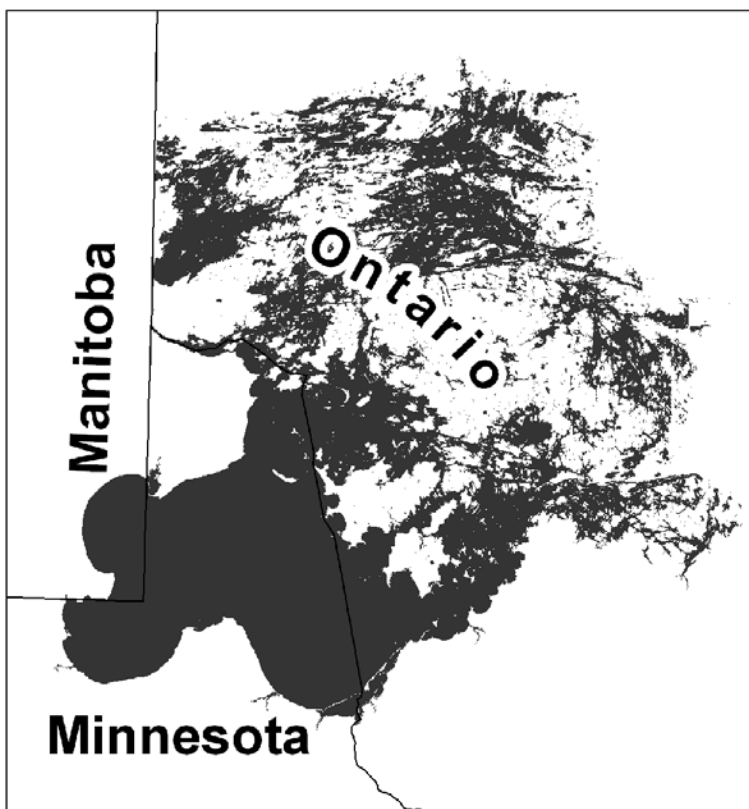


MINNESOTA DEPARTMENT OF NATURAL RESOURCES

Fisheries Management Plan for Lake of the Woods 2018-2023



Division of Fish and Wildlife, Fisheries Management Section
Minnesota Department of Natural Resources
204 Main Street East
Baudette, MN 56623

December 1, 2018

Authors and Contributors

Minnesota Department of Natural Resources

Division of Fish and Wildlife

Phil Talmage, Area Fisheries Supervisor, Baudette

Henry Drewes, Regional Fisheries Manager, Bemidji

Brett Nelson, Large Lake Specialist – Lake of the Woods

Lake of the Woods Fisheries Input Group

Organization/Affiliation	Representative
Lake of the Woods Tourism	Joe Henry
Roseau County Commissioner	Roger Falk
Lake of the Woods County Commissioner	Jon Waibel
Lake of the Woods County Commissioner/Business	Ed Arnesen
Warroad Chamber of Commerce	Kent Peterson
Baudette Chamber of Commerce	Brian Ney
Statewide Walleye Work Group	Gary Korsgaden
Statewide Northern Pike and Muskellunge Work Group	Bob Eli
Resort Owner (South Shore)	Nick Anthony
Resort Owner (South Shore)	Mike Kinsella
Business Owner (Northwest Angle)	Chuck Haggemiller
Business Owner (South Shore)	Alan Thomas
Statewide Angler	Wayne Larson
Statewide Angler	Les Lemm

Table of Contents

Lake of the Woods Fisheries Input Group.....	2
Executive Summary.....	5
Purpose.....	5
Background.....	5
Sportfish Population Goals and Objectives.....	6
Management Actions.....	8
Fisheries Assessments—.....	8
Minnesota Department of Natural Resources Mission Statement.....	11
Purpose.....	11
Lake Characteristics.....	11
Survey History.....	12
Recent Fisheries Status and Trends.....	12
Sportfish Population Goals, Objectives, and Actions.....	15
Goal 1: Maintain Lake of the Woods as a high-quality multispecies fishery.....	15
Walleye.....	15
Northern Pike.....	25
Lake Sturgeon.....	26
Other Species.....	29
Goal 2: Protect and enhance valuable habitats within Lake of the Woods.....	29
Objectives:.....	29
Management Actions.....	30
Fisheries Assessments.....	30
Annual.....	30
Five-year Rotation (assess once every five years).....	31
Ten-year Rotation (assess once every 10 years).....	31
Creel Surveys.....	31
Regulations.....	32
Walleye & Sauger Regulations.....	32
Habitat.....	32
Development— There are no habitat development plans at this time.....	32
Protection.....	32

Lake Sturgeon Juvenile Assessment.....	32
Examination of TOHA parameters.....	32
Aquatic Invasive Species (AIS)	33
Other Considerations	33
Cooperative information sharing and management with Ontario	33
Regulation change	33
Tournament permitting	33
Access.....	33
Annual Stakeholder Meetings.....	33
Literature Cited	35
Appendix.....	37
Appendix 1. History of regulations for Minnesota-Canada border waters.....	37

Executive Summary

Purpose

Update the 2013-2018 Lake of the Woods Fisheries Management Plan for another 5 years.

Background

Throughout the late 1800s into the mid-1900s, commercial fishing was the primary usage of the Lake of the Woods fishery. In the mid-1900s, sport fishing began to increase and competition arose between the two components. While commercial endeavors focused on Walleye and Lake Sturgeon, Walleye were the primary target of sport anglers. By the early 1900s, the Lake Sturgeon population had collapsed, while the Walleye fishery was showing signs of over-exploitation.

The first fishery survey was conducted in the 1930s and 40s. Carlander (1942) reported Walleye stocks were showing signs of instability, due to overexploitation, during the late 1930's. In 1948 competition for allocation of the Walleye harvest between sport and commercial fishing interests lead to a policy of reducing participation of the commercial fishery through license holder attrition. Despite overall reduction in commercial license holders, Schupp and Macins (1977) commented that commercial catch per unit of effort (CPUE) had declined severely and the bulk of the harvest was dependent on individual strong year classes during the 1950's and 1960's.

During the 1984 legislative session, the Minnesota Department of Natural Resources (DNR) was directed to purchase the remaining commercial Walleye quotas to accelerate removal of the commercial fishery. The last commercial game fish harvest took place in 1985. Sport fishing limits and regulations were liberalized concurrent with the elimination of the commercial fishery. In 1991 Walleye and Sauger limits, and general regulations, were returned to pre-1985 levels.

Walleye and Sauger harvests exceeded the target harvests with an increasing trend in annual harvest in the early 2000s. In 2004, in the face of increasing angling pressure, the Walleye and Sauger limits were further reduced to bring harvest back to sustainable levels.

Concurrent passing of the federal clean water legislation in the early 1970s, and the coinciding improvements with municipal and industrial wastewater handling, restored water-quality and habitat conditions in the Rainy River and started the recovery of the Lake Sturgeon population. Strong year-classes began to appear in the late 1960s and early 1970s, and by the early 1990s larger Lake Sturgeon (over 40 inches) were beginning to become more abundant in the population.

Recreational angling interest in Lake Sturgeon increased dramatically in the early 2000s while this fishery was still in the state of recovery. Actions were taken to maintain some harvest opportunity while the fishery continues to recover.

Walleye, Sauger, and Lake Sturgeon are popular species that are targeted on Lake of the Woods and the Rainy River. Currently the Walleye and Sauger populations are doing well, though both species are sustaining harvests greater than the potential yield estimates for

each species. Pressure from the winter fishery continues to rise, and when conditions are right, harvest can be high. Proactive management will be critical to ensuring the long-term sustainability of all species.

Since the early 1980s annual monitoring has been conducted on large lakes throughout the state of Minnesota. The data and information collected from these surveys allows for sound science to inform management decisions. For over 30 years DNR and the Ontario Ministry of Natural Resources and Forestry have been working cooperatively on shared resource management. It is in this forum where target harvest and management direction are shared with our counterparts in Ontario.

The DNR engaged a group of 14 stakeholders for the purpose of providing input in the management planning process. This group, referred to as the Lake of the Woods Fisheries Input Group (LOW FIG), provided diverse local and statewide perspectives and made recommendations on Lake of the Woods fisheries management. This plan builds upon the successes of and knowledge gained from previous plans by recommending specific goals, objectives, and management actions aimed at preserving a high-quality, species-diverse fishery on Lake of the Woods. New to the 2018-2023 management plan is the use of 3-year moving averages (most recent three observations) for most of the objectives. Moving averages are used to smooth the year to year variability to more closely reflect current trends.

The DNR will continue to hold annual update meetings with the LOW FIG and other interested stakeholders to review the previous year's information and status with regards to the management plan. A weight of evidence approach will be used to assess if deviations from the management plan are necessary and appropriate.

Sportfish Population Goals and Objectives

Fishery Goal 1: Maintain Lake of the Woods as a high-quality multispecies fishery.

Species Goals/Objectives:

Walleye—are managed to provide a diverse, high-quality size structure with high angler catch and harvest rates. Specific objectives include:

- 1) Abundance – Maintain gill net catch rate (3-year moving average) greater than 14 Walleye per net (25th percentile).
- 2) Size Structure – The percentage of Walleye sampled in gill nets (3-year moving average) greater than 500mm (20 inches) should be 5-15% of the Walleye catch.
- 3) Recruitment – Maintain year class strength index (3-year moving average) greater than 0.67 (25th percentile).
- 4) Angler Harvest – Sustain an annual total Walleye harvest at, or below, target harvest of 540,000 pounds (6-year moving average).

Sauger—are managed to provide a harvest-oriented fishery with a high catch rate. Specific objectives include:

- 1) Abundance – Maintain gill net catch rate (3-year moving average) greater than 15 Sauger per net (25th percentile).

- 2) Recruitment – Maintain year class strength index (3-year moving average) greater than 0.78 (25th percentile).
- 3) Angler Catch Rate – Maintain a targeting winter angler harvest rate (3-year moving average) greater than 0.22 (25th percentile) Sauger per hour.
- 4) Angler Harvest – Sustain an annual total Sauger harvest at, or below, target harvest of 250,000 pounds (6-year average).

Northern Pike—are managed to provide a trophy fishing opportunity. Anglers have defined trophy Northern Pike as fish exceeding 40-inches. Specific objectives include:

- 1) Spring ice-out netting should reflect a trophy / high-quality size distribution, containing 7% female pike over 36”, and 2% female pike over 40”.
- 2) Spring ice-out trap netting should show a population with a RSD-30 of 30-40. RSD-30 (relative stock density greater than 30 inches) is the percentage of Northern Pike greater than 30 inches divided by all Northern Pike greater than 14 inches captured in ice-out trap nets.

