



# The Eat Safe Fish Program

## Evaluating PFAS in Fish for Consumption Guidelines

Brandon Reid, Eat Safe Fish Program Manager

Michigan Department of Health and Human Services

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# Overview



- Eat Safe Fish (ESF) Program Goals and Guidelines
- Testing Fish Fillets for PFAS
- Fish Consumption Screening Values for PFOS
- Preview of 2023 *Eat Safe Fish Guide* Updates

# Eat Safe Fish Program Goals

- To promote the safe consumption of fish from Michigan waterbodies.
- To create consumption guidelines based on the health risks of eating fish that contain environmental contaminants, like mercury, PCBs, or PFAS.
- To provide Michiganders with the knowledge they need to make informed decisions about which fish and how much fish to eat.



# Eat Safe Fish Consumption Guidelines

- Eat Safe Fish consumption guidelines are recommendations that people can use to guide their decision-making when eating locally caught fish.
- These guidelines are based on chemical levels measured in the edible portions of fish collected from Michigan waterbodies.

# Fish Collection and Preparation

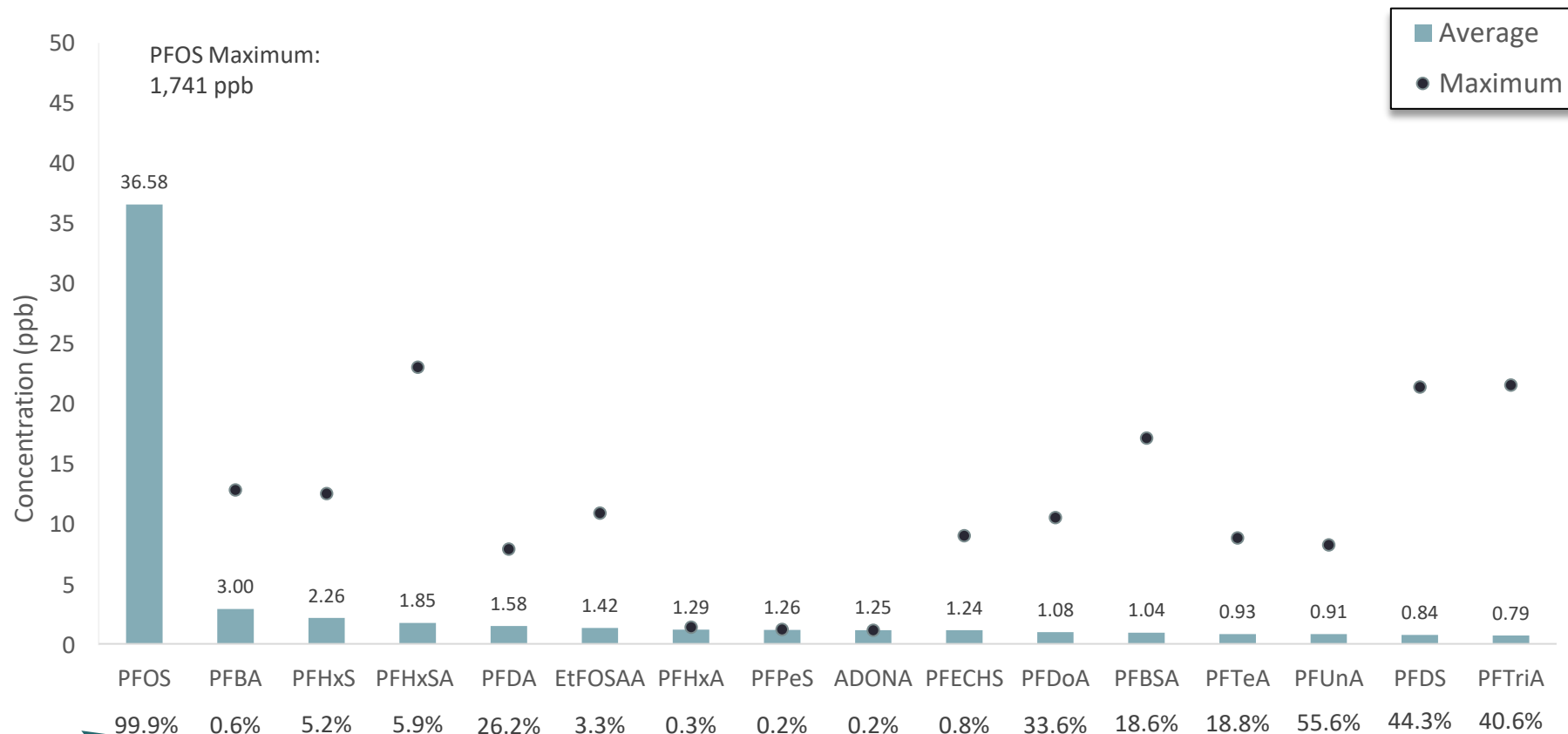
- Fish are primarily collected by EGLE's Fish Contaminant Monitoring Program (FCMP).
- EGLE prepares the fish for testing by taking size measurements and removing the edible portion (usually the fillet).
- The edible portion of the fish is then tested for contaminants at the MDHHS laboratory.
- Data from these edible portions are used to inform the Eat Safe Fish consumption guidelines.



