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Statewide Fisheries Lake and Stream Management Planning
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MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
SECTION OF FISHERIES

COMPLETION REPORT FOR THE MINNESOTA WATERS OF LAKE SUPERIOR

2017

Prepared by:

Josh Blankenheim

Reimbursed under Federal
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Restoration Act

Executive Summary

The Sea Lamprey (*Petromyzon marinus*) wounding rate was above the target level of 5.0 fresh wounds per 100 Lake Trout (*Salvelinus namaycush)* in MN-3 (11.3) but below the target level in MN-1 (4.7) and MN-2 (1.5). The shorewide wounding rate was slightly below the target at 4.7 wounds per 100 fish.

The overall catch rate of Lake Trout in the May assessment was 15.3 fish per 1,000 feet of net, and 99% were wild fish. CPUE by management zone was 16.2 in MN-1, 11.7 in MN-2, and 35.3 in MN-3. All were increases over 2016 levels, and the CPUE in MN-2 was the highest since the early 1990s while the CPUE in MN-3 was well above any previous CPUE. This was the first year heads were collected rather than just otoliths from May assessment fish in MN-3, which increased agreement between field calls of Lake Trout or Siscowet and age analysis of otoliths.

In the juvenile Lake Trout assessment (fish less than 17 inches), the CPUE was 13.8 fish per 1,000 feet of net. The CPUE in the juvenile Lake Trout assessment has remained relatively consistent during the past decade. Shorewide, 97% of juvenile Lake Trout captured were wild. Despite annual stocking in MN-1 through 2015, 93% of juvenile Lake Trout captured in MN-1 were wild fish.

The Summer Commercial assessment was expanded in 2017 to include MN-1 with a quota of 500 Lake Trout. Commercial fishermen in MN-1 harvested 469 Lake Trout and the CPUE was 18.9 fish per 1,000 feet of net. Lake Trout harvest in MN-2 was 1,139 fish and the CPUE was 11.8 fish per 1,000 feet of net. In MN-3, 2,431 Lake Trout were harvested and the CPUE was 32.6 fish per 1,000 feet of net. The commercial harvests represented 2.6%, 17.7%, and 31.2% of the estimated combined Lake Trout harvests between commercial and sport fishermen.

CPUEs in the Lake Trout spawning assessment were 101.0 (MN-1), 61.3 (MN-2), and 98.7 (MN-3) Lake Trout per 1,000 feet of net. The percent wild fish was 27.7% (MN-1), 95.7% (MN-2), and 99.3% (MN-3). The percent wild in MN-1 should increase with the cessation of stocking and as wild fish replace stocked Lake Trout.

Cisco harvest in the traditional gill net fishery (all months excluding November) was only 104,234 pounds, which was the lowest harvest since 1987. However, the catch rate was 199 Cisco per 1,000 feet of net and similar to recent years. Harvest during the November fishery was 83,250 pounds and the catch rate was 795 pounds per 1,000 feet of net.

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Introduction

This report summarizes the assessment work conducted by the Lake Superior Area Office in Minnesota's portion of Lake Superior in 2017 including the May Lake Trout (*Salvelinus namaycush)*, juvenile Lake Trout, summer expanded commercial Lake Trout, spawning Lake Trout, and Cisco (*Coregonus artedi*) assessments.

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*) (Horns et al. 2003). Lake Trout is the primary species caught by anglers and at present supports a recreational fishery with an average annual harvest of 24,370 fish (2008-2017) in the Minnesota waters of Lake Superior (Reeves 2018). The deepwater morphotype of Lake Trout, known as the Siscowet, generally lives in depths greater than 240 feet and is the most abundant predator in Lake Superior. 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". Chinook Salmon (*Oncorhynchus tshawytscha)*, Coho Salmon (*O. kisutch)*, and Rainbow Trout (*O. mykiss*) are generally not vulnerable to MNDNR assessment gill nets. The status of these salmonid species is discussed in creel survey reports and French and Knife River trap reports (Peterson 2018a; Peterson 2018b; Pinkerton and Peterson 2018; Reeves 2018).

Cisco are an important forage species in Lake Superior and supports a commercial fishery. Population dynamics are monitored by hydroacoustic surveys, MNDNR assessment netting, and analyzing commercial fishing records. Annual quotas are established based on hydroacoustic biomass estimates. Commercial harvest is summarized thoroughly in an annual commercial fishing report (Blankenheim 2018).

Methods

MNDNR 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 fishermen set nets of variable length. Nets 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. Net sets were for one night unless weather interfered with net retrieval.

The juvenile Lake Trout assessment is conducted solely by MNDNR. The assessment utilizes five nets each 200 feet in length tied together for a total gang length of 1,000 feet. Mesh sizes include 1.5, 1.75, 2.0, 2.25, and 2.5 inch stretch-measure mesh. Nets were set in six locations in MN-1, four locations in MN-2, and three locations in MN-3 with each set starting in 120 feet of water and ending shallower than 240 feet. Net sets were for two nights, with the exception of Hovland which is always set for one night. In 2017 poor weather caused two nets to be left out for three nights.

MNDNR conducts the Lake Trout spawning assessment in MN-1 while commercial operators participate in MN-2 and MN-3. Spawning assessment nets utilize 5.5 inch stretch-measure mesh. In MN-1 each net is a single 250 foot panel; commercial fishermen occasionally fish 500 foot gangs. Nets were set in four locations in MN-1 (Fitger's Reef, Moen Tire, Stoney Point, Bluebird Landing), and one location each in MN-2 (Split Rock) and MN-3 (Grand Marais), with net sets beginning in 20 feet of water and typically ending by 50 feet of depth. Net sets were set for one night unless weather interfered with retrieval.

Locations for net sets and statistical zones are shown in Figures 1 and 2. Detailed net specifications can be found in Ebener (2001). In all surveys length, weight, sex, fin clips, and lamprey wounds were recorded for each fish caught. MNDNR collected otoliths and stomach contents on all fish while commercial operators did so on a subsample of fish.

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 are 3,000 fish in MN-3, 2,000 fish in MN-2, and 500 fish in MN-1. The season was open from June 1st through September 30th. Aging structures and diet information were collected from a sub-sample of each commercial

operator's catch; length, weight, fin clips, and lamprey wounds were recorded for every fish. Detailed information on the limited commercial Lake Trout fishery can be found in Blankenheim (2018).

Beginning in 2006, catch per unit effort (CPUE) 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 MNDNR Cisco assessment consists of 300 foot multi-mesh (2.0-, 2.5-, and 3.0-inch stretch mesh) nets, with 100 feet of each mesh size per net. Two gangs were set: one at 12 feet below the surface and the other at 25 feet below the surface. Sampling began in mid-October with a goal of collecting 100 Cisco. Due to the time constraints of otolith aging and reporting, age data of Cisco sampled in 2017 were not yet available. Hydroacoustic surveys with accompanying mid-water trawls have been conducted since 2003; methodology can be found in Hrabik et al. (2006).

Results and Discussion

May Assessment

The number of fresh Sea Lamprey wounds per 100 Lake Trout (wounding rate) in the May assessment was 4.7 in MN-1, 1.5 in MN-2, and 11.3 in MN-3 (Table 1, Figure 3). The overall wounding rate was 4.7 (Figure 4). The target wounding rate for all zones is not more than 5 fresh wounds per 100 Lake Trout. Wounding rates increased by size category (Table 1).

Sea Lamprey control is conducted by the U.S. Fish & Wildlife Service and Fisheries and Oceans Canada. Control efforts have kept the population at or below 10% of peak abundance. Nevertheless, Sea Lamprey are still a major cause of Lake Trout mortality in Minnesota waters. Although the wounding rate was below target in two of the three zones, it is consistently high in MN-3. Furthermore, the Great Lakes Fishery Commission (GLFC) recently found Sea Lamprey abundance to be increasing in Lake Superior, which may increase wounding rates and Lake Trout mortality in the future.

