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## SECTION OF FISHERIES



COMPLETION REPORT:

## LAKE SUPERIOR SPRING CREEL SURVEY

**2019**

Report Completed by:  
Nick Peterson

Creel Clerks:  
Andrew Larson, Trevor Rodd, Phil Kunze

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## BACKGROUND

Minnesota Department of Natural Resources (MNDNR) fisheries assessments and creel surveys provide data needed to implement the MNDNR Fisheries Management Plan for the Minnesota Waters of Lake Superior (LSMP; Goldsworthy et al. 2017). The LSMP supplements joint strategic documents for lake-wide management formed by the Great Lakes Fisheries Commission and other agencies who manage the Lake Superior fishery (GLFC 1997; Horns et al. 2003). Angler creel surveys collect information to supplement data collected in fisheries assessments. Spring creel surveys are used to monitor fishing pressure, catch, catch rates, and harvest of fish species in Minnesota waters of Lake Superior, particularly Rainbow Trout.

The first spring creel survey was implemented in 1992 to monitor the rehabilitation of Rainbow Trout in Minnesota waters after the species declined in the 1960s. The survey was designed to target anglers who fished for Rainbow Trout as they migrated upstream in tributaries to spawn. The State of Minnesota currently manages two types of Rainbow Trout in Lake Superior that were introduced from the west coast of North America. This includes steelhead, a migratory life-history form, and Kamloops, a domesticated hatchery strain. Steelhead were first introduced to Lake Superior in the late 1800s (Krueger et al. 1994). Steelhead have naturalized to Lake Superior streams and now provide a sought-after sport fishery in Minnesota waters. Kamloops were originally introduced into Ontario waters of Lake Superior in 1946 (Krueger et al. 1994), and they were introduced in Minnesota waters in 1972 to provide harvest opportunities for Rainbow Trout while steelhead populations were rehabilitated (Close and Hassinger 1981).

The first creel surveys on the North Shore were conducted in 1961 through 1967 (Hassinger et al. 1974), and then in 1981 and 1982 (Close and Siesennop 1984). The MNDNR spring creel survey has been conducted annually since 1985, except in 1991. From 1985 to 1990, the spring creel surveys used a non-uniform probability design that provided good shorewide information but did not permit statistically valid estimates for individual tributaries. In 1992, the survey was changed to a stratified random design to also obtain information from specific tributaries (Ostazeski and Morse 2002). A modified bus-route format was implemented in 1995, 2002, and for part of 2003, to enable a survey with two clerks when three clerks were unavailable. Data in this report are summarized and compared from 1992 to 2016 based on the stratified random design used in the creel survey throughout this period.

The annual spring creel survey typically begins once tributaries thaw and are fishable. The spring creel survey has provided useful information for many other species in Lake Superior. Brook Trout (*Salvelinus fontinalis*), one of two native sport fish to Lake Superior, are typically the second most reported species in the spring creel survey. Public interest in Brook Trout has increased as agencies around Lake Superior examined protection and restoration strategies for the species (Newman et al. 2003; Schreiner et al. 2008). Many non-native sport fish in Lake Superior also provide angling opportunities in the spring and fall. Brown Trout (*Salmo trutta*), Atlantic Salmon (*Salmo salar*), Chinook

Salmon (*Oncorhynchus tshawytscha*), Coho Salmon (*Oncorhynchus kisutch*), and Pink Salmon (*Oncorhynchus gorbuscha*) are targeted by some anglers fishing in the spring, but the majority of these species are caught by anglers fishing in Lake Superior near rivers. Other than steelhead, very few non-native sport fish are caught in tributaries in the spring because they return to spawn in the fall. Lake Trout (*Salvelinus namaycush*), White Sucker (*Catostomus commersoni*), Longnose Sucker (*Catostomus catostomus*), and Round Whitefish (*Prosopium cylindraceum*) are also periodically caught in rivers and near river mouths in the spring.

The MNDNR recognized that fishing pressure was often high in winter and early spring before the start of the annual spring creel survey, particularly in years when sufficient ice formed in Lake Superior. An early-spring creel survey was initiated in 2013 to evaluate angling pressure and catch of some species, particularly adipose fin-clipped Rainbow Trout (hereafter referred to as Kamloops). The early-spring creel surveys are completed during the period before ice-out when shore anglers fish exclusively in Lake Superior. This survey includes five creel locations in the lower shore because most of the pressure for Kamloops occurs along the lower shore, near Duluth. The early-creel survey has also provided useful information for other species (e.g., Coho Salmon). The early-spring creel survey was completed in 2013, 2015, and 2016. A winter creel was completed on Lake Superior, from Duluth to Two Harbors, throughout winter 2018. The winter creel was used to estimate fishing pressure, catch and catch-rates for Lake Trout, Salmon (Coho and Chinook), and Lake Herring (also called Cisco), and did not specifically target anglers who were specifically targeting Rainbow Trout (i.e., anglers fishing near shore at French River and in McQuade Harbor).

The Minnesota shore of Lake Superior is divided into two geographic regions. The area from the Lester River to the Split Rock River is referred to as the “Lower Shore,” while the area from the Beaver River to the Brule River is referred to as the “Upper Shore.” The spring creel survey collects interviews from anglers at nine tributaries in the lower shore and nine tributaries in the upper shore (Figure 1). Estimates from the lower and upper shore are collectively referred to as “shorewide” estimates. Pressure, catch, and catch rates are determined for individual tributaries, and for the lower shore, upper shore, and shorewide. Anglers fishing in tributaries are considered “stream” anglers and anglers shore fishing in Lake Superior near the tributary mouths are considered “lake” anglers. The term “lake” refers to Lake Superior waters near tributary mouths and includes McQuade Harbor.

Separate estimates of catch and catch rate were made for Rainbow Trout 16 inches and greater and Rainbow Trout less than 16 inches to isolate the influence of juvenile steelhead from the analyses. Unless otherwise specified, estimates for Rainbow Trout are summarized and reported only for fish 16 inches or greater. References to a ‘long-term’ average in this report refer to the period from 1992 to 2018.

Kamloops possess an adipose fin clip making them legal for anglers to harvest. No adipose-clipped steelhead stocked in the early 2000s should still exist in Lake Superior. Adipose-clipped steelhead (plus one other fin-clipped) were stocked in the French and Lester rivers in 2018, and the first return of these

fish as adults should be in 2020 and 2021. The vast majority of unclipped steelhead caught before 2020 were produced in the wild, and some were products of the MNDNR steelhead fry stocking program. Some stocked steelhead, including captive broodstock from French River Coldwater Hatchery, released back into Lake Superior, possess a maxillary clip that is often difficult for anglers to identify. These fish were reported by anglers as simply 'steelhead'. Maxillary clipped steelhead could influence the catch and catch rate in the spring creel at the Knife River, which received all of the (maxillary clipped) steelhead stocked from 2003 to 2007. However, these fish are only rarely caught in the spring at the Knife River fish trap (Peterson 2018), and very few (if any) likely still exist in Lake Superior.

Unclipped Rainbow Trout (steelhead) are currently maintained as a catch-and-release-only fishery. Clipped Rainbow Trout (Kamloops or clipped steelhead)  $\geq 16$  inches are allowed to be harvested, however, 25-40% of Kamloops caught each spring are voluntarily released. Most fish lengths reported in the creel surveys were estimated by anglers or measured by creel clerks before release. Individual fish weights were obtained using regression relationships derived from Knife River adult trap data. All other methods are summarized in Ostazeski (2004).

Angler population estimates were determined using a cumulative total of the number of 'new' anglers (not previously interviewed this spring) and 'recap' anglers (previously interviewed this spring) that were interviewed each day. 'New' or 'Recap' anglers were determined by asking the question "Have you previously been interviewed by a creel clerk this spring?" This question was not asked in 1992 to 1995 creel surveys, so estimates could not be determined before 1996. The Schnabel modification of the Lincoln-Petersen estimator was used to calculate daily estimates of angler abundance and its variance. Angler population estimates generally increase throughout the first half of the survey period and then stabilize. Therefore, the average of the last nine estimates was used to calculate final angler population estimates and confidence intervals.

## RESULTS

### Fishing Pressure

The annual spring creel survey went from April 6 through May 19, 2019. A total of 1,380 interviews were collected shorewide. The majority (76%) of anglers interviewed in the annual spring creel were fishing in the lower shore, and most (77%) were fishing streams. Most interviews in the lower and upper shore were collected at the Sucker (180) and the Baptism (99) rivers, respectively. A total of 905 'new' (first time interviewed this year) anglers were interviewed in 2019.

