STATE OF MICHIGAN
OFFICE OF THE GREAT LAKES
LANSING

RICK SNYDER
GOVERNOR

JON W. ALLAN
DIRECTOR

May 29, 2017

Ms. Tinka Hyde, Director
Great Lakes National Program Office
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard (G-17J)
Chicago, Illinois 60604-3507

Dear Ms. Hyde:

I am writing to request the United States Environmental Protection Agency (USEPA), Great Lakes National Program Office's (GLNPO) concurrence with the removal of the Restrictions on Fish and Wildlife Consumption Beneficial Use Impairment (BUI) from the Lower Menominee River Area of Concern (AOC). The Michigan Department of Natural Resources (MDNR), Office of the Great Lakes (OGL) and the Wisconsin Department of Natural Resources (WNDR), Office of Great Waters have assessed the status of this BUI in accordance with the delisting targets established in 2008. We recommend that it be removed from the list of impairments for the Lower Menominee River AOC.

Enclosed please find documentation to support this recommendation, including the BUI Removal Recommendation prepared by OGL and WDNR staff. The Lower Menominee River Citizens Advisory Committee provided a letter of support for this action, dated July 24, 2017. A copy is included. Please note that a public comment period was held from April 26 to May 18, 2018. No comments were received during the 30-day comment period.

We value our continuing partnership in the AOC Program and look forward to continuing to work with GLNPO in the removal of other BUIs and the delisting of AOCs. If you need further information concerning this request, please contact Ms. Stephanie Swart at 517-284-5046, or you may contact me.

Sincerely,

Jon W. Allan, Director
Office of the Great Lakes
517-284-5035

Enclosure
cc/enc: Mr. Marc Tuchman, USEPA
Mr. John Perrecone, USEPA
Ms. Leah Melody, USEPA
Mr. Steve Galarneau, WDNR
Ms. Kendra Axness, WDNR
Ms. Cheryl Bougie, WDNR
Mr. Rick Hobrla, MDNR
Mr. Stephanie Swart, MDNR

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 S. Webster Street
Box 7921
Madison WI 53707-7921

Scott Walker, Governor
Daniel L. Meyer, Secretary
Telephone 608-266-2621
Toll Free 1-888-936-7463
TTY Access via relay - 711

May 31, 2018

Ms. Tinka Hyde, Director
Great Lakes National Program Office
U.S. Environmental Protection Agency
77 West Jackson Boulevard (G-17J)
Chicago WI 60604-3507

Subject: Removal of the Restrictions on Fish and Wildlife Consumption Beneficial Use Impairment in the Lower Menominee River Area of Concern

Dear Ms. Hyde:

We are pleased to request the U.S. Environmental Protection Agency (U.S. EPA) Great Lakes National Program Office's (GLNPO's) concurrence with the removal of the Restrictions on Fish and Wildlife Consumption Beneficial Use Impairment (BUI) in the Lower Menominee River Area of Concern.

The Wisconsin Department of Natural Resources (WDNR) and the Michigan Department of Natural Resources (MDNR) have assessed the status of the Restrictions on Fish and Wildlife Consumption BUI relative to the delisting target that was established in 2008. We are able to report that all actions associated with this impairment have been completed and the target has been met. WDNR and MDNR have conducted a public review of the recommendation, including consultation with the Citizens Advisory Committee (CAC) and Technical Advisory Committee (TAC) and a 22-day public comment period. No comments or inquiries were received from the advisory committees, GLNPO, or the public during the review period.

Please find enclosed the Restrictions on Fish and Wildlife Consumption Beneficial Use Impairment Removal Recommendation document, prepared by WDNR and MDNR, which provides documentation to support this recommendation. The Lower Menominee River Area of Concern CAC has provided a letter of support for the BUI removal (attached to the removal document as Appendix A).

We value our continuing partnership in the AOC Program and look forward to working closely with GLNPO in the removal of BUIs and the delisting of Wisconsin's AOCs.

If you need additional information, please contact Cheryl Bougie, WDNR, 920-662-5170, or you may contact me.

Sincerely,

Stephen Galarneau, Director
Office of Great Waters - *Great Lakes & Mississippi River*
Wisconsin Department of Natural Resources
608-266-1956
stephen.galarneau@wisconsin.gov

Enclosures

cc: Scott Cieniawski, U.S. EPA
Leah Medley, U.S. EPA
Amy Pelka, U.S. EPA
John Perrecone, U.S. EPA
Marc Tuchman, U.S. EPA
Kendra Axness, Wisconsin DNR
Cheryl Bougie, Wisconsin DNR
Victor Pappas, Wisconsin DNR
Richard Hobrla, Michigan DNR
Stephanie Swart, Michigan DNR

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

JUN 20 2018

Jon W. Allan, Director
Office of the Great Lakes
Michigan Department of Environmental Quality
525 West Allegan Street
P.O. Box 30473
Lansing, Michigan 48909-7973

Dear Mr. Allan:

Thank you for your May 29, 2018, request to remove the "Restrictions on Fish and Wildlife Consumption" Beneficial Use Impairment (BUI) at the Lower Menominee River Area of Concern (AOC) located within the cities of Marinette, WI and Menominee, MI. As you know, we share your desire to restore all of the Great Lakes AOCs and to formally delist them.

Based upon a review of your submittal and the supporting data, the U.S. Environmental Protection Agency (EPA) hereby approves your request to remove this BUI from the Lower Menominee River AOC. EPA will notify the International Joint Commission (IJC) of this significant positive environmental change at this AOC.

We congratulate you and your staff as well as the many federal, state and local partners who have worked so hard and been instrumental in achieving this important environmental improvement. Removal of this BUI will benefit not only the people who live and work in the Lower Menominee River AOC, but all residents of Wisconsin, Michigan and the Great Lakes Basin as well.

We look forward to the continuation of this important and productive relationship with your agency and the Lower Menominee River Citizens Advisory Committee as we work together to delist this AOC in the years to come. If you have any further questions, please contact me at (312) 886-9296, or your staff can contact John Perrecone at (312) 353-1149.

Sincerely,

Chris Korleski, Director
Great Lakes National Program Office

cc: Rick Hobrla, MDNR
Stephanie Swart, MDNR
Vic Pappas, WDNR
Cheryl Bougie, WDNR
Raj Bejankiwar, IJC
John Perrecone, EPA, GLNPO
Leah Medley, EPA, GLNPO
Keith West, LMR Citizens Advisory Committee, WI
Trygve Rhude, LMR Citizens Advisory Committee, MI

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

JUN 20 2018

Stephen Galarneau, Director
Office of Great Waters – *Great Lakes and Mississippi River*
Wisconsin Department of Natural Resources
101 S. Webster Street
P.O. Box 7921
Madison, WI 53707-7921

Dear Mr. Galarneau:

Thank you for your May 31, 2018, request to remove the "Restrictions on Fish and Wildlife Consumption" Beneficial Use Impairment (BUI) at the Lower Menominee River Area of Concern (AOC) located within the cities of Marinette, WI and Menominee, MI. As you know, we share your desire to restore all of the Great Lakes AOCs and to formally delist them.

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Sincerely,

Chris Korleski, Director
Great Lakes National Program Office

cc: Vic Pappas, WDNR
Cheryl Bougie, WDNR
Rick Hobrla, MDNR
Stephanie Swart, MDNR
Raj Bejankiwar, IJC
John Perrecone, EPA, GLNPO
Leah Medley, EPA, GLNPO
Keith West, LMR Citizens Advisory Committee, WI
Trygve Rhude, LMR Citizens Advisory Committee, MI

Removal Recommendation for the Restrictions on Fish and Wildlife Consumption Beneficial Use Impairment In the Lower Menominee River Area of Concern

Submitted to
U.S. EPA-Region 5
Great Lakes National Program Office
77 West Jackson Boulevard
Chicago, Illinois 60604

By
Wisconsin Department of Natural Resources
And
Michigan Department of Natural Resources

March 23rd, 2018

Acknowledgements

Prepared by:

Stephanie Swart, Michigan's Lower Menominee River AOC Coordinator
Office of the Great Lakes
Michigan Department of Natural Resources

Laurel Last, Wisconsin's Lower Menominee River AOC Coordinator
Office of Great Waters
Wisconsin Department of Natural Resources

The Wisconsin Department of Natural Resources and the Michigan Department of Natural Resources would like to acknowledge the many contributions and support by the members of the Lower Menominee River Area of Concern (AOC) Citizens Advisory Committee (CAC) and Technical Advisory Committee (TAC) in the development of this Lower Menominee River AOC Restrictions on Fish and Wildlife Consumption Beneficial Use Impairment (BUI) Removal Package. CAC and TAC collaboration with state and federal agencies has resulted in materials and activities that reflect local issues and concerns.

Disclaimer

The Great Lakes Water Quality Agreement is a non-regulatory agreement between the U.S. and Canada, and criteria developed under its auspices are non-regulatory. The actions identified in this document were needed to meet beneficial use impairment (BUI) removal targets leading to the delisting of the Lower Menominee River AOC. These actions are not subject to enforcement or regulatory actions.

Executive Summary

In 1987, the lower three miles of the Menominee River, along with Green Island and the Green Bay shoreline three miles north and south of the river mouth, were designated a Great Lakes Area of Concern (AOC), primarily due to toxic chemical contamination. Polycyclic aromatic hydrocarbons (PAHs), heavy metals (specifically arsenic), and paint sludge associated with industrial activities were present in river and bay sediments at elevated levels within the AOC. Six impairments were assigned to the AOC, including the "Restrictions on Fish and Wildlife Consumption" BUI. This impairment indicates that there are chemicals in fish or wildlife that inform public health advisories against eating them. Within this AOC, concerns related to consuming contaminants have been limited to eating fish, not wildlife. The specific chemicals of concern are polychlorinated biphenyls (PCBs), mercury, and dioxins. Within-AOC sources of these pollutants have been controlled, and remaining advisories are caused by sources outside of the AOC. The Wisconsin Department of Natural Resources (WDNR) Office of Great Waters (OGW) and Michigan Department of Natural Resources (MDNR) Office of the Great Lakes (OGL) are proposing to remove the fish consumption impairment.

To address the impairment, polluted sediments were removed from the bottom of the river and bay by dredging and disposing of them in approved locations. The projects are being monitored according to their approved plans and are meeting their remedial action goals. In addition, sediment assessments in the Lower Scott Flowage and Rio Vista Slough show only very low levels of PCBs, mercury, and dioxins. Sediments in the AOC are not a current source of impairment.

In addition, pulp and paper mills along the Menominee River upstream and within the AOC that historically contained dioxin in waste byproducts have made production changes to dramatically reduce or eliminate the production of dioxin. Any wastewater discharged to the river is monitored to assure that it is meeting permit requirements. Therefore, the mills are no longer active sources for this impairment.

Although sources in the AOC have been controlled, there are still fish consumption advisories in the AOC. To assess whether the sources of the impairment are outside of the AOC, fish from the AOC were collected and tested to see how their contaminant levels compared to fish from local and regional reference sites. Results showed that the levels were generally similar to the reference sites. Where fish contaminants were higher, it could be explained by sources or factors outside of the AOC.

Since the impairment is caused by sources outside of the AOC, the impairment can be removed. It is important to note that fish consumption advisories will remain in the AOC, and will be updated as new data is collected. Also, addressing "out of AOC" sources is then recognized as the responsibility of another party.

This BUI removal is proposed by the WDNR OGW and MDNR OGL and is supported by the Lower Menominee River AOC Technical Advisory Committee (TAC) and the Lower Menominee River AOC Citizens Advisory Committee (CAC). This document describes the fish contaminant assessment results and analysis, and shows how the BUI targets are being met. The proposal also includes documentation of public involvement in the process.

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List of Appendices

Issue

The Michigan Department of Natural Resources (MDNR) Office of the Great Lakes and Wisconsin Department of Natural Resources (WDNR) Office of Great Waters recommend removal of the Restrictions on Fish and Wildlife Consumption Beneficial Use Impairment (BUI) in the Lower Menominee River Area of Concern (AOC). This recommendation is made with the support of the Michigan Department of Environmental Quality (MDEQ) Water Resources Division, the Michigan Department of Health and Human Services (MDHHS), the WDNR Fisheries Management Program, the Wisconsin Department of Health Services (WDHS), the Lower Menominee River Citizens Advisory Committee (CAC), and the Lower Menominee River AOC Technical Advisory Committee (TAC). This document provides information supporting the recommendation and documents the actions completed to meet the locally established criteria set forth in the *Lower Menominee River AOC BUI Restoration Targets* (*Restoration Targets*) (WDNR and MDEQ, 2008).

Background

The Lower Menominee River AOC is the lower three miles of the river from the Park Mill Dam (Upper Scott Dam) to the river's mouth in northeast Wisconsin and in the southwest portion of Michigan's Upper Peninsula. The boundary extends approximately three miles north of the river mouth to John Henes Park and approximately three miles south of the river mouth past Seagull Bar along the bay of Green Bay. The AOC includes Seagull Bar as well as Green Island in the bay of Green Bay. The AOC includes portions of Marinette County, Wisconsin and Menominee County, Michigan (Figure 1).

The Lower Menominee River became an AOC primarily due to arsenic-contaminated sediment found in the turning basin of the river (Figure 1) during the U.S. Army Corps of Engineers navigational dredging sampling between 1980 and 1989 (WDNR and Michigan Department of Natural Resources [MDNR], 1990). The 1990 Stage One Remedial Action Plan (RAP) identified the scope of contamination in the Menominee River and adjacent Green Bay shore (WDNR and MDNR). The RAP recognized two additional sites in the immediate area that contained legacy sediment contamination requiring remedial action: the Lloyd-Flanders paint sludge site along the Green Bay shoreline in Menominee, Michigan and the Wisconsin Public Service Corporation (WPSC) coal tar site in the Menominee River near Boom Landing in Marinette, Wisconsin (WDNR and MDNR, 1990). An additional sediment remediation site, Menekaunee Harbor, was identified later and added to the list (WDNR and MDEQ, 2011).

Various sizes of common carp, walleye, and rock bass collected from 1976 through 1988 by the MDNR and WDNR Fish Contaminant Monitoring Programs contained elevated levels of mercury and polychlorinated biphenyls (PCBs), which led to recommendations for fish consumption and the Restrictions on Fish and Wildlife Consumption BUI (WDNR and MDNR, 1990). In 1993, Michigan added an advisory for dioxin for carp in the Menominee River above the first dam, based on samples collected from the Chalk Hill Flowage upstream of the AOC (WDNR, 1996).

Three BUIs—Restrictions on Recreational Contact (Beach Closings; Baker and Galarneau, 2011), Degradation of Benthos (Baker et al., 2017), and Restrictions on Dredging Activities (Bougie et al., 2017)—have been assessed and removed. Restrictions on Fish and Wildlife Consumption, Degradation of Fish and Wildlife Populations, and Degradation of Fish and Wildlife Habitat are the three BUIs remaining for the Lower Menominee River AOC. This recommendation pertains only to the Restrictions on Fish and Wildlife Consumption BUI.

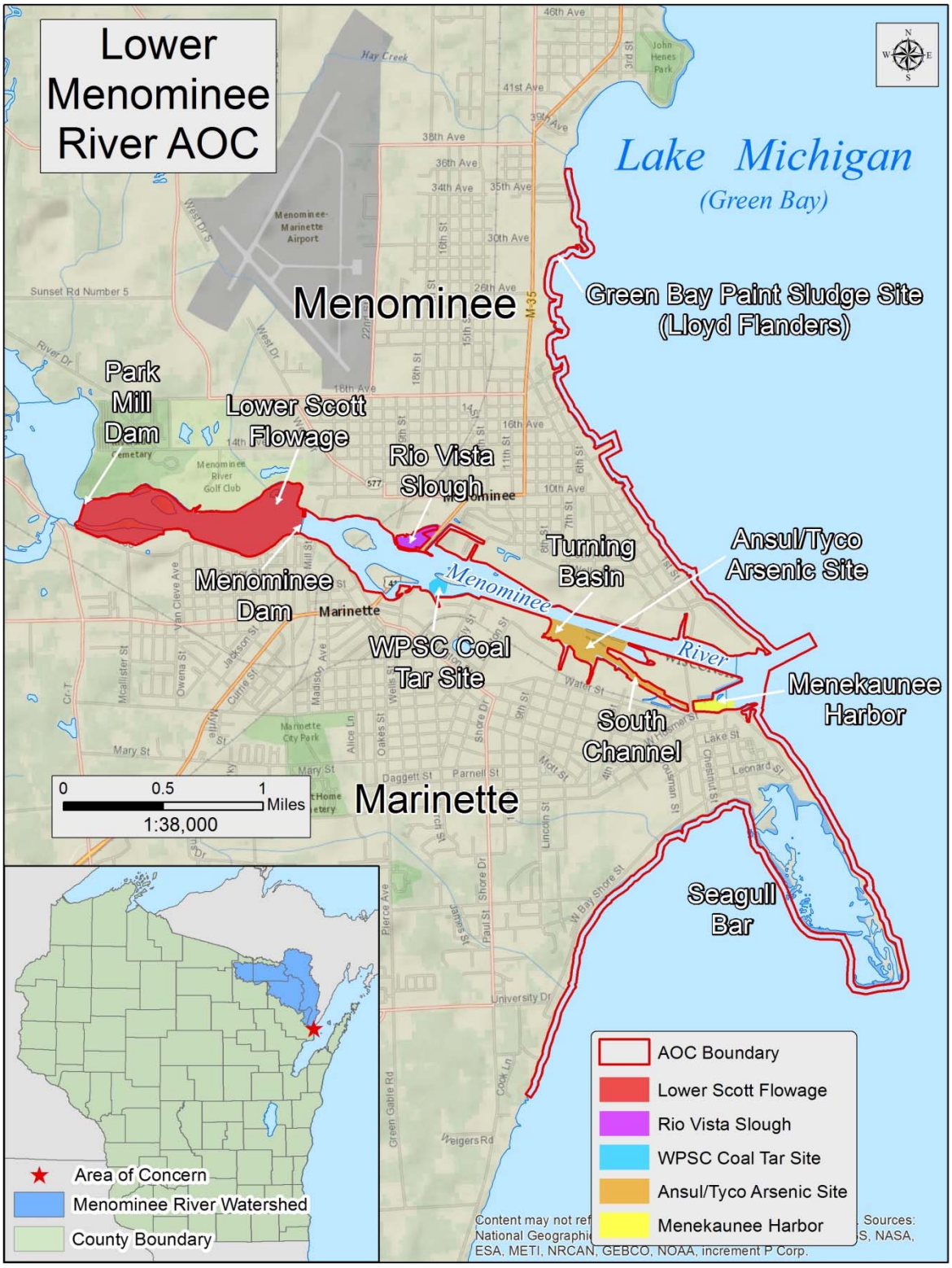
Lower Menominee River AOC
Lake Michigan
(Green Bay)
Menominee
Marinette
Green Bay Paint Sludge Site (Lloyd Flanders)
Park Mill Dam
Lower Scott Flowage
Rio Vista Slough
Menominee Dam
Turning Basin
Ansul/Tyco Arsenic Site
WPSC Coal Tar Site
South Channel
Menekaunee Harbor
Seagull Bar
Menominee River
Hay Creek
0 0.5 1 Miles
1:38,000
Area of Concern
Menominee River Watershed
County Boundary
AOC Boundary
Lower Scott Flowage
Rio Vista Slough
WPSC Coal Tar Site
Ansul/Tyco Arsenic Site
Menekaunee Harbor

Figure 1. Lower Menominee River AOC Boundary. Green Island, which was included in the AOC in the 1996 RAP, is not visible on this map, and is located approximately five miles east from Seagull Bar.

BUI Removal Criteria (2008 Final Delisting Target)

The *Restoration Targets* document lists these removal criteria for the Restrictions on Fish and Wildlife Consumption BUI. This BUI is considered restored when:

A. Sources of PCBs, mercury, and dioxins within the AOC have been controlled or eliminated; and,

B. Waters within the Lower Menominee River AOC are no longer listed as impaired due to PCB or dioxin fish consumption advisories in the most recent Impaired Waters 303(d) list for either state; OR

C. Fish tissue contaminants causing advisories in the AOC are the same or lower than those in the associated Great Lake or appropriate control site.

Note that the AOC does not have any restrictions on wildlife consumption; therefore, the target and this BUI removal recommendation only refer to contaminants in fish. In addition, although arsenic is a primary contaminant in this AOC, it was not included in the target because the two states do not issue fish consumption advisories for arsenic, which does not biomagnify through aquatic food chains (Williams et al., 2006). Also, in 2006 the WDHS (formerly WDHFS) reviewed fish arsenic data and calculated exposures and found no apparent health hazard associated with arsenic in fish from the Menominee River (ATSDR, 2006).

The BUI can be removed when both Part A and either Part B or Part C of the target have been achieved. This analysis uses Parts A and C of the target. Part A is intended to assess whether contaminant sources within the AOC that might contribute to the impairment have been controlled. Part C is intended to assess whether the sources of the impairment are outside of the AOC. The 2001 U.S. Policy Committee report (USPC, 2001) that describes delisting principles and guidelines for U.S. AOCs states that a BUI can be removed if the impairment is caused by sources outside of the AOC. For these purposes, appropriate control sites include regional background and sites upstream and downstream of the AOC. Little Bay de Noc was chosen as the primary reference (control) site, while White Rapids, Chalk Hill, and Big Quinnesec flowages upstream of the AOC and Green Bay downstream of the AOC (Figure 2) were used for additional comparisons (Bohr, 2017a; Attachment D). Note that if an impairment is not restored, responsibility for addressing “out of AOC” sources is recognized as resting with another party (USPC, 2001).

Supporting Data and Analysis

All sediment remediation projects required for BUI removal have been completed and are meeting their remediation goals. This includes the Green Bay (Lloyd-Flanders) paint sludge site, the WPSC coal tar site, the Ansul/Tyco arsenic site, and the Menekaunee Harbor legacy site (Baker et al., 2017; Bougie et al., 2017). A sediment investigation in the Lower Scott Flowage—the area between the Menominee Dam and the Park Mill Dam—has shown that this area is not a significant source of PCBs, mercury, or dioxins to the AOC (Figure 1; CH2MHill,

2014). A sediment assessment in Rio Vista Slough—in Michigan just upstream of the US 41 highway bridge—has shown that this area is not a significant source of PCBs or mercury to the AOC (Figure 1; MDEQ, 2015). In addition, the Kimberly-Clark (formerly Scott Paper) Mill in Marinette, which may have produced dioxins as a byproduct in the past, does not currently produce them. Thus, Part A of the *Restoration Target* is now considered to be achieved: there are no known significant sources of PCBs, mercury, or dioxins within the AOC.
Even though no known significant sources of PCBs, mercury or dioxins exist within the AOC, the Lower Menominee River remains on the 303(d) list of impaired waterbodies for contaminated fish tissue and therefore Part B of the *Restoration Target* has not been achieved. The pollutants causing the Wisconsin 303(d) listing are mercury and PCBs; the pollutants causing the Michigan 303(d) listing are mercury, PCBs, and dioxins[1].

Part C of the target was created in recognition of the potential for contaminants in fish in the AOC to be caused by sources outside of the AOC. Because Part B of the restoration target has not been achieved, and because resource managers have evidence that sources of contaminants causing fish consumption advisories derive from outside of the AOC, Part C has been the focus of AOC investigations. Therefore, the remainder of this document describes the studies and analyses that have been done to compare chemical concentrations that drive consumption advice in fish from the AOC with those from appropriate control sites.

In selecting appropriate control sites (or reference locations), it is important to note that the AOC is comprised of two sections that need to be considered separately: the Lower Scott Flowage, and the river below the Menominee Dam (Figure 2). The two sections have different biological and chemical cycling processes. Also, the fish in the river below the Menominee Dam would have had access to Green Bay and its other tributaries, while the fish in the flowage would have been isolated from the bay by the dam. These factors influence the amount and types of contaminants found in the tissue of fish captured in each AOC section.

In 2011, the MDHHS was provided funding from the USEPA through the Great Lakes Restoration Initiative (GLRI) to partner with the MDEQ and the local AOC advisory committees to assess the status of the Fish and Wildlife Consumption BUI at five of Michigan's AOCs (Bruneau, 2017; Attachment E). MDEQ selected reference sites and MDHHS selected fish species to facilitate comparisons that would provide insight to the BUI status. Figure 3 provides a summary of the comparisons by fish species. Additional details are provided in Attachment D.

Reference sites

The BUI was evaluated in the Lower Menominee River AOC based on an analysis of fish from two sections of the AOC—the Lower Scott Flowage and the river below the Menominee Dam—as compared to fish from Little Bay de Noc (Figure 2). Little Bay de Noc was chosen as the primary reference site for both sections of the AOC because the regional inputs are similar to those around the Lower Menominee River, and they have similar fish species, but Little Bay de Noc has not been influenced by direct contaminant inputs (Bruneau, 2017). In addition, to better understand the potential influence of flowage conditions on mercury levels in fish tissue, smallmouth bass collected from the White Rapids and Big Quinnesec flowages upstream of the AOC (Figure 2) were compared with fish collected from the Lower Scott Flowage. Also, dioxin levels in carp

[1] MDHHS and WDNR issue fish consumption advisories for these contaminants in the AOC. Current Michigan and Wisconsin fish consumption advice may be found online at www.michigan.gov/eatsafefish, and http://dnr.wi.gov/topic/fishing/consumption/index.html, respectively.

from the AOC were compared to those in carp collected previously in Green Bay and the Chalk Hill Flowage (Bohr, 2017a; Attachment D).

Fish Species

Fish species selected for comparison were northern pike, rock bass, smallmouth bass, and common carp. Northern pike and rock bass were selected because they are both popular with anglers and have good site fidelity (meaning that they tend to return and reuse the same areas). Smallmouth bass were selected because they are a popular sport fish and have good site fidelity. Common carp were selected because they tend to have high PCB and dioxin burdens relative to other species in a given water body, they are relatively ubiquitous, and results from previous sampling are available.

WDNR collected carp, smallmouth bass, and rock bass from the Lower Scott Flowage and carp, smallmouth bass, and northern pike from the Menominee River below the Menominee Dam from 2012 to 2014. MDNR collected carp, smallmouth bass, and northern pike from Little Bay de Noc in 2012 and 2014 (Bohr, 2017a). Rock bass collected by MDNR from Little Bay de Noc in 2008 were used for comparisons with rock bass collected from Lower Scott Flowage in 2012. In addition, mercury concentrations in smallmouth bass collected in 2014 by Wisconsin Electric (WE) Energies from the White Rapids and Big Quinnesec Flowages upstream of the AOC to meet hydroelectric facility licensing requirements were used for comparison with smallmouth bass collected from the Lower Scott Flowage. All fish used for comparison in this study were processed by MDEQ staff into standard edible portions and all whole fish and fillets were analyzed at the MDHHS laboratory for a standard suite of contaminants. The full scope and methods can be found in Attachment D.

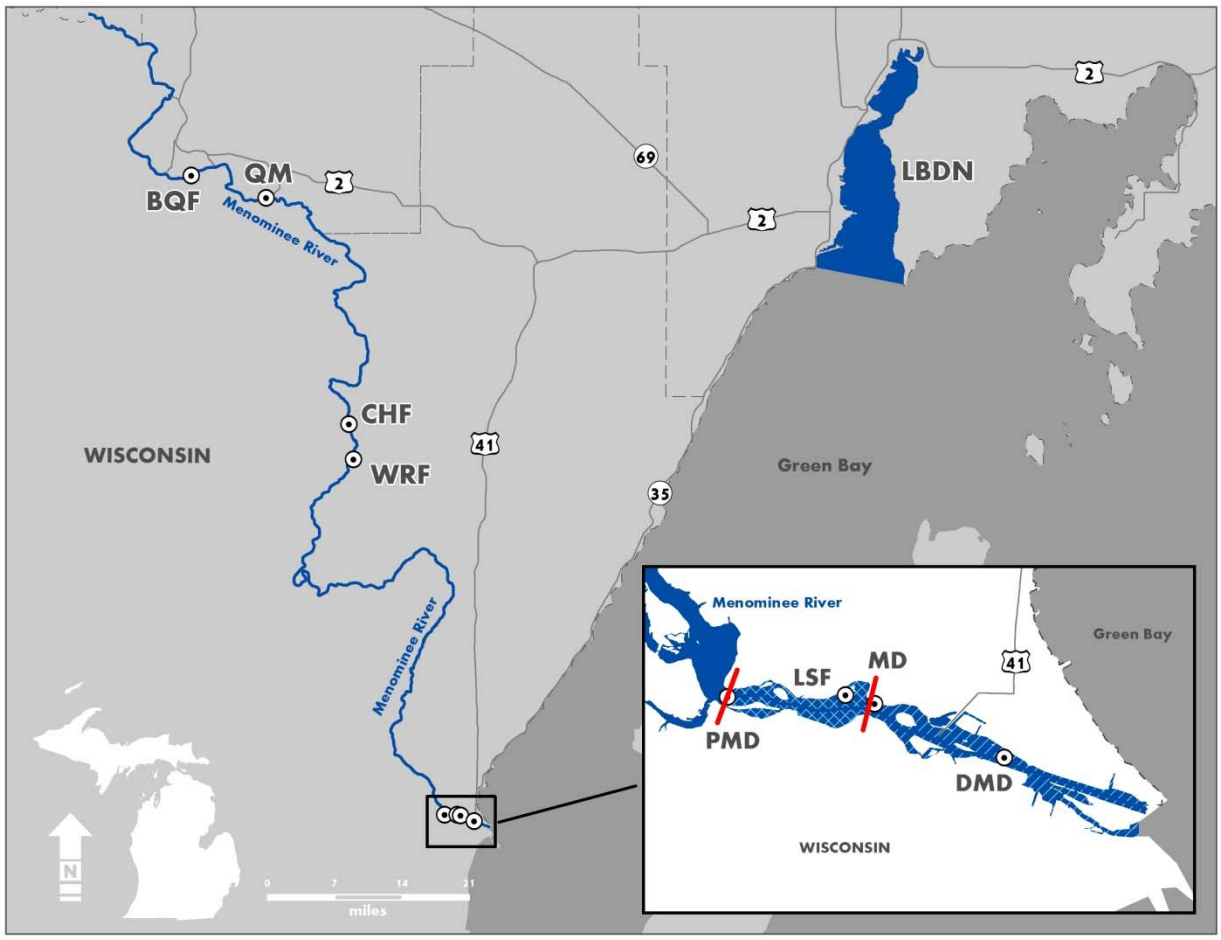

Figure 2. Sections of the Lower Menominee River AOC (crosshatched in inset) with locations of the Park Mill Dam (PMD) and Menominee Dam (MD), and fish collection locations at Big Quinnesec Flowage (BQF), Quinnesec Mill (QM), Chalk Hill Flowage (CHF), White Rapids Flowage (WRF), Lower Scott Flowage (LSF), downstream of the Menominee Dam (DMD), and Little Bay de Noc (LBDN) (Bohr, 2017a).

Rock Bass Comparisons

AOC location compared to *reference location* (sampling year and number of fish sampled in parentheses)		Contaminants compared
Lower Scott Flowage (2012; 10)	*Little Bay De Noc (2008; 14)*	PCBs, Mercury

Smallmouth Bass Comparisons

AOC locations compared to *reference location* (sampling year and number of fish sampled in parentheses)			Contaminants compared
Lower Scott Flowage (2012, 2013; 10)	Menominee River downstream of the Menominee Dam (2012, 2013; 10)	*Little Bay De Noc (2012; 10)*	PCBs, Mercury
Lower Scott Flowage (2012, 2013; 9)		*White Rapids Flowage (2014; 8)* *Big Quinnesec Flowage (2014; 10)*	Mercury

Common Carp Comparisons

AOC locations compared to *reference location* (sampling year and number of fish sampled in parentheses)			Contaminants compared
Lower Scott Flowage (2012, 2013, 2014; 11)	Menominee River downstream of the Menominee Dam (2012; 10)	*Little Bay De Noc (2012; 9)*	PCBs, Mercury
Lower Scott Flowage (2014; 5)	Menominee River downstream of the Menominee Dam (2006; 7)	*Little Bay De Noc (2012; 9)* *Chalk Hill Flowage (1991, 1996; 12)* *Green Bay (2000; 10)*	Dioxins

Figure 3. Summary of comparisons for the BUI evaluation. (all images courtesy of WDNR; drawings by Virgil Beck)

Note that the WDNR did have additional data points for the Lower Menominee River AOC that were not included in this analysis because Wisconsin's Lower Scott Flowage data are too old to provide accurate across-site comparisons and results are not comparable because of differences in the analytical procedures: MDEQ and MDHHS process carp and pike as skin-off fillets, unlike Wisconsin, and the MDHHS Laboratory determines total PCBs as the sum of congeners instead of aroclors (Bruneau, 2017). Michigan's and Wisconsin's fish consumption advisories differ somewhat because different advisory protocols are used. To learn more about the Michigan Fish Consumption program and methods, see http://www.michigan.gov/documents/mdch/MFCAP_Guidance_Document_500546_7.pdf. To learn more about the Wisconsin Fish Consumption program and methods, request the *Fisheries Management Handbook Chapter 530 Section B,* titled *Fish Consumption Advisory Determination,* from the WDNR. WDNR AOC and Fisheries Management Program staff and WDHS staff concur with the conclusions of the MDEQ staff report and the recommendation to remove the BUI.

