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Completion Report
Summer Creel Survey Report for Leech Lake
2019

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Completion Report

**Summer Creel Survey
Leech Lake
2019**

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ABSTRACT

A non-uniform access-based creel survey using clusters of sampling stations was conducted on Leech Lake from 11 May through 30 September 2019; aerial boat counts were used for estimating fishing pressure. In addition to the daytime angler survey, an independent nighttime component was included to determine the amount of angling pressure and harvest that occurs after the normally scheduled creel shift ends. Estimated fishing effort was 864,001 daytime and 76,353 nighttime angler-hours. The daytime estimate was an increase from the 2016 creel (707,075) and was similar to the 1965-2019 mean of 855,054 angler-hours. An estimated 834,140 fish were caught in 2019 during the daytime survey, of which 220,485 were harvested (26% of total catch). The majority of the total catch and harvest (number of fish) was comprised of Yellow Perch (57% and 44%, respectively) and Walleye (19% and 38%, respectively). Most daytime angling parties targeted Walleye (70.0%) with an estimated 83,238 Walleye (149,530 pounds) harvested during the day in 2019, 91.3% of nighttime anglers targeted Walleye and they harvested 10,722 Walleye (19,539 pounds). Management actions implemented in 2005 to address low Walleye and Yellow Perch recruitment include reducing the resident double-crested cormorant population, protecting mature female Walleye with a protected slot limit (PSL) and habitat protection have had the desired effect on the Walleye population. This is evidenced in the catch and harvest statistics for Walleye in subsequent years including the 2019 open water creel season and allowed for removal of the Walleye protected slot limit starting on the 2019 open water fishing opener. The removal of the PSL resulted in 19.7% of harvested Walleye being over 20 inches compared to 0.4% in the 2016 creel. While Walleye show strong signs of recovery lower Yellow Perch numbers still need to be considered when making future management decisions.

INTRODUCTION

In 1983, the Minnesota Department of Natural Resources (MNDNR) increased its commitment to managing Leech Lake and other large lakes by establishing the Large Lake Monitoring Program (LLP). For Leech Lake, this program includes annual collection, analysis, and reporting of fish population data for monitoring long-term population trends, the development of management recommendations, and public input (Wingate and Schupp 1984).

In conjunction with annual fish surveys, angler use and harvest information is collected using creel surveys. Surveys are typically conducted every four years to estimate catch, harvest, and pressure statistics of the recreational fishery. The 2019 survey was unscheduled and was added to evaluate angler impacts with the removal of the Walleye protected slot limit that had been in place in various forms since 2005. Yield estimates are compared to safe harvest targets prescribed in Special Publication No. 151 (MDNR 1997). If yield estimates routinely exceed established safe target harvest levels and the population exhibits signs of biological stress (Gangl and Pereira 2003) more restrictive harvest regulations would be considered.

While Leech Lake is well known among anglers as an exceptional multi-species fishery, most anglers target and harvest Walleye *Sander vitreus*. During the 1998-99 open water seasons, anglers averaged 1.2 million angler hours and harvested 174,000 pounds of Walleye per year (Sledge, 1999, 2000). However, several consecutive years without a large Walleye year class caused declines in overall abundance and an unbalanced population size structure; this in turn produced low levels of angler effort and harvest during the 2004-2005 open water seasons (Rivers 2005, 2006). These changes to the Walleye fishery, as well as changes in the Yellow Perch population, coincided with high Walleye and Yellow Perch harvest in the late 1990's, expanding populations of double-crested cormorants during the early 2000's, and expanding aquatic invasive species such as Rusty Crayfish *Orconectes rusticus* and Eurasian Watermilfoil (EWM) *Myriophyllum spicatum*. Management changes implemented in 2005 led to increases in Walleye and Yellow Perch abundance in the late-2000s and increased angler success shortly thereafter (Schultz 2010a); however while Walleye numbers have remained within management objective ranges Yellow Perch numbers have declined. These increases in Walleye abundance led to management goals being met and resulted in the 18"-26" protected slot limit (PSL) being relaxed to 20"-26", effective open water fishing opener 2014. The PSL was removed in 2019 in order to provide some protection for the prey base, reduce spawner stock biomass and provide additional harvest opportunities to anglers.

STUDY AREA

Leech Lake (DOW # 11-0203; Lake Class 26, Schupp 1992) is located in northern Cass County, Minnesota and is within the Chippewa National Forest and the Leech Lake Indian Reservation. The lake is the third-largest entirely within State boundaries and has nearly 112,000 surface acres. In its original state, Leech Lake covered about 106,000 acres. A dam constructed on the Leech River in 1884 raised the lake level approximately two feet and increased the surface area to the present state (Wilcox 1979).

Leech Lake is located in three glacial zones and has an irregular shape with many large and small bays (Figure 1). Leech Lake varies considerably from a morphological perspective. Some large bays, such as Steamboat and Boy, display highly eutrophic water characteristics whereas other large bays, such as Walker and Kabekona, have properties more consistent with oligotrophic lakes. The main portion of the lake, like most large Minnesota Walleye lakes, is windswept and mesotrophic. Previous estimates of shoreline miles have varied, but using remote sensing technology, the current estimate is 201 miles. Approximately 23 percent of the shoreline consists of a gravel-rubble-boulder mixture, nearly all of which is used by spawning Walleye (Wilcox 1979).

The diversity of the Leech Lake shoreline and substrate, as well as its extensive littoral zone, provides excellent spawning and nursery habitats for a number of species, including Percids and Esocids which dominate the fish community. Walleye, Northern Pike *Esox lucius* and Muskellunge *E. masquinongy* are the principal predators and are located throughout the lake. Although most fish species are found in every portion of the lake, the largest Walleye and Muskellunge concentrations exist in the mesotrophic areas. Northern Pike are most common in vegetated eutrophic bays. Yellow Perch *Perca flavescens* are abundant throughout the lake and are the primary forage for most predators. Tullibee (Cisco) *Coregonus artedi* and Lake Whitefish *C. clupeaformis* are an important forage base for larger predators (Engstrom-Heg et al. 1986) and are typically found in the mesotrophic and oligotrophic areas. Juvenile Tullibee (Cisco) also comprise larger proportions of predator diets when large year classes are present. Other species present in the lake include: White Sucker *Catostomus commersoni*, Burbot *Lota lota*, Rock Bass *Ambloplites rupestris*, Bowfin *Amia calva*, Shorthead Redhorse *Moxostoma macrolepidotum*, bullheads *Ameiurus spp.*, Pumpkinseed *Lepomis gibbosus*, Bluegill *L. macrochirus*, Largemouth Bass *Micropterus salmoides*, Smallmouth Bass *M. dolomieu*, and Black Crappie *Pomoxis nigromaculatus*.

Leech Lake is infested with a number of Aquatic Invasive Species. A survey of Leech Lake boat harbors in 2004 found established beds of EWM in several harbors between Stony and Rogers points, EWM is now considered widespread across the main basin harbors of the lake, and now is establishing in open areas of the main lake despite previous annual control efforts. While conducting EWM harbor searches during 2009 Curly-leaf Pondweed *Potamogeton crispus* (CLP) was identified and removed from a harbor near Whipholt Beach. This is not the first occurrence of CLP, as it had been previously documented in the Leech Lake River embayment near Federal Dam. Rusty crayfish were first recorded in the lake in the late 1980s. Staff began reporting the number of rusty and native crayfish entangled per gill net during the annual gill net assessment in 2002 after numbers had expanded. Crayfish entanglement rates in 2019 were significantly lower than the highest historical entanglement rates seen in 2018. Zebra Mussel *Dreissena polymorpha* veligers were first found in Leech Lake in 2016. In 2019 isolated pockets of adults were reported in Agency, Walker and Kabekona Bays.

