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COMPLETION REPORT:
LAKE SUPERIOR SPRING CREEL SURVEY
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ABSTRACT

The early-spring “Kamloops” creel and annual spring creel survey are useful tools for examining long-term trends in fishing pressure, catch, and catch rates of Lake Superior fishes, particularly Rainbow Trout. A stratified random spring creel survey has been conducted annually along the Minnesota shore since 1992 and the early-spring creel survey was completed in 2013 and 2015; these surveys typically occur from early April through late May. The early-spring “Kamloops” creel survey was conducted from April 8 through April 13, 2015. Fishing pressure and catch in 2015 was much lower than 2013. Although based on only two years of data, the variability in fishing pressure between years indicates that it would be difficult to know how the fishing pressure in this time period influences catch in the annual spring creel without an annual early-spring creel survey. The annual spring creel survey was conducted from April 14 through May 20, 2015. The number of anglers that fished the North Shore in 2015 was similar to the historic average; however, fishing pressure was the second lowest since 1997. The catch and catch-rates for Steelhead in 2015 were one of the highest observed in the history of the Lake Superior spring creel survey. The lower shore and shorewide catch rates exceeded 0.15 fish per angler-hour (6.6 hours per fish caught) for the first time ever, whereas the upper shore catch-rate has remained above 0.15 fish per angler-hour in 13 of the last 14 years. The shorewide catch of clipped Rainbow Trout (Kamloops) 16 inches and greater in 2015 (734) was the lowest estimate in the past 24 years. The catch and catch-rates in the lower and upper shore were some of the lowest observed in the history of the spring creel survey. Catch and catch-rates of Kamloops have decreased considerably in the Lester River, which could indicate increased straying or decreased survival of stocked fish at this location. The decrease in catch of Kamloops and increased reports of Kamloops straying beyond the Lester and French rivers are concerns shared by MNDNR and anglers. In response these concerns, the MNDNR has revised the Kamloops stocking and production protocols from the Spire Valley Coldwater Hatchery. Although few anglers actively target Brook trout below barriers in the spring, they were the second most commonly caught species after Rainbow Trout. The largest Brook Trout reported in the spring creel survey was 17 inches. Coho Salmon were the second most targeted species by anglers and an estimated 120 were caught in spring 2015.

INTRODUCTION

The Minnesota Department of Natural Resources (MNDNR) manages the fisheries in the Minnesota waters of Lake Superior, from Duluth northeast to the Canada border. The MNDNR conducts annual fisheries assessments and creel surveys that provide valuable data needed to implement the *MNDNR Fisheries Management Plan for the Minnesota Waters of Lake Superior* (Goldsworthy et *al*. 2016, *in review*). This plan supplements joint strategic documents for lakewide 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 are used to collect angler use, catch and harvest information, and supplement data collected in annual fisheries assessments. This creel survey is a valuable management tool for the MNDNR. It provides information on annual fishing pressure, catch, and catch rates of fish during the spring fishery Minnesota waters of Lake Superior. The annual spring creel survey typically begins once tributaries thaw and anglers can fish them.

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 fishing for Rainbow Trout as the fish migrate upstream in tributaries to spawn. The State of Minnesota manages two types of Rainbow Trout in Lake Superior: Steelhead, a migratory life-history form of Rainbow Trout derived from the upper west coast, and Kamloops, a domesticated hatchery strain derived from land-locked populations from the west coast. Steelhead were first introduced to Lake Superior in the late 1800s. Steelhead have become naturalized to the Lake Superior ecosystem, and now provide the most sought-after sport fishery in Minnesota tributaries of Lake Superior. Kamloops were first introduced in Minnesota waters of Lake Superior in 1983 by the MNDNR. The goal of the Kamloops program was to provide harvest opportunities for Rainbow Trout while Steelhead populations were rehabilitated.

Some of the first spring creel surveys were conducted in 1961 through 1967 (Hassinger et al. 1974), and then in 1981 and 1982 (Close and Siesennop 1984). The MNDNR has conducted an annual spring creel survey since 1985, except in 1991. From 1985 to 1990, the spring creel surveys were non-uniform probability surveys which provided good shorewide information but did not permit statistically valid estimates for individual tributaries. The survey design was changed to a stratified random survey in 1992 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 2015 based on the stratified random design used in the creel survey throughout this time period.

The spring creel survey has provided valuable information for many other species in Lake Superior. Brook Trout (*Salvelinus fontinalis*), one of two native char to Lake Superior, provide ample angling opportunities in the spring fishery, depending on the year. After Rainbow Trout, Brook Trout are often the most frequently caught species in the spring creel survey and have been reported in all surveys since 1992. 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). Like Rainbow Trout, many other non-native sport fish introduced into Lake Superior have become naturalized and currently provide additional angling opportunities in the spring fishery. These species include Brown Trout (*Salmo trutta*), Atlantic Salmon (*Salmo salar*), Chinook Salmon (*O. tshawytscha*), Coho Salmon (*O. kisutch*), and Pink Salmon (*O. gorbuscha*). Most of these species are seldom caught in tributaries during the spring creel survey, although a small number of anglers actively target and catch Coho salmon. Brown Trout are sometimes caught by shore anglers fishing in Lake Superior near river mouths. Lake Trout (*Salvelinus namaycush*), White Sucker (*Catostomus commersoni*), Longnose Sucker (*Catostomus catostomus*), and Round Whitefish (*Prosopium cylindraceum*) are also periodically caught at river mouths in the spring.

The MNDNR recognized that fishing pressure is often high prior to the start of the annual spring creel survey (in winter and early-spring), particularly in years when sufficient ice forms in Lake Superior. In 2013, the MNDNR initiated the first ever early-spring "Kamloops" creel survey to evaluate the catch of some species, particularly clipped Rainbow Trout (hereafter referred to as Kamloops), during the period prior to ice-out when shore anglers fish exclusively in Lake Superior. This survey concentrated on five locations in the lower shore because most of the pressure for Kamloops occurs along the lower shore near Duluth. Although the main goal of the early-creel survey was to evaluate fishing pressure, catch, and harvest of Steelhead and Kamloops, it also provides useful information for other species (e.g., Coho Salmon).

METHODS

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 samples 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.

An early-spring creel survey was completed in 2015 during the period prior to ice-out when shore anglers were targeting Kamloops in the lake along the lower shore. Three stations that are not included in the annual spring creel survey were added to the 2015 early-spring creel survey: Blue Bird Landing, Stoney Point, and the Two Harbors break wall. These stations were added to evaluate angling pressure at other areas known to receive angling pressure in the early-spring fishing season.

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 time period from 1992 to 2014. Interquartile ranges refer to the range of values between the first (25^{th}) and third (75^{th}) quartiles, or the "middle fifty" of the values in the data set.

There are no longer any adipose-clipped Steelhead remaining from stocking events in the early 2000s. Kamloops possess an adipose fin clip making them legal for anglers to harvest. The majority of unclipped Steelhead (hereafter referred to as Steelhead) caught were produced in the wild or the result of fry stocking, but some were produced in the hatchery and possess a maxillary clip that is difficult for anglers to identify. These fish were reported by anglers as simply 'Steelhead'. Maxillary clipped Steelhead could have the greatest impact on the catch and catch-rate at the Knife River, which received all of the (maxillary clipped) Steelhead stocked from 2003 to 2007. Very few of these fish still exist due to their age, and they rarely ever contribute to the catch in the spring fishery.

The number of anglers that participate in the spring anadromous fishery on Lake Superior is estimated annually. Angler population estimates are determined using a cumulative total of the number of 'new' anglers (not previously interviewed) and 'recap' anglers (previously interviewed) that were interviewed each day. The days where no anglers were interviewed or the creel was not conducted were not included in the analysis. The Schnabel modification of the Lincoln-Petersen estimator is 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 is used to calculate a final angler population estimates and confidence intervals of the final estimate. The question "Have you previously been interviewed by a creel clerk this spring?" was not asked in 1992 to 1995 creel surveys, so estimates could not be determined prior to this time.

The Steelhead fishery currently has a catch-and-release-only regulation, and generally 25-40% of Kamloops are voluntarily released. Therefore, most fish lengths reported in the spring creel survey were estimated by interviewed anglers. No individual fish weights were obtained during the creel, but estimates were developed for each species using regression relationships derived from Knife River adult trap data. All other methods are summarized in Ostazeski (2004).

RESULTS

EARLY-SPRING CREEL SURVEY

The early-spring "Kamloops" creel survey was conducted from April 8 through April 13, 2015. A total of 92 interviews were conducted, with 73% of all interviews coming from the French River and McQuade Harbor/Talmadge River. There were 60% less interviews conducted in 2015 compared to 2013 (232 interviews), with the same number of survey days each year (N=6). In 2015, 45% of the total interviews occurred between 6:00 am and 1:30 pm, while 55% occurred between 1:30 and 9:30 pm. Fifty-eight percent of all interviews were obtained on weekends versus 42% on weekdays (Table 1).

Fishing Pressure

Total fishing pressure was 2,302 angler-hours, with 80.5% of the total pressure at the French River and McQuade Harbor/Talmadge River. The Two Harbors break wall (THB), which was added to the survey in 2015 to evaluate catch of Coho salmon, accounted for 8.4% of the total pressure; anecdotal reports indicate that very few Rainbow Trout are typically caught at the THB. The total estimated fishing pressure at the French River and McQuade Harbor/Talmadge River increased to 87.9% after excluding the fishing pressure at THB (195 angler-hours). The Lester River and Sucker River received very little fishing pressure and accounted for only 7.6% of the total estimated fishing pressure; pressure at these stations increased to 8.3% after excluding the THB. Two of three stations added to the early-Spring creel survey in 2015, Blue Bird Landing and Stoney Point, accounted for only 3.4% of the total pressure; 3.7% excluding the THB (Table 2).

Catch, Catch Rates and Harvest

An estimated total of 7 Steelhead were caught in early-spring creel survey, and all were caught at the French River. The shorewide catch-rate for Steelhead in the early-spring fishery was 0.003 fish per angler hour, which was lower than 2013 (0.0159 fish per angler hour). The catch-rate at the French River (0.007 fish per angler hour) was also lower than 2013 (0.015 fish per angler hour). The average length of Steelhead caught and measured was 25 inches (range: 25-25). All Steelhead were released (Table 3).