PCBs

Common carp and smallmouth bass were collected for PCB analysis at three locations: in the Lower Scott Flowage, below the Menominee Dam, and at Little Bay de Noc (Figure 2). Northern pike were also collected downstream of the Menominee Dam and at Little Bay de Noc. PCB congeners were measured, and total PCB concentration was estimated by summing the individual congeners. PCBs tend to collect in the fat of fish, so a fattier fish will carry more contaminants. "Lipid-normalizing" provides a way to compare locations and fish with differing fat levels. The method consists of dividing the contaminant results by the amount of fat in each fish. The MDEQ and MDHHS do not lipid-normalize the data when deriving fish consumption guidelines because the guidelines are waterbody-specific and not intended for between-site comparisons. However, for the assessment of this BUI, MDEQ utilized both non-lipid normalized and lipid-normalized data to allow for a point-by-point statistical comparison (Bruneau, 2017).

The median total PCB and median lipid-normalized total PCB concentrations in carp were higher in the samples obtained downstream of the Menominee Dam compared to those from Little Bay de Noc. These differences are not statistically significant, reflecting high variance within a small sample size (Table 1, Figure 4; Bohr, 2017a). Concentrations of PCBs in carp collected from the Lower Scott Flowage were significantly lower than those from both below the Menominee Dam and Little Bay de Noc (Table 1, Figure 4; Bohr, 2017a). Unfortunately, the northern pike did not provide a good comparison due to the difference in lengths of the fish collected. Rock bass total PCB concentrations in the Lower Scott Flowage and Little Bay de Noc were not significantly different. PCB concentrations were higher downstream of the Menominee Dam than in Little Bay de Noc and the Lower Scott Flowage in smallmouth bass, while smallmouth bass PCB concentrations in Little Bay de Noc and the Lower Scott Flowage were not significantly different (Bohr, 2017a).

Table 1. Median total PCB and median lipid-normalized total PCB concentrations in fish collected from the Lower Scott Flowage (LSF), downstream of the Menominee Dam (DMD), and Little Bay de Noc (LBDN) (Bohr, 2017a).

Species	Median Total PCB (mg/kg)			Median Lipid-Normalized Total PCB (mg/kg)		
	LSF	DMD	LBDN	LSF	DMD	LBDN
Carp	0.04 (11)	1.83 (10)	0.67 (9)	0.02 (11)	0.29 (10)	0.12 (9)
Rock Bass	0.002 (10)	--	0.002 (14)	0.004 (10)	--	0.008 (14)
Smallmouth Bass	0.002 (10)	0.05 (10)	0.008 (10)	0.02 (10)	0.13 (10)	0.02 (10)

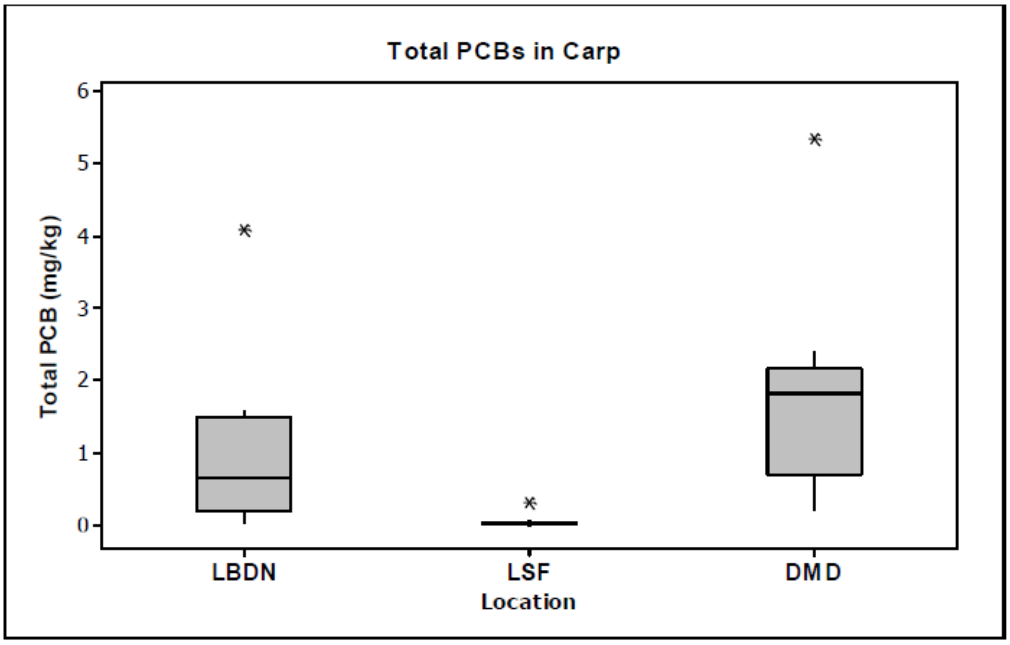

Figure 4. Boxplots of total (non-lipid-normalized) PCB concentrations in fillets of carp from Little Bay de Noc (LBDN; n=9), Lower Scott Flowage (LSF; n=11), and downstream of the Menominee Dam (DMD; n=10) (Bohr, 2017a). PCB concentrations in LSF carp were significantly lower than LBDN and DMD carp. PCB concentrations in LBDN carp and DMD carp were not significantly different under the sample conditions.

A semi-permeable membrane device (SPMD) study was conducted in the Lower Menominee River AOC from August 30, 2011 to September 27, 2011. The purpose of this study was to determine if significant sources of PCBs, polycyclic aromatic hydrocarbons (PAHs), and organochlorine pesticides exist in the Menominee River watershed and to narrow the search for such sources (Bohr, 2012). SPMDs were placed at 12 locations in the Menominee River, including four above the AOC (upstream of the Park Mill Dam) and eight within the AOC below the Menominee Dam. There was no net uptake of PCBs at any of the four sampling sites

upstream of the Park Mill Dam, indicating that there is no significant source of PCBs upstream of the AOC (Bohr, 2012). Some net uptake of PCBs occurred within the AOC downstream of the Menominee Dam, but the maximum observed net uptake was relatively low compared to other watersheds in the region (Bohr, 2012).

The results from the SPMD study do not explain the relatively high concentrations of PCBs measured in fish collected in the lower Menominee River. Also, a sediment investigation in the Lower Scott Flowage has shown that this area is not a significant source of PCBs to the AOC (CH2MHill, 2014). On the other hand, multiple lines of evidence suggest that the lower Fox River is the primary source of PCBs in fish collected from the Menominee River below the Menominee Dam. These fish likely spend significant amounts of time in Green Bay where they are exposed to PCBs that originate largely from the Fox River area (Bohr, 2012). The USEPA Lake Michigan *Mass Balance Project*, which calculated the amount of PCBs contributed to Lake Michigan by all its major tributaries in 1994 and 1995, showed that the Menominee River was adding only a small amount of the total PCBs going into the lake. In comparison, the Fox River was adding 44 times more PCBs than the Menominee River (USEPA, 2006). Additionally, a 2001-2002 study of white perch in Green Bay found that fish collected in the southern part of the bay (closest to the Fox River) had higher concentrations of PCBs than those collected further north (WDNR, n.d.).

Although the lower Fox River has been a historical source of PCBs to Green Bay and Lake Michigan, an extensive, multi-year effort is currently underway to clean up PCB-contaminated sediment in the river. Goals of this project include reducing the transport of PCBs from the lower Fox River into Green Bay and Lake Michigan and protecting humans who consume fish from exposure to contaminants. This is a Superfund project, not under the purview of the AOC program, and is occurring within the Lower Green Bay and Fox River AOC. See below and http://foxrivercleanup.com/ for more details on the cleanup.

The Lower Fox River PCB Cleanup Project began in 2004 in Little Lake Butte Des Morts (LLBDM), located just downstream of Lake Winnebago. After 16 years of successful remedial dredging, the project is planned to conclude in the lower reaches of the Fox River and Green Bay in 2019. Dredging and capping to address PCB concentrations above 1 ppm are planned for approximately 20 of the 39 miles of river, and when completed will have removed an estimated 5.65 million cubic yards of contaminated sediment from the Fox River system.

The LLBDM remedy was implemented from 2004 through 2009 and resulted in an immediate reduction of PCB concentrations for the three media of interest: fish, sediment, and water (Boldt, 2011). Natural recovery was occurring in these media pre-remedy; the PCB concentrations in fish, sediment, and water were declining. However, the remedy has markedly accelerated the rate of decline for PCB concentrations in all three media by 10-15 years (Boldt, 2011).

PCB fish tissue analysis in Fox River walleye has shown a decrease in concentrations of PCBs by 73% comparing pre-dredging and post dredging data for a 6-mile stretch of river from the outlet of Lake Winnebago to the upper Appleton Dam (WDNR, 2011). It is anticipated that a similar decrease in PCB fish tissue results will occur in the Lower Fox River, Green Bay, and the Lower Menominee River.

Mercury

Common carp, northern pike, rock bass, and smallmouth bass from the Lower Scott Flowage, downstream of the Menominee Dam, and Little Bay de Noc were measured for total mercury (Bohr, 2017a). Mercury concentrations in common carp, rock bass, and smallmouth bass from the Lower Scott Flowage were significantly higher as compared to the same species from downstream of the Menominee Dam and from Little Bay de Noc (Table 2). However, concentrations measured in the Lower Scott flowage are not unusual compared to other impoundments upstream on the Menominee River; smallmouth bass from the Lower Scott Flowage had mercury levels equivalent to concentrations in smallmouth bass from Big Quinnesec Flowage and slightly higher than levels in the White Rapids Flowage (Figure 5; Bohr, 2017a). The northern pike samples did not provide adequate between-site comparisons since the length ranges were not similar.

It is unlikely that elevated mercury levels in fish from the Lower Scott Flowage are due to mercury sources within the AOC. There are no known significant direct sources to the AOC. In addition, the Lower Scott Flowage was studied in 2013 to assess the levels of contaminants in the sediment at the bottom of the flowage. Extensive poling in the flowage by two distinct efforts by WDNR and USEPA indicated extremely limited sediment deposits located in isolated pockets, and these sediment deposits were targeted for sampling. Samples for metals were collected at thirty-six locations within the flowage and three locations upstream of the flowage (CH2MHill, 2014). Mercury was detected within the flowage, but only at very low levels, confirming that the sediment is not a significant source of mercury to the AOC.

Higher mercury concentrations in the Lower Scott Flowage are most likely due to favorable conditions for mercury methylation within the impoundment or the Menominee River in general. Atmospheric deposition of mercury from regional and global fossil fuel combustion is the primary source of mercury in the region (Lepak, 2015). Methylmercury is the form of mercury taken up by fish. Studies have shown that in some cases, atmospheric mercury may be a more important source of methylmercury to Great Lakes fish than historical contaminated sediments (Lepak, 2015). The abundant wetlands and higher sulfur levels found in the watersheds of Michigan's Upper Peninsula tend to lead to increased methylation rates (Bruneau, 2017). In addition, in the USEPA Lake Michigan Mass Balance Study, the Menominee River was one of four rivers with the lowest total mercury concentrations (USEPA, 2004). The Menominee River did have elevated dissolved methylmercury concentrations, which are indicative of a river system conducive to methylation, but without the presence of an uncontrolled source (Bruneau, 2017; USEPA, 2004).

Table 2. Median total mercury in fish collected from the Lower Scott Flowage (LSF), downstream of the Menominee Dam (DMD), and Little Bay de Noc (LBDN) (Bohr, 2017a).

Species	Median Total Mercury (mg/kg)		
	LSF	DMD	LBDN
Carp	0.44	0.20	0.29
Northern Pike	--	0.22	0.49
Rock Bass	0.16	--	0.08
Smallmouth Bass	0.50	0.33	0.28

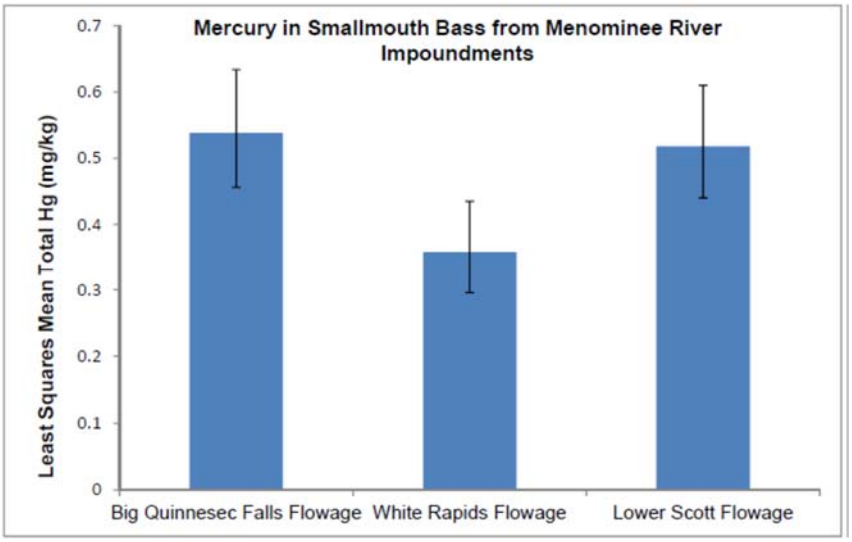

Figure 5. Least squares mean total mercury concentrations in smallmouth bass collected from three impoundments of the Menominee River in 2013 and 2014 (Bohr, 2017a).

Dioxins

Common carp were sampled for dioxins from the Lower Scott Flowage, Little Bay de Noc, downstream of the Menominee Dam, Chalk Hill Flowage, and Green Bay (Figure 2; Bohr, 2017a). By observation in Wisconsin and Michigan fish consumption advisories, dioxins and PCBs are always highest in carp compared to other species from the same water. There was not enough funding to analyze dioxins in all samples, so only the carp were used, since they were most likely to give the best comparison (J. Bohr, personal communication). MDEQ and MDHHS calculate dioxins using *toxic equivalency factors*, also known as TEQ. The TEQ is a calculation that generally includes the various forms of dioxin, furans, and dioxin-like PCBs.[2] TEQ is used in Michigan to determine fish consumption guidelines because furans and dioxin-like PCBs tend to act the same as dioxins in the body after they are eaten (Bruneau, 2017). Michigan added the dioxin-like PCBs to the TEQ calculation for consumption advice in 2004. Michigan and Wisconsin consumption advice for the same waterbody is sometimes different because the states calculate TEQ differently.

Like PCBs, dioxins collect in the fat of fish, so fattier fish tend to have more dioxins. The MDEQ and MDHHS do not normally lipid-normalize the data when calculating for fish consumption guidelines because the guidelines are not intended for between-site comparisons. However, for the assessment of this BUI, MDEQ utilized both non-lipid normalized and lipid-normalized data, to allow for a point-by-point statistical comparison (Bruneau, 2017). In addition, for this BUI assessment, MDEQ calculated dioxin TEQ without the dioxin-like PCBs, since dioxins and furans may have sources independent of PCB sources.

[2] There is a long list of chlorinated dioxins, furans, and PCBs that are of concern in sediments and fish. These chemicals differ in their toxicity, but are similar in their toxicological mechanism. One chemical, 2,3,7,8-tetrachlorodibenzodioxin, also known as TCDD or simply dioxin, is considered most toxic among these chemicals. To simplify the evaluation of these chemicals, which often occur together in the environment, the TEQ of each chemical is expressed in terms of its toxicological comparison to TCDD. This allows combining the concentrations of the individual chemicals into a single combined TEQ number for the purpose of environmental evaluations.

Lipid-normalized dioxin TEQ concentrations in carp downstream of the Menominee Dam were not statistically different than in the carp from Little Bay de Noc. Lipid-normalized dioxin TEQ concentrations in carp from the Lower Scott Flowage were significantly greater than those in carp from Little Bay de Noc (Figure 6; Bohr, 2017a; Bruneau, 2017). However, the lipid-normalized dioxin TEQ concentrations were not statistically different in carp from Lower Scott Flowage and Chalk Hill Flowage, which is upstream of the AOC, suggesting that upstream sources of dioxin may be contributing to the AOC (Figure 6; Bohr, 2017a; Bruneau, 2017).

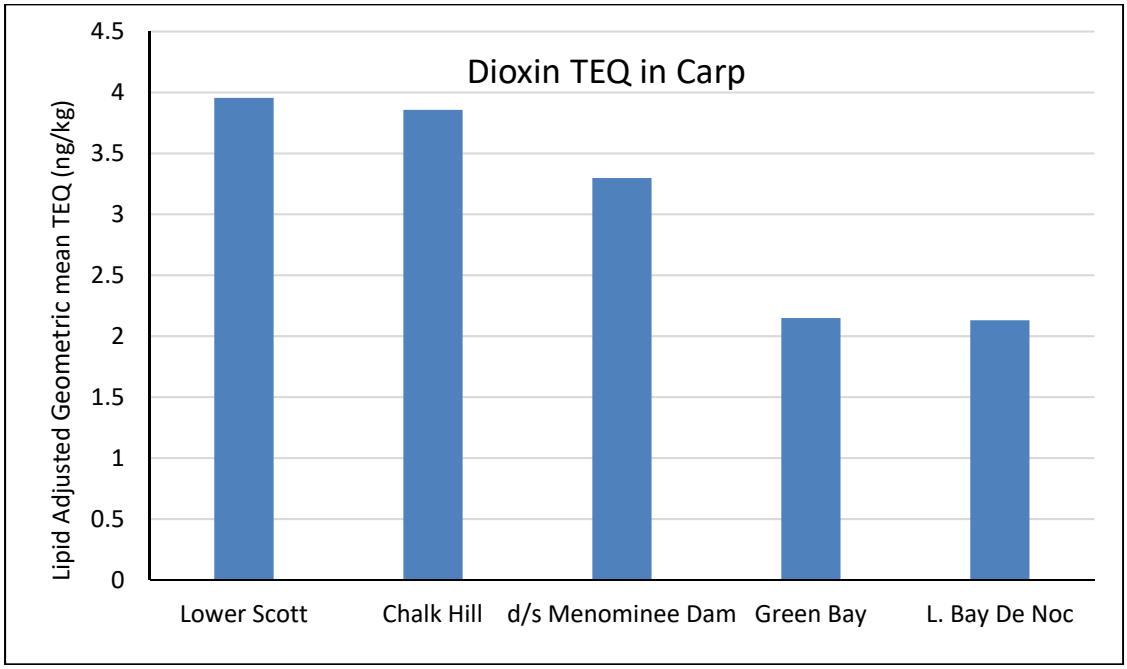

Figure 6. Lipid-adjusted geometric mean dioxin TEQ concentration in carp collected from Lower Scott Flowage in 2014, Chalk Hill Flowage in 1991 and 1996, Menominee River downstream of the Menominee Dam in 2006, Green Bay in 2000, and the Little Bay De Noc in 2012 (J. Bohr, personal communication).

Dioxins are produced mainly as by-products of manufacturing processes, including smelting, some herbicide and pesticide production, and preparation of paper pulp. Historically, pulp and paper mills worldwide that used chlorine in their pulp bleaching process unknowingly produced and released dioxin to the environment. Three mills in the Menominee River watershed produced dioxins through their bleaching process. Of these three—the Quinnesec Mill (Figure 2), the former Niagara Mill across the river in Wisconsin, and the Kimberly-Clark (formerly Scott Paper) Mill in Marinette—only the latter is located within the AOC. Due to increased awareness in the 1970s and 1980s, industries and governments began to act to address the problem of dioxins. In 1998, the USEPA amended its Pulp, Paper and Paperboard Effluent Guidelines (40 CFR Part 30) to cover toxic pollutants, including dioxin. From the 1990s on, the use of chlorine was reduced and replaced by alternative bleaching processes to reduce the emissions of dioxin and related toxins. With the implementation of this regulation, a review of wastewater permitting data has shown that only one mill on the Menominee River, the Quinnesec Mill located

upstream of the AOC, has any current potential for dioxin in its effluent, and this mill has been meeting its permit requirements. There are no significant sources of dioxin within the AOC.

In 1989, walleye were assayed for dioxin from the upper Menominee River upstream and downstream of Champion International Paper Quinnesec Mill (Figure 2; Taft, 1991). Dioxin was not detected in the fish collected upstream of the mill, but measurable quantities were found in the fish collected downstream. In 1990, the Quinnesec paper mill eliminated the bleaching process that produced the dioxin, and it is not an ongoing source of dioxin to the river. Champion Mill is now Verso Quinnesec, LLC. They have a National Pollutant Discharge Elimination System (NPDES) permit with the MDEQ that expires in 2018 and includes monitoring twice annually for dioxin TEQ. They have been meeting their permit requirements.

The Niagara Mill, across the river from the Quinnesec Mill, also produced bleached kraft paper for a period of time prior to 1979. Based on production information from the mill and estimated dioxin production from the USEPA, the Niagara Mill produced significantly more dioxin than the Quinnesec Mill (Steve Casey, personal communication). However, a National Council for Air and Stream Improvement, Inc. study found that the level of dioxin detected in the mill's effluent in 2004 was very low, falling within the range often found in laboratory blanks (Letter, Stora Enso North America, F. Andrew Gilbert, Jr., January 10th, 2005). The Niagara Mill closed permanently in 2008 and is not an ongoing source of dioxin to the river.

Of the three pulp and paper mills within the AOC—Clearwater Paper-Menominee (formerly Menominee Paper Company), Fibrek-Menominee (Resolute Forest Products), and Kimberly-Clark-Marinette, only the Kimberly-Clark facility was identified as an historic potential source for dioxin. The Clearwater Paper and Fibrek mills use processes that do not produce dioxin; therefore, they are not sources. The Kimberly-Clark mill likely produced dioxins in the past, but current operations do not produce them. In May 2012, the Kimberly-Clark mill submitted effluent monitoring data for dioxins and furans that supported the conclusion that no effluent limits were necessary and the proposed limits and compliance schedule were not included in the permit issued in 2013.

The Lower Scott Flowage was studied in 2013 to assess the levels of contaminants in the sediment at the bottom of the flowage. Extensive poling in the flowage by two distinct efforts by WDNR and USEPA indicated extremely limited sediment deposits located in isolated pockets, and these sediment deposits were targeted for sampling. Samples were collected at seven locations within the flowage and one location upstream of the flowage (CH2MHill, 2014). Although low levels of dioxin were found both within and upstream of the flowage, concentrations were below any level of concern or action, confirming that the sediment is not a significant source of dioxin within the AOC. Impoundments upstream of the AOC have not been assessed, and may still release some level of contamination to the water and biota downstream.

Although more work is needed to reevaluate dioxin advisories in the Menominee River, encouraging national trends apply here. Nationally, there has been a general downward trend of dioxin fish consumption advisories in response to elimination of dioxin emissions from U.S. pulp and paper mills (AET, 2005). Although Michigan and Wisconsin do not have enough data to confirm these trends within the Menominee River AOC, the national trend provides reason to believe that dioxin levels are declining in Menominee River fish over time. When Michigan collects new samples to reevaluate dioxin advisories in the Menominee River, it is expected that dioxin levels will be significantly lower than last time (Joe Bohr, personal communication).

Conclusions

WDNR and MDNR conclude that Part A of the *Restoration Target* has been achieved: there are no known significant sources of PCBs, mercury, or dioxins within the AOC. All sediment remediation projects required for BUI removal have been completed and are meeting their targets (Baker et al., 2017; Bougie et al., 2017). In addition, sediment investigations in the Lower Scott Flowage and Rio Vista Slough have shown that the flowage is not a significant source of PCBs, mercury, or dioxins and the slough is not a significant source of PCBs or mercury to the AOC (Figure 1; CH2MHill, 2014; MDEQ, 2015). Also, the Kimberly-Clark (formerly Scott Paper) Mill in Marinette is no longer using a process that produces dioxins as a byproduct.

MDNR and WDNR conclude that PCBs in fish tissue in the AOC are due to outside sources. PCB concentrations in fish from the Lower Scott Flowage are lower or the same as fish from the Little Bay de Noc control site (Figure 2; Bruneau, 2017; Bohr, 2017a). According to the USEPA Lake Michigan Mass Balance project, the Menominee River is a minor source of PCBs to Green Bay, contributing roughly 20 times less than the Fox River (Bohr, 2017a; USEPA, 2006). This supports the conclusion that the source of PCBs to the Lower Menominee River AOC is not within the AOC, but rather outside influences such as Green Bay and the Fox River (Bohr, 2017a; USEPA, 2006).

WDNR and MDNR conclude that mercury in fish tissue in the AOC is due to outside sources. Median mercury concentrations in fish from the Lower Scott Flowage were higher than in fish from Little Bay de Noc; however, smallmouth bass from the Lower Scott Flowage had mercury levels equivalent to concentrations in smallmouth bass from Big Quinnesec Flowage and slightly higher than levels in the White Rapids Flowage, both upstream of the AOC (Figure 2; Bohr, 2017a). Atmospheric deposition of mercury from regional and global fossil fuel combustion is the primary source of mercury in the region (Lepak, 2015). In the USEPA Lake Michigan Mass Balance Study, the Menominee River was one of four rivers with the lowest total mercury concentrations (USEPA, 2004). It is likely that the high median totals of mercury in fish from the Lower Scott Flowage are influenced by certain characteristics of the Menominee River and watershed that promote conversion to methylmercury, the form of mercury that is taken up by fish (Bohr, 2017a; Bruneau, 2017).

MDNR and WDNR conclude that dioxin in fish tissue in the AOC is due to outside sources. Dioxin concentrations in carp from downstream of the Menominee Dam and carp from Little Bay de Noc were not statistically different (Bohr, 2017a). Dioxin concentrations in carp from the Lower Scott Flowage were higher than in carp from Green Bay and Little Bay de Noc, but they were not statistically different from concentrations in carp from the Chalk Hill Flowage, which is upstream of the AOC (Bohr, 2017a; Figure 2). Although direct sources of dioxin upstream of the AOC have been controlled, sediments in upstream impoundments may still release some level of contamination to the water and biota downstream.

Therefore, WDNR and MDNR assert that Part C of the *Restoration Target* has also been achieved: the sources of the impairment are outside the AOC. In conclusion, this BUI meets the criteria for removal, according to Parts A and C of the *Restoration Targets* criteria outlined on page 4 of this report.

Stakeholder/Public Involvement

This removal recommendation was discussed with the Lower Menominee River TAC and CAC at their regular meetings on May 24th, 2017 and July 20th, 2017, April 19th 2018, respectively. The Lower Menominee River TAC and CAC concur with the recommendation, and the CAC has submitted a formal letter of support for removal of the BUI, dated July 24th, 2017 (Appendix A). This proposed action was public noticed via listing in the MDNR Calendar (http://www.michigan.gov/dnr/0,4570,7-350-79119_11859---,00.html) and WDNR Public Meetings Calendar (http://dnr.wi.gov/Calendar/Meetings/), and also publicized via AOC e-mail distribution lists and the AOC GovDelivery listserv (3,226 recipients) on April 26th, 2018. Supporting documents were posted on the WDNR's AOC program web page (http://dnr.wi.gov/topic/greatlakes/aoc.html) for public review and comment from April 26th through May 18th, 2018.

In addition, the WDNR and MDEQ have worked with MDHHS to provide targeted fish consumption advisory outreach to the local fish-eating populations. MDHHS staff attended local fishing and AOC events to answer questions and distribute Michigan Eat Safe Fish guides and materials. Sixteen AOC-specific signs were installed along the shoreline at public access points to inform the fishing public of safe eating guidelines. These activities were funded by the same GLRI grant that funded the fish contaminant assessment work.

The TAC was formed in 1988 to bring together technical experts familiar with the AOC for the development and implementation of the RAP (WDNR and MDNR, 1990). In addition, TAC members review and provide input on project plans, monitoring data, RAP updates, and BUI removal documents. The TAC members also provide support for monitoring programs to assess impaired uses, removal of the BUI, and ultimately removing/delisting the AOC status.

The CAC was formed in 1988 as a means of incorporating stakeholder feedback into the RAP documents and to serve as ambassadors on AOC issues to the Marinette and Menominee communities (WDNR and MDNR, 1990). CAC members help the agencies by identifying local issues, developing local targets and goals, serving as a resource for historical information, and assisting in project implementation when possible. The CAC developed governing bylaws in June of 2011, and then revised them in October of 2016, to ensure the committee's long-term viability and balanced representation of the community. As of March 2018, there are 12 membership positions filled of a possible 26. Dozens more individuals have attended monthly meetings and currently receive meeting minutes and AOC updates through e-mail. The WDNR and the MDNR strongly prefer that requests to remove the impaired designation of a BUI be agreed to by the TAC and CAC. The CAC letter of support and the CAC and TAC meeting announcements, agenda, and minutes documenting support for the removal of the Restrictions on Fish and Wildlife Consumption BUI are located in Appendix A and Appendix B, respectively.

The CAC holds nine or ten regular meetings per year on the University of Wisconsin-Marinette campus, open to all interested parties. Meetings are advertised through the WDNR Public Meetings Calendar (http://dnr.wi.gov/Calendar/Meetings/) and the CAC e-mail distribution list. Participation in meetings is the primary way members of the CAC stay informed and provide input on AOC activities. In addition to attending CAC meetings, the CAC members have been active in the AOC in the following ways: participated in tours of remediation and restoration projects, reviewed documents and provided letters of support for AOC projects, provided local representation or feedback at various state and federal AOC meetings, and hosted and participated in AOC open house events.

Removal Statement

The MDNR and WDNR AOC program staff recommend removal of the Restrictions on Fish and Wildlife Consumption BUI in the Lower Menominee River AOC. This decision is based upon review of the data and technical input from the MDHHS, MDEQ's Water Resources Division, WDNR Fisheries Management Program, WDHS, and USEPA.

References

ATSDR. 2006. Health Consultation: Health risks associated with arsenic in fish from arsenic-contaminated areas of the Menominee River near Tyco Safety Products – Ansul. Agency for Toxic Substances and Disease Registry, United States Department of Health and Human Services. https://www.atsdr.cdc.gov/hac/pha/AnsulChemical/Ansul-TycoSafetyProductsHC051506.pdf

AET. 2005. Eco-System Recovery: Lifting of Fish Consumption Advisories for Dioxin Downstream of U.S. Pulp Mills - 2005 Update. Alliance for Environmental Technology, Washington D.C. http://www.aet.org/reg_market_news/press_releases/2005/aet_fish.pdf?_sm_au_=ifVD0LqN6QNsnQ7Q

Baker, S. and S. Galarneau. 2011. Lower Menominee River Area of Concern Remedial Action Plan Proposed Removal Recommendation for the Restrictions on Recreational Contact Beneficial Use Impairment. Office of the Great Lakes, MDEQ, Lansing, Michigan and Office of the Great Lakes, WDNR, Madison, Wisconsin. http://dnr.wi.gov/topic/GreatLakes/documents/MenomineeRiverRecContact.pdf

Baker, S., L. Last, and C. Bougie. 2017. Removal Recommendation for the Degradation of Benthos Beneficial Use Impairment in the Lower Menominee River Area of Concern. Office of the Great Lakes, WDNR, Madison, Wisconsin and Office of the Great Lakes, MDEQ, Lansing, Michigan. http://dnr.wi.gov/topic/GreatLakes/documents/MRBenthosRemoval.pdf

Bohr, J. 2012. Investigation of PCB, PAH, and Pesticide Concentrations in the Menominee River Using Semi-Permeable Membrane Devices August 30-September 27, 2011. Water Resources Division, MDEQ, Lansing, Michigan. MI/DEQ/WRD-12/038. https://dnr.wi.gov/topic/GreatLakes/documents/LMRSPMDFinal.pdf

Bohr, J. 2017a. Status of Fish Contaminant Levels in the Lower Menominee River Area of Concern. Water Resources Division, MDEQ, Lansing, Michigan. MI/DEQ/WRD-16/005, Revised March 8, 2017. Attachment in http://www.michigan.gov/documents/mdhhs/MENOMINEE_RIVER_AOC_FISH_BUI_WHITE_PAPER_-_FINAL_2016-08_002_547090_7.pdf.

Bohr, J. 2017b. Personal communication.

