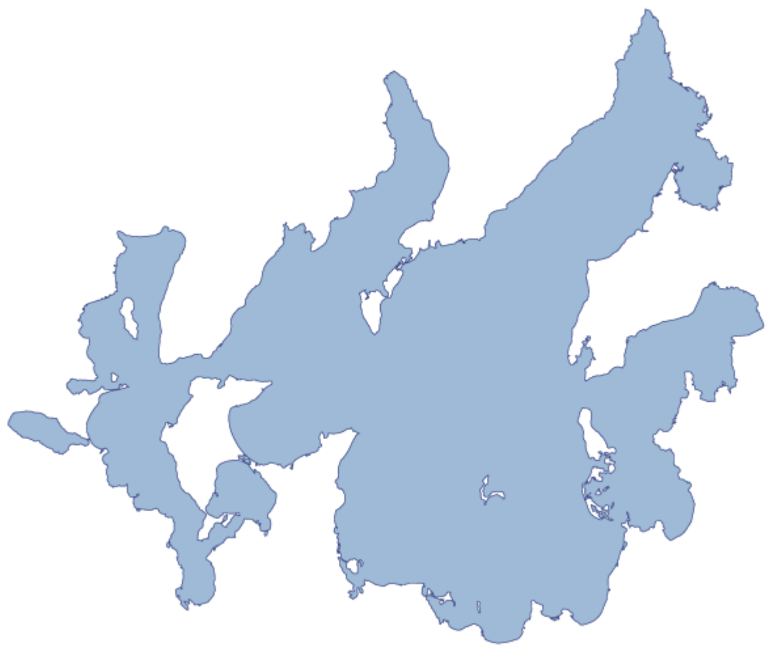
Fisheries Management Plan for Leech Lake

2026 – 2035



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Executive Summary

Leech Lake is a large lake located entirely within northern Cass County, Minnesota, within the Chippewa National Forest and Leech Lake Reservation. The Minnesota Department of Natural Resources (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 2026 – 2035 Leech Lake Management Plan include the designation of primary and secondary management species, updated sportfish objectives, and updated management actions. Primary management species in Leech Lake include walleye, yellow perch, and muskellunge. Secondary management species include northern pike, bluegill, and black crappie.

Plan Purpose

The purpose of this plan is to guide fisheries management on Leech Lake from 2026 – 2035. It is written for use by both the MN DNR and citizens that are interested in the management of the fishery resource including local, tribal, and state governments. This plan uses a fish community approach to fisheries management and serves as an extension of the 2021 – 2025 Leech Lake Management Plan. This plan will be evaluated and revised if necessary five years after adoption.

Background

Leech Lake supports the most diverse fishery of the eleven lakes monitored by the Large Lake Program. Over the last few decades, the Leech Lake fishery has experienced various changes and challenges with its fish populations and status. Declines in walleye and yellow perch populations during the early 2000s prompted the development of an evolving series of management objectives and actions with increased citizen involvement in the process for management plan development. Walleye and yellow perch populations recovered because of these management objectives, but yellow perch abundance declined again by 2012. The DNR has continued to implement management efforts to address the decline in forage, including cormorant control and the relaxation of walleye harvest regulations in 2019 to reduce predation pressure. Management actions outlined in this plan aim to strike a balance between the predator/prey relationships in the lake and refine objectives and actions related to muskellunge, northern pike, bluegill, black crappie, and several additional species (2025).

The DNR continues to co-manage Leech Lake with the Leech Lake Band of Ojibwe Division of Resource Management (LLBO DRM) and works with a group of stakeholders which comprise the Leech Lake Fisheries Input Group (LLFIG). This group provides diverse local and statewide perspectives and input on Leech Lake fisheries management. This plan builds upon the successes of, and knowledge gained from previous plans by recommending specific goals, objectives, and management actions aimed at preserving a high-quality, species-diverse fishery in Leech Lake. This plan provides an overview of Leech Lake's historical significance, water quality, fish community trends, angling pressure and harvest, management activities, fish habitat, aquatic invasive species (AIS), and climate change impacts. The DNR will continue to hold annual update meetings with LLFIG and other interested stakeholders to review the previous year's information and status with regards to the management plan. A weight of evidence approach will be used annually to assess if deviations from the management plan are necessary and appropriate.

Primary Management Species Goals, Objectives, and Actions

Walleye Goal:

Support a self-sustaining walleye population that balances harvest opportunity, with the opportunity to catch quality-sized fish.

Walleye Objectives:

Table 1. 2026 – 2035 walleye sportfish objectives.

Population Objectives	Target Range or Threshold (*3-year moving average)	Data Source
Abundance	*7 – 10 fish/gill net	Fall gill netting (1983 – present)
Reproductive Potential (mature female biomass)	*1.5 – 2.0 pounds/acre	Fall gill netting (1983 – present)
Female Length at 50% maturity	≥ 17.2 inches	Fall gill netting (1983 – present)
Recruitment (Year class strength)	4-year moving average ≥ 0.94	Fall gill netting (1983 – present) Summer trawling (1988 – present)
Targeting Summer Angler Catch Rate	≥ 0.3 fish/hour	Summer creel surveys (1991 – present, quadrennially)
Angler Harvest (annual)	130,000 – 190,000 lbs.	Creel surveys (1965 – present, quadrennially)
Condition (relative weight)	*81 – 85	Fall gill netting (1983 – present)

Walleye Actions:

1. If the 4-year moving average of year class strength index values falls below the 25th percentile (for the 1983 – 2024 time series), walleye fry stocking will be considered the following year. Fry will be marked with oxytetracycline (OTC) to evaluate stocking contribution. See Table 6 for additional stocking details.
2. If the mature female density estimate observed in a single year is below 1.25 pounds per acre or above 2.75 pounds per acre, a low-density fry stocking effort will be considered the following year. Fry will be marked with OTC to evaluate stocking contribution (contingent on yellow perch abundance).
3. Continue to refine young-of-the-year (YOY) predictors of potential walleye year class strength.
4. Continue evaluating effects of climate change and aquatic invasive species on walleye populations, specifically the length and intensity of the growing season and changes in phytoplankton and zooplankton following zebra mussel establishment.

Yellow Perch Goal:

Support a self-sustaining yellow perch population that provides both a stable prey base and harvest opportunities for anglers.

Yellow Perch Objectives:

Table 2. 2026 – 2035 yellow perch sportfish objectives.

Population Objectives	Target Range or Threshold (*3-year moving average)	Data Source
Abundance	*≥ 15 fish/gill net	Fall gill netting (1983 – present)
Size Structure	*≥ 8 inches should exceed 30%	Fall gill netting (1983 – present)
Female Length at 50% maturity	≥ 5.5 inches	Fall gill netting (1983 – present)
Recruitment (age-4)	*≥ 3.3 fish/net	Fall gill netting (1983 – present) Summer trawling (1988 – present)
Angler Harvest (annual)	< 98,000 lbs.	Creel surveys (1965 – present, quadrennially)

Yellow Perch Actions:

1. If the 3-year running average of the percentage of yellow perch ≥ 8 inches in gill net assessments falls below 30% for two consecutive years, yellow perch-targeted creel funding will be pursued to evaluate angling pressure and harvest impacts.
2. Special regulations will be considered if creel survey and annual assessment data indicate overharvest is limiting abundance of yellow perch greater than 9 inches.
3. Continue to improve upon our understanding of yellow perch limiting factors, production, recruitment, and sustainable harvest models to meet fishery objectives.

Muskellunge Goal:

Maintain a self-sustaining muskellunge population that preserves the Leech Lake Proper genetic strain for statewide production needs and provides angling opportunity to catch trophy size fish (≥ 50 inches).

Muskellunge Objectives:

Table 3. 2026 – 2035 muskellunge sportfish objectives.

Population Objectives	Target Range or Threshold	Data Source
Production	Maintain catch rates of mature muskellunge during spawn take operations every 4 years in Miller's Bay to meet production needs	Spring Spawn Take (2003 – present, quadrennially)
Size Structure	Muskellunge measuring ≥ 50 inches should be present in spawn take catches, summer creel surveys, or annual tournament reporting	Creel surveys (1965 – present, quadrennially), Spring Spawn Take (2003 – present, quadrennially), annual tournament reporting

Muskellunge Actions:

1. Return 600 Leech Lake Proper strain muskellunge fingerlings to Leech Lake during spawn take years. Implant Passive Integrated Transponder (PIT) tags in fingerlings (as funding permits) to track recruitment.
2. Continue identifying novel evaluation methods (in addition to spawn take assessments, creel surveys, acoustic telemetry, and angler assisted genetic population estimates) to assess the muskellunge fishery and meet objectives.
3. Refine muskellunge size structure objectives.
4. Continue collecting supplemental creel data from annual muskellunge tournaments.
5. PIT- tag all incidental captured muskellunge during annual assessments to build upon growth evaluation data.

Secondary Management Species Goals, Objectives, and Actions

Northern Pike Goal:

Support a self-sustaining northern pike population that balances harvest opportunity with catch quality and guards against overabundance that outcompetes other species for forage.

Northern Pike Objectives:

Table 4. 2026 – 2035 northern pike sportfish objectives.

Population Objectives	Target Range or Threshold *3-year moving average	Data Source
Abundance	*≤ 5.3 fish/gill net	Fall gill netting (1983 – present)
Size Structure	*≥ 26 inches should exceed 9%	Fall gill netting (1983 – present)

Panfish (Bluegill and Black Crappie) Goal:

Maintain a self-sustaining bluegill and black crappie population that provides angling opportunity for quality sized fish.

Panfish Objectives:

Table 5. 2026 – 2035 panfish sportfish objectives.

Population Objectives	Target Range or Threshold *3-year moving average	Data Source
Size Structure	Define size structure objectives for bluegill and black crappie by 2032	Spring electrofishing (2012 – present)

Panfish Actions:

1. Conduct lake-wide bluegill and black crappie assessments every four years based on standardized gears, locations, and timing. Monitor for potential changes in size structure. The next scheduled assessments are in 2026 and 2030.
2. Set up a series of meetings with the LLFIG to discuss the size structure objective and evaluation of the special regulation in 2032.
3. Explore methodologies to refine winter creel survey estimates of ice angler pressure and harvest of panfish.

Fish Habitat Goals and Actions

Habitat Goal:

To achieve healthy resilient lake and watershed habitats and provide resource access within Leech Lake. This goal will be realized through collaboration with DNR partners to protect, enhance, and restore aquatic habitat (MN DNR Fish Habitat Plan 2013).

Note: many of these initiatives will only be possible with additional resources (funding and staff)

1. Continue to partner with and/or provide support to government and non-governmental organizations to acquire shoreland areas via fee title or conservation easement within the Leech Lake watershed with the intent to protect key habitats and implement best management practices (BMPs) where appropriate.
2. Continue mapping emergent aquatic plant stands to monitor alterations in fish habitat.
3. Continue to monitor fish populations for disease and contaminants.
4. Continue to support watershed restoration and protection measures through participation and environmental review of proposed projects.
5. Coordinate with Minnesota Department of Natural Resources Ecological and Water Resources (EWR) staff and Cass County Environmental Services to assist with aquatic invasive species prevention, education, and management efforts by EWR and the Leech Lake Band of Ojibwe, Division of Resource Management.
6. Continue to support efforts to evaluate fish habitat impacts from the establishment of aquatic invasive species, quantify impairments, and develop methods to protect and restore critical habitats.

Additional Management Actions

Monitor Species of Interest

1. Conduct lake-wide largemouth bass assessments every four years based on standardized gears, locations, and timing, as well as monitor for potential changes in size structure. The next scheduled assessments are in 2026 and 2030.

2. Complete smallmouth bass electrofishing assessments once every three years to collect lengths, weights, and aging structures to expand species datasets and aid in the future goal and objective setting. The next scheduled assessment in 2027.
3. Collect lengths and aging structures from a subsample of smallmouth bass collected by tournament anglers for age and growth evaluation.
4. Explore research opportunities to work with partners to increase our understanding of burbot, cisco (tullibee), and lake whitefish populations.
5. Assist the Leech Lake Band of Ojibwe, Division of Resource Management with lake whitefish projects to determine effective population size.
6. Continue to collect data from a subsample of tullibee (cisco) and lake whitefish, when possible, in coordination with the Leech Lake Band of Ojibwe, Division of Resource Management commercial fishery.

Continue Annual Fisheries Assessments

1. Conduct standardized annual assessments, including seining, trawling, electrofishing, gill netting, zooplankton collection, water quality, and temperature monitoring.
2. Conduct summer and winter creel surveys every four years. The next scheduled surveys are summer of 2028 and winter of 2028-2029. Pursue additional funding to add unscheduled and/or supplemental creel surveys for regulation review and estimation of seasonal harvest.

Maintain Existing Special Regulations

Walleye: possession limit of four fish, only one over 20-inches allowed in possession.

Panfish (bluegill and black crappie): daily limit of five fish.

Lake whitefish and cisco (tullibee): bag limits of 50 cisco (tullibee) and 25 lake whitefish within the Leech Lake Indian Reservation. Daily and possession limits are the same.

Other species managed under statewide regulations: If changes to statewide regulations occur, implement regulations consistent with statewide recommendations and evaluate angler and fish population responses through standardized creel and fish population surveys.

Additional Planned Work

1. Continue to provide financial and technical support to the Leech Lake Band of Ojibwe, Division of Resource Management for double-crested cormorant control and evaluation efforts on Leech Lake.
2. Continue to monitor food chain dynamics to assess potential impacts of aquatic invasive species on fish populations and carrying capacity.
3. Continue to work with tournament applicants to encourage CPR (Catch Photo Release) formats for tournaments to the extent possible to reduce fish mortality.

4. Explore opportunities to utilize innovative technologies to gather creel data on years when standard creel surveys are not being completed.
5. Ensure stakeholders and interest groups are kept up to date on management activities through public outreach and continued community engagement.
6. Hold annual meetings to update the LLFIG and other interested stakeholders to share the previous year's information and track status with regards to the management plan.
7. Develop statewide educational and interpretive materials to explain the history, cooperative management, and status of the Leech Lake fishery.

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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. Leech Lake has approximately 112,000 surface acres and supports the most diverse fishery of the ten lakes monitored by the Large Lake Program. This plan guides the State of Minnesota's fisheries management for Leech Lake from 2026 – 2035.

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. It uses a fish community approach to maintain ecological integrity and enable adaptive fisheries management. The plan's goals, objectives, and management actions support the DNR mission statement below and are designed to protect fish populations, enhance habitat, and maintain sustainable harvests; these are intended to be flexible and adaptive to changes in the fishery or citizen utilization of the resource. This plan will guide effective and efficient allocation of staff and fiscal resources to protect and enhance fisheries resources and provide for its sustained use. This plan is written for use by both the DNR and citizens that are interested in the management of the Leech Lake fishery resource.

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

Minnesota Department of Natural Resources Mission Statement

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

Plan Development

This plan was developed by the DNR Walker Area Fisheries office and the Leech Lake Band of Ojibwe Division of Resource Management (LLBO DRM) in collaboration with the Leech Lake Fisheries Input Group (LLFIG) and is an extension of the 2021 – 2025 Leech Lake Management Plan. The LLFIG consists of representatives from the DNR, LLBO DRM, and 13 stakeholders with diverse local and statewide interests. The LLFIG advised on revisions made to plan content throughout the 2025 management planning process (June – December 2025).

Internal Coordination

This 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 Walker 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.

Tribal Coordination

The Leech Lake Band of Ojibwe, Division of Resource Management fisheries staff have participated as members of the LLFIG since the group's inception in 2015 and co-manage the fishery with the DNR. The LLBO was given an opportunity to review the draft plan and provide comment prior to the public comment period in April 2026.

Leech Lake Fisheries Input Group

The DNR's Leech Lake Fisheries Input Group (LLFIG; Table 6) advised on and reviewed plan content. LLFIG is similar in composition and function to advisory groups the DNR has established to inform its management of other Minnesota resources. The LLFIG was formed in 2015 and includes appointments by stakeholder partners as well as selected participants from a statewide application process. The LLFIG met several times throughout the entirety of the planning process to inform and influence plan content. After plan finalization, LLFIG meetings will be conducted annually to update the group on monitoring efforts and management considerations. Ongoing communication with LLFIG ensures that management remains responsive, collaborative, and grounded in shared stewardship of the resource. DNR staff involved in LLFIG include:

- Erin Haws, Leech Lake Specialist
- Marc Bacigalupi, Northwest Regional Fisheries Manager
- Wade Massure, Walker Area Fisheries Supervisor
- Jody Derks, Walker Area Fisheries Assistant Supervisor
- Kristen Patterson, Fisheries Research Scientist

Table 6. Members of the Leech Lake Fisheries Input Group

Organization/Affiliation	***Representative***
City of Walker	Jerecho Worth
Walker Chamber of Commerce	Sarah Bruns
Leech Lake Association	John Eaton
Leech Lake Band of Ojibwe, Division of Resource Management	Tanya Roerick
Leech Lake Band of Ojibwe, Division of Resource Management	Michael O'Brien
Northern Waters Land Trust	Annie Knight
Statewide Bass Work Group	Scott Peterson
Cass County Aquatic Invasive Species	Steve Henry
Statewide Muskellunge Work Group	Chris Thury
Resort Owner	Tim Anderson
Resort Owner	Ben Jacobson
Local Business Owner	Chip Leer

Local Business Owner	Adam Arnold
Resort Owner	Bob Weeks
Local Angler	Jim Bedell
Statewide Angler	Chuck Hasse
Academic, Bemidji State University	Dr. Andy Hafs

Public Review

A draft of the plan was released for public review in August 2026.

Background and Current Conditions

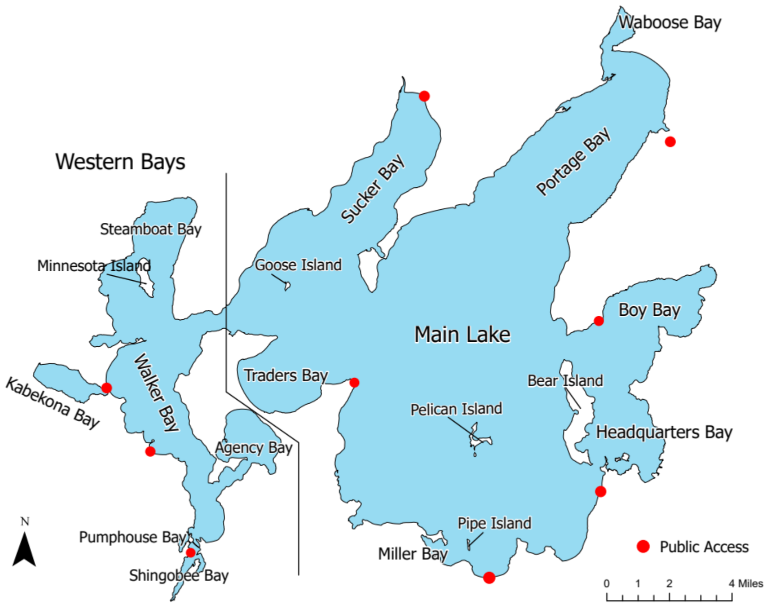
Lake Characteristics and Habitat

Leech Lake currently has approximately 112,000 surface acres; In its original state, the lake covered approximately 106,000 acres until1884 when a dam was built on the Leech Lake River, raising the water level and increasing the surface area to its present size (Wilcox 1979). The maximum depth of the lake is near 150 feet; however, nearly 80 percent of the lake is less than 35 feet deep. Leech Lake has approximately 58,000 littoral acres (≤ 15 feet).

Leech Lake is in three glacial zones and possesses an irregular shape and complex morphology with numerous large and small bays. Some large bays, such as Steamboat and Boy, display nutrient rich water quality, whereas other large bays, such as Walker and Kabekona, are borderline nutrient-poor. The main lake, like most large Minnesota walleye fisheries, is windswept and moderately productive. Remote sensing estimates the shoreline length to be 201 miles. Roughly 23% of the shoreline consists of gravel-cobble-boulder, nearly all of which is used as spawning habitat by walleye (Wilcox 1979).

The diversity of the Leech Lake shoreline, as well as its extensive littoral zone, provides excellent spawning and nursery habitats for numerous species including percids and esocids which dominate the fish community. Walleye *Sander vitreus*, northern pike *Esox lucius*, largemouth bass *Micropterus nigricans*, smallmouth bass *Micropterus dolomieu*, and muskellunge *Esox masquinongy* are the principal predators. Although most species are found throughout the lake, the largest walleye and muskellunge concentrations exist in the mesotrophic areas. Northern pike are common in vegetated eutrophic bays. Yellow perch *Perca fluvescans* are abundant throughout the lake and are the primary forage species for walleye and northern pike. Tullibee (cisco) *Coregonus artedi* and lake whitefish *Coregonus clupeaformis* are an important forage species for larger predators (Engstrom-Heg et al. 1986) and are typically found in the mesotrophic and oligotrophic portions of the lake.

Figure 1. Map of Leech Lake features referenced in this management plan.



Cultural History

The Leech Lake region in north-central Minnesota is a landscape of deep cultural, ecological, and economic significance. Its abundant natural resources of fish, wild rice, forests, and water have supported human life for thousands of years and continues to sustain the Leech Lake Band of Ojibwe and the local community. The area has experienced extensive changes through time, shaped by Indigenous stewardship, the fur trade, treaty-making, resource exploitation, tourism, and modern environmental management. Understanding this history provides context for current conservation and resource management challenges.

Long before European contact, the Leech Lake area was inhabited by ancestral Woodland peoples who hunted, fished, and harvested wild rice across the region's interconnected lakes and rivers. The Anishinaabe (Ojibwe) expanded westward by the 1700s into what is now north-central Minnesota, establishing permanent villages along Leech Lake and its tributaries. The lake's Ojibwe name, Gaa-zagaskwaajimekaag ("the place of the leeching lake"), reflects its spiritual and ecological importance. Archaeological and oral histories indicate that Leech Lake was both a subsistence and ceremonial center, linking fishing grounds, wild rice (*manoomin*) lakes, and maple sugar camps through extensive travel networks (Minnesota Indian Affairs Council [MIAC], n.d.). Fish such as walleye, lake whitefish, and cisco (tullibee) were vital food sources, while the surrounding wetlands provided one of the state's largest natural wild rice beds. These ecological foundations sustained Ojibwe lifeways, ceremonies, and trade systems before the arrival of Europeans.

The 1700s brought the fur trade to the region, introducing French and later British traders. The Ojibwe quickly became central partners in these trade networks, exchanging pelts and wild rice for goods such as cloth, tools, and firearms (Cleland, 1992). Leech Lake occupied a strategic position between the Red River and Mississippi headwaters routes, making it a key hub for transportation and exchange. The fur trade, however, declined by the mid-1800s as animal populations declined and fashion demands shifted. Leech Lake's modern history began with a series of treaties between the Ojibwe and the United States. The Treaty of Washington (1855) created the

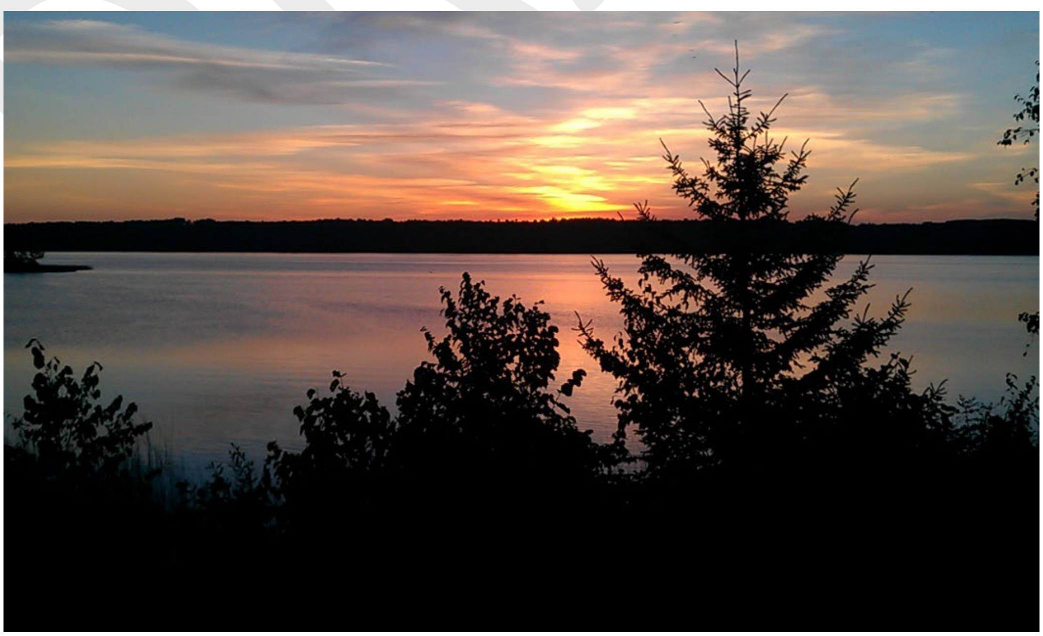
Leech Lake Reservation as a homeland for the Pillager and Lake Winnibigoshish bands of Ojibwe (US Statutes at Large, 1855).

The town of Walker was founded following the arrival of the rail line in 1896. Logging became the dominant industry in the late 19th century, driven by the Pine Tree Lumber Company and others, which harvested vast stands of white pine from the Leech Lake watershed (Minnesota Historical Society, 2010). The city of Walker is named after logging giant Thomas B. Walker, and the town was founded by Patrick McGarry. The construction of the Leech Lake Dam (1882–1884) at the lake's outlet dramatically altered water levels, flooding wild rice beds and burial sites but facilitating log transport downstream (US Army Corps of Engineers, 2015). These changes underscored rising tensions between the US Army and the Pillager Band of Ojibwe. A defining moment of Ojibwe resistance occurred during the Battle of Sugar Point (1898), often described as the last armed conflict between the US Army and Native Americans in the continental United States (Meyer, 1994). The confrontation underscored tensions over broken treaties and unlawful arrests and solidified Leech Lake's place in Native American resistance history.

The 1900s saw a rise in tourism which became the mainstay to the local economy and laid the groundwork for Leech Lake's future as a major vacation destination. The new century brought about the building of many lodges, hotels, campgrounds, and steamboats with visitors coming from around the country to enjoy the recreational and angling opportunity the lake provides. Leech Lake remains a premier sport-fishing destination.

The DNR and the Leech Lake Band of Ojibwe Division of Resource Management (LLBO DRM) began joint management of the lake in the late 20th century. Collaborative efforts have included stocking, fishery assessments and regulations, double-crested cormorant management, fish habitat mapping and protection, and numerous other ecological protection measures. In 2020, the Leech Lake Reservation Restoration Act (Public Law 116-255) returned approximately 11,760 acres of federally managed land to tribal trust status. Today, Leech Lake spans roughly 112,000 acres, making it one of Minnesota's largest and most ecologically diverse lakes.

Figure 2. View across Walker Bay, Leech Lake Minnesota.



Aquatic Invasive Species

Eurasian Water Milfoil

A survey of Leech Lake boat harbors in 2004 found established beds of Eurasian water milfoil (EWM) *Myriophyllum spicatum* in several harbors between Stony and Rogers point. Invasive milfoil continues to be discovered in new harbors and open water areas throughout the lake. EWM is now considered widespread across the main basin harbors of Leech Lake and has been established in open areas of the main lake despite previous annual control efforts. While conducting EWM harbor searches in 2009, curly-leaf pondweed *Potamogeton crispus* (CLP) was identified and removed from a harbor near Whipholt Beach. This was not the first occurrence of CLP, as it has been previously documented in the Leech Lake River embayment near Federal Dam. Like EWM, CLP can be an aggressive invasive aquatic plant and DNR and LLBO DRM personnel will continue to monitor CLP presence in Leech Lake.

