Minnesota Statewide Fisheries Lake
and Stream Management Planning
F23AF00870
R29G60F29RP36
Segment 36, Year 2
Objective 2
03/14/2025

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
SECTION OF FISHERIES

COMPLETION REPORT FOR THE MINNESOTA WATERS OF LAKE SUPERIOR

2024

Prepared by:

Josh Blankenheim
Minnesota Department of Natural Resources
Lake Superior Fisheries Office

Reimbursed under Federal Aid by the Sport Fish Restoration Act

Executive Summary

The overall catch rate of Lake Trout (*Salvelinus namaycush)* in the May Lake Trout assessment was 14.5 fish per 1,000 feet of net and equal to the third quartile (interquartile range: 8.6-14.5) of the 45-year dataset. CPUE (catch per unit effort) by management zone was 16.2 in MN-1, 8.9 in MN-2, and 20.5 in MN-3. Shorewide, 97% of Lake Trout were wild fish. The Sea Lamprey (*Petromyzon marinus*) wounding rate in the May Lake Trout assessment was slightly below the target level (less than 5.0 fresh wounds per 100 Lake Trout) at 4.6 fresh wounds per 100 Lake Trout. Wounding rates were above target in MN-1 (7.3) and MN-3 (5.4) but below target in MN-2 (0.0).

In the deepwater predator assessment, the CPUE of Siscowet was 9.6 fish per 1,000 feet of net. The CPUE was below the 25th quartile (interquartile range: 10.3-12.3) but there has been little variation in Siscowet abundance between surveys. Over 96% of Siscowet were captured at depths greater than 240 feet. All Lake Trout were captured shallower than 240 feet, while Burbot were found at all depth strata.

In the juvenile Lake Trout assessment, the overall CPUE was 18.4 fish per 1,000 feet of net, which was within the interquartile range of the 45-year dataset (14.5-25.5). CPUE by management zone was 16.9 in MN-1, 16.1 in MN-2, and 25.3 in MN-3. Shorewide, 98% of juvenile Lake Trout captured were wild. Despite the discontinuation of stocking by the MNDNR in 2016, some clipped juveniles are still being caught and are likely originating from stocking efforts in Wisconsin waters.

In the summer expanded commercial Lake Trout assessment, commercial operators in MN-1 harvested 679 Lake Trout and the CPUE was 19.2 fish per 1,000 feet of net. Lake Trout harvest in MN-2 was 704 fish and the CPUE was 10.9 fish per 1,000 feet of net. In MN-3, 2,413 Lake Trout were harvested and the CPUE was 19.5 fish per 1,000 feet of net. Collectively, commercial operators harvested 69% of the available quota. Commercial operators accounted for 10% of the total shorewide Lake Trout harvest between sport (35,532) and commercial (3,796) fishers combined.

The estimated biomass of spawning-size Cisco (*Coregonus artedi*) from the fall hydroacoustic survey was 11.94 million pounds and represents a 96% increase from 2023. Offshore zones accounted for 74% of the total biomass and nearshore zones accounted for 26%. Nearshore biomass was the highest observed over the period-of-record. The overall increase in biomass was likely attributable to the 2020 year-class fully recruiting to the fishery. The Cisco from the massive 2022 year-class are still too small to be counted as adults in hydroacoustic surveys, but are expected to recruit to the fishery within the next two years.

Table of Contents

Figures

Tables

Introduction

This report summarizes the assessment work conducted by the Lake Superior Area Office in Minnesota's portion of Lake Superior in 2024 including the May Lake Trout (*Salvelinus namaycush)*, deepwater predator, juvenile Lake Trout, summer expanded commercial Lake Trout, and Cisco (*Coregonus artedi*) assessments.

Lake Trout are the top native predator in Lake Superior and historically supported important recreational and commercial fisheries. Rehabilitation of self-sustaining Lake Trout stocks has been the major goal for agencies around Lake Superior since the collapse of the Lake Trout fishery due to commercial over-exploitation and predation by Sea Lamprey (*Petromyzon marinus*) in the mid-1950s. In Minnesota waters, over the past few decades wild Lake Trout abundance has increased, limited commercial harvest of Lake Trout has resumed, and stocking was deemed no longer necessary and discontinued. Rehabilitation has been so successful around the lake that in 2024 the Lake Superior Committee of the Great Lakes Fisheries Commission deemed Lake Trout fully rehabilitated for most of Lake Superior. Lake Trout is the primary species caught by anglers fishing Minnesota waters, supporting a robust fishery with an average annual catch of 31,758 fish (2015-2024) (Beckman 2025).

There are four recognized morphotypes of Lake Trout in Lake Superior: lean, Siscowet, humper, and redfin (Muir et. al 2014). The humper and redfin morphotypes are generally not encountered in the Minnesota portion of Lake Superior. However, the deepwater morphotype of Lake Trout, known as the Siscowet, along with the lean Lake Trout morphotype, are commonly observed in Minnesota waters. For consistency throughout this report, lean Lake Trout will be referred to as "Lake Trout" and Siscowet Lake Trout will be referred to as "Siscowet".

Cisco are an important native forage species in Lake Superior and have also supported a commercial fishery since the late 1800s. Cisco stocks crashed in the 1950s, and although populations have rebounded, they remain well below historic levels. Cisco population dynamics are monitored by hydroacoustic surveys, assessment netting, sampling the commercial catch, and analyzing commercial fishing records. Commercial harvest for Cisco, Lake Trout, and other species is summarized thoroughly in an annual commercial fishing report (Blankenheim 2025).

Chinook Salmon (*Oncorhynchus tshawytscha)*, Coho Salmon (*O. kisutch)*, and Rainbow Trout (*O. mykiss*) are generally not vulnerable to MN DNR assessment gill nets. The status and trends of these salmonid species is discussed in creel survey reports (Peterson 2025a; Beckman 2025) and the Knife River trap report (Peterson 2025b).

Methods

Lake Superior is divided into statistical zones and grids. In Minnesota, zones include MN-1, MN-2, and MN-3 (Figure 1). MN-1 encompasses the area from the Duluth Entry to the Encampment River; MN-2 extends from the Encampment River to the Popular River; MN-3 extends from the Poplar River to the Canadian border. These zones will regularly be referred to throughout this report.

The MN DNR conducts the May Lake Trout assessment in MN-1 while commercial operators provide data for MN-2 and MN-3. The May Lake Trout assessment utilizes 4.5-inch stretch-measure mesh. In MN-1 each gang consists of three 250-foot nets for a total of 750 feet per gang; commercial operators set gangs of variable length. Gangs were set in eight locations in MN-1, two in MN-2, and one in MN-3, with each gang set between 120 and 240 feet of water. Gangs set by the MN DNR were for one night unless weather interfered with net retrieval; participating commercial operators generally set gangs for one or two nights.

The MN DNR conducts a deepwater predator assessment every third year near Fisherman's Point northeast of Two Harbors. Gillnets for the deepwater predator assessment consist of nine 250-foot nets with stretch-measure mesh sized from 2.0 to 6.0 inches in ½-inch increments. Randomly selected mesh sizes were combined into two gangs, one of five nets (1,250 feet) and one of four nets (1,000 feet). Six different depth strata of 120 feet apiece were sampled during the assessment, covering depth ranges from near zero to 600+ feet deep. Each gang fished one night in a depth stratum, then was re-deployed in the

complementing depth stratum occupied by the other gang the previous night. For example, on the first day of the assessment in 2024 the five-net gang was set in the 480-600 foot depth stratum and four-net gang was set in the 120-240 foot depth stratum. The next day the five-net gang was set in the 120-240 foot depth stratum and the four-net gang was set in the 480-600 foot depth stratum. This way, two different depth strata were fished with the entire compliment of mesh sizes in two days.

The juvenile Lake Trout assessment is conducted solely by the MN DNR. The assessment had consisted of five nets each 200 feet in length tied together for a total gang length of 1,000 feet. Mesh sizes included 1.5-, 1.75-, 2.0-, 2.25-, and 2.5-inch stretch-measure mesh. However, in 2022 the 1.75-inch and 2.25-inch meshes were dropped due to difficulty obtaining those mesh sizes, and because they were sizes not commonly used by other jurisdictions around the lake. Gangs were reconfigured as three nets each 300 feet in length for a total gang length of 900 feet, utilizing 1.5-, 2.0-, 2.5-inch stretch-measure mesh. Gangs were set in six locations in MN-1, four locations in MN-2, and three locations in MN-3, with each gang starting in 120 feet of water and ending shallower than 240 feet. Gang sets were for two nights, except for at Hovland, which is always set for one night.

A limited summer expanded commercial Lake Trout assessment fishery was permitted beginning in 2007 for MN-3, 2010 for MN-2, and 2017 for MN-1. The annual Lake Trout limits had been 3,000 fish in MN-3, 2,000 fish in MN-2, and 500 fish in MN-1, but in 2023 the MN-1 quota was increased to 700 fish. Commercial operators selected the statistical zone and grid they wished to fish in, with no more than two operators per grid. Lake Trout were allotted based on the number of applicants per zone, with a maximum of 1,000 Lake Trout per operator. The season was open from June 1st through September 30th. Detailed harvest information for this fishery can be found in the annual commercial fishery summary report (Blankenheim 2025).