Boldt, 2011. Lower Fox River Operable Unit 1 Post-Remediation Executive Summary. http://ua.dnr.wi.gov/topic/ImpairedWaters/FoxRiver/original/documents/OU1_Executive_Summary2011-03-29.pdf

Bougie, C., K. Axness, S. Galarneau, S. Inman, J. Killian, L. Last, V. Pappas, S. Baker, and S. Swart. 2017. Menominee River Area of Concern Restrictions on Dredging Activities Beneficial Use Impairment Removal Package and Dredge Management Plan. Office of the Great Lakes, WDNR, Madison, Wisconsin and Office of the Great Lakes, MDEQ, Lansing, Michigan. http://dnr.wi.gov/topic/GreatLakes/documents/MRDredgingRemoval.pdf

Bruneau, M. 2017. Review on the Status of Fish Contaminant Levels in the Lower Menominee River. MDCH, Lansing, Michigan. http://www.michigan.gov/documents/mdhhs/MENOMINEE_RIVER_AOC_FISH_BUI_WHITE_PAPER_-_FINAL_2016-08_002_547090_7.pdf.

Casey, S. 2017. Personal communication.

CH2MHill, 2014. Final Site Characterization Report: Assessment of Contaminated Sediments in the Lower Scott Flowage in the Menominee River Area of Concern Site. Prepared for USEPA. U.S. Environmental Protection Agency, 77 West Jackson Boulevard, Chicago, IL 60604.

Gilbert, F. A., Jr. 2005. Letter to Mr. Mike Hammers, WDNR. Stora Enso North America, January 10th, 2005.

GLWQA, 1987. Agreement on Great Lakes water quality, 1978, with annexes and terms of reference. *Signed at Ottawa November 22, 1978. Entered into force November 22, 1978.* 30 UST 1383; TIAS 9257; 1153 UNTS 187. Amendments: October 16, 1983 (35 UST 2370; TIAS 10798), November 18, 1987 (TIAS 11551; 2185 UNTS 504).

GLWQA, 2013. Agreement on Great Lakes water quality, 1978, with annexes and terms of reference. *Signed at Ottawa November 22, 1978. Entered into force November 22, 1978.* 30 UST 1383; TIAS 9257; 1153 UNTS 187. Amendments: October 16, 1983 (35 UST 2370; TIAS 10798), November 18, 1987 (TIAS 11551; 2185 UNTS 504), September 7, 2012 (TIAS 13-212), last amendment entered into force February 12, 2013. http://www.epa.gov/glnpo/glwqa/20120907-Canada-USA_GLWQA_FINAL.pdf.

Lepak, R. F., R. Yin, D. P. Krabbenhoft, J. M. Ogorek, J. F. DeWild, T. M. Holsen, and J. P. Hurley, 2015. Use of Stable Isotope Signatures to Determine Mercury Sources in the Great Lakes. Environ. Sci. Technol. Lett., 2015, 2 (12), pp 335–341. http://pubs.acs.org/doi/abs/10.1021/acs.estlett.5b00277

MDEQ, 2015. Sediment Chemistry of Rio Vista Slough, Menominee River Area of Concern, Menominee County, Michigan, June 24, 2014. MI/DEQ/WRD-15/023. Keiper, W. MDEQ-Water Resources Division, 525 W. Allegan, P.O. Box 30242, Lansing, MI 48909-7742

MDHHS, 2016. *Eat Safe Fish Guide: Upper Peninsula 2016*. http://www.michigan.gov/documents/mdch/MDCH_EAT_SAFE_FISH_GUIDE_-_UPPER_PENINSULA_WEB_455361_7.pdf

Taft, W.H. 1991. Interstate fish contaminant monitoring study of the Menominee River in the vicinity of the Champion International – Quinnesec Mill, Dickinson County, Michigan, April-September, 1989. MI/DNR/SWQ-90/110.

USEPA. 2004. Results of the Lake Michigan Mass Balance Study: Mercury Data Report. U.S. Environmental Protection Agency, Office of Research and Development. EPA 905 R-01-012. https://www.epa.gov/sites/production/files/2015-08/documents/lmmbhg.pdf.

USEPA. 2006. Results of the Lake Michigan Mass Balance Project: Polychlorinated Biphenyls Modeling Report. U.S. Environmental Protection Agency, Office of Research and Development. EPA-600/R-04/167. 621 pp. http://1.usa.gov/1QHagE6

USPC, 2001. Restoring United States Areas of Concern: Delisting Principles and Guidelines. Adopted by the United States Policy Committee, December 6, 2001. . https://www.epa.gov/sites/production/files/2015-08/documents/aoc-delisting-principles-guidelines-20011206.pdf

Williams, L., R. A. Schoof, J. W. Yager, and J. W. Goodrich-Mahoney. 2006. Arsenic Bioaccumulation in Freshwater Fishes. Human and Ecological Risk Assessment: An International Journal Vol. 12, Iss. 5, 2006. http://www.redorbit.com/news/science/750857/arsenic_bioaccumulation_in_freshwater_fishes/

WDNR, n.d. Green Bay's Other Perch. http://dnr.wi.gov/topic/fishing/documents/consumption/WhitePerchPCBGreenBay.pdf

WDNR, 1996. The Lower Menominee River Remedial Action Plan Update. PUBL WR-410 96. http://dnr.wi.gov/topic/greatlakes/documents/MenomineeRiverRAP1996.pdf.

WDNR, 2011. Press Release *Successfully Cleaning up the Fox River*. http://ua.dnr.wi.gov/topic/ImpairedWaters/FoxRiver/original/documents/PCB_monitoring_results_for_Little_Lake_Butte_des_Morts.pdf

WDNR and MDEQ. 2008. Lower Menominee River AOC BUI Restoration Targets. Office of the Great Lakes, WDNR, Madison, Wisconsin and Water Resources Division, MDEQ, Lansing, Michigan. http://dnr.wi.gov/topic/greatlakes/documents/MenomineeRiverDelistingTargets2008.pdf.

WDNR and MDEQ. 2011. Stage 2 Remedial Action Plan for the Lower Menominee River Area of Concern, Office of the Great Lakes, WDNR, Madison, Wisconsin and Office of the Great Lakes, MDEQ, Lansing, Michigan. http://dnr.wi.gov/topic/greatlakes/documents/Stage2RAPLowerMenomineeRiver.pdf.

WDNR and MDNR. 1990. The Lower Menominee River Remedial Action Plan Stage One Report. PUBL WR-246 90. http://dnr.wi.gov/topic/greatlakes/documents/MenomineeRiverRAPStage1Report1990.pdf.

List of Acronyms and Initialisms

AOC	Area of Concern
BQF	Big Quinnesec Flowage
BUI	Beneficial Use Impairment
CAC	Citizens Advisory Committee
CHF	Chalk Hill Flowage
DMD	Menominee River Downstream of the Menominee Dam
GLWQA	Great Lakes Water Quality Agreement
GLRI	Great Lakes Restoration Initiative
LBDN	Little Bay De Noc
LLBDM	Little Lake Butte Des Morts
LSF	Lower Scott Flowage
MD	Menominee Dam
MDEQ	Michigan Department of Environmental Quality
MDHHS	Michigan Department of Health and Human Services
MDNR	Michigan Department of Natural Resources
NPDES	National Pollutant Discharge Elimination System
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PMD	Park Mill Dam
QM	Quinnesec Mill
RAP	Remedial Action Plan
SPMD	Semi-permeable membrane device
TAC	Technical Advisory Committee
USEPA	U.S. Environmental Protection Agency
WDHS	Wisconsin Department of Health Services
WDNR	Wisconsin Department of Natural Resources
WPSC	Wisconsin Public Service Corporation
WRF	White Rapids Flowage

Definitions

Area of Concern (AOC) - Defined by Annex 2 of the 1987 Protocol to the U.S.-Canada Great Lakes Water Quality Agreement (GLWQA, 1987) as "geographic areas that fail to meet the general or specific objectives of the Agreement where such failure has caused or is likely to cause impairment of beneficial use or of the area's ability to support aquatic life." These areas are, or were, the "most contaminated" areas of the Great Lakes, and the purpose of the AOC program is to bring these areas to a point at which they are not environmentally degraded more than other comparable areas of the Great Lakes. When that point has been reached, the AOC can be removed from the list of AOCs in the Annex, or "delisted." The GLWQA can be found at http://www.ijc.org/rel/agree/quality.html

Beneficial Use Impairment (BUI) - Defined by the QLWQA as a reduction in the chemical, physical, or biological integrity of the waters of the Great Lakes sufficient to cause impairment to a designated use (GLWQA, 2013). The Lower Menominee River AOC has three BUIs remaining: restrictions on fish and wildlife consumption; degradation of fish and wildlife populations; and loss of fish and wildlife habitat.

Beneficial use(s) are ways that a water body can improve the quality of life for people or for fish and wildlife. For example, providing habitat for fish and wildlife is a beneficial use of a water body. If a beneficial use is suppressed or unavailable due to environmental problems, like loss of habitat, then that beneficial use is considered impaired. The International Joint Commission provided a list of 14 possible beneficial use impairments in the 1987 amendments to the GLWQA.

Fish Consumption Advisory - Some fish from certain waterbodies contain harmful chemicals. These chemicals build up in the fish over time, and can build up in people when they eat the fish. The WDNR and MDEQ routinely test fish and issue recommendations typically to "eat no more than" or "eat up to," on how much fish a person could eat based on protecting human health from contaminants which may be found in fish. Current Wisconsin and Michigan fish consumption advisories are available online at http://dnr.wi.gov/topic/fishing/consumption/ and www.michigan.gov/eatsafefish.

Polychlorinated Biphenyls (PCBs) - A group of more than 200 compounds, PCBs have been manufactured since 1929 for uses including electrical insulation, hydraulics, fluorescent lights, and carbonless paper to name a few. In 1979, PCBs were banned because of their persistence in the environment and tendency to magnify up the food chain. They have been linked to reproductive problems in wildlife and are suspected of causing developmental problems in human infants.

Polycyclic Aromatic Hydrocarbons (PAHs) - Chemicals commonly associated with oils, greases, and other components derived from petroleum. Some PAH compounds have been identified as cancer or mutation causing.

Remedial Action Plan (RAP) - A RAP is developed for each AOC to identify the status of BUIs and their sources, document restoration targets, and list actions needed to reach those targets. RAPs are updated periodically to report progress toward achieving the restoration targets. This Plan, along with the most current RAP Update for the Lower Menominee River AOC, constitutes a complete strategy for removing all BUIs in the Lower Menominee River AOC.

Restoration Target - Specific goals and objectives established to track restoration progress of beneficial use impairments. Once targets have been met, the beneficial use is no longer considered impaired. Targets should be locally derived. Working with the Lower Menominee AOC Citizens Advisory Committee, delisting targets were developed in partnership with the WDNR and the MDEQ. Wisconsin and Michigan use different criteria when assessing BUIs. The agencies and CAC agreed to implement the most restrictive criteria from either state when developing the Menominee AOC specific delisting targets.

Appendices

Appendix A	Lower Menominee River AOC CAC letter supporting BUI removal, July 24, 2017
Appendix B	Lower Menominee River AOC CAC July 20th and TAC May 24th meeting announcements, agendas, and minutes
Appendix C	Status of Fish Contaminant Levels in the Lower Menominee Area of Concern, March 2017, Joseph Bohr, MDEQ
Appendix D	2017 Review on the Status of the Fish Contaminant Levels in the Lower Menominee River, Michelle Bruneau, MDHHS

Appendix A Lower Menominee River AOC CAC letter supporting BUI removal, July 24, 2017

LOWER MENOMINEE RIVER

Lower Menominee River Area of Concern Citizens Advisory Committee

The Lower Menominee River: A Great Lakes Area of Concern

July 24, 2017

Laurel Last
Lower Menominee River AOC Coordinator
Wisconsin Department of Natural Resources
2984 Shawano Avenue
Green Bay, Wisconsin 54313

Stephanie Swart
Lower Menominee River AOC Coordinator
Michigan Department of Environmental Quality
Constitution Hall 6FS
525 West Allegan Street
PO Box 30473
Lansing, Michigan 48909

Subject: Support for the Lower Menominee River AOC Fish Consumption BUI Removal

Dear Ms. Last and Ms. Swart:

The Lower Menominee River Area of Concern (AOC) Citizens Advisory Committee (CAC) supports the efforts of the Wisconsin Department of Natural Resources (WDNR) and the Michigan Department of Environmental Quality (MDEQ) to remove the Fish Consumption Beneficial Use Impairment (BUI) from the Lower Menominee River AOC.

Over the years, the CAC has partnered with local, state, and federal agencies, businesses, and volunteers to clean up toxic sediments and other contamination issues in the AOC. It has also worked closely with various stakeholders to educate the public on the hazards of mercury and other pollutants that persist in regional waters, as well as the steps to be taken for safer fish consumption.

Signage that details the best practices for safe fish consumption within the AOC has been posted at boat launches and other prominent locations. Recently completed projects in the AOC to remove extremely large volumes of contaminated sediments are expected to reduce the introduction of such contaminants into the food webs occupied by most game and commercial fish.

The CAC believes that these actions along with the dedication of the WDNR, the MDEQ, the USEPA and other partners to continuing to improve the quality of fish stocks within the Lake Michigan basin clearly merits the removal of this Fish Consumption BUI.

Thank you for your time and consideration.

Respectfully Submitted,

Keith West
CAC Wisconsin Co-Chair
keith.west@uwc.edu

Mark Erickson
CAC Michigan Co-Chair
merickson@lloydflanders.com

Appendix B Lower Menominee River AOC CAC July 20th and TAC May 24th meeting announcements, agendas, and minutes

Last, Laurel L - DNR

From:	Last, Laurel L - DNR
Sent:	Monday, May 15, 2017 10:53 AM
To:	' (albrightc@michigan.gov)'; ' (mistakj@michigan.gov)'; 'Angela Pierce'; Axness, Kendra A - DNR; 'Betsy Galbraith'; Bougie, Cheryl - DNR; 'Brian Hinrichs'; 'Darren Kramer'; 'Derek Strohl'; 'Donna Buechler (menomineecd@gmail.com)'; Donofrio, Michael C - DNR; 'Ed Johnson'; 'Emily Lang (emily.lang@resolutefp.com)'; 'Gail Clark'; Galarneau, Stephen G - DNR; 'Greg Cleereman'; 'Greg Sevener'; 'Gumtow, Jon'; Halfmann, David A - DNR; Hudak, Andrew J - DNR; Huff, John J - DNR; 'Jennifer Johnson (JohnsonJ17 @michigan.gov)'; 'John Groleau (John.groleau@resolutefp.com)'; 'John Perecone (Perrecone.John@epamail.epa.gov)'; 'Ken Potrykus (ken.potrykus@foth.com)'; Killian, James - DNR; 'Lori Ostanek-Maki (makil@michigan.gov)'; 'Mandy Annis (mandy_annis@fws.gov)'; 'Margaret Gielniewski'; 'Mark Erickson (merickson@lloydflanders.com)'; 'Mark Erickson (merickson1705@gmail.com)'; 'Martin Kuhn (Martin.T.Kuhn@usace.army.mil)'; Masterson, John P - DNR; 'Michael Mikulka'; 'Mike Grimm'; 'Nancy Douglas'; 'Neal, Conor'; 'Nick Utrup'; Paoli, Tammie J - DNR; Pappas, Victor C - DNR; 'Richer, Renee'; 'Rick Hobrla (hobrlar@michigan.gov)'; 'Sarah_Warner@fws.gov'; 'Sharon Baker (sharonbaker1951@gmail.com)'; 'Stephanie Swart (swarts@michigan.gov)'; 'Steven Zander (yellowchevyz@yahoo.com)'; 'Steven_Choy@fws.gov'; 'Susan Pastor (pastor.susan@epa.gov)'; 'Trygve Rhude (rhude@new.rr.com)'; Uvaas, Benjamin J - DNR; 'Wendel Johnson (biota@new.rr.com)'; 'West, Keith'
Cc:	'Bohr, Joseph (DNRE)' (BOHRJ@michigan.gov); Bruneau, Michelle (DCH) (BruneauM@michigan.gov); 'LEDERLEP@michigan.gov'
Subject:	RE: Lower Menominee River AOC TAC meeting May 24th, 1 to 3 pm
Attachments:	TAC Agenda 5-24-17.doc

Hi, Everyone,

See attached for the agenda for next week's Lower Menominee River AOC Technical Advisory Committee meeting. Let me know if you have any questions or comments about the draft Restrictions on Fish Consumption BUI removal document that you would like to share before the meeting. See you the 24th!

Thanks,

Laurel

We are committed to service excellence.
Visit our survey at http://dnr.wi.gov/customersurvey to evaluate how I did.

Laurel L. Last
Phone: (920) 662-5103
laurel.last@wisconsin.gov

From: Last, Laurel L - DNR
Sent: Tuesday, May 02, 2017 2:27 PM

Subject: Lower Menominee River AOC TAC meeting May 24th, 1 to 3 pm

Hi, Everyone,

Thank you to those who filled out the Doodle poll for our next Technical Advisory Committee meeting. Let's plan to meet on May 24th from 1 to 3 pm Central (2 to 4 pm Eastern). There will be a call-in option for those who can't make it in person. I've attached the draft Restrictions on Fish Consumption BUI removal document so you can review it before the meeting. If you will be participating in the meeting, feel free to bring your comments and questions for the discussion. If you won't be able to make the meeting, then please let me know if you have comments or edits before the 24th. Besides the draft Fish Consumption BUI removal document discussion, we'll also have time for updates on the other remaining BUIs and the habitat restoration projects. I'll send out an agenda the week before the meeting. Just let me know if you have any suggestions for topics.

Note that Sharon Baker retired at the end of January, so Stephanie Swart is now our Michigan AOC Coordinator. Stephanie and I worked together to get the draft BUI removal document ready for your review. If you haven't met Stephanie yet, you'll get the chance at our May 24th meeting, as she'll be participating by phone. Thanks, Everyone!

See (or hear) you in 3 weeks!

Laurel

We are committed to service excellence.
Visit our survey at http://dnr.wi.gov/customersurvey to evaluate how I did.

Laurel L. Last
Phone: (920) 662-5103
laurel.last@wisconsin.gov

From: Last, Laurel L - DNR
Sent: Thursday, April 27, 2017 10:08 AM
Subject: Please respond: Doodle poll for May Lower Menominee River AOC TAC meeting

Dear Lower Menominee River AOC Technical Advisory Committee members and friends,

I know it's been a while since we met, but it's time to get the team together again! Let's meet in May to discuss the draft Restrictions on Fish Consumption BUI removal document. I'll send you all the document next week so you can review it before the meeting. We'll also have a chance to discuss the status and progress of the other remaining BUIs and the habitat restoration projects. Please fill out the Doodle poll at http://doodle.com/poll/5merdixcnnb7v38z by next Wednesday (May 3rd) and let me know your availability. Note that there will be a call-in option for those who can't make it in person.

If you haven't seen it yet, here's the link to the 2016 Remedial Action Plan Update: http://dnr.wi.gov/topic/greatlakes/documents/LMRRAP2016.pdf

I'm looking forward to a great discussion! Thank you all for your help in restoring our AOC. Just let me know if you have any questions.

Take care,

Laurel

We are committed to service excellence.
Visit our survey at http://dnr.wi.gov/customersurvey to evaluate how I did.

Laurel L. Last
Lower Menominee River Area of Concern Coordinator
Office of Great Waters – Lake Michigan, Lake Superior, and Mississippi River
Wisconsin Department of Natural Resources
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dnr.wi.gov

Lower Menominee River Area of Concern
Technical Advisory Committee Meeting Agenda
May 24th, 2017
1:00 – 3:00 pm CST
WDNR Service Center
101 N Ogden Rd, Peshtigo, WI

Dial-in Audio Number: 1-(855)-947-8255 or 1-(630)-424-2356 Access Code: 9205-440#

Meeting Objectives

- TAC members discuss and provide input on the draft Restrictions on Fish Consumption BUI removal document
- TAC members decide whether to support moving forward with BUI removal process
- TAC members are updated on the status of the other remaining BUIs
- TAC members are updated on the AOC habitat restoration projects

Agenda

1:00 Introductions and review of the agenda

1:10 Draft Restrictions on Fish Consumption BUI removal document – Laurel Last (WDNR) and Stephanie Swart (MDEQ)
- Overview of draft document (e-mailed by Laurel on May 2nd)
- Proposed schedule for review and submittal to EPA
- TAC members discuss and provide input on draft
- TAC members decide whether to support moving forward with BUI removal process

1:40 Updates on other remaining BUIs
- Restrictions on Dredging Activities BUI – Cheryl Bougie (WDNR)
- Degradation of Benthos BUI – Laurel
- Fish and Wildlife Habitat and Populations BUIs – Laurel and Cheryl

1:50 South Channel Habitat Project Update – Laurel and Cheryl

2:10 Menekaunee Harbor Project Update – Cheryl

2:20 Lower Menominee River Fish Passage Update – Laurel

2:30 Island Rookery Habitat Enhancement Project update – Laurel

2:45 Other News

- 2016 RAP Update
- AOC Conference
- Waterfront Cleanup report
- AOC Celebration plans
- AOC signs
- AOC video
- Others?

2:55 Future Agenda Items and Next Meeting Date

3:00 Adjourn

CONTACT INFORMATION

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Stephanie Swart, Michigan DEQ
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John Perrecone, EPA Area of Concern Task Force Leader
Perrecone.John@epamail.epa.gov
312-353-1149

ONLINE RESOURCES

EPA – http://www.epa.gov/grtlakes/aoc/menominee/index.html

MDEQ – http://www.michigan.gov/deq/0,1607,7-135-3313_3677_15430_57388---,00.html

WDNR – http://dnr.wi.gov/topic/greatlakes/menominee.html

CAC – https://www.facebook.com/menomineeriveraoc, http://www.menomineewatershed.com/

2016 RAP Update
http://dnr.wi.gov/topic/greatlakes/documents/LMRRAP2016.pdf

2015 RAP Status Report
http://dnr.wi.gov/topic/greatlakes/documents/Menominee2015RAPUpdate.pdf

2013 F&W Plan
http://dnr.wi.gov/topic/greatlakes/documents/Menominee2013FishAndWildlifePlan.pdf

Lower Menominee River Area of Concern
Technical Advisory Committee Meeting
May 24th, 2017, 1:00 – 3:00 pm CST
WDNR Service Center
101 N Ogden Rd, Peshtigo, WI
Minutes prepared by Laurel Last

Meeting Objectives

- TAC members discuss and provide input on the draft Restrictions on Fish Consumption BUI removal document
- TAC members decide whether to support moving forward with BUI removal process
- TAC members are updated on the status of the other remaining BUIs
- TAC members are updated on the AOC habitat restoration projects

Attendees
Cheryl Bougie (WDNR), David Halfmann (WDNR), Jennifer Johnson (MDNR, by phone), Wendel Johnson (UW-Marinette), Laurel Last (WDNR), Conor Neal (USEPA, by phone), Tammie Paoli (WDNR), Vic Pappas (WDNR), John Perrecone (USEPA-GLNPO, by phone), Stephanie Swart (MDEQ, by phone)

Introductions and review of the agenda

Draft Restrictions on Fish Consumption BUI removal document – Laurel Last (WDNR) and Stephanie Swart (MDEQ)

- Overview of draft document (e-mailed by Laurel on May 2nd)
  - Follows general format of previous BUI removal documents
  - Cites and relies heavily on information from MDEQ / MDHHS fish contaminant study report and white paper
  - Describes study results and shows that BUI can be removed
  - Draft has been reviewed by WDNR and MDEQ staff
  - Draft has been submitted to USEPA GLNPO for review
- Proposed schedule for review and submittal to EPA
  - TAC will provide input on draft and decide whether to support BUI removal
  - EPA GLNPO is also reviewing current draft
  - Address comments and send revised draft to CAC for input and approval in June or July
  - Topic of discussion for July CAC meeting
  - With CAC letter of support, move forward with public review process
  - Finalize document by end of September
- TAC members discussed and provided input on draft

  - Conor—Background section states arsenic contamination was main reason for AOC designation. Why isn't arsenic included in BUI target?
  - Laurel—Neither state has fish consumption advisories for arsenic. Thinks it's not bioaccumulated; will check on this and add explanation to document.
  - Conor—Can we say arsenic is controlled (at the Ansul/Tyco remediation site), or should we wait for results of 5-year review?
  - John—AOC program is not regulatory; can remove BUIs before 5-year review
  - Tammie—Figure 6 is good; would like to see similar figures for other contaminants
  - Tammie—Would like to see more information on what contaminant levels mean for health effects/advisories
  - Wendel—What about future monitoring?
  - Laurel and Stephanie—Both states will continue regular monitoring for fish consumption advisories
- John—Beth Murphy is reviewing document for EPA. Agrees that data supports BUI removal. Will send Laurel and Stephanie comments in a week or two.
- *TAC members agreed to support moving forward with BUI removal process*
- *Laurel and Stephanie will address comments and prepare next draft for CAC review*

Updates on other remaining BUIs

- Restrictions on Dredging and Degradation of Benthos BUIs – John Perrecone (USEPA)
  - States submitted final removal documents to EPA in November
  - Some discussion and questions related to Tyco request for variance and source of 20 ppm arsenic target
  - Issues now resolved, and sent concurrence letters yesterday
  - Two more BUIs officially removed!
- Fish and Wildlife Habitat and Populations BUIs – Laurel and Cheryl
  - Will review habitat project monitoring results through 2017
  - Confirm that Goals and Objectives from the 2013 Fish and Wildlife Plan have been met
  - Confirm that necessary Activities from Fish and Wildlife Plan are completed
  - Move ahead with BUI removal document draft and review process
  - Goal is to remove BUIs in 2018
- John—Will take 6-9 months to delist the AOC after all BUIs are removed
- Stephanie's recent experience with the process will help us save some time
- Laurel—Goal is to delist in 2018, so we will aim for early 2018 to remove the fish and wildlife BUIs

South Channel Habitat Project Update – Laurel and Cheryl

- Laurel shared handout with project summary and map
- Continuing to work with City of Marinette on GLRI-funded restoration project
- Reminder—Project design was modified last year due to high bids and water levels
- Modifications included removing bar extensions, adjusting for water levels, adding fish sticks and pike spawning access, and increasing project area (City property)
- Aquatic Ecological Services (AES) completed most work last year, so AOC management actions could be "substantially complete" in 2017
- Osprey nesting platform is being used!
- This year so far:
  - Picked up and removed debris and garbage
  - Installed missing tree tubes and fixed broken stakes, damaged plant protections, and fencing
  - Installed remaining live stakes and bare root plants
  - Began first invasive species herbicide application
- What's left to do:
  - Complete site preparation activities end of May
  - Install remaining live plants early June
  - Begin 3–year monitoring and maintenance period this summer (ends 2019)
  - REL is planning two site assessments, one in summer and one in fall
  - Keith West (UW-Marinette) would like to have students assist with long-term monitoring and maintenance, but his summer lab was cancelled

Menekaunee Harbor Project Update – Cheryl

- Second year of monitoring and maintenance
- Fixed fences, replaced shrouds, etc.
- Year 1 annual monitoring report: project is on track
- *John asked to see monitoring report; Cheryl will send it to him*
- Added 6.7 acres to project for invasive plant control
- Laurel and Cheryl helped Keith West (UW-Marinette) install tern nesting platforms
- City of Marinette installed kayak launch and boat ramp on north side, and is installing transient docks
- City will hold harbor dedication on August 16th during national walleye fishing tournament
- Will re-assess wild rice and decide whether to plant again this year
- Monitoring and maintenance period (contract) ends in 2018
- Keith would like to have students assist with long-term monitoring and maintenance

Lower Menominee River Fish Passage Update – Laurel

- Downstream passage at Menominee Dam was completed last year

- Downstream passage working at both dams without issue since ice out
- Contractor is there this week installing cameras so we can monitor whether fish are using these devices
- Cameras will be connected to computers so images can be saved for later review
- Fish lift was used for four weeks this spring; last time was last week
- Moved record number of sturgeon upstream this spring: 20 males and 29 females
- Maximum number of sturgeon to be moved per year per agreement is 90
- Question—What size fish are moved? Answer—those over 50 inches long
- Question—Will video be available online? Would be great if public could view fish in action.
- Jennifer—Not sure if there are plans for that. Might need to get permission from Eagle Creek (dam owner).
- John—Would like to have pictures or videos of fish for presentations

Island Rookery Habitat Enhancement Project update – Laurel

- Shared handouts—2016 summary and update from this spring
- Project is on track, scheduled to complete this year
- Mechanical and chemical control of invasive plants
- Selective planting of natives (20% in fall 2016)
- Bird community and vegetation monitoring
- Strawberry Island rookery activity surveys
  - 57 active nests in 2016
  - 65 active nests in 2017, including 58 great egret, plus some great blue heron and black-crowned night herons
- Remaining activities
  - Continue chemical and mechanical control as needed
  - Complete remaining 80% of restoration planting effort in spring and fall
  - Continue bird community and vegetation surveys
  - Provide tours to communicate invasive species conditions and status of habitat restoration
  - Transfer technical and monitoring data to entities that can develop and implement a long-term resource management plan
- Requesting funding for another year (2018) of monitoring and maintenance

Other News

- 2016 RAP Update—complete (see link below)
- AOC Conference
  - March 29-30 in Grand Rapids, Mich.
  - Donna Buechler (MCD), Laurel, and Stephanie attended

- May 6th Waterfront Cleanup report
  - Successful event!
  - 38 volunteers
  - 40 bags of trash
  - Tire, door frame, large sign, part of a kiddie pool, sink, styrofoam, plastic of all sorts
  - Venue provided by Jon Kukuk (Nestegg Marine)
  - Pizza supplied by M&M Great Lakes Sport Fishermen
  - CAC members agreed they would like to hold annual spring event
  - Thank you to everyone who helped out!
- AOC Celebration plans
  - August 16-18th national walleye tournament championship will be based at Menekaunee Harbor in Marinette
  - CAC members agreed they would like to hold AOC Celebration in conjunction with walleye tournament championship
  - Event would celebrate BUI removals and work done to restore LMR AOC
  - City is planning Menekaunee Harbor dedication for 11 am August 16th
  - Since invitee lists will be similar, CAC decided to hold AOC event after dedication
  - Tentative schedule: AOC event kick-off/welcome 12-1 pm, AOC tour 1-3 pm
  - Speakers from USEPA, WI, MI, CAC (Trygve volunteered), legislators (5 min. each)
  - Refreshments: Provide beverages and sheet cake with sturgeon design
  - Bus tour to view key sites—South Channel, dredge project areas, etc.
  - There will already be buses/shuttles for the tournament—coordinate with the City
  - Rent large tent and invite presenters/displays similar to last year's Open House
  - CAC members will coordinate with City and fishing championship planning committee
  - Stay tuned for more details!
- AOC signs
  - South Channel and new Menekaunee Harbor signs in progress
    - Shared draft sign designs
    - Will finalize designs and send off for printing in May or early June
  - Other priorities (still need to design):
    - AOC overview with habitat and sediment projects
    - Ansul/Tyco and WPS cleanup signs
  - *John—Would like to see sign designs; Laurel will send them*
- New AOC video focused on South Channel—not moving ahead yet, but should hear soon

- Spring AOC newsletter—Will be out soon; Laurel submitted articles on island habitat project and waterfront cleanup event

Future Agenda Items and Next Meeting Date

- Next meeting date—no set date, will plan as needed
- Potential Agenda Topics for next meeting
  - Restrictions on Fish Consumption BUI
  - Fish and Wildlife Habitat and Populations BUIs
  - Updates on habitat restoration projects

CONTACT INFORMATION

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John Perrecone, EPA Area of Concern Task Force Leader
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312-353-1149

ONLINE RESOURCES

EPA – http://www.epa.gov/grtlakes/aoc/menominee/index.html

MDEQ – http://www.michigan.gov/deq/0,1607,7-135-3313_3677_15430_57388---,00.html

WDNR – http://dnr.wi.gov/topic/greatlakes/menominee.html

CAC – https://www.facebook.com/menomineeriveraoc, http://www.menomineewatershed.com/

2016 RAP Update

http://dnr.wi.gov/topic/greatlakes/documents/LMRRAP2016.pdf

2015 RAP Status Report

http://dnr.wi.gov/topic/greatlakes/documents/Menominee2015RAPUpdate.pdf

2013 F&W Plan

http://dnr.wi.gov/topic/greatlakes/documents/Menominee2013FishAndWildlifePlan.pdf

Last, Laurel L - DNR

From:	Last, Laurel L - DNR
Sent:	Thursday, June 29, 2017 3:47 PM
To:	'Becky Berry (berrb8050@students.uwc.edu)'; 'Bill Ray (wmray03@centurylink.net)'; 'Brian Bartoszek (bfbartoszek@integrysgroup.com)'; 'Chuck Boyle (chuck@boyledesigngroup.net)'; 'Denise Taylor (wdtaylor@wildblue.net)'; 'Donna Buechler (menomineecd@gmail.com)'; 'Doug Oitzinger (doitzinger@new.rr.com)'; 'ed baetke (ebaetke@gmail.com)'; 'Emily Lang (emily.lang@resolutefp.com)'; 'Gail Clark'; 'Gene Davenport'; 'Greg Sevener'; 'Guy Reiter (anahkwet@hotmail.com)'; 'James Rettke'; 'Jean Arnold (djarnold63@aol.com)'; 'jim Cox (jimcox@tycoint.com)'; 'Jim Fossum'; 'jlshort@wisconsinpublicservice.com'; 'John Clark'; 'John Groleau (John.groleau@resolutefp.com)'; 'Jon Kukuk'; 'Joseph Stone (stonj1995 @students.uwc.edu)'; 'Karen Purgill (Knpurgill@gmail.com)'; 'Ken and Sandy Olive'; 'Ken Potrykus (ken.potrykus@foth.com)'; 'Linda Garcia (sunnylg96@gmail.com)'; 'Mark Erickson (merickson@lloydflanders.com)'; 'Mark Erickson (merickson1705@gmail.com)'; 'mike and renae alswager-klein'; 'Miller, Brian'; 'Nancy Douglas'; 'Pat and Glenda Keiran'; 'Paul Theis (pgtheis@hotmail.com)'; 'Raj Shukla (rshukla@wisconsinrivers.org)'; 'Rich Mator (rmator@tyco.com)'; 'Richer, Renee'; 'Rick Loeffler (rloeffler@centurytel.net)'; 'SNadeau@honigman.com'; 'Stephen Kellner (skellner1@new.rr.com)'; 'Stephen V. Donohue (steve.donohue@foth.com)'; 'Steven Zander (yellowchevyz@yahoo.com)'; 'Thomas Thuemler'; 'Trygve Rhude (rhude@new.rr.com)'; 'Valerie Mellon (vmellon@cityofmenominee.net)'; 'Wendel Johnson (biota@new.rr.com)'; 'West, Keith'
Cc:	'Bohr, Joseph (DNRE)' (BOHRJ@michigan.gov); 'Angela Kowalzek-Adrians'; 'Anne Bartels (ABartels@marinettecounty.com)'; Axness, Kendra A - DNR; 'Betsy Galbraith'; Bougie, Cheryl - DNR; 'Brian Hinrichs'; 'Deborah Nett'; 'Derek Strohl'; DuFresne, Kristin I - DNR; Galarneau, Stephen G - DNR; 'Greg Cleereman'; 'Heather Williams (Williams.heather@Epa.gov)'; 'Jay Settersten (jay@settertech.com)'; 'Jennifer Johnson (JohnsonJ17@michigan.gov)'; 'John Lefebvre'; 'John Perecone (Perrecone.John@epamail.epa.gov)'; Killian, James - DNR; 'Lori Ostanek-Maki (makil@michigan.gov)'; 'Margaret Gielniewski'; Masterson, John P - DNR; 'Michelle Bruneau'; 'Mike Grimm'; 'Mikulka.Michael@epamail.epa.gov'; 'Nick Utrup'; Paoli, Tammie J - DNR; Pappas, Victor C - DNR; Punke, Emily M - DNR; 'Rafael P. Gonzalez (gonzalez.rafaelp@epa.gov)'; 'Ryan Van Camp (rvancamp@sehinc.com)'; 'Scherbert, Lynn'; 'Sharon Baker (sharonbaker1951@gmail.com)'; 'Stephanie Swart (swarts@michigan.gov)'; 'Steven_Choy@fws.gov'; Stoll, Richard C - DNR; 'Susan Pastor (pastor.susan@epa.gov)'; Uvaas, Benjamin J - DNR
Subject:	Please review: Lower Menominee River AOC draft fish consumption BUI removal recommendation
Attachments:	LMR Fish BUI Removal draft 06292017 for CAC.pdf

Dear Lower Menominee River AOC Citizens Advisory Committee members and friends,

Please see attached for the latest draft of the Lower Menominee River AOC "Restrictions on Fish Consumption" BUI removal recommendation document. We will be discussing this document at our next Citizens Advisory Committee (CAC) meeting on July 20th. The AOC Technical Advisory Committee (TAC) has approved moving ahead with the BUI removal, and I've revised the document in response to comments from TAC members and Elizabeth Murphy, our EPA reviewer. At the July 20th meeting, we'll be asking for CAC input and support to move forward with the BUI removal. Feel free to send me your questions and comments before the 20th, especially if you won't be able to attend the meeting.