Rusty Crayfish

Rusty crayfish *Faxonius rusticus*, native to the Ohio River drainage basin, were first recorded in Leech Lake in the late 1980s. Rusty crayfish are an aggressive species, often displacing native crayfish and causing the destruction of aquatic plant beds. Staff began reporting the number of rusty crayfish and native crayfish entangled in gill nets during annual assessments beginning in 2002. Rusty crayfish entanglement rates reached a historical high in 2024, following several years of a decline in numbers since 2018. This observed increase may be related to a rise in benthic energy following zebra mussel expansion lake wide beginning in 2021 (Figure 3). Increases in rusty crayfish abundance have prompted questions on the species trophic significance, specifically their role in the expansion of smallmouth bass over the last decade and their importance to the diet of other sportfish populations.

Zebra Mussels

In 2016, zebra mussel *Dreissena polymorpha* veligers (larval stage) were found in zooplankton samples in Leech Lake. No veligers were found in 2017, but were again documented in several samples in 2018. By 2019, adults were found in numerous locations across the lake, mostly localized on docks that were removed in the fall. Considerable veliger density increases were observed by 2021 and densities continued to increase annually until 2023 (Figure 3). Zebra mussels are filter feeders capable of filtering up to a liter of water a day (per individual). They feed on algae, phytoplankton, bacteria, and some smaller zooplankton. It is unclear what the long-term effects of zebra mussels will be on the Leech Lake fishery as dramatic changes in water quality have now been observed.

A general decline in zooplankton density and biomass (Figure 4) has been observed in the lake since 2012. Increases in water clarity up to a meter (MacIsaac 1996) and declines in zooplankton biomass by up to 50% have been documented in some systems (Stayer et al. 2014). Concurrently with lower zooplankton densities and increases in water clarity, a shift in primary production from the main water column (pelagic zone) of a lake to the bottom of the lake (benthic zone) (Higgins and Vander Zanden 2010) can be expected. Changes in water quality and trophic composition may have a negative effect on the growth of walleye and yellow perch during their first year (Hansen et al. 2020) as well as species assemblage in the lake.

Zebra mussels negatively impact walleye recruitment through disruption of food web composition and capacity, leading to low survival of age-0 walleye at the larval (fry) stage (Hanson 2021). Zooplankton are highly responsive to environmental change due to their size and short generation time (Olden et al. 2006). Reductions in zooplankton availability during the larval stage can greatly increase mortality of age-0 fish, reducing the number of walleyes that survive to catchable size. Recent research completed by the Minnesota Aquatic Invasive Species Research Center (MAISRC) and Legislative-Citizen Commission on Minnesota Resources (LCCMR) showed that infested lakes in Minnesota are linked to a 41% decrease in age-0 survival of walleye to age-1. Recent years of low to moderate walleye recruitment in Leech Lake (2022 – 2024) coincide with substantial declines in zooplankton biomass in bottles samples collected in May (Figure 5). Continued monitoring of changes in zooplankton communities and water quality are imperative to understanding impacts to the fishery long-term.

Figure 3. Average zebra mussel veliger density from May through October at five sampling stations in Leech Lake (3 in Western Bays, 2 in Main Lake) by year (2014 – 2024).

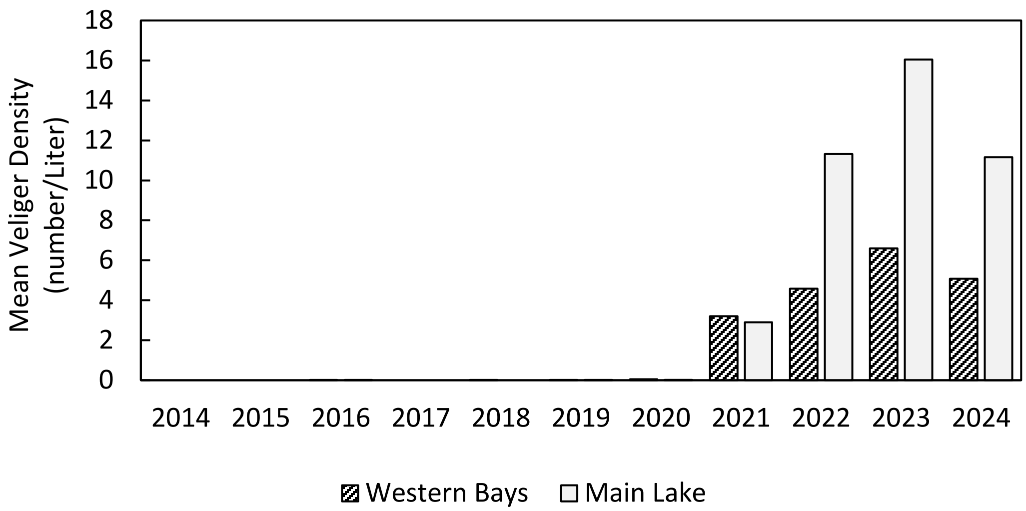


Figure 4. Mean zooplankton biomass (µg/liter), including 95% confidence intervals, from vouchers collected in May through October at five sampling stations in Leech Lake (3 in Western Bays, 2 in Main Lake) by year (2012 – 2024).

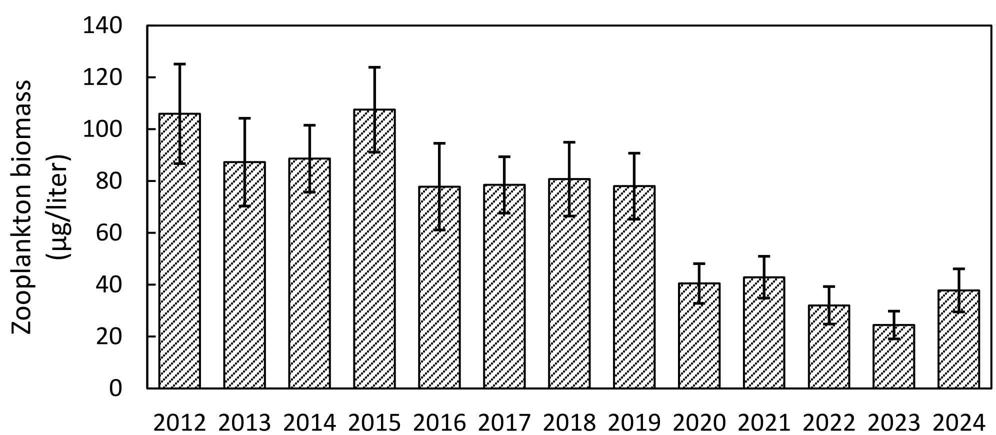
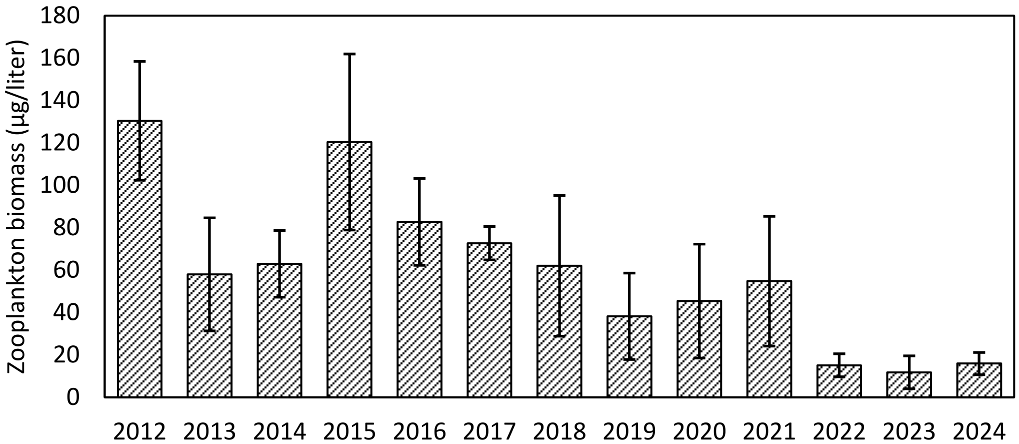


Figure 5. Mean zooplankton biomass (µg/liter), including 95% confidence intervals from vouchers collected in **May** at five sampling stations in Leech Lake (3 in Western Bays, 2 in Main Lake) by year (2012 – 2024). May is a critical period when larval fish rely on zooplankton as their primary diet source.



Other AIS currently found in Leech Lake include *Heterosporosis spp*. and banded mystery snail *Viviparus georgianus*.

Climate Change

Climate change has the potential to alter Leech Lake's fishery in the future. Projected changes include warmer annual water temperatures, decreased ice season duration, and increased frequency of extreme weather events (MN DNR Climate Trends 2025). Increased water temperatures may lead to more frequent stress events (periods of low oxygen) of cold-water species like cisco (tullibee), lake whitefish, and burbot (eelpout), while warmwater species like panfish and bass may increase in abundance. Decreased ice season duration (Figure 7) and increased annual air temperature have been observed (Figure 6) in Cass County over the past 50 years (MNDNR Climate Trends online tool). Increased temperatures will lengthen growing seasons which have been shown to influence first-year growth of many fish species. A longer growing season may lead to favorable conditions for some AIS species including EWM and CLP. Earlier ice-outs have the potential to disrupt the synchronous timing of fish spawning with zooplankton hatches, resulting in changes in recruitment and abundance of some species. Extreme weather events and sporadic hydrologic events (severe drought or flooding) may lead to lasting impacts on lake and ecosystem resiliency.

Figure 6. Cass County annual mean air temperature (°F) by year (adapted from the MNDNR Climate trends online tool).

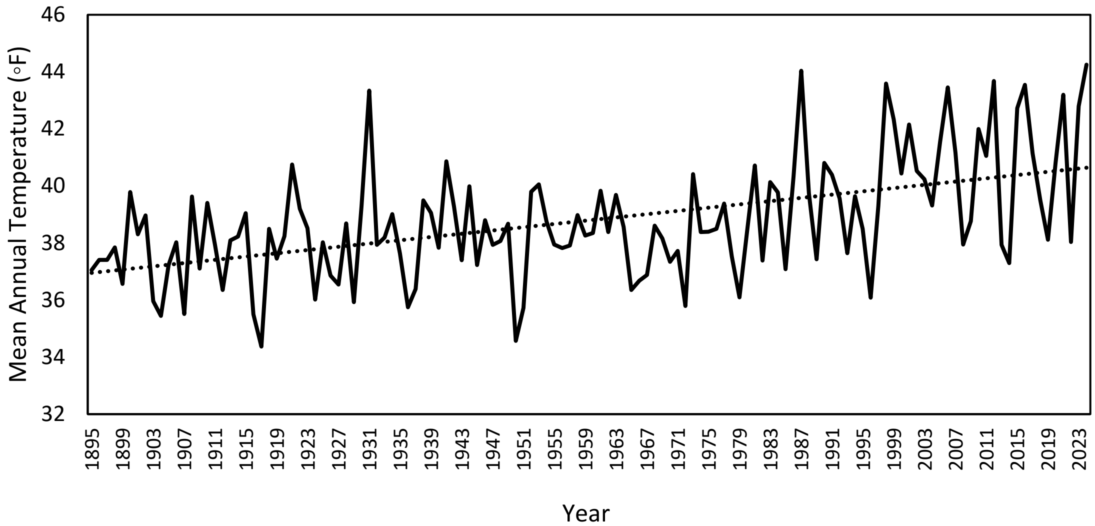
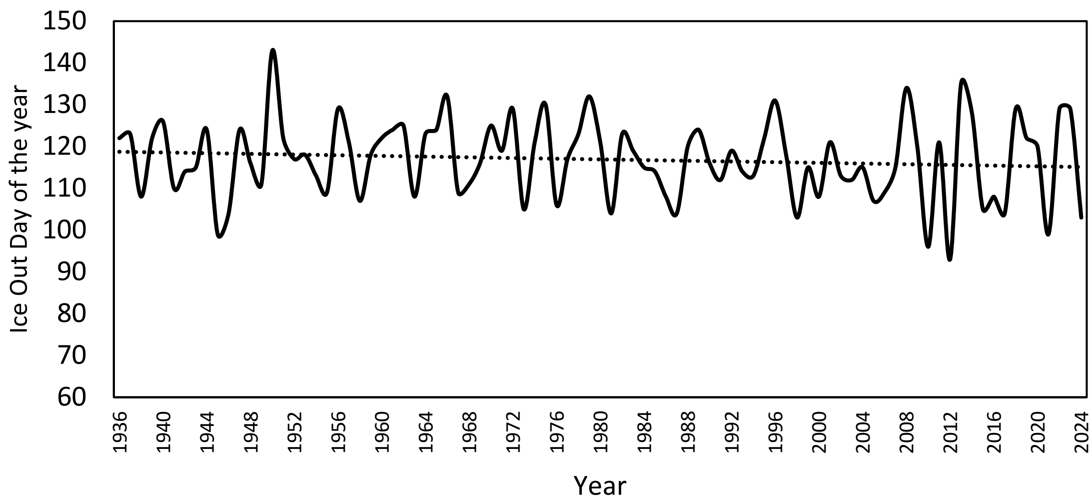


Figure 7. Leech Lake ice-out date by year (1936 – 2024) reported by the MN DNR Lakes Database.

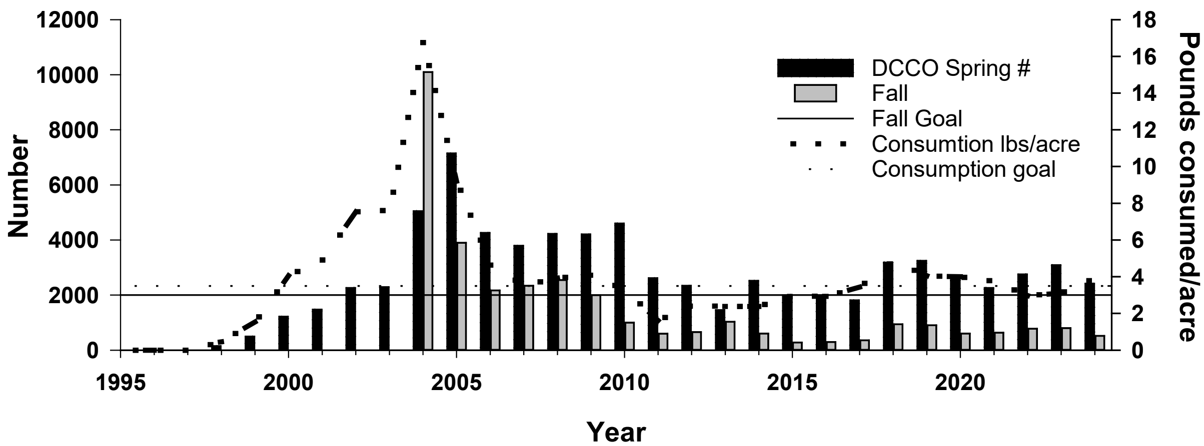


Cormorants

Double-crested cormorants *Nannopterum auritum* are a piscivorous (fish-eating) bird native to Leech Lake. The LLBO DRM has jurisdiction over the double-crested cormorant control policy on tribal lands and waters on Leech Lake. The DRM conducted studies from 2004 to 2006, 2010, and 2017 to 2019 to evaluate the effects of cormorant predation on fish populations in Leech Lake. Based on findings in these studies, along with standard fisheries assessment results, the DNR will continue to support maintaining the cormorant population at 500 reproducing pairs, which equates to a total fall population at or below 2,000 birds (Figure 8). The annual removal of most birds earlier in the year will continue to be encouraged as this reduces total fish predation and was included under the previous Federal Public Resource Depredation Order. The MN DNR will continue to support

DRM's efforts to secure funding sources and provide technical assistance for continued cormorant control and research evaluating cormorant impacts on Leech Lake sportfish populations as requested by DRM and pursue long-term permitting of control.

Figure 8. Spring and fall double-crested cormorant numbers (Roerick, DRM, LLBO) and estimated pounds of fish consumed/acre on Leech Lake, 1998-2024. The horizontal line depicts the current fall population goal of 2,000 birds ([500 nesting pairs x 2 adults] + 2 offspring/nest).



Fish Community Status and Trends

Leech Lake is the third largest lake within the state of Minnesota and supports the most diverse fish community of the eleven lakes monitored by the Large Lake Program. Species commonly targeted by anglers on Leech Lake include walleye, yellow perch, muskellunge, northern pike, bluegill *Lepomis macrochirus*, black crappie *Pomoxis nigromaculatus*, smallmouth bass, largemouth bass, cisco (tullibee), lake whitefish, and burbot (eelpout). Other species frequently encountered by anglers include white sucker *Catostomus commersonii*, bowfin (dogfish) *Amia calva*, bullhead (spp.), hybrid sunfish, shorthead redhorse *Moxostoma macrolepidotum*, pumpkinseed *Lepomis gibbosus*, and rock bass *Ambloplites rupestris*. Nearshore assessments commonly document Iowa darter *Etheostoma exile*, Johnny darter *Etheostoma nigrum*, bluntnose minnow *Pimephales notatus*, central mudminnow *Umbra limi*, logperch *Percina caprodes*, longnose dace *Rhinichthys cataractae*, mimic shiner *Notropis volucellu*s, spotfin shiner *Cyprinella spiloptera*, tadpole madtom *Noturus gyrinus*, and troutperch *percopsis omiscomaycus*. Nearshore fish communities serve important ecological functions, provide forage, and can be used to measure a lake's health and habitat quality (MN DNR IBI).

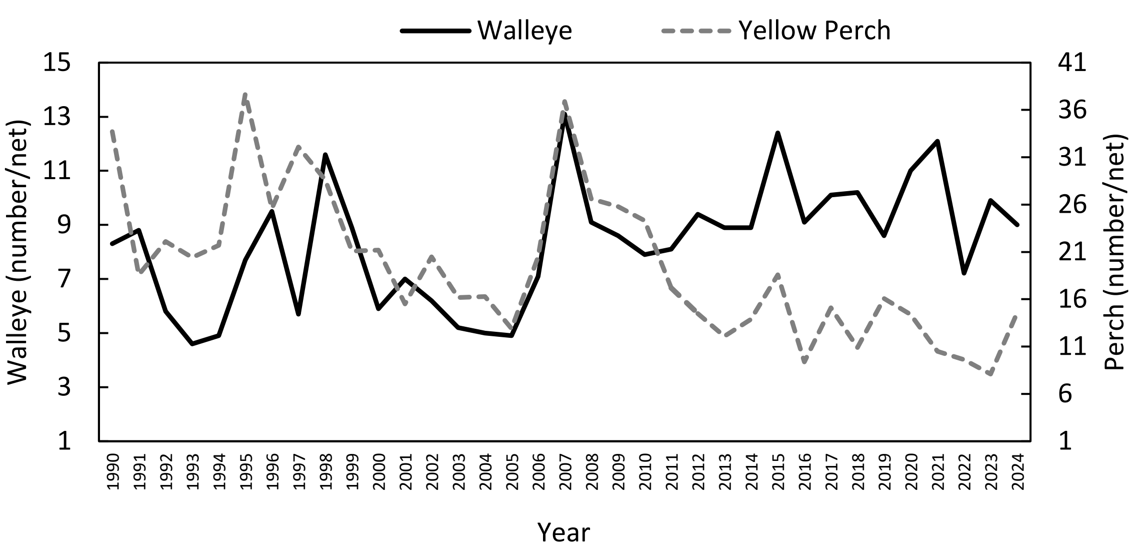
Walleye

Walleye are the most popular species targeted by anglers on Leech Lake. The DNR manages walleye through a combination of science-based population monitoring, harvest regulations, habitat management, and selective stocking based on population status. Walleye abundance declined in the mid-2000s relative to the historical time series. Comparatively high angler pressure and harvest in the late 1990s and into the 2000s (Sledge 1999, 2000) combined with increasing double-crested cormorant abundance (and subsequent predation on yellow perch) between 2000 – 2004 led to five of the seven weakest walleye year classes observed since 1983 (Schultz et al. 2013). Beginning in 2005, the DNR implemented conservative regulation, cormorant management, and walleye fry stocking to increase the walleye population.

Walleye abundance increased in response to combined management actions and has remained relatively high since 2007. The increased abundance was evidenced by gill net catch rates exceeded the long-term average from 2012 to 2024 (Figure 12), female spawner biomass was within or above the management objective range from 2011 to 2024 (Figure 13), and walleye recruitment was met from 2005 to 2023 (Figure 14). During this period of relatively high abundance, walleye condition (overall plumpness) fell below management thresholds. These declines in walleye condition tracked with an observed decrease in yellow perch abundance, highlighting a shift in forage availability in the lake that has persisted since 2012 (Figure 9). Following ten years of management actions, mature female biomass began to exceed the outlined management range sparking concern over high natural fry densities (Shultz 2016).

Observed trends in walleye spawner stock biomass and yellow perch abundance prompted the removal of the 20 – 26-inch protected slot limit in 2019 to allow for increased anger harvest and predation relief on yellow perch. Natural reproduction maintained the walleye fishery from 2015 to 2024, highlighting a period of variable recruitment and documenting several of the largest observed year classes in the historical time series. While abundance, female spawner biomass, and size structure objectives were met in 2024, recruitment fell below the management threshold, prompting the fry stocking action (completed in the spring of 2025) outlined in the 2021 – 2025 Leech Lake Management Plan. Moderate walleye year class strength in recent years (2022 – 2024) is believed to be linked to the observed declines in spring zooplankton availability post zebra mussel establishment (Figure 5). Given recent trends in forage, primary production, and walleye recruitment, management actions that promote growth and balanced predator/prey densities in the lake are imperative to maintaining a stable walleye fishery.

Figure 9. Walleye and yellow perch gill net catch rates from 1990 – 2024. Trends highlight a decoupling of the species beginning in 2012 that has persisted to date.



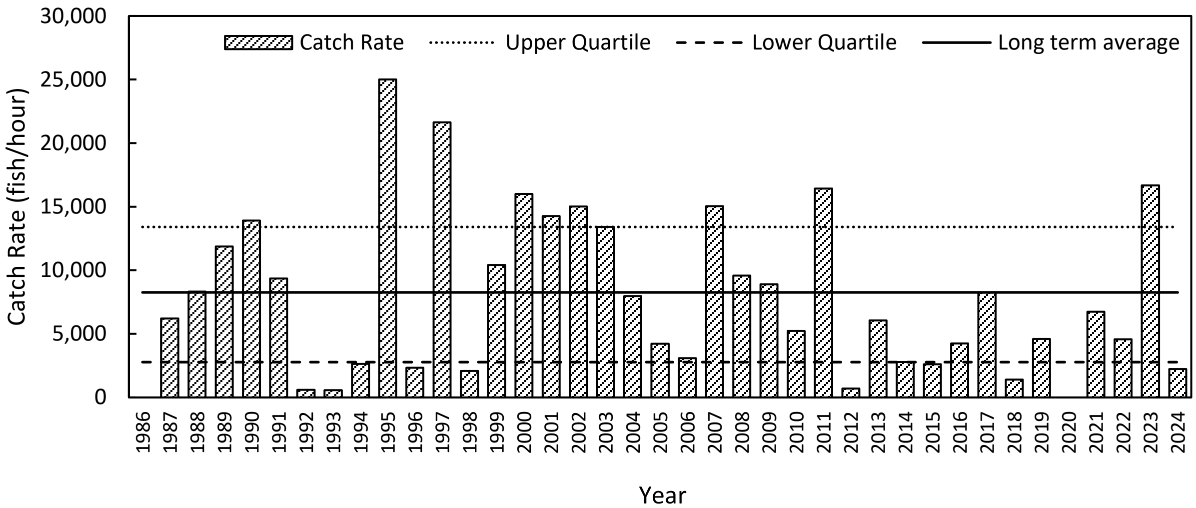
Yellow Perch

Yellow perch are the primary prey species for walleye, among other predatory sportfish in the lake, and serve a fundamental role in the Leech Lake food web. In the early to mid-2000s, increased predation by double-crested cormorants led to a decline in yellow perch recruitment (Schultz et al. 2013). In 2005, yellow perch gill net catch rates were below the 25th percentile when cormorant culling commenced, and by 2007, catch rates exceeded the 75th percentile. This rapid increase was attributed to predation relief in conjunction with fast growth and high survival. However, as walleye abundance increased at both the juvenile and adult levels, subsequent predation pressure from walleye on yellow perch again led to declines in abundance indices.

By 2008, yellow perch gill net catch rates declined and fell below the abundance objective by 2013 and have remained below 20 perch per net to date. Additional indices of abundance have signaled declines across varying life stages. Trawling catch rates of young-of-the-year (YOY) yellow perch fell below the long-term average from 2012 to 2022 (Figure 10). Elevated predation by walleye, aquatic invasive species (AIS) related changes in productivity, and increased harvest by winter anglers have all been hypothesized as factors contributing to the population decline. A negative relationship exists between yellow perch recruitment and total walleye fry density estimates from the same year class (Appendix C, Figure C1). Declines in zooplankton biomass since 2019 signal a potential bottleneck in annual productivity. Record perch harvest was documented during the 2010-11 and 2014-15 winter angling seasons (Schultz and Vondra 2011, Stevens and Ward 2015) and considerable harvest was documented earlier in the ice season in 2024-25, signifying novel winter pressure from sleeper house anglers (Haws 2025). Cormorant predation on yellow perch has been reduced by 90% relative to 2004 levels and are like pre-2000 levels (Schultz et al. 2013, Mortenson 2020).

A high catch rate of YOY yellow perch in 2023 trawl tows exhibited the first sign of a potential increase in yellow perch abundance at the juvenile life stage since 2011 (Figure 10). Presence of the 2023 cohort of yellow perch in annual fall gill net surveys will aid in the evaluation of yellow perch recruitment. The evolving changes in the yellow perch fishery warrants further investigation into the impact predation, production, and angler harvest have on mortality. As a key prey species, sustainable management of yellow perch is central to supporting Leech Lake's fishery.

Figure 10. Catch-per-effort of YOY yellow perch sampled at standardized trawling locations, Leech Lake, 1987-2024.



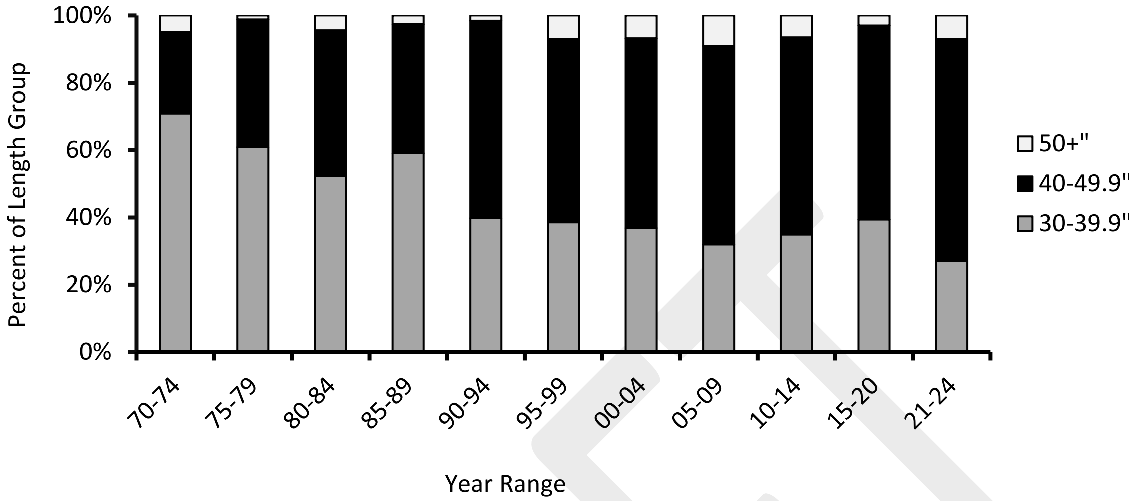
Muskellunge

Leech Lake possesses a premier muskellunge fishery known for its trophy size potential, natal to its unique genetic strain. Muskellunge angling has evolved greatly over the past 50 years. Once a species subject to considerable harvest on Leech Lake, muskellunge angling has become an almost exclusive catch-and-release fishery (54-inch minimum, possession limit of one fish, early-June through end of November). Identification of the Leech Lake Proper genetic strain in 1989 earned its use for statewide rearing and Leech Lake now serves as the primary egg source for brook stock lakes in Minnesota's Muskellunge Stocking Program.