Total angling pressure in 2019 was 33,003 angler-hours, which was slightly higher than the historic average of 31,549 angler-hours (Table 1, Figure 2). Most (70%) angling pressure was at lower shore rivers. Angling pressure in the lower shore (23,191 angler-hours) was slightly lower than the historic average (25,562 angler-hours) and ranged from 3,830 angler-hours at the Stewart River to 759 angler-hours at Silver Creek. Angling pressure in the upper shore (9,812 angler-hours) was higher than the

historic average (5,974 angler-hours) and ranged from 2,918 angler-hours at the Baptism River to 301 angler-hours at the Cascade River. The Stewart River experienced the highest angling pressure since 2010. Kadunce Creek experienced the highest angling pressure on record, and the Devil Track River experienced the third-highest angling pressure on record (Table 2, Figure 3).

Rainbow Trout were by far the most sought-after species in spring 2019, and steelhead or Kamloops was the primary target species in 95% of all interviews (72% targeted steelhead, 23% targeted Kamloops). Other primary species targeted were Coho Salmon at 3%, Brook Trout at 2%, and six other species at less than 1.0%. Twenty-one percent of anglers listed steelhead as their secondary target species and 48% listed Kamloops as their secondary species. Other secondary species included Brook Trout and Coho Salmon at 13%, Brown Trout at 2%, and seven other species at 1% or less.

## **Catch, Catch-Rates and Harvest**

### *Steelhead*

An estimated 3,619 steelhead were caught in 2019, which was higher than the historic average (2,904). Catch in the lower shore (2,533) was higher than the historic average (2,025), and catch in the upper shore (1,086) was higher than the historic average (879) (Figure 4). The highest catch in the lower shore was at the Stewart River (818), followed by the Lester and Knife rivers (409). The highest catch in the upper shore was at the Baptism River (428), followed by the Devil Track River (357) and Kadunce Creek (102). Small steelhead (<16 inches) were reported at 10 creel stations; the estimated shorewide catch was 246, which was lower than the historic average (593) (Table 3). No steelhead was illegally harvested in 2019. The average length of an adult steelhead was 23.2 inches and the average weight was 4.0 pounds (Table 4).

The shorewide catch-rate for steelhead was 0.110 fish per angler-hour (9.1 angler-hours per fish) which was better than the historic average (17.2 angler-hours per fish) (Figure 5). Catch rates in the lower shore were 0.109 fish per angler hour (9.1 angler-hours per fish) and the upper shore was 0.111 fish per angler hour (9.0 angler-hours per fish), both were better than historic averages (Figure 6). The best catch-rates in the lower shore were at Stewart River (0.213; 4.7 angler-hours per fish), the Split Rock River (0.151; 6.6 angler-hours per fish), and the Lester River (0.131; 7.6 angler-hours per fish). The best catch-rates in the upper shore were at the Devil Track River (0.295; 3.4 angler-hours per fish), the Temperance River (0.178; 5.6 angler-hours per fish), and the Cross River (0.168; 5.9 angler-hours per fish) (Table 3). Approximately 96% (3,476) of all steelhead were caught fishing in streams versus shore fishing Lake Superior. The shorewide catch-rate for steelhead in tributaries was 0.132 fish per angler-hour (7.6 angler-hours per fish) and in the lake was 0.022 fish per angler-hour (46.5 angler-hours per fish).



### *Kamloops*

The estimated shorewide catch of Kamloops was 921, which was significantly lower than the historic average (2,368). More Kamloops were caught in streams (643) than in the lake (278) (Figure 7). Catch in both the lower shore (862) and the upper shore (59) were lower than the historic averages (Figure 8). In the lower shore, most Kamloops were caught at McQuade/Talmadge River (216), the Lester River (176), and the Sucker River (143). In the upper shore, Kamloops were only caught at the Brule River (25), Kadunce Creek (23), and the Baptism River (11). Eleven sub-legal-sized Kamloops (<16 inches) were caught at the Lester River. Approximately 70% (649) of all legal-sized Kamloops caught were harvested (Table 3). The average length was 24.0 inches and the average weight was 4.9 pounds (Table 4).

The shorewide catch rate for Kamloops was 0.028 fish per angler-hour (35.7 angler-hours per fish) (Figure 5). The catch rate in the lower shore was 0.037 fish per angler-hour (27.0 angling-hours per fish), which was lower than the historic average (0.086; 15.6 angler-hours per fish). Catch rates were best at McQuade Harbor/Talmadge River (0.068; 14.7 angler-hours per fish), the Lester River (0.056; 17.9 angler-hours per fish), and the Sucker River (0.040; 25.0 angler-hours per fish).

The catch of Kamloops at the Lester River (176) and French River (64) were lower than their historic averages (Lester, 465; French, 417). Catch rates at the Lester River improved from 2015 (35.8 angler-hours per fish) through 2017 (8.6 angler-hours per fish) but declined in 2018 (23.8 angler-hours per fish) and 2019 (17.9 angler-hours per fish). Catch rates at the French River improved slightly from 10.4 angler-hours per fish in 2015 to 7.4 angler-hours per fish in 2018 but declined significantly to 31.3 angler-hours per fish in 2019 (Table 3).

### *Brook Trout*

An estimated 685 Brook Trout were caught in spring 2019, which was higher than the historic average but lower than was caught in the three previous years (Figure 9). The shorewide catch-rate was 0.021 fish per angler-hour (48.2 angler-hours per fish), 0.012 (80.9 angler-hours per fish) in the lower shore, and 0.041 (24.7 angler-hours per fish) in the upper shore. No Brook Trout were illegally harvested in the spring creel. The average length was 11.3 inches and the average weight was 1.1 pounds (Table 4).

### *Other Species*

An estimated 126 Coho Salmon were caught during the annual spring creel survey with a shorewide catch-rate of 0.004 fish per angler-hour (261.1 angler-hours per fish); no salmon were reported in the upper shore. The average length was 15.9 inches and the average weight was 1.3 pounds. All Coho salmon were harvested. Estimated catch of other species included Suckers (136; White and Longnose suckers), Round Whitefish (25), Lake Whitefish (17), Lake Trout (11), and Walleye (11) (Table 4).

## Angler Population Estimates and Demographics

An estimated 1,561 anglers participated in the Lake Superior spring fishery in 2019, which was slightly lower than the historic average (1,640) (Figure 10). A total of 905 were 'new' (first time interviewed this spring) anglers that were residents of 13 U.S. states and Canada. The majority (93.3%; 839) of all anglers interviewed were residents of Minnesota, 3.4% (31) were from Wisconsin, and less than 1% were from other states. Approximately 1.2% (11) were residents of Canada. Only 3.4% (31) of anglers interviewed in 2019 were female, of which 25 were from Minnesota, 2 were from Wisconsin, 1 was from Illinois, and 3 were from Canada (Table 5).

## DISCUSSION

Most North Shore streams experienced average or above-average fishing pressure in 2019. The number of anglers that fish North Shore streams in the spring has gradually increased since 1992, but has remained relatively stable over the last decade. Both the number of anglers that fish the North Shore and angling pressure each year are influenced by sporadic changes in fishing conditions throughout the spring. Anglers and angling pressure are often highest in years that provide adequate fishing conditions with stable and consistent stream discharge and moderate to low turbidity throughout the spring creel season (e.g., 2016). Streams in the lower shore always experience more anglers and higher angling pressure than streams in the upper shore, likely due to the proximity to Duluth metropolitan area. Angling pressure was slightly lower than average in 2019 in lower shore, but still within the range observed over the last two decades. Angling pressure was well above average in the upper shore, and six of nine rivers experienced above-average angling pressure.

Angling pressure at the French River was the second-lowest on record since 1992. The catch and catch rates of Kamloops at French River were the lowest ever on record in 2019. This was expected given the relatively low angling pressure and low overall return of Kamloops at French River this spring. Compared to previous years, fewer Kamloops were captured during the French River trap and seining operations in 2019 (Peterson 2019). Angling pressure, catch, and catch rates of Kamloops are expected to decline over time because Kamloops is no longer stocked in Minnesota waters of Lake Superior. The clipped steelhead stocking program will provide catch and harvest opportunities for clipped Rainbow Trout in the coming years.