Statistical zones, grids, and locations for the May Lake Trout and juvenile Lake Trout assessments are shown in Figure 1. Detailed specifications for survey nets can be found in Ebener (2001). In all surveys the length, weight, sex, fin clips, and lamprey wounds were recorded for each fish caught. The MN DNR collected otoliths and stomach contents on all Lake Trout retained, while commercial operators did so on a subsample of the fish they harvested in the May Lake Trout and summer expanded commercial assessments.

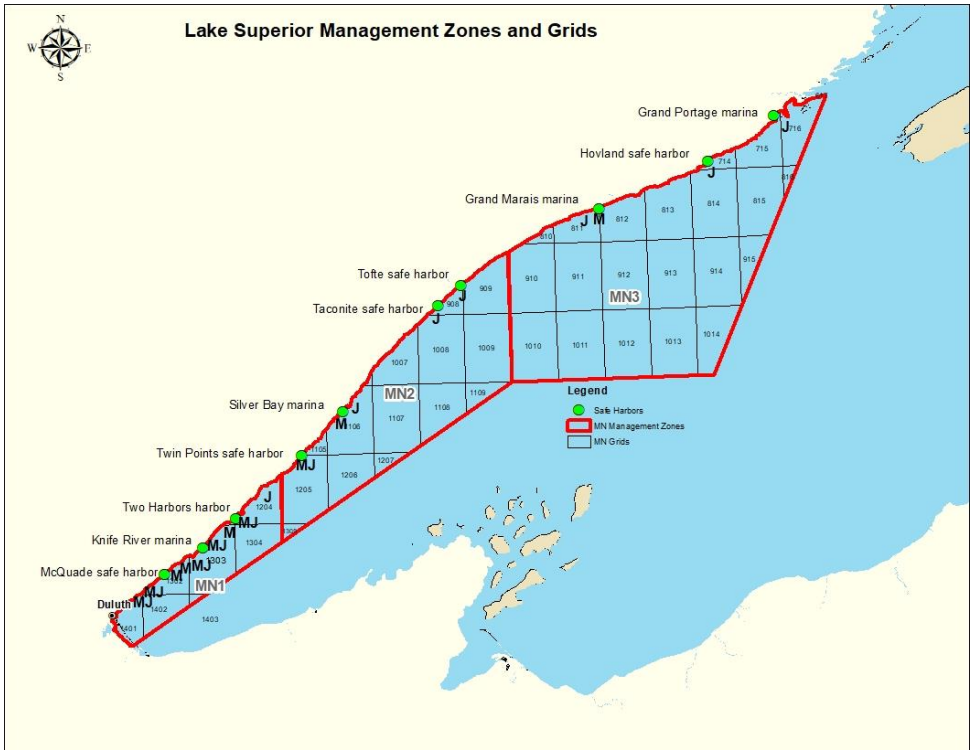


Figure 1. Statistical zones, grids, and sampling stations for May (M) and juvenile (J) assessments, Minnesota waters of Lake Superior.

Beginning in 2006, catch per unit effort (CPUE) for Lake Trout has been corrected for soak time (i.e., the numbers of nights the nets were fished). Correction factors for gill net CPUE developed by G.L. Curtis (Great Lakes Science Center, unpublished; cited in Hansen et al. 1998) were used to standardize 2- and ≥3-night sets to a uniform base of one night. Thus, the net length was multiplied by 1.52 for 2-night sets and 1.8 for ≥3-night sets.

Previously in MN-1, Lake Trout CPUE was calculated using an average of individual net CPUE's:

$$\overline{CPUE_i} = \frac{\sum \frac{C_i}{f_i}}{n},$$

where C_i = individual net catch (number of Lake Trout), f_i = fishing effort (1,000 feet of gill net), and n = the number of net sets in a given year. The benefit of this equation is confidence limits can be calculated for the CPUE value, which we do not utilize in this report. For data clarity, consistency between statistical districts, and ease of understanding in reporting, the CPUE calculation was changed to:

$$CPUE = \frac{\sum C_i}{\sum f_i},$$

and all previous years' CPUEs were recalculated for MN-1. Therefore, historical CPUEs in this report may be slightly different than in some previous reports.

Cisco are assessed in two ways: netting assessments and hydroacoustic surveys. The MN DNR Cisco assessment consists of 300-foot multi-mesh (2.0-, 2.5-, and 3.0-inch stretch-measure mesh) nets, with 100 feet of each mesh size per net. Two nets are fished east of Two Harbors in Burlington Bay. One net is fished 12 feet below the surface while the other is fished 24 feet below the surface in approximately 150 feet of water. Nets are checked daily until a minimum of 100 Cisco total are collected. Length, weight, sex, and otoliths are collected from each fish. Additionally, length, sex, and otoliths are collected from commercial operators' Cisco samples in both spring/summer and fall from each statistical zone. Due to the time constraints of otolith aging and reporting, age data of Cisco sampled in 2024 from the MN DNR assessment and the commercial fishing sampling were not yet available for this report.

Hydroacoustic surveys with accompanying mid-water trawling have been conducted since 2003; methodology can be found in Hrabik et al. (2006). From 2003-2014 hydroacoustic surveys were conducted in the summer but have been conducted in the fall since 2015. From 2017 to 2021, all hydroacoustic work was conducted aboard the University of Minnesota Duluth Large Lakes Observatory's R/V Blue Heron. In all other fall surveys, the offshore transects (>260 feet) were completed from the R/V Blue Heron and the nearshore transects (<260 feet) were completed aboard the MN DNR Blackfin. The advantage to utilizing the smaller MN DNR vessel for nearshore transects is that it can more thoroughly cover shallow water where the larger R/V Blue Heron cannot go. Sampling the MN-3 nearshore transect was discontinued after 2015 because it contributed very little to the overall Cisco biomass estimate. Prior to 2023, Biosonics hydroacoustic equipment was used for all surveys, but beginning in 2023 Simrad equipment was utilized. Data analysis procedures are described in the MN DNR Lake Superior Hydroacoustic Standard Operating Procedure.

Results and Discussion

May Assessment

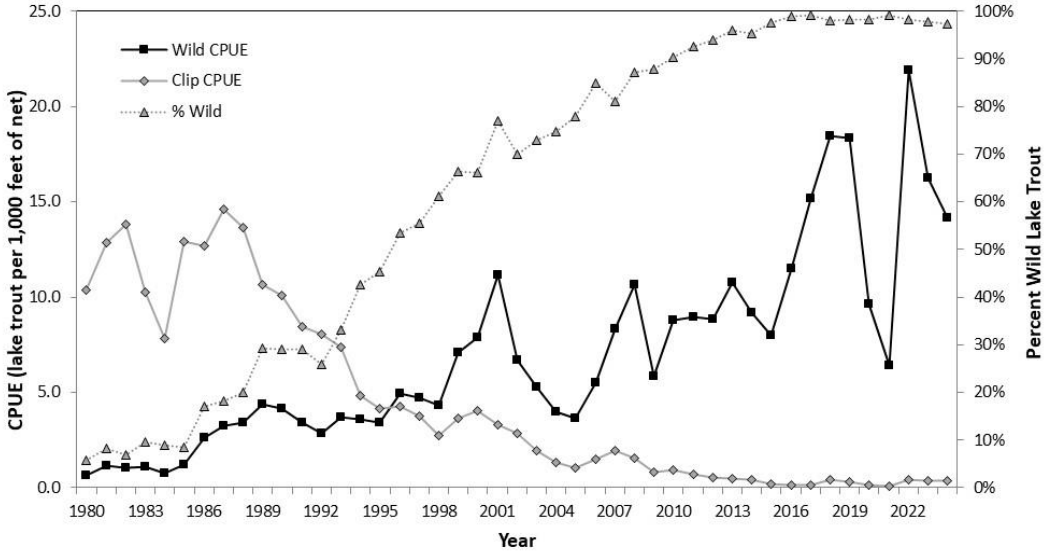
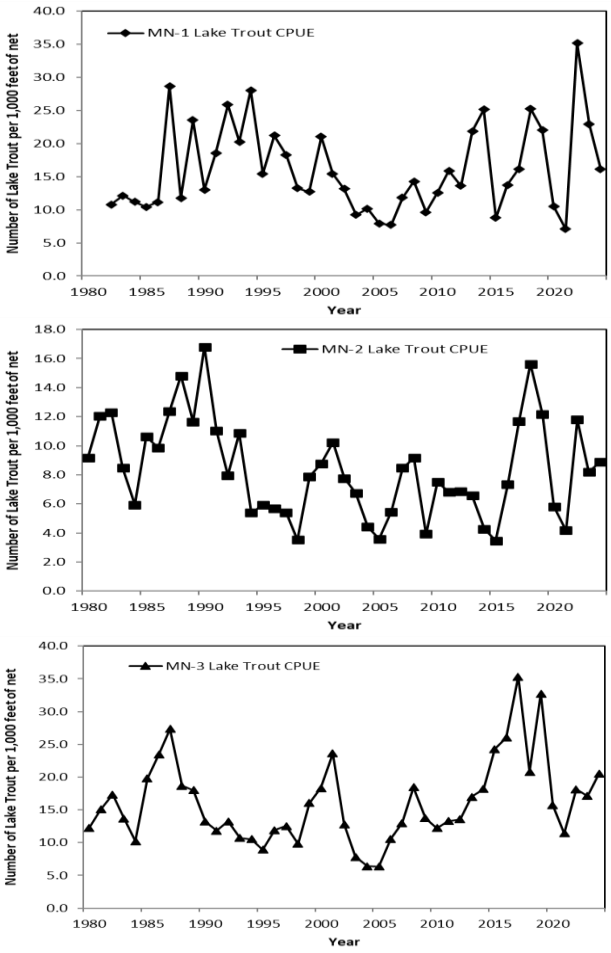


Figure 2. Catch rate (number of fish per 1,000 feet of net) of wild and stocked Lake Trout, and percentage wild Lake Trout in the May assessment, 1980-2024.



