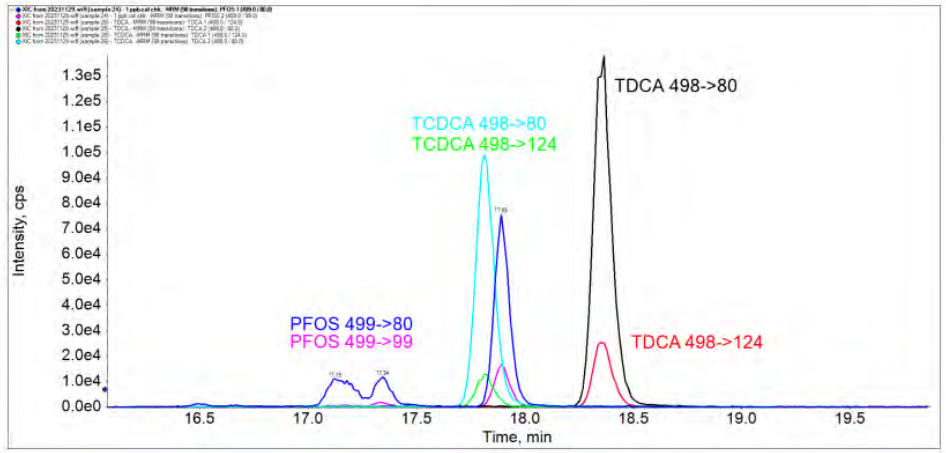
Chicken Coop and Pen

PFAS Egg Analysis

- PFAS analysis method - FDA Method C-010.02 LC-MS/MS isotope dilution

- Cholic acid interference: Optimize chromatographic conditions and cholic acid clean up using Envi-Carb cartridge and addition of TCDA and TCDCA standards

- All samples analyzed in duplicate



https://www.fda.gov/food/laboratory-methods-food/foods-program-compendium-analytical-laboratory-methods

How much is too much PFOS in Chicken Eggs?

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

2 ng/kg/day

Do not adjust for exposure from "background" sources

1

$$\frac{Toxicity\ Value}{Consumption\ Rate} \times Relative\ Source\ Contribution = 0.6\ ng/g\ \ (child)$$