# Testing Fish for PFAS

- All edible portions of fish submitted to the MDHHS Laboratory are tested for both mercury and PFAS.
  - Some edible portions are also tested for organochlorines, including PCBs, dioxins, and pesticides.
- The MDHHS laboratory currently tests for 39 different PFAS in fish fillets, including perfluorooctane sulfonate (PFOS).
- Over the last two fiscal years (FY2021 and FY2022), MDHHS tested nearly 2,500 fish fillets.
- In total, MDHHS has tested over 5,000 fish fillets for PFAS.

# PFAS Concentrations When Detected in Fillets, FY21-22 (n=2,499)



All other PFAS:  
 < 10% detections  
 < 1 ppb average

% of fillets with detections

**Note: these results are not representative for all waterbodies in Michigan. Waterbodies with known or suspected contamination are targeted for fish fillet testing.**

# Testing Fish for PFAS – Conclusions

- Our data indicate that among PFAS, PFOS is most frequently detected in Michigan fish fillets.
- Among PFAS, PFOS accumulates in Michigan fish fillets at the highest concentrations.
  - The available data do not indicate that other PFAS are accumulating in Michigan fish fillets at levels of a health concern.
- Based on these findings, MDHHS currently uses PFOS concentrations to issue fish consumption guidelines.
  - We will continue to evaluate trends in PFAS data from Michigan fish fillets to assess whether fish consumption guidelines for other PFAS are warranted.



# Considerations for Statewide Fish Consumption Guidelines

- ESF currently issues statewide consumption guidelines for 16 fish species based on levels of mercury and PCBs.
- MDHHS recommends that people follow statewide consumption guidelines for all fish from inland lakes and rivers that do not have waterbody-specific guidelines.

# Considerations for Statewide Fish Consumption Guidelines

- MDHHS will issue statewide fish consumption guidelines when:
  - A Contaminant of Concern prompts guidelines for waterbodies that are dispersed across a wide geographic range; and
  - The data support the conclusion that guidelines are appropriate for many species and waterbodies, including those without existing data; and
  - The species-waterbody specific guideline approach is not feasible for every affected waterbody and species given the statewide extent of the contamination.

Source: [Michigan Fish Consumption Advisory Program Guidance](#)

# Considerations for Statewide Fish Consumption Guidelines

- Statewide guidelines for mercury incorporate around 25 years of contaminant data.
  - These data indicate that nearly all fish from waterbodies in Michigan contain mercury.
  - These data also indicate that levels of mercury are consistent across species.
- Statewide guidelines for PCBs incorporate 9 years of contaminant data for carp and 25 years of data for catfish.
  - These data indicate that nearly all carp and catfish in Michigan contain PCBs.