The overall CPUE of Lake Trout was 14.5 fish per 1,000 feet of net in the May assessment (Table 1). The CPUE was equal to the third quartile (interquartile range: 8.6-14.5 fish per 1,000 feet) for the 45-year time series. The wild Lake Trout CPUE was 14.1 fish per 1,000 feet of net while the stocked Lake Trout CPUE was 0.4 fish per 1,000 feet of net (Table 1, Figure 2). Wild fish comprised 97% of all Lake Trout sampled in the assessment. Stocked fish are uncommon in MN-2 and MN-3, but some are still caught in MN-1 because stocking was discontinued in Minnesota waters only relatively recently (2016) and Wisconsin stocks Lake Trout annually.

By zone, Lake Trout CPUEs for MN-1, MN-2, and MN-3 were 16.2, 8.9, and 20.5 fish per 1,000 feet of net (Table 2, Figure 3). The CPUEs for MN-1 and MN-2 were within their interquartile ranges (MN-1: 11.2-21.1 fish per 1,000 feet; MN-2: 5.8-10.9 fish per 1,000 feet), while the CPUE for MN-3 was slightly above its respective interquartile range (11.9-18.5 fish per 1,000 feet).

Figure 3. Lake Trout catch rate (number of fish per 1,000 feet of net) by statistical district in the May assessment, 1980-2024.

The average size of Lake Trout captured in the assessment was 22.8 inches and 4.0 pounds, with fish ranging from 15 to 39 inches (Figure 4). Seventy-one percent of the catch was between 20 and 24 inches. The May assessment only utilizes one mesh size, so it will not effectively capture very small or very large specimens as effectively.

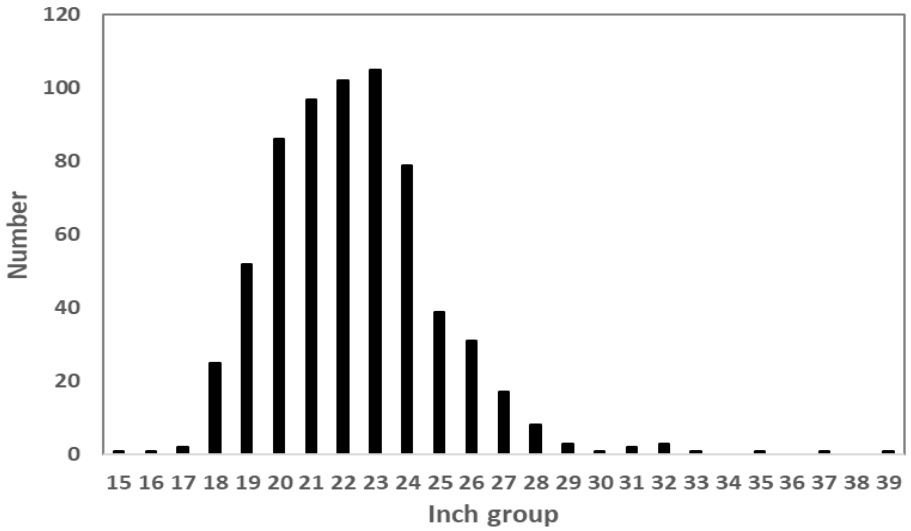


Figure 4. The length-frequency distribution of Lake Trout caught in the May assessment, 2024.

Sea Lamprey control is conducted by the U.S. Fish & Wildlife Service and Fisheries and Oceans Canada. Control efforts have kept the population of Sea Lamprey at or below 10% of peak abundance. Nevertheless, Sea Lamprey are still a major cause of Lake Trout mortality in Minnesota waters. The number of fresh Sea Lamprey wounds per 100 Lake Trout (hereafter referred to as the wounding rate) in the May assessment was 4.6 for all management zones combined (Table 3, Figure 5). By management zone, wounding rates were 7.3 in MN-1, 0.0 in MN-2, and 5.4 in MN-3 (Table 3, Figure 6).

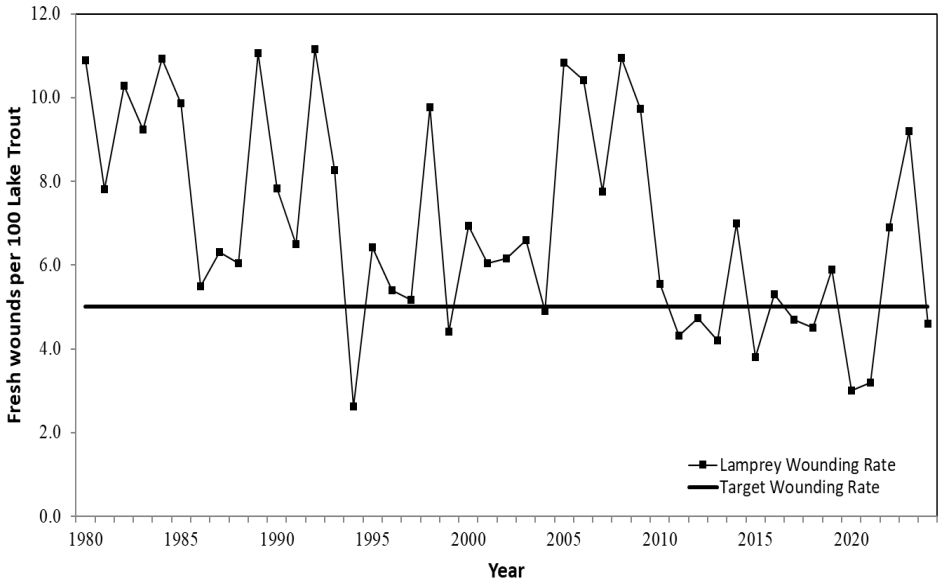
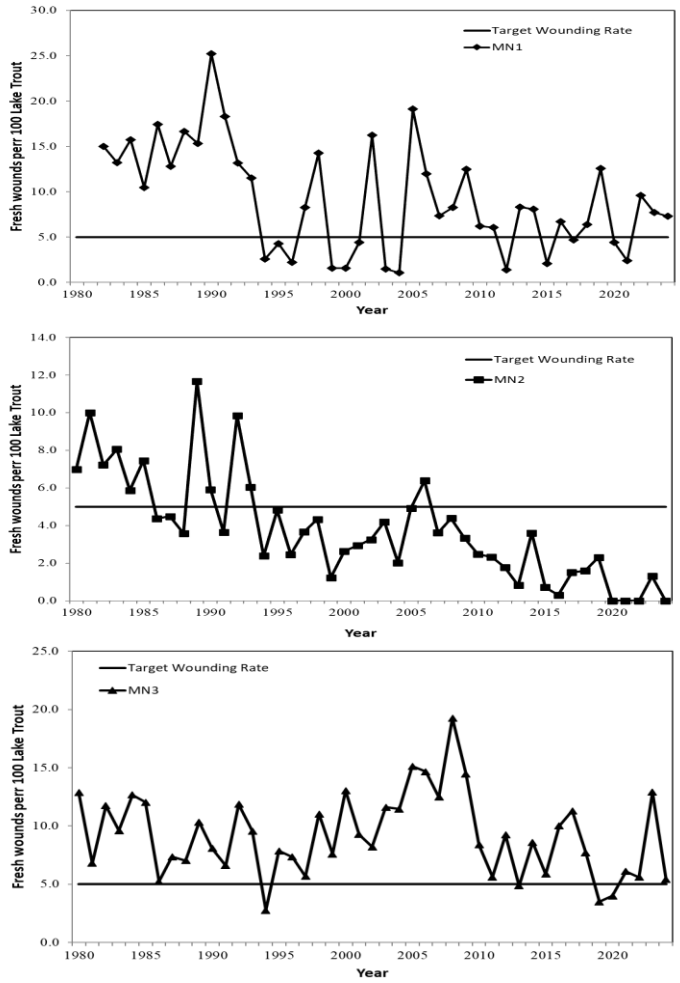


Figure 5. The shorewide number of fresh Sea Lamprey wounds per 100 Lake Trout in the May assessment, 1980-2024.



The target wounding rate for all zones is not more than 5.0 fresh wounds per 100 Lake Trout. Fortunately, the overall wounding rate decreased after being above target for two consecutive years. However, the Sea Lamprey population is currently well above the target of 10,000 fish at an estimated 56,000 in 2024 (GLFC 2024 status report), which could lead to higher wounding rates.

