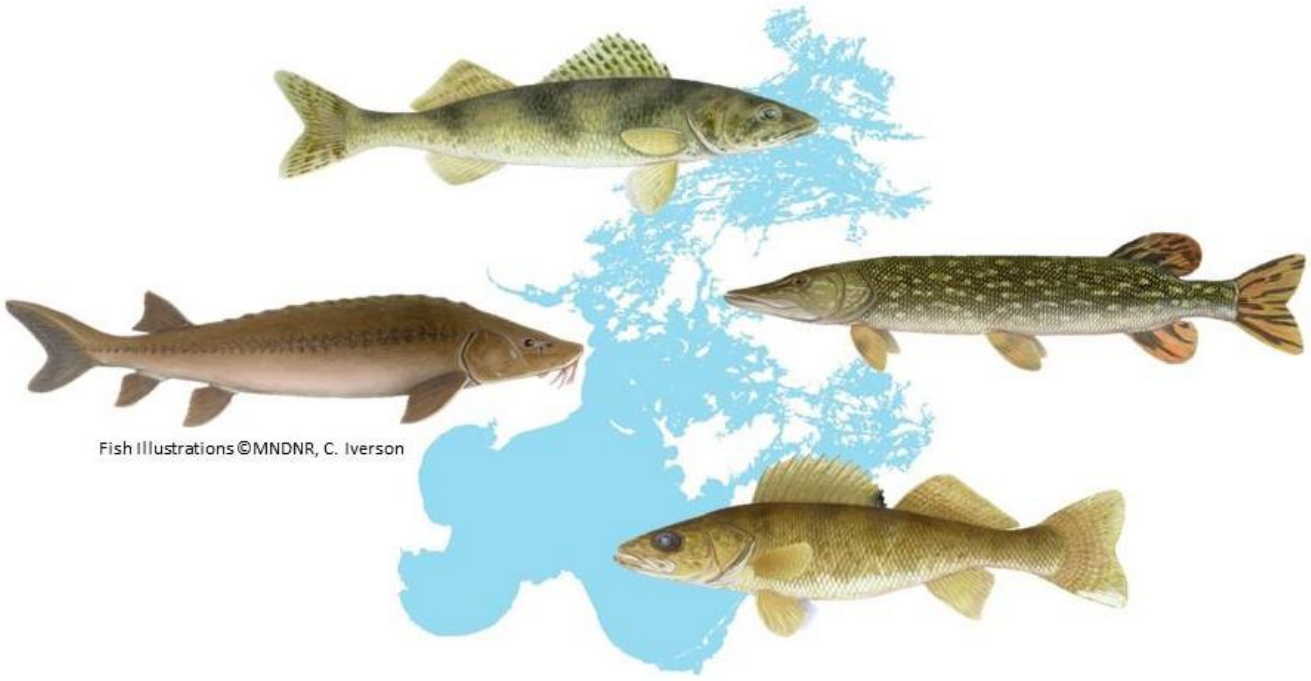
2025-2035 Fisheries Management Plan for Lake of the Woods



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Executive Summary

Lake of the Woods is a large lake found in northwestern Minnesota, with portions in Minnesota, Ontario, and Manitoba. The Minnesota section of Lake of the Woods is managed by the Minnesota Department of Natural Resources (DNR) Baudette fisheries management area. The DNR produces plans for many of the resources it manages, including the state's ten largest lakes. Large lake plans are updated every five to ten years; notable updates in the 2025 - 2035 Lake of the Woods plan include the definition of primary and secondary management species, additional background and current conditions information, updated goals and objectives, updated survey schedules, and the definition of management actions. Primary management species for Lake of the Woods include walleye and sauger, while secondary management species include northern pike and lake sturgeon.

Plan purpose and development:

The purpose of the Lake of the Woods management plan is to guide fisheries management from 2025 - 2035. The plan:

- Provides background information on Lake of the Woods' fish populations and distribution, Minnesotans' attitudes towards angling and fisheries management, management authority and public involvement, and fisheries management activities;
- Summarizes management questions, opportunities and challenges the DNR seeks to address through this plan, and angler preferences for the fishery;
- Outlines strategic direction by describing goals, objectives, and activities for the DNR's approach to fisheries management that will be used to prioritize agency resources and activities; and
- Identifies performance measures and indicators that will be used to track and report progress on fish populations and distribution during plan implementation.

The goals contained in this plan seek to incorporate the diverse views of Minnesotans and emphasize cooperation and collaboration with tribal, international, state, and local governments. This plan will guide Lake of the Woods fisheries management for 10 years and will be evaluated and revised if necessary five years after adoption.

Background and current conditions

The background and current conditions section of this plan provides an overview of the history of the Lake of the Woods region, the habitat in and around the lake, water clarity and productivity, aquatic invasive species, climate change impacts, fish community status and trends, angler pressure, harvest, current regulations and management activities, and social and economic characteristics.

Management direction: goals, objectives, and strategies

The plan's three goals to support fisheries management are to:

1. Maintain Lake of the Woods as a high-quality multispecies fishery for recreation through sustainable management
2. Protect and enhance valuable habitats within Lake of the Woods
3. Improve communication and coordination with other government interests and stakeholders regarding Lake of the Woods management

Objectives and strategies are nested within each goal. Objectives include activities that can be tracked to determine progress through the life of the plan. Strategies include specific, actionable statements describing how the DNR will achieve its goals and strategies. Goal 1 is broken into sub-goals for each management species, with nested objectives organized into three categories of sustainability, fisheries quality, and long-term recovery.

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Purpose and Scope

The Minnesota Department of Natural Resources (DNR) produces plans for many of the resources it manages, including the state's ten largest lakes. Of all the lakes managed by the DNR, Lake of the Woods is the state's second largest lake after Lake Superior in surface area, totaling 782,582 acres, with 317,000 acres in Minnesota and the remaining acres in Ontario and Manitoba, Canada. This plan guides the State of Minnesota's fisheries management on Minnesota waters of Lake of the Woods from 2025-2035. The Fisheries Supervisor and Large Lake Specialist for Lake of the Woods are the primary positions responsible for implementation of this plan.

The plan's approach to fisheries management synthesizes ecological, economic, political, and sociocultural information to determine actions (e.g., regulations, population monitoring) to achieve fish resource goals. Its goals, objectives, and strategies will guide effective and efficient allocation of staff and fiscal resources to protect and enhance fisheries resources. Finally, the plan describes how information is to be shared by the DNR and collected from interested stakeholders by the DNR. This ongoing engagement will guide future management planning.

Efficient description of some aspects of fisheries management requires the use of technical language. Definitions for many of these terms can be found in the Glossary (Appendix 1).

Management plans focus on work within the DNR's authority, with this plan specifically focusing on fisheries management for Minnesota waters of Lake of the Woods. This plan includes an overview of the lake's background, current conditions, and strategic issues, as well as identifies management goals, objectives, and strategies that will guide fisheries management.

Plan Development

This plan was developed by the DNR Baudette area fisheries office in collaboration with several internal and external partners. Additional input was received from a variety of stakeholder groups through various methods. The subsequent sections describe the plan development process in further detail.

Internal Coordination

The plan was developed by an interdisciplinary project team within the DNR's Fish and Wildlife division and was largely developed by fisheries staff from the Baudette area fisheries office in collaboration with DNR leadership. The plan development included an iterative process of content development and review by DNR fisheries staff and leadership.

International Coordination

The DNR discussed the management plan drafting process and potential changes from the previous plan with the Ontario Ministry of Forestry and Natural Resources at the 2024 annual meeting of the Ontario-Minnesota Fisheries Committee. Ontario and Manitoba fisheries staff were given an opportunity to review the draft plan and provide comments prior to the public comment period in January 2025.

International Coordination

Area fisheries staff met with the Lake of the Woods County Board in March 2024 to provide background on the planning process and issues the plan would address. Board members were given an opportunity to ask questions and share perspectives and input. Both Lake of the Woods and Roseau County Boards are members of the Lake of the Woods Fisheries Input Group (LOWFIG; described in subsequent section).

Public Input

Throughout 2023 and 2024, the DNR used a variety of methods to gather input from individuals and groups to inform this plan. Lake of the Woods area fisheries staff engaged anglers at boat ramps during the summer of 2023 to gather input on the current status of the lake, future directions for the fishery, major concerns or issues, and proposed regulation changes. DNR staff interviewed 34 angling parties at Warroad or Wheelers Point public access points.

Over 1,200 individuals also participated in an online scoping survey (open mid-February to mid-March 2024), where they provided input on issues or concerns with the Lake of the Woods fishery, angler values, and preferences for fisheries management. Through the DNR website, press releases, social media, and local media, individuals with an interest in the management of Lake of the Woods were kept updated on the planning process and encouraged to participate and provide input.

DNR staff also regularly receive input through annual stakeholder meetings (e.g. South Shore and Northwest Angle Resort Meetings) and through informal unsolicited input (e.g., emails from stakeholders).

Lake of the Woods Fisheries Input Group

The DNR's Lake of the Woods Fisheries Input Group (LOWFIG; Table 1) advised on and reviewed plan content. LOWFIG is similar in composition and function to advisory groups the DNR has established to inform its management of other Minnesota resources.

Table 1. Lake of the Woods Fisheries Input group slots and representative.

Slot	Member
Lake of the Woods Tourism	Joe Henry
Roseau County/City of Warroad	Glenda Phillipe
Lake of the Woods County	Ed Arneson
Lake of the Woods County	Jon Waibel
Warroad Chamber of Commerce/Warroad Fishing Business	Kent Peterson
Baudette Chamber of Commerce/Baudette Fishing Business	Brian Ney
Red Lake Band	Pat Brown
South Shore Resort	Nick Anthony
South Shore Resort	Jeff Andersen
NW Angle Resort/Business	Travis Palmquist
South Shore Business Owner	Alan Thomas
Statewide Angler	Wayne Larson
Statewide Angler	Les Lemm
Local Angler	Chris Pieper
Small Resort/Guide with Rainy River focus	Kevin Hinrichs
Outdoor Social Media Influencer	Nicole Stone

Public review

A draft of the plan will be released for public review in January 2025. Staff will review comments and evaluate where changes can be made and incorporated into the final plan. This process is described further in Appendix 2.

Tribal Coordination

The 1863 Treaty Lands include the south shore of Lake of the Woods. Red Lake Nation holds 70% of land in the Northwest Angle in trust and has business interests around the Lake including the Seven Clans Casino in Warroad. Red Lake Nation fisheries staff participated as a member of LOWFIG throughout the plan creation. Information regarding the Lake of the Woods management planning process was presented at the annual regional coordination meeting with Red Lake Nation DNR staff and Chairman Seki in February 2024. Red Lake Nation was supplied a draft of the plan for their review and comment prior to the draft being available for public comment in January 2025.

Background and Current Conditions

This section summarizes background on the social, historical, and biological influences on Lake of the Woods to provide context for the goals, objectives, and strategies for fisheries management. A glossary is included in Appendix 1.

Cultural History

The Lake of the Woods area is rich in natural resources, with a long history of different communities using these resources for socially, culturally, and economically important reasons. The lake has undergone a variety of human and ecological changes since Euro-American settlement. Knowledge of these changes throughout history is important to understand current issues surrounding management of the lake.

The Lake of the Woods region has been home to indigenous communities for thousands of years. Long before Europeans arrived, several indigenous communities inhabited the region, including the Laurel, the Blackduck, the Cree, the Monsonis, and the Dakota. The first people to leave extensive archaeological evidence were the Laurel people, who made use of the springtime abundance of fish in the Rainy River, with a particular interest in lake sturgeon. The abundance of food from the fish harvest enabled large gatherings along the Rainy River, as well as established the Lake of the Woods region as an important site for social and ceremonial purposes. In 800 CE, the Blackduck culture began to replace the Laurel culture in this region (Lund 1984; Lake of the Woods County Historical Society 1997). The Blackduck culture made use of the abundance of fish in the Rainy River, including the spring spawning aggregation of lake sturgeon, as well as harvested wild rice and used the bow and arrow. There is evidence to suggest that the Blackduck culture evolved into the residents found in the Lake of the Woods region when the first European fur traders arrived in the area (Lake of the Woods County Historical Society).

The first person of European descent to explore the Lake of the Woods region was Jaques De Noyon in 1688 as part of the French fur trade. Other notable explorers during this time included Pierre La Vérendrye and Father J. P. Alneau. The primary goal of the early European explorers was to find sources of fur and routes to the western sea. The early European explorers established several notable forts in the region, including Fort St. Charles in the Northwest Angle and Fort St. Pierre in present day Fort Frances, Ontario at the outlet of Rainy Lake. Fish were an important resource for the early French-Canadian settlers, who used nets to capture whitefish, trout, sturgeon, and other fish. Alneau wrote about the importance of fish for the diet of the early settlers, remarking "…we endured much suffering, all we had to eat was the spoiled pike, boiled, or dried over the fire" (Lund 1984).

When the first Europeans came to the Lake of the Woods region for the fur trade, the indigenous peoples living in the area included the Assiniboine on the north and west side of the lake, the Cree on the north and eastern portions of the lake, the Monsonis east of the Lake, and the Dakota south of the lake. The number of indigenous peoples living in the area can be estimated from Vérendrye's writings: "generally from two to five thousand Indians in the vicinity of the companies fort" (i.e., Fort St. Pierre, Lund 1975). The arrival of the fur traders coincided with the arrival of the Ojibwe people who had expanded westward. After the Ojibwe people arrived, conflict began between the Dakota and Ojibwe peoples (Lake of the Woods County Historical Society). This conflict continued for nearly a century (Lund 1975) and resulted in the Ojibwe becoming the primary non-Euro-American residents in the Lake of the Woods region to the present.

During this time period, Lake of the Woods was a main link for transportation and a rich source of natural resources including fish, waterfowl, and wild rice (Lake of the Woods County Historical Society). Lund (1984) reports that fish were eaten daily by the indigenous people of the Lake of the woods area. Early explorers also recounted the importance of fish to the indigenous diet; Vérendrye wrote that in September of 1734, due to heavy rains and discoloration of the water, "the local Indians were unable to spear sturgeon and had nothing to eat".

The French control of the fur trade ended when the British gained control of Canada in 1763 as a result of the French and Indian War (Lake of the Woods County Historical Society). With this shift, the British slowly gained control of the Lake of the Woods area through the Hudson's Bay Company (HBC). The HBC competed with the Northwest Company, a conglomerate of French traders and trappers not associated with HBC, for control of the area. HBC established several trading posts throughout the area, including the first post in 1793 by John McKay at Manitou Rapids on the Rainy River. The competition for control of the fur trade between HBC and Northwest Company continued until they merged in 1891. HBC domination of the fur trade continued up until the establishment of the international border in 1872. After the international border was established, the American Fur Trading Company became the dominant trading company south of the US-Canada border. By the early 1840s, the fur trade declined dramatically in the Minnesota region due to

changes in fashion tastes and the availability of materials (Minnesota Historical Society). The decline of the fur trade and arrival of the railroad resulted in a shift to timber harvest and mining (primarily in Canada) as the primary economic drivers in the region. The timber industry on the American side began in the 1900s with the arrival of the railroad on the south side of the Lake of the Woods (Lund 1975).

Many of the first permanent European settlers engaged in fishing for both subsistence and as a commercial enterprise. Alonzo Wheeler became the first Euro-American settler in 1853 in what would become Lake of the Woods County. He primarily worked on steamboats but was also a trader and engaged in fishing. Wilhelm Zippel was the first fisherman on the south shore of Lake of the Woods to engage in large-scale commercial fishing in the 1880s and was soon followed by a number of other commercial fishermen. Fishing was an important food source and enabled the establishment of many communities in the Lake of the Woods region, including areas which had been isolated from major population centers other than by travel across Lake of the Woods or on the Rainy River. By 1885, commercial fishing emerged as an important economic driver when the first commercial pound nets were used. By 1896, more than 300 commercial pound nets were in use on Lake of the Woods (Lund 1975).

From the late 1800s through the mid-1900s, commercial fishing was the predominant use of Lake of the Woods fish stocks, primarily targeting burbot, lake sturgeon, walleye, and tullibee (Figure 1). The first commercial fishing regulations were implemented by the Minnesota Legislature in 1895 (Lund 1975). Initially, lake sturgeon were the primary commercially targeted species, which were used for caviar, meat, and isinglass (Lake of the Woods Historical Society 1997). Harvest of lake sturgeon peaked in the 1890s, and by the early 1900s, lake sturgeon populations collapsed due to overfishing and habitat degradation, resulting in closure of the fishery in 1930 (Talmage et al. 2009). By 1915, there was interest by the Minnesota Legislature to eliminate the commercial fishery on Lake of the Woods (Lake of the Woods Historical Society 1997).

During this early period of commercial fishing, walleye (colloquially called “dories” or “walleyed pike”) were not considered valuable, with reports of commercial fishermen hauling boat loads of walleye and dumping them onshore to decay (Spooner News, November 6, 1908). However, after the closure of the lake sturgeon fishery, commercial harvest transitioned to walleye and peaked in the 1930s. Carlander (1942) reported signs of instability in the walleye fishery due to overexploitation as early as the late 1930s. In 1937, work on a state fish hatchery on the Winterroad River was completed (Lake of the Woods Historical Society 1997). During this time period, commercial fisheries for “rough fish” and burbot started taking off. Burbot were harvested for the making of liver oil, while burbot and other “rough fish” were used as feed for mink farming (Moorman 1987; Lake of the Woods Historical Society 1997).

In response to the declines in the abundance of various fish, issuance of new commercial fishing licenses ceased to reduce the number of commercial license holders through attrition. Commercial walleye harvest continued into the 1980s until the Minnesota Legislature directed the DNR to purchase all remaining commercial quotas in 1984 due to declining fish populations and pressure from the Save our Gamefish Committee chaired by Douglas Wahl. This change was opposed by the Minnesota Fish Producers Association-Border Lakes Chapter (President Lamonde Lemm). The final commercial harvest of most fish species, excluding burbot and shiner, occurred in the Minnesota waters of Lake of the Woods in 1985 by Art Johnston (Lake of the Woods Historical Society 1997; Nelson 2024).

Commercial burbot and tullibee harvest peaked in the 1960s, when up to one million pounds of burbot were commercially harvested on an annual basis from Minnesota waters of Lake of the Woods, largely for furbearer feed and manufacturing liver oil-based products. Minimal commercial burbot harvest continued into the early 2000s. The only current ongoing commercial fish harvest in the Minnesota waters of Lake of the Woods is for emerald shiner, which are harvested primarily for the bait industry.

Today, the Minnesota waters of Lake of the Woods are used primarily by recreational anglers and the businesses that serve them. This recreational fishery is highly valued as a popular destination for local anglers as well as those from greater Minnesota, the Twin Cities metro area, and other states. The fishery also provides strong economic value for the local community, creating a robust market of resorts, restaurants, fishing guides, bait and tackle stores, boat repair, outfitters, and other retailers.

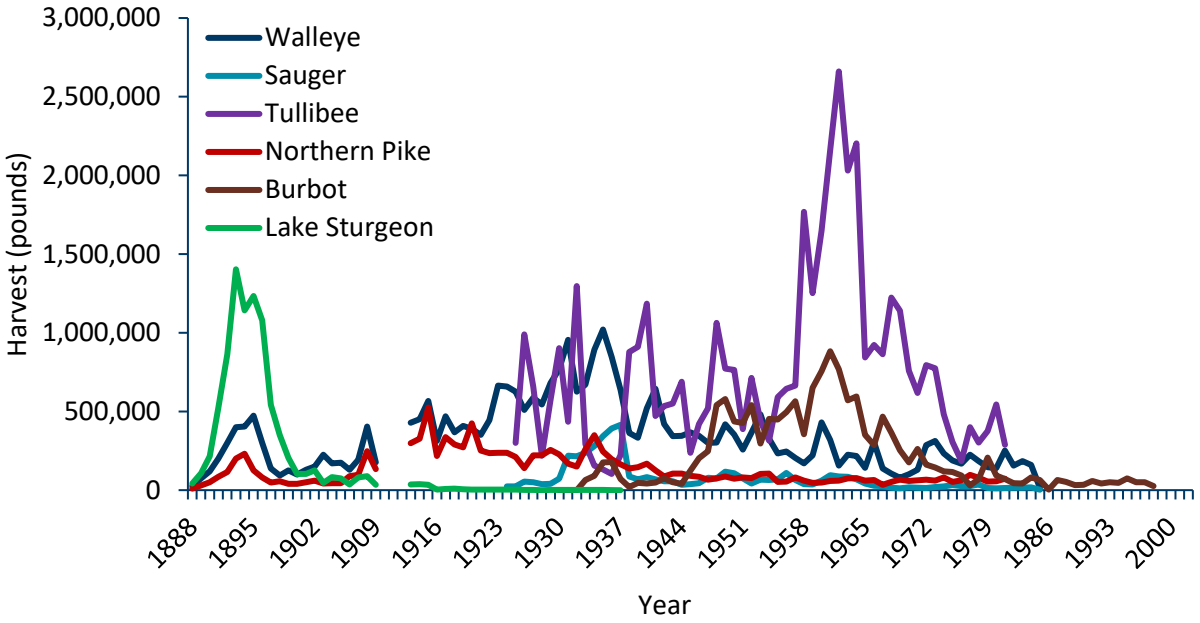

Figure 1. Pounds of commercial harvest for walleye, sauger, tullibee, northern pike, burbot, and lake sturgeon from 1888 – 2002.

Habitat

Lake of the Woods lies in the Hudson Bay drainage basin at latitude 49° N, straddling the Canada-United States border. The lake is managed by both the DNR and the Canadian provinces of Manitoba and Ontario, with each jurisdiction managing waters within their territorial borders. The water level is controlled by three hydroelectric dams located at the head of the Winnipeg River in Kenora, Ontario. The Rainy River provides 75% of the inflow to the lake (Schupp and Macins 1977). The water flow into the Rainy River is controlled by 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 primary land uses in the drainage basin in Minnesota.