$$= 2.0\ ng/g\ (adult)$$

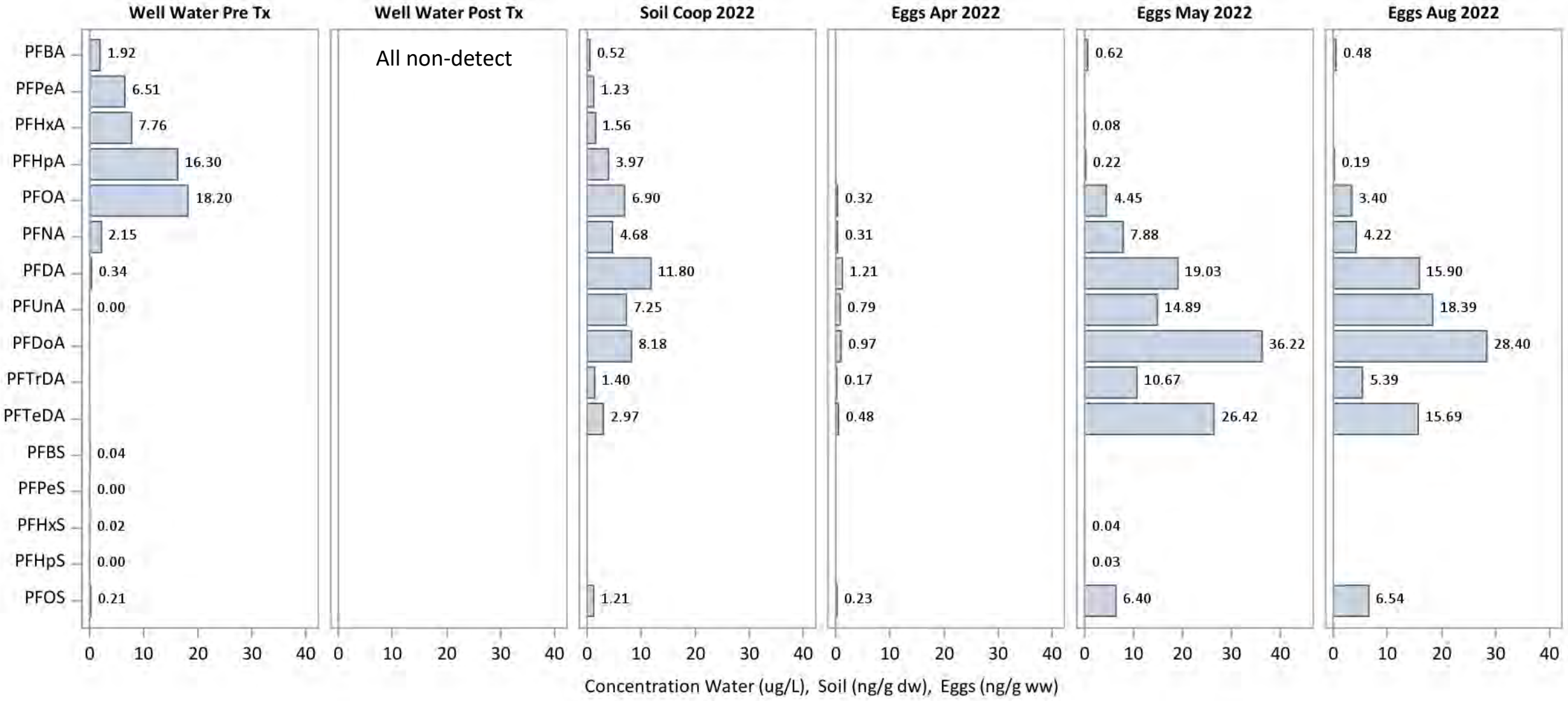
USDA

FPED
Food Patterns
Equivalents
Database

90th Percentile
egg consumption
Child – 3.4 g/kg/day
Adult – 1.0 g/kg/day

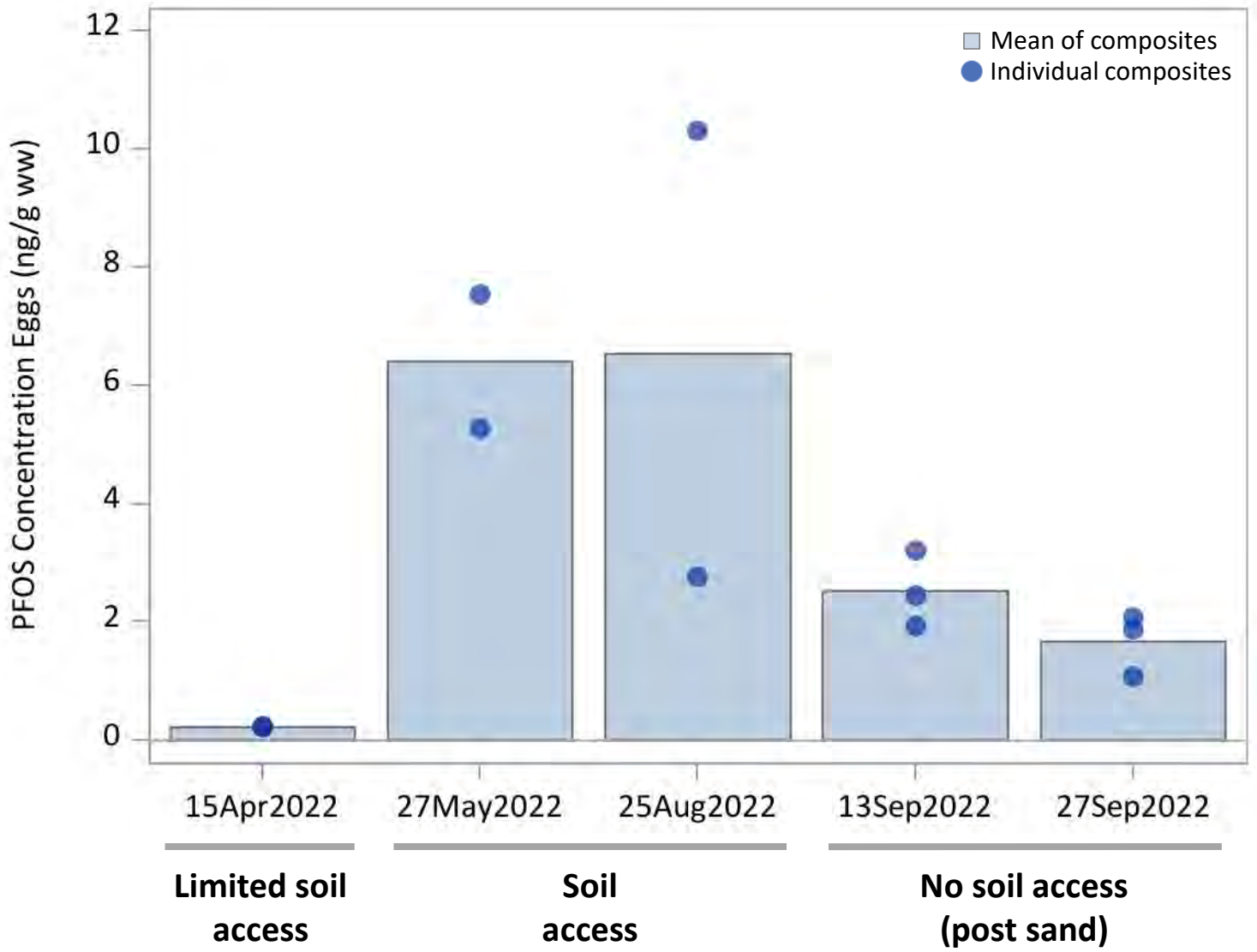
European Union Maximum Level for PFOS in eggs adopted in 2022 is 1 ng/g
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022R2388