An estimated total of 31 Kamloops were caught in the early-spring creel survey. All Kamloops were caught at McQuade Harbor/Talmadge River (17) and the French River (14). The shorewide catch-rate for Kamloops was 0.015 fish per angler hour, which was lower than 2013 (0.0621 fish per angler hour). The catch-rates for Kamloops at the French River (0.013 fish per angler hour) and McQuade Harbor/Talmadge River (0.021 fish per angler hour) were lower than 2013 (French River: 0.090 fish per angler hour, McQuade/Talmadge: 0.037 fish per angler hour). The average length of Kamloops caught and measured was 25.5 inches (range: 24-27 inches). All legal-sized Kamloops caught were harvested, and no sub-legal sized Kamloops were caught (Table 3).

Coho salmon were the only other species besides Rainbow Trout caught in the 2015 early-spring creel survey. Catch of Coho salmon at each creel location were too small to produce reliable station estimates; therefore, estimates of catch and catch rate were determined for these species shorewide. An estimated 19 Coho salmon were caught during the 2015 early-spring creel survey; all were caught at the THB. The shorewide catch-rate was 0.009 fish per angler hour, and 0.098 at the THB. The average length of caught and measured Coho salmon was 16.7 inches (range: 16-17 inches). All Coho salmon caught were harvested (Table 3).

ANNUAL SPRING CREEL SURVEY

The annual spring creel survey was conducted from April 14 through May 20, 2015. A total of 1,005 interviews were conducted in the 2015 spring creel survey, with 769 on the lower shore and 236 on the upper shore. There were only 2.8% more interviews conducted in 2015 than 2014 (977 interviews). On the lower shore, the most interviews were conducted at the Lester River (160); very few interviews were gathered at the Gooseberry River (28). On the upper shore, most interviews were gathered at the Baptism River (66) and few were gathered at the Poplar River (12). Shorewide, 75% of anglers fished in a tributary while 25% fished the lake. Anglers that fished the upper shore rarely fished the lake (2%), whereas 32% of lower shore anglers interviewed fished the lake. Fifty-two percent of all anglers were interviewed fishing the early time period (6:00 a.m. and 1:30 p.m.), while 48% were interviewed fishing the late time period (1:30 and 9:30 p.m.); 53% of anglers fished weekdays and 47% fished weekends (Table 1).

Rainbow Trout were by far the most sought after species in the Lake Superior spring shore fishery. Steelhead and Kamloops were the primary target species in 58.7% and 33.9% of interviews, respectively. Other primary species included Coho Salmon at 3.6%, and several others at <1.0%. Twenty percent of anglers listed Steelhead as their secondary target species and 52.2% listed Kamloops as their secondary species. Other secondary species included Coho Salmon at 18.6%, Brook Trout at 4.8%, and numerous other species at <1.0%.

Fishing Pressure and Angler Participation

The estimated shorewide angling pressure in 2015 was 21,120 angler-hours, with 74% (15,641 angler-hours) that occurred in the lower shore and 26% (5,479 angler-hours) that occurred in the upper shore (Table 2; Figure 2). Of the total angling pressure, 78% (16,428 angler-hours) occurred in tributaries and 22% (4,692 angler-hours) occurred in the lake (Table 2). Total pressure was 9,992 hours less than average (31,112 angler-hours). Fishing pressure was much lower than average in the lower shore, which showed a 39% decrease in pressure compared to the long-term mean. The upper shore pressure estimate was similar to the long-term average. In the lower shore, fishing pressure ranged from 3,699 angler-hours at the Lester River to 532 angler-hours at the Gooseberry River. Among upper shore rivers, fishing pressure was the highest at the Devil Track River (1,384 angler-hours) and lowest at the Cross River (338 angler-hours)(Table 4).

An estimated 1,744 anglers participated in the spring fishery in 2015. The number of unique (first time interviewed this year) angler interviews in 2015 was 793, which was slightly higher than average (764). The number of anglers participating in the Lake Superior spring fishery has increased over time (Table 5; Figure 3).

Catch, Catch Rates and Harvest

The shorewide catch of all Rainbow Trout (Steelhead and Kamloops) in 2015 was 4,337 fish, which included 3,588 Steelhead and 749 Kamloops (Tables 6 and 7). At least 90% of all Rainbow Trout caught in 2015 were 16 inches or larger (Table 8). The shorewide catch-rate for all Rainbow Trout was 0.205 fish per angler-hour (4.9 angling-hours per fish), which was better than the historic average (0.164 fish per angler-hour, 6.1 angling-hours per fish), and the third highest catch-rate on record since 2004 (Table 9).

The shorewide catch of Steelhead was 3,588, which was higher the long-term average (2,568) and at the upper end of the interquartile range (1,069 - 3,682). The catch of Steelhead in the lower shore was 2,463 and 1,126 in the upper shore; both were above their long-term averages (Table 6; Figure 4). The highest catch in the lower shore was at the Lester River (706), followed by the Knife River (559) and the Sucker River (471). The highest catch in the upper shore was at the Devil Track River (357), followed by the Baptism River (344) and the Cascade River (134)(Table 7). Catch of small Steelhead (<16 inches) were reported at seven creel stations shorewide, which resulted in an estimated shorewide catch of 410 in 2015 (Table 8).

The shorewide catch-rate for Steelhead was 0.170 fish per angler-hour, which was the highest catch-rate observed in the history of the spring creel survey (Table 9; Figure 5). Catch-rate in the lower shore was 0.157 fish per angler hour, which was the highest catch-rate observed in this area since 1992. Catch-rate for the upper shore was 0.205, the second highest observed in this area since 1992 (Table 9; Figure 6). Catch-rates in the lower shore were highest at the Knife River (2.9 hours per fish), followed by the Sucker River (4.8 hours per fish) and the Lester River (5.2 hours per fish). Catch-rates in the upper shore were highest at the Cascade River (3.3 hours per fish), followed by the Baptism River (3.4 hours per fish) and the Devil Track River (3.8 hours per fish)(Table 7). Shorewide, the catch-rate in tributaries (0.204 fish per angler hour) was higher than in the lake (0.051 fish per angler hour); it took only 4.9 hours to catch a Steelhead in a tributary compared to 19.4 hours in Lake Superior (Table 10).

Most Steelhead caught ranged from 20 to 28 inches (Figure 7). The average length and weight was 24.5 inches and 4.6 pounds. Three Steelhead were reported as illegally harvested at two stations in the lower shore (Table 11).

The shorewide catch of Kamloops was 749, which was lower the long-term average (2,485) and the interquartile range (1,604-3,516). The catch of Kamloops in the lower shore (709) and the upper shore (39) were both below their interquartile ranges (lower shore: 1,492-3,167; upper shore: 88-210)(Table 6; Figure 8). The highest catch in the lower shore was at the French River (231), followed by the Sucker River (142) and McQuade Harbor/Talmadge River (109). An estimated 103 Kamloops were caught at the Lester River, which was significantly lower than the historic average at this station (409). Kamloops were only caught at two stations in the upper shore, the Temperance River (27) and the Devil Track River (13)(Table 7). Sub-legal Kamloops (<16 inches) were only caught at the French River and McQuade Harbor/Talmadge River, which resulted in an estimated shorewide catch of 34 in 2015 (Table 8).

The shorewide catch-rate for Kamloops was 0.035 fish per angler-hour (28.6 hours per fish), which was the lowest catch-rate observed in the history of the spring creel survey (Table 9; Figure 5). Catch-rate in the lower shore was 0.045 fish per angler hour (22.1 angling-hours per fish), which was the second lowest catch-rate observed in this area since 1992 (Table 9; Figure 9). Catch-rates in the lower shore were highest at the French River (10.4 angler-hours per fish), McQuade Harbor/Talmadge River (15.2 angler-hours per fish), and the Sucker River (15.9 angler-hours per fish; Table 7). It took a staggering 35.8 angler-hours to catch a Kamloops at the Lester River in 2015 (Table 7). Catch-rate for the upper shore was 0.007, with 0.074 (13.5 angler-hours per fish) at the Temperance River and 0.010 (105.0 angler-hours per fish) at the Devil Track River (Tables 7 and 9; Figure 9). Shorewide, the Kamloops catch-rate in tributaries (0.027 fish per angler-hour) was lower than in the lake (0.066 fish per angler hour); it took 37.4 hours to catch a Kamloops in a tributary compared to 15.2 hours in Lake Superior (Table 10).

Kamloops caught in 2015 averaged 23.9 inches (range: 12-27 inches) and 4.8 pounds (Table 11; Figure 7). Of all legal sized Kamloops caught, 523 Kamloops (total weight=2,563 pounds) were harvested (Table 11). The majority of Kamloops caught were age-4 or age-5 (Table 12).

An estimated 412 Brook Trout were caught during the 2015 creel survey, which was slightly higher than the historic average (383; Figure 10). The shorewide catch-rate was 0.020 fish per angler-hour (51.2 angler-hours per fish), with 0.071 (14.1 angler-hours per fish) in the upper shore, and 0.002 (613.4 angler-hours per fish) in the lower shore (Table 13). The average length of Brook Trout caught was 10.9 inches, and ranged from 6 to 17 inches (Table 11). No Brook Trout harvest was reported (Table 13).

An estimated 120 Coho Salmon were caught in spring 2015, and the shorewide catch-rate was 0.006 fish per angler-hour (176 angler-hours per fish)(Table 3). Average length was 16.8 inches, and ranged from 9 to 19 inches (Table 11). Approximately 68% of all Coho Salmon caught in 2015 were harvested (Table 11). Other species reported in the spring creel survey included Cisco (Lake Herring), Northern Pike, and Sucker species (White Sucker and Longnose Sucker). Data for these species can be found in Tables 11 and 13.

DISCUSSION

This was the second year that an early-spring creel survey was conducted in Minnesota waters of Lake Superior. The early-spring creel documented a lower amount of fishing pressure and catch compared to the early-spring creel survey in 2013. Unlike 2013, angling pressure and harvest in early-spring 2015 likely had minimal influence on the catch and catch-rate of Kamloops in the annual spring creel. The variability in fishing pressure between years could indicate how difficult it could be to predict how the fishing pressure in early-spring influences catches in the annual spring creel; however, this is based on only two years of data. More years of early-spring creel data are needed. The early-spring creel continues to provide useful information with minimal time and budgetary constraints and should continue in future years.

The number of anglers that fished the North Shore in 2015 was similar to the historic average; however, fishing pressure was the second lowest since 1997. Although the number of anglers that participated in the shore fishery in 2015 was close to average, the lower than average fishing pressure indicates anglers spent less time fishing per trip than in previous years. April is generally considered the prime month for Rainbow Trout angling in tributaries, however, anglers simply did not fish them as long as they have in previous years. Ice cleared rivers at an expected time in April, the creel survey started near the average start date it has in previous years, and the lake and streams provided suitable fishing conditions for most of the spring season. It impossible to know why anglers spent less time fishing in 2015; however, some believe it was correlated to the low catches of Kamloops in the lower shore.