# Considerations for Statewide Fish Consumption Guidelines

- Currently, ESF does not have a dataset appropriate for issuing statewide consumption guidelines for PFOS.
  - PFOS levels in fish are highly variable across waterbodies and fish species.
  - The current PFOS dataset is skewed towards known/suspected PFAS sites and may not be representative of the average Michigan waterbody.
- ESF will continue to evaluate the appropriateness of statewide PFOS guidelines as more data come in.

# Comparison of Michigan's fish PFAS data to recent literature

- **Barbo et al. (2023): Locally caught freshwater fish across the United States are a significant source of exposure to PFOS and other perfluorinated compounds.**
  - Over 500 composite samples of fish fillets collected across the United States (2013-2015) were analyzed for concentrations of PFAS.
- ESF has also found that fish from Michigan waterbodies can be a significant source of PFOS.
  - However, levels of PFOS are highly variable from waterbody to waterbody.
- Study authors found that PFOS was the largest contributor to total PFAS levels, averaging 74% of the total.
  - Michigan's Fish Contaminant Monitoring Program data: PFOS composes over 88% of total PFAS measured in fish fillets.

# Comparison of Michigan's fish PFAS data to recent literature

## **Ecology Center, Friends of the Rouge, Huron River Watershed Council (2023): Community-Based Study on PFAS in Fish.**

- 20 fish from the Huron and Rouge Rivers were collected and tested for PFAS.
- In the study, PFOS was found in every fish tested (whole fish and fillet).
  - Consistent with Michigan FCMP data, which also found PFOS in every fish fillet collected from the Rouge River from 2019-2021 and the Huron River in 2021.
- Eat Safe Fish guidelines are already in place for the Huron River and Rouge River.
  - A large section of the Huron River (N Wixom Rd, Oakland Co. to I-275, Wayne Co.) is currently under a Do Not Eat advisory based on PFOS.
  - Most ESF guidelines in the Rouge River are based on PCBs and mercury, particularly the section of the Middle Branch that includes Newburgh Lake.
    - Bluegill and sunfish in the lower and main branches (downstream of Ford Dam) are the exception (Do Not Eat advisory based on PFOS).

# Fish Consumption Screening Values (FCSVs)

- FCSVs are chemical-specific health-based screening values based on toxicity values.
  - EPA Reference Dose (RfD)
  - ATSDR Minimal Risk Levels (MRLs)
- FCSVs are designed to be protective against the most sensitive toxicity endpoint.
- Concentrations of chemicals from edible portions of fish are compared to FCSVs as a basis for consumption guidelines.
- ESF uses the 95% Upper Confidence Limit (95% UCL) of the mean contaminant concentration for comparison with FCSVs.
  - This is a health-protective approach that accounts for variability of chemical concentrations within fish populations.

# FCSV Equation for PFOS

$$\text{FCSV} = \frac{\text{RfD} \times \text{RSC} \times \text{BW} \times \text{AT}}{\text{IR} \times \text{EF} \times \text{ED}}$$

Where:

FCSV (Fish Consumption Screening Value)

RfD (Reference Dose)

RSC (Relative Source Contribution)

BW (Body Weight)

AT (Averaging Time)

IR (Ingestion Rate)

EF (Exposure Frequency)

ED (Exposure Duration)

= chemical specific,  $\mu\text{g/g}$  or  $\text{pg/g}$  wet weight

= chemical specific,  $\mu\text{g/kg-d}$  or  $\text{pg/kg-d}$

= chemical specific, unitless

= kg

= days

= g/day

= days/year

= years



# FCSV Equation Factors

$$FCSV = \frac{RfD \times RSC \times BW \times AT}{IR \times EF \times ED}$$

- **Reference Dose (RfD)**

- [EPA](#): estimate of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without a significant risk of adverse effects during a lifetime.
- Based on exposure level at which no adverse effects are observed.