Home Water, Soil, and Egg PFAS Results

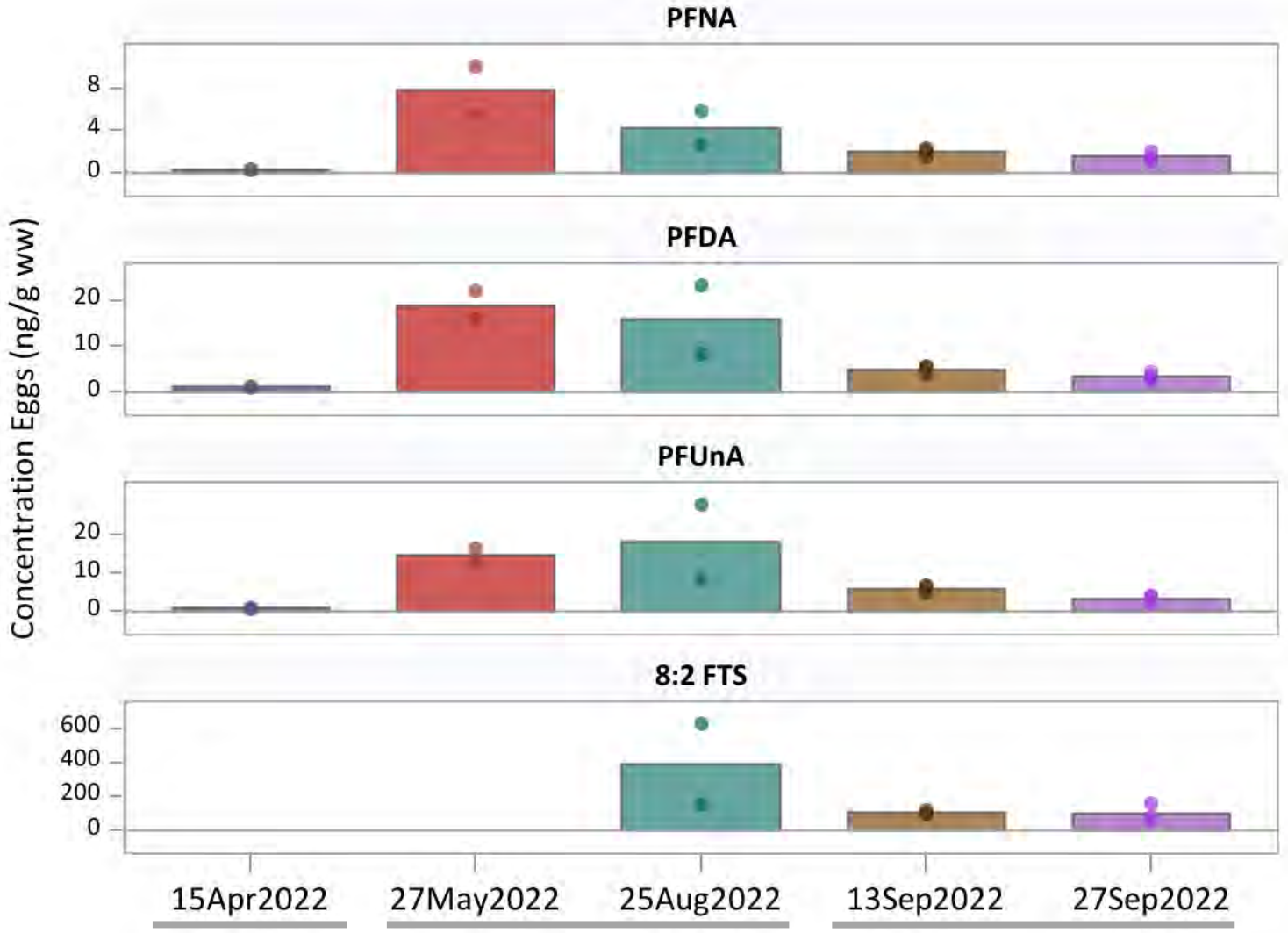


Mitigation: Clean Sand Layer Application

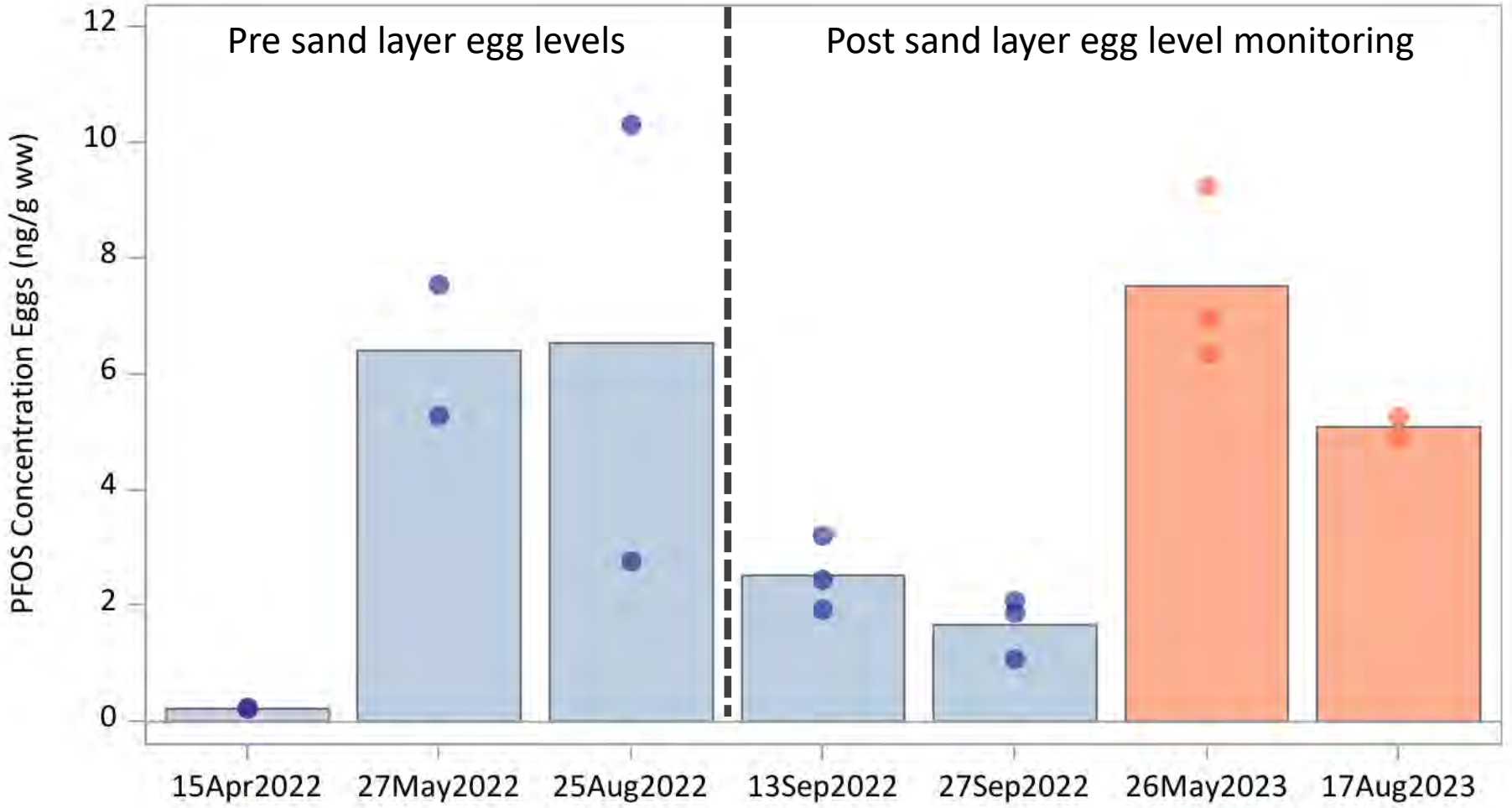