The catch and catch-rates for Steelhead in 2015 were one of the highest observed in the history of the Lake Superior spring creel survey. The lower shore and shorewide catch rates exceeded 0.15 fish per angler-hour (6.6 hours per fish caught) for the first time in 2015, whereas the upper shore catch-rate has remained above 0.15 fish per angler-hour in 13 of the last 14 years. The above average catch and catch-rates in 2015 correspond with above average returns to the Knife River fish trap (Peterson 2015a, Peterson 2015b). This supports previous assumptions that lower than average catch in 2013 and 2014 was due to environmental conditions and not low population abundance.

The shorewide catch-rate of Steelhead increased from the late 1990's until 2006, which suggests the population was increasing and/or fish were being caught multiple times. Since 2006, the catch-rate has remained consistently high, but more variable among years. This trend 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. Unlike many other limiting factors such as prey availability or environmental conditions, stream habitat is something that can be addressed to improve Steelhead populations. Poor spawning and rearing habitat in North Shore streams has long been a limitation to Steelhead production (Smith and Moyle 1944). Future management strategies will emphasize habitat restoration and enhancement, particularly spawning and nursery habitat in tributaries (Goldsworthy et al. 2016, *in review*).

The catch-and-release regulation for Steelhead has been in effect since August 1997. Regulation compliance was decent in 2015, with only a few illegally harvested Steelhead reported in the creel survey. 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)*. Feedback from the LSAG included both the desire to maintain the catch-and-release regulation and to establish new criteria that would initiate discussions on changes to harvest regulations. Based on this feedback, the MNDNR developed criteria for the lower shore and upper shore, which can be found in Goldsworthy *et* al. (2016, *in review*).

The shorewide estimate of catch and catch-rates for Kamloops has remained low over the last 10 years, and the lowest catch and catch-rates were reported in 2014 and 2015. The shorewide catch-rate for Kamloops has displayed a decreasing trajectory since 2006; however, catch-rates have remained

fairly steady since 2006, with neither a marked increase nor decrease. The catch and catch-rates in the lower and upper shore were some of the lowest observed in the history of the spring creel survey.

The majority of Kamloops were caught in the lower shore in 2015. Kamloops were reported at only two locations in the upper shore. The stocking locations explain much of the catch distribution of Kamloops in the spring creel survey. Kamloops stocking is limited to three locations in the lower shore (Lester River, French River, and McQuade Harbor/Talmadge River) to reduce potential negative impacts of Kamloops spawning with Steelhead (Miller et al. 2004; Schreiner et al. 2006; Page et al. 2011). Therefore, catch and catch-rate are expected to be relatively low for Kamloops in the upper shore.

The low catch of Kamloops in recent years could be a function of environmental and lake conditions, intra- or interspecific competition for resources (prey), and/or changes to the hatchery production and stocking protocols. Environmental conditions also likely influenced angling pressure, catch, and catch-rates for Kamloops. Spring creel survey data shows that the angling effort for Kamloops in the lake is very dependent on the daily lake conditions, whereas fishing is often not effective with strong northeast winds and/or ice. The survival of all fish species in Lake Superior, including Kamloops, is largely dictated by lake conditions (e.g., water temperature) that fluctuate from year-to-year and are impossible to control. The inverse relationship between Steelhead and Kamloops catch-rates 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), indicating that competition for prey with other predators in Lake Superior might be more than previously assumed (Negus and Hoffman 2013).

The spring creel survey shows catch and catch-rates of Kamloops have decreased considerably in the Lester River, which could indicate increased straying or decreased survival of stocked fish at this location. The MNDNR and some anglers are also concerned that the poor returns could have resulted from recent changes to the MNDNR hatchery production and stocking protocols. In 2010, the MNDNR was mandated to change hatchery production and stocking protocols because fish in Lake Superior tested positive for Viral Hemorrhagic Septicemia (VHS). Starting in 2010, a portion (approx. 75%) of the total annual production of Kamloops began to be reared at the Spire Valley Coldwater Hatchery (SVH), and then returned to the French River Cold Water Hatchery (FRH) prior to reaching smolt size (5.9 inches; Negus 2003). Kamloops raised at the FRH cannot be stocked above the first barrier falls to Lake Superior. Since 2010, Kamloops partially-raised at SVH have been held in the FRH for as long as possible (dependent on source water temperatures from Lake Superior), and stocked near the mouth of the Lester River. In the past five years, Kamloops from SVH have been smaller than fish reared entirely at the FRH and, in some years, have been equal-to, or exceeded, smolt size before they were stocked. Reports of straying have increased in recent years. The MNDNR has had reports of adipose clipped Rainbow Trout caught in other jurisdictions including 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.

The decrease in catch of Kamloops and increased reports of Kamloops straying beyond the Lester and French rivers are concerns shared by MNDNR and anglers, particularly regarding potential impacts of introgression with naturalized Steelhead. Negus (1999) found poorer survival of eggs from Kamloops x Steelhead crosses compared to Steelhead x Steelhead crosses. If male Kamloops spawn unsuccessfully with female steelhead, then Steelhead gametes are wasted. Kamloops have been shown to successfully spawn with Steelhead in the wild and produce juvenile hybrids (Close 1999). Juvenile hybrids survive significantly less well compared to juvenile Steelhead in the stream environment (Miller et al. 2004), which is simply another form of gamete wastage. If hybrids did survive to reproduce, genetic introgression could occur which would decrease the fitness of wild Steelhead. More recently, Page et al. (2011) modeled the effects of Kamloops stocking on wild Steelhead populations and concluded that continual stocking of Kamloops greatly increases the risk of extinction of wild Steelhead through non-introgressive hybridization.

In response these concerns, the MNDNR has reconfigured the Kamloops stocking and production protocols from the Spire Valley Coldwater Hatchery. One of the changes included the use of differentiating clips to allow biologists to better assess the efficacy of the different stocking strategies. A full description of changes to the Kamloops program is described in Section 8.4.2 of the 2016 Lake Superior Management Plan (Goldsworthy *et* al. 2016, *in review*). These changes should increase catch and catch-rates for Kamloops and decrease straying to other management jurisdictions.

Brook Trout were the second most commonly caught species after Rainbow Trout, and have been reported in the spring creel survey every year since 1992. Coaster Brook Trout rehabilitation is a management priority for the MNDNR, and regulation compliance is essential for this to occur. Fortunately, no illegal harvest of Brook Trout was observed by the creel census clerks in 2015. Although many Brook Trout are caught each year, very few anglers actively target them below barriers in the spring.

Coho Salmon were the second most targeted species by anglers in spring 2015. Catch and fishing pressure for Coho salmon in Minnesota is sporadic and is largely dependent on the fishing conditions of Lake Superior and year-class abundances. All Coho Salmon caught in Minnesota waters are naturally-produced because the last Coho Salmon stocking event occurred in Michigan in 2006. Due to limited spawning habitat on Minnesota's North Shore, Coho Salmon caught in Minnesota waters are likely wild fish that migrated from other jurisdictions (e.g., Wisconsin, Michigan, and Ontario, Canada).

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Job 976

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISHERIES

COMPLETION REPORT: LAKE SUPERIOR SPRING CREEL SURVEY 2015

Completed by:
Nick Peterson

Area Supervisor — Date: 24 February 2016

Regional Fisheries Approval — Date: May 24, 2016

Table 1. Summary statistics from the 2015 early-spring Lake Superior creel survey (top) and annual Lake Superior spring creel survey (bottom).

Early-Spring Creel Survey

	Weekdays			Weekends			Number of interviews								
	Number of visits			Number of visits			Time period type				Day type				
							Early		Late		Weekdays		Weekends		Total
Station	Early	Late	Total	Early	Late	Total	N	%	N	%	N	%	N	%	N
Lower Shore															
Lester River	1	1	2	1	1	2	0	0%	4	100%	2	50%	2	50%	4
McQuade/Talmadge	1	1	2	2	1	3	28	65%	15	35%	15	35%	28	65%	43
French River	1	1	2	0	1	1	1	4%	23	96%	10	42%	14	58%	24
Blue Bird Landing	1	1	2	1	1	2	2	1	0	0	0	0	2	1	2
Sucker River	1	1	2	1	1	2	0	0%	5	100%	4	80%	1	20%	5
Stoney Point	1	1	2	1	1	2	2	1	0	0	2	1	0	0	2
Two Harbors Breakwall	1	1	2	1	1	2	8	67%	4	33%	6	50%	6	50%	12
Total	**7**	**7**	**14**	**7**	**7**	**14**	**41**	**45%**	**51**	**55%**	**39**	**42%**	**53**	**58%**	**92**

Spring Creel Survey

	Weekdays			Weekends			Interviews												
	Number of visits			Number of visits			Angler type				Time period type				Day type				
							Stream		Lake		Early		Late		Weekdays		Weekends		Total
Station	Early	Late	Total	Early	Late	Total	N	%	N	%	N	%	N	%	N	%	N	%	N
Lower Shore																			
Lester River	7	8	15	5	5	10	145	91%	15	9%	73	46%	87	54%	82	51%	78	49%	160
McQuade/Talmadge	7	8	15	5	5	10	16	21%	60	79%	32	42%	44	58%	46	61%	30	39%	76
French River	7	8	15	5	5	10	0	0%	144	100%	72	50%	72	50%	102	71%	42	29%	144
Sucker River	7	8	15	5	5	10	110	95%	6	5%	64	55%	52	45%	66	57%	50	43%	116
Knife River	7	8	15	5	5	10	84	99%	1	1%	36	42%	49	58%	48	56%	37	44%	85
Stewart River	7	5	12	5	4	9	75	91%	7	9%	54	66%	28	34%	41	50%	41	50%	82
Silver Creek	5	6	11	6	3	9	29	100%	0	0%	17	59%	12	41%	12	41%	17	59%	29
Gooseberry River	6	7	13	6	3	9	28	100%	0	0%	16	57%	12	43%	15	54%	13	46%	28
Split Rock River	5	5	10	3	3	6	38	78%	11	22%	19	39%	30	61%	27	55%	22	45%	49
Upper Shore																			
Beaver River	6	7	13	5	3	8	21	91%	2	9%	19	83%	4	17%	13	57%	10	43%	23
Baptism River	6	5	11	5	4	9	66	100%	0	0%	48	73%	18	27%	21	32%	45	68%	66
Cross River	4	6	10	4	3	7	14	100%	0	0%	8	57%	6	43%	5	36%	9	64%	14
Temperance River	6	6	12	3	4	7	15	94%	1	6%	4	25%	12	75%	6	38%	10	63%	16
Poplar River	5	4	9	4	3	7	12	100%	0	0%	7	58%	5	42%	5	42%	7	58%	12
Cascade River	4	6	10	3	3	6	14	88%	2	13%	7	44%	9	56%	7	44%	9	56%	16
Devil Track River	5	6	11	4	3	7	37	100%	0	0%	20	54%	17	46%	16	43%	21	57%	37
Kadunce Creek	6	6	12	3	4	7	20	100%	0	0%	11	55%	9	45%	8	40%	12	60%	20
Brule River	5	6	11	4	5	9	32	100%	0	0%	20	63%	12	38%	9	28%	23	72%	32
Lower Shore	58	63	121	45	38	83	525	68%	244	32%	383	50%	386	50%	439	57%	330	43%	769
Upper Shore	47	52	99	35	32	67	231	98%	5	2%	144	61%	92	39%	90	38%	146	62%	236
Shorewide	105	115	220	80	70	150	756	75%	249	25%	527	52%	478	48%	529	53%	476	47%	1005

Table 2. Fishing pressure estimates (angler-hours ± 1 standard error [SE]) from the 2013 and 2015 early-spring Lake Superior creel survey (top), and the 2015 Lake Superior spring creel survey (bottom).

