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MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISHERIES

COMPLETION REPORT: LAKE SUPERIOR

SPRING CREEL SURVEY

2014

Completed by:
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Abstract

Annual spring creel surveys called for in the *Rainbow Trout Chapter of the Fisheries Management Plan for the Minnesota Waters of Lake Superior* (Schreiner et al. 2006) are useful tools for examining long-term trends in fishing pressure, catch, and catch rates of Rainbow Trout. A stratified random creel survey has been conducted annually on 17 tributaries along the Minnesota shore since 1992 and at McQuade Safe Harbor/Talmadge River since 2010, typically from early April through late May. The estimated number of hours anglers fished for Rainbow Trout in 2014 (18,607) was 13,000 less than the long-term mean and the lowest in the past 23 years. The reduction in pressure was largely attributed to the late spring and frequent high water conditions. Rivers remained frozen much of April and rain events kept rivers running high most of the spring. Poor fishing reports among anglers may also have contributed to the reduction in pressure. Many anglers may have opted to skip fishing for Rainbow trout in North Shore streams or fished less due to these factors. The estimated catches of unclipped steelhead and clipped Rainbow Trout (Kamloops) 16 inches and greater were 1,435 and 734, respectively. The shorewide catch of unclipped steelhead was below the long-term average of 2,619 but within the interquartile range (1,048-3,721), while the catch of clipped Rainbow Trout was below the average of 2,644 and the poorest in the past 23 years. The 2014 shorewide catch rate for unclipped steelhead 16 inches and greater (0.077 fish/a-hr) was very similar to the long-term mean of 0.079 fish/a-hr, but only the second time in the past nine years it has been below 0.10 fish/a-hr. The catch rate for clipped Rainbow Trout (0.039 fish/a-hr) was the poorest in the past 23 years. Catch rates for both unclipped steelhead and clipped Rainbow Trout have remained fairly stable since 2006. It is possible that given the current prey base in Lake Superior, competition with other predators, and limited spawning and rearing habitat in streams, the abundance of unclipped steelhead may not increase as it did prior to 2006.

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Introduction

Several species of anadromous sport fish have been introduced into Lake Superior. Among these species, Rainbow Trout (*Oncorhynchus mykiss*) provide a popular sport fishery. The state of Minnesota manages two strains of Rainbow Trout in Lake Superior: steelhead, a naturalized strain derived of sea-run Rainbow Trout from the west coast, and Kamloops, a domesticated hatchery strain. Other west coast salmonids that have been introduced into Lake Superior include Chinook Salmon (*O. tshawytscha*), Coho Salmon (*O. kisutch*), and Pink Salmon (*O. gorbuscha*). These species are seldom caught in tributaries during the spring creel survey, but Coho Salmon are sometimes caught by shore anglers fishing in Lake Superior near river mouths. Brown Trout (*Salmo trutta*), native to Europe, have been stocked in some tributaries of Lake Superior, and occasionally contribute to the spring shore fishery. Brook Trout (*Salvelinus fontinalis*), native to Lake Superior, also contribute substantially at times to the spring fishery. Public interest in Brook Trout has increased as agencies around the lake examine protection and restoration strategies of Brook Trout populations (Newman et al. 2003; Schreiner et al. 2008). Lake Trout (*Salvelinus namaycush*), White Suckers (*Catostomus commersoni*), Longnose Suckers (*Catostomus catostomus*), and Round Whitefish (*Prosopium cylindraceum*) are also periodically caught at river mouths in the spring.

Annual spring creel surveys, called for in the Rainbow Trout Chapter in the *Fisheries Management Plan for the Minnesota Waters of Lake Superior* (Schreiner et al. 2006), are useful for examining long-term trends in fishing pressure, catch, and catch rates of Rainbow Trout. The spring creel survey was designed to target anglers fishing for naturalized and stocked Rainbow Trout that migrate up tributaries to spawn. Other species that contribute to the fishery are also recorded. Spring creel surveys were conducted in April and May from 1961 through 1967 by Hassinger et al. (1974) and in 1981 and 1982 by Close and Siesennop (1984). The Lake Superior Area Fisheries staff has conducted annual spring creel surveys 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. Therefore, 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 to be

conducted with two clerks, when three clerks were unavailable. Data within this report are summarized and compared from 1992 to present (23 years) based on the stratified random design used in the creel survey throughout this time period.

Methods

The Minnesota shore is divided into two geographic regions. Sampling stations are shown in Figure 1. The area from the Lester River to the Split Rock River is referred to as the lower shore and contains nine tributaries that are sampled, while the area from the Beaver River to the Brule River is referred to as the upper shore and also contains nine tributaries that are sampled. Estimates from the lower and upper shore are collectively referred to as shorewide estimates. Pressure, catch, and catch rate estimates are determined for individual tributaries and also summarized as lower shore, upper shore, and shorewide estimates. Anglers fishing in the tributaries are considered "stream" anglers and those fishing in Lake Superior near the tributary mouths are considered "lake" anglers.

The 2014 survey period was from April 22nd through June 4th. The spring creel survey begins once tributaries thaw and anglers can fish them. An experimental "Kamloops creel" was scheduled for the period prior to ice-out when shore anglers target Kamloops along the lower shore. However, frequently changing and/or unfishable conditions produced very sporadic angler presence, and because of this the additional creel survey was not conducted.

Separate estimates of catch and catch rate were made for Rainbow Trout 16 inches and greater, and Rainbow Trout less than 16 inches in order to isolate the influence of emigrating juvenile steelhead from the analyses. Unless otherwise specified in this report, estimates for Rainbow Trout are for fish 16 inches or greater in all tables and figures. References to a 'long-term' average in this report refer to the 1992-2013 time period. Interquartile ranges refer to numbers falling between the 25th and 75th percentiles, or "middle fifty".

In 2014 all clipped Rainbow Trout caught were Kamloops strain Rainbow Trout. 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 (no adipose fin clip) caught were steelhead produced in the wild or the result of fry stocking, but some

unclipped steelhead were produced in the hatchery and possess a maxillary clip that is difficult for anglers to identify. These fish were reported as unclipped steelhead by anglers. The greatest impact these maxillary clipped steelhead have on the catch and catch rate is at the Knife River which received all of the stocked (maxillary clipped) steelhead from 2003-2007. These stocked fish are becoming scarce due to their age and did not contribute significantly to the spring fishery.

The number of anglers that participate in the spring anadromous fishery on Lake Superior is estimated annually. Angler population estimates were determined on a daily basis with the cumulative number of 'new' anglers (not previously interviewed) and the cumulative number of 'recap' anglers (anglers previously interviewed) providing the data. The days each year in which either the creel was not conducted or no anglers were interviewed were removed from the analysis. The Schnabel modification of the Lincoln-Petersen estimator was used to calculate daily estimates of angler abundance and its variance. The estimates generally increase throughout the first half of the survey period, and then stabilize. The average of the last nine estimates with variances was used to calculate a final estimate and 95% confidence intervals. Extreme outliers were excluded from the final estimate calculation. Prior to 1996, the question "Have you previously been interviewed by a creel clerk this spring?" was not asked, so estimates could not be determined from 1992-1995.

Most fish lengths recorded by clerks were angler estimates because the steelhead fishery is catch-and-release by regulation and generally 25-40% of Kamloops are voluntarily released. No individual fish weights were obtained during the creel, but estimates were developed using regression relationships derived from Knife River adult trap data. All other methods are summarized in Ostazeski (2004).

Results

Sampling

A total of 977 interviews were conducted in 2014, with 819 on the lower shore and 158 on the upper shore (Table 1). There were 4.5% fewer interviews conducted in 2014 compared to 2013 (1,023 interviews). On the lower shore, the most anglers were interviewed at the Sucker River (180) while the least were interviewed at the Gooseberry River (14). On the upper shore, the most anglers were

interviewed at the Brule River (33) while the least were interviewed at the Temperance River (3). Shorewide, 72% of anglers fished in a tributary while 28% fished the lake. Anglers fishing the upper shore rarely fished the lake (8%) whereas 31% of interviewed lower shore anglers fished the lake. Fifty-eight percent of all anglers fished between 6:00 am and 1:30 pm, while 42% fished between 1:30 and 9:30 pm. Forty-seven percent fished weekdays and 53% fished weekends.