Minnesota's portion of Lake of the Woods (317,000 acres) lies primarily within Muskeg, Big Traverse, and Little Traverse Bays (Figure 2). Big Traverse Bay and Muskeg Bay largely lack bottom structure and islands. Little Traverse Bay is similar to the Ontario waters of Lake of the Woods and contains numerous islands and reefs. The Minnesota waters are relatively shallow, with maximum depths of less than 40 feet in all three of the major basins. In addition to being the largest tributary to Lake of the Woods, the Rainy River supports robust recreational fisheries and provides important habitat for various life stages of fishes that inhabit Lake of the Woods (e.g., many walleye migrate from Lake of the Woods to the Rainy River to spawn at the Long Sault Rapids). Fish can freely move between Canadian and Minnesota waters and between Lake of the Woods and Rainy River, meaning that the fish stocks in Minnesota waters are not

closed populations. These three basins do not stratify and in most years have widespread, dense, blue-green algae blooms that are first evident in July and continue through September.

A sufficient quantity and quality of habitat exist in Lake of the Woods to support its diverse, high-quality fishery. Although habitat conditions are good, government and private landowners have altered the aquatic habitat in ways that present challenges. Some examples include the construction of groynes (shore protection structures built perpendicular to the shoreline) in Long Point to reduce longshore drift; jetty construction at the entrance to Zippel Bay and the Warroad River; shoreline stabilization projects using riprap; construction of marinas; and dredging of navigational channels. Generally, the effects to habitat from the projects are localized, though the construction of the jetty at the Zippel Bay entrance in combination with the construction of groynes in the Long Point area are likely a large contributing factor in the erosion of Pine and Curry Islands. Projects within the watershed (e.g., extensive ditching of headwater tributaries and wetlands, logging and land use conversion to agriculture) likely have an impact on the fish community through altered hydrology and on water quality through increased phosphorus inputs.

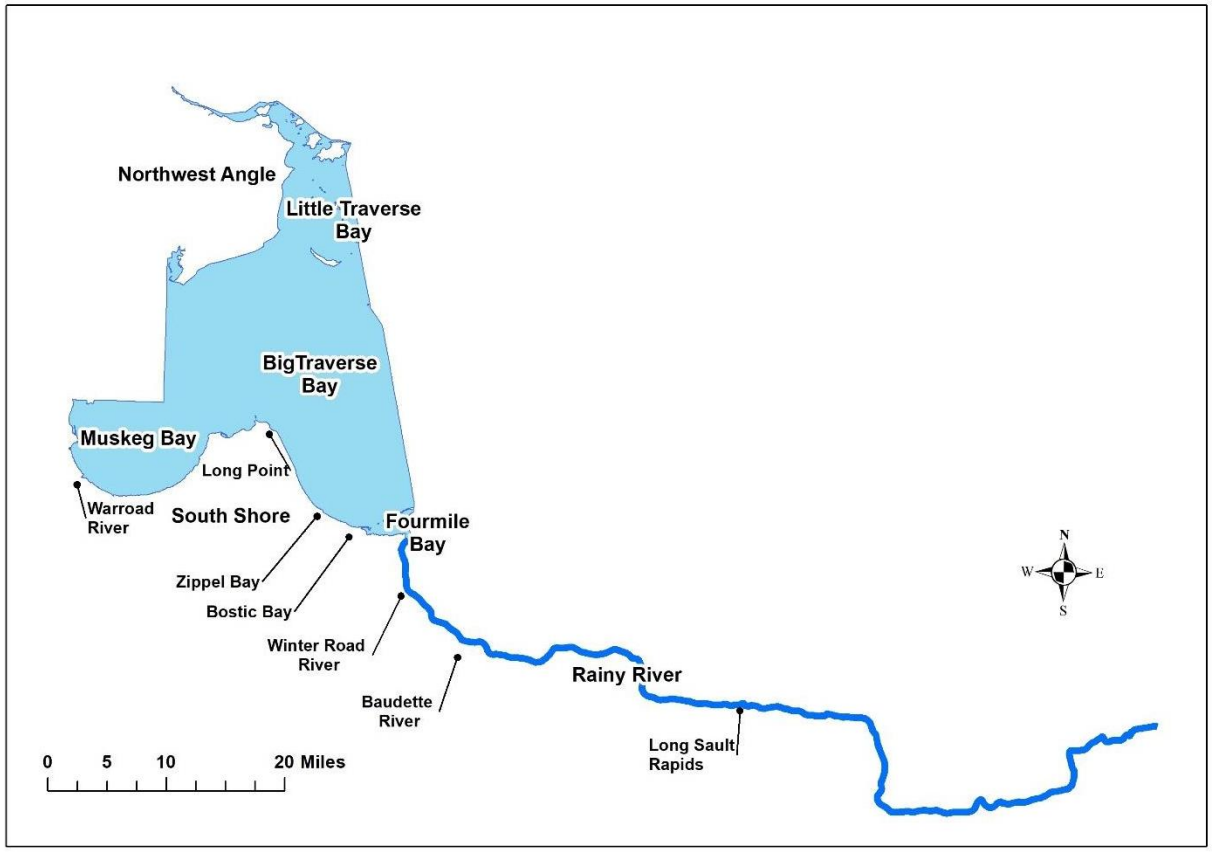

Figure 2. Map of geographic feature locations referenced in this management plan.

Water Quality and Productivity

Concerns about water quality and impacts to fish populations go back at least to the 1940s. In 1946, game warden E. Pohrte wrote to fisheries research scientist L. L. Smith that “People have tried to angle in the Rainy River, give it up as the pollution from the mills at International Falls has very definitely taken care of all of the fish in the Rainy. The pike refuse to come up the river against such pollution. The Rainy is licked as far as angling is concerned.” Though water

quality has long been a concern on Lake of the Woods, water quality condition has improved substantially since the passage of the Clean Water Act in 1972 (33 U.S.C. §1251 et seq.).

Water clarity is related to a waterbody's productivity, with very clear water tending to be less productive. Fish species also tolerate water clarity differently, with walleye, for example, favoring Secchi depths (the depth at which a disk lowered into the water can no longer be seen from the surface) of 6 to 6.5 feet (Lester et al. 2004, Hansen et al. 2020). The lake is typically well-mixed and not stratified, meaning that dissolved oxygen and temperature is relatively consistent from the surface to the bottom of the lake. The water is tannic (brown) and turbid (cloudy), with a mean Secchi depth of 4.25 feet.

The concentration of calcium in the lake is strongly associated with zebra mussel distribution, where low calcium concentrations can reduce zebra mussels' ability to form shells (Cohen and Weinstein 2001). Current calcium concentrations in the lake are low enough that the risk of a substantial zebra mussel infestation is low (Whittier et al. 2008; Figure 3). Phosphorus is also a major nutrient present in Lake of the Woods, and although inputs have declined since the Clean Water Act, Lake of the Woods is still listed as impaired for phosphorus (Hirst et al. 2021). Nearly 90% of the phosphorus originates in the Rainy River, with approximately 60% of inputs occurring in the spring due to melt water and rain runoff. The Little Fork River is the largest contributor of phosphorus to the Rainy River (Fong et al. 2023). Phosphorus concentrations are sufficient to cause annual blue-green algae blooms, with the extent across the lake and severity of each bloom varying from year-to-year (Figure 4).

In addition to water quality impacts from the broader watershed, there has been increased public concern around pollution connected to increasing fishing pressure. These concerns are primarily related to anglers disposing of trash, human waste, grey water, and black water on the ice during the winter months. A new "keep it clean" law went into effect in 2023 that strictly regulates garbage and other waste on ice (MS 97C.363), and the DNR is actively involved in addressing this issue with local partners through the statewide Keep It Clean initiative. The DNR Enforcement division is responsible for enforcing this statute.

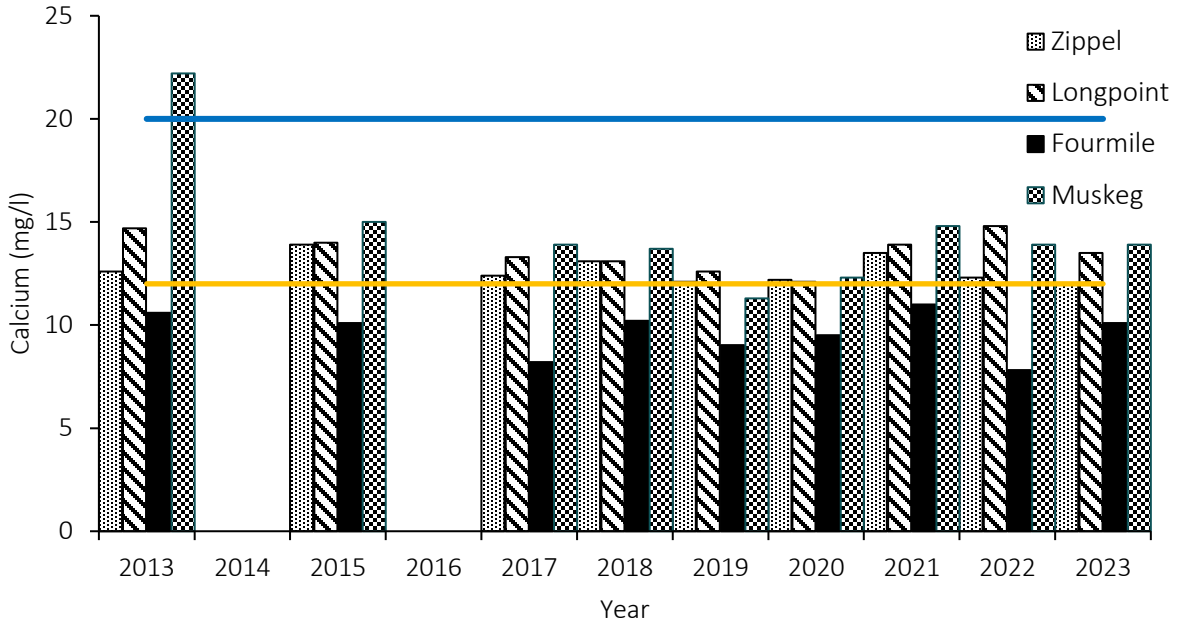

Figure 3. Calcium concentrations (mg/l) at water quality sites on Lake of the Woods in July from 2013 to 2023. The yellow line is the very low threshold (12 mg/l) for zebra mussel infestation and the blue line is the low threshold for zebra mussel infestation (20 mg/l; Whittier et al. 2008).

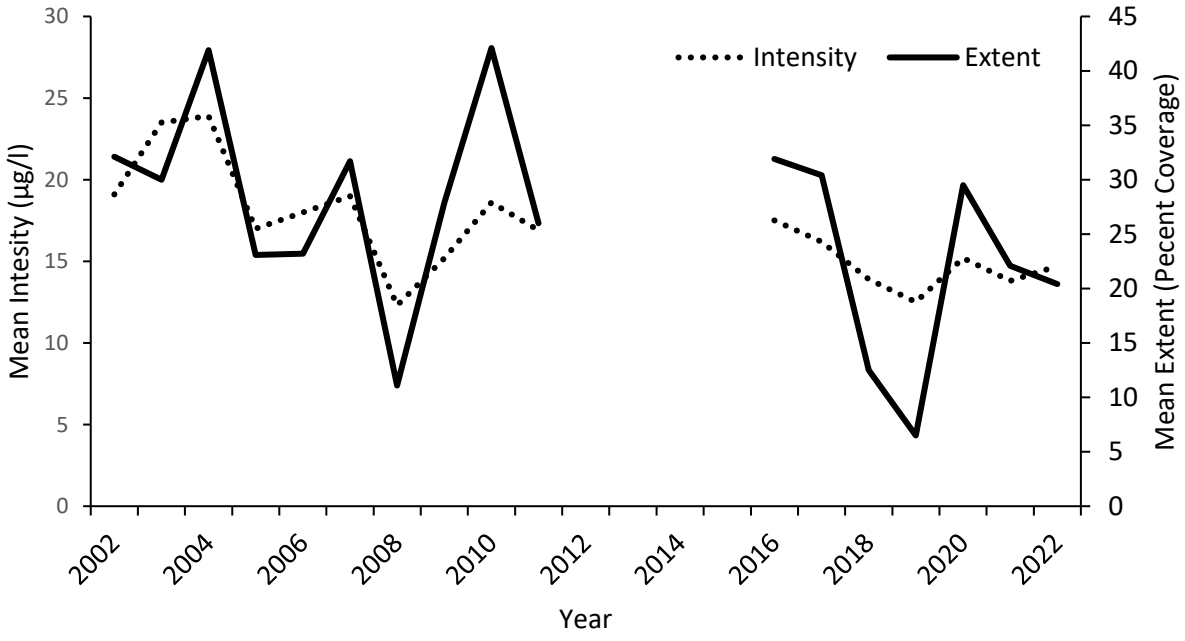

Figure 4. Severity and extent of blue-green algae blooms on Lake of the Woods since 2002.

Aquatic Invasive Species

Aquatic invasive species can impact lake productivity - when a species invades a lake, its population first grows slowly, before dramatically increasing to a level often exceeding the water body's carrying capacity. Invasive species abundance then drops and remains stable at a lower abundance (Jones and Montz 2020). Spiny water-fleas and rusty crayfish have both invaded Lake of the Woods, and zebra mussel veligers, or larvae, have been observed, although no adult zebra mussels have been discovered as of the writing of this plan. To minimize the risk of additional invasions, invasive species inspectors are stationed at high-use public boat access sites.

Spiny Water Flea

Spiny water-fleas were first observed in Lake of the Woods in the mid-2000s, with densities varying widely each year. The presence of spiny water-fleas has been correlated with decreased percid, or perch family, growth rates in some lakes (Hansen et al. 2020), but this correlation has not been observed in Lake of the Woods. The invasion of spiny water-fleas has distinctly altered the zooplankton community structure and reduced zooplankton (aquatic microorganisms) abundance (Figure 5). Zooplankton are an important food source for all juvenile fish and some species of fish which remain planktivorous as adults (e.g., emerald shiners and tulibee). Planktivorous fishes are important forage for predators like walleye. The effects of these shifts in the base of the Lake of the Woods food web (i.e., plankton) on the fish community are not clear (Nelson 2022).

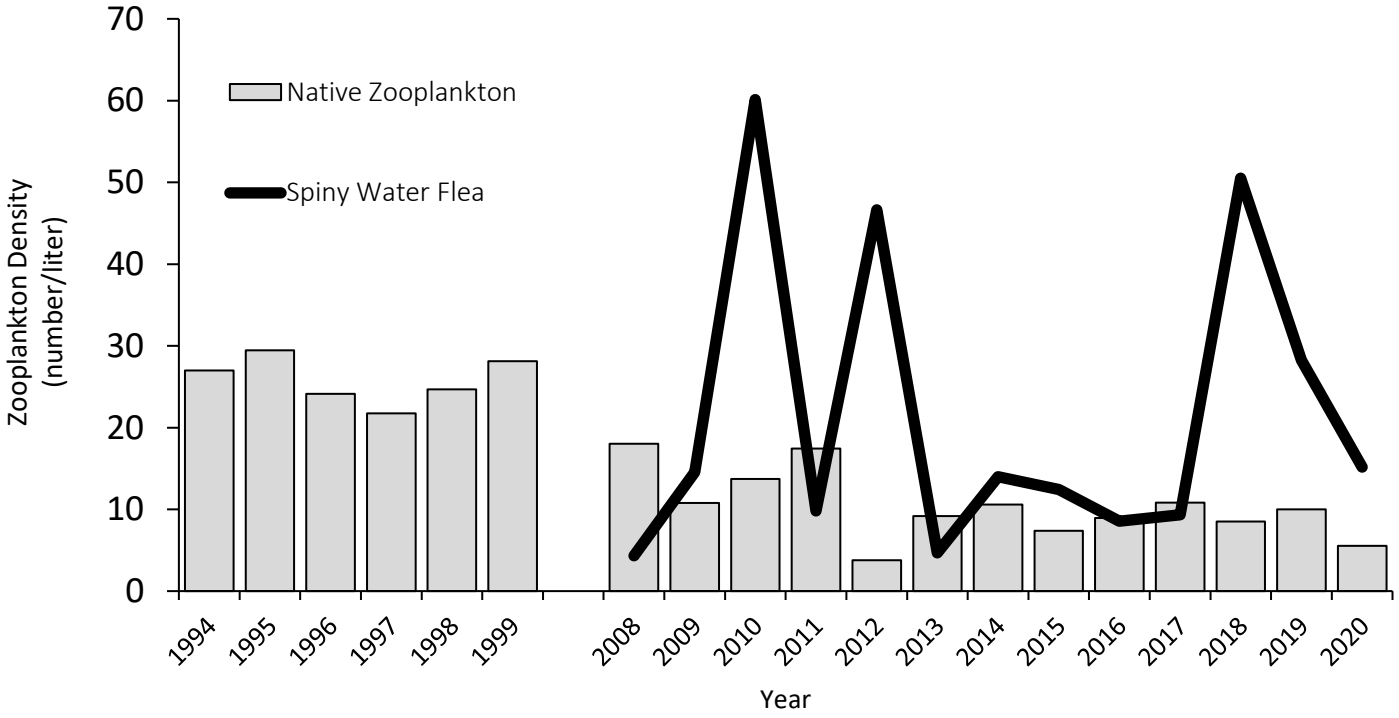

Figure 5. Density of native zooplankton and spiny water flea from zooplankton samples collected in August at Lake of the Woods zooplankton sampling sites from 1994 to 1999 (pre- spiny water flea invasion) and 2008 to 2020 (post-spiny water flea invasion).

Rusty Crayfish

Rusty crayfish were first observed in Lake of the Woods in the late 1960s and were discovered in the Minnesota waters in 2006. Since 2006, rusty crayfish have slowly expanded their range southward and are now present in all Minnesota waters of Lake of the Woods, with the highest density in Little Traverse Bay. Once established, rusty crayfish displace native crayfish and have been associated with declines in aquatic vegetation (Wilson et al. 2004; Peters and Lodge 2013).

Zebra Mussel

Zebra mussel veligers were first observed in Lake of the Woods in 2019 in Muskeg Bay. No adult zebra mussels have been observed as of the writing of this plan. Lake of the Woods is listed as infested for zebra mussels because veligers continue to be sampled during lake surveys. Veliger densities have been low since their first observation (Figure 6). During the initial phase of the invasion in other waterbodies, typical veliger densities range from 0.5 to 1.0 per liter, while the typical range of zebra mussel veligers after establishment is 10 to 80 per liter. In other large lakes in Minnesota, densities ranged from 0.0 to 3.17 per liter during the initial phase of the invasion. Within the full dataset for Minnesota's large lakes, densities ranged from 0.0 to 14.6 per liter (K. Cattoor, personal communication, November 2024). Zebra mussels could alter energy flow in Lake of the Woods (McEachran et al. 2018) through food web alterations that could limit growth of young-of-year walleyes (Hansen et al. 2020). Though zebra mussels pose a risk to the ecological processes in Lake of the Woods, as described above, low calcium concentrations may limit their densities and mitigate ecological risks.

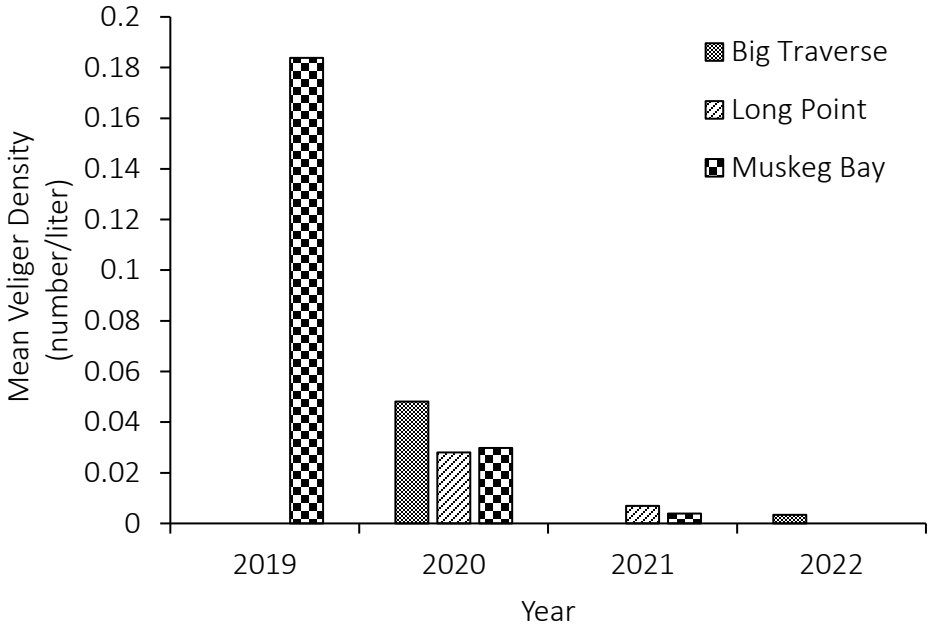

Figure 6. Average zebra mussel veliger density from May through September at various sampling stations on Lake of the Woods by year (2019-2022).

Cormorants

Double crested cormorants are a piscivorous (fish-eating) bird native to Lake of the Woods. The cormorant population expanded rapidly from 1976-1989, from very few nests to up to 6,000 nests in the early 2000s, sparking public concern

on the impacts to the recreational fishery. Analyses show that cormorants have no measurable negative effect on walleye, sauger, and yellow perch populations (Heinrich 2008). The three most recent surveys from 2010, 2015, and 2021 have all found relatively low nest counts (range 1240 – 1692). At these abundances, it is still improbable that cormorants are having a negative effect on walleye, sauger, or yellow perch.

Climate Change

Climate change has the potential to alter ecological processes in Lake of the Woods in the future. Warmer temperatures have the potential to lead to fish kills of cold-water fish such as tullibee during the summer and a shift to a more warmwater fish community. Though there is potential for warmer summer temperatures, there has not been an observed trend in increased mean summer air temperature for the Lake of the Woods watershed. The effect of climate change is much more evident when examining the effects on winter temperatures. Mean air temperature in the winter has increased (Figure 7; MNDNR Climate Trends online tool https://arcgis.dnr.state.mn.us/ewr/climatetrends) and ice out is also occurring earlier in the year. On average (though highly variable), ice out on the Rainy River at the international bridge near Baudette, Minnesota occurs about 11.5 days earlier in the year than it did in 1934 (Figure 8; Wolf 2024). Earlier ice-out and changes to hydrologic conditions have the potential to alter spawning behavior and timing for many species which may result in shifts in abundance of some species. Most or all of these changes are expected to occur slowly and effects likely will not be observed during the life of this plan. Even though climate change effects are expected to occur on a timescale beyond the life of this plan, potential effects of management actions on resiliency to climate change are considered when making management decisions.