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The meeting will be at the usual place (UW-Marinette) and time (6 pm/7 pm Eastern). Donna will send out a meeting agenda closer to the date. The other main topic of the meeting will be planning for the August 16th AOC Celebration outreach event. See you on the 20th!

Thanks so much for all your help!

Laurel

We are committed to service excellence.
Visit our survey at http://dnr.wi.gov/customersurvey to evaluate how I did.

Laurel L. Last
Lower Menominee River Area of Concern Coordinator
Office of Great Waters – Lake Michigan, Lake Superior, and Mississippi River
Wisconsin Department of Natural Resources
Phone: (920) 662-5103
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laurel.last@wisconsin.gov


dnr.wi.gov


Last, Laurel L - DNR

From: Executive Director <menomineecd@gmail.com>
Sent: Thursday, July 13, 2017 9:39 AM
To: Punke, Emily M - DNR; Johnsonj17@michigan.gov; Axness, Kendra A - DNR; makil@michigan.gov; Angela Pierce; Anne Bartels (ABartels@marinettecounty.com); Uvaas, Benjamin J - DNR; Betsy Galbraith; Brian Hinrichs; Deborah Nett; Derek Strohl; Greg Cleereman; Heather Williams (Williams.heather@Epa.gov); Killian, James - DNR; Jay Settersten; John Lefebvre; Masterson, John P - DNR; John Perecone (Perrecone.John@epamail.epa.gov); DuFresne, Kristin I - DNR; Lynn Scherbert; Margaret Gielniewski; Michelle Bruneau; Mike Grimm; Mikulka.Michael@epamail.epa.gov; Nick Utrup; Rafael P. Gonzalez (gonzalez.rafaelp@epa.gov); Stoll, Richard C - DNR; Ryan Van Camp (rvancamp@sehinc.com); Galarneau, Stephen G - DNR; Steven_Choy@fws.gov; Susan Pastor (pastor.susan@epa.gov); Paoli, Tammie J - DNR; Pappas, Victor C - DNR; SNadeau@honigman.com; Bill Ray; Brian Miller; Chuck Boyle; Denise Taylor; Doug Oitzinger; Ed Baetke; Emily Lang; Gail Clark; Greg Sevener; Guy Reiter; James Rettke; Jean Arnold; Jim Fossum; John Clark; John Groleau; Ken & Sandy Olive; Ken Potrykus; Linda Garcia; Mike & Renae Alswager-klein; Pat & Glenda Keiran; Paul Theis; Raj Shukla; Renee Richer; Rich Mator; Rick Loeffler; Robin Quigley; Short, Jennifer L; Stephen Donohue; Steven Zander; Valerie Mellon; Becky Berry; Bougie, Cheryl - DNR; Donna Buechler; jim Cox (jimcox@tycoint.com); Jon Kukuk; Keith West; Last, Laurel L - DNR; Mark Erickson; Mark Erickson; Nancy Douglas; Stephanie Swart; Stephen Kellner (skellner1@new.rr.com); Trygve Rhude (rhude@new.rr.com)
Subject: July agenda
Attachments: CAC Agenda 7-20-17.doc

Attached is a copy of the agenda for July's CAC meeting.

Also Laurel would like me to remind you to look at the draft fish consumption BUI removal document she sent out a few weeks ago. See you next week.

--
Donna Buechler
Executive Director
Menominee Conservation District
906-753-6921 ex 101

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Lower Menominee River Area of Concern
Citizens Advisory Committee Meeting Agenda
July 20th, 2017
6:00 – 8:00 p.m. CST

Call-in: 1-(855)-947-8255 or 1-(630)-424-2356 Access Code: 9205-440#

Theatre/Fine Arts Building Conference Room (T-139)
(online map: http://www.marinette.uwc.edu/about/campus-maps/)

DESIRED OUTCOMES

- CAC members discuss AOC outreach
  - Continue planning for August 16th AOC Celebration
  - Share updates on educational signs, video, and other AOC outreach projects
- CAC members provide input on draft Restrictions on Fish Consumption BUI removal document and decide whether to provide letter of support for BUI removal

AGENDA

6:00 Introductions, Overview of Agenda, Review of Minutes – Mark Erickson and Keith West, CAC Co-Chairs

6:10 Community Outreach

- AOC Celebration planning – Keith West and others
  - Share current plans and ask for input from CAC members
    - Event location and layout
    - Schedule
    - Tours
    - Invitations—speakers, presenters (tables), and others
    - Rentals—bus, tent, tables, chairs
    - Publicity
    - Food/refreshments
  - CAC members ask questions and provide input
  - Ask for volunteers as needed
- Additional signs/displays about AOC projects – Laurel Last (WDNR)
  - South Channel and new Menekaunee Harbor signs
  - AOC overview with habitat and sediment projects
  - Ansul/Tyco and WPS cleanup signs
- Other outreach plans – Laurel
  - Spring AOC newsletter—brought copies
  - AOC video
  - Others?

7:30 Draft Restrictions on Fish Consumption BUI removal document – Laurel Last and Stephanie Swart (MDEQ)

- Overview of draft document (e-mailed by Laurel on June 29th)
- Proposed schedule for review and submittal to EPA

- CAC members discuss and provide input on draft
- CAC members decide whether to provide letter of support for BUI removal

7:45 Agency Updates – Laurel Last and Stephanie Swart
- Degradation of Benthos BUI removal
- Restrictions on Dredging Activities BUI removal
- June 12-13 SPAC meeting

7:50 Public Comment, Other News

7:55 Future Agenda Items and Next Meeting Date
- Next meeting August 17th?

8:00 Adjourn

CONTACT INFORMATION

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swarts@michigan.gov
517-284-5046

John Perrecone, EPA Area of Concern Task Force Leader
Perrecone.John@epamail.epa.gov
312-353-1149

ONLINE RESOURCES

EPA – http://www.epa.gov/grtlakes/aoc/menominee/index.html

MDEQ – http://www.michigan.gov/deq/0,1607,7-135-3313_3677_15430_57388---,00.html

WDNR – http://dnr.wi.gov/topic/greatlakes/menominee.html

CAC – https://www.facebook.com/menomineeriveraoc, http://www.menomineewatershed.com/

2016 RAP Update
http://dnr.wi.gov/topic/greatlakes/documents/LMRRAP2016.pdf

2015 RAP Status Report
http://dnr.wi.gov/topic/greatlakes/documents/Menominee2015RAPUpdate.pdf

2013 F&W Plan
http://dnr.wi.gov/topic/greatlakes/documents/Menominee2013FishAndWildlifePlan.pdf

Lower Menominee River Area of Concern
Citizens Advisory Committee Meeting
July 20, 2017, 6:00 – 8:00 p.m. CST
UW-Marinette Field House (F-108)
Minutes prepared by Donna Buechler

DESIRED OUTCOMES

- CAC members discuss AOC outreach
  - Continue planning for August 16th AOC Celebration
  - Share updates on educational signs, video, and other AOC outreach projects
- CAC members provide input on draft Restrictions on Fish Consumption BUI removal document and decide whether to provide letter of support for BUI removal

ATTENDEES
Becky Berry (UW-Marinette), Cheryl Bougie (WDNR), John Clark & Gail Clark (M & M Great Lakes Sport Fishermen), Mark Erickson (Co-Chair), Laurel Last (WDNR), Donna Buechler (Menominee Conservation District), Keith West (Co-Chair), Stephanie Swart (MDEQ-by phone for beginning of meeting)

Introductions, Overview of Agenda, Review of Minutes – Mark Erickson and Keith West, CAC Co-Chairs

Community Outreach – Laurel Last (WDNR) and others

- AOC Celebration planning – Keith West and others
  - Share current plans and ask for input from CAC members
    - Event location and layout—share site layout handout
    - Schedule
      - Tent setup-should be Tuesday, Wednesday am at latest
      - Shuttles-start at 10:30 should be done at 1, then shuttle last guests from bus tour when completed
      - Harbor dedication 11:30
      - AOC celebration 12:00
      - Take down tables and displays
      - Take down tent-rental company was asked to leave it up for Thurs.
    - Tours
      - AOC bus tour-Mark will be in charge, should start 1:30-2, tickets available on first come first serve basis
      - AOC boat tour-John Kukuk will do a boat tour for 20 dignitaries, participants will be decided once the rsvp's have come in
    - Invitations—speakers, presenters (tables), and others
      - Donna sent out invitations to EPA, WDNR, MDEQ speakers
      - Mark and Keith will provide welcome and introduce the other speakers
      - Laurel sent preliminary (heads-up) table presenter invitations via e-mail —need to follow up with details
      - City sending joint invitations to EPA, DNR, DEQ, state and federal reps

        - Others we might want to invite: other agencies, companies, contractors, folks who worked on other AOC projects. Donna & Laurel will coordinate who still needs invites after the city has sent theirs
    - Rentals—bus, tent, tables, chairs
        - Westlund will provide the busing
        - K & M rentals are doing the tent, tables and chairs, Donna will request an additional table
        - Note that Donna cannot come on the 16th
    - Publicity
        - AOC stakeholders: e-mail lists, GovDelivery
        - General public: press release, news article, radio
        - Mark is going to see what the city has planned so there isn't duplication
    - Food/refreshments
        - Donna will order full sheet cake and request the sturgeon logo
        - Mark & Keith offered to cover the cake cost
        - Plates, napkins, and forks will need to be purchased, receipt to Donna for reimbursement
- Additional signs/displays about AOC projects
    - South Channel and new Menekaunee Harbor signs
        - 3 large (same) and 9 small (various) S.C. signs
        - 1 large (same as before) and 1 small (osprey platform) M.H. sign
        - Designs will be finished and sent off for printing soon
        - Laurel and/or Cheryl will pick up signs and work with City on installation
    - AOC overview with habitat and sediment projects
        - Large signs, like S.C. and M.H.
        - Design in progress
        - Shared draft map—CAC members requested that bridges be added to map
        - Funding for 8 signs/locations
        - CAC members will provide input on sign locations later
    - Ansul/Tyco and WPS cleanup signs
        - To be designed after AOC overview signs
        - Install near project sites (Boom Landing and 6th St Slip)
- Other outreach plans – Laurel
    - Spring AOC newsletter—brought copies
        - New issue of WI AOC newsletter is out
        - Includes articles on island restoration and waterfront cleanup
    - AOC video
        - Making plans for new AOC video focusing on habitat projects
        - South Channel main topic, but include island project and M.H. update
        - Messages: Partnerships, Remediation-Restoration-Revitalization
        - Potential interviewees: Mayor, contractors, DNR fish and wildlife
        - Video dates: August 15-16

Agency Updates – Laurel Last and Stephanie Swart (MDEQ)

Draft Restrictions on Fish Consumption BUI removal document –Overview of draft document (e-mailed by Laurel on June 29th)

- TAC met May 24th and support moving ahead with BUI removal
- Laurel addressed comments from TAC and EPA

- Proposed schedule for review and submittal to EPA
  - If CAC supports BUI removal, then will move forward with public review process
  - Public review period to include August 16th event
  - Goal is to submit final BUI removal package to EPA in September
- CAC members discuss and provide input on draft-Mark noticed a simple typing error
- CAC members present unanimously support BUI removal; will provide letter of support for BUI removal unless any objections come in by Monday [no objections were received]

Degradation of Benthos BUI removal

- EPA sent official concurrence in May
- Posted on WDNR AOC website

Restrictions on Dredging Activities BUI removal

- EPA sent official concurrence in May
- Posted on WDNR AOC website
- MDEQ sent out news release about both BUI removals

June 12-13 SPAC meeting-Stephanie attended and reported there wasn't anything we missed by not being there

Public Comment, Other News

Future Agenda Items and Next Meeting Date

- Meeting date: September 21, 2017
- Ask Jason from UP RC&D to attend an upcoming meeting to talk about phragmites

CONTACT INFORMATION

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John Perrecone, EPA Area of Concern Task Force Leader
Perrecone.John@epamail.epa.gov
312-353-1149

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2013 F&W Plan
http://dnr.wi.gov/topic/greatlakes/documents/Menominee2013FishAndWildlifePlan.pdf

Lower Menominee River Area of Concern
Citizens Advisory Committee Meeting
April 19th, 2018, 6:30 – 7:45 p.m. CST
Minutes prepared by Donna Buechler

Theatre/Fine Arts Building Conference Room (T-139)
(online map: http://www.marinette.uwc.edu/about/campus-maps/)

DESIRED OUTCOMES

- Meeting attendees learn about process and schedule for remaining beneficial use impairment (BUI) removals and AOC delisting
- Meeting attendees learn about Upper Peninsula *Phragmites* control project
- Plan Waterfront Cleanup Event

ATTENDEES

Keith West (Co-Chair), Cheryl Bougie (WDNR), Donna Buechler (Menominee Conservation District), Jim Cox (Johnson Controls), Darcy Rutkowski (UP RC&D), Robert Rutkowski, Gail Clark (M&M GLSF), John Clark (M&M GLSF), Wendel Johnson (Chappee Rapids), Stephanie Swart (MDNR-by phone)

AGENDA

Introductions, Overview of Agenda, Review of Minutes – Keith West (CAC Chair)

Upper Peninsula Phragmites Control Project – Darcy Rutkowski (UP RC&D)

- Darcy provided an overview of what the project has completed across the UP and specifically in Menominee County
- Need help with a boat and knowledgeable person to scout and map *phragmites* locations in the lower Menominee River
- http://www.uprcd.org/phragmitesup.asp

Status of "Restrictions on Fish and Wildlife Consumption" BUI removal document – Cheryl Bougie (WDNR) and Stephanie Swart (MDNR)

- **Document is complete waiting final approval to post to website for Public Comment**
- **Once posted it will be open for public comment (April 26 – May 18)**

Status of "Degradation of Fish and Wildlife Populations and Loss of Habitat" BUI removal document – Cheryl Bougie (WDNR) and Stephanie Swart (MDNR)

- The draft will be available to the CAC & TAC at their next meetings (May)
- WDNR & MDNR will seek comments and approval to move through the BUI removal process and eventually a letter of support.

2017 Remedial Action Plan (RAP) Update- Cheryl Bougie (WDNR) and Stephanie Swart (MDNR)

- Completed and now posted on the WDNR AOC website
- https://dnr.wi.gov/topic/GreatLakes/documents/LMRRAP2017.pdf

Fish Passage-Cheryl Bougie (WDNR)

- Tours will be available on May 22 to the public

- http://www.ehextra.com/Content/COMMUNITY/Community-Articles/Article/Sturgeon-passage-tours-are-available/153/766/46695
- They are willing to do a separate tour for the CAC. Cheryl will see if it could be May 24th at 4:30 pm to coordinate with the next CAC meeting

Menominee River Islands-Cheryl Bougie (WDNR)

- Cheryl provided copies of the most recent Island Update Fact Sheet April 2018 from Ecology & Environment Inc (E&E)
- Volunteers are needed to going forward - E&E will conduct outreach with the goal of identifying groups to take the lead on habitat restoration via stewardship and natural resource mgmt planning. Volunteers should contact Kris Erickson at (715) 684-8060 or kerickson@ene.com

Mark Erickson Memorial-Keith West (CAC Chair)

- Requested the CAC members make suggestions
- Will talk with Schloegels to see if anything can be done there
- Lloyd Flanders may have input
- Henes Park may be a possible location
- Keith will follow up and look for ideas

Waterfront Clean Up Event-Donna Buechler and all

- Cheryl will do inventory on supplies, but Laurel thought we still had most of what we needed
- Possible new location at Stephenson Island or Red Arrow Park for check-in & lunch
- Will city take care of the bags after?
- Cheryl has a copy of the past flier, but not the map of locations
- Jim offered to contact the media
- Looking toward a Fall date (September) to hold event
- Cheryl will follow up with City to reserve shelter for meeting point.

2018 Conference, Sheboygan, WI, May 16-17

- Keith, Stephanie, and Cheryl are going. Cheryl will check to see if there will be a general AOC display.

Future Agenda Items and Next Meeting Date

- Next meeting May 24th 6:30 pm
- Process and schedule for remaining BUI removals and AOC delisting-John Perrecone (USEPA) and Others
    - Share general process and schedule for BUI removals
    - Share state/federal approach to AOC delisting
    - Share Wisconsin delisting process steps
    - Discussion & questions
- Comment Period Over-Finalize Fish and wildlife consumption BUI removal document
- Draft fish and wildlife populations and habitat BUI removal document
- Moved to adjourn by Wendel Johnson, second by Gail Clark. Motion carried.

CONTACT INFORMATION

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Trygve Rhude CAC Vice Chair
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cheryl.bougie@wisconsin.gov
(920) 662-5170

Stephanie Swart, Michigan DNR
swarts@michigan.gov
517-284-5046

John Perrecone, EPA Area of Concern Task Force Leader
Perrecone.John@epamail.epa.gov
312-353-1149

ONLINE RESOURCES

EPA – http://www.epa.gov/grtlakes/aoc/menominee/index.html

MDNR – http://www.michigan.gov/ogl/0,9077,7-362-85255_15430_57388---,00.html

WDNR – http://dnr.wi.gov/topic/greatlakes/menominee.html

CAC – https://www.facebook.com/menomineeriveraoc, http://www.menomineewatershed.com/

2017 RAP Update

https://dnr.wi.gov/topic/GreatLakes/documents/LMRRAP2017.pdf

2013 F&W Plan

http://dnr.wi.gov/topic/greatlakes/documents/Menominee2013FishAndWildlifePlan.pdf

Appendix C Status of Fish Contaminant Levels in the Lower Menominee Area of Concern, March 2017, Joseph Bohr, MDEQ

REVISED MARCH 8, 2017
MI/DEQ/WRD-16/005

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
MARCH 2016

STAFF REPORT

STATUS OF FISH CONTAMINANT LEVELS IN THE LOWER MENOMINEE RIVER AREA OF CONCERN

INTRODUCTION

The Lower Menominee River Area of Concern (MR-AOC) includes the lower three miles (4.8 km) of the river from the Park Mill (Wisconsin) Dam (aka Upper Scott Dam) downstream to the river mouth and approximately 3.1 miles (5 km) north and south of the mouth along the adjacent shoreline of Green Bay (GB). The Lower Scott Flowage (LSF), an impoundment formed by the Menominee Dam (aka Lower Scott Dam and Hattie Street Dam), is included in the AOC (Figure 1). The AOC watershed is shared between Michigan and Wisconsin.

Both Michigan and Wisconsin have issued consumption advisories for certain species of fish from the MR-AOC. Those advisories date back to 1976 (Zander, 1995) and are primarily due to elevated levels of polychlorinated biphenyls (PCBs). The MR-AOC is relatively close to the Lower GB and Fox River AOC. A large part of the problem in that AOC is due to historic discharges of PCB from numerous paper mills along the lower Fox River, and the MR-AOC may be impacted to some degree by that legacy contamination. The Lake Michigan Mass Balance Project (United States Environmental Protection Agency (U.S. EPA), 2006) estimated PCB loadings by major tributaries to the lake and compared PCB concentrations in Lake Michigan sediments. Based on that study it is believed that the Menominee River is a minor source of PCBs to GB, contributing roughly 20 times less than the Fox River. The mass balance study also estimated that the PCB loading from the Menominee River is only slightly higher than loadings from the Muskegon, Pere Marquette, and Manistique Rivers. A water quality study conducted on the Menominee River in 2011 found no evidence of a significant PCB source within the MR-AOC (Bohr, 2012).

Mercury is also a contaminant of concern and is a primary cause of fish consumption advisories covering the full length of the Menominee River. The source of mercury is most likely air-borne emissions, primarily from regional and global fossil fuel combustion, with subsequent atmospheric deposition throughout the watershed.

The pesticide DDT has a history of extensive use worldwide. The compound or its degradation products are present in measurable quantities in nearly all fish sampled from Michigan waters, including the Menominee River; if DDT was the only contaminant of concern it would cause a fish consumption advisory for the Menominee River downstream of the Menominee Dam. The source of DDT to the Menominee River watershed is likely a combination of atmospheric deposition and runoff from agricultural fields treated with the pesticide prior to its being banned in 1972.

Dioxins and furans are by-products of paper pulp bleaching, waste incineration, and the production of chlorinated chemicals. They have been measured in fish tissue samples from the Menominee River upstream of the Park Mill Dam, downstream of the Menominee Dam (DMD), and in fish from GB and Little Bay De Noc (LBDN). Currently, dioxins would cause fish consumption advisories in the upper Menominee River and in the MR-AOC if it was the only contaminant of concern.

Fish move freely between GB and the Menominee River up to the first dam, and it is thought that the primary source of PCBs and perhaps other contamination lies outside of the MR-AOC (Zander, 1995). Fish in the LSF are isolated from GB and the Menominee River downstream of the Menominee Dam. One goal of this project is to determine if the MR-AOC is a source of the contaminants causing fish consumption advisories in the AOC by comparing contaminant concentrations in fish from the LSF with concentrations in fish from DMD and LBDN. The latter site is considered to be a reference site in that the area is sufficiently far from any AOC, but should be subject to the same regional climate and atmospheric contaminant inputs as the MR-AOC.

SUMMARY

1. Three species of fish were collected from the MR-AOC and LBDN from 2012 through 2014 and analyzed for mercury, PCBs, and chlorinated pesticides. Rock bass collected in 2008 from LBDN were compared to the same species collected from LSF in 2012.
2. Dioxin toxic equivalence (TEQ) was measured in carp collected from LSF and LBDN in 2014 and 2012, respectively. The results were compared to TEQ measurements in carp collected from DMD in 2006, GB in 2000, and upstream of the MR-AOC in 1991 and 1996.
3. Carp and smallmouth bass were collected in the LSF, DMD, and LBDN. Total PCB concentrations in both species were lowest in the LSF and highest in the DMD. The differences were statistically significant for both species.
4. Carp, northern pike, and smallmouth bass were collected from both DMD and LBDN. Total PCB concentrations in all three species were higher in the samples from DMD compared to LBDN, and the differences were statistically significant. The fish consumption guidance based on those results also differed for all three species.
5. Mercury concentrations in fish collected from upstream of the Menominee Dam were consistently higher than in fish of the same species collected from DMD or from LBDN.
6. Total DDT would be a secondary cause of fish consumption advisories for carp from both DMD and LBDN. Concentrations were slightly higher in carp from DMD than from LBDN but the projected consumption guidance was the same for both areas. Total DDT concentrations were low in all other fish populations sampled for this project and would not cause fish consumption advisories for those species.
7. Dioxin TEQ concentrations in carp from LSF were higher than measured in LBDN and GB. Dioxin TEQ concentrations in carp from DMD were not significantly different than in carp from LBDN. Sources of dioxins are most likely upstream of the MR-AOC.
8. The results of this project, in combination with previous studies, supports the hypothesis that PCBs and dioxins measured in fish collected from the MR-AOC are primarily from sources outside of the AOC.

METHODS

Carp (*Cyprinus carpio*) and smallmouth bass (*Micropterus dolomieu*) were the primary target species and were collected in both areas of the MR-AOC (LSF and DMD) and in LBDN, providing the best overall between site comparisons (Table 1). Carp were selected as a target species because they tend to have high PCB burdens relative to other species in a given water body, they are relatively ubiquitous, and results from previous sampling are available. Smallmouth bass were selected because they are a popular sport fish and have good site fidelity.

Northern pike (*Esox lucius*) and rock bass (*Ambloplites rupestris*) were collected at varying sites and provide additional between-site comparisons. Both species are popular with anglers and have good site fidelity.

Fish from the MR-AOC were collected by the Wisconsin Department of Natural Resources (WiDNR) primarily in 2012. Collections of sufficient numbers of carp and smallmouth bass were problematic and necessitated additional effort in 2013 and 2014. Fish from LBDN were collected by the Michigan Department of Natural Resources (MDNR) in 2012 and 2014. Rock bass collected from LBDN in 2008 were used for comparisons with fish collected from LSF in 2012. In addition, mercury concentrations in smallmouth bass collected in 2014 by We Energies from Menominee River impoundments to meet hydroelectric facility licensing requirements were used for comparison with fish collected from LSF.

Table 1. Number of fish samples collected from the Lower Menominee River AOC and Little Bay De Noc and analyzed by the MDHHS Laboratory (years of collection in parentheses). Little Bay De Noc samples provided by MDNR, all others provided by the WiDNR.

Species	Lower Scott Flowage	Menominee River d/s Menominee Dam	Little Bay De Noc
Carp	11 (2012, '13, '14)	10 (2012)	9 (2012)
Smallmouth Bass	10 (2012, '13)	10 (2012, '13)	10 (2012)
Northern Pike	0	9 (2012)	10 (2014)
Rock Bass	10 (2012)		14 (2008)

The fish were processed as standard edible portions in accordance with the MDEQ, Water Resources Division, Fish Contaminant Monitoring Fish Collection Procedure WRD-SWAS-004. Total length was measured to the nearest millimeter and converted to inches for reporting. Length data are presented in Appendix A1. Total weight was measured to the nearest 10 grams and gender was recorded. Standard edible portions are untrimmed, skin-on fillets for rock bass and smallmouth bass, and untrimmed, skin-off fillets for carp and northern pike. Each sample was individually wrapped in aluminum foil, appropriately labeled, and frozen until preparation for analysis. A total of 65 fillet samples from the MR-AOC, 10 from CHF, and 53 from LBDN were analyzed (Table 1).

Table 2. Standard suite of contaminants quantified in fish tissue samples for the MDEQ Fish Contaminant Monitoring Program.

2,4'-DDD	*gamma*-Chlordane
2,4'-DDT	*trans*-Nonachlor
4,4'-DDD	*alpha*-Chlordane
4,4'-DDE	*cis*-Nonachlor
4,4'-DDT	Hexachlorobenzene
Aldrin	Mercury
Dieldrin	Mirex
gamma-BHC (Lindane)	Octachlorostyrene
Heptachlor	PBB (FF-1, BP-6)
Heptachlor Epoxide	Pentachlorostyrene
Heptachlorostyrene	Terphenyl
Hexachlorostyrene	Toxaphene
Oxychlordane	
Total PCB (as congeners; Aroclors prior to 2000)	

Since 2000, the MDHHS Laboratory has measured PCB concentrations using the congener method; total PCB concentration was estimated by summing the concentrations of PCB congeners. Individual congeners below the quantification level were assigned a concentration equal to 0 for the purpose of calculating a total PCB concentration. Also, congener analyses that did not meet retention time criteria or were subject to analytical interference were assigned a concentration equal to 0 for the purpose

of calculating a total PCB concentration. All fillet and whole fish samples were analyzed for a standard suite of contaminants including total mercury, organochlorinated pesticides (Table 2), and PCB congeners (Table 3) by the Michigan Department of Health and Human Services (MDHHS) Analytical Chemistry Laboratory.

Table 3. PCB structure and corresponding identification number of congeners assayed in fish tissue samples.

Structure	BZ#	Structure	BZ#	Structure
TRICHLOROBIPHENYLS		PENTACHLOROBIPHENYLS		HEPTACHLOROBIPHENYLS
2,2',4	82	2,2',3,3',4	170	2,2',3,3',4,4',5
2,2',5	84	2,2',3,3',6	171	2,2',3,3',4,4',6
	87	2,2',3,4,5'	172	2,2',3,3',4,5,5'
2,3,4'	90	2,2',3,4',5	174	2,2',3,3',4,5,6'
2,3',4	91	2,2',3,4',6	175	2,2',3,3',4,5',6
2,3',5	92	2,2',3,5,5'	177	2,2',3,3',4',5,6
2,4,4'	95	2,2',3,5',6	178	2,2',3,3',5,5',6
2,4',5	97	2,2',3',4,5	179	2,2',3,3',5,6,6'
2,4',6	99	2,2',4,4',5	180	2,2',3,4,4',5,5'
2',3,4	100	2,2',4,4',6	182	2,2',3,4,4',5,6'
3,4,4'	101	2,2',4,5,5'	183	2,2',3,4,4',5',6
	105	2,3,3',4,4'	185	2,2',3,4,5,5',6
TETRACHLOROBIPHENYLS	110	2,3,3',4',6	187	2,2',3,4',5,5',6
2,2',3,3'	118	2,3',4,4',5	190	2,3,3',4,4',5,6
2,2',3,4'	126	3,3',4,4',5	193	2,3,3',4',5,5',6
2,2',3,5'				
2,2',3,6		HEXACHLOROBIPHENYLS		OCTACHLOROBIPHENYLS
2,2',4,4'	128	2,2',3,3',4,4'	194	2,2',3,3',4,4',5,5'
2,2',4,5'	130	2,2',3,3',4,5'	195	2,2',3,3',4,4',5,6
2,2',5,5'	132	2,2',3,3',4,6'	196	2,2',3,3',4,4',5,6'
2,3,3',4'	135	2,2',3,3',5,6'	198	2,2',3,3',4,5,5',6
2,3,4,4'	136	2,2',3,3',6,6'	199	2,2',3,3',4,5,6,6'
2,3',4',5	137	2,2',3,4,4',5	201	2,2',3,3',4,5,5',6'
2,3,4',6	138	2,2',3,4,4',5'	203	2,2',3,4,4',5,5',6
2,3',4,4'	141	2,2',3,4,5,5'	205	2,3,3',4,4',5,5',6
2,3',4',5	144	2,2',3,4,5',6		
2,3',4',6	146	2,2',3,4',5,5'		NONACHLOROBIPHENYLS
2,4,4',5	149	2,2',3,4',5',6	206	2,2',3,3',4,4',5,5',6
3,3',4,4'	151	2,2',3,5,5',6		
	153	2,2',4,4',5,5'		
	156	2,3,3',4,4',5		
	157	2,3,3',4,4',5'		
	158	2,3,3',4,4',6		
	163	2,3,3',4',5,6		
	167	2,3',4,4',5,5'		

BZ# = identification numbers adopted by the International Union of Pure and Applied Chemists (IUPAC)

Total DDT concentrations were calculated by summing concentrations of the para, para' and ortho, para' forms of DDT, dichlorodiphenyldichloroethylene (DDE), and 1,1-bis(4-chlorophenyl)-2,2-dichloroethane (DDD). Individual chemicals below the quantification level were assigned a concentration equal to 0 for the purpose of calculating a total DDT concentration. If all six components were below the quantification level, then the total DDT concentration was reported as less than the lowest quantification level of the metabolites.