Early-Spring Creel Survey

Year	2013		2015	
Station	Lake Pressure	*(SE)*	Lake Pressure	*(SE)*
Lower Shore				
Lester River	360	*99*	97	*58*
McQuade/Talmadge	1,314	*249*	817	*212*
French River	2,250	*652*	1,037	*585*
Blue Bird Landing	--	--	39	*39*
Sucker River	216	*79*	78	*78*
Stoney Point	--	--	39	*39*
Knife River	0	*0*	--	--
Two Harbors Breakwall	--	--	195	*89*
Total	4,140	*709*	2,302	*638*

Spring Creel Survey

Station	Stream Pressure	*(SE)*	Lake Pressure	*(SE)*	Total Pressure	*(SE)*
Lower Shore						
Lester River	3,306	*424*	393	*143*	3,699	*447*
McQuade/Talmadge	315	*97*	1,344	*344*	1,659	*357*
French River	0	*0*	2,409	*528*	2,409	*528*
Sucker River	2,145	*307*	120	*57*	2,265	*313*
Knife River	1,629	*374*	0	*0*	1,629	*374*
Stewart River	1,473	*272*	180	*150*	1,653	*311*
Silver Creek	577	*163*	0	*0*	577	*163*
Gooseberry River	532	*164*	0	*0*	532	*164*
Split Rock River	1,048	*218*	169	*113*	1,217	*245*
Upper Shore						
Beaver River	418	*135*	55	*55*	473	*146*
Baptism River	1,173	*342*	0	*0*	1,173	*342*
Cross River	338	*120*	0	*0*	338	*120*
Temperance River	338	*131*	21	*21*	359	*132*
Poplar River	357	*144*	0	*0*	357	*144*
Cascade River	438	*142*	0	*0*	438	*142*
Devil Track River	1,355	*270*	0	*0*	1,355	*270*
Kadunce Creek	448	*114*	0	*0*	448	*114*
Brule River	539	*151*	0	*0*	539	*151*
Lower Shore	11,026	*773*	4,615	*676*	15,641	*1,027*
Upper Shore	5,402	*563*	77	*59*	5,479	*566*
Shorewide	16,428	*956*	4,692	*678*	21,120	*1,172*

Table 3. Catch and catch-rates of Rainbow Trout and Coho Salmon by station in the 2015 Lake Superior early-spring creel survey.

Early-Spring Creel Survey

		Unclipped Steelhead						Clipped Rainbow Trout (Kamloops)						Coho Salmon			
		Catch			Rate			Catch			Rate			Catch		Rate	
Station		All	≥16 inches	(SE)	All	≥16 inches	(SE)	All	≥16 inches	(SE)	All	≥16 inches	(SE)	All	(SE)	All	(SE)
Lester	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
River	Released	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
	Total	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
McQuade	Harvested	0	0	0	0.000	0.000	0.000	17	17	21	0.021	0.021	0.026	0	0	0.000	0.000
Harbor	Released	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
	Total	0	0	0	0.000	0.000	0.000	17	17	21	0.021	0.021	0.026	0	0	0.000	0.000
French	Harvested	0	0	0	0.000	0.000	0.000	14	14	8	0.013	0.013	0.003	0	0	0.000	0.000
River	Released	7	7	6	0.007	0.007	0.004	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
	Total	7	7	6	0.007	0.007	0.004	14	14	8	0.013	0.013	0.003	0	0	0.000	0.000
Sucker	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
River	Released	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
	Total	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
Knife	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
River	Released	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
	Total	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
Blue Bird	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
Landing	Released	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
	Total	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
Stoney	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
Point	Released	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
	Total	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
Two Harbors	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	19	19	0.098	0.115
Breakwall	Released	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
	Total	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000	19	19	0.098	0.115
Lower Shore	Harvested	0	0	0	0.000	0.000	0.000	31	31	22	0.015	0.015	0.012	19	19	0.009	0.003
Total	Released	7	7	6	0.003	0.003	0.003	0	0	0	0.000	0.000	0.000	0	0	0.000	0.000
	Total	7	7	6	0.003	0.003	0.003	31	31	22	0.015	0.015	0.012	19	19	0.009	0.003

Table 4. Fishing pressure estimates (angler-hours) from the annual Lake Superior spring creel survey by year.

Spring Creel Survey

Station	Year												Mean	Range
Lower Shore	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	1992-2014	1992-2014
Lester River	6,830	7,415	5,312	5,105	5,315	10,476	9,892	6,644	4,928	3,588	2,580	3,699	6,095	2,580 - 10,476
McQuade/Talmadge	--	--	--	--	--	--	1,399	2,996	3,938	2,407	1,340	1,659	2,416	1,340 - 3,938
French River	3,480	3,535	2,112	4,610	2,456	6,068	6,505	3,206	3,015	3,544	3,080	2,409	4,170	2,112 - 8,544
Sucker River	7,960	6,845	7,066	3,385	3,823	6,376	6,824	4,620	6,008	3,566	2,880	2,265	5,654	2,880 - 12,990
Knife River	4,150	4,255	2,887	2,635	2,508	6,253	4,885	3,565	3,308	1,903	1,540	1,629	3,025	1,225 - 6,253
Stew art River	2,050	5,031	3,134	2,808	3,991	3,957	4,079	5,782	1,557	1,885	1,280	1,653	2,382	720 - 5,782
Silver Creek	1,112	968	880	1,299	1,256	1,230	930	1,996	818	131	312	577	879	131 - 1,996
Gooseberry River	1,538	1,860	887	886	493	1,728	1,418	1,994	1,076	325	257	532	1,016	257 - 2,475
Split Rock River	2,490	3,041	2,798	3,956	1,973	2,050	3,212	5,400	2,087	1,940	1,200	1,217	2,212	1,145 - 5,400
Upper Shore														
Beaver River	549	619	466	594	362	481	776	824	820	304	233	473	640	233 - 1,159
Baptism River	1,734	1,990	2,198	1,046	1,506	1,198	3,570	2,771	2,662	866	630	1,173	1,384	448 - 3,570
Cross River	135	203	260	151	432	444	559	900	383	525	339	338	283	53 - 900
Temperance River	371	195	181	198	472	651	434	488	170	630	83	359	349	77 - 788
Poplar River	424	173	338	548	580	291	439	888	383	420	330	357	504	168 - 1,347
Cascade River	339	194	455	774	767	346	675	488	905	296	309	438	514	194 - 939
Devil Track River	698	372	242	1,089	818	447	1,264	1,050	1,163	857	677	1,355	561	75 - 1,264
Kadunce Creek	236	258	228	79	502	581	259	746	500	642	770	448	422	79 - 1,365
Brule River	617	806	560	557	796	800	1,059	1,283	1,206	963	767	539	764	207 - 1,505
Lower Shore	29,610	32,950	25,075	24,684	21,816	38,137	39,142	36,203	26,735	19,289	14,469	15,641	25,691	14,469 - 39,994
Upper Shore	5,103	4,810	4,927	5,036	6,235	5,238	9,035	9,438	8,192	5,503	4,138	5,479	5,405	3,046 - 9,438
Shorewide	34,713	37,760	30,003	29,719	28,051	43,375	48,177	45,641	34,927	24,792	18,607	21,120	31,112	18,607 - 48,177

Table 5. The estimated number of anglers (± 95% confidence limits) that participated in the Lake Superior spring anadromous fishery by year.

Spring Creel Survey		
Year	Angler Estimate	95% CI
1996	832	393 - 1,336
1997	1,269	764 - 1,775
1998	1,463	756 - 2,170
1999	1,587	1,051 - 2,122
2000	1,454	775 - 2,601
2001	1,069	494 - 1,725
2002	833	416 - 1,329
2003	1,218	468 - 1,968
2004	1,752	923 - 2,712
2005	2,133	1,122 - 3,145
2006	1,794	703 - 2,885
2007	2,073	840 - 3,744
2008	1,664	757 - 2,571
2009	1,923	1,106 - 2,741
2010	2,070	1,112 - 3,080
2011	2,243	1,379 - 3,107
2012	1,698	1,078 - 2,318
2013	1,325	769-1,882
2014	1,459	948-1,970
2015	1,744	872 - 2,616
Mean	1,580	836 - 2,390

Table 6. Catch estimates for Rainbow Trout (≥16 inches) from the Lake Superior spring creel survey by year.

Spring Creel Survey															
		Year												Mean	Range
	Area	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	1992-2014	1992-2014
Unclipped	Lower Shore	1,589	2,071	2,742	2,588	2,822	4,391	5,587	3,733	1,967	2,527	823	2,463	1,797	203 - 5,587
steelhead	Upper Shore	774	803	1,018	921	1,298	583	1,597	2,021	1,302	1,076	612	1,126	771	105 - 2,021
	Shorewide	2,363	2,874	3,761	3,509	4,119	4,974	7,184	5,754	3,269	3,603	1,435	3,588	2,568	403 - 7,184
Clipped	Lower Shore	4,377	4,735	1,783	1,627	937	2,726	2,039	2,326	1,358	1,543	734	709	2,323	784 - 4,873
Rainbow	Upper Shore	161	248	78	114	218	46	143	342	193	114	0	39	162	24 - 653
Trout	Shorewide	4,538	4,983	1,861	1,741	1,155	2,773	2,181	2,668	1,551	1,657	734	749	2,485	905 - 5,108
All	Lower Shore	5,966	6,806	4,526	4,215	3,759	7,117	7,626	6,059	3,325	4,070	1,557	3,172	4,120	1,207 - 7,626
Rainbow	Upper Shore	935	1,051	1,096	1,035	1,516	629	1,740	2,363	1,495	1,190	612	1,165	933	143 - 2,363
Trout	Shorewide	6,901	7,857	5,622	5,249	5,274	7,747	9,365	8,422	4,820	5,260	2,169	4,337	5,053	1,584 - 9,365

Table 7. Rainbow Trout catch and catch-rate estimates by station in the 2015 Lake Superior spring creel survey.