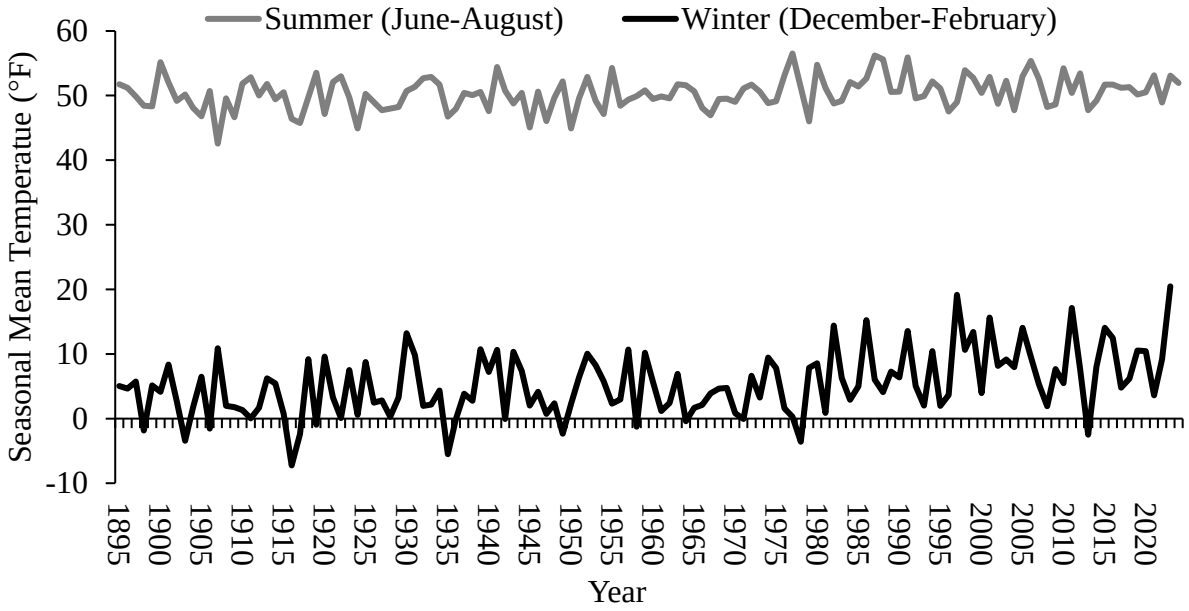

Figure 7. Lake of the Woods watershed summer and winter mean air temperature (°F) by year (adapted from MNDNR Climate trends online tool).

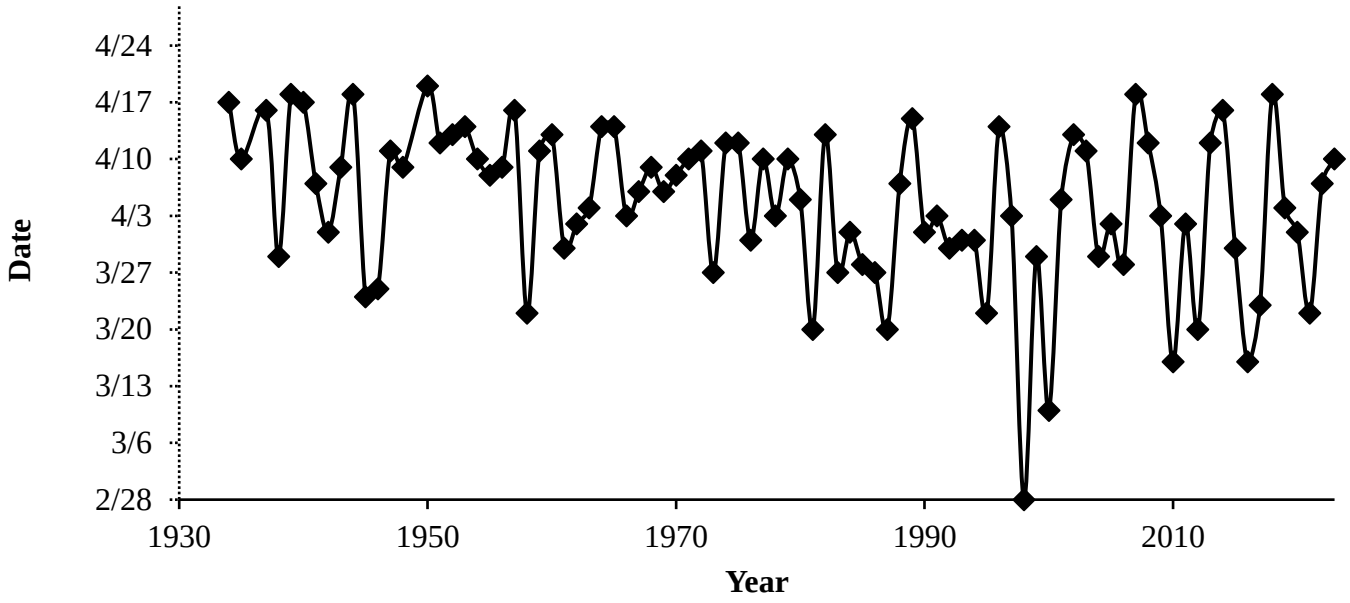

Figure 8. Ice out date at the international bridge near Baudette, Minnesota as reported by the Northern Light Region (adapted from Wolf 2024).

Fish Community Status and Trends

Lake of the Woods has a diverse fish community that supports recreational fisheries. DNR fisheries has sampled nearly 60 species in Lake of the Woods since 1990 out of the 70 (Siems et al. 2001) species that occur within the Rainy River watershed. Species commonly targeted by anglers on the Minnesota portion of Lake of the Woods include walleye, sauger, northern pike, yellow perch, smallmouth bass, tullibee (cisco), burbot, black crappie, muskellunge, and lake sturgeon. Other species that are present in Lake of the Woods that are encountered by anglers include white sucker, shorthead redhorse, silver redhorse, lake whitefish, and lake trout. Additionally, emerald and spottail shiners both have commercial importance to the bait industry and are important forage species. There are many species that have little commercial or recreational value in Lake of the Woods, but serve important ecological functions such as quillback, trout-perch, Johnny darter, and others.

Numerous comments were received during the management plan scoping process indicating that anglers fishing Lake of the Woods have observed a decline in the overall fishery quality, including a decrease in walleye and sauger population abundance and size structure (Haberman 2024). The DNR manages several fish species in Lake of the Woods and routinely collects samples and data for these species to inform management actions and regulations. Current data collected from these methods do not support observations of walleye and sauger population or size structure decline. Annual fall gill net sampling for walleye and sauger has shown normal variability in catch rates for both species as a result of varying year class strength, with no signs of stress in the population. The status and trends of these managed species (walleye, sauger, northern pike, and lake sturgeon) and other species are discussed in the subsequent sections.

Walleye

Walleye are the most popular and sought-after species on Lake of the Woods. Walleye are managed to provide a diverse, high quality size structure with high angler catch and harvest rates (Talmage et al. 2018). The walleye fishery is sustained by abundant and diverse size and age classes. Declining abundance of walleye is one of the primary concerns

of anglers (Haberman 2024), however, monitoring data shows that there is not a trend of declining walleye abundance. Nearshore walleye relative abundance (herein: abundance, as measured by gill net catch rate) has ranged from 6.3 to 26.6 per net (Figure 9) with significant upward trend since 1981. The overall walleye catch rate from 2002 to 2023 (inclusion of offshore nets), has ranged from 9.9 to 24.4 per net with no trend. Abundance is cyclical and is driven by strong and weak year-classes (relative number of fish hatched each year; Figure 10). For instance, high catches observed in the early to mid-2000s were largely driven by strong year-classes produced in 1999 and 2001; while less than average catches observed from 2020 to 2022 were the result of moderate to weak year-classes in 2017 and from 2019 to 2020. Walleye recruitment, or year-class strength, is often variable in naturally reproducing populations and is driven by climatic and/or ecological conditions such as temperature and prey availability. Since 1981, walleye year-class strength has been variable from year to year, but has remained stable (no long-term trend), yielding a sustainable and healthy walleye population.

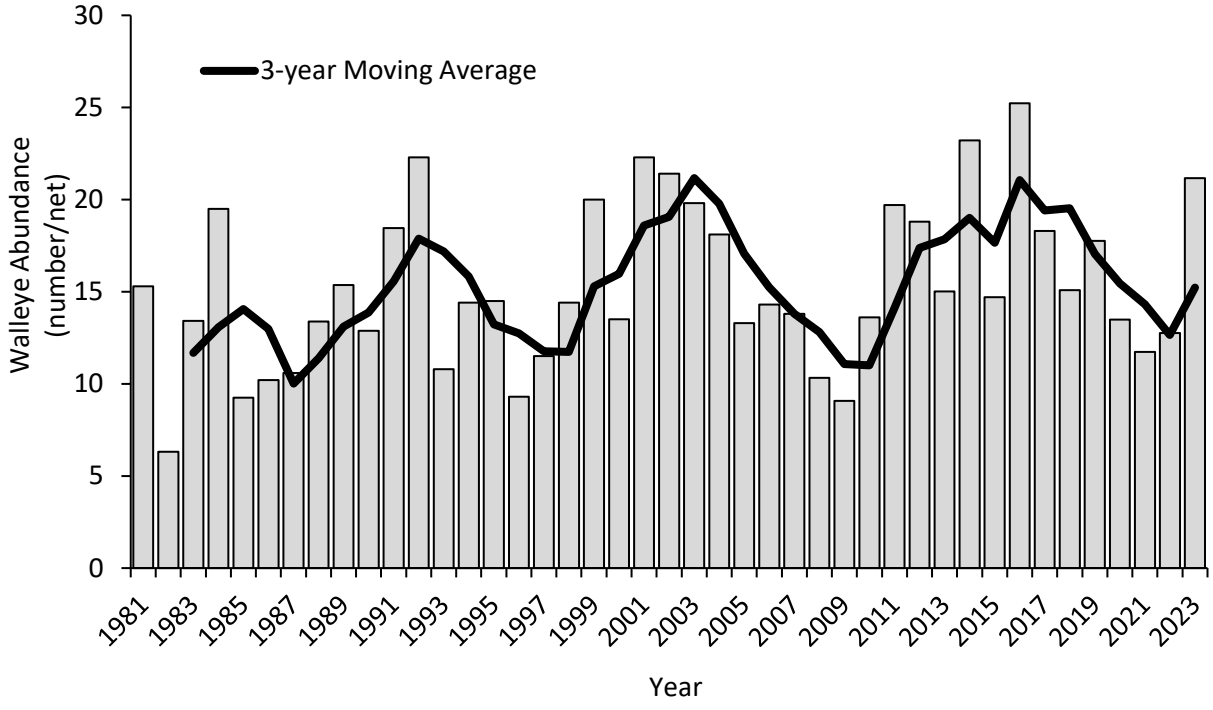

Figure 9. Nearshore walleye gill net catch rates (number per net) from 1981-2023. Solid black line denotes the 3-year moving average.

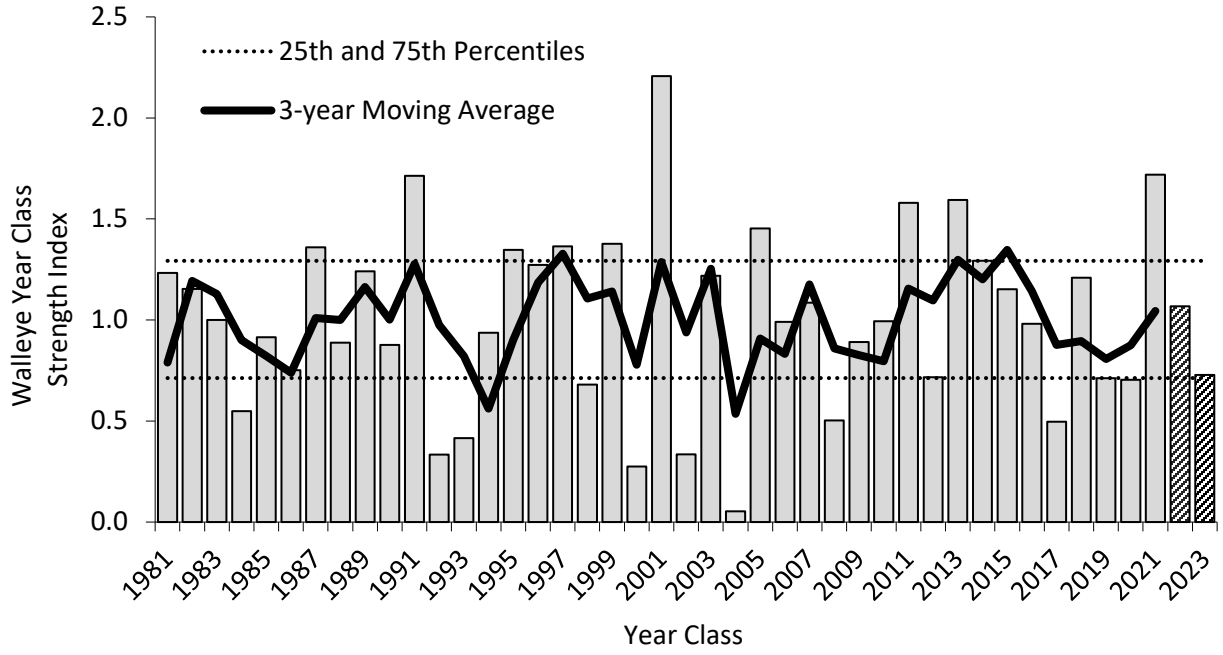

Figure 10. Relative walleye year-class strength, based on least squares means of natural log transformed age-2 to age-5 gill net CPUE, from fall gill net assessment near-shore sample, for the Minnesota waters of Lake of the Woods. Horizontal dotted lines are the 25th and 75th percentiles of the year-class strength values and mark the bounds for strong and weak year-classes. The 25th and 75th percentiles are based on all measured year-class strength values from 1981 to 2021. Year-class strength values for 2022 and 2023 are predicted.

Declining abundance of large walleyes is another concern stakeholders expressed in both the scoping survey (Haberman 2024) and during boat ramp surveys. This concern is best examined via analysis of walleye spawning stock. Spawning stock or large-bodied walleye are described by abundance of walleye greater than 20-inches. Near and offshore catch rates are significantly related, but with higher and more variable catches in the offshore nets. Like overall abundance and recruitment, walleye abundance greater than 20-inches includes both the near and offshore fish (2002-present). From 2002 to 2009 catches averaged 0.74 per net and rapidly increased and stabilized to 1.38 per net on average from 2010 to 2023 (Figure 11). As of 2023 sampling, the 3-year moving average is 1.3 per net and is within the management bounds of 1 to 2 walleye greater than 20-inches per net. Abundance of walleye 14 to 19 inches (desirable size selected for harvest; tracked annually) ranged from 2.5 to 8.1 per net with no trend. Catches steadily declined from 2016 to 2020 and remained close to 3 per net until 2022. In 2023, the catch rate returned to near the historic average (4.6 per net).

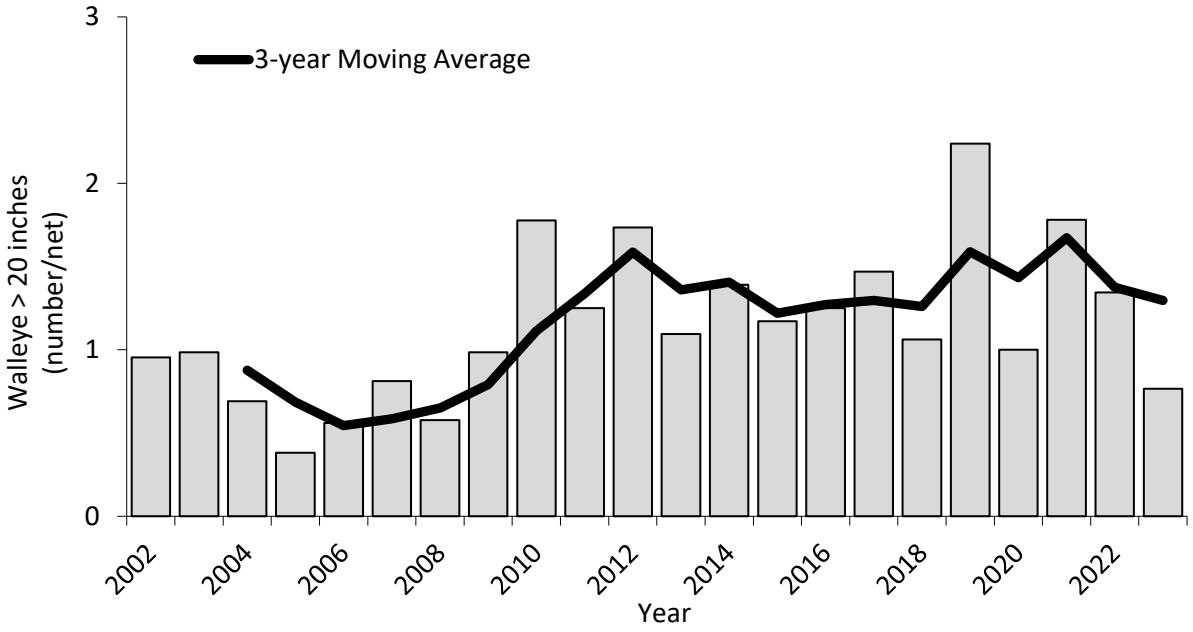

Figure 11. Gillnet catch rate (nearshore and offshore nets combined) of walleyes greater than 20 inches since 2002.

Declining abundance of "eater" (defined as 14 - 19 inch) walleyes has been a concern that has been raised by stakeholders from both the scoping survey (Haberman 2024) and interviews with anglers at boat ramps. Though the abundance of "eater" walleyes was average to below average in recent years, the abundance of "eater" walleyes is within the range of observed values since 1991 (Figure 12).

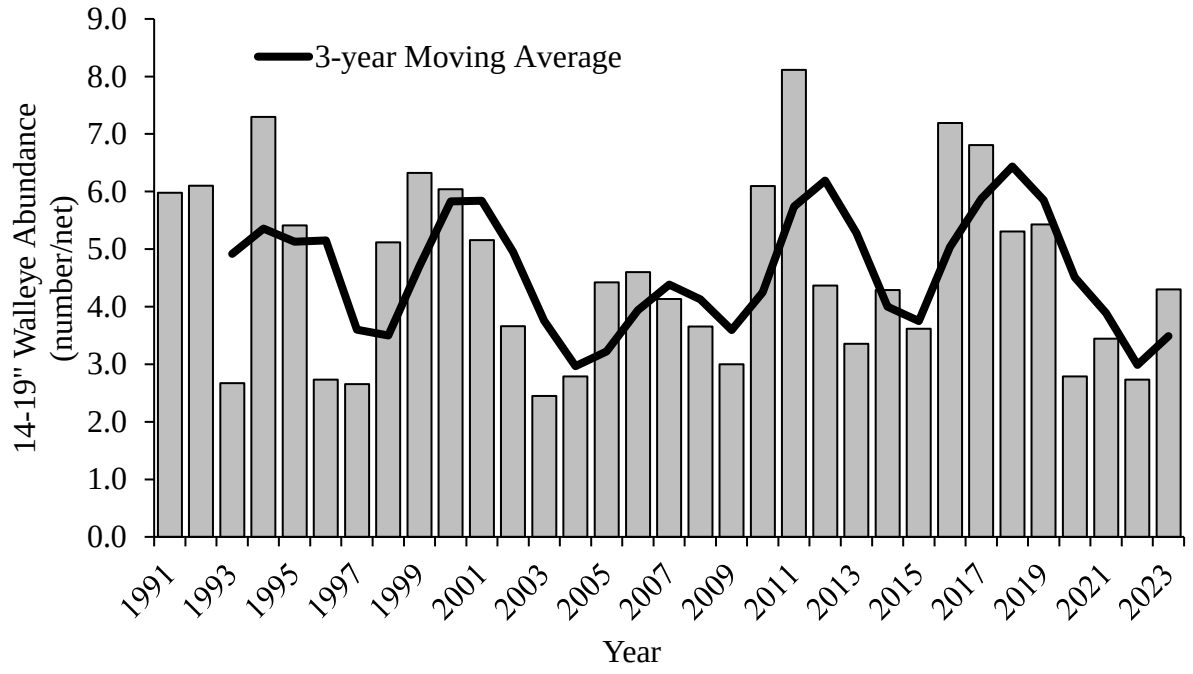

Figure 12. Gillnet catch rate (nearshore nets only) of walleyes between 14 and 19 inches since 1991.

Sauger

Sauger are managed to provide a high catch rate, harvest oriented, fishery (Talmage et al. 2018). Sauger abundance in Lake of the Woods is more variable than walleye. Nearshore sauger abundance in fall gill nets has ranged from 4.5 to 30.8 per net since 1981 with a significant increase in abundance temporally (Figure 13). Over the past two decades (2002 to 2023) sauger abundance has been stable with the current 3-year average at 18.4 per net. Catches the past two years have dropped to the twenty-year average of just over 16 per net and is attributed to moderate to weak year-classes produced in 2018, 2020, and 2021. Despite the recent year-class production, overall recruitment of sauger has been exceptional over the past decade and has significantly improved since the early 1980s (Figure 14). Fall gill netting in 2023 revealed the presence of 13 age-classes of sauger with a large proportion of the population of fish from the 2019 and 2022 year-classes (greater than 60%).