Lake Sturgeon—are in a state of recovery from past over-harvest, followed by a period of reproductive failure due to water pollution. The Lake Sturgeon population is being managed to allow the recovery to continue while allowing limited harvest and catch-and-release fishing to take place. Specific objectives include:

- 1) Presence of male fish to age-40.
- 2) Presence of female fish to age-70.
- 3) Presence of female fish greater than 80 inches.
- 4) A minimum of forty year-classes present.
- 5) Support harvest at or below 0.036 lb./ac of available habitat.

Other species—

- 1) Maintain Yellow Perch harvest within the target harvest level of 67,200 pounds on a six-year average.
- 2) Smallmouth Bass and Muskellunge both provide localized fisheries, with harvest being a small component of all captured fish. Continue to monitor harvest of these species through standard creel surveys.
- 3) Monitor Tullibees and Lake Whitefish abundances to ensure sustainability of resources.

Goal 2: Provide protection and enhancement to valuable habitats within Lake of the Woods.

Objectives:

Environmental Review—Review all permit applications to ensure that rules and regulations are being met, and to ensure that the best conservation practice is being opted for.

- 1) Review permits promptly and coordinate responses with the Area Hydrologist.
- 2) Participate in FERC (Federal Energy Regulatory Commission) and IJC (International Joint Commission) relevant to Lake of the Woods and tributary waters.
- 3) Work with local government units on stream crossings to ensure connectivity and eliminate fish barriers.
- 4) Participate with One Watershed One Plan process to ensure protection of resources.

Shoreline Protection/Projects—Work with local government units to ensure that projects are either improving or protecting shoreline/habitat conditions.

- 1) Carefully investigate the need any shoreline protection or restoration project.
- 2) Work with the Lake of the Woods Soil and Watershed Conservation District to explore all alternatives.

Management Actions

Fisheries Assessments

Annual

Spring Walleye spawning run sampling (Target – adult Walleye. Purpose – to monitor size structure.) This boat electrofishing survey will be conducted annually at the Long Sault Rapids of the Rainy River. Length, gender, and stage of maturity to be collected from all Walleye.

Young-of-Year percid sampling (Target – YOY Walleye, Sauger, Yellow Perch, and forage species. Purpose – to produce year class strength predictions and monitor forage species abundance). Young of the year sampling will begin each open water season with two consecutive week samples collected from six different locations. The second component of YOY sampling will begin in August with trawling. Four trawling stations will be trawled (two in Big Traverse and two in Muskeg Bay). All fish will be identified to species, identified as YOY or 1+, measured, and weighed. Both seining and trawling will follow the standardized protocols highlighted in the Large Lake Sampling Guide (Wingate and Schupp 1984).

Fall gill net sampling (Target – juvenile and adult Walleye, Sauger, Yellow Perch, cisco, White Sucker. Purpose – to monitor trends in biological performance indicators, determine relative abundance, monitor growth and condition, and determine year-class strength). Fall gill netting will be conducted at 64 (52 near shore and 12 off shore sets) sites with overnight sets beginning the day after Labor Day. All fish will be identified, measured, weighed, gender and stage of maturity will be documented, and ageing structures will be collected from gamefish. Fall gill netting will follow the standardized protocols highlighted in the Large Lake Sampling Guide (Wingate and Schupp 1984).

Spawning Lake Sturgeon tagging (Target – spawning Lake Sturgeon. Purpose - to monitor size structure and sex ratios on spawning runs, tag Lake Sturgeon,

understand spawning periodicity and maturity schedule). Gill nets will be set in the Rapid River bay. The exact timing will be determined by water temperature and the presence of Lake Sturgeon. Protocols will follow those defined in the Annual Large Lake Sampling Report (Nelson 2018).

Juvenile Lake Sturgeon sampling in the lower Rainy River (Target – sub adult Lake Sturgeon. Purpose – to monitor abundance/reproductive success, identify critical habitat, and index abundance of juvenile Lake Sturgeon). To be conducted in August or October, based on water temperatures, using experimental gill nets. In addition to sampling sturgeon, habitat and flow measurements will be recorded (Nelson 2018).

Water-Quality Sampling (Target—basic water-quality parameters. Purpose – for long-term monitoring of water-quality parameters)

Zooplankton Sampling (Target—open water sampling at long-term monitoring sites. Purpose – monitor trends of abundance of native and invasive zooplankton species). Two stations (Zippel and Long Point) will be sampled bi-weekly beginning in May/June into September (Nelson 2018). All samples will be sent to the biology lab in St. Paul for identification and enumeration.

Five-year Rotation (once every five years)

Ice-out trap netting (Target – adult Northern Pike. Purpose - monitor size structure). Next in 2021. Sampling will begin as ice comes free in the tributaries (Warroad River, Zippel Creek, Bostic Bay, Winteroad River, Wabanica Creek) using $\frac{3}{4}$ " double-frame trap nets. The goal will be to capture 300-500 Northern Pike. All pike will be measured, weighed, and gender and stage of maturity will be documented (Nelson 2018).

Lake Sturgeon population monitoring (Target – juvenile and adult Lake Sturgeon. Purpose - to monitor overall Lake Sturgeon population age and size structure for progress to recovery goals). Next in 2019. Cooperate with the Ontario Ministry to sample sturgeon in Fourmile Bay and the inside channel. Netting should aim to be conducted between April 15th and May 15th to remain consistent in timing. Four, five, six, and seven-inch mesh nets should be used to capture a wide length range of fish to adequately sample the size distribution of the population.

Ten-year Rotation (once every 10 years)

Lake Sturgeon population estimate (Target – Lake Sturgeon longer than 40 inches. Purpose - to monitor progress to recovery goals, produce a population estimate for Lake Sturgeon longer than 40 inches, and provide input for target harvest and exploitation estimate). Next in 2024. This project will be conducted during the open-water season and include both mark and recapture phases. Protocols and recommendations should follow Heinrich and Friday (2015).

Creel Surveys

Winter creel of south shore fishery should be conducted 2 out of 4 years. Next survey scheduled for the winter of 2018-2019; then again 2021-22. This survey will be conducted from December through mid/late March using a roving design (Heinrich 2017a).

Rainy River spring creel survey should be conducted 2 out of 4 years. Spring creel should be conducted in the spring immediately following every winter survey. Next survey 2019, then again 2022. Survey period should roll from the winter creel to the spring river fishery and run through April 14th (Nelson 2017)

Lake of the Woods summer south shore creel should be conducted 2 out of 4 years, and on the same schedule as the winter and spring creels. Next survey will be conducted during the open water season in 2018. Creel survey should be conducted using a complete trip design (Heinrich 2017b)

Rainy River fall creel survey should be conducted 2 out 4 years, immediately following the south shore summer creel survey. Next survey to be conducted in fall of 2018. This creel is conducted using a roving creel design and sector counts (Topp 2017).

North West Angle creel survey should be conducted if there appears to be a change in angler behavior/pressure or once every 10 years. This creel survey starts Memorial Weekend and runs through September.

Fisheries Management Plan for Lake of the Woods, 2018-2023

Minnesota Department of Natural Resources Mission Statement

The mission of the Minnesota Department of Natural Resources (DNR) is to work with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life.

Purpose

Management plans describe goals, objectives, and actions that support the DNR mission statement. The purpose of this plan is to guide fisheries management on Lake of the Woods. It is written for use by both the DNR and citizens that are interested in the management of this fishery resource. This plan is based on a fish community approach to fisheries management and highlights why this approach is important. This plan is designed to guide effective and efficient allocation of staff and fiscal resources to protect the fish community and provide for its sustained use. The goals, objectives, and actions identified in this plan will focus the work of the DNR over the next five years. Although this plan contains clearly defined goals, objectives, and actions, it is written to be flexible and deviations can occur based on changes to the fishery or the citizens that utilize it. Citizen participation is a major component in the development of this plan and will continue to be critical throughout its life. The success of this plan will ultimately be determined by its benefits to the resource and users.

Lake Characteristics

Lake of the Woods lies in the Hudson Bay drainage basin at latitude 49° N. Lake of the Woods straddles the Canada-United States border, and is shared between the Canadian provinces of Manitoba and Ontario, and the state of Minnesota. Water level is directly controlled through three hydroelectric dams located at the head of the Winnipeg River in Kenora, Ontario (Schupp and Macins 1977). The Rainy River provides 75% of the inflow to the lake (Schupp and Macins 1977). Water flow into the Rainy River is controlled through a hydroelectric dam located between Fort Frances, Ontario and International Falls, Minnesota.

The Minnesota portion of the Lake of the Woods shoreline is primarily sandy beach ridges adjacent to large marshy areas. The surrounding drainage is characterized by glacial lake sediment and bog. Forestry and agriculture are the major land uses within that portion of the drainage basin located in Minnesota.

The lake is comprised of several distinct basins. The Minnesota waters of Lake of the Woods (320,000 acres) are within Muskeg, Big Traverse, and Little Traverse Bays. Big Traverse Bay and Muskeg Bay are largely devoid of bottom structure and islands. Little Traverse Bay is more characteristic of the Ontario waters of Lake of the Woods, with numerous islands and reefs. These three basins do not stratify and in most years have widespread, dense, blue-

green algae (*Aphanizomenon* spp) blooms that are first evident in July and continue through September.

Survey History

Lake of the Woods is one of ten lakes categorized as Large Walleye Lakes (>25,000 acres) by the MN-DNR, and is sampled annually in accordance with the Large Lake Sampling Guide (Wingate and Schupp 1984). The guide provided a standard sampling and reporting format to allow trends to be identified and between lake comparisons to be made.

Reports summarizing annual fish population survey findings (Large Lake sampling) have been produced annually since 1981. Creel surveys have been conducted on several distinct fisheries that target Lake of the Woods fish stocks. The summer south shore-based fishery was sampled annually from 1981 through 2007, 2012-13, and 2016. The south shore-based winter fishery was sampled in 1982, 1987, 1989-1994, 1997-2006, 2012-13, 2016, 2017. The fishery based on the Northwest Angle was sampled 1994-1996, 2002, 2007, and 2012. The Rainy River fishery is sampled during the spring and fall. These fisheries were sampled 1990-2005, 2012-13, 2016-17 (spring), and 1989, 1990, 1997-2000, 2002-2006, 2012-13, 2016 (fall).