Fishing pressure

The total estimated shorewide angling pressure was 18,607 angler-hours (a-hrs), with 13,505 a-hrs in tributaries and 5,102 a-hrs in the lake (Table 2). The lower and upper shore pressure estimates were 14,469 a-hrs and 4,138 a-hrs. The pressure estimate in 2014 was the lowest pressure estimate in the past 23 years (Table 3, Figure 2). Pressure decreased by approximately 6,100 hours compared to 2013 and has trended downward since 2010 (Table 3). Total pressure was approximately 13,000 hours less than average (31,680 a-hrs), which represents a decrease of 41%. The percent decrease in fishing pressure was more pronounced along the lower shore, which experienced a 45% decrease in pressure compared to the long-term mean. The upper shore pressure estimate was 24% below the long-term mean. Lower shore stations received much more pressure (78%) when compared to the upper shore stations (22%), which is typical in the spring creel survey. Lower shore pressure ranged from 3,080 a-hrs at the French River to 312 a-hrs at Silver Creek. Kadunce Creek had the highest pressure among upper shore stations (770 a-hrs) while the Temperance River had the lowest (83 a-hrs). This was the only year Kadunce Creek has ever had the highest pressure estimate of upper shore stations.

Rainbow Trout catch

The estimated shorewide catch included 1,435 unclipped steelhead and 734 clipped Rainbow Trout for a total of 2,169 Rainbow Trout (Table 4). The shorewide unclipped steelhead catch of 1,425 fish was below the long-term average of 2,619 but within the interquartile range (1,048-3,721) (Figure 3). The lower shore unclipped steelhead catch of 823 was below the long-term average (1,841) but within the interquartile range (540-2,704), and the upper shore catch of 612 was also below the long-term average (778) but within the interquartile range (445-1,011). The shorewide clipped Rainbow Trout catch of 734

was nearly 2,000 fish below the average (2,644) and the poorest in the past 23 years (Figure 4). All Kamloops were caught along the lower shore. Catch estimates of Kamloops along the upper shore are generally low, but have not been zero in previous creel surveys.

On the lower shore, the highest catch of unclipped steelhead was at the Lester River (287), followed by the Knife River (215) and Silver Creek (90) (Table 5). On the upper shore, the highest catch of unclipped steelhead was at the Devil Track River (190), followed by the Baptism River (105), Kadunce Creek (88), and the Brule River (87). Shorewide, the highest catch of clipped Rainbow Trout was at the French River (373), followed by McQuade Harbor/Talmadge River (128) and the Lester River (108). Clipped Rainbow Trout were caught at seven of the eighteen creel stations.

Catch and release of small steelhead (<16 inches) occurred at twelve of the creel stations, which resulted in an estimated catch of 342 juvenile steelhead (Table 6). Juvenile steelhead generally emigrate downstream from late April through May and are often caught by anglers. An estimated zero sub-legal Kamloops (<16 inches) were caught during the 2014 spring creel survey. In some years Kamloops yearlings were stocked in the Lester River in mid-May and were, at times, caught in great numbers in the creel. In 2010 new stocking policies were enacted that resulted from fish in Lake Superior testing positive for Viral Hemorrhagic Septicemia (VHS). Since 2010, Kamloops stocking now occurs adjacent to the mouth of the Lester River in Lake Superior in summer when most anglers are done fishing for Rainbow Trout.

Rainbow Trout catch rates

The shorewide catch rate for all Rainbow Trout combined was 0.117 fish/a-hr (8.5 angling-hours per fish; Table 7) and the lowest since 1997. The unclipped steelhead catch rate was 0.057 fish/a-hr for the lower shore and 0.148 fish/a-hr for the upper shore (Figure 5). Both were within their respective interquartile ranges (lower shore 0.023-0.108; upper shore 0.076-0.195). The clipped Rainbow Trout catch rate was 0.051 fish/a-hr for the lower shore and 0.000 fish/a-hr for the upper shore (Figure 6). Both were below their respective interquartile ranges (lower shore 0.065-0.134; upper shore 0.021-0.048). Shorewide, the unclipped steelhead catch rate of 0.077 fish/a-hr (13.0 angling-hours per fish) was very similar to the long-term mean of 0.079 fish/a-hr and within the interquartile range (0.037-0.124). It was

only the second time in the past nine years that the unclipped steelhead catch rate was below 0.10 fish/a-hr (Figure 7). The catch rate for clipped Rainbow Trout (0.039 fish/a-hr, 25.6 angling-hours per fish) was the poorest in the past 23 years.

The unclipped steelhead catch rate was highest on the lower shore at Silver Creek (0.288 fish/a-hr), followed by the Knife River (0.140 fish/a-hr) and the Lester River (0.111 fish/a-hr) (Table 5). On the upper shore, the highest catch rates for unclipped steelhead were at the Devil Track River (0.281 fish/a-hr), Temperance River (0.217 fish/a-hr) and the Poplar River (0.188 fish/a-hr). The clipped Rainbow Trout catch rate was highest at the French River (0.121 fish/a-hr), followed by McQuade Harbor/Talmadge River (0.096 fish/a-hr), and the Lester River (0.042 fish/a-hr).

Length, weight, age, and yield data

Most unclipped and clipped Rainbow Trout caught ranged from 20-25 inches (Figure 8). The estimated average length and weight of unclipped steelhead was 22.6 inches and 4.0 pounds (Table 8). Clipped Rainbow Trout averaged 23.6 inches and 4.9 pounds. The majority of clipped Rainbow Trout caught were age-4 (66%; Table 9). An estimated 611 clipped Rainbow Trout totaling 2,994 pounds were harvested during the 2014 spring creel (Table 8). Of all legal sized clipped Rainbow Trout caught in 2014, 83% were harvested, which was the highest percentage harvested in any year of the spring creel survey.

Rainbow Trout catch rates in streams versus lake

The term “lake” refers to Lake Superior waters near tributary mouths and includes McQuade Harbor. On a shorewide basis, the unclipped steelhead catch rate in tributaries (0.100 fish/a-hr) was only 5.9 times higher than in the lake (0.017 fish/a-hr) (Table 10). It took 10.0 hours to catch an unclipped steelhead in a tributary compared to 58.8 hours in Lake Superior. In recent years the difference between the catch rates in tributaries versus the lake was much greater than in 2014. The clipped Rainbow Trout catch rate in tributaries was 0.016 fish/a-hr while in the lake it was 0.101 fish/a-hr. Therefore, it took a staggering 62.5 hours to catch a clipped Rainbow Trout in a tributary compared to 9.9 hours in the lake.

Estimated number of anglers

An estimated 1,459 anglers participated in the spring fishery in 2014 (Table 11, Figure 9). The number of unique angler interviews was 656, which was the same as in 2013 and the fewest since 2003. The number of anglers participating in the spring fishery showed an increasing trend from 2002 through 2011, but has dropped the past few years.

Rainbow Trout are by far the most sought after species in the spring. Steelhead and Kamloops were the primary target species in 55% and 36% of interviews, respectively. Other primary species included "trout" (2.7%), no particular species (2.6%), Coho Salmon (2.4%), and several others at <1.0%. Twenty-five percent of anglers listed steelhead as their secondary target species and 51% listed Kamloops as their secondary species. Other secondary species included Coho Salmon (12.0%), Brook Trout (5.9%), and numerous others at <2.0%.

Other species

Numbers for other species observed are generally too small to produce reliable station estimates. Lower, upper, and shorewide estimates of catch and catch rate were determined for these species (Table 12). After Rainbow Trout, Suckers (Longnose and White) were the most frequently caught species with 428 caught shorewide (Table 12). Brook Trout are commonly caught during the spring creel and have been caught in all surveys conducted in the past 23 years. An estimated 409 Brook Trout were caught during the survey, with an average length of 9.0 inches and a range of 5 to 16 inches (Table 8, Figure 10). Regulations require release of all Brook Trout less than 20 inches in length below posted tributary boundaries and in Lake Superior. No illegally harvested Brook Trout were observed by the creel clerks this year. An estimated 72 Coho Salmon were caught in 2014, with an average length and weight of 14.6 inches and 1.2 pounds. Coho Salmon were caught at McQuade Harbor/Talmadge River, the French River, and the Split Rock River.

Discussion

Fishing Pressure

The estimated 18,607 a-hrs of fishing pressure in 2014 was the lowest in the past 23 years and

represents a decrease in pressure by 41% compared to the long-term mean. The decrease in fishing pressure is likely attributable to several factors. Similar to 2013, the winter of 2014 was long and spring arrived late. The creel survey did not begin until April 22nd, which is second only to 2013 for the latest starting date for the survey. April is generally considered the prime month for Rainbow Trout angling in tributaries, and anglers simply could not fish them. Ice covered tributaries for much of the month, and once they did thaw, rivers remained at high-flow conditions for much of the remaining spring. Duluth received 130 inches of snow in the winter of 2013/14, which provided substantial run-off as it melted. Additionally, rain events kept rivers flowing at levels that were not conducive to fishing. With a late start and frequently unfavorable stream conditions, many anglers may have chosen to not partake in fishing for Rainbow Trout along the North Shore.

Though anecdotal, anglers, even experienced ones, reported frustrating outings with few hook-ups. As word of the adverse conditions and reported lack of fish spread among anglers, some may have decided to quit fishing or not even fish at all. Just as word of a hot bite may spur anglers into action, poor reports may keep some people from participating, resulting in fewer angler-hours of pressure.