The overall CPUE of Lake Trout was 15.3 fish per 1,000 feet of net in the 2017 May assessment (Table 2, Figure 5). The 2017 CPUE has only been exceeded during the mid-1980s, when the high Lake Trout abundance observed most likely resulted from stocked fish filling niches made vacant by Sea Lamprey predation, and extremely high numbers of Rainbow Smelt as prey. Wild Lake Trout CPUE was 15.2 fish per 1,000 feet of net which continued the positive trend for wild Lake Trout abundance, and stocked Lake Trout CPUE was 0.1 fish per 1,000 feet of net (Figure 5). Lake Trout CPUE was highest for fish in the 17.0-20.9 inch range (Table 2). By zone, Lake Trout CPUEs for MN-1, MN-2, and MN-3 were 16.2, 11.7, and 35.3 fish per 1,000 feet of net (Table 3, Figure 6). While catch rates in all three zones were higher than in 2016, the CPUE in MN-2 was the highest observed since the early 1990s and the CPUE in MN-3 was well above any previous CPUE. Wild fish comprised 99% of Lake Trout sampled in the assessment (Table 3, Figure 5). Creel survey data and anecdotal reports have indicated that a higher proportion of the summer Lake Trout catch is stocked fish compared to what is observed in the May assessment, so Lester River/Brighton Beach was added as a station starting in 2015 after not

being sampled since 2008. Even with the addition of this station, wild fish have still accounted for over 90% of the catch in MN-1 each year since it was added back into the survey.

Lake Trout ages ranged from age-3 to age-27 (Table 4). By design, the May assessment typically captures Lake Trout age-6 to age-10. Eighty-eight percent of Lake Trout captured were age-6 to age-10.

The age and growth patterns observed on otoliths help confirm correct species identification from the calls made in the field by biologists and commercial operators. In recent years, age analysis has indicated that there have been some Siscowet that were mistakenly identified as Lake Trout, primarily in MN-3. In 2017, there were no discrepancies with fish in MN-1 (n=178), meaning that all fish that were called Lake Trout in the field appeared to be so based on the age and growth characteristics seen on the otoliths. In MN-2 only two fish were discrepancies (99% agreement, n=180). However, in MN-3 there were 18 fish that were discrepancies, resulting in only 81% agreement (n=93). Due to the low level of agreement observed in 2016 (70%), MNDNR requested the heads of MN-3 samples rather than just the otoliths so that staff could verify the commercial operator's field calls. Of the 18 fish in question, 9 were reversed and called Siscowet by MNDNR staff; the remaining 9 were still called Lake Trout but age analysis did not corroborate these calls (an additional four were called Siscowet by MNDNR but age analysis disagreed). While this was an improvement, it is troubling that there was still a fair amount of disagreement between field calls and age analysis. It is possible that hybrids or the humper morphotype of Lake Trout are being caught in MN-3. Genetic samples should be collected to investigate this possibility. Continued incorrect identification of Lake Trout could create a variety of problems such as biased CPUEs or poorly functioning Lake Trout models.

By weight, diet composition of Lake Trout in the May assessment was almost entirely Rainbow Smelt (73.4%) and unidentifiable fish remains (24.2%) (Table 5). Rainbow Smelt commonly comprise the greatest weight of diet items in Lake Trout stomachs during the May assessment. Nineteen percent of Lake Trout (n=91) had no prey items in their stomachs, which was in the range observed the previous five years (3% to 30%).

Juvenile Lake Trout Assessment

In 2017, the CPUE of juvenile Lake Trout (less than 17 inches) was 13.8 fish per 1,000 feet of net (Table 6). CPUE has been relatively consistent during the past decade (Figure 7). The CPUE of wild juveniles was 13.4 Lake Trout per 1,000 feet of net and the CPUE of stocked fish was only 0.4 Lake Trout per 1,000 feet of net. Ninety-seven percent of the juvenile Lake Trout catch was wild (Table 7, Figure 7). CPUEs in MN-1, MN-2, and MN-3 were 12.0, 7.4, and 27.7 Lake Trout per 1,000 feet of net, respectively. All juveniles captured in MN-2 and MN-3 were wild as expected due to the discontinuation of stocking in 2003 (MN-3) and 2007 (MN-2). Even though annual stocking occurred in MN-1 through 2015, 93% of the juvenile Lake Trout catch in MN-1 was wild fish. Lake Trout recruitment may be reaching a level representative of self-sustaining Lake Trout populations in Lake Superior indicated by high proportions of wild juveniles and a plateauing CPUE.

By weight, juvenile Lake Trout diets were comprised primarily of Rainbow Smelt (49.4%), unidentifiable fish remains (19.9%), and *Mysis* (9.8%) (Table 5). The percentage of *Mysis* was much lower than in 2016 (30%) and 2015 (48%). Twenty-six percent (n = 77) of juvenile Lake Trout stomachs contained no prey items in 2017, which was in the range observed the previous five years (15% to 40%).

Summer Expanded Commercial Assessment

In accordance with the 2016 Lake Superior Management Plan (LSMP; Goldsworthy et al. 2016), a limited commercial fishery for Lake Trout in MN-1 was established in 2017 and commercial fishermen in this zone got to target Lake Trout for the first time in many years. The quota was set at 500 fish and two operators chose to participate. A total of 469 Lake Trout were harvested and the CPUE was 18.9 Lake Trout per 1,000 feet of net (Figure 8). Commercial fishermen harvested 94% of the total-allowable-catch (TAC). Commercial harvest of Lake Trout represented 2.6% of the estimated total Lake Trout harvest between sport (17,346) and commercial (469) fishers combined.

In MN-2, the number of Lake Trout harvested by commercial fishermen was 1,139 and the CPUE was 11.8 Lake Trout per 1,000 feet of net (Figure 8). The CPUE was the highest since this fishery was

established. An additional 67 Siscowet were harvested. Commercial netters harvested 60% of the 2,000 fish TAC (Lake Trout and Siscowet) from MN-2. The estimated number of Lake Trout harvested in the MN-2 sport fishery was 5,294 Lake Trout; therefore, commercial fishermen accounted for 17.7% of the total Lake Trout harvest in MN-2.

In MN-3, commercial fishermen harvested 2,431 Lake Trout and the CPUE was 32.6 Lake Trout per 1,000 feet of net (Figure 8). An additional 64 Siscowet were harvested. Commercial fishermen harvested 83% of the 3,000 fish TAC. Sport anglers harvested an estimated 5,366 Lake Trout in MN-3; therefore commercial fishing accounted for 31.2% of the total Lake Trout harvest in MN-3.

Lake Trout diet composition by weight in the summer commercial assessment was dominated by Rainbow Smelt (51.1%), unidentifiable fish remains (23.9%), and coregonids (9.8%). *Mysis* was not preyed upon nearly as much as in many other years, perhaps due to Rainbow Smelt appearing to be more abundant. Forty-four percent of Lake Trout stomachs (n = 355) had no diet items, which was very similar to the previous five years (37%-42%).

Spawning Assessment

Lake Trout spawning assessments are conducted in alternate years. Age data were not available at the time of this writing. In 2017, the CPUEs for MN-1, MN-2, and MN-3 were 101.0, 61.3, and 98.7 Lake Trout per 1,000 feet of net, respectively (Table 8, Figure 9). Ninety-nine percent of Lake Trout captured in MN-3 were wild and 96% were wild in MN-2, but only 28% of the Lake Trout captured in MN-1 were wild (Table 8, Figure 10). The percentage of wild fish in MN-1 should gradually increase with the cessation of stocking and as wild fish replace hatchery fish, as has been seen in MN-2, MN-3 and other parts of Lake Superior.

Despite sampling into November, males outnumbered females in all zones (Table 8). Eighty-eight percent of examined Lake Trout stomachs were empty; remaining Lake Trout had consumed primarily Rainbow Smelt and unidentifiable fish remains (Table 5). Empty stomachs are commonly seen during the Spawning Assessment.

Cisco Assessment

Age data from the 2017 spring and fall commercial Cisco samples and MNDNR Cisco assessment were not yet available at the time of this writing. Age analysis from the 2016 spring and fall Cisco samples collected from commercial fishermen (n=574) showed that the fishery was highly dependent on two year-classes, with the 2003 and 2009 year-classes accounting for 74% of the total commercial catch (Figure 11). Fish up to age-30 (1986 year-class) were captured. The MNDNR fall Cisco assessment uses multi-mesh nets that includes a smaller mesh size (2.5 inch) than used by commercial fishermen. In 2016, 24% (n=23) of the catch were age-2 Cisco from the 2014 year-class (Figure 11).