Shorewide catch and catch-rates for steelhead have continued to improve over the last decade. Catch rates for steelhead are typically higher in the upper shore versus the lower shore. However, catch rates were very similar in 2019; catch rates in the lower shore were similar or above the historic average, and catch rates in the upper shore were slightly lower than the historic average. However, catch rates in the upper shore have remained above 0.15 fish per angler-hour (6.6 hours per fish caught) in 16 of the last 22 years. Shorewide, the catch-rate of steelhead increased from the late 1990s until 2006. Since 2006, the shorewide catch-rate has remained consistently high but variable over years, which could be an indication that steelhead abundances have reached (or are close to reaching) equilibrium with the



available forage base and other predators in Lake Superior. The reduced catch rate in the upper shore could be influenced by the suspension of steelhead fry stocking in some upper shore rivers over the last decade (see Goldsworthy et al. 2017). Steelhead fry stocking was suspended after 2016 to allow all gametes to be utilized for the clipped steelhead stocking program. Catch rates for steelhead declined significantly in 2019 at some rivers that were the previous fry stocked (e.g., Cascade River). More years of creel data are needed to account for potential influences of natural produced year-class abundances and environmental conditions that could influence angling success at stocked rivers.

The catch-and-release regulation for steelhead has been in effect since August 1997. Regulation compliance has been decent in recent years; no steelhead was illegally harvested in 2019. The catch-and-release regulation was discussed with the Lake Superior Advisory Group (LSAG) on February 15, 2015, during meetings to revise the 2006 Fisheries Management Plan for the Minnesota Waters of Lake Superior (Schreiner et al. 2006), and again on October 23, 2017, during a meeting to discuss results from the Steelhead Genetics Project. The vast majority of the LSAG supported a continuation of the catch-and-release regulation. Compliance with the catch-and-release regulation will continue to be monitored in the spring creel survey, and increased enforcement action will be called for if compliance standards are not met.

Poor spawning and rearing habitat in North Shore streams have long been a limitation to steelhead production (Smith and Moyle 1944). Unlike many other limiting factors, such as prey availability or environmental conditions, stream habitat is something that can be addressed to sustain abundant steelhead populations. The MNDNRs have prioritized fish habitat protection and restoration, particularly for fish spawning and nursery habitat in streams, as a primary management strategy for steelhead (Goldsworthy et al. 2017). The MNDNR, Minnesota Trout Unlimited, the Lake Superior Steelhead Association, and other stakeholders are currently implementing habitat restoration and protection projects in North Shore streams.

Kamloops catch in 2019 was the third lowest on record, well below the historic average, and catch rates were the lowest on record since 1992. The low catch and catch rates in 2019 marks the first significant decrease since 1992. Similar to previous years, the majority of Kamloops were caught in the lower shore, with few reported in the upper shore. Stocking locations explain most of the catch distribution of Kamloops in the spring creel survey. Spring creel survey data shows that the angling pressure for Kamloops in the lake is very dependent on the daily lake conditions, whereas fishing is often not effective or limited with strong northeast winds and/or floating ice. The catch could be a function of competition for resources (prey) with steelhead or other predators in Lake Superior. Recent diet analyses found that Kamloops had a higher percentage of fish in their diet than previously estimated by Negus et al. (2008), which indicated that competition for prey with other predators in Lake Superior might be more than previously assumed (Negus and Hoffman 2013). However, this assumes that prey is limited (to some point) in Lake Superior. The survival of all fish species in Lake Superior, including Kamloops, is

largely dictated by stream and lake conditions (e.g., water temperature) that fluctuate from year-to-year and are impossible to control.

The low catch of Kamloops in recent years is a function of environmental and lake conditions, intra- or interspecific competition for resources (prey), and changes to the hatchery production and stocking protocols. It is also likely influenced by recent changes to the hatchery production and stocking protocols that potentially increased straying and/or decreased survival in Lake Superior, and the suspension of Kamloops stocking in 2017. Although some straying of stocked Kamloops has occurred, increased reports of straying and decreased catch and catch rates have become more apparent in recent years. The MNDNR has had reports of adipose-clipped Rainbow Trout caught in the St. Mary's River in Michigan, the Brule River in Wisconsin, and rivers both on the upper North Shore of Minnesota and into Canada. Recent genetic analyses found that Kamloops are successfully spawning with steelhead in the wild, both in Minnesota waters and other jurisdictions (Miller et al. *in review*). Straying of Kamloops beyond the Lester and French rivers is a concern shared by MNDNR, agencies in other jurisdictions, and anglers. Particularly concerning is the impact of introgression of Kamloops genes into naturalized steelhead populations. Negus (1999) found poorer survival of eggs from Kamloops x steelhead crosses compared to steelhead x steelhead crosses in the hatchery and concluded that when Kamloops spawn with steelhead, steelhead gametes are essentially wasted. In the stream environment, Kamloops can successfully spawn with steelhead in the wild and produce juvenile hybrids (Close 1999; Miller et al. *in review*). However, Miller et al. (2004) found that juvenile hybrids survive significantly less well compared to juvenile steelhead in the stream environment. Cumulative relative survival of cross types combining hatch rates from Negus (1999) and juvenile survival from Miller et al (2004) indicates a 42-70% reduction in survival to age-1 of a hybrid compared to a STT x STT cross (Miller et al. 2004). If hybrids survived to reproduce, genetic introgression could occur which would further increase the chance for introgression and decrease the fitness of wild steelhead populations. Continued stocking of Kamloops will negatively influence the fitness and increase the risk of extinction of wild steelhead through non-introgressive hybridization (Page et al. 2011). Kamloops are no longer stocked in Minnesota waters of Lake Superior, therefore the catch of Kamloops will continue to decline in coming years.

Brook Trout remains the second most commonly caught species after Rainbow Trout and has been reported in the spring creel survey every year since 1992. Many Brook Trout are caught each year despite the lack of anglers that actively target them below barriers in the spring. Catch and catch rates for Brook Trout are much lower in the spring versus during their spawning season in the fall. Coaster Brook Trout rehabilitation is a management priority for the MNDNR, and regulatory compliance is essential for this to occur. Compliance with the restrictive harvest regulation for Brook Trout (bag limit of 1, minimum size 20 inches) was good in spring 2019. However, MNDNR has received anecdotal reports of Brook Trout illegally harvested in the summer months after the spring creel has ended. More public outreach via social media and signposting should be considered in future years.

Catch and fishing pressure for Coho Salmon remains sporadic and is largely dependent on the conditions of Lake Superior and year-class abundances. Coho Salmon caught in Minnesota waters are naturally produced because the last Coho Salmon stockings in Lake Superior occurred in Michigan in 2006. The production of salmon in Minnesota's tributaries to Lake Superior, and whether or not fish captured in Minnesota waters were produced here, remains unknown. Unlike streams in many other jurisdictions, streams on Minnesota's North Shore provide limited spawning and rearing habitat for migratory fish. Furthermore, Minnesota's streams provide less than ideal spawning conditions for fall spawning fish. Stream conditions on the North Shore in the fall are often characterized by low water levels, excessive ice formation, and lack of stream access due to gravel bars that block off access for fish from Lake Superior. Therefore, it's likely that the vast majority of Coho Salmon caught in Minnesota waters migrated from other jurisdictions where stream habitat is more conducive for reproduction and survival of fall-run fish (e.g., Wisconsin, Michigan, and Ontario, Canada).

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MINNESOTA DEPARTMENT OF NATURAL RESOURCES  
DIVISION OF FISHERIES

COMPLETION REPORT:

**LAKE SUPERIOR SPRING CREEL SURVEY**

**2019**

Completed by:  
Nick Peterson

Cory  
Goldsworthy

 Digitally signed by Cory  
Goldsworthy  
Date: 2020.08.27 12:31:24 -05'00'

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Area Supervisor \ Date

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Regional Fisheries Approval \ Date

Table 1. Fishing pressure estimates (angler-hours) from the Lake Superior spring creel survey by shore zone, station, and year.