Unclipped steelhead

Although the shorewide and lower shore catch rates for unclipped steelhead were lower than in recent years, the shorewide, lower, and upper shore catch rates for unclipped steelhead have all remained above the level of 0.02 fish/a-hr since 1998, which is considered poor fishing in the 1996 *Fisheries Management Plan for the Minnesota Waters of Lake Superior* (Schreiner et. al 1996). The upper shore catch rate has remained above 0.10 fish/a-hr since 2002, while the lower shore and shorewide catch rates have been above 0.10 fish/a-hr for seven of the past nine years. The modest catch rates for unclipped steelhead in 2014 were somewhat of a surprise considering they were excellent in the spring of 2013, despite a similarly late and cold spring. The low catch of unclipped steelhead was the product of the modest catch rate and very low pressure estimate. It is difficult to determine if the fish were present but very hard to catch because of the frequent high-water conditions, or absent due to environmental conditions that either reduced steelhead numbers or kept them from ascending rivers to spawn.

The shorewide catch rate of unclipped steelhead displayed an increasing trend from the late 90's until 2006, which suggests the population was increasing and/or fish were being caught multiple times. Since 2006, the catch rate has been relatively stable, displaying neither an increasing nor decreasing trend. It is quite possible that given the current available forage base in Lake Superior, abundance of other predators, and general lack of suitable spawning and rearing habitat in rivers, a substantial increase in the steelhead stock may not occur beyond what has been achieved in the past few decades.

The catch-and-release regulation for unclipped steelhead has been in effect since August 1997. Compliance was good in 2014 and no illegally harvested steelhead or freshly clipped adipose fins were observed by creel census clerks. Anglers continue to have strong opinions on the catch-and-release regulation, and will have their opportunity to express their thoughts on the matter in the winter/spring of 2015 during the revision of the *Fisheries Management Plan for the Minnesota Waters of Lake Superior.*

Clipped Rainbow Trout

The stocking location of Kamloops explains much of the catch distribution of Kamloops in the spring creel. The Lester and French rivers and the McQuade Harbor/Talmadge River area are the only locations stocked with Kamloops in an effort to reduce potential negative impacts of Kamloops spawning with unclipped steelhead (Miller et al. 2004; Schreiner et al. 2006; Page et al. 2011). Because Kamloops are stocked only along the lower shore, the catch and catch rate for the lower shore are expected to be relatively high for clipped Rainbow Trout, but in 2014 both were not. The estimated catch of 734 clipped Rainbow Trout and catch rate of 0.039 fish/a-hr were the poorest in the past 23 years. However, the low catch was due partially to the lack of fishing pressure and not just the catch rate, because the catch rate was fairly similar to the catch rates observed from 2006 through 2013. The catch rate of clipped Rainbow Trout has displayed a similar pattern as unclipped steelhead, remaining fairly steady with neither a marked increase nor decrease since 2006. As with unclipped steelhead, environmental conditions may have also negatively impacted the success of Kamloops anglers in 2014. Interestingly, there were anecdotal reports of anglers catching Kamloops into early July, which is remarkably late, and demonstrates just how unusual the spring of 2014 was.

It should be noted that the spring creel survey does not capture the fishing pressure for Kamloops

near river mouths prior to ice-out. A late winter/early spring creel targeting shore anglers was planned for 2014, but was not conducted because of very sporadic angler presence in the most popular shore fishing areas. A late winter/early spring creel would be beneficial to better determine the extent of fishing pressure, catch, and catch rate of Kamloops prior to ice-out. A winter creel has not been conducted since 2001.

Many Kamloops anglers are convinced that the poor success in 2014 was the result of the shift in a portion of the production of Kamloops from the French River Cold Water Hatchery (FRCWH) to the Spire Valley Hatchery (SVH), which began with the 2010 year-class. Kamloops produced at SVH are smaller when stocked compared to fish reared at FRCWH, and a larger stocking size has been shown to have a positive influence on return rates of Kamloops (Negus et. al 2012). However, a single year-class from the production shift has yet to fully recruit to the fishery, so the effects of this change cannot yet be assessed. Other factors beyond the size of stocked fish play a role in survival of Kamloops, including predation, forage availability, water temperature, and other conditions in the lake. Bioenergetics modeling has shown that Lake Superior is near its predatory species carrying capacity, especially in nearshore waters where Kamloops reside (Negus et al. 2008). Furthermore, stable isotope analyses suggest that Kamloops include a higher percentage of fish in their diet than previously estimated (Negus and Hoffman 2013), and there may be increased competition for this prey source with the other salmonid predators than in the past.

Other species

Brook Trout were the most commonly caught salmonid behind Rainbow Trout. No illegal harvest of Brook Trout was observed by the creel census clerks in 2014. Coaster Brook Trout rehabilitation is a management priority and regulation compliance is essential for this to occur.

Few Coho Salmon were caught in 2014. Coho Salmon are a short-lived species, so fluctuations in their abundance are to be expected. After steelhead and Kamloops, Coho Salmon was the most common species targeted by anglers, indicating it is a desirable species for anglers who are fishing the lake. All Coho Salmon are naturally reproduced wild fish and this shows that Coho Salmon stocking is not necessary to produce a successful fishery.

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2014

Completed by:
Josh Blankenheim

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Area Supervisor Date

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Regional Fisheries Approval Date

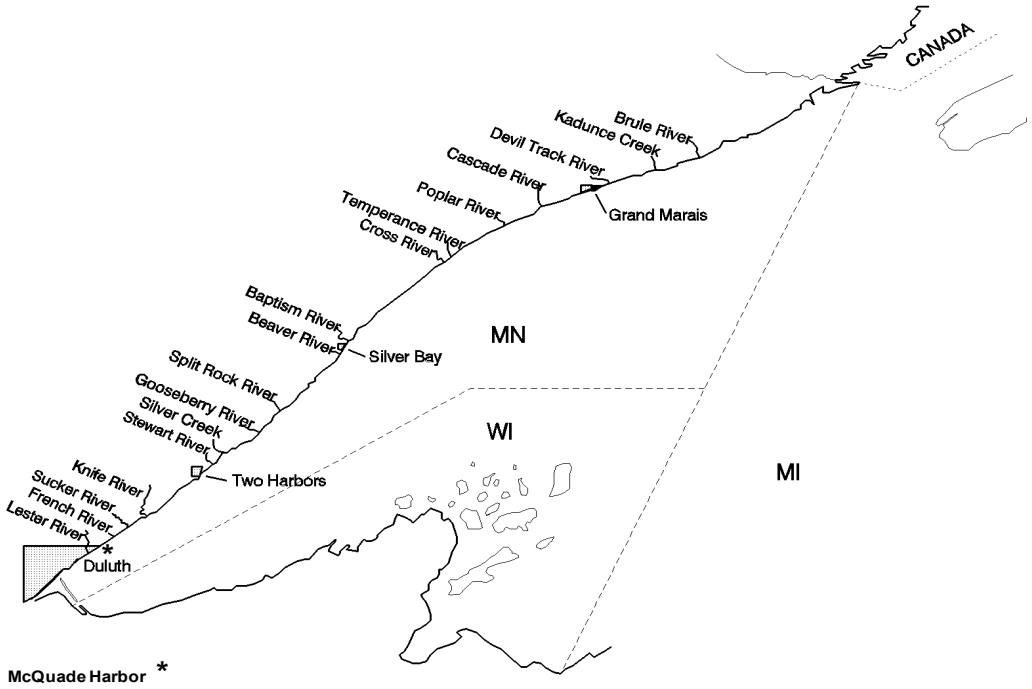

Figure 1. Map of sampling stations for the 2014 Lake Superior spring creel survey.