PFOS Egg Levels Pre and Post Sand Layer



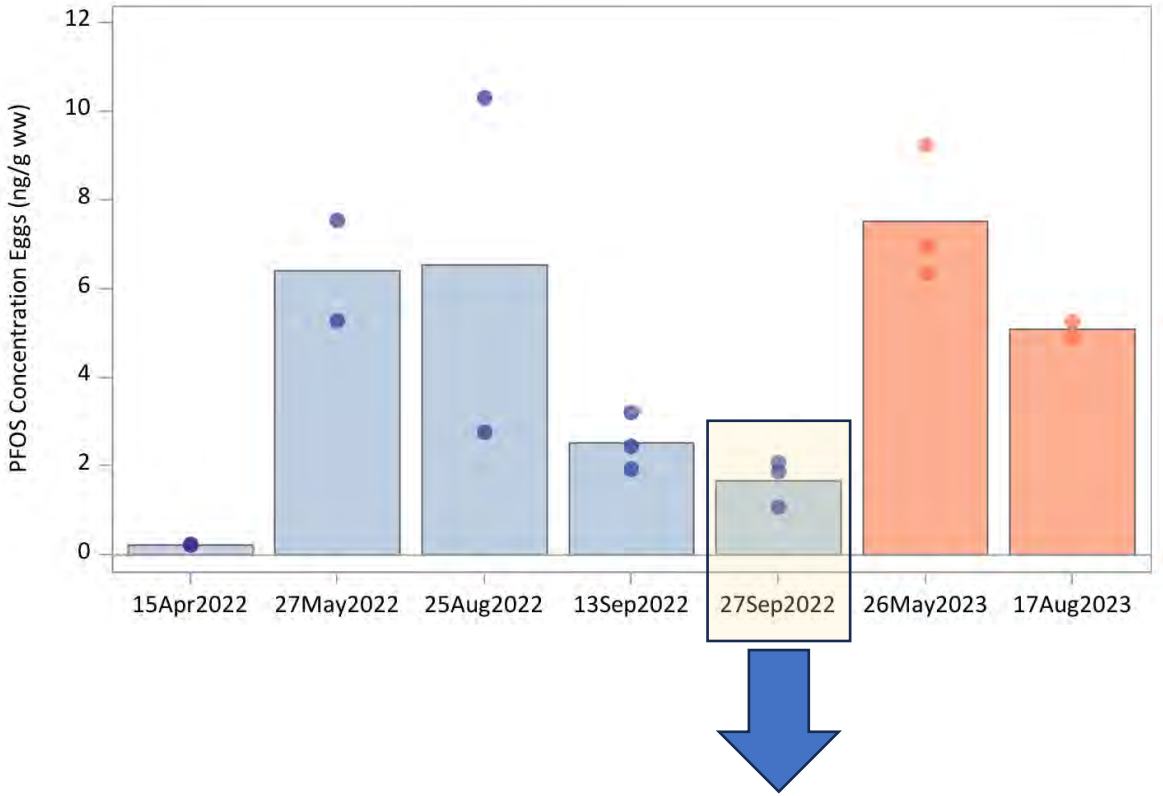
Similar Trend with other PFAS



Continued PFOS Egg Monitoring Post Sand



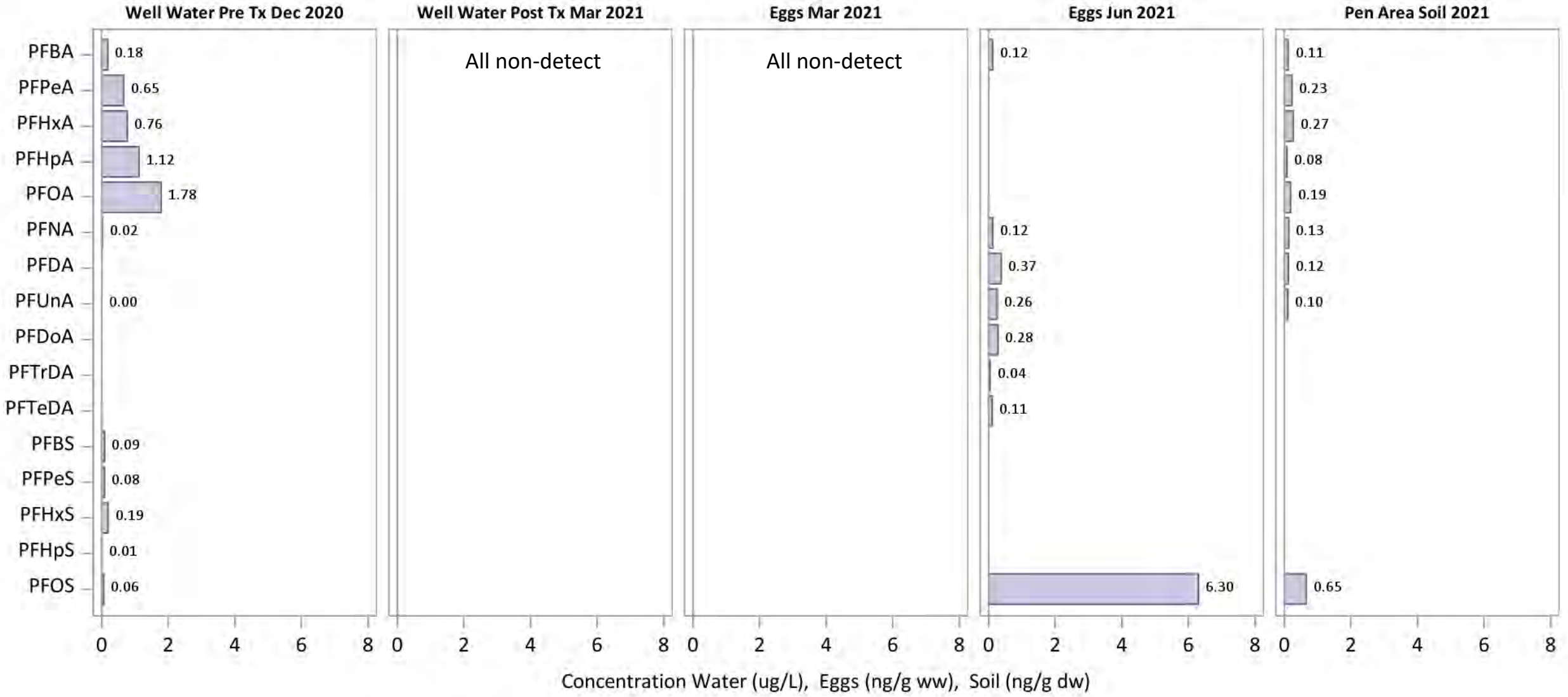