The Leech Lake muskellunge population remains a challenge to monitor as the species is notoriously hard to sample using standard methods. Elevated sampling constraints exist on Leech Lake due to its large size. Despite collaborative efforts (Shultz 2011), a population evaluation has not been successfully completed on Leech Lake to date, though efforts are currently underway by DNR Fisheries Research to obtain a population estimate through genetic mark-recapture methods. Muskellunge population estimates in other lakes stocked with Leech Lake strain fingerlings reflect the low-density nature of the species. Carrying capacity limitations keep muskellunge from reaching high densities despite the numerous stocking strategies used around the state (MN DNR Muskellunge Long Range Plan 2025). Reductions in mortality of low-density species can alter the size structure of a population, promoting an increase in trophy sized fish. Despite limitations in available long-term datasets, evidence of this shift has been documented in Leech Lake (Figure 11) by citizen-collected catch data (Muskies Inc. 1970 – 2014) and supplemental creel information from tournament anglers (Pedersen 2015 – 2024).

Concern expressed by stakeholders in recent years regarding advancing angler technologies paired with limited long-term species data prompted an increase in muskellunge-focused research beginning in 2025 through collaborative efforts between the non-profit fishing advocacy group MN-FISH, DNR, LLBO DRM, and Bemidji State University. Current muskellunge-focused projects aim to learn more about the status of the population, identify critical habitats, and obtain Leech Lake specific population metrics for use in population modeling.

Figure 11. Percentage of three size groups of muskellunge over varying time blocks on Leech Lake. Data between 1970 – 2015 are from the Muskies Inc. database and data from 2015 – 2024 come from reported catch by tournament anglers.



Northern Pike

Leech Lake supports a low to moderate northern pike density and falls within Minnesota's North Central Pike Management Zone, where anglers can keep 10 northern pike, but no more than two longer than 26-inches and all fish measuring 22 to 26-inches must be released. The objective of this regulation is to allow increased harvest of small pike and shift the population size structure to promote more quality sized fish. Northern pike abundance and recruitment in Leech Lake have decreased in annual assessments since 2015. Catch rates of northern pike measuring ≤ 22 inches have remained below the 25th percentile in the last three annual assessments (since 2022).

Since the early 2000s, interest in pike angling across seasons on Leech Lake has decreased and the number of pike harvested has dropped from roughly 50,000 pike annually in the 1990s to approximately 11,000 pike in creel surveys completed over the last two decades (Pedersen 2024). The last two summer creel surveys (2019 and 2024) indicated an average of 17.5% of harvested northern pike measuring below the 22-inch protected slot, 79% of harvested pike measuring above 26 inches, and 3.5% measuring within the protected slot (i.e., taken illegally). Additionally, the percentage of northern pike (3-year moving average) sampled in gill nets ≥ 22 inches has exceeded 30% since 2004, characteristic of a stable abundance of mid-size and larger fish. Evaluation of the North Central Northern Pike Zone Regulation is scheduled to occur in 2028.

Panfish (Bluegill and Black Crappie)

Leech Lake supports quality panfish populations, providing angling opportunity year-round. Bluegill harvest has decreased in summer creel surveys since the early 2000s, while black crappie harvest has increased over the past three summer creel surveys (Pedersen 2024). Panfish abundance in gill net assessments has increased since 2005. Panfish growth is relatively fast in Leech Lake and stock indices highlight a quality size structure.

Rising popularity in panfish angling paired with improvements in angler technology has bolstered rising concern over exploitation of schooling sportfish species. Given stakeholder concerns, a special regulation on panfish was discussed in 2015 and support from anglers (Pedersen and Schultz 2016), the Leech Lake Association (LLA), and the LLFIG led to implementation of the special regulation (daily limit of 5) in 2021. The goal of the special regulation is to restrict harvest to maintain quality size structure.

Other Sportfish Species

Smallmouth Bass

The smallmouth bass population in Leech Lake has expanded over the last two decades. Increased numbers of juvenile smallmouth bass have been reported in trawling assessments beginning in 2014, and increased angler catch has been observed in the preceding three summer creel surveys (Pedersen 2016, 2019, and 2024). Angler interest in smallmouth bass has simultaneously increased. Smallmouth bass were targeted by 2.4% of anglers in the 2024 summer creel survey, comparable to largemouth bass, northern pike, and panfish (Pedersen 2024).

Targeted sampling for smallmouth bass was completed by area staff in 2013 and 2024 to collect baseline age and growth data. Smallmouth bass are a difficult species to sample, and targeted electrofishing assessments were largely unsuccessful at obtaining adequate sample sizes. Limited data on smallmouth bass have been collected through gill netting, trawling, and electrofishing assessments. A citizen-based approach was taken in 2025 through partnership with tournament anglers to sample the adult population (MN DNR, unpublished data).

Largemouth Bass

Leech Lake supports a moderate density largemouth bass population with comparatively fast growth and quality size relative to other bass fisheries in Cass County. Increased catch rates of largemouth bass in the 2024 summer creel survey highlight the indirect effect of rising angler interest in the bass fishery in 2024 and 2025 (Pedersen 2024).

Burbot

The Leech Lake burbot population receives pressure and harvest throughout the ice angling season (Haws 2025), made famous by the annual International Eelpout Festival which ran from 1980 to 2019. The effects of high exploitation rates on burbot populations have received little research (Stapanian et al. 2010).

As angler interest toward burbot has grown, an effort was initiated in 2020 to remove their designation as a rough fish and begin the rulemaking process to list burbot as a game species. The 2023-24 winter creel survey reported most anglers (86%) were in support of the proposed daily limit of four burbot, and just under half (44%) of anglers stated they would keep their limit of burbot. In 2025, a daily harvest regulation went into effect statewide (possession limit of 4 burbot).

Cisco (Tullibee)

Cisco (tullibee) populations rely on deep water refuge habitats in Leech Lake and provide a high-energy food source for predator species like walleye, northern pike, and muskellunge. The cisco population in Leech Lake is constrained by summer climate trends, particularly in the main lake where oxygen-rich habitat is limited. Harvest of cisco during the ice season can be substantial, though it is highly associated with seasonal ice conditions.

Lake Whitefish

Lake whitefish are found in the mesotrophic and oligotrophic portions of Leech Lake, and the population status remains largely unknown. Winter creel surveys report a high harvest rate of lake whitefish, and the species is a significant part of the tribal culture and heritage of the Leech Lake Band of Ojibwe, who works to ensure the conservation and sustainability of the species.

Management Actions

Survey History

DNR Surveys

Lake surveys and evaluations are important management tools to monitor fish populations. Prior to the inception of the large lake program in 1983, non-standardized gill netting, seining, trawling (netted gears used to sample fish at varying life stages) and creel survey assessments were infrequently conducted by the DNR. Gill net assessments were completed during 1943, 1944, 1950, 1976, and 1982. Seining assessments were completed from 1965-1968 and1970-1982. Trawling assessments were completed from 1965-1968 and in 1976. Summer creel surveys were conducted in 1965, 1966, and 1967, and a winter creel survey was conducted in 1965-66. Gear and locations used during these surveys were not consistent with the standardized protocols established with the inception of the Large Lake Program in 1983 (Wingate and Schupp 1984).

Annual Large Lake Program surveys initiated in 1983 included seining in mid-July and gill netting in mid-September; additional gears targeting specific species and age classes have been added over the past 42 years. Currently, in addition to gill netting and seining, annual surveys include water quality in mid-July (1986- present), trawling in mid-August (1987-present), hourly water temperature loggers (2006-present), electrofishing in mid-September (2007-present) and monthly zooplankton sampling (2012-present).

Summer creel surveys have been conducted in 1984-1985, 1991-1992, 1998-1999, 2004-2005, 2008-2011, 2014, 2016, 2019, and 2024. Winter creel surveys were conducted in 1984-85, 1990-91, 1991-92, 2004-05, 2005-06, 2010-11, 2014-15, 2015-2016, 2019-20, 2023-24, and 2024-25. Muskellunge are collected and spawned for the statewide broodstock program every four years, with the last spawning operations occurring in 2025. Spring bluegill, black crappie and largemouth bass assessments were conducted in 2012, 2015, 2018, and 2022. Assessments were originally planned for every three years but adjusted to every four years starting in 2022 to avoid conflict with muskellunge spawning scheduled in 2021. Smallmouth bass sampling was completed in 2013 and 2024. A summarized history of DNR surveys is included below.

1965-68: The first extensive walleye population survey was completed on Leech Lake from 1966-1968 by Schupp (1978) as part of a broader status update of the State's flagship walleye fisheries. The first creel survey was also conducted from 1965-1967 and estimated annual fishing pressure to be 785,905 angler-hours per year, a harvest rate of 0.183 walleye per hour, and total walleye harvest of 208,120 pounds of walleye per year (Schupp 1972).

1979-80: A muskellunge telemetry study was conducted to identify spawning areas, seasonal distribution, and movement throughout 1979 and 1980 (Strand 1986). Six spawning locations were determined lake wide through the tracking of 14 females. Spawning sites were characterized as being approximately 3-6 feet deep with Chara spp. As the dominant vegetation type.

2002-2005: The first lake-wide survey of aquatic vegetation distribution and assemblage was conducted (Perleberg and Loso 2010).

2005-2014: Walleye fry that were stocked into Leech Lake were marked with Oxytetracycline hydrochloride (OTC) to get an understanding of the contribution that stocking versus natural reproduction had on recruitment (Ward 2016).

2005-2010, 2017-2019: Double-crested cormorant studies assessed cormorant diets (Göktepe 2008; Hundt 2009; Göktepe et al. 2012), and associated fish consumption and trends in fish population metrics in response to management efforts (Schultz et al. 2013; Mortensen et al. 2020).

2007: A critical review of young-of-the-year walleye sampling (Schultz et al. 2007) concluded walleye year class strength was most accurately predicted using mid-August bottom trawling data, when compared to mid-July seining data. However, mid-September electrofishing data may serve as an additional tool to predict walleye year class strength.

2012: Miller (2012) compared genetic variation in Leech Lake and Woman Lake walleye populations. No declines in genetic diversity in Leech Lake were detected between the pre-stocking (pre-2005) and stocking (2005-present) time periods. Additionally, no signs of increased relatedness or inbreeding depression were observed and no increases in genetic diversity are needed.

Ward et al. (2012) compared variation in juvenile walleye growth rates in Leech Lake. Growth rates for both age-0 and age-1 walleye for both stocked and naturally produced year classes were compared, and no statistically meaningful differences were observed. Growth was negatively associated with higher fry densities and positively associated with longer and warmer growing seasons.

2016-2019: In cooperation with the Leech Lake Association, monthly water quality monitoring at a variety of sites throughout the lake was conducted. Phytoplankton samples were added beginning in 2017.

2018: Near shore habitat was mapped using Score the Shore protocols outlined in Perleberg et al. 2012. Score the Shore is a natural resources survey to describe the habitat nearest to the shoreline, determine shoreline changes over time, and provide a ranking score to compare lakeshore habitat between Leech Lake and other lakes and watersheds to assess potential impacts and encourage proper shoreline maintenance.

2019-2022: Emergent Aquatic vegetation mapping was initiated in 2019, starting in the western bays and moving towards the east. The DNR completed the emergent aquatic vegetation mapping of the entire lake in 2022. This survey will be used to track long-term changes to the emergent plant community.

2020: The COVID-19 pandemic had an impact on sampling, specifically cancelation of trawling activities and the planned 2020 summer creel survey.

2023: A fisheries survey on the Leech Lake River was completed to collect fish community data and compare results to previous assessments completed by the MN Pollution Control Agency for consideration of future fish passage work.

2024: Fisheries Research began a 2-year burbot focused pilot project that includes Leech Lake. The goal of this project is to develop a single nucleotide polymorphism (SNPs) panel for Minnesota burbot populations and determine if genetic depression is present in populations targeted by Minnesota anglers.

2025: Walleye fry that were stocked into Leech Lake were marked with Oxytetracycline (OTC) to estimate wild fry production and interpret potential limiting factors to recruitment.

Fisheries Research began a two-year muskellunge population assessment project on Leech Lake relying on angler submission of fin samples for mark-recapture methods using microsatellite genetic markers.

Neuston net tows, a specialized net used for sampling larval fish, were completed to sample yellow perch to collect baseline data on annual production and growth. Declines in yellow perch abundance in gill nets has been observed since 2012.

A targeted angling survey was completed through collaboration with the 2025 Bassmaster Open Tournament to collect fish lengths and a subsample of age and growth structures on angled fish to establish a dataset on the adult smallmouth bass population.

Other Management Agencies Surveys

1978-79: The Army Corps of Engineers completed an assessment evaluating nearshore habitat and the effect of various water level regimes on fish production in Leech Lake (Wilcox 1979). It was recommended that water levels should be rising from April 15 to May 15 to prevent exposure of walleye and northern pike eggs, as well as limit the potential for difficult access to spawning areas and mitigate the risk for northern pike to get stranded in spawning areas.

1988-91: A hydrology and groundwater quality study were conducted from 1988-1991 (Lindgren 1996).

1992: The Leech Lake Band of Ojibwe completed a report evaluating water quality and productivity of Leech Lake (LLBO 1992). The report indicated good water quality was present and recommended alternatives for maintenance.

1993: A watershed report and plan (Leech Lake River Basin Study Report) was sponsored by the Leech Lake Band of Ojibwe and the Cass, Hubbard, and Beltrami Soil and Water Conservation Districts (USDA 1993).

1997: A watershed report (A Water Quality Assessment of the Leech Lake Watershed) was sponsored by the Leech Lake Division of Resource Management and the Minnesota Chippewa Tribe (LLDRM 1997).

2010-2017: Watershed Restoration and Protection (WRAP) strategies outlined under the guidance of MN Pollution Control Agency (West et al. 2017).

2024: A substrate coring survey led by the University of Minnesota, Minnesota Science Museum, Red Lake Department of Natural Resources, LLBO DRM, and the MN DNR Environmental and Natural Resources Trust Fund was initiated to review 200+ years of sediment in 15 Minnesota lakes.

2025: A 3-year muskellunge telemetry project between the MN DNR, LLBO DRM, and Bemidji State University was initiated to study movement and habitat use through active and passing tracking of tagged muskellunge.

Social Considerations

The DNR recognizes the economic base supported by Leech Lake and the role fishing quality in Leech Lake has in the local quality of life. Communication and cooperation between the DNR and stakeholders as well as the need for an adaptive management framework that provides context for framing biological and social questions and goals with stakeholder involvement is critically important. Adaptive management promotes flexible decision making that can be adjusted over time as outcomes from management actions and other events become better understood (i.e., learning by doing).

To facilitate the adaptive management process, the DNR met monthly (five meetings) with the LLFIG in 2025. The LLFIG was formed in 2015 and has representation from the DNR and LLBO DRM, as well as seven organizations, including the Leech Lake Association, Leech Lake Fishing Task Force, City of Walker, Leech Lake Area Watershed Foundation (now Northern Waters Land Trust), Statewide Walleye Work Group, Statewide Northern Pike and Muskellunge Work Group, and the Statewide Bass Work Group. In addition, eight members were selected from a statewide web-based application process. LLFIG built upon the successes of the previous plan by providing input and recommendations on proposed goals, objectives, and actions aimed at preserving a quality fishery in Leech Lake. The DNR holds annual update meetings with the LLFIG and other interested stakeholders with the previous year's information with regards to the management plan. This plan is an extension of that original process and will continue the collaborative management of Leech Lake.

Primary Management Species Goals, Objectives, and Actions

The following sub-sections list goals, objectives, and management actions for the primary management species in Leech Lake, which include walleye, yellow perch, and muskellunge. Relevant details are listed under the objectives for each primary management species to provide additional context for selected objectives.

Walleye Goal

Support a self-sustaining walleye population that balances harvest opportunity with the opportunity to catch quality-sized fish.

Walleye Objectives

The DNR has identified seven objectives for the management of walleye in Leech Lake. Additional details are found in the subsequent sections for each objective.

Table 7. 2026 – 2035 walleye sportfish objectives.

Population Objectives	Target Range or Threshold (*3-year moving average)	Data Source
Abundance	*7 – 10 fish/gill net	Fall gill netting (1983 – present)
Reproductive Potential (mature female biomass)	*1.5 – 2.0 pounds/acre	Fall gill netting (1983 – present)
Female Length at 50% maturity	≥ 17.2 inches	Fall gill netting (1983 – present)
Recruitment (Year class strength)	4-year moving average ≥ 0.94	Fall gill netting (1983 – present) Summer trawling (1988 – present)
Targeting Summer Angler Catch Rate	≥ 0.3 fish/hour	Summer creel surveys (1991 – present, quadrennially)
Angler Harvest (annual)	130,000 – 190,000 lbs.	Creel surveys (1965 – present, quadrennially)
Condition (relative weight)	*81 – 85	Fall gill netting (1983 – present)

Abundance

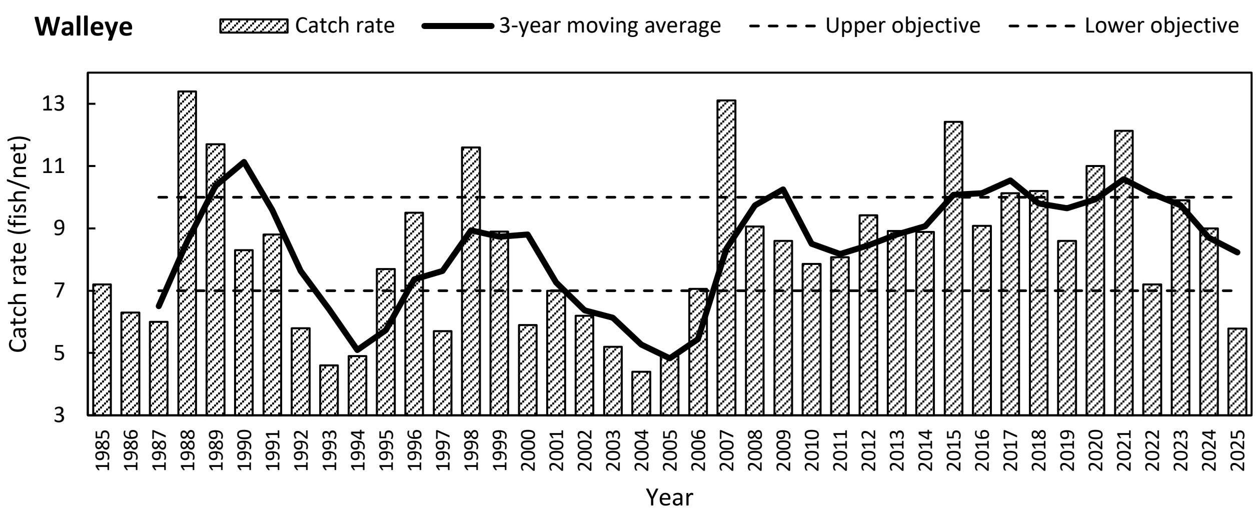
Objective: Maintain walleye gill net catch rate of 7-10 fish per net on a three-year moving average.

Maintaining a stable abundance (relative number of fish) of walleye benefits anglers and maintains conditions conducive to recruitment. The DNR monitors abundance through fisheries surveys and sampling, including gill netting. Walleye gill net catch rates have ranged from 4.6 fish per net (1993) to 13.4 fish per net (1988) in Leech Lake between 1983 – 2024 (Figure 12). The objective range of 7 to 10 fish per net (30^{th} and 79^{th} percentiles) is the same range from the 2021 – 2025 management plan. Maintaining an annual gill net catch rate at or above the 75^{th} percentile is not realistic in a natural system due to annual variability in the number of juvenile walleyes surviving to catchable sizes (i.e., recruitment) and the negative impact sustained high abundance would have on the prey base.

Peaks in gill net catch rates (i.e., catch rates ≥ 10 fish per net) have been attributed to a disproportionately large number of age-0 and/or age-1 fish being sampled relative to other years (1988, 1989, 1998, 2007, 2015, 2019, and 2021). Thus, gill net catch rates can be strongly influenced by recruitment variability, and the highs and lows in catch rates tend to be driven by the frequency of unusually strong or weak year classes moving through the age-1 to age-6-year classes. Gill net catch rates can also be influenced by the growth rate of a specific cohort (gill net capture efficiency is related to fish size, particularly smaller and larger ones), and angler harvest, which is typically correlated with pressure (angler-hours). Maintaining the objective range of 7 to 10 fish per net allows for variability, as gill net catch rates have remained within or above this range since 2007 (Figure 12). Changes in carrying capacity following the establishment of zebra mussels (lake-wide by 2021) may reduce walleye recruitment and biomass in the future given observed trends in other systems (Irwin et al. 2008, Hansen et al.

2020). Therefore, maintaining a gill net catch rate between 7 to 10 fish per net may not be sustainable in post-zebra mussel conditions.

Figure 12. Gill net catch rates (fish per net) of walleye in Leech Lake, 1983 – 2025. The horizontal dashed lines represent the upper and lower abundance objective. The darker line represents the 3-year moving average.



Reproductive Potential

Objective: Maintain walleye mature female biomass between 1.5 – 2.0 pounds per acre on a three-year moving average.

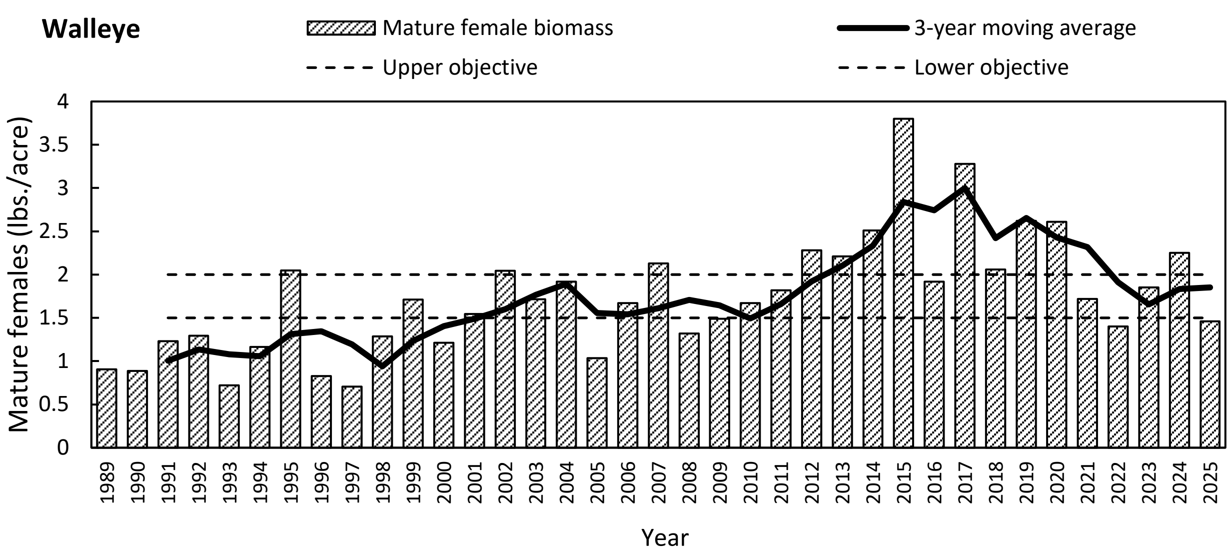
Maintaining an adequate density of mature females (i.e., spawners) reduces recruitment variability and increases the relative abundance of subsequent year classes. Uncontrollable factors such as climate, growing conditions, forage availability, density-dependence, and predation also influence year class strength. The density of mature females in Leech Lake has ranged from 0.7 pounds per acre (1997) to 3.8 pounds per acre (2015) between 1989 – 2024 (Figure 13). The values of 1.5 to 2.0 pounds per acre in the 2026 – 2035 management plan represent the 38th and 68th percentiles through the time series (1989 – 2024). Prior to 1989, maturity observations were not recorded for walleye.

In addition to mature female biomass, wild fry densities were assessed from 2005 to 2014. Based on marking rates, wild fry densities are estimated to average between 270 – 370 fry per littoral acre relative to the mature female biomass range of 1.5 – 2.0 pounds per acre. Growth, survival, and recruitment of age-0 fish increase as fry density decreases, and fry densities ≥ 500 fry per littoral acre have consistently resulted in lower recruitment (Figure 19). Given these observations, the current target range for spawner biomass is expected to continue to be appropriate for supporting consistent fry production.

Spawner density is influenced by the strength of year classes reaching maturity, fishing pressure, and angler harvest. Walleye harvest regulations are an important tool for managing reproductive potential. Removal of the 20–26-inch protected slot limit in 2019 was a result of the mature female biomass exceeding the objective range of 1.5 – 2.0 pounds per acre and other key population metrics. These metrics included walleye and yellow perch gill net catch rates, the percentage of walleye within the protected slot, and walleye density-dependence which indicated signs of an unbalanced walleye population. The DNR reviews the status of these metrics annually in collaboration with the LLFIG.

Regulation adjustment(s) over time should be used cautiously to avoid compulsive responses to short-term dynamics common to and frequent in walleye populations, as over-reactive modifications could be detrimental to population balance. Summer and winter creel surveys provide critical information for considering potential walleye regulation changes along with summer trawl, fall gill net, and fall electrofishing surveys.

Figure 13. Estimated biomass (pounds per acre) of mature female walleye in Leech Lake, 1989 – 2025. The horizontal dashed lines represent the upper and lower reproductive potential objective. The darker line represents the 3-year moving average.



Maturity

Objective: Maintain female length at 50% maturity ≥ 17.2 inches.

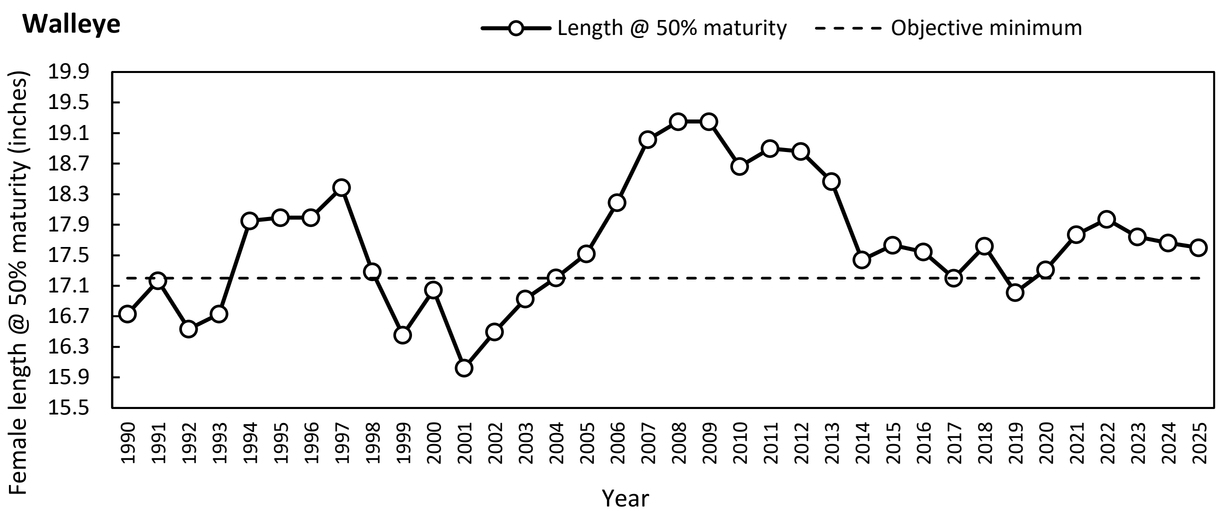
Monitoring the length at which fish reach sexual maturity serves as a tool for fishery managers to understand how environmental stressors impact fish growth and reproduction. Biological indicators of population stress can result in shifts in vital rates including the size (length) at which fish reach sexual maturity and are able to reproduce. A decrease in length at which fish reach sexual maturity signals that energy is being shifted away from growth and being directed towards reproduction, likely from a rise in population mortality (Gangl and Pereira 2003). Increases in mortality could be attributed to overexploitation, density-dependence, or other environmental stressors.