- **PFOS RfD for Fish Consumption = 0.014 µg/kg-day**

- Based on repeated dose oral toxicity study in cynomolgus monkeys (Seacat et al. 2002).
- Critical effect: reduced cholesterol and thyroid hormone levels.
- Uncertainty factors applied (person-person variability, and animal-person extrapolation).

# FCSV Equation Factors

$$FCSV = \frac{RfD \times RSC \times BW \times AT}{IR \times EF \times ED}$$

- **Relative Source Contribution (RSC)**

- Portion of exposure to a chemical that can be attributed to eating fish.
- Accounts for exposure to chemicals from other sources (food, drinking water, air).
- If exposure is only expected from fish consumption, an RSC of 1 is assigned.
- **PFOS RSC for Fish Consumption = 1**

# FCSV Equation Factors

- **Body Weight (BW)**
  - Body weight of the individual consuming fish.
- **Ingestion Rate (IR)**
  - Weight of fish consumed per meal.
  - IR is assumed to be proportional to BW, at a rate of 1 ounce of fillet per 10 kg of body weight.
    - See table.
- These assumptions standardize Eat Safe Fish guidelines so that they are the same for people of varying body weights.

$$FCSV = \frac{RfD \times RSC \times BW \times AT}{IR \times EF \times ED}$$

Body Weight (BW) kg	Ingestion Rate (IR) per Meal ounces	Ratio IR:BW
	10	
20	2.0	0.10
30	3.0	0.10
40	4.0	0.10
50	5.0	0.10
60	6.0	0.10
70	7.0	0.10
80	8.0	0.10
90	9.0	0.10
100	10.0	0.10
110	11.0	0.10
120	12.0	0.10
130	13.0	0.10

BW and IR are the same for each fish contaminant.

# FCSV Equation Factors

$$\text{FCSV} = \frac{RfD \times RSC \times BW \times AT}{IR \times EF \times ED}$$

- **Exposure Frequency (EF)**
  - Number of fish meals per year.
  - Used to calculate meal categories.
- **Exposure Duration (ED)**
  - Assumed number of years of exposure.
  - Default = 70 years
- **Averaging Time (AT)**
  - Time period over which exposure is averaged.
  - Default = 25,550 days (70 years)

EF, ED, and AT are the same for each fish contaminant.

Table 1. Fish Consumption Screening Values (FSCV) for DDT plus metabolites, dioxin-like chemicals, mercury, PCBs, PFOS, selenium, and toxaphene.

Meal Category	DDT, DDE, DDD	Dioxins/Furans/co-planar PCBs	Mercury	PCBs
<i>meals per month</i>	$\mu\text{g/g (ppm)}^a$	$\text{pg TEQ/g (ppt-TEQ)}^b$	$\mu\text{g/g (ppm)}^a$	$\mu\text{g/g (ppm)}^a$
16	$\leq 0.11$	$\leq 0.5$	$\leq 0.07$	$\leq 0.01$
12	>0.11 to 0.15	>0.5 to 0.6	>0.07 to 0.09	>0.01 to 0.02
8	>0.15 to 0.23	>0.6 to 0.9	>0.09 to 0.13	>0.02 to 0.03
4	>0.23 to 0.45	>0.9 to 1.9	>0.13 to 0.27	>0.03 to 0.05
2	>0.45 to 0.91	>1.9 to 3.7	>0.27 to 0.53	>0.05 to 0.11
1	>0.91 to 1.8	>3.7 to 7.5	>0.53 to 1.1	>0.11 to 0.21
6 meals per year	>1.8 to 3.7	>7.5 to 15	>1.1 to 2.2	>0.21 to 0.43
Limited	>3.7 to 20	>15 to 90	NA	>0.43 to 2.7
Do Not Eat	>20	>90	>2.2	>2.7