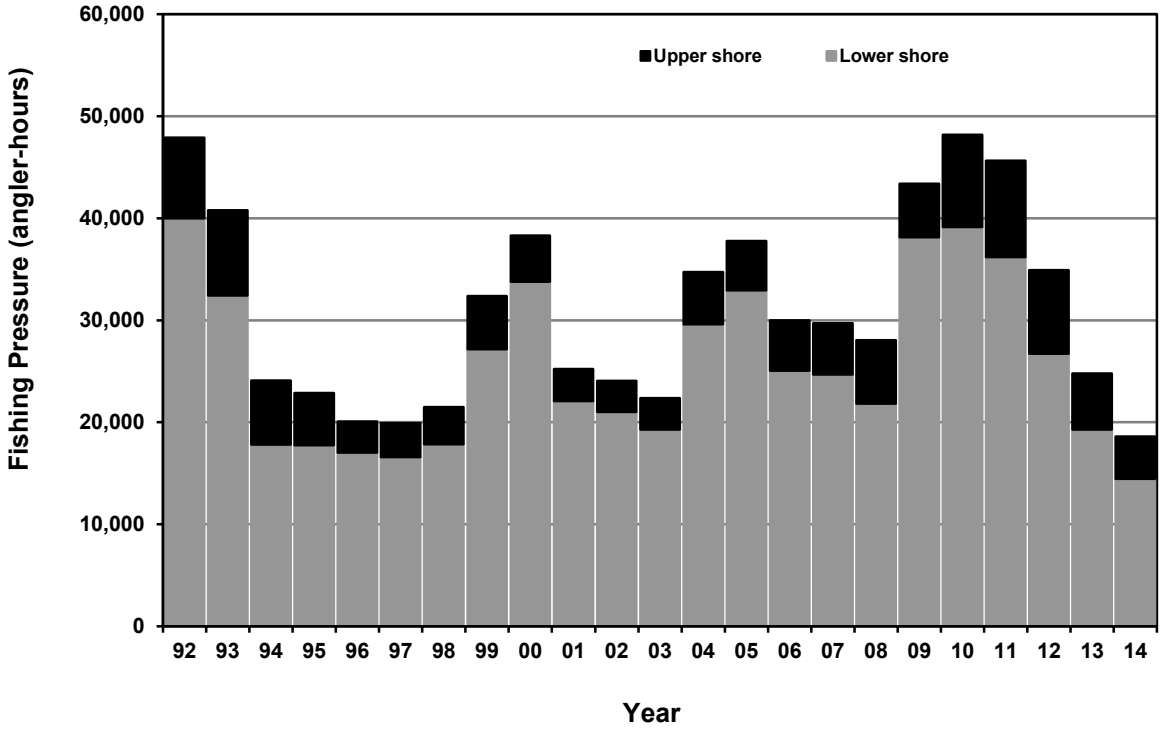

Figure 2. Shorewide, lower shore, and upper shore fishing pressure (angler-hours) from the Lake Superior spring creel survey, 1992-2014.

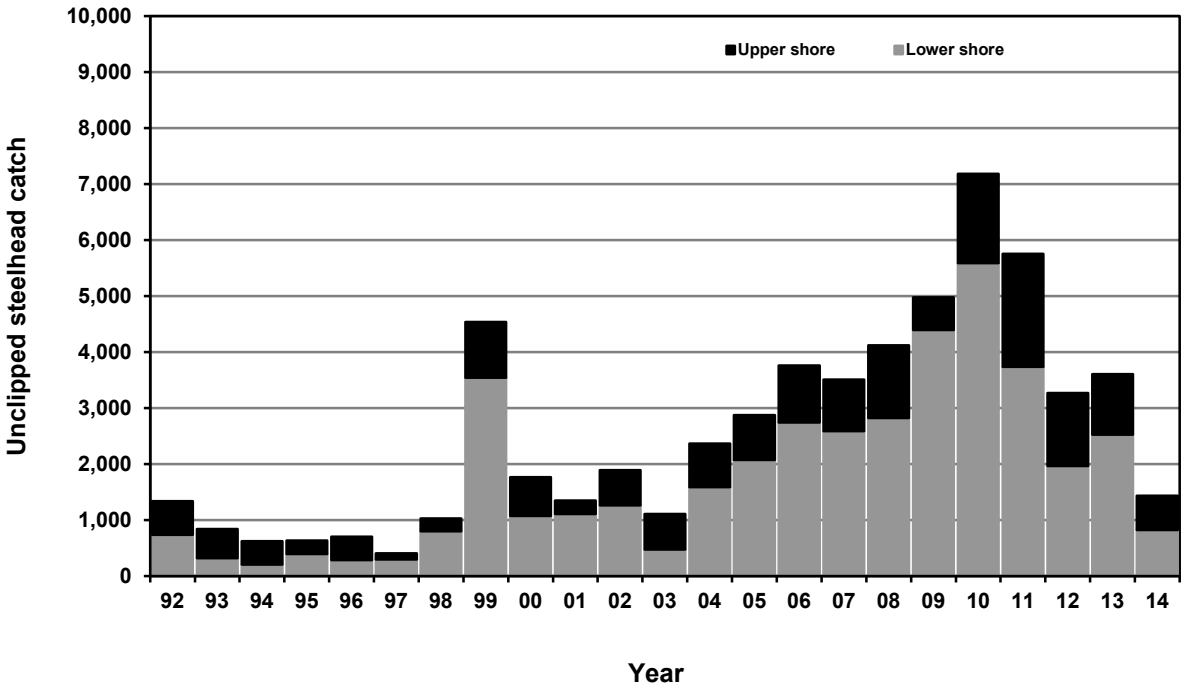

Figure 3. Shorewide, lower shore, and upper shore catch of unclipped steelhead ≥16" from the Lake Superior spring creel survey, 1992-2014.

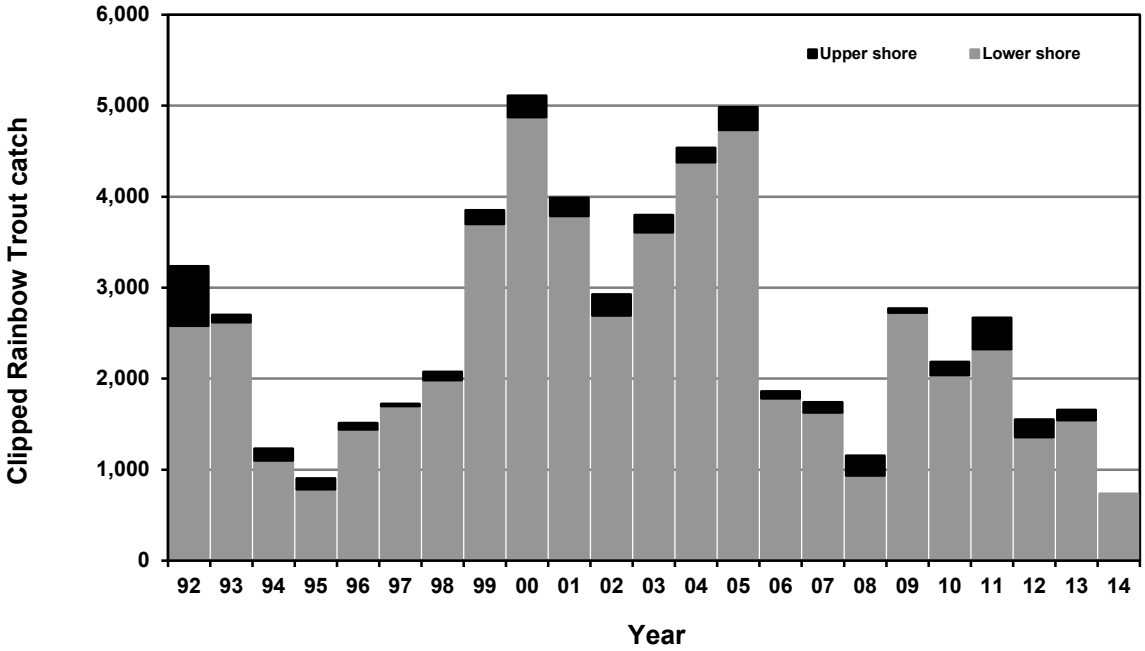

Figure 4. Shorewide, lower shore, and upper shore catch of clipped Rainbow Trout ≥16" from the Lake Superior spring creel survey, 1992-2014.

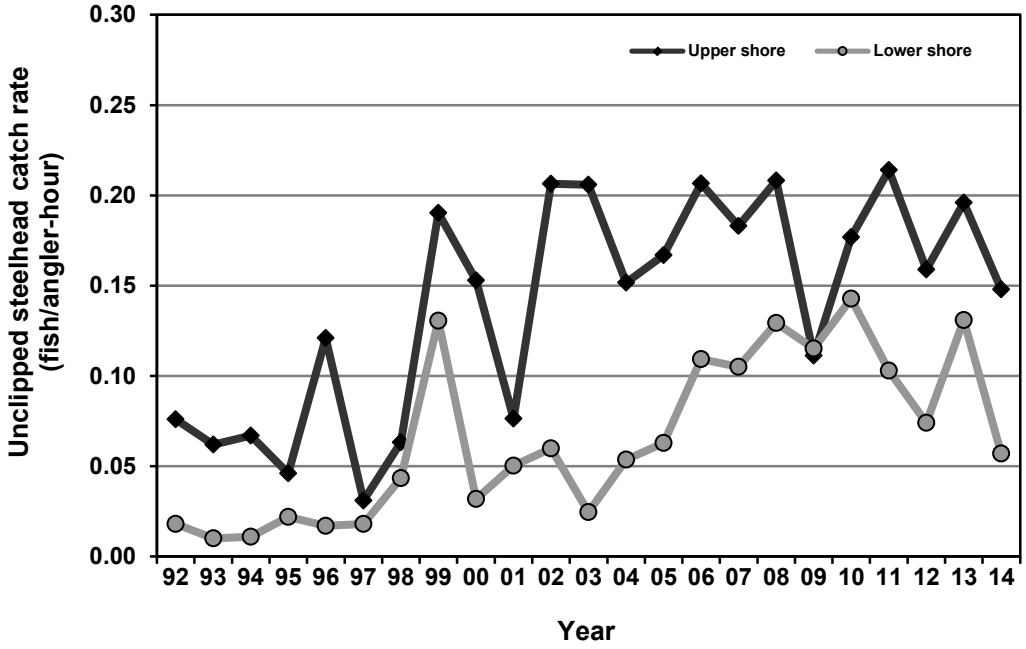

Figure 5. Lower shore and upper shore catch rate (fish/angler-hour) of unclipped steelhead ≥16" from the Lake Superior spring creel survey, 1992-2014.

