# Lower Menominee River AOC Fisheries Data Roundup

# Final Report

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## Executive Summary

Results of the Fisheries Data Roundup are critical to identifying the next step to remove the degradation of fish populations BUI. A project team of fisheries experts from Michigan DNR, Wisconsin DNR, and the US Fish and Wildlife service were assembled to review existing fisheries data for the Lower Menominee River AOC. The data was gathered by Wisconsin DNR staff, but included data collected by other agencies. The project team selected metrics to assess target species recruitment, and then set recruitment goals based on the evaluation metrics. When existing data was not available, inadequate, or not comparable for the selected evaluation, the team recommended the collection of additional fisheries data. Occasionally, the team modified the target species list based on environmental conditions and available data.

Yellow perch are considered to be above their recruitment goal in the lower river section of the AOC. The team recommends collecting additional data for the Lower Scott Flowage and lower river before other species recruitment status can be evaluated. In addition, the team recommends collecting three years of reference site data for the lower river. Once additional data has been gathered the project will reconvene to assess the recruitment status of remaining target species.

Understanding the strong interest in completing all restoration actions in the Lower Menominee River AOC by 2016, the project team suggests beginning aquatic habitat improvement prior to the collection of all additional data. The team has provided a list of natural areas and proposed restoration actions adequate to remove the “degradation of fish populations” Beneficial Use Impairment.

## Project Team

The team met six times from 7/12/2012 to 1/15/2013. There were two changes to the team through the course of the project. Schacht's employment with WDNR ended in October, all interim reports had been submitted by that point. In November, Hanchin joined the team when a portion of his job duties with MDNR were reassigned to the AOC program.

| Team Member | Title | Organization | Chief Responsibilities |
|---|---|---|---|
| **Sharon Baker** | Menominee River AOC Coordinator | Michigan DEQ | Provide feedback from the MI AOC program on methods proposed to assess fish recruitment, ensuring final methodology suits both States. |
| **Jessica Mistak** | Northern Lake Michigan Fisheries Supervisor | Michigan DNR | Oversee data gathering efforts for completeness and accuracy, especially related to data from MDNR. Identify data needs and use limitations. |
| **Patrick Hanchin** | Fisheries Biologist | Michigan DNR | Oversee data gathering efforts for completeness and accuracy, especially related to data from MDNR. Identify data needs and use limitations. |
| **Steve Choy** | Fish and Wildlife Biologist | US Fish and Wildlife Service | Oversee data gathering efforts for completeness and accuracy, especially related to data from US FWS. Identify data needs and use limitations. |
| **Andy Fayram** | Monitoring Data Coordinator | Wisconsin DNR | Oversee data gathering efforts for completeness and accuracy, especially related to data from WDNR. Identify data needs and use limitations. |
| **Benjamin Uvaas** | Menominee River AOC Coordinator | Wisconsin DNR | Meeting organization, facilitation, recording of meeting minutes, and completion of the final report |
| **Donalea Dinsmore** | Quality Assurance Project Coordinator | Wisconsin DNR | Oversight of quality assurance planning. |
| **Garret Schacht** | Fisheries Technician | Wisconsin DNR | Gather data and organize into interim reports. |
| **Mike Donofrio** | Lower Fox/Upper Green Bay Fisheries Supervisor | Wisconsin DNR | Oversee data gathering efforts for completeness and accuracy, especially related to data from WDNR. Identify data needs and use limitations. |
| **Tammie Paoli** | Fisheries Biologist | Wisconsin DNR | Oversee data gathering efforts for completeness and accuracy, especially related to data from WDNR. Identify data needs and use limitations. |

## Introduction

The purpose of this activity is to meet objectives set in the Fish and Wildlife Population and Habitat Management Plan and Stage 2 Remedial Action Plan, making progress towards the

removal of the "degradation of fish populations" beneficial use impairment (BUI). This is done by determining the recruitment status for target species of fish in the Area of Concern (AOC). This effort is essentially a BUI assessment, because BUI removal targets are closely tied to fish recruitment for the Menominee River Area of Concern. For BUI removal, no further actions are suggested for target species found to be meeting their recruitment goals. Outputs of future habitat restoration activities will revolve around the needs of target species not meeting their recruitment goals.

As a boundary water, the States of Wisconsin and Michigan are both responsible for restoring the Lower Menominee River AOC. Staff from the Michigan Departments of Environmental Quality (MDEQ) and Natural Resources (MDNR) were involved throughout the Fish Data Roundup effort. Wisconsin and Michigan have worked together to develop the recruitment metrics, recruitment goals, and recommendations found in this report and jointly accepted each.

Project Area

The Lower Scott Flowage (segment 1) and lower river (segments 2-6b) will be evaluated separately as the Lower Scott Dam (Menominee Dam) separates these populations (Appendix A). Lake sturgeon were deliberately excluded from this effort. Sturgeon are addressed in the Fish and Wildlife Population and Habitat Management Plan and Stage 2 Remedial Action Plan through a separate restoration goal. Objectives related to the lake sturgeon goal are closely tied to the outputs of sturgeon passage efforts currently taking place at the Upper and Lower Scott Dams.

Modifications to Target Species Lists

After all available data had been gathered for the Lower Scott Flowage, it became apparent that the target species list required modification. The original target species list included walleye, yellow perch, smallmouth bass, largemouth bass, and northern pike. Yellow perch was removed from the list, and in its place rock bass and bluegill were added. The team felt strongly that panfish needed to be represented in the assessment, but the flowage environment is more favorable for both of these species compared to yellow perch.

The team agreed to remove whitefish from the lower river target species list. No catch per effort or relative abundance data exists for whitefish. Existing data consists of length, age, weight, sex statistics. Brian Belonger's "*Documentation of a Menominee River Whitefish Run"* memo records the recent resurgence of a fall whitefish run, and the presence of adequate spawning habitat in the lower river. The team does support efforts to pass whitefish above the Lower and Upper Scott Dams to further improve recruitment, but does not consider these actions necessary for BUI removal.

Project Activities

Work can be broken into four sequential steps: gather existing data, select metrics to assess recruitment, set recruitment goals, and evaluate recruitment status and provide recommendations.

## Data Gathering

Primary investigator Garret Schacht worked under the guidance of Tammie Paoli and other WDNR staff to gather existing target species population data for the AOC. His findings are contained in several reports and data summary tables. Two additional reports and one raw data table were also included. The usefulness of these additional documents varies. A bulleted overview of the information contained in each of these documents follows:

*Lower Scott Flowage Fisheries Data Roundup* - Schacht, 2012
- Spring fyke net surveys, spring and fall electrofishing results
- Various descriptive statistics by species

*Lower Scott Flowage Catch per Effort* - Schacht, 2012
- Spring and fall catch per effort from double anode boom shocking data by species

*Lower Scott Flowage Data Summary Table* - Schacht, 2012
- Gear used, season, survey dates, target species, original purpose, assumptions, use limitations, and data sources

*Lower River Spring Musky Fyke Netting* - Schacht, 2012
- Spring fyke net survey results that targeted muskellunge
- Various descriptive statistics by species

*Lower River Fall Electrofishing* - Schacht, 2012
- Fall catch summary from double anode boom shocking data by species
- Fall catch per effort from double anode boom shocking data by species

*Lower River Data Summary Table* - Schacht, 2012
- Gear used, season, survey dates, target species, original purpose, assumptions, use limitations, and data sources
- Does not include *Summary of Menominee River Walleye Run Estimation, Yellow Perch Seining Data Table, Documentation of a Menominee River Whitefish Run,* or MDNR's offshore gillnet data

*Summary of Menominee River Walleye Run Estimation* - Zorn, 2006
- Estimate of total spring walleye spawning run
- Contains no catch per effort or catch summary data
- Targets only walleye

*Documentation of a Menominee River Whitefish Run* - Belonger, 1995
- Memorandum to George Boronow documenting presence of a fall whitefish run and mentions quality of whitefish spawning habitat in the lower river
- Contains no catch per effort or catch summary data
- Pertains solely to whitefish.

## Metric Selection

The project team composed of Wisconsin and Michigan DNR fisheries biologists, USFWS biologists, Menominee River AOC Coordinators, and other WDNR staff was convened to review the data gathered to identify metrics for evaluating target species recruitment. It was decided early on that the Lower Scott Flowage and lower river would be assessed separately due to fish passage limitations.

Lower Scott Flowage

The team sought to describe relative densities of target fish populations (smallmouth bass, largemouth bass, northern pike, bluegill, rockbass, and walleye) that might be expected in the Lower Scott Flowage in the absence of the "degradation of fish populations" beneficial use impairment. Fayram suggested the team compare electrofishing data from the Flowage to that

from regional lakes and flowages. The team agreed this could be an acceptable metric with further considerations.

The team explored describing young of year and adult densities separately, considering YOY fish as the best representatives of recruitment. Efforts to do this were eventually abandoned. In the absence of aging data, length was considered as a surrogate, adding some uncertainty. In addition, electrofishing protocols do not specifically target YOY fish, resulting in very low sample sizes. The team felt that the added uncertainty and decreased statistical power of small sample sizes did not outweigh potential benefits. All length/age fish were considered equally in assessing recruitment.

Several team members expressed concern about comparing a small and relatively lotic flowage environment to other regional lakes. It was agreed that the simplest solution was to compare the Lower Scott Flowage to other upriver flowages of the Menominee River, of which there are eight.

Relative densities of target fish species, as measured by double anode electrofishing which is related to actual density (Schoenebeck and Hansen, 2005), were examined from flowages on the Menominee River upstream of Lower Scott Flowage. These flowages were sampled between 2001 and 2011 and targeted the six species outlined above for at least a portion of the survey effort. Surveys with gear other than double anode electrofishing, sampling efforts in a season other than spring (March-May) or fall (September-November), and surveys without a recorded distance surveyed were removed. Zero values were included for catch per effort if a species was targeted but not captured. Zero values were not included if a species was not targeted as part of a survey effort.

The normality of species and season specific catch per effort data and metric specific was examined using Shapiro-Wilk test ($\alpha = 0.05$). In cases, where data were significantly different from normal, a natural log transformation was used to improve normality. In some instances, 0.01 was added to metric values to facilitate natural log transformation of 0 values. The mean and standard deviation for each group was recorded. These means and standard deviations were then used to describe the relative location of data from the Lower Scott Flowage on the appropriate reference distribution. The team could then easily compare species specific catch per effort rates in the Lower Scott Flowage to the upriver reference sites, facilitating the development of a recruitment goal.

<u>Lower River</u>

The team sought to describe relative densities of target fish populations (smallmouth bass, largemouth bass, northern pike, muskellunge, yellow perch, and walleye) that might be expected in the Lower Menominee River in the absence of the “degradation of fish populations” beneficial use impairment. Existing data for the lower river is considerably different than for the Lower Scott Flowage. See *Lower River Data Summary Table* for additional detail.

Although a significant amount of data has been collected on the lower river fisheries, gear used varies widely, and therefore comparable data is limited. Paoli suggested using a large river Index of Biotic Integrity (IBI) to assess the fishery, similar to work being done in other AOCs. The team decided against pursuing the IBI approach for the following reasons:

- Lack of Historical Perspective – Inadequate data exists to develop an IBI score for the lower river from past years. Therefore, any assessment using IBI would be only from “this point forward”, which was not considered desirable by the team. This was the primary reason for avoiding the use of an IBI.

- Cost & Effort – The amount of effort required to collect data for the IBI would likely be beyond what WDNR fisheries staff could add to their existing workload.

As other potential metrics were investigated, Uvaas began capturing the pros and cons of each in the Lower River Metric Evaluation Table (Table 1). Comparing lower river fall electrofishing to upriver flowage data, use of fall electrofishing data to develop internal trends, and offshore gillnet data each had significant drawbacks. Shoreline seining data was considered valuable for assessing yellow perch recruitment, and by process of elimination, the team decided that additional data would need to be collected to assess the recruitment of other target species.

For largemouth bass, smallmouth bass, northern pike, muskellunge, and walleye; lower river fall electrofishing will be compared to data collected from select reference sites. The reach below the first dam of the Peshtigo and Escanaba Rivers were selected as reference sites. References sites were selected based on the watershed size, distance to Lake Michigan from the most downstream dam, and proximity to the Lower Menominee River AOC (Table 2). Data may be collected at additional reference sites (Oconto & Ford Rivers), but these sites are considered secondary to the Peshtigo and Escanaba Rivers. Multiple reference sites were selected for increased statistical confidence in a brief temporal range. At least three years of data will be needed from each site to make satisfactory comparisons.

Yellow perch recruitment will be evaluated separately from other target species. Wisconsin DNR has collected shoreline seining data at Seagull Bar State Natural Area (Seagull Bar) and a number of other sites along Green Bay annually since 1998. Only yellow perch young of year are targeted. Paoli suggested comparing Seagull Bar and Winegar Pond data. Winegar Pond is located at the mouth of the Peshtigo River, and has similar habitat types, habitat quantity, hydraulic connection to Green Bay, and available data. The team agreed that Winegar Pond would be an excellent reference site for Seagull Bar yellow perch data.

Once additional sampling data has been collected, the normality of species and season specific catch per effort data and metric specific will be examined using Shapiro-Wilk test ($\alpha = 0.05$). In cases, where data were significantly different from normal, a natural log or other transformation was used to improve normality. When necessary, 0.01 will be added to metric values to facilitate natural log transformation of 0 values. The mean and standard deviation for each group will be recorded. These means and standard deviations will then be used to describe the relative location of data from the lower river and seagull bar on the appropriate reference distribution. In other words, the team will then compare species specific catch per effort rates in the lower river bar to the appropriate references sites, facilitating the development of a recruitment goal.

**Table 1: Lower River Metric Evaluation Table.** Selected metrics indicated by asterisk (*)

| Potential Metric | Pros | Cons |
|---|---|---|
| Lower river (LR) fall electroshocking compared to select reference sites* | LR data from 2008-2012 readily available | Need to select reference site(s) |
| | Provides strong comparison with limited uncertainty | Need to collect reference site data |
| | Appropriate reference sites allow comparison of "open systems" only | |
| LR fall electroshocking compared to upriver flowages | LR and upriver flowage data readily available | Only one year of panfish data is available from the LR |
| | | Strong concerns about comparing the LR, an "open system", to a "closed system" flowage |
| Fall electroshocking internal trends | Data readily available | Only one year of panfish data is available from the LR, no trend |
| | | Data from 2008-2012 for other species has been plotted, no significant trends are apparent |
| | | Many additional years of data could be required to develop trends |
| MDNR offshore gillnet data | Acceptable quantity and quality of lower river and reference site data available spanning several years | Offshore gillnet sampling is more indicative of Bay than River conditions |
| Compare Seagull Bar Pocket and Winegar Pond seining data* | Acceptable quantity (12 sample years) and quality (multiple samples per year) of data available | Data only available for young of year yellow perch |
| | Winegar pond is very similar to Seagull Bar Pocket in size, location, habitat, and connectivity to the Bay | |

**Table 2: Lower River Potential Reference Site Attributes.** Prioirty reference sites indicated by asterisk (*)

| Potential Reference Sites | Drains to Green Bay (yes/no) | Watershed Size (square miles) | Distance to 1st Dam (miles) | Comments |
|---|---|---|---|---|
| Menominee River | YES | 4070 | 2.5 | |
| Escanaba River* | YES | 924 | 1.75 | Selected as a priority reference |
| Ford River | YES | ≈ 500 | > 20 | Watershed considered too small and distance to first dam too great to be a priority reference. |
| Oconto River | YES | 1035 | 15 | Considered slightly inferior to the Peshtigo, not a priority |
| Peshtigo River* | YES | 1165 | 12 | Selected as a priority reference |

## Setting Recruitment Goals

Data gathered through this effort and collected afterward will be used to describe the relative location of data from the lower river and Lower Scott Flowage to their appropriate reference site

distributions. The team decided to set the 25th percentile of the appropriate reference site distribution for each target species as the restoration goal. The 25th percentile goal is considered reflective of a restored Area of Concern, not pristine conditions, and is consistent with the goals of the *Lower Menominee River Stage 2 Remedial Action Plan*.