Commercial fishermen from all three zones commented on the seemingly high abundance of small Cisco and a lack of large fish in their catches in 2017. The length-frequency distribution of Cisco in the commercial catch in 2017 suggests a portion of Cisco will likely age to the 2014 year-class. Approximately 25% of the commercially caught Cisco that were examined by MNDNR (n=293) were 14 inches or smaller (data not shown). Despite a fairly weak relative abundance of the 2014 year-class (14.3 age-1 Cisco per hectare), it is probable that it will be fished heavily due to the scarcity of other year-classes. Care must be taken to manage the few available year-classes of Cisco conservatively to avoid collapse of the fishery.

A management strategy to assess forage species as stated in the LSMP is to use hydroacoustic sampling complemented by mid-water trawling to monitor year-class strength and determine biomass of Cisco in Minnesota's portion of Lake Superior. This strategy was implemented in 2003 and collaboration with Dr. Tom Hrabik at the University of Minnesota Duluth led to the development of a sampling program to quantify spawning size Cisco abundance (Hrabik et al. 2006). Hydroacoustic surveys have been conducted annually since 2003; they have been conducted in the fall since 2014. Estimated biomass in the fall has declined each year regardless of analysis method utilized and now is estimated to be less than 2,000 metric tons (Figure 12). Acoustic data from fall 2017 have not been analyzed yet.

Commercial Cisco and Rainbow Smelt Harvest

Cisco harvest in the traditional fishery (all months except November) was 104,234 pounds in 2017. The 2017 harvest in the traditional fishery was the lowest since 1987. However, the CPUE was similar to recent years at 199 pounds per 1,000 feet of net (Figure 13).

Experimental netting for a potential November roe fishery started in 2001 in Minnesota waters, and beginning in 2006 harvest was permitted during November using TAC quotas established for each statistical district (Schreiner et al. 2006). The yearly November TAC is calculated from hydroacoustic data and in 2017 was set at 212,115 pounds for Minnesota waters. Beginning in 2016, the Grand Portage Band of Chippewa set a Cisco TAC for their waters. With permission, some Minnesota licensed commercial fishermen are allowed to harvest from Grand Portage waters. Commercial fishermen fishing in Minnesota waters harvested 52,690 pounds of Cisco and Minnesota-licensed commercial fishermen fishing in Grand Portage waters harvest 30,560 pounds for a combined harvest of only 83,250 pounds of Cisco in the November season (Figure 13). However, the CPUE was 795 pounds per 1,000 feet of net, which was notably higher than the average November CPUE of 651 pounds per 1,000 feet of net. Further detail of commercial Cisco harvest is available in Blankenheim (2018). Some caution should be used when assessing commercial Cisco CPUE data because it is not adjusted for soak time. It is possible that commercial fishermen could leave their nets in the water for longer periods of time to catch more fish when fishing is poor, thereby artificially inflating CPUE. For the second year in a row, no commercial operators fished for Rainbow Smelt.

Although the overall harvest of Cisco during November was relatively low, it may have been due in part to market conditions. Discussions with commercial fishermen indicated that there was some uncertainty with the market and the buyers of the roe and flesh. At least one commercial fisherman opted to only supply local markets rather than deal with the larger buyers and the issues that came with them this year.

Stocking

Stocking played an important role in rehabilitation of Lake Trout in Lake Superior, but was discontinued in the Minnesota waters of the lake and the last year of stocking was 2015. Criteria regarding the use of Lake Trout stocking as a management tool in Lake Superior are discussed in the Lake Trout Restoration Plan (Hansen ed. 1996) and the LSMP (Goldsworthy et al. 2016).

Two strains of Rainbow Trout were stocked in Minnesota waters of Lake Superior in 2017: steelhead and Kamloops. Summaries of the 2017 stocking and proposed 2018 stocking are given in Table 9. More information on the return rates of these programs are available in the annual spring creel and trap reports (Peterson 2018a; Peterson 2018b; Pinkerton and Peterson 2018).

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MINNESOTA DEPARTMENT OF NATURAL RESOURCES
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SECTION OF FISHERIES

COMPLETION REPORT FOR MINNESOTA WATERS OF LAKE SUPERIOR

2017

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Approved by: _____ 4/10/2018
Area Fisheries Supervisor — Date

Approved by: _____ 4/10/18
Regional Fisheries Approval — Date

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Table 1. Number of fresh lamprey wounds per 100 Lake Trout in 4.5 inch stretch mesh May assessment gill nets, by size class and statistical district, 2017. Number of Lake Trout sampled in each length range 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	2.4 (83)	2.4 (83)	16.0 (25)	50.0 (2)	4.7 (193)
MN-2	0.3 (305)	3.2 (219)	0.0 (18)	0.0 (8)	1.5 (550)
MN-3	6.0 (133)	15.3 (111)	16.7 (24)	33.3 (6)	11.3 (274)
TOTALS	2.1 (521)	6.3 (413)	11.9 (67)	18.8 (16)	4.7 (1,017)

Table 2. Number of Lake Trout by size class per 1,000 feet of 4.5 inch stretch mesh May assessment gill nets, 2017.

	Size Class					
Assessment	<432 mm (<17 inches)	432-532 mm (17-20.9 inches)	533-634 mm (21-24.9 inches)	635-736 mm (25-28.9 inches)	737+ mm (29 + inches)	Overall
May	0.24	7.72	6.12	0.99	0.24	15.32

Table 3. Corrected Lake Trout catch by station in the May assessment, 2017.

Location	Effort in Feet (corrected effort)	Total Catch (number)	Total Weight (pounds)	Number per 1,000 feet	Pounds per 1,000 feet	Percent Wild
MN-1						
All Stations (n = 8)	12,000 (12,000)	194	713	16.2	59.4	95.4
MN-2						
Split Rock	14,750 (18,280)	297	951	16.2	52.0	100
Silver Bay	20,000 (29,100)	257	883	8.8	30.3	99.6
Totals MN-2	34,750 (47,380)	554	1,834	11.7	38.7	99.8
MN-3						
Grand Marais	6,250 (8,070)	285	933	35.3	115.6	100
Totals MN-3	6,250 (8,070)	285	933	35.3	115.6	100
All locations						
Shorewide	**53,000 (67,450)**	**1,033**	**3,481**	**15.3**	**51.6**	**99.0**

Table 4. Age-length frequency distribution of otolith aged Lake Trout in 4.5 inch stretch measure gill nets, May assessment, 2017. Bold numbers indicate fish that were identified as Lake Trout but age analysis suggested they were Siscowet.

Length (in)	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI+
9.0 - 9.9														
10.0 - 10.9	1													
11.0 - 11.9														
12.0 - 12.9														
13.0 - 13.9			1											
14.0 - 14.9				1										
15.0 - 15.9				1										
16.0 - 16.9				3										
17.0 - 17.9				4	1		1							
18.0 - 18.9			1	28	9	2	2	1	1	1				
19.0 - 19.9				15	44	6	6			1				**1**
20.0 - 20.9				10	53	15	5	2						**2**
21.0 - 21.9				5	29	25	4	1		2		1		**1**
22.0 - 22.9				2	9	30	4	3	1	1		1		**1**
23.0 - 23.9				1	3	15	12	7	1					**2**
24.0 - 24.9				1	1	6	5		3		2			
25.0 - 25.9					1	5	3	3	1		1	1	2	**2,1**
26.0 - 26.9						1	1	2	1		3	1	1	**1**
27.0 - 27.9						1		1			2			1
28.0 - 28.9									1	1		1		**1**
29.0 - 29.9											1			
30.0 - 30.9														
31.0 - 31.9														1
32.0 - 32.9													1	
33.0 - 33.9														1
34.0 - 34.9														
35.0 - 35.9														1
36.0 - 36.9														
37.0 - 37.9														
38.0 - 38.9														
39.0 - 39.9														
Total	1	0	2	71	150	106	43	20	9	6	9	5	4	16
Average Length	10.5		15.7	19.2	20.4	22.1	22.2	23.5	24.2	21.7	26.5	24.8	27.4	25.5

Table 5. Diet composition by weight of prey items in Lake Trout stomachs in the May, juvenile, summer, and spawning assessments, 2017. The number of stomachs sampled with prey items is shown in parentheses.