		Unclipped Steelhead						Clipped Rainbow Trout (Kamloops)					
		Catch			Catch-rate			Catch			Catch-rate		
			≥16			≥16			≥16			≥16	
Station		All	inches	(SE)	All	inches	(SE)	All	inches	(SE)	All	inches	(SE)
Lester	Harvested	0	0	0	0.000	0.000	0.000	56	56	29	0.015	0.015	0.020
River	Released	718	706	180	0.194	0.191	0.381	103	103	45	0.028	0.028	0.005
	Total	718	706	180	0.194	0.191	0.060	103	103	45	0.028	0.028	0.022
McQuade	Harvested	0	0	0	0.000	0.000	0.000	61	61	30	0.036	0.036	0.041
Harbor	Released	15	15	16	0.009	0.009	0.011	58	49	38	0.035	0.029	0.033
	Total	15	15	16	0.009	0.009	0.011	119	109	49	0.071	0.066	0.052
French	Harvested	0	0	0	0.000	0.000	0.000	190	190	59	0.079	0.079	0.012
River	Released	27	27	15	0.011	0.011	0.007	256	231	78	0.106	0.096	0.012
	Total	27	27	15	0.011	0.011	0.007	256	231	78	0.106	0.096	0.021
Sucker	Harvested	0	0	0	0.000	0.000	0.000	117	117	44	0.052	0.052	0.022
River	Released	471	471	258	0.208	0.208	0.057	25	25	19	0.011	0.011	0.005
	Total	471	471	258	0.208	0.208	0.057	142	142	48	0.063	0.063	0.017
Knife	Harvested	0	0	0	0.000	0.000	0.000	8	8	10	0.005	0.005	0.008
River	Released	559	559	259	0.343	0.343	0.178	24	24	17	0.015	0.015	0.011
	Total	559	559	259	0.343	0.343	0.178	32	32	20	0.020	0.020	0.011
Stew art	Harvested	21	21	15	0.012	0.012	0.010	48	48	34	0.029	0.029	0.021
River	Released	265	265	103	0.161	0.161	0.061	0	0	0	0.000	0.000	0.000
	Total	286	286	106	0.173	0.173	0.063	48	48	34	0.029	0.029	0.021
Silver	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
Creek	Released	31	31	20	0.054	0.054	0.037	0	0	0	0.000	0.000	0.000
	Total	31	31	20	0.054	0.054	0.037	0	0	0	0.000	0.000	0.000
Gooseberry	Harvested	15	15	17	0.027	0.027	0.035	15	15	16	0.027	0.027	0.029
River	Released	152	146	61	0.286	0.275	0.143	0	0	0	0.000	0.000	0.000
	Total	167	161	62	0.313	0.302	0.150	15	15	16	0.027	0.027	0.029
Split Rock	Harvested	0	0	0	0.000	0.000	0.000	29	29	18	0.024	0.024	0.017
River	Released	207	207	87	0.170	0.170	0.083	0	0	0	0.000	0.000	0.000
	Total	207	207	87	0.170	0.170	0.083	29	29	18	0.024	0.024	0.017
Low er Shore	Harvested	35	35	23	0.002	0.002	0.001	523	523	95	0.033	0.033	0.006
Total	Released	2,446	2,428	434	0.156	0.155	0.030	467	432	101	0.030	0.028	0.007
	Total	2,481	2,463	435	0.159	0.157	0.030	744	709	122	0.048	0.045	0.008

Table 7. (Continued)

		Unclipped Steelhead						Clipped Rainbow Trout (Kamloops)					
		Catch			Catch-rate			Catch			Catch-rate		
			≥16			≥16			≥16			≥16	
Station		All	inches	(SE)	All	inches	(SE)	All	inches	(SE)	All	inches	(SE)
Beaver	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
River	Released	54	54	41	0.115	0.115	0.116	0	0	0	0.000	0.000	0.000
	Total	54	54	41	0.115	0.115	0.116	0	0	0	0.000	0.000	0.000
Baptism	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
River	Released	361	344	166	0.308	0.294	0.165	0	0	0	0.000	0.000	0.000
	Total	361	344	166	0.308	0.294	0.165	0	0	0	0.000	0.000	0.000
Cross	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
River	Released	28	28	22	0.082	0.082	0.071	0	0	0	0.000	0.000	0.000
	Total	28	28	22	0.082	0.082	0.071	0	0	0	0.000	0.000	0.000
Temperance	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
River	Released	0	0	0	0.000	0.000	0.000	27	27	29	0.074	0.074	0.089
	Total	0	0	0	0.000	0.000	0.000	27	27	29	0.074	0.074	0.089
Poplar	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
River	Released	36	36	28	0.101	0.101	0.087	0	0	0	0.000	0.000	0.000
	Total	36	36	28	0.101	0.101	0.087	0	0	0	0.000	0.000	0.000
Cascade	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
River	Released	182	134	59	0.417	0.307	0.097	0	0	0	0.000	0.000	0.000
	Total	182	134	59	0.417	0.307	0.097	0	0	0	0.000	0.000	0.000
Devil Track	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
River	Released	559	357	135	0.413	0.263	0.065	13	13	16	0.010	0.010	0.011
	Total	559	357	135	0.413	0.263	0.065	13	13	16	0.010	0.010	0.011
Kadunce	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
Creek	Released	155	85	46	0.347	0.190	0.116	0	0	0	0.000	0.000	0.000
	Total	155	85	46	0.347	0.190	0.116	0	0	0	0.000	0.000	0.000
Brule	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
River	Released	142	87	42	0.264	0.162	0.136	0	0	0	0.000	0.000	0.000
	Total	142	87	42	0.264	0.162	0.136	0	0	0	0.000	0.000	0.000
Upper Shore	Harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
Total	Released	1,517	1,126	236	0.277	0.205	0.048	39	39	33	0.007	0.007	0.006
	Total	1,517	1,126	236	0.277	0.205	0.048	39	39	33	0.007	0.007	0.006
Shorew ide	Harvested	35	35	23	0.002	0.002	0.001	523	523	95	0.025	0.025	0.005
Total	Released	3,963	3,553	495	0.188	0.168	0.025	506	472	106	0.024	0.022	0.005
	Total	3,998	3,588	495	0.189	0.170	0.025	783	749	126	0.037	0.035	0.006

Table 8. Size distribution of Rainbow Trout caught in the 2015 Lake Superior spring creel survey that were above and below the legal size limit for Rainbow Trout (16 inches).

Spring Creel Survey

Length Group	Less than 16 inches		16 inches or greater	
Category	Number	Percent of Total	Number	Percent of Total
Unclipped Steelhead	410	10%	3,588	90%
Clipped Rainbow Trout (Kamloops)	34	4%	749	96%
All Rainbow Trout	444	9%	4,337	91%

Table 9. Catch-rates (fish per angler-hour) for Rainbow Trout in the Lake Superior spring creel survey by year.

Spring Creel Survey

		Year												Mean	Range
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	1992-2014	1992-2014
Unclipped steelhead	Lower Shore	0.054	0.063	0.109	0.105	0.129	0.115	0.143	0.103	0.074	0.131	0.057	0.157	0.070	0.010 - 0.143
	Upper Shore	0.152	0.167	0.207	0.183	0.208	0.111	0.177	0.214	0.159	0.196	0.148	0.205	0.143	0.031 - 0.214
	Shorewide	0.068	0.076	0.125	0.118	0.147	0.115	0.149	0.126	0.094	0.145	0.077	0.170	0.083	0.020 - 0.149
Clipped Rainbow Trout	Lower Shore	0.148	0.144	0.071	0.066	0.043	0.071	0.052	0.064	0.051	0.080	0.051	0.045	0.092	0.043 - 0.187
	Upper Shore	0.032	0.052	0.016	0.023	0.035	0.009	0.016	0.036	0.024	0.021	0.000	0.007	0.031	0.007 - 0.083
	Shorewide	0.131	0.132	0.062	0.059	0.041	0.064	0.045	0.058	0.044	0.067	0.039	0.035	0.082	0.040 - 0.170
All Rainbow Trout	Lower Shore	0.202	0.207	0.180	0.171	0.172	0.186	0.195	0.167	0.125	0.211	0.108	0.202	0.162	0.068 - 0.270
	Upper Shore	0.183	0.218	0.222	0.206	0.243	0.120	0.193	0.250	0.183	0.216	0.148	0.212	0.173	0.042 - 0.292
	Shorewide	0.199	0.208	0.187	0.177	0.188	0.179	0.194	0.184	0.138	0.212	0.117	0.205	0.164	0.070 - 0.262

Table 10. Catch and catch-rates (*± 1 standard error*) of Steelhead and clipped Rainbow Trout (Kamloops) ≥16 inches in streams and the lake in the 2015 Lake Superior spring creel survey.

Spring Creel Survey

	Unclipped Steelhead				Clipped Rainbow Trout (Kamloops)			
	Stream	*SE*	Lake	*SE*	Stream	*SE*	Lake	*SE*
Lower Shore								
Catch	2,222	*424*	241	*98*	400	*83*	309	*89*
Catch Rate (Fish/a-hour)	0.201	*0.041*	0.052	*0.023*	0.036	*0.008*	0.067	*0.022*
Upper Shore								
Catch	1,126	*236*	0	*0*	39	*33*	0	*0*
Catch Rate (Fish/a-hour)	0.208	*0.049*	0.000	*0.000*	0.007	*0.006*	0.000	*0.000*
Shorewide								
Catch	3,347	*486*	241	*98*	440	*90*	309	*89*
Catch Rate (Fish/a-hour)	0.204	*0.032*	0.051	*0.022*	0.027	*0.006*	0.066	*0.021*

Table 11. Yield, Average length (inches), average weight (pounds), and yield of selected species in the 2015 Lake Superior spring creel survey.