METHODS

Sampling Design

A non-uniform access-based creel survey using clusters of sampling stations was conducted on Leech Lake from 11 May through 30 September 2019; aerial boat counts were used for estimating fishing pressure (Rivers 2005). A reduction in the number of aerial counts from previous surveys was done in 2019 and is explained further in Appendix 3. Interview data was separated into strata. Sampling and data organization were stratified by day type (weekday or weekend/holiday), period (May-June and July-September), and lake basin (western bays or main lake). Observed holidays included Memorial Day (May 27), Independence Day (July 4), and Labor Day (September 2). In order to determine the amount of angling pressure and harvest that occurs after normally scheduled creel survey shifts end a part-time night clerk was also utilized to interview anglers during the first few hours after sunset. Calculated creel statistics are for daytime anglers except for instances when the nighttime results are specifically referenced.

Estimation of Catch, Harvest and Angling Pressure

The majority of the angler and fish statistics were calculated using the Creel Application Software (CAS) program developed by South Dakota Department of Game, Fish, and Parks (Soupir and Brown 2002). Statistics were calculated for each sampling period on a lake-wide and basin specific basis. Post-release mortality of Walleye, or hooking mortality (Reeves and Bruesewitz 2007), was determined during each sampling period, by basin, using the angler-reported length distribution of released Walleye extrapolated to the total estimated number of released Walleye and mean water temperature recorded daily throughout the open water season by submerged loggers. A temperature logger was located off Stony Point for the main basin and in Walker Bay adjacent to the MNDNR office for the western bays. Targeting angler catch rates in previous creel surveys (2008-2011) were incorrectly summarized by CAS due to a programming error. This statistic has been corrected for 2008-2019 creel surveys and the methods for this correction are documented in Appendix 4.

Angling pressure was estimated using aerial boat counts. A total of 36 daytime and 20 night time flights were scheduled throughout the season. Flights were conducted by MNDNR Conservation Officer and Wildlife pilots. Nighttime counts were conducted using night vision goggles. A minimum of 8 flights were scheduled within each stratum (Soupir et al. 2006). Flights canceled due to inclement weather were made up at the same time period during the first available day within the same strata (day type and creel period). In some cases flights were pre-flown based on the pending weather forecast to avoid losing sampling days, particularly towards the end of a sampling period.

For obtaining angler interviews, the lake was divided into 14 clusters with each cluster containing one to four sampling stations (Figure 1). These stations included resorts, marinas, and public accesses. Two creel clerks were assigned to a separate group of clusters. Sampling days were randomly selected for each clerk except holidays when no clerks were scheduled as per union contract. Non-uniform access probabilities were developed based on the frequency

of interviews obtained at each location during the 2008-2016 creel survey. Therefore, sampling clusters were randomly selected for each clerk based upon the probability of an angler completing a trip within a particular cluster. Sampling times were randomly selected with equal probability. A sampling day was divided into two non-overlapping periods of equal length, entirely covering daylight hours. The sampling day was 14 hours (0800-2200) from May through August and 13 hours (0800-2100) during September. The night time clerk was scheduled to work 4 hour shifts from 2200 to 0100 on randomly selected nights.

On a scheduled sampling day each clerk sampled one cluster, visiting all stations within the cluster. The clerks conducted as many interviews as possible, collecting information on catch, catch rate, effort, and angler demographics. Additional questions were included to determine the angler's level of satisfaction with their fishing trip and their opinions on statewide Walleye bag limit preferences. Clerks were given the latitude to roam in order to sample other stations within the assigned cluster more frequently if there was no or relatively light angling pressure at an assigned station. This was done to increase the number of anglers interviewed by the clerk that day. During interviews, clerks identified and measured as many harvested fish as time allowed and remaining harvested fish were enumerated. Species, number, and length of released fish were obtained through angler recollection. Bluegill and Pumpkinseed Sunfish were also pooled for analysis because anglers were likely to misidentify these species. Similarly, fish weight for Walleye, Yellow Perch, and Northern Pike was estimated using length-weight regression formulas from the fall gillnetting survey. Fish weight for all other species was estimated using length-weight regression formulas from historical gillnet data collected from 1983-2014.

RESULTS

Anglers

A total of 1,761 Leech Lake angling parties were interviewed from 1 May through 30 September 2019 (Table 1). The estimated total angling pressure was 940,355 angler-hours (Table 2) (Figure 6) with 864,001 hours during the day and 76,353 hours estimated from the night time component of the survey. This was an increase in daytime pressure from the 2016 survey (707,075 angler hours) (Pedersen and Schultz 2016) and is close to the 1965-2019 daytime mean of 843,833 angler-hours (Table 2). No parties were interviewed utilizing a launch service in 2019 or 2016; only two parties were interviewed from launches in 2014, associated effort and harvest from launches has been less than 1% of total effort and harvest in recent surveys (Schultz 2009; Schultz 2010b; Vondra and Schultz 2011).

The median distance traveled by anglers interviewed during the 2019 survey (145 miles), as indexed using zip codes, was similar to the most recent surveys but below the median distances from the 1990s and 2000s, (overall range 118-177 miles) (Figure 3). Similar to the past four creel surveys, 21% of anglers interviewed traveled less than 50 miles (Table 3). Thirty one percent of effort was from local anglers (<100 miles), 46% was from anglers that traveled 100-249 miles. Since the large population centers of the Fargo, St. Cloud and Minneapolis/St. Paul areas are within this range they are referred to as "metro" anglers for ease of reporting even though not all anglers within this range come from a metro area. Nineteen percent of effort was

from anglers that traveled greater than 250 miles, which will be referred to as “destination” anglers. Average fuel prices in 2019 were higher than prices in 2016 but pressure does not show a correlation with fuel prices. As fuel prices have fluctuated in the past 10 years summer pressure has remained relatively stable with a slight increase in 2019 (Figure 2). Local angler effort (274,180 angler hours) in 2019 was up from 2016 (226,161 angler hours) which was the highest since 1998. Metro angler effort was higher than the 1998-2019 average. Destination angler effort was up from 2016 but below the long term average (Table 4). Most anglers interviewed (76.5%) were Minnesota residents (Table 5) but there were anglers from 34 different states that were interviewed in 2019. Seventy percent of daytime angling parties targeted Walleye, 91% of the nighttime anglers targeted Walleye (Table 6; Figure 4).

When asked to rate their fishing success on a scale of 1-5 with 5 being the highest and 1 the lowest, 18.2% of angling parties interviewed rated their experience with the highest level of satisfaction and 28.2% the lowest success level, with most responses equally distributed (Table 15). It is interesting to note that in 2016, when fewer total numbers of fish were caught, anglers were asked how satisfied they were with their fishing experience not their fishing success, those responses were more positive with 33% of anglers reporting a 5 and only 16% a 1 (Table 15). Clerks also asked a question concerning support for a statewide Walleye bag limit reduction. There were two different scripts used with slightly different wording. One daytime clerk used script A, and the other daytime clerk and nighttime clerk used script B. Overall the responses were fairly similar with 41% reporting they strongly support a reduced bag from script A and 52% reporting strong support when asked the question from script B (Table 15).

Catch and Harvest

An estimated 834,140 fish, or 7.4 fish/acre, were caught in 2019 by daytime anglers (Table 7), of which 220,485 were harvested (26% of total catch; 2.0 fish/acre). Most of the total catch and harvest (in terms of numbers of fish) was comprised of Yellow Perch (57% and 44%, respectively) and Walleye (19% and 38%, respectively). Nighttime anglers caught an estimated 41,195 fish and 14,366 of those were harvested (Table 7). Of the fish caught during nighttime hours 31% were perch and 42% were Walleye with 11% of the harvested fish being perch and 75% Walleye.