Recent Fisheries Status and Trends

Walleye are the primary management species in Lake of the Woods. Consequently the management of Walleye in Lake of the Woods has been extensive. Commercial exploitation of Lake of the Woods fish stocks began in 1888 with a pound net fishery directed at Lake Sturgeon (*Acipenser fulvescens*) and lake whitefish (*Coregonus clupeaformis*). These fisheries collapsed in the early 1900's and effort was redirected to Walleye (*Sander vitreus*) and Sauger (*S. canadensis*) primarily using gill nets. Carlander (1942) reported Walleye stocks were showing signs of instability, due to overexploitation, during the late 1930's. In 1948 competition for allocation of the Walleye harvest between sport and commercial fishing interests lead to a policy of reducing participation of the commercial fishery through license holder attrition (see Appendix 1 for description of regulations). Despite overall reduction in commercial license holders, Schupp and Macins (1977) commented that commercial catch per unit of effort (CPUE) had declined severely and the bulk of the harvest was dependent on individual strong year classes during the 1950's and 1960's.

During the 1984 legislative session, the DNR was directed to purchase the remaining commercial quotas to accelerate removal of the commercial fishery. The last commercial game fish harvest took place in 1985. Sport fishing limits and regulations were liberalized concurrent with the elimination of the commercial fishery. In 1989, in an effort to align seasons with Ontario, Walleye season was extended to April 14th. In 1991 Walleye and Sauger limits, and general regulations, were returned to pre-1985 levels, resulting in expanded limits and an extended season to expand angling opportunities.

Walleye and Sauger harvests exceeded the target harvests, and the trend was to increasing harvest during the early 2000s. On November 30, 2004, limits for Walleye and Sauger were reduced from an aggregate of 14 to 8 during the winter season (December 1 through April 14), and to an aggregate limit of 6 during the summer (Fishing opener through November

30). During the entire open season no more than 4 Walleye may be possessed, and no Walleye between 19.5 and 28 inches total length may be possessed. Exceptions to these rules apply to the Rainy River and Fourmile Bay during some times of the year. The regulation history is summarized in Appendix 1.

Target Harvests— Previous studies conducted by the MN-DNR and the Ontario Ministry of Natural Resources (OMNR) have demonstrated that many of the angled species are a shared resource (OMNR 2004). Consequently, resource managers from MN-DNR and the OMNR identified a methodology to determine sustainable harvests for the sport fishery of Lake of the Woods.

Target harvests, by species, are calculated through a multi-step process. The Thermal Optical Habitat Area (TOHA) is used for Walleye (Table 1). TOHA uses several physical and chemical parameters to define productivity for Walleye (Lester et al. 2004). For all other species the Morphoedaphic Index (MEI) is partitioned to determine potential yield. For the MEI calculation, total dissolved solids of 138 mg/l and a mean depth of 7.96 m (Carlander 1942) yield a morphoedaphic index (MEI: Ryder 1965) of 18.6 (Schupp and Macins 1977), for a potential yield of 4.9 lbs. per acre ($1.4 (\text{MEI})^{0.45}$). For the Minnesota waters this equals 1,372,800 lbs./yr. Further partitioning determined the percentage distribution of that total available for harvest of each species based on previous research and knowledge of population status (Table 2).

Table 1 - Values of variables and constants used to generate maximum sustained harvest levels (MSH) utilizing the Thermal Optical Habitat Area (TOHA) model.

Symbol	Description	Value
Area (ha)	Lake area, Lake of the Woods doesn't stratify	124,027
Pt	Corrects for stratification	1
Z^{sec}	Secchi depth. The mean of measurements taken across years during the open water season. Units are in m.	1.4
Z^{mean}	Mean lake depth. Units are in m.	7.96
Z^{max}	Maximum lake depth. Units are in m.	11.3
Color	Mean Pt-Co Color Units w/o Fourmile Bay	59
k	Vertical extinction Coefficient, calculated from $0.034 * \text{color}$	2.01
r	Relative depth, relates mean to maximum depth	0.70
s	Lake profile description.	3.88
Z^{rel}	Relative Secchi depth.	0.13
k*SD	Vertical extinction coefficient combined w/ Secchi Depth as in- $k * \text{SD}$	2.8
e	Math constant (Euler's Number) - 2.71828	2.71828
TDS	Total dissolved solids, mean of annual water quality sampling typically collected Late July or early August, 1988-2008 mean. Units are mg l-l.	100
GDD	Growing degree days, base 5 C from Warroad	1826

Symbol	Description	Value
TOHA-I	Area adjusted Thermal Optical Habitat Area, for non-stratified lakes	15.41
MSH (kg)	Maximum Sustained Harvest. Units are Kg year-1 of Walleye	245,798
MSH (lbs.)	Maximum Sustained Harvest. Units are Lbs. year-1 of Walleye	540,756

Table 2—Potential yield estimates, by species, for the Minnesota waters of Lake of the Woods/Rainy River; determined using the Thermal Optical Habitat Area (TOHA) for Walleye and Morph edaphic Index (MEI) for all other species. Percentages listed are the percentages of the total potential yield.

		Potential Yield	Potential Yield	Annual Target
Species	%	kg	lbs.	lbs.
Walleye	NA	204,500	450,000	540,000
Northern Pike	20	122,200	268,800	100,000
Smallmouth bass	5	30,500	67,200	67,200
Sauger	18	113,600	250,000	250,000
Yellow perch	5	30,500	67,200	67,200
Lake Sturgeon	0.04	5,200	11,600	11,600
Total		506,500	1,114,800	946,000

Sportfish Population Goals, Objectives, and Actions

Goal 1: Maintain Lake of the Woods as a high-quality multispecies fishery.

Walleye

Are managed to provide a diverse, high quality, size structure with high angler catch and harvest rates.

An abundant and diverse age/size class Walleye population supports the majority of the Lake of the Woods fishery. The 2002-2017 near and off-shore composite Walleye gill net catch rate is 17.3 fish per net (Figure 1). While abundance varies on an annual basis, consistent recruitment has produced a sustainable and healthy Walleye population (Figure 2). In addition to the abundance and recruitment annual monitoring includes the tracking of biological performance indicators (Gangl 2001, Heinrich 2012).

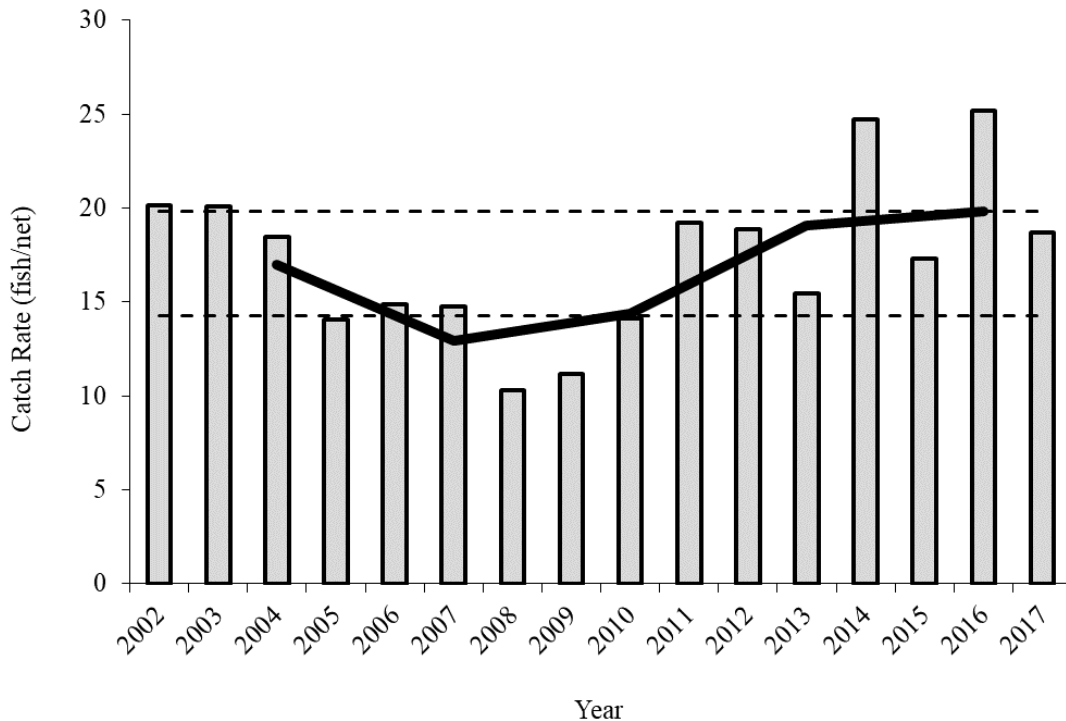


Figure 1—Catch per unit effort of Walleye in September gill nets, 2002 through 2017. Lake of the Woods, MN. Solid black line denotes the three-year average from 2003-2017. The bottom dashed line denotes management goal of 14.3 Walleye per lift (1st quartile), while the top dashed line is the 3rd quartile. The area between the 1st and 3rd quartile represents the normal range of abundance.

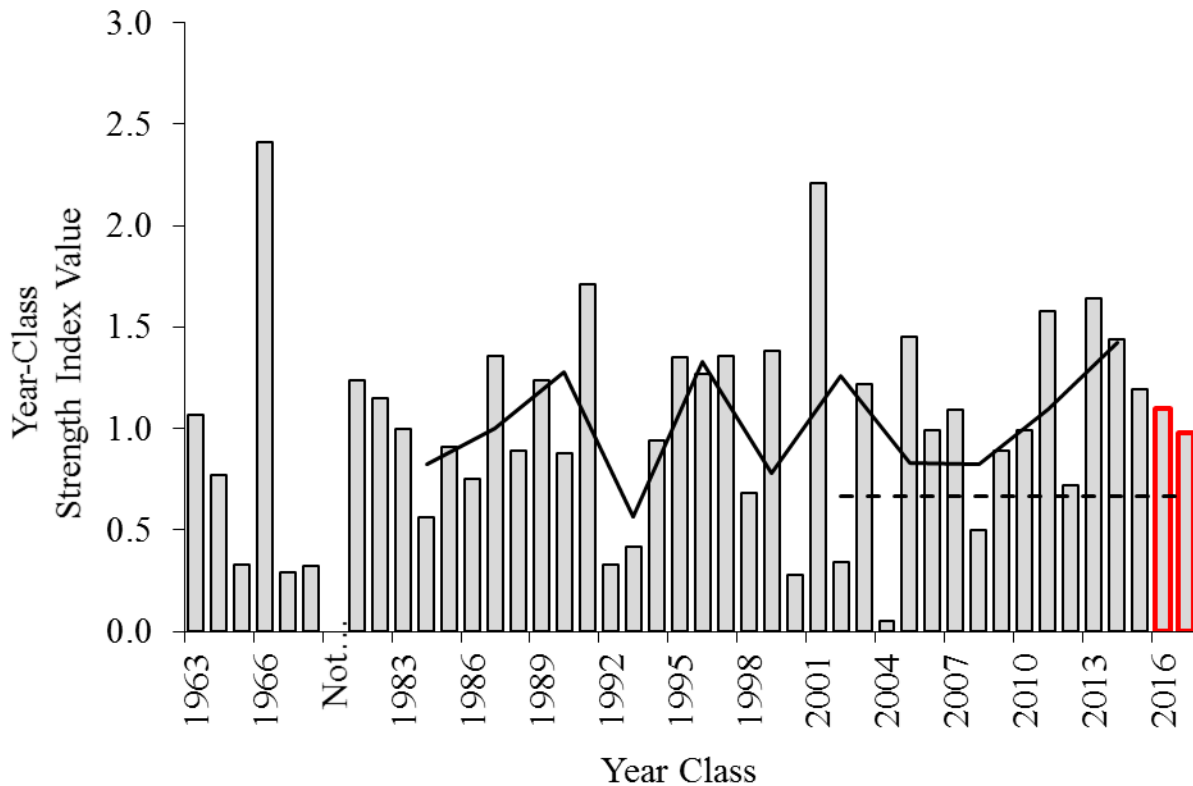


Figure 2—Year-class strength of Walleye, 1968 through 2017. Lake of the Woods, MN.* The 2016 and 2017 values are predicted. Solid black line represents the three-year average from 1983-2015. Dashed line represents management goal of 0.67 (25th percentile) from 2002-2015.