Shore Zone	Station	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean 1992-2019	Range 1992-2019
Lower Shore	Lester River	10,476	9,892	6,644	4,928	3,588	2,580	3,699	7,293	4,955	3,051	3,115	5,797	2,580 - 10,476
	McQuade/Talmadge	--	1,399	2,996	3,938	2,407	1,340	1,659	5,453	3,612	2,657	3,158	2,862	1,340 - 5,453
	French River	6,068	6,505	3,206	3,015	3,544	3,080	2,409	6,014	3,678	1,868	2,033	3,997	1,868 - 8,544
	Sucker River	6,376	6,824	4,620	6,008	3,566	2,880	2,265	4,914	4,713	4,131	3,613	5,346	2,265 - 12,990
	Knife River	6,253	4,885	3,565	3,308	1,903	1,540	1,629	6,597	3,215	3,363	3,461	3,137	1,225 - 6,597
	Stewart River	3,957	4,079	5,782	1,557	1,885	1,280	1,653	3,385	3,658	2,620	3,830	2,498	720 - 5,782
	Silver Creek	1,230	930	1,996	818	131	312	577	582	529	522	759	811	131 - 1,996
	Gooseberry River	1,728	1,418	1,994	1,076	325	257	532	1,105	1,330	612	778	990	257 - 2,475
	Split Rock River	2,050	3,212	5,400	2,087	1,940	1,200	1,217	1,993	2,402	1,756	2,444	2,167	1,145 - 5,400
Upper Shore	Beaver River	481	776	824	820	304	233	473	436	685	346	572	615	233 - 1,159
	Baptism River	1,198	3,570	2,771	2,662	866	630	1,173	2,285	3,303	2,370	2,918	1,567	448 - 3,570
	Cross River	444	559	900	383	525	339	338	700	1,004	549	381	338	53 - 1,004
	Temperance River	651	434	488	170	630	83	359	370	494	319	306	352	77 - 788
	Poplar River	291	439	888	383	420	330	357	645	508	299	803	508	168 - 1,347
	Cascade River	346	675	488	905	296	309	438	846	601	307	301	511	194 - 939
	Devil Track River	447	1,264	1,050	1,163	857	677	1,355	1,421	1,841	2,066	1,833	765	75 - 2,066
	Kadunce Creek	581	259	746	500	642	770	448	1,420	1,030	570	1,630	529	79 - 1,630
	Brule River	800	1,059	1,283	1,206	963	767	539	1,410	1,015	829	1,069	801	207 - 1,505
Lower Shore		38,137	39,142	36,203	26,735	19,289	14,469	15,641	37,336	28,093	20,579	23,191	25,562	14,469 - 39,994
Upper Shore		5,238	9,035	9,438	8,192	5,503	4,138	5,479	9,533	10,480	7,656	9,812	5,974	3,046 - 10,480
Shorewide		43,375	48,177	45,641	34,927	24,792	18,607	21,120	46,868	38,573	28,235	33,003	31,549	18,607 - 48,177



Table 2. Fishing pressure estimates (angler-hours  $\pm$  standard error [SE]) from the 2019 Lake Superior spring creel survey by shore zone and station.

Shore Zone	Station	Stream Pressure	(SE)	Lake Pressure	(SE)	Total Pressure	(SE)
Lower Shore	Lester River	2,661	336	454	163	3,115	354
	McQuade/Talmadge	173	54	2,985	451	3,158	442
	French River	0	0	2,033	498	2,033	498
	Sucker River	3,548	569	65	48	3,613	590
	Knife River	3,461	713	0	0	3,461	713
	Stewart River	3,377	937	453	151	3,830	932
	Silver Creek	759	236	0	0	759	236
	Gooseberry River	778	189	0	0	778	189
	Split Rock River	1,955	467	489	223	2,444	450
Upper Shore	Beaver River	572	246	0	0	572	246
	Baptism River	2,918	397	0	0	2,918	397
	Cross River	293	140	88	48	381	140
	Temperance River	306	145	0	0	306	145
	Poplar River	736	338	67	46	803	367
	Cascade River	301	114	0	0	301	114
	Devil Track River	1,833	541	0	0	1,833	541
	Kadunce Creek	1,602	366	28	28	1,630	364
	Brule River	1,069	369	0	0	1,069	369
Lower Shore		16,711	1,462	6,480	743	23,191	1,609
Upper Shore		9,630	974	183	73	9,812	984
Shorewide		26,340	1,756	6,663	747	33,003	1,886

Table 3. Rainbow Trout catch and catch rate (fish per angler-hour) estimates in the 2019 Lake Superior spring creel survey by station.

Station		Unclipped Steelhead						Clipped Rainbow Trout (Kamloops)					
		Catch ≥16			Catch-rate ≥16			Catch ≥16			Catch-rate ≥16		
		All	inches	(SE)	All	inches	(SE)	All	inches	(SE)	All	inches	(SE)
Lester River	Harvested	0	0	0	0.000	0.000	0.000	129	129	47	0.041	0.041	0.021
	Released	488	409	106	0.157	0.131	0.034	59	47	24	0.019	0.015	0.013
	Total	488	409	106	0.157	0.131	0.034	187	176	64	0.060	0.056	0.031
McQuade Harbor	Harvested	0	0	0	0.000	0.000	0.000	185	185	80	0.059	0.059	0.046
	Released	69	69	39	0.022	0.022	0.043	31	31	18	0.010	0.010	0.006
	Total	69	69	39	0.022	0.022	0.043	216	216	85	0.068	0.068	0.047
French River	Harvested	0	0	0	0.000	0.000	0.000	64	64	29	0.032	0.032	0.012
	Released	19	19	10	0.009	0.009	0.004	0	0	0	0.000	0.000	0.000
	Total	19	19	10	0.009	0.009	0.004	64	64	29	0.032	0.032	0.012
Sucker River	Harvested	0	0	0	0.000	0.000	0.000	86	86	45	0.024	0.024	0.012
	Released	352	333	90	0.097	0.092	0.020	57	57	22	0.016	0.016	0.006
	Total	352	333	90	0.097	0.092	0.020	143	143	57	0.040	0.040	0.014
Knife River	Harvested	0	0	0	0.000	0.000	0.000	67	67	32	0.019	0.019	0.008
	Released	434	409	110	0.125	0.118	0.020	25	25	18	0.007	0.007	0.005
	Total	434	409	110	0.125	0.118	0.020	92	92	36	0.026	0.026	0.009
Stewart River	Harvested	0	0	0	0.000	0.000	0.000	69	69	43	0.018	0.018	0.011
	Released	851	818	315	0.222	0.213	0.062	54	54	28	0.014	0.014	0.006
	Total	851	818	315	0.222	0.213	0.062	123	123	68	0.032	0.032	0.016
Silver Creek	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
	Released	77	66	60	0.101	0.087	0.075	0	0	0	0.000	0.000	0.000
	Total	77	66	60	0.101	0.087	0.075	0	0	0	0.000	0.000	0.000
Gooseberry River	Harvested	0	0	0	0.000	0.000	0.000	11	11	10	0.014	0.014	0.012
	Released	42	42	37	0.054	0.054	0.045	11	11	11	0.014	0.014	0.014
	Total	42	42	37	0.054	0.054	0.045	21	21	14	0.027	0.027	0.016
Split Rock River	Harvested	0	0	0	0.000	0.000	0.000	28	28	13	0.011	0.011	0.005
	Released	369	369	160	0.151	0.151	0.074	0	0	0	0.000	0.000	0.000
	Total	369	369	160	0.151	0.151	0.074	28	28	13	0.011	0.011	0.005
Lower Shore Total	Harvested	0	0	0	0.000	0.000	0.000	638	638	121	0.028	0.028	0.006
	Released	2,701	2,533	403	0.116	0.109	0.019	236	225	51	0.010	0.010	0.002
	Total	2,701	2,533	403	0.116	0.109	0.019	874	862	147	0.038	0.037	0.007

Table 3 continued. Rainbow Trout catch and catch rate (fish per angler-hour) estimates in the 2019 Lake Superior spring creel survey by station.