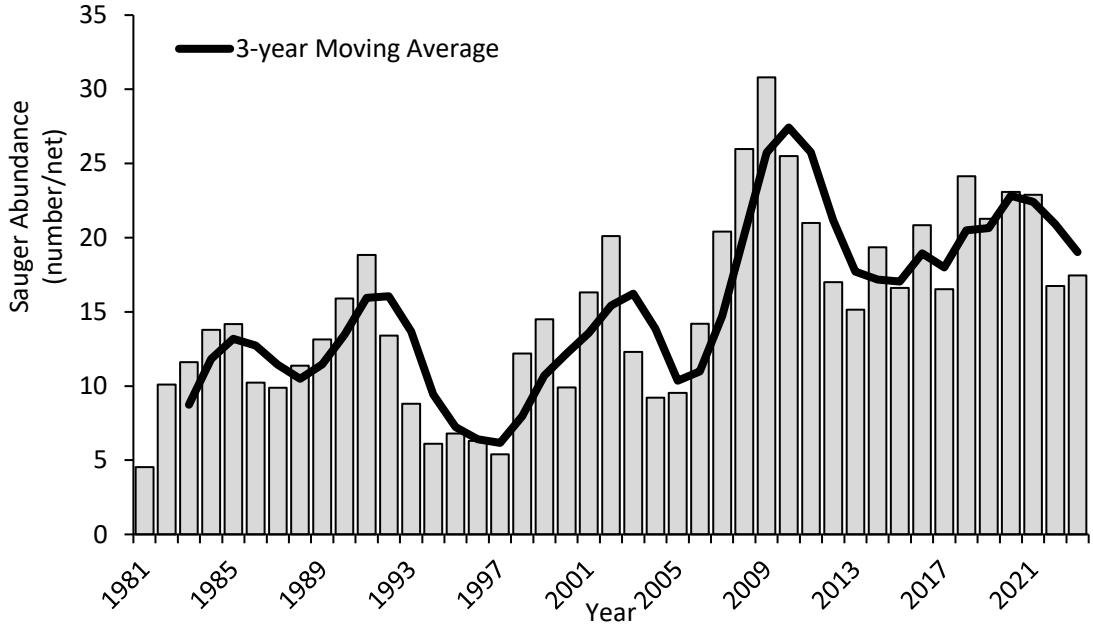

Figure 13. Nearshore sauger gill net catch rates (number per net) from 1981-2023. Solid black line denotes the 3-year moving average.

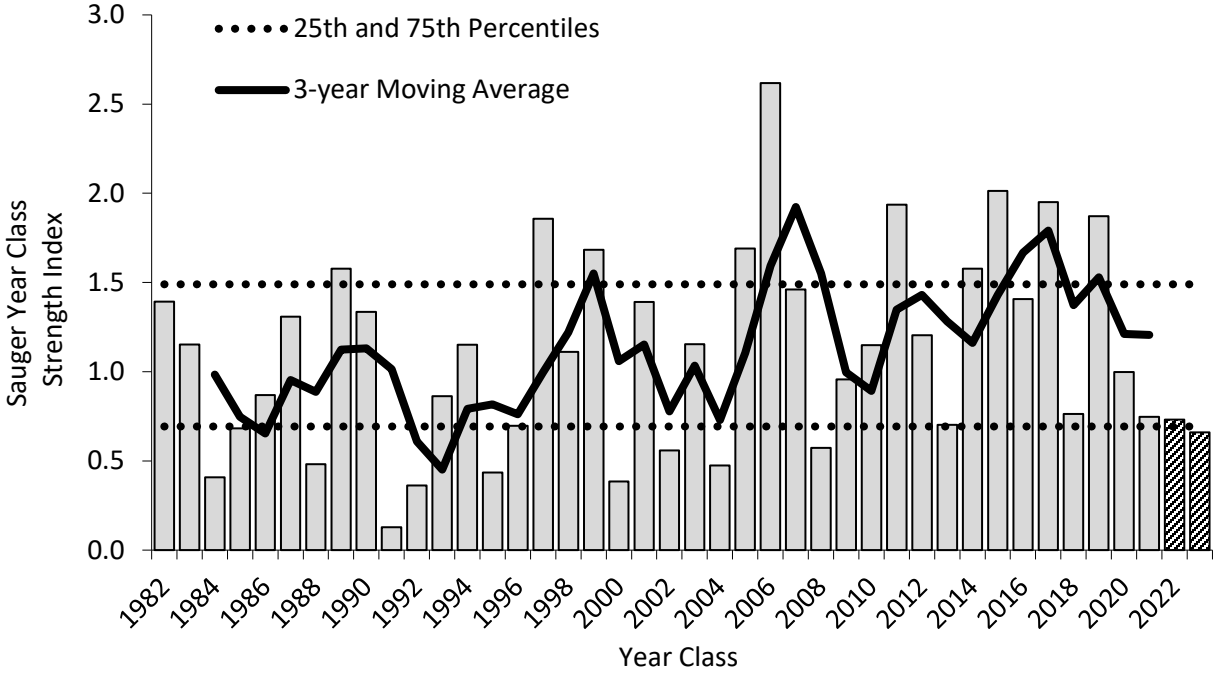

Figure 14. Relative sauger year-class strength, based on least squares means of natural log transformed age-2 to age-5 gill net CPUE, from fall gill net assessment near-shore sample, for the Minnesota waters of Lake of the Woods. Horizontal lines are the 25th and 75th percentiles of year-class strength values and mark the bounds for strong and weak year-classes. The 25th and 75th percentiles are based on all measured year-class strength values from 1982 to 2021. Year-class strength values from 2022 and 2023 are predicted.

Northern Pike

Nearshore gill net abundance for northern pike has ranged from 0.8 to 2.7 with an average of 1.7 per net since 1981 with no prominent trend. Due to low sample sizes of northern pike encountered during fall gill netting, spring ice-out trap netting has been conducted to provide a more robust dataset. These assessments have documented a steady increase in the number of female northern pike over 36 and 40 inches (Figure 15). This increase coincides with the implementation of a protective slot limit from 30 to 40 inches in the mid-1990s. Values have tripled in each recent tributary survey for females greater than 36 inches and doubled for females greater than 40 inches. The DNR has heard concerns from stakeholders from informal input and public meetings that the increase in large northern pike could be detrimental to the walleye fishery because of increased predation. The DNR has not observed any negative trends in the walleye population that coincide with the increased abundance of large northern pike. During examination of diets during fall gill netting, the most commonly observed diet item for large (greater than 30 inches) northern pike was tullibee, with no evidence of walleye or sauger in large northern pike diets. There is evidence that smaller northern pike consume some walleye and sauger - approximately 10% of all northern pike had consumed walleye or sauger, primarily young-of-year or juveniles (Nelson 2023, Nelson 2024).

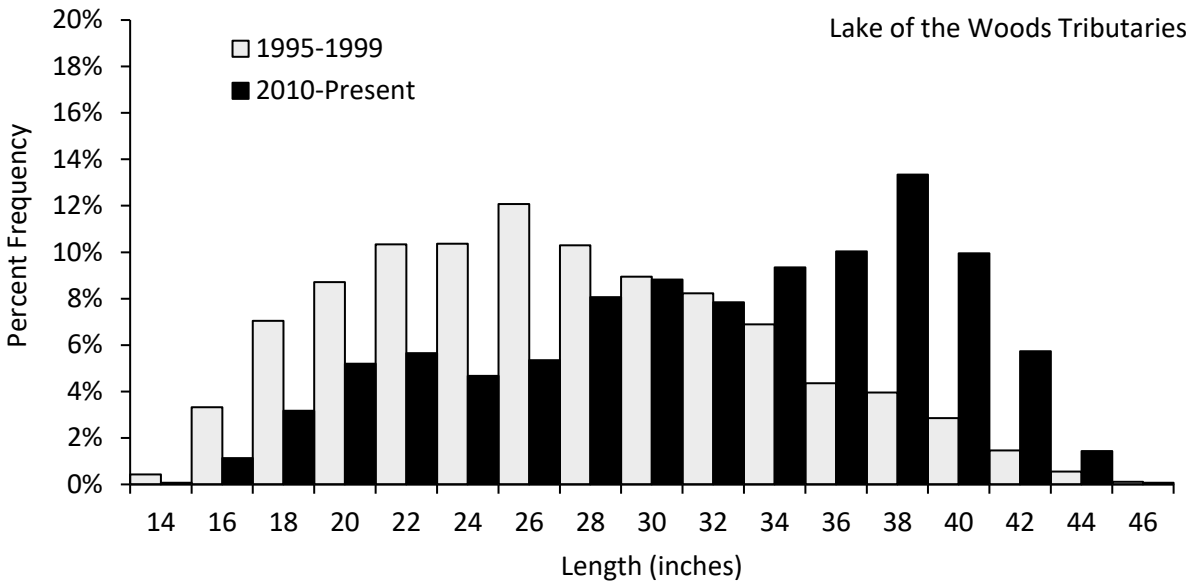

Figure 15. Length frequency of female northern pike sampled from Lake of the Woods tributaries during spring ice-out trap netting from 1995-1999 and from 2010 to 2022.

Lake Sturgeon

The lake sturgeon population collapsed on Lake of the Woods in the early 1900s from over-harvest and were unable to recover because of poor water quality in the Rainy River at the primary spawning and nursery habitats. Water quality was degraded due to paper mill, timber mill, and municipal wastewater discharges. The population started to recover concurrently with enactment of the federal 1972 Clean Water Act aimed at restricting and improving the quality of wastewater discharge.

Three population estimates have been conducted on the Lake of the Woods and the Rainy River for lake sturgeon, with a focus on fish greater than 40 inches. In 1990, the population estimate was 16,710. This number nearly quadrupled by 2004 with an estimate of 59,050. The most recent population estimate in 2014 yielded 92,286 lake sturgeon over 40 inches, providing evidence that the population is continuing to recover (Heinrich and Friday 2015). Anglers have expressed concern that the increase in lake sturgeon abundance could be detrimental to the walleye fishery due to egg predation. The DNR has not observed any negative trends in the walleye population that coincide with the increased abundance of lake sturgeon.

Minnesota and Ontario officials agreed that the short-term recovery goals had been met in 2012. Lake sturgeon management then shifted to new goals of long-term recovery to be evaluated in 2030. Lake sturgeon were petitioned for listing as endangered or threatened under the Endangered Species Act in 2018 by the Center for Biological Diversity. In 2024, the US Fish and Wildlife Service issued a 12-month finding that the listing under the Endangered Species Act was not warranted (USFWS 2024). In 2017, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determined that lake sturgeon in the Nelson River watershed including the Canadian waters of Lake of the Woods and the Rainy River were endangered. The Canadian federal listing process separates science and policy; COSEWIC is a body of subject matter experts in the biology of the species in question who study the available science and data on the species in question, and then make a recommendation to the federal Minister of the Environment who decides whether to adopt the recommendation of the COSEWIC scientists. The legal status of a species is listed in the Species at Risk Act (SARA) registry. While COSEWIC recommended endangered status for this population of Lake Sturgeon, the Minister of

the Environment responded that consultation with the affected provinces was required before a listing could be made. At time of writing this plan (2025), no decision has yet been made on the SARA status of lake sturgeon. It is also worth noting that in 2017, COSEWIC decided not to view the Lake of the Woods and Rainy River stock of sturgeon as a separate population for conservation, and instead lumped it in with all lake sturgeon in the Nelson River and Saskatchewan River populations (COSEWIC 2017).

Other Species

Yellow perch nearshore abundance has been variable through time, with abundance ranging from 6 to 30 yellow perch per net with a historical average of 15 per net. The current 3-year average for yellow perch abundance is 18.8 per net which is the third consecutive year where catches exceeded the long-term average. Recent above average catches are driven by strong to above average year-classes in 2020 and 2021. Presently, all 1-inch length intervals from 7 to 14 inches exceed the twenty-year average. Recruitment for yellow perch shows no prominent trend since 1989.

Smallmouth bass and black crappie have been sampled in gill nets annually at low abundance. Since 1981, both species' nearshore abundance has ranged from 0 to 2.0. Recent black crappie aging identified six-consecutive year-classes demonstrating some level of reproductive success annually (Nelson 2024).

Burbot were historically abundant throughout much of their native range; however, many populations have been extirpated, endangered, or have been in decline (Stapanian et al 2010). In Mille Lacs Lake, there has been substantial decline in burbot abundance since 1979 and is suspected to be related to warmer water temperatures (Stapanian et al. 2010). Similar declines have been observed for Minnesota waters of Lake of the Woods from angler reports and commercial fishermen. Current sampling methods used on Lake of the Woods do not effectively capture burbot, and thus temporal trends in abundance cannot be made. Lake of the Woods burbot population dynamics were first described by Muth and Smith (1972) and later by Standera (2004) and Nelson (2020b).

High tullibee abundance is associated with strong year classes that can be observed when they become vulnerable to gill nets. Seventy percent of the tullibee sampled in 2023 were 7 to 8 inches in length and from the 2022 year-class. On average, cisco attain “harvestable” size by age-3 (12 inches).

Lake whitefish abundance is the highest observed since 2016 (0.67/net) and marks a continued increase over the past decade.

Muskellunge are caught occasionally during fall gill netting.

There has been a notable decline in trawl catches of emerald shiners over the last two decades, though a modest increase has occurred in the past few years.

Angling Pressure

Lake of the Woods is a popular recreational fishing destination, due to its status as a high-quality, multi-species fishery that provides opportunities for recreational sport fishing and subsistence. The combination of summer and winter angling pressure consistently places Lake of the Woods as one of the most heavily fished lakes in Minnesota. Many anglers from around the state make multiple trips to the area each year. Since 2020, About 20% of Lake of the Woods anglers come from out-of-state. In the summer, about 20% of anglers are local (i.e., from Roseau or Lake of the Woods counties) and 15% are from the seven-county metro area (i.e., Hennepin, Ramsey, Dakota, Anoka, Washington, Scott, or Carver County). In the winter, approximately 15% of Minnesota anglers are local, while 20% are from the seven-county

metro area. Weather and ice conditions on Lake of the Woods and other popular fishing destinations can greatly influence angling pressure.

Over 80% of ice anglers and ~99% of open water anglers in the most recent survey report fishing for walleye and/or sauger, with northern pike as the third most targeted species. The most recent winter creel survey results show 10% of ice anglers on Lake of the Woods target northern pike. Other seasonally or locally popular fisheries include:

- Northern pike at tributary inlets immediately prior to and after ice out
- Muskellunge in the Northwest Angle during open-water season
- Walleye during the spring spawning run and fall emerald shiner run in the Rainy River
- Lake sturgeon during the spring spawning run (with some targeted effort for the rest of the year)
- Smallmouth bass, black crappie, and yellow perch at various locations
- Burbot after dark during the ice fishing season
- Tullibee during the ice fishing season

Summer Pressure

Fishing pressure during the summer months has been stable since 1990 with a range of 600,000 to 1,000,000 angler hours and an average annual pressure of around 750,000 angler hours. Summer angling pressure peaked in 1990 at 986,000 angler hours. In the last six surveyed years, summer fishing pressure averaged just under 700,000 angler hours (Figure 16).

Winter Pressure

The DNR has heard increased concerns about increased ice fishing pressure and related activities (e.g., expanding paid ice road networks) from anglers and stakeholders from the scoping survey, boat ramp surveys, public meetings, and unsolicited public input. Ice fishing on Lake of the Woods has increased in popularity since the late 1990s. In recent years, fishing pressure has averaged approximately 2,500,000 angler hours with the most recent estimate in 2022 - 2023 peaking at nearly 3,200,000 angler hours (Figure 16). The record pressure in 2022 – 2023 was largely driven by a change in creel design from a roving creel design that didn't account for overnight pressure to an access-based design which tracks overnight pressure. The general trend in increasing ice fishing popularity has been a result of an expansive ice road network, higher quality fish houses, and general ease of participation. Though there is concern about the impacts of increased ice fishing pressure, there is not evidence that shows that the rise in winter pressure has resulted in a proportional increase to harvest or a decrease in the walleye and sauger populations.

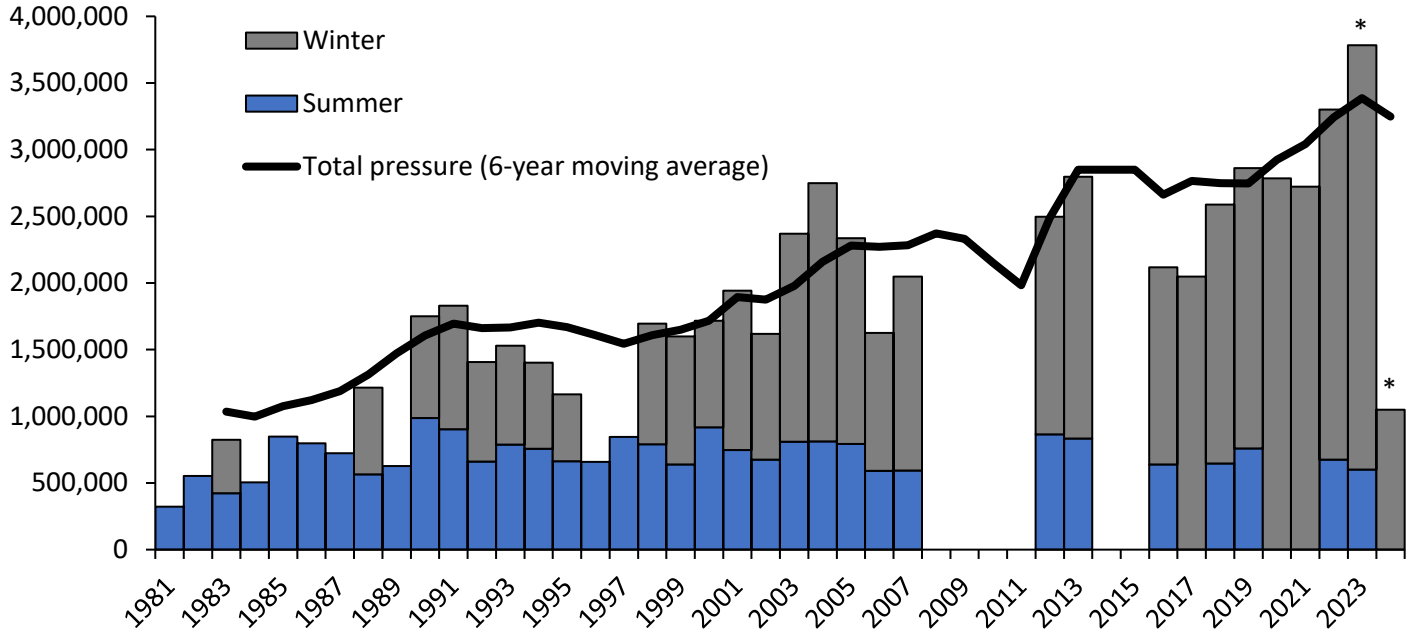

Figure 16. Pressure estimates from winter and summer south shore angler creel surveys conducted on Lake of the Woods (stacked bars) and six-year moving average of total pressure. Note: No survey has been conducted annually. Years with missing estimates indicate no survey was conducted, not a pressure estimate of zero. * indicates a change in winter creel design from roving to access based. Pressure estimates are not directly comparable between the designs. Results from Rainy River and Northwest Angle creel surveys are included in the six-year moving average, but are not presented in the bar chart.

Fishing Mortality and Angler Harvest

The DNR manages several fish species in Lake of the Woods and routinely samples and collects data for these species to inform regulations. The DNR uses sampling and monitoring data to set safe harvest levels for managed fish species to ensure populations are sustained. Numerous comments were received during the management plan scoping process indicating that anglers fishing Lake of the Woods have a perception of an issue of over-harvest, especially during the ice fishing season in recent years. Current data collected for managed fish species populations does not support the observation of over-harvest within the fishery. The subsequent section contains a detailed analysis of angler harvest of the managed fish species on Lake of the Woods.

Walleye

Safe harvest levels for walleye are derived using a thermal-optical habitat area (TOHA) model (Lester et at. 2004), with a current estimate of safe harvest level of 540,000 pounds for Minnesota waters (MNDNR and OMNRF 2017). Throughout the 1980s, walleye harvest remained near 300,000 pounds and steadily increased until the early 2000s. It has remained near the safe harvest level on average (Figure 17; Appendix 3). Walleye harvest is currently just over 475,000 pounds on a six-year moving average, which is under the threshold in the Border Water Atlas (MNDNR and OMNRF 2017). Harvest is assessed using a six-year moving average to account for variability and captures two full cycles of summer and winter creel survey on the south shore of Lake of the Woods. Additionally, anglers have expressed concerns about a perceived trend in harvesting smaller walleyes under 12 inches (Haberman 2024). Upon examination of trends in percent of

harvested walleyes that are under 12 inches, the opposite is true; the percent of harvest of walleyes less than 12 inches has decreased through time (Figure 18).