## Recommendations

The project team developed recommendations based on available data gathered through this effort. The original intent was to determine if target species populations are meeting defined recruitment goals. Where inadequate data is available to make that determination, the team has recommended what type and how much data should be collected in order to make that evaluation possible.

Lower Scott Flowage

The team feels that the four years of fall and two years of spring electrofishing data are inadequate to evaluate target species recruitment (Table 3-4). They recommend that additional double anode electrofishing data for the Lower Scott Flowage for all target species be gathered. Donofrio informed the group that the owners of the Upper Scott Dam intend to open the dam from approximately May to October in 2013, allowing free downstream passage for fish and limited upstream passage. The team agreed that although the Upper Scott Dam is open for about one week annually, it will be open for too long in 2013 to be comparable to past years. The team recommends that WDNR sample the entire shoreline of the Lower Scott Flowage in the spring of 2013 using a double anode boom shocker prior to the dam being opened and collect all gamefish and panfish observed. Once data are available the team will reconvene and assess target species recruitment status. Preliminary results are recorded in Table 3 and Table 4.

**Table 3: Interim Spring Lower Scott Flowage Average Catch per Effort (CPE) by Species Compared to Reference Sites.** Catch per effort is determined by the number of fish collected divided by the distance sampled. Results are preliminary until data from 2013 sampling efforts can be included. Percentiles in **red** considered to be below recruitment goal, and those in **green**, above.

| Spring Electrofishing Catch per Effort | | | | | | |
|---|---|---|---|---|---|---|
| **Survey Year** | 2011 | 2011 | 2012 | **Average CPE ( 2011-2012)** | **Recruitment Percentile Goal** | **Percentile Compared to Reference** |
| **Survey Date** | 25-Apr | 24-May | 22-May | | | |
| **Species** | | | | | | |
| Bluegill | | 3 | 4 | 2.6 | 25th | **3** |
| Largemouth Bass | 1 | 0 | 0 | 0.1 | 25th | **24** |
| Northern Pike | 14 | 8 | 1 | 2.5 | 25th | **44** |
| Rock Bass | | 28 | 14 | 17.9 | 25th | **57** |
| Smallmouth Bass | 7 | 87 | 11 | 12.5 | 25th | **39** |
| Walleye | 31 | 24 | 0 | 5.5 | 25th | **55** |

**Table 4: Interim Fall Lower Scott Flowage Average Catch per Effort (CPE) by Species Compared to Reference Sites.** Catch per effort is determined by the number of fish collected divided by the distance sampled. Data from 1990 was excluded due to uncertainty about species targeted during sampling. Percentiles in **red** considered to be below recruitment goal, and those in **green**, above.

| **Survey Year** | 1987 | 1989 | 2003 | 2003 | 2011 | 2012 | **Average CPE ( 1987-2012)** | **Recruitment Percentile Goal** | **Percentile Compared to Reference** |
|---|---|---|---|---|---|---|---|---|---|
| **Survey Date** | 16-Sep | 04-Oct | 31-Jul | 04-Aug | 03-Oct | 01-Oct | | | |
| **Species** | | | | | | | | | |
| Bluegill | 2.8 | 6.4 | 0.0 | | | 2.1 | 2.8 | 25th | **24** |
| Largemouth Bass | 2.0 | 0.0 | 0.0 | 0.0 | 0.8 | 1.7 | 0.9 | 25th | **53** |
| Northern Pike | 0.4 | 4.4 | 2.0 | 3.0 | 2.7 | 0.0 | 2.0 | 25th | **4** |
| Rock Bass | 21.2 | 32.0 | 4.0 | | | 15.9 | 18.3 | 25th | **94** |
| Smallmouth Bass | 10.4 | 3.2 | 7.0 | 29.0 | 19.4 | 9.2 | 12.0 | 25th | **81** |
| Walleye | 6.4 | 8.8 | 0.0 | 0.0 | 5.4 | 2.1 | 4.1 | 25th | **17** |

Lower River

No acceptable reference data set was available for smallmouth bass, largemouth bass, northern pike, muskellunge, and walleye, and therefore recruitment could not be evaluated at this time. The team recommends collecting at least three years of data from the Escanaba and Peshtigo Rivers, which were selected as priority reference sites. Data should be collected by nighttime double anode electrofishing between September and November to be as consistent as possible with data from the lower river. At a minimum, all gamefish species should be collected. Multiple sampling events per year would also be beneficial.

After review of yellow perch shoreline seining data, the team determined that yellow perch are above their designated recruitment goal (Table 5). The team does not recommended habitat restoration work specifically target yellow perch, however, perch may benefit from recommended habitat restoration activities.

**Table 5: Yellow Perch Shoreline Seining Catch per Effort (CPE) at Seagull Bar State Natural Area (Red Arrow Park) and Winegar Pond.** Each sampling event is a single day during June or July and consisted of a 100' seine. The average CPE is the average of all sampling events in a given year.

| Site | # Sampling Events | Year | Average CPE |
|---|---|---|---|
| Red Arrow Park | 4 | 1998 | 150.3 |
| Red Arrow Park | 3 | 1999 | 6.7 |
| Red Arrow Park | 3 | 2000 | 26.3 |
| Red Arrow Park | 3 | 2001 | 79.0 |
| Red Arrow Park | 3 | 2002 | 8.0 |
| Red Arrow Park | 3 | 2003 | 91.3 |
| Red Arrow Park | 3 | 2004 | 5.3 |
| Red Arrow Park | 3 | 2005 | 3.0 |
| Red Arrow Park | 3 | 2006 | 273.0 |
| Red Arrow Park | 3 | 2007 | 381.3 |
| Red Arrow Park | 3 | 2008 | 3.0 |
| Red Arrow Park | 1 | 2009 | 0.0 |
| Red Arrow Park | 1 | 2010 | 424.0 |
| Red Arrow Park | 2 | 2011 | 8.5 |
| Red Arrow Park | 2 | 2012 | 43.0 |
| **1998-2012 Average CPE** | | | **100.2** |
| **Recruitment Goal:** ≥ 25th percentile of Winegar Pond Distribution | | | |
| **Percentile Compared to Winegar Pond Distribution** | | | **84th** |
| | | | |
| Winegar Pond | 4 | 1998 | 657.0 |
| Winegar Pond | 3 | 1999 | 0.0 |
| Winegar Pond | 3 | 2000 | 16.7 |
| Winegar Pond | 3 | 2001 | 0.0 |
| Winegar Pond | 3 | 2002 | 0.7 |
| Winegar Pond | 3 | 2003 | 0.0 |
| Winegar Pond | 3 | 2004 | 0.0 |
| Winegar Pond | 3 | 2005 | 3.3 |
| Winegar Pond | 3 | 2006 | 11.0 |
| Winegar Pond | 3 | 2007 | 81.0 |
| Winegar Pond | 3 | 2008 | 24.3 |
| Winegar Pond | 1 | 2009 | 93.0 |
| Winegar Pond | 1 | 2010 | 177.0 |
| Winegar Pond | 2 | 2011 | 0.5 |
| Winegar Pond | 2 | 2012 | 1.5 |

## Recommended Habitat Restoration

Understanding the strong interest in completing all restoration actions in the Lower Menominee River AOC by 2016, the project team suggests beginning aquatic habitat improvement prior to the collection of all reference site data. In their professional opinion, species associated with wetland spawning habitat may not be achieving their recruitment goals. It will take at least three years until all reference site data has been collected and each target species' recruitment status can be assessed. Project planning, design, feasibility studies, and landowner agreements all

take time, and should be begun at the earliest date possible to assist timely delisting of the AOC.

The project team reviewed potential aquatic habitat sites developed by the Lower Menominee River Technical and Citizen Advisory Committees, and recommends the actions in Table 6 be pursued. The project team believes that completion of this list of habitat restorations would be adequate for BUI removal. Other important aspects like cost, funding sources, partners, and project management were not examined by the team. These factors and others are being investigated and recorded in the *Lower Menominee River 2012 Stage 2 Remedial Action Plan Update*.

**Table 6: Fisheries Data Roundup Project Team Habitat Restoration Recommendations**

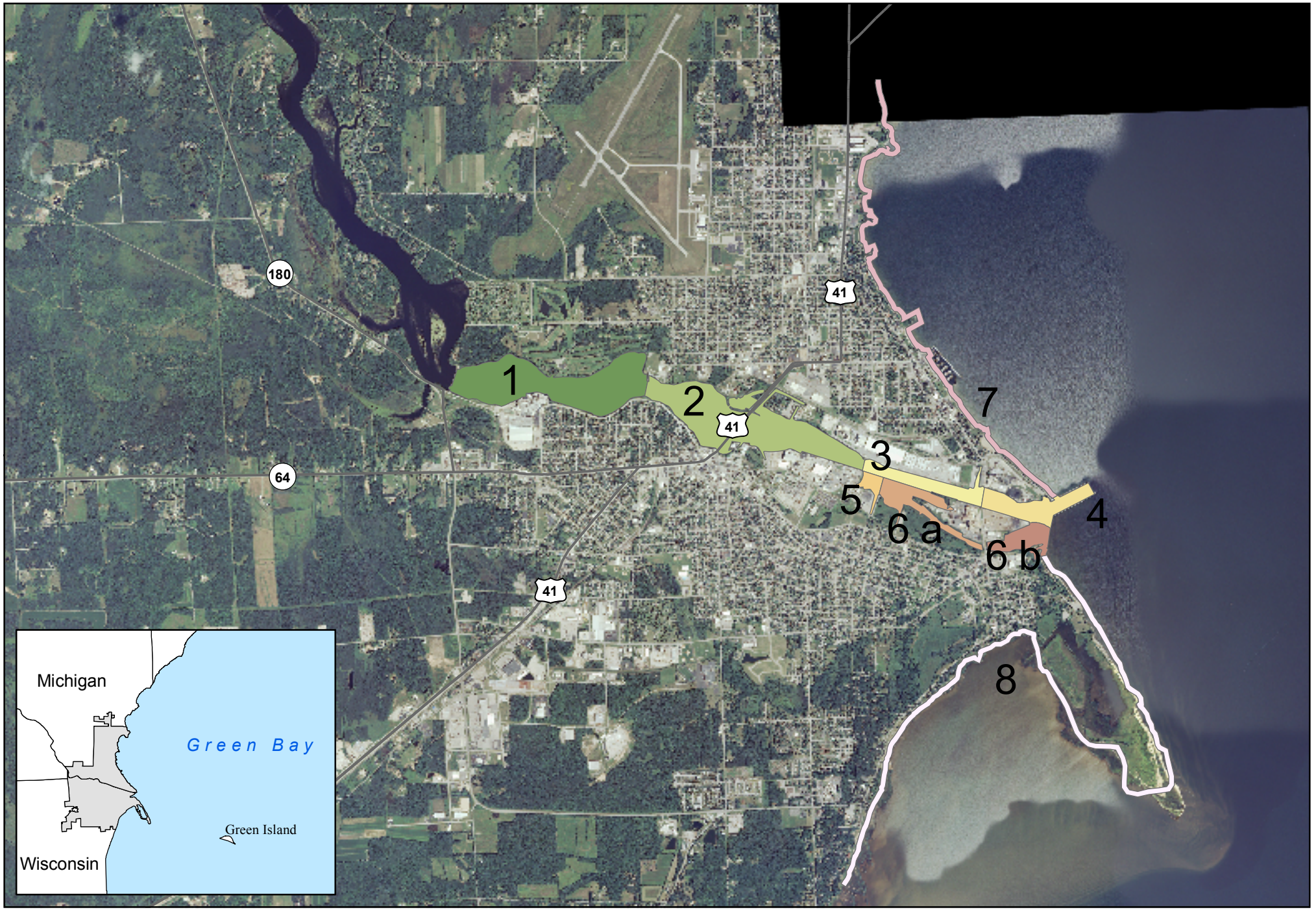
| Natural Area | Acres | Proposed Actions |
|---|---|---|
| Seagull Bar Pocket | 46 | Explore detrimental use by common carp and potential for carp exclusion barrier. |
| Rio Vista Slough | 5.5 | Assess sediment, determine ownership boundaries, and survey biological community. Pursue AIS control (EWM & Phragmites), establish native plants, and increasing connection to the River. |
| South Channel | 11 | Control AIS, establish native plants, improve connection to south channel through Ogden Street. More details will be available once final dredging plans are complete. |
| Menekaunee Harbor | 2 | Control AIS (EWM & Phragmites), establish emergent and floating leaf plant communities, soften shoreline. More details will be available once final dredging plans are complete. |
| 11th Avenue Boat Launch | 8 | Remove soft sediment adding depth if possible, pursue AIS control (EWM), establish native plants, add large woody debris. Flowage may be drawn down in the next few years allowing work in "dry" conditions. |
| River Park Campground Canal* | 4 | Improve water circulation by adding culvert linking Canal to Mystery ship Canal if possible. |
| *Recommended only if other management actions cannot be taken, considered a "backup" project. | | |

## Conclusions

Yellow perch are considered to be above their recruitment goal in the lower river section of the AOC. The team recommends collecting additional data for the Lower Scott Flowage, lower river, and select reference sites before other species recruitment status can be evaluated. The project team suggests beginning aquatic habitat improvement prior to the collection of all additional data to preserve the proposed timeframe for delisting of the Menominee River AOC. The team has provided a list of natural areas and restoration actions adequate to remove the “degradation of fish populations” Beneficial Use Impairment.

## References

Schoenebeck, C. W., and M. J. Hansen. 2005. Electrofishing catchability of walleyes, largemouth bass, smallmouth bass, northern pike, and muskellunge in Wisconsin lakes. North American Journal of Fisheries Management 25: 1341-1352.

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**Menominee River Area of Concern, Lower Scott Flowage**

**WBIC: 609200**

**Fisheries Data Roundup**


Wisconsin Department of Natural Resources

Fisheries Management

Prepared by Garret Schacht

September 18, 2012

Contents Pages

## Introduction

The Lower Scott Flowage (LSF) refers to the lowest reservoir in the Menominee River. Starting at the Hattie St. Dam, it stretches upstream 1.2 miles to the Scott Paper Company Dam (Figure 1). The flowage is 139 acres with a maximum depth of 20 feet. The littoral substrate is a composite consisting of: 60% sand, 20% rock, 10% gravel, and 10% muck.


**Figure 1**. The Lower Scott Flowage is located on the on the Menominee River in-between the Hattie St Dam (the first dam on the river, upstream from Green Bay) and the Scott Paper Company Dam.

The Lower Scott Flowage fisheries data roundup is comprised of 20surveys which took place in between 1987-2012. Prior to 1987, there was not a boat launch to the flowage which limited survey work.

In this summary, the 20 surveys are divided by gear type and season, which yielded 3 spring fyke netting surveys, 3 spring electrofishing surveys, and 14 fall electrofishing surveys (Table 1). Of the 20 surveys found, 5 were conducted in 2011. The 2011 surveys were the most extensive; they recorded lengths on a larger variety of fish species as well as the only year when aging structures were collected during electrofishing.

Several figures in this document were developed prior to the inclusion of 2012 data. These figures may be updated at a later date as deemed necessary.

**Table 1.** Summation of all surveys collected. Each "X" represents one completed survey.

| Year | Spring Fyke | Spring Electrofishing | Fall Electrofishing |
|---|---|---|---|
| 1987 | | | X |
| 1989 | X | | X |
| 1990 | | | X |
| 1991 | X | | X |
| 2003 | | | X X |
| 2005 | | | X |
| 2007 | | | X |
| 2008 | | | X |
| 2009 | | | X |
| 2011 | X | X X | X X |
| 2012 | | X | X X |

In 1991, the fyke netting survey was conducted relatively later (June) than the 1989 and 2011 surveys (April). s In that survey, three nets captured 60 fish in 3 net nights. The catch was comprised mostly of smallmouth bass and channel catfish with some panfish and a few walleye. Creel-sized panfish (black crappie, bluegill, pumpkinseed, and rock bass) were harvested for contaminant samples. However, due to the inconsistency in the time of year the sampling occurred along with fewer nets and nights fished, this survey was not used for any data analysis.