Spring Creel Survey

	Yield						Average Length (inches)						Average Weight (pounds)					
Species	Number Caught	*SE*	Number Harvested	*SE*	Pounds Harvested	*SE*	Harvested	*SE*	Released	*SE*	Total	*SE*	Harvested	SE	Released	*SE*	Total	*SE*
Brook Trout	412	*168*	0	--	0	--	0	--	10.9	*0.5*	10.9	*1*	0	--	1.0	*0.1*	1.0	*0.1*
Coho Salmon	120	*48*	82	*41*	131	*28*	17.5	*0.3*	14.4	*2.8*	16.8	*1*	1.6	0.1	1.1	*0.4*	1.5	*0.1*
Cisco (Lake Herring)	29	*27*	16	*16*	30	--	16.8	*0.4*	0	--	16.8	*0*	1.9	0.2	0.0	--	1.9	*0.2*
Kamloops Rainbow Trout (≥16")	749	*126*	523	*95*	2,563	*136*	24.1	*0.2*	23.3	*0.7*	23.9	*0*	4.9	0.1	4.6	*0.4*	4.8	*0.1*
Kamloops Rainbow Trout (<16")	35	*19*	0	--	0	--	0	--	13.8	*0.5*	13.8	*1*	0	--	0.9	*0.1*	0.9	*0.1*
Northern Pike	13	*13*	0	--	0	--	0	--	27	--	27	--	0	--	4.2	--	4.2	--
Unclipped Steelhead (≥16")	3,588	*495*	35	*23*	207	*77*	26.8	*0.4*	24.4	*0.1*	24.5	*0*	5.9	0.3	4.6	*0.1*	4.6	*0.1*
Unclipped Steelhead (<16")	410	*105*	0	--	0	--	0	--	8.8	*0.3*	8.8	*0*	0	--	0.2	*0*	0.2	*0.0*
Sucker species	389	*125*	49	*17*	103	*39*	16.7	*1.7*	16.7	*0.5*	16.7	*1*	2.1	0.7	2.1	*0.2*	2.1	*0.2*

Table 12. The estimated age distribution of Kamloops caught in the 2015 Lake Superior spring creel survey. Ages were assigned based on the age distribution of Kamloops captured in the French River trap in 2015.

Spring Creel Survey

Year-Class	Age in 2015	Number	% of Total Caught
2014	1	0	0%
2013	2	43	6%
2012	3	23	3%
2011	4	265	34%
2010	5	361	46%
2009	6	86	11%
2008	7	5	1%
2007	8	0	0%
Total		**783**	**100%**

Table 13. Catch and catch-rate estimates (± *1 standard error*) for Brook Trout, Coho Salmon, and Suckers in the 2015 Lake Superior spring creel survey.

Spring Creel Survey

			Brook Trout	*(SE)*	Coho Salmon	*(SE)*	Suckers	*(SE)*
Lower Shore	Catch	Harvested	0	*0*	82	*41*	27	*9*
		Released	26	*16*	100	*45*	113	*43*
		Total	**26**	***16***	**120**	***48***	**139**	***44***
	Catch Rate	Harvested	0.000	*0.000*	0.005	*0.003*	0.002	*0.001*
		Released	0.002	*0.001*	0.006	*0.003*	0.007	*0.003*
		Total	**0.002**	***0.001***	**0.008**	***0.003***	**0.009**	***0.003***
Upper Shore	Catch	Harvested	0	*0*	0	*0*	23	*14*
		Released	387	*168*	0	*0*	227	*116*
		Total	**387**	***168***	**0**	***0***	**250**	***117***
	Catch Rate	Harvested	0.000	*0.000*	0.000	*0.000*	0.004	*0.003*
		Released	0.071	*0.031*	0.000	*0.000*	0.041	*0.022*
		Total	**0.071**	***0.031***	**0.000**	***0.000***	**0.046**	***0.022***
Shorewide	Catch	Harvested	0	*0*	82	*41*	49	*17*
		Released	412	*168*	100	*45*	340	*124*
		Total	**412**	***168***	**120**	***48***	**389**	***125***
	Catch Rate	Harvested	0.000	*0.000*	0.004	*0.002*	0.002	*0.001*
		Released	0.020	*0.008*	0.005	*0.002*	0.016	*0.006*
		Total	**0.020**	***0.008***	**0.006**	***0.002***	**0.018**	***0.006***

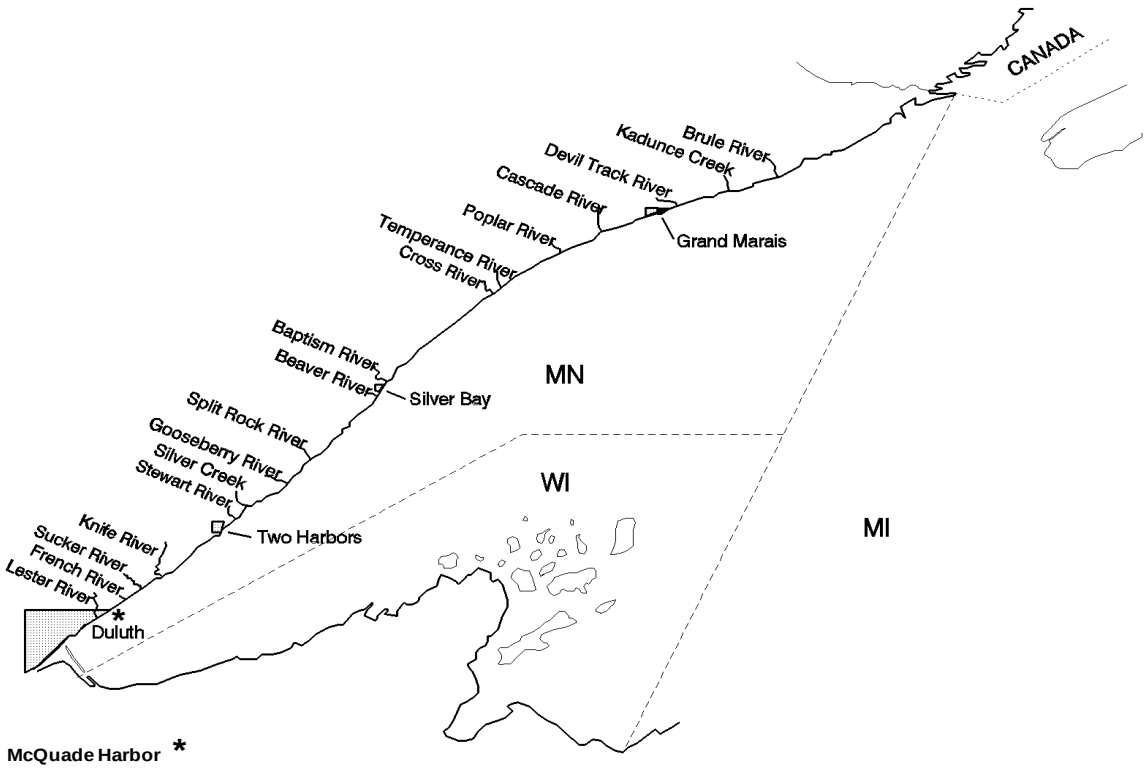

Figure 1. Sampling stations for the annual Lake Superior spring creel survey.

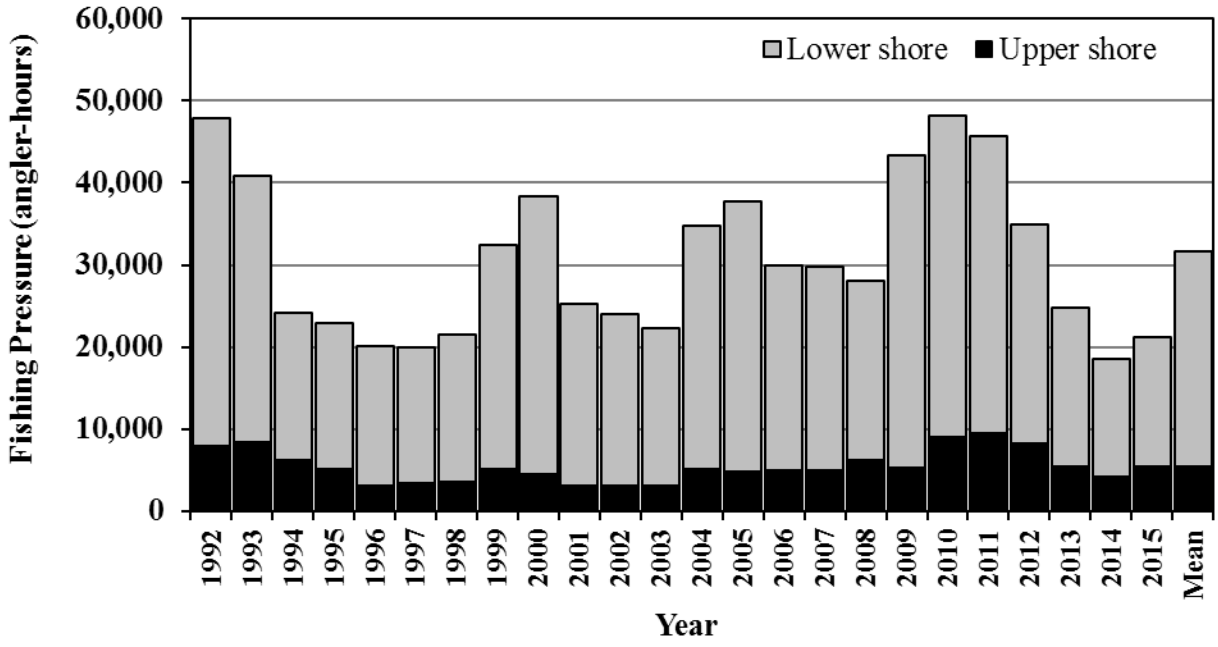

Figure 2. Fishing pressure (angler-hours) in the lower shore, upper shore, and shorewide from the Lake Superior spring creel survey by year. The historic average from 1994 to 2014 (Mean) is also provided.