Walleye are a highly sought after species on Lake of the Woods. The five-year mean annual pressure is 2.76 million angler hours (Table 3), most of which is heavily focused on Walleye and Sauger. During the same period of time the annual Walleye harvest has averaged 593,000 pounds. Walleye pressure throughout the summer season has been relatively consistent through survey years, while ice fishing pressure has demonstrated a nearly two-fold increase since the mid-1990s.

Despite the increased pressure and associated harvest, all indications of stock status show a sustainable Walleye fishery thrives in Lake of the Woods. To further protect the fishery and maintain harvests at the sustainable yield, a protective slot limit was enacted on Lake of the Woods. The regulation went into effect in 2004, and protects all Walleye from 19.5 to 28 inches. Survey data and angler reports indicate that the regulation continues to protect spawning stock while providing a high yield fishery (Figure 3). Identifying the importance of larger Walleye and their contributions to reproduction lend value to spawning stock fish being considered as a Walleye management objective in this plan; a comparable metric was not included in the previous management.

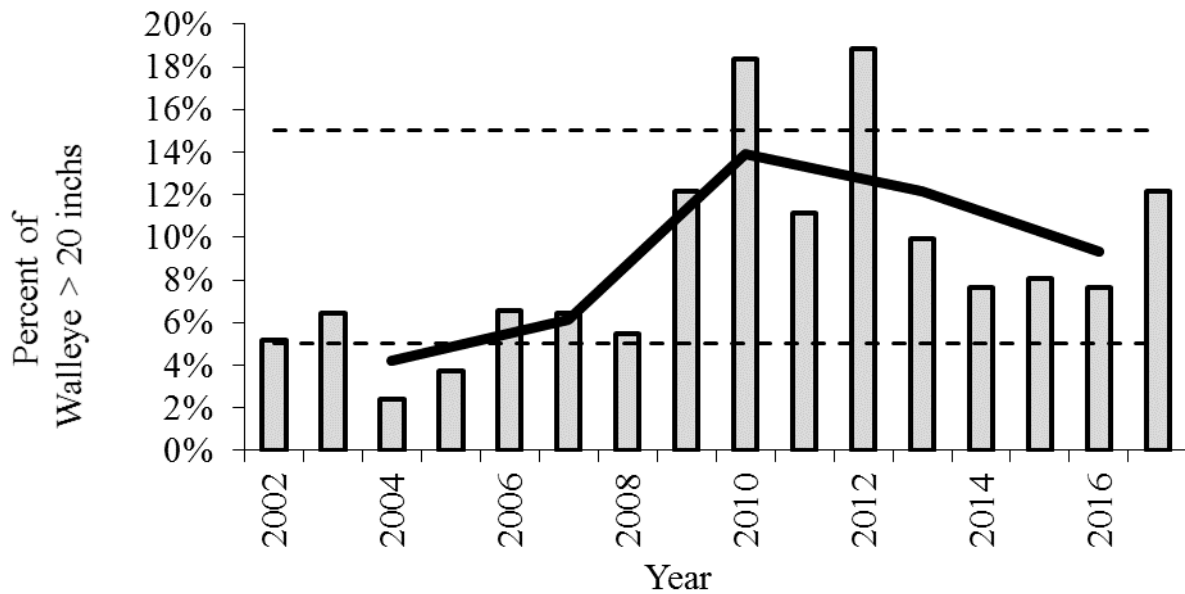


Figure 3- Average percentage of Walleye over 20 inches sampled by both near and off-shore gill nets from 2002 to 2017. Solid black line denotes the three-year average from 2003-2017. Dashed lines denote management goal of 5 to 15% of gill net catch over 20 inches.

Walleye Objectives

1. Abundance – Maintain gill net catch rate (3-year moving average) greater than 14 Walleye per net (25th percentile).
2. Size Structure – The percentage of Walleye sampled in gill nets (3-year moving average) greater than 20 inches should be 5-15% of the Walleye catch.
3. Recruitment – Maintain year class strength index (3-year moving average) greater than 0.67 (25th percentile).
4. Angler Harvest – Sustain an annual total Walleye harvest at, or below, target harvest of 540,000 pounds (6-year moving average). Sauger

Sauger are managed to provide a high catch rate, harvest oriented, fishery. Sauger are a very important component of the recreational fishery of Lake of the Woods. Sauger abundance in Lake of the Woods is more dynamic than Walleye. Sauger abundance in the fall gill nets range from 10 to 31 Sauger per lift since 2002 (Figure 4). Recent year-class production of Sauger has been exceptional (Figure 5). This high level of production has resulted in a high Sauger harvest in the most recent winter creel surveys (Table 4). Sauger contribute significantly to the recreational fishery during the winter season, while being a much smaller portion of the harvest during the spring, summer, and fall. Since 1991, harvest rates for winter anglers has been consistent with an average harvest rate of 0.26 Sauger per angler hour (Figure 6).

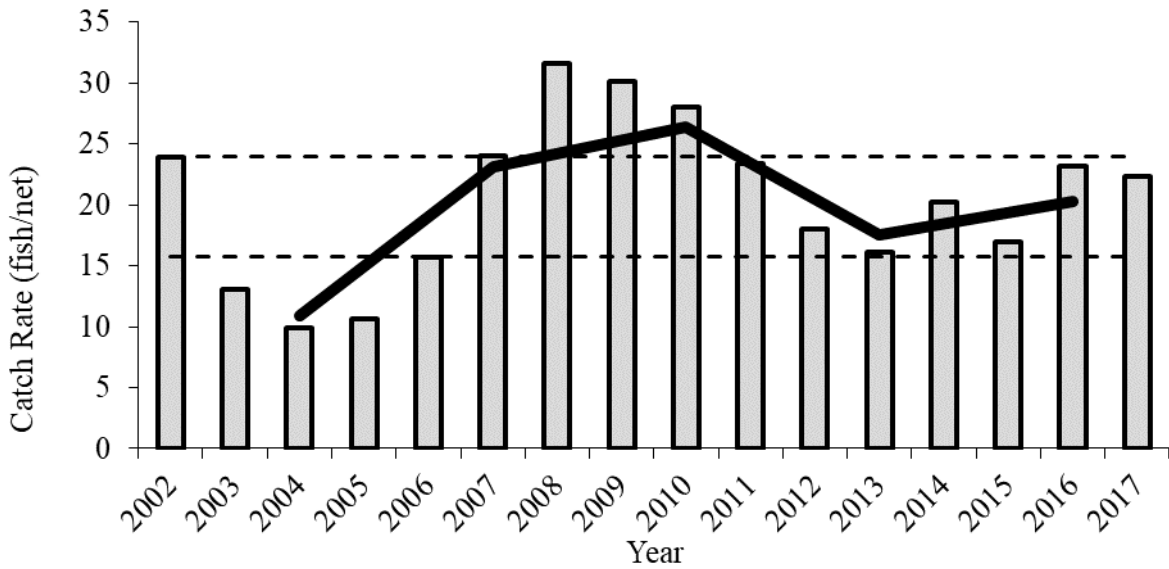


Figure 4—Catch per unit effort of Sauger in September gill nets, 2002 through 2017. Lake of the Woods, MN. Solid black line represents the three-year average from 2003-2017. The bottom dashed line represents management goal of 15.8 Sauger per lift (1st quartile), while the top dashed line represents the 3rd quartile. The area between the 1st and 3rd quartile represents the normal range of abundance.

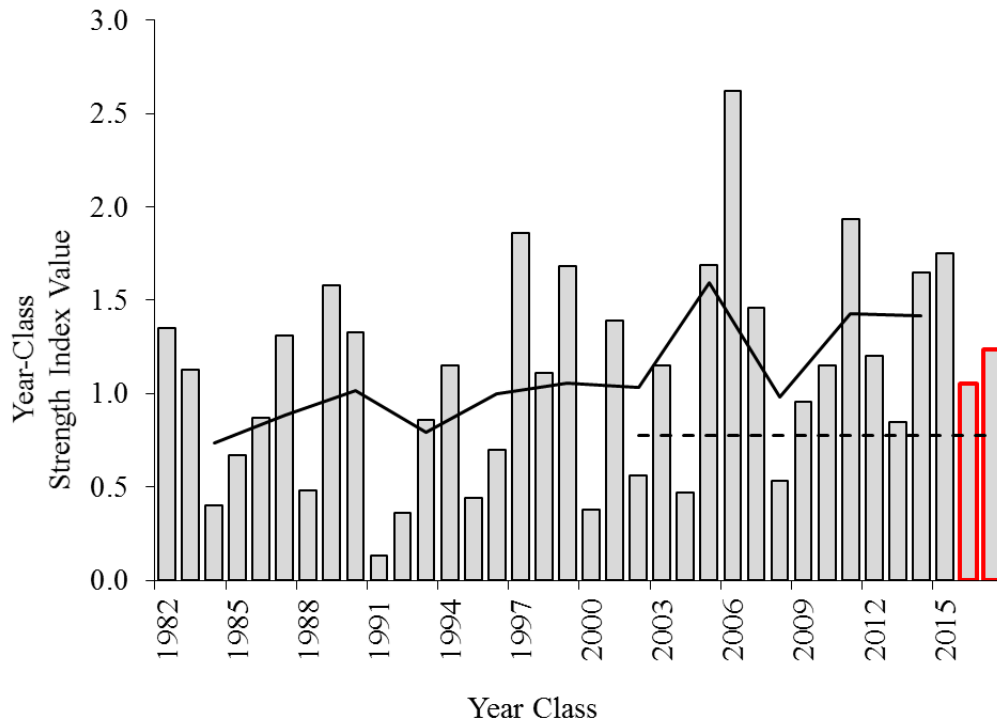


Figure 5— Year-class strength of Sauger, 1982 through 2017. Lake of the Woods, MN.* The 2016 and 2017 values are predicted. Solid black line represents the three-year average from 1983-2015. Dashed line represents management goal of 0.78 (25th percentile) from 2002-2015.