Female walleye length at 50% maturity has ranged from 16.0 inches (2001) to 19.1 inches (2008) between 1990 – 2024 (Figure 14). Based on growth predictors and lake-specific observations of abundance and growth, the threshold identified as a signal of overexploitation in Leech Lake is a female length at 50% maturity less than 17.2 inches (Gangl and Pereira 2003). A decrease in length at maturity was observed between 1997 and 2001 (Figure 14) as a result of consecutive years of low walleye recruitment and high harvest by anglers (Sledge 2000).

In 2005, the DNR began management intervention to address concerns over the walleye and yellow perch populations, and as a result, exceptional growth was observed between 2007 and 2013. Maturity observations have since leveled off over the last decade from 2014 to 2024.

Additional biological performance indictors (BPIs) for monitoring walleye populations for overexploitation include female age at 50% maturity and female walleye length at age-3. Taken together, this suite of metrics can be used to forecast the onset of an overfished population and provide insight into overall population health.

Figure 14. Female walleye length at 50% maturity in Leech Lake from 1990 to 2025. Values below the dotted line indicate a potential population stress response (Gangl and Pereira 2003).



Recruitment

Objective: Maintain a walleye year-class strength index of ≥ 0.94 (25th percentile) on a four-year moving average.

Maintaining a stable number of juvenile walleyes that survive to catchable sizes (i.e., recruitment) ensures there are fish available both for angler harvest and sexually mature individuals entering the spawning population. Recruitment variability, or the variability in the size or strength of a year class, is influenced by many factors. These factors include spawner abundance, spawning conditions, juvenile density, length and intensity of growing season, predation, and prey abundance, among others. Most recruitment concerns center on consecutive years where the year class strength index (i.e., the relative abundance of walleye produced in an individual year) is below the 25th percentile. The 25th percentile is a threshold below which year class strength is defined as poor. Year class strength (YCS) values on Leech Lake have ranged from 0.04 (2024) to 3.52 (2021) between 1983 – 2024 (Figure 15).

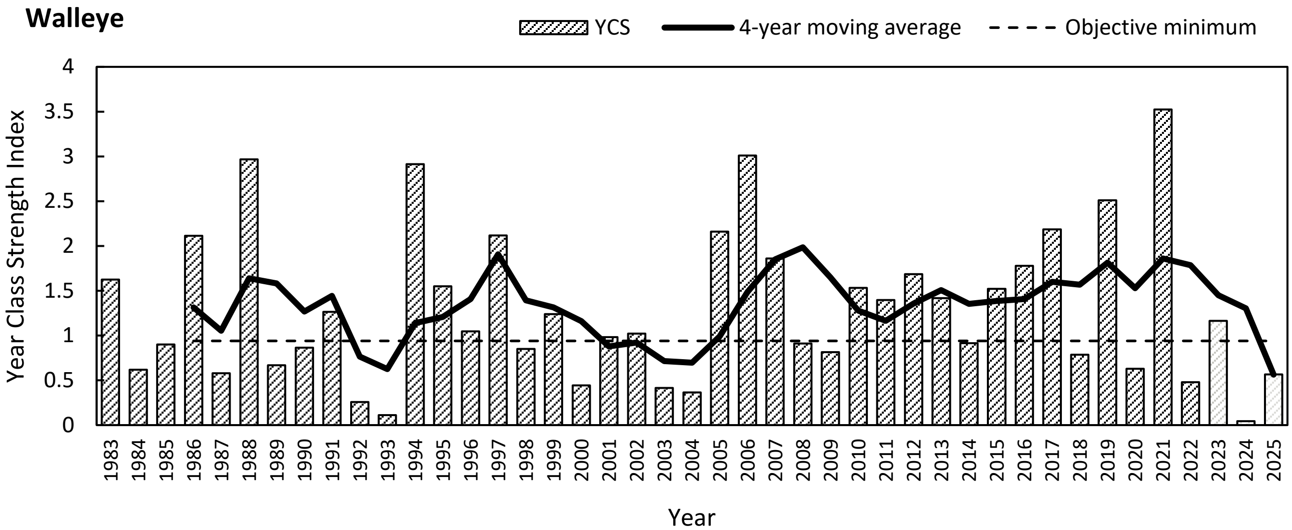
The recruitment objective under the 2016 – 2020 management plan was to maintain a walleye year class strength index (YCI) above the 25th percentile on a three-year moving average. This methodology incorporated estimates of YCS based on the catch of age-0, age-1, and age-2 walleye. Using identical methods, percentile values were updated based on added observations in the 2021 – 2025 revision of the management plan. Since 1983, YCI has dropped below the 25th percentile for two consecutive years on two occasions, from 1992 – 1993 and from 2000 – 2004. The low observed in 1992 and 1993 was attributed to those summers being among the coldest on record (i.e., having the fewest days with average air temperatures ≥ 50°F), which led to poor growth and survival of walleye statewide (Schupp 2002). YCI values below the 25th percentile from 2000 – 2004 were attributed to increased cormorant predation on yellow perch (Schultz et al. 2013). Though YCI values did not drop below the 25th percentile for two consecutive years, the recruitment objective (3-year moving average) was not met in 2024 following three years without a strong (above the 75th percentile) year class.

Walleyes are not fully recruited to standard gill nets until reaching roughly 15-inches, typically by age-3 in Leech Lake. For year classes younger than age-3, the YCS estimate is a prediction, or incomplete assessment, based on limited observations. To determine incomplete values, trawl data is used along with any available gill net data. Predictive models based on YOY sampling alone present challenges due to low gear effectiveness. Lake-wide changes in water quality and habitat following zebra mussel establishment have likely altered juvenile fish foraging behavior. Trawling and fall electrofishing catch rates of age-0 walleye over the past decade have not shown a strong predictive relationship with YCS by age-3. Age-0 estimates of YCI were originally included in the 2016 – 2020 management plan as a proactive approach to identifying gaps in recruitment. However, estimates of recruitment based on incomplete evaluations (prior to age-3) introduce uncertainty.

To address recruitment uncertainty, this objective was modified in the 2026 – 2035 revision of the management plan to include YCS of age-3 walleye (4-year moving average). The rationale for making this modification aims to address the recognized disadvantage of applying only incomplete estimates of YCS to estimate walleye recruitment. By incorporating a fourth year of data (age-3 walleye) the objective maintains its intent to accurately quantify poor recruitment, while integrating one year of complete data to the average.

Management action based on a comprehensive overview of the walleye fishery is critical to meeting goals of predation relief, minimizing density-dependence effects, and ensuring high survival of juvenile walleye. In short, the “boom-bust” potential of a year class observed in the past appears to be strongly tied to fry densities, growing season, and forage availability. Recent declines (2022 – 2024) in primary production associated with the establishment of zebra mussels has likely influenced year class strength since 2022, based on observed May zooplankton biomass and density trends (Figure 5). Employing adaptive management strategies that result in increased fry densities should only be considered if the weight of evidence suggests it is appropriate.

Figure 15. Year class strength (YCS) index of walleye in Leech Lake from 1983 – 2025. Both year classes that are fully recruited (dark bars) to the fishery and those still incomplete (light bars) are indicated. The horizontal dashed line represents the 25th percentile (of the 4-year moving average). The black line represents the 4-year moving average.



Angler Catch Rate

Objective: Maintain a targeting angler summer catch rate of 0.30 fish per hour or higher.

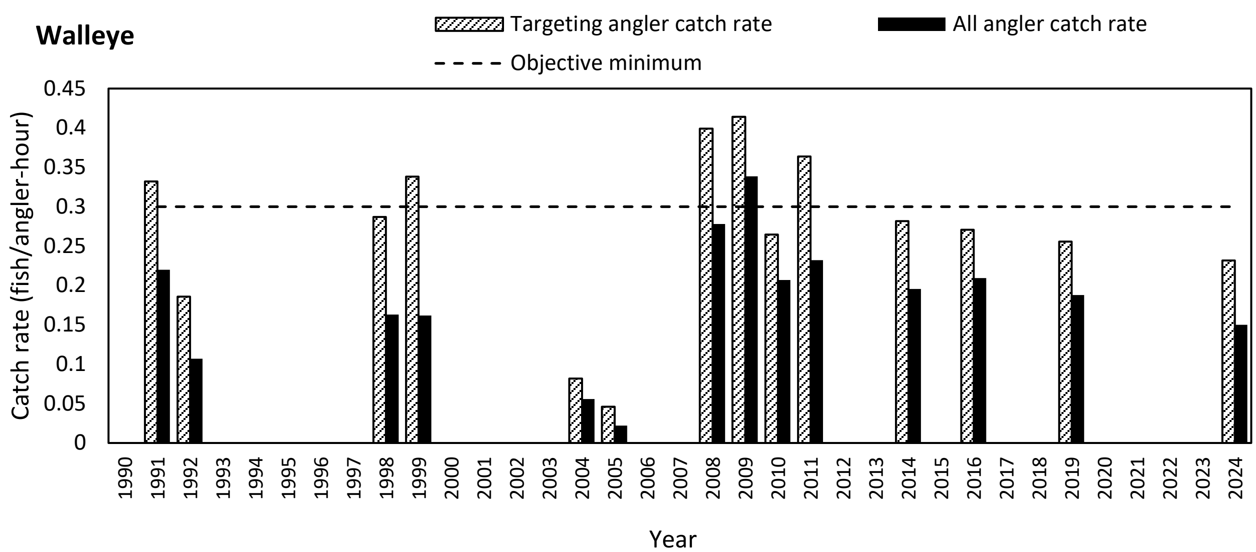
Maintaining stable abundance of walleye for anglers to catch and harvest is important, as walleye are the species most frequently targeted by summer and winter anglers on Leech Lake. Length limits, such as protective slot limits (PSLs), are intended to reduce or eliminate harvest of a particular size group of fish, improve size structure and/or improve the quality of fishing with higher catch rates and larger fish. Uncontrollable factors such as weather, forage availability, angler behavior and skill, water clarity, and other factors also influence angler catch rates.

Summer catch rates for anglers targeting walleye have ranged from 0.05 (2005) to 0.41 (2009) from 1991 – 2024 (Figure 16). Statistics of anglers targeting specific species are a more precise measure of angling quality for a particular species than statistics generated across all anglers. The threshold of 0.30 represented the 60th percentile for the 1991 – 2019 time series and the 65th percentile for the 1991 – 2024 time series. The only angler-oriented walleye objective in the 2011 – 2015 management plan was harvest oriented, stating that the summer harvest rate for anglers targeting walleye should be 0.25 fish per hour or higher. This objective was acknowledged as unachievable considering the regulation change that was intended to reduce harvest that was in place from 2005 – 2019. Additionally, this objective exceeded the 90th percentile for the 1991 – 2009 time series, which included pre-protected slot limit angling seasons. Therefore, the two objectives added in the 2016 – 2020 revision of the management plan were intended to recognize catch and release anglers, harvest-oriented anglers, and the contribution of fish that are released due to regulations.

Achieving a targeting summer catch rate of 0.30 fish per hour is an aggressive objective as it aims for an above average result, meaning you can expect not to attain this objective in every creel survey based on the historical time series. Open water creel surveys are completed every four years, presenting a challenge to interpret catch rates over time. For example, elevated catch rates are often observed following an exceptionally strong year class which may not align with a given creel survey year. Therefore, it is imperative to state that not meeting this objective does not imply low relative abundance, except in extreme cases (catch rates less than the 25th percentile), which occurred in 2004 and 2005. Despite these limitations, the LLFIG showed interest in retaining this objective, citing the value of having an objective tied directly to angler experience.

As influences from zebra mussels progress lake wide, increased water clarity will likely have a negative impact on catch rates, posing added challenges to angling success. As was observed on Cass Lake, fishing pressure and success shifted mainly to low light (after dark) conditions (Kennedy, pers. communication). Night pressure is not accurately measured by the standard creel surveys associated with this time series. Consideration of these limitations should be used in addition to a weight of evidence approach utilizing other objectives to draw inferences about the status of the walleye fishery.

Figure 16. Summer angler catch rates of walleye in Leech Lake, 1991 – 2024. Catch rates for all anglers and anglers targeting walleye are indicated. The horizontal line represents the 65th percentile (anglers targeting walleye catch rate objective).

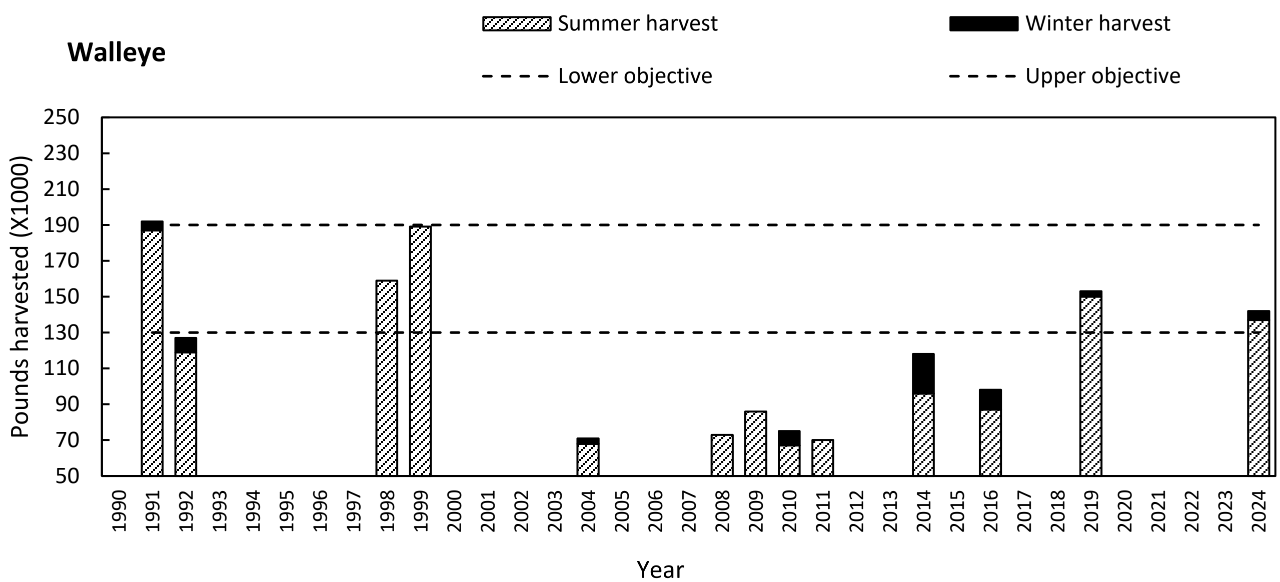


Angler Harvest

Objective: Maintain annual total walleye harvest between 130,000 – 190,000 pounds.

Maintaining an angler-oriented walleye harvest objective is important, as it is a measure of fish returned to the angler. The total annual pounds of walleye harvested have ranged from 6,881 (2005) to 224,310 (1966) between 1965 – 2024 (Figure 17). The objective range of 130,000 to 190,000 pounds represents the 56th and 84th percentiles for the 1984 – 2024 time series and is based on estimates of safe harvest levels. This range demonstrates that additional harvest is currently available, and management steps have been taken to provide additional harvest opportunity (e.g., the removal of the protected slot that went into effect in 2019). Total annual fishing pressure and regulation type will have strong influences on this objective and will continue to be evaluated when creel survey data is available. Zebra mussel expansion may impact overall lake productivity and yield (safe harvest) of the fishery. Rutherford et al. (1999) predicted reductions in walleye recruitment and abundance of up to 30% and reductions in yield up to 10% because of zebra mussel infestation. Therefore, 190,000 pounds of harvest may not be sustainable in post-zebra mussel conditions. Evaluating safe harvest quotas for walleye should be revisited post-zebra mussel establishment to account for changes in carrying capacity of the fishery.

Figure 17. Total harvest (pounds x 1,000) of walleye by Leech Lake anglers throughout the summer and winter seasons, 1990 – 2024. The horizontal shaded range represents the angler harvest objective.



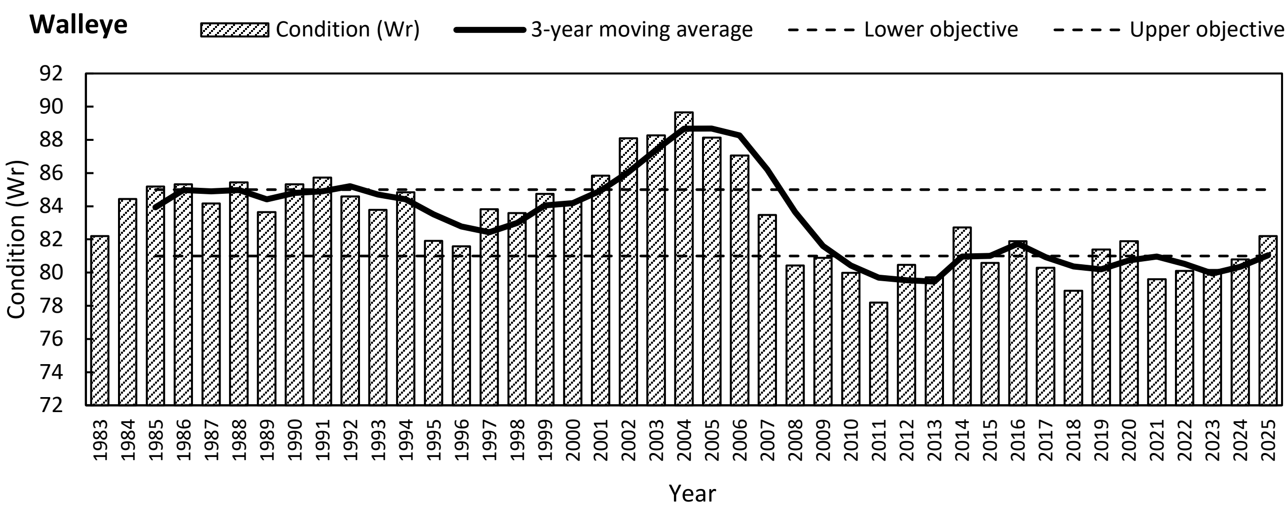
Condition

Objective: Maintain walleye condition factor between 81 – 85 on a three-year moving average.

Walleye condition is assessed using relative weight (Wr), which is a ratio of individual weight versus length (Murphy et al. 1990). Condition serves as a proxy for the health of a population and can be used as a surrogate to assess prey availability. If an individual must increase the amount of energy expended to locate preferable prey or if it must opt for less desirable prey, its condition values are lower. Lower walleye condition values over the past several years coincide with the period of low yellow perch abundance in gill net assessments (below the 25th percentile). Walleye condition values have ranged from 78 (2011) to 90 (2004) from 1983 – 2024 (Figure 18). Values of 81 and 85 represent the 25^{th} and 75^{th} percentiles for the 1983 – 2024 time series.

Increases in walleye condition were observed between 2001 and 2006, coinciding with poor walleye and yellow perch recruitment between 2000 – 2004. The decline in the number of juvenile walleyes entering the fishery led to a decrease in intraspecies competition. As a result, walleye sampled in annual assessments exhibited excellent condition as little competition for resources was present. Following management actions to address low recruitment of both species, conditions dropped and have remained below the objective range since 2015 (last ten annual assessments). Increases in walleye abundance track with declines in yellow perch abundance and poor walleye condition, signifying reduced forage availability over the past decade.

Figure 18. Annual mean condition (Wr) of walleye in gill nets in Leech Lake, 1983 – 2025. The horizontal dashed lines represent the upper and lower condition objective. The darker line represents the 3-year moving average.



Walleye Management Actions

Management actions are specific measures or decisions taken to protect, conserve, or sustainably utilize a resource and are in place as a method to address specific failed objectives or investigate a potential management question or concern.

Fry Stocking

1. If the 4-year moving average (of YCS index values) falls below the 25th percentile (for the 1983 – 2024 time series), walleye fry stocking will be considered the following year. Stocking decisions will be based on metrics of spawner stock biomass (wild fry densities) and forage availability. If fry stocking is deemed appropriate, fry will be marked with oxytetracycline (OTC) to evaluate wild fry production.

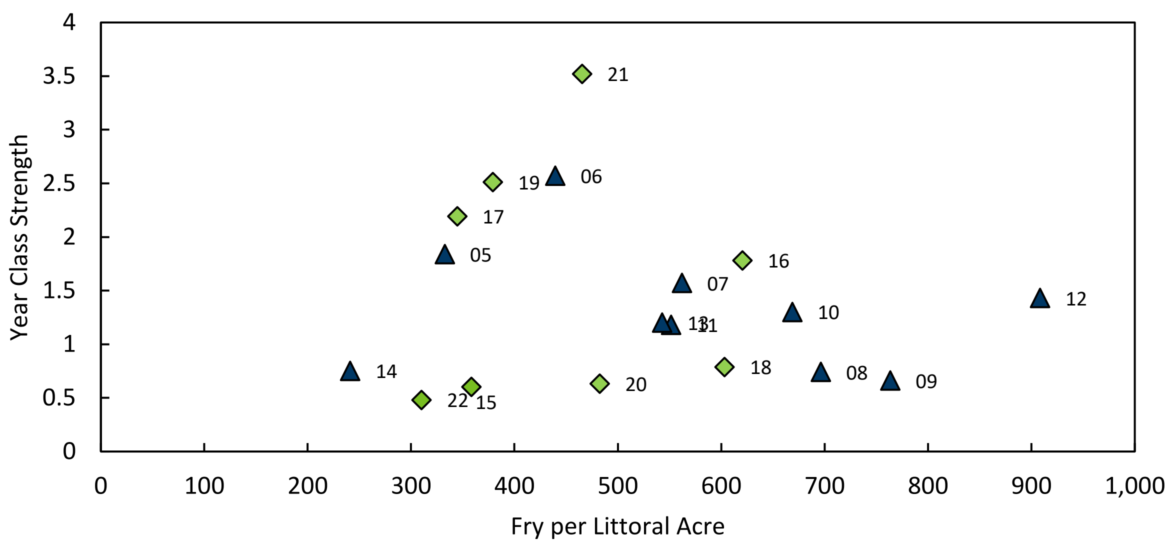
2. If the mature female density estimate observed in a single year is below 1.25 pounds per acre or above 2.75 pounds per acre, a low-density fry stocking will be considered the following year. Fry will be marked with OTC to evaluate wild fry production. It is important to note that this is contingent on yellow perch abundance.

The DNR recognizes stocking as a valuable management tool when used to meet defined management objectives if natural reproduction is limited. In general, stocking has not been necessary for maintenance of walleye populations in Minnesota’s large natural walleye lakes. Stocking evaluations completed by the DNR have determined that stocking on top of adequate natural reproduction can be detrimental to walleye fisheries.

Stocking OTC-marked walleye fry (i.e., oxytetracycline-marked) was one of four tools used to increase walleye abundance in Leech Lake from 2005 to 2014. The use of variable densities of marked fry facilitated a thorough evaluation of total fry density effects on first-year growth and eventual recruitment to the fishery. Annual fry stocking densities during those years ranged from 7.5 to 22.0 million fry and total fry density (wild + stocked) ranged from 237 to 908 fry per littoral-acre. This evaluation determined the following findings:

- During periods of extremely low spawner stock (e.g., 2005), supplemental stocking could be beneficial.
- Higher fry stocking rates have not resulted in increased numbers of walleye surviving to catchable sizes.
- Higher fry stocking rates have resulted in slower growth rates of YOY walleye.
- Poor first year growth resulted in fewer walleyes surviving to catchable sizes.
- Higher fry densities have increased predatory demand for YOY yellow perch and have corresponded with lower abundances of yellow perch recruitment to age-4 produced the same year.
- Yellow perch are the primary prey of walleye, years with lower abundance of yellow perch have resulted in below average adult walleye condition.

Figure 19. Observed YCI estimates at corresponding annual predicted fry (wild + stocked) densities on Leech Lake from 2005 – 2022. Blue triangles represent stocked years, and green diamonds represent non-stocked years (natural reproduction). Wild fry estimations and hatch rates were obtained through OTC stocked evaluation between 2005 – 2014 (Ward 2015).

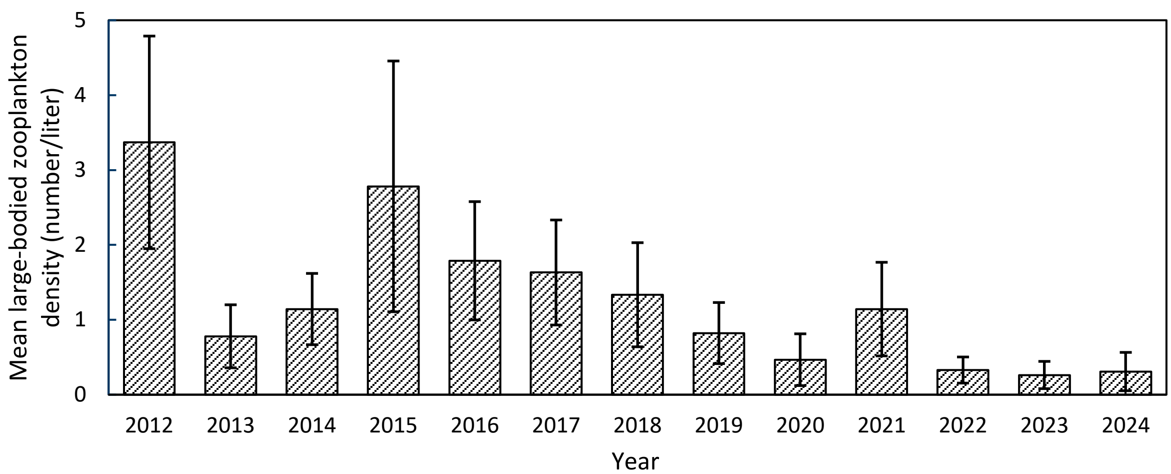


It is important to outline circumstances when fry stocking may be an appropriate and/or an informative management action, suitably balanced with potential short- or long-term risks imposed on the fishery. Most recruitment concerns center on consecutive years where year class strength (i.e., the relative abundance of walleye produced in an individual year) is below the 25th percentile. Research indicates the current level of cormorant control is appropriate (Schultz et al. 2013) and the stocking evaluation completed between 2005 – 2014 confirmed wild fry production is sufficient to maintain a robust walleye population in Leech Lake. Several of the largest year classes observed on Leech Lake were produced by natural reproduction (1994, 2019, and 2021). Fry densities exceeding 500 fry per littoral acre (LA) have resulted in poorer year classes (Figure 19).

Recent years (2022 – 2024) of low to moderate walleye YCS and failure to meet the recruitment objective in 2024 are thought to be linked to the changes observed in primary production post-zebra mussel establishment. Large declines in phytoplankton have been observed in samples collected by the LLA between 2017 and 2023 (Rantala 2024). Declines in zooplankton biomass and density have been observed in May (Figure 5), a critical period for walleye fry survival and growth. Studies have shown that zooplankton density strongly affects growth and survival of larval walleye (fry stage), influencing recruitment (Fielder 1992, Hoxmeier et al. 2004).

Observed declines of large-bodied zooplankton in May suggest a potential bottleneck effect on fry survival to the juvenile stage (Figure 20). Since 2020, a significant increase in small-sized immature copepodites and a significant decrease in adult calanoid and cyclopoid copepods as well as large daphnia has been documented in collected samples (Cattoor et al. 2025). Given recent trends in productivity, managing for survival of walleye fry through appropriate fry densities is imperative to fishery sustainability.

Figure 20. Mean large-bodied (large daphnia and calanoids) zooplankton density (number per liter), including 95% confidence intervals from vouchers collected in May at five sampling stations in Leech Lake (3 in Western Bays, 2 in Main Lake) by year (2012 – 2024).