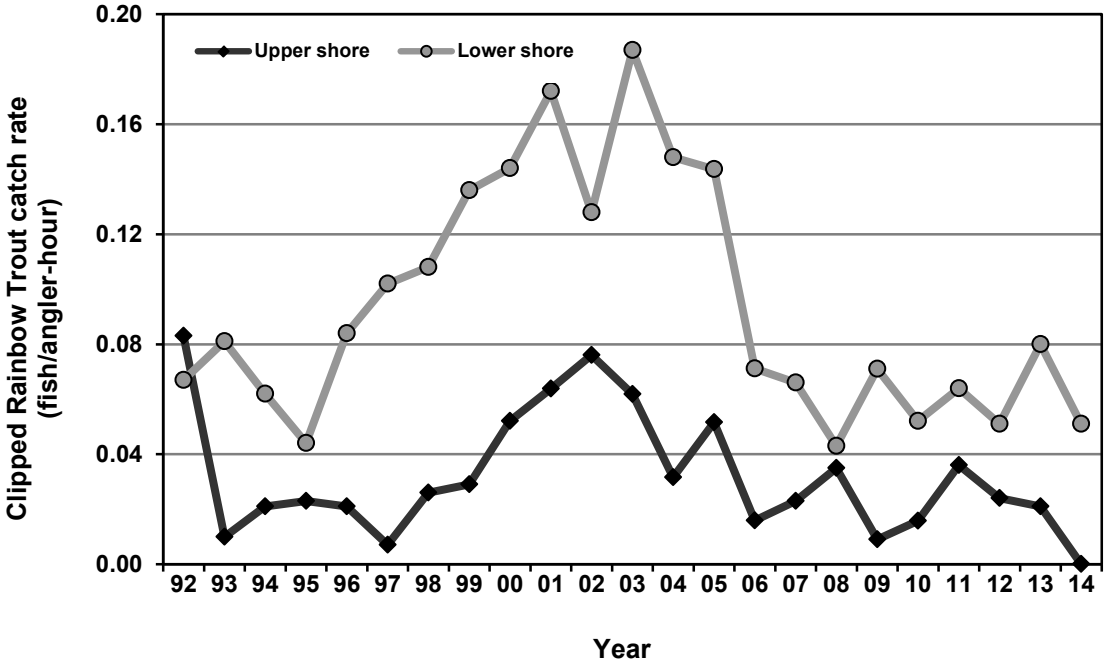

Figure 6. Lower shore and upper shore catch rate (fish/angler-hour) of clipped Rainbow Trout ≥16" from the Lake Superior spring creel survey, 1992-2014.

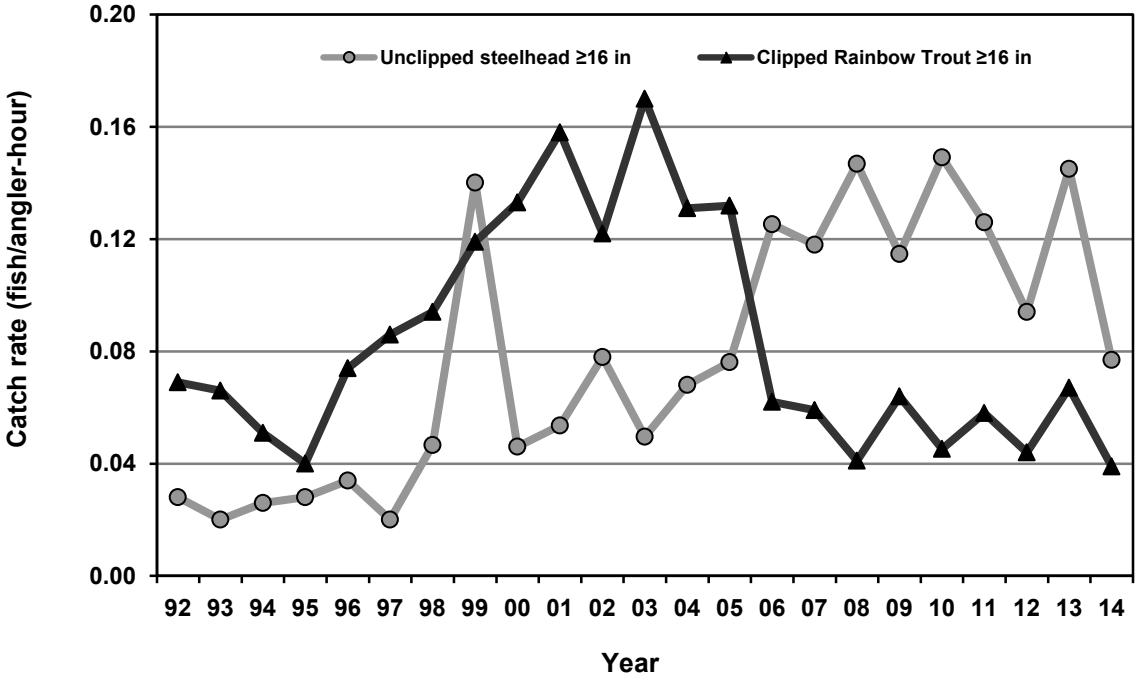

Figure 7. Shorewide catch rate (fish/angler-hour) of unclipped steelhead and clipped Rainbow Trout ≥16" from the Lake Superior spring creel survey, 1992-2014.

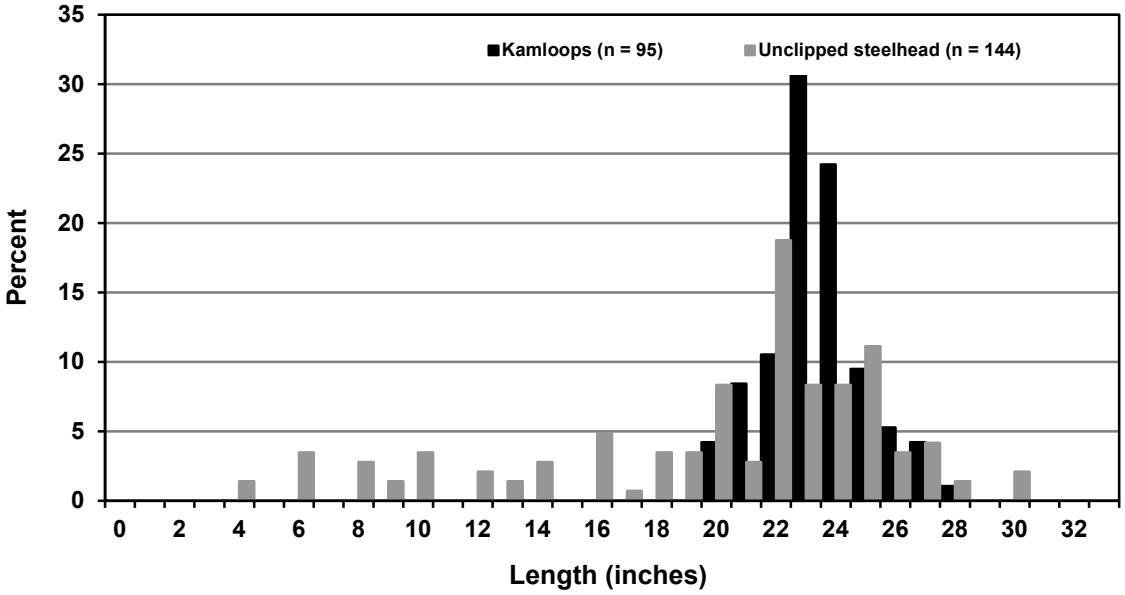

Figure 8. Length frequency of unclipped steelhead and clipped Rainbow Trout (Kamloops) in the 2014 Lake Superior spring creel survey. These include both measured and angler reported lengths.

