Bioconcentration of PFAS in fathead minnows (*Pimephales promelas*) exposed to AFFF-contaminated groundwater

THE UNIVERSITY OF RHODE ISLAND GRADUATE SCHOOL OF OCEANOGRAPHY

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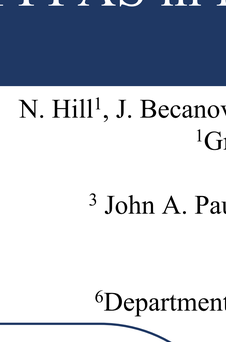
STEEP Sources, Transport, Exposure & Effects of PFASs
UNIVERSITY OF RHODE ISLAND SUPERFUND RESEARCH PROGRAM

Objective: Evaluate bioconcentration behavior and tissue distribution of PFAS and PFAS precursors originating from AFFF-contaminated groundwater in fish.

- **Liver & kidney often contain higher PFAS burdens in comparison to gonad**
- **Gonads may be sites of PFAS predisposition for fecund female fish & offspring**
- **Hypothesized that BCF of PFSA > FASA > PFCA for same chain length**

Study Design

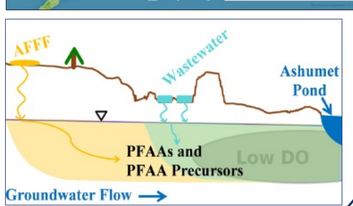
- **Flow-through exposure of fathead minnows (n = 24) to an AFFF-contaminated groundwater plume at Joint Base Cape Cod, MA.**
- **Tissue samples collected at d0, d1, d7, & d21 (n = 6).**



- **Tissue was homogenized, solvent extracted, followed by ENVI-Carb cleanup**
- **Water samples analyzed via direct injection**
- **Analysis: UHPLC-HRMS/MS in ESI- for 41 targeted compounds**

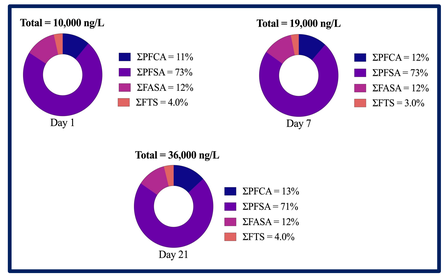
$$BCF = C_{tissue} / C_{water}$$

- **Mean tissue burdens (ng/g ww) and mean log BCF reported**

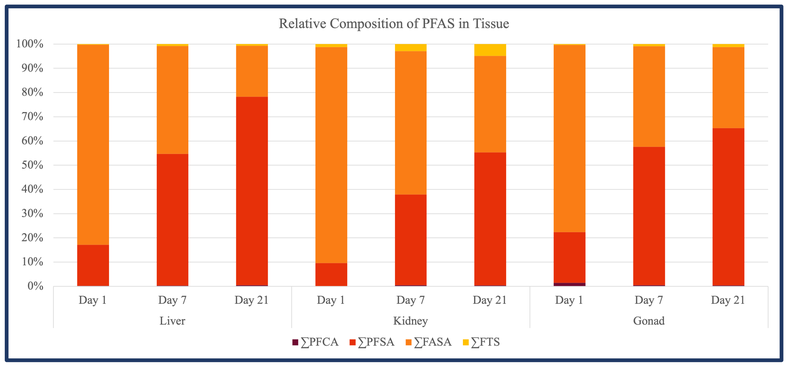


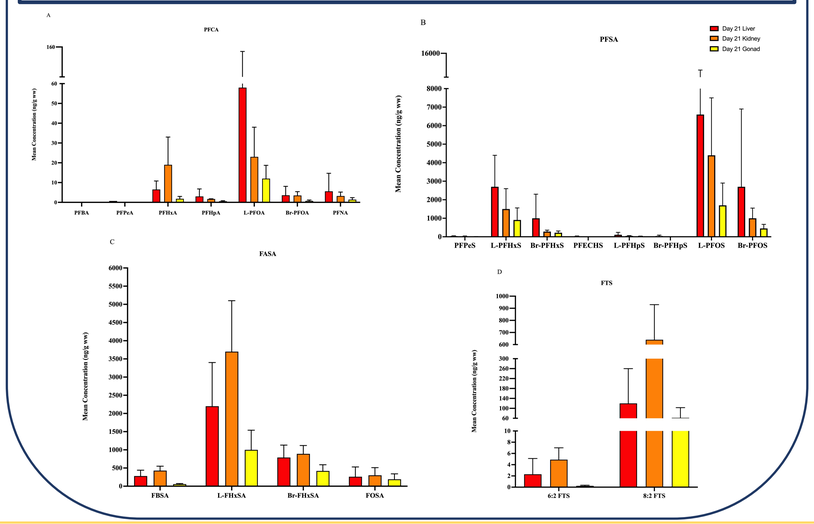
Results

PFAS concentrations in groundwater increased over time, but the PFAS profiles remained stable from d1 to d7, d21.

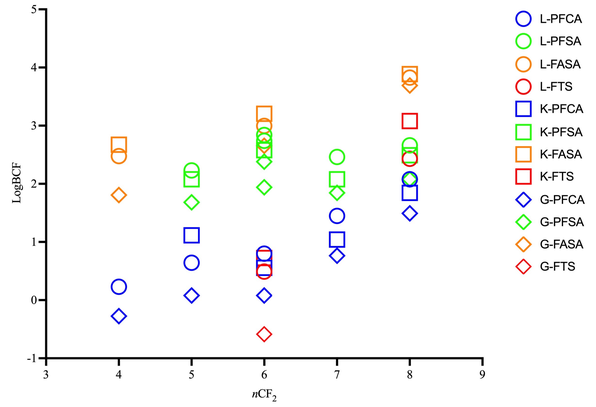


Relative composition of PFAS functional groups in tissue-specific compartments changed over time.





Log BCFs (d21) increased in bioconcentration with fluorinated chain length (*nCF*2) for PFCA, FASA and FTS, but not PFSA.



Log BCF and *nCF*2 linear regression coefficients (n = 4)

Tissue	Functional Group	Pearson *r*	R-squared	Slope ± SE
Liver	PFCA	0.98	0.96	0.45 ± 0.055
	PFSA	0.35	0.12	0.074 ± 0.12
	FASA	0.99	0.98	0.34 ± 0.045
	FTS	Too few pairs	1.0	0.97
Kidney	PFCA	0.65	0.42	0.27 ± 0.22
	PFSA	0.36	0.13	0.074 ± 0.14
	FASA	1.0	0.99	0.30 ± 0.022
	FTS	Too few pairs	1.0	1.2
Gonad	PFCA	0.95	0.90	0.42 ± 0.082
	PFSA	0.29	0.085	0.068 ± 0.13
	FASA	1.0	1.0	0.47 ± 0.027
	FTS	Too few pairs	1.0	1.3

Conclusions

- **Mobile flow-through lab is one of few studies to report environmentally derived BCF values for teleost fish**
- **FASA display increased propensity to bioconcentrate in tissue during early exposure compared to other groups**
- **Fluorinated chain length may serve as a qualitative predictor of FASA, PFCA, and FTS bioconcentration**
- **PFSA display greater tissue burdens over long-term PFAS exposure**

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