Quantitative determination of limiting factors impacting first-year survival of walleye is central to effective management. Several factors have been identified impacting walleye recruitment in Leech Lake and include first year growth, growing season, and fry densities. Discontinuation of walleye stocking as an annual management action in 2015 was based on strong empirical evidence of negative impacts of supplemental fry stocking across multiple year classes of walleye and yellow perch. Productivity changes following zebra mussel establishment bolsters the significance of managing sustainable fry densities, as pelagic resources are likely more limited now than between 2005 to2014 (Higgins and Vander Zanden 2010).

This plan includes two scenarios when walleye fry stocking will be considered, modified from the original fry stocking actions developed in the 2016 – 2020 revision of the management plan. The first is directly related to the walleye recruitment objective (Figure 15). The action states that if the 4-year moving average (of YCS index values) falls below the 25th percentile (for the 1983 – 2024 time series), walleye fry stocking will be considered the following year. Stocking decisions will be based on a tiered approach that takes into consideration metrics of prey availability, density-dependence, and fry densities to minimize the potential for negative effects on first-year walleye growth and survival, as well as minimizing predation pressure on yellow perch (Table 6).

The second scenario when walleye fry stocking action would be taken would be for research purposes to expand on the range of total fry density observations (237 – 908 fry per littoral acre) if mature female density falls below

1.25 pounds per acre or above 2.75 pounds per acre. The action states if the mature female density estimate observed in a single year is below 1.25 or above 2.75 pounds per acre, a low-density fry stocking will be considered the following year. A weight of evidence approach will be used to determine if implementing this action will pose low risk to sportfish populations, specifically yellow perch. Stocking density will be determined based on statistical needs to meet the target objective (e.g., achievable sample size requirements for recapture rates with a reasonable expectation to meet the target density).

Any stocked walleye fry will originate from the Boy River (Cass County) and will be marked with OTC prior to stocking. This genetic stocking strategy is based on recommendations from the University of Minnesota which determined that the Boy River strain is the most similar and appropriate strain to use in Leech Lake (Miller 2007). Other recommended strategies for reducing the risk for adverse population impacts at the genetic level include stocking early life stages (fry instead of fingerlings), stocking fewer fish, stocking less often, and not stocking from multiple sources (e.g., other strains).

Table 8. 2026 – 2035-tiered stocking actions based on three scenarios related to measures of walleye recruitment, prey availability, and density-dependence.

Stocking Action	Walleye recruitment	Yellow perch abundance (prey availability)	Walleye mature female biomass (SSB) (density-dependence)	Fry stocking recommendation
Scenario 1a	Not met	Not met	Met	Stocking is not recommended
			Not met	Stock fry to attain density of 270 fry per LA.
Scenario 1b	Not met	Met	Met	Stocking is not recommended
			Not met	Stock fry to attain density of 370 fry per LA.
Scenario 2	Met	Met	>2.75 pounds per acre	Experimental low density fry stocking (density based on statistical requirements)
			<1.25 pounds per acre	

Research Actions

The DNR has identified two research actions to expand upon knowledge gaps related to YOY walleye sampling and impacts of climate change and aquatic invasive species on the walleye population. Additional details about each research action can be found in the subsequent sections.

1. Continue to refine YOY predictors of potential walleye year class strength.
2. Continue evaluating effects of climate change and aquatic invasive species on walleye populations, specifically the length and intensity of the growing season and changes in phytoplankton and zooplankton following zebra mussel establishment.

1. Young-of-the-Year Sampling

One challenging aspect of Leech Lake sampling has been classifying the optimal method to predict walleye YCS at age-0. Identifying dependable predictors of recruitment is beneficial for forecasting management outcomes (Isermann 2007). Accurate forecasts of age-0 abundance can be confounded by high levels of juvenile mortality throughout the first year of life. As a result, cohort establishment is highly variable and consequently difficult to predict. This is why accurate estimates of recruitment are finalized using catch at age-3 in annual gill net assessments (1985 – 2024). A critical review of YOY sampling methods was completed in 2007 to establish the current sampling protocol for estimating YCS of age-0 walleye (Schultz 2007).

Fall nighttime electrofishing targeting YOY walleye has been completed annually on Leech Lake from 2007 – 2025 to investigate its utility as a YOY predictor. Fall electrofishing has proven to be an effective gear for assessing age-0 walleye abundance in other large lakes (Schultz 2007). Based on preliminary analysis, electrofishing catch rate (fish per hour on time) does not show a strong predictive relationship with YCS at age-3. With an established 20-year dataset, a secondary review of YOY sampling will be completed during the life of this plan to better interpret how this methodology compares, and if it has utility to complement the current trawl-only relationship.

2. Climate Change and Aquatic Invasive Species

Lake-wide changes linked to climate change and aquatic invasive species have been observed in Leech Lake that have the potential to impact the walleye fishery. Warmer annual air temperatures have been documented in Cass County (Figure 6) over the past 50 years, lengthening growing seasons (MNDNR Climate Trends online tool). Annual growing degree day (GDD50) values are calculated using water temperature data from loggers. Growing season length and intensity have a strong influence on walleye first-year growth recruitment. Decreased ice season duration and earlier ice-out dates may negatively impact reproduction, growth, and survival of walleye through disruption of spawning cues and lake-wide productivity (Feiner et al. 2025). Continued evaluation of climate change effects on walleye recruitment is essential to developing adaptive management strategies in the future.

Aquatic invasive species often have ecological, economic, and social impacts on freshwater systems through outcompeting native species, disrupting trophic webs, altering water quality, damaging infrastructure, and threatening ecosystem health. Zebra mussels are an aquatic invasive species that have altered the Leech Lake food web by reducing phytoplankton and zooplankton availability. Percid populations rely heavily on pelagic resources, particularly at the larval stage when they are suspended in the water column. When pelagic resources are reduced, there may be negative consequences to walleye growth, survival, and recruitment (Bethke et al. 2023). Declines in zooplankton biomass and density have been documented in Leech Lake following the establishment of zebra mussels (Figure 4) and are likely a contributing factor to low to moderate walleye recruitment in recent years (2022 – 2024). Zooplankton and water quality data collected between 2012 – 2025 on Leech Lake will be imperative to quantifying relationships between aquatic invasive species impacts and key walleye population metrics throughout the 2026 – 2035 Leech Lake Management Plan.

Yellow Perch Goal

Support a self-sustaining yellow perch population that provides both a stable prey base and harvest opportunities for anglers.

Yellow Perch Objectives

The DNR has identified five objectives for the management of yellow perch in Leech Lake. Additional details are found in the subsequent sections for each objective.

Table 9. 2026 – 2035 yellow perch sportfish objectives.

Population Objectives	Target Range or Threshold (*3-year moving average)	Data Source
Abundance	*≥ 15 fish/gill net	Fall gill netting (1983 – present)
Size Structure	*≥ 8 inches should exceed 30%	Fall gill netting (1983 – present)
Female Length at 50% maturity	≥ 5.5 inches	Fall gill netting (1983 – present)
Recruitment (age-4)	*≥ 3.3 fish/net	Fall gill netting (1983 – present) Summer trawling (1988 – present)
Angler Harvest (annual)	< 98,000 lbs.	Creel surveys (1965 – present, quadrennially)

Abundance

Objective: Maintain yellow perch gill net catch rate ≥ 15 fish per net on a three-year moving average.

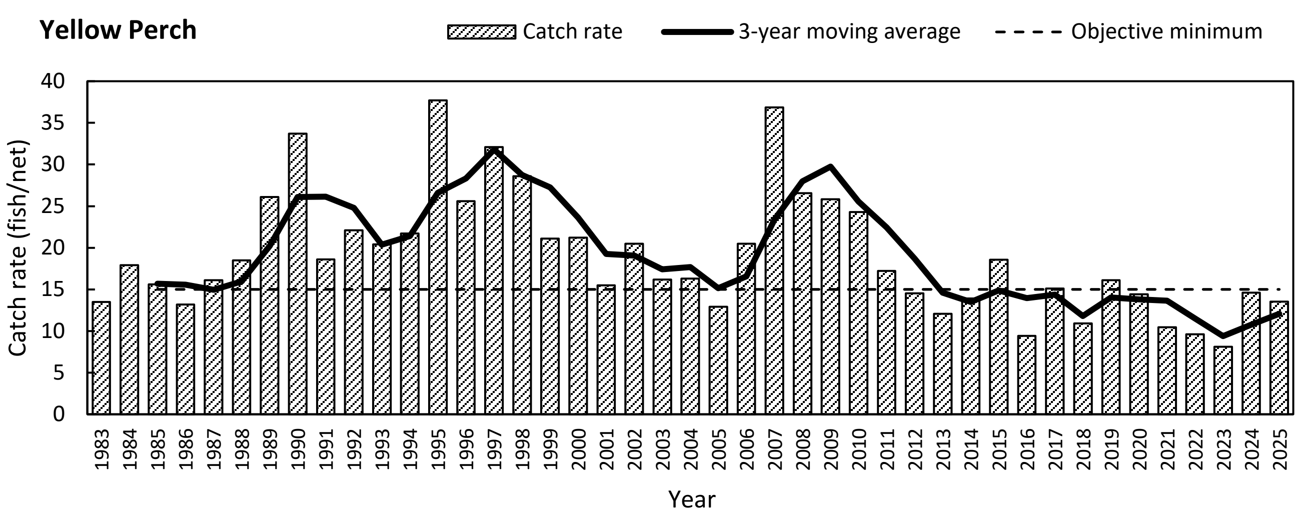
Yellow perch are the primary prey species for most predator sportfish in Leech Lake. Anglers harvest more yellow perch (by number) than any other species throughout the year. Yellow perch gill net catch rates have ranged from 8.1 fish per net (2023) to 37.7 fish per net (1995) in Leech Lake from 1983 – 2024 (Figure 21). The objective threshold of 15 fish per net represents the 31st percentile for the time series (1983 – 2024). The abundance objective under the 2015 – 2020 management plan was to maintain a gill net catch rate ≥ 16.0 fish per net, the 25th percentile for that time series, and ≥ 15.0 fish per net in the 2021 – 2025 revision of the management plan. Following a decade of repressed yellow perch abundance in annual assessments and a historical low catch rate observed in 2023, the decision was made to retain this objective at 15 fish per net (31st percentile) to address concerns over forage declines. Management actions in the 2026 – 2035 management plan address this concern, with the intent of increasing yellow perch abundance in the lake.

Although some variability in catch rates can be attributed to fluctuations in recruitment, the decline in yellow perch catch rates from 1997 – 2005 occurred concurrently with marked increases in the cormorant population. Cormorant diet studies indicated that yellow perch were the principal prey of cormorants at that time (Schultz et al. 2013). Action was taken to address elevated predation of yellow perch by cormorants and assessments indicate the current level of cormorant control is appropriate (Schultz et al. 2013). Elevated predation by increased numbers of juvenile and adult walleye following management actions between 2005 – 2019 were identified as a contributing factor to the decline in yellow perch abundance since 2012. A strong negative relationship exists between yellow perch recruitment and total walleye fry density (Appendix C, Figure C1). Steps taken to reduce predation pressure on yellow perch include continued cormorant control, discontinuation of annual walleye fry stocking, and expanded walleye harvest opportunity for anglers (regulation change).

Following actions taken to address forage concerns, yellow perch abundance has continued to decline between 2020 – 2024. Elevated predation by walleye, changes in productivity post-zebra mussel establishment, and increased harvest by winter anglers have all been hypothesized by stakeholders as contributing factors to sustained declines over the past decade. Although the driving force behind declines has not been conclusively determined, yellow perch mortality has increased over time since 2000 based on catch curve analysis (Appendix C, Figure C2). A large spike in mortality occurred in the early 2000s as a result of the impact of predation by increased numbers of cormorants. Since then, mortality has continued to rise after initially rebounding post-cormorant control. Investigation of the mechanisms behind declines in yellow perch abundance will be completed throughout the life of this plan to improve upon adaptive management strategies.

Based on the 1983 – 2025 time series the 25th percentile represents a threshold below which yellow perch recruitment, walleye growth, and walleye condition are negatively impacted. Walleye and yellow perch are ecologically connected; subsequently both species must possess sustainable management objectives to meet long-term fishery goals. Given recent concerning trends in abundance, retaining the objective catch rate value at the 31st percentile aims to avoid designating a long-term forage shortage as status quo.

Figure 21. Gill net catch rates (fish per net) of yellow perch in Leech Lake, 1983 – 2025. The horizontal dashed line represents the abundance objective (31st percentile). The darker line represents the 3-year moving average.



Size Structure

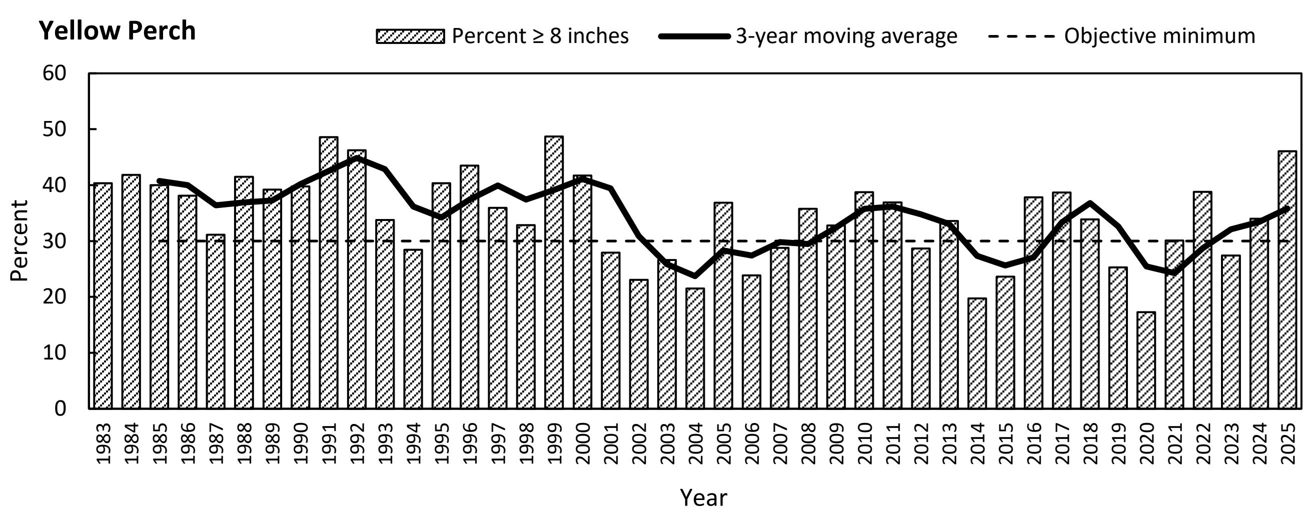
Objective: The percentage of yellow perch sampled in gill nets ≥ 8 inches should exceed 30% on a three-year moving average.

Summer and winter anglers begin consistently harvesting yellow perch on Leech Lake at 8-inches (Haws 2025). Leech Lake provides premier angling for yellow perch, so it is important to maintain a percentage of the population that is of the size anglers elect to harvest. Acknowledging that yellow perch are managed as both a primary prey species and a species for angler harvest, the 25th percentile (30%) from the 1983 – 2014 time series was originally established as the size structure management objective. This objective was retained in the 2021 – 2025 revision of the management plan. The 25th percentile from the 1983 – 2024 time series equate to 28.5%, slightly lower than the previous time series. This change reflects recent years of relatively fewer perch in annual assessments. This objective will be retained at 30% (now the 31st percentile) in the 2026 – 2035 management plan to emphasize the value of preserving quality size structure and avoid masking a harvest concern.

The percentage of yellow perch sampled in gill nets ≥ 8 inches has ranged from 17% (2020) to 49% (1999) from 1983 – 2024 (Figure 22). The size structure objective under the 2011 – 2015 management plan stated that the percentage of yellow perch sampled in gill nets ≥ 8 inches (PSD-8) and ≥ 10 inches (RSD-10) should exceed the 25th percentile thresholds for the 1983 – 2009 time series, which were 30% and 7%, respectively (Murphy and Willis 1996). Although the previous objective quantified length frequency data, the methodology was complex and subsequently altered.

The time periods where the size structure metric fell below the 30% threshold for multiple years included the early to mid-2000s, two of the three years from 2012 – 2014, and between 2020 – 2021. Reductions in the early to mid-2000s were attributed to elevated cormorant predation of juvenile yellow perch, which resulted in fewer fish reaching harvestable size. Reductions in recent years are suspected to be attributed to elevated walleye predation of juvenile yellow perch and changes in productivity post-zebra mussel establishment. Angler concerns have been expressed over high levels of ice angler pressure and harvest, citing increased traffic by wheelhouses and expanded ice road systems as potential contributing influences. Two new actions centered on maintaining quality yellow perch size structure were added to the 2026 – 2035 management plan to address these concerns (page 46).

Figure 22. The percentage of yellow perch in gill nets ≥ 8 inches in Leech Lake, 1983 – 2025. The horizontal line represents the size structure objective (31st percentile). The darker line represents the 3-year moving average.



Recruitment

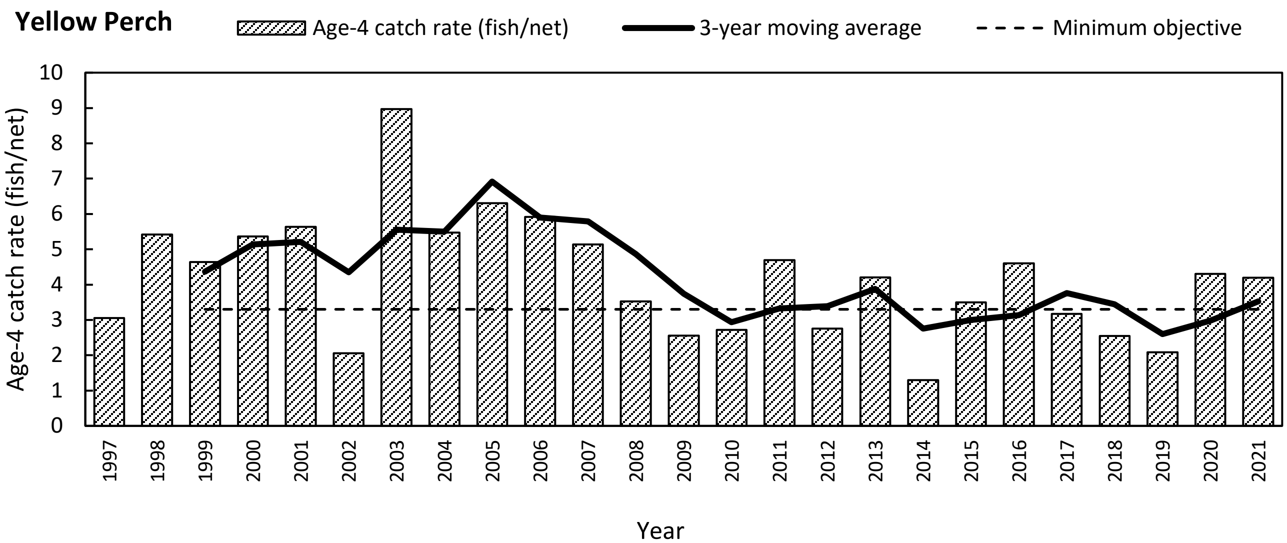
Objective: Maintain gill net catch rate of age-4 yellow perch ≥ 3.3 fish per net on a three-year moving average.

Maintaining stable yellow perch recruitment ensures fish are available for consumption by sportfish and angler harvest. Monitoring yellow perch recruitment is important, as it is a metric that indicates increased mortality of juvenile yellow perch or declines in production. Although YOY and age-1 yellow perch are sampled annually via seine in mid-July and bottom trawl in mid-August, there are no statistical relationships between the relative abundance of juvenile perch sampled with standardized gears and the number of individuals sampled in gill nets. Likely reasons include the numerous bottlenecks present between juvenile life stages and maturity. These include, but are not limited to climate shifts, consumption by predators, and abundance of alternative prey for predators. At age-4, yellow perch are approximately 7-inches on Leech Lake, meaning all individuals in this year class are large enough to be sampled in a gill net, yet are smaller than most anglers elect to harvest. Therefore, age-4 gill net catch rates serve as an index of recruitment.

Yellow perch gill net catch rates for age-4 individuals have ranged from 1.3 (2018) to 9.0 (2007) from 2001 – 2020 Figure 23). Yellow perch were aged with scales prior to 2001, sample sizes were small, and the distribution of the sample around the lake was poor. Consequently, the data used to calculate this metric is restricted to 2001 and later. The threshold of 3.3 fish per net refers to the 25th percentile of the 3-year moving average. Suspected explanations for the decline in recruitment since 2007 include increased predation pressure by walleye in response to aggressive walleye management actions in previous plans (e.g., stocking and walleye protected slot limits) and changes in productivity following zebra mussel establishment. The removal of the PSL in 2019 was in part done to create a heathier predator prey balance in the lake, with the goal being better survival of both species.

Predictive metrics of juvenile yellow perch are not well documented in large lakes (Dettmers et al. 2001) and many factors affect age-0 yellow perch recruitment making it difficult to predict year class strength (Irwin et al. 2009; Weber et al. 2011). Several mechanisms have been found to influence yellow perch survival during the first year of life including zooplankton availability, predation pressure, offshore transport by wind-driven currents, and water temperature (Dettmers et al 2001, VanDeHay et al. 2013). A sampling method used target larval fish (Neuston towing) was completed on Leech Lake for the first time in 2025 to identify trends in age-0 yellow perch densities across the lake and explore new methodologies to better interpret yellow perch recruitment.

Figure 23. Gill net catch rates (fish per net) of age-4 yellow perch by year class in Leech Lake, 1997 – 2021. Year indicates the year the fish was born. The horizontal line represents the recruitment objective (25th percentile). The darker line represents the 3-year moving average.



Angler Harvest

Objective: The annual total yellow perch harvest should be less than 98,000 pounds.

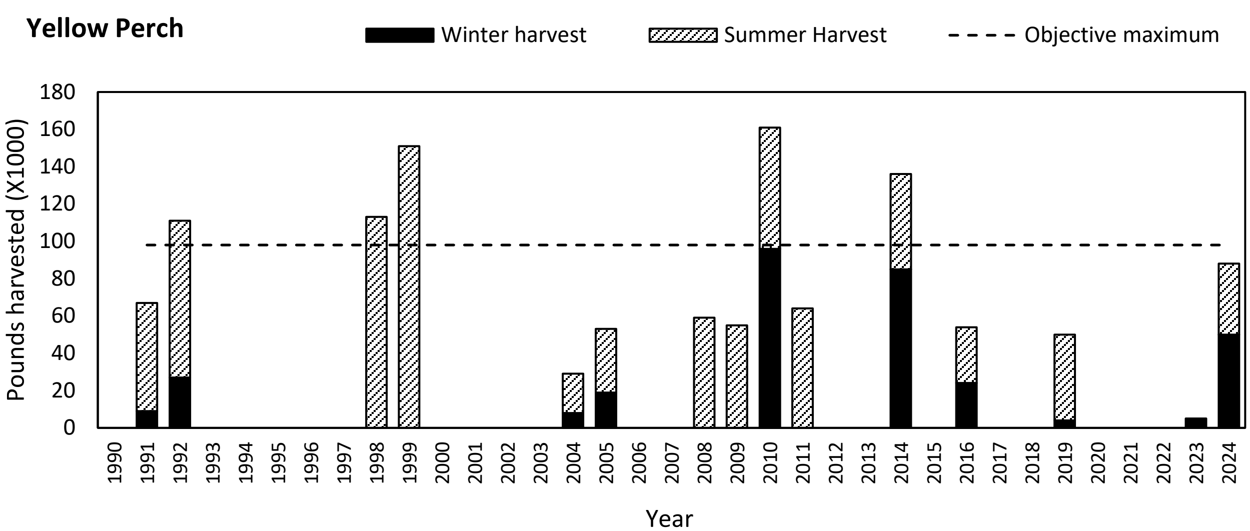
An angler-oriented objective focused on yellow perch harvest is important, as it is a measure of fish returned to the angler. Yellow perch are the most targeted species in Leech Lake at certain times of the year (September and March) and are sought by anglers year-round. The total annual pounds of yellow perch harvested (summer + following winter) have ranged from 28,909 (2004) to 160,217 (2010) pounds between 1965 and 2024 (not all years being sampled in that time series, Figure 24). Winter harvest exceeded summer harvest in the 2010-11, 2014-15, and 2024-25 winter creel surveys when favorable ice travel conditions were documented.

The threshold of 98,000 pounds first used in the 2016 – 2020 management plan represents harvest levels below which angling quality is protected or enhanced (MN DNR Large Lake Atlas 1997). If the annual pounds harvested exceed the threshold on an infrequent basis, changes to population metrics (e.g., abundance, growth, age at maturity, etc.) will likely not be observed. Although the threshold can be exceeded in an individual year, sustained exceedance may result in changes to population metrics. For example, if annual total harvest consistently exceeds the objective, growth rates may increase and maturity rates may decrease in response to elevated mortality. If harvest is driving this effect, a noticeable decline in yellow perch ≥ 8.0 inches should also occur. Therefore, if annual harvest routinely exceeds the threshold and changes to population metrics are observed, a weight of evidence approach should be used to determine if regulation modifications are appropriate.

Increases in winter angler pressure over the past 15 years have resulted in unprecedented harvest of yellow perch. The removal of the walleye PSL in 2019 was anticipated to provide benefits to the yellow perch population. Five annual assessments have been completed since the removal of the PSL, and the yellow perch abundance objective has not been met. Two additional winter creel surveys were completed between 2021 – 2024. Improved access (via ice conditions and ice roads) led to a substantial increase in harvest of yellow perch during the 2024-25 ice season (Haws 2025). Though angler success was highest in March, harvest occurred principally in January (38% of total harvest) and February (50% of total harvest). This is a deviation from previous creel survey observations (Pedersen 2024b and Pedersen 2020b).

Zebra mussel expansion lake-wide may impact overall lake productivity and alter safe harvest yields of yellow perch. Unfavorable changes in zooplankton density and species composition may lead to declines in population yields in the future. Therefore, 98,000 pounds of harvest may not be sustainable in post-zebra mussel conditions. Documentation of the continued rise in angler pressure and access in the winter is necessary to evaluate changes to the yellow perch harvest fishery. Two related actions concerning yellow perch harvest were added to the 2026 – 2035 revision of the management plan addressing rising concerns over yellow perch harvest.

Figure 24. Total harvest (pounds x 1,000) of yellow perch by Leech Lake anglers throughout summer and winter seasons, 1990 – 2024. The horizontal dashed line represents the harvest level below which angling quality is protected or enhanced (MN DNR 1997).



Maturity

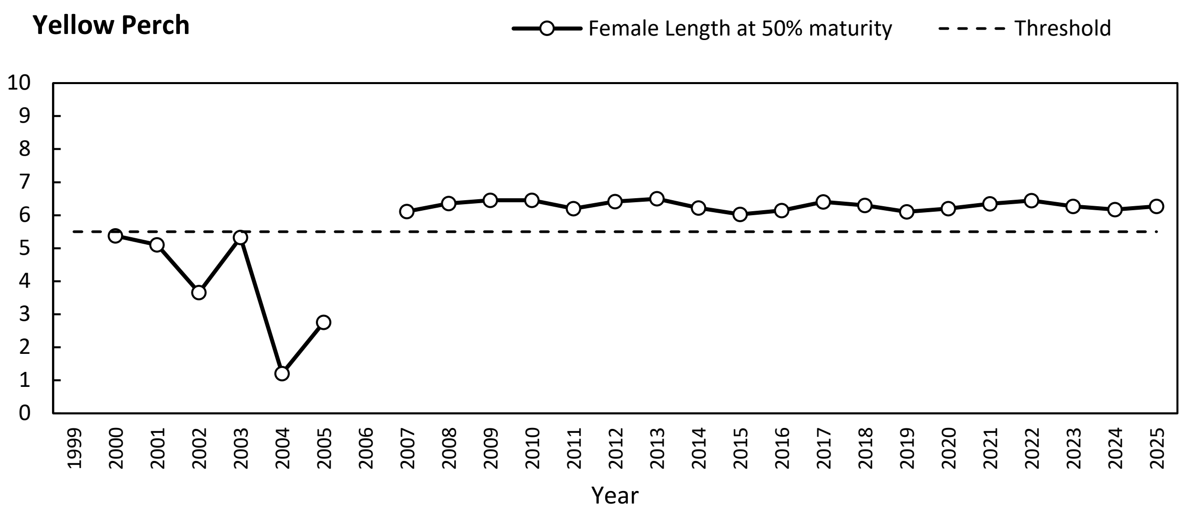
Objective: Female length at 50% maturity exceeds 5.5 inches.