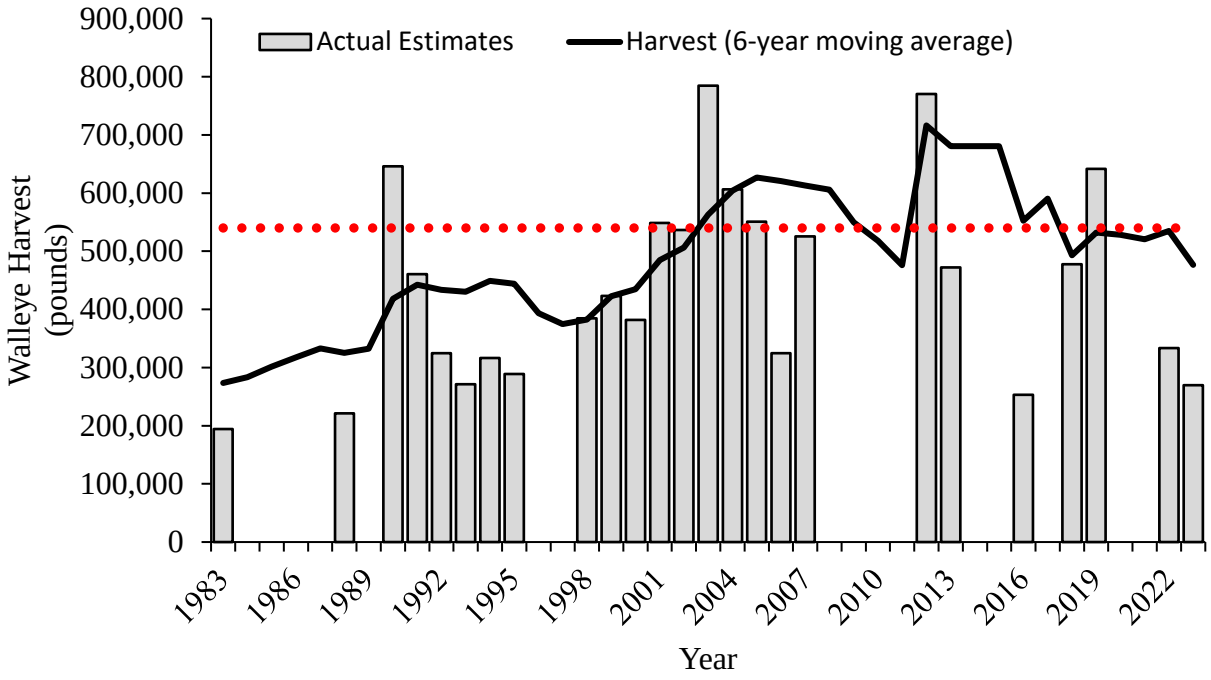

Figure 17. Annual walleye harvest estimates from 1983 to 2023 from summer and winter south shore creel surveys (grey bars) and 6-year moving average of harvest estimates (black line). Horizontal red dotted line denotes current safe harvest threshold for walleye (540,000 pounds).

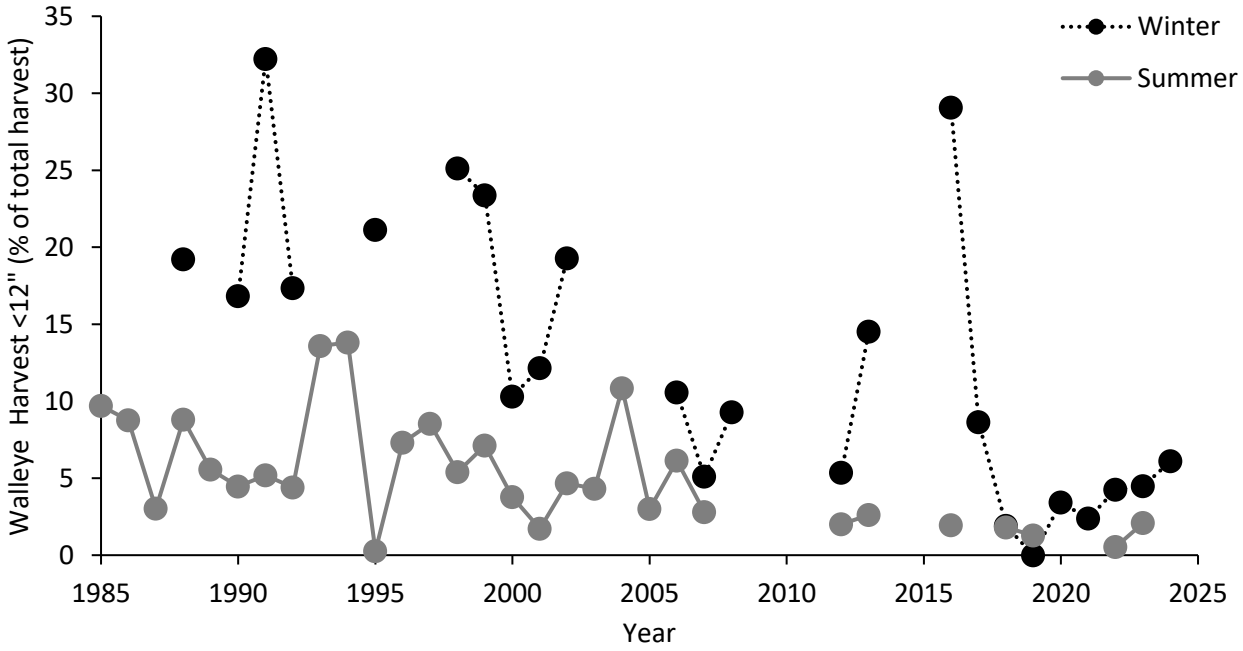

Figure 18. Percent of total winter and summer Lake of the Woods walleye harvest that is less than 12 inches in length from winter and summer south shore creel surveys since 1985.

Another source of walleye mortality is release mortality (also referred to as hooking mortality), which is when a caught and released fish dies due to factors related to its capture. Concern about release mortality (primarily from barotrauma) was a concern cited from the scoping survey (Haberman 2024). Barotrauma is an injury to a fish as a result of changing pressure caused by a sudden change in water depth (i.e. reeling a fish in from deep water). Barotrauma is not always lethal. Studies in Minnesota have found that the most important factors in determining release mortality of walleyes during the open water season are water temperature (varies by fish size; Reeves and Bruesewitz 2007) and depth (varies with handling time; Talmage and Staples 2011). Ice fishing release mortality is significantly related to capture depth (Lyon et al. 2022). The most common depth for ice anglers to fish is between 30 and 32 feet, which results in a 2 - 4% release mortality for walleyes from 9 - 18 inches (Lyon et. al 2022). 48% of ice anglers report fishing in 30 feet of water or greater with only 18% fishing deeper than 32 feet (Nelson 2023b).

Sauger

Safe harvest levels for sauger were derived using the methods outlined in Radomski (1999), with the safe harvest level selected in the 2018 to 2023 management plan of 250,000 pounds (DNR and OMNR 2004). The DNR has recently evaluated sauger exploitation rates and is in the process of updating the safe harvest level. The updated safe harvest level will be a 25% exploitation rate to account for changes in sauger abundance (Nelson and Skoog 2024). This is discussed in more detail in the Goals, Strategies, and Objectives section under Goal 1.

The increase in sauger abundance over the last two decades has resulted in higher harvest during the past decade compared to harvest levels observed from the mid-1980s to late 2000s (Figure 19, Appendix 4). The winter fishery on Lake of the Woods is dependent on the availability of sauger, as such, low sauger abundance and high harvest have concerned fisheries managers about the possibility of overharvest (Radomski 1999). Additionally, anglers have expressed concern about a perceived trend in harvesting smaller sauger (Haberman 2024). Upon examination of trends in percent of harvested sauger that are under 11 inches, the opposite is true; the percent of harvest of sauger less than 11 inches has decreased through time (Figure 20).

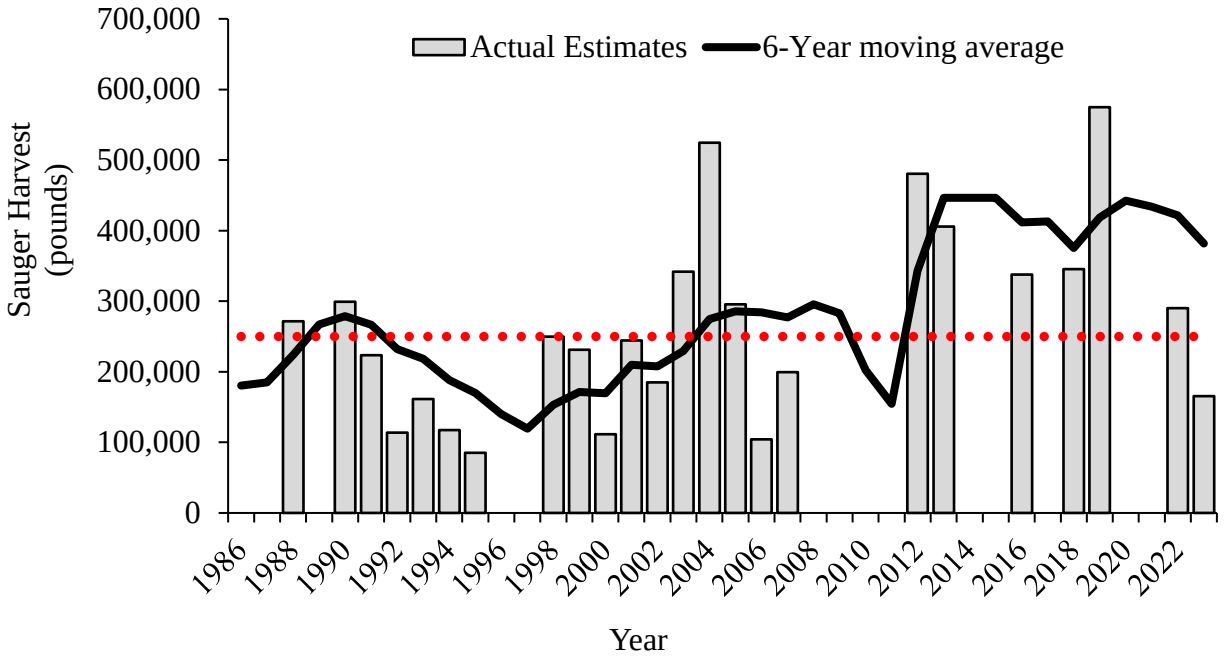

Figure 19. Annual sauger harvest estimates from 1986 to 2023 from summer and winter south shore creel surveys (grey bars) and 6-year moving average of harvest estimates (black line). Horizontal red dotted line denotes current safe harvest threshold for sauger from the 2018-2023 management plan (250,000 pounds).

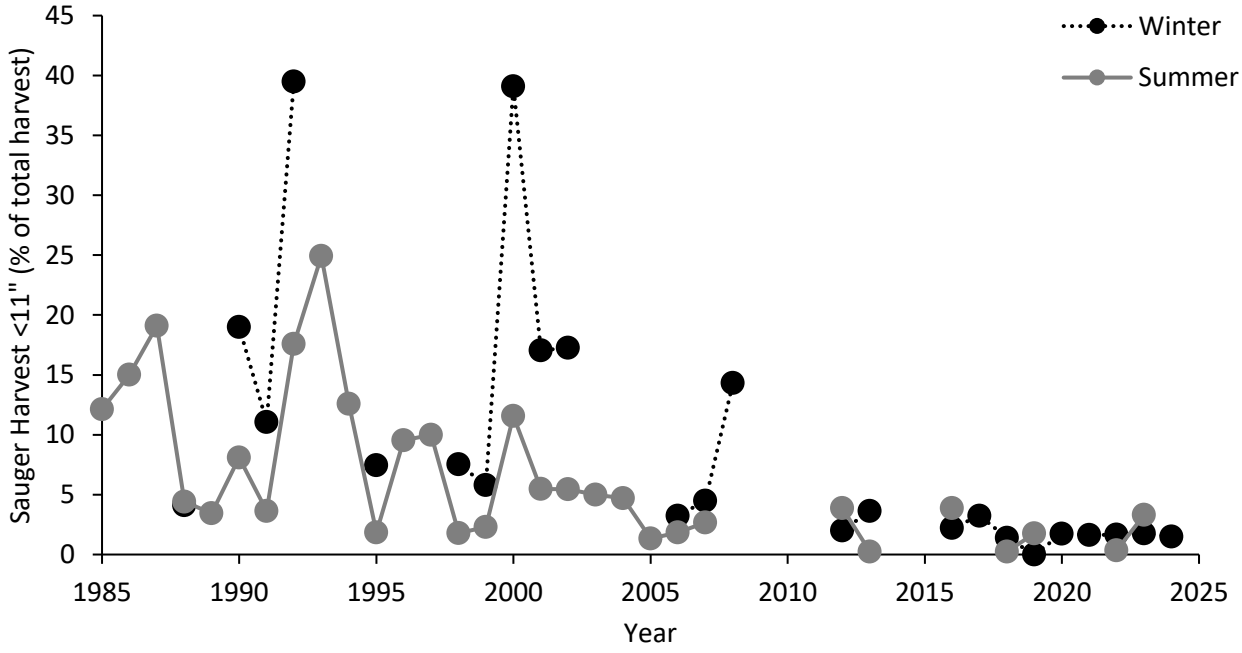

Figure 20. Percent of total winter and summer Lake of the Woods sauger harvest that is less than 11 inches in length from winter and summer south shore creel surveys since 1985.

Additionally, the DNR has heard concerns about release mortality (primarily due to barotrauma). Sauger release mortalities are significantly related to depth, with mortality estimates for 20 - 29 feet at 2.4% and 30 - 39 feet at 21.4%

(Meerbeek and Hoxmeier 2011). However, Betolli et al. (2000) and Kitterman and Betolli (2011) both observed that signs of barotrauma were not significantly related to mortality in released saugers.

Northern Pike

Northern pike harvest is difficult to quantify with traditional creel designs because anglers target northern pike outside of the typical creel survey areas and times. One of the most popular areas for anglers to target northern pike during the late icefishing season is the Warroad public access, which is not included in the winter creel survey. Additionally, northern pike anglers tend to fish during early ice, late ice, and immediately after ice out, when standard creel surveys are not conducted as frequently. Environmental conditions (i.e., poor ice conditions) have led to highly variable harvest from year to year (Eckstrom et al. 1997). Over the past two decades, northern pike harvest has been stable and averaged 20,000 pounds annually based on best estimates from creel surveys. A change in winter creel design will allow for an improved estimation of northern pike harvest with creel clerks stationed at more access points on Fourmile, Bostic, and Zippel Bays (Warroad Public Access is still excluded; Nelson 2024b). Northern pike release mortality tends to be very low to negligible (Tomcko 1997).

Lake Sturgeon

In the early 1990s, lake sturgeon angling effort was focused on the Rainy River around Birchdale, Minnesota, and near the mouths of the Big Fork and Littlefork Rivers. Harvest was estimated to be approximately 1,000 pounds annually during this time period. Angling pressure increased significantly on the lower part of the Rainy River and Fourmile Bay in the mid-1990s, causing the DNR to begin monitoring the increased angling pressure and harvest through creel surveys. Topp and Stewig (2005) reported an average annual lake sturgeon harvest from 1997 to 2000 of 11,900 pounds, with a slight increase to over 13,440 pounds from 2001 through 2003. Average annual harvest declined to 6,750 pounds in 2004 and 2005 (Topp and Stewig 2006).

In 2006, a harvest tag system was put into place to better manage the lake sturgeon population by providing high quality harvest data. The current 6-year average for lake sturgeon harvest is an average of 215 fish, or 5,370 pounds (Figure 21, 2018-2023), which is well below the harvest of threshold of 11,600 pounds (Talmage et al. 2009, MNDNR and OMNRF 2017) for the Minnesota waters of Lake of the Woods and the Rainy River.

Release mortality of lake sturgeon is likely very low. Multiple tagged lake sturgeon have been reported as caught by anglers with one lake sturgeon being caught and released at least 10 times in the Rainy River (DNR unpublished data). Studies in Wisconsin (Shaw et al. 2023) and Michigan (Briggs et al. 2020) also observed negligible hooking mortality associated with catch and release angling for lake sturgeon.

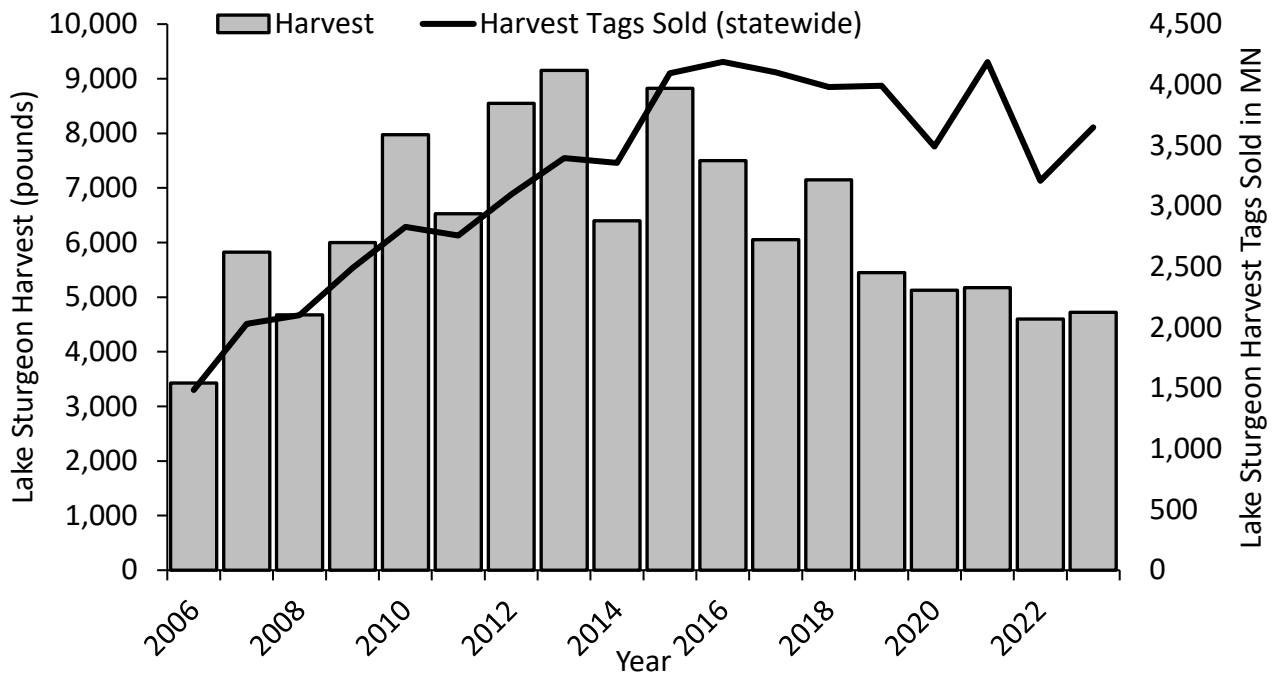

Figure 21. Lake sturgeon harvest in pounds (grey bars) from Lake of the Woods and Rainy River from 2006 to 2023, based on angler reporting and number of harvest tags sold (black line). Anglers are required to report a harvested lake sturgeon by submitting a harvest tag within 48 hours of harvesting a lake sturgeon. The mean weight of a harvested lake sturgeon is based on the mean weight of a 47.52-inch lake sturgeon, the midpoint of the 45 to 50-inch harvest slot.

Other Species

Both smallmouth bass and black crappie are observed occasionally in south shore creel surveys, but at levels that do not allow any meaningful harvest statistics.

Harvest for yellow perch has ranged from just over 1,000 pounds to 108,000 pounds annually with a notable drop from 2004 to present. Over the past twenty years, yellow perch harvest has averaged 35,000 pounds annually and has been stable with over two-thirds of harvest occurring during the winter.

Annual sport harvest of burbot by anglers has ranged from 3,000 to 150,000 pounds since the late 1980s with a 30,000-pound average the past two decades.

Tullibee harvest occurs during the winter months and averages 20,000 pounds annually with high variability.

Muskellunge are a sought-after gamefish on Lake of the Woods, with most effort occurring at the Northwest Angle. Current length regulations make muskellunge almost completely a catch and release fishery.

Cooperative Management

Because Lake of the Woods is located in multiple jurisdictions, several natural resource agencies are responsible for fisheries management on Lake of the Woods. These management agencies manage fish stocks that can and do move

across international boundaries, especially between Minnesota waters and adjoining Canadian portions of Lake of the Woods (MNDNR and OMNR 1998).

International coordination on fisheries management occurs through annual meetings of the Ontario-Minnesota Fisheries Committee for which the terms are formalized in Chapman et al. (2024). The purpose of this committee is to collaborate on the fisheries management of the border water in the two jurisdictions to conserve fisheries resources of these border waters (Chapman et al. 2024).

The DNR and Ontario Ministry of Natural Resources and Forestry have been working collaboratively on shared resource management for 40 years. The cooperative management process was formalized in 1984 with the first edition of the Border Water Atlas (OMNR et al. 1984). Boundary Water Atlases were completed in 1992, 1998, 2004, and 2017. The purpose of the Border Water Atlas is to provide necessary background information to allow development of options for managing these border water fisheries (MNDNR and OMNRF 2017).

The goal of cooperative management of Lake of the Woods has not always been achieved. From the 1980s through the early 2000s, allocation of resources (primarily walleye recreational harvest) was a point of contention between Minnesota and Ontario. Consensus on fisheries management alternatives was uncommon during this time period, though collaborative work continued including the completion of multiple border water atlases.

Though the Ontario-Minnesota Fisheries Committee strives for cooperative management, Minnesota maintains sovereignty over fisheries management decisions for Minnesota waters of Lake of the Woods (Chapman et al. 2024). Currently, fisheries management of Minnesota waters of Lake of the Woods is guided by the 2018-2023 Lake of the Woods Management Plan (Talmage et al. 2018). This management plan was created within the context of the 2017 Ontario-Minnesota Boundary Waters Atlas (MNDNR and OMNRF 2017), which lays out harvest thresholds for Minnesota waters of Lake of the Woods (Table 2).

Table 2. Harvest thresholds and potential yields by species from each Boundary Water Atlas. * indicates value was not reported.

Atlas Year	Walleye Potential Yield	Walleye Harvest Threshold	Sauger Potential Yield	Sauger Harvest Threshold	Northern Pike Potential Yield	Northern Pike Harvest Threshold	Lake Sturgeon Potential Yield	Lake Sturgeon Harvest Threshold
1984	430,100	430,100	134,400	134,400	268,800	268,800	*	*
1992	430,100	430,100	134,400	300,000	268,800	268,800	*	*
1998	430,100	430,100	134,400	107,500	268,800	100,000	11,500	7,600
2004	450,000	450,000	250,000	250,000	268,800	100,000	11,500	7,600
2017	541,000	541,000	250,000	250,000	270,000	*	11,600	11,600

Fishing Regulations

Lake of the Woods was managed as a commercial fishery until 1985. After the 1985 closure of commercial fishing for sportfish, management has since focused on recreational angling. Several changes to recreational fishing regulations have occurred over time (Appendix 5), including bag limit reductions, adoption of protected slots, and season changes in response to increased harvest thresholds defined in Border Water Atlases (OMNR et al. 1984, MNDNR et al. 1992, MNDNR and OMNR 1998, OMNR and MNDNR 2004, and DNR and OMNR 2017). Some regulations were implemented in response to desires from anglers, such as the 30 – 40-inch protected slot for northern pike in response to a desire for a

trophy northern pike fishery. Angler concerns related to other biological indicators such as a skewed sex ratio in the Rainy River during spring spawn resulted in a regulation change to a catch and release fishery.