Meal Category	PFOS	Selenium	Total Toxaphene	Toxaphene Parlars 26, 50, 62 ( $\Sigma 3\text{PC}_{26,50,62}$ )
<i>meals per month</i>	$\mu\text{g/g (ppm)}^a$	$\mu\text{g/g (ppm)}^a$	$\mu\text{g/g (ppm)}^a$	$\mu\text{g/g (ppm)}^a$
16	$\leq 0.009$	$\leq 2.3$	$\leq 0.02$	$\leq 0.001$
12	>0.009 to 0.013	>2.3 to 3.1	>0.02 to 0.03	>0.001 to 0.002
8	>0.013 to 0.019	>3.1 to 4.6	>0.03 to 0.05	>0.002 to 0.003
4	>0.019 to 0.038	>4.6 to 9.2	>0.05 to 0.09	>0.003 to 0.006
2	>0.038 to 0.075	>9.2 to 17	>0.09 to 0.18	>0.006 to 0.011
1	>0.075 to 0.15	NA	>0.18 to 0.36	>0.011 to 0.023
6 meals per year	>0.15 to 0.3	NA	>0.36 to 0.73	>0.023 to 0.046
Limited	NA	NA	>0.73 to 4.5	>0.046 to 0.28
Do Not Eat	>0.3	>17	>4.5	>0.28

<sup>a</sup>: micrograms of chemical per gram of wet weight fish tissue ( $\mu\text{g/g}$ ) that is the same as parts per million (ppm).

<sup>b</sup>: picograms of toxic equivalents calculated according to US EPA methods<sup>7</sup> per gram of wet weight fish tissue ( $\text{pg TEQ/g}$ ) that is the same as parts per trillion of toxic equivalents (ppt-TEQ).

# FCSV Examples

- **Sample Group #1 (n=10)**
  - Mercury 95% UCL: 0.67 ppm
    - Meal Category: 1
  - PFOS 95% UCL: 0.015 ppm
    - Meal Category: 8
  - Final Meal Category: 1/month based on Mercury
- **Sample Group #2 (n=10)**
  - Mercury 95% UCL: 0.21 ppm
    - Meal Category: 4
  - PFOS 95% UCL: 0.055 ppm
    - Meal Category: 2
  - Final Meal Category: 2/month based on PFOS

Table 1. Fish Consumption Screening Values (FCSV) for DDT plus metabolites, dioxin-like chemicals, mercury, PCBs, PFOS, selenium, and toxaphene.

Meal Category	DDT, DDE, DDD	Dioxins/Furans/co-planar PCBs	Mercury	PCBs
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Meal Category	PFOS	Selenium	Total Toxaphene	Toxaphene Parlars 26, 50, 62 ( $\sum 3\text{PC}_{26,50,62}$ )
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Limited	NA	NA	>0.73 to 4.5	>0.046 to 0.28
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# Future FCSV Values for PFOS

- MDHHS is currently reviewing its FCSVs for PFOS to determine whether they continue to be health-protective in light of evolving science.
- This review includes analysis of available toxicological and epidemiological studies on potential health effects related to PFOS.
- If MDHHS determines that the existing FCSVs need to be updated, MDHHS will review and issue new FCSVs.
- MDHHS is planning to complete its review of PFOS FCSVs in time to incorporate any guideline changes into the 2024 Update to the Eat Safe Fish Guide.

# Updates in the 2023 Eat Safe Fish Guide

- The 2023 version of the Eat Safe Fish Guide is in the final stages of review.
- The 2023 version will include 291 new or updated fish consumption guidelines.
- Fish from 56 new waterbodies were tested for the first time.
  - Total number of waterbodies in the Eat Safe Fish Guide now over 550.



# Thank you!

For more information on the Eat Safe Fish program,  
please visit [michigan.gov/eatsafefish](https://michigan.gov/eatsafefish)

Brandon Reid  
Eat Safe Fish Program Manager  
Michigan Department of Health and Human Services