Dioxin, dibenzofuran (furan), and dioxin-like PCB congener concentrations were measured in carp collected from LSF and LBDN (Tables 4a and 4b). In addition, dioxin and furan results are available for carp collected in 2006 from DMD. Total 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) TEQ was calculated for those samples using toxic equivalency factors developed by the World Health Organization (Van den Berg et al., 2006). The concentrations of individual dioxin, furan, and dioxin-like PCB congeners in a fish sample were multiplied by chemical-specific toxic equivalency factors and the resulting products summed to calculate a TCDD TEQ concentration. Individual congener concentrations less than the detection level were assigned a value of 0 for the

purpose of calculating the dioxin TEQ. Dioxin TEQ was measured in carp collected from CHF in 1991 and 1996 (n=12), from LSF in 2014 (n=5), from DMD in 2006 (n=7), from GB in 2000 (n=10), and from LBDN in 2012 (n=9).

The complete dataset is available electronically (by request) or through the Fish Contaminant Monitoring Program Web site (www.deq.state.mi.us/fcmp).

The MDHHS, Division of Environmental Health, develops fish consumption advice following protocols described in the *Michigan Fish Consumption Advisory Program Guidance Document*. That document along with links to supporting documentation and other related reports is available online at http://www.michigan.gov/eatsafefish (Reports & Science button). The guidance was used in this report to predict the likely fish consumption advice based only on the most recent analytical results. Specifically, the projected advice was determined by comparing the 95 percent upper confidence limit (95% UCL) on the mean concentration in legal-size fish for each species/site/contaminant combination with the appropriate MDHHS screening value for that contaminant. The screening values developed by the MDHHS are presented in Appendix B. It is important to note that the projected consumption advice reported here may not be the final advice put forth by the MDHHS; the MDHHS bases consumption guidance on the most current analytical results in combination with previous data for the water body as well as knowledge of legacy or ongoing contamination issues.

The MDHHS fish consumption guidance is presented as a recommended number of meals per month of a given species. The meal categories range from 16 meals per month to a "Do Not Eat" category; the latter category is reserved for those species and water bodies where the estimated contaminant concentration in a single meal would exceed the annual safe level of exposure. In addition the MDHHS has designated a "Limited" category; healthy adults may eat 1 or 2 meals per year of fish in this category but it is recommended that women of childbearing age, young children, and adults with a chronic health condition not eat these fish.

Contaminant loads in fish are sometimes positively correlated with the age of the fish, and fish length is generally used as a surrogate for age. In addition, chlorinated contaminants such as PCBs, DDT, and dioxins tend to accumulate preferentially in lipids. Since the length range and lipid content of fish can vary from site to site, a simple comparison of contaminant concentrations has the potential to be biased. To compensate for the potential bias, statistical comparisons were conducted using a Generalized Linear Model (GLM) with lipid content, gender, and fish length as covariates for the chlorinated contaminant concentrations, and fish length and gender as covariates for mercury concentrations. Contaminant concentrations were transformed using the natural log in order to meet assumptions of the GLM.

In addition, chlorinated contaminant results were lipid normalized by dividing the contaminant concentration by the lipid content and compared using the Kruskal-Wallis (KW) and Mann-Whitney statistical tests, the nonparametric equivalent of Analysis of Variance, and the t-test, respectively.

Statistical tests were considered significant at $p \leq 0.05$. The software package Minitab 15 was used to perform the statistical tests.

Table 4a. Chlorinated dibenzo-p-dioxin (CDD) and chlorinated dibenzofuran (CDF) congeners quantified in fish tissue samples.

CDD	Quantification Limit (ppt)	TEF*
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1.0	1
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PCDD)	1.0	1
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	1.0	0.1
1,2,3,6,7,8-HxCDD	1.0	0.1
1,2,3,7,8,9-HxCDD	1.0	0.1
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	1.0	0.01
1,2,3,4,6,7,8,9,-Octachlorodibenzo-p-dioxin (OCDD)	1.0	0.003
CDF		
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	1.0 ppt	0.1
1,2,3,7,8-Pentachlorodibenzofuran (PCDF)	1.0 ppt	0.03
2,3,4,7,8-PCDF	1.0 ppt	0.3
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	1.0 ppt	0.1
1,2,3,6,7,8-HxCDF	1.0 ppt	0.1
1,2,3,7,8,9-HxCDF	1.0 ppt	0.1
2,3,4,6,7,8-HxCDF	1.0 ppt	0.1
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	1.0 ppt	0.01
1,2,3,4,7,8,9-HpCDF	1.0 ppt	0.01
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	1.0 ppt	0.0003

Table 4b. Coplanar PCB congeners analyzed for Michigan's Fish Contaminant Monitoring Program.

BZ#	Structure	Quantification Limit (ppt)	TEF*
	TETRACHLOROBIPHENYLS		
77	3,3'4,4'	50	0.0001
81	3,4,4',5	50	0.0003
	PENTACHLOROBIPHENYLS		
105	2,3,3',4,4'	50	0.00003
114	2,3,4,4',5	50	0.00003
118	2,3',4,4',5	50	0.00003
123	2',3,4,4',5	50	0.00003
126	3,3',4,4',5	50	0.1
	HEXACHLOROBIPHENYLS		
156	2,3,3',4,4',5	50	0.00003
157	2,3,3',4,4',5'	50	0.00003
167	2,3',4,4',5,5'	50	0.00003
169	3,3',4,4',5,5'	50	0.03
	HEPTACHLOROBIPHENYLS		
189	2,3,3',4,4',5,5'	50	0.00003

* - World Health Organization 2,3,7,8 TCDD Toxic Equivalency Factors (Van den Berg et al., 2006)

RESULTS AND DISCUSSION

The following discussion includes between-site comparisons of results for total PCBs, mercury, total DDT, and dioxin. Elevated levels of PCBs, mercury, or both have led to the need for consumption advisories for certain species of fish taken from the MR-AOC since the early 1990s. While DDT has not caused advisories for MR-AOC fish, it is either known or likely to be present at concentrations high enough to cause advisories under the revised MDHHS advisory protocol now in use.

Table 5. Percentage of fish samples with quantifiable levels of total PCBs from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

Species	LSF	DMD	LBDN
Carp	100	100	100
Northern Pike	--	100	70
Rock Bass	60	--	40
Smallmouth Bass	90	100	100

PCBs

PCBs were quantified in all fish collected from the DMD, and in all carp regardless of sampling site (Table 5). Otherwise, rates of quantification varied somewhat by species and sampling site. The highest PCB concentrations were measured in carp, regardless of sampling site; concentrations in northern pike, rock bass, and smallmouth bass were considerably lower (Table 6; Appendix A2). This pattern of concentrations between species is typical of other water bodies where these species coexist.

Table 6. Median total PCB and median lipid-normalized total PCB concentrations in fish collected from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

Species	Median Total PCB (mg/kg)			Median Lipid-Normalized Total PCB (mg/kg)		
	LSF	DMD	LBDN	LSF	DMD	LBDN
Carp	0.04	1.83	0.67	0.02	0.29	0.12
Northern Pike	--	0.02	0.002	--	0.10	0.01
Rock Bass	0.002	--	0.002	0.004	--	0.008
Smallmouth Bass	0.002	0.05	0.008	0.02	0.13	0.02

There was no significant relationship between fish length and total PCB concentrations in carp from any of the three sampling sites in 2012, and the size range of carp collected at all sites was similar (Figure 2; Appendix A1). Gender was not a significant factor in the carp total PCB GLM. There was a strong correlation between lipid content and total PCB concentrations ($r=0.6$; $p<0.001$). The median total PCB and median lipid-normalized total PCB concentrations in carp from DMD were higher than in carp from LBDN (Table 6; Figure 3). Those differences were not statistically significant, although a larger sample size would probably indicate statistical significance. PCB concentrations in carp from both DMD and LBDN were significantly higher than concentrations in carp from LSF. These relationships were verified using the GLM. The projected consumption advice based on PCBs for carp from DMD and LBDN differs substantially from advice for carp from LSF (Table 7).

The northern pike collected from DMD and LBDN did not provide a good comparison due to the difference in lengths of the fish collected (Appendix A1). The northern pike from DMD were

mostly clustered between 22 and 25 inches, while those from LBDN were fairly evenly spaced between 24 and 35 inches in length (Figure 4). Both total PCB and lipid-normalized PCB concentrations in the northern pike from DMD are higher than in northern pike from LBDN (Table 6; Figure 5), and the differences were statistically significant. Analysis using the GLM also indicated a significant difference between PCB concentrations in northern pike from the two areas. Gender was not a significant factor in the northern pike total PCB GLM. In addition, the projected consumption advice based on PCBs for northern pike from DMD is substantially more restrictive than for pike from LBDN (Table 7).

Table 7. The 95% UCL on the mean total PCB concentration and projected consumption advice due to total PCBs, based only on the most recent results for fish collected from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

Species	95% UCL (ppm)			Meals per Month		
	LSF	DMD	LBDN	LSF	DMD	LBDN
Carp	0.12	2.85	2.06	1	DNE	Limited
Northern Pike	--	0.16	0.01	--	1	16
Rock Bass	0.01	--	0.003	16	--	16
Smallmouth Bass	0.07	0.09	0.02	2	2	12

DNE = Do Not Eat; MDHHS recommends that no one ever eat the fish in this category

Limited = Healthy adults may safely eat one or two meals per year of fish in this category. MDHHS recommends that women of childbearing age, young children, or adults with a chronic health condition should not eat these fish.

Note: *Meals per Month presented here do not represent the final MDHHS determinations*

Rock bass were collected from LSF in 2012 and from LBDN in 2008. Total PCB concentrations in rock bass from the two sites were not significantly different. Lipid-normalized total PCB concentrations in LSF rock bass were higher than in LBDN rock bass, although there was not a strong correlation between total PCBs and lipid content. The difference was due to an unusually high concentration measured in one fish from LSF (Figures 6 and 7). Gender was not a significant factor in the rock bass total PCB GLM. The projected consumption advice based on PCBs for rock bass from LSF is the same as for rock bass from LBDN (Table 7).

There was no significant relationship between fish length and total PCB concentrations in smallmouth bass from any of the three sites sampled in 2012 and 2013. Lipid content and total PCB concentrations were not strongly correlated in smallmouth bass. Gender was not a significant factor in the smallmouth bass total PCB GLM. Total PCB and lipid-normalized total PCB concentrations in smallmouth bass from DMD were higher than in both LSF and LBDN (Table 6; Figures 8 and 9), and the differences were statistically significant based on the KW tests. Total PCB concentrations in smallmouth bass from LSF were not different from bass from LBDN. The relationships were verified using the GLM. Overall, based on graphical interpretation and statistical analysis it appears that smallmouth bass from DMD have slightly higher concentrations of PCBs than those fish from LSF and LBDN. In addition, the projected consumption advice based on PCBs for smallmouth bass from the MR-AOC (both LSF and DMD) was more restrictive than for smallmouth bass from LBDN (Table 7).

Mercury

Total mercury was quantified in all samples from all sampling sites. The species having the highest median mercury concentration varied by sampling site (Table 8; Appendix A3). The interspecies pattern of mercury concentrations is unusual; generally a top predator (e.g., northern pike or smallmouth bass) has significantly higher mercury concentrations compared to species lower in the food web, but the median concentration in redhorse sucker from LSF was higher than in smallmouth bass from the same water body.

Table 8. Median total mercury in fish collected from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

Species	Median Total Mercury (mg/kg)		
	LSF	DMD	LBDN
Carp	0.44	0.20	0.29
Northern Pike	--	0.22	0.49
Rock Bass	0.16	--	0.08
Smallmouth Bass	0.50	0.33	0.28

There was no significant relationship between fish length and total mercury in carp from any of the three sites sampled in 2012 (Figure 10). Gender was not a significant factor in the carp total mercury GLM. The highest mercury concentrations in carp were measured in samples taken from LSF (Table 8; Figure 11); the concentrations in all three sites were significantly different from each other, both using the KW and GLM statistical methods. The most restrictive projected consumption advice for carp is for fish from LSF while the least restrictive advice for carp is for fish from DMD (Table 9). This, along with results for other species, suggests that the mercury concentration in carp from the MR-AOC is not strongly related to mercury sources within the AOC. It might also indicate that the carp collected from DMD may have spent time in GB, outside of the Menominee River.

Table 9. The 95% UCL on the mean total mercury concentration and projected consumption advice due to mercury, based only on the most recent results for fish collected from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

Species	95% UCL (ppm)			Meals per Month		
	LSF	DMD	LBDN	LSF	DMD	LBDN
Carp	0.57	0.25	0.38	1	4	2
Northern Pike	--	0.47	0.55	--	2	1
Rock Bass	0.24	--	0.11	4	--	8
Smallmouth Bass	0.69	0.42	0.36	1	2	2

Note: *Meals per Month presented here do not represent the final MDHHS determinations*

The northern pike samples do not provide an adequate between site comparison since the length ranges of fish collected from DMD and LBDN are not similar (Figures 12 and 13). However, if we assume northern pike from the two areas either intermingle or are exposed to similar levels of mercury we can combine the datasets and evaluate the relationship between fish length and mercury concentration. A regression of mercury concentration on fish length using the combined dataset produced a line with a statistically significant slope (Figure 12). Using the GLM with fish length as a covariate indicates that mercury concentrations in northern

pike from DMD are higher than in those fish from LBDN. Gender was not a significant factor in the northern pike total mercury GLM. If advice for consumption of northern pike were based only on the mercury results for these sample sets, the advice for DMD would be less restrictive than for LBDN (Table 9).

Mercury concentrations in rock bass from LSF were significantly higher than in rock bass from LBDN (Figures 14 and 15). Mercury concentrations were positively correlated to fish length in both rock bass populations, and regressions of mercury concentration on fish length were significant for both populations. Gender was not a significant factor in the rock bass total mercury GLM. The projected consumption advice based only on these mercury results is more restrictive for rock bass from LSF as compared to LBDN (Table 9).

Both KW and GLM statistical methods indicate that mercury concentrations in smallmouth bass from DMD and LBDN were similar, and concentrations in smallmouth bass from LSF were significantly higher than in those fish from the other two sites (Figures 16 and 17). Mercury concentrations were weakly positively correlated with fish length in all three smallmouth bass populations. Gender was not a significant factor in the smallmouth bass total mercury GLM. The projected consumption advice based only on these mercury results is equivalent for smallmouth bass from DMD and LBDN and most restrictive for fish from LSF (Table 9).

Concentrations measured in the LSF are not unusual compared to other impoundments upstream on the Menominee River; smallmouth bass from LSF had mercury levels equivalent to concentrations in smallmouth bass from Big Quinnesec Flowage and slightly higher than levels in the White Rapids Flowage (Figure 18).

DDT

Total DDT was quantified in nearly all carp samples regardless of sampling site, but spatial differences were apparent for the other species sampled (Table 10; Appendix A4). Based on the rates of detection and the 95% UCL (Table 11) DDT concentrations are lowest in fish from LSF; concentrations in fish from DMD and LBDN are roughly equivalent.

Table 10. Percentage of fish samples with quantifiable levels of total DDT from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

Species	LSF	DMD	LBDN
Carp	91	100	100
Northern Pike	--	80	40
Rock Bass	0	--	7
Smallmouth Bass	10	100	100

There was no significant relationship between fish length and total DDT in carp from any of the three sites sampled in 2012 (Figure 19), but there was a strong positive correlation between lipid content and total DDT concentrations ($r=0.70$; $p<0.001$). Lipid normalized total DDT concentrations in carp from DMD did not differ from concentrations in carp from LBDN, but carp from LSF had significantly lower concentrations than fish from the other two sites. The projected consumption advice based on these total DDT results for carp from DMD and LBDN differs substantially from advice for carp from LSF (Table 11).

There was no significant relationship between fish length or lipid content and total DDT concentrations in northern pike collected from DMD or LBDN (Figure 20). Based on these

results, total DDT would not cause a fish consumption advisory for northern pike from either site that is more restrictive than 16 meals per month (Table 11).

Total DDT was not quantified in any of the rock bass collected from LSF and in only 1 of 14 rock bass collected from LBDN (Table 10). Based on the results, total DDT would not cause a fish consumption advisory for rock bass from either site more restrictive than 16 meals per month (Table 11).

Table 11. The 95% UCL on the mean total DDT concentration and projected consumption advice due to total DDT, based only on the most recent results for fish collected from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

Species	95% UCL (ppm)			Meals per Month		
	LSF	DMD	LBDN	LSF	DMD	LBDN
Carp	0.004	0.45	0.28	16	4	4
Northern Pike	--	0.01	0.003	--	16	16
Rock Bass	0.001	--	0.001	16	--	16
Smallmouth Bass	0.001	0.008	0.004	16	16	16

Note: *Meals per Month presented here do not represent the final MDHHS determinations*

Total DDT was quantified in all smallmouth bass samples from both DMD and LBDN, but in only 1 of 10 smallmouth bass collected from LSF (Table 10). There was a positive correlation between total DDT and fish length (r=0.5; p=0.03) and between total DDT and lipid content (r=0.6; p=0.006) for smallmouth bass collected at DMD and LBDN (Figure 21). Both total DDT and lipid normalized concentrations in smallmouth bass from DMD were higher than in those fish from LBDN, and the differences were statistically significant. Based on these results total DDT would not cause a fish consumption advisory for smallmouth bass from either site that was more restrictive than 16 meals per month (Table 11).

Dioxin TEQ

Since dioxins and furans may have sources independent of PCB sources, TCDD TEQ was calculated without dioxin-like PCB congeners. The dioxin-like PCB concentrations were assayed only in the carp from LSF and LBDN, and were not used for between-site comparisons. The complete set of 7 dioxin, 10 furan, and 12 dioxin-like PCB congeners are used by the MDHHS to develop fish consumption advice whenever those results are available.

Quantifiable concentrations of 2,3,7,8 TCDD TEQs were measured in all carp analyzed to-date from the CHF, LSF, DMD, GB, and LBDN. Lipid content was strongly correlated with TEQ across all samples (r=0.8; p<0.001), but fish length was only correlated with TEQ for the GB samples (r=0.7; p=0.02). Dioxin TEQ concentrations were highest in DMD and lowest in LSF (Table 12; Figure 22), but differences were not statistically different. Lipid normalized TEQ concentrations in carp were highest in LSF, CHF, and DMD (Figure 23); the concentrations at those sites were not significantly different but those concentrations were significantly different than the lipid normalized TEQ concentrations in carp from GB. Lipid-normalized TEQ concentrations in LSF carp were higher than in both LBDN and GB, and the difference was statistically different.

Historically, dioxin TEQ was also assayed in a limited number of walleye from the Menominee River, including three samples from the Badwater Impoundment (upstream of Iron Mountain) collected in 1992 and four samples from the CHF collected in 1991. No quantifiable concentrations were measured in the walleye samples from the Badwater Impoundment, while all four samples from the CHF had low but quantifiable concentrations. Although the small sample size prevents a definitive comparison, the results suggest a dioxin source downstream of the Badwater Impoundment and upstream of the MR-AOC.

Table 12. The 95% UCL on the mean dioxin TEQ concentration and projected consumption advice due to dioxin TEQ, based only on the most recent results for carp collected from the Chalk Hill Flowage (CHF), the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), Green Bay (GB), and Little Bay De Noc (LBDN).

95% UCL (ppt)					Meals per Month				
CHF	LSF	DMD	GB	LBDN	CHF	LSF	DMD	GB	LBDN
7.7	3.9	11.4	5.6	4.7	0.5	1	0.5	1	1

Note: *Meals per Month presented here do not represent the final MDHHS determinations*

Lastly, 2,3,7,8 TCDD was assayed in walleye collected in 1989 from the upper Menominee River upstream and downstream of the Champion International Paper – Quinnesec Mill (Taft, 1991). Dioxin was not detected in the fish collected upstream of the mill, but measurable quantities were found in the fish collected downstream. This suggests that the paper mill was a possible dioxin source and provides further evidence that there have been sources upstream of the MR-AOC.

SYNOPSIS

Total PCB concentrations in fish from DMD were consistently higher than the concentrations in the same species from LBDN and from the Menominee River upstream of the Menominee Dam. This pattern held for lipid-normalized total PCB concentrations as well. These results support the hypothesis that PCB contamination in GB is a likely source of contamination in the MR-AOC.

Total mercury concentrations in fish from the LSF were consistently higher than in fish from DMD and LBDN. It is unlikely that elevated mercury levels in the LSF are due to mercury sources within the MR-AOC; rather, higher concentrations in the LSF are most likely due to favorable conditions for mercury methylation within the LSF or the Menominee River watershed in general.

Total DDT concentrations were low in all fish populations sampled, and were lowest in fish from LSF. There are no known or likely point sources for DDT within the MR-AOC, with atmospheric deposition and agricultural runoff being the most likely inputs to the Menominee River watershed.

Previous sampling indicated that legacy paper mill discharges from upstream of the AOC are a likely source of the dioxin contamination observed in fish collected in LSF and probably contribute to dioxin contamination in fish from the DMD.

The MDHHS issues consumption guidance based on the contaminant(s) causing the most restrictive advice. Based on this evaluation, PCBs are the primary cause of advisories for carp and northern pike caught in the DMD (Table 13). Mercury would be the primary contaminant causing advisories for rock bass and smallmouth bass caught in the LSF. Total PCBs and mercury would together be primary causes of consumption advice for carp from the LSF and for smallmouth bass from DMD. It is important to reiterate that the projected consumption advice reported here may not be the final advice put forth by the MDHHS; the MDHHS bases consumption guidance on the most current analytical results in combination with previous data for the water body as well as knowledge of legacy or ongoing contamination issues.

Table 13. Projected consumption advice based on samples collected in 2010, 2012, and 2013, and contaminants causing the advice for fish collected from the Chalk Hill Flowage (CHF), the Lower Scott Flowage (LSF), the Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

Species		Sampling Site			
		CHF	LSF	DMD	LBDN
Carp	Meals/Month	1	1	DNE	Limited
	Cause	TEQ	PCBs, TEQ & Mercury	PCBs	PCBs
Northern Pike	Meals/Month	--	--	1	1
	Cause	--	--	PCBs	Mercury
Rock Bass	Meals/Month	--	4	--	8
	Cause	--	Mercury	--	Mercury
Smallmouth Bass	Meals/Month	--	1	2	2
	Cause	--	Mercury	PCBs & Mercury	Mercury

DNE = Do Not Eat; MDHHS recommends that no one ever eat the fish in this category.
Limited = Healthy adults may safely eat one or two meals per year of fish in this category. MDHHS recommends that women of childbearing age, young children, or adults with a chronic health condition should not eat these fish.
Note: *Meals per Month presented here do not represent the final MDHHS determination.*

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REFERENCES

Bohr, J. 2012. *Investigation of PCB, PAH, and pesticide concentrations in the Menominee River using semi-permeable membrane devices, August 30 – September 27, 2011*. MDEQ Staff Report #MI/DEQ/WRD-12/038.

Taft, W. H. 1991. *Interstate fish contaminant monitoring study of the Menominee River in the vicinity of the Champion International – Quinnesec Mill, Dickinson County, Michigan, April-September, 1989*. MDEQ Staff Report #MI/DNR/SWQ-90/110.

U.S. EPA. 2006. *Results of the Lake Michigan Mass Balance Project: Polychlorinated Biphenyls Modeling Report*. U. S. Environmental Protection Agency, Office of Research and Development. EPA-600/R-04/167. 621 pp.

Van den Berg, M., L.S. Birnbaum, M. Denison, M. DeVito, W. Farland, M. Feeley, H. Fiedler, H. Hakansson, A. Hanberg, L. Haws, M. Rose, S. Safe, D. Schrenk, C. Tohyama, A. Tritscher, J. Tuomisto, M. Tysklind, N. Walker, and R.E. Peterson. 2006. *The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds*. Toxicological Sciences 93(2):223-241.

Zander, S. D. 1995. *Working Together to Improve and Protect the Great Lakes: A Summary of the Lower Menominee River RAP*. Available at: http://www.epa.gov/glnpo/aoc/menominee/index.html

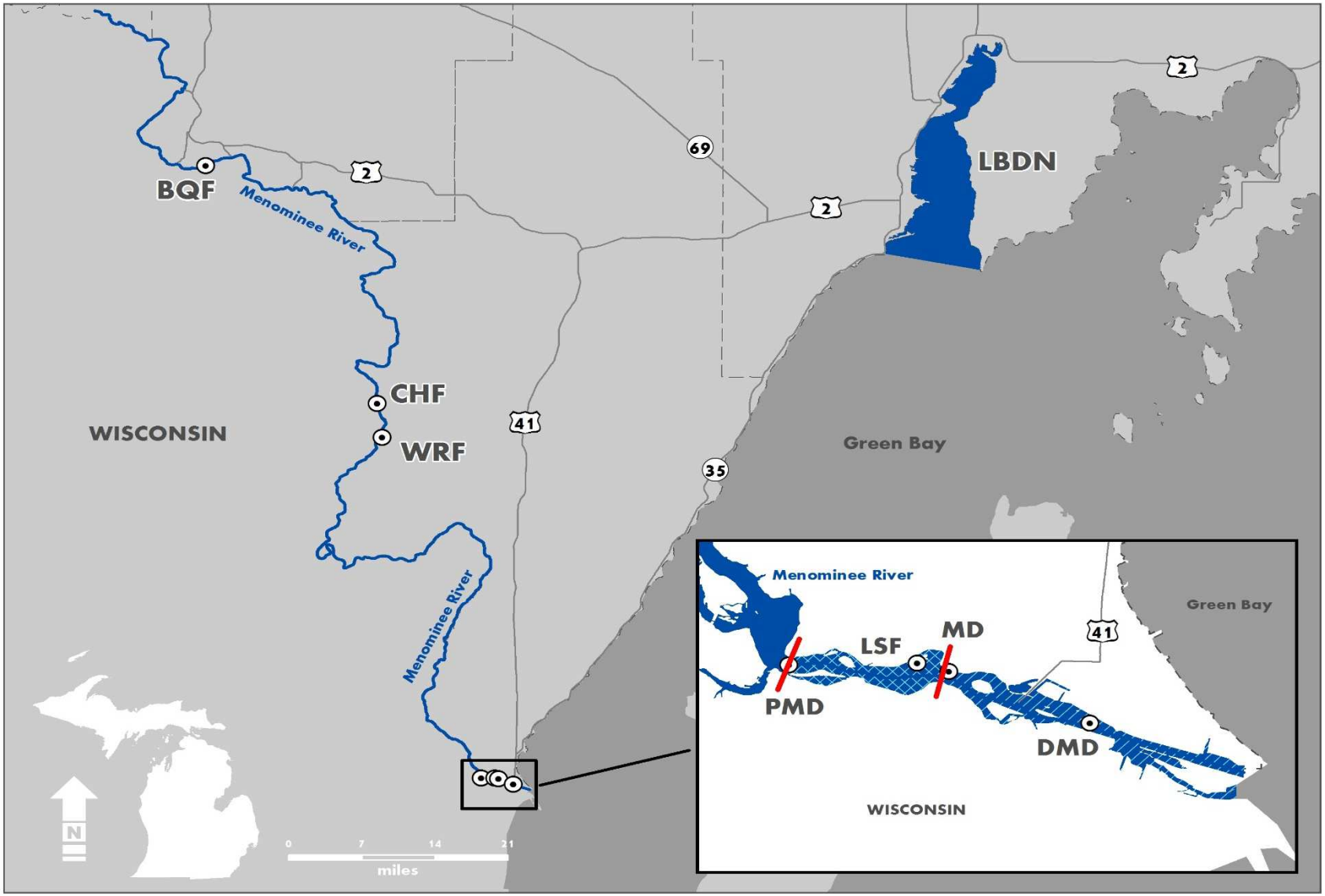


Figure 1. Map of Menominee River AOC (crosshatched in inset) indicating locations of the Park Mill Dam (PMD) and Menominee Dam (MD), and fish collection locations at Big Quinnesec Flowage (BQF), White Rapids Flowage (WRF), Chalk Hill Flowage (CHF), Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

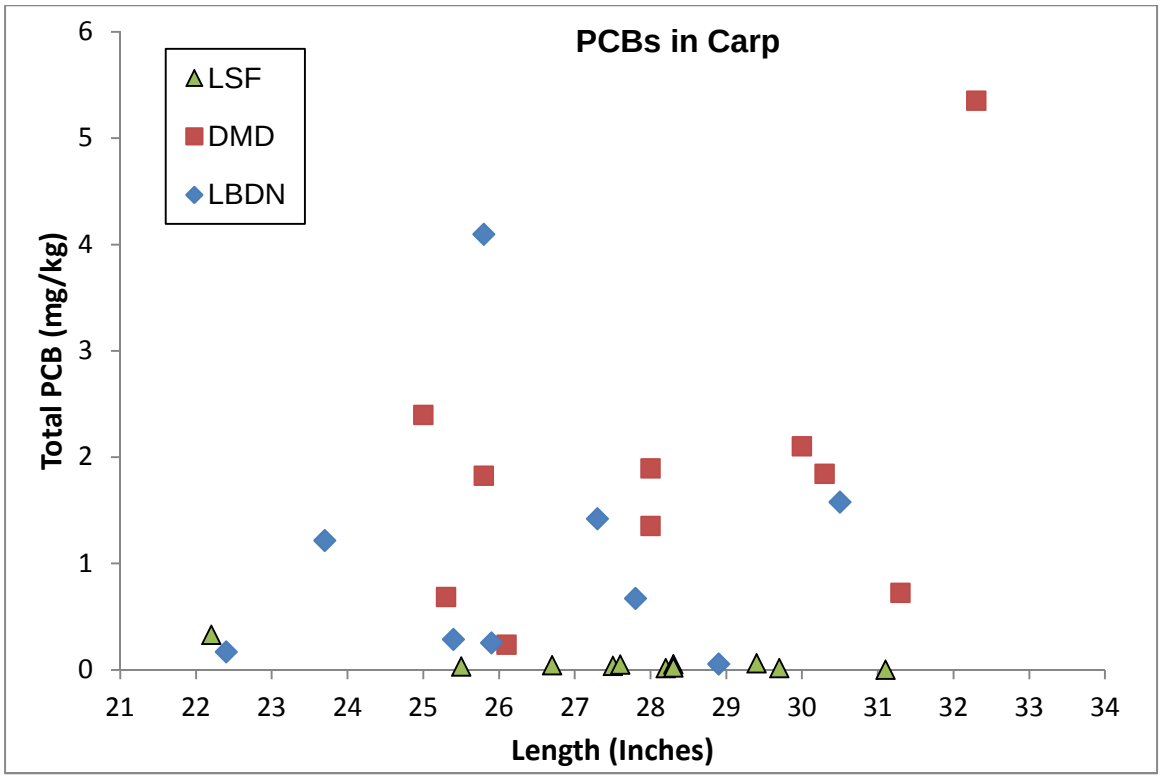


Figure 2. Length versus total PCB concentration in carp collected from Lower Scott Flowage (LSF), the Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

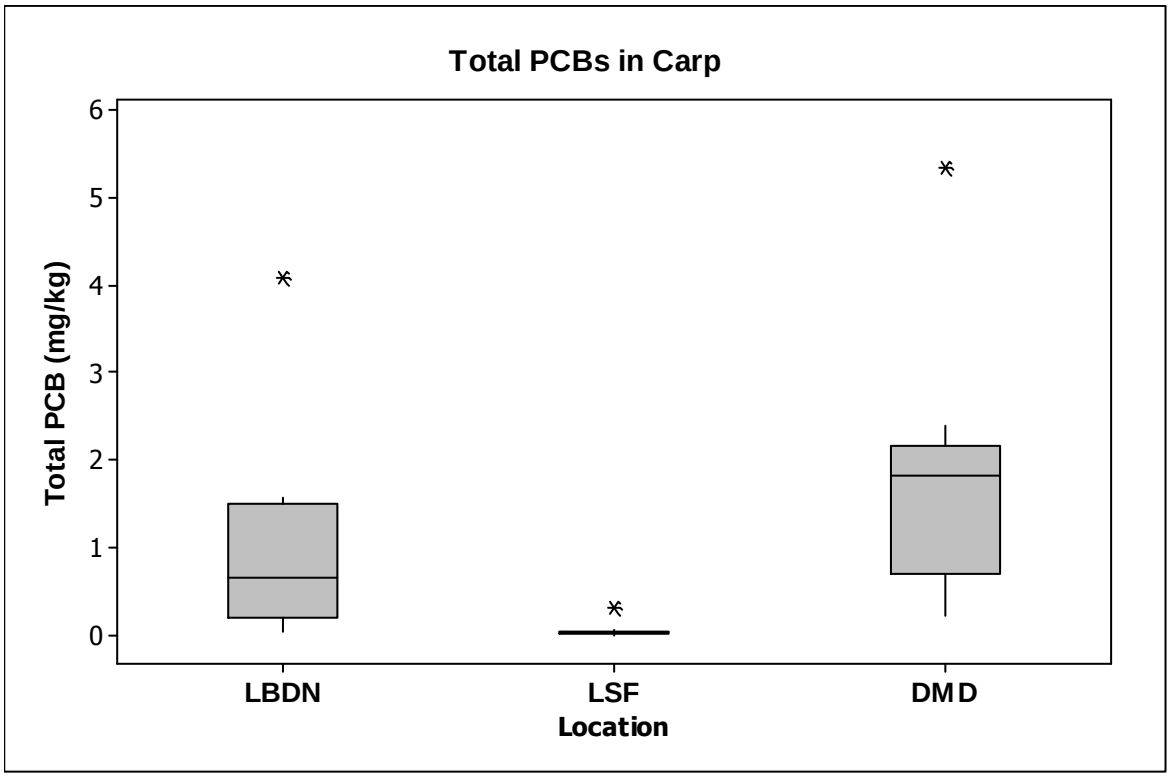


Figure 3. Boxplots of total PCB concentrations in fillets of carp from Little Bay De Noc (LBDN), Lower Scott Flowage (LSF), and the Menominee River downstream of the Menominee Dam (DMD).