Total yield was estimated to be 255,176 pounds (Table 8) which was an increase from 2016 (176,319 pounds; Pedersen and Schultz 2016). During 2016, the overall daytime catch and harvest rates across all anglers were 0.849 and 0.256 fish/hour, respectively, compared to respective rates from 2019 of 0.9654 and 0.255. Nighttime overall catch rates were 0.539 and the harvest rate was 0.188 per angler hour (Table 9). Basin-specific estimates of fishing effort, catch, and harvest are summarized in the appendix (Tables A1-A7).

Walleye- Most daytime angling parties targeted Walleye (70.0%: Table 6) with 91.3% of nighttime anglers targeting Walleye. An estimated 83,238 Walleye (149,530 pounds) were harvested during 2019 by daytime anglers (Table 2, Figure 7) with an additional 85,605 Walleye released (Table 13). Nighttime anglers caught a total of 17,140 Walleye and released 10,722 of those fish (Table 7). Post-release hooking mortality (3,125 Walleye; 6,439 pounds)

increased the total daytime Walleye kill to 86,363 fish (155,969 pounds, Table 2 Figure 7). The estimated total number of Walleye harvested by daytime anglers in 2019 was just below the 1965-2019 average (110,640) but the pounds of Walleye harvested was above the average (129,524).

The overall catch and harvest rates of Walleye were 0.1879 fish/hour and 0.0963 fish/hour, respectively, across all anglers (Table 9). Overall catch and harvest rates for targeting daytime anglers were 0.2556 fish/hour and 0.1346 fish/hour, respectively (Table 10, Figure 5) and 0.3277 and 0.2083 for nighttime anglers. (Table 10).

Creel clerks measured 926 Walleye and anglers reported lengths on 1,895 released Walleye. The average harvested Walleye across the entire season was 17.2 inches and 1.8 pounds (Table 8). Lengths of fish caught ranged from 4-30 inches (Table 13). The majority of harvested fish were 14"-18.9" long and comprised 66% of harvested Walleye. Only 5% of the Walleye harvested were less than 13". It is estimated that 19% of the Walleye caught by all anglers that were harvested were over 20" (Figure 10). Overall, 5% of interviewed parties targeting Walleye harvested their limit in 2019 (Table 12) compared to 6% in 2016 (Pedersen and Schultz 2016).

Northern Pike- An estimated 15,320 Northern Pike (35,805 pounds) were harvested by daytime anglers and 601 pike (1,011 pounds) were harvested by nighttime anglers (Tables 2, 7 and 8). The overall daytime catch rate was 0.1164 fish/hour across all anglers (Table 2), which is slightly above the long-term averages (0.1141, Table 14). Overall 5.0% of anglers interviewed were targeting Northern Pike (Table 6) with no nighttime anglers targeting pike. The estimated total number and pounds of Northern Pike harvested was within the range of the past seven creel surveys (number range 10,890-16,987; pounds range 33,588-49,015; Table 2).

Harvested Northern Pike averaged 21.5 inches long and 2.3 pounds (Table 8). Lengths of Northern Pike caught ranged from 7 to 38 inches (Figure 11). The percent of pike harvested less than 22 inches was 72% and over 26 inches was 15%. Twelve percent of harvested fish were in the protected slot and were illegally harvested fish (Table 13, Figure 11). There were no anglers that reported harvesting a full limit of Northern Pike (Tables 11 and 12).

Yellow Perch- An estimated 474,263 Yellow Perch were caught in the open water season of 2019 of which 97,180 (45,619 pounds) were harvested by daytime anglers at a rate of 0.114 fish/hour for all anglers (Tables 2 and 7). Nighttime anglers caught an estimated 12,969 perch with 1,580 of those harvested. The overall catch and harvest rates increased from 2016 (Tables 2 and 14). The estimated total number and pounds of Yellow Perch harvested in 2016 was the lowest since sport fish rehabilitation efforts were initiated for Leech Lake in 2005 (Table 2) and reflect the historically low abundance (Pedersen 2017).

Anglers reported catching Yellow Perch that ranged in length from 3 to 14 inches (Table 13, Figure 12). The average size of harvested fish was 9.8 inches and 0.5 pounds (Table 8). The percent of fish harvested less than 8" was 4%, 8-9.9" was 43%, 10-11.9" was 46% and greater than 12" was 8% (Table 13). Overall, 6.7% of anglers targeted Yellow Perch (Table 6) and 0%

of those anglers reported catching their limit (Table 11). There were only 2 nighttime anglers interviewed that targeted perch.

Muskellunge- An estimated 1,742 Muskellunge were caught during the creel season all by daytime anglers in 2019 with no harvested Muskellunge observed (Table 7). This is an increase from the number reported caught in the 2016 creel (1,274). Angler catch rates were 0.002 fish/hour for all anglers and 0.0163 fish/hour for targeting anglers (Tables 9 and 10, Figure 9). Lengths of released fish ranged from 16 to 52 inches (Table 13). There were only 4 anglers encountered by the nighttime creel clerk that were targeting Muskellunge and no Muskellunge were reported caught by these anglers.

Largemouth Bass- An estimated 36,828 Largemouth Bass were caught by daytime anglers with 2,180 (691 pounds) of those harvested. This is an increase from 2016 when 26,605 Largemouth Bass were caught with 270 harvested (422 pounds) (Table 7). Largemouth Bass ranged in length from 4 to 22 inches, with harvested fish ranging from 12 to 19 inches (Table 13). The average size of harvested fish was 16.1 inches and 2.1 pounds (Table 8). Only 3.5% of anglers targeted Largemouth Bass and there were no nighttime anglers that targeted Largemouth Bass.

Black Crappie- An estimated 14,095 Black Crappie were caught by daytime anglers and 1,368 caught by nighttime anglers (Tables 7). There were 9,678 pounds harvested by daytime anglers and 595 pounds harvested by nighttime anglers. Length of crappies ranged from 6 to 15 inches. Of the caught fish that were harvested 23% were less than 10", 73% were between 10 and 14" and 5% were over 14" (Table 13).

Bluegill/Pumpkinseed (sunfish) – There were 21,632 sunfish caught with 9,224 harvested. This is down from the 2016 catch when an estimated 12,352 sunfish were harvested (Tables 7 and 8). Only 2.1% of anglers targeted sunfish during the 2019 open water creel season (Table 6). Lengths of sunfish caught ranged from 4 to 10 inches (Table 13). The percent of fish harvested less than 6" was 1%, 6-7.9" was 15%, 8-9.9" was 54% and over 10" was 10% (Table 13).

Additional Species – An estimated 2,609 Smallmouth Bass were caught, with 388 being harvested (Table 7) this was similar to 2016 when 2,261 were caught and 267 harvested. Other numbers of species caught included Rock Bass (19,699), Bowfin (251) and Burbot (49). Although bullhead were caught in previous creel surveys, they have had a declining trend since 2005 and none were reported caught in 2014, 2016 or 2019 (Stevens et al. 2015 and Pedersen and Schultz 2016).

DISCUSSION

Management actions implemented in 2005 to address low Walleye and Yellow Perch recruitment included reducing the resident double-crested cormorant population, protecting mature female Walleye with a PSL and habitat protection have had the desired result on the Walleye population. This is evidenced in the catch and harvest statistics for Walleye in

subsequent years including the 2019 open water creel season. While Walleye numbers are strong, harvest numbers of Yellow Perch in the creel are tracking with low catch rates in the fall gill net sample but did show some improvement in 2019. The increase in catch rates of Yellow Perch in the 2019 creel is encouraging and the perch population should benefit in the future with the removal of the Walleye PSL.