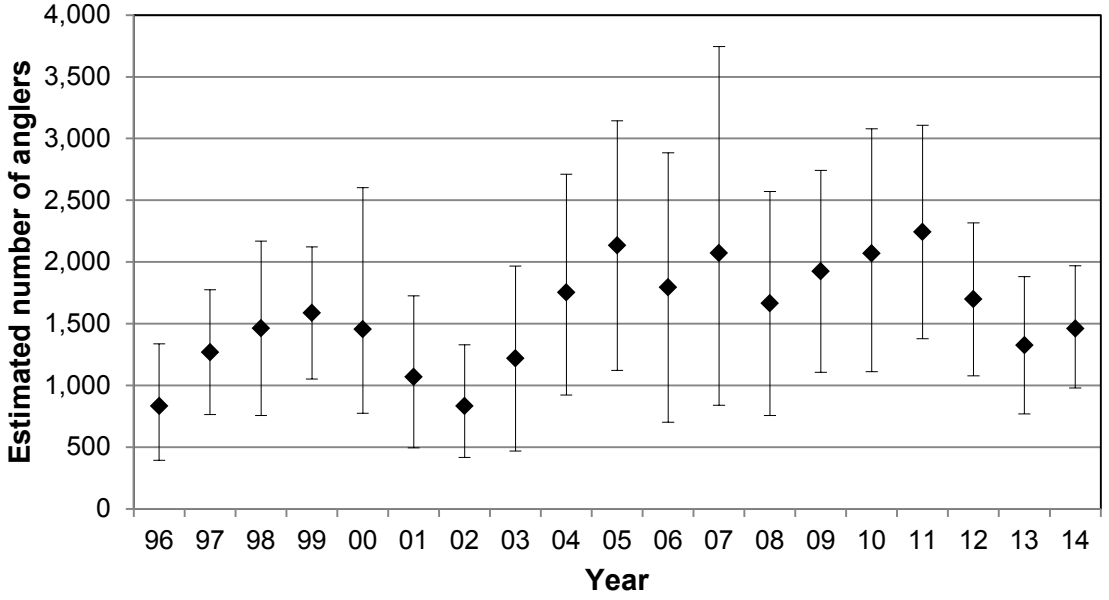

Figure 9. The estimated number of anglers that have participated in the spring anadromous fishery, 1996-2014.

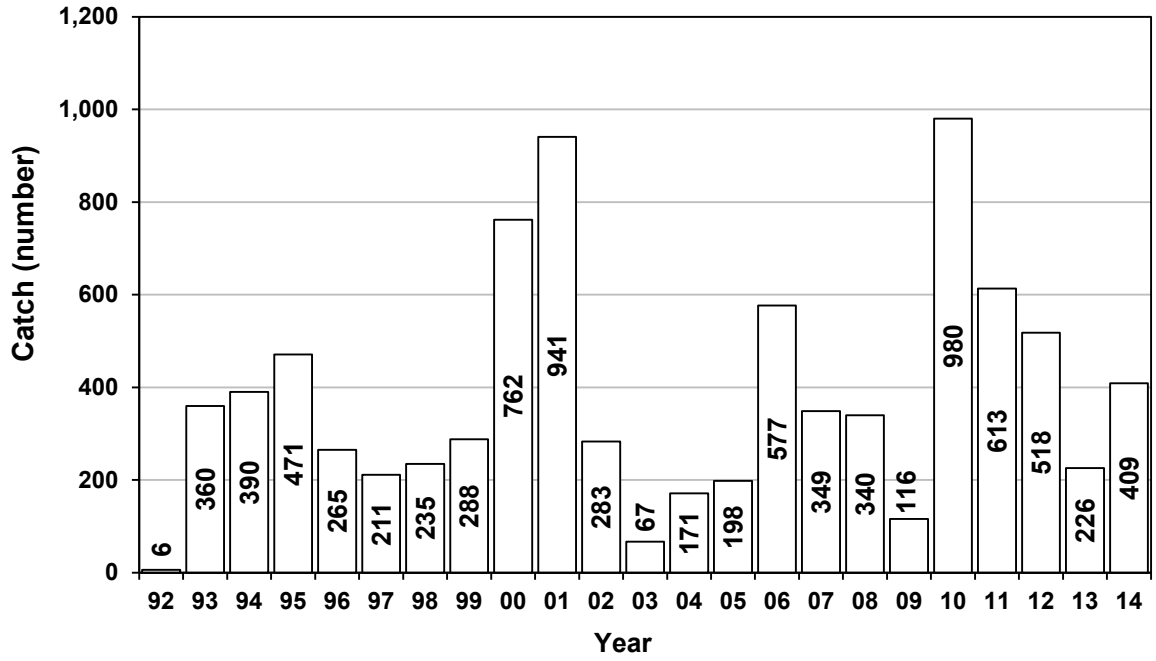

Figure 10. Brook Trout catch estimates from the Lake Superior spring creel survey, 1992-2014.

Table 1. Number of visits and interviews at each station for each day type, time period type, and angler type, 2014 Lake Superior spring creel survey.

Station	Weekdays			Weekends			Interviews												
	Number of visits			Number of visits			Angler type				Time period type				Day type				Total
							Stream		Lake		Early		Late		Weekdays		Weekends		
	Early	Late	Total	Early	Late	Total	N	%	N	%	N	%	N	%	N	%	N	%	
Lower Shore																			
Lester River	7	9	16	5	6	11	119	85%	21	15%	72	51%	68	49%	85	61%	55	39%	140
McQuade/Talmadge	7	9	16	6	5	11	17	27%	46	73%	36	57%	27	43%	32	51%	31	49%	63
French River	8	8	16	6	5	11	0	0%	173	100%	113	65%	60	35%	86	50%	87	50%	173
Sucker River	8	8	16	6	5	11	171	95%	9	5%	108	60%	72	40%	87	48%	93	52%	180
Knife River	8	8	16	6	5	11	99	100%	0	0%	75	76%	24	24%	50	51%	49	49%	99
Stewart River	5	5	10	3	5	8	71	96%	3	4%	29	39%	45	61%	33	45%	41	55%	74
Silver Creek	4	3	7	3	5	8	21	100%	0	0%	14	67%	7	33%	7	33%	14	67%	21
Gooseberry River	3	5	8	3	3	6	14	100%	0	0%	8	57%	6	43%	5	36%	9	64%	14
Split Rock River	3	4	7	4	4	8	50	91%	5	9%	33	60%	22	40%	29	53%	26	47%	55
Upper Shore																			
Beaver River	5	5	10	3	4	7	8	80%	2	20%	10	100%	0	0%	1	10%	9	90%	10
Baptism River	5	3	8	4	4	8	28	100%	0	0%	14	50%	14	50%	12	43%	16	57%	28
Cross River	5	7	12	3	4	7	10	77%	3	23%	7	54%	6	46%	0	0%	13	100%	13
Temperance River	6	5	11	4	3	7	3	100%	0	0%	0	0%	3	100%	2	67%	1	33%	3
Poplar River	4	4	8	5	2	7	7	78%	2	22%	6	67%	3	33%	2	22%	7	78%	9
Cascade River	4	4	8	4	4	8	10	77%	3	23%	8	62%	5	38%	3	23%	10	77%	13
Devil Track River	5	6	11	4	4	8	21	95%	1	5%	9	41%	13	59%	5	23%	17	77%	22
Kadunce Creek	6	4	10	5	3	8	25	93%	2	7%	14	52%	13	48%	13	48%	14	52%	27
Brule River	5	5	10	5	5	10	33	100%	0	0%	11	33%	22	67%	12	36%	21	64%	33
Lower Shore	53	59	112	42	43	85	562	69%	257	31%	488	60%	331	40%	414	51%	405	49%	819
Upper Shore	45	43	88	37	33	70	145	92%	13	8%	79	50%	79	50%	50	32%	108	68%	158
Shorewide	98	102	200	79	76	155	707	72%	270	28%	567	58%	410	42%	464	47%	513	53%	977

Table 2. Fishing pressure estimates (angler-hours) from the 2014 Lake Superior spring creel survey. Standard errors are in italics.

Station	Stream Pressure	*(SE)*	Lake Pressure	*(SE)*	Total Pressure	*(SE)*
Lower Shore						
Lester River	2,180	*311*	400	*154*	2,580	*347*
McQuade/Talmadge	440	*104*	900	*216*	1,340	*240*
French River			3,080	*745*	3,080	*745*
Sucker River	2,640	*407*	240	*117*	2,880	*423*
Knife River	1,540	*318*	0	*0*	1,540	*318*
Stew art River	1,260	*296*	20	*20*	1,280	*297*
Silver Creek	312	*99*	0	*0*	312	*99*
Gooseberry River	257	*103*	0	*0*	257	*103*
Split Rock River	1,032	*351*	168	*92*	1,200	*363*
Upper Shore						
Beaver River	169	*169*	64	*46*	233	*175*
Baptism River	630	*204*	0	*0*	630	*204*
Cross River	287	*148*	52	*36*	339	*152*
Temperance River	83	*60*	0	*0*	83	*60*
Poplar River	264	*117*	66	*45*	330	*125*
Cascade River	278	*119*	31	*31*	309	*123*
Devil Track River	651	*208*	26	*26*	677	*210*
Kadunce Creek	715	*209*	55	*55*	770	*216*
Brule River	767	*231*	0	*0*	767	*231*
Lower Shore	9,661	*778*	4,808	*805*	14,469	*1,120*
Upper Shore	3,844	*514*	294	*100*	4,138	*523*
Shorewide	13,505	*932*	5,102	*811*	18,607	*1,236*

Table 3. Pressure estimates (angler-hours) from Lake Superior spring creel surveys, 2003-2014. The 1992-2013 mean and range are included.

