



Comparison of Published Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) Fish Consumption Advisories in Australia and USA

Fifth International Symposium on Bioremediation and
Sustainable Environmental Technologies – April 17, 2018

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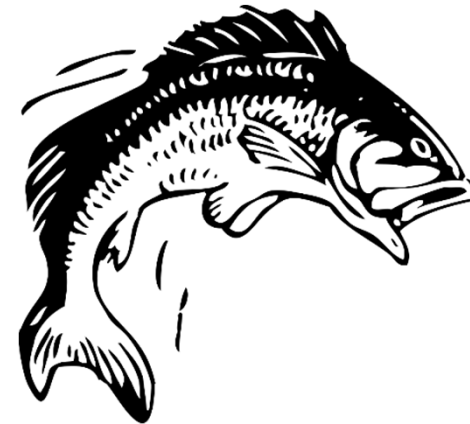
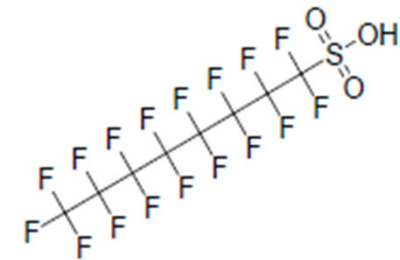
Outline

- Introduction
 - Relevance & Purpose
- Study Methods
 - Research & Calculations
- Results
 - Fish Advisory Comparison
- Discussion
 - Policy vs Science
 - Other Considerations



Introduction – PFOS in Fish

- Perfluorooctane sulfonate (PFOS)
 - Fully fluorinated - eight-carbon chain
 - Found globally in fish tissue - fresh and marine
 - Binds to proteins (not fats)
 - PFOS bioaccumulates **but**
 - highly variable across age/size/species
 - may not biomagnify



Introduction – PFOS in Fish – Initial Investigations

USA

- Fish concentrations compared to USEPA RSLs
 - Target hazard quotient = 0.1 (10% safe level)

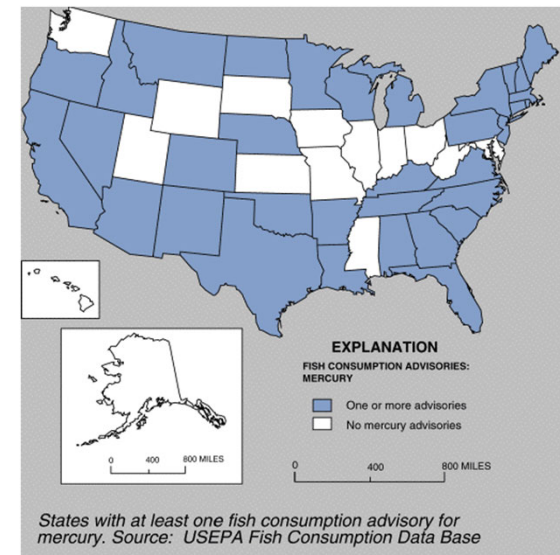
Australia

- Fish concentrations compared to FSANZ “trigger levels”
 - Similar to RSLs in purpose
 - Target hazard quotient = 1
 - High consumption rate



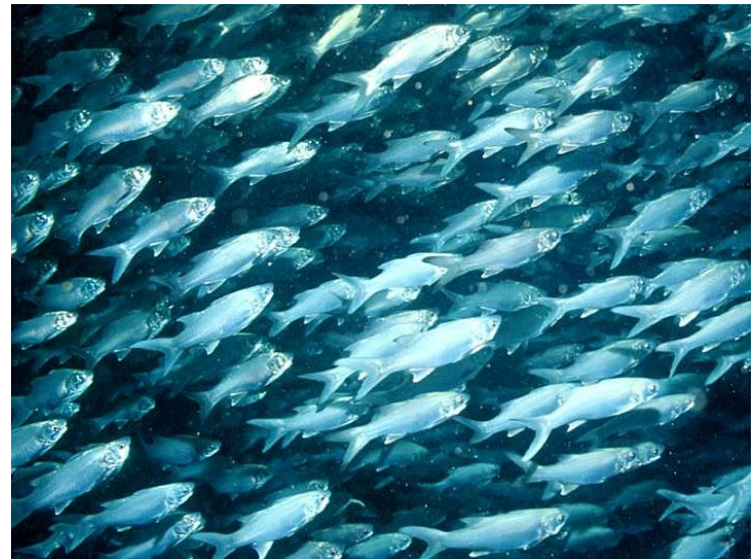
Introduction - Fish Consumption Advisories

- Recommendations to limit or avoid eating certain fish
 - Help consumers make health protective decisions
 - Not enforceable
- All 50 US states have fish consumption advisories
- USEPA Guidance (2000) provides calculation methodology