	Lake Trout							
Diet item	May		Juvenile		Summer		Spawning	
Alewife			0.6%	(1)				
Aquatic insects	0.1%	(6)	0.2%	(7)	1.2%	(30)		
Bird					0.1%	(1)		
Burbot	1.3%	(2)			2.3%	(4)		
Central Mudminnow	0.0%	(1)						
Cisco (lake herring)					0.5%	(1)		
Clam sp.								
Coregonid sp.	0.5%	(3)	3.8%	(4)	9.2%	(28)		
Deepwater Sculpin	0.0%	(1)			0.3%	(6)		
Detritus	0.0%	(1)						
Empty		(91)		(77)		(355)		(162)
Fish eggs								
Kiyi								
Larval fish								
Minnow sp.	0.0%	(1)						
Mysis	0.1%	(2)	9.8%	(83)	2.7%	(38)		
Ninespine Stickleback			0.1%	(1)	0.0%	(1)		
Rainbow Smelt	73.4%	(278)	49.4%	(42)	51.1%	(180)	59.8%	(8)
Rainbow Trout					0.6%	(1)		
Rocks	0.2%	(11)	0.0%	(2)	0.4%	(24)		
Round Whitefish								
Salmonid sp.					1.2%	(1)		
Sculpin sp.	0.0%	(4)	5.6%	(18)	1.2%	(22)		
Slimy Sculpin			2.9%	(10)	0.5%	(5)		
Spoonhead Sculpin					0.1%	(2)		
Stickleback sp.					0.0%	(2)		
Terrestrial insects	0.0%	(1)	7.1%	(17)	4.5%	(48)	0.1%	(2)
Unidentifiable fish remains	24.2%	(230)	19.9%	(82)	23.9%	(255)	40.0%	(16)
Woody debris	0.0%	(11)	0.7%	(15)	0.2%	(13)	0.1%	(1)

Table 6. Summary of fishing effort, catch, percentage of wild Lake Trout and CPUE (number of fish per 1,000 feet) in the juvenile Lake Trout (less than 17 inches; 432 mm) assessment, 2017.

Location	Effort in Feet	Corrected Effort in Feet*	Number of lake trout	Percent Wild	CPUE Wild	CPUE Stocked	CPUE Total
MN-1							
Lester River	1,000	1,520	11	82%	5.9	1.3	7.2
Pumping Station	1,000	1,520	34	91%	20.4	2.0	22.4
Stoney Point	1,000	1,520	15	93%	9.2	0.7	9.9
Larsmont	1,000	1,520	30	100%	19.7	0.0	19.7
Two Harbors	1,000	1,800	12	83%	5.6	1.1	6.7
Encampment Island	1,000	1,800	14	100%	7.8	0.0	7.8
MN-1 Total	**6,000**	**9,680**	**116**	**93%**	**11.2**	**0.8**	**12.0**
MN-2							
Split Rock	1,000	1,520	9	100%	5.9	0.0	5.9
Silver Bay	1,000	1,520	6	100%	3.9	0.0	3.9
Taconite Harbor	1,000	1,520	19	100%	12.5	0.0	12.5
Tofte	1,000	1,520	11	100%	7.2	0.0	7.2
MN-2 Total	**4,000**	**6,080**	**45**	**100%**	**7.4**	**0.0**	**7.4**
MN-3							
Grand Marais	1,000	1,520	62	100%	40.8	0.0	40.8
Hovland	1,000	1,000	17	100%	17.0	0.0	17.0
Grand Portage	1,000	1,520	33	100%	21.7	0.0	21.7
MN-3 Total	**3,000**	**4,040**	**112**	**100%**	**27.7**	**0.0**	**27.7**
Shorewide Total	**13,000**	**19,800**	**273**	**97%**	**13.4**	**0.4**	**13.8**

*For CPUE calculations fishing effort was corrected for two night sets (1,000 ft. actual effort x 1.52 = 1,520 feet except for Hovland, which was a one night set). Two Harbors and Encampment were left an additional night and corrected for three night sets (1,000 ft. actual effort x 1.80 = 1,800 ft.).

Table 7. 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, 1980-2017.

Year	No. 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	586	1.2	29.6	30.9	4%
1981	914	2.2	51.7	54	4%
1982	551	1.9	37.7	39.6	5%
1983	454	4.5	22.2	26.7	17%
1984	585	6.7	33.7	40.4	17%
1985	336	4.1	19.9	24	17%
1986	404	5.6	22.6	28.2	20%
1987	350	6	16.8	22.8	26%
1988	271	3.7	12.7	16.4	23%
1989	168	2.7	8.6	11.3	24%
1990	242	3.7	11.1	14.7	25%
1991	384	4.8	15.5	20.3	24%
1992	278	5.1	11.7	16.8	31%
1993	389	6	18.5	24.5	24%
1994	458	6.7	19.4	26.1	26%
1995	352	7.3	12.6	20	37%
1996	468	10.3	16	26.3	39%
1997	439	12	14.9	26.9	45%
1998	557	13.5	16.9	30.4	44%
1999	640	19	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	6.3	20.3	69%
2006	306	11	4.9	15.9	69%
2007	222	8.4	3.1	11.5	73%
2008	282	13	1.6	14.7	89%
2009	295	14	1.3	15.3	92%
2010	235	11.5	0.7	12.2	94%
2011*	-	-	-	-	-
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%

*No data due to State of Minnesota government shutdown.

Table 8. Catch summary, 2018 Lake Trout spawning assessment.

	MN-1	MN-2	MN-3
Total effort (feet)	2,000	1,500	1,500
Total catch (number)	202	92	148
Number/1,000 feet	101.0	61.3	98.7
Percent native	27.7	95.7	99.3
Number by Sex			
male	174	63	114
female	28	19	34
not examined	0	10	0

Table 9. Trout stocked in 2017 and proposed stocking for 2018, Minnesota waters of Lake Superior.

2017 Salmonid Stocking			
Species	**Number**	**Size**	**Fin Clip**
Rainbow Trout			
Kamloops	46,614	Yearling	Adipose Left Ventral (ALV)
Kamloops	54,239	Yearling	Adipose Right Ventral (ARV)
Total Kamloops	100,853		
Steelhead	474,372	Fry	None

Proposed 2018 Salmonid Stocking			
Species	**Number**	**Size**	**Fin Clip**
Rainbow Trout			
Steelhead	120,000	pre-smolts	Adipose (A)

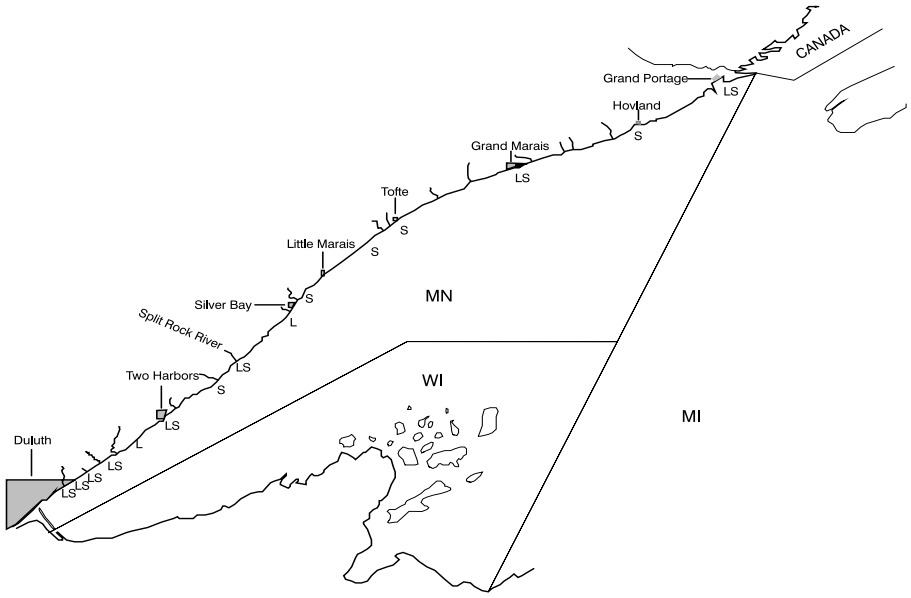

Figure 1. Sampling stations for adult (L) and juvenile (S) assessments, Minnesota waters of Lake Superior.