The length at which individuals become sexually mature is one of several metrics that can indicate overharvest or, more precisely, increased mortality. As mortality increases, populations respond by shifting more energy to reproduction than growth, resulting in maturation at shorter lengths. Changes in growth rate and recruitment patterns are two additional metrics that can indicate increased mortality.

Female length at 50% maturity refers to the length at which females have a 50% chance of being mature. Prior to 2000, maturity observations were not recorded for yellow perch. Two distinct time periods exist within this time series, 2000 – 2005 and 2007 – 2024 (Figure 25). From 2000 – 2005 when cormorant predation was excessive, female length at 50% maturity never exceeded 5.4 inches. Specifically, in 2002, 2004, and 2005, less than four immature individuals were sampled in gill nets, while no immature fish were sampled in 2006. From 2007 through 2024, the length at 50% maturity averaged 6.3 inches (range 6.1-6.5).

The differences in these metrics across the two respective time periods indicate the expected population responses by yellow perch to changes in mortality as cormorant abundance increased and was then reduced and maintained by control efforts (Schultz 2013). There was not a maturity objective for yellow perch in the 2011 – 2015 management plan. A yellow perch maturity objective was added in the 2015 – 2019 revision of the management plan and has been retained since to monitor for signs of population stress as an impact of elevated mortality.

Figure 25. Total length of female yellow perch at 50% maturity in gill nets in Leech Lake, 2000 – 2025. The horizontal line represents the mortality threshold below which yellow perch matured at shorter lengths.



Yellow Perch Management Actions

The DNR has identified three yellow perch management actions. Two actions relate to angler harvest and the failure to meet specified size structure objectives. The third research action focuses on improving recruitment indices of yellow perch. Additional details about each research action can be found in the subsequent sections.

Angler Harvest Actions

1. If the three-year running average of the percentage of yellow perch ≥ 8 inches in gill net assessments falls below 30% for two consecutive years, yellow perch targeted creel funding will be pursued to evaluate angling pressure and harvest impacts.
2. Special regulations will be considered if creel survey and annual assessment data indicate overharvest is limiting abundance of yellow perch greater than 9 inches.

1. Seasonal Yellow Perch Harvest

Yellow perch targeted pressure and harvest on Leech Lake have historically been quantified by summer and winter creel surveys completed every four years. Additional creel surveys were completed in 2009, 2010, and 2016 to evaluate impacts of walleye management actions. Funding supplementary creel surveys can be challenging, as specific management needs are required for justification of expense. Winter creel surveys are less expensive than summer creel surveys because angling pressure estimates are obtained using access probabilities rather than aerial flight counts. Given yellow perch winter harvest has exceeded summer harvest in recent creel surveys, increasing the frequency of winter creels would expand upon estimates of yellow perch pressure and harvest allowing for improved understanding of the impacts from changes in access (ice roads) and pressure (sleeper house anglers). Given concerning declines in yellow perch abundance over the last decade, expansion of winter creel survey frequency would be justified if consistent declines in yellow perch ≥ 8 inches in gill net assessments are observed, suggesting harvest impacts may be occurring.

Yellow perch angling is highly seasonal on Leech Lake, with increased targeted pressure occurring in the fall (October) and during the late ice season (March) when ice conditions are favorable. High-quality yellow perch fisheries have documented high angler effort and harvest during the fall, suggesting this period should be sampled to avoid underestimation of effort and harvest (Schoenebeck et al. 2010). Fall pressure and harvest have not been documented on Leech Lake using standard creel survey methodologies as open water creel surveys traditionally end in September. Consideration of an extension of summer creel surveys (if funding is available) to capture October pressure on Leech Lake may be warranted to document seasonal harvest of yellow perch.

2. Special Regulations

Yellow perch are targeted year-round by anglers on Leech Lake and are a central component of the harvest fishery. On average, summer anglers harvest 1.2 yellow perch per angler-hour (1999 – 2024, Pedersen 2024). Targeted winter pressure for yellow perch is highly variable and is largely dependent on annual ice conditions. Winter anglers targeting yellow perch have accounted for as low as 10% to has high as 52% of parties visiting Leech Lake. On average, winter anglers harvest 0.8 yellow perch per angler-hour (2004 – 2025, Haws 2025), though catch rates vary considerably by season and angler type. Angler success has historically been highest in March, though harvest occurred principally in January and February in the 2024-25 winter creel survey, a deviation from historical patterns (Haws 2025). Expansion of ice angler effort paired with a decade long decline in yellow perch abundance in annual assessments prompted concern by stakeholders who have raised questions regarding the impact harvest has on the quality of the fishery. Most anglers elect to harvest yellow perch once they exceed 9 inches in length.

Yellow perch populations in Minnesota lakes often exist in one of two states that are categorized by the abundance of large (greater than 9 inches) individuals (Colby et al. 1987). When large yellow perch are abundant in a system, growth rates are typically fast. If a shift occurs causing the absence of large yellow perch, slow growth and poor size structure may lead to reduced recreational value (Radomski 2003). Indicators of overharvest can include a decline in average size, an increase in recruitment, and decreased overall condition (Radomski 2003). Regulating yellow perch recreational harvest can be challenging, as estimates of optimum sustainable yield are often uncertain. Tracking the abundance of yellow perch greater than 9 inches in annual gill net assessments and creel surveys is important for recognizing concerning shifts in size structure. Modeling predictive outcomes of various daily and possession limit reductions should be done preemptively; in the case a need is identified for a regulation change to reduce exploitation in the future.

Research Action

3. Continue to improve upon our understanding of yellow perch limiting factors, production, recruitment, and sustainable harvest models to meet fishery objectives.

3. Yellow Perch Research

Understanding the interplay between production, recruitment, and mortality is a cornerstone of fisheries management. Questions persist regarding the drivers limiting abundance of yellow perch in Leech Lake since 2012, specifically the influence production and mortality (predation) have on recruitment. Yellow perch often display erratic recruitment patterns in inland fisheries, driven by high mortality at the early life stage (Irwin et al. 2009).

Neuston net tows were completed in 2025 to expand upon yellow perch datasets by collecting novel estimates of age-zero yellow perch during the 60-day pelagic period following hatch. Abundance data related to juvenile yellow perch and their prey are not well documented in large lakes (Dettmers et al. 2001) and many factors affect age-0 yellow perch recruitment making it difficult to predict year class strength (Irwin et al. 2009; Weber et al. 2011). Several mechanisms have been found to affect survival during the first year of life including zooplankton availability, predation pressure, offshore transport by wind driven currents, and water temperature (development delays) (Dettmers et al 2001, VanDeHay et al. 2013). Future larval fish sampling will build upon this effort to gain information related to yellow perch production.

Increased predation pressure by walleye in response to aggressive management actions in previous plans (i.e., stocking and walleye PSL) have been cited as a leading factor influencing declines in yellow perch abundance between 2012 and 2019 (Pedersen 2021). Increased walleye biomass in Leech Lake following the protected slot limit likely had a negative impact on the yellow perch population. Moreover, higher walleye fry densities increased predatory demand for YOY yellow perch which has statistically corresponded with lower abundances of yellow perch surviving to age-4 produced the same year (Appendix C, Figure C1). The removal of the walleye PSL in part aimed to address negative impacts of high fry densities and reduce predation pressure on yellow perch.

Improving recruitment indices of yellow perch would provide managers with a means to determine when principal mortality occurs and how management efforts can be utilized to address concerning changes in abundance.

Muskellunge Goal

Maintain a self-sustaining muskellunge population that preserves the Leech Lake Proper genetic strain for statewide production needs and provides angling opportunity to catch trophy size fish (≥ 50 inches).

Muskellunge Objectives

The DNR has identified two objectives for the management of muskellunge in Leech Lake. Additional details are found in the subsequent sections for each objective.

Table 10. 2026 – 2035 muskellunge sportfish objectives.

Population Objectives	Target Range or Threshold	Data Source
Production	Maintain catch rates of mature muskellunge during spawn take operations every 4 years in Miller's Bay to meet production needs	Spring Spawn Take (2003 – present, quadrennially)
Size Structure	Muskellunge measuring ≥ 50 inches should be present in spawn take catches, summer creel surveys, or annual tournament reporting	Creel surveys (1965 – present, quadrennially), Spring Spawn Take (2003 – present, quadrennially), annual tournament reporting

Production

Objective: Maintain catch rates of mature muskellunge during spawn take operations every four years in Miller's Bay to meet production needs.

Identification of the Leech Lake Proper genetic strain in 1989 earned its use for statewide rearing, and Leech Lake now serves as the primary egg source for brook stock lakes in Minnesota's Muskellunge Stocking Program. Muskellunge spawning operations are completed every four years on Leech Lake to maintain genetic diversity in brood source lakes. Netting is completed in Miller's Bay which has been identified as an important muskellunge spawning area, possessing predominantly *Chara spp.* bottom-cover habitat protected from the Main Lake (Strand 1986, Figure 1). Ten large frame trap nets are set in the spring when water temperatures reach approximately 50° F. The number of female muskellunge spawned varies by year, dependent on spring temperatures, length distribution of females captured, and statewide egg quotas. The number of female muskellunge spawned during spring operations has ranged from four (2003) to 24 (2013) fish. Failure to sample adequate numbers of adult muskellunge to meet production demands would prompt investigation of potential management concerns (e.g., spawning habitat alterations or population changes).

Size Structure

Objective: Muskellunge measuring ≥ 50 inches should be present in spawn take catches, summer creel surveys, or annual tournament reporting.

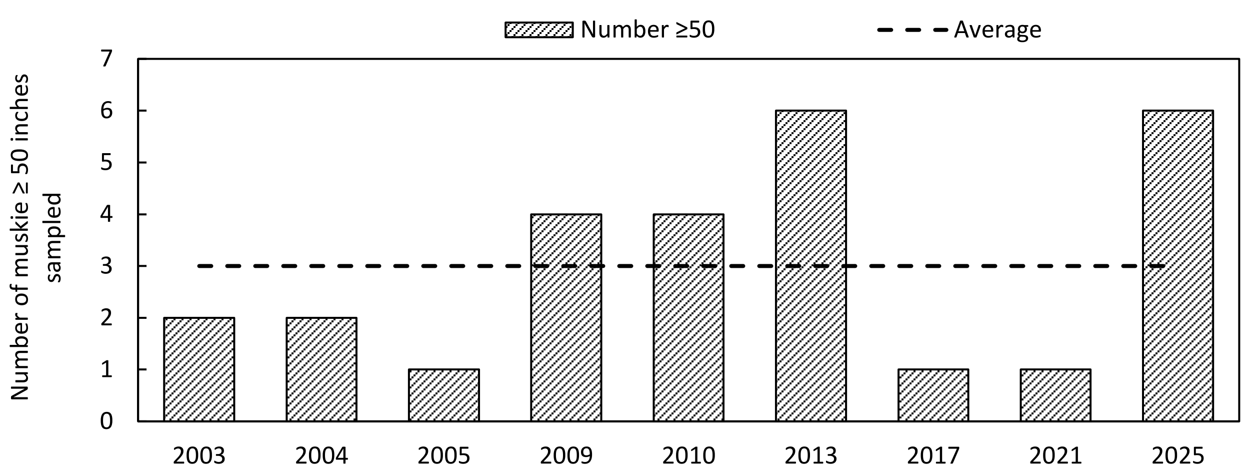
Protecting the Leech Lake muskellunge population for both propagation value and high-quality angling opportunity have been expressed as a priority by the LLFIG and various stakeholders in recent years. The overarching goal of preserving angling opportunity for trophy sized muskellunge was voiced throughout the 2026 – 2035 management planning process. Now designated as a primary management species, muskellunge research has become a focal point of collaborative efforts by the DNR, LLBO DRM, Bemidji State University, and the local community. The increase of focus on muskellunge management was based on the significance of Leech

Lake to the muskellunge angling community, their status as a high-value fishery, the population's ecological significance as a statewide resource, and growing stakeholder concerns over population status.

Muskellunge are a notoriously difficult species to sample, particularly in large systems that support a robust population. For this reason, limited long-standing datasets exist on muskellunge in Leech Lake despite their significance as a sportfish species. Information collected on the muskellunge population derives primarily from summer creel surveys, spawning assessments, tournament data (voluntarily collected since 2015), and citizen-based data collection initiatives (Muskies Inc.). Summer creel estimates of muskellunge caught throughout an angling season have ranged from 724 (2009) to as high as 3,275 (1999) fish. The percentage of anglers targeting muskellunge in Leech Lake has ranged from 4.8% (2008) to 12% (2005) (Pedersen 2024). Over time, harvest has dropped to nearly zero following statewide regulation changes (54-inch minimum, possession limit of one fish, early-June through end of November) and a general transformation in angler mindset toward the species.

Although representative distributions of population size structure are limited, evidence of decreased exploitation coupled with a documented increase in average size based on spawn take and angler-reported catch data indicate a shift in population size structure has occurred since the 1970s. Given data limitations, a size structure objective was incorporated in the 2026 – 2035 management plan to monitor for the absence of trophy sized fish based on available data sources. Muskellunge measuring ≥ 50 inches should be present in spawn take catches, summer creel surveys, or annual tournament reporting. The loss of the presence of trophy muskellunge from these combined datasets would call for further investigation of potential sources of increased mortality related to catchability, hooking/handling, or other size-specific vulnerabilities.

Figure 26. The number of female muskellunge ≥ 50 inches sampled during spawn take assessments on Leech Lake, 2003 – 2025. Metric allows us to verify presence/absence of trophy sized fish.



Muskellunge Management Actions

The DNR has identified five muskellunge management actions. One action relates to muskellunge production and stocking in Leech Lake. Four additional actions focus on efforts to gain information on the muskellunge population to inform management of the species. Additional details about each research action can be found in the subsequent sections.

Fingerling Stocking

1. Return 600 Leech Lake Proper strain muskellunge fingerlings to Leech Lake during spawn take years. Implant Passive Integrated Transponder (PIT) tags in fingerlings (as funding permits) to track recruitment.

To compensate for removing gametes (reproductive cells) during muskellunge spawn take operations, approximately 600 Leech Lake Proper muskellunge fingerlings will be returned to Leech Lake under the traditional DNR put-back policy on systems with spawn take operations. Stocked fingerlings will be implanted with PIT tags (when funding permits) to facilitate future investigations of stocking contribution. The next scheduled spawn take is in 2029.

Figure 27. Muskellunge fingerlings implanted with PIT tags being stocked into Leech Lake in October 2025.

Muskellunge Management and Research

2. Continue identifying novel evaluation methods (in addition to spawn take assessments, creel surveys, acoustic telemetry, and angler assisted genetic population estimates) to assess the muskellunge fishery and meet objectives.
3. Once a population estimate is obtained, refine muskellunge size structure objectives.
4. Continue collecting supplemental creel data from annual muskellunge tournaments.
5. PIT- tag all incidental captured muskellunge during annual assessments to build upon growth evaluation data.

Population estimates can provide a central basis to effective fisheries management and broader interpretation of ecological dynamics within a system. Efforts to estimate muskellunge population size in Leech Lake have been unsuccessful to date. Assessments of feasibility to complete a mark-recapture survey utilizing spring trap nets determined lake size and staffing constraints would largely impede efforts. A new approach to estimate muskellunge population size using microsatellite DNA genotyping was attempted in 2009 – 2010 (Schultz 2011). Angler submitted samples aimed to provide a suitable alternative to traditional tagging methods where sample sizes would be limited by gear ineffectiveness. Despite considerable efforts to promote angler awareness of the study, limited participation had a large influence on results and ultimately sample sizes were too low to meet statistical requirements. A genetic based mark-recapture project was again initiated in 2025 by DNR Fisheries Research staff to improve upon previous efforts by bolstering angler participation.

Considerable concerns were raised by various stakeholder groups in 2025 regarding the increased use of forward-facing sonar (FFS) with respect to the Leech Lake Muskellunge population, specifically as it relates to deep water angling. Based on the 2024 Leech Lake summer creel survey, 60% of anglers targeting muskellunge reported using FFS on their outing (Pedersen 2024). A multi-year movement study was initiated in 2025 between the DNR, LLBO DRM, and Bemidji State University. The project plans to use a combination of active and passive acoustic telemetry methods to evaluate muskellunge movement, seasonal habitat use, and mortality. In 2025, a total of 21 muskellunge received acoustic tags (15 from spawn take and 6 angled), with plans to tag additional fish in the future. Throughout the 2025 open water season, 32 acoustic receivers were deployed around the lake focused on areas of interest (deep water habitats) and pinch points/river exits.

Creel data has been collected from a minimum of three muskellunge tournaments on Leech Lake annually since 2015, except for in 2020 when COVID-19 restricted creel data collection to only one tournament. These surveys collect information on angler effort, angler success, and the length distribution of fish caught. Continued collection of reported catch data from participating tournaments is valuable for building a long-term dataset. Additional data integration methods could be explored to supplement this effort in the future, including the use of social media or phone applications to offer a modern and cost-effective option to collect angler information.

Secondary Management Species Goals, Objectives, and Actions

The following sub-sections list goals, objectives, and management actions for the secondary management species in Leech Lake, which include northern pike, bluegill, and black crappie.

Northern Pike Goal

Support a self-sustaining northern pike population that balances harvest opportunity with catch quality and guards against overabundance that outcompetes other species for forage.

Northern Pike Objectives

The DNR has identified two objectives for the management of northern pike in Leech Lake. Additional details are found in the subsequent sections for each objective.

Table 11. 2026 – 2035 northern pike sportfish objectives.

Population Objectives	Target Range or Threshold *3-year moving average	Data Source
Abundance	*≤ 5.3 fish/gill net	Fall gill netting (1983 – present)

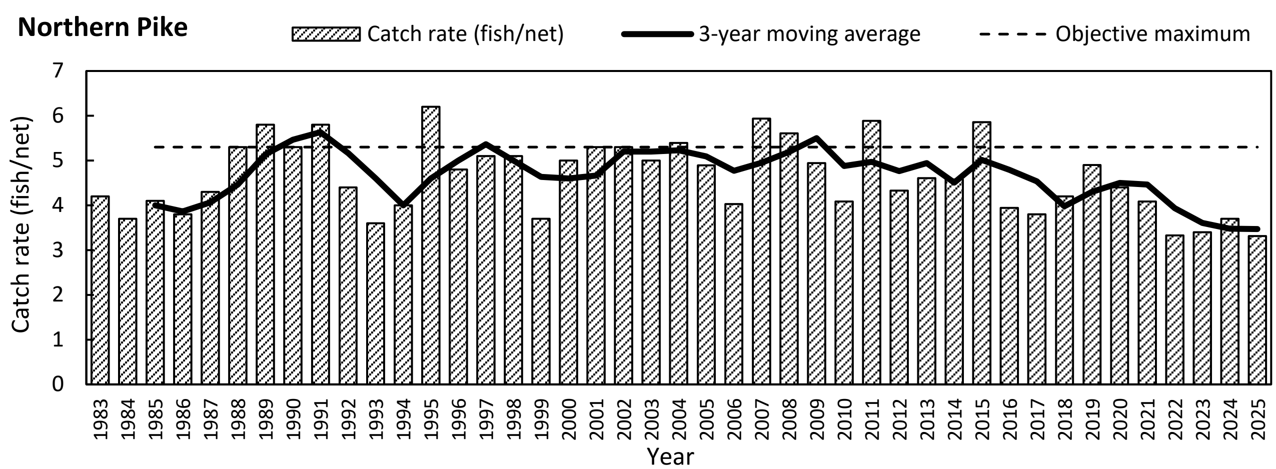
Size Structure	*≥ 26 inches should exceed 9%	Fall gill netting (1983 – present)

Abundance

Objective: Maintain a gill net catch rate ≤ 5.3 fish per net on a three-year moving average.

Maintaining a stable abundance of northern pike is important, as the species provides angling year-round and is a predator in competition with walleye for forage. Gill net catch rates showed little variation between 1983 and 2015, while recent years of consistently lower catch rates suggest a general decline in abundance over the last decade. Catch rates have ranged from 3.3 fish per net (2022) to 6.2 fish per net (1995) between 1983 – 2024 (Figure 28). The objective threshold of 5.3 fish per net represents the 75th percentile of the time series, altered from the preceding objective during the 2026 – 2035 management planning process. The abundance objective under the 2016 – 2020 (retained in the 2021 – 2025 revision) plan was to maintain a gill net catch rate between 4.1 and 5.3 fish per net. This objective was altered to a maximum catch rate based on the concern of increasing pike abundance within the North Central Pike Management Zone. Northern pike are in competition with walleye for forage (Glade et al. 2023), and low abundance promotes quality size structure, an objective that has been recognized as important to anglers visiting Leech Lake. Evaluation of the North-Central Zone regulation is scheduled to occur in 2028. Growth and maturity rates, recruitment, and harvest statistics are additional metrics to monitor if considering the appropriateness of regulation changes in the future.

Figure 28. Gill net catch rates (fish per net) of northern pike in Leech Lake, 1983 – 2025. The horizontal dashed line represents the 75th percentile. The darker line represents the 3-year moving average.



Size Structure

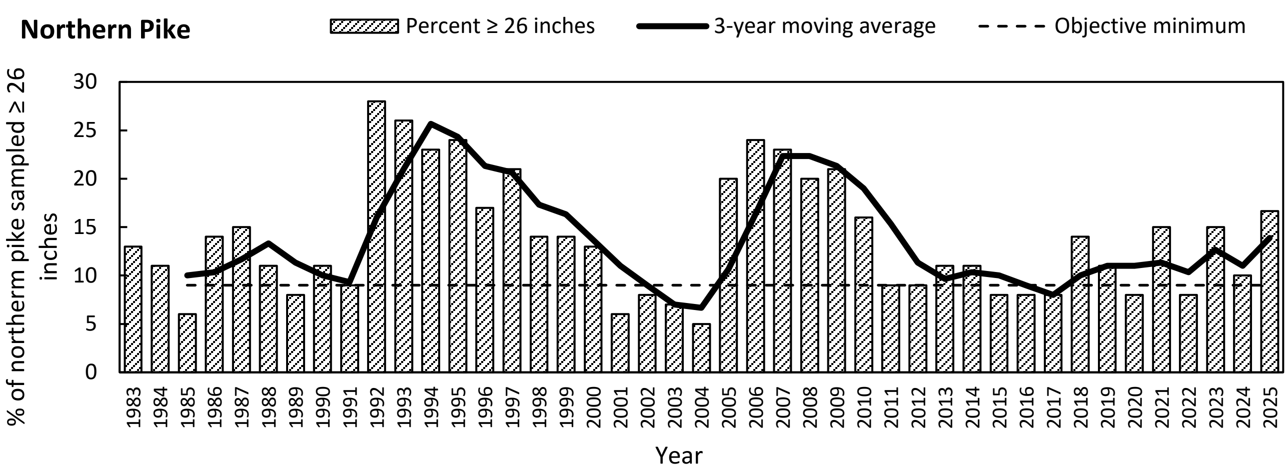
Objective: The percentage of northern pike sampled in gill nets ≥ 26 inches should exceed 9% (25th percentile) on a three-year moving average.

Increases in the abundance of small northern pike can result in slow growth, increases in consumption of prey (yellow perch), lower harvest potential, and lead to fewer trophy-sized fish. Therefore, maintaining a balanced size structure of northern pike reduces the likelihood these conditions will occur and maintains the catch quality and harvest potential for anglers.

Anglers on Leech Lake consistently begin harvesting northern pike beginning at 22 inches. It is important to maintain a certain percentage of the northern pike population that is of the size anglers elect to harvest. The percentage of northern pike sampled in gill nets ≥ 22 inches has ranged from 22% (2001) to 62% (2007) from 1983 – 2024 (Figure 29). Abundance of small pike has remained static in Leech Lake since 2012, following recent years of low recruitment and a decade long decrease in abundance of yellow perch. The size structure objective in the 2021 – 2025 Leech Lake Management Plan stated the percentage of northern pike sampled in gill nets (three year moving average) ≥ 22 inches should exceed 31%. The threshold of 31% (25th percentile) provided perspective on mid-size and larger individuals.

Since the adoption of the North Central Zone regulation in 2019, anglers are to release all northern pike between 22 and 26-inches on Leech Lake, except for spearers who are granted one incidental fish harvested within the slot. Based on reports of harvest in angler creel surveys since 2016, most harvest of northern pike occurs above 26 inches, with few anglers electing to capitalize on northern pike less than 22 inches (Pedersen 2024). In the 2024 summer creel survey, 14% of harvested northern pike were below 22 inches, while 83% were greater than 26 inches. In the 2024-25 winter creel survey, 13% of harvested northern pike were less than 22 inches, 83% were greater than 26 inches, and 4% were within the protected slot (22 – 26 inches). The size structure objective was altered during the 2026 – 2035 management planning process to track the proportion of northern pike greater than 26 inches given angler harvest preference.

Figure 29. The percentage of northern pike in gill nets ≥ 22 inches in Leech Lake, 1983 – 2025. The horizontal dashed line represents the 25th percentile. The darker line represents the 3-year moving average.



Panfish Goal

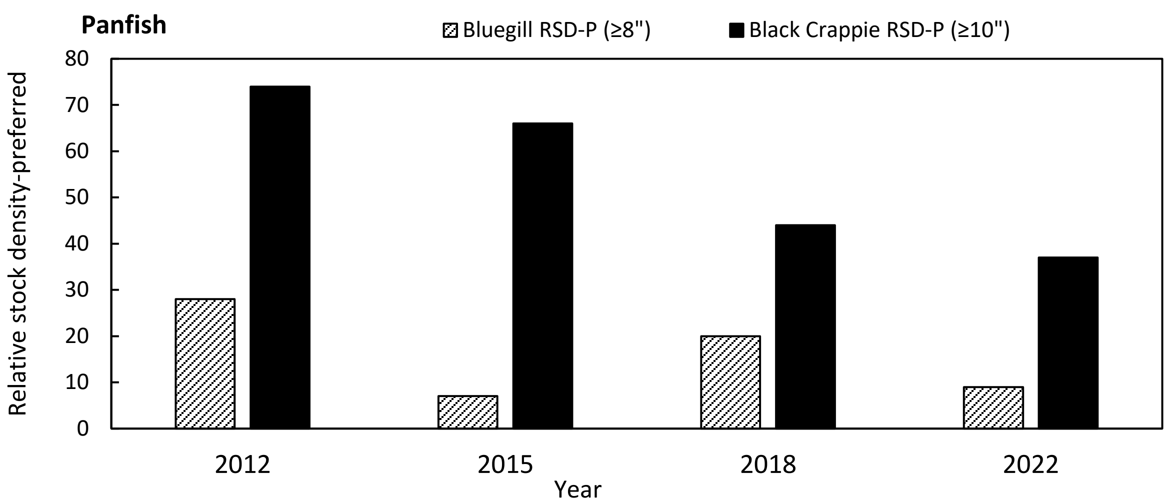
Maintain a self-sustaining bluegill and black crappie population that provides angling opportunity for quality sized fish.

Panfish Objective

Size Structure

Objective: Define size structure objectives for bluegill and black crappie by 2032.

Figure 30. The relative stock density-preferred (RSD-P) of bluegill and black crappie sampled during spring panfish assessments completed on Leech Lake, 2012 – 2022. Preferred size of bluegill is ≥8 inches and black crappie is ≥10 inches.