**Spring Fyke Netting**

In 1989 and 2011, fyke netting surveys were conducted to target spawning northern pike in order to achieve a population estimate. In addition to the northern pike PE, all other gamefish and panfish were measured. The sum total of each year's catch is separated by species and coupled with the corresponding average length (Table 2).

**Table 2.** Catch Totals for Spring Fyke Netting on the Lower Scott Flowage in 1989 and 2011.

| Species | 1989 | $\bar{x}$ Length (in) | 2011 | $\bar{x}$ Length (in) |
|---|---|---|---|---|
| Black Bullhead | 55 | 5.3 | 0 | |
| Black Crappie | 28 | 7.3 | 30 | 6.50 |
| Bluegill | 27 | 6.1 | 39 | 6.60 |
| Brown Bullhead | 5 | 6.6 | 4 | 10.0 |
| Common Carp | 0 | | 2 | |
| Channel Catfish | 1 | 26.5 | 1 | 30.4 |
| Largemouth Bass | 5 | 8.0 | 2 | 10.7 |
| Northern Pike | 293 | 18.4 | 141 | 20.1 |
| Pumpkinseed | 25 | 4.8 | 63 | 4.70 |
| Rock Bass | 221 | 5.8 | 182 | 5.60 |
| Smallmouth Bass | 22 | 13.0 | 15 | 16.5 |
| Walleye | 86 | 12.4 | 11 | 15.1 |
| Yellow Perch | 90 | 7.1 | 31 | 8.60 |
| Yellow Bullhead | 15 | 5.7 | 5 | 8.40 |
| Total Fish Caught | 873 | | 526 | |

The northern pike data was further analyzed with a statistical breakdown and length frequency comparison (Table 3 and Figure 2). Since all panfish lengths were recorded, statistical analyses of the panfish data along with length frequencies were also calculated (Table 4 and Figures 3-7).

**Table 3.** Descriptive Statistics for Northern Pike Spring Fyke Netting on the Lower Scott Flowage.

| Measures | 1989 | 2011 |
|---|---|---|
| Sample Size | 293 | 141 |
| Survey Begin Date | 4-5-89 | 4-11-11 |
| Survey End Date | 4-27-89 | 4-26-11 |
| Net Nights | 23 | 16 |
| Mean Length (in) | 18.4 | 20.7 |
| Standard Deviation | 4.5 | 6.3 |
| Variance | 20.5 | 40.1 |
| Minimum | 9 | 10 |
| Maximum | 36 | 35 |
| Number of Males | 134 (46%) | 39 (28%) |
| Number of Females | 74 (25%) | 63 (44%) |
| Number of Unknown | 85 (29%) | 39 (28%) |
| PSD (% of NP ≥ 21″) | 28 | 59 |
| RSD (% of NP ≥ 28″) | 4 | 19 |
| PE (Schumacher Estimate) Total | 214 | 293 |
| PE (Schumacher Estimate) Total/Acres | 1.5/acre | 2.1/acre |

*****PSD & RSD lengths are set at AFS standards.
*PSD quality length = 21″ and RSD preferred length = 28″

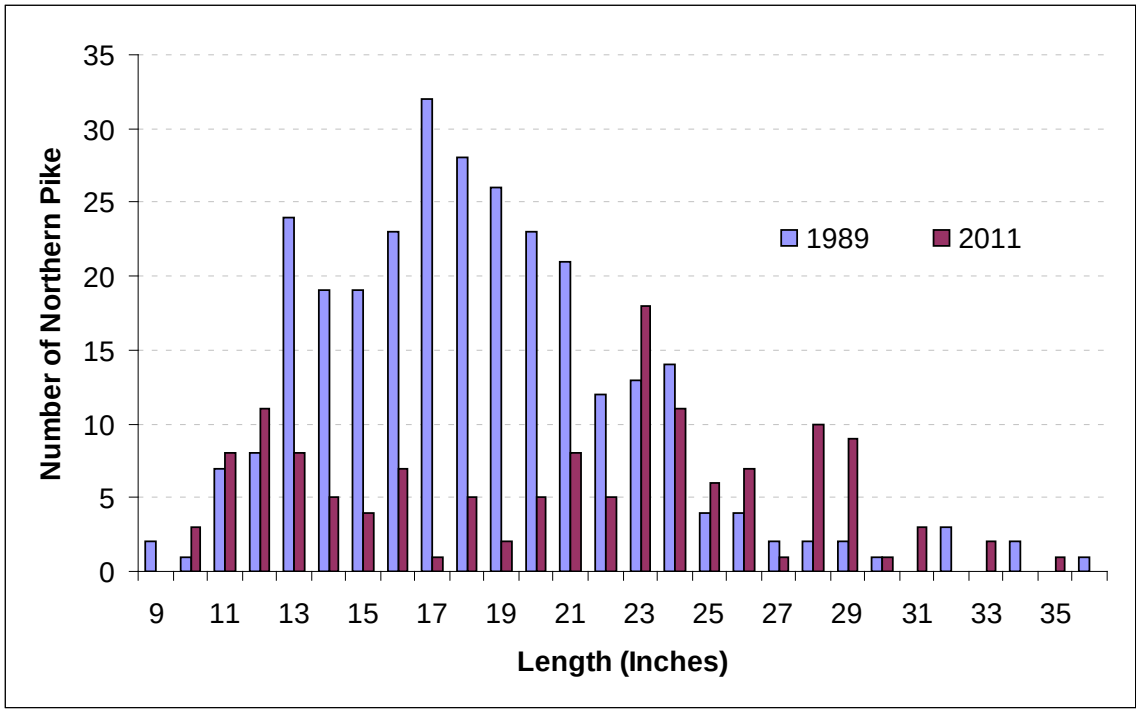
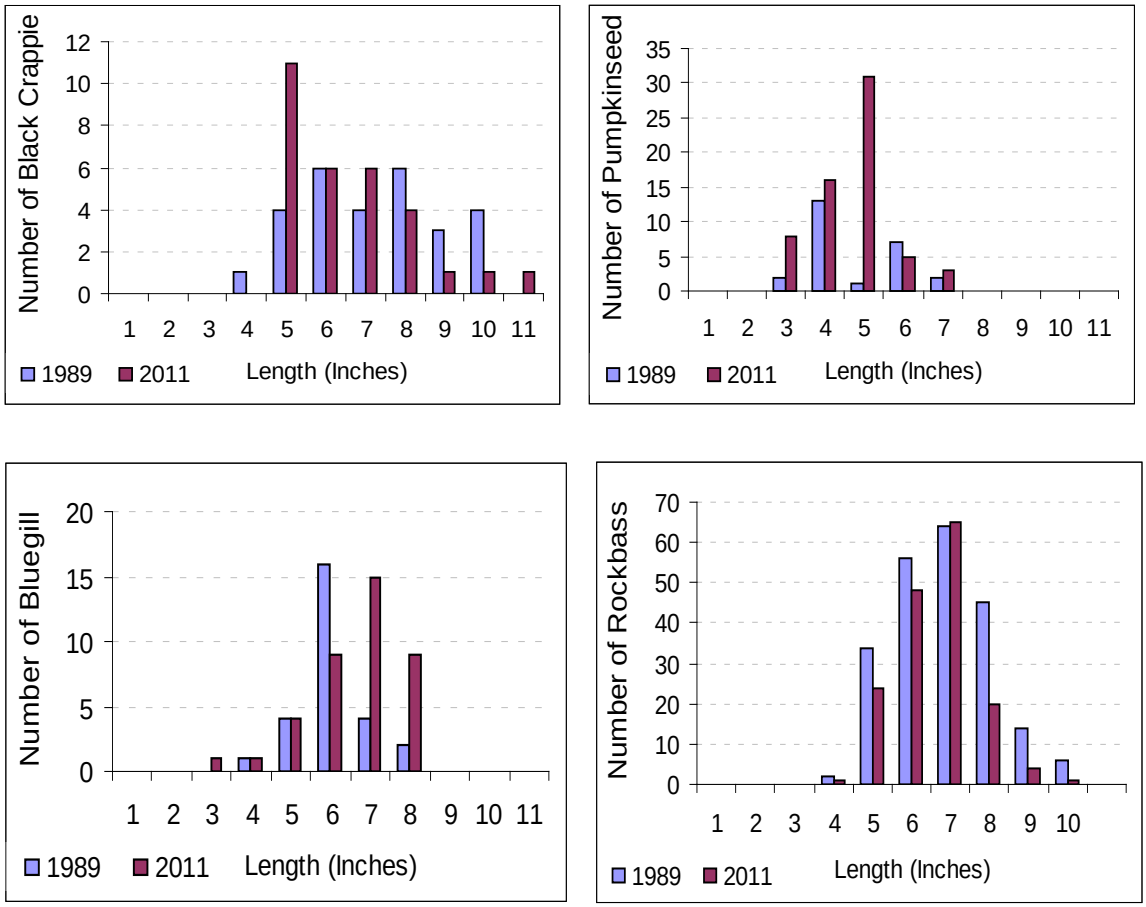



**Figure 2**. Length frequency comparison for Northern Pike. Data was collected during spring fyke netting surveys on the Lower Scott Flowage in 1989 and 2011.

**Table 4.**

Descriptive Statistics for Panfish and Rock Bass during Spring Fyke Netting on the Lower Scott Flowage in 1989 and 2011

| Measures | 1989 | 2011 |
|---|---|---|
| Black Crappie | | |
| Sample Size | 28 | 30 |
| Mean Length (in) | 7.3 | 6.5 |
| Standard Deviation | 1.8 | 1.6 |
| Variance | 3.1 | 2.6 |
| Minimum | 4 | 5 |
| Maximum | 10 | 11 |
| PSD (Proportional Stock Density,% ≥ 8") | 46 | 23 |
| RSD (Relative Stock Density, % ≥ 10") | 14 | 0.07 |
| Bluegill | | |
| Sample Size | 27 | 39 |
| Mean Length (in) | 6.1 | 6.6 |
| Standard Deviation | 0.9 | 1.2 |
| Variance | 0.8 | 1.4 |
| Minimum | 4 | 3 |
| Maximum | 8 | 8 |
| PSD (Proportional Stock Density, % ≥ 6") | 82 | 85 |
| RSD (Relative Stock Density, % ≥ 8") | 0.08 | 23 |
| Pumpkinseed | | |
| Sample Size | 25 | 63 |
| Mean Length (in) | 4.8 | 4.7 |
| Standard Deviation | 1.2 | 1.0 |
| Variance | 1.4 | 0.9 |
| Minimum | 3 | 3 |
| Maximum | 7 | 7 |
| PSD (Proportional Stock Density,% ≥ 6") | 36 | 13 |
| RSD (Relative Stock Density, %≥ 8") | 0 | 0 |
| Rock Bass | | |
| Sample Size | 221 | 163 |
| Mean Length (in) | 5.8 | 5.6 |
| Standard Deviation | 1.3 | 1.0 |
| Variance | 1.6 | 1.1 |
| Minimum | 3 | 3 |
| Maximum | 9 | 9 |
| PSD (Proportional Stock Density, % ≥ 7") | 29 | 15 |
| RSD (Relative Stock Density, % ≥ 9") | 0.03 | 0.001 |




**Figures 3-6**. Length Frequency for Black Crappie, Bluegill, Pumpkinseed, and Rock Bass during the spring fyke netting surveys on the Lower Scott Flowage in 1989 and 2011.

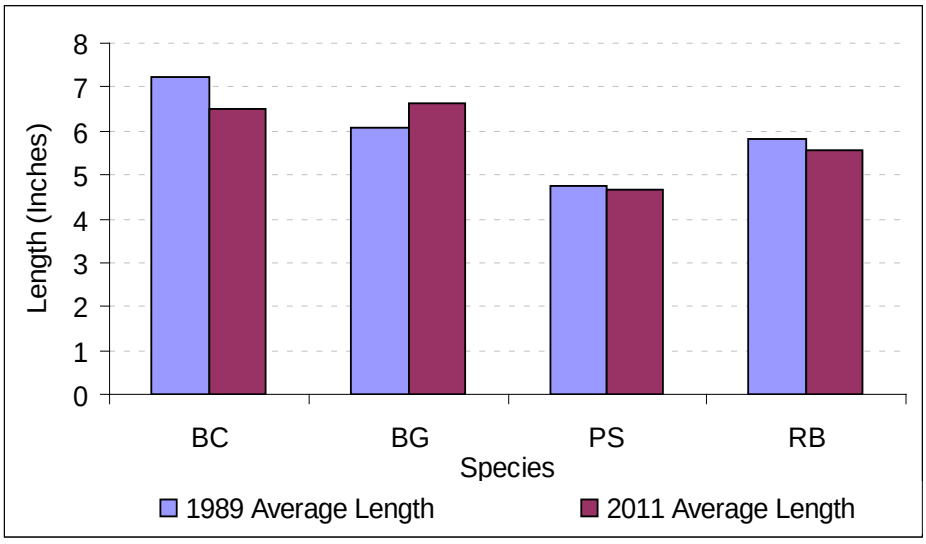



**Figure 7**. Average length for Black Crappie, Bluegill, Pumpkinseed, and Rock Bass during the spring fyke netting surveys on the Lower Scott Flowage in 1989 and 2011.

## Spring Electrofishing in 2011

Spring Electrofishing occurred in 2011 and 2012. Three separate boom shocking surveys were conducted: April 11, 2011, May 24, 2011, and May 22, 2012 (Table 5).

**Table 5.** Catch Totals for Spring Electrofishing on the Lower Scott Flowage. Method and Gear: MB-single anode miniboom shocker, BS-double anode boom shocker. Species Targeted: G-gamefish, All-gamefish, panfish and roughfish, ?- species targeted unknown

| **Survey Year** | 2011 | 2011 | 2012 |
|---|---|---|---|
| **Survey Date** | 25-Apr | 24-May | 22-May |
| **Distance (miles)** | 2.5 | 2.5 | 1.8 |
| **Method & Gear** | BS | BS | BS |
| **Species Targeted** | G | All | All |
| | | | |
| **Species** | | | |
| Black Crappie | | 0 | 0 |
| Bluegill | | 3 | 4 |
| Largemouth Bass | 1 | 0 | 0 |
| Northern Pike | 14 | 8 | 1 |
| Pumpkinseed | | 5 | 1 |
| Rock Bass | | 28 | 14 |
| Smallmouth Bass | 7 | 87 | 11 |
| Walleye | 31 | 24 | 0 |
| Yellow Perch | | 19 | 4 |

Walleye Results for Spring Electrofishing in 2011

In April, the most abundant species sampled was walleye. Dorsal fin rays and scales were collected from these walleye for aging (Figure 8). Scales were used to age all walleyes under 12 inches and dorsal fin rays were used to age all walleyes 12 inches and above. While the May survey only collected aging structures from 16 walleyes, it sampled the oldest walleye at age 11 and 28.2 inches long (Figure 9).

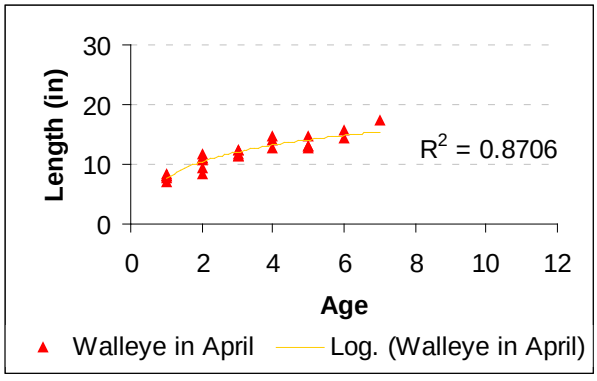



**Figure 8.** Growth curve for walleyes (n=26) sampled on April 11, 2011.

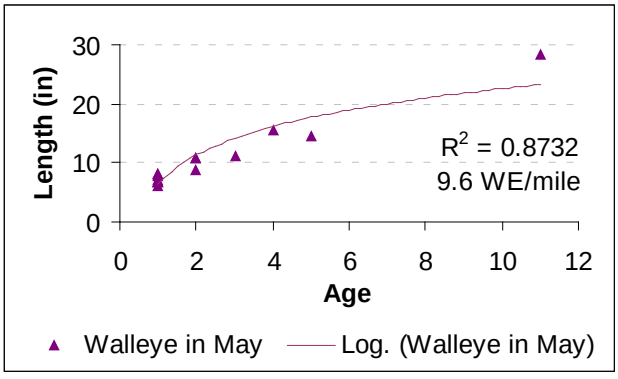



**Figure 9.** Growth curve for walleyes (n=16) sampled on May 24, 2011.

These two spring electrofishing surveys (Figures 8 & 9) were combined with the walleye data from the previously discussed spring fyke netting survey (Table 2). With all three surveys conducted in the spring of 2011, the larger sample size is a better representation of the walleye population. This age to length growth curve was contrasted with the average Northeast Region's (NER) spring sampled walleyes (Figure 10).