Station	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Mean 92-13	Range 92-13
Lower Shore														
Lester River	4,526	6,830	7,415	5,312	5,105	5,315	10,476	9,892	6,644	4,928	3,588	2,580	6,255	3,450 - 10,476
McQuade/Talmadge								1,399	2,996	3,938	2,407	1,340	2,685	1,399 - 3,938
French River	3,036	3,480	3,535	2,112	4,610	2,456	6,068	6,505	3,206	3,015	3,544	3,080	4,219	2,112 - 8,544
Sucker River	6,266	7,960	6,845	7,066	3,385	3,823	6,376	6,824	4,620	6,008	3,566	2,880	5,780	3,132 - 12,990
Knife River	1,562	4,150	4,255	2,887	2,635	2,508	6,253	4,885	3,565	3,308	1,903	1,540	3,093	1,225 - 6,253
Stewart River	720	2,050	5,031	3,134	2,808	3,991	3,957	4,079	5,782	1,557	1,885	1,280	2,432	720 - 5,782
Silver Creek	527	1,112	968	880	1,299	1,256	1,230	930	1,996	818	131	312	917	131 - 1,996
Gooseberry River	1,213	1,538	1,860	887	886	493	1,728	1,418	1,994	1,076	325	257	1,050	300 - 2,475
Split Rock River	1,436	2,490	3,041	2,798	3,956	1,973	2,050	3,212	5,400	2,087	1,940	1,200	2,258	1,145 - 5,400
Upper Shore														
Beaver River	307	549	619	466	594	362	481	776	824	820	304	233	658	304 - 1,159
Baptism River	524	1,734	1,990	2,198	1,046	1,506	1,198	3,570	2,771	2,662	866	630	1,419	448 - 3,570
Cross River	83	135	203	260	151	432	444	559	900	383	525	339	280	53 - 900
Temperance River	224	371	195	181	198	472	651	434	488	170	630	83	361	77 - 788
Poplar River	278	424	173	338	548	580	291	439	888	383	420	330	512	168 - 1,347
Cascade River	474	339	194	455	774	767	346	675	488	905	296	309	523	194 - 939
Devil Track River	590	698	372	242	1,089	818	447	1,264	1,050	1,163	857	677	556	75 - 1,264
Kadunce Creek	270	236	258	228	79	502	581	259	746	500	642	770	407	79 - 1,365
Brule River	329	617	806	560	557	796	800	1,059	1,283	1,206	963	767	763	207 - 1,505
Lower Shore	19,286	29,610	32,950	25,075	24,684	21,816	38,137	39,142	36,203	26,735	19,289	14,469	26,201	16,584 - 39,994
Upper Shore	3,079	5,103	4,810	4,927	5,036	6,235	5,238	9,035	9,438	8,192	5,503	4,138	5,463	3,046 - 9,438
Shorewide	22,365	34,713	37,760	30,003	29,719	28,051	43,375	48,177	45,641	34,927	24,792	18,607	31,680	19,928 - 48,177

Table 4. Catch estimates for Rainbow Trout from the Lake Superior spring creel survey, 2003-2014. The 1992-2013 mean and range are included.

Rainbow Trout	Area	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Mean 92-13	Range 92-13
Unclipped	Lower Shore	475	1,589	2,071	2,742	2,588	2,822	4,391	5,587	3,733	1,967	2,527	823	1,841	203 - 5,587
steelhead	Upper Shore	634	774	803	1,018	921	1,298	583	1,597	2,021	1,302	1,076	612	778	105 - 2,021
	Shorewide	1,109	2,363	2,874	3,761	3,509	4,119	4,974	7,184	5,754	3,269	3,603	1,435	2,619	403 - 7,184
Clipped	Lower Shore	3,608	4,377	4,735	1,783	1,627	937	2,726	2,039	2,326	1,358	1,543	734	2,469	784 - 4,873
Rainbow	Upper Shore	190	161	248	78	114	218	46	143	342	193	114	0	175	24 - 653
Trout	Shorewide	3,798	4,538	4,983	1,861	1,741	1,155	2,773	2,181	2,668	1,551	1,657	734	2,644	905 - 5,108
All	Lower Shore	4,083	5,966	6,806	4,526	4,215	3,759	7,117	7,626	6,059	3,325	4,070	1,557	4,369	1,207 - 7,626
Rainbow	Upper Shore	824	935	1,051	1,096	1,035	1,516	629	1,740	2,363	1,495	1,190	612	956	143 - 2,363
Trout	Shorewide	4,907	6,901	7,857	5,622	5,249	5,274	7,747	9,365	8,422	4,820	5,260	2,169	5,325	1,584 - 9,365

Table 5. Rainbow Trout catch and catch rate estimates by station, 2014 Lake Superior spring creel survey. Standard errors (SE) are shown.

		Unclipped steelhead (n = 144)						Clipped Rainbow Trout (n = 95)					
		Catch			Rate			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	97	97	42	0.038	0.038	0.025
River	released	309	287	114	0.120	0.111	0.048	11	11	12	0.004	0.004	0.005
	total	309	287	114	0.120	0.111	0.048	108	108	44	0.042	0.042	0.026
McQuade	harvested	0	0	0	0.000	0.000	0.000	82	82	43	0.061	0.061	0.035
Harbor	released	10	10	11	0.007	0.007	0.010	47	47	38	0.035	0.035	0.037
	total	10	10	11	0.007	0.007	0.010	128	128	72	0.096	0.096	0.063
French	harvested	0	0	0	0.000	0.000	0.000	347	347	99	0.113	0.113	0.017
River	released	27	27	15	0.009	0.009	0.004	27	27	17	0.009	0.009	0.005
	total	27	27	15	0.009	0.009	0.004	373	373	105	0.121	0.121	0.017
Sucker	harvested	0	0	0	0.000	0.000	0.000	38	38	16	0.013	0.013	0.005
River	released	100	69	32	0.035	0.024	0.011	23	23	13	0.008	0.008	0.004
	total	100	69	32	0.035	0.024	0.011	62	62	22	0.022	0.022	0.007
Knife	harvested	0	0	0	0.000	0.000	0.000	26	26	15	0.017	0.017	0.009
River	released	258	215	72	0.168	0.140	0.037	9	9	9	0.006	0.006	0.006
	total	258	215	72	0.168	0.140	0.037	34	34	18	0.022	0.022	0.010
Stew art	harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
River	released	91	66	31	0.071	0.052	0.021	8	8	8	0.006	0.006	0.006
	total	91	66	31	0.071	0.052	0.021	8	8	8	0.006	0.006	0.006
Silver	harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
Creek	released	90	90	38	0.288	0.288	0.080	0	0	0	0.000	0.000	0.000
	total	90	90	38	0.288	0.288	0.080	0	0	0	0.000	0.000	0.000
Gooseberry	harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
River	released	27	18	16	0.105	0.070	0.054	0	0	0	0.000	0.000	0.000
	total	27	18	16	0.105	0.070	0.054	0	0	0	0.000	0.000	0.000
Split Rock	harvested	0	0	0	0.000	0.000	0.000	21	21	18	0.018	0.018	0.014
River	released	72	41	35	0.060	0.034	0.028	0	0	0	0.000	0.000	0.000
	total	72	41	35	0.060	0.034	0.028	21	21	18	0.018	0.018	0.014

Table 5. (continued) Rainbow Trout catch and catch rate estimates by station, 2014 Lake Superior spring creel survey. Standard errors (SE) are shown.