Panfish Management Actions

The DNR has identified three panfish management actions. Two actions relate to panfish sampling, and one relates to refining estimates of panfish harvest. Additional details about each research action can be found in the subsequent sections.

Panfish Sampling

1. Conduct lake-wide bluegill and black crappie assessments every four years based on standardized gears, locations, and timing. Monitor for potential changes in size structure. The next scheduled assessments are in 2026 and 2030.
2. Set up a series of meetings with LLFIG to discuss the size structure objective and evaluation of the special regulation in 2032.

Lake-wide sampling for bluegill and black crappie will continue to be completed every four years, following established sampling methodology, locations, and timing developed in 2018. Panfish species are not effectively sampled utilizing annual gill net assessments, which prompted a management need for increased effort to establish a long-term dataset on panfish beginning in 2012. Initial spring electrofishing surveys were completed to standardize sampling locations. Electrofishing sites were selected based on the presence of firm bottom substrate near vegetation where males create nests. Four panfish population evaluations have been completed to date (2012, 2015, 2018, and 2022) with the next scheduled assessments planned for 2026 and 2030. Panfish sampling aims to monitor changes in size structure and abundance (evidence of exploitation). Following the completion of the next two scheduled assessments, a size structure objective for both species will be defined in the next management plan revision to aid in the evaluation of the special regulation.

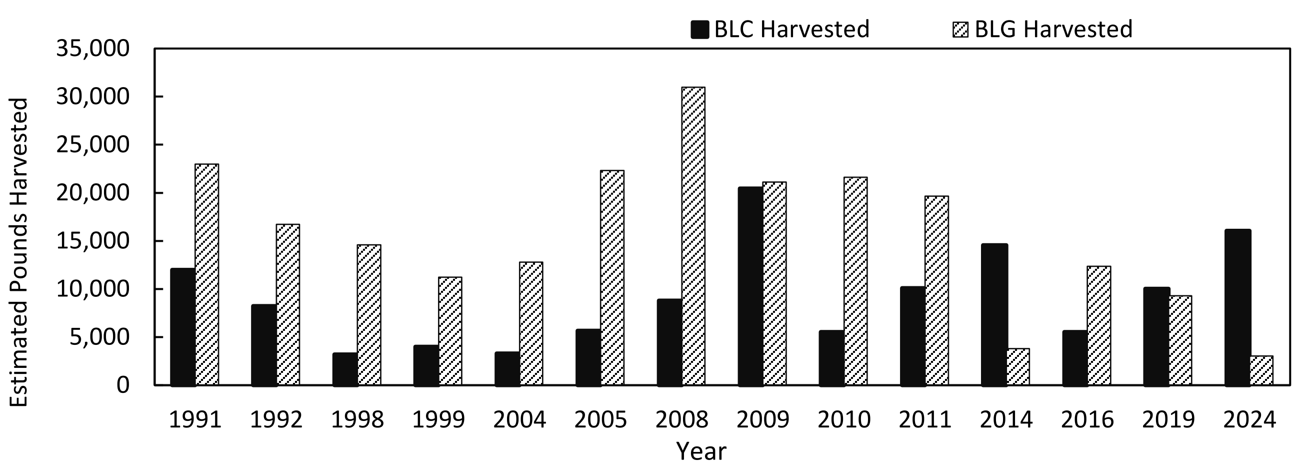
Panfish Harvest

3. Explore methodologies to refine winter creel survey estimates of ice angler pressure and harvest of panfish.

Over the past ten years a rise in social media, video blogging, and improvements in angler technology have many anglers wondering how schooling species will be impacted by these changes. Strong concerns have been expressed by lakeshore owners, area guides, fishing industry personalities, and LLFIG members concerning how harvest impacts will affect the exceptional size quality of both species in Leech Lake.

In Minnesota, a suite of special regulations was enacted as part of the Quality Panfish Initiative to restrict the harvest of large spawning males and maintain size structure of panfish populations across the state. A special regulation on panfish on Leech Lake was discussed among stakeholders and an angler opinion question was asked in the 2015-2016 winter and 2016 summer creel surveys. Anglers were largely in support of the special regulation (Stevens and Ward 2015, Pedersen and Schultz 2016) which was enacted in 2021 (daily limit of 5 sunfish, daily limit of 5 crappies). The next step will be evaluating if and how the special regulation has impacted panfish populations in the lake.

Figure 31. Total harvest (pounds) of bluegill and black crappie harvested by Leech Lake anglers throughout summer creel surveys, 1991 – 2024.



Panfish angling continues to gain popularity, particularly when it comes to ice anglers. Summer estimates of bluegill harvest have (Figure 31) ranged from 3,031 pounds (2024) to 30,992 pounds (2008) and black crappie harvest has ranged from 3,209 pounds (1998) to 20,444 pounds (2009). Winter estimates of sunfish harvest have ranged from 67 to 1,764 pounds (1965 – 2024) and crappie anglers are infrequently intercepted by clerks (no harvest estimates available). Historical estimates of angler pressure and harvest of panfish on Leech Lake have been low throughout the winter season relative to other sportfish species (Haws 2025). Based on the low encounter rate of panfish anglers and estimates of winter pressure, measures of panfish harvest on Leech Lake are likely underestimated using standard creel survey methodology. Refinement of access probabilities throughout the season to include additional access locations should be explored to expand upon novel techniques to improve upon measures of panfish angler behavior.

Fish Habitat Goals and Actions

Habitat Goal

To achieve healthy resilient lake and watershed habitats and provide resource access within Leech Lake. This goal will be realized through collaboration with our partners to protect, enhance, and restore aquatic habitat (MN DNR Fish Habitat Plan 2013).

Habitat Management Actions

To support the long-term resilience of the fish community in Leech Lake the DNR has defined several habitat related actions found in the subsequent sections. It should be noted that many of these actions will only be possible with additional resources (e.g., funding and staff).

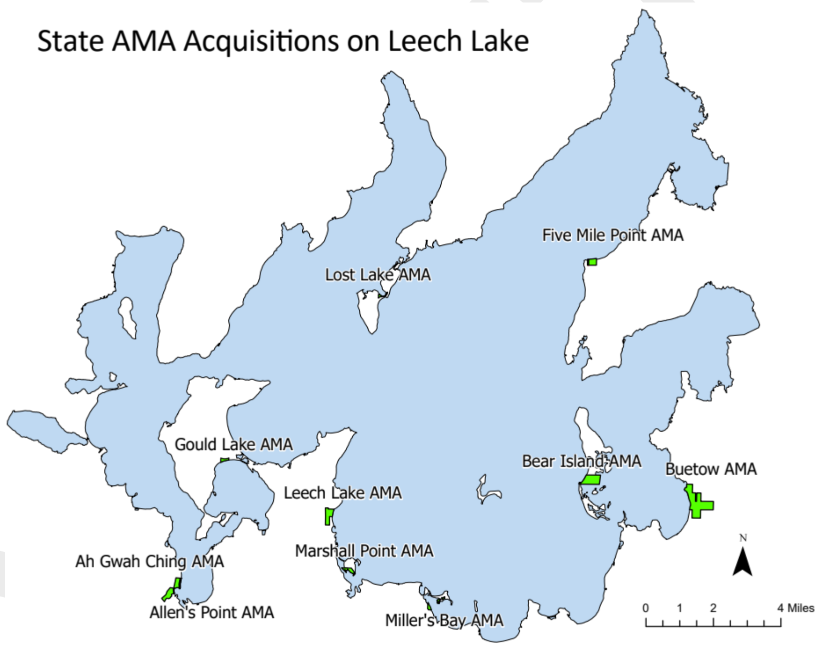
1. Continue to partner with and/or provide support to government and non-governmental organizations to acquire via fee title or conservation easement shoreland areas within the Leech Lake watershed with the intent to protect key habitats and to implement best management practices (BMPs) where appropriate.
2. Continue mapping emergent aquatic plant stands to monitor alterations in fish habitat.
3. Continue to monitor fish populations for disease such as viral hemorrhagic septicemia (VHS) and contaminants.
4. Continue to support watershed restoration and protection measures through participation and environmental review of proposed projects.
5. Coordinate with DNR Ecological and Water Resources staff and Cass County Environmental Services to assist with aquatic invasive species prevention, education, and management efforts by DNR Ecological and Water Resources Division and the Leech Lake Band of Ojibwe, Division of Resource Management.
6. Continue to support efforts to evaluate fish habitat impacts from establishment of aquatic invasive species, quantity impairments, and develop methods to protect and restore critical habitats.

1. Protection

Over the past several decades, emphasis on sustaining freshwater ecosystems has led to a large expansion in the development of protective policies aiming to preserve aquatic habitats in Minnesota. Many of the proposed habitat management actions referenced in this plan will require additional funding and/or staff or rely heavily on partner agencies or non-governmental organizations (NGOs) and will only be possible when specific opportunities present themselves (Appendix D). The DNR Division of Fisheries will make recommendations or support actions with other NGOs and/or government agencies as appropriate to protect the aquatic resource.

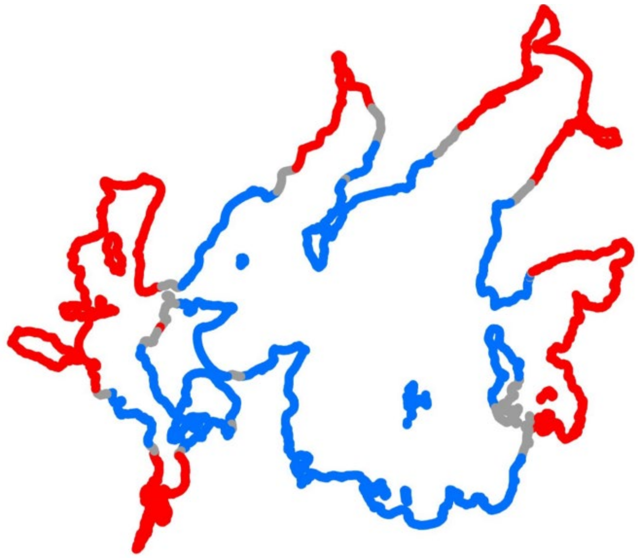
Ten aquatic management areas (AMAs) exist on Leech Lake (Figure 32) that provide angler and resource access, protect critical habitat, and provide areas for aquatic education and research. Aquatic management areas comprise a total of 538 acres of protected land around Leech Lake. Leech Lake lies within the Leech Lake River watershed, part of the larger Upper Mississippi Headwaters watershed. The Leech Lake River watershed encompasses 1,335 square miles, over 750 lakes, and approximately 277 miles of streams and rivers. The watershed is largely undeveloped and is considered highly protected at 79.4% (Upper Mississippi Headwaters 2024 Protection Summary Dashboard). The Leech Lake River watershed supports excellent water quality and a diverse aquatic community (LLR Watershed Monitoring and Assessment Report 2016), providing an important resource to the state of Minnesota. Land use within the watershed is predominantly forest (57.9%) and wetland (16.2%) (Appendix F).

Figure 32. Map of all state aquatic management areas (AMAs) on Leech Lake.



Five Mile Point and Miller’s Bay (Whipholt) were identified as high priority areas for acquisition because they are muskellunge spawning areas, are potentially sensitive to anthropogenic disturbance, and have been partially protected to date. Through partnership between the Northern Waters Land Trust, DNR, LLA, and the Twin Cities Chapter of Muskies Inc., several tracts of land were acquired and are now designated as AMAs adding an additional 5.25 acres and 1,300 feet of undeveloped shoreline to the existing Miller’s Bay Aquatic Management Area in 2022. Prioritizing additional areas for acquisition can be accomplished using findings from the Cass County Sensitive Shorelands project (Figure 33), Minnesota Pollution Control Agency’s WRAPS program (Watershed Restoration and Protection Strategy), DNR sampling information, and other habitat-oriented evaluations. The DNR will continue to thoroughly review project proposals requiring a permit within the context of short- and long-term environmental impact.

Figure 33. GIS-identified cluster points with similar scores of sensitive shorelines. Red areas are those with highly sensitive shoreline. Final Report, MN DNR, EWR, Sensitive Lakeshore Survey 2010, Leech Lake, Cass County, MN.



2. Nearshore Habitat Inventory

Natural lakeshores provide a transition zone between the land and the aquatic resource, providing critical ecological services that benefit water quality. Riparian zones comprised of stable vegetation reduce erosion impacts, trap sediments and nutrients, and provide numerous ecological benefits. Protecting natural vegetation or re-establishing it directly or through natural succession is critical for a functioning buffer zone (MN DNR, Score Your Shore 2012).

A Score the Shore inventory of Leech Lake was completed in 2018. Score the shore is a natural resources survey used to estimate the amount of habitat in three lakeshore zones. The shoreland zone is the portion of land which is most likely to be developed and approximates the required minimum setback distance for shoreland structures. The shoreline zone is the portion of land between the shoreland and aquatic zones. The shoreline zone begins at the water's edge and extends landward to the bank. This zone may be narrow or broad, depending on the slope. The aquatic zone begins at the land-water interface and extends to 50 feet. It includes shallow water where rooted aquatic plants may grow; this is also the zone of a lake most likely to be utilized and impacted by riparian residents.

Score the Shore results on Leech Lake consisted of 732 survey sites evenly spaced 500 meters around the lake. Survey scores are designed to provide a means to quantify and compare lakeshore habitat between lakes and the average score statewide is 73.6. The average lake wide habitat score on Leech Lake was 78.9 (+/- 0.8) indicating overall lakeshore habitat quality was moderate. Repeating this survey in the future would be beneficial for tracking lakeshore changes and/or improvements over time.

2. Aquatic Vegetation History

Classifying aquatic vegetation is important for natural resource planning, management, and protection. Data on aquatic plants stands are used for a variety of conservation goals. Many fish species utilize aquatic plants for spawning habitat, protection, and other specific environmental conditions fish species need to successfully complete all stages of their life cycle. Other aquatic plants, like wild rice (*Zizania spp.*) are important for cultural and economic reasons. Aquatic invasive species can become established and dominate plant stands, outcompete native species, or destroy aquatic vegetation (uprooting and foraging behavior). Delineating aquatic plant stands and recording taxa composition allows resource managers to quantify changes over time.

The first quantitative assessment of Leech Lake's aquatic plant communities was done between 2002 – 2009 through collaboration between the DNR Division of Ecological and Water Resources (EWR) and the LLBO DRM (Perleberg 2010). A total of 9,720 sites were surveyed to collect baseline data on the aquatic plant community. Roughly 30% of Leech Lake supports aquatic plant growth. A second survey was completed between 2019 and 2023 by DNR Fisheries and EWR, delineating all floating leaf and emergent vegetation using GPS mapping and GIS software. Emergent vegetation is considered to include all aquatic plants that can be seen above the surface of the water. A total of 7,926.1 acres of floating and emergent plants were mapped (Appendix G). Wild rice, waterlilies, and bulrush were the primary species present.

3. Fish Health

The Minnesota fish consumption guidance program is updated periodically by the Minnesota Department of Health (MDH). This tracks contaminant data for Minnesota waterbodies, specifically levels of mercury, polychlorinated biphenyl (PCBs), and per- and polyfluoroalkyl substance (PFAS). When eating fish from Leech Lake, it is recommended to follow the statewide fish consumption guidelines found on the MN Dept. of Health Web page. Additional fish health projects have been completed on Leech Lake focused on the prevalence of the parasite *Heterosporis spp.* in sportfish populations (MN DNR unpublished data).

Concern has been expressed regarding the potential for increased bioaccumulation of mercury in fish tissue following the expansion of zebra mussels in Leech Lake. Zebra mussels disrupt aquatic foods webs, affecting aquatic mercury cycling in inland lakes. Research in Minnesota lakes with and without zebra mussels found that mercury concentration in adult walleye and yellow perch was 72% and 157% higher, respectively, in lakes containing zebra mussels compared to uninvaded lakes (Blinick et al. 2024).

Game fish from Leech Lake will continue to be tested for mercury following the DNR contaminant tracking program protocol (Fish Guidelines Program) to inform consumption guidelines. Large amounts of mercury can be harmful to the nervous system, specifically during childhood development (MN Dept. of Health). Questions concerning how changes in bioaccumulation of mercury in fish will impact fish in Leech Lake remain, specifically how increases in mercury concentrations may disproportionately impact subsistence harvest by the Leech Lake Band of Ojibwe, prompting a joint research project between the LLBO DRM and the University of Minnesota, Minnesota Aquatic Invasive Species Research Center (UMN CFANS MAISRC Research Center, pers. communication).

5. Aquatic Invasive Species Management and Education

Aquatic invasive species (AIS) are non-native plants, animals and diseases that do not naturally occur in our waters and may cause harm to the environment, the economy, human health, or natural resources. Citizens can help protect Leech Lake by reporting new species detections and reducing the spread of AIS through decontamination of watercrafts and water recreation equipment. People can spread AIS by releasing bait, aquarium pets, and aquatic plants. More information on preventing AIS can be found at Help Protect Minnesota Waters.

The MN DNR will continue to coordinate with the MN DNR Ecological and Water Resources staff and Cass County Environmental Services to assist with AIS prevention, education, and management efforts by DNR Ecological and Water Resources Division, the LLBO DRM, and other agencies.

Operational Plan Detail

Stocking

Walleye fry stocking will only be considered under the following two scenarios:

1. If the four-year moving average (of YCS index values) falls below the 25th percentile (for the 1983 – 2024 time series), walleye fry stocking will be considered the following year. Stocking decisions will be based on metrics of spawner stock biomass (wild fry densities) and forage availability. If fry stocking is deemed appropriate, fry will be marked with oxytetracycline (OTC) to evaluate wild fry production. See Table 6 for additional details.

2. If the mature female density estimate observed in a single year is below 1.25 pounds per acre or above 2.75 pounds per acre, a low-density fry stocking will be considered the following year. Fry will be marked with OTC to evaluate wild fry production. Note – this is contingent on yellow perch abundance.

Approximately 600 Leech Lake Proper muskellunge fingerlings will be returned to Leech Lake on production years (every four years) to compensate for removing gametes during spawn take operations.

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. These targeted fishery assessments, in combination with the creel survey, are conducted to provide comprehensive information that will help track progress towards goals, determine objective success, and inform adaptive management.

Annual Large Lake Surveys

Annual surveys will continue to include water quality sampling and seining in mid-July, trawling in mid-August, electrofishing in mid-September, gill netting in mid-September, water temperature loggers (recording hourly year-round), and monthly zooplankton sampling (mid-May through mid-October).

Summer seining

Two seine hauls will be completed at five stations once per week over a two-week period in mid-July (Julian Weeks 28-29). Two hauls per week will be made at each station using a bag seine (100-ft. long, 5-ft. deep, 0.25-

in. untreated mesh) for a total of 20 seine hauls. All gamefish will be identified and a representative sample measured (TL, mm). Gamefish will be recorded as either YOY or older. When necessary, seine hauls will be sub-sampled due to large numbers of fish captured. The objective of seining is to characterize early growth rates of YOY fish (specifically walleye and yellow perch).

Summer trawling

Trawling will be conducted at the three long-term stations using a semi-balloon bottom trawl (25-ft. head rope, 0.25-in. mesh cod end liner) in mid-August (Julian Weeks 33-34). Eight hauls will be conducted at Five Mile Point, six at Goose Island, and six at Whipholt Beach, for a total of 20 hauls. Hauls at the three long-term stations consist of five-minute tows at a fixed speed of 3.5 mph for a total effort of 100 minutes of trawl time. Trawled depths range from 6-12 feet depending on transect and location. Fish will be identified, measured, and enumerated as per the methods described for shoreline seining. The objective of trawling (and electrofishing) is to index relative abundance of YOY walleye and yellow perch and characterize early growth rates for both species.

Fall electrofishing

Electrofishing will be conducted using an MLES-Infinity pulsed-DC electrofishing boat in mid-September (Julian Weeks 37-38). Standardized stations are located on the east side of the main basin near Bear Island and Brevik public access, the south side of the main basin near Roger's Point, the west side of the main basin near Stony Point, and the southern portions of Walker Bay (Figure 1). The 11 transects are approximately 3-5 feet deep on sand/gravel/cobble shorelines. If available, up to 25 age-0 walleyes per transect will be measured (TL, mm) and released and the remainder counted and released.

Fall gill netting

Fall gill netting will be conducted annually at 36 sites with overnight sets from early through mid-September using standard experimental gill nets. All fish will be identified, measured, and weighed. Gender and stage of maturity will be documented in all walleye, yellow perch, northern pike, cisco (tullibee), and lake whitefish. Otoliths for aging will be collected from all walleye and a subset of yellow perch, cisco (tullibee), and lake whitefish. Aging structures from northern pike may be collected. A variety of metrics 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 may be collected as the need arises.

Water temperature monitoring

Temperature loggers will be deployed and data offloaded annually to track water temperatures in Walker Bay and the Main Lake. Data will be used to calculate growing degree days and investigate trends in fish growth.

Zooplankton sampling

Five sites (Stony, Agency, Portage, Kabekona, Walker Bay) will be sampled (i.e., vertical plankton tows) twice monthly from May through June and once a month from July through October. Data will be used to track trends in zooplankton community structure, abundance of native, and abundance of invasive zooplankton species.

Creel Surveys

Summer and winter creel surveys will be conducted every four years. The most recent completed surveys were in the summer of 2024 and the winters of 2023-24 and 2024-25. Funding was acquired to repeat the winter creel survey two winters in a row due to the poor ice conditions in the 2023-24 winter creel survey. The next scheduled creel surveys on Leech Lake are for the summer of 2028 and the winters of 2028-2029. Angler satisfaction will continue to be incorporated into future creel surveys at the request of the LLFIG.

Maintain Existing Special Regulations

Walleye: possession limit of four fish, only one over 20 inches allowed in possession.

An 18–26-inch walleye PSL, four fish possession limit was implemented in 2005 to protect and increase spawner biomass; the regulation was relaxed to a 20–26-inch PSL in 2014 after management objectives were exceeded. In 2019, the regulations were further relaxed to a 1 over 20-inch limit with a possession limit of 4 fish. Spawner stock biomass has dropped back within target range following five years of the regulation change which is central to promoting a balanced predator/prey dynamic in the lake. If spawner biomass drops below management objectives (three -year moving average) reinstatement of a protected slot limit will be considered.

Panfish (bluegill and black crappie): daily limit of five fish.

A special regulation on panfish on Leech Lake was discussed among stakeholders and an angler opinion question was asked in the 2015-2016 winter and 2016 summer creel surveys. Anglers were largely in support of the special regulation (Stevens and Ward 2015, Pedersen and Schultz 2016) which was enacted in 2021 (daily limit of 5 sunfish, daily limit of 5 crappies). This regulation will be evaluated utilizing future creel surveys and targeted spring sampling. The proposed regulations are intended to reduce exploitation and maintain quality size structure.

Lake whitefish and cisco (tullibee): bag limits of 50 cisco (tullibee) and 25 lake whitefish within the Leech Lake Indian Reservation will be continued. Daily and possession limits are the same.

Other species: If changes to statewide regulations occur, the DNR will implement regulations consistent with statewide recommendations and evaluate angler and fish population responses through standardized creel and fish population surveys.

Monitor Species of Interest

Species of interest are species that are monitored through fisheries assessments that provide additional angling opportunity.

1. Conduct lake wide largemouth bass assessments every four years based on standardized gears, locations, and timing. Monitor for potential changes in size structure. The next scheduled assessment in 2026 and 2030.
2. Complete smallmouth bass electrofishing assessments once every three years to collect lengths, weights, and aging structures to expand species datasets and aid in the future goal and objective setting. The next scheduled assessment in 2027.
3. Collect lengths and aging structures from a subsample of smallmouth bass collected by tournament anglers for age and growth evaluation.
4. Explore research opportunities to work with partners to increase our understanding of burbot, cisco (tullibee), and lake whitefish populations.
5. Assist the Leech Lake Band of Ojibwe, Division of Resource Management with lake whitefish projects to determine effective population size.
6. Continue to collect data from a subsample of tullibee (cisco) and lake whitefish, when possible, in coordination with the Leech Lake Band of Ojibwe, Division of Resource Management commercial fishery.

Smallmouth Bass Sampling

Given the expansion of the smallmouth bass population in Leech Lake over the last two decades, the LLFIG has expressed interest in increasing efforts to collect information on the species' population status. Catch rate of YOY smallmouth bass in annual trawling assessments increased from roughly 20 fish per hour in 2014 to 90 fish per hour in 2023 (LLAR 2024). Angler interest in smallmouth bass has subsequently increased, targeted by 2.4% of anglers in the 2024 summer creel survey (Pedersen 2024). The first assessment targeting smallmouth bass on Leech Lake was completed in 2013 to collect baseline age and growth data. Approximately 18 hours of electrofishing covering roughly 35 miles of shoreline was largely unsuccessful at collecting a representative sample of smallmouth bass (19 fish collected). A second targeted assessment was completed in 2024 with similar results (12 fish collected). Targeted sampling has been challenging on Leech Lake, likely associated with deep spawning habitat and gear limitations. Future efforts to target smallmouth bass will be prioritized every three years to collect lengths, weights, and aging structures to expand species datasets and aid in the future goal and objective setting. The next scheduled assessment in 2027.

A citizen-based approach was taken through partnership with tournament anglers on Leech Lake to sample the adult population in 2025 (MN DNR, unpublished data). This effort resulted in the sampling of 455 angled smallmouth bass, including a sub sample of aging structures to provide novel estimates of growth. Collection of smallmouth bass through collaboration with tournament anglers will be completed in the future when opportunities present themselves.

Cold-water Species Monitoring

Burbot, cisco (tullibee), and lake whitefish require cold well-oxygenated water below 70 °F. Predicted increases in water temperatures because of climate change will likely reduce the amount of habitat available to these species in the future. Cold-water species provide recreational opportunity throughout the ice angling season and accounted for 8.3% of targeted angling trips on Leech Lake throughout the winter of 2024-25 (Haws 2025).

Information on population status of cold-water species present in Leech Lake is limited, as they are not consistently sampled utilizing applied gears. Opportunities to work collaboratively on projects related to these species should be explored in the future, including ongoing projects by DNR Fisheries Research and the LLBO DRM.

Additional Planned Work

Additional details for several of the listed initiatives can be found in the subsequent sections.

1. Continue to provide financial and technical support to the Leech Lake Band of Ojibwe, Division of Resource Management for double-crested cormorant control and evaluation efforts on Leech Lake.
2. Continue to monitor food chain dynamics to assess potential impacts of Aquatic Invasive Species on fish populations and carrying capacity.
3. Continue to work with tournament applicants to encourage CPR (Catch Photo Release) formats for tournaments to the extent possible to reduce fish mortality.
4. Ensure stakeholders and interest groups are kept up to date on management activities through public outreach and continued community engagement.
5. Hold annual meetings to update the LLFIG and other interested stakeholders to share the previous year’s information and track status with regards to the management plan.
6. Develop statewide educational and interpretive materials to explain the history, cooperative management, and status of the Leech Lake fishery.

1. Double-crested Cormorant Control

The Leech Lake Band of Ojibwe, Division of Resource Management has jurisdiction over the double-crested cormorant control policy on tribal lands and waters on Leech Lake. The DNR will continue to support maintaining the cormorant population at 500 reproducing pairs equating to a total fall population at, or below 2,000 birds. The annual removal of most birds earlier in the year will continue to be encouraged, as this reduces total fish predation and was included under the previous federal Public Resource Depredation Order. The MN DNR will continue to support DRM’s efforts to secure funding sources and provide technical assistance for continued cormorant control and research evaluating cormorant impacts on Leech Lake sportfish populations as requested by DRM and pursue long-term permitting of control.