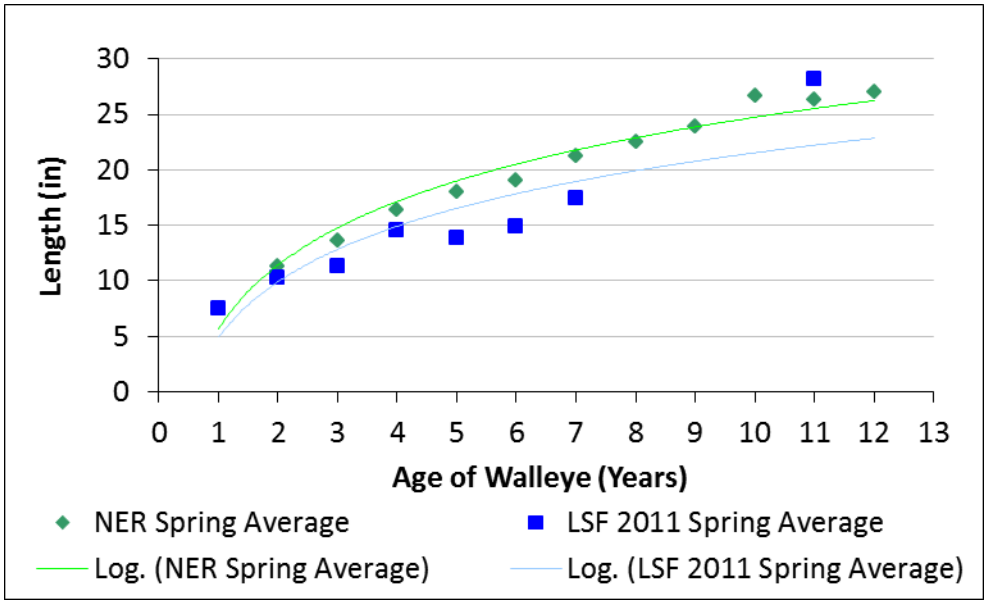



**Figure 10.** Walleye - Age and Growth Trend Comparison. The Northeast Region (NER) is compared to the Lower Scott Flowage (LSF). The NER contains all historic data for the region on file in the Fisheries Management Database, "resources for biologist → state growth summaries." The LSF average was derived from aging structures collected in all three spring surveys in 2011 (spring fyke and both spring electrofishing surveys). These three surveys yielded (via aging structures) a LSF spring sample size of 52 walleyes.

Smallmouth Bass Results for Spring Electrofishing in 2011

The last species examined under Spring Electrofishing in 2011 is smallmouth bass. The May 2011 electrofishing survey provided a large sample for smallmouth. With a total of 87 collected, this survey yielded the highest smallmouth bass CPUE at 34.8 (SMB/mile). A total of 62 smallmouth bass were aged using both scales and dorsal fin rays (Figure 11). The 12 inch length cutoff from scale to fin ray was used while collecting aging structures.

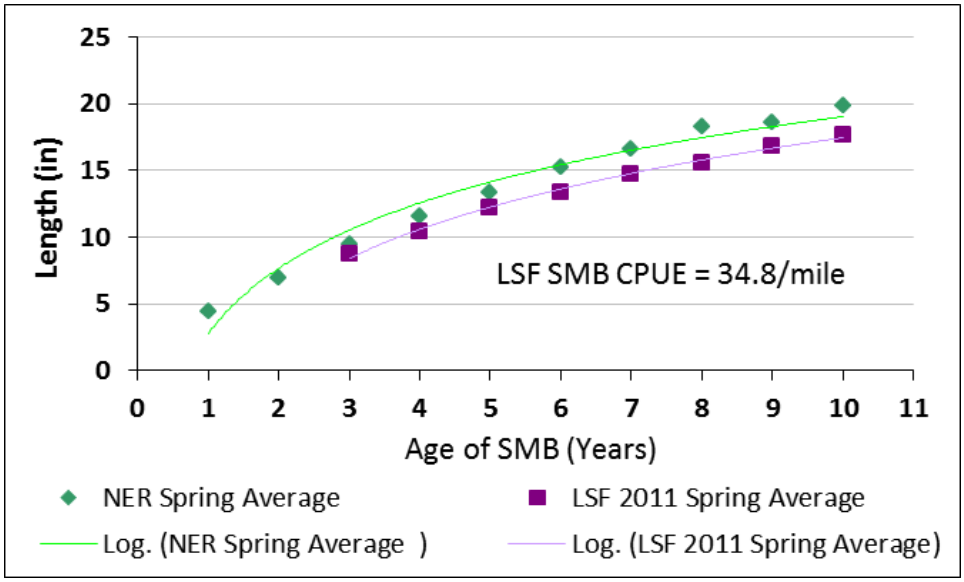



**Figure 11.** Smallmouth Bass - Age and Growth Trend Comparison. Smallmouth bass were sampled on May 24, 2011 via electrofishing; N = 62. The NER spring average was derived from all historic data for the region on file in the Fisheries Management Database, "resources for biologist → state growth summaries."

## Fall Electrofishing Results

**Table 6.** Catch totals for fall electrofishing on the Lower Scott Flowage. Method and Gear: MB-single anode miniboom shocker, BS-double anode boom shocker. Species Targeted: G-gamefish, All-gamefish, panfish and roughfish, ?- species targeted unknown

| **Survey Year** | 1987 | 1989 | 1990 | 1991 | 2003 | 2003 | 2005 | 2007 | 2008 | 2009 | 2011 | 2011 | 2012 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Survey Date** | 16-Sep | 04-Oct | 01-Oct | 30-Sep | 31-Jul | 04-Aug | 12-Sep | 20-Sep | 19-Sep | 20-Aug | 06-Sep | 03-Oct | 27-Sep | 01-Oct |
| **Distance (miles)** | 2.5 | 2.5 | 2.5 | 2.5 | 1 | 1 | 1 | 1 | 1 | 1.1 | 1 | 2.6 | 1 | 2.4 |
| **Gear (type)** | BS | BS | BS | BS | BS | BS | MB | MB | MB | MB | MB | BS | MB | BS |
| **Target (species)** | All | All | ? | ? | All | G | All | All | All | All | All | G | All | All |
| | | | | | | | | | | | | | | |
| **Species** | | | | | | | | | | | | | | |
| Black Crappie | 3 | 2 | 0 | 0 | 1 | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 |
| Bluegill | 7 | 16 | 0 | 5 | 0 | | 0 | 15 | 9 | 0 | 4 | | 0 | 5 |
| Largemouth Bass | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 2 | 2 | 1 | 4 |
| Northern Pike | 1 | 11 | 0 | 2 | 2 | 3 | 0 | 2 | 0 | 1 | 1 | 7 | 0 | 0 |
| Pumpkinseed | 2 | 14 | 0 | 2 | 0 | | 0 | 3 | 2 | 6 | 1 | | 1 | 4 |
| Rock Bass | 53 | 80 | 21 | 3 | 4 | | 7 | 26 | 43 | 19 | 10 | | 2 | 38 |
| Smallmouth Bass | 26 | 8 | 0 | 8 | 7 | 29 | 10 | 31 | 58 | 46 | 11 | 50 | 7 | 22 |
| Walleye | 16 | 22 | 18 | 15 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 7 | 0 | 12 |
| Yellow Perch | 42 | 14 | 0 | 6 | 1 | | 0 | 1 | 0 | 2 | 1 | | 0 | 4 |

Smallmouth Bass Results for Fall Electrofishing

The average length for smallmouth bass varied over the past years (Table 8). The relatively small average length in 2005 may be contributed to the small sample size of only ten smallmouth bass. In contrast the 2008 and 2009 the sample sizes were reasonably large; still the average length is noticeably low in comparison to other years (Table 8). The CPUE for these surveys was calculated as the number of smallmouth bass caught per mile. The highest CPUE was in 2008 when 58 smallmouth bass were caught in one mile (Figure 12).

**Table 8.**
Descriptive statistics for smallmouth bass caught during fall electrofishing on the LSF

| Year | N | $\bar{x}$ Length (in) | Variance | $\sigma$ | Standard Error |
|---|---|---|---|---|---|
| 1987 | 26 | 5.5 | 9.2 | 3.0 | 0.60 |
| 1989 | 8 | 9.4 | 12.6 | 3.5 | 1.25 |
| 1990 | 0 | | | | |
| 1991 | 8 | 10.5 | 1.1 | 1.1 | 0.38 |
| 2003 | 36 | 10.0 | 11.6 | 3.4 | 0.57 |
| 2005 | 10 | 4.5 | 4.3 | 2.1 | 0.65 |
| 2007 | 31 | 6.9 | 11.1 | 3.3 | 0.60 |
| 2008 | 58 | 4.5 | 8.0 | 2.8 | 0.37 |
| 2009 | 46 | 4.9 | 8.4 | 2.9 | 0.43 |
| 2011 | 61 | 11.2 | 10.49 | 3.2 | 0.41 |

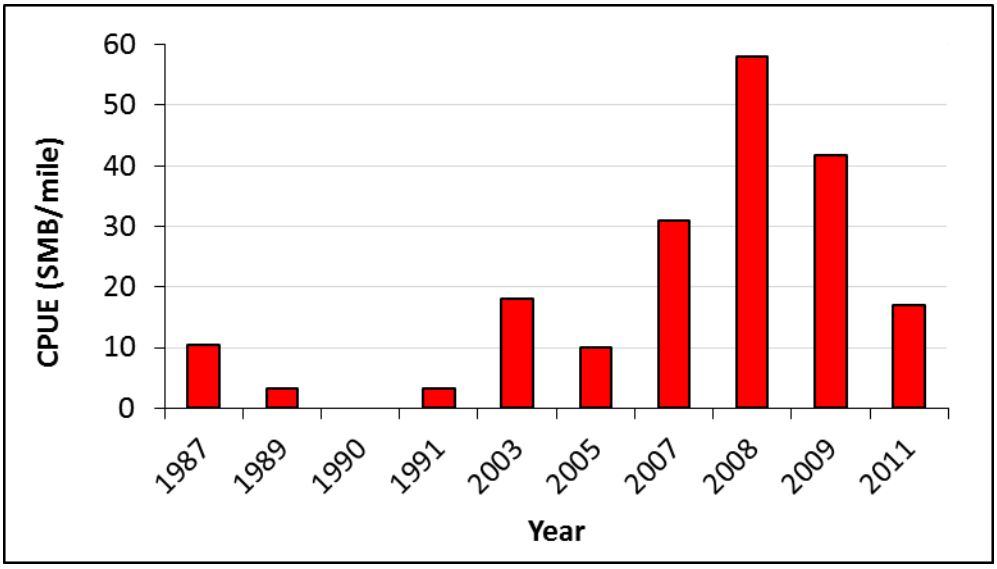



**Figure 12.** The average CPUE for smallmouth bass collected during fall electrofishing surveys. Data and sample sizes correlate to Tables 6 & 7.

Walleye Results for Fall Electrofishing

The number of walleye caught during fall electrofishing was just about nonexistent during the 2000s (Table 9). However there was a fair rise in 2011, when 14 walleyes were caught. This yielded a CPUE of 3.9 WE/mile (Figure 13). Length frequencies were also calculated to compare growth and recruitment trends of past years (Figure 14 and 15).

**Table 9.**
Descriptive statistics for walleyes caught during fall electrofishing on the LSF

| Year | N | $\bar{x}$ Length (in) | Variance | $\sigma$ | Standard Error |
|---|---|---|---|---|---|
| 1987 | 16 | 8.9 | 8.6 | 2.9 | 0.73 |
| 1989 | 22 | 9.1 | 2.4 | 1.6 | 0.33 |
| 1990 | 18 | 12.7 | 5.9 | 2.4 | 0.57 |
| 1991 | 15 | 15.1 | 34.0 | 5.8 | 1.50 |
| 2003 | 0 | | | | |
| 2005 | 0 | | | | . |
| 2007 | 0 | | | | |
| 2008 | 1 | 5.9 | | | . |
| 2009 | 0 | | | | |
| 2011 | 14 | 11.1 | 16.7 | 4.1 | 1.10 |

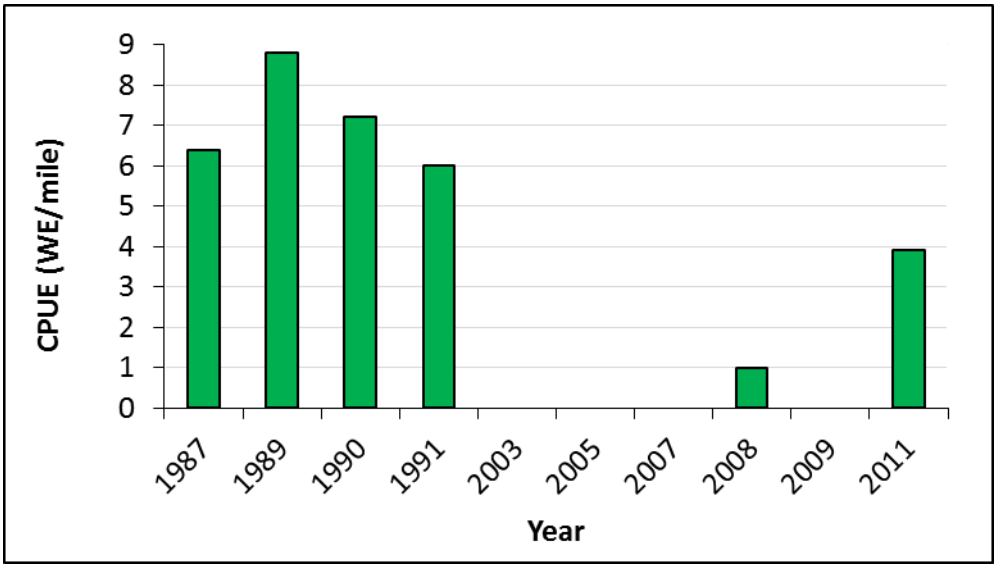



**Figure 13.** CPUE for walleye collected during fall electrofishing on the Lower Scott Flowage. Data and sample sizes correlate to Tables 6 & 7.

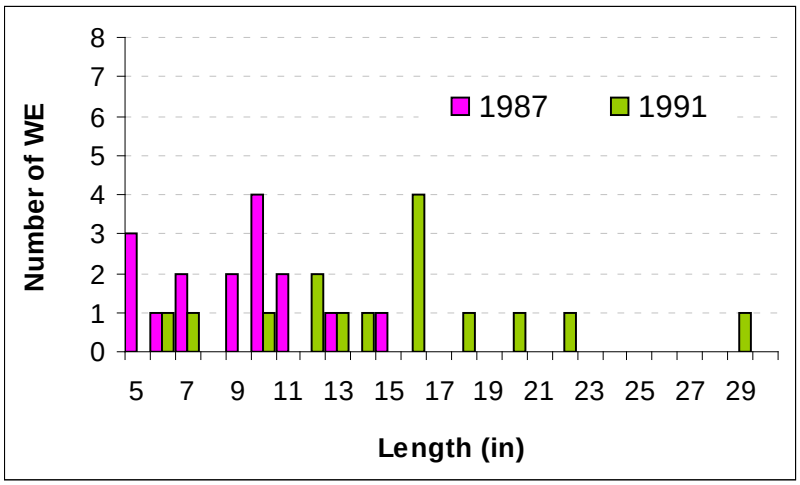



**Figure 14**. Length Frequency for walleye collected during fall electrofishing on the Lower Scott Flowage. Data and sample sizes correlate to Tables 6 & 7.

