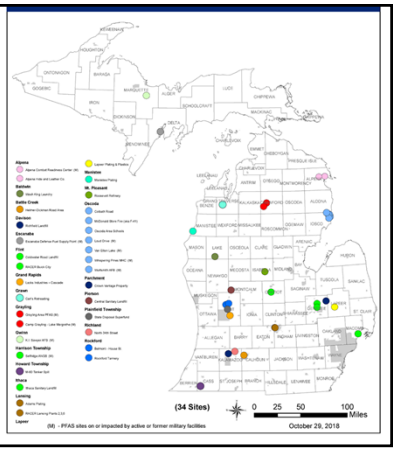
Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) in Fish and Wildlife

Tammy J. Newcomb, Ph.D.
Senior Water Policy Advisor
Michigan Department of Natural Resources
December 12, 2018

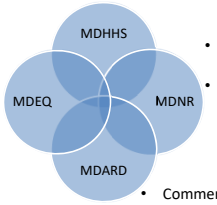
Confirmed PFAS Sites for Investigation



The Michigan Fish and Wild Game Consumption Advisory Program

Fish and Wildlife Consumption Advisory Committee (FAWCAC)

- Evaluation of data for human health
- Set fish and wildlife consumption advisories



- Environmental protection programs
- Fish and wildlife sampling, including caged organisms to measure uptake of contaminants

- Management of fish and wildlife
- Fish and wildlife sampling

- Commercially sold or raised fish and wildlife
- Fish and wildlife sampling (commercial products)

General Process for Consumption Guideline Development

Sampling & analysis
- Fish collection
- Processing
- Analysis for the ESF Guides (MDHHS Analytical Chemistry Laboratory)

MDNR, MDEQ, MDARD

Data evaluation
- Comparing fish tissue chemical levels to screening levels
- Additional considerations

MDEQ and MDHHS

Issuing a guideline
- Outreach products – ESF Guides and others (statewide and site-specific)
- Michigan Public Health Code – Act 368

MDHHS

PFAS in Fish

- PFOS shows up the most in fish
- Some places, PCBs, dioxins, and mercury are high than PFOS
- Species include bluegill, sunfish, largemouth bass, smallmouth bass, suckers, crappie
- Range from Do Not Eat to limited portions of meals

Example of Eat Safe Fish Guidelines

Au Sable River

(downstream of Foote Dam; includes Van Etten Creek)

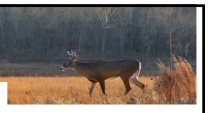
Type of Fish	Chemicals of Concern	Size of Fish (length in inches)	MI Servings per Month*
Brown Trout	PCBs	Any	6 Per Year[2x]
Carp	PFOS	Any	Do Not Eat[▲]
Chinook Salmon	PCBs	Any	6 Per Year[2x]
Coho Salmon	PCBs	Any	6 Per Year[2x]
Largemouth Bass	PFOS	Any	Do Not Eat[▲]
Rainbow Trout	PCBs	Any	6 Per Year[2x]
Rock Bass	Mercury & PFOS	Any	Do Not Eat[▲]
Smallmouth Bass	PFOS	Any	Do Not Eat[▲]
Steelhead	PCBs	Any	6 Per Year[2x]
Suckers	PFOS	Any	Do Not Eat[▲]
Walleye	Dioxins	Any	6 Per Year[2x]
All Other Species	PFOS	Any	Do Not Eat[▲]

PFOS can't be reduced by trimming and cooking. Do not double MI Servings.

PFAS in Fish

- DO NOT EAT: Huron River below Wixom to Lake Erie, Clark's Marsh in Oscoda, Allen Lake in Iosco County, Au Sable below Foot Dam (nonmigratory fish), Kent County Freska Lake, ponds
- Eat Safe Fish guidelines and MPART website

Eat Safe Wild Game



Do not eat wild game organs

Hunting in Michigan can be a lifelong hobby and a great source of food for you and your family. Eating meat from wild game can provide you with a lean source of protein. However, wild game organs can have much higher amounts of chemicals and metals than the meat. Eating wild game organs should always be avoided.

Why should I avoid eating wild game organs?

Chemicals used in manufacturing and industry can get into the environment where wild game live. Some chemicals last a long time in the environment and can build up in wild game. Listed below are some of the chemicals and metals that can build up to high levels in wild game organs.