Total Walleye harvest remains below the long-term average, but increased from 2016. Length limits, such as the PSL that was in place from 2005 to 2018 had the desired effect of protecting spawning fish and allowed the lake to recover to a point where natural reproduction is able to sustain the Walleye fishery. With the removal of the PSL in 2019 anglers were able to harvest some of the fish that were previously protected providing space for future year classes of Walleye to recruit to the fishery and provide some relief to the prey population in the lake. With the annual sampling and regularly scheduled creel surveys, adaptive management of Leech Lake will continue and hopefully be able to strike a balance between a proper amount of Walleye and Yellow Perch.

Winter pressure is increasing and comprising a larger portion of total angling pressure (Figure 6) and harvest on Leech Lake. In the future it will be important to combine winter and summer creel surveys to get an accurate picture of harvest for a given fishing season, especially given the seasonal shift in fishing pressure that has been recently observed. While summer pressure has remained relatively static for the past 10 years, winter pressure has increased. Prior to 2006 winter fishing pressure made up less than 15% of the total angling pressure on Leech Lake. Since then, winter pressure has increased with each additional winter creel survey and in 2016 represented over 50% of the annual effort.

The addition of the night time creel survey was to determine the level of angling pressure and harvest that occurs after the traditional creel survey would end. Anglers, lake association and Leech Lake Fisheries Input Group members have expressed concerns in the past with an increased amount of pressure and harvest occurring after dark that is not being represented in the creels. While there is certainly some after dark pressure it was not significant in the 2019 survey. Catch and harvest rates were similar to the daytime levels. There is the potential that the amount of pressure and harvest could shift as the lake continues to evolve due to changing climates and AIS.

It is uncertain how the lake and fishery will respond to the recent infestation of Zebra Mussels. It is anticipated that Zebra Mussels will continue to expand throughout the lake in the coming years and begin to impact water clarity and the food web. Clearer water will not benefit Walleye as they prefer low light and cooler water but there are examples of lakes that are infested with Zebra Mussels that have continued to have strong Walleye and Yellow Perch populations. Cass Lake in Beltrami County is a local example and a nighttime creel component is scheduled there in 2020 to describe the potential shift in angling effort to nighttime in response to clearing water.

Like many of Minnesota's large lakes, Leech Lake has been known as a destination fishery. It was originally thought that high fuel prices and uncertainty about the national economy since the late 2000s (EIA 2017) may have contributed to reduced fishing trips and effort from

destination-type (hometown >250 miles) anglers. Historically these anglers made up approximately 40% of angler effort on Leech Lake. Destination anglers made up 18% of the pressure in 2016 and 22% in 2018 (Table 4). Previously, this reduced angler effort had been attributed to low Walleye catch rates and limited fishing success. However greater fishing success and higher fishing pressure by local anglers in 2016 and 2018 no longer allow for this explanation (Figure 8). Local angler effort has returned to pre-2005 levels when local pressure was at its lowest. Unlike the other distance groups fishing pressure from local anglers has rebounded and increased since 2004-2005 while similar results from destination anglers have not been realized. It appears that larger socioeconomic factors beyond fishing quality are driving angler effort.

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TABLES

Table 1. Creel survey sampling summary and angling pressure estimates by stratum for Leech Lake, Minnesota, May 11th – September 30th, 2019. Standard errors appear in parentheses.

	Stratum 1 May and June		Stratum 2 July, August, September		Season Total Day	Season Total Night	Season Totals Combined
<i>Sampling Summary (Number)</i>							
Work Period	Day	Night	Day	Night			
Days in stratum	50	50	92	92	142	142	142
N Weekdays sampled	32	21	61	32	93	53	146
N Wknd/Hol sampled	16	14	25	25	41	39	80
N Interviews	738	75	895	53	1,633	128	1,761
<i>Boat Angler Trip Length & Party Size</i>							
Mean anglers/boat	2.33 (0.07)	2.34	2.36 (0.05)	2.23	2.35 (0.04)	2.3	2.33(0.03)
Mean trip length (h)	4.31 (0.18)	4.28	4.72 (0.14)	3.94	4.75 (0.11)	4.13	4.57 (0.08)
<i>Fishing Pressure</i>							
Total angler hours	407,955 (36,754)	44,756 (7,921)	456,046 (34,425)	31,598 (5,531)	864,001 (45,518)	76,353 (9,660)	940,355 (46,532)

Day - 8:00 a.m. to 10:00 p.m. (May-August)

Night - 10:00 p.m. until 1:00 a.m. (May-August)

Night - 9:00 p.m. until 12:00 a.m. (September)

Table 2. Estimated total angling pressure and total catch statistics for the summer open water creel season on Leech Lake, Minnesota, 1965-2019.

	Year							
	1965	1966	1967	1984	1985	1991	1992	1998
<i>Angling Pressure</i>								
Angler Trips	221,220	217,185	201,093	182,530	352,646	306,585	246,198	316,930
Angler Hours	858,960	862,346	785,905	697,267	1,290,339	1,195,683	935,553	1,274,985
-Walleye Tourn.								
-Total hours	858,960	862,346	785,905	697,267	1,290,339	1,195,683	935,553	1,274,985
<i>Number of Harvested Fish</i>								
Northern pike	60,943	52,336	48,108	40,109	79,144	42,376	26,610	50,255
Muskellunge	139	151	236	20	372	81	32	-
Largemouth Bass	-	-	-	1,023	1,166	1,024	1,466	2,649
Yellow Perch	150,599	145,510	13,359	143,756	229,660	176,646	216,323	391,367
Walleye (Legal)	149,917	162,091	147,822	76,170	161,193	179,898	86,877	141,577
-Protected ¹								
-Released ²								
-Total kill	149,917	162,091	147,822	76,170	161,193	179,898	86,877	141,577
<i>Pounds of Harvested Fish</i>								
Northern pike	155,800	138,666	125,081	73,609	148,562	96,655	65,526	122,684
Yellow Perch	78,050	77,813	70,805	54,236	87,033	58,412	83,777	113,444
Walleye (Legal)	199,012	224,310	201,038	95,625	163,537	186,882	119,076	159,393
-Protected ¹								
-Released ²								
-Total kill	199,012	224,310	201,038	95,625	163,537	186,882	119,076	159,393
<i>Harvest per Angler Hour (all anglers)</i>								
Northern pike	0.071	0.061	0.061	0.058	0.061	0.035	0.028	0.044
Muskellunge	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Largemouth Bass	-	-	-	0.001	0.001	0.001	0.002	0.002
Yellow Perch	0.175	0.169	0.170	0.206	0.178	0.148	0.231	0.347
Walleye	0.174	0.188	0.188	0.109	0.125	0.150	0.093	0.100
<i>Harvest per Angler Hour (targeting anglers)</i>								
Northern pike						0.159	0.110	0.128
Muskellunge						0.001	<0.001	-
Largemouth Bass						0.013	0.079	0.040
Yellow Perch						1.870	2.184	2.156
Walleye						0.242	0.162	0.184

^a18-26" Walleye protected slot limit, possession limit 4

^b20-26" Walleye protected slot limit, possession limit 4

^cWalleye - one over 20" total possession limit of 4

¹Walleye protected slot limit (PSL)

²Estimated post-release hooking mortality (Reeves and Bruesewitz 2007)

Table 2 continued. Estimated total angling pressure and total harvest statistics for the summer open water creel season on Leech Lake, Minnesota, 1965-2019.