		Unclipped steelhead (n = 144)						Clipped Rainbow Trout (n = 95)					
		Catch			Rate			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	57	38	84	0.245	0.163	0.085	0	0	0	0.000	0.000	0.000
	total	57	38	84	0.245	0.163	0.085	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	118	105	58	0.187	0.167	0.072	0	0	0	0.000	0.000	0.000
	total	118	105	58	0.187	0.167	0.072	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	48	24	30	0.142	0.071	0.081	0	0	0	0.000	0.000	0.000
	total	48	24	30	0.142	0.071	0.081	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	18	18	0	0.217	0.217	0.215	0	0	0	0.000	0.000	0.000
	total	18	18	0	0.217	0.217	0.215	0	0	0	0.000	0.000	0.000
Poplar	harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
River	released	62	62	47	0.188	0.188	0.163	0	0	0	0.000	0.000	0.000
	total	62	62	47	0.188	0.188	0.163	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	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	harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
River	released	261	190	84	0.386	0.281	0.083	0	0	0	0.000	0.000	0.000
	total	261	190	84	0.386	0.281	0.083	0	0	0	0.000	0.000	0.000
Kadunce	harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
Creek	released	117	88	47	0.152	0.114	0.051	0	0	0	0.000	0.000	0.000
	total	117	88	47	0.152	0.114	0.051	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	112	87	44	0.146	0.113	0.048	0	0	0	0.000	0.000	0.000
	total	112	87	44	0.146	0.113	0.048	0	0	0	0.000	0.000	0.000
Low er Shore	harvested	0	0	0	0.000	0.000	0.000	611	611	119	0.042	0.042	0.009
Total	released	984	823	153	0.068	0.057	0.011	125	125	46	0.009	0.009	0.003
	total	984	823	153	0.068	0.057	0.011	734	734	139	0.051	0.051	0.010
Upper Shore	harvested	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
Total	released	793	612	157	0.192	0.148	0.042	0	0	0	0.000	0.000	0.000
	total	793	612	157	0.192	0.148	0.042	0	0	0	0.000	0.000	0.000
Shorew ide	harvested	0	0	0	0.000	0.000	0.000	611	611	119	0.033	0.033	0.007
Total	released	1,777	1,435	219	0.096	0.077	0.013	125	125	46	0.007	0.007	0.003
	total	1,777	1,435	219	0.096	0.077	0.013	734	734	139	0.039	0.039	0.008

Table 6. Size distribution of Rainbow Trout above and below the legal size limit, 2014 Lake Superior spring creel survey.

Category	Less than 16 inches		16 inches or greater	
	N	%	N	%
Unclipped steelhead	342	19%	1,435	81%
Clipped steelhead	0	0%	0	0%
Kamloops	0	0%	734	100%
All Rainbow Trout	342	14%	2,169	86%

Table 7. Catch rates (fish/angler-hour) for Rainbow Trout, Lake Superior spring creel survey, 2003-2014. The 1992-2013 range is included.

		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Range 92-13
Unclipped steelhead	Lower Shore	0.025	0.054	0.063	0.109	0.105	0.129	0.115	0.143	0.103	0.074	0.131	0.057	0.010 - 0.143
	Upper Shore	0.206	0.152	0.167	0.207	0.183	0.208	0.111	0.177	0.214	0.159	0.196	0.148	0.031 - 0.214
	Shorewide	0.050	0.068	0.076	0.125	0.118	0.147	0.115	0.149	0.126	0.094	0.145	0.077	0.020 - 0.149
Clipped Rainbow Trout	Lower Shore	0.187	0.148	0.144	0.071	0.066	0.043	0.071	0.052	0.064	0.051	0.080	0.051	0.043 - 0.187
	Upper Shore	0.062	0.032	0.052	0.016	0.023	0.035	0.009	0.016	0.036	0.024	0.021	0.000	0.007 - 0.083
	Shorewide	0.170	0.131	0.132	0.062	0.059	0.041	0.064	0.045	0.058	0.044	0.067	0.039	0.040 - 0.170
All Rainbow Trout	Lower Shore	0.212	0.202	0.207	0.180	0.171	0.172	0.186	0.195	0.167	0.125	0.211	0.108	0.068 - 0.270
	Upper Shore	0.268	0.183	0.218	0.222	0.206	0.243	0.120	0.193	0.250	0.183	0.216	0.148	0.042 - 0.292
	Shorewide	0.220	0.199	0.208	0.187	0.177	0.188	0.179	0.194	0.184	0.138	0.212	0.117	0.070 - 0.262

Table 8. Mean length, weight, and yield of selected species, 2014 Lake Superior spring creel survey. Standard errors are in italics. Rainbow Trout length and weight numbers exclude sub-legal fish.

	Unclipped steelhead ≥16"	*(SE)*	Clipped Rainbow Trout ≥16"	*(SE)*	Brook Trout	*(SE)*	Suckers	*(SE)*	Coho Salmon	*(SE)*
Number reported in creel	1,435	*219*	734	*139*	409	*124*	428	*136*	72	*43*
Length (in)										
Harvested			23.5	*0.2*					15.3	*1.0*
Released	22.6	*0.3*	24.2	*0.5*	9.0	*0.5*	15.9	*0.6*	11.0	*0.0*
All	22.6	*0.3*	23.6	*0.2*	9.0	*0.5*	15.9	*0.6*	14.6	*1.1*
Weight (lb)										
Harvested			4.9	*0.1*					*1.3*	*0.2*
Released	4.0	*0.2*	5.3	*0.3*	0.3	*0.1*	1.9	*0.1*	*0.5*	*0.0*
All	4.0	*0.2*	4.9	*0.1*	0.3	*0.1*	1.9	*0.1*	*1.2*	*0.2*
Estimated number harvested	0	*0*	611	*119*	0	*0*	0	*0*	*66*	*42*
Yield (lb)	0	*0.0*	2,994	*178.8*	0	*0.0*	0	*0.0*	86	*32.9*

Table 9. The estimated age distribution of Kamloops caught in the 2014 Lake Superior spring creel survey. Ages were assigned based on the age distribution of fish captured in the French River trap.

Age	2		3		4		5		6		7		8		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Number	5	1%	64	9%	485	66%	133	18%	47	6%	0	0%	0	0%	734	100%

Table 10. Catch rates of unclipped steelhead and clipped Rainbow Trout (≥16 inches) in streams and the lake, 2014 Lake Superior spring creel survey. Standard errors (SE) of catch and catch rates are in italics.

	Unclipped steelhead				Clipped Rainbow Trout			
	Stream	*SE*	Lake	*SE*	Stream	*SE*	Lake	*SE*
Lower Shore								
Catch	756	*150*	67	*29*	219	*52*	515	*129*
Catch Rate (Fish/a-hour)	0.078	*0.017*	0.014	*0.006*	0.023	*0.006*	0.107	*0.032*
Upper Shore								
Catch	590	*156*	22	*22*	0	*0*	0	*0*
Catch Rate (Fish/a-hour)	0.153	*0.045*	0.075	*0.079*	0.000	*0.000*	0.000	*0.000*
Shorewide								
Catch	1,346	*216*	89	*36*	219	*52*	515	*129*
Catch Rate (Fish/a-hour)	0.100	*0.017*	0.017	*0.008*	0.016	*0.004*	0.101	*0.030*

Table 11. The estimated number of anglers that have participated in the Lake Superior spring anadromous fishery 1996-2014. The 95% confidence limits are shown.

Year	Angler Estimate	95% CI
96	832	393 - 1,336
97	1,269	764 - 1,775
98	1,463	756 - 2,170
99	1,587	1,051 - 2,122
00	1,454	775 - 2,601
01	1,069	494 - 1,725
02	833	416 - 1,329
03	1,218	468 - 1,968
04	1,752	923 - 2,712
05	2,133	1,122 - 3,145
06	1,794	703 - 2,885
07	2,073	840 - 3,744
08	1,664	757 - 2,571
09	1,923	1,106 - 2,741
10	2,070	1,112 - 3,080
11	2,243	1,379 - 3,107
12	1,698	1,078 - 2,318
13	1,325	769-1,882
14	1,459	948-1,970

Table 12. Catch and catch rate estimates for Brook Trout, Coho Salmon, and Suckers in the 2014 Lake Superior spring creel survey. Standard errors are in italics.

			Brook Trout	*(SE)*	Coho Salmon	*(SE)*	Suckers	*(SE)*
Lower Shore								
	Catch	Harvested	0	*0*	66	*42*	0	*0*
		Released	111	*70*	7	*7*	272	*114*
		Total	111	*70*	72	*43*	272	*114*
	Catch Rate	Harvested	0.000	*0.000*	0.005	*0.003*	0.000	*0.000*
		Released	0.008	*0.005*	0.000	*0.000*	0.019	*0.008*
		Total	0.008	*0.005*	0.005	*0.003*	0.019	*0.008*
Upper Shore								
	Catch	Harvested	0	*0*	0	*0*	0	*0*
		Released	298	*102*	0	*0*	156	*75*
		Total	298	*102*	0	*0*	156	*75*
	Catch Rate	Harvested	0.000	*0.000*	0.000	*0.000*	0.000	*0.000*
		Released	0.072	*0.026*	0.000	*0.000*	0.038	*0.019*
		Total	0.072	*0.026*	0.000	*0.000*	0.038	*0.019*
Shorewide								
	Catch	Harvested	0	*0*	66	*42*	0	*0*
		Released	409	*124*	7	*7*	428	*136*
		Total	409	*124*	72	*43*	428	*136*
	Catch Rate	Harvested	0.000	*0.000*	0.004	*0.002*	0.000	*0.000*
		Released	0.022	*0.007*	0.000	*0.000*	0.023	*0.007*
		Total	0.022	*0.007*	0.004	*0.002*	0.023	*0.007*