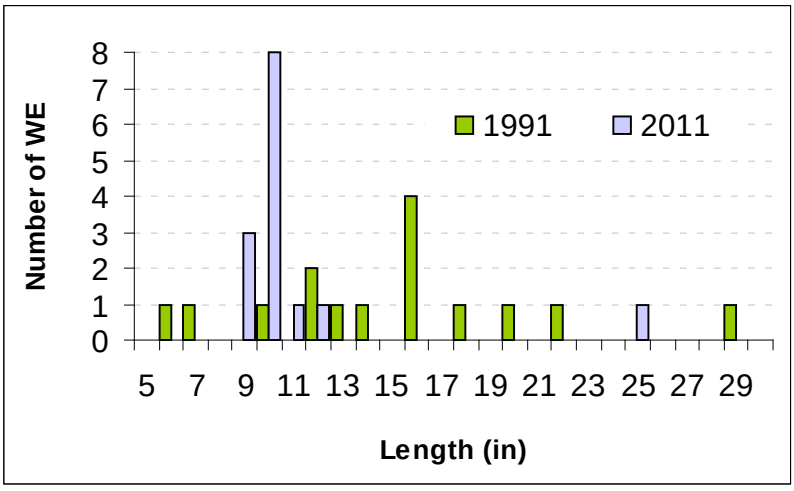



**Figure 15**. Length Frequency for walleyes collected during fall electrofishing on the Lower Scott Flowage. Data and sample sizes correlate to Tables 6 & 7.

Rock Bass CPUE Results for Fall Electrofishing

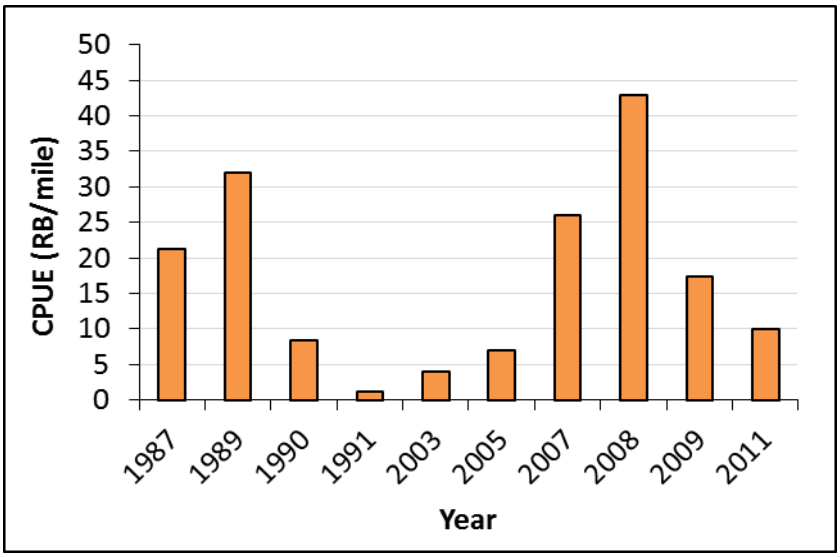



**Figure 16**. CPUE for rock bass collected during fall electrofishing on the Lower Scott Flowage. Data and sample sizes correlate to Tables 6 & 7.

**Menominee River Area of Concern, Lower Scott Flowage**

**Fisheries Data Roundup**

**CPUE Data**

Wisconsin Department of Natural Resources

Fisheries Management

Prepared by Garret Schacht

September 18, 2012

Contents: Pages

**Table 1**. CPUE, catch per unit effort, or the number of fish caught per mile for Fall Electrofishing on the Lower Scott Flowage. Method and Gear: MB- single anode miniboom shocker, MB- double anode boom shocker. Species Targeted: G-gamefish, All- gamefish, panfish and roughfish, ?- species targeted unknown.

| **Survey Year** | 1987 | 1989 | 1990 | 1991 | 2003 | 2003 | 2005 | 2007 | 2008 | 2009 | 2011 | 2011 | 2012 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Survey Date** | 16-Sep | 04-Oct | 01-Oct | 30-Sep | 31-Jul | 04-Aug | 12-Sep | 20-Sep | 19-Sep | 20-Aug | 06-Sep | 03-Oct | 27-Sep | 01-Oct |
| **Distance (miles)** | 2.5 | 2.5 | 2.5 | 2.5 | 1 | 1 | 1 | 1 | 1 | 1.1 | 1 | 2.6 | 1 | 2.4 |
| **Method & Gear** | BS | BS | BS | MB | BS | BS | MB | MB | MB | MB | MB | BS | MB | BS |
| **Species Targeted** | All | All | ? | ? | All | G | All | All | All | All | All | G | All | All |
| | | | | | | | | | | | | | | |
| **Species** | | | | | | | | | | | | | | |
| BC | 1.2 | 0.8 | 0.0 | 0.0 | 1.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 |
| BG | 2.8 | 6.4 | 0.0 | 2.2 | 0.0 | | 0.0 | 15.0 | 9.0 | 0.0 | 4.0 | | 0.0 | 2.1 |
| LMB | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 8.2 | 2.0 | 0.8 | 1.0 | 1.7 |
| NP | 0.4 | 4.4 | 0.0 | 0.8 | 2.0 | 3.0 | 0.0 | 2.0 | 0.0 | 0.9 | 1.0 | 2.7 | 0.0 | 0.0 |
| PS | 0.8 | 5.6 | 0.0 | 0.8 | 0.0 | | 0.0 | 3.0 | 2.0 | 5.5 | 1.0 | | 1.0 | 1.7 |
| RB | 21.2 | 32.0 | 8.4 | 1.2 | 4.0 | | 7.0 | 26.0 | 43.0 | 17.3 | 10.0 | | 2.0 | 15.9 |
| SMB | 10.4 | 3.2 | 0.0 | 3.2 | 7.0 | 29.0 | 10.0 | 31.0 | 58.0 | 41.8 | 11.0 | 19.4 | 7.0 | 9.2 |
| WE | 6.4 | 8.8 | 7.2 | 6.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 5.4 | 0.0 | 2.1 |
| YP | 16.8 | 5.6 | 0.0 | 2.4 | 1.0 | | 0.0 | 1.0 | 0.0 | 1.8 | 1.0 | | 0.0 | 1.7 |

CPUE results take into account that panfish were targeted for one mile of the total distance shocked in Oct, 2011 and Oct 2012. Survey data (9-6 and 10-3) is found in Table 2. 2003 survey data (7-31 and 8-4) is found in Table 3.

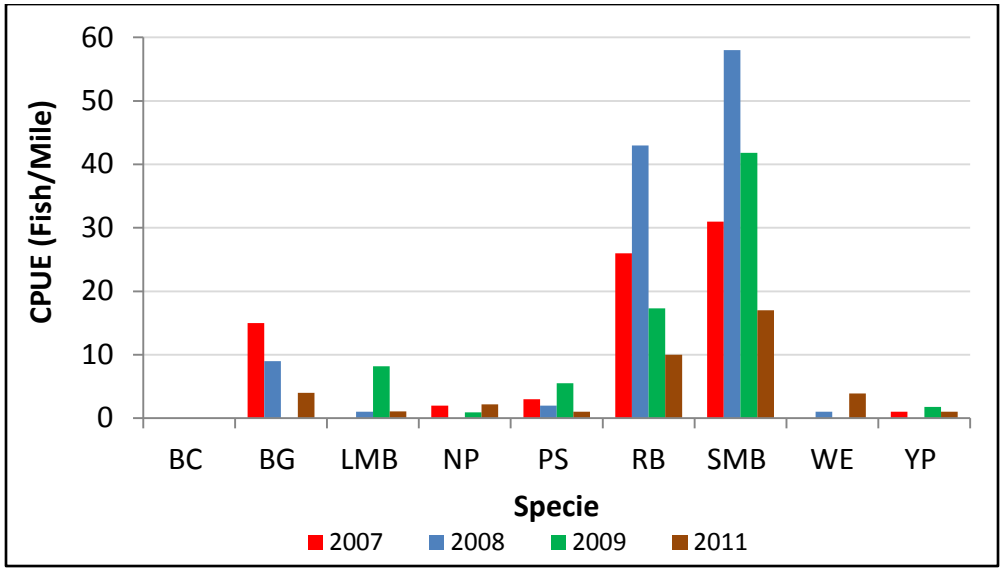



**Figure 1.** CPUE (# of fish caught per mile) from 2007-2011. All fish were sampled during the fall season in the Lower Scott Flowage. CPUE data correlates to table 1.

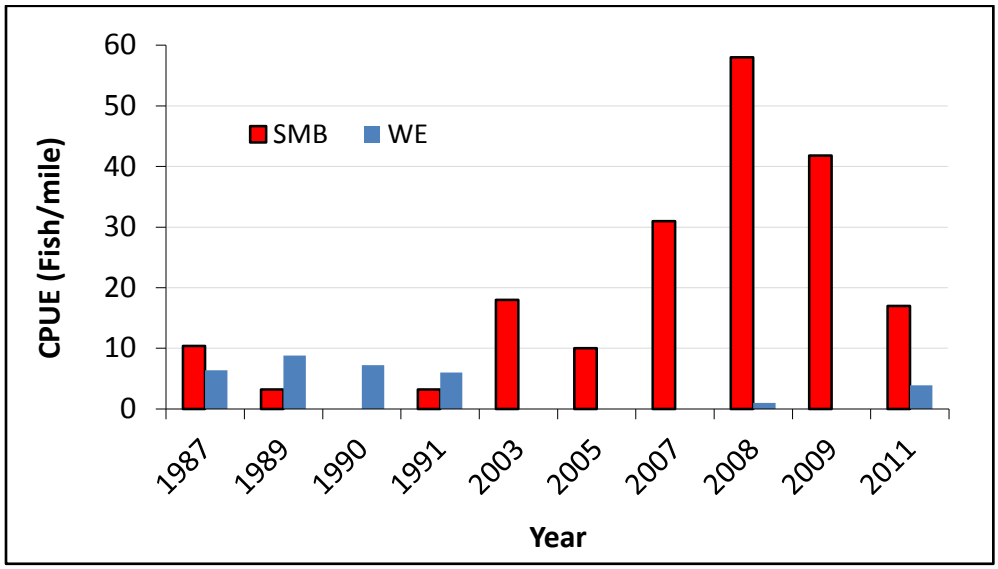



**Figure 2**. All Year Comparison of CPUE (# of fish caught per mile) for Smallmouth Bass and Walleye. All fish were sampled during the fall season in the Lower Scott Flowage. CPUE data correlates to table 1.

**CPUE**
**2011 Fall Electrofishing**

**Table 2**. CPUE is for Fall Electrofishing on the Lower Scott Flowage in 2011.

| Variables | | | |
|---|---|---|---|
| Date | (of survey) | | 9/06/2011 |
| Distance | (miles) | | 1 |
| Total Time | (minutes) | | 37 |
| Gear | (type) | | Mini Boom |
| Target | (species) | | All Species |
| | | Total | CPUE (fish/mile) |
| BC | per mile | 0 | 0.0 |
| BG | per mile | 4 | 4.0 |
| LMB | per mile | 2 | 2.0 |
| NP | per mile | 1 | 1.0 |
| PS | per mile | 1 | 1.0 |
| RB | per mile | 10 | 10.0 |
| SMB | per mile | 11 | 11.0 |
| WE | per mile | 0 | 0.0 |
| YP | per mile | 1 | 1.0 |

| | | | |
|---|---|---|---|
| Date | (of survey) | | 10/03/2011 |
| Distance | (miles) | | 2.6 |
| Total Time | (minutes) | | 81 |
| Gear | (type) | | Boom Shocker |
| Target | (species) | | Gamefish |
| | | Total | CPUE (fish/mile) |
| LMB | per mile | 2 | 0.8 |
| NP | per mile | 7 | 2.7 |
| SMB | per mile | 50 | 19.4 |
| WE | per mile | 14 | 5.4 |

*Species listed were the target species of the survey

**CPUE**
**2003 Fall Electrofishing**

**Table 3**. CPUE is for Fall Electrofishing on the Lower Scott Flowage in 2003.

| Variables | | | |
|---|---|---|---|
| Date | (of survey) | | 7/31/2003 |
| Distance | (miles) | | 1 |
| Total Time | (minutes) | | 48 |
| Gear | (type) | | Boom Shocker |
| Target | (species) | | All Species |
| | | Total | CPUE (fish/mile) |
| BC | per mile | 1 | 1.0 |
| BG | per mile | 0 | 0.0 |
| LMB | per mile | 0 | 0.0 |
| NP | per mile | 2 | 2.0 |
| PS | per mile | 0 | 0.0 |
| RB | per mile | 4 | 4.0 |
| SMB | per mile | 7 | 7.0 |
| WE | per mile | 0 | 0.0 |
| YP | per mile | 1 | 1.0 |
| Date | (of survey) | | 8/04/2003 |
| Distance | (miles) | | 1 |
| Total Time | (minutes) | | 54 |
| Gear | (type) | | Boom Shocker |
| Target | (species) | | Gamefish |
| | | Total | CPUE (fish/mile) |
| LMB | per mile | 0 | 0.0 |
| NP | per mile | 3 | 3.0 |
| SMB | per mile | 29 | 29.0 |
| WE | per mile | 0 | 0.0 |

*Species listed were the target species of the survey

**CPUE**
**Spring Electrofishing**

**Table 4**. CPUE is for Spring Electrofishing on the Lower Scott Flowage. CPUE, catch per unit effort, or the number of fish caught per mile for Fall Electrofishing on the Lower Scott Flowage. Method and Gear: MB- single anode miniboom shocker, MB- double anode boom schocker. Species Targeted: G-gamefish, All- gamefish, panfish and roughfish, ?- species targeted unknown.

| **Survey Year** | 2011 | 2011 | 2012 |
|---|---|---|---|
| **Survey Date** | 25-Apr | 24-May | 22-May |
| **Distance (miles)** | 2.5 | 2.5 | 1.8 |
| **Method & Gear** | BS | BS | BS |
| **Species Targeted** | G | G/P | G/P |
| | | | |
| **Species** | | | |
| BC | | 0.0 | 0.0 |
| BG | | 3.0 | 2.2 |
| LMB | 0.4 | 0.0 | 0.0 |
| NP | 5.6 | 3.2 | 0.6 |
| PS | | 5.0 | 0.6 |
| RB | | 28.0 | 7.8 |
| SMB | 2.8 | 34.8 | 6.1 |
| WE | 12.4 | 9.6 | 0.0 |
| YP | | 19.0 | 2.2 |

CPUE results take into account panfish were targeted for one mile of the total distance shocked May, 2011 and May 2012. The 5/24/2011 survey consisted of two ½ mile panfish runs.