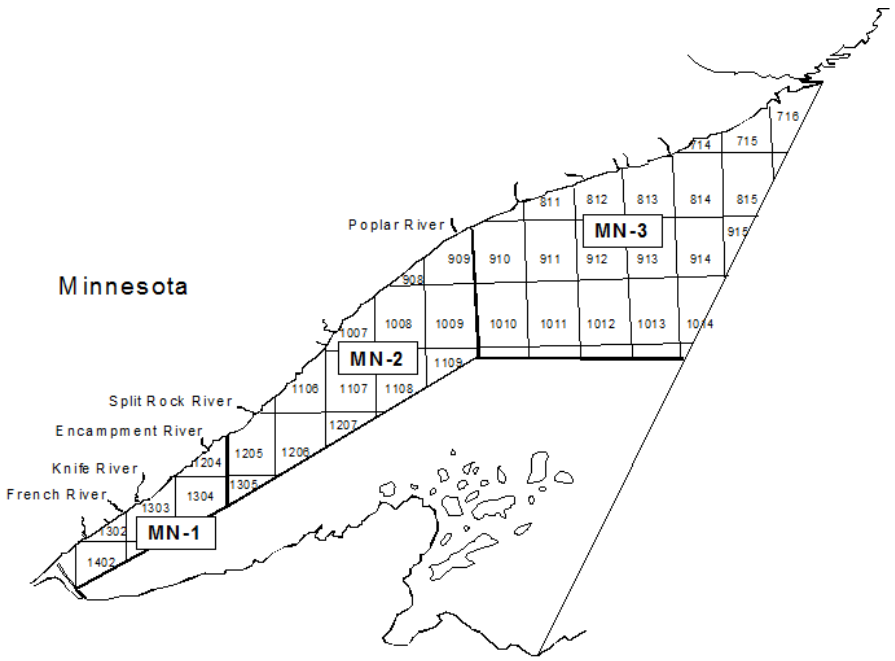

Figure 2. Statistical districts in Minnesota waters of Lake Superior.

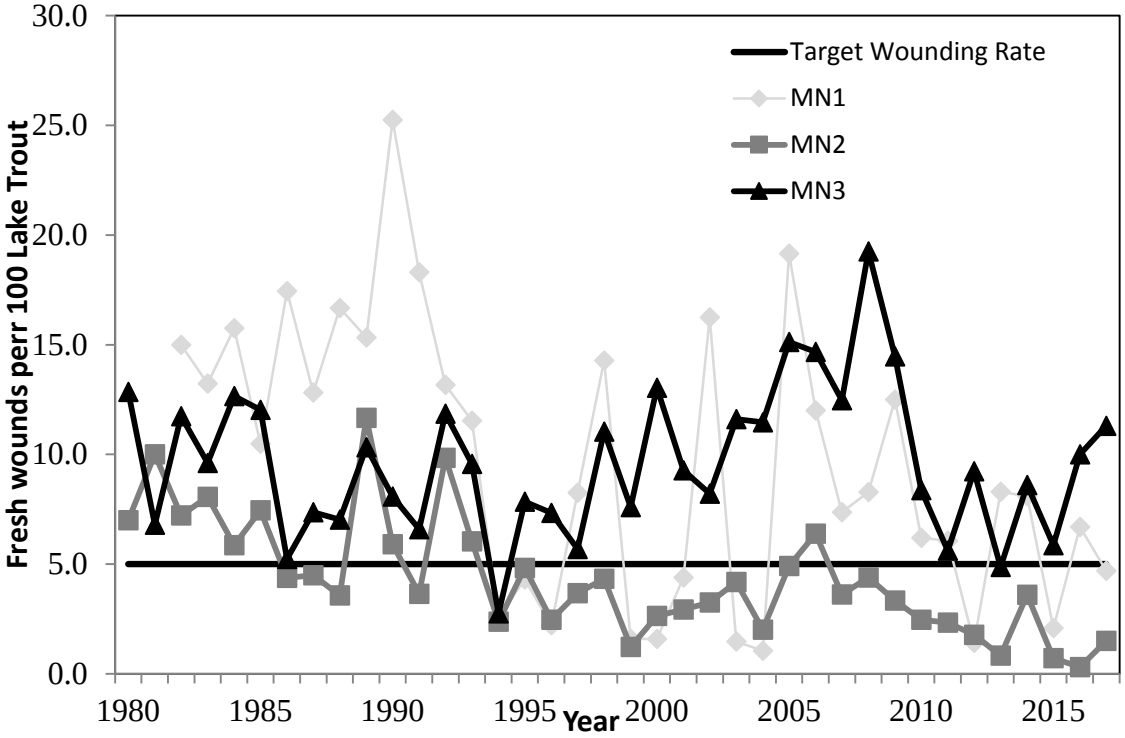

Figure 3. Number of fresh Sea Lamprey wounds per 100 Lake Trout in the May assessment, by statistical district, 1980-2017.

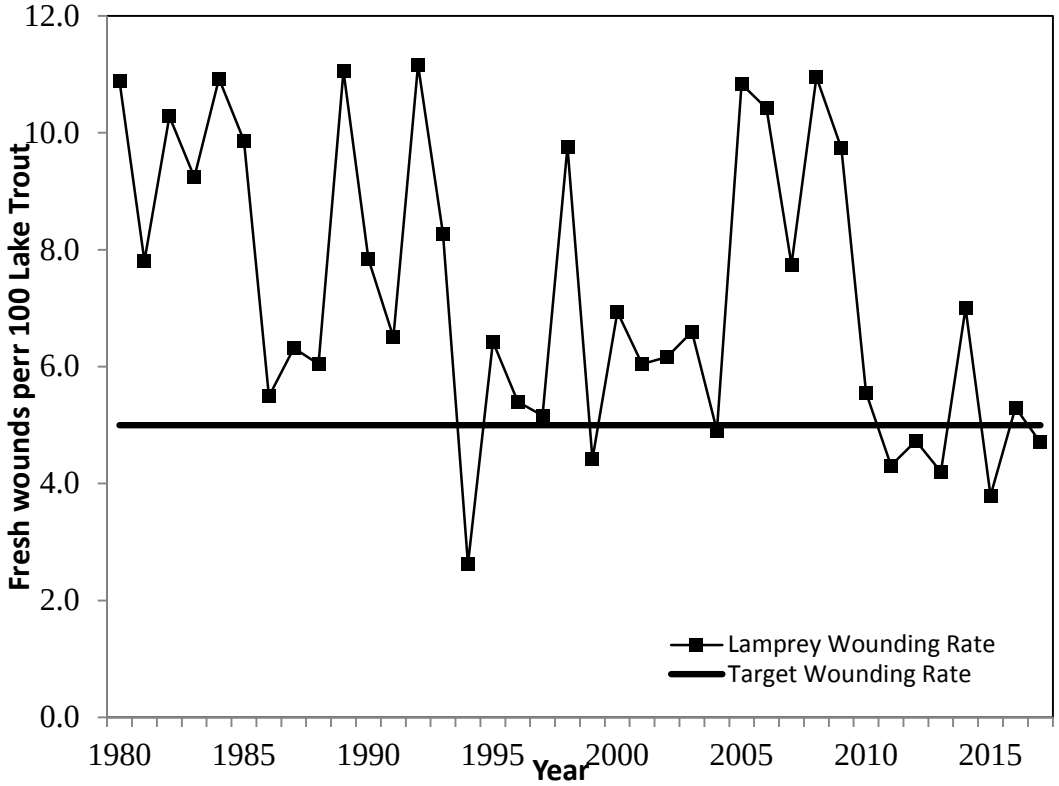

Figure 4. Shorewide number of fresh Sea Lamprey wounds per 100 Lake Trout in the May assessment, 1980-2017.