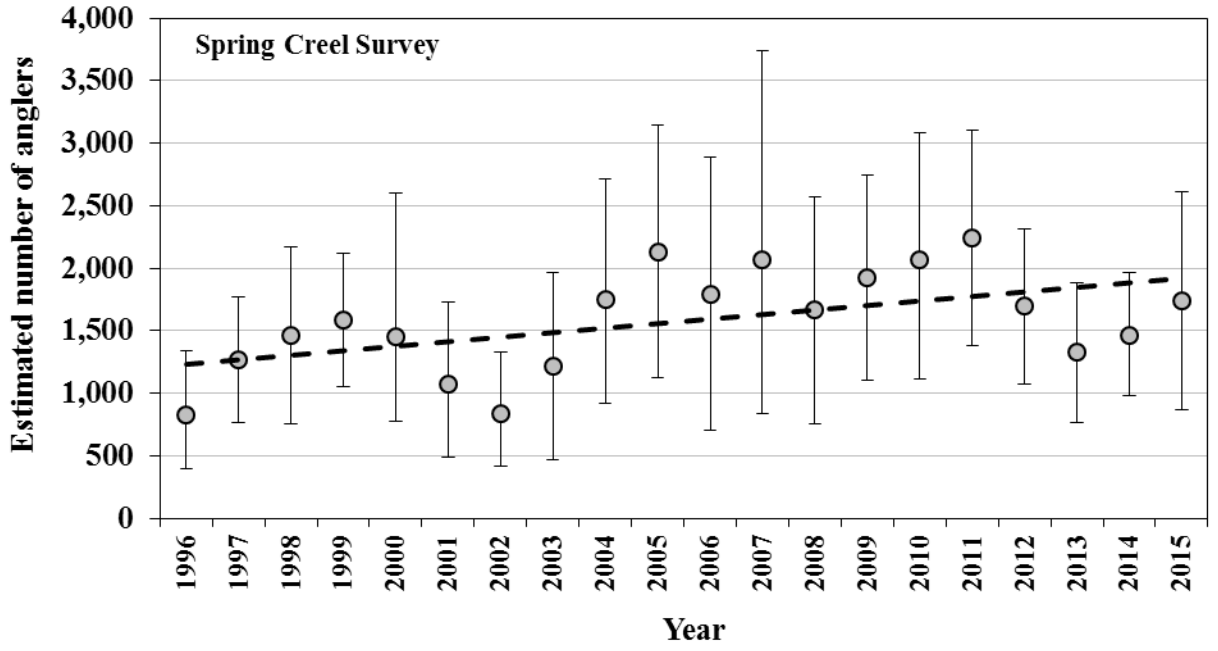

Figure 3. The estimated number of anglers that have participated in the Lake Superior spring fishery by year. The dashed line is a linear trendline of the estimated number of anglers for all years shown.

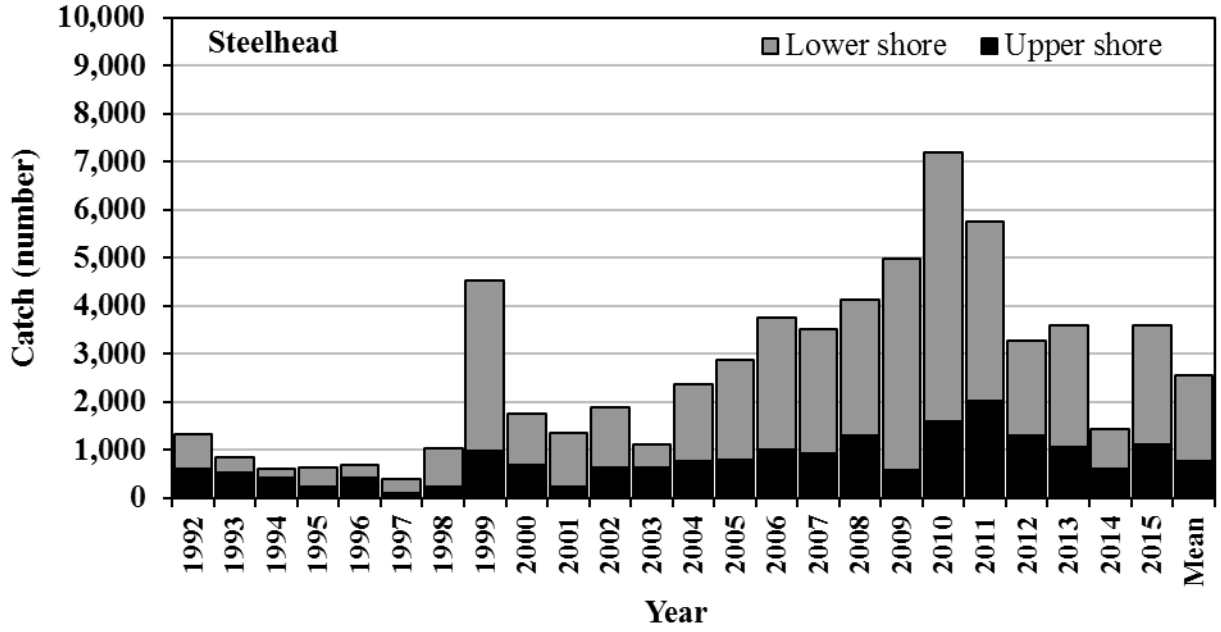

Figure 4. Catch of Steelhead ≥ 16 inches in the lower shore, upper shore, and shorewide from the Lake Superior spring creel survey by year. Mean represents the historic averages for each stratum from 1994 to 2015.

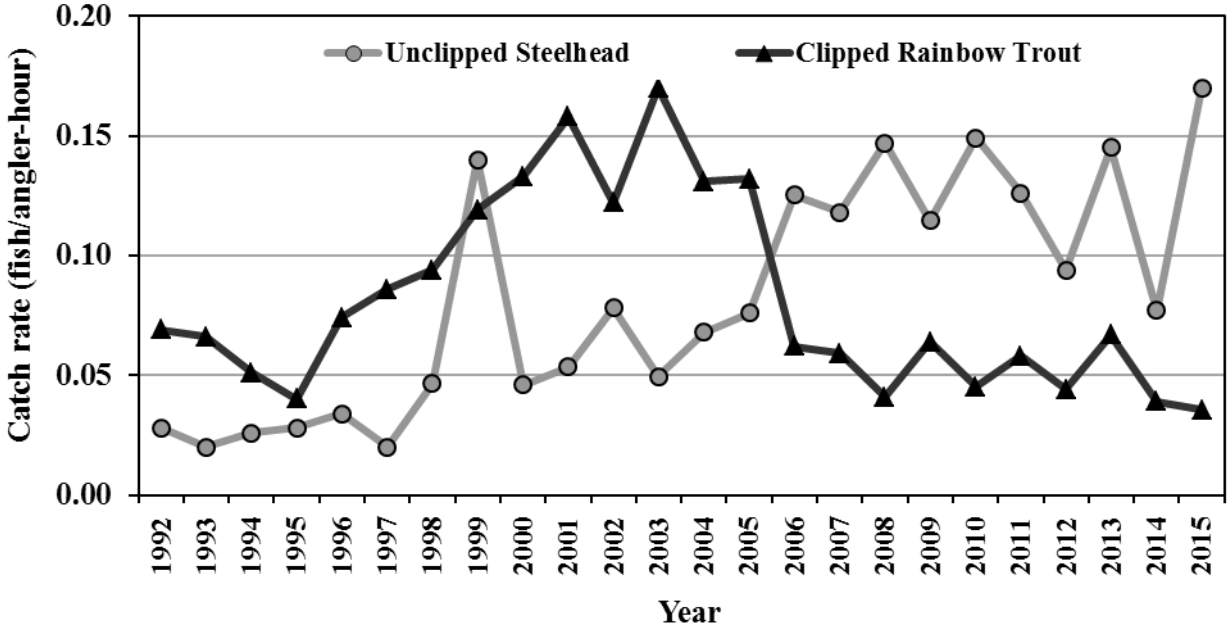

Figure 5. Shorewide catch-rate (fish per angler-hour) of Steelhead and clipped Rainbow Trout (Kamloops) ≥ 16 inches from the Lake Superior spring creel survey by year.

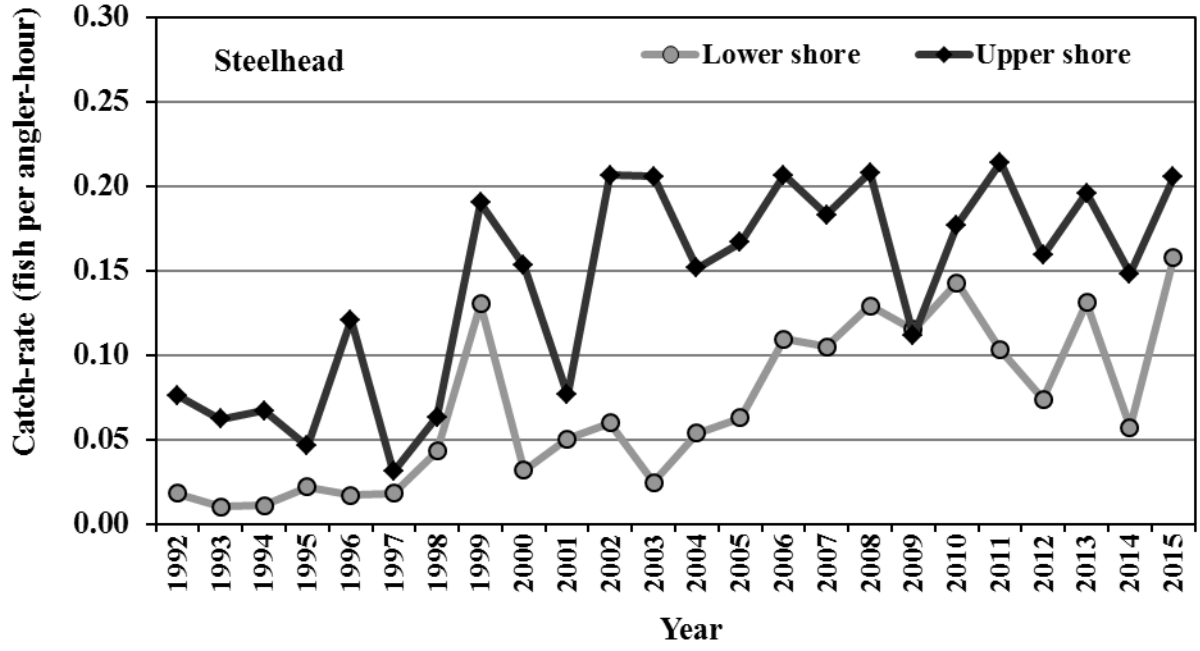

Figure 6. Catch rate (fish per angler-hour) of Steelhead (≥ 16 inches) from the Lake Superior spring creel survey by year.