There were 12 different categories of prey consumed by Lake Trout captured in the May assessment (Table 4). Rainbow Smelt (*Osmerus mordax*) commonly comprise the greatest weight of diet items in Lake Trout stomachs during the May assessment, sometimes exceeding 90% of the diet biomass. In 2024, Rainbow Smelt biomass comprised 59.2% of the total prey biomass, and 40% of Lake Trout stomachs contained at least one Rainbow Smelt. Other prominent diet items included unidentifiable fish remains (22.8%) and Coregonids (both Cisco and unidentifiable Coregonids; 15.6%). The counts of Cisco in Lake Trout stomachs were higher than normally seen in recent years and were small specimens from the big 2022 year-class.

Figure 6. Number of fresh Sea Lamprey wounds per 100 Lake Trout in the May assessment, by statistical district, 1980 -2024.

Deepwater Predator Assessment

Siscowet are the primary species captured in the deepwater predator assessment. The CPUE of Siscowet in the deepwater predator assessment was 9.6 fish per 1,000 feet of net (Figure 7). The CPUE was below the 25th quartile (interquartile range: 10.3-12.3 fish per 1,000 feet) but there has been little variation in Siscowet abundance between surveys.

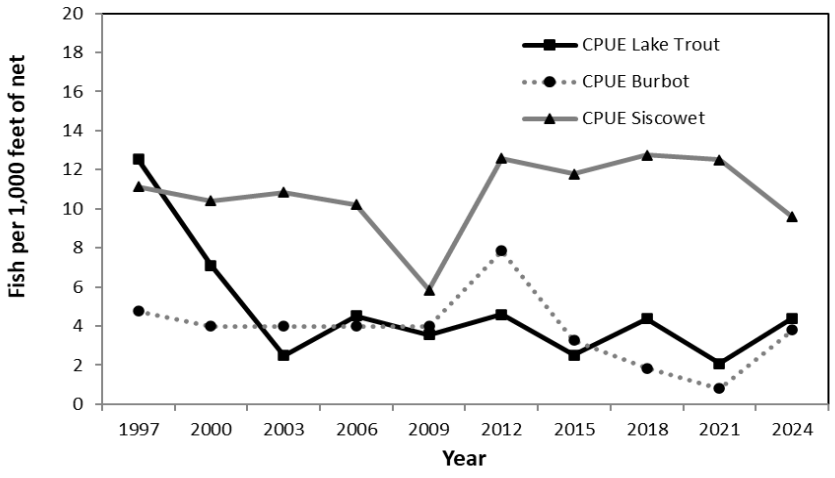


Figure 7. Catch-per-unit-effort of Siscowet, Lake Trout, and Burbot in the deepwater predator assessment, 1997-2024.

Over 96% of Siscowet were captured at depths greater than 240 feet, and the greatest catch of Siscowet was in the 480–600-foot depth stratum (Table 5). The average size of Siscowet was 17.4 inches and 1.6 pounds. The overall wounding rate on Siscowet was 5.7 wounds per 100 fish (≥17 inches). The wounding rate on Siscowet was the same as Lake Trout for fish 17.0-20.9 inches, but much higher for Siscowet (20.0) than Lake Trout (5.5) for fish in the 21.0-24.9-inch group. Despite there being nine different mesh sizes utilized in the assessment which should adequately sample the entire length distribution of Siscowet, none were over 24 inches (Figure 8). Given the higher wounding rate on medium size Siscowet and the lack of Siscowet over 24 inches, it is possible that Siscowet serve as a buffer for Lake Trout from Sea Lamprey attacks.

Lake trout and Burbot are less abundant in the survey, and CPUEs were 4.4 and 3.8 for these species (Table 5). Predictably, all Lake Trout were captured at depths less than 240 feet, while Burbot were caught at all depths. Bloater (*Coregonus hoyi*) and Kiyi (*Coregonus kiyi*), collectively known as the "deepwater chubs", were present in low abundance beyond 240 feet. Most mesh sizes used in the deepwater predator assessment are too large for adequately sampling these forage species, so catches are not expected to be very high. Other species captured included Cisco, Lake Whitefish (*Coregonus clupeaformis*), Longnose Sucker (*Catostomus catostomus*), Rainbow Smelt, Round Whitefish (*Prosopium cylindraceum*), and Eurasian Ruffe (*Gymnocephalus cernua*).

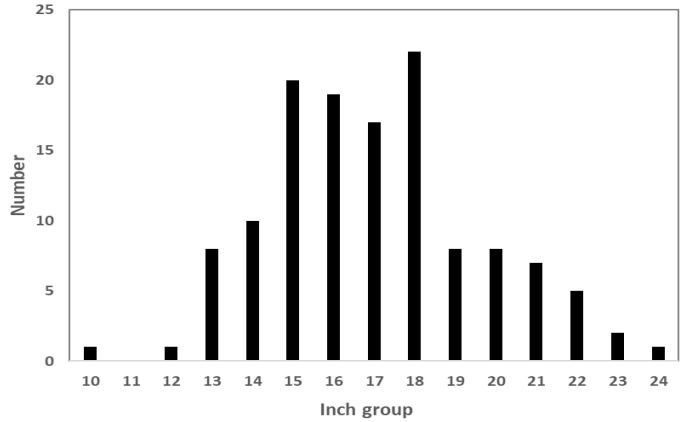


Figure 8. The length-frequency distribution of Siscowet in the deepwater predator assessment, 2024.

Siscowet diet composition by weight was predominantly Rainbow Smelt (42.1%), unidentifiable fish remains (26.2%), Burbot (10.1%), sculpin species (8.7%), and coregonids (7.6%), (Table 7). Burbot consumed sculpin species (29.4%), *Mysis* (28.4%), rocks/woody debris (22.4%) and unidentifiable fish remains (11.9%) (Table 7). Lake Trout captured during the deepwater predator assessment consumed Rainbow Smelt (56.4%), unidentifiable fish remains (41.2%), and terrestrial insects (2.4%) (Table 4).

<u>Juvenile Lake Trout Assessment</u>

The overall CPUE of juvenile Lake Trout (less than 17 inches/432 mm) was 18.4 fish per 1,000 feet of net, which was within the 45-year interquartile range (14.5-25.5 fish per 1,000 feet of net) (Table 8). The CPUE of wild juveniles was 18.1 Lake Trout per 1,000 feet of net and the CPUE of stocked juveniles was 0.3 Lake Trout per 1,000 feet of net (Table 8, Figure 9).

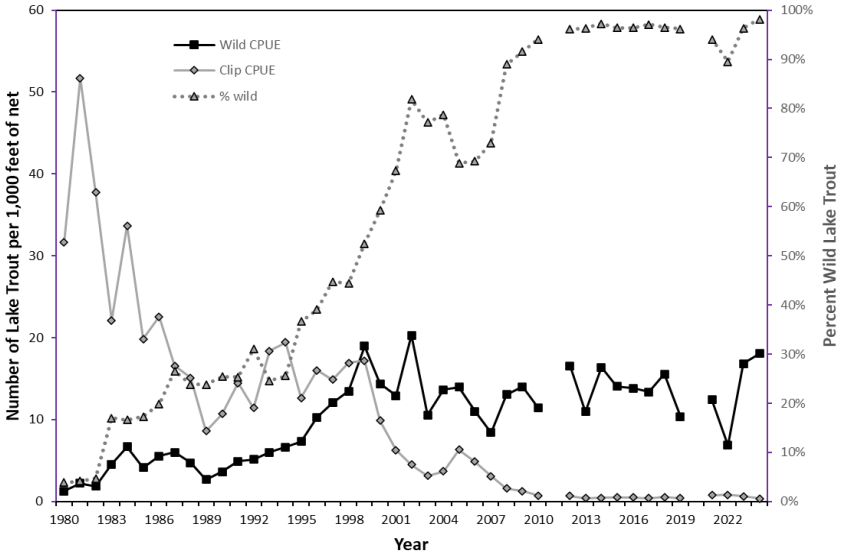
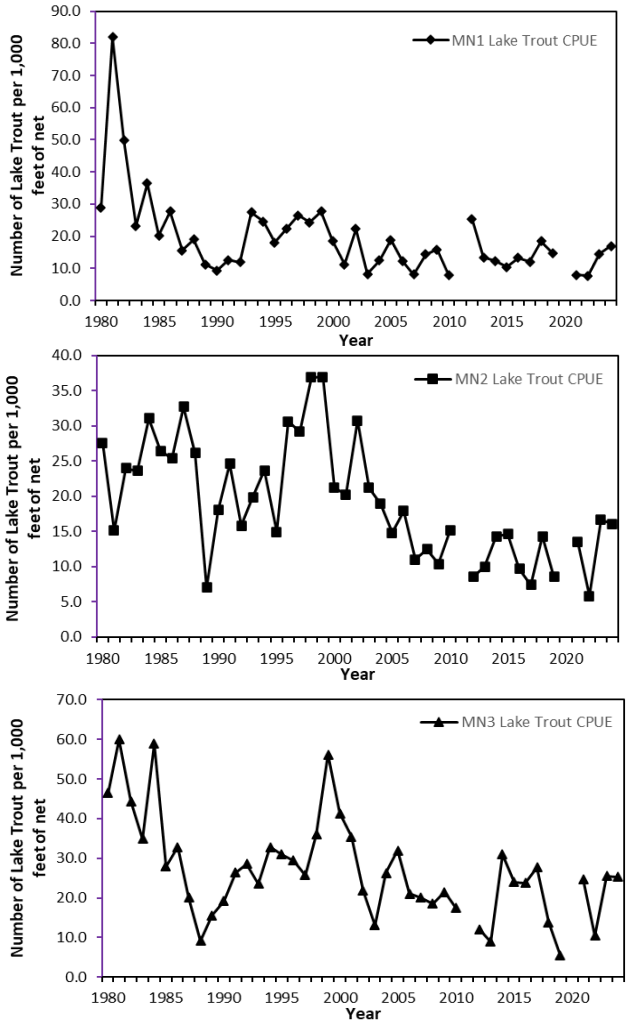


Figure 9. Catch rate (number of fish per 1,000 feet of net) of wild and stocked Lake Trout, and percent wild Lake Trout in the juvenile (<17") Lake Trout assessment, 1980-2024.