	1999	2004	2005 ^a	2008 ^a	2009 ^a	2010 ^a	2011 ^a	2014 ^b	2016 ^b	2019 ^c (day)	1965-2019 Mean
<i>Angling Pressure</i>											
Angler Trips	295,976	192,407	119,114	152,044	179,118	169,590	156,514	167,368	166,763		214,311
Angler Hours	1,193,941	682,346	430,003	585,371	779,163	658,009	696,536	709,642	707,075	864,001	844,840
-Walleye Toum.					15,545	14,056		6,262	-	-	
-Total hours	1,193,941	682,346	430,003	585,371	794,708	672,065	696,536	715,904		864,001	855,054
<i>Number of Harvested Fish</i>											
Northern pike	47,749	23,638	13,967	16,908	10,890	16,987	15,133	16,545	14,776	15,320	32,877
Muskellunge	-	38	119	-	-	-	116	-	-	-	72
Largemouth Bass	2,349	3,807	3,105	2,412	1,243	2,611	851	527	270	2,180	1,482
Yellow Perch	439,768	51,355	84,783	136,096	126,476	146,750	146,774	112,230	76,228	97,180	160,270
Walleye	149,717	29,022	3,940	64,969	81,242	60,300	125,998	187,027	65,358	83,238	108,686
-Protected ¹			No est.	2,533	4,660	628	756	-	5	-	1,430
-Released ²		708	171	3,424	9,947	1,975	3,004	1,806	2,419	3,125	2,953
-Total kill	149,717	29,730	4,111	70,926	95,849	62,903	129,758	188,833	67,782	86,363	110,640
<i>Pounds of Harvested Fish</i>											
Northern pike	127,013	62,659	37,654	54,820	33,588	49,015	44,490	44,884	41,472	35,805	80,999
Yellow Perch	150,666	21,175	34,485	59,149	54,733	64,516	64,275	51,325	30,433	45,619	66,664
Walleye	189,028	68,355	6,348	72,959	86,428	67,236	69,740	95,981	87,428	149,530	124,550
-Protected ¹			No est.	8,451	10,334	2,485	2,888	-	-	-	3,451
-Released ²		973	533	5,585	27,002	6,216	7,925	5,406	5,280	6,439	7,262
-Total kill	189,028	69,328	6,881	86,995	123,764	75,937	80,553	101,387	92,708	155,969	129,524
<i>Harvest per Angler Hour (all anglers)</i>											
Northern pike	0.045	0.035	0.033	0.029	0.014	0.025	0.022	0.023	0.017	0.015	0.038
Muskellunge	-	<0.001	<0.001	-	-	-	<0.001	-	-	-	<0.001
Largemouth Bass	0.002	0.006	0.007	0.004	0.002	0.004	0.001	0.001	-	0.002	0.002
Yellow Perch	0.408	0.075	0.197	0.233	0.162	0.218	0.228	0.158	0.098	0.114	0.195
Walleye	0.107	0.043	0.009	0.115	0.110	0.091	0.079	0.097	0.113	0.107	0.111
<i>Harvest per Angler Hour (targeting anglers)</i>											
Northern pike	0.122	0.082	0.074	0.118	0.077	0.114	0.080	0.124	0.096	0.282	0.120
Muskellunge	-	-	0.001	-	-	-	0.001	-	-	-	<0.001
Largemouth Bass	0.009	0.054	0.070	0.074	0.025	0.030	0.024	0.009	-	0.072	0.038
Yellow Perch	2.283	0.479	0.442	0.848	0.920	1.176	0.914	0.990	0.929	1.730	1.302
Walleye	0.227	0.054	0.019	0.158	0.146	0.122	0.129	0.135	0.146	0.336	0.158

^a18-26" Walleye protected slot limit, possession limit 4

^b20-26" Walleye protected slot limit, possession limit 4

^cWalleye - one over 20" possession limit of 4

¹Walleye protected slot limit (PSL)

²Estimated post-release hooking mortality (Reeves and Bruesewitz 2007)

Table 3. Hometown distances of anglers fishing Leech Lake, Minnesota relative to Walker, MN, May 11th – September 30th 2019.

Distance (miles)	N	Percent
0-49	721	20.6
50-99	390	11.1
100-149	730	20.9
150-199	640	18.3
200-249	241	6.9
250-299	128	3.7
300-349	119	3.4
350-399	140	4.0
400-449	105	3.0
450-499	107	3.1
500-5,000	180	5.1
Total	3,501	100.0

Table 4. Fishing pressure on Leech Lake from 1998-2019 by hometown distances of anglers, sorted by angler group.

Angler Group	Hometown Distance	1998	1999	2004	2005	2008	2009	2010	2011	2014	2016	2019	1998-2019 Average
<i>Angling Pressure</i>													
Local	0-99	229,022	188,996	100,790	59,774	234,734	293,744	180,952	217,319	254,724	226,161	274,180	205,491
Metro	100-249	562,988	525,762	316,648	196,699	180,880	352,961	312,554	337,820	330,917	353,538	397,574	351,667
Destination	>250	482,975	479,183	264,909	173,530	170,343	132,458	165,818	142,093	124,001	127,376	192,247	223,176
Total Pressure		1,274,985	1,193,941	682,346	430,003	585,956	779,163	659,325	697,233	709,642	707,075	864,001	780,334

<i>Percent of pressure (%)</i>													
Local	0-99	18%	16%	15%	14%	40%	38%	27%	31%	36%	32%	32%	
Metro	100-249	44%	44%	46%	46%	31%	45%	47%	48%	47%	50%	46%	
Destination	>250	38%	40%	39%	40%	29%	17%	25%	20%	17%	18%	22%	

Table 5. State of residence of anglers fishing Leech Lake, Minnesota during the summer open water creel season which runs from the game fish open in mid-May through September 30th, 1998 to 2019.

State of Residence	Year										
	1998	1999	2004	2005	2008	2009	2010	2011	2014	2016	2019
	<i>Percentage of Pressure</i>										
Illinois	8.7	11.3	11.9	10.6	6.4	3.6	5.6	3.8	2.3	3.5	3.3
Indiana	2.6	2.9	2.5	2.6	2.8	1.0	1.8	1.0	1.4	0.5	0.8
Iowa	12.7	10.6	10.9	10.9	9.8	6.1	8.6	8.9	7.0	6.7	7.9
Minnesota	63.4	60.1	62.1	61.1	63.7	74.1	69.2	74.2	77.6	80.2	76.5
Nebraska	1.0	1.8	1.6	1.2	0.9	0.8	1.2	0.6	0.9	1.4	1.4
North Dakota	1.8	1.8	1.1	1.1	1.2	1.3	1.4	1.7	1.5	1.5	1.3
South Dakota	-	1.0	0.8	0.8	1.0	0.6	0.8	0.8	0.6	0.4	0.7
Wisconsin	3.6	4.9	4.5	5.2	3.6	2.6	3.5	2.7	3.2	3.0	3.8
Other	6.2	5.6	4.4	6.7	10.6	9.9	7.9	6.3	5.4	2.9	4.4
Total	100	100	100	100	100	100	100	100	100	100	100.0

Table 6. Frequencies (%) of species targeted by boat parties during each stratum for Leech Lake, Minnesota, May 11th – September 30th 2019.