Walleye and Sauger

Walleye and sauger are currently managed with a possession and daily bag limit of six walleye and sauger combined, with a maximum of four walleye. Walleye currently have a 19.5-28-inch protected slot, prohibiting the harvest of fish within the protected slot size. The harvest season for walleye begins on the statewide walleye season opener (the Saturday two weeks prior to the Saturday of Memorial Day weekend) and is open through April 14 of the following year, with the exception of Fourmile Bay and the Rainy River which close to harvest on March 1, with catch and release angling allowed until April 14. Some stakeholders have expressed a desire for changes to either the bag limit or length limits for walleyes (Haberman 2024; boat ramp surveys). At this time, the DNR does not plan to change regulations because the biological data suggests a healthy walleye population, though changes to the bag and length limits are options for rectifying a failure to meet objectives (see Goals, Objectives and Strategies Section). Anglers have also frequently advocated for the closure of the spring catch and release season on the Rainy River due to concern for the impact on spawning. The DNR does not have evidence to support the closure of this fishery, as harvest in the Minnesota waters is nonexistent due to the catch and release season and hooking mortality is negligible due to the cold shallow water in which angling occurs.

Northern Pike

Current regulations allow the harvest of three northern pike, with a 30-40-inch protected slot limit, with only one fish over 40 inches in possession. The angling season is continuous, and open year-round. There is also a dark house spearing season for northern pike which follows the same season as the dark house spearing season for inland waters.

Lake Sturgeon

Current lake sturgeon regulations follow the standard Canadian border water regulations, allowing the harvest of one fish between 45 and 50-inches or greater than 75-inches per calendar year during one of two harvest seasons in the spring and mid to late summer. The catch and release season is open for the majority of the year, with the exception of the lake sturgeon spawning season in late spring. To harvest a lake sturgeon, anglers must purchase a harvest tag from the DNR, put a field tag on the harvested fish, and register the fish with DNR fisheries within 48 hours of harvest. Party fishing for lake sturgeon is not allowed.

Other Species

Other species in Lake of the Woods are managed according to the standard Canadian border water regulations (see current Minnesota fishing regulations booklet).

General Fishing Regulations

General fishing regulations are the same as the statewide regulations, with the exception of possession of a gaff is prohibited on the Rainy River. Stakeholders have expressed a desire to implement a variety of general fishing regulations (Haberman 2024, unsolicited informal input), including a regulation on the number of ice roads and wheelhouses for user groups and a restriction on forward facing sonar. These regulations are not under consideration at this time for Lake of the Woods because there is no evidence to suggest that increased fishing pressure and new technologies have resulted in measurable proportional effects to the sport fisheries on Lake of the Woods. Regulating resource access and

technologies are both issues that are more suitably addressed at a statewide level than on a lake-by-lake basis and as such, are outside the scope of this management plan.

Enforcement of Fishing Regulations

Enforcement of fishing regulations is conducted by the Enforcement Division of the DNR. Stakeholders have expressed a desire for increased enforcement presence on Lake of the Woods (Haberman 2024). Enforcement of fishing regulations is outside of the scope of the DNR fisheries staff other than requesting increased DNR Enforcement presence and is not addressed further in this plan.

Other Management Actions

Stocking

Lake of the Woods fisheries are managed sustainably as naturally reproducing populations. For this reason, no recent stocking of any species (other than ceremonial stocking of lake sturgeon) has been conducted on Lake of the Woods. Historically, the stocking of rainbow trout occurred in the mid-1980s by resort owners. This stocking was predicted by DNR to have little to no ecological impact with a low likelihood of success. J.N. Alexander (DNR commissioner) in correspondence (August 23, 1983) to G. R. Spangler (President of the MN Chapter of the American Fisheries Society) stated, “We agree with your assessment that … stocking could probably result in slim or small survival of the fish” and “we felt the species with the least opportunity for major impacts was rainbow trout”.

There has been interest in walleye stocking from stakeholders including at the 2023 Northwest Angle Resort meeting and in the scoping survey (Haberman 2024). Stocking has long been recognized by DNR fisheries as likely to be an ineffective management tool for Lake of the Woods walleyes. L.L. Smith (Fisheries Research Supervisor) in correspondence with E.A. Shanahan (May 13, 1946) wrote: “Fry planting has proved inadequate to maintain fisheries or improve theme in large bodies of water. Planting fingerlings on a scale sufficiently large to have any influence is impossible for a lake the size of Lake of the Woods.”

Surveys and Evaluations Completed

Lake of the Woods is one of ten lakes categorized as large walleye lakes (greater than 25,000 acres) by the DNR, and is sampled annually per the Large Lake Sampling Guide (Wingate and Schupp 1984). For detailed description of individual sampling components see the Operational Plan Detail Section (**PAGE ADD**). The guide provides a standard sampling and reporting format which enables the identification of trends and cross lake comparisons. Since 1981, the DNR has produced annual Lake of the Woods Large Lake Survey reports summarizing the fish population survey findings. Prior to the start of the DNR’s large lake program, two surveys of Lake of the Woods were completed including: Carlander (1942), and Schupp (1974).

Creel surveys have been conducted on several temporally or spatially distinct fisheries that target Lake of the Woods fish stocks. These surveys have employed a variety of different creel designs. A detailed description of individual creel design components can be found in the Operational Plan Detail Section (**PAGE ADD**). A listing of all of the creel surveys targeted at Lake of the Woods walleye and sauger anglers along with high level results can be found in appendices 3 and 4. In addition to the standard walleye and sauger creel surveys, a number of targeted creel surveys have been conducted, including a northern pike creel survey in 1996, targeted lake sturgeon creel surveys in the early 2000s, and summer Rainy River creel surveys in the early 2000s.

Communication with Stakeholders

In making management decisions about the Lake of the Woods fishery, the DNR considers an array of stakeholder interests, including lakeshore property owners, community members, area and statewide businesses, visitors, government agencies, and non-governmental organizations. The DNR uses multiple communication tools to reach these audiences (e.g., press interviews, websites, press releases, social media, brochures, and signage). Historically, the DNR has also relied on input groups to provide public input on Lake of the Woods.

The DNR's current input group is the Lake of the Woods Fisheries Input Group (LOWFIG), which was convened initially in 2017 to provide a forum for discussion, review technical information, weigh management alternatives, and provide practical counsel to the DNR about Lake of the Woods fisheries management. The current membership (finalized in spring of 2024; Table 1) comprises representatives from resorts, Red Lake Nation, tourism, municipal and county governments, angling businesses, and anglers. The group meets annually to discuss the status and management of the fishery.

Social Aspects

Public Amenities

A number of amenities are located on or near Lake of the Woods that serve local residents and visitors to the area. Public water accesses that provide access to Lake of the Woods and the Lower Rainy River include Pine Creek, Springsteel, Warroad Point, Ka Ka Geesik, Swift Ditch, Zippel Bay, Wheelers Point, Ships Wheel, Wabanica Creek, Twin Rivers, Baudette Bay, Timbermill, Silver Creek, Vidas, Frontier, and Birchdale Public Accesses. These accesses primarily serve anglers, though there is some pleasure boat traffic.

Shore fishing opportunities exist at most public access sites. Fishing piers are located at Clementson Rapids, Timbermill Park, Baudette Bay, and Zippel Bay State Park.

Zippel Bay State Park and Garden Island State Recreation area are both located directly adjacent to Lake of the Woods and Franze Jevne State Park is located on the Rainy River at the Long Sault Rapids. There are also a number of parks located near Lake of the Woods that are managed by county or city governments. Additional DNR lands directly adjacent to Lake of the Woods that provide recreational opportunity to residents of and visitors to the Lake of the Woods area include Northwest Angle State Forest, Border WMA, South Shore WMA, Rocky Point WMA, Larry Bernhoft WMA, Prosper WMA, Lake of the Woods State Forest, Pine and Curry SNA, and Four Mile Bay WMA. There is also a lot of public lands managed by local and state governments that are near Lake of the Woods.

Additionally, there is an extensive maintained snowmobile trail system on the lake and in the area during the winter months.

Economic Impact

Lake of the Woods serves a wide variety of stakeholders including individual anglers and large recreational angling businesses (resorts, tourism, etc.). The Minnesota waters of Lake of the Woods are used primarily for recreation and economic gain related to recreational use. The recreational fishery has high intrinsic value for both local and non-local anglers. Other economic activities that benefit from the Lake of the Woods fishery include resorts, restaurants and bars, fishing guide businesses, bait and tackle sales, boat repair shops, grocery and liquor stores, hardware stores, retail

outfitters, and others. Additionally, bars and food trucks serve users on the lake in the winter, which draws both anglers and non-anglers for a unique experience.

Goals, Objectives, and Strategies

Goal 1- Maintain Lake of the Woods as a high-quality multispecies fishery for recreation through sustainable management

Objectives Overview

The objectives used to assess Goal 1 are targeted at the primary and secondary management species. The primary management species include walleye and sauger, and the secondary management species include northern pike and lake sturgeon. Walleye and sauger are listed as primary management species because of their popularity among anglers. Northern pike are listed as secondary management species because they are the third-most target species, with the lake supporting a robust high-quality population where trophy-sized northern pike (exceeding 40-inches in length) can be found. Lake sturgeon are also listed as a secondary management species due to the continued population recovery and popularity among anglers who target lake sturgeon in the Rainy River. Additionally, there are several other species that are managed with statewide and border water regulations, including black crappie, yellow perch, tullibee, lake whitefish, burbot, muskellunge, and smallmouth bass that could become primary or secondary management species if a change occurred that justified elevating these species to a primary or secondary management species.

Species Goals are used to describe the desired state for a given species.

Fisheries Sustainability Objectives use biological performance indicators (BPIs) and harvest thresholds as indicators of potential over-exploitation. Fisheries sustainability objectives are only used for walleye and sauger because they are the species that are managed to support high harvest levels. BPIs are measurements of various population characteristics that respond to density dependent processes with resulting shifts in vital rates (i.e., population dynamics) including reproduction, maturity, growth, mortality, and population size. Harvest thresholds are the level of harvest the fish population can safely support.

The full suite of BPI thresholds for a species will be examined on an annual basis based on a three-year moving average and individual BPIs will be examined over a longer temporal scale. Harvest thresholds will be examined on a six-year moving average. If a plurality of the annual BPI thresholds are not met, the DNR will have evidence that there is a problem and can respond quickly. Examining individual BPI thresholds on a longer timescale will account for chronic and persistent impacts to vital rates that may not show up in all vital rates.

Descriptions of BPI and harvest thresholds for each species are presented in the section for that species.

Fisheries Quality Objectives are tied to angler desires for the fishery. Not meeting these objectives means the desires of stakeholders may not be met but does not imply there is a population level problem that needs to be addressed with management actions. Any management action that is taken to address an issue must have broad social support because the management action would be addressing a social concern.

Long-term Recovery Objectives are used for evaluating the recovery of the lake sturgeon population. Because lake sturgeon are still recovering and objectives are defined in the Lake Sturgeon Recovery Plan; setting of fisheries

sustainability or quality objectives through the Lake of the Woods fisheries management planning process would be inappropriate.

Strategies Overview

Potential problems and causes are difficult to predict, and thus a general framework to help define the issue, identify potential causes of the issue, and evaluate alternative management actions has been developed. Appendix 6 contains a worksheet that may be a useful tool in defining the issue and potential causes. Appendix 7 contains a worksheet that may be useful in examining alternative management actions. These worksheets will be used if there is a need to define a problem and examine potential solutions. Solutions to social problems require broad social support, while solutions to fishery sustainability problems (as defined by BPIs and harvest thresholds) do not.

Generally, several broad management action alternative categories exist including:

- Status quo
- Research and/or additional monitoring and analysis
- Education/outreach
- Regulatory change
- Habitat restoration or enhancement
- Regulatory review such as permitting
- Participation in project teams and work groups
- Stocking

Within the regulatory change management action, there is a broad range of sub-actions including (but not limited to):

- Bag limits
- Length limits
- Seasonal restrictions
- Area specific restrictions
- Gear restrictions or requirements

While most issues and subsequent management actions are not predictable, for Goal 1, there are several situations where logical management actions exist to address the suite of fisheries sustainability objectives. These scenarios are presented in the subsequent sections for walleye and sauger.

Walleye

Species Goal

To maintain a healthy and robust population that can continue to support the angler desire for harvest while maintaining a trophy component to the fishery.

Fisheries Sustainability Objectives

Overexploitation of the walleye fishery is a primary concern for fisheries managers; therefore, a full suite of biological performance indicators (BPIs) were developed in the late 1990s to detect and evaluate overexploitation in walleye populations in Minnesota's large lakes (Gangl and Pereira 2003). The safe harvest threshold of 540,000 pounds (MNDNR and OMNRF 2017) for walleyes is based on the TOHA model (Lester et al. 2004). Robust discussion of the selection of

540,000 pounds was included in the Lake of the Woods management Plan for 2018 - 2023 (Talmage et al. 2018). These BPIs include population characteristics that describe growth, mortality, and recruitment and are calculated annually and examined in relation to the thresholds based on three-year moving averages, which provide an objective method of monitoring the health of the population. The harvest threshold is examined on a six-year moving average.

Objectives

1. Meet at least four BPI thresholds and at least one BPI threshold from each population metric category on a three-year moving average (Table 3).
2. Meet each BPI threshold at least one out of three consecutive years (Table 3).
3. Sustain angler harvest at or below 540,000 lbs. on a six-year moving average during consecutive years.

Table 3. Walleye BPI Parameters and thresholds for assessing walleye Fisheries Sustainability Objectives 1 and 2.

BPI Parameter	Population Metric	BPI Threshold	Current 3-Year Average	10-Year Trend	Data Source
Female length at 50% maturity	Growth	≥17 inches	18.1	Stable	Fall Gillnetting (1991-present)
Female age at 50% maturity	Growth	≥4.0	6.4	Stable	Fall Gillnetting (1991-present)
Age diversity of mature females	Mortality	≥0.5	0.8	Stable	Fall Gillnetting (1991-present)
Size structure of mature females (>28 inches)	Mortality	≥8%	15%	Stable	Spring Electrofishing (1991-present)
Year-class strength	Recruitment	≥0.5	1.1	Stable	Fall Gillnetting (1991-present)
Abundance (near-shore gill net CPUE)	Recruitment	≥10	15.2	Stable	Fall Gillnetting (1991-present)

Fisheries Sustainability Strategies

Table 4. Fisheries management strategies associated with not meeting walleye fishery sustainability objectives.

Objective	**Management Action**
Meet at least four BPI thresholds and at least one BPI threshold from each Population Metric category on a three-year moving average (Table 3).	If the walleye population is showing signs of biological stress as indicated by failing to meet at least four BPI thresholds and not meeting at least one threshold from each population metric category, the problem will be defined and potential alternatives will be evaluated. The most appropriate and effective management action will be taken.
Meet each BPI threshold at least one out of the previous three consecutive years (Table 3).	If the walleye population is showing signs of biological stress as indicated by failing to meet a BPI threshold for one out of three consecutive years, the problem will be defined and potential alternatives will be evaluated. The most appropriate and effective management action will be taken.
Sustain angler harvest at or below 540,000 lbs. on a six-year moving average during consecutive years	If the harvest threshold is exceeded for more than two consecutive years on a 6-year moving average, summer creel surveys will be prioritized (depending on funding availability) for implementation for the next two years to allow for calculation of annual south shore harvest.
Exceeding 540,00 pounds of walleye harvest on a six-year moving average for three out of four years AND The walleye population shows signs of significant stress as defined by one or both BPI objectives	Immediate regulatory action may include 1) proposing the closure of walleye fishing on the statewide closure date and 2) separating the walleye and sauger bag limits. Additional steps to reduce over exploitation will include 3) reduced walleye bag limits and 4) changes to the protected slot limit. If these actions fail to return the walleye population to “meeting objectives” status within five years, other management alternatives will be considered.

Fisheries Quality Objectives

Maintaining a target overall gillnet catch rate satisfies the need for a robust fishery where anglers can reasonably expect to catch walleye if they are targeting them. Maintaining a target gillnet catch rate of walleyes over 20-inches satisfies angler desires for a trophy fishery. Maintaining a target year class strength ensures that there are fish entering the recreational fishery on a regular basis. Though not meeting these objectives is not an indicator of over exploitation by itself, meeting these objectives certainly indicates a healthy population with good abundance of walleyes, robust spawning stock biomass, and consistent recruitment.

Objectives

1. Maintain a gillnet catch rate of at least 14 walleye per net on a 3-year moving average.

2. Maintain a gillnet catch rate of walleyes greater than 20-inches TL between 1 and 2 walleye per net on a 3-year moving average.
3. Maintain a year class strength index of 0.76 on a 3-year moving average.

Fisheries Quality Strategies

Table 5. Fisheries management strategies associated with not meeting walleye fishery quality objectives.

Objective	Management Action
Maintain a gillnet catch rate of at least 14 walleye per net on a three-year moving average.	If a gillnet catch rate of at least 14 per net is not maintained, further analysis to determine the likely causes of the lower than desired walleye abundance will be conducted. The most appropriate and effective management action will be taken to address the issue. Status quo is a reasonable alternative.
Maintain a gillnet catch rate of walleyes greater than 20-inches TL between 1 and 1.8 walleye per net on a three-year moving average.	If a gillnet catch rate of 1-1.8 walleye per net is greater than 20" is not maintained, further analysis to determine the likely causes of the lower or higher than desired large walleye abundance will be conducted. The most appropriate and effective management action will be taken to address the issue. Status quo is a reasonable alternative.
Maintain a year class strength index of 0.67 on a three-year moving average	Because the DNR has little influence on walleye year class strength unless declines are related to decreased spawning stock biomass, not meeting this objective will result in continued monitoring of year class strength and further analysis of likely causes will be conducted. If the issue is persistent, a management action may be necessary to address the resulting lower abundance of walleyes.

Sauger

Species Goal

To support a harvest-oriented fishery that is self-sustaining.

Fisheries Sustainability Objectives

Over-exploitation of the Lake of the Woods sauger population is a primary concern for fisheries managers. Because of this concern, BPIs were developed to detect potential over exploitation. Additionally, the historic harvest threshold for sauger of 250,000 pounds was exceeded 17 of 19 years between 2005 and 2023 without measurable impacts to sauger population dynamics. For this reason, an analysis to update the safe harvest threshold was conducted using an exploitation rate instead of pounds of harvest to account for the highly variable nature of sauger abundance. Detailed

descriptions of the development of BPIs and the establishment of a harvest threshold can be found in Nelson and Skoog (2024). These BPIs include population characteristics that describe growth, mortality, and recruitment and are calculated annually and examined in relation to the thresholds based on three-year moving averages, which provide an objective method of monitoring the health of the population. The harvest threshold is examined on a six-year moving average.

Objectives

1. Meet at least four BPI thresholds and at least one BPI threshold from each population metric category on a three-year moving average (Table 6).
2. Meet each BPI threshold at least one out of three consecutive years (Table 6).
3. Sustain sauger exploitation at or below 0.25 on a three-year moving average.

Table 6. Sauger BPI Parameters and thresholds for assessing sauger Fisheries Sustainability Objectives 1 and 2.

BPI Parameter	Population Metric	BPI Threshold	Current 3-Year Average	10-Year Trend	Data Source
Mean relative weight	Growth	≤91	86.9	Decreasing	Fall Gillnetting (1991-present)
Female age at 50% maturity	Growth	≥3.0	3.3	Stable	Fall Gillnetting (1991-present)
Age diversity of mature females	Mortality	≥0.5	0.7	Increasing	Fall Gillnetting (1991-present)
Nearshore gillnet catch rate >14 inches	Mortality	≥0.9	1.2	Stable	Fall Gillnetting (1991-present)
Year-class strength	Recruitment	≥0.5	1.2	Stable	Fall Gillnetting (1991-present)
Abundance (near-shore gill net CPUE)	Recruitment	≥10	19.0	Stable	Fall Gillnetting (1991-present)

Fisheries Sustainability Strategies

Table 7. Management actions associated with not meeting sauger fishery sustainability objectives.

Objective	**Management Action**
Meet at least four BPI thresholds and at least one BPI threshold from each Population Metric category on a three-year moving average (Table 6).	If the sauger population is showing signs of biological stress as indicated by not meeting at least four BPI thresholds and not meeting at least one threshold from each population metric category, the problem will be defined, and potential alternatives will be evaluated. The most appropriate and effective management action will be taken.
Meet each BPI threshold at least one out of three consecutive years (Table 6).	If the sauger population is showing signs of biological stress as indicated failing to meet a BPI threshold for at least one out of three consecutive years, the problem will be defined, and potential alternatives will be evaluated. The most appropriate and effective management action will be taken.
Fail to sustain sauger exploitation at or below 0.25 on a three-year moving average. AND The sauger population shows signs of significant stress as defined by one or both BPI objectives.	Immediate regulatory action may include proposing the closure of the sauger fishery on the statewide closure date, separating the walleye and sauger bag limits, and implementing a 14-inch maximum length limit to stabilize spawning stock biomass. If these actions fail to return the sauger population to "meeting objectives" status within five years, other management alternatives will be considered.

Fisheries Quality Objectives

Maintaining a target catch rate ensures that anglers can have a reasonable expectation to catch sauger if they are targeting them. Maintaining a year class strength ensures that saugers are entering the recreational fishery on a regular basis.

Objectives

1. Maintain a gillnet catch rate of at least 16 sauger per net on a three-year moving average.
2. Maintain a year-class strength index of at least 0.78 on a three-year moving average.

Fisheries Quality Strategies

Table 8. Management actions associated with not meeting sauger Fisheries Quality Objectives.