CPUEs in MN-1, MN-2, and MN-3 were 16.9, 16.1, and 25.3 Lake Trout per 1,000 feet of net, respectively (Table 9, Figure 10). The CPUEs for all three zones were within their respective interquartile ranges (MN-1: 12.1-23.8; MN-2: 13.9-25.0; MN-3: 19.6-32.4). Although the overall juvenile CPUE has been much lower than that observed in the 1980s, it is important to consider Lake Trout rehabilitation was still underway and influenced by heavy stocking at that time, and recent CPUEs likely represent recruitment levels of self-sustaining Lake Trout populations in Lake Superior. Overall, Lake Trout recruitment appears to be both consistent and relatively stable.

Ninety-eight percent of the juvenile Lake Trout catch was wild (Table 9, Figure 9). Zones MN-2 and MN-3 were 100% wild fish, as would be expected since stocking was discontinued in those zones in 2007 (MN-2) and 2003 (MN-3). Stocking was discontinued in MN-1 in 2016, but despite this, 4% of juveniles captured in this zone were fin clipped hatchery fish. The Wisconsin DNR continues to stock Lake Trout and is the most likely source for these hatchery juveniles. The Lester River/Brighton Beach and Pumping Station locations typically have the highest percentage of hatchery fish and are also nearest to Wisconsin stocking locations.

Figure 10. Lake Trout catch rate (number of fish per 1,000 feet of net) by statistical district in the juvenile Lake Trout assessment, 1980-2024.

The juvenile Lake Trout assessment is designed to provide a measure of recruitment and uses appropriately small mesh sizes to achieve this objective. Most Lake Trout caught in the assessment were less than 17 inches (Figure 11). Fish over 17 inches that were still alive were released.

There were 15 categories of diet items consumed by juvenile Lake Trout (Table 4). Juvenile Lake Trout diets were comprised heavily of fish: unidentifiable fish remains (47.9%), Rainbow Smelt (25.3%), and Coregonids (Cisco, Bloater, and Kiyi that could not be identified to species) (13.7%). *Mysis* (5.0%), sculpin species (4.2%), and terrestrial insects (2.3%) were also present but less so than in some years.

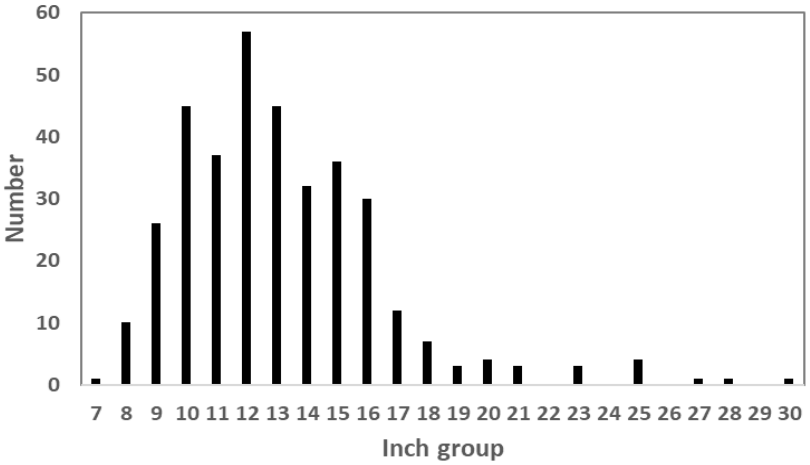


Figure 11. The length-frequency distribution of Lake Trout in the juvenile Lake Trout assessment, 2024.

Of noteworthy significance in the juvenile Lake Trout assessment was the presence of young Cisco. While not the target species of the survey, Cisco are typically captured in low numbers. For example, in 2022 the CPUE of Cisco in the juvenile Lake Trout assessment was 4.3 fish per 1,000 feet of net. In 2024, the Cisco CPUE was 61.5 fish per 1,000 feet of net. Nearly all of the Cisco were captured in the 1.5-inch mesh and were age-2 individuals from the 2022 year-class.

Summer Expanded Commercial Assessment

In 2024, a total of 679 Lake Trout were harvested in MN-1, and the CPUE was 19.2 Lake Trout per 1,000 feet of net (Table 10, Figure 12). Commercial operators harvested 97% of the 700 fish total-allowable-catch (TAC; Lake Trout and Siscowet combined). Commercial harvest of Lake Trout represented 3% of the estimated total Lake Trout harvest in MN-1 between sport (24,468) and commercial (679) fishers combined.

In MN-2, the number of Lake Trout harvested by commercial operators was 704 and the CPUE was 10.9 Lake Trout per 1,000 feet of net (Table 10, Figure 12). Thirty-one Siscowet were also harvested. Commercial operators harvested 37% of the 2,000 fish TAC for MN-2. Commercial harvest of Lake Trout represented 9% of the estimated total Lake Trout harvest in MN-2 between sport (6,739) and commercial (704) fishers combined.

In MN-3, commercial operators harvested 2,413 Lake Trout and the CPUE was 19.5 Lake Trout per 1,000 feet of net (Table 10, Figure 12). An additional 92 Siscowet were harvested. Commercial operators harvested 84% of the 3,000 fish TAC. Commercial harvest of Lake Trout represented 36% of the estimated total Lake Trout harvest in MN-3 between sport (4,325) and commercial (2,413) fishers combined. In the three zones combined, commercial operators harvested 69% of the TAC. Overall, commercial harvest accounted for 10% of the total estimated Lake Trout harvest between sport (35,532) and commercial (3,796) fishers.

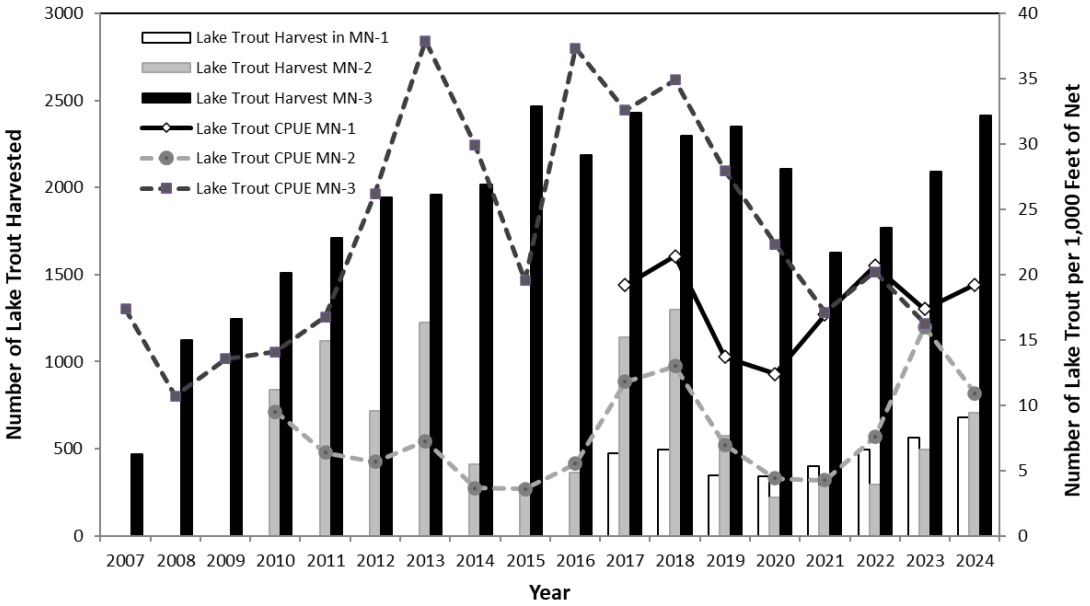


Figure 12. Lake Trout harvest and catch rate (number of fish per 1,000 feet of net) in the summer expanded commercial assessment, 2007-2024.

Commercial operators are allowed to use only 4.5-inch stretch-measure mesh in the summer expanded commercial assessment, which is the same size used in the May Lake Trout assessment. Thus, the length-frequency distribution is similar between these assessments. The peak of the length-frequency distribution in the summer expanded commercial assessment was 23 to 24 inches (Figure 13). The average size of Lake Trout harvested was 23.5 inches and 4.2 pounds.