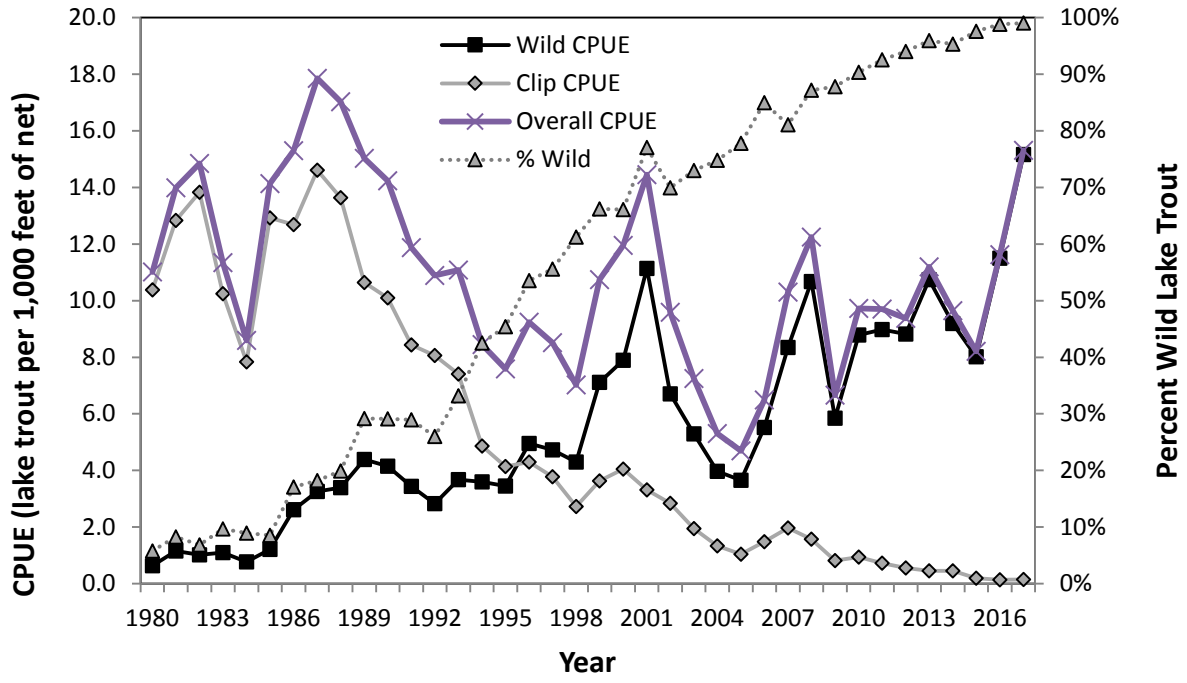

Figure 5. Catch rate (number of fish per 1,000 feet of net; CPUE) of wild, stocked, and overall Lake Trout, and percentage wild Lake Trout in the May assessment, 1980-2017.

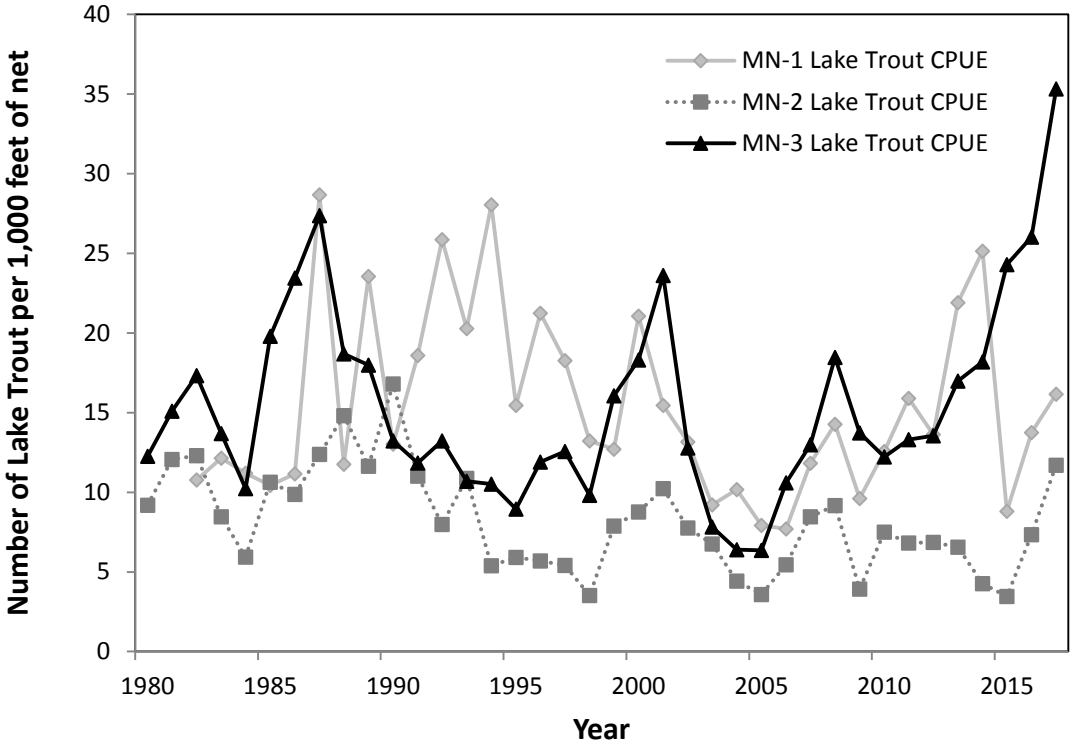

Figure 6. Lake Trout catch rate (number of fish per 1,000 feet of net; CPUE) by statistical district in the May assessment, 1980-2017.

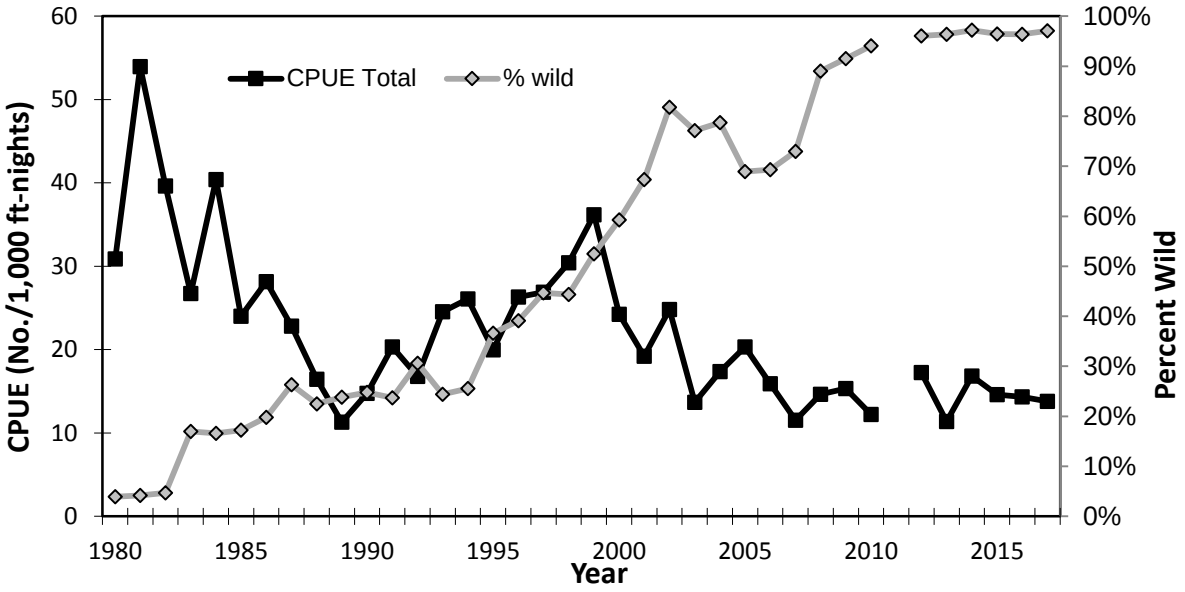

Figure 7. Catch rate (number of fish per 1,000 feet of net; CPUE) and percent wild Lake Trout in the juvenile (<17") Lake Trout assessment, 1980-2017.