Objective	Management Action
Maintain a gillnet catch rate of at least 16 sauger per net on a three-year moving average.	If a gillnet catch rate of at least 16 per net is not maintained, further analysis to determine the likely causes of the lower than desired sauger abundance will be conducted. The most appropriate and effective management action will be taken. Status quo is a reasonable alternative.
Maintain a year class strength index of 0.78 on a three-year moving average.	Because we have little influence on sauger year class strength, unless declines are related to decreased spawning stock biomass, not meeting this objective will result in continued monitoring of year class strength and further analysis of likely causes will be conducted. If the issue is persistent, management action may be necessary to address the resulting lower abundance of sauger.

Northern Pike

Species Goal

To maintain the high-quality trophy opportunity that northern pike provide to anglers while allowing for moderate harvest. Anglers have defined a “trophy” northern pike as a fish exceeding 40 inches.

Fisheries Quality Objectives

Objectives Overview

Northern pike in Lake of the Woods are primarily managed as a “trophy” opportunity. Maintaining the fisheries quality objectives confirms that a trophy northern pike fishery continues to exist in Lake of the Woods.

Objectives

1. Maintain an average female northern pike RSD-36 greater than 7% and RSD-40 greater than 2% at three out of five sites.
2. Maintain an average RSD-30 for all northern pike between 30-40% at three out of five sites.

Fisheries Quality Strategies

Table 9. Management actions associated with not meeting northern pike fishery quality objectives.

Objective	Management Action
Maintain an average female northern pike RSD-36 greater than 7% and RSD-40 greater than 2% at three out of five sites.	Failing to meet this objective suggests that the quality of the size structure is declining. Further analysis of likely causes of size structure decline will be conducted. The most appropriate and effective management action will be taken to address the issue. Status quo is a reasonable alternative.
Maintain an average RSD-30 for all northern pike between 30-40% at three out of five sites.	Failing to meet this objective suggests that the quality of the size structure is declining. Further analysis of likely causes of size structure decline will be conducted. The most appropriate and effective management action will be taken to address the issue. Status quo is a reasonable alternative.

Lake Sturgeon

Species Goal

To allow recovery to continue while allowing for catch-and-release opportunities and some limited harvest.

Long-Term Recovery Objectives

The lake sturgeon objectives are indicators of a fully recovered population and are set by Talmage et al. (2009). These objectives are not intended to be met on an annual basis, but instead are to be used to determine if the population is fully recovered. Maintenance of the catch-and-release season and limited highly regulated harvest currently meets the social needs of Lake of the Woods and Rainy River lake sturgeon anglers.

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. Minimum of forty year classes present
5. Support harvest at 0.036 lb. / ac of available habitat

Goal 2- Protect and enhance valuable habitats and resource access within Lake of the Woods

Overview

Aquatic habitat in Lake of the Woods is in generally good condition. Connections to Lake of the Woods and the Lake of the Woods watershed support the long-term sustainability of fish populations that enable a healthy fishery. The following objectives and strategies aim to protect or enhance the resource condition of Lake of the Woods and provide resource access for a variety of stakeholders and users.

Objective 2A: Participate in processes and project teams that influence habitat, water quality, and hydrology on Lake of the Woods and provide timely and relevant information to partners to support decision-making processes for habitat protection, restoration, and enhancement projects.

Strategies:

1. **Continue to support shoreline protection projects:** Shoreline projects will be evaluated in coordination with local governments to ensure that projects are either improving or protecting shoreline and habitat conditions. This will include a thorough investigation of the need for a shoreline protection or restoration project including special consideration of anything that might disrupt nearshore drift, especially in the highly erodible shores of Big Traverse and Muskeg Bays. This will require working closely with Lake of the Woods Soil and Water Conservation District to explore all alternatives especially for any project involving the barrier islands (Pine and Curry).
2. **Continue to support watershed level protection, restoration, and enhancement projects:** Projects within the Lake of the Woods watershed will be evaluated either through permitting or as part of a project team. Projects will be evaluated on their potential to protect or enhance habitat conditions in Lake of the Woods and in the watershed. This also includes participation in assessment and prioritization efforts such as part of the One Watershed One Plan and Watershed Restoration and Protection Strategies processes.
3. **Participate in the International Joint Commission (IJC):** Area staff will participate in IJC processes and projects that are relevant to Lake of the Woods and tributaries. The IJC was formed under the authority of Article VII of the Boundary Waters Treaty of 1909. The IJC primarily works on water level management and water quality issues on Lake of the Woods. The Baudette area fisheries supervisor is a member of the Adaptive Management Committee under the International Rainy-Lake of the Woods Watershed Board.
4. **Support “Keep it Clean” efforts:** Staff will participate in and support “Keep It Clean” initiatives on Lake of the Woods as long as the activities are not counter to the goals and objectives of MNDNR fisheries. “Keep it Clean” is a grassroots organization that was formed to address the issue of trash left on the ice related to increased recreational ice usage. The local group is led by the Lake of the Woods and Roseau County Soil and Water Conservation Districts.

Objective 2B: Provide timely review of applications for permits while carefully considering potential impacts of issuing the permit.

Strategies:

1. **Perform environmental review for proposed projects and development:** All permit applications will be reviewed to ensure rules and regulations are being met, and the best conservation practice is being opted for. This will include reviewing permits promptly and coordinating responses with the area hydrologist through the Minnesota Water Permitting and Reporting system (MPARS). Special consideration will be given to any project that may disrupt long-shore drift of sand, especially along the highly erodible shorelines of Big Traverse and Muskeg Bays.
2. **Implement best practices for fishing tournaments:** 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-release (CPR) format to reduce stress and mortality rate.

Objective 2C: Conduct AIS monitoring and share the results with partners in a timely fashion to inform AIS spread prevention efforts annually.

Strategies:

1. **Support aquatic invasive species "Stop the Spread" prevention program:** Staff will also support "Stop the Spread", watercraft inspection, and "Clean, Drain, Dry" initiatives to help prevent the spread of invasive species. Additionally, monitoring of and for invasive species will continue. The local effort is led by the Lake of the Woods and Roseau County Soil and Water Conservation Districts.

Objective 2D: Provide timely feedback and participate in (when asked) efforts to increase access to Lake of the Woods.

Strategies:

1. **Support increased public access to Lake of the Woods when feasible:** 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. DNR Fisheries will continue to support development of opportunities for public access, specifically those that would increase summer access and Americans with Disabilities Act compliant shore-fishing access.

Goal 3- Maintain or improve effective communication and coordination with other government interests and stakeholders regarding Lake of the Woods management.

A variety of government bodies and stakeholders have interest in receiving communications regarding Lake of the Woods fisheries issues and management. Timely communication with these stakeholders is essential for information-sharing and exchange to ensure effective fisheries management. LOWFIG recommended MNDNR improve communication regarding Lake of the Woods issues during the lake management planning process. External

communication with the public will enable realistic expectations for fisheries management, will be based on the best available science, and consider the multiple interests involved.

Objective 3A: Provide timely and relevant information to other government interests regarding Lake of the Woods Fisheries management to support decision making processes and to keep them informed about Lake of the Woods fisheries management activities, survey results, and fisheries.

Strategies:

1. **Continue formal coordination meetings:** Coordination with Red Lake Nation and Ontario will maintain status quo, as the current processes have been successful in recent years. Coordination meetings occur annually with Red Lake Nation and the Province of Ontario. The coordination meetings with Red Lake Nation are generally conducted at the region level or higher. Updates will be shared with the Red Lake Nation through Northwest tribal coordination meetings and via the input group which Red Lake Nation has a representative on. Coordination meetings with Ontario will continue to occur to share information about yield estimates, stock status, and potential regulation changes. This coordination will occur through the Ontario-Minnesota Fisheries Committee, which meets on an annual basis (typically in the spring: Chapman et al. 2024). Additional information sharing will occur at the biologist level as the need arises.

2. **Support informational meetings and presentations:** Information on stock status and trends can be shared formally with county commissioners at county board meetings upon request of the county board.

3. **Support project-specific communication and meetings:** Area staff regularly participate in project teams addressing specific issues with representatives of other interested parties. Most often these projects are partnerships with Lake of the Woods Soil and Water Conservation District, Minnesota Pollution Control Agency, or representatives from other local and state government agencies. Some of the projects that fall into this category include projects listed under Goal 2.

4. **Continue to work with the Lake of the Woods Fisheries Input Group:** LOWFIG includes representation from Red Lake Nation, Lake of the Woods, and Roseau Counties. Government representatives on LOWFIG serve the interests of their respective bodies and utilize the information discussed in LOWFIG meetings in their work.

Objective 3B: Provide stakeholders timely and relevant information regarding Lake of the Woods fisheries management activities, survey results, angling information (e.g., regulation information), and fisheries biology information that may be of general interest to stakeholders.

Strategies:

1. **Continue to work with the Lake of the Woods Fisheries Input Group:** Annual meetings will be held in March or April with the Lake of the Woods Fisheries Input Group to stay informed of Lake of the Woods issues and provide guidance on topics which come up during non-revision years. The goal of these meetings will be to update the group on stock status, short-term plans, and gather ideas or concerns.

2. **Develop statewide educational and interpretive materials:** Develop educational and interpretive materials (online and print) for use by DNR's Lake of the Woods staff, to explain the history of the lake's fishery, state and

cooperative management of the lake, current ecological and social trends, and how these issues influence current management. This includes updates to the Lake of the Woods fisheries website with up-to-date information that is relevant to stakeholders, as well as the creation of educational materials in text or video format. The topics of information will include:

- Seasonal Fishing Brochures-Spring and Winter
- Summary of Sampling Results (Stock-Status Update)
- Frequently Asked Questions
- Updated Management Plan

The area website may also include material that highlights:

- Research items of interest
- News from the Baudette Fisheries Area (Annual Area Newsletter)
- Results of special projects
- Overviews of specific monitoring programs
- Overview/information on other relevant topics

3. **Provide information to external media:** Provide timely communication and information to external media when requested or initiated by DNR fisheries. Media outlets include the Northern Light Region as the primary local outlet for fisheries information, as well as the Grand Forks Herald and Star Tribune for issues of regional or statewide importance. Communication with other media outlets will occur when requested.

4. **Utilize social media channels to distribute relevant information:** Distribute relevant information regarding Lake of the Woods fisheries issues or management through social media channels, including DNR news releases, DNR GovDelivery fisheries newsletters, and DNR fish-related social media channels. Additionally, information can be distributed using popular channels outside of the DNR, including Lake of the Woods Tourism Bureau's social media pages to broaden the reach of communication efforts. Communication through the various social media channels will link the reader to the Baudette Fisheries Area webpage and Lake of the Woods page to connect information across multiple platforms.

5. **Support stakeholder meetings:** When requested, meet with additional stakeholder groups, including South Shore and Northwest Angle Resort meetings, local school groups, 4-H, conservation groups, local business groups, and other special interest groups.

6. **Support informal communication:** Engage in informal communication with stakeholders and the public through in-person interactions, and phone calls or emails to the Baudette fisheries office. This communication provides an opportunity to share information directly with individuals interested in fisheries management and listen to perspectives and concerns about Lake of the Woods fisheries issues.

Operational Plan Detail

Stocking

No stocking is proposed for any reason during the life of this plan.

Regulation Change

Walleye

There are no proposed changes to walleye management to be implemented at the beginning of this plan. Ongoing evaluation will continue throughout the life of this plan.

Sauger

There are no proposed changes to sauger management to be implemented at the beginning of this plan. Ongoing evaluation will continue throughout the life of this plan.

Northern Pike

Consensus of the LOWFIG membership recommended increased harvest opportunity for northern pike either through an increase in the bag limit or alteration to the protected slot, as long as such a change would not be detrimental to the current status of the trophy northern pike fishery. Currently, no such analysis has been completed, but the DNR plans to conduct an analysis in the future. During the life of this plan, changes to the northern pike regulations may occur to expand harvest opportunity if there is little risk to the trophy northern pike fishery and there is strong social support for such a regulation change.

Lake Sturgeon

There are no proposed changes to lake sturgeon management to be implemented at the beginning of this plan. Any changes to lake sturgeon management will be made through the lake sturgeon recovery planning process. LOWFIG membership recommended increased harvest opportunity if it can be expanded without risk to the lake sturgeon population. A desire was also expressed for simplification of the lake sturgeon seasons. Examination of the possibility of such a change will be completed through the lake sturgeon recovery planning process, not through the Lake of the Woods management planning process.

General Angling Regulations

No regulation changes to general angling regulations are proposed currently.

Surveys and Evaluations

A variety of annual and intermittent sampling programs will be conducted to monitor fish populations, angler usage, zooplankton, and water quality which will be used to guide management decisions. Most of the Lake of the Woods

sampling program is based on the Large Lake Sampling guide (Wingate and Schupp 1984). Most other sampling protocols follow standard fisheries techniques or other protocols described in the scientific literature. Data collected through these programs shed light on the drivers of change in the lake. Additionally special monitoring or research projects can and will be designed and conducted as the need to answer questions that cannot be answered with standard monitoring arises.

Annual Assessments and Surveys

Spring Walleye Run Sampling

This survey will be conducted annually at the Long Sault Rapids of the Rainy River in the spring when water temperatures are approximately 45°F via boat pulsed DC electrofishing (60 pps). Data collected will include length, gender, and stage of maturity from all walleye. Primary metrics calculated will be size diversity of walleye spawning stock by gender and proportional catch of females greater than 28-inches (one of the BPI Metrics).

Young-of-year percid sampling

This survey will be conducted annually to monitor abundance and growth of age-0 percids to predict year class strength. This survey follows the protocols from the Large Lake Sampling Guide (Wingate and Schupp 1984) and uses three distinct components. The first component of the young-of-year percid sampling program will be beach seining (arcs) with a 100-foot bag seine. Seining will be conducted in two non-consecutive weeks in July at eight sites located in Big Traverse (five sites) Muskeg (one site), and Little Traverse (two sites) depending on lake water levels. The second component is trawling in August for four consecutive weeks at two sites in Big Traverse and two sites in Muskeg. The final component is pulsed DC boat electrofishing (60 pps), which will be conducted from the end of September through end of October in Big Traverse and Fourmile Bays as conditions allow until 100 young of year walleye are collected or conditions are not favorable for electrofishing. All fish will be identified to species, identified as YOY or 1+, measured, and weighed. Extremely large catches may be subsampled following standard subsampling techniques. Primary metrics calculated will include predicted year class strength and relative abundance of forage species.

Fall Gillnet Sampling

Fall gill netting will be conducted annually at 64 (52 near-shore and 12 off-shore sets) sites with overnight sets beginning the day after Labor Day using standard experimental gillnets following the protocols in the Large Lake Sampling Guide (Wingate and Schupp 1984). All fish will be identified, measured, and weighed. Gender and stage of maturity will be documented in all walleye, sauger, yellow perch, black crappie, northern pike, tullibee, and lake whitefish. Otoliths for aging will be collected from a subset of walleye, sauger, yellow perch, black crappie, tullibee, and lake whitefish. Aging structures from northern pike may be collected. A variety of metrics and biological performance indicators (Gangl 2001; Nelson and Skoog 2024) will be examined using this data including catch rates, growth, relative abundance, age at maturity, length at maturity, age diversity, size structure, age structure, condition, year class strength, and size diversity. Additional data (e.g. stomach contents) may be collected as the need arises.

Spawning Lake Sturgeon Tagging

This survey will be conducted annually at the Long Sault Rapids in conjunction with lake sturgeon egg take operations in the spring. Timing of this survey will be based on water temperature and presence of lake sturgeon following the protocols of Nelson (2018). Additionally, all lake sturgeon will be PIT tagged and individuals greater than 600 mm will be tagged with a Carlin dangler tag. More sampling at other locations such as Clementson Rapids may also occur once egg

take operations are complete. This survey will be used to examine size structure and sex ratio of spawning runs. Periodicity may also be examined.

Adult Lake Sturgeon Sampling

This is a multi-year survey in which a portion of Lake of the Woods/Rainy River will be sampled each year in June-August (Lake of the Woods) or August-October (Rainy River) with a full rotation to be completed within eight years. Adult lake sturgeon will be sampled using large mesh (4-7-inch mesh) gill nets and tagged (Carlin dangler and PIT), length will be recorded, weight and girth will be measured on exceptionally large fish, and pectoral spines will be taken for all sub-adult lake sturgeon in accordance with the methods described in Nelson (2021). This survey will be used to examine relative abundance, distribution, size structure, and growth of lake sturgeon in the Lake of the Woods/Rainy River population.

Juvenile Lake Sturgeon Sampling

This survey will occur annually in August or October in the Rainy River depending on river conditions. Using experimental and 2.5-inch gill nets. All lake sturgeon will receive a PIT tag. Additionally, lake sturgeon greater than 600 mm will receive a Carlin dangler tag. All fish lengths will be recorded. Pectoral Spines will be taken from all sub-adult lake sturgeon. This survey will be used to monitor relative abundance, tag subadults, and identify critical juvenile habitat.

Zooplankton Sampling

Three sites (Zippel, Long Point, Muskeg) will be sampled (i.e., vertical plankton tows) twice monthly from the beginning of June through September. Data will be used to track trends in zooplankton community structure, abundance of native, and abundance of invasive zooplankton species.

Winter South Shore Creel Survey

The south shore winter creel survey will be conducted annually. This complete trip, random, stratified access based survey will be conducted from mid-December through the end of March using the methods described in Nelson (2023). This survey will be used to estimate pressure and harvest for Big Traverse and Muskeg bays during the winter fishing season.

Water Quality Sampling

Water quality will be sampled annually at four sites (Fourmile, Zippel, Long Point, Muskeg) in Lake of the Woods in July. Basic water quality parameters will be measured for long-term monitoring purposes. Additionally, calcium concentrations will be measured. Samples will be processed by the Minnesota Department of Agriculture lab in St. Paul.

Intermittent Assessments and Surveys

Ice-out Northern Pike Trapnetting

This is a multi-year survey in which at least five tributaries (Warroad River, Zippel Bay, Bostic Bay, Winter Road River, and Baudette River will be sampled at once every five years. If all of the primary locations are sampled prior to the completion of the five-year evaluation window, additional sites may be added at the discretion of the area fisheries supervisor. Each year, one to two of these tributaries will be sampled immediately after ice-out using ¾ -inch double

frame trapnets. All northern pike will be measured, and gender and stage of maturity will be determined. Primary metrics calculated will include female RSD-36, Female RSD-40, and RSD-30.

Rainy River Spring Pressure Estimate

The Rainy River spring pressure estimate will be conducted a minimum of two out of four years on the same schedule as the summer south shore creel survey. If time allows, this survey may be conducted up to annually. This survey will be conducted following the methods described in Wolf (2022). The purpose of this survey is to estimate fishing pressure on the Rainy River during the spring catch and release walleye season.

Summer South Shore Creel Survey

The summer south shore creel survey will be conducted on a 2 out of 4 year schedule (back-to-back years) using a complete trip, random stratified access-based design following the methods described in Nelson (2020). The next summer creel with be during the open water of 2026. This survey will be used to estimate pressure and harvest for Big Traverse and Muskeg bays during the summer fishing season.

Rainy River Fall Creel Survey

The Rainy River fall creel survey will be conducted on a 2 out of 4-year schedule in the fall immediately following the summer south shore creel survey. The fall creel survey will be conducted in October and the first half of November using a roving design with sector counts following the methods of Skoog (2023). The purpose of the fall creel survey is to estimate pressure and harvest on the Rainy River during the fall walleye run.

Unscheduled Surveys and Evaluations

These are surveys or assessments that are not part of the regularly scheduled monitoring at this time due to lack of funding, difficult logistics, low priority, and/or monitoring design needs. They may become annual or intermittently scheduled surveys during the life of this plan. Additional unscheduled surveys and evaluations may be considered as the need arises.

Assessment of Lake Sturgeon Long-term Recovery Goals

This is a high priority project to be completed around 2030. This project will use data collected across a variety of projects to assess measurability and progress towards meeting long-term recovery goals and objectives for the Rainy River and Lake of the Woods lake sturgeon population. Outputs from the project will include a determination as to whether lake sturgeon have reached the long-term recovery goals and objectives. If recovery goals have been met, a lake sturgeon management plan will be created and implemented.

Adult Zebra Mussel Density Monitoring

Development of this monitoring program is high priority due to the recent finding of zebra mussel veligers in Lake of the Woods. The presence of adults has not yet been confirmed. At this time, no monitoring program design has been proposed, but this will be an ongoing, annually conducted, monitoring program once a design is developed.

Northwest Angle Summer Creel Survey

This survey will be conducted if there appears to be a change in angler behavior or if funding is available to conduct the survey. This survey starts on Memorial Day week and runs through September. This survey is a complete trip, random, stratified access based survey and will follow the methods discussed in Heinrich (2013).

Northwest Angle Winter Creel Survey

This survey will be conducted if funding is available and the logistics of this survey are able to be worked out. This survey has never been conducted, but would need to be a roving creel survey. It would be conducted from mid-December through the beginning of March.

Lower Rainy River Summer and Winter Creel Surveys

Both of these surveys would include a roving design similar to the Fall Rainy River creel survey. One or both of these surveys could be proposed if a need for information about the recreational fishery on the Rainy River in the summer or winter becomes a priority.

Targeted Northern Pike Creel Survey

Development of this survey is a high priority for examining the risk to expanding harvest opportunity for northern pike. Development of a design needs to be completed. Completing this survey would be a matter of starting the winter creel survey earlier, ending it later, and adding survey locations on the Rainy River and at Warroad during these early and later time periods. This survey should be added as a component of the winter creel survey. This survey should also include a question(s) gauging angler desire for expanded northern pike harvest opportunity.

Research Needs

At the time of management plan creation, these are the priority research needs for Lake of the Woods. The priority of research needs is subject to change throughout the life of this plan. This list is not in order of priority. Additional research needs may be added as appropriate.