Stratum	Targeted Species								
	Walleye	Northern Pike	Yellow Perch	Largemouth Bass	Black Crappie	Muskellunge	Sunfish spp.	Other/Any	
May and June (day)	86.2	3.1	1.8	3.5	1.2	1.3	1.1	1.0	
July - Sept. (day)	56.3	7.3	11.8	4.1	0.7	12.6	3.0	3.4	
May and June (night)	94.8	-	-	-	5.2	-	-	-	
July-Sept. (night)	86.6	-	-	-	1.6	7.9	3.9	-	
Season (day)	70.0	5.3	7.2	3.8	0.9	7.4	2.1	2.3	
Season (night)	91.3	-	-	-	3.7	3.3	1.7	-	
All Combined	71.6	5.0	6.7	3.5	1.1	7.1	2.1	2.1	

Table 7. Catch and harvest estimates by stratum for the open water creel survey on Leech Lake, Minnesota, 2019. Standard errors are in parentheses.

Species	<i>Number Caught</i>			
	May-June(day)	July-September (day)	May-June (night)	July-September (night)
Bowfin	70 ---	181 ---	0 ---	0 ---
Bullhead spp.	0 ---	--- ---	0 ---	0 ---
Northern Pike	46,376 (5,257)	54,221 (5,176)	4,554 (448)	555 (125)
Muskellunge	124 (58)	1,619 (312)	0 ---	0 ---
Burbot	22 ---	28 ---	0 ---	0
Rock Bass	10,143 (2,196)	9,556 (804)	3,218 (456)	450 ---
Sunfish spp.	6,564 (680)	15,068 (7,624)	65 (44)	171 ---
Smallmouth Bass	1,462 (376)	1,146 (145)	655 (606)	0
Largemouth Bass	13,358 (3,134)	23,470 (2,560)	0 ---	0 ---
Black Crappie	3,268 (1,554)	10,827 (5,656)	1,287 (132)	81 ---
Yellow Perch	87,156 (15,182)	387,107 (53,222)	8,729 (4,125)	4,240 (179)
Walleye	90,801 (11,039)	71,574 (7,197)	12,151 (2,313)	5,038 (543)
Cisco/Whitefish	0 ---	0 ---	0 ---	0 ---
Overall	259,344 (29,068)	574,796 (61,285)	30,659 (6,728)	10,536 (911)

Species	<i>Number Harvested</i>			
	May-June (day)	July-September (day)	May-June (night)	July-September (night)
Bowfin	0 ---	81 ---	0 ---	0 ---
Bullhead spp.	0 ---	0 ---	0 ---	0 ---
Northern Pike	4,089 (1,420)	11,232 (2,099)	506 ---	95 (83)
Muskellunge	0 ---	0 ---	0 ---	0 ---
Burbot	0 ---	0 ---	0 ---	0 ---
Rock Bass	2,210 (1,115)	1,907 (344)	111 ---	0 ---
Sunfish spp.	2,062 (526)	7,162 (3,260)	65 (44)	0 ---
Smallmouth Bass	158 (88)	231 (46)	0 ---	0 ---
Largemouth Bass	555 (22)	1,626 (691)	0 ---	0 ---
Black Crappie	2,580 (1,000)	6,177 (2,565)	1,287 (132)	0 ---
Yellow Perch	23,490 (4,913)	73,690 (11,953)	1,580 (376)	0 ---
Walleye	51,088 (6,047)	32,149 (3,567)	8,068 (1,949)	2,654 (279)
Cisco/Whitefish	0 ---	0 ---	0 ---	0 ---
Overall	86,231 (10,175)	134,255 (16,161)	11,618 (2,155)	2,748 (328)

Table 7 continued. Catch and harvest estimates by stratum for the open water creel survey on Leech Lake, Minnesota, 2019. Standard errors are in parentheses.

<i>Number Caught</i>			
Species	Season (day)	Season (night)	All combined
Bowfin	251 ---	0 ---	251 (---)
Bullhead spp.	0 ---	0 ---	0 ---
Northern Pike	100,597 (7,377)	5,109 (465)	105,705 (7,392)
Muskellunge	1,742 (318)	0 ---	1,742 (318)
Burbot	49 ---	0 ---	49 ---
Rock Bass	19,699 (2,338)	3,669 (456)	23,368 (2,382)
Sunfish spp.	21,632 (7,655)	237 (44)	21,869 (7,655)
Smallmouth Bass	2,609 (403)	655 (606)	3,264 (728)
Largemouth Bass	36,828 (4,047)	0 ---	36,828 (4,047)
Black Crappie	14,095 (5,866)	1,368 (132)	15,462 (5,867)
Yellow Perch	474,263 (55,345)	12,969 (4,129)	487,232 (55,499)
Walleye	162,374 (13,178)	17,190 (2,376)	179,564 (13,391)
Cisco/Whitefish	0 ---	0 ---	0 ---
Overall	834,140 (67,829)	41,195 (6,789)	875,335 (68,168)

<i>Number Harvested</i>			
Species	Season (day)	Season (night)	All combined
Bowfin	81 ---	0 ---	81 ---
Bullhead spp.	0 ---	0 ---	0 ---
Northern Pike	15,320 (2,535)	601 (83)	15,921 (2,536)
Muskellunge	0 ---	0 ---	0 ---
Burbot	0 ---	0 ---	0 ---
Rock Bass	4,118 (1,167)	111 ---	4,228 (1,167)
Sunfish spp.	9,224 (3,303)	65 (44)	9,290 (3,303)
Smallmouth Bass	388 (99)	0 ---	388 (99)
Largemouth Bass	2,180 (691)	0 ---	2,180 (691)
Black Crappie	8,756 (2,753)	1,287 (132)	10,043 (2,757)
Yellow Perch	97,180 (12,923)	1,580 (376)	98,760 (12,929)
Walleye	83,238 (7,020)	10,722 (1,969)	93,959 (7,291)
Cisco/Whitefish	0 ---	0 ---	0 ---
Overall	220,485 (19,097)	14,366 (2,180)	234,851 (19,221)

Table 8. Yield estimates and mean weights of harvested fish by stratum for Leech Lake, Minnesota, May 11th – September 30th 2019. Standard errors are in parentheses.

Species	May-June(day)	July-September (day)	May-June (night)	July-September (night)
<i>Total Pounds Harvested</i>				
Northern Pike	10,954 (7,061)	24,851 (6,963)	710 ---	301 ---
Muskellunge	--- ---	--- ---	--- ---	--- ---
Rock Bass	2,141 (3,136)	1,883 (1,005)	112 ---	--- ---
Sunfish spp.	974 (1,019)	4,287 (4,962)	38 (28)	--- ---
Largemouth Bass	1,572 (43)	3,688 (2,750)	--- ---	--- ---
Black Crappie	3,019 (4,403)	6,658 (3,888)	595 ---	--- ---
Yellow Perch	11,845 (3,550)	33,775 (8,750)	913 (198)	--- ---
Walleye	96,621 (18,724)	52,909 (7,303)	15,644 (5,621)	3,894 (282)
Cisco/Whitefish	--- ---	--- ---	--- ---	--- ---
<i>Mean Weight (pounds) of Harvested Fish</i>				
Northern Pike	2.7 (2.0)	2.2 (0.7)	1.4 ---	3.2 ---
Muskellunge	--- ---	--- ---	--- ---	--- ---
Rock Bass	1.0 (1.5)	1.0 (0.6)	1.0 ---	--- ---
Sunfish spp.	0.5 (0.5)	0.6 (0.7)	0.6 (0.6)	--- ---
Largemouth Bass	2.8 ---	2.3 (1.9)	--- ---	--- ---
Black Crappie	1.2 (1.8)	1.1 (0.8)	0.5 ---	--- ---
Yellow Perch	0.5 ---	0.5 (0.1)	0.6 (0.2)	--- ---
Walleye	1.9 ---	1.6 (0.3)	1.9 (0.8)	1.5 ---
Cisco/Whitefish	--- ---	--- ---	--- ---	--- ---
<i>Mean Length (in) of Harvested Fish</i>				
Northern Pike	22.4 (18.3)	21.3 (6.8)	18.4 ---	24.5 ---
Muskellunge	--- ---	--- ---	--- ---	--- ---
Rock Bass	10.5 (15.1)	10.5 (6.1)	10.6 ---	--- ---
Sunfish spp.	8.0 (7.0)	8.7 (11.0)	8.5 (8.5)	--- ---
Largemouth Bass	17.0 ---	15.8 (14.1)	--- ---	--- ---
Black Crappie	12.3 (20.4)	12.0 (8.8)	9.0 ---	--- ---
Yellow Perch	9.9 (3.3)	9.8 (3.0)	10.6 (3.5)	--- ---
Walleye	17.5 (4.0)	16.7 (2.9)	17.7 (8.1)	16.3 (2.1)
Cisco/Whitefish	--- ---	--- ---	--- ---	--- ---

Table 8 continued. Yield estimates and mean weights of harvested fish by stratum for Leech Lake, Minnesota, May 11th – September 30th 2019. Standard errors are in parentheses.