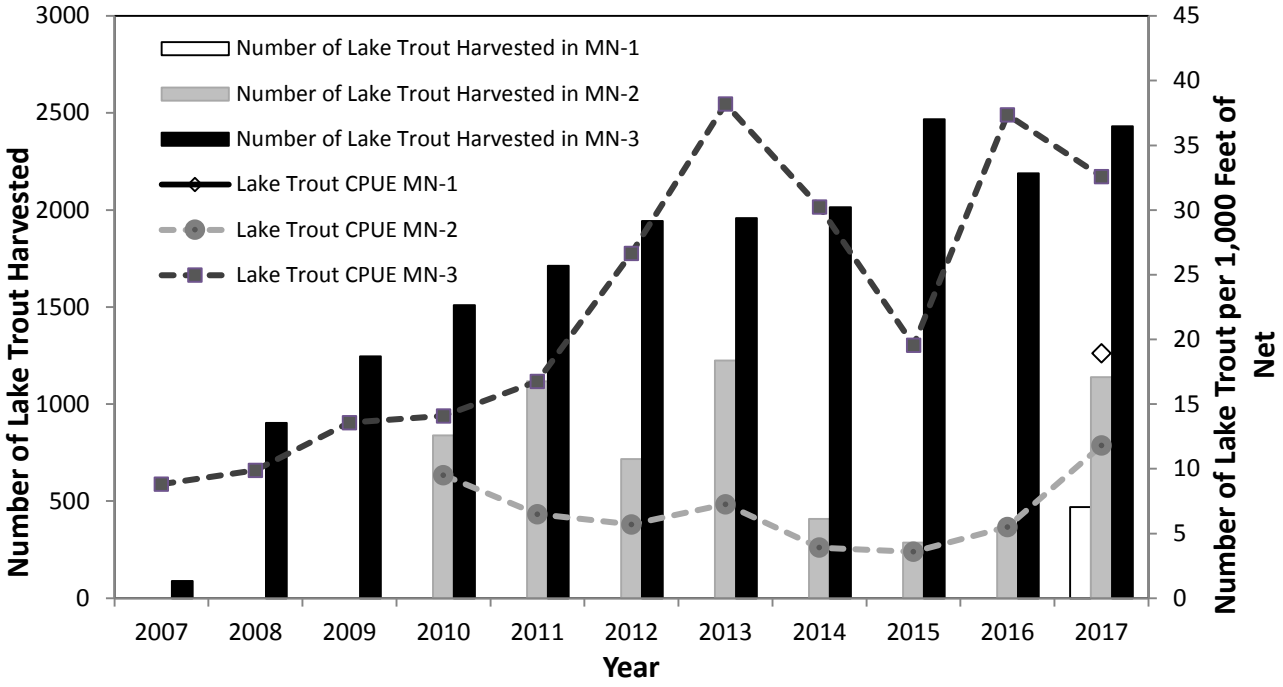

Figure 8. Lake Trout harvest and catch rate (number of fish per 1,000 feet of net; CPUE) in the summer commercial assessment, 2007-2017.

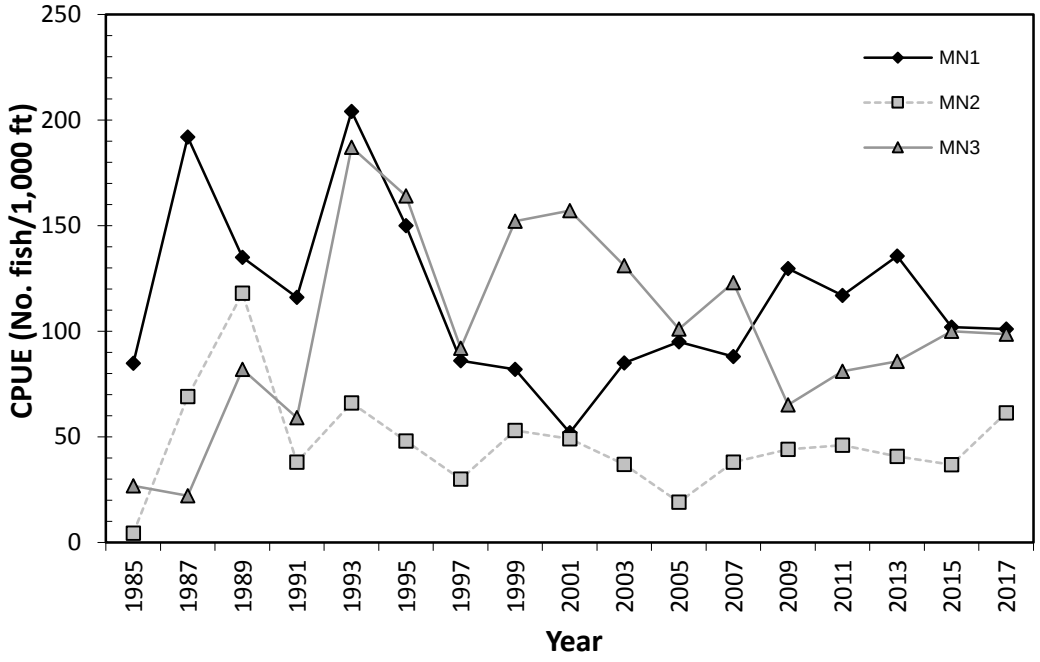

Figure 9. Catch per unit effort by management zone in the Lake Trout spawning assessment, 1985-2017. Spawning assessments are conducted every two years.

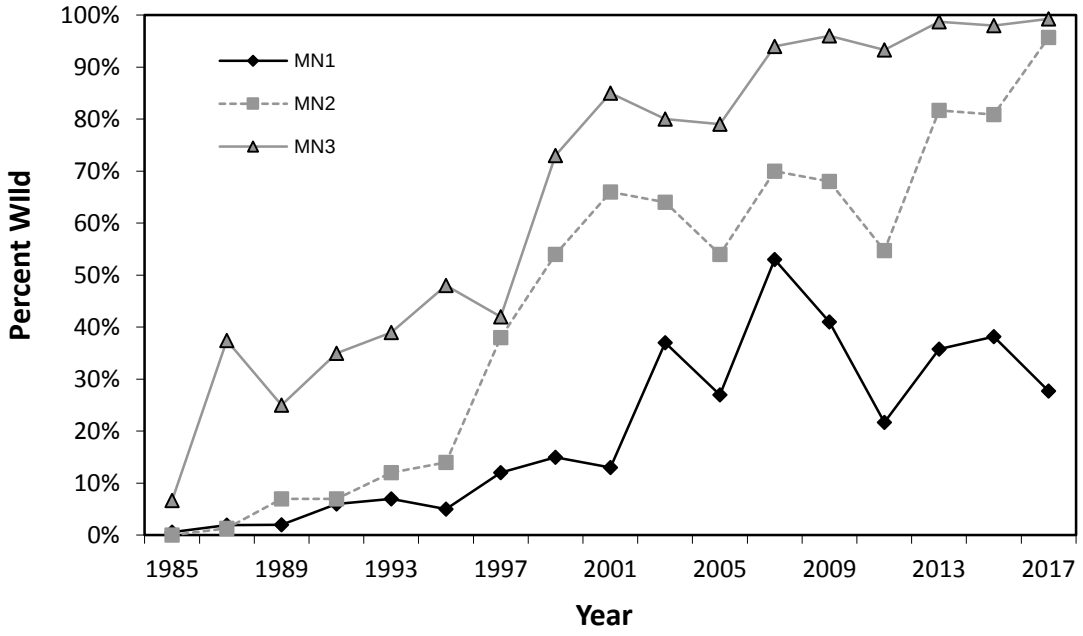

Figure 10. Percent wild Lake Trout in the Lake Trout spawning assessment, 1985-2017. Spawning assessments are conducted every two years.