What if chickens are eating their own eggs?



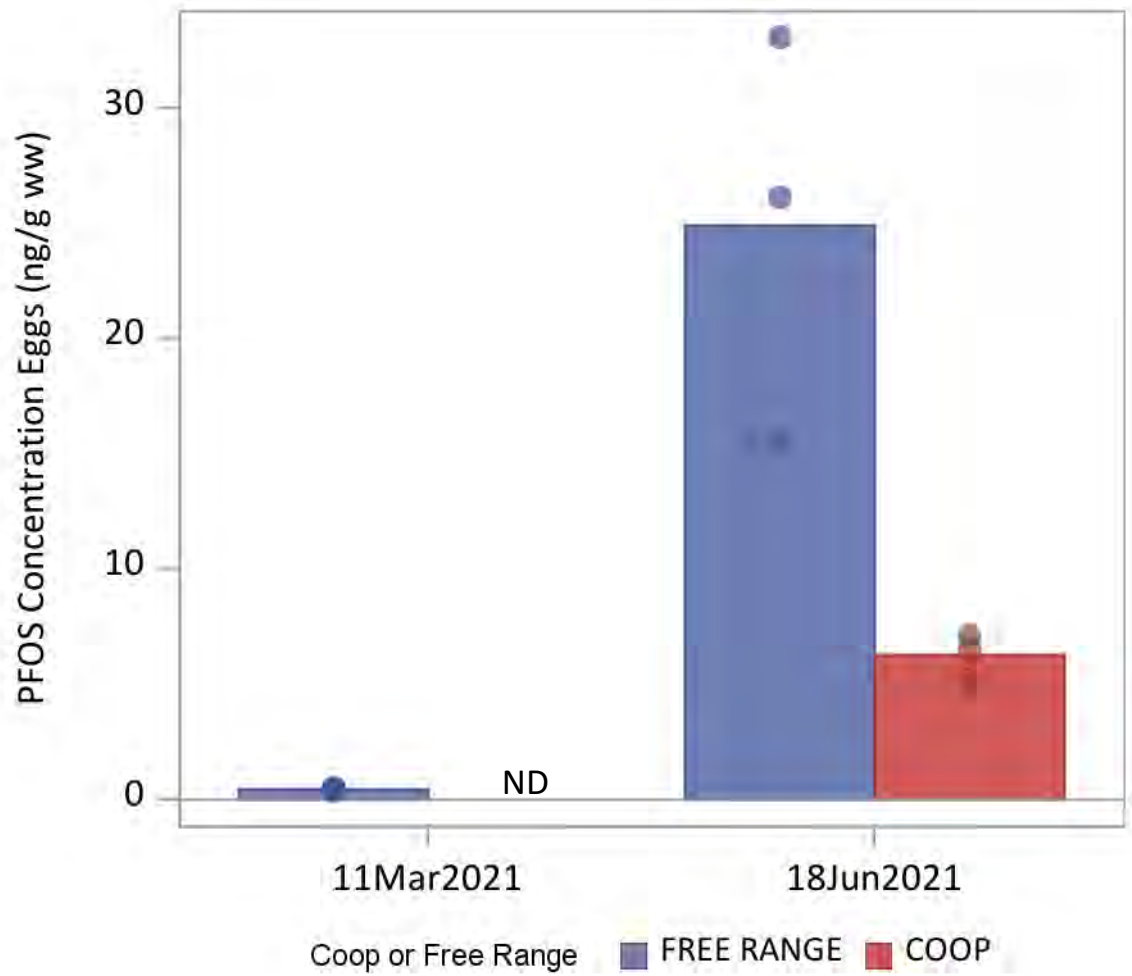
Eating 1 to 2 eggs per day with 2 ng/g PFOS could explain the spike in eggs seen in May/Aug 2023