Station		Unclipped Steelhead						Clipped Rainbow Trout (Kamloops)					
		Catch ≥16			Catch-rate ≥16			Catch ≥16			Catch-rate ≥16		
		All	inches	(SE)	All	inches	(SE)	All	inches	(SE)	All	inches	(SE)
Beaver River	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
	Released	10	0	0	0.018	0.000	0.000	0	0	0	0.000	0.000	0.000
	Total	10	0	0	0.018	0.000	0.000	0	0	0	0.000	0.000	0.000
Baptism River	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
	Released	428	428	117	0.147	0.147	0.035	11	11	11	0.004	0.004	0.004
	Total	428	428	117	0.147	0.147	0.035	11	11	11	0.004	0.004	0.004
Cross River	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
	Released	78	67	29	0.204	0.175	0.074	0	0	0	0.000	0.000	0.000
	Total	78	67	29	0.204	0.175	0.074	0	0	0	0.000	0.000	0.000
Temperance River	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
	Released	58	58	70	0.191	0.191	0.232	0	0	0	0.000	0.000	0.000
	Total	58	58	70	0.191	0.191	0.232	0	0	0	0.000	0.000	0.000
Poplar River	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
	Released	27	0	0	0.034	0.000	0.000	0	0	0	0.000	0.000	0.000
	Total	27	0	0	0.034	0.000	0.000	0	0	0	0.000	0.000	0.000
Cascade River	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
	Released	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
	Total	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
Devil Track River	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
	Released	375	357	131	0.204	0.195	0.045	0	0	0	0.000	0.000	0.000
	Total	375	357	131	0.204	0.195	0.045	0	0	0	0.000	0.000	0.000
Kadunce Creek	Harvested	0	0	0	0.000	0.000	0.000	11	11	12	0.007	0.007	0.007
	Released	113	102	60	0.069	0.062	0.035	11	11	12	0.007	0.007	0.007
	Total	113	102	60	0.069	0.062	0.035	23	23	25	0.014	0.014	0.015
Brule River	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
	Released	75	75	60	0.070	0.070	0.052	25	25	26	0.023	0.023	0.023
	Total	75	75	60	0.070	0.070	0.052	25	25	26	0.023	0.023	0.023
Upper Shore Total	Harvested	0	0	0	0.000	0.000	0.000	11	11	12	0.001	0.001	0.001
	Released	1,164	1,086	209	0.119	0.111	0.024	47	47	31	0.005	0.005	0.003
	Total	1,164	1,086	209	0.119	0.111	0.024	59	59	38	0.006	0.006	0.004
Shorewide Total	Harvested	0	0	0	0.000	0.000	0.000	649	649	122	0.020	0.020	0.004
	Released	3,865	3,619	455	0.117	0.110	0.015	283	272	59	0.009	0.008	0.002
	Total	3,865	3,619	455	0.117	0.110	0.015	932	921	152	0.028	0.028	0.005

Table 4. Yield, average length (inches), and average weight (pounds) of fish species caught in the 2019 Lake Superior spring creel survey.

Species	Yield			Average Length (inches)				Average Weight (pounds)			
	Number Caught	Number Harvested	Pounds Harvested	Harvested	Released	All	(SE)	Harvested	Released	All	(SE)
Brook Trout	685	0	0	--	11.3	11.3	0.4	--	1.1	1.1	0.1
Coho Salmon	126	126	159	15.9	--	15.9	0.4	1.3	--	1.3	0.1
Kamloops ( $\geq 16"$ )	921	649	3,089	23.8	24.3	24.0	0.2	4.8	5.1	4.9	0.1
Lake Trout	11	0	0	--	43.0	43.0	--	--	25.9	25.9	--
Lake Whitefish	17	0	0	--	18.0	18.0	--	--	--	--	--
Round Whitefish	25	25	0	--	15.0	15.0	1.0	--	--	--	--
Sucker species	136	0	0	--	16.6	16.6	0.5	--	2.0	2.0	0.2
Unclipped Steelhead ( $\geq 16"$ )	3,619	0	0	--	23.2	23.2	0.2	--	4.0	4.0	0.1
Unclipped Steelhead ( $< 16"$ )	246	0	0	--	12.4	12.4	0.7	--	0.7	0.7	0.1
Walleye	11	0	0	--	25.0	25.0	0.0	--	6.0	6.0	--

Table 5. The number of 'new' (first time interviewed in 2019) anglers who were interviewed in the 2019 Lake Superior spring creel survey by gender and state, and the percent of total interviews collected by state (Percent of Total).

State/Country	Female	Male	Total	Percent of Total
Alaska	0	1	1	0.1%
Colorado	0	3	3	0.3%
Florida	0	1	1	0.1%
Illinois	1	1	2	0.2%
Indiana	0	2	2	0.2%
Michigan	0	1	1	0.1%
Minnesota	25	814	839	93.3%
Montana	0	1	1	0.1%
North Dakota	0	3	3	0.3%
New York	0	1	1	0.1%
South Dakota	0	2	2	0.2%
Texas	0	1	1	0.1%
Wisconsin	2	29	31	3.4%
Canada	3	8	11	1.2%
Total	31	868	899	100.0%

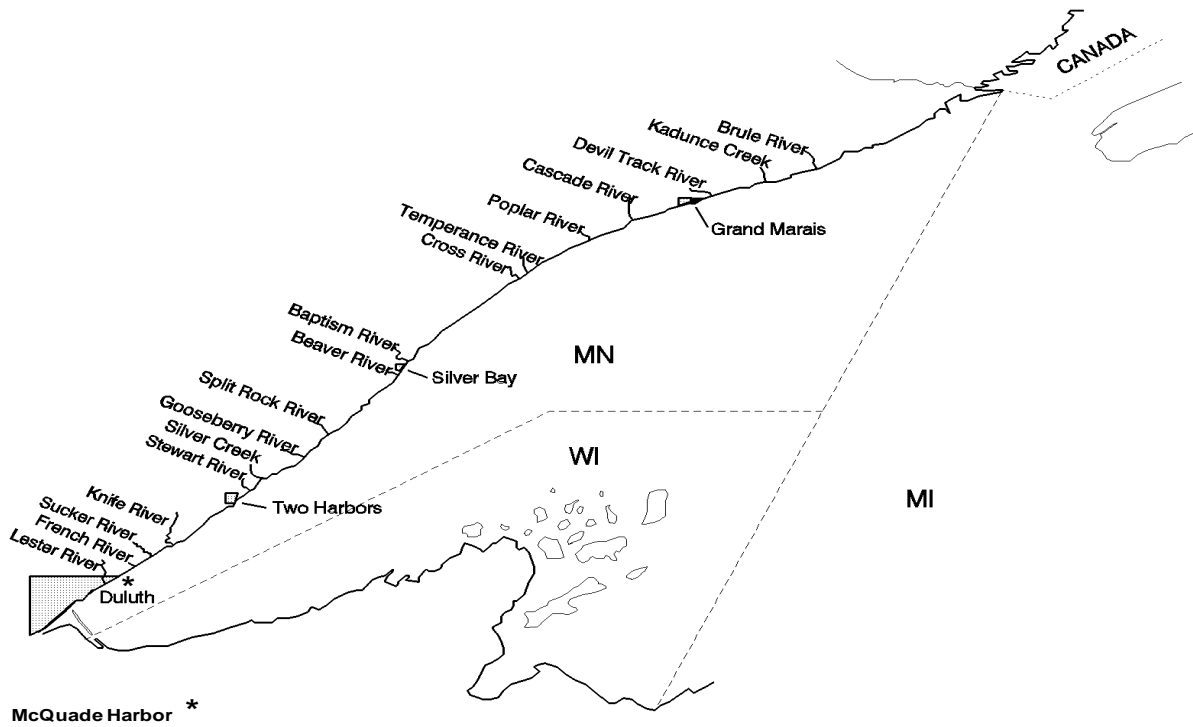


Figure 1. Sampling stations for the Lake Superior spring creel survey.