3. Tournaments

Fishing tournaments in Minnesota waters are guided by MN Statutes 97C.081 and MN Rules Chapter 6212.2400 through 6212.2800. The MN DNR will continue to work with tournament applicants to, when feasible, promote tournament permittees to conduct catch-photograph-release (CPR) formats to reduce fish stress and mortality. Tournament organizers are encouraged to follow recommendations to protect Leech Lake from AIS by creating a prevention plan regarding decontamination during pre-fishing and tournaments.

5. Annual Stakeholder Meetings

Annual update meetings with the LLFIG will occur in March. The purpose of these meetings will be to share current data and information with LLFIG and other interested stakeholders regarding the status of the fishery. Management objectives and actions outlined in this document are intended to provide the framework for management on Leech Lake for the next ten years. Most management objectives and actions outlined here are directed at fish populations. While adaptive management relies upon "learning by doing", appropriate timelines are needed to ensure the outcomes of management actions can be accurately assessed and lessons learned can be applied to future decision-making processes.

6. Outreach and Education

Interest in Leech Lake fisheries management extends across broad ranging stakeholder groups and the public often contacts fisheries staff requesting information related to Leech Lake. Effective and timely communication with the public is indispensable for disseminating current information and ensuring constituents are kept up to date on fisheries management related activities.

The development of educational and interpretative materials to explain the history, cooperative management, and status of the Leech Lake fishery will be completed during the life of this plan to streamline information access across formats (text, web, media). Educational materials may include topics highlighting survey results, frequently asked questions, research projects, and other relevant topics. Continued informal communication with the public will be prioritized to share information and listen to perspectives and concerns regarding Leech Lake fisheries topics.

Plan Review and Revision Schedule

The maximum life of this plan is ten years. A full review and revision process of this plan will begin in 2034 with a target completion of 2035. If deemed necessary, the review and revision of this plan can be started prior to 2034. Five years (2030) after completion of this plan, internal review will be conducted.

Approvals

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Walker Area Fisheries Supervisor

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Northwest Regional Fisheries Manager

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Fisheries Section Manager

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Appendices

Appendix A: Comparison of Management Plan Objectives for Leech Lake

A comparison of the 2005 – 2010, 2011 – 2015, 2016 – 2020, 2021 – 2025, and 2026 – 2025 Fisheries Management Plan objectives for Leech Lake. Cells highlighted grey denote a change was made from the previous management plan revision.

Walleye	2005 – 2010	2011 – 2015	2016 – 2020	2021 – 2025	2026 – 2035
Abundance (fish/gill net)	≥ 7.4 (60th percentile)	≥ 8.5 (75th percentile)	3-year running average between 7-10 (40th - 90th percentiles)	3-year running average between 7-10 (29th - 85th percentiles)	3-year running average between 7-10 (30th – 79th percentiles)
Female spawner biomass (pounds/acre)	1.25 – 1.75 (50th - 80th percentiles)	1.5 – 2.0 (60th - 90th percentiles)	3-year running average between 1.5 – 2.0 (50th - 80th percentiles)	3-year running average between 1.5 – 2.0 (40th - 77th percentiles)	3-year running average between 1.5 – 2.0 (38th – 68th percentiles)
Size structure	50% < 15" (40th percentile)	45 – 65% ≤ 15" (25th - 75th percentiles)	3-year running average between 10 - 20% ≥ 20" (50th - 80th percentiles)	3-year running average between 10 - 20% ≥ 20" (39th - 70th percentiles)	Moved to Appendix
Year class strength (recruitment)	Two strong year classes by 2009 (≥75th percentile)	Average or stronger year classes produced 2 out of 4 years (50th percentile)	3-year running average >1.1* (>25th percentile)	3-year running average >0.80 (>25th percentile)	4-year running average >0.94 (>25th percentile)
Maturity Length at 50% maturity	None	None	None	None	3-year running average ≥ 17.2 inches
Age-1 abundance	Age-1 trawl catch rate 45 fish/hour (50th percentile)	None	None	None	None
Angler catch (fish/hour)	None	None	Targeting angler summer catch rate ≥0.30 (50th percentile)	Targeting angler summer catch rate ≥0.30 (60th percentile)	Targeting angler summer catch rate ≥0.30 (63rd percentile)
Angler harvest	None	Targeting angler summer harvest rate 0.25 (fish/hour) (90th percentile)	Annual pounds harvested between 130,000 and 190,000 (50th and 80th percentiles)	Annual pounds harvested between 130,000 and 190,000 (53th and 78th percentiles)	Annual pounds harvested between 130,000 and 190,000 (52nd and 79th percentiles)

Natural reproduction	None	Natural reproduction alone can maintain population	None	None	None
Condition	None	None	3-year running average between 82 and 86 (25th and 75th percentiles)	3-year running average between 81 and 85 (25th and 75th percentiles)	3-year running average between 81 and 85 (25th and 75th percentiles)
Yellow Perch	***2005 – 2010***	***2011 – 2015***	***2016 – 2020***	***2021-2025***	***2026-2035***
Abundance (fish/gill net)	None	≥16.3 (25th percentile	3-year running average ≥ 16 (25th percentile)	3-year running average ≥ 15 (25th percentile)	3-year running average ≥ 15 (31st percentile)
Size structure	None	Proportion ≥8 inches (PSD-8) and ≥10 inches (RSD-10) (25th percentile)	3-year running average ≥ 8 inches exceed 30% (25th percentile)	3-year running average ≥ 8 inches exceed 30% (25th percentile)	3-year running average ≥ 8 inches exceed 30% (31st percentile)
Year class strength (recruitment)	None	None	3-year running average age-4 perch ≥ 3.2 (25th percentile)	3-year running average age-4 perch ≥3.3 (25th percentile)	3-year running average age-4 perch ≥3.3 (25th percentile)
Angler Harvest	None	None	Harvest should be ≤ 98,000 pounds annually	Harvest should be ≤98,000 pounds annually	Harvest should be ≤98,000 pounds annually
Maturity	None	None	Female length at 50% maturity > 5.5"	Female length at 50% maturity > 5.5"	Female length at 50% maturity > 5.5"
Muskellunge	***2005 – 2010***	***2011 – 2015***	***2016 – 2020***	***2021-2025***	***2026-2035***
Production	None	None	None	None	Maintain catch rates of mature muskellunge during spawn take operations every 4 years in Miller's Bay to meet production needs.

Size structure	None	None	None	None	Muskellunge measuring ≥ 50 inches should be present in spawn take catches, summer creel surveys, or annual tournament reporting
Northern Pike	***2005 – 2010***	***2011 – 2015***	***2016 – 2020***	***2021-2025***	***2026-2035***
Abundance (fish/gill net)	None	≥ 4.1 (25^{th} percentile)	3-year running average between 4.2 and 5.3 (25^{th} and 75^{th} percentiles)	3-year running average between 4.1 and 5.3 (25^{th} and 75^{th} percentiles)	3-year running average ≤ 5.3 (75^{th} percentile)
Size structure	None	Proportion ≥ 8 inches (PSD-21) and ≥10 inches (RSD-28) (25^{th} percentile)	3-year running average ≥ 22 inches exceed 30% (25^{th} percentile)	3-year running average ≥ 22 inches exceed 31% (25^{th} percentile)	3-year running average ≥ 26 inches exceed 9% (25^{th} percentile)
Recruitment	None	None	3-year running average age-3 catch rate between 1.0 and 1.6 (25^{th} and 75^{th} percentiles)	3-year running average age-3 catch rate between 1.0 and 1.7 (25^{th} and 75^{th} percentiles)	Moved to Appendix
Panfish	***2005 – 2010***	***2011 – 2015***	***2016 – 2020***	***2021-2025***	***2026-2035***
Size structure	None	None	None	None	Define size structure objectives for bluegill and black crappie by 2032

Appendix B: 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.

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

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.

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

Electrofishing: The use of electricity to capture fish.

Esocid: Any fish belonging to the family esocidae, in Leech Lake this includes northern pike and muskellunge.

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.

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

Gill net: A net with vertical panels 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.

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.

Littoral acre: 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 are implemented.

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.

Neuston net: A specialized net with a rectangular mouth, designed to collect larval fish.

Percentile: A value in a dataset that shows the percentage of other values that fall below it.

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

Plankton/phytoplankton: 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 estimate: An estimate of the actual number of fish in a population.

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

Relative weight (condition): A ratio relating fish length to fish weight and measuring the relative plumpness of a fish.

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 the water.

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.

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

Spawn take: The operation of collecting and spawning fish for propagation.

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: The ability to be maintained at a certain level over time.

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

Water quality: The measure of water's suitability for a specific use, assessed by its physical, chemical, and biological characteristics.

Year class: The fish born in a certain year.

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

Young-of-the-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.

Zooplankton: Small, often microscopic, primary consumers that drift in aquatic environments.

Appendix C: Relationships Observed Through the Evaluation of Total Walleye Stock Density Effects on Yellow Perch Recruitment and Mortality on Leech Lake

Figure C 1. Estimated total walleye fry density (fry per littoral acre) and the resulting strength of yellow perch year classes (age-4 gill net catch rate) produced the same year, 2005 – 2014.

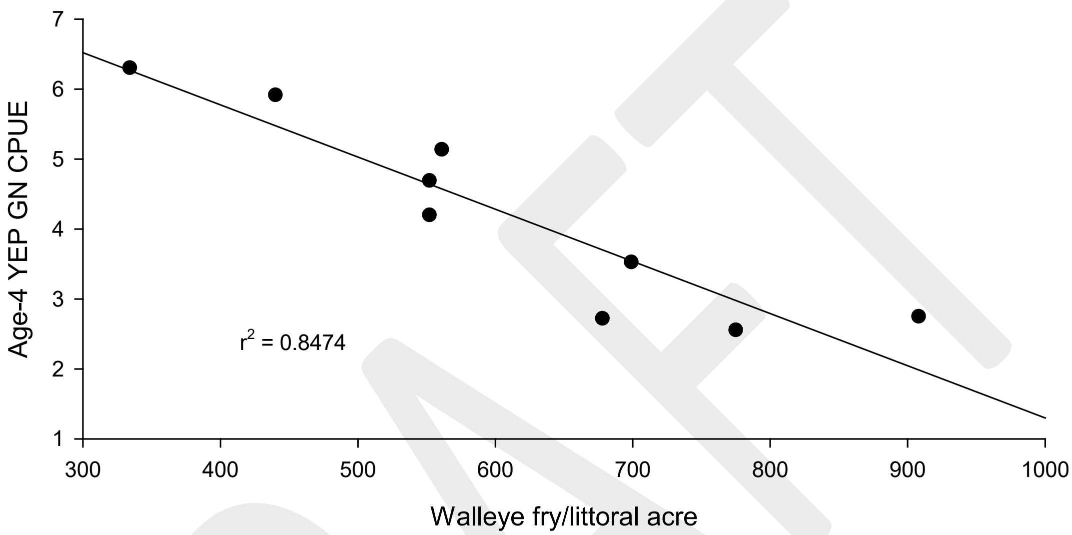
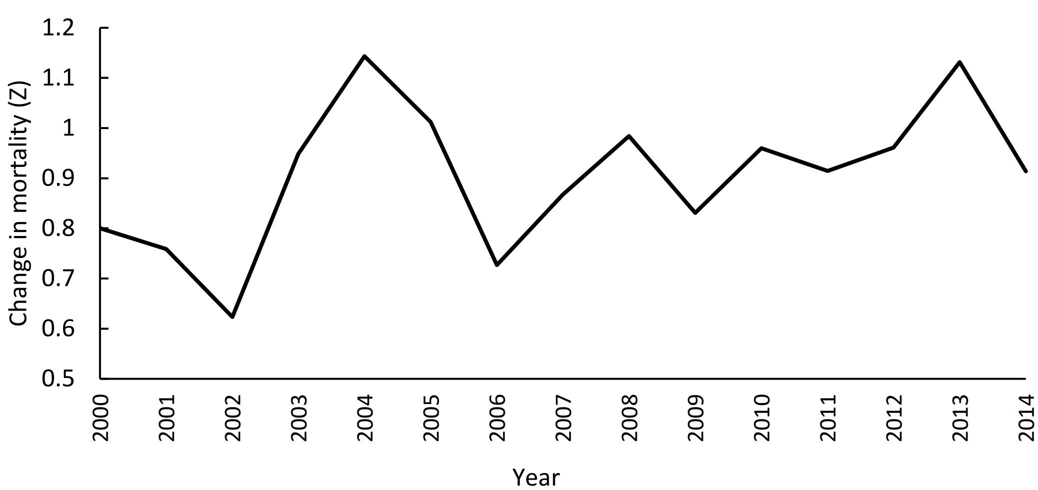


Figure C 2. Change in mortality (Z) by year class measured by a catch-at-age table between 2000 – 2014. Increases in Z denote an increase in mortality related to non-environmental pressures such as harvest or increased predation.



Appendix D: Sportfish Objectives from the 2021 – 2025 Leech Lake Management Plan

These objectives were moved to the Appendix following the 2026 – 2035 Leech Lake Management Plan revision process.

Figure D 1. Walleye size structure objective, maintain a percentage of walleye sampled in gill nets (3-year moving average) ≥ 20 inches between 10 and 20% (39th-70th percentiles). The LLFIG consensus was that this objective was redundant with the spawner stock biomass objective and was replaced with a maturity objective that serves as a biological indicator of mortality.

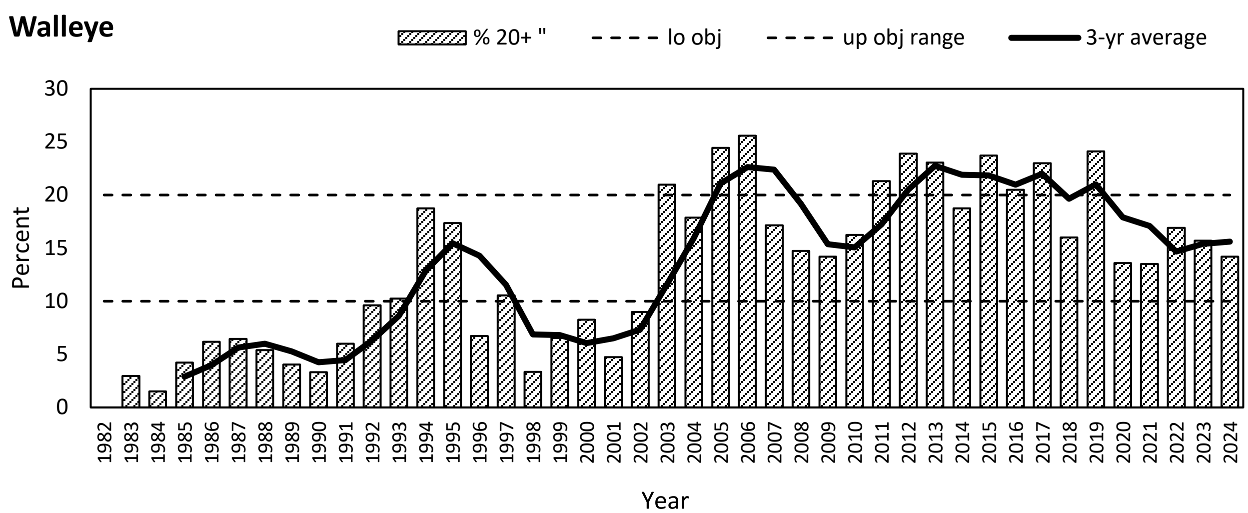
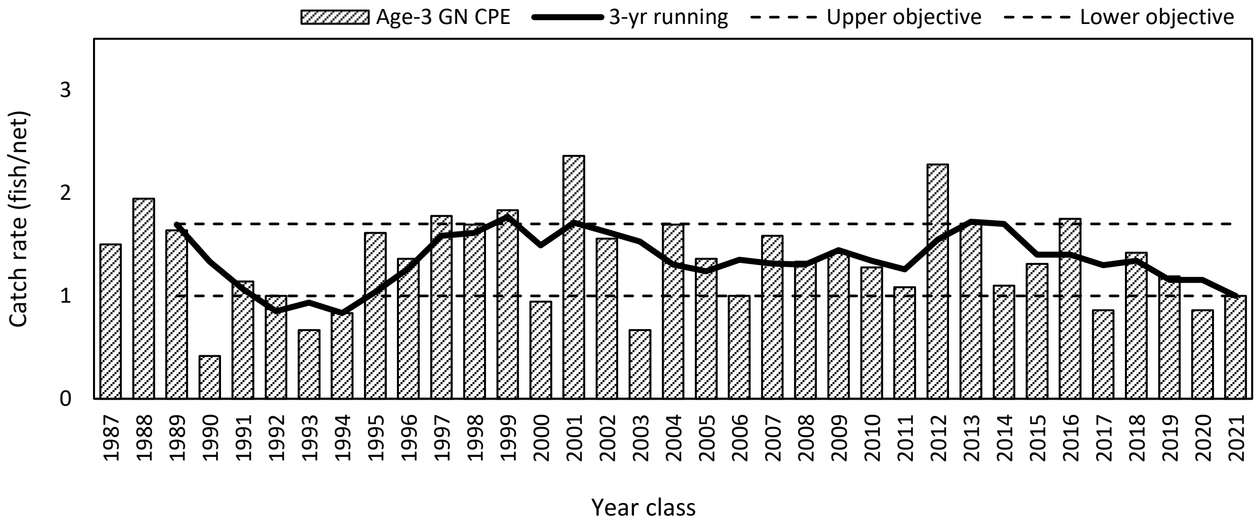


Figure D 2. Northern pike recruitment objective, maintain a percentage of age-3 northern pike between 1.0 and 1.7. Management actions were discussed by the LLFIG, consensus was that low northern pike recruitment would not be addressed utilizing management actions. Low recruitment of northern pike promotes quality size structure and reduces competition with walleye for forage.

Northern Pike



Appendix E: Habitat and AIS Initiatives outlined by the LLFIG

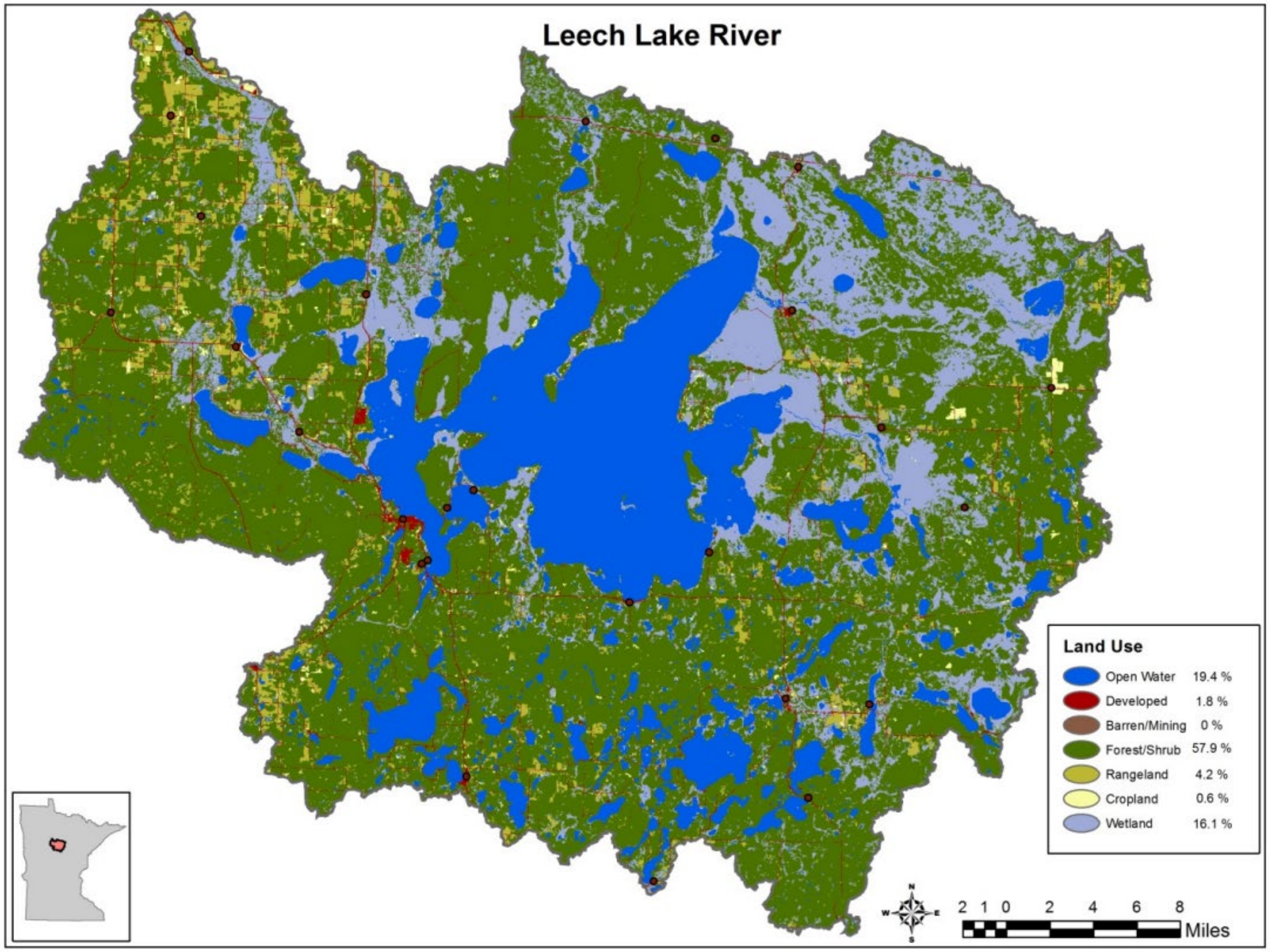
Habitat and AIS initiatives outlined by the LLFIG to pursue throughout the life of the 2026 – 2035 management plan with updates as of 2024. Staffing and funding limitations necessitate that much of this work will only be accomplished with supplemental funding and collaboration among the many partners interested in maintaining Leech Lake's quality habitat.

	Habitat Related Recommendations	Lead Agency/Partners	Relative Priority (1 = high, 2 = moderate, 3 = low)	Funding	Status as of 2024
1	Inventory nearshore aquatic habitat	FAW[1], partners	2	External funding	Completed 2018
2	Lake wide inventory of emergent aquatic vegetation (FLEM)	FAW, LLBO, partners	2	External funding	Completed 2023
3	Lake wide inventory of aquatic vegetation	EWR, LLBO[8]	2	External funding	Funded 2026 – 2027
4	Inventory spawning areas for sportfish species	FAW, partners	2	External funding	Not completed
5	Continuing Environmental Review	FAW, EWR[2], COE[3], ESDCC[4]	1	Agency base funding	Ongoing
6	Protect vegetation beds including wild rice	EWR, LLBO, ESDCC	1	Agency base funding	Ongoing
7	Enforce shoreland rules, vegetation removal rules, and invasive species	DOE, EWR, ESDCC	1	Agency base funding	Ongoing
7	Acquire important shoreland	FAW, LLAWF[6], LLA[7], partners	1	External funding	Ongoing
8	Continue shoreland development rulemaking	EWR, ESDCC	1	Agency base funding	Ongoing
9	Continue aquatic invasive species prevention and treatment	EWR, ESDCC, LLBO partners	1	Agency base funding	Ongoing
10	Continuing tournament watercraft inspections, enforcement, and aquatic education	EWR, ESDCC, partners	1	Agency base funding	Ongoing
11	Continuing invasive species and vegetation management, education, and outreach for guides, resorts, law enforcement and industries	FAW, LLBO, EWR, ESDCC, partners	1	Agency base funding	Ongoing

FAW[1] DNR Division of Fish and Wildlife
EWR[2] DNR Division of Ecological and Water Resources
LLBO[8] Leech Lake Band of Ojibwe
COE[3] Army Corps of Engineers
ESDCC[4] Environmental Services Division, Cass County
DOE[5] DNR Division of Enforcement
LLAWF[6] Leech Lake Area Watershed Foundation
LLA[7] Leech Lake Association

Appendix F: Map of Leech Lake River Watershed

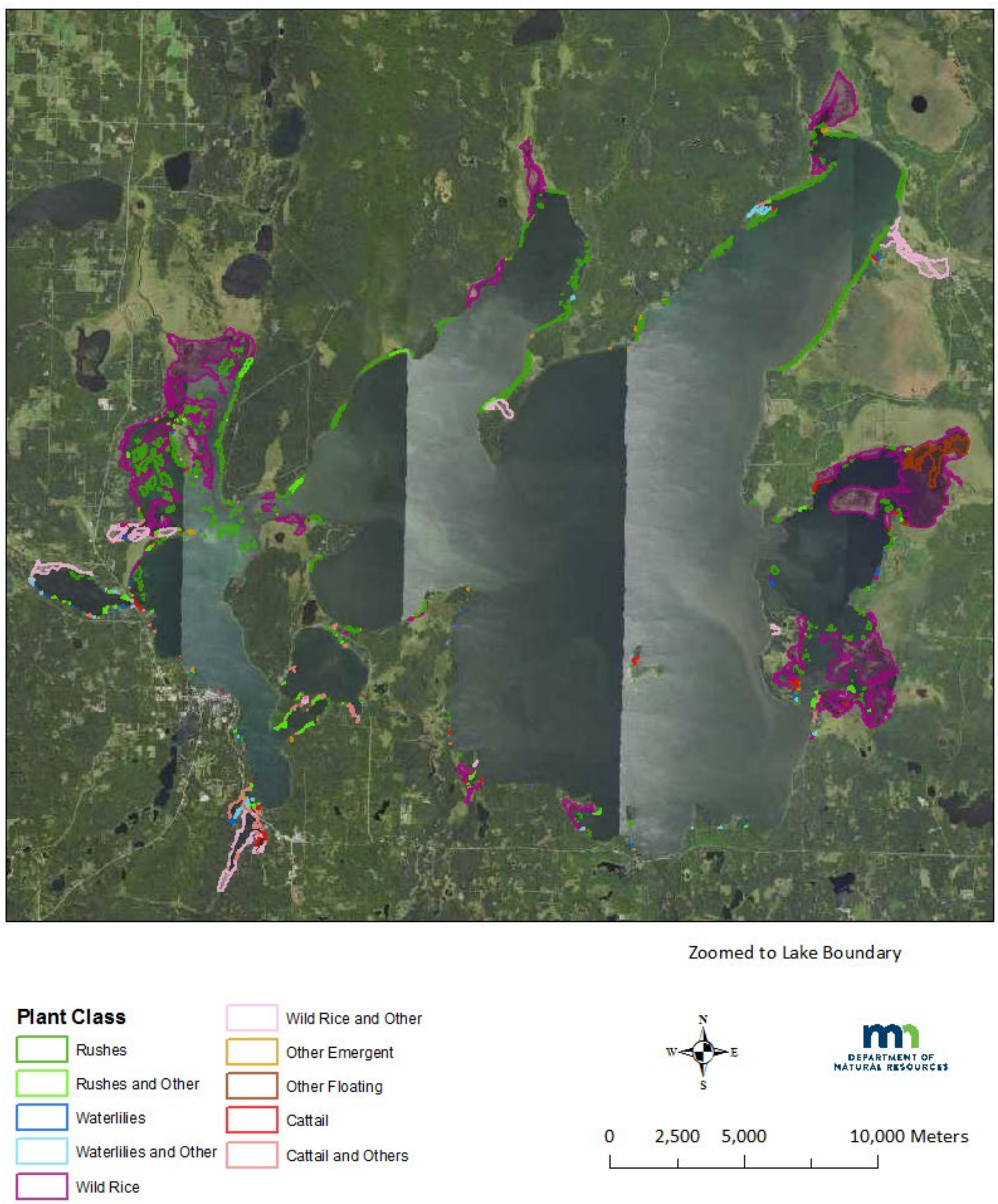
Map of the Leech Lake River Watershed, including composition of land use type.



Appendix G: Map of all Delineated Floating and Emergent Plant Stand on Leech Lake

Map of all delineated floating and emergent plant stands on Leech Lake, collected by MN DNR staff between 2019 – 2023. Plant class identification is denoted by color.

Leech Lake Floating and Emergent Plants



Appendix H: Public Review Methods

This section will be added after public review is complete.