- Dioxins
- Polychlorinated biphenyls (PCBS)
- Cadmium
- Per- and polyfluoroalklyl substances (PFAS)
- Lead
- Mercury

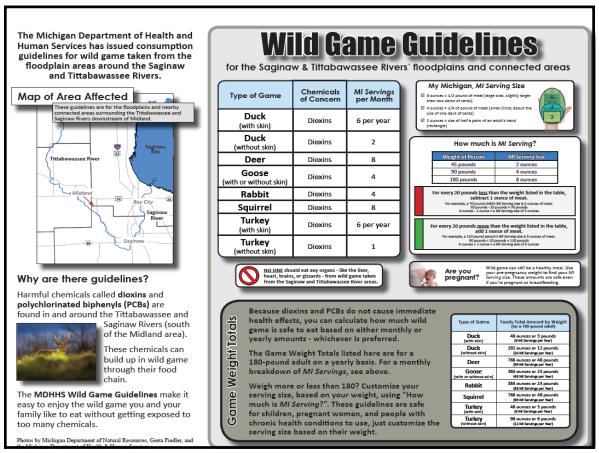
Wild game organs can have higher amounts of chemicals and metals than the meat:

- The **liver** and **kidneys** filter chemicals and metals from the blood. This can lead to high amounts of chemicals and metals in the organs.
- Some chemicals can build up in the **brain** of animals.
- The **gizzard** helps the bird with mechanical breakdown of food. Birds may store contaminated food in this organ, which can lead to build up of chemicals and metals in the gizzard.

What health concerns are related to these chemicals and metals?

Eating wild game organs can cause some chemicals to build up in your body. This could lead to health concerns such as:

- Development of cancer
- Development of diabetes
- Problems with fertility
- Reduced thyroid and immune system function
- Disrupted brain development in fetuses and children



The Michigan Department of Health and Human Services has issued consumption guidelines for wild game taken from the floodplain areas around the Saginaw and Tittabawassee Rivers.

Map of Area Affected

These guidelines are for the floodplains and nearby connected areas surrounding the Tittabawassee and Saginaw Rivers downstream of Midland

Why are there guidelines?

Harmful chemicals called **dioxins** and **polychlorinated biphenyls (PCBs)** are found in and around the Tittabawassee and Saginaw Rivers (south of the Midland area).

These chemicals can build up in wild game through their food chain.

The **MDHHS Wild Game Guidelines** make it easy to enjoy the wild game you and your family like to eat without getting exposed to too many chemicals.

Photo by Michigan Department of Natural Resources, Geets Fiedler, and

Wild Game Guidelines

for the Saginaw & Tittabawassee Rivers' floodplains and connected areas

Type of Game	Chemicals of Concern	MI Servings per Month
Duck (with skin)	Dioxins	6 per year
Duck (without skin)	Dioxins	2
Deer	Dioxins	8
Goose (with or without skin)	Dioxins	4
Rabbit	Dioxins	4
Squirrel	Dioxins	8
Turkey (with skin)	Dioxins	6 per year
Turkey (without skin)	Dioxins	1

My Michigan, MI Serving Size

- 8 ounces = 1/2 pound of meat (large ear, slightly larger than two decks of cards)
- 4 ounces = 1/4 of pound of meat (small circle; about the size of one deck of cards)
- 2 ounces = size of half a palm of an adult's hand (teaspoon)

How much is MI Serving?

Weight of Person	MI Serving Size
45 pounds	2 ounces
90 pounds	4 ounces
180 pounds	8 ounces

For every 20 pounds **less** than the weight listed in the table, subtract 1 ounce of meat.

For example, a 110 pound person's MI Serving size is 7 ounces of meat.
Calculate: 180 pounds – 90 pounds = 70 pounds
70 pounds / 5 ounces = 14 ounces
14 ounces / 2 ounces = 7 MI Serving size of 2 ounces

For every 20 pounds **more** than the weight listed in the table, add 1 ounce of meat.

For example, a 225 pound person's MI Serving size is 9 ounces of meat.
Calculate: 225 pounds – 180 pounds = 45 pounds
45 pounds / 5 ounces = 9 MI Serving size of 2 ounces

Do not should not eat any organs - like the liver, heart, brains, or gizzards - from wild game taken from the Saginaw and Tittabawassee River areas.

Are you pregnant? Wild game can still be a healthy meal. Use your pre-pregnancy weight to find your MI Serving size. These amounts are safe even if you're pregnant or breastfeeding.

Game Weight Totals

Because dioxins and PCBs do not cause immediate health effects, you can calculate how much wild game is safe to eat based on either monthly or yearly amounts - whichever is preferred.

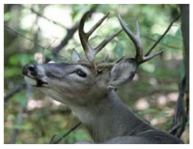
The Game Weight Totals listed here are for a 180-pound adult on a yearly basis. For a monthly breakdown of *MI Servings*, see above.