| Method & Gear | Date | Season | Survey Location | Species Targeted | Survey Agency | Database | Hardcopy loc. | Original Purpose | Time | Distance | Survey Info |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Double Anode Boom Shocker | 04/06/1993 | Spring | Lower Menominee | WE, NP, Rainbows, Browns | WDNR | None | Peshtigo | "Pest Samples"? | 3.16 hours | Unknown | Water Temp: 38°F; Air Temp 40°F |
| Double Anode Boom Shocker | 04/07/1994 | Spring | Lower Menominee | WE, Browns, Rainbows | WDNR | None | Peshtigo | ? | 1.12 hours | Unknown | Shocking Times: run 1 = 22 min & run 2 = 45 min; Water Temp: 39.5°F. Walleyes were sexed and spawning stage was rated. Recaps of tagged or fin clipped walleyes and trout noted. |
| Double Anode Boom Shocker | 04/03/1995 | Spring | Lower Menominee | Walleye | WDNR | None | Peshtigo | ? | Unknown | Unknown | Walleyes had lengths taken, were sexed, spawning stage was rated, and lymph's were counted. |
| Fyke Net | 5/2/2006 - 5/12/2006 | Spring | Lower Menominee | MU | WDNR | None | Peshtigo | Assess Musky Fishery | N/A | N/A | Muskys were measured, sexed, and PIT tagged. All other gamefish and panfish were measured and roughfish were counted. For detailed report, see *LMR Spring Fyke* |
| Fyke Net | 5/9/2012 - 5/17/2012 | Spring | Lower Menominee | MU | WDNR | None | Peshtigo | Assess Musky Fishery | N/A | N/A | Muskys were measured, sexed, and PIT tagged. All other gamefish and panfish were measured and roughfish were counted. For detailed report, see *LMR Spring Fyke* |
| Double Anode Boom Shocker | 06/01/1978 | Summer | Lower Menominee | Walleye | WDNR | None | Peshtigo | Unknown | Unknown | Unknown | Shocking time and distance are both unknown. Hardcopy only contains length data (73 walleyes total). |
| Double Anode Boom Shocker | 06/24/1992 | Summer | Lower Menominee | Walleye | MDNR | None | Peshitgo | Unknown | 3.8 hours | Unknown | Shocking time: 3 runs for a total of 230 min (3.8 hours). Mostly walleyes were sampled with lengths, wieghts, and aging structures taken. In addition, 3 smallmouth bass were also measured. |
| Double Anode Boom Shocker | 06/25/1992 | Summer | Lower Menominee | Walleye | MDNR | None | Peshitgo | Unknown | 6.2 hours | Unknown | Shocking time: 3 runs for a total of 373 min (6.2 hours). Mostly walleyes were sampled with lengths, wieghts, and aging structures taken. In addition, 7 smallmouth bass were also measured. |
| Double Anode Boom Shocker | 07/29/1997 | Summer | Lower Menominee | Unknown, but all species were netted and gamefish measured | WDNR | None | Peshitgo | Unknown | 1.12 hours | 2.5 miles | Shocking time: 2 runs for a total of 67 min; Distance: 2.5 miles. Gamefish were measured and even roughfish were weighed |
| Double Anode Boom Shocker | 09/16/1994 | Fall | Lower Menominee | Trout, WE, Bass | WDNR | None | Peshtigo | Assesment/Tag Browns | 55 minutes | Unknown | Walleyes had lengths recorded. Few browns were caught. |
| Double Anode Boom Shocker | 09/23/1994 | Fall | Lower Menominee | Trout, WE, Bass | WDNR | None | Peshtigo | Assesment/Tag Browns | Unknown | Unknown | Walleyes had lengths recorded. Browns/Rainbows were checked for fin clips, sex, maturity and floy tags were given. |
| Double Anode Boom Shocker | 09/29/1994 | Fall | Lower Menominee | Trout, WE, Bass | WDNR | None | Peshtigo | Assesment/Tag Browns | Unknown | Unknown | Brown trout were the dominant specie and were given floy tags. Walleyes and some LMB were also captured. |
| Double Anode Boom Shocker | 10/05/1994 | Fall | Lower Menominee | Trout, WE, Bass | WDNR | None | Peshtigo | Assesment/Tag Browns | Unknown | Unknown | The survey seemed to target brown trout, but some WE and SMB were also caught. Water Temp: 54°F |
| Double Anode Boom Shocker | 10/13/1994 | Fall | Lower Menominee | Trout, WE, Bass | WDNR | None | Peshtigo | Assesment/Tag Browns | 30 minutes | Unknown | The survey seemed to target brown trout, but some WE and SMB were also caught. Water Temp: 53°F |
| Double Anode Boom Shocker | 10/15/2008 | Fall | Lower Menominee | Gamefish | WDNR | None | Peshtigo | Fall Assessment | 68 minutes | 2 miles | Walleyes were the dominant specie captured. Lengths, weights, and aging structures were collected (aging is done and on file). SMB, LMB, an NP were also picked up, but in few numbers. |
| Double Anode Boom Shocker | 10/21/2009 | Fall | Lower Menominee | Gamefish | WDNR | None | Peshtigo | Fall Assessment | 60 minutes | 2 miles | Walleyes were the dominant specie captured. Lengths, weights, and aging structures were collected (aging is done and on file). SMB, LMB, an NP were also picked up, but in few numbers. |
| Double Anode Boom Shocker | 10/12/2010 | Fall | Lower Menominee | Gamefish | WDNR | None | Peshtigo | Fall Assessment | 44 minutes | 2 miles | Walleyes were the dominant specie captured. Lengths, weights, and aging structures were collected (aging is done and on file). SMB, LMB, an NP were also picked up, but in few numbers. |
| Double Anode Boom Shocker | 10/11/2011 | Fall | Lower Menominee | Gamefish | WDNR | None | Peshtigo | Fall Assessment | 50 minutes | 2 miles | Walleyes were the dominant specie captured. Lengths, weights, and aging structures were collected (aging is done and on file). SMB, LMB, an NP were also picked up, but in few numbers. |
| Double Anode Boom Shocker | 10/23/2012 | Fall | Lower Menominee | Panfish & Gamefish | WDNR | Yes | Peshtigo | Fall Assessment | 50 minutes | 1.5 miles | All gamefish and panfish observed were collected and measured. Two unclipped, YOY musky were captutred indicating natural reproduction. |

Fisheries Data Roundup

Menominee River - Area of Concern

Lower Menominee River

Spring Fyke Netting


Wisconsin Department of Natural Resources

Fisheries Management

Garret Schacht

August 29, 2012

Muskellunge Spring Fyke Netting Comparison: 2006 vs. 2012

**Table 1.**
Descriptive Statistics of Muskellunge in the Lower Menominee River for Spring Fyke Netting

| Measures | 2006 | 2012 |
|---|---|---|
| Survey Begin Date | 5/02/2006 | 5/09/2012 |
| Survey End Date | 5/12/2006 | 5/17/2012 |
| Number of Net Nights | 27 | 28 |
| Number of Nets | 3 | 4 |
| Sample Size | 21 | 44 |
| Catch per Net Night | 0.8 | 1.6 |
| Mean Length (in) | 42.6 | 46.3 |
| Standard Deviation | 2.14 | 4.71 |
| Variance | 4.57 | 22.18 |
| Minimum | 39 | 37 |
| Maximum | 47 | 55 |
| Number of Males | 11 (52%) | 18 (41%) |
| Number of Females | 8 (38%) | 23 (51%) |
| Number of Unknown | 2 (9%) | 3 (6%) |
| PSD (Memorable ≥ 42″) | 62 | 72 |
| RSD (Trophy ≥ 50″) | 0 | 32 |
| PE Total (Modified Schnabel) | 81 | 52 |

* Lengths used for PSD and RSD (Memorable 42″ and Trophy 50″) are AFS standards
* The customary PSD and RSD (Quality ≥ 30 and Preferred ≥ 38) lengths were both too small for the given range (i.e. both years have produced relatively very large muskies)

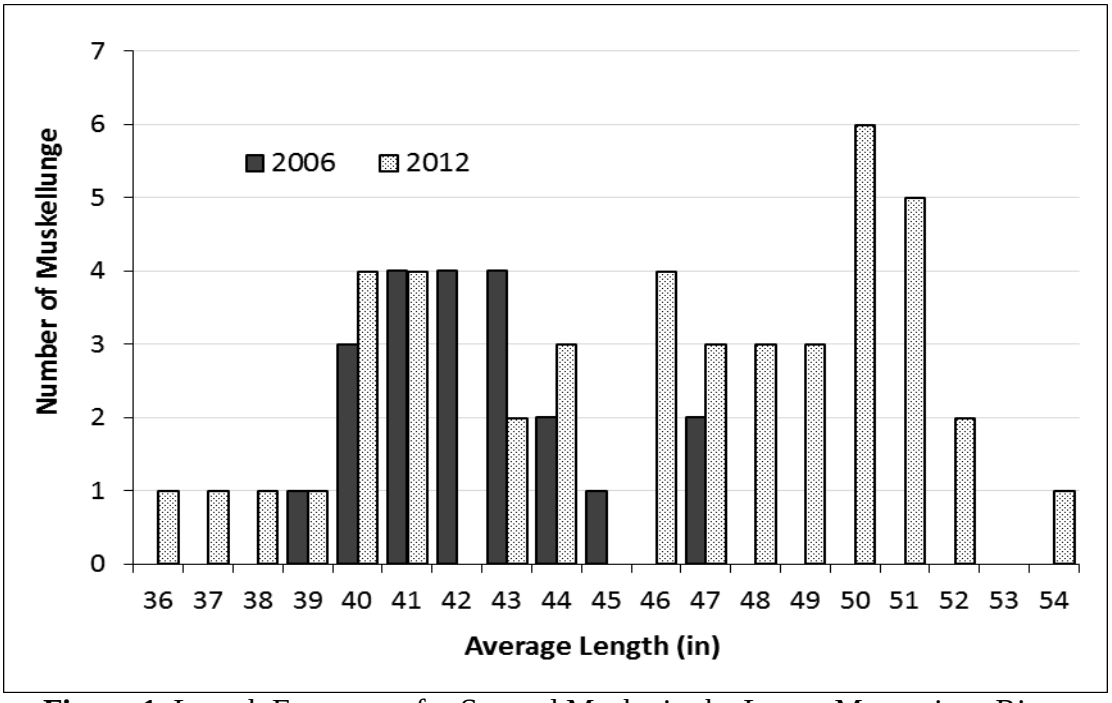



**Figure 1**. Length Frequency for Spotted Musky in the Lower Menominee River

**Table 2.**
Catch Totals for Spring Fyke Netting in the Lower Menominee River

| Specie | 2006 | 2006 | 2012 | 2012 |
|---|---|---|---|---|
| | Total | Total/Net Nights | Total | Total/Net Nights |
| Black Crappie | **10** | **0.37** | **55** | **1.96** |
| Bluegill | **31** | **1.15** | **184** | **6.57** |
| Muskellunge | **21** | **0.77** | **44** | **1.57** |
| Northern Pike | **17** | **0.63** | **10** | **0.36** |
| Pumpkinseed | **4** | **0.15** | **55** | **1.96** |
| Rock Bass | **64** | **2.37** | **32** | **1.14** |
| Smallmouth Bass | **16** | **0.59** | **11** | **0.39** |
| Walleye | **11** | **0.41** | **10** | **0.36** |
| Yellow Perch | **3** | **0.11** | **12** | **0.43** |

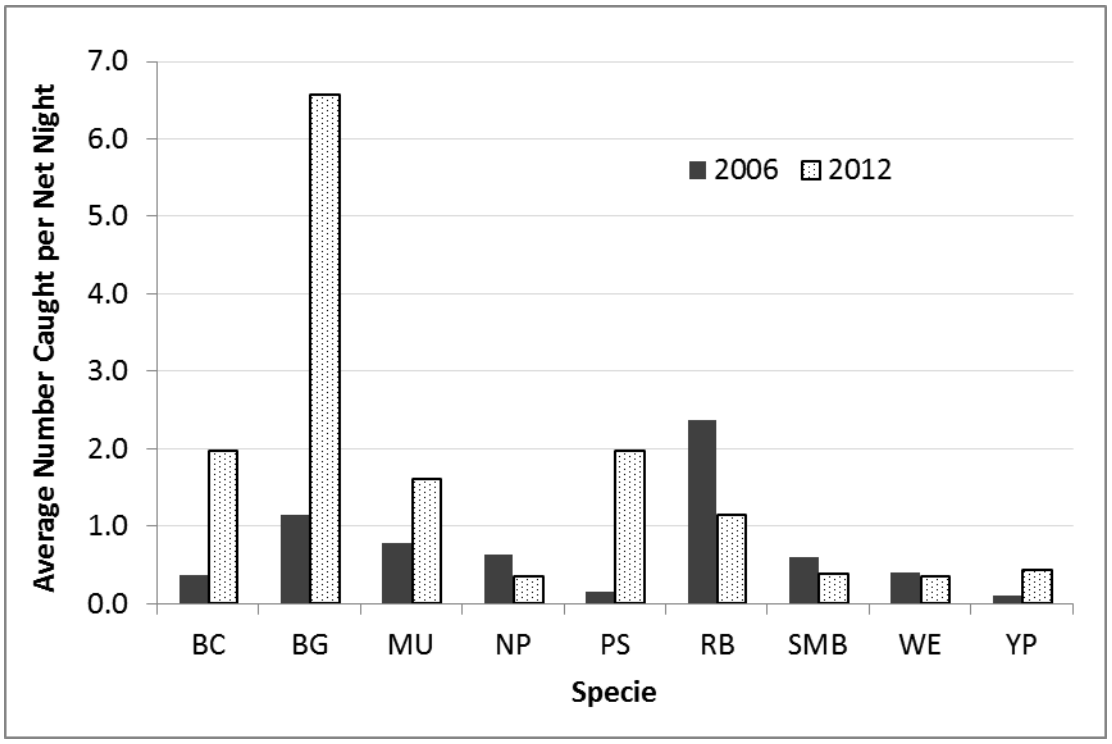



**Figure 2**. The average number of fish caught per net night during Spring Fyke Netting on the Lower Menominee River

**Table 3.**

YOY Catch Totals for Spring Fyke Netting in the Lower Menominee River

| Specie | 2006 | 2006 | 2012 | 2012 |
|---|---|---|---|---|
| | Total | Total/Net Nights | Total | Total/Net Nights |
| Black Crappie | 0 | 0.00 | 0 | 0.00 |
| Bluegill | 0 | 0.00 | **4** | **0.14** |
| Muskellunge | 0 | 0.00 | 0 | 0.00 |
| Northern Pike | **1** | **0.03** | 0 | 0.00 |
| Pumpkinseed | 0 | 0.00 | **7** | **0.25** |
| Rock Bass | 0 | 0.00 | **3** | **0.11** |
| Smallmouth Bass | 0 | 0.00 | 0 | 0.00 |
| Walleye | **3** | **0.11** | 0 | 0.00 |
| Yellow Perch | 0 | 0.00 | 0 | 0.00 |

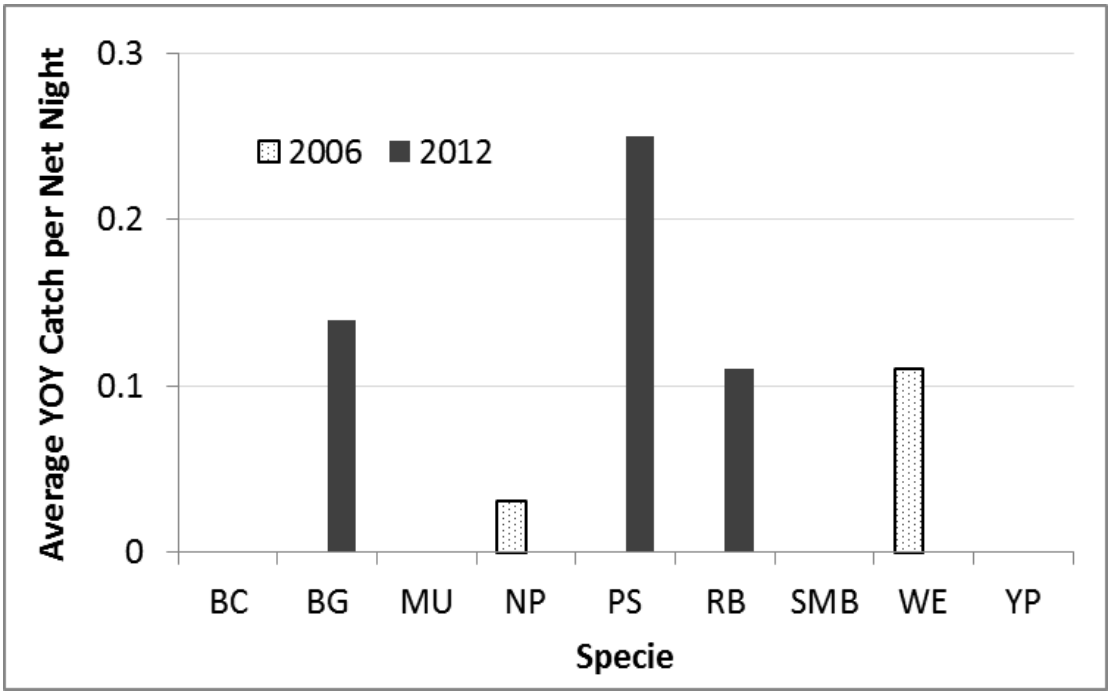



**Figure 3**. The average number of YOY fish caught per net night during Spring Fyke Netting on the Lower Menominee River

Fisheries Data Roundup

Area of Concern

Lower Menominee River

Fall Electrofishing


Wisconsin Department of Natural Resources

Fisheries Management

Garret Schacht

Updated November 28, 2012

Contents: 2008-2012 Pages

This report summarizes fall nighttime electroshocking surveys completed on the lower Menominee River from the Interstate Bridge downstream. Additional daytime fall surveys from Stephenson Island and upstream have been completed, but those surveys are not included in this summary report. Some of those surveys targeted only brown trout, which is not a species of concern for this effort. Other surveys not included were conducted to collect bio (length, weight, age, sex) data on spawning adult lake whitefish and/or track their movement and distribution. Catch per effort or relative abundance data is not available for whitefish surveys.