Species	Season (day)	Season (night)	All combined
<i>Total Pounds Harvested</i>			
Northern Pike	35,805 (9,916)	1,011 ---	36,816 (9,916)
Muskellunge	--- ---	--- ---	--- ---
Rock Bass	4,024 (3,293)	112 ---	4,136 (3,293)
Sunfish spp.	5,261 (5,065)	38 (28)	5,299 (5,065)
Largemouth Bass	5,260 (2,750)	--- ---	5,260 (2,750)
Black Crappie	9,678 (5,874)	595 ---	10,273 (5,874)
Yellow Perch	45,619 (9,443)	913 (198)	46,533 (9,445)
Walleye	149,530 (20,098)	19,539 (5,628)	169,068 (20,871)
Cisco/Whitefish	--- ---	--- ---	--- ---
Total Pounds Harvest	255,176		277,384
<i>Mean Weight (pounds) of Harvested Fish</i>			
Northern Pike	2.3 (0.8)	1.7 ---	2.3 (0.7)
Muskellunge	--- ---	--- ---	--- ---
Rock Bass	1.0 (0.8)	1.0 ---	1.0 (0.8)
Sunfish spp.	0.6 (0.6)	0.6 (0.6)	0.6 (0.6)
Largemouth Bass	2.4 (1.5)	--- ---	2.4 (1.5)
Black Crappie	1.1 (0.8)	0.5 ---	1.0 (0.6)
Yellow Perch	0.5 ---	0.6 ---	0.5 ---
Walleye	1.8 ---	1.8 (0.6)	1.8 ---
Cisco/Whitefish	--- ---	--- ---	--- ---
<i>Mean Length (in) of Harvested Fish</i>			
Northern Pike	21.6 (7.)	19.4 ---	21.5 (6.7)
Muskellunge	--- ---	--- ---	--- ---
Rock Bass	10.5 (8.6)	10.6 ---	10.5 (8.4)
Sunfish spp.	8.5 (8.7)	8.5 (8.5)	8.5 (8.6)
Largemouth Bass	16.1 (10.6)	--- ---	16.1 (10.6)
Black Crappie	12.1 (8.6)	9.0 ---	11.7 (7.5)
Yellow Perch	9.8 (2.4)	10.6 (3.5)	9.8 (2.4)
Walleye	17.2 (2.7)	17.3 (6.1)	17.2 (2.5)
Cisco/Whitefish	--- ---	--- ---	--- ---

Table 9. Estimates of catch and harvest rates of selected species for **all** anglers by stratum during the open water season on Leech Lake, Minnesota, 2019.

Species	Stratum			
	May-June (day)	July-Sept. (day)	May-June (night)	July-Sept. (night)
<i>Catch per Angler Hour</i>				
Bowfin	0.0002 ---	0.0004 ---	---	---
Bullhead spp.	---	---	---	---
Northern Pike	0.1137 (0.0283)	0.1189 (0.0268)	0.1017 (0.0206)	0.0176 (0.0050)
Muskellunge	0.0003 (0.0002)	0.0035 (0.0007)	---	---
Burbot	0.0001 ---	0.0001 ---	---	---
Rock Bass	0.0249 (0.0047)	0.0210 (0.0030)	0.0719 (0.0163)	0.0143 ---
Sunfish spp.	0.0161 (0.0032)	0.0330 (0.0168)	0.0015 (0.0010)	0.0054 ---
Smallmouth Bass	0.0036 (0.0006)	0.0025 (0.0004)	0.0146 (0.0138)	---
Largemouth Bass	0.0327 (0.0075)	0.0515 (0.0064)	---	0.0000 ---
Black Crappie	0.0080 (0.0039)	0.0237 (0.0124)	0.0288 (0.0059)	0.0026 ---
Yellow Perch	0.2136 (0.0490)	0.8488 (0.1499)	0.1950 (0.1282)	0.1342 (0.0242)
Walleye	0.2226 (0.0543)	0.1569 ---	0.2715 (0.0740)	0.1595 (0.0328)
Cisco/Whitefish	---	---	---	---
Overall	0.6357 (0.1295)	1.2604 (0.1807)	0.6850 (0.2309)	0.3334 (0.0651)
<i>Harvest per Angler Hour</i>				
Bowfin	0.0000 ---	0.0002 ---	---	---
Bullhead spp.	---	---	---	---
Northern Pike	0.0100 (0.0038)	0.0246 (0.0069)	0.0113 (0.0020)	0.0030 (0.0027)
Muskellunge	0.0000 (0.0000)	0.0000 (0.0000)	---	---
Burbot	0.0000 ---	0.0000 ---	---	---
Rock Bass	0.0054 (0.0025)	0.0042 (0.0011)	0.0025 (0.0004)	---
Sunfish spp.	0.0051 (0.0022)	0.0157 (0.0072)	0.0015 (0.0010)	---
Smallmouth Bass	0.0004 (0.0001)	0.0005 (0.0001)	0.0000 (0.0000)	---
Largemouth Bass	0.0014 (0.0001)	0.0036 (0.0015)	---	---
Black Crappie	0.0063 (0.0025)	0.0135 (0.0057)	0.0288 (0.0059)	---
Yellow Perch	0.0576 (0.0141)	0.1616 (0.0300)	0.0353 (0.0093)	---
Walleye	0.1252 (0.0331)	0.0705 (0.0118)	0.1803 (0.0568)	0.0840 (0.0171)
Cisco/Whitefish	---	---	---	---
Overall	0.2114 (0.0497)	0.2944 (0.0432)	0.2596 (0.0692)	0.0870 (0.0184)

Table 9 continued. Estimates of catch and harvest rates of selected species for **all** anglers by stratum during the open water season on Leech Lake, Minnesota, 2019.