Ice fishing Walleye and Sauger Post-release Mortality

A study examining the effects of depth, species (walleye vs sauger), length, and method of fishing (active vs passive) has been proposed. Additionally, the efficacy of descender devices in reducing post-release mortality is included in the proposed study. Knowing the effects of depth, species, and size will improve the DNR's ability to predict the effects of increased ice fishing pressure on the walleye and sauger populations in Lake of the Woods. In recent years, there has been a slight divergence between predicted year class strength and observed year class strength based on gill net catch rates (walleye age 1 to 2 CPUE). One possible cause of this divergence is increased post-release mortality of small walleyes and saugers with increased fishing pressure. If this divergence is driven by post-release mortality of small fish, this likely means that the DNR's ability to predict year class strength is impaired. Additionally, this information would be informative when examining implementation of a change to the size restrictions for walleye or sauger. The ability to examine size specific post-release mortality would be informative as to whether a proposed length regulation's effectiveness would be significantly influenced by post-release mortality. The knowledge of factors affecting post-release mortality would also lend a scientific basis to any educational messaging put forward to anglers who are concerned, such as recommending/not recommending or requiring descender devices in deeper water. The

prioritization of fisheries information needs was completed in September 2023. This project ranked as priority high-moderate and difficulty of moderate-difficult (Schmalz et al. 2023).

Rainy River Lake Sturgeon Critical Habitat and Movement

This project started with receiver array placement and tag implantation in May 2024. Data collection and receiver array maintenance will continue until October 2029. Final reporting would be due at the federal aid reporting deadline in summer of 2030 in time for use during the review of the lake sturgeon recovery plan for Rainy River and Lake of the Woods. Progress reports will be submitted annually. This project will examine seasonally critical habitat and seasonal movements of juvenile and adult lake sturgeon in the Rainy River and major tributaries (Rapid, Little Fork, Big Fork) and Lake of the Woods using a combination of active and passive acoustic telemetry. Existing data will be used to examine the effects of various abiotic factors such as depth, substrate, discharge, and water temperature.

Angler desire for and risks to the trophy northern pike fishery with expanded harvest opportunity through regulation change

Consensus of the LOWFIG membership recommended increased harvest opportunity for northern pike either through a bag limit increase or alteration to the protected slot as long as it would not be detrimental to the current status of the northern pike trophy fishery. Angler desire for expanded northern pike harvest opportunities has not been quantified nor have the risks to the trophy fishery that northern pike support. This study likely would use existing data, add targeted surveys of northern pike ice anglers to quantify harvest, and include a broader angler survey. The objectives of this survey would be to quantify current northern pike harvest and desire for more harvest opportunity, examine potential risks associated with changing regulations to allow for more harvest, and examine the social acceptability of various alternatives. Options examined should include status quo, increased bag limit, changes to the protected slot limit, and a combination of expanded bag limit and changes to the protected slot. The specific details of how this study would be completed are still to be determined.

Plan Review and Revision Schedule

The maximum life of this plan is ten years. The full review and revision process should begin in 2034 with a target completion of 2035. Though the maximum life of this plan is ten years, if necessary the review and revision process can be instituted prior to 2034. Five years (2030) after completion of this plan, internal review of the plan should be conducted. A full review and revision cycle will be conducted if major revisions are needed after completion of the five-year review.

Approvals

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Baudette Area Fisheries Supervisor

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Northwest Region Fisheries Manager

1 Fisheries Section Manager

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Appendices

Appendix 1. Glossary of Fisheries Terms

Abundance: Biomass (such as total pounds or pounds per acre) or numbers of individuals in a population, a part of the population (such as year class), or a sample (fish/net).

Angler catch rate: the rate fish are caught. Includes fish that are kept and released by anglers per hour spent fishing.

Angler harvest rate: the rate fish are harvested (released fish not counted) by anglers per hour spent fishing.

Angler-hour: One hour of fishing by a single angler.

Aquatic invasive species: A species of plant or animal that is not native to a body of water.

Barotrauma: Injury to a fish due to a change in pressure related to a change in depth.

Benthic: Plants or animals that live on the bottom of a water body.

Bias: Something that results in the sample not reflecting the entire population

Biomass: The aggregate weight of a given group of organisms.

Biological performance indicator (BPI): A biological parameter used to assess the health of a fish population.

Catch per unit effort (CPE or CPUE; catch rate): the average or number of fish caught per unit of effort.

Carrying capacity: The average maximum number, or weight, of an organism that an environment can sustain.

Commercial fishery: A fishery in which fish are caught for sale.

Condition factor: A ratio relating fish length to fish weight and measuring the relative plumpness of a fish.

Creel survey: A survey used to estimate fish harvest and kill, angler catch rates and pressure.

Detritus: Nonliving material.

Electrofishing: The use of electricity to capture fish.

Exploitation: Removal of fish from a population by humans.

Fingerling: Young-of-year walleye ranging in size from 5-8 inches long, depending on month sampled and summer growing conditions.

Fishery: The use and exploitation of a fish population by humans, the habitat in which they exist, and other species that live there.

Fishing mortality: Death of a fish caused by angling or exploitation.

Fishing pressure: Total number of angler-hours spent fishing over a specified period.

Fry: The larval stage of fish. Walleye are typically referred to as fry until they absorb their yolk sack and start to feed.

Food web: The way energy (in terms of food) moves through organisms.

Gill net: A net resembling a volleyball net that captures fish by entanglement.

Growth rate: The per unit time increase in length (inches/year), weight (pounds/year), number of individuals, or biomass.

Harvest: Fish that are caught and taken home by anglers.

Index: A value or quantity. Since biologists cannot drain a lake and count all the fish in it, they use catch rates (e.g., gillnet catch rates) to index the relative abundance of the population. That is, a change in the relative abundance of an animal is assumed to be similarly reflected by a change in the catch rate of that animal.

Juvenile: Fish that have survived their first winter but are not sexually mature and not yet able to contribute to reproduction. Recruitment refers to young –of-year fish that survived their first winter and are entering the population as juveniles.

Kill: Fish that are caught and taken home, as well as those that are released, but are estimated to have died from hooking mortality.

Littoral area: The area of the lake where water depth is less than 15 feet. This is a surrogate measure of lake productivity; this is where vegetation, insects, and small fish (prey) are most abundant in lakes.

Managed species: A species of fish for which the population is actively monitored, and specific management actions (in addition to standard border water regulations) are implemented.

Median: The value at which half of the observations in a data set are greater, and half of the observations are lower.

Mortality: The rate at which fish die. Can also be expressed as a percentage of the fish that were in the population at the beginning of a period that remain in the population.

Natural mortality: Death of a fish not related to angling or exploitation.

Parameter: A characteristic of a population.

Percid: A member of the family percidae; in Lake of the Woods this is primarily in reference to walleye, sauger, and yellow perch.

Planktonic/plankton: Referring to plants (phytoplankton) or animals (zooplankton) that are suspended, or primarily move through, the water column, rather than living on the bottom. Zooplankton are planktonic animals, while phytoplankton are planktonic plants.

Population: All individuals of the same species within a defined geographic location at a given time.

Population dynamics: The interactions of recruitment, growth, and mortality that determine the abundance, age structure, and sizes of individuals in a population. Because recruitment (number of young fish entering population), growth, and mortality (rate individuals die) are constantly occurring, populations are constantly changing.

Population estimate: An estimate of the actual number of fish in a population.

Population structure: The proportional distribution of sizes, ages, or genders in a population resulting from the processes of recruitment, growth, and mortality.

Pressure: Total number of angler-hours spent fishing over a specified time period.

Production: The amount of total biomass, or fish, that can be produced in a body of water, typically expressed in weight.

Otolith: Bony inner ear structures of fish formed from layers of calcium carbonate that are used for balance and orientation, just like the inner ear of people. These bony structures are used for assigning fish age.

Recreational fishery: A fishery in which fish are caught for pleasure, not for sale.

Recruitment: The number of fish surviving to a defined size or age.

Release mortality (hooking mortality): Death resulting from angling not due to harvest.

Sampling: Collecting information about a subset of individuals in a population.

Secchi depth: A measure of water clarity using a Secchi disk. Secchi depth is measured by lowering a Secchi disk into the water and observing when it is no longer visible. It is an indication of how deep light can penetrate into the water.

Secchi disk: A 8-inch diameter disk that is divided into quadrants, with the quadrants painted alternately painted black and white.

Seining: Sampling using a seine, which is a net that is pulled through shallow water to capture fish near to the shore.

Selectivity: The ability of a gear to catch a certain size or kind of fish relative to its ability to catch other sizes or kinds.

Size selectivity: Relative over- or underrepresentation of specific sizes (lengths) of fish or other animals in a sample taken with a particular gear.

Spawner/spawning stock biomass: The aggregate weight of mature female walleyes in the population.

Stable/stability: A population that is neither increasing nor decreasing over the long term It does not mean the population is the same every year, just that there are not long-term trends in abundance.

Standardized sampling: Sampling conducted in a prescribed manner that defines conditions such as specific gear, methods of operation, timing, and location. Standardized sampling reduces the amount of variability (noise) in data that could be attributed to infrequent changes in sampling methods.

Sustainable Management: Managing to maintain naturally reproducing fish populations which can sustain the regulatorily allowed harvest without experiencing population collapse.

Trawl: A pocket-shaped net that is towed through the water by a boat; like seining except in deeper water.

Year class: The fish born in a certain year.

Year class strength: The relative abundance of a year class.

Young-of-year (YOY, age-0): A fish that has not reached its first birthday (January 1). Fry, fryling, and fingerling all refer to general size groupings of YOY fish.

Appendix 2. Summary of the Public Input Process

To inform this plan, the DNR requested input to identify the interests of various stakeholders of the fishery. In total, over 1,200 individuals provided input through the online scoping survey (Haberman 2024), boat ramp survey, and stakeholder meetings. Opportunities to provide input on the plan were communicated in a variety of ways, including the DNR website, social media and GovDelivery newsletters, and local media. A summary of input methods is below.

Boat ramp surveys: Lake of the Woods area fisheries staff engaged anglers at the Warroad and Wheeler's Point public boat ramps in the summer of 2023 to collect input on the current status of the lake, future directions for the fishery, issues and concerns, and proposed regulation changes.

Stakeholder meetings: Three stakeholder meetings were held with external stakeholder groups and local and international government bodies to provide background on the planning process and issues the plan would address, an opportunity to ask questions and discuss their perspectives, and options to provide input. One meeting was held with Lake of the Woods resort owners, where participants shared concerns related to winter pressure and suggestions for regulation changes. One meeting was held with Lake of the Woods County board members and another with the Ontario Ministry of Forestry and Natural Resources.

Online scoping survey: A survey was developed to gather input on issues or concerns with the Lake of the Woods fishery, angler values, and preferences for fisheries management. The survey was open from February 12, 2024 through March 15, 2024. Through the DNR website, press releases, social media, e-newsletters, and local media, individuals with an interest in the management of Lake of the Woods were encouraged to participate and provide input (Haberman 2024).

Tailored outreach: DNR staff also held a number of informal conversations in the community, at businesses, and the Baudette Fisheries Office. Finally, as management goals were developed, they were presented to the Lake of the Woods Fisheries Input Group for comment.

Tribal coordination (2023 – 2024)

Plan input: DNR staff met with fisheries and planning staff from the Red Lake Nation in 2024 to discuss the lake management planning process.

Draft plan review: The draft plan was provided to LOWFIG, Red Lake Nation, and the Ontario Ministry of Natural resources for comment in December 2024.

Draft plan public review (2024)

Comments that resulted in plan changes or additions:

Comments that were outside the scope of the plan or did not result in changes:

Appendix 3. Angler pressure and walleye harvest, by weight (pounds), 1981-2024. Minnesota waters of Lake of the Woods summer south shore, Lake of the Woods winter south shore, spring Rainy River, fall Rainy River, and summer Northwest Angle creel surveys. For winter surveys the year of the survey is the year in which the survey ended. Winter creel surveys start in December and are completed in March. Dashed lines represent years for which data were not collected or have not been summarized by publication. note: LOW is Lake of the Woods, RR is Rainy River, and NWA is Northwest Angle.

	Summer LOW Pressure	Summer LOW Harvest	Winter LOW Pressure	Winter LOW Harvest	Spring RR Pressure	Spring RR Harvest	Fall RR Pressure	Fall RR Harvest	Summer NWA Pressure	Summer NWA Harvest
1981	321,124	109,861	---	---	---	---	---	---	---	---
1982	552,575	205,658	---	---	---	---	---	---	---	---
1983	421,974	156,462	401,467	37,618	---	---	---	---	---	---
1984	504,477	196,392	---	---	---	---	---	---	---	---
1985	846,989	257,415	---	---	---	---	---	---	---	---
1986	796,705	283,760	---	---	---	---	---	---	---	---
1987	721,944	201,769	---	---	---	---	---	---	---	---
1988	564,789	196,164	649,226	24,899	---	---	---	---	---	---
1989	628,230	239,357	---	---	---	---	61,301	38,613	---	---
1990	986,044	550,329	764,088	95,399	29,548	24,465	54,744	21,536	---	---
1991	904,081	387,363	925,682	73,314	42,895	20,791	---	---	---	---
1992	660,436	260,178	747,063	64,561	27,697	7,134	---	---	---	---
1993	787,416	220,347	741,322	50,900	33,978	4,462	---	---	---	---
1994	757,847	274,281	643,575	42,342	50,336	22,885	---	---	55,203	15,494
1995	662,934	272,872	502,712	16,105	62,799	26,608	---	---	64,288	24,855
1996	657,534	270,905	---	---	61,521	37,478	---	---	53,961	24,417
1997	846,370	358,526	---	---	32,097	3,545	53,446	16,427	---	---
1998	789,385	310,673	906,587	74,227	56,310	12,295	50,946	8,443	---	---
1999	638,634	288,321	960,853	134,893	52,613	986	74,603	38,072	---	---
2000	916,541	337,423	799,342	44,659	35,359	7,875	72,543	21,806	---	---
2001	745,983	411,425	1,196,923	137,464	40,853	9,369	---	---	---	---
2002	675,129	387,688	943,611	148,950	67,193	20,778	79,818	45,461	31,277	13,916
2003	809,994	382,387	1,559,161	402,464	76,736	15,648	70,548	26,026	---	---
2004	811,341	286,466	1,938,509	319,698	50,993	3,478	67,777	36,904	---	---
2005	792,835	278,763	1,542,822	272,150	45,021	7,893	88,196	37,736	---	---
2006	591,679	209,284	1,034,476	115,168	---	---	---	---	---	---
2007	593,861	220,712	1,453,530	304,970	---	---	---	---	14,397	5,105
2012	865,678	417,401	1,632,044	353,203	132,090	31,004	51,131	26,995	49,722	15,135
2013	833,344	298,196	1,963,605	173,674	74,534	12,497	46,265	18,441	---	---
2016	638,412	172,388	1,478,862	80,755	78,885	7,509	42,024	20,526	---	---
2017	---	---	2,047,408	349,657	151,725	20,190	---	---	---	---
2018	646,361	220,756	1,940,690	256,944	57,235	10,259	42,940	20,491	---	---
2019	759,389	272,571	2,102,782	368,819	46,053	---	33,459	14,652	---	---
2020	---	---	2,785,560	243,805	---	---	---	---	---	---
2021	---	---	2,723,055	215,089	117679	---	---	---	---	---
2022	674,276	171,956	2,627,299	161,577	49,351	---	56,215	15,306	---	---
2023	600,837	175,424	3,182,049	94,212	47,072	---	38,870	20,762	---	---
2024	---	---	1,049,413	75,539	---	---			---	---
	678,167	206,650	2,411,693	193,173	65,039	---	42,848	16,907	49,722	15,135

Appendix 4. Angler pressure and sauger harvest, by weight (pounds), 1981-2024. Minnesota waters of Lake of the Woods summer south shore, Lake of the Woods winter south shore, spring Rainy River, fall Rainy River, and summer Northwest Angle creel surveys. For winter surveys the year of the survey is the year in which the survey ended. Winter creel surveys start in December and are completed in March. Dashed lines represent years for which data were not collected or have not been summarized by publication. note: LOW is Lake of the Woods, RR is Rainy River, and NWA is Northwest Angle.

Year	Summer LOW Pressure	Summer LOW Harvest	Winter LOW Pressure	Winter LOW Harvest	Spring RR Pressure	Spring RR Harvest	Fall RR Pressure	Fall RR Harvest	Summer NWA Pressure	Summer NWA Harvest
1981	321,124	15,380	---	---	---	---	---	---	---	---
1982	552,575	16,493	---	---	---	---	---	---	---	---
1983	421,974	17,384	401,467	160,899	---	---	---	---	---	---
1984	504,477	15,672	---	---	---	---	---	---	---	---
1985	846,989	16,930	---	---	---	---	---	---	---	---
1986	796,705	35,377	---	---	---	---	---	---	---	---
1987	721,944	41,877	---	---	---	---	---	---	---	---
1988	564,789	40,090	649,226	231,359	---	---	---	---	---	---
1989	628,230	51,062	---	---	---	---	61,301	2,300	---	---
1990	986,044	60,073	764,088	239,051	29,548	484	54,744	2,104	---	---
1991	904,081	35,440	925,682	187,914	42,895	89	---	---	---	---
1992	660,436	28,318	747,063	85,367	27,697	40	---	---	---	---
1993	787,416	42,546	741,322	118,740	33,978	32	---	---	---	---
1994	757,847	36,914	643,575	80,536	50,336	258	---	---	55,203	860
1995	662,934	34,476	502,712	50,624	62,799	585	---	---	64,288	733
1996	657,534	17,422	---	---	61,521	496	---		53,961	376
1997	846,370	41,994	---	---	32,097	20	53,446	1,105	---	---
1998	789,385	47,643	906,587	202,070	56,310	709	50,946	3,267	---	---
1999	638,634	30,836	960,853	200,377	52,613	42	74,603	1,504	---	---
2000	916,541	34,148	799,342	77,297	35,359	172	72,543	1,086	---	---
2001	745,983	28,783	1,196,923	215,748	40,853	45	---	---	---	---
2002	675,129	22,380	943,611	162,519	67,193	33	79,818	1,177	31,277	119
2003	809,994	58,335	1,559,161	283,552	76,736	201	70,548	2,527	---	---
2004	811,341	38,762	1,938,509	485,931	50,993	52	67,777	839	---	---
2005	792,835	45,739	1,542,822	249,971	45,021	29	88,196	2,031	---	---
2006	591,679	33,136	1,034,476	70,948	---	---	---	---	---	---
2007	593,861	28,944	1,453,530	170,544	---	---	---	---	14,397	315
2012	865,678	110,573	1,632,044	369,769	132,090	1,193	51,131	1,499	49,722	1,036
2013	833,344	87,951	1,963,605	317,713	74,534	187	46,265	2,007	---	---
2016	638,412	57,643	1,478,862	280,022	78,885	777	42,024	3,087	---	---
2017	---	---	2,047,408	325,109	151,725	3,099	---	---	---	---
2018	646,361	66,583	1,940,690	278,799	57,235	83	42,940	1,921	---	---
2019	759,389	95,361	2,102,782	479,395	46,053	---	33,459	1,069	---	---
2020	---	---	2,785,560	461,240	---	---	---	---	---	---
2021	---	---	2,723,055	312,769	117679	---	---	---	---	---
2022	674,276	32,513	2,627,299	257,489	49,351	---	56,215	1,809	---	---
2023	600,837	44,390	3,182,049	121,094	47,072	---	38,870	5,307	---	---
2024	---	---	1,049,413	101,780	---	---	---	---	---	---
2018-2024	678,167	57,421	2,411,693	288,961	65,039	---	42,848	2,728	49,722	1,036

Appendix 5. Chronology of Minnesota-Ontario border water regulations.

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

- Walleye- Possession limit 8, Open Season Saturday Closest to May 15 until April 14 of following year
- Sauger- Possession limit 8, Open Season Saturday Closest to May 15 until April 14 of following year
- Lake sturgeon-Possession limit 1, 40" minimum length, open season July 1 until May 31 of following year
- Northern pike-Possession limit 3, Open Season Saturday Closest to May 15 until April 14 of following year
- Muskellunge-Possession limit 2, Open Season Saturday Closest to June 20 until October 1.
- Lake Trout- Possession limit 5, Open December 29 until September 25 of Following year.

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

2016 Walleye possession limit of eight (not more than four can be walleye). All walleye from 16-26” must be immediately released. One walleye over 26” allowed in possession on Rainy Lake (including the Rainy River above the dam at International Falls, all of Rainy Lake to the dam at Kettle Falls. Previously walleye from 17-28” must be immediately released with one walleye over 28” allowed in possession.

Walleye and sauger season closes on April 14. Previously, walleye and sauger season closed on April 14 except it closed on April 15 in years when April 14 was Saturday.

2019 Lake of the Woods (1 December – 14 April)-The walleye/sauger aggregate limit is six (not more than four can be walleye). Rainy River (1 March – 14 April)-walleye and sauger are catch and release only.

Appendix 6. Defining a problem worksheet.

Define the Problem							
Species affected							
Proposed causes of the Problem							
Relevant information							
Information Needs							
Is the problem perceived, measured, or both	Perceived		Both		Measured		Neither
Is it likely to develop into a measured problem?	Yes		No		NA		
Fishery sustainability or fishery quality problem?	Quality		Both		Sustainability		Neither
Effect Type	Individual	Both	Population	Unknown	None		
Vital Rate Impacted	Recruitment	Survival	Growth	Indirect	None		
What life stage(s) are being affected?	Egg	Larval	Young of Year	Juvenile	Adult	Unknown	None
Is the problem persistent or temporary?	Persistent		Unknown		Temporary	NA	
Is there a likely detrimental population level effect?	Yes		No		Unknown		

Appendix 7. Evaluating proposed management action alternatives worksheet.

Define the proposed management action alternative				
Solution Type	Regulation	Education	Habitat work	Stocking
Desired outcome from alternative?				
Vital Rate Addressed	recruitment	survival	growth	None/indirect
Is this alternative likely to have a population level effect?	Yes		No	
Why?				
Is this alternative likely to have the desired biological effect?	Yes		No	
Why?				
Is the effect likely to be measurable?	Yes		No	
Why?				
Level of Social Support	Low	Medium	High	
Supporting Information				
Social Support equitable to severity of problem and Solution?	Yes		No	
Economic impact	Negative	Neutral	Positive	
Supporting Information				
Other Alternatives Considered for this problem				
Recommended Action	Accept Alternative	Reject Alternative	Consider Other Alternatives	Further Research is needed