Weigh more or less than 180? Customize your serving size, based on your weight, using "How much is *MI Serving*?". These guidelines are safe for children, pregnant women, and people with chronic health conditions to use, just customize the serving size based on their weight.

Type of Game	Yearly Total Amount by Weight (for a 180-pound adult)
Duck (with skin)	48 ounces or 3 pounds (0.00 Servings per Year)
Duck (without skin)	192 ounces or 12 pounds (0.00 Servings per Year)
Deer	768 ounces or 48 pounds (0.00 Servings per Year)
Goose (with or without skin)	384 ounces or 24 pounds (0.00 Servings per Year)
Rabbit	384 ounces or 24 pounds (0.00 Servings per Year)
Squirrel	768 ounces or 48 pounds (0.00 Servings per Year)
Turkey (with skin)	48 ounces or 3 pounds (0.00 Servings per Year)
Turkey (without skin)	96 ounces or 6 pounds (0.00 Servings per Year)

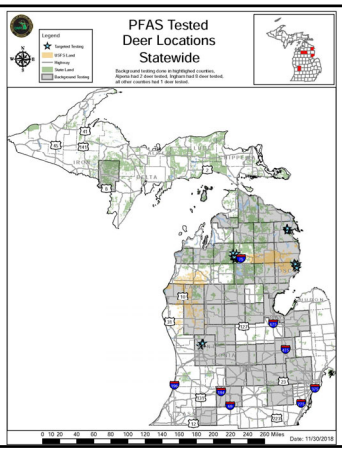
PFAS in Deer

- Hunters asked, "What about PFAS in deer?"
- What deer were tested and how?
- Results from those deer
- Conclusions
- Next steps



What deer were tested and how?

- Background and targeted samples (min 20 each)
  - Volunteer program for disease testing (48)
  - Targeted- Alpena, Oscoda, Rockford, Grayling (80)
- Collection of muscle, liver, kidney, fat
- USDA APHIS collection –Complete September 1, 2018
  - FIRST - all tested first for Chronic Wasting Disease and Bovine Tuberculosis
- Laboratory analysis for PFAS included 16 different types of PFAS



Results

- One deer out of twenty tested in the area was found to have high levels of PFOS
  - 547 ppb in the muscle
  - 6080 ppb in the liver
  - 3540 ppb in the kidney
- PFDS (1.72 ng/g) and PFHxS (3.64 ng/g) also detected in the muscle

Next Steps

Deer in Oscoda –

- Evaluate circumstances
- Develop a model -use as a tool to determine next steps
- Determine if other locations in Michigan require targeted deer sampling.

Next Steps

Other Wildlife

- In January, begin interagency discussions related to risk in other wildlife such as turkey and waterfowl.

For Fish

- Look to Clark's Marsh and Huron River – ecosystem approach

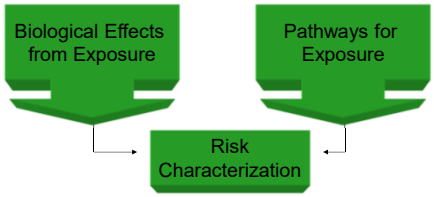
PFAS Impacts on Fish and Wildlife

- Developmental effects on exposed organisms and offspring
- Adverse effects on embryo development
- Decreased survival
- Altered lipid metabolism and liver cell development
- Disrupts intracellular communication and mitochondrial function
- Causes neural and endocrine disruption
- Liver, testicular, pancreatic tumors
- Immunotoxicity
- Wasting syndrome
- ……. Affects a wide range of biological processes

What is Unknown about PFAS in Fish and Wildlife

- Exposure pathways
- Biomagnification in foodweb
- Understanding of risk

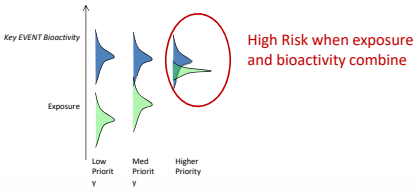
Assessing Risk to Fisheries and Wildlife Populations Through Ecological Risk Assessment



19

Ecological Risk Assessment

A combination of biological effects and exposure determines risk, and this risk can be used to prioritize monitoring and evaluation.



Ecological Risk Assessments Inform…..

- Status of the issue for fish and wildlife
- Prioritization for monitoring and evaluation
- Better understanding of the potential for human health effects
- Understanding of potential population outcomes for key sport & commercial fisheries and other wildlife of interest

https://www.michigan.gov/pfasresponse/