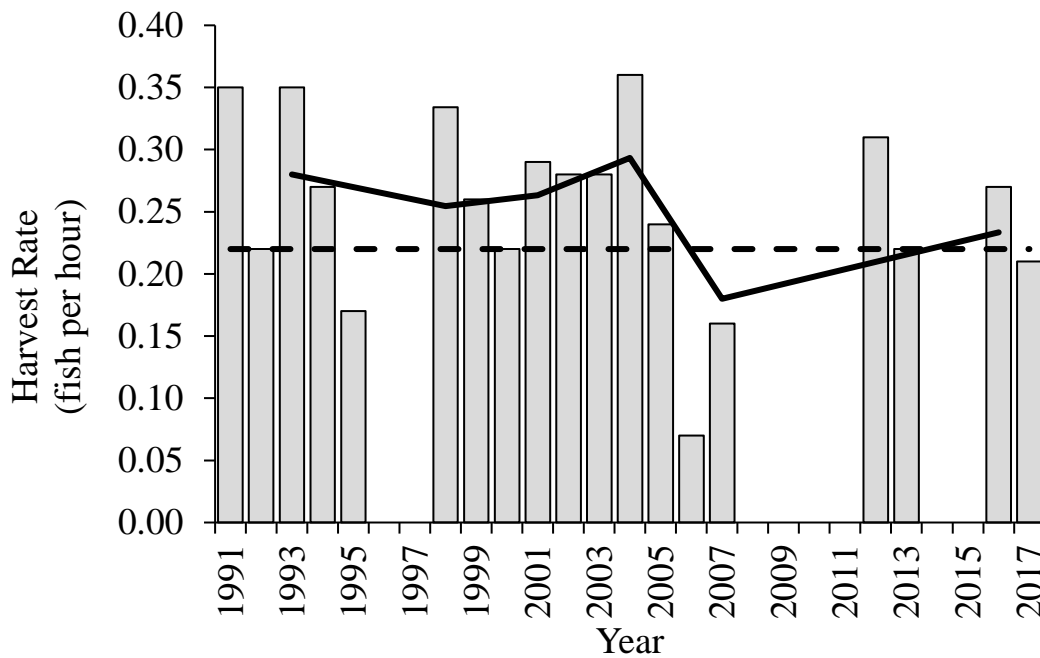


Figure 6 — Angler harvest rate for Sauger documented during Lake of the Woods winter creel survey from 1991 to 2017. Solid black line represents the three-year average from 1991-2017. Dashed line represents management goal of 0.22 (25th percentile) from 1991-2017.

Sauger Objectives

1. Abundance – Maintain gill net catch rate (3-year moving average) greater than 16 Sauger per net (25th percentile).
2. Recruitment – Maintain year class strength index (3-year moving average) greater than 0.78 (25th percentile).
3. Angler Catch Rate – Maintain a targeting winter angler harvest rate (3-year moving average) greater than 0.22 (25th percentile) Sauger per hour.
4. Angler Harvest – Sustain an annual total Sauger harvest at, or below, the target of 250,000 pounds (6-year average).

Table 3—Angler pressure and Walleye harvest, by pounds, 1981-2017. Minnesota waters of Lake of the Woods and the Rainy River. For winter surveys the year of the survey is the year in which the survey finished. Dashed lines represents years for which data were not collected or have not been summarized for publication. Note four year gap of creel surveys from 2008 to 2011 and two year gap from 2014 to 2015.

Year	Lake of the Woods Summer Pressure	Lake of the Woods Summer Harvest	Lake of the Woods Winter Pressure	Lake of the Woods Winter Harvest	Rainy River Spring Pressure	Rainy River Spring Harvest	Rainy River Fall Pressure	Rainy River Fall Harvest	Northwest Angle Summer Pressure	Northwest Angle Summer Harvest	Total Pressure	Total Harvest
1981	321,124	109,861	---	---	---	---	---	---	---	---	na	na
1982	552,575	205,658	---	---	---	---	---	---	---	---	na	na
1983	421,974	156,462	401,467	37,618	---	---	---	---	---	---	na	na
1984	504,477	196,392	---	---	---	---	---	---	---	---	na	na
1985	846,989	340,639	---	---	---	---	---	---	---	---	na	na
1986	796,705	283,760	---	---	---	---	---	---	---	---	na	na
1987	721,944	201,769	---	---	---	---	---	---	---	---	na	na
1988	564,789	196,164	649,226	24,899	---	---	---	---	---	---	na	na
1989	628,230	239,357	---	---	---	---	61,301	38,613	---	---	na	na
1990	986,044	550,329	764,088	95,399	29,548	24,465	54,744	21,536	---	---	na	na
1991	904,081	387,363	925,682	73,314	42,895	20,791	---	---	---	---	na	na
1992	660,436	260,178	747,063	64,561	27,697	7,134	---	---	---	---	na	na
1993	787,416	220,347	741,322	50,900	33,978	4,462	---	---	---	---	na	na
1994	757,847	274,281	643,575	42,342	50,336	22,885	---	---	55,203	15,494	na	na
1995	662,934	272,872	502,712	16,105	62,799	26,608	---	---	64,288	24,855	na	na
1996	657,534	270,905	---	---	61,521	37,478	---	---	53,961	24,417	na	na
1997	846,370	358,526	---	---	32,097	3,545	53,446	16,427	---	---	na	na
1998	789,385	310,673	906,587	74,227	56,310	12,295	50,946	8,443	---	---	na	na
1999	638,634	288,321	960,853	134,893	52,613	986	74,603	38,072	---	---	na	na
2000	916,541	337,423	799,342	44,659	35,359	7,875	72,543	21,806	---	---	na	na
2001	745,983	411,425	1,196,923	137,464	40,853	9,369	---	---	---	---	na	na
2002	675,129	387,688	943,611	148,950	67,193	20,778	81,595	46,108	31,277	13,916	na	na

Year	Lake of the Woods Summer Pressure	Lake of the Woods Summer Harvest	Lake of the Woods Winter Pressure	Lake of the Woods Winter Harvest	Rainy River Spring Pressure	Rainy River Spring Harvest	Rainy River Fall Pressure	Rainy River Fall Harvest	Northwest Angle Summer Pressure	Northwest Angle Summer Harvest	Total Pressure	Total Harvest
2003	809,994	382,387	1,559,161	402,464	76,736	15,648	71,115	26,236	---	---	na	na
2004	811,341	286,466	1,938,509	319,698	50,993	3,478	67,777	36,904	---	---	na	na
2005	792,835	278,763	1,542,822	272,150	45,021	7,893	89,991	38,506	---	---	na	na
2006	591,679	209,284	1,034,476	115,168	---	---	---	---	---	---	na	na
2007	593,861	220,712	1,453,530	304,970	---	---	---	---	14,397	5,105	na	na
2012	865,678	417,401	1,632,044	353,203	132,090	31,004	53,176	28,076	49,722	15,135	na	na
2013	833,344	298,196	1,963,605	173,674	74,534	12,497	51,463	20,513	---	---	na	na
2016	638,412	172,388	1,478,862	80,755	78,885	7,509	55,441	27,079	---	---	na	na
2017	---	---	2,047,408	349,657	151,725	20,190	---	---	---	---	na	na
2012-2017 Mean	779,145	295,995	1,780,480	239,322	109,309	17,800	53,360	25,223	49,722	15,135	2,772,015	593,475

Table 4—Angler pressure and Sauger harvest, by pounds, 1981-2017. Minnesota waters of Lake of the Woods and the Rainy River. For winter surveys the year of the survey is the year in which the survey finished. Dashed lines represents years for which data were not collected or have not been summarized for publication. Note four year gap of creel surveys from 2008 to 2011 and two year gap from 2014 to 2015.

Year	Lake of the Woods Summer Pressure	Lake of the Woods Summer Harvest	Lake of the Woods Winter Pressure	Lake of the Woods Winter Harvest	Rainy River Spring Pressure	Rainy River Spring Harvest	Rainy River Fall Pressure	Rainy River Fall Harvest	Northwest Angle Summer Pressure	Northwest Angle Summer Harvest	Total Pressure	Total Harvest
1981	321,124	15,380	---	---	---	---	---	---	---	---	na	na
1982	552,575	16,493	---	---	---	---	---	---	---	---	na	na
1983	421,974	17,384	401,467	160,899	---	---	---	---	---	---	na	na
1984	504,477	15,672	---	---	---	---	---	---	---	---	na	na
1985	846,989	24,641	---	---	---	---	---	---	---	---	na	na
1986	796,705	35,377	---	---	---	---	---	---	---	---	na	na
1987	721,944	41,877	---	---	---	---	---	---	---	---	na	na
1988	564,789	40,090	649,226	231,359	---	---	---	---	---	---	na	na
1989	628,230	51,062	---	---	---	---	61,301	2,300	---	---	na	na
1990	986,044	60,073	764,088	239,051	29,548	484	54,744	2,104	---	---	na	na
1991	904,081	35,440	925,682	187,914	42,895	89	---	---	---	---	na	na
1992	660,436	28,318	747,063	85,367	27,697	40	---	---	---	---	na	na
1993	787,416	42,546	741,322	118,740	33,978	32	---	---	---	---	na	na
1994	757,847	36,914	643,575	80,536	50,336	258	---	---	55,203	860	na	na
1995	662,934	34,476	502,712	50,624	62,799	585	---	---	64,288	733	na	na
1996	657,534	17,422	---	---	61,521	496	---	---	53,961	376	na	na
1997	846,370	41,994	---	---	32,097	20	53,446	1,105	---	---	na	na
1998	789,385	47,643	906,587	202,070	56,310	709	50,946	3,267	---	---	na	na
1999	638,634	30,836	960,853	200,377	52,613	42	74,603	1,504	---	---	na	na
2000	916,541	34,148	799,342	77,297	35,359	172	72,543	1,086	---	---	na	na
2001	745,983	28,783	1,196,923	215,748	40,853	45	---	---	---	---	na	na
2002	675,129	22,380	943,611	162,519	67,193	33	81,595	1,200	31,277	119	na	na