2nd Home with Backyard Chickens

2nd Home with Backyard Chickens in Coop/Pen



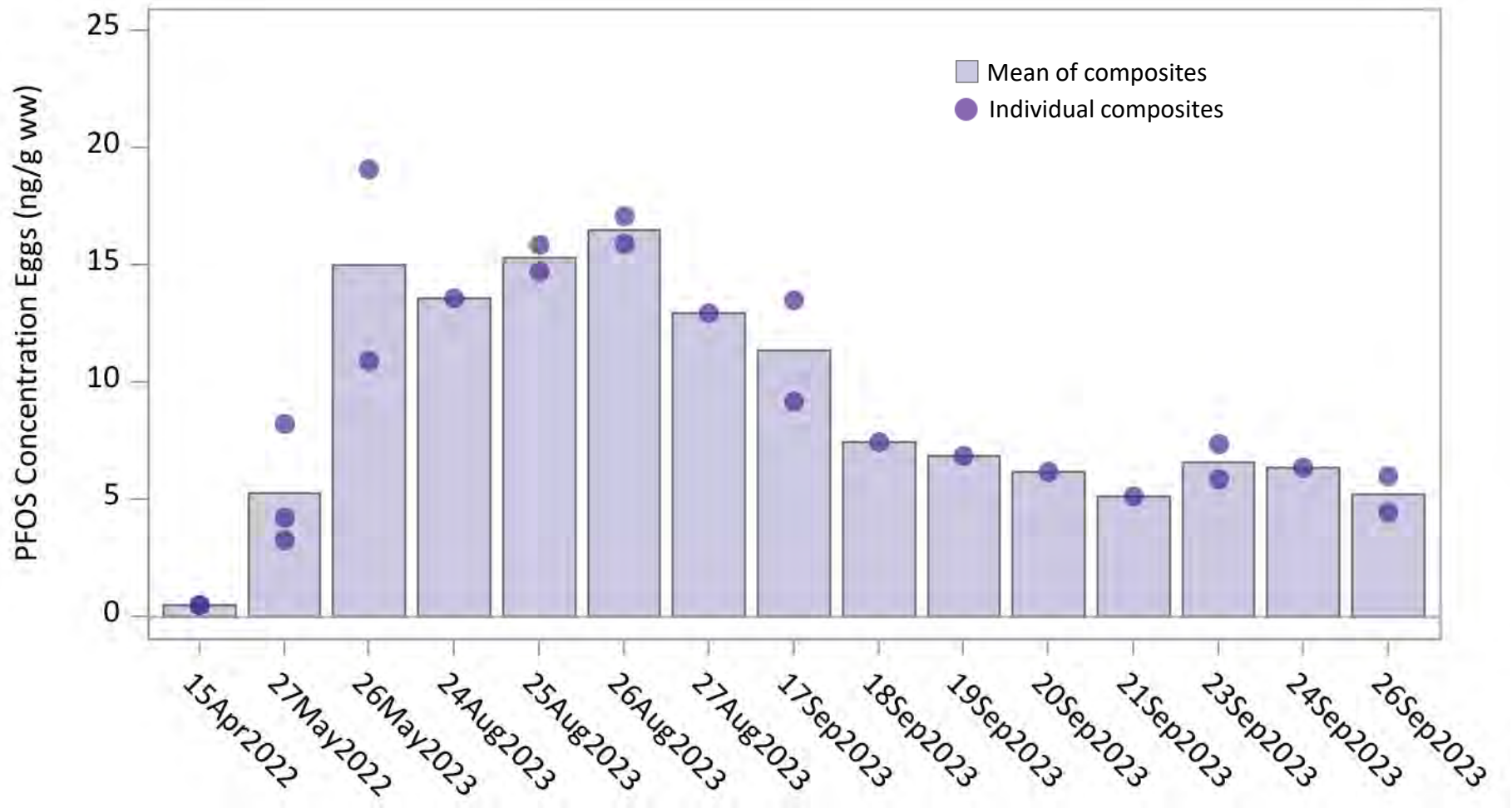
2nd Home: Free-Range versus Penned Chickens