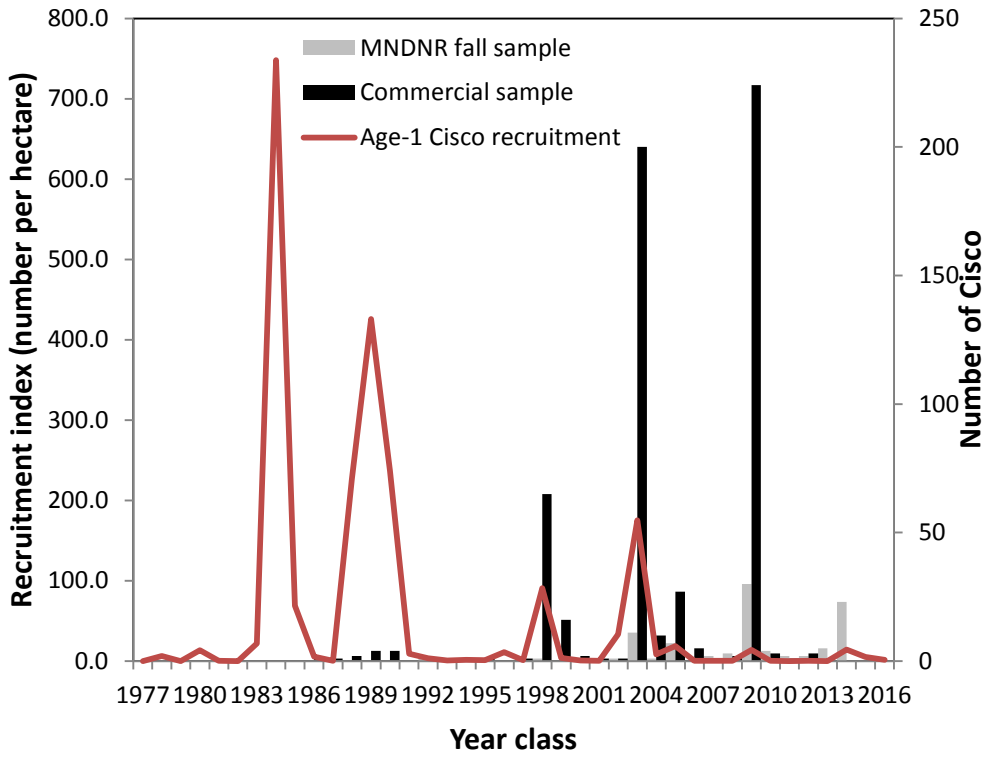

Figure 11. Cisco year-class strength, 1977-2016, as measured by the relative density of age-1 Cisco that were caught during USGS bottom trawl surveys, and the number of Cisco caught by age-class sampled in commercial and MNDNR surveys, 2016.

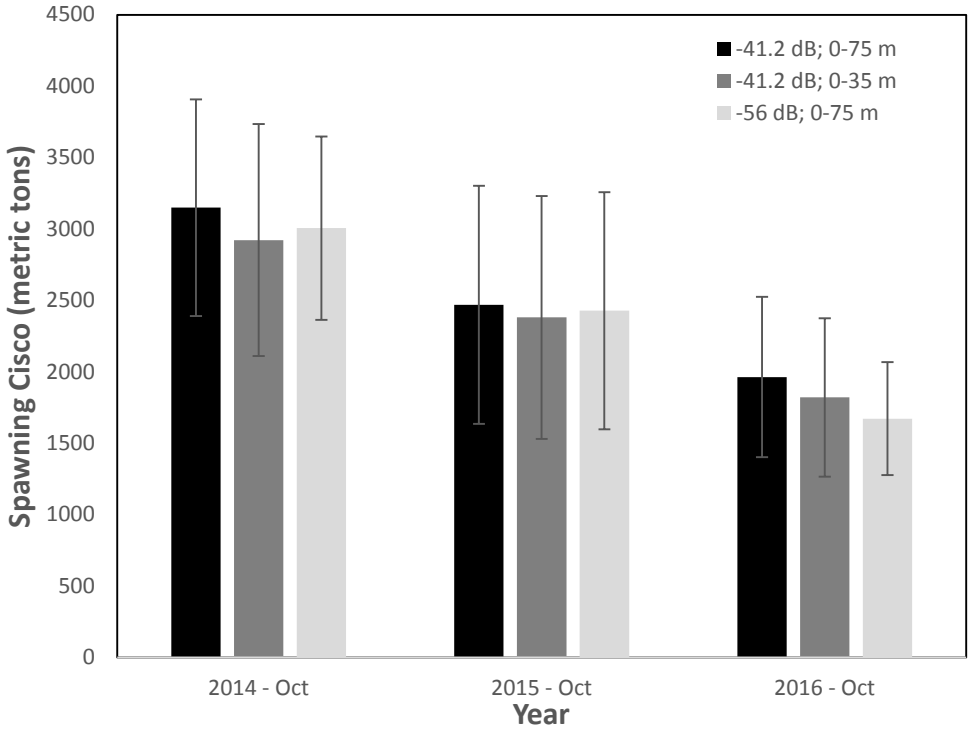

Figure 12. The estimated biomass of spawning size Cisco by analysis method from fall hydroacoustic surveys, 2014-2016.

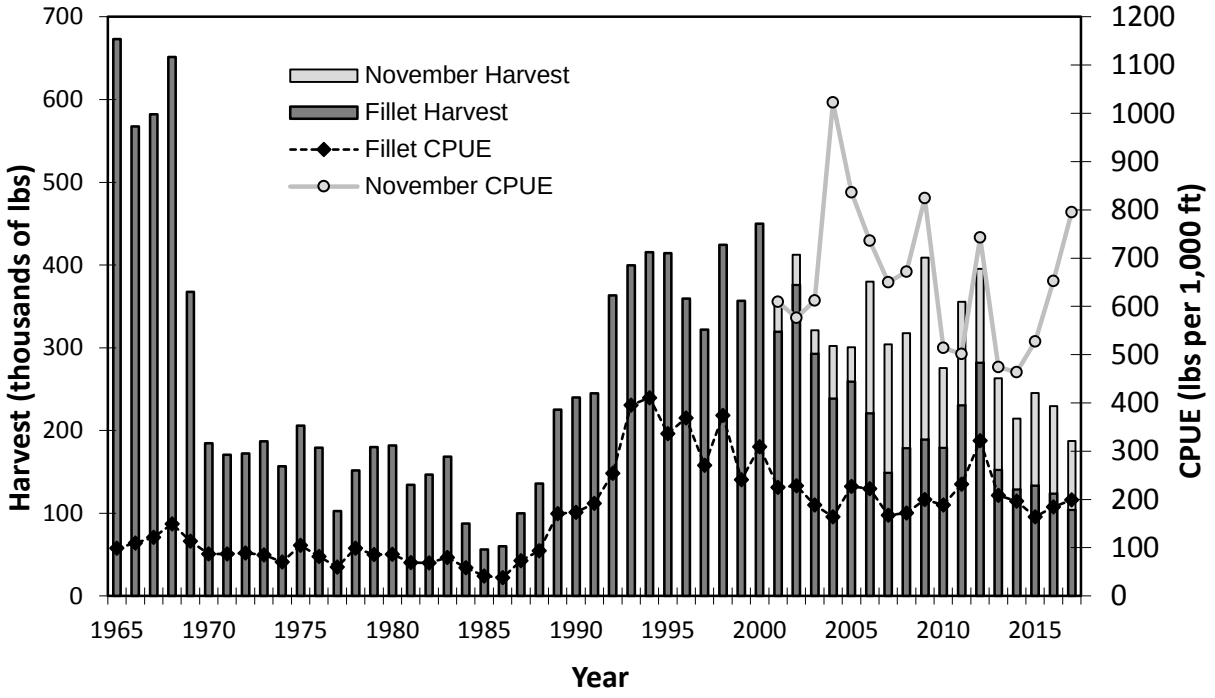

Figure 13. Cisco harvest (thousands of pounds) and catch rate (pounds per 1,000 feet of net; CPUE) in the commercial gill net fishery in Minnesota waters of Lake Superior, 1965-2017.