Twenty categories of diet items were consumed by Lake Trout in the summer expanded commercial assessment. Lake Trout diet composition by weight was predominately Rainbow Smelt (39%), unidentifiable fish remains (30.7%), Coregonid species (Cisco, Kiyi, and Coregonids that could not be differentiated) (21.0%), and terrestrial insects (4.0%) (Table 4). Small Coregonids from the massive 2022 year-class were observed more frequently than Coregonids usually are, whereas *Mysis* and terrestrial insects were both consumed in lesser quantities. Despite the abundance of forage, 40 percent of Lake Trout stomachs (n = 405) had no diet items, which was more than the previous five years (27% to 38%).

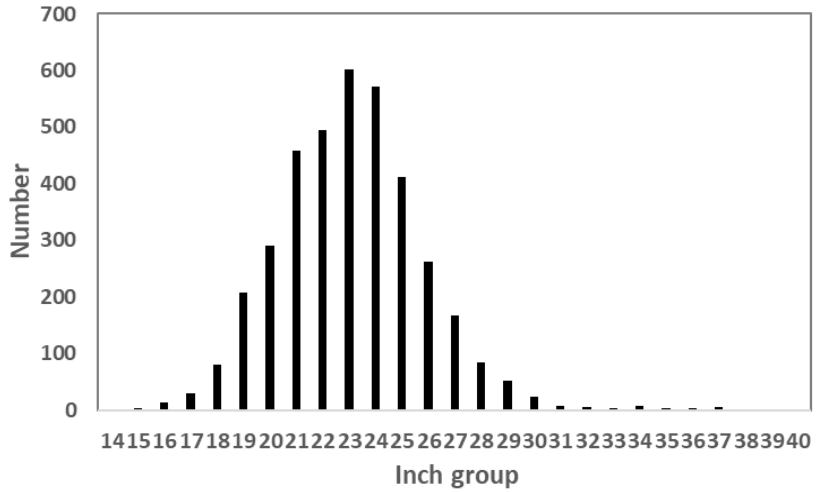


Figure 13. The length-frequency distribution of Lake Trout caught in the summer expanded commercial assessment, 2024.

Cisco Assessment

The estimated biomass of spawning-size Cisco in the 2024 hydroacoustic survey was 11.94 million pounds (Table 11, Figure 14). While the nearshore zone (<260 feet) often has higher densities of adult Cisco, the majority of the adult Cisco biomass is often in the offshore zone (>260 feet) because it is a much larger volume. By zone, MN-3 offshore accounted for 30% of the total Cisco biomass, followed by MN-2 offshore (24%), MN-1 nearshore (22%), MN-1 offshore (20%), and MN-2 nearshore (4%). Both MN-1 nearshore and MN-1 offshore had the highest biomass estimates observed in these zones over the period-of-record.

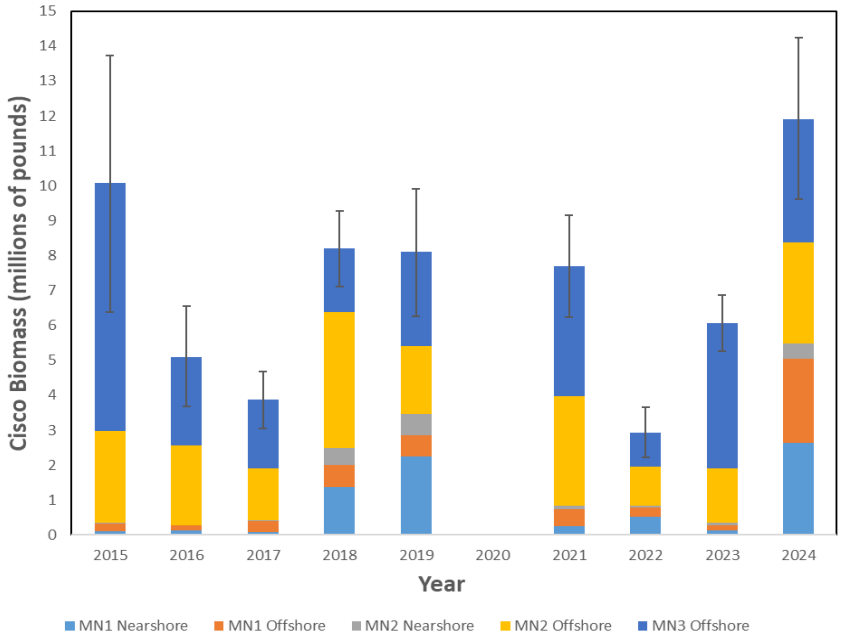


Figure 14. The estimated biomass of spawning-size Cisco from fall hydroacoustic surveys, 2015-2024. Upper and lower 95% confidence intervals are shown.

The 2024 estimate represents a 96% increase in biomass from 2023. The increase in biomass may be attributable to a modest 2020 year-class of Cisco. During their annual trawl survey in 2021, the USGS recorded a density of 10 age-1 Cisco/ha for the 2020 year-class (Vinson 2024). Cisco grow quickly during their first few years of life, with some reaching adult size by age-3 and most by age-4. Three-year-old Cisco were present in the age assessment of commercially harvested Cisco in the fall of 2023 and therefore should contribute as age-4 fish in 2024 as well (age assessment is not yet complete on 2024 Cisco). Thus, the addition of their biomass to the adult population could be accountable for the increase in Cisco biomass observed in the 2024 hydroacoustic survey. Cisco from the record 2022 year-class are still too small to count as targets in hydroacoustic data analysis, but these fish should begin to recruit to adult size in 2025 or 2026.

Literature Cited

Beckman, N. 2025. Completion Report Lake Superior summer creel survey, 2024. Minnesota Department of Natural Resources, R29G60F29RP36 Segment 36-2, Job 1165.

Blankenheim, J. 2025. Commercial fishing summary, Minnesota waters of Lake Superior, 2024. Minnesota Department of Natural Resources, St. Paul, MN.

Ebener, M.P. (Editor). 2001. Sampling and reporting protocols of the Lake Superior Technical Committee. Report to the Lake Superior Technical Committee.

Great Lakes Fisheries Commission. 2024. Status of Sea Lamprey Control in Lake Superior. http://www.glfc.org/pubs/pdfs/4.1.3%20SL%20Status_Superior%20(Oct%202024).pdf

Hansen, M.J., R.G. Schorfhaar and J.H. Selgeby. 1998. Gill-net saturation by Lake Trout in Michigan waters of Lake Superior. North American Journal of Fisheries Management 18:847-853.

Hrabik, T., D. Schreiner, M. Balge and S. Geving. 2006. Development of a hydroacoustic survey design to quantify prey fish abundance in the Minnesota waters of Lake Superior. Minnesota Department of Natural Resources Investigational Report 530.

Muir, Andrew M., C.R. Bronte, M.S. Zimmerman, H.R. Quinlan, J.D. Glase and C.C. Kruger. 2014. Ecomorphological diversity of Lake Trout at Isle Royale, Lake Superior. Transactions of the American Fisheries Society, 143: 972-987.

Peterson, N. 2024a. Completion Report: Lake Superior Spring Creel Survey 2024. Minnesota Department of Natural Resources, R29G60F29RP36 Segment 36-2, Job 1166

Peterson, N. 2024b. Results of operating the Juvenile and adult fish trap on the Knife River, 2024. Minnesota Department of Natural Resources. R29G60F29RP36 Segment 36-2.

Vinson, Mark R., L. Evrard, O. Gorman, S. Phillips and D. Yule. Status and Trends in the Lake Superior Fish Community, 2023. U.S. Geological Survey, Great Lakes Science Center, Lake Superior Biological Station, Ashland, WI.

Minnesota Statewide Fisheries Lake
and Stream Management Planning
F23AF00870
R29G60F29RP36
Segment 36, Year 2
Objective 2
03/14/2025

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
SECTION OF FISHERIES

COMPLETION REPORT FOR MINNESOTA WATERS OF LAKE SUPERIOR

2024

Prepared by:

Josh Blankenheim

Approved by: Cory Goldsworthy Digitally signed by Cory Goldsworthy Date: 2025.03.19 11:44:31 -05'00' _____ _____
Area Fisheries Supervisor Date

Approved by: David Weitzel Digitally signed by David Weitzel Date: 2025.05.13 10:26:39 -05'00' _____ _____
Regional Fisheries Approval Date

Reimbursed under Federal Aid by the Sport Fish Restoration Act

Table 1. Historical catch summary of Lake Trout caught in the May Lake Trout assessment, CPUE (number of fish per 1,000 feet) and percent wild Lake Trout, Minnesota waters of Lake Superior, 1980-2024.