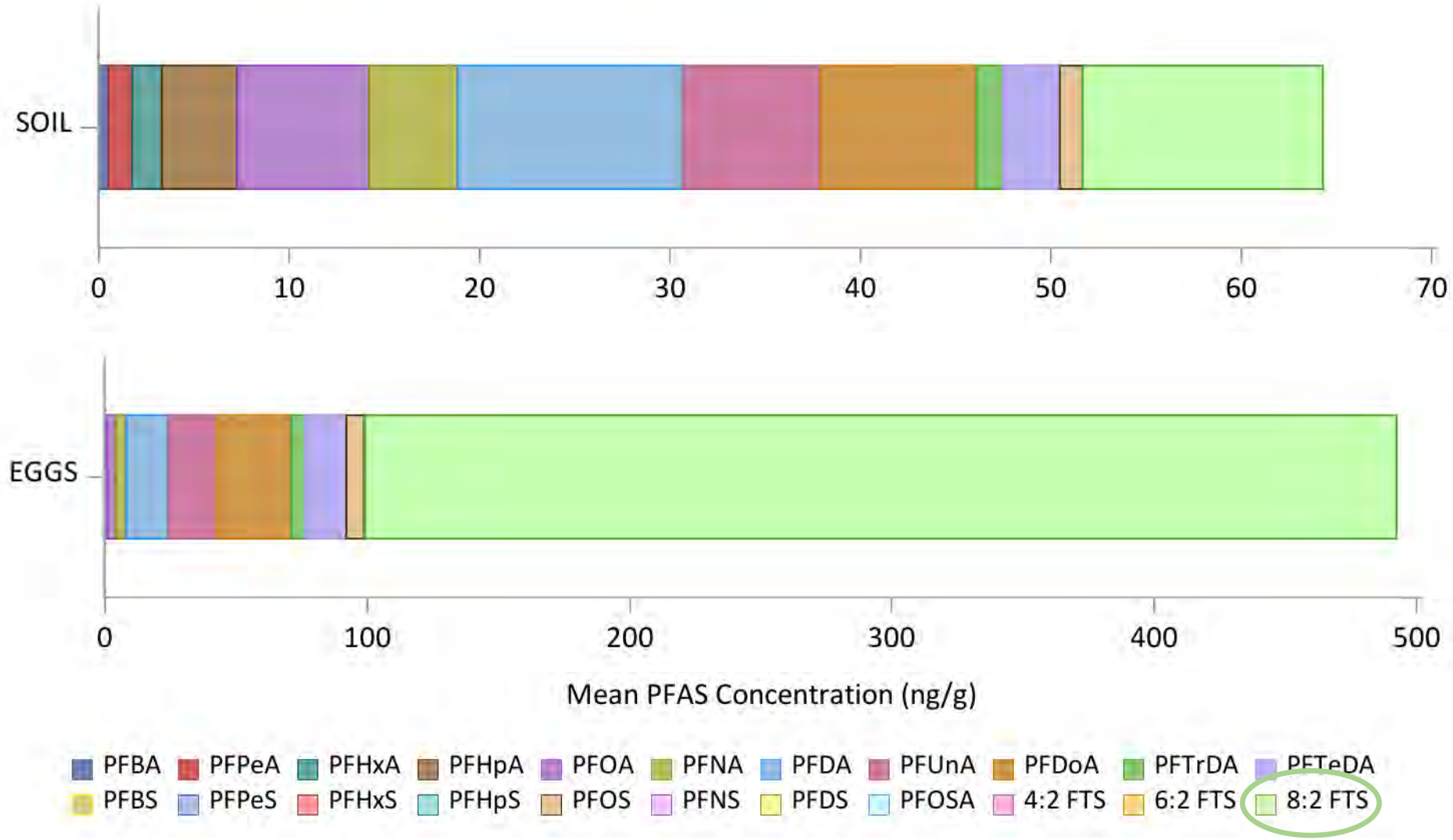
Yard PFOS Soil is
~ 2-3 ng/g

Coop/Pen soil is
~ 0.7 ng/g

2nd Home: Seasonal changes in Egg PFOS levels



8:2 Fluorotelomer Sulfonates (8:2 FTS) in Eggs



Conclusions

- Make sure your laboratory analytical methods can separate cholic acids from PFOS.
- There appears to be a soil related pathway for chickens that we do not yet fully understand; models for chicken soil ingestion have had mixed results in explaining observed egg levels.
- The jury is out on whether a clean soil barrier is an effective mitigation.
- There may be seasonal changes in either egg characteristics or exposure that cause PFOS concentrations to decrease from summer to fall while chickens still have access to soil.
- New data suggest the long chain fluorotelomer sulfonates (e.g., 8:2 FTS) can readily accumulate in eggs.

Collaborators and Acknowledgements

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U.S Food and Drug Administration