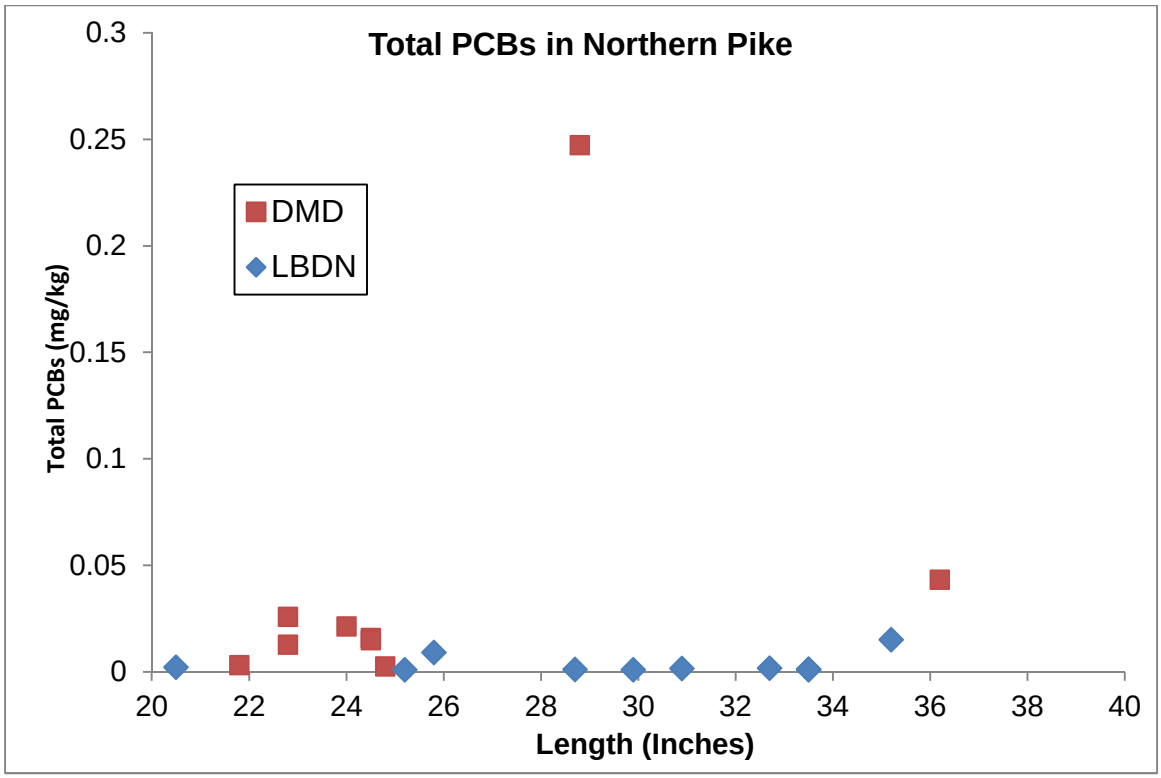


Figure 4. Length versus total PCB concentration in northern pike collected from the Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

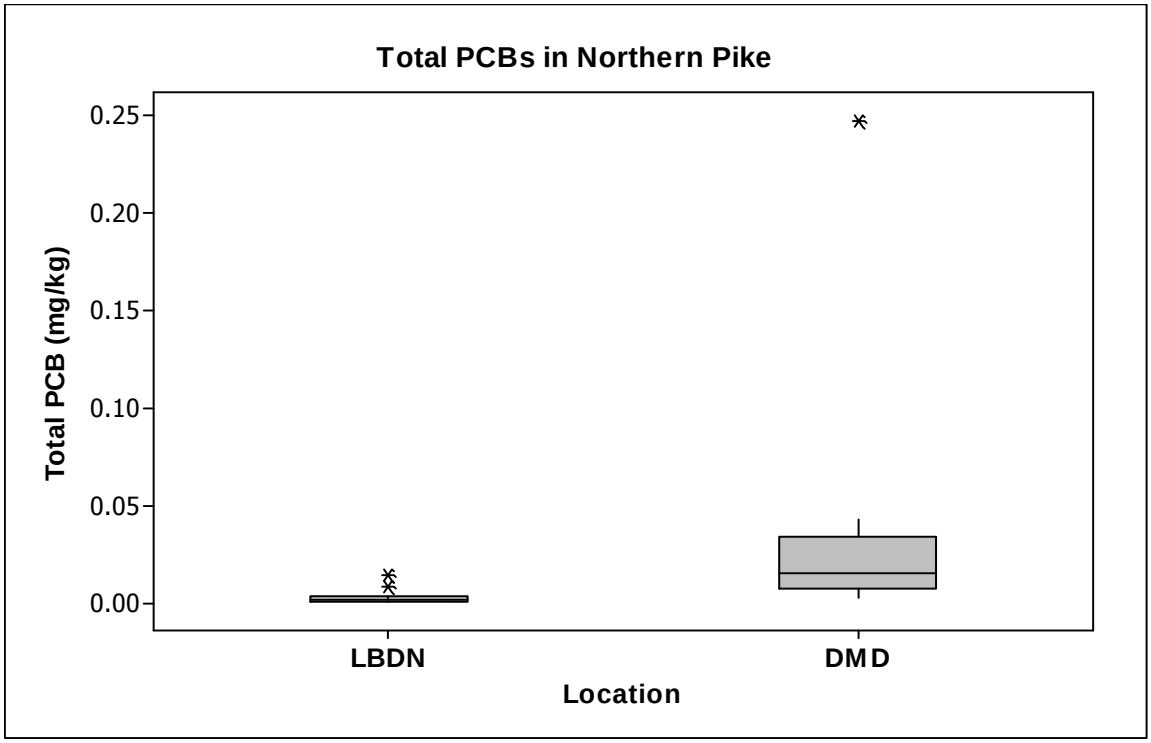


Figure 5. Boxplots of total PCB concentrations in fillets of northern pike from Little Bay De Noc (LBDN) and the Menominee River downstream of the Menominee Dam (DMD).

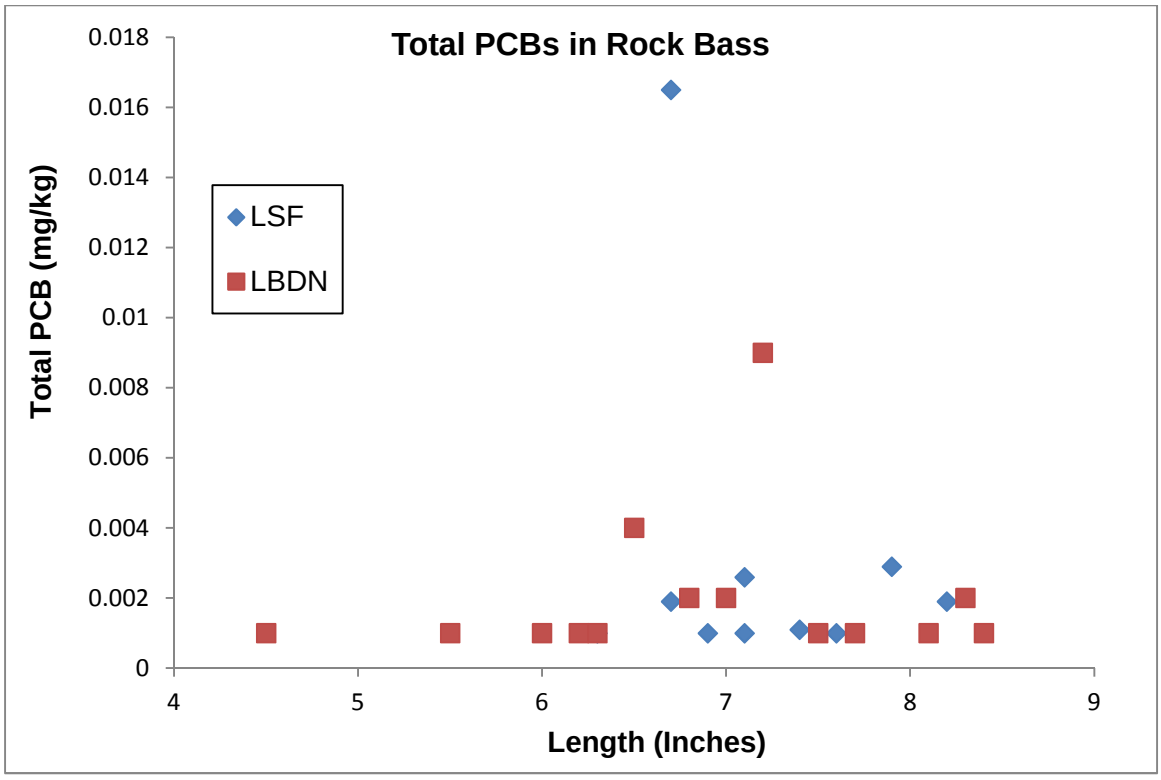


Figure 6. Length versus total PCB concentration in rock bass collected from Lower Scott Flowage (LSF) and Little Bay De Noc (LBDN).

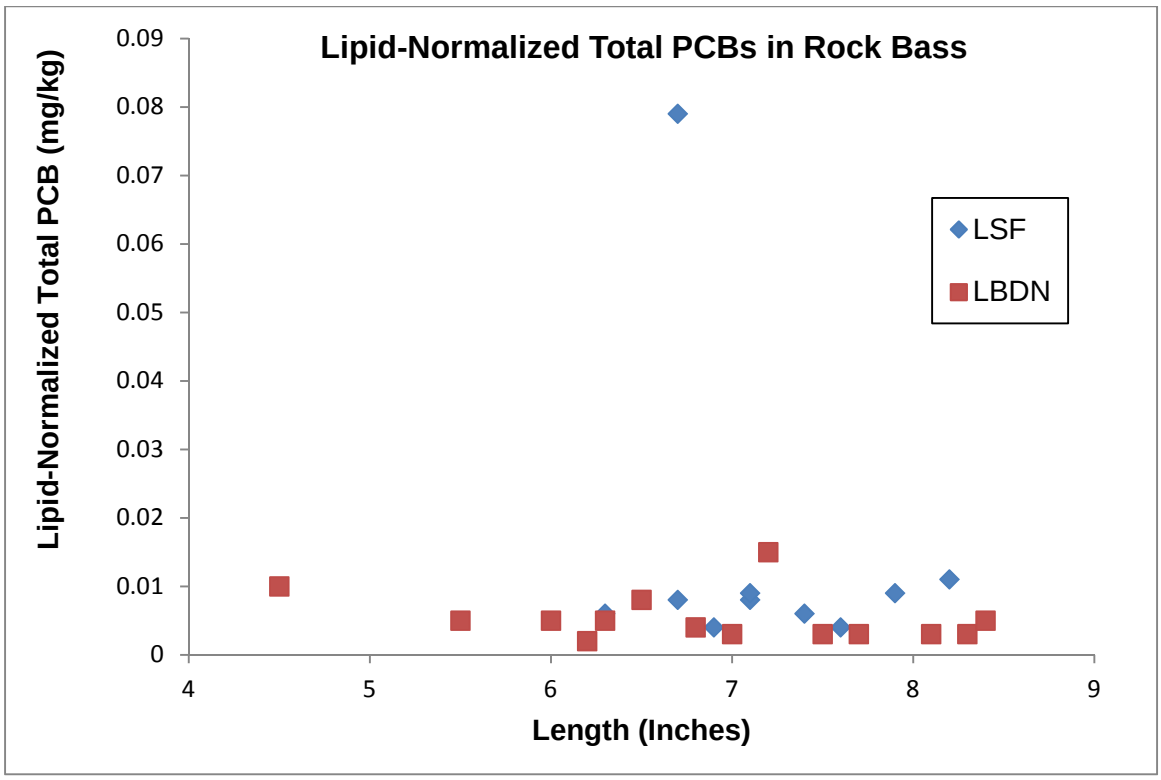


Figure 7. Length versus lipid-normalized total PCB concentration in rock bass collected from Lower Scott Flowage (LSF) and Little Bay De Noc (LBDN).

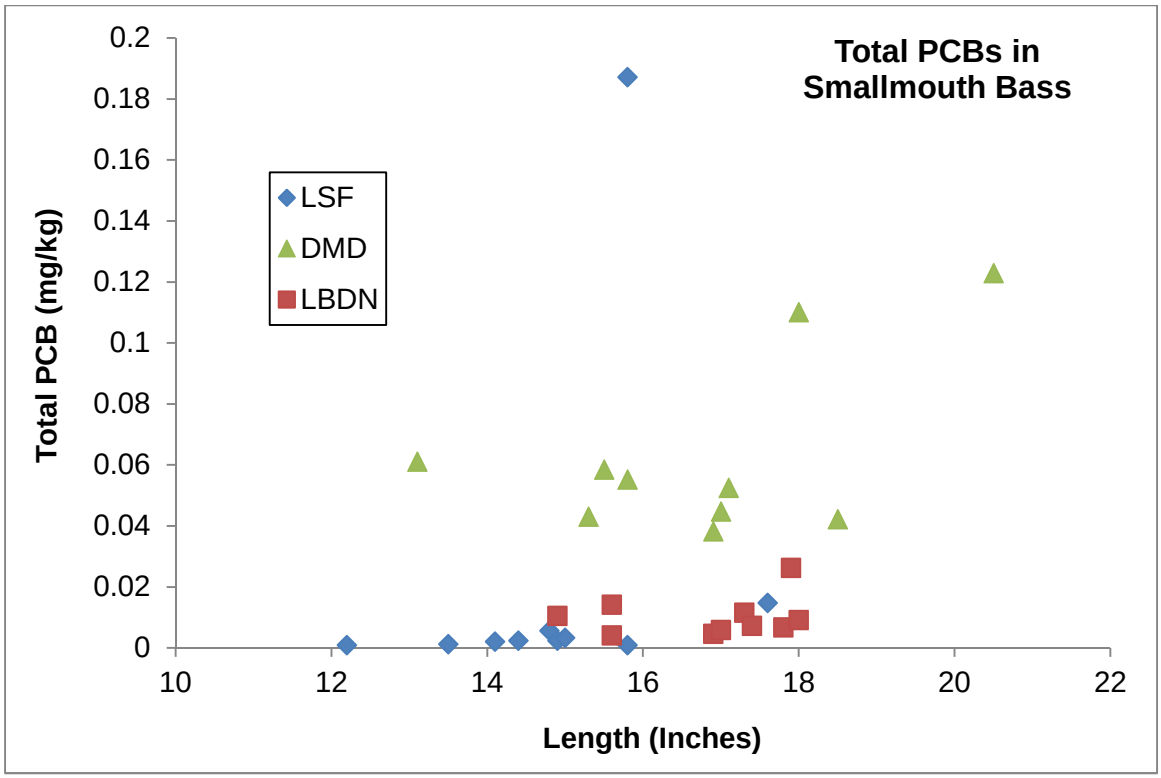


Figure 8. Length versus total PCB concentration in smallmouth bass collected from Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

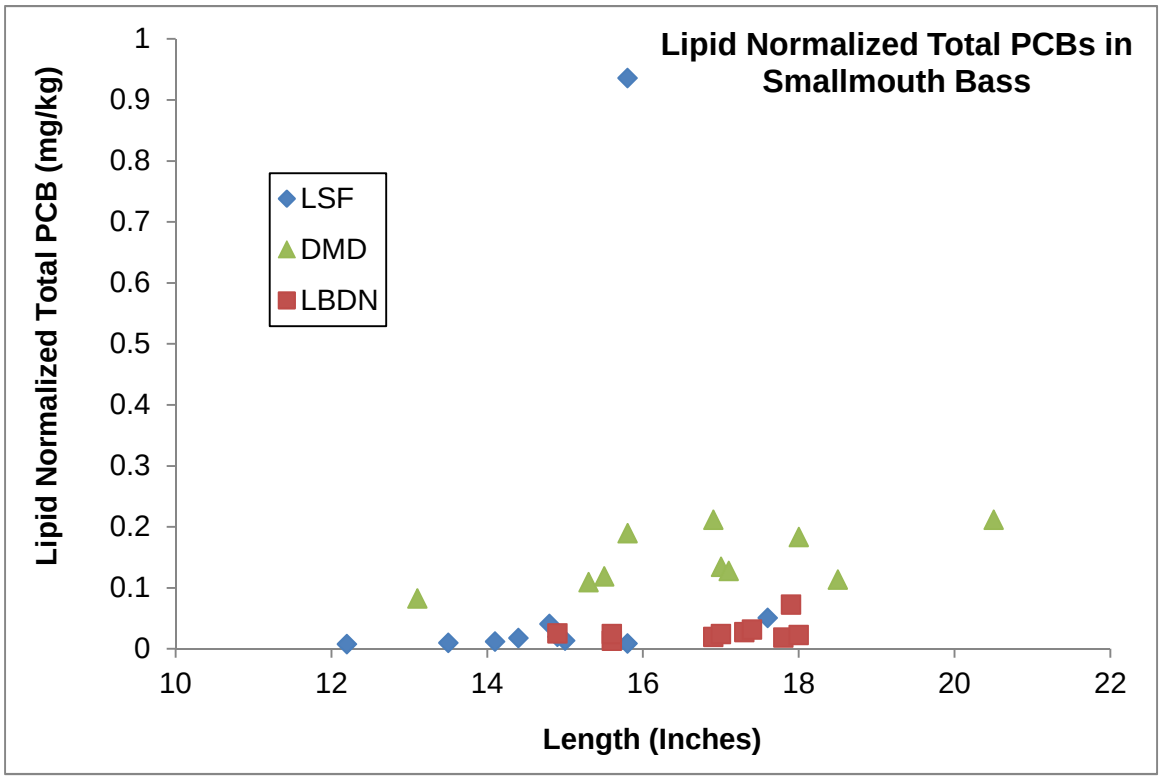


Figure 9. Length versus lipid-normalized total PCB concentration in smallmouth bass collected from Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

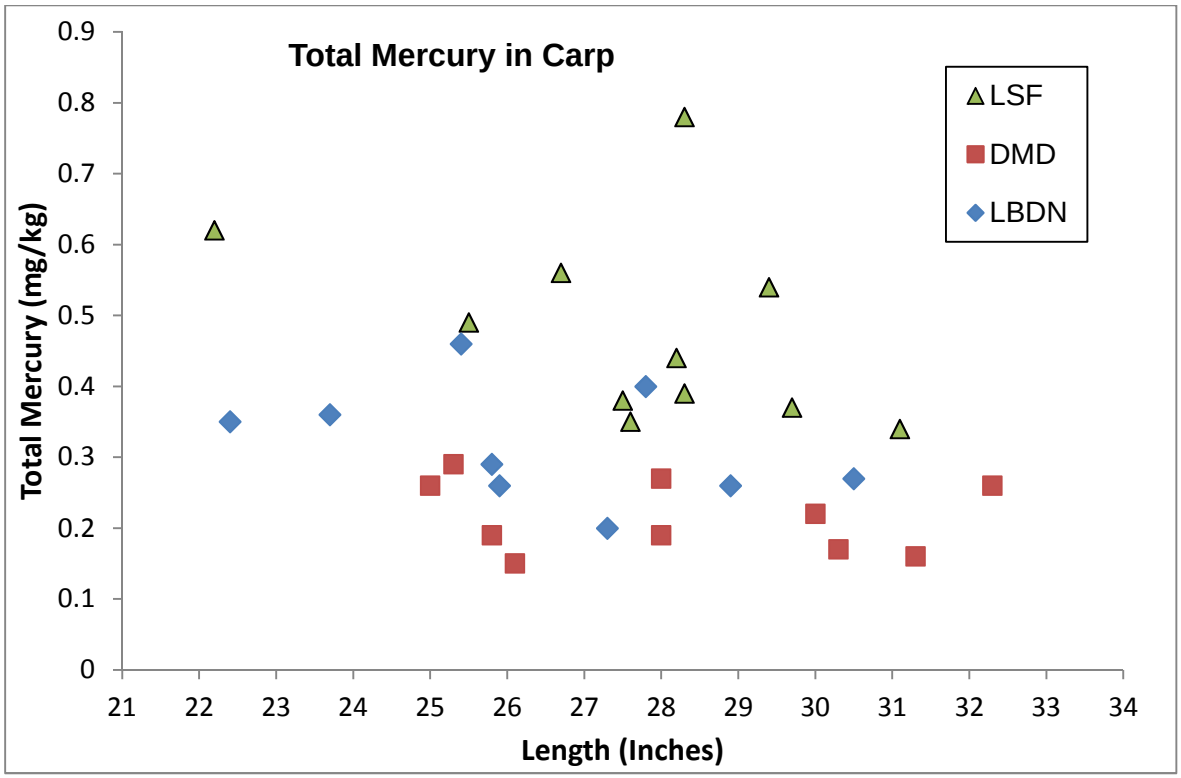


Figure 10. Length versus total mercury concentration in carp collected from Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

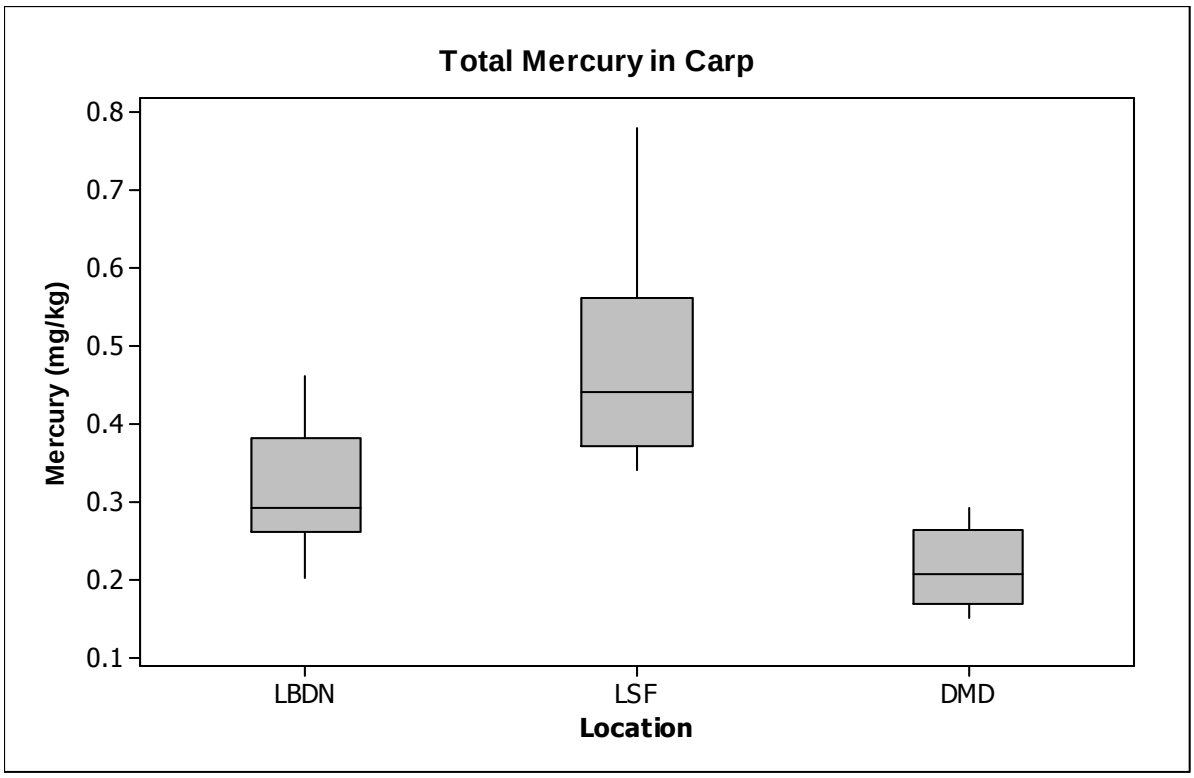


Figure 11. Boxplots of total mercury concentrations in fillets of carp from Little Bay De Noc (LBDN), Lower Scott Flowage (LSF), and the Menominee River downstream of the Menominee Dam (DMD).

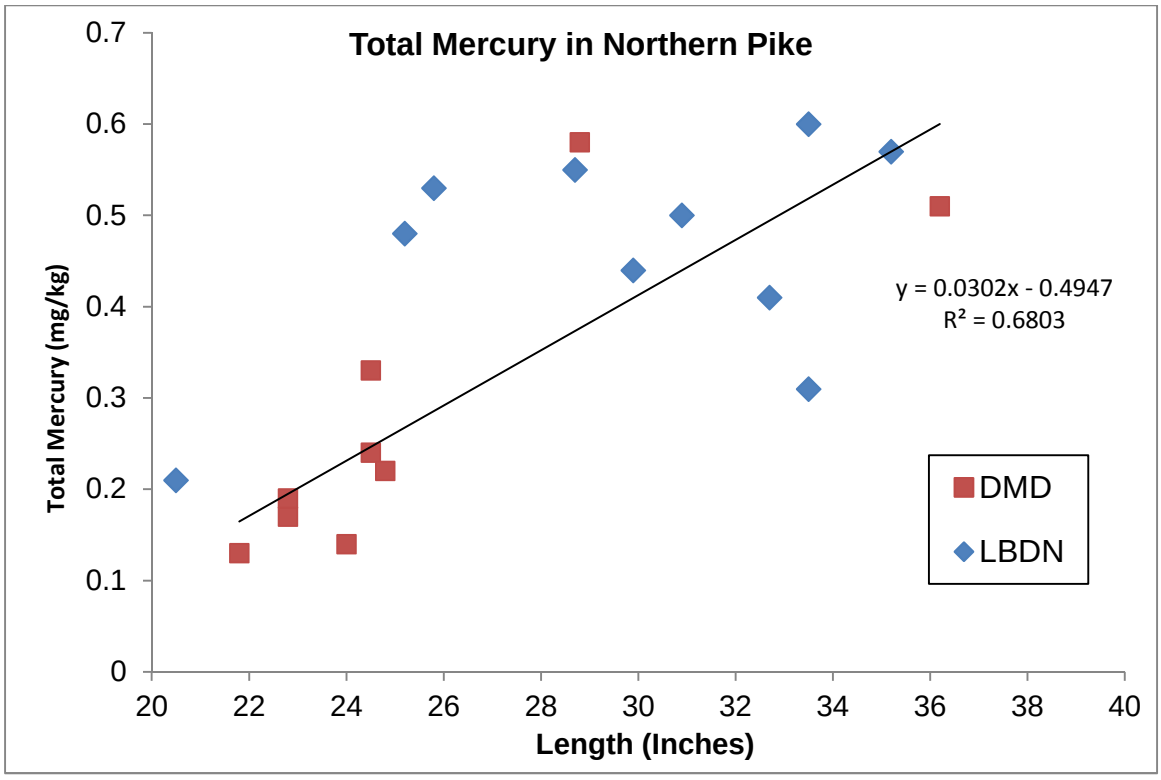


Figure 12. Length versus total mercury concentration in northern pike collected from the Menominee River downstream of the Menominee Dam (DMD) and Little Bay De Noc (LBDN).

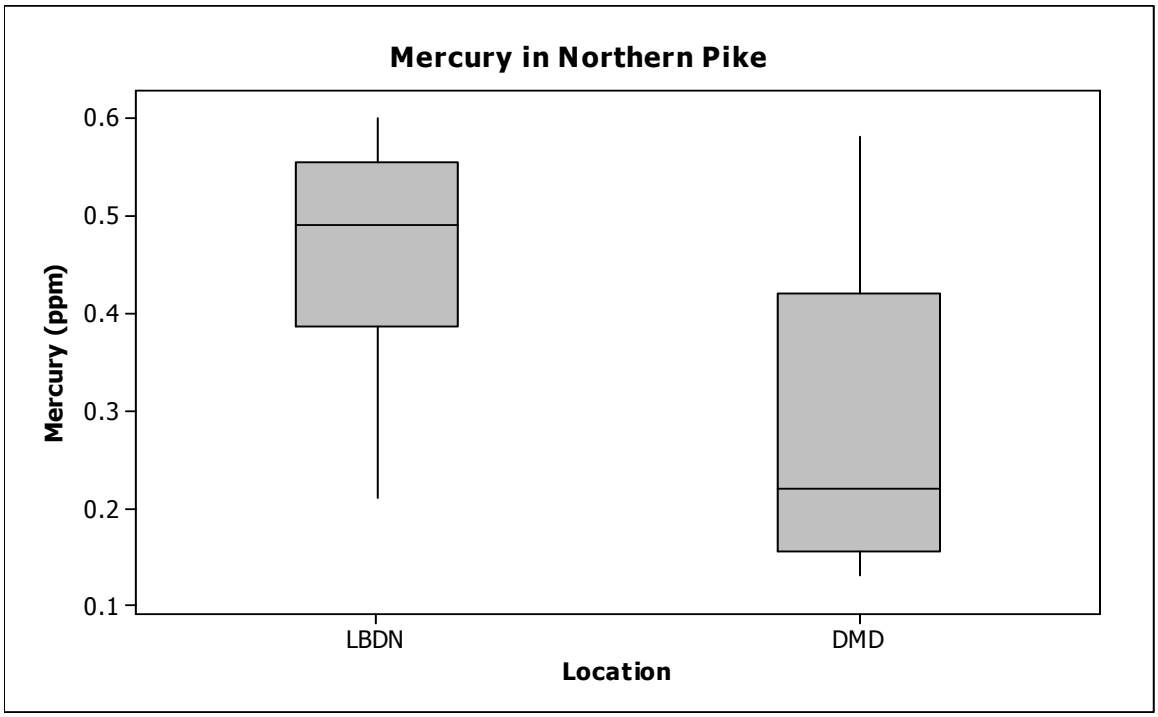


Figure 13. Boxplots of total mercury concentrations in fillets of northern pike from Little Bay De Noc (LBDN) and the Menominee River downstream of the Menominee Dam (DMD).