Year	Number of Fish Sampled	Number of Wild Fish Per 1,000 Feet	Number of Stocked Fish Per 1,000 Feet	Total Number Per 1,000 Feet	Percent Wild
1980	2,436	0.6	10.4	11.0	6%
1981	3,080	1.2	12.8	14.0	8%
1982	3,017	1.0	13.8	14.8	7%
1983	2,930	1.1	10.2	11.3	10%
1984	2,580	0.8	7.8	8.6	9%
1985	2,698	1.2	12.9	14.1	9%
1986	3,117	2.6	12.7	15.3	17%
1987	2,882	3.3	14.6	17.9	18%
1988	2,846	3.4	13.6	17.0	20%
1989	3,201	4.4	10.6	15.0	29%
1990	2,860	4.1	10.1	14.2	29%
1991	2,402	3.4	8.4	11.9	29%
1992	2,197	2.8	8.1	10.9	26%
1993	2,197	3.7	7.4	11.1	33%
1994	1,847	3.6	4.9	8.4	43%
1995	1,612	3.4	4.1	7.6	45%
1996	1,490	4.9	4.3	9.2	54%
1997	1,157	4.7	3.8	8.5	56%
1998	887	4.3	2.7	7.0	61%
1999	1,306	7.1	3.6	10.7	66%
2000	1,542	7.9	4.1	11.9	66%
2001	1,290	11.1	3.3	14.5	77%
2002	1,250	6.7	2.8	9.6	70%
2003	890	5.3	1.9	7.2	73%
2004	809	4.0	1.3	5.3	75%
2005	666	3.6	1.0	4.7	78%
2006	957	4.9	1.4	6.3	78%
2007	1,286	8.3	2.0	10.3	81%
2008	1,207	10.7	1.6	12.2	87%
2009	845	5.8	0.8	6.7	88%
2010	892	8.8	0.9	9.7	90%
2011	1,030	9.0	0.7	9.7	93%
2012	1,004	8.8	0.6	9.4	94%
2013	1,035	10.3	0.4	10.8	96%
2014	794	8.8	0.4	9.2	95%
2015	541	7.7	0.2	7.9	98%
2016	782	11.5	0.1	11.6	99%
2017	1,033	15.1	0.1	15.2	99%
2018	1,089	18.5	0.4	18.9	98%
2019	865	18.4	0.3	18.7	98%
2020 [1]	581	9.7	0.1	9.8	99%
2021	541	6.4	0.1	6.5	99%
2022	799	21.9	0.4	22.3	98%
2023	650	16.2	0.4	16.6	98%
2024	658	14.1	0.4	14.5	97%

[1] entire survey was conducted by commercial operators due to Covid restrictions on MNDNR field work

Table 2. Corrected Lake Trout catch and yield by station in the May Lake Trout assessment, 2024.

Location	Effort in Feet (corrected effort)	Number Caught	Total Pounds	Number per 1,000 feet	Pounds per 1,000 feet	Percent Wild
MN-1						
All stations (n = 8)	12,000 (12,000)	194	846	16.2	70.5	91
MN-2						
Split Rock	6,250 (6,250)	93	381	14.9	61.0	100
Silver Bay	9,000 (12,640)	75	302	5.9	23.9	100
Totals MN-2	15,250 (18,890)	168	683	8.9	36.2	100
MN-3						
Grand Marais	9,750 (14,430)	296	1,114	20.5	77.2	100
All locations						
Shorewide	**37,000 (45,320)**	**658**	**2,643**	**14.5**	**58.3**	**97**

Table 3. Number of fresh lamprey wounds per 100 Lake Trout (>17 inches/432 mm) in the May Lake Trout assessment, by size class and statistical district, 2024. Number of Lake Trout sampled in each length category is listed in parenthesis.

	Size Class				
	432-532 mm (17-20.9 in.)	533-634 mm (21-24.9 in.)	635-736 mm (25-28.9 in.)	737 + mm (29 + in.)	Total
MN-1	4.3 (47)	7.8 (103)	7.9 (38)	25.0 (4)	7.3 (192)
MN-2	0.0 (48)	0.0 (94)	0.0 (23)	0.0 (3)	0.0 (168)
MN-3	1.4 (70)	7.0 (186)	5.9 (34)	0.0 (6)	5.4 (296)
TOTALS	1.8 (165)	5.5 (383)	5.3 (95)	7.7 (13)	4.6 (656)

Table 4. Diet composition by weight of prey items in Lake Trout stomachs in the May, deepwater predator, juvenile, and summer expanded commercial assessments, 2024. The number of stomachs sampled with prey items is shown in parentheses.

	Lake Trout							
Diet item	**May**		**Deepwater**		**Juvenile**		**Summer**	
Alewife							0.1%	(2)
Aquatic insects	0.0%	(3)			0.1%	(4)	0.3%	(50)
Artificial fishing bait							0.0%	(1)
Bird								
Burbot	1.9%	(3)					0.9%	(3)
Clam spp	0.0%	(1						
Cisco	3.4%	(5)					1.5%	(5)
Coregonid spp	12.2%	(30)			13.6%	(5)	18.1%	(63)
Deepwater Sculpin					0.4%	(2)	0.1%	(3)
Detritus					0.0%	(1)		
Eggs								
Empty		(103)		(16)		(111)		(405)
Garbage							0.0%	(1)
Kiyi							1.4%	(4)
Minnow (unidentifiable)					0.1%	(1)		
Mysis	0.2%	(7)			5.0%	(45)	1.6%	(26)
Ninespine Stickleback					0.0%	(1)	0.0%	
Pygmy Whitefish					1.1%	(1)		
Rainbow Trout								
Rainbow Smelt	59.2%	(167)	56.4%	(4)	25.3%	(30)	39.0%	(142)
Rock	0.1%	(7)					0.1%	(14)
Rodent							0.8%	(1)
Sculpin spp	0.1%	(2)			2.6%	(10)	0.3%	(18)
Slimy Sculpin					1.2%	(4)	0.4%	(8)
Spoonhead Sculpin					0.2%	(1)	0.0%	(1)
Stickleback spp							0.0%	(1)
Terrestrial insects	0.1%	(12)	2.4%	(4)	2.3%	(14)	4.5%	(69)
Threespine Stickleback								
Troutperch								
Unidentifiable fish remains	22.8%	(200)	41.2%	(13)	47.9%	(12)	30.7%	(330)
Woody debris	0.0%	(18)			0.0%	(3)	0.2%	(17)

Table 5. Catch summary of Lake Trout, Siscowet, Burbot, Bloater, and Kiyi in the deepwater predator assessment, 2024.

Depth Stratum	Length of Net (ft)	Catch					CPUE (fish/1000 ft)				
		Lake Trout	Siscowet	Burbot	Bloater	Kiyi	Lake Trout	Siscowet	Burbot	Bloater	Kiyi
0-119	2,250	13	0	13	0	0	5.8	0.0	5.8	0.0	0.0
120-239	2,250	41	5	29	0	0	18.2	2.2	12.9	0.0	0.0
240-359	2,250	6	25	3	1	1	2.7	11.1	1.3	0.4	0.4
360-479	2,250	0	35	1	0	1	0.0	15.6	0.4	0.0	0.4
480-599	2,250	0	48	3	0	2	0.0	21.3	1.3	0.0	0.9
600+	2,250	0	16	2	0	2	0.0	7.1	0.9	0.0	0.9
Total	**13,500**	**60**	**129**	**51**	**1**	**6**	**4.4**	**9.6**	**3.8**	**0.1**	**0.4**

Table 6. The number of fresh lamprey wounds per 100 Siscowet by size class in the deepwater predator assessment, 2024. The number of Siscowet sampled in each length category is listed in parenthesis.

	Size Class				
	432-532 mm (17-20.9 in.)	533-634 mm (21-24.9 in.)	635-736 mm (25-28.9 in.)	737 + mm (29 + in.)	Total
MN-1	1.8 (55)	20.0 (15)	----	----	5.7 (70)

Table 7. The diet composition by weight of prey items in Burbot and Siscowet stomachs in the deepwater predator assessment, 2024. The number of stomachs sampled with prey items is shown in parentheses.

Diet item	Burbot		Siscowet	
Alewife			1.4%	(1)
Aquatic insects			0.0%	(1)
Burbot			10.1%	(1)
Clam spp	0.1%	(1)		
Coregonid			7.6%	(2)
Deepwater Sculpin	10.8%	(1)	4.8%	(9)
Empty		(21)		(51)
Fish Eggs	5.6%	(2)		
Mysis	28.4%	(14)	0.2%	(1)
Rainbow Smelt			42.1%	(11)
Rock	21.6%	(13)	0.9%	(4)
Sculpin spp	18.6%	(5)	3.7%	(10)
Slimy Sculpin			0.2%	(1)
Stickleback spp	2.1%	(1)	0.2%	(1)
Terrestrial insects			2.6%	(19)
Unidentified fish remains	11.9%	(10)	26.2%	(47)
Woody debris	0.8%	(3)	0.1%	(4)

Table 8. Historical catch summary of Lake Trout less than 17 inches (432 mm) caught in small mesh gill nets (1.5-2.5 inch stretch-measure), CPUE (number of fish per 1,000 feet) and percent wild in the juvenile Lake Trout assessment, Minnesota waters of Lake Superior, 1980-2024.