**Table 1.** Fall Electrofishing from 2008-2012 in the Lower Menominee River. Method and Gear: MB- single anode miniboom shocker, MB- double anode boom shocker. Species Targeted: G-gamefish, All- gamefish, panfish and roughfish, ?- species targeted unknown.

| **Survey Year** | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| **Survey Date** | 15-Oct | 21-Oct | 12-Oct | 11-Oct | 23-Oct |
| **Distance (miles)** | 2 | 2 | 2 | 2 | 1.5 |
| **Method & Gear** | BS | BS | BS | BS | BS |
| **Species Targeted** | G | G | G | G | All |
| **Water Temp (°F)** | 59 | 44 | 62 | 68 | |
| | | | | | |
| **Species** | **Catch Summary** | | | | |
| Black Crappie | | | | | 0 |
| Bluegill | | | | | 4 |
| Largemouth Bass | 14 | 1 | 14 | 2 | 5 |
| Muskellunge | 2 | 1 | 2 | 0 | 2 |
| Northern Pike | 1 | 13 | 0 | 1 | 1 |
| Pumpkinseed | | | | | 1 |
| Rock Bass | | | | | 2 |
| Smallmouth Bass | 15 | 3 | 2 | 3 | 1 |
| Walleye | 21 | 4 | 19 | 17 | 12 |
| Yellow Perch | | | | | 39 |
| | | | | | |
| **Species** | **Catch Per Effort (CPE)** | | | | |
| Black Crappie | | | | | 0.0 |
| Bluegill | | | | | 2.7 |
| Largemouth Bass | 7.0 | 0.5 | 7.0 | 1.0 | 3.3 |
| Muskellunge | 1.0 | 0.5 | 1.0 | 0.0 | 1.3 |
| Northern Pike | 0.5 | 6.5 | 0.0 | 0.5 | 0.7 |
| Pumpkinseed | | | | | 0.7 |
| Rock Bass | | | | | 1.3 |
| Smallmouth Bass | 7.5 | 1.5 | 1.0 | 1.5 | 0.7 |
| Walleye | 10.5 | 2.0 | 9.5 | 8.5 | 8.0 |
| Yellow Perch | | | | | 26.0 |

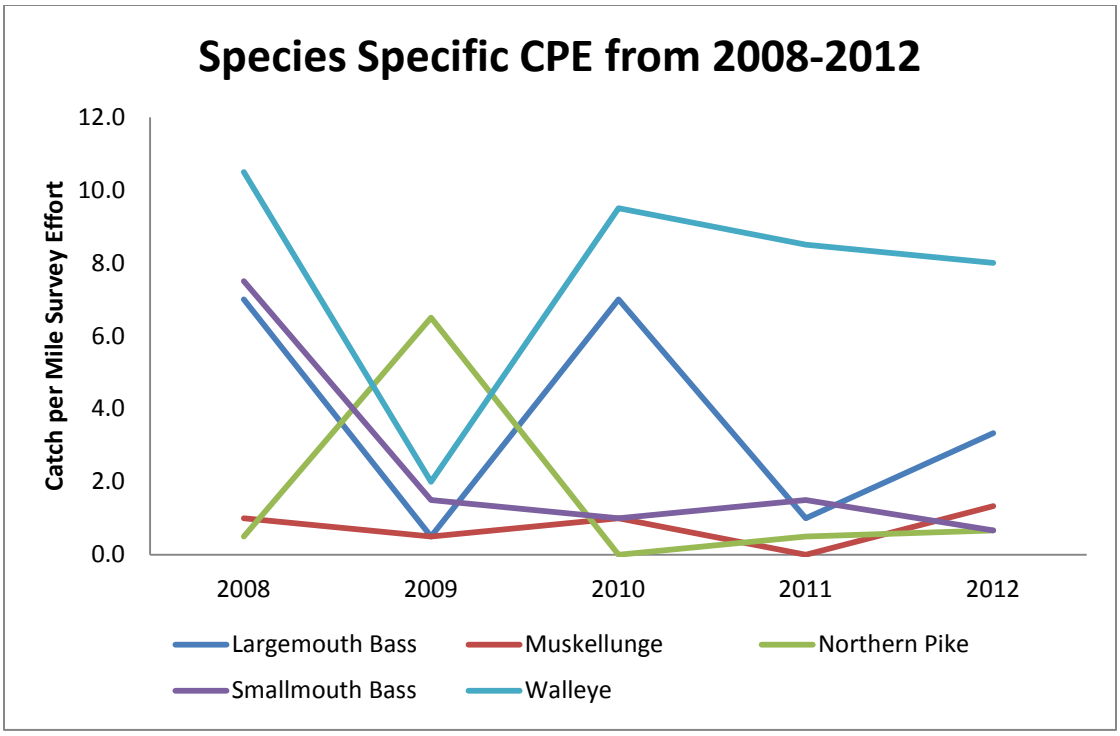



**Figure 1**. CPE is per species in the Lower Menominee River from 2008-2012. Fish were caught during nighttime October electrofishing surveys using a double anode boom shocker.

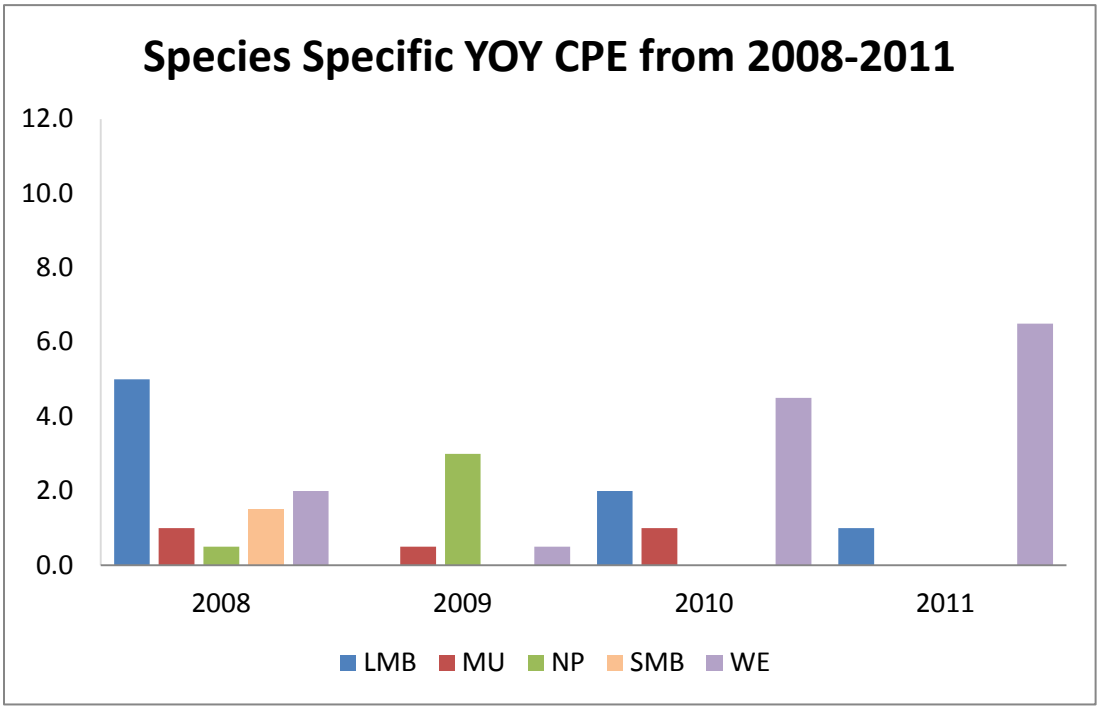



**Figure** 2. YOY CPE is per species for the Lower Menominee River from 2008-2011. Fish were caught during nighttime October electrofishing surveys using a double anode boom shocker. YOY length cut-offs were obtained from Becker (1983)

APPENDIX B: Lower Scott Flowage Data Summary Table

| Method & Gear | Date | Season | Species Targeted | Survey Agency | Database | Hardcopy Location | Original Purpose | Limitations, Assumptions, & Comments |
|---|---|---|---|---|---|---|---|---|
| double anode boom shocker | 9/16/1987 | fall | all species | WDNR | Fisheries Management Database | Peshtigo | first assessment of the flowage | Shocking distance not recorded, assumed to be 2.5 miles based on field notes stating the entire shoreline was sampled. |
| double anode boom shocker | 10/4/1989 | fall | all species | WDNR | Fisheries Management Database | Peshtigo | assess young-of-year | Shocking distance not recorded, assumed to be 2.5 miles based on field notes stating the entire shoreline was sampled. Field notes state: two large walleyes missed as well as a few large carp. No largemouth bass were observed. |
| double anode boom shocker | 10/1/1990 | fall | unknown | WDNR | Fisheries Management Database | Peshtigo | tissue contaminant study | Shocking distance not recorded, assumed to be 2.5 miles based on field notes stating the entire shoreline was sampled. Survey results were excluded from the LSF analysis due to concerns regarding which fish species were actually being collected. |
| double anode boom shocker | 9/30/1991 | fall | unknown | WDNR | Fisheries Management Database | Peshtigo | tissue contaminant study | Shocking distance not recorded, assumed to be 2.5 miles based on field notes stating the entire shoreline was sampled. All gamefish and panfish collected were measured. Field notes state: all walleyes and carp were targeted although a few missed. |
| double anode boom shocker | 7/31/2003 | fall | all species | WDNR | Fisheries Management Database | Peshtigo | baseline monitoring | 7/31/2003 and 8/4/2003 surveys recorded as one event in database. |
| double anode boom shocker | 8/4/2003 | fall | gamefish | WDNR | Fisheries Management Database | Peshtigo | baseline monitoring | 7/31/2003 and 8/4/2003 surveys recorded as one event in database. |
| double anode boom shocker | 10/3/2011 | fall | gamefish | WDNR | Fisheries Management Database | Peshtigo | baseline monitoring | |
| double anode boom shocker | 10/1/2012 | fall | all species | WDNR | Fisheries Management Database | Peshtigo | baseline monitoring | |
| single anode boom shocker | 9/12/2005 | fall | all species | WDNR | Fisheries Management Database | Peshtigo | baseline monitoring | |
| single anode boom shocker | 9/20/2007 | fall | all species | WDNR | Fisheries Management Database | unknown | baseline monitoring | |
| single anode boom shocker | 9/19/2008 | fall | all species | WDNR | Fisheries Management Database | unknown | baseline monitoring | |
| single anode boom shocker | 8/20/2009 | fall | all species | WDNR | Fisheries Management Database | unknown | baseline monitoring | |
| single anode boom shocker | 9/6/2011 | fall | all species | WDNR | Fisheries Management Database | unknown | baseline monitoring | |
| single anode boom shocker | 9/27/2012 | fall | all species | WDNR | Fisheries Management Database | Peshtigo | baseline monitoring | |
| double anode boom shocker | 10/1/2012 | fall | all species | WDNR | Fisheries Management Database | Peshtigo | baseline monitoring | |
| double anode boom shocker | 4/25/2011 | spring | gamefish | WDNR | Fisheries Management Database | Peshtigo | baseline monitoring | Gamefish given finclip. |
| double anode boom shocker | 5/24/2011 | spring | gamefish & panfish | WDNR | Fisheries Management Database | Peshtigo | baseline monitoring | Two separate 1/2 mile runs conducted to pick up both gamefish and panfish. |
| double anode boom shocker | 5/22/2012 | spring | gamefish & panfish | WDNR | Fisheries Management Database | Peshtigo | tissue contaminant study | Conducted to gather fish tissues for contaminant analysis for fish consumption advisories. |
| fyke netting survey | 4/11/2011 - 4/26/2011 | spring | northern pike | WDNR | Fisheries Management Database | Peshtigo | northern pike assessment | All gamefish and panfish collected were measured. |
| fyke netting survey | 4/5/1989-4/27/1989 | spring | northern pike | WDNR | Fisheries Management Database | Peshtigo | northern pike assessment | All gamefish and panfish collected were measured. |
| fyke netting survey | 6/25/1991 - 6/28/1991 | summer | unknown | WDNR | Fisheries Management Database | Peshtigo | unknown | All gamefish and large panfish were measured, some were taken for contaminant samples. Not included in any of the Lower Scott Fisheries reports due to season incongruity and low number of net nights compared to other fyke net surveys. |

**All Species Targeted** - All fish species are netted, including gamefish, panfish, and even roughfish.
**Gamefish & Panfish** - Only gamefish and panfish are netted.
**Gamefish** - Only gamefish are netted.

Data collected using different methods & gear or during different seasons is not considered comparable due to increased variability.

# CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: December 1, 1995 FILE REF :3600

TO: George Boronow

FROM: Brian Belonger BB

SUBJECT: DOCUMENTATION OF A MENOMINEE RIVER WHITEFISH RUN

This memo is being written to document the increasing numbers of spawning-condition whitefish in the lower Menominee River.

Historically, whitefish ran the Menominee River in great numbers (Larson 1963). By 1870, no whitefish runs remained in the river, primarily due to degrading of the Menominee by sawdust from the numerous sawmills lining its banks (Goode 1887).

Since 1992, weekly fall boomshocker surveys have been conducted on the lower Menominee River, primarily from the Interstate Bridge to the lower Scott dam, a distance of approximately one-half mile. The dam represents the furthest point upstream that the fish can move from Green Bay. These surveys were designed to evaluate the performance of brown trout strains. However, during these surveys, an attempt was also made to catch, measure, sex, and determine the maturity of whitefish (Table 1).

In 1992, no whitefish were seen. Since then, the number of mature ripe whitefish has increased from 5 in 1993 to 33 in 1994, and 58 in 1995. These fish, which were predominantly males, were caught between November 1 and December 1, with water temperatures ranging from 32.5°F to 44.

November 22, 1995 was the last day shocked in 1995, due to an earlier freeze-up this year. On that day, substantial numbers of whitefish were seen in the river, but not caught due to time constraints. If we would have been able to collect those fish and also shock the last week of November, the 1995 total would have been considerably higher.

Table 2 shows the length frequency distribution and mean length of both mature male and female whitefish caught in the Menominee River from 1993 through 1995. This information for males from 1994 and 1995 is shown graphically in Figures 1 and 2. Without having the benefit of an aged sample, these size distributions probably represent several year classes from age 2+ to age 4+ or 5+ (personal communication - Mike Toneys). Scales will be collected next fall if the run continues.

High whitefish abundance in Green Bay from a series of strong year classes may be causing some spill over of spawners into the Menominee River. The substrate is rocky between the dam and interstate bridge and hopefully the whitefish will successfully reproduce there and establish an annual spawning run. Part of objective number 2 of the Menominee River Fishery Plan calls for restoring and enhancing historic runs of whitefish to the river. Mother nature may all ready be working on that idea.

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References

Goode, George B. 1887. The Fishery and Fishery Industries of the United States. Section II. Government Printing Office, Washington, D.C.

Larson, Hubert F. 1963. Be-Wa-Bic County, The Story of the Menominee Iron Range in the Upper Peninsula of Michigan. Carlton Press. New York, N.Y.