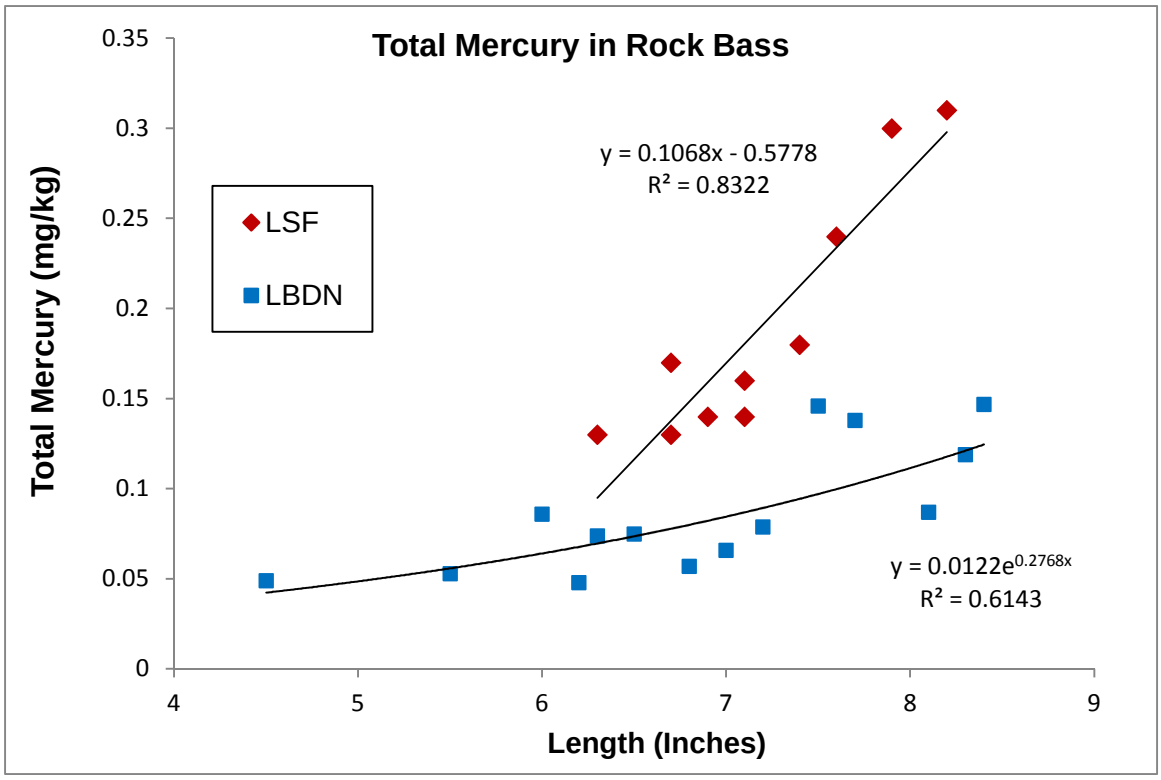


Figure 14. Length versus total mercury concentration in rock bass collected from the Lower Scott Flowage (LSF) and Little Bay De Noc (LBDN).

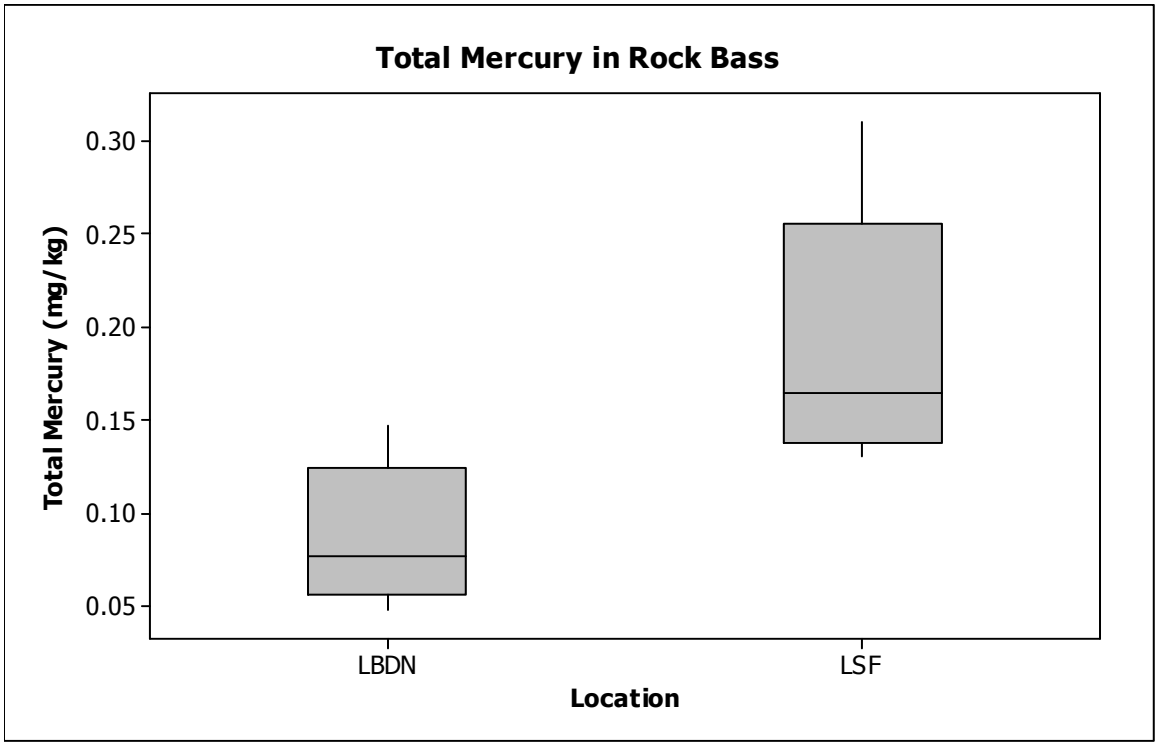


Figure 15. Boxplots of total mercury concentrations in fillets of rock bass from Little Bay De Noc (LBDN) and the Lower Scott Flowage (LSF).

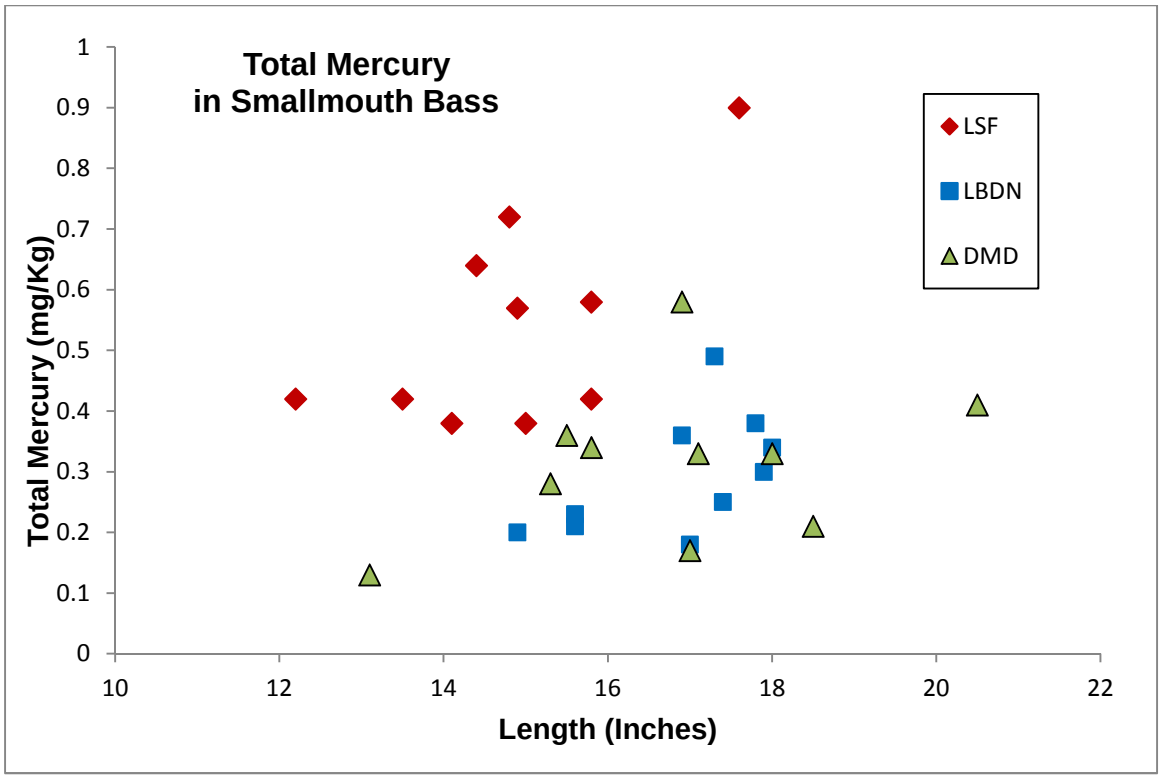


Figure 16. Length versus total mercury concentration in smallmouth bass collected from Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

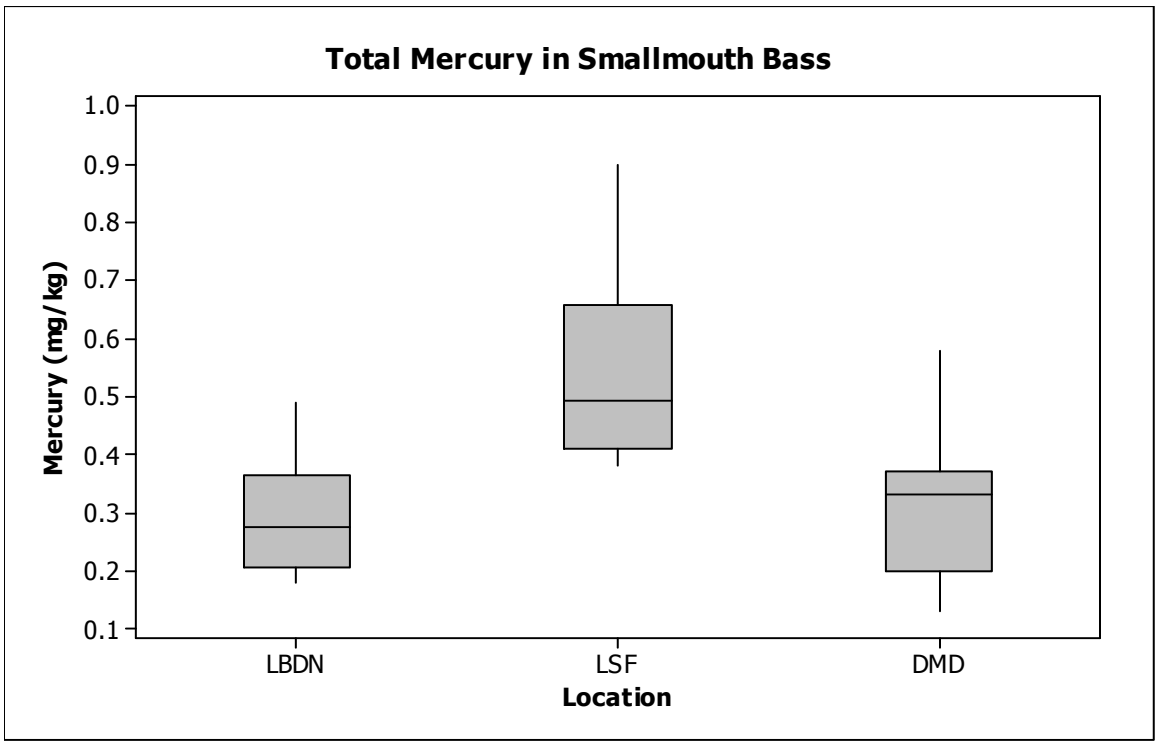


Figure 17. Boxplots of total mercury concentrations in fillets of smallmouth bass from Little Bay De Noc (LBDN), Lower Scott Flowage (LSF), and the Menominee River downstream of the Menominee Dam (DMD).

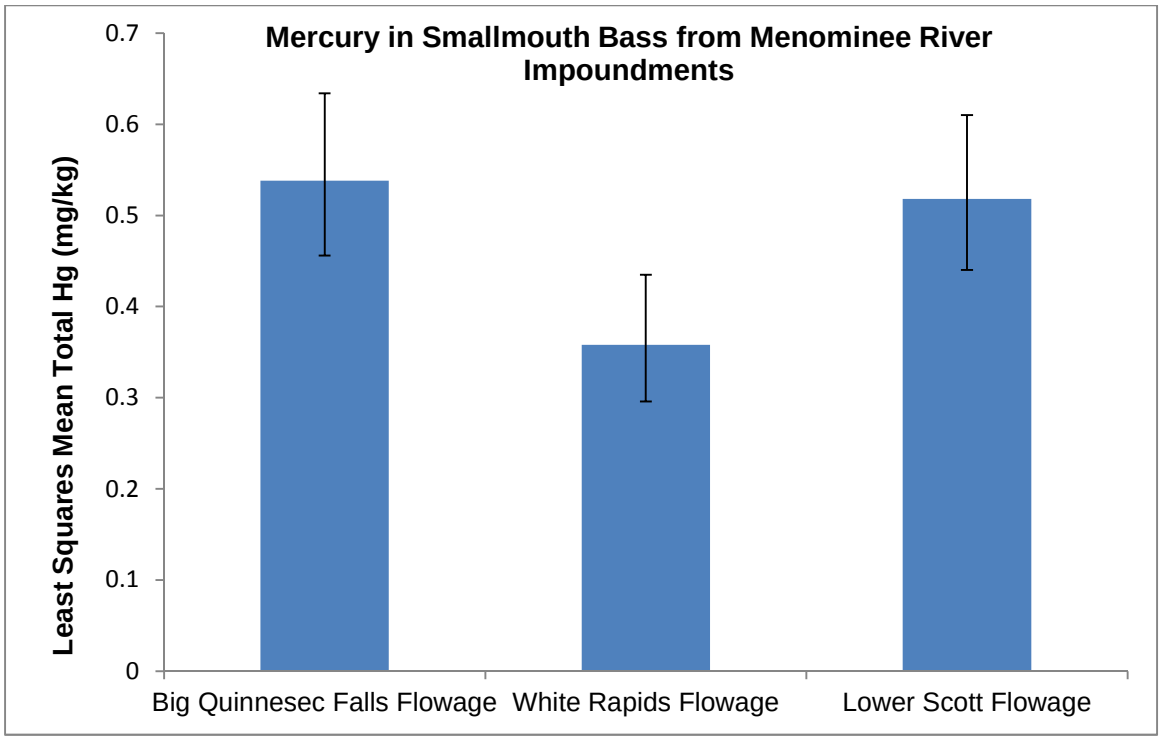


Figure 18. Least squares mean total mercury concentrations in smallmouth bass collected from three impoundments of the Menominee River in 2013 and 2014.

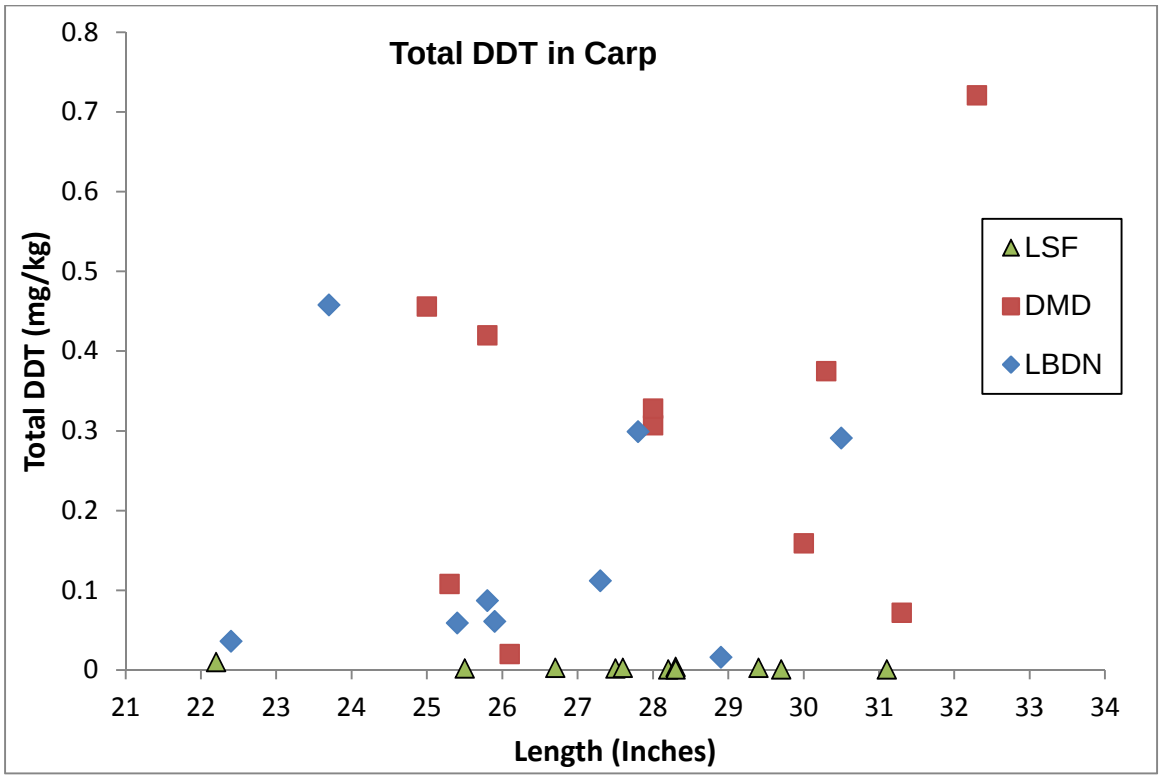


Figure 19. Length versus total DDT concentration in carp collected from Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

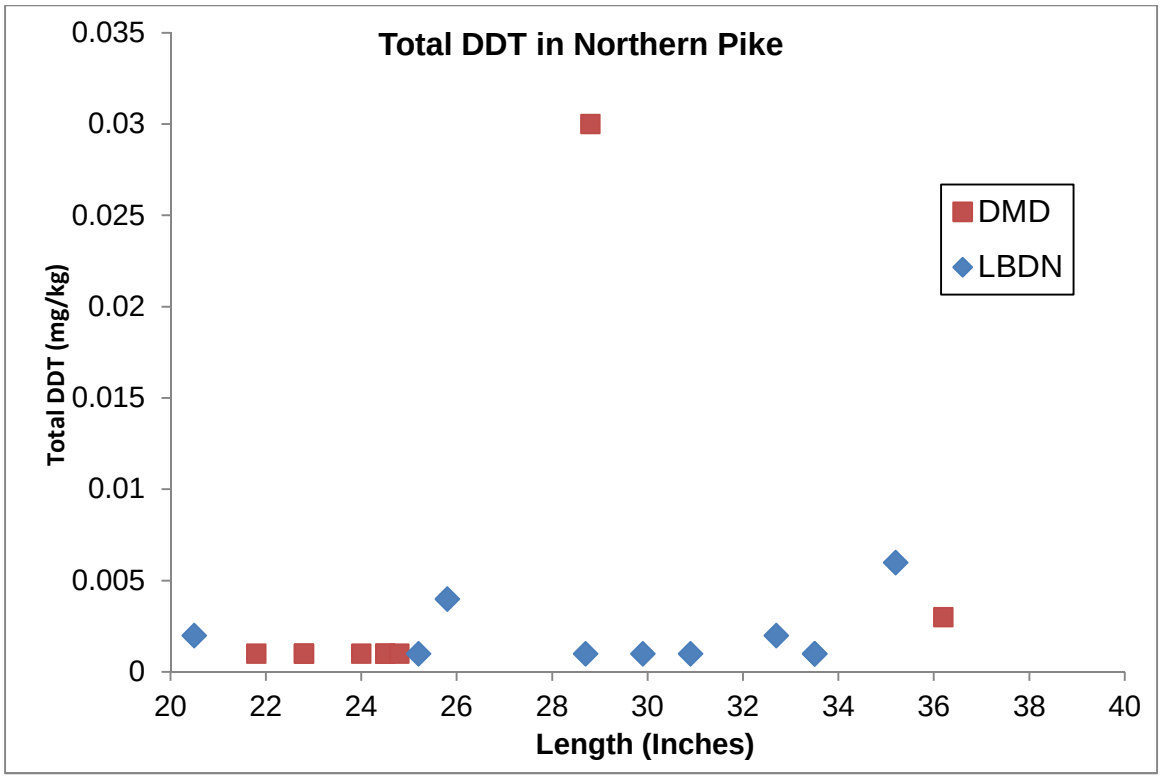


Figure 20. Length versus total DDT concentration in carp collected from Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

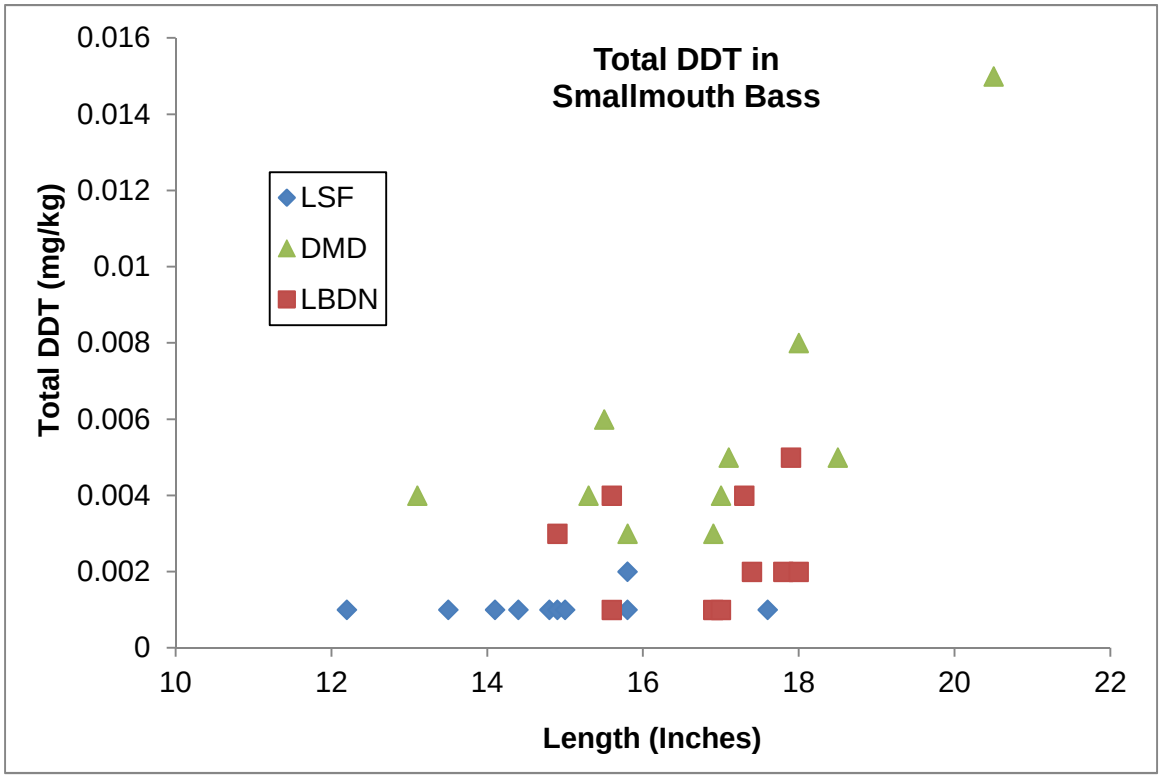


Figure 21. Length versus total DDT concentration in smallmouth bass collected from Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

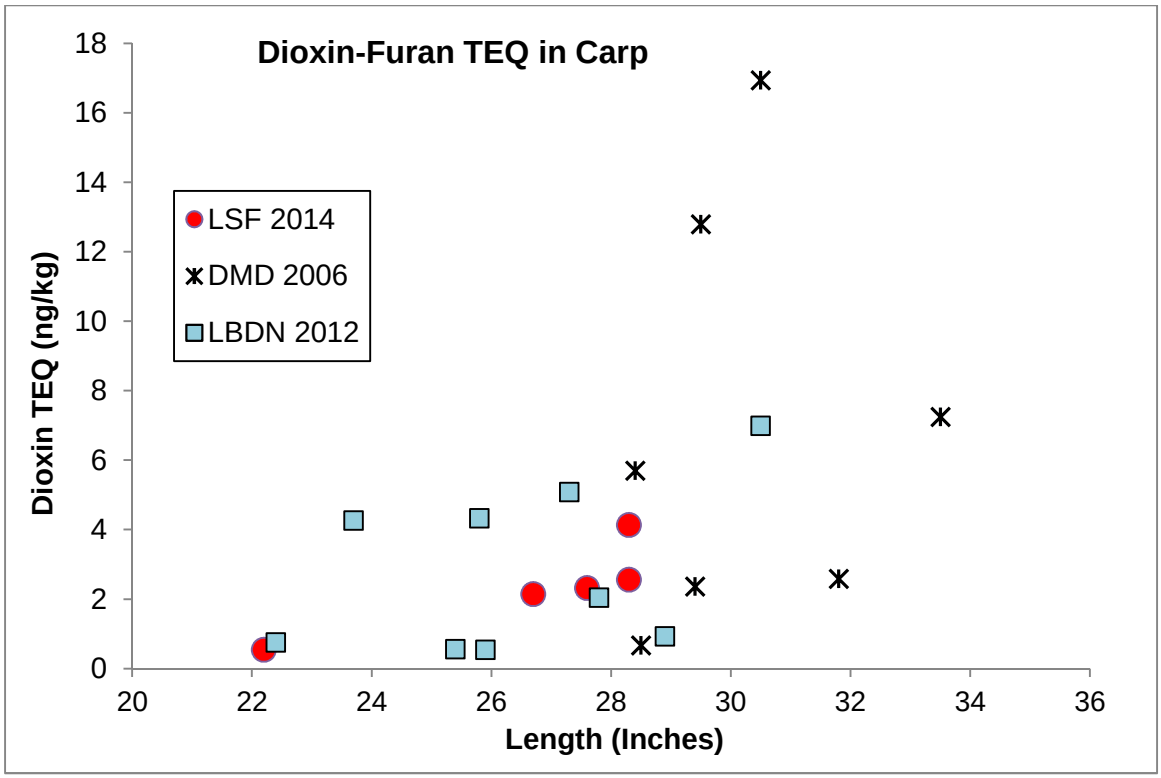


Figure 22. Length versus dioxin TEQ concentration in carp collected from Lower Scott Flowage in 2014 (LSF 2014), Menominee River downstream of the Menominee Dam in 2006 (DMD 2006), and the Little Bay De Noc in 2012 (LBDN 2012).

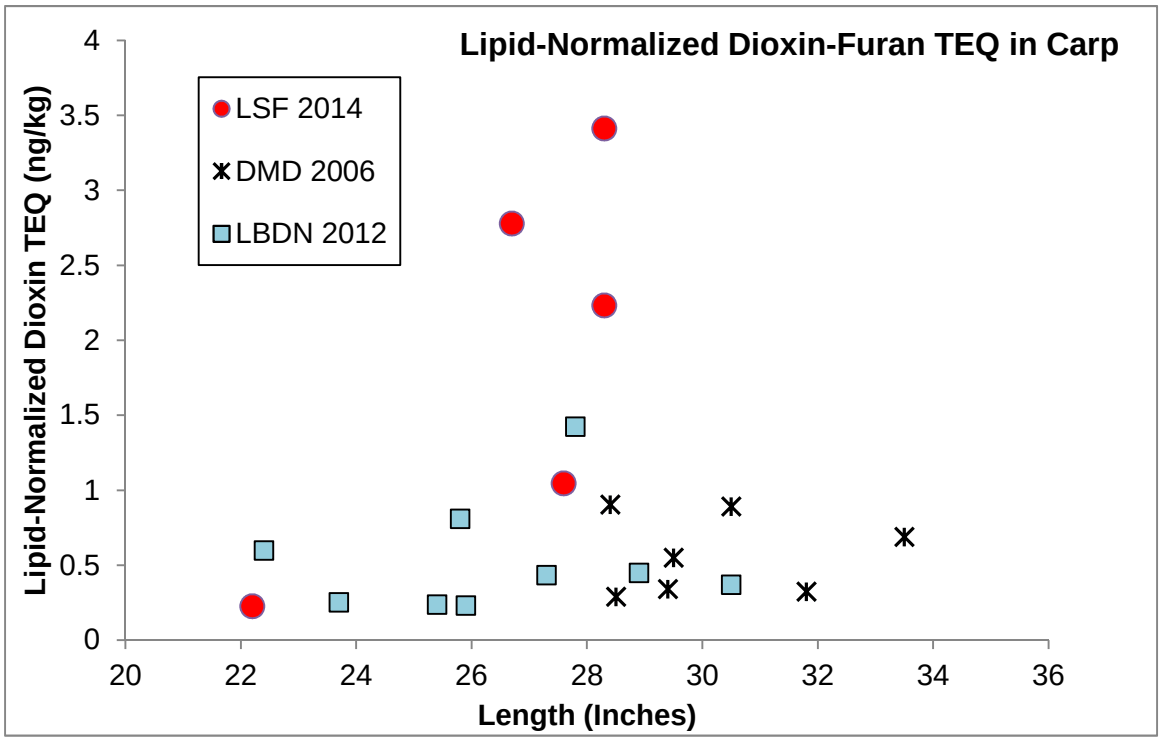


Figure 23. Length versus lipid-normalized dioxin TEQ concentration in carp collected from Lower Scott Flowage in 2014 (LSF 2014), Menominee River downstream of the Menominee Dam in 2006 (DMD 2006), and the Little Bay De Noc in 2012 (LBDN 2012).

Appendix A1.

Summary statistics for lengths of fish samples collected from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), Little Bay De Noc (LBDN), and Chalk Hill Flowage (CHF).

Species	Length (Inches)						
	Site	Median	Mean	St Dev	Min	Max	N
Carp	LSF	28.2	27.7	2.4	22.2	31.1	11
	DMD	28.0	28.2	2.6	25.0	32.3	10
	LBDN	25.9	26.4	2.5	22.4	30.5	9
Northern Pike	DMD	24.5	25.6	4.4	21.8	36.2	9
	LBDN	30.4	29.6	4.6	20.5	35.2	10
Redhorse Sucker	LSF	20.5	20.2	0.6	19.4	20.9	5
	LBDN	22.9	22.7	1.8	20.2	25.4	10
	CHF	21.3	19.9	3.6	12.4	23.0	10
Rock Bass	LSF	7.1	7.2	0.6	6.3	8.2	10
	LBDN	6.9	6.8	1.1	4.5	8.4	14
Smallmouth Bass	LSF	14.9	14.8	1.5	12.2	17.6	10
	DMD	17.0	16.8	2.0	13.1	20.5	10
	LBDN	17.2	16.8	1.1	14.9	18.0	10

Appendix A2.

Summary statistics for total PCB concentrations fish samples collected from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), Little Bay De Noc (LBDN), and Chalk Hill Flowage (CHF).

Species	Total PCB Concentration (mg/kg)						
	Site	Median	Mean	St Dev	Min	Max	N
Carp	LSF	0.04	0.06	0.09	0.003	0.33	11
	DMD	1.83	1.84	1.42	0.24	5.35	10
	LBDN	0.67	1.08	1.27	0.06	4.10	9
Northern Pike	DMD	0.02	0.04	0.08	0.003	0.25	9
	LBDN	0.002	0.004	0.005	0.001	0.015	10
Redhorse Sucker	LSF	0.006	0.009	0.006	0.004	0.02	5
	LBDN	0.03	0.05	0.04	0.006	0.13	10
	CHF	0.002	0.008	0.01	0.001	0.03	10
Rock Bass	LSF	0.002	0.003	0.005	0.001	0.31	10
	LBDN	0.001	0.002	0.002	0.001	0.15	14
Smallmouth Bass	LSF	0.002	0.02	0.06	0.001	0.19	10
	DMD	0.054	0.06	0.03	0.038	0.12	10
	LBDN	0.008	0.01	0.01	0.004	0.03	10

Appendix A3.

Summary statistics for total mercury concentrations fish samples collected from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), Little Bay De Noc (LBDN), and Chalk Hill Flowage (CHF).

Species	Total Mercury Concentration (mg/kg)						
	Site	Median	Mean	St Dev	Min	Max	N
Carp	LSF	0.44	0.48	0.14	0.34	0.78	11
	DMD	0.20	0.22	0.05	0.15	0.29	10
	LBDN	0.29	0.32	0.08	0.20	0.46	9
Northern Pike	DMD	0.22	0.28	0.16	0.13	0.58	9
	LBDN	0.49	0.46	0.12	0.21	0.60	10
Redhorse Sucker	LSF	0.81	0.77	0.33	0.27	1.10	5
	LBDN	0.28	0.37	0.27	0.09	0.85	10
	CHF	0.82	0.71	0.32	0.11	1.10	10
Rock Bass	LSF	0.16	0.19	0.07	0.13	0.31	10
	LBDN	0.08	0.09	0.04	0.05	0.15	14
Smallmouth Bass	LSF	0.50	0.54	0.17	0.38	0.90	10
	DMD	0.33	0.31	0.13	0.13	0.58	10
	LBDN	0.28	0.29	0.10	0.18	0.49	10

Appendix A4.