Center for Food Safety and Applied Nutrition

Office of Regulatory Science

Maine Households

For more information

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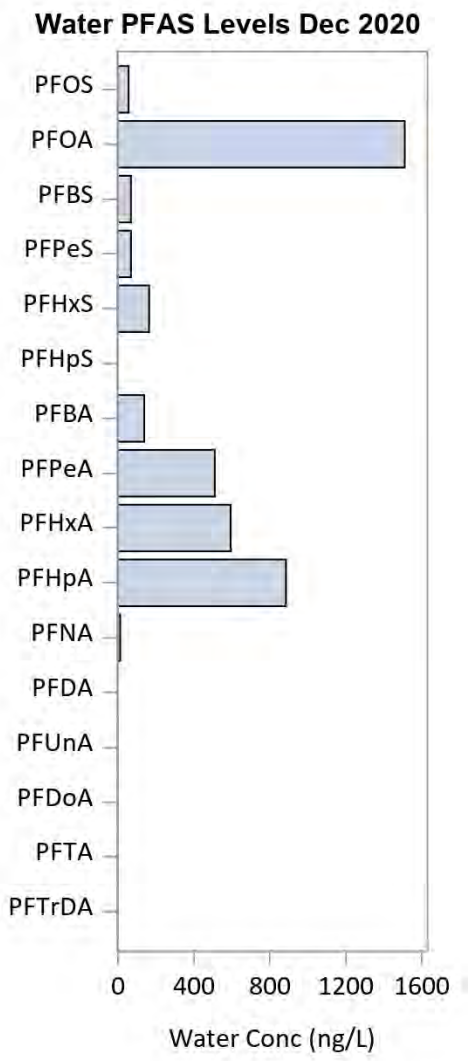
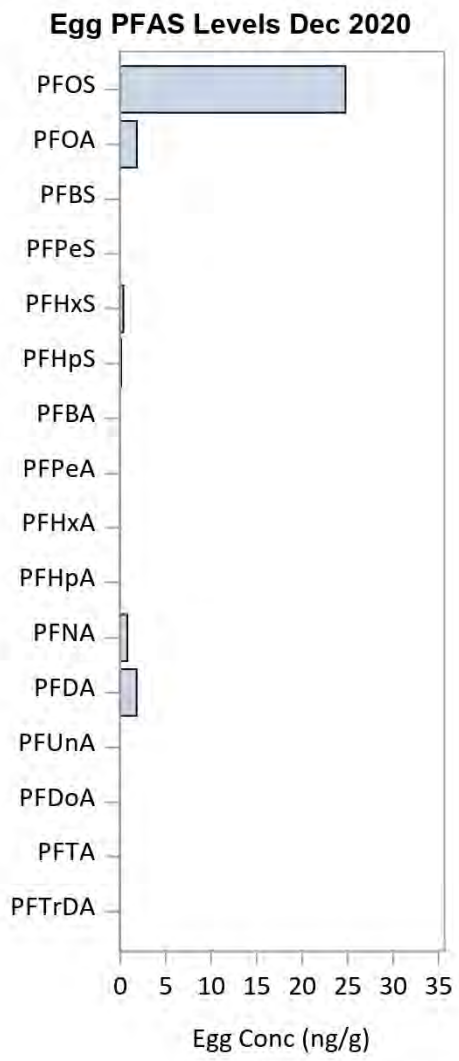
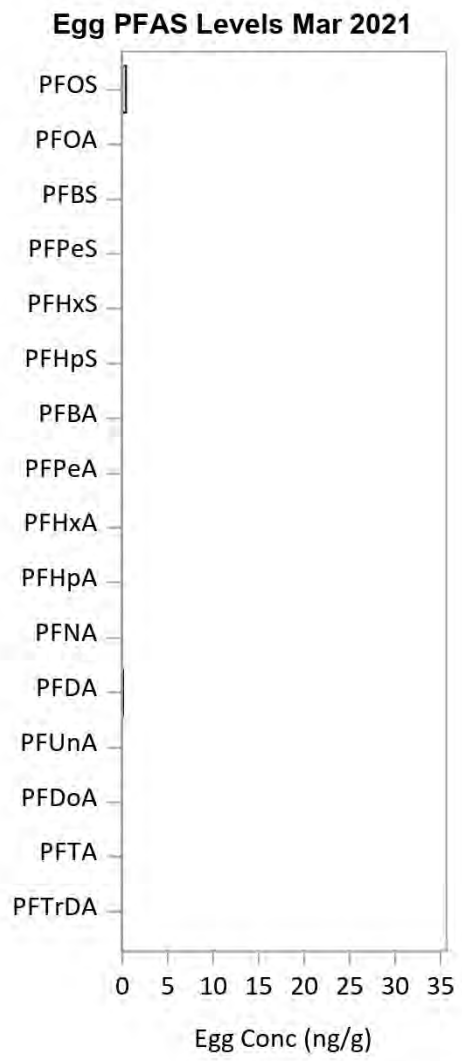
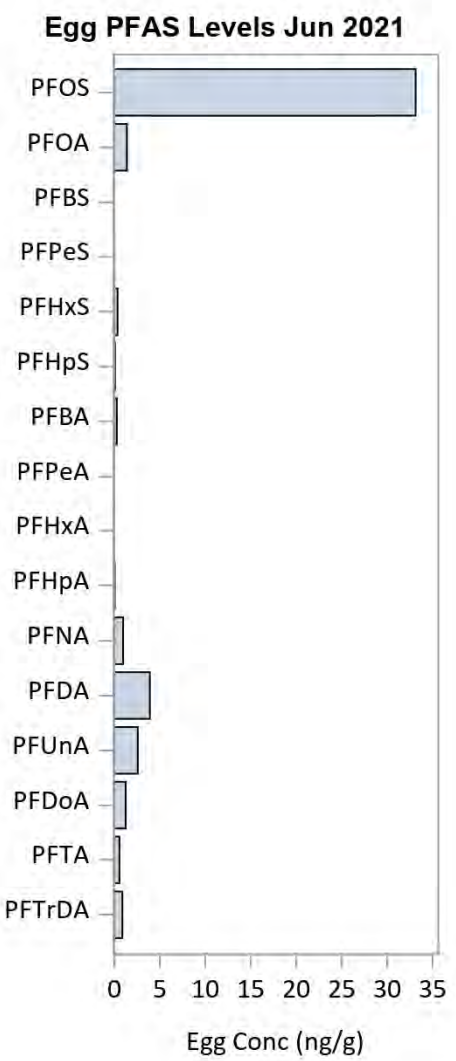
Extra / Alternative Slides

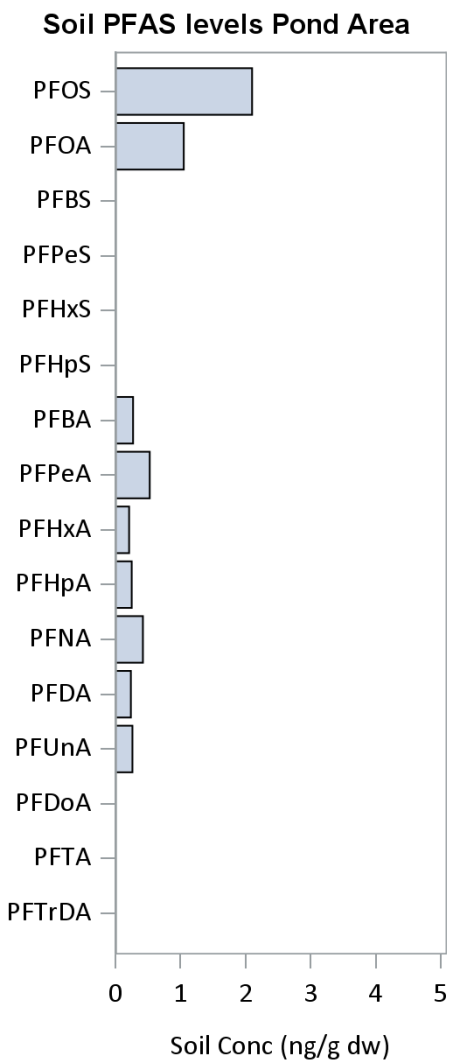
2nd Home with Backyard Chickens











Draft, preliminary figures