Year	Lake of the Woods Summer Pressure	Lake of the Woods Summer Harvest	Lake of the Woods Winter Pressure	Lake of the Woods Winter Harvest	Rainy River Spring Pressure	Rainy River Spring Harvest	Rainy River Fall Pressure	Rainy River Fall Harvest	Northwest Angle Summer Pressure	Northwest Angle Summer Harvest	Total Pressure	Total Harvest
2003	809,994	58,335	1,559,161	283,552	76,736	201	71,115	2,527			na	na
2004	811,341	38,762	1,938,509	485,931	50,993	52	67,777	839			na	na
2005	792,835	45,739	1,542,822	249,971	45,021	29	89,991	2,072	---	---	na	na
2006	591,679	33,136	1,034,476	70,948	---	---	---	---	---	---	na	na
2007	593,861	28,944	1,453,530	170,544	---	---	---	---	14,397	315	na	na
2012	865,678	110,573	1,632,044	369,769	132,090	1,193	53,176	1,559	49,722	1,036	na	na
2013	833,344	87,951	1,963,605	317,713	74,534	187	51,463	2,233			na	na
2016	638,412	57,643	1,478,862	280,022	78,885	777	55,441	4,072	---	---	na	na
2017	---	---	2,047,408	325,109	151,725	3,099	---	---	---	---	na	na
2012-2017 Mean	779,145	85,389	1,780,480	323,153	109,309	1,314	53,360	2,621	49,722	1,036	2,772,015	413,514

Northern Pike

Northern Pike are managed to provide a trophy fishing opportunity. Anglers have defined trophy Northern Pike as fish exceeding 40-inches.

Lake of the Woods supports a high-quality Northern Pike population; Northern Pike over 40 inches in length are frequently caught by sport anglers and are sampled annually in fall gill net assessment. The primary method for assessing Northern Pike is by ice-out trap netting. These assessments have documented a steady increase in the number of Northern Pike over 40 inches. The Warroad River (Figure 7) depicts the increase in sizes of Northern Pike observed. This increase coincides with the implementation of a protective slot limit from 30 to 40 inches.

Due to the sporadic and seasonal nature of Northern Pike fishing on Lake of the Woods, it has been difficult to quantify Northern Pike harvest. In general, anglers targeting Northern Pike are fishing outside of traditional creel survey area and time.

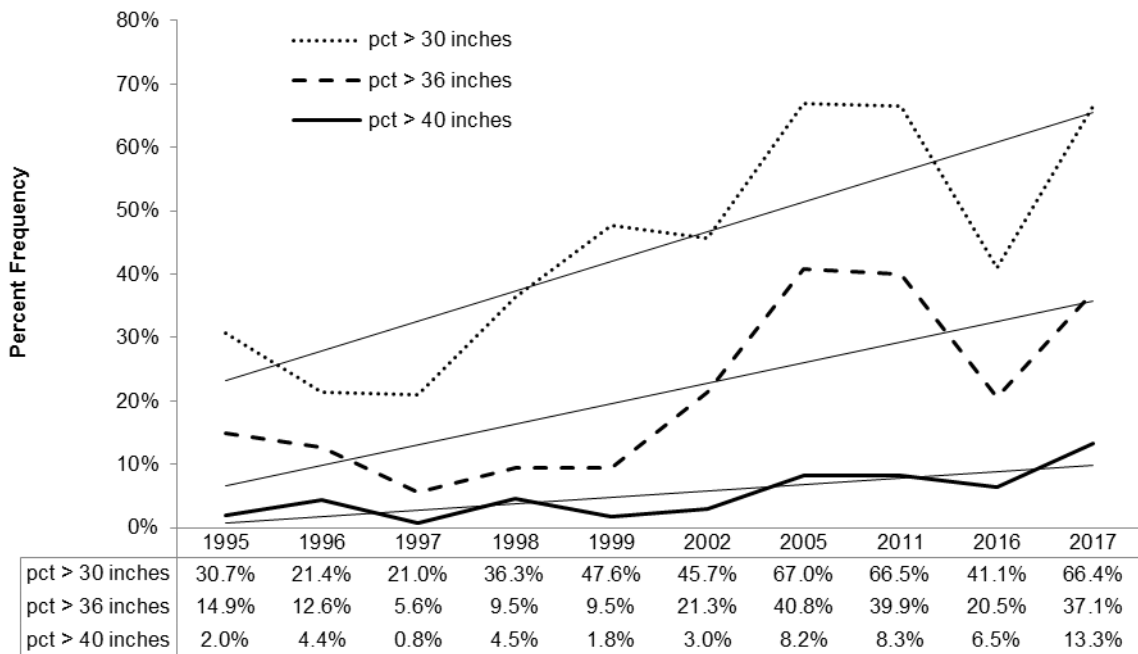


Figure 7— Percentage of female Northern Pike longer than 30, 36, and 40 inches sampled from the Warroad River during spring Northern Pike assessment, by year. Spring Northern Pike sampling, 1995 to 2017.

Northern Pike Objectives

1. Spring ice-out netting should reflect a trophy / high-quality size distribution, containing 7% pike over 36", and 2% pike over 40".
2. Spring ice-out trap netting should show a population with a RSD-30 of 30-40%.

Lake Sturgeon

Lake Sturgeon are managed to allow the recovery to continue, while allowing limited harvest and catch-and-release fishing opportunities.

The Lake Sturgeon population collapsed on Lake of the Woods at the turn of the last century due to over-harvest. Poor water quality in the Rainy River, the primary spawning and nursery habitats, prevented the population from recovering. Water quality was degraded due to paper mill, timber mill and municipal wastewater discharges. The population started to recover concurrent with enactment of the federal 1972 Clean Water Act aimed at restricting and improving the quality of wastewater discharge.

Sport angling has been the only legal method of harvesting Lake Sturgeon in Minnesota since 1940. Through the mid-1990's Lake Sturgeon angling was focused on the Rainy River around Birchdale MN, and near the mouths of the Big Fork and Littlefork Rivers. Through the early 1990s it was estimated that Lake Sturgeon harvest was approximately 1,000 pounds annually (MN-DNR 1998). Angling pressure increased rapidly on the lower portion of the Rainy River and Fourmile Bay through the mid-1990's and the new millennium. In order to monitor changing angling pressure and harvest, creel surveys were conducted through this period of expansion. Topp and Stewig (2005) reported that average annual Lake Sturgeon harvest from 1997 to 2000 was 11,900 lbs, but rose to over 13,440 lbs from 2001 through 2003. Mean annual harvest declined to 6,750 lbs in 2004 and 2005 (Topp and Stewig 2006). To reduce harvest to a level that would support continued recovery of the sturgeon population, creel limits and seasons were made more restrictive in 2001 and again in 2004. These regulation changes were somewhat controversial within some segments of the angling community at the time as some stakeholders believed sturgeon were more abundant than fisheries survey data suggested and that the population could sustain higher levels of harvest. The current regulation allows anglers to harvest one sturgeon, between 45 to 50 inches, per calendar year. Since 2006 anglers must purchase a sturgeon tag prior to harvesting the fish and then report the harvested fish within 48 hours. Average Lake Sturgeon harvest has been reported at 310 fish for an average of 7,746 lbs. (Table 5, 2012-2017).

Three population estimates have been conducted on the Lake of the Woods/Rainy River Lake Sturgeon Population (Nelson 2018), all focusing on Lake Sturgeon greater than 40 inches. In 1990 the population estimate was 16,710. The number nearly quadrupled by 2004 with an estimate of 59,050. The population has continued recovery with the most recent estimate of 92,286 Lake Sturgeon over 40 inches in 2014.

In 2012 Minnesota and Ontario officials agreed that the short-term recovery goals had been met. That shifted Lake Sturgeon management towards the goals of the long-term recovery. Consequently, Lake Sturgeon are currently managed with a target harvest of 11,600 pounds, similar to the potential yield of 11,523 lbs (Talmage et al., 2009), for the Minnesota waters of Lake of the Woods and the Rainy River. It is felt that the Lake Sturgeon population is recovering, but still has very few large, old individuals.

Lake Sturgeon Objectives

1. Presence of male fish to age-40.
2. Presence of female fish to age-70.
3. Presence of female fish greater than 80 inches.
4. A minimum of forty year classes present.
5. Support harvest at 0.036 lb. /ac of available habitat.

Table 5— Annual sturgeon harvest tag statistics from the State of Minnesota registration system, 2006 to 2017.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2012-2017
Number tags purchased	1,485	2,027	2,101	2,488	2,818	2,754	3,098	3,409	3,363	4,094	4,164	4,129	3,710
LOW/Rainy R. registration number													
Spring season	107	188	111	123	226	192	217	204	127	213	158	116	173
Summer season	30	45	76	117	93	69	125	162	129	140	142	126	137
Rainy Lake and Namakan System													
Rainy Lake				1	2	0	4	0	2	1	2	3	2
St. Croix River registration number													
Fall Season	5	7	1	1	1	1	2	1	0	2	0	1	1
Unidentified waters registration number	0	1	2	0	1	0	1	0	0	0	0	0	0
LOW/Rainy River Total Registration	137	233	187	240	319	261	342	366	256	353	300	242	310
Total number registered statewide	142	241	190	242	323	262	349	367	258	356	302	246	313
Harvest rate for those who purchased tags---->	9.6%	11.9%	9.0%	9.7%	11.5%	9.5%	11.3%	10.8%	7.7%	8.7%	7.3%	6.0%	8.6%
Estimated lbs harvested, based on registration---->	3,425	5,825	4,675	6,000	7,975	6,525	8,550	9,150	6,400	8,825	7,500	6,050	7,746

Other Species

Other Species Objectives— Yellow perch, burbot, cisco, and many minnow species are also important components of the Lake of the Woods fishery. Continuing to monitor these species through annual large lake monitoring is important to our understanding of the entire fishery.

Other species—

1. Maintain Yellow Perch harvest within the target harvest level of 67,200 pounds on a six-year average.
2. Smallmouth Bass and Muskellunge both provide localized fisheries, with harvest being a small component of all captured fish. Continue to monitor harvest of these species through standard creel surveys.

Goal 2: Protect and enhance valuable habitats within Lake of the Woods.

Objectives:

Environmental Review—Review all permit applications to ensure that rules and regulations are being met, and to ensure that the best conservation practice is being opted for.