Summary statistics for total DDT concentrations fish samples collected from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), Little Bay De Noc (LBDN), and Chalk Hill Flowage (CHF).

Species	Total DDT Concentration (mg/kg)						
	Site	Median	Mean	St Dev	Min	Max	N
Carp	LSF	0.002	0.003	0.003	0.001	0.010	11
	DMD	0.318	0.297	0.213	0.020	0.721	10
	LBDN	0.087	0.158	0.154	0.016	0.458	9
Northern Pike	DMD	0.001	0.004	0.010	0.001	0.030	9
	LBDN	0.001	0.002	0.002	0.001	0.006	10
Redhorse Sucker	LSF	0.001	0.001	0.000	0.001	0.001	5
	LBDN	0.010	0.016	0.015	0.002	0.050	10
	CHF	0.001	0.001	0.000	0.001	0.001	10
Rock Bass	LSF	0.001	0.001	0.000	0.001	0.001	10
	LBDN	0.001	0.001	0.000	0.001	0.002	14
Smallmouth Bass	LSF	0.001	0.001	0.000	0.001	0.002	10
	DMD	0.005	0.006	0.004	0.003	0.015	10
	LBDN	0.002	0.003	0.001	0.001	0.005	10

Appendix B. Michigan Department of Health and Human Services Fish Consumption Screening Values 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**
meals per month	*µg/g (ppm)*	*pg TEQ/g (ppt-TEQ)*	*µg/g (ppm)*	*µg/g (ppm)*
16	≤ 0.11	≤ 0.5	≤ 0.07	≤ 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 (provisional)**	**Selenium**	**Total "Apparent" Toxaphene**	**Toxaphene Parlars 26, 50, 62 (Σ3PC26,50,62)**
meals per month	*µg/g (ppm)*	*µg/g (ppm)*	*µg/g (ppm)*	*µg/g (ppm)*
16	≤ 0.009	≤ 2.3	≤ 0.02	≤ 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

Appendix D 2017 Review on the Status of the Fish Contaminant Levels in the Lower Menominee River, Michelle Bruneau, MDHHS

(Note: does not include the attachment, which is the same as Appendix C of this document.)

Menominee River Area of Concern

This document features excerpts from the Michigan Department of Environmental Quality (MDEQ) Staff Report: *Status of Fish Contaminant Levels in the Lower Menominee River Area of Concern* released in March 2017 and the *Stage 2 Remedial Action Plan for the Lower Menominee River* released in December 2011. If you have questions about either document, please contact the MDEQ Office of the Great Lakes' Area of Concern program at 517-284-5035.

Overview of Areas of Concern (AOCs)

In the 1980s, the United States and Canadian governments identified 43 places in the Great Lakes region that had severe, long-term environmental problems. These places are called *Areas of Concern* or *AOCs*. Michigan originally had 14 AOCs located in both the upper and lower peninsulas. Two have been remediated and removed from the list. Now there are only 12 remaining, including the Lower Menominee River Area of Concern shared by the states of Wisconsin and Michigan.

People in federal, state, and local governments are working together to address the problems in all of these areas. Locally, the Lower Menominee River Citizens Advisory Committee (CAC) addresses these environmental problems with the support of partners from the state governments of Michigan and Wisconsin, as well as the U.S. Environmental Protection Agency.

Beneficial Use Impairments (BUIs)

These environmental problems are called *beneficial use impairments* or *BUIs.* There are 14 categories of BUIs named in the U.S.-Canadian Great Lakes Water Quality Agreement. However, a place does not have to have all 14 problems to be called an AOC. The Lower Menominee River AOC originally had six BUIs, now only five are remaining.

Each BUI has goals that need to be met in order to be removed from the AOC's list of problems. Once all BUIs are removed from the list, the AOC is considered to be no longer impaired and can be *delisted,* or removed from the list of AOCs.

The Goal: Delisting & a Healthy Environment

Once all of the assigned BUIs have been removed from an AOC, the CAC and Michigan Department of Environmental Quality, and the Wisconsin Department of Natural Resources submit a petition to the U.S. Environmental Protection Agency requesting it be removed from the list of AOCs. This is called "delisting." Two of Michigan's 14 original AOCs were delisted in 2014. Other sites in both states, including the Lower Menominee River AOC, are closer to delisting thanks to the dedication of the local, state, and federal stakeholders working to improve our environment, along with funding from the U.S. Environmental Protection Agency and the Great Lakes Restoration Initiative.

The Lower Menominee River's BUIs:

- Restrictions on Fish and Wildlife Consumption
- Degraded Fish and Wildlife Populations
- Loss of Fish and Wildlife Habitat
- Degradation of Benthos
- Restrictions on Dredging Activities
- Beach Closings *(Removed March 2011)*

Additional BUIs not affecting this area:

- Restrictions on Drinking Water Consumption or Taste and Odor Problems
- Tainting of Fish and Wildlife Flavor
- Fish Tumors or Other Deformities
- Bird or Animal Deformities or Reproductive Problems
- Degradation of Phytoplankton and Zooplankton Populations
- Degradation of Aesthetics
- Eutrophication or Undesirable Algae
- Added Costs to Agriculture or Industry

2017 Review on the Status of Fish Contaminant Levels in the Lower Menominee River

Assessing the Fish Consumption BUI in the Lower Menominee River AOC is challenging given that the AOC extends into areas that are likely influenced by sources beyond the scope of the Lower Menominee River AOC.

The focus of this white paper prepared by Michelle Bruneau of the Michigan Department of Health and Human Services at the behest of the Menominee River AOC Coordinators at the MDEQ and WDNR is to summarize the MDEQ Staff Report that follows this document, which compares fish contaminant levels in the AOC with those in a control site, which is one of the three options in the restoration targets.

The Menominee River flows into Green Bay. Green Bay has many direct source contaminant inputs, as well as tributaries that are far more contaminated than the Menominee River, including the Wisconsin's Lower Green Bay and Fox River AOC. Fish are able to move from Green Bay into the Menominee River AOC, unobstructed until they reach the Menominee Dam. The section of the river between the Menominee Dam and the upper limits of the AOC, the Park Mill/Upper Scott Dam - an area otherwise known as the Lower Scott Flowage - is the section of the AOC that most likely reflects the true status of the AOC's Fish Consumption BUI. This is because although the area downstream of the Menominee Dam is still part of the AOC, fish collected here do not present an accurate snapshot of the current status of the Fish Consumption BUI given the likely influence of contaminated areas outside of the AOC.

The Park Mill/Upper Scott Dam serves as a barrier preventing fish from traveling upstream of the AOC. Therefore, comparing fish from the upstream portion of the Menominee River and the selected primary reference site of Little Bay de Noc, to the fish from the Lower Scott Flowage, will provide the best assessment of the AOC's Fish Consumption BUI. Little Bay de Noc was selected as the primary reference site for the Lower Menominee River AOC because the regional inputs are going to be similar to those around the Lower Menominee River AOC, but the bay was not historically influenced by direct contaminant inputs like the Menominee River, and fish species are going to be similar in both locations.

In 2011, the Michigan Department of Health and Human Services (MDHHS) was provided funding from the U.S. EPA through the Great Lakes Restoration Initiative to partner with the Michigan Department of Environmental Quality (MDEQ) and the local AOC Public Advisory Councils to assess the status of the Fish Consumption BUIs in five of Michigan's then fourteen AOCs.

The MDEQ, in partnership with the Wisconsin Department of Natural Resources (WDNR) and MDHHS, collected fish from the AOC and the agreed upon reference site, Little Bay de Noc in 2012 and 2014. The fish were analyzed and the ***MDEQ Staff Report: Status of Fish Contaminant Levels in the Lower Menominee Area of Concern*** (draft attached to this document) detailing this work was produced by Joseph Bohr, MDEQ Water Resources Division in 2017.

The following white paper summarizes the 2017 MDEQ Staff Report and other pertinent information that can be used by the MDEQ Office of the Great Lakes AOC Program, the Lower Menominee River Citizens' Advisory Committee, and the Wisconsin Department of Natural Resources to assess the current status of the Fish Consumption BUI.

It should be noted that WDNR has additional data points for the Menominee River AOC that were not included in the attached MDEQ Staff Report, and therefore not accounted for in this White Paper for three reasons:

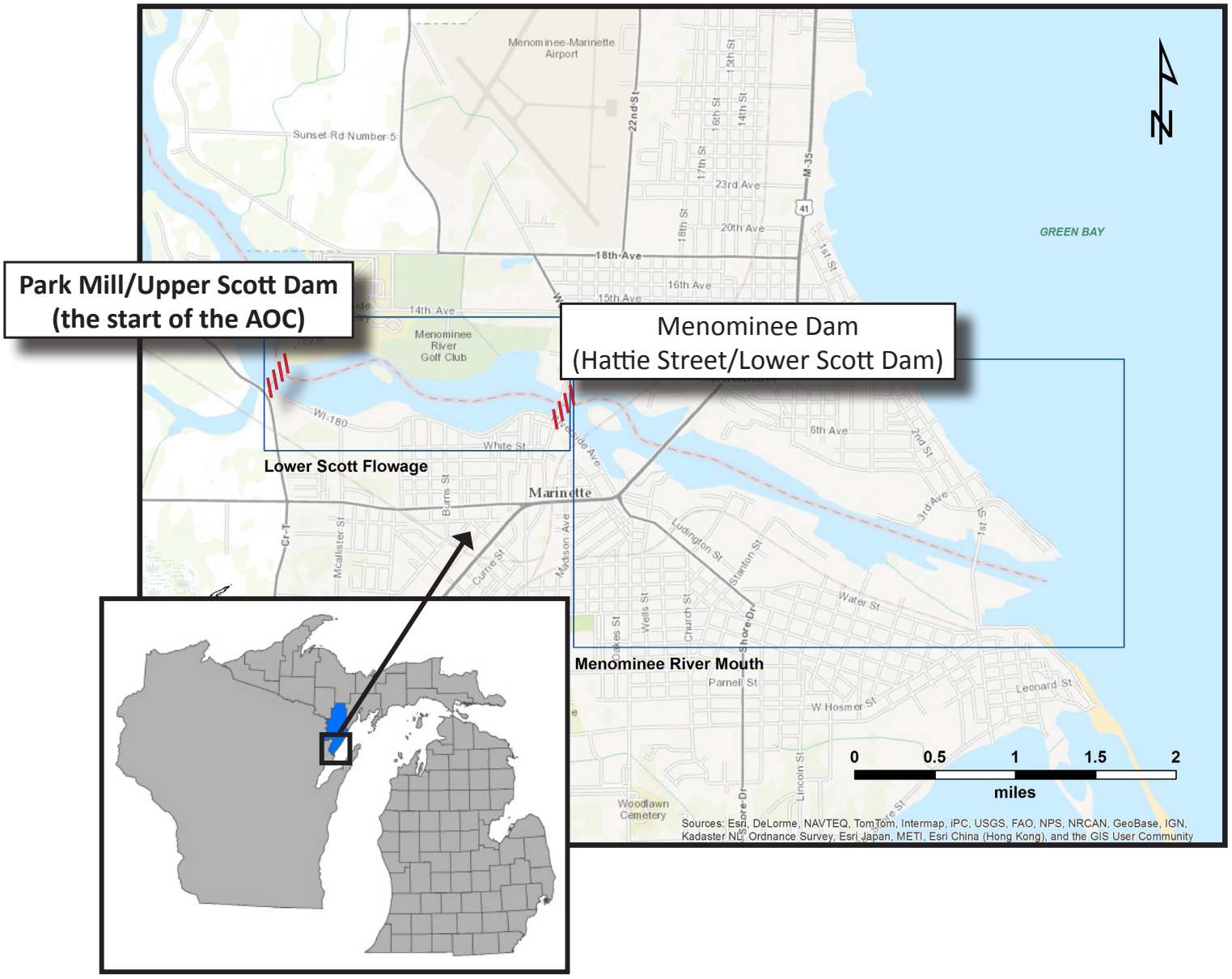
- Wisconsin's Lower Scott Flowage data were not included in the MDEQ analysis because they were too old to provide for accurate across-site comparisons
- MDEQ and MDHHS run carp and pike as skin-off fillets, unlike Wisconsin
- The MDHHS Laboratory runs analysis of PCBs as congeners instead of aroclors.

To learn more about the Michigan Fish Consumption program and methods:
http://www.michigan.gov/documents/mdch/MFCAP_Guidance_Document_500546_7.pdf

To learn more about the Wisconsin Fish Consumption program and methods:
Request the *Fisheries Management Handbook Chapter 530 Section B, titled Fish Consumption Advisory Determination* from the WDNR. Not available online.

About the Lower Menominee River Area of Concern (AOC)

The Lower Menominee River AOC includes the lower three miles (4.8 km) of the river from the Park Mill Dam (aka Upper Scott Dam) downstream to the river mouth and approximately 3.1 miles (5 km) north and south of the mouth along the adjacent shoreline of Green Bay. It includes the Lower Scott Flowage, which is an impoundment formed by the Menominee Dam (aka Lower Scott Dam and Hattie Street Dam), Green Island, and Seagull Bar. The AOC and its watershed is shared between Michigan and Wisconsin.



Restrictions on Fish Consumption Beneficial Use Impairment

According to the Stage 2 Remedial Action Plan (RAP) for the Lower Menominee AOC (2011), this beneficial use is considered impaired due to mercury and PCBs. Per the Stage 2 RAP, the restoration targets for this AOC are as follows:

- Sources of PCBs, mercury, and dioxins within the AOC have been controlled or eliminated; and
- Waters within the Lower Menominee River AOC are no longer listed as impaired due to PCB or dioxin fish consumption advisories in the most recent Impaired Waters (303(d)) list for either state; **OR**
- Fish tissue contaminants causing advisories in the AOC are the same or lower than those in the associated Great Lake or appropriate control site.

PCBs

In 2006, the US EPA completed the ***Results of the Lake Michigan Mass Balance Project: Polychlorinated Biphenyls Modeling Report (December 2006)*** (http://1.usa.gov/1QHagE6). This study looked at all of the major tributaries that lead into Lake Michigan and calculated the amount of PCBs they add to the lake. This study showed that the Menominee River only adds a small amount of the total PCBs going into the lake. In fact, it was determined that the Fox River adds 20 times MORE PCBs than the Menominee; however, work is underway to reduce the amount of PCBs in the Lower Fox River.

According to PCB analysis conducted by the MDEQ and MDHHS in 2012 [Table 6 from the attached MDEQ Staff Report], PCB concentrations in carp from both the area downstream of the Menominee Dam and Little Bay de Noc were significantly higher than concentrations in carp from Lower Scott Flowage. PCB concentrations in northern pike, rock bass, and smallmouth bass were also the same or higher in the reference site compared to the AOC.

Table 6. Median total PCB and median lipid-normalized total PCB concentrations in fish collected from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

Species	Median Total PCB (mg/kg)			Median Lipid-Normalized Total PCB (mg/kg)		
	LSF	DMD	LBDN	LSF	DMD	LBDN
Carp	0.04*	1.83*	0.67*	0.02*	0.29*	0.12*
Northern Pike	--	0.02*	0.002*	--	0.10*	0.01*
Rock Bass	0.002	--	0.002	0.004	--	0.008
Smallmouth Bass	0.002*	0.05*	0.008*	0.02*	0.13*	0.02*

Source: Table 6 - MDEQ Staff Report: Status of Fish Contaminant Levels in the Lower Menominee River Area of Concern, 2017

*significantly different

Also, when referencing the ***MDHHS 2015 Eat Safe Fish Guide - Upper Peninsula***, fish have consumption guidelines driven by PCBs not only in the Lower Scott Flowage, but also in adjacent areas below the Menominee Dam and throughout Green Bay, as well as above the Upper Scott Dam, which is the upper limits of the AOC.

This demonstrates that Menominee River fish are likely influenced by PCB inputs not only downstream of the AOC, but also upstream. And in fact, the section of the river which is essentially the heart of the AOC - the Lower Scott Flowage - has only one fish species (carp) that includes PCBs as a Chemical of Concern in the ***2015 Eat Safe Fish Guide*** compared to four fish species above (carp, largemouth bass, smallmouth bass, and suckers) and five fish species below (black crappie, carp, largemouth bass, smallmouth bass, and white crappie). In addition, suckers are listed for PCBs below and above the Lower Scott Flowage, and only for mercury within the Lower Scott Flowage.

SUMMARY:

- **There are no apparent direct sources of PCBs in the Lower Menominee River AOC.**
- **Median totals of PCBs in fish from the Lower Scott Flowage are lower or the same as fish from Little Bay de Noc.**

MDHHS 2015 Eat Safe Fish Guidelines for the Menominee River

UPSTREAM OF THE AOC

Menominee River

(between the Twin Falls Dam in Dickinson Co. and Upper Scott [Park Mill] Dam; including the Big & Little Quinnesec Falls Impoundments in Dickinson Co., and the Chalk Hill Impoundment, White Rapids Impoundment, Grand Rapids Impoundment, and the Upper Scott Flowage in Menominee Co.)

Type of Fish	Chemicals of Concern	Size of Fish (length in inches)	MI Servings per Month*
Carp	PCBs	Any	Limited▲
Largemouth Bass	PCBs	Any	1[2x]
Northern Pike	Mercury	Any	1
Rock Bass	Mercury	Any	4
Smallmouth Bass	PCBs	Any	1[2x]
Suckers	PCBs & Mercury	Under 18"	4
	Mercury	Over 18"	1
Walleye	Mercury	Any	1

LOWER SCOTT FLOWAGE

Menominee River

(between the Upper Scott [Park Mill] Dam and the Menominee Dam)

Type of Fish	Chemicals of Concern	Size of Fish (length in inches)	MI Servings per Month*
Carp	PCBs & Mercury	Any	2
Rock Bass	Mercury	Any	2
Suckers	Mercury	Any	6 Per Year
Walleye	Mercury	Under 20"	1
		Over 20"	6 Per Year

DOWNSTREAM OF MENOMINEE DAM

Menominee River

(between the Menominee Dam and Green Bay)

Type of Fish	Chemicals of Concern	Size of Fish (length in inches)	MI Servings per Month*
Black Crappie	Mercury	Under 9"	8
	PCBs & Mercury	Over 9"	4
Bluegill	Mercury	Any	8
Carp	PCBs	Any	Do Not Eat▲
Largemouth Bass	PCBs & Mercury	Under 18"	2
	Mercury	Over 18"	1
Northern Pike	Mercury	Any	1
Smallmouth Bass	PCBs & Mercury	Under 18"	2
	Mercury	Over 18"	1
Sunfish	Mercury	Any	8
White Crappie	Mercury	Under 9"	8
	PCBs & Mercury	Over 9"	4
Yellow Perch	Mercury	Any	4

When fishing the river downstream of the Menominee Dam, please use the Green Bay guidelines on page 20 for species not listed above.

Source: MDHHS' 2015 Eat Safe Fish Guide

Mercury

Unfortunately, mercury is a worldwide problem - not one just limited to the Menominee River. The majority of fish consumption guidelines in Michigan's Upper Peninsula are caused by mercury. Of note, when comparing mercury levels in Lower Peninsula and Upper Peninsula fish, Upper Peninsula fish tend to have higher concentrations of mercury at smaller sizes than their Lower Peninsula counterparts. However, this is most likely due to slower fish growth rates due to lower water temperatures and a limited nutrient base in Upper Peninsula waterbodies.

In addition, watershed characteristics, including the number of wetlands and higher sulfur levels in these northern areas tend to lead to increased methylation rates. These environmental factors, rather than exceptionally higher levels of mercury in the lakes and rivers, are likely what lead to the elevated mercury levels in Upper Peninsula fish.

To learn more, read: ***The Growing Degree-Day and Fish Size-at-Age: the Overlooked Metric*** **at** http://sites.google.com/site/abneuheimer/Neuheimer_Taggart_2007.pdf **and MDEQ's Water Investigation: Groundwater in Menominee County (1963)** at http://www.michigan.gov/documents/deq/GIMDL-WI02I_216279_7.PDF.

According to studies cited by the International Joint Commission, concentrations of mercury in top predator fish are likely atmospherically driven and likely due to increased global mercury emissions affecting the Great Lakes Basin. To learn more, read ***Atmospheric Deposition of Mercury in the Great Lakes Basin*** found at https://www.epa.gov/sites/production/files/2015-08/documents/lmmbhg.pdf.

Another source examining mercury deposition in the Great Lakes region is the article titled: ***Use of Stable Isotope Signatures to Determine Mercury Sources in the Great Lakes*** found at: http://pubs.acs.org/doi/pdf/10.1021/acs.estlett.5b00277. This article demonstrates that overall, more mercury collects in the northern Lake Michigan basin than the southern portion of the basin, which further demonstrates that the mercury inputs into the Menominee River are more regional in nature, than localized within the AOC.

Michigan's Mercury Consumption Guideline Comparisons					
	MI Servings Per Month				
Species	**Statewide Guidelines**	**Lake Michigan**	**Green Bay**	**Menominee River - DMD**	**Menominee River - LSF**
Black/White Crappie	4	N/A	N/A	Under 9" - 8 Over 9" - 4	N/A
Bluegill/Sunfish	8	N/A	N/A	8	N/A
Large- and Small-mouth Bass	Under 18" - 2 Over 18" - 1	N/A	Under 18" - 2 Over 18" - 1	1	Under 18" - 1 Over 18" - 6 Per Year
Northern Pike	Under 30" - 2 Over 30" - 1	N/A	1	1	N/A
Yellow Perch	4	Under 10" - 4/8 (PCBs) Over 10" - 4	N/A	4	N/A

In fact, when comparing fish consumption guidelines driven by mercury in the Lower Menominee Area of Concern, most consumption guidelines in the area are the same or are better than the Michigan Statewide Safe Fish Guidelines which account for atmospheric deposition input of mercury into Michigan's waterways.

To learn more, read the ***MDHHS 2015 Eat Safe Fish Guide - Upper Peninsula***.

Based on fish contamination data collected by MDEQ and MDHHS in 2012 assessing mercury, the Lower Scott Flowage of the Menominee River does show higher levels of mercury than the reference site in all species of fish tested: carp, rock bass, and smallmouth bass. However, this data alone does not provide an accurate portrait of the current status of the AOC.

Per the US EPA's Lake Michigan Mass Balance Study conducted in 2004, the Menominee River received a top scoring of 1 on the Index of Watershed Indicator. This best quality rating was assigned to just two of Lake Michigan's tributaries, the Menominee and the Manistique Rivers. A score of one represents "better quality, low vulnerability" in the river system.

In addition, according to the report, the lowest total mercury concentrations were observed in the Muskegon, Pere Marquette, Manistique, and Menominee Rivers. However, dissolved methylmercury concentrations in the Menominee River were significantly higher than in the Muskegon, Fox, Grand, and Grand Calumet Rivers. This leads one to conclude that it isn't necessarily an uncontrolled direct source of mercury to the Menominee River that results in higher mercury levels in fish, but rather, the natural environment within the river is actually conducive to methylation. Methylmercury is the type of mercury that is found in fish. This unfortunate mercury to methylmercury conversion efficiency is likely what leads to the slightly higher rates of mercury in fish tissue in the Menominee River despite the lower overall measurements of mercury in the river system.

Table 8. Median total mercury in fish collected from the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), and Little Bay De Noc (LBDN).

Species	Median Total Mercury (mg/kg)		
	LSF	DMD	LBDN
Carp	0.44*	0.20*	0.29*
Northern Pike	--	0.22	0.49
Rock Bass	0.16	--	0.08
Smallmouth Bass	0.50	0.33	0.28

Source: Table 8 - MDEQ Staff Report: Status of Fish Contaminant Levels in the Lower Menominee River Area of Concern, 2017

To learn more, read the US EPA's ***Lake Michigan Mass Balance Study: Mercury Data Report (February 2004)*** found at https://www.epa.gov/sites/production/files/2015-08/documents/lmmbhg.pdf.

SUMMARY:

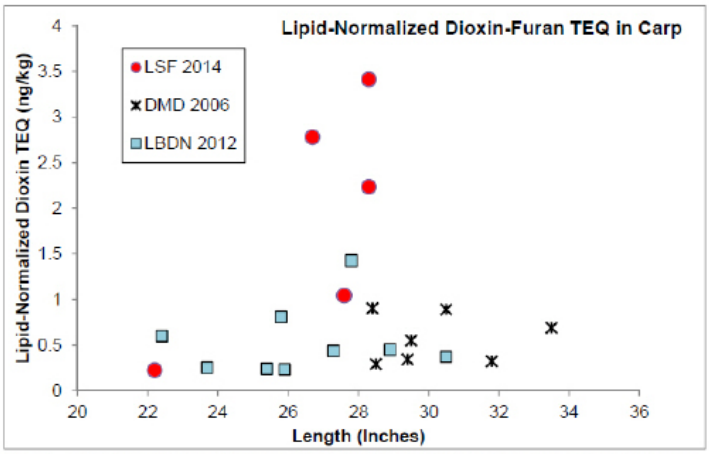
- **There are no apparent direct sources of mercury in the Lower Menominee River AOC.**
- **Median totals of mercury in fish from the Lower Scott Flowage are higher than fish from Little Bay de Noc; however, it is likely due to environmental influences beyond the scope of the AOC program.**

Dioxins

To assess this contaminant, carp were collected and analyzed from multiple locations within the Menominee River, Green Bay, and Little Bay de Noc. Carp were used because they generally present the worst case scenario for chlorinated contaminants like PCBs and dioxins due to their feeding habits and other biological factors.

To determine appropriate fish consumption guidelines, MDEQ and MDHHS calculate amounts of dioxins using toxic equivalency factors, also known as TEQ. The TEQ is a calculation that generally includes dioxin, furans, and dioxin-like PCBs. TEQ is used in Michigan to determine fish consumption guidelines because furans and dioxin-like PCBs tend to act the same as dioxins in the body after they are eaten. It's important to note that WDNR's fish consumption program does not do this. Another key difference between Michigan and Wisconsin's fish consumption program is Wisconsin runs aroclors, and not congeners like Michigan. Therefore, consumption advice for the same waterbody is sometimes different between states due to the inclusion of TEQ in MDHHS's guidelines.

When calculating for fish consumption guidelines, MDEQ and MDHHS use non-lipid normalized data (because guidelines are not calculated using comparisons) and set guidelines based on the 95% Upper Confidence Limit or regression analysis, whichever is most approriate. However, for the assessment of the Lower Menominee AOC Fish Consumption BUI, the MDEQ Staff Report utilizes both non-lipid normalized, as well as lipid normalized data, to allow for a more apples-to-apples statistical comparison. *Lipid normalized* means the contaminant results were divided by the amount of fat in each of the fish. Statistical methods of adjusting for differences in fat content were also used. This was done to ensure like comparisons between fish and sites. This is important because dioxins collect in the fat of a fish, so a fatter carp will carry more contaminants, even if the waterbody is not highly contaminated.



Source: Figure 23 - MDEQ Staff Report: Status of Fish Contaminant Levels in the Lower Menominee River Area of Concern, 2017

The lipid-normalized dioxin TEQ concentrations in carp from the Lower Scott Flowage were greater than TEQ in carp from Little Bay de Noc, and the amounts were significantly different. However, lipid-normalized dioxin TEQ levels from within the AOC were not statistically different than TEQ levels in the Chalk Hill Flowage, which is upstream of the AOC [Figure 23 from the MDEQ Staff Report, 2017].

In addition, when comparing non-lipid normalized data between the Chalk Hill Flowage and the Lower Scott Flowage, the mean dioxin TEQ concentration in the Chalk Hill Flowage is nearly double than what is found in Lower Scott Flowage fish. The Lower Scott Flowage fish also show the lowest mean concentrations of dioxin TEQ of all sites, although the differences are not significantly different [Table 12 from the MDEQ Staff Report, 2017].

Table 12. The 95% UCL on the mean dioxin TEQ concentration and projected consumption advice due to dioxin TEQ, based only on the most recent results for carp collected from the Chalk Hill Flowage (CHF), the Lower Scott Flowage (LSF), Menominee River downstream of the Menominee Dam (DMD), Green Bay (GB), and Little Bay De Noc (LBDN).

95% UCL (ppt)					Meals per Month				
CHF	LSF	DMD	GB	LBDN	CHF	LSF	DMD	GB	LBDN
7.7	3.9	11.4	5.6	4.7	0.5	1	0.5	1	1

Note: *Meals per Month presented here do not represent the final MDHHS determinations*

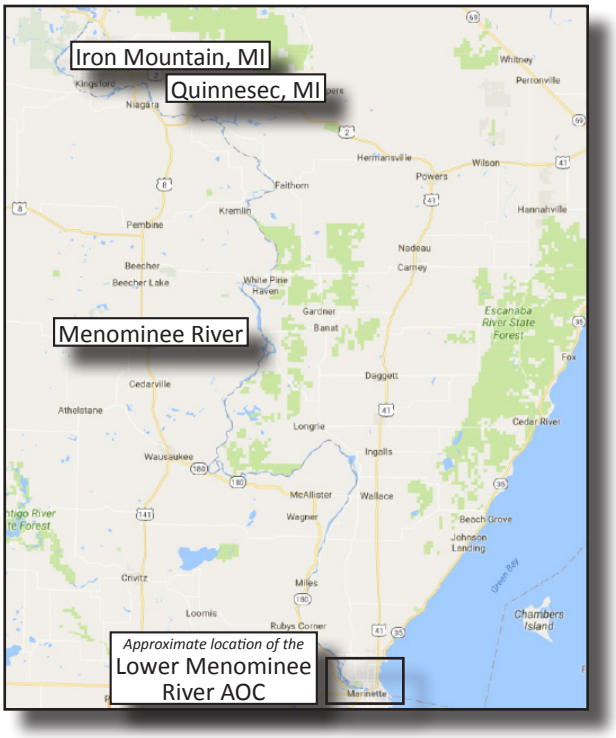
Source: Table 12 - MDEQ Staff Report: Status of Fish Contaminant Levels in the Lower Menominee River Area of Concern, 2017

*no significant differences

These two analyses demonstrate that dioxins upstream of the AOC are likely carried downstream into the Lower Scott Flowage and below the Menominee Dam. Similar to the other two chemicals cited in the Lower Menominee River AOC Fish Consumption BUI removal criteria, a direct source of dioxins does not seem to be present within the AOC

based on fish contaminant analysis.

Dioxin-like PCBs are primarily associated with the Lower Green Bay and Fox River AOC. Additional upstream contamination also likely stems from historical release of waste by-products from the Champion International Paper - Quinnesec Mill, a source outside of the boundaries of the Lower Menominee River AOC. All of these locations are outside the boundaries of the Menominee River AOC. Because of this, MDEQ opted to exclude dioxin-like PCBs from the calculations above because dioxins and furans have historically been found only in areas far upstream of the AOC. Additional potential sources of these dioxins and furans include paper mill operations in the Kingsford and Iron Mountain areas.



SUMMARY:

- **There are no apparent direct sources of dioxins in the Lower Menominee River AOC.**
- **Lipid-normalized dioxin TEQ in carp from the Lower Scott Flowage are higher than carp from Little Bay de Noc. However, the fish are likely influenced by sources upstream of the AOC.**

Resources

MDEQ Staff Report: Status of Fish Contaminant Levels in the Lower Menominee Area of Concern (attached)

Stage 2 Remedial Action Plan for the Lower Menominee AOC (2011)
http://www.michigan.gov/documents/deq/deq-ogl-aoc-MenomineeStage2RAP_378187_7.pdf

US EPA's Results of the Lake Michigan Mass Balance Project: Polychlorinated Biphenyls Modeling Report (December 2006) https://www.epa.gov/sites/production/files/2015-08/documents/lmmbpcb.pdf

MDHHS 2015 Eat Safe Fish Guide - Upper Peninsula
http://www.michigan.gov/documents/mdch/MDCH_EAT_SAFE_FISH_GUIDE_-_UPPER_PENINSULA_WEB_455361_7.pdf

International Joint Commission's Atmospheric Deposition of Mercury in the Great Lakes Basin
http://bit.ly/1XW2jAI

US EPA's Lake Michigan Mass Balance Study: Mercury Data Report (February 2004)
https://www.epa.gov/sites/production/files/2015-08/documents/lmmbhg.pdf

The Growing Degree-Day and Fish Size-at-Age: the Overlooked Metric
http://sites.google.com/site/abneuheimer/Neuheimer_Taggart_2007.pdf

MDEQ's Water Investigation: Groundwater in Menominee County (1963)
http://www.michigan.gov/documents/deq/GIMDL-WI02I_216279_7.PDF

MDEQ Impaired Waters (303(d))
http://www.michigan.gov/deq/0,4561,7-135-3306_71085_7257-12711--,00.html

About this Document

This White Paper was prepared by Michelle Bruneau, Project Manager for the Assessing Michigan's Beneficial Use of Sport-Caught Fish project at MDHHS in May 2016 and revised in March 2017 and provided to the state and local stakeholders working to remove the BUIs on the Menominee River AOC.