Introduction - Purpose

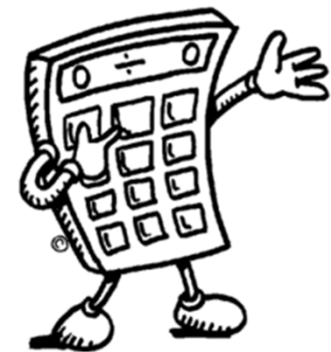
- PFOS consumption advisories – who/where?
 - Compare policy vs science
 - Consider bioconcentration factors
 - Consider existing advisories



Methods

Study Methods – Research & Calculations

- On-line research
 - Selected follow-up correspondence
- Calculations
 - Specific meal frequencies calculated
 - direct comparison
 - Applied bioconcentration factors
 - Compared PFOS advisories to mercury advisories



Study Methods – US Equations



- Short Form

$$\text{Fish Tissue Concentration} = (\text{RfD} * \text{BW}) / (\text{IR})$$

- Long Form

$$\text{Fish Tissue Concentration} = (\text{RfD} * \text{RSC} * \text{BW} * \text{AT}) / (\text{IR} * \text{EF} * \text{ED})$$

Where:

Fish Tissue Concentration = Fish consumption advisory ($\mu\text{g}/\text{kg}$)

RfD = Noncancer toxicity value ($\mu\text{g}/\text{kg}/\text{d}$)

RSC = Relative source contribution (1)

BW = Body weight (kg)

AT = Averaging time ($\text{AT} = \text{ED} * 365$ days per year)

IR = Ingestion rate (g/day)

EF = Exposure frequency (days/year)

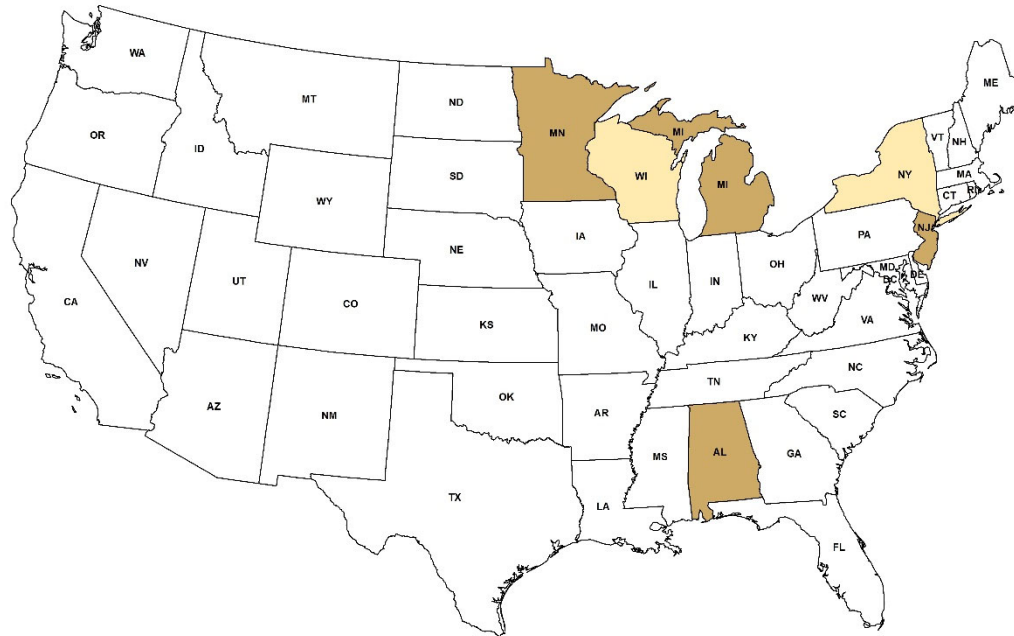
ED = Exposure duration (years)



Results

Results – US States with PFOS Advisories

- Michigan, Minnesota, New Jersey (draft), and Alabama
 - New York (based on Michigan and Minnesota), and
 - Wisconsin (based on Minnesota)



In Australia – Precautionary advice dietary advice for NSW, NT, VIC, and QLD.