1. Review permits promptly and coordinate responses with the Area Hydrologist.

Shoreline Protection/Projects—Work with LGU to ensure that projects are either improving or protecting shoreline/habitat conditions.

1. Carefully investigate the need any shoreline protection or restoration project.
2. Work with the Lake of the Woods SWCD to explore all alternatives.

Management Actions

Fisheries Assessments

Surveys

Annual

Spring Walleye spawning run sampling (Target – adult Walleye. Purpose - monitor size structure) this survey will be conducted annually at the Long Sault Rapids of the Rainy River. Length, gender, and stage of maturity to be collected from all Walleye.

Young-of-Year percid sampling (Target – YOY Walleye, Sauger, Yellow Perch, and forage species. Purpose - produce year class strength predictions, monitor forage species abundance) Young of the year sampling will begin each open water season with two consecutive week samples collected from six different locations. The second component of YOY sampling will begin in August with trawling. Four trawling stations will be trawled (two in Big Traverse and two in Muskeg Bay). All fish will be identified to species, identified as YOY or 1+, measured, and weighed. Both seining and trawling will follow the standardized protocols highlighted in the Large Lake Sampling Guide (Wingate and Schupp 1984).

Fall gill net sampling (Target – juvenile and adult Walleye, Sauger, Yellow Perch, cisco, White Sucker. Purpose - monitor trends in biological performance indicators) Fall gill netting will be conducted at 64 (52 near shore and 12 off shore sets) sites with overnight sets beginning the day after Labor Day. All fish will be identified, measured, weighed, gender and stage of maturity will be documented, and ageing structures will be collected from gamefish. Fall gill netting will follow the standardized protocols highlighted in the Large Lake Sampling Guide (Wingate and Schupp 1984).

Spawning Lake Sturgeon tagging (Target – spawning Lake Sturgeon. Purpose - monitor size structure and sex ratios on spawning runs, tag Lake Sturgeon) Gill net will be set in the Rapid River bay. The exact timing will be determined by water temperature and the presence of Lake Sturgeon. Protocols will follow those defined in the Annual Large Lake Sampling Report (Nelson 2018).

Juvenile Lake Sturgeon sampling in the lower Rainy River (Target – sub adult Lake Sturgeon. Purpose - monitor abundance/reproductive success, identify critical habitat). To be conducted in August or October, based on water temperatures, using experimental gill nets. In addition to sampling sturgeon, habitat and flow measurements will be recorded (Nelson 2018).

Water-Quality Sampling (Target—basic water-quality parameters. Purpose - long-term monitoring). Conducted in mid-July.

Zooplankton Sampling (Target—open water sampling at long-term monitoring sites. Purpose - monitor trends of abundance of native and invasive zooplankton species). Two stations (Zippel and Long Point) will be sampled bi-weekly beginning in May/June into September (Nelson 2018). All samples will be sent to the biology lab in St. Paul for identification and enumeration.

Five-year Rotation (assess once every five years)

Ice-out trap netting (Target – adult Northern Pike. Purpose - monitor size structure). Next in 2021. Sampling will begin as ice comes free in the tributaries (Warroad River, Zippel Creek, Bostic Bay, Winteroad River, Wabanica Creek) using ¾” double-frame trap nets. The goal will be to capture 300-500 Northern Pike. All pike will be measured, weighed, and gender and stage of maturity will be documented (Nelson 2018).

Lake Sturgeon population monitoring (Target – juvenile and adult Lake Sturgeon. Purpose - monitor overall Lake Sturgeon population age and size structure for progress to recovery goals). Next in 2019. Cooperate with the Ontario Ministry to sample sturgeon in Fourmile Bay and the inside channel. Netting should aim to be conducted between April 15th and May 15th to remain consistent in timing. Four, five, six, and seven-inch mesh nets should be used to capture a wide length range of fish to adequately sample the size distribution of the population.

Ten-year Rotation (assess once every 10 years)

Lake Sturgeon population estimate (Target – Lake Sturgeon longer than 40 inches. Purpose - monitor progress to recovery goals, produce a population estimate for Lake Sturgeon longer than 40 inches, provide input for target harvest and exploitation estimate). Next in 2024. This project will be conducted during the open-water season and include both mark and recapture phases. Protocols and recommendations should follow Heinrich and Friday (2015).

Creel Surveys

Winter creel of south shore fishery should be conducted 2 out of 4 years. Next survey scheduled for the winter of 2018-2019; then again 2021-22. This survey will be conducted from December through mid/late March using a roving design (Heinrich 2017a).

Rainy River spring creel survey should be conducted 2 out of 4 years. Spring creel should be conducted in the spring immediately following every winter survey. Next survey 2019, then again 2022. Survey period should roll from the winter creel to the spring river fishery and run through April 14th (Nelson 2017)

Lake of the Woods summer south shore creel should be conducted 2 out of 4 years, and on the same schedule as the winter and spring creels. Next survey will be conducted during the open water season in 2018. Creel survey should be conducted using a complete trip design (Heinrich 2017b)

Rainy River fall creel survey should be conducted 2 out 4 years, immediately following the south shore summer creel survey. Next survey to be conducted in fall of 2018. This creel is conducted using a roving creel design and sector counts (Topp 2017).

North West Angle creel survey should be conducted if there appears to be a change in angler behavior or once every 10 years. This creel survey starts Memorial Weekend and runs through September.

Regulations

Walleye & Sauger Regulations –

Fishing opener through November 30th; possession limit is 6 (not more than 4 can be Walleye; only 1 Walleye over 28"; Walleye 19.5" through 28" must be immediately released).

December 1st through April 14th; possession limit is 8 (not more than 4 can be Walleye; only 1 Walleye over 28"; Walleye 19.5" through 28" must be immediately released).

Exceptions –

Fourmile Bay and Rainy River; possession limit is 2 (Walleye 19.5" and larger must be released immediately).

Rainy River Fishing Opener through February 28th; possession limit is 6 (not more than 4 can be Walleye; only 1 Walleye over 28"; Walleye 19.5" through 28" must be immediately released).

Northern Pike Regulations –

Continuous season; possession limit 3 (All from 30" through 40" must be immediately released. Only one over 40" allowed in possession).

Lake Sturgeon Regulations –

October 1st thorough April 23rd; catch and release only. No tag required.

April 24 through May 7th; 1 per calendar year (fish must be 45-50" inclusive, or over 75"). Tag must be purchased to harvest a sturgeon.

May 8th through May 15th; catch and release only. No tag required.

May 16 through June 30th; Closed

July 1st through September 30th; 1 per calendar year (fish must be 45-50" inclusive, or over 75"). Tag must be purchased to harvest a sturgeon.

Habitat

Development— There are no habitat development plans at this time.

Protection— Protect the highly erosive shores of the Big Traverse and Muskeg Bays, with special consideration to anything that might disrupt the along shore movement of sand. Work, and or coordinate, with Lake of the Woods SWCD on any projects involving the barrier islands (Pine and Curry).

Lake Sturgeon Juvenile Assessment – While documented recovery of the Lake Sturgeon fishery is being observed, understanding recruitment and habitat needs of juvenile sturgeon will help ensure protection of the species and a continued recovery of the population.

Examination of TOHA parameters – Continue to collect data, and look for new ways of collecting data, to allow for refinement of TOHA parameters. These data include, but are not limited to, temperature, light penetration, GDD, and TDS. Work with fisheries research biologists to refine these parameters.

Aquatic Invasive Species (AIS) – Continue to monitor for invasive species. Specifically collection of zooplankton samples for identification and analysis. With the potential for new AIS, such as Zebra Mussel, be prepared to ramp up monitoring of important physical parameters such as water clarity and others pertinent; additionally, monitor Walleye recruitment for early signs of failure.

Other Considerations

Cooperative information sharing and management with Ontario – Continue to meet biannually with OMNR to discuss stock status and potential changes to yield estimates and regulations. Should concerns or change occur, continue to communications with OMNR biologists and managers.

Regulation change – Consider regulation changes to reduce Walleye and Sauger harvest, and also to provide protection to pre-spawn Walleye during the spring season on the Rainy River. Options discussed included;

- 1) Changing the aggregate winter limit from 8 Walleye/Sauger combined with no more than 4 Walleye to, an aggregate limit of 6, of which no more than 4 could be Walleye. This change would serve to reduce overall Sauger harvest and make winter regulations consistent with summer regulations.
- 2) Change the spring angling regulations on the Rainy River and Fourmile Bay (March 1-April 14) from a 2 fish limit with no Walleye over 19.5” to a catch and release fishery. This change would reduce overall Walleye harvest, while sustaining fishing opportunities. This change would also eliminate spring harvest focus on pre-spawn males, a potential cause of declined male Walleye during spawning assessments.

Other regulations and directions discussed included;

- 1) Conduct survey of Lake Sturgeon tag purchasers to determine if the regulation allowing harvest of Lake Sturgeon greater than 75 inches is desirable, or if the State Catch and Release Record system replaces that need.
- 2) Addressing current regulation pertaining to “Quick Strike Rigs” to allow lures up to 18 inches.

These options were generally accepted and understood by the input group. DNR will consider seeking broader public input on these proposals.

Tournament permitting – Continue to work with tournament applicants to develop consistent tournament rules that equitably balance demand for participation with potential biological impact. When feasible, encourage tournament permittees to conduct Catch Photograph and Release (CPR) format.

Access – Much of the winter access on Lake of the Woods is provided through private businesses. For the size of the resource, there are relatively few public water accesses on Lake of the Woods. We should continue to support development of opportunities for public access, specifically those that would increase summer access.

Annual Stakeholder Meetings – Annual meetings will be held in early April with members of the Lake of the Woods Fisheries Input Group. The goal of these meetings will

be to update the group on stock status, long-term trends, short-term plans, and gather ideas/concerns.