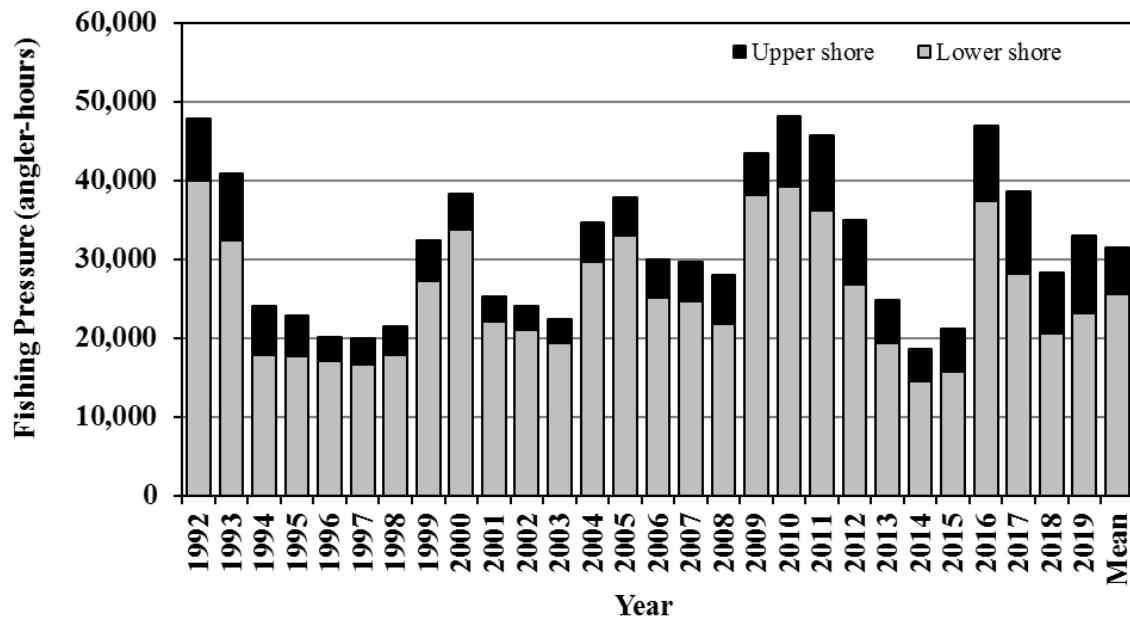


Figure 2. Fishing pressure (angler-hours) in the lower shore, upper shore, and shorewide from the Lake Superior spring creel survey by year, including the historic average (Mean) from 1992 to 2019.



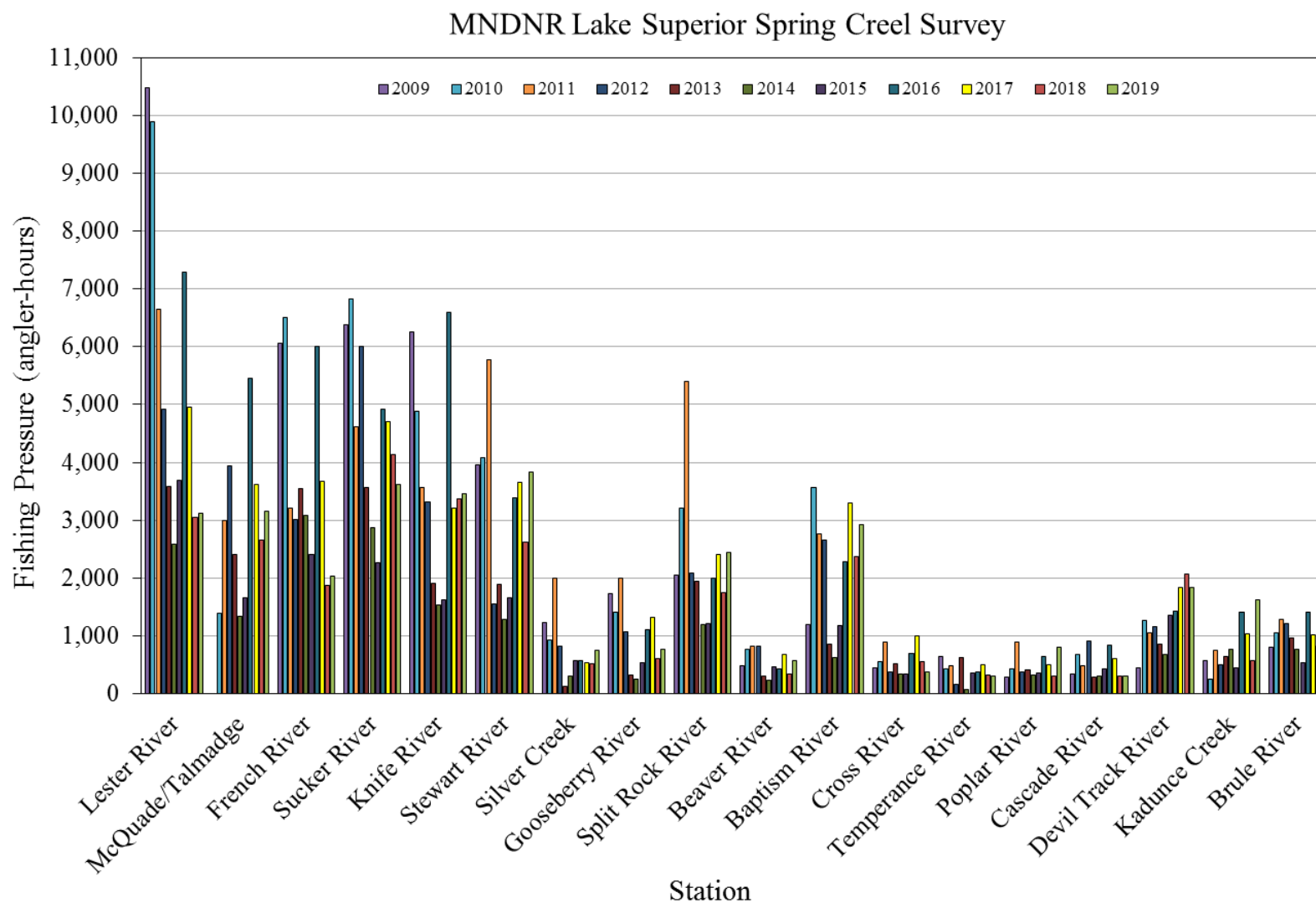


Figure 3. Fishing pressure (angler-hours) by station in the Lake Superior spring creel survey from 2009 to 2019.

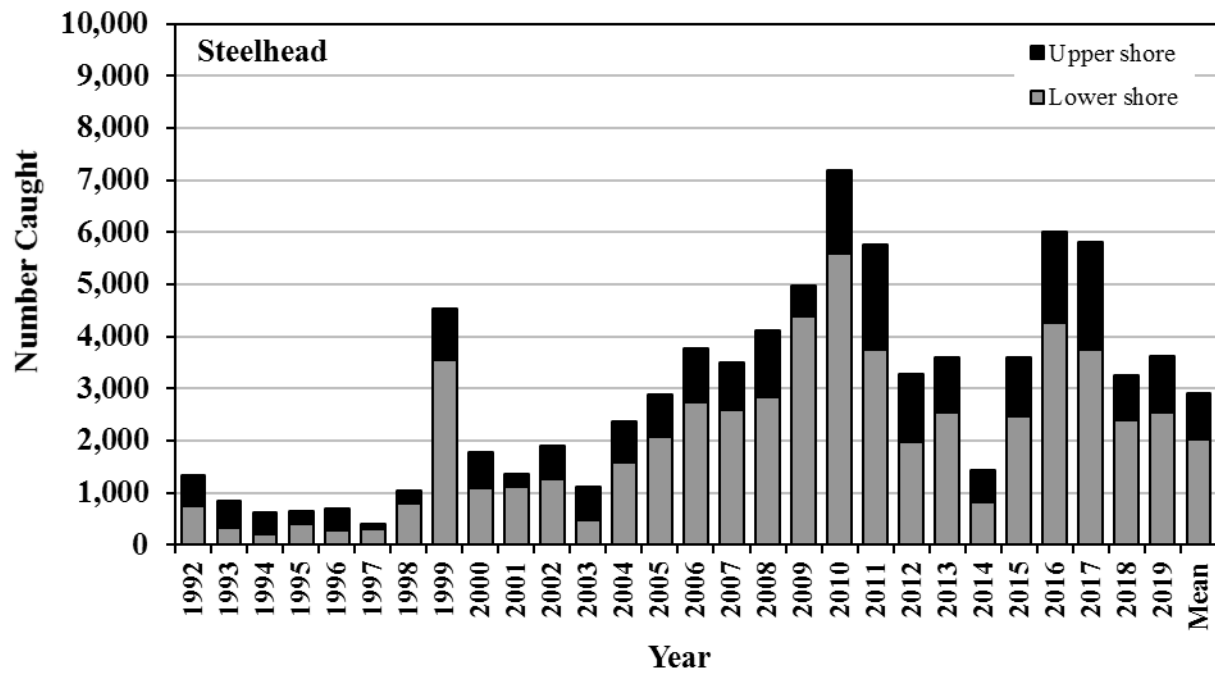


Figure 4. The number of steelhead  $\geq 16$  inches caught in the lower shore, upper shore, and shorewide from the Lake Superior spring creel survey by year, including the historic average (Mean) from 1992 to 2019.