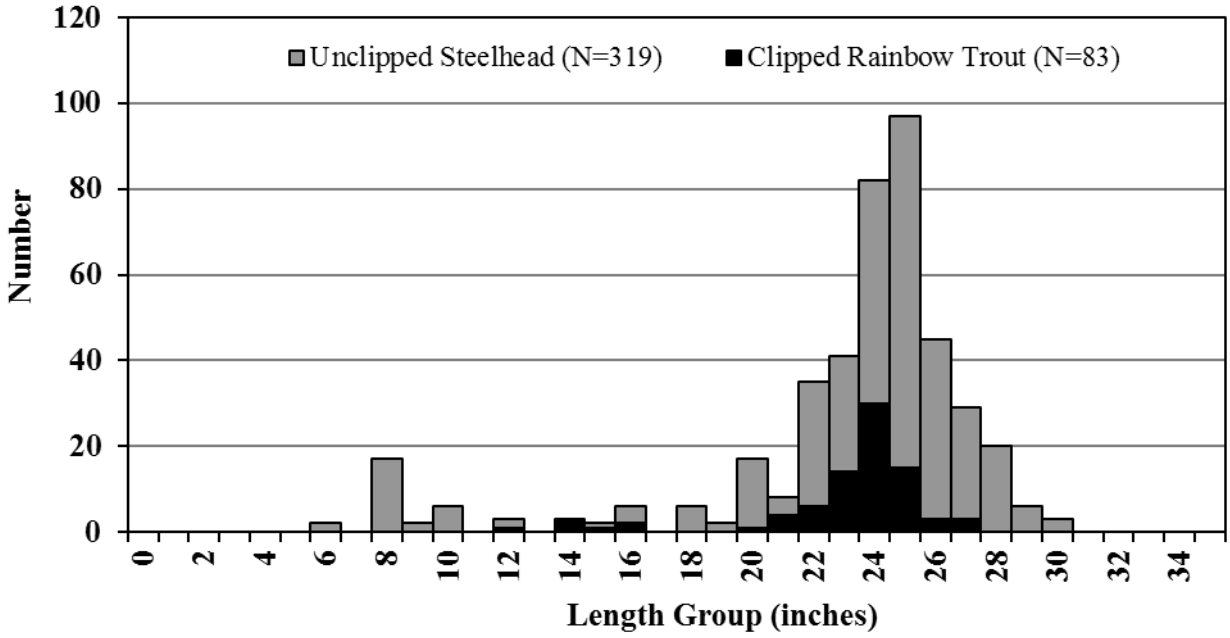

Figure 7. Number of Steelhead and clipped Rainbow Trout (Kamloops) caught by length group (inches) in the 2015 Lake Superior spring creel survey. The values shown include both measured and angler reported lengths.

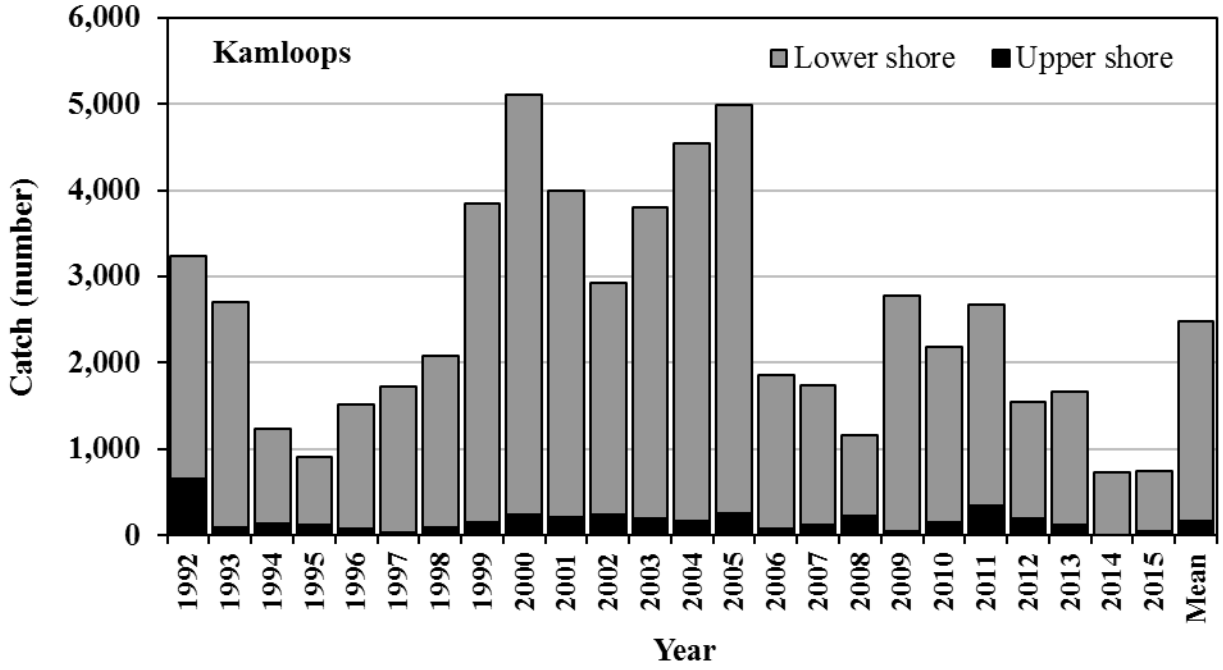

Figure 8. Catch of clipped Rainbow Trout (Kamloops) ≥ 16 inches in the lower shore, upper shore, and shorewide from the Lake Superior spring creel survey by year. Mean represents the historic averages for each stratum from 1994 to 2015.

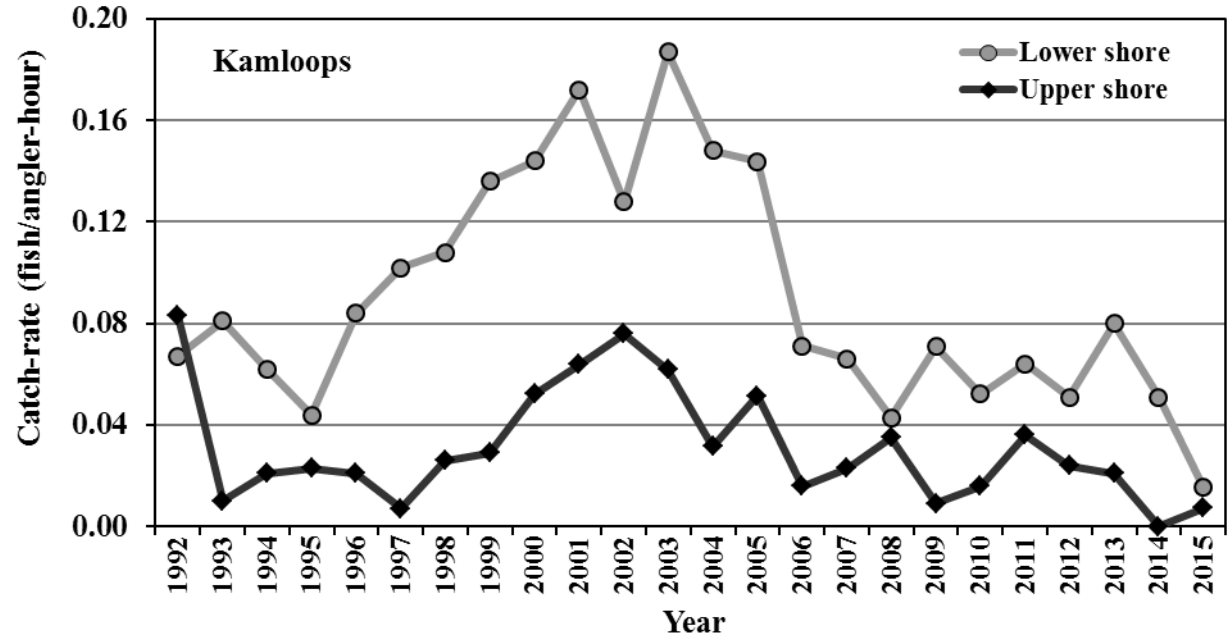

Figure 9. Catch rate (fish/angler-hour) of clipped Rainbow Trout (Kamloops) ≥ 16 inches from the Lake Superior spring creel survey by year.

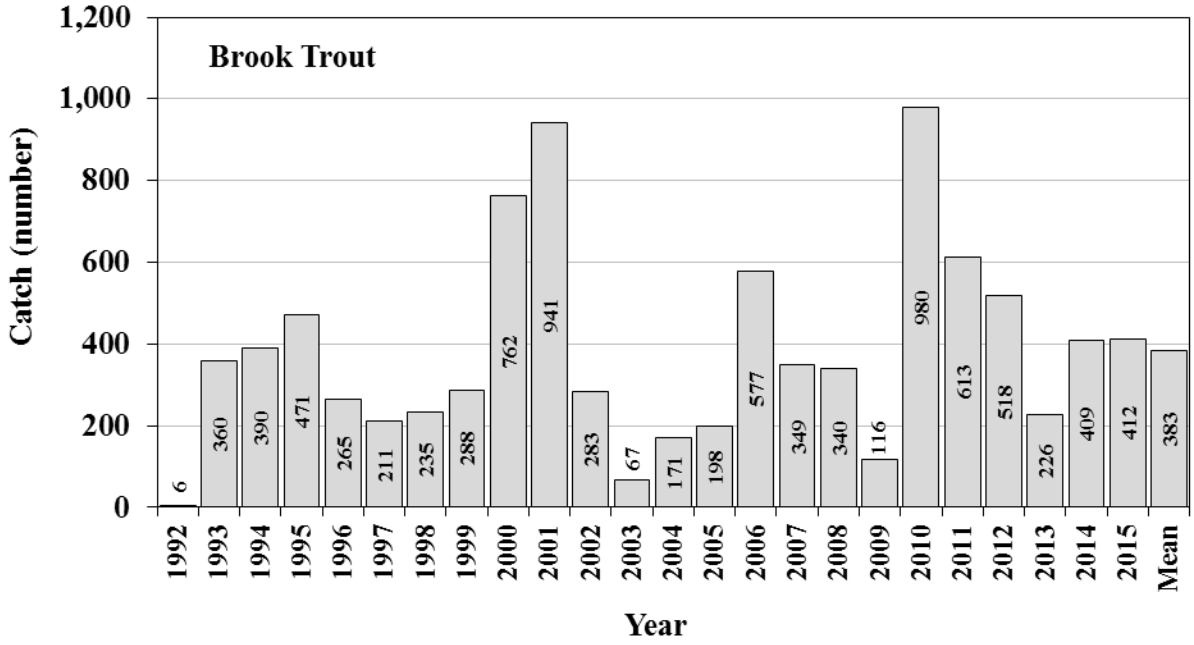

Figure 10. Brook Trout catch estimates from the Lake Superior spring creel survey by year. The historic mean from 1992 to 2015 (Mean) is also provided.