REVIEW AND REVISION OF PLAN

This plan should be formally reviewed, and revised if necessary, every five years

APPROVED BY

Phil Talmage (Date)
Baudette Area Fisheries Supervisor

Henry Drewes (Date)
Northwest Regional Fisheries Manager

Literature Cited

- Carlander, K. D. 1942. An investigation of Lake of the Woods, Minnesota with particular reference to commercial fisheries. Minn. Dept. Conservation. Invest. Rep. 42:384 pp.
- Gangl, R. S. 2001. Components of a management procedure for Minnesota's large Walleye lakes. M. S. Thesis, University of Minnesota, St. Paul.
- Heinrich, T. 2007. Lake of the Woods summer south shore creel survey, May through September, 2007. Minn. Dept. Nat. Resources. Unpublished.
- Heinrich, T. 2012. A large lake sampling program assessment report for Lake of the Woods, 2011. Minn. Dept. Nat. Resources. Unpublished.
- Heinrich T. and M. Friday. 2015 A population assessment of the Lake of the Woods – Rainy River Lake Sturgeon Population, 2014. Minnesota Dept. of Nat. Res. Unpublished.
- Heinrich T. 2017a. Lake of the Woods Winter Creel Survey, December 2016-March 2017. Minn. Dept. of Nat. Res. Unpublished
- Heinrich T. 2017b. A Large Lake Sampling Program Assessment Report for Lake of the Woods, 2016. Minn. Dept. Nat. Res. Unpublished.
- Lester, N.P., A.J. Dextrase, R.S. Kushneriuk, M.R. Rawson, and P.A. Ryan. 2004. Light and temperature: key factors affecting Walleye abundance and production. Transactions of the American Fisheries Society 133: 588-605.
- Nelson, B. 2018. A large lake sampling program assessment report for Lake of the Woods, 2018. Minn. Dept. Nat. Resources. Unpublished.
- Nelson, B. 2017. Completion Report for the Rainy River Spring Creel Survey, 12-March through 14-April, 2016. Minn. Dept. Nat. Res. Unpublished.
- OMNR. 2004. Ontario-Minnesota boundary waters fisheries atlas. Ont. Min. Nat. Resour. Northwest Sci. and Info. Thunder Bay, Ont. 95 pp.
- MNDNR and OMNRF. 2017. Ontario-Minnesota Boundary Waters Fisheries Atlas. Minnesota Department of Natural Resources and Ontario Ministry of Natural Resources and Forestry. Section of Fisheries, 500 Lafayette Road, St. Paul, MN USA 97 pages + appendices.
- Schupp, D. H. and V. Macins. 1977. Trends in percid yields from Lake of the Woods, 1888-1973. J. Fish. Res. Board Can. 34: 1784-1791.
- Talmage, P., T. Heinrich, D. Topp, and K. Peterson. 2009. Objectives and strategies for Lake Sturgeon management for Lake of the Woods & Rainy River. Minnesota Department of Natural Resources, Fisheries Management Section.
- Topp, D. and J. Stewig. 2005. Part A-Rainy River spring creel survey March 16-April 14, 2004, Part B-Rainy River spring sturgeon creel survey April 15-May 16, 2004, Part C-Rainy River summer creel survey July 1-September 30, 2004, Part D-Rainy River fall creel survey October 1-October 31, 2004. Minnesota Department of Natural Resources.

- Topp, D. and J. Stewig. 2006. Part A-Rainy River spring creel survey March 30-April 14, 2005, Part B-Rainy River spring sturgeon creel survey April 15-May 12, 2005, Part C-Rainy River summer creel survey July 1-September 30, 2005, Part D-Rainy River fall creel survey October 1-October 31, 2005. Minnesota Department of Natural Resources.
- Topp, D. 2017. Completion Report for the Rainy River Fall Creel Survey, October 1 through November 15, 2016. Minn. Dept. Nat. Res. Unpublished.
- Wingate, P. J. and D. H. Schupp. 1984. Large lake sampling guide. Special Publication no. 140. Minnesota Department of Natural Resources.

Appendix

Appendix 1. History of regulations for Minnesota-Canada border waters

1952 Special regulations were established for Minnesota-Canada border waters:

Species	Limit	Size Restriction	Season
Walleye	8	None	Saturday closest to May 15, through April 14
Sauger	8	None	Saturday closest to May 15, through April 14
Lake Sturgeon	1	40" min.	July 1 through May 31
Northern Pike	3	None	Saturday closest to May 15, through April 14

1953 Size restriction on sturgeon dropped

1956 Walleye limit reduced to 6, and muskellunge limit was reduced to 1.

1959 Walleye and Sauger limit combined to 14 in aggregate, with no more than 6 Walleye.

1961 Muskellunge size limit of 30" established. This aligned the border-waters muskellunge size limit with the general statewide size limit. Bass season opens second weekend in May.

1962 Lake trout limit reduced to 3.

1972 Lake trout winter season established as December 29 to last day in February. Lake trout summer season established as second weekend in May to September 30.

1978 Lake Sturgeon minimum size limit set at 45" minimum. Lake Sturgeon season was shortened to period of June 30 through May 15.

1980 While fishing on any Minnesota-Canada border water, only one limit of fish, of a species, may be possessed, even if the angler is licensed in both Minnesota and Ontario. An angler may no longer possess a limit of fish caught in Minnesota in addition to a limit caught in Ontario, if those fish were taken from a border-water.

1981 Walleye/Sauger limit reduced to 6, except for Lake of the Woods, where aggregate limit remained at 14.

1984 Lake of the Woods commercial game fish fishery was placed on declining quota.

1985 Only one commercial game fish fisher continues to fish on Lake of the Woods. All others sold their quota to the State of Minnesota.

Walleye/Sauger aggregate limit was increased to 20, with only 10 Walleye on Lake of the Woods. Northern Pike limit increased to 6 on Lake of the Woods. Power trolling with two lines per angler is permitted on Lake of the Woods.

1986 Remaining Lake of the Woods and Rainy Lake commercial game fish fishers sold their quota to the State of Minnesota.

- 1987** Northern Pike season expanded to “no closed season.” Northern Pike limit expanded to 6 on all border waters except Rainy Lake. Bass season changed to “open year round.” Muskellunge open season changed to third Saturday in May through November 30, and the minimum size for muskellunge was raised to 40 inches. Lake Sturgeon opener changed to June 30.
- 1988** Spring Walleye season on Rainy River closed on February 28.
- 1989** Walleye season on Rainy River is aligned with border waters open season. Creel limit on Rainy River reduced to 6 Walleye/Sauger in combination, with only one longer than 19.5 inches. From March 1 through April 14, no Walleye/Sauger longer than 19.5 inches may be harvested from the Rainy River.
- 1991** Lake of the Woods Walleye/Sauger limits reduced to 14 in aggregate, only 6 of which can be Walleye. Only one Walleye over 19.5 inches in length may be possessed.
- 1994** Only one Walleye over 19.5 inches may be harvested per day on Lake of the Woods.
- 1995** Northern Pike bag limit for Lake of the Woods remains at six, but anglers may harvest only one Northern Pike longer than 36 inches per day.
- 1996** On Lake of the Woods and the Rainy River, Northern Pike bag limit reduced to 3. All Northern Pike from 30-40 inches must be immediately released. Only 1 Northern Pike over 40 inches may be possessed.
- 1997** For 1997 only: For Lake of the Woods, 2 additional Walleye may be possessed (8 total), if those Walleye were caught north of Big Island, in Ontario waters, of Lake of the Woods.
- 1999** Rainy River Walleye/Sauger limit reduced to two from March 1 through April 14.
- 2000** Lake of the Woods Walleye/Sauger limit reduced to 8 in aggregate, with no more than 6 Walleye, from May 13 to November 30. Walleye/Sauger aggregate limit remains at 14 from December 1 through April 14.
- 2001** Lake of the Woods/Rainy River Lake Sturgeon limit set at 1 per license year. All sturgeon less than 45 inches or greater than 55 inches must be immediately released. The open season for sturgeon was shortened by sixteen days. The new season was set at July 1 to April 30. Previously, the open season was June 30 – May 15.
- 2003** Crappie possession limit reduced to 10 on border waters. Lake trout possession limit reduced to 2. Anglers are prohibited from possessing a gaff while fishing on the Rainy River.

2004 Lake Sturgeon harvest season on Canada-Minnesota border waters is April 24 – May 7 and July 1 – September 30. One fish allowed per license year, but must be between 45-50 inches, or over 75 inches, total length. Immediately upon reducing a Lake Sturgeon to possession, anglers must sign and date their fishing license in the space that is dedicated for that purpose. Catch and release angling for sturgeon is allowed from May 8 – May 15, and from October 1 – April 23.

Beginning on December 1, 2004, the Walleye/Sauger regulations for Rainy River and Lake of the Woods are as follows: Lake of the Woods (Dec. 1 – Apr. 14)

The Walleye/Sauger aggregate limit is eight (not more than four can be Walleye). Walleye and Sauger from 19.5 to 28 inches must be immediately released. Only one Walleye over 28 inches total length can be possessed.

Four Mile Bay of Lake of the Woods (Mar. 1 – Apr. 14)

The Walleye/Sauger aggregate limit is two (no fish over 19.5 inches).

Rainy River (Walleye opener through February)

The Walleye/Sauger aggregate limit is six (not more than four can be Walleye). Walleye and Sauger from 19.5 to 28 inches must be immediately released. Only one Walleye over 28 inches total length can be possessed.

Rainy River (Mar. 1 – Apr. 14)

The Walleye/Sauger aggregate limit is two (no fish over 19.5 inches).

2005 On January 18, 2005, the State Rule restricting the harvest of Sauger between 19.5 and 28 inches was stricken.

- 2006** Anglers intending to harvest a Lake Sturgeon must first purchase a (\$5.00) Lake Sturgeon harvest tag. Lake Sturgeon tags and mail-in registration cards are required for anyone who wishes to harvest and possess a Lake Sturgeon, including those otherwise exempt from angling license requirements. The following requirements apply:
- Lake Sturgeon may not be possessed or transported without a tag. Validate and attach your tag immediately upon reducing a fish to your possession. Party fishing is not allowed.
 - Tag must be attached to the narrow portion of the body in front of the tail fin.
 - Tag must be attached so that it cannot be easily removed.
 - Tags are not transferable and no duplicate tags will be issued.
 - Registration cards must be completed and mailed within 48 hours after harvesting a fish.
 - Lake Sturgeon must be transported intact (gills and internal organs may be removed).
- 2007** The restitution values (statewide including Lake of the Woods, Rainy River and Rainy Lake) for Lake Sturgeon are as follows (effective October 22, 2007):
- A:** 4 inches to less than 40 inches, \$500;
- B:** 40 inches to less than 50 inches, \$1,000, and;
- C:** 50 inches and over, \$1,000 plus \$100 for each inch over 50 inches.
- 2008** Unless otherwise excepted (such as for Lake of the Woods and Rainy River), the border waters Northern Pike possession limit is reduced from 6 to 3 (only 1 over 30 inches). Lake of the Woods and the Rainy River are listed as infested waters for Spiny Waterflea.
- 2011** A bow fishing season is established for waters of Minnesota, including the Minnesota portion of Canada-Minnesota border waters. The season runs from May 1 to the last Sunday in February.
- 2015** The muskellunge minimum size limit for Minnesota-Canada borders waters is 50 inches. Previously, the minimum size had been the same as inland waters. The minimum size for muskellunge in inland waters was raised from 48 to 54 inches in 2015.