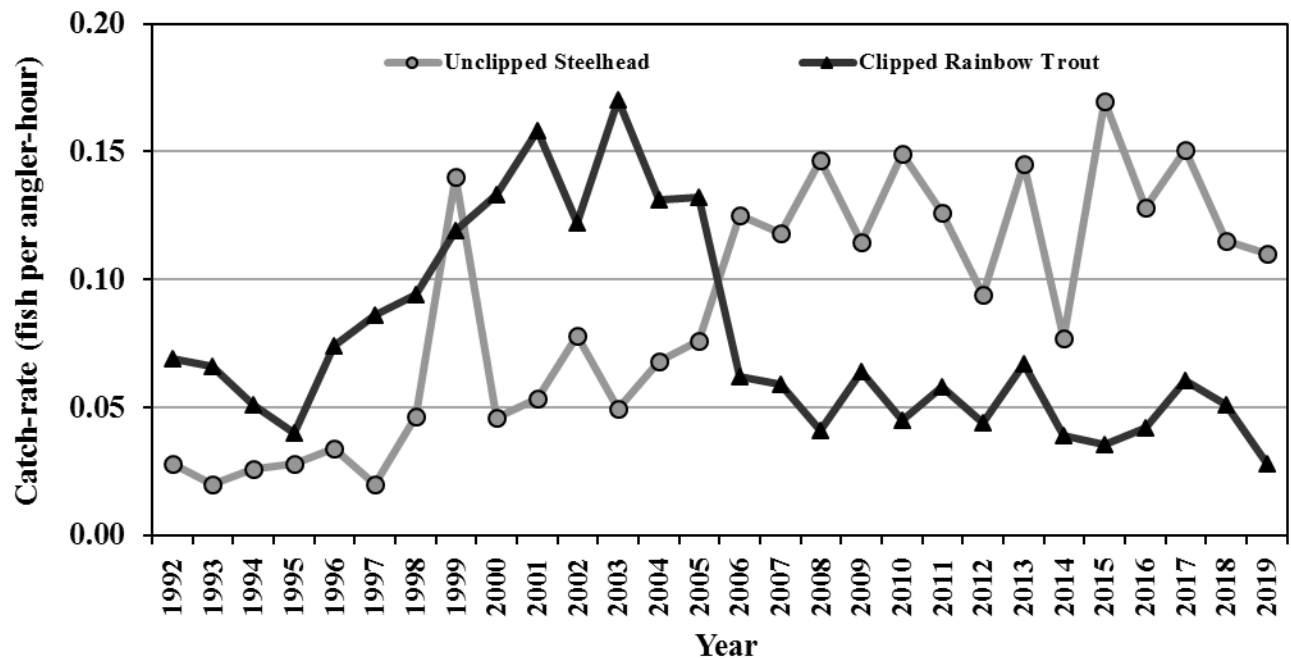


Figure 5. Shorewide catch-rate (fish per angler-hour) of steelhead and clipped Rainbow Trout (Kamloops and clipped steelhead)  $\geq 16$  inches from the Lake Superior spring creel survey by year.

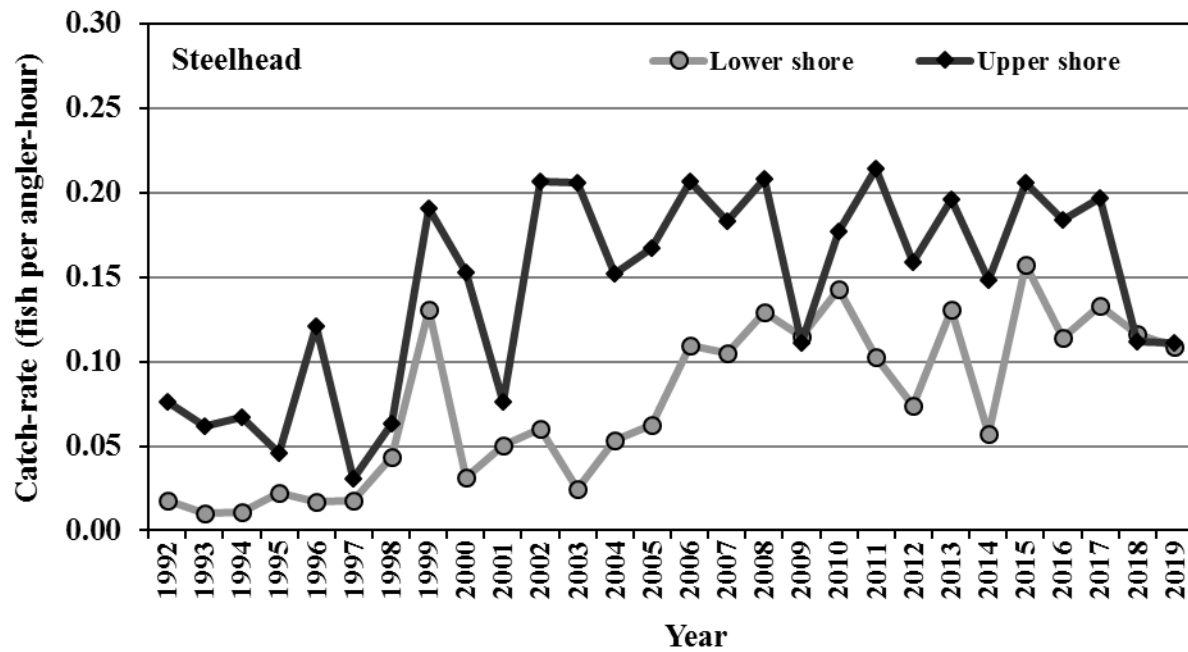


Figure 6. Catch-rate (fish per angler-hour) of steelhead  $\geq 16$  inches from the Lake Superior spring creel survey in the lower shore and upper shore by year.

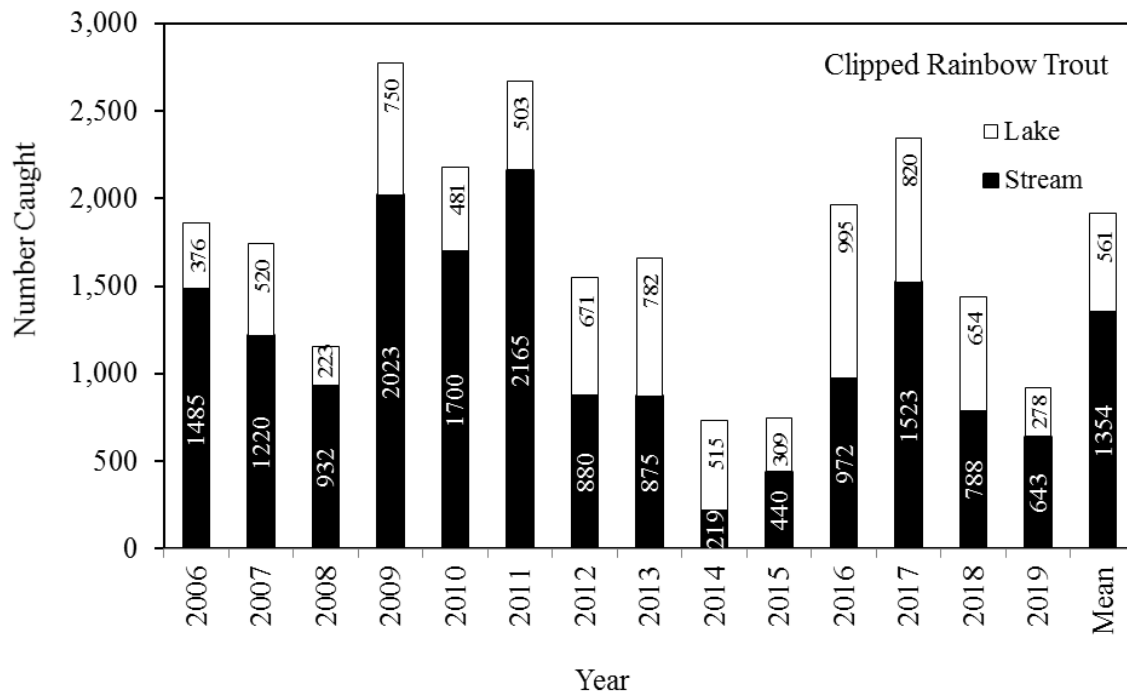


Figure 7. The number of clipped Rainbow Trout (Kamloops)  $\geq 16$  inches caught in the lake and stream, including the average (Mean) from 2006 to 2019.

