NHDES Fish Tissue Study Results: What does it mean and what might it mean.



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2020 Study Overview

Objective of this study was to learn about the occurrence of certain PFAS in southern NH waterbodies.

- 14 waterbodies in NH sampled in October
 2020
- Water samples at 3 depths and 1 sediment sample were also collected at each lake.
 - Analyzed at Eurofins (36 PFAS)
- 2 fish species were sampled per waterbody
 - 5 individual fish were combined to make 1 sample per composite
 - Analyzed at SGS-AXYS (34 PFAS) after difficulties at Eurofins.



Study Lakes in Southern NH

- 1. Arlington Mill Reservoir, Salem
- 2. Baboosic Lake, Merrimack
- 3. Beaver Lake, Derry
- 4. Big Island Pond, Derry
- 5. Canobie Lake, Salem
- 6. Captain Pond, Salem
- 7. Cobbetts Pond, Windham
- 8. Great Pond, Kingston
- 9. Horseshoe Pond, Merrimack
- 10. Lake Massabesic, Auburn
- 11. Naticook Lake, Merrimack
- 12. Robinson Pond, Hudson

Reference Lakes

13. Highland Lake, Andover
 14. Armington Lake, Piermont



Water Results

PFAS in the Water Column

- **PFOA** –n.d.-9 ng/L in most lakes; highest at Horseshoe Pond (22-26 ng/L) and Naticook Lake (15-16 ng/L)
- PFOS n.d.-5.4 ng/L in most lakes; Robinson Pond (11-12 ng/L)
- **PFHxS** n.d. to 3.1 ng/L in most lakes; highest at Horseshoe Pond (4.8-6.1 ng/L)
- PFNA n.d. in all lakes except Lake Massabessic (n.d.-2.3 ng/L)

Other PFAS were detected at low levels, ranging in the single digits down to detection limits. (*plus a peculiarity or two*)



Sediment Results

PFAS in the Sediment

- **PFOA**, **PFHxS** and **PFNA** n.d. in all sediments
- **PFOS** Robinson Pond (11 μg/kg, J-flagged)

Other PFAS were detected at low levels, ranging in the single digits down to detection limits.



Fish Tissue Results

- Of the 34 assessed PFAS, only 10 were detected in fish tissue.
 - 7 Carboxylic acids, 2 Sulfonic acids and 1 Fluorotelomer sulfonic acid
- PFOS detected in all fish tissue, ranging from 0.8 18.3 μg/kg (ppb)
- Total (summed) PFAS in fish tissue ranged from 3.1 24.4 $\mu g/kg$
- Levels of PFOA, PFNA and PFHxS were not high enough to generate consumption advisories.







Recommended Additional Advisories Above and Beyond the State-wide Mercury Advisory

Lake	Species	Population Segment	Recommended Maximum Consumption Rate (meals/month)
NH Statewide Mercury Advisory	Most Species	Typical Adult	4 meals/month
		Women CBA & Children	1 meal/month
Derry, Beaver Lake	Bass Species	Typical Adult*	3 meals/month
		Women CBA & Children	1 meal/month (same as Hg)
Salem, Canobie Lake	All Species	Typical Adult*	3 meals/month
		Women CBA & Children	1 meal/month (same as Hg)
Windham, Cobbetts Pond	Bass Species	Typical Adult*	2 meals/month
		Women CBA & Children	1 meal/month (same as Hg)
Merrimack, Horseshoe Pond	All Species	Typical Adult*	1 meal/month
		Women CBA Children (<7 years old)	1 meal/month (same as Hg) DO NOT EAT
Hudson, Robinson Pond	All Species	Typical Adult*	2 meals/month
		Women CBA Children (<7 years old)	1 meal/month (same as Hg) DO NOT EAT

Words of Caution

- Sample sizes and composite sampling of fish tissue.
- Sampling is biased to South Central NH, not representative of the state.
- Risk of total PFAS is unknown.
- Other contaminants.
- Relative risks and benefits of fish consumption.



Compare tissue data to assorted metrics. Establish thresholds from those with the greatest predictive power.

Apply thresholds to all the other New Hampshire Lakes.

- Watershed Metrics Human pressures Potential current issues
 - Census (2020)
 - Population
 - Population/Sq mile
 - 2016 NLCD
 - Percent "Forest"
 - Percent "Crop/Pasture/Grassland"
 - Percent "Developed"
 - Percent Impervious



- Water Quality Variables Human pressures & Degree of risk
 - Alkalinity

 - DOC
 - Hardness
 - Specific Conductance



- Hydromorphic Lake Metrics Degree of risk Potential future issues
 - Areal Load (m/yr)
 - Flush Rate (times/yr)
 - Phosphorus Retention Coeff ()
 - Relative Depth
 - Shoreline Configuration
 - Watershed Percent Ponded



Fish Tissue Relationships (example)



Watershed Metrics – Human pressures



Water quality variables - Human Pressures



Lake Metrics – Degree of Risk



Context for the Whole State? Watershed Metrics – Human pressures



Context for the Whole State? Water quality variables - Human Pressures



Context for the Whole State? Lake Metrics – Degree of Risk



Context for the Whole State? Human Pressures & Degree of Risk

- Human pressure indicators suggest that ~4 8% of New Hampshire Lakes may have fish tissue PFOS issues right now.
- Degree of risk indicators suggest that ~20% of New Hampshire lakes could develop fish tissue PFOS issues were development to proceed "business as usual".
- Of course, that is all based on two target species collected from 14lakes...

Discussion

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