Results – PFOS Fish Consumption Advisories

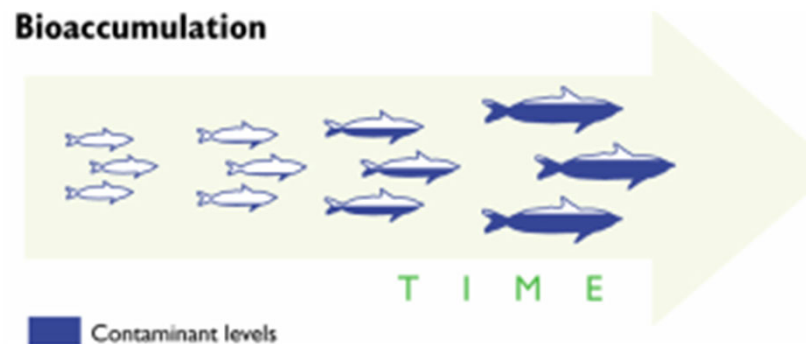
	RfD (mg/kg/d)	BW (kg)	No Restriction (ug/kg)	1 meal per wk (ug/kg)	12 meals per yr (ug/kg)	6 meals per yr (ug/kg)	1 meal per yr (ug/kg)
Adult ingestion rate based on 227 g (8 oz) meal size:				(32 g/d)	(7.4 g/d)	(3.7 g/d)	(0.62 g/d)
Michigan	1.40E-02	80	Not Provided	38	150	300	1867
Minnesota	2.00E-02	80	< = 10	50	200	432	2595
New Jersey	1.80E-03	70	0.56	3.9	17	34	204
Alabama	7.70E-02	70	< 40	200	800	1457	8741
Investigation Level	2.00E-02	15	5.2 (Target hazard quotient = 0.1, Child ingestion Rate of 6 g/d)				
Adult ingestion rate based on 150 g (5.3 oz) meal size:				(21 g/d)	(5 g/d)	(2.5 g/d)	(0.041 g/d)
Australia	2.00E-02	70	-	66	284	568	3407
“Trigger Level”	2.00E-02	19	5.2 (Target hazard quotient = 1, Child ingestion rate of 73 g/d)				

- Values calculated by Wood are shown in *italics* (these are not published advisories).
- “Do Not Eat” advisories are shown in blue shaded cells.



Results – Bioconcentration Factors

- Range of bioconcentration factors:
 - RIVM (Dutch) value of **4,500** L/kg
 - geometric mean calculated from field data (RIVM, 2010)
 - ECCC (Canada) average value of **779** L/kg
 - range of 31.6 to 3,614 L/kg for whole body (ECCC, 2017)



- Surface water corresponding to 1 meal/week
= 0.00087 ug/L to 0.257 ug/L







Results – Existing Fish Consumption Advisories

- US and Australia mercury advisory = 3 meals/week
 - Most general state advisories < 3 meals/week
 - Most PFOS advisories < 1 meals/week

Example: Wisconsin state-wide advisory:

Safe -eating guidelines for most of Wisconsin's inland (non-Great Lakes) waters

<p>Women of childbearing years, nursing mothers and all children under 15 may eat:</p> <p>1 meal per week - Bluegill, crappies, yellow perch, sunfish, bullhead and inland trout;</p> <p>and</p> <p>1 meal per month - Walleye, pike, bass, catfish and all other species</p>  <p>Black crappie</p>	<p>Women beyond their childbearing years and men may eat:</p> <p>Unrestricted* - Bluegill, crappies, yellow perch, sunfish, bullhead and inland trout;</p>  <p>Bluegill</p>
<p>DO NOT EAT - Musky</p>  <p>Muske lunge</p>	<p>1 meal per week - Walleye, pike, bass, catfish and all other species</p> <p>and</p> <p>1 meal per month - Musky</p>  <p>Channel catfish</p>

**Doctors suggest that eating 1-2 servings per week of low-contaminant fish or shellfish can benefit your health. Little additional benefit is obtained by consuming more than that amount, and you should rarely eat more than 4 servings of fish within a week.*

Source: <https://dnr.wi.gov/topic/fishing/documents/consumption/SafeEatingGuideEnglish.pdf>



Discussion



Discussion – Science vs Policy

Fish Consumption Advisories based on two components:

- “Science” Decisions
 - Exposure and Toxicity Inputs
- Policy Decisions
 - Which frequency to recommend



Do Not Eat – Wide Range

- 200 ug/kg to 800 ug/kg
- 1 meal per year to 12 meals per year
 - Different choices in meal frequencies = a wider range
17 ug/kg to 8,500 ug/kg





Discussion - Bioconcentration

Bioconcentration Modelling

- Unusual Bioconcentration Mechanism
 - does not fit traditional models
- High level of uncertainty
 - 3 order of magnitude range in calculated surface water
 - lower end may fall within background concentrations
- Direct measurement of fish preferable



Discussion – Advisories for Other Compounds



PFOS fish advisories set a safe consumption level

- Additional to advisories for other compounds
- Minimal overlap

Existing advisories

- Relevant to investigation levels (10% of the safe level)
- Risk communication



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Thank You!

Questions?

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