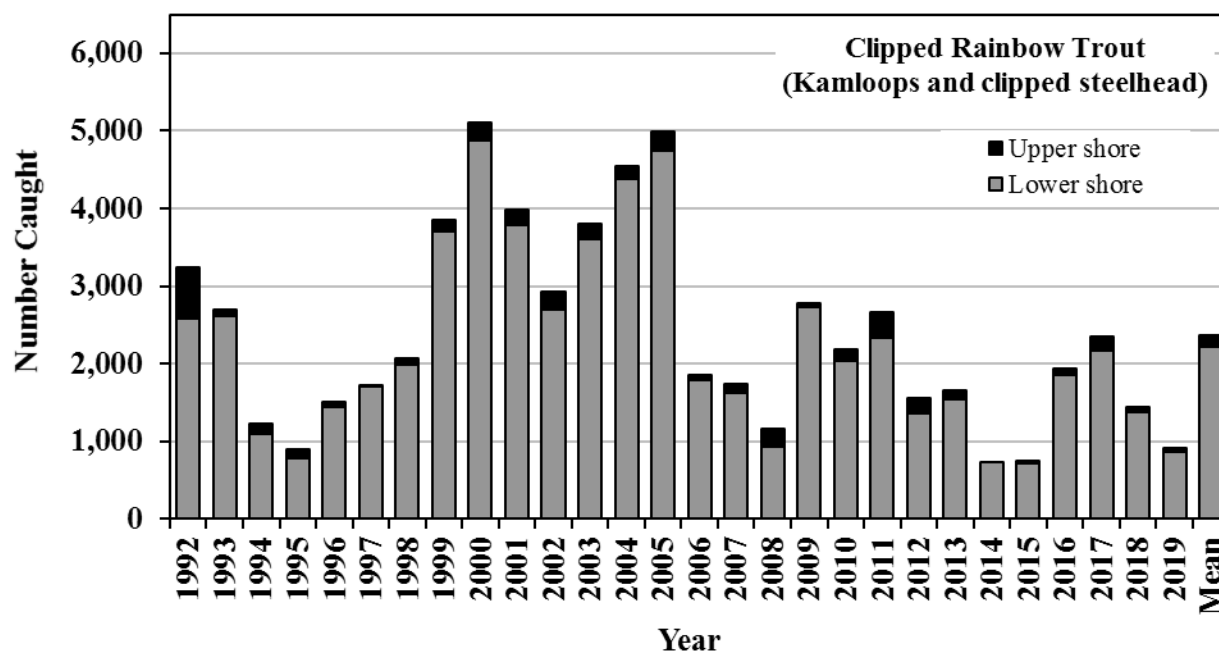


Figure 8. The number of clipped Rainbow Trout (Kamloops and clipped steelhead)  $\geq 16$  inches caught in the lower shore, upper shore, and shorewide from the Lake Superior spring creel survey by year, including the historic average (Mean) from 1992 to 2019.

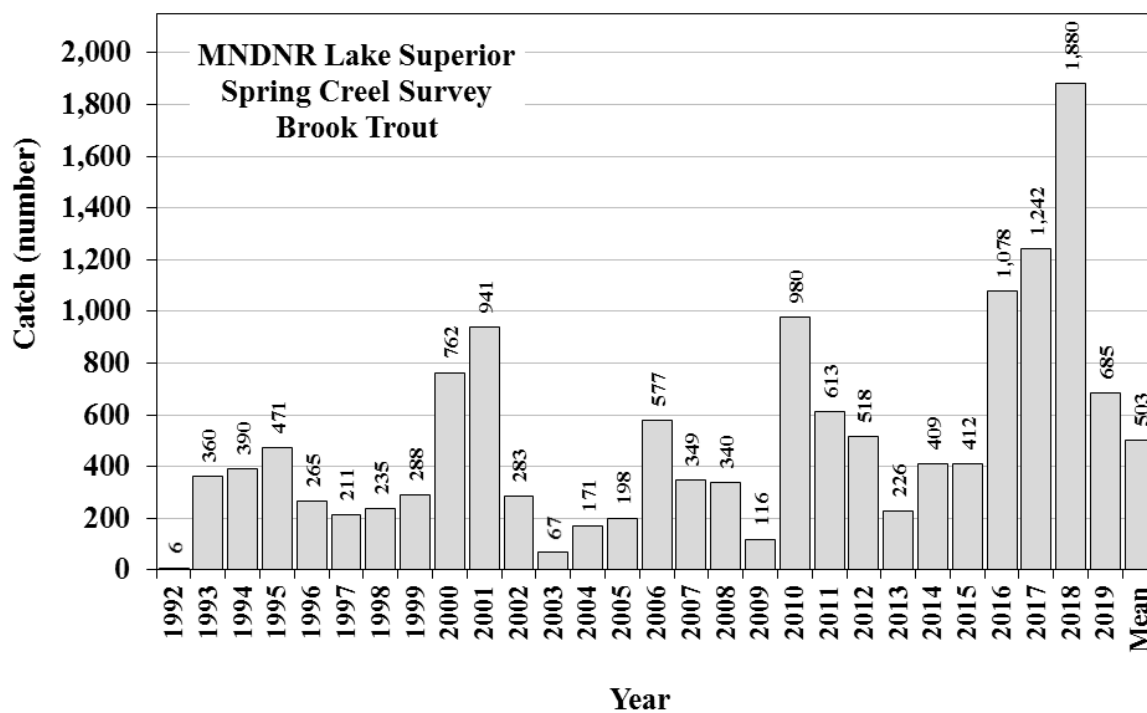


Figure 9. The number of Brook Trout caught by year during the Lake Superior spring creel survey by year, including the historic mean (Mean) from 1992 to 2019.

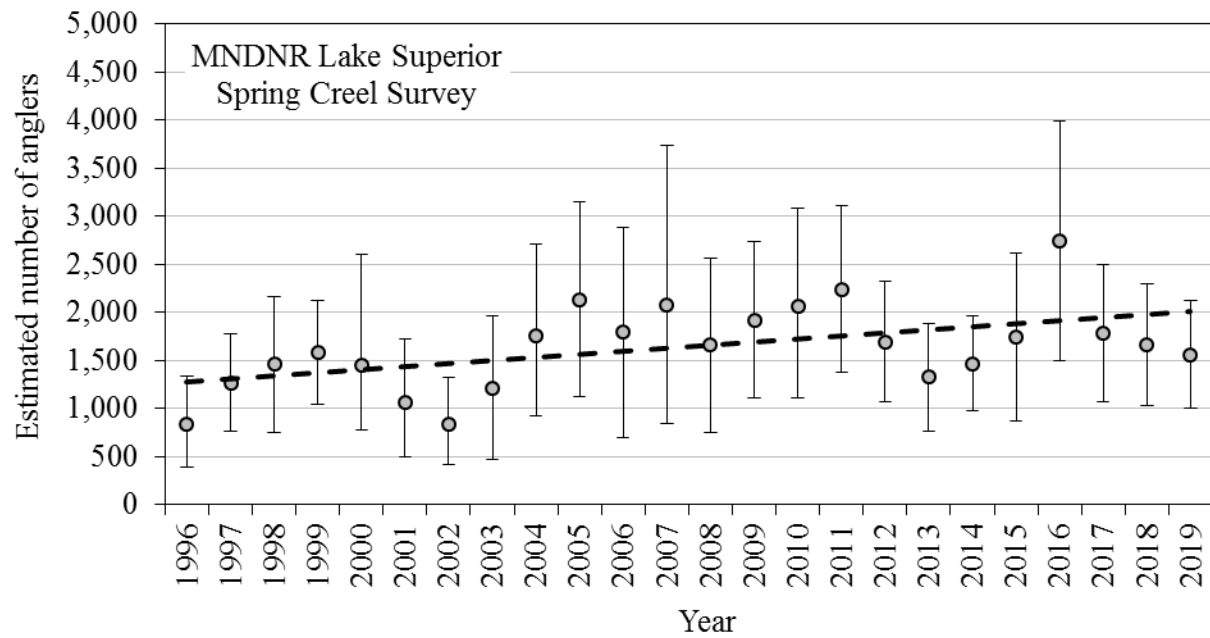


Figure 10. The estimated number of anglers that have participated in the Lake Superior spring fishery by year from 1996 to 2019. The dashed line shows the linear trendline for all years.