**Table 1.** **Menominee River fall weekly boom shocking whitefish catch**

| Year | No. males | No. females | Total | Date range of catch | Temp. range of catch | Date range of sampling |
|---|---|---|---|---|---|---|
| 1992 | 0 | 0 | 0 | | Deg. F | Oct. 21 - Dec. 03 |
| 1993 | 4 | 1 | 5 | Nov. 10 - Nov. 17 | 37.0 - 37.0 | Sept. 15 - Dec. 20 |
| 1994 | 32 | 1 | 33 | Nov. 23 - Dec. 01 | 35.0 - 32.5 | Sept. 16 - Dec. 29 |
| 1995 | 54 | 4 | 58 | Nov. 01 - Nov. 16 | 44.0 - 33.0 | Oct. 04 - Nov. 22 |

In 1995, whitefish were seen on Nov. 22, but were not caught due to time constraints. The total would have been approximately 78 had fish been caught on Nov.22. Ice prevented the continuation of sampling after Nov. 22.

**Table 2.** **Menominee River Whitefish Length Frequency Distribution**

| | | Total Length in Inches | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1993 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | TOTAL | Mean | SD | C.V. |
| Males | | 1 | 1 | | | 1 | | | 1 | | | 4 | 19.5 | 3.2837 | 16.861 |
| Females | | | | | 1 | | | | | | | 1 | 19.5 | | |
| **TOTAL** | | **1** | **1** | | **1** | **1** | | | **1** | | | **5** | **19.5** | **2.8438** | **14.598** |
| | | | | | | | | | | | | | | | |
| 1994 | | | | | | | | | | | | | | | |
| Males | | 5 | 9 | 7 | 6 | 3 | 2 | | | | | 32 | 18.3 | 1.3866 | 7.5742 |
| Females | | | | | 1 | | | | | | | 1 | 19.9 | | |
| **TOTAL** | | **5** | **9** | **7** | **7** | **3** | **2** | | | | | **33** | **18.4** | **1.3926** | **7.5874** |
| | | | | | | | | | | | | | | | |
| 1995 | | | | | | | | | | | | | | | |
| Males | 2 | 3 | 1 | 7 | 13 | 15 | 10 | 3 | | | | 54 | 19.8 | 1.5845 | 8.0139 |
| Females | | | 1 | | | 1 | | 2 | | | | 4 | 20.6 | 2.4541 | 11.899 |
| **TOTAL** | **2** | **3** | **2** | **7** | **13** | **16** | **10** | **5** | | | | **58** | **19.8** | **1.6429** | **8.2843** |

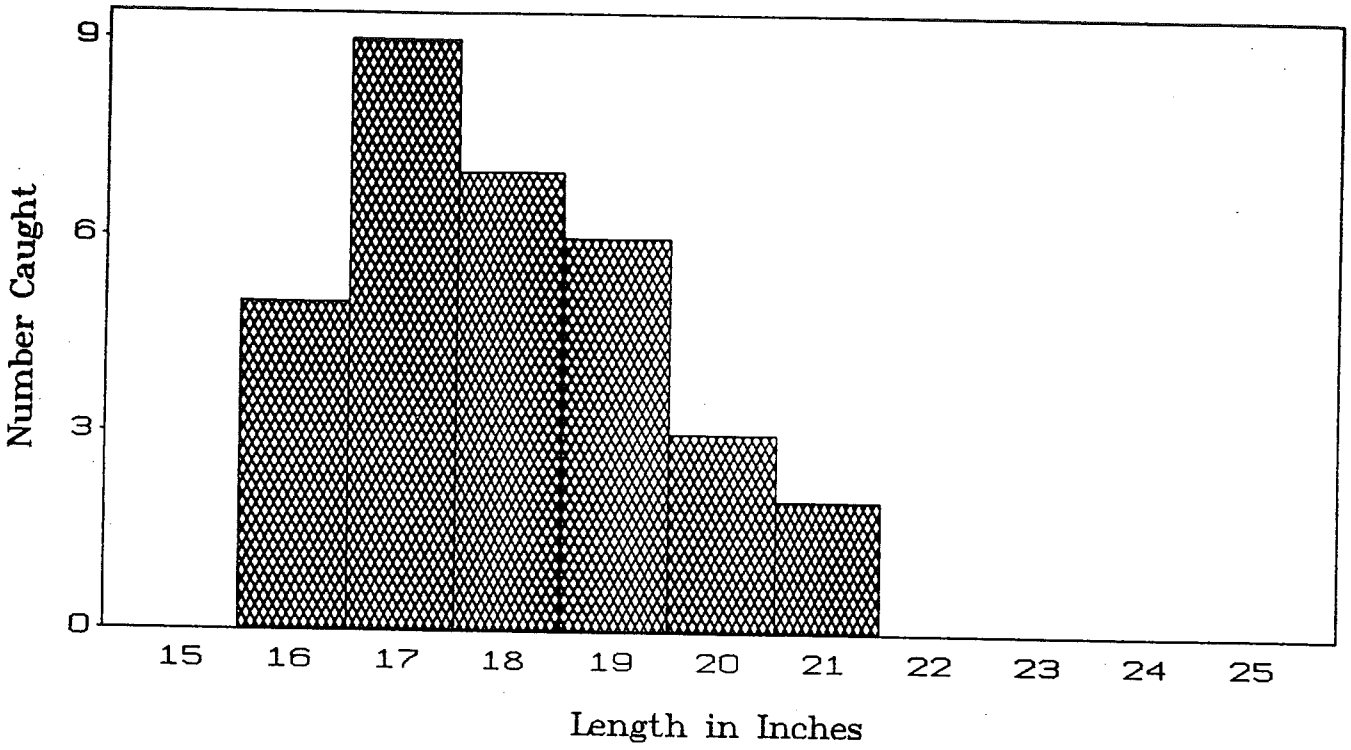



Figure 1. 1994 Menominee R. Mature Male Whitefish

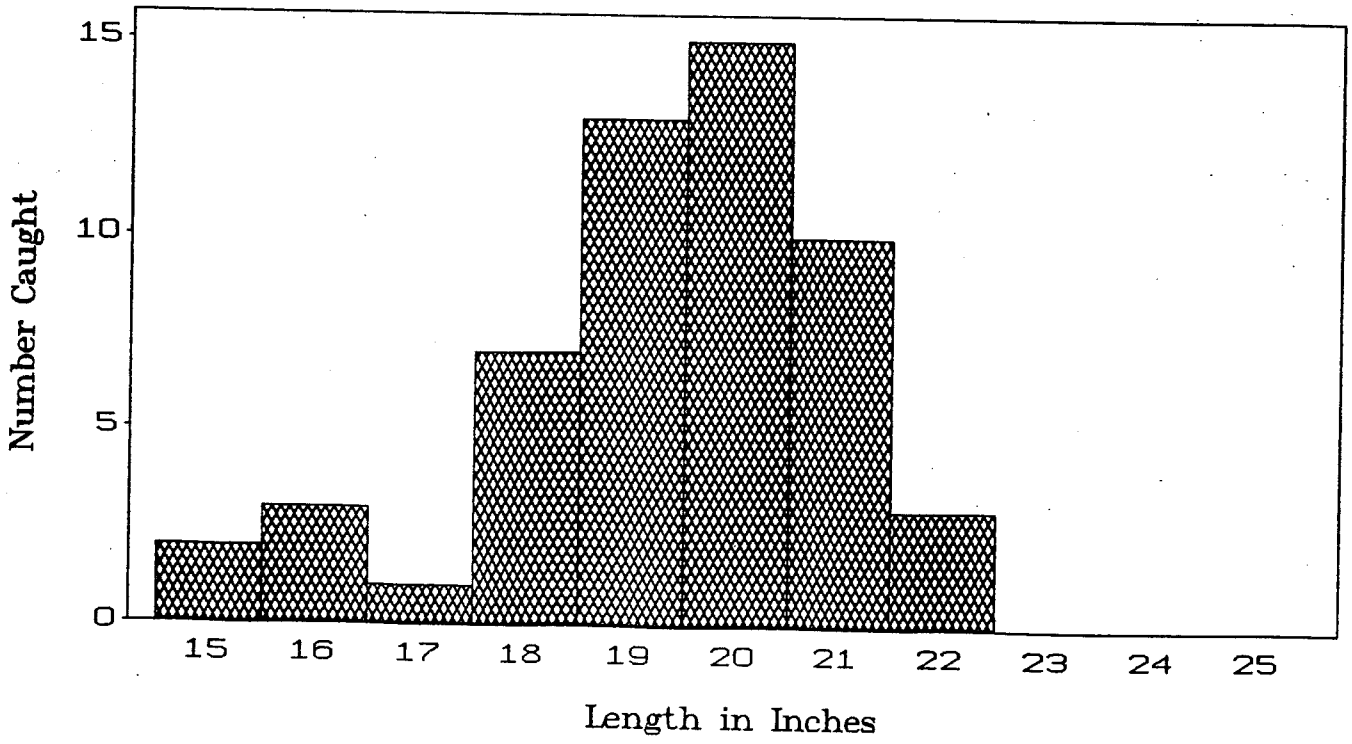



Figure 2. 1995 Menominee R. Mature Male Whitefish

**Summary of Menominee River Walleye Run Estimation 2006**

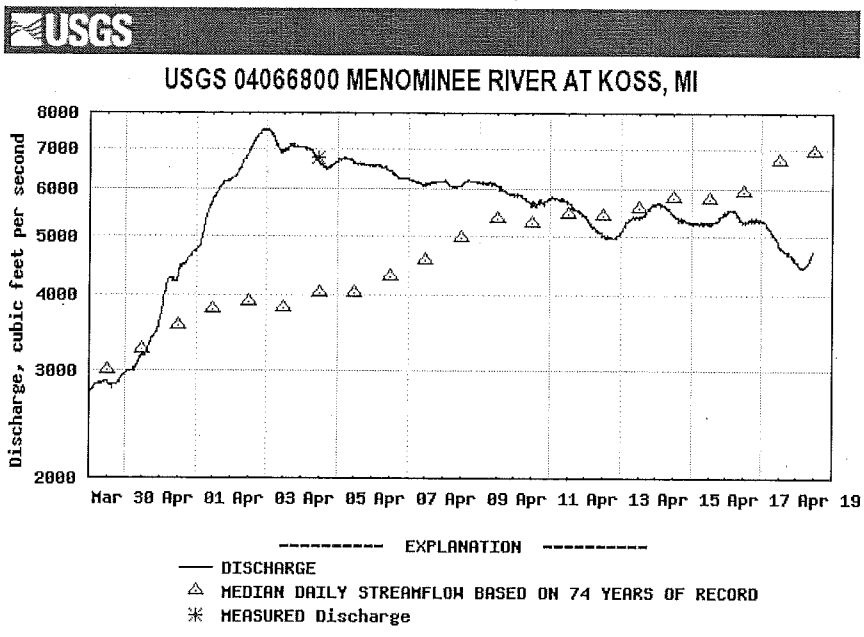
Troy Zorn
Marquette Fisheries Research Station
September 7, 2006

## Intro and methods

From March 30 to April 14, 2006 Wisconsin DNR Fisheries and Marquette Fisheries Research Station staff conducted a multiple pass, mark-recap survey of the Menominee River to estimate the size of the walleye run in the river below the most downstream dam. The primary objective was to assess the size, age, and sex composition of the run.

Fish were sampled with two boomshocking units. Unique marks were given each day, enabling the spawning run to be estimated using both closed and open population methods. Spines were also collected from 20 fish per sex and inch group for aging. Tissue samples were also collected from a subset of fish for potential genetic analyses in the future.

Spring conditions in the river were somewhat different when compared to typical values. The "spring thaw" occurred relatively early due to unusually warm weather in late March. River flows on March 30 were at long-term median levels, but quickly climbed due to meltwater, peaking on April 2. Then, flows declined gradually through the remainder of the sampling period. Typically the river's discharge gradually increases through the first few weeks of April. These conditions did not appear to obviously disrupt the walleye run or effect sampling efficiency.

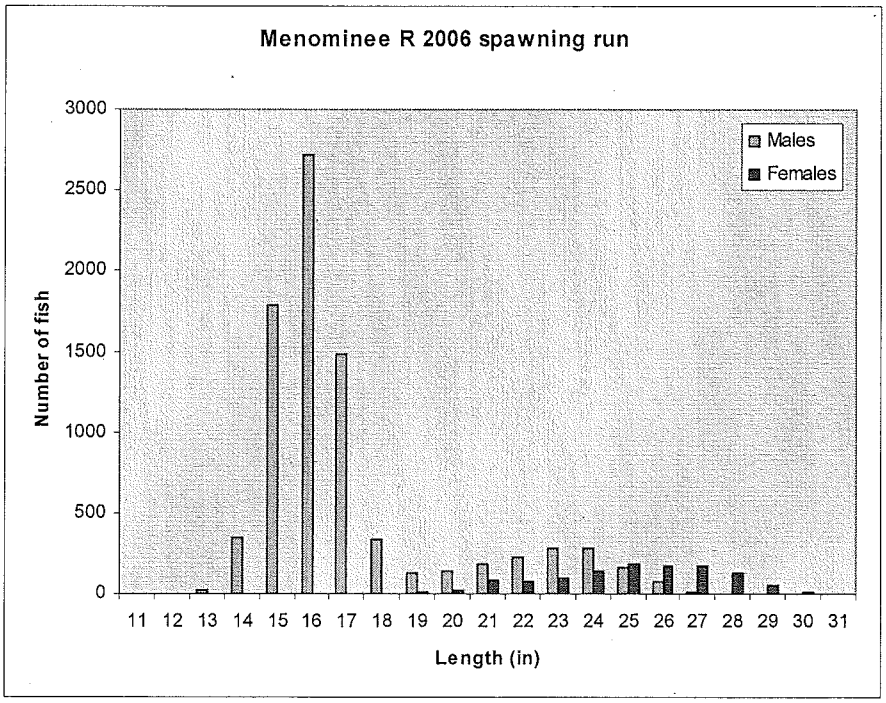


## Results

Total number of fish captured and numbers of marked fish observed each day occur below.

| Date | Day | Total catch | Recaps |
|---|---|---|---|
| 03/30/2006 | 1 | 483 | 0 |
| 04/03/2006 | 2 | 952 | 11 |
| 04/04/2006 | 3 | 878 | 30 |
| 04/05/2006 | 4 | 1000 | 37 |
| 04/06/2006 | 5 | 1103 | 47 |
| 04/07/2006 | 6 | 1079 | 88 |
| 04/10/2006 | 7 | 903 | 95 |
| 04/11/2006 | 8 | 1146 | 145 |
| 04/13/2006 | 9 | 999 | 150 |
| 04/14/2006 | 10 | 945 | 137 |
| sum | | 9488 | 740 |

The sample was heavily skewed to small males, with 72% of the walleyes examined being males less than 20" long. These males may represent the 2003 year class, which was strong in Little Bay de Noc and elsewhere in the Great Lakes, and was expected to be strong in the Menominee River area. A large run of females from this year class can be expected within the next couple years as they mature to spawning size. Spine ages (when available) will be used to assess the age composition of the run.



The preliminarily estimate for the 2006 spawning run was 58,382 walleyes (95% confidence interval of 15,044) using the Shumacher-Eschmeyer (SE) estimation. The estimate of the run by sex was 45,221 males and 13,161 females. Data from days 8-10 were excluded from this estimate due to the increased proportion of spent females observed (and likely emigration of spent fish) which would violate the assumption of a closed population. Cormack-Jolly-Seber (CJS) estimation assumes an open population, but confidence limits are not reported (at least not in the spreadsheet I have). The CJS estimate for the population using data up to day 7 produces very similar estimates for each sex (45,861 males and 11,559 females). Generally, the greatest agreement between population estimates occurs when population data up to day 7 are used. Inclusion of data from days 8-10 results in a CJS estimate that is roughly 4,000 fish higher, but a SE estimate that is about 5,400 fish lower.

Availability of age data for the run will enable description of run composition by year class, as well as some assessment of the contribution of wild vs. hatchery-reared fish to the current spawning run.