Year	Number of Fish Sampled	Number of Wild Fish Per 1,000 Feet	Number of Stocked Fish Per 1,000 Feet	Total Number Per 1,000 Feet	Percent Wild
1980	625	1.3	31.6	32.9	4%
1981	914	2.2	51.7	54.0	4%
1982	551	1.9	37.7	39.6	5%
1983	453	4.5	22.2	26.7	17%
1984	585	6.7	33.7	40.4	17%
1985	336	4.1	19.9	24.0	17%
1986	404	5.6	22.6	28.2	20%
1987	346	6.0	16.5	22.5	27%
1988	285	4.7	15.1	19.8	24%
1989	168	2.7	8.6	11.3	24%
1990	236	3.7	10.7	14.4	25%
1991	363	4.9	14.5	19.4	25%
1992	274	5.1	11.4	16.6	31%
1993	387	6.0	18.4	24.4	25%
1994	458	6.7	19.4	26.1	26%
1995	352	7.3	12.6	20.0	37%
1996	468	10.3	16.0	26.3	39%
1997	440	12.0	14.9	26.9	45%
1998	557	13.5	16.9	30.4	44%
1999	640	19.0	17.2	36.2	53%
2000	454	14.4	9.9	24.3	59%
2001	370	12.9	6.3	19.2	67%
2002	484	20.3	4.5	24.8	82%
2003	249	10.5	3.1	13.7	77%
2004	334	13.7	3.7	17.4	79%
2005	402	14.0	6.3	20.3	69%
2006	306	11.0	4.9	15.9	69%
2007	222	8.4	3.1	11.5	73%
2008	282	13.0	1.6	14.7	89%
2009	295	14.0	1.3	15.3	92%
2010	235	11.5	0.7	12.2	94%
2011 [1]	-	-	-	-	-
2012	332	16.6	0.7	17.3	96%
2013	219	11.0	0.4	11.4	96%
2014	324	16.4	0.5	16.8	97%
2015	281	14.1	0.5	14.6	96%
2016	276	13.8	0.5	14.3	96%
2017	273	13.4	0.4	13.8	97%
2018	315	15.6	0.6	16.2	97%
2019	208	10.4	0.4	10.8	96%
2020 [2]	-	-	-	-	-
2021	254	12.4	0.8	13.2	94%
2022	133	6.9	0.8	7.7	89%
2023	303	16.9	0.6	17.5	96%
2024	319	18.1	0.3	18.4	98%

[1] No data due to State of Minnesota government shutdown

[2] No data due to coronavirus pandemic

Table 9. Summary of fishing effort, catch, percentage of wild Lake Trout and CPUE (number of fish per 1,000 feet of 1.5-2.5 inch stretch-measure gill net) in the juvenile Lake Trout (less than 17 inches; 432 mm) assessment, 2024.

Location	Effort in Feet	Corrected Effort in Feet*	Number of lake trout	Percent Wild	CPUE Wild	CPUE Stocked	CPUE Total
MN-1							
Lester River	900	1,368	9	89%	5.8	0.7	6.6
Pumping Station	900	1,368	25	84%	15.4	2.9	18.3
Stoney Point	900	1,368	28	96%	19.7	0.7	20.5
Larsmont	900	1,368	12	100%	8.8	0.0	8.8
Two Harbors	900	1,368	34	100%	24.9	0.0	24.9
Encampment Island	900	1,368	31	100%	22.7	0.0	22.7
MN-1 Total	**5,400**	**8,208**	**139**	**96%**	**16.2**	**0.7**	**16.9**
MN-2							
Split Rock	900	1,368	25	100%	18.3	0.0	18.3
Silver Bay	900	1,368	23	100%	16.8	0.0	16.8
Taconite Harbor	900	1,368	16	100%	11.7	0.0	11.7
Tofte	900	1,368	24	100%	17.5	0.0	17.5
MN-2 Total	**3,600**	**5,472**	**88**	**100%**	**16.1**	**0.0**	**16.1**
MN-3							
Grand Marais	900	1,368	52	100%	38.0	0.0	38.0
Hovland	900	900	12	100%	13.3	0.0	13.3
Grand Portage	900	1,368	28	100%	20.5	0.0	20.5
MN-3 Total	**2,700**	**3,636**	**92**	**100%**	**25.3**	**0.0**	**25.3**
Shorewide Total	**11,700**	**17,316**	**319**	**98%**	**18.1**	**0.3**	**18.4**

For CPUE calculations fishing effort was corrected for two night sets (900 ft. actual effort x 1.52 = 1,368 feet except for Hovland, which was a one night set).

Table 10. Commercial catch of Lake Trout (LAT) and Siscowet (SCT), Lake Trout CPUE (fish per 1,000 feet of net), percent of commercial quota harvested, Lake Trout harvest in the sport fishery, and percentage of total Lake Trout harvest taken by commercial fishing, 2007-2024.

	MN-1						MN-2						MN-3					
Year	LAT harvest	SCT harvest	LAT CPUE	Percent of quota	Sport LAT harvest	Commercial percentage of LAT	LAT harvest	SCT harvest	LAT CPUE	Percent of quota	Sport LAT harvest	Commercial percentage of LAT	LAT harvest	SCT harvest	LAT CPUE	Percent of quota	Sport LAT harvest	Commercial percentage of LAT
2007													470	92	17.4	19%	4,350	10%
2008													1,122	109	10.7	41%	1,310	46%
2009													1,246	100	13.6	45%	2,450	34%
2010							839	119	9.5	48%	8,729	9%	1,510	140	14.1	55%	2,118	42%
2011							1,118	89	6.4	60%	4,711	19%	1,713	106	16.8	61%	2,484	41%
2012							716	130	5.7	42%	3,899	16%	1,944	121	26.2	69%	2,583	43%
2013							1,224	113	7.2	67%	4,728	21%	1,959	48	37.9	67%	1,638	54%
2014							409	166	3.7	29%	3,872	10%	2,015	77	29.9	70%	2,190	48%
2015							287	88	3.6	19%	4,923	6%	2,468	216	19.6	89%	3,254	43%
2016							364	36	5.5	20%	7,432	5%	2,189	42	37.4	74%	3,872	36%
2017	475	0	19.2	95%	17,346	3%	1,139	67	11.8	60%	5,294	18%	2,431	64	32.6	83%	5,366	31%
2018	494	1	21.4	99%	18,352	3%	1,297	20	13.0	66%	5,466	19%	2,295	110	34.9	80%	3,683	38%
2019	349	0	13.7	70%	12,651	3%	576	46	7.0	31%	3,924	13%	2,353	158	28.0	84%	2,163	52%
2020	341	0	12.4	68%	14,312	2%	220	29	4.4	12%	3,713	6%	2,109	177	22.3	76%	2,620	45%
2021	398	2	16.9	80%	18,623	2%	288	44	4.2	17%	5,251	5%	1,625	155	17.1	59%	2,672	38%
2022	496	2	20.7	100%	14,207	3%	294	28	7.6	16%	3,685	7%	1,770	125	20.2	63%	2,303	43%
2023	566	0	17.4	81%	18,402	3%	495	16	16.0	26%	8,450	6%	2,091	58	16.3	72%	3,899	35%
2024	679	0	19.2	97%	24,468	3%	704	31	10.9	37%	6,739	9%	2,413	92	19.5	84%	4,325	36%

Table 11. Spawning-size Cisco biomass estimates (millions of pounds) from fall hydroacoustic surveys, 2015-2024. Lower and upper 95% confidence limits are shown.

Year	MN1 Nearshore			MN1 Offshore			MN2 Nearshore			MN2 Offshore			MN3 Offshore			Shorewide		
	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Biomass	Lower	Upper
2015	0.106	0.030	0.182	0.214	0.123	0.324	0.017	0.009	0.029	2.640	1.674	3.775	7.104	3.403	10.307	9.971	6.276	13.617
2016	0.127	0.057	0.211	0.156	0.083	0.230	0.005	0.004	0.006	2.271	1.191	3.402	2.539	1.631	3.441	5.127	3.713	6.570
2017	0.089	0.071	0.108	0.308	0.242	0.378	0.020	0.016	0.025	1.490	1.177	1.832	1.973	1.208	2.671	3.853	3.028	4.650
2018	1.377	0.716	2.085	0.631	0.455	0.810	0.478	0.257	0.714	3.892	3.294	4.547	1.821	1.343	2.341	8.224	7.135	9.313
2019	2.258	1.154	3.360	0.598	0.310	0.891	0.608	0.201	1.020	1.955	0.865	2.929	2.684	1.741	3.623	8.043	6.209	9.849
2020																		
2021	0.263	0.103	0.459	0.480	0.078	0.951	0.087	0.034	0.151	3.154	2.538	3.819	3.700	2.438	4.918	7.694	6.248	9.152
2022	0.515	-0.025	1.107	0.276	0.201	0.357	0.049	0.024	0.077	1.114	0.726	1.457	0.977	0.773	1.202	2.939	2.230	3.656
2023	0.140	0.096	0.192	0.130	0.125	0.134	0.074	0.044	0.124	1.562	1.241	1.881	4.149	3.421	4.919	6.076	5.280	6.900
2024	2.641	1.439	3.715	2.411	1.730	3.108	0.439	0.332	0.555	2.886	1.322	4.731	3.521	2.843	4.194	11.944	9.658	14.282