Species	Stratum		
	Season (day)	Season (night)	All Combined
<i>Catch per Angler Hour</i>			
Bowfin	0.0003 ---	--- ---	0.0003 ---
Bullhead spp.	--- ---	--- ---	--- ---
Northern Pike	0.1164 (0.0195)	0.0669 (0.0104)	0.1124 (0.0176)
Muskellunge	0.0020 (0.0004)	--- ---	0.0019 (0.0004)
Burbot	0.0001 ---	--- ---	0.0001 ---
Rock Bass	0.0228 (0.0028)	0.0480 (0.0085)	0.0249 (0.0026)
Sunfish spp.	0.0250 (0.0091)	0.0031 (0.0007)	0.0233 (0.0083)
Smallmouth Bass	0.0030 (0.0004)	0.0086 (0.0080)	0.0035 (0.0007)
Largemouth Bass	0.0426 (0.0049)	0.0000 ---	0.0392 (0.0045)
Black Crappie	0.0163 (0.0068)	0.0179 (0.0029)	0.0164 (0.0063)
Yellow Perch	0.5489 (0.0803)	0.1699 (0.0735)	0.5181 (0.0734)
Walleye	0.1879 (0.0225)	0.2251 (0.0438)	0.1910 (0.0210)
Cisco/Whitefish	--- ---	--- ---	0.0000 ---
Overall	0.9654 (0.1163)	0.5395 (0.1300)	0.9309 (0.1064)
<i>Harvest per Angler Hour</i>			
Bowfin	0.0001 ---	--- ---	0.0001 ---
Bullhead spp.	--- ---	--- ---	--- ---
Northern Pike	0.0177 (0.0039)	0.0079 (0.0015)	0.0169 (0.0035)
Muskellunge	0.0000 (0.0000)	--- ---	0.0000 (0.0000)
Burbot	--- ---	--- ---	0.0000 ---
Rock Bass	0.0048 (0.0013)	0.0015 (0.0002)	0.0045 (0.0012)
Sunfish spp.	0.0107 (0.0040)	0.0009 (0.0006)	0.0099 (0.0037)
Smallmouth Bass	0.0004 (0.0001)	0.0000 (0.0000)	0.0004 (0.0001)
Largemouth Bass	0.0025 (0.0008)	0.0000 ---	0.0023 (0.0007)
Black Crappie	0.0101 (0.0032)	0.0169 (0.0027)	0.0107 (0.0030)
Yellow Perch	0.1125 (0.0172)	0.0207 (0.0052)	0.1050 (0.0156)
Walleye	0.0963 (0.0156)	0.1404 (0.0326)	0.0999 (0.0148)
Cisco/Whitefish	--- ---	--- ---	0.0000 ---
Overall	0.2552 (0.0338)	0.1882 (0.0383)	0.2497 (0.0310)

Table 10. Estimates of catch and harvest rates of selected species for **targeting** anglers by stratum during the open water season on Leech Lake, Minnesota, 2019.

Species	Stratum			
	May-June (day)	July-Sept. (day)	May-June (night)	July-Sept. (night)
<i>Catch per Angler Hour</i>				
Northern pike	0.3013 (0.0446)	0.3039 (0.0490)	0.2113 (0.0776)	0.1455 (0.0838)
Muskellunge	0.0061 (0.0043)	0.0171 (0.0034)	--- ---	0.0000 (0.0000)
Sunfish spp.	0.5269 (0.2283)	0.7147 (0.3132)	--- ---	--- ---
Largemouth Bass	0.4098 (0.1100)	0.7726 (0.1692)	--- ---	0.0000 ---
Black Crappie	0.1705 (0.1135)	0.4136 (0.1895)	0.9247 (0.8358)	1.0000 ---
Yellow Perch	1.0763 (0.2698)	3.5377 (0.4072)	0.1841 (0.0419)	--- ---
Walleye	0.2454 (0.0158)	0.2697 (0.0208)	0.3754 (0.0663)	0.2757 (0.0682)
<i>Harvest per Angler Hour</i>				
Northern pike	0.0858 (0.0358)	0.1244 (0.0269)	0.0313 (0.0251)	0.0727 (0.0584)
Muskellunge	0.0000 (0.0000)	0.0000 (0.0000)	--- ---	0.0000 (0.0000)
Sunfish spp.	0.4419 (0.1905)	0.3435 (0.1786)	--- ---	--- ---
Largemouth Bass	0.0179 (0.0121)	0.0457 (0.0239)	--- ---	--- ---
Black Crappie	0.1194 (0.0734)	0.2408 (0.0814)	0.9247 (0.8358)	--- ---
Yellow Perch	0.4918 (0.1166)	0.8055 (0.0901)	0.1674 (0.0484)	--- ---
Walleye	0.1438 (0.0136)	0.1218 (0.0126)	0.2609 (0.0550)	0.1379 (0.0483)

Table 10 continued. Estimates of catch and harvest rates of selected species for **targeting** anglers by stratum during the open water season on Leech Lake, Minnesota, 2019.

Species	Stratum		
	Season (day)	Season (night)	All Combined
<i>Catch per Angler Hour</i>			
Northern pike	0.3061 (0.0355)	0.1996 (0.0634)	0.2934 (0.0334)
Muskellunge	0.0163 (0.0032)	0.0000 (0.0000)	0.0155 (0.0031)
Sunfish spp.	0.6406 (0.2050)	0.5581 ---	0.6457 (0.1888)
Largemouth Bass	0.6096 (0.1253)	0.0000 ---	0.6063 (0.1248)
Black Crappie	0.2933 (0.1249)	0.9262 (0.7926)	0.3700 (0.1371)
Yellow Perch	2.8898 (0.3971)	0.1841 (0.0419)	2.8124 (0.3948)
Walleye	0.2556 (0.0127)	0.3277 (0.0529)	0.2615 (0.0118)
<i>Harvest per Angler Hour</i>			
Northern pike	0.1118 (0.0218)	0.0386 (0.0233)	0.1030 (0.0194)
Muskellunge	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Sunfish spp.	0.3823 (0.1309)	0.0000 ---	0.3708 (0.1122)
Largemouth Bass	0.0332 (0.0142)	0.0000 ---	0.0330 (0.0141)
Black Crappie	0.1771 (0.0591)	0.9057 (0.7927)	0.2667 (0.1055)
Yellow Perch	0.7243 (0.0766)	0.1674 (0.0484)	0.7081 (0.0750)
Walleye	0.1346 (0.0099)	0.2083 (0.0433)	0.1402 (0.0098)

Table 11. Percent of all angling parties who harvested a given number of fish by stratum from Leech Lake, Minnesota, May 11th – September 30th 2019.

Species/stratum	Number Harvested per Angler						
Northern Pike	N	0	0.1-0.9	1.0-1.9	2.0-2.9	3.0-9.9	10
May-June (day)	738	95%	3.4%	1.1%	0.0%	0.4%	0%
July-Sept. (day)	895	90%	5.3%	3.7%	0.8%	0.4%	0%
May-June (night)	75	95%	4.0%	1.3%	0.0%	0.0%	0%
July-Sept. (night)	53	98%	0.0%	1.9%	0.0%	0.0%	0%
Season (day)	1,643	92%	4.4%	2.5%	0.4%	0.4%	0%
Season (night)	128	96%	2.3%	1.6%	0.0%	0.0%	0%
All Combined	1,771	92%	4.2%	2.4%	0.4%	0.4%	0%
Yellow Perch	N	0	0.1-4.9	5.0-9.9	10.0-14.9	15.0-19.9	20+
May-June (day)	738	83%	15%	1%	1%	0%	0%
July-Sept. (day)	895	82%	12%	3%	2%	1%	0%
May-June (night)	75	84%	16%	0%	0%	0%	0%
July-Sept. (night)	53	100%	0%	0%	0%	0%	0%
Season (day)	1,633	82%	13%	2%	1%	1%	0%
Season (night)	128	91%	9%	0%	0%	0%	0%
All Combined	1,761	83%	13%	2%	1%	1%	0%
Walleye	N	0	0.1-0.9	1.0-1.9	2.0-2.9	3.0-3.9	4+
May-June (day)	738	54%	18%	13%	8%	3%	4%
July-Sept. (day)	895	75%	10%	8%	3%	1%	2%
May-June (night)	75	36%	17%	21%	11%	8%	7%
July-Sept. (night)	53	70%	13%	9%	0%	6%	2%
Season (day)	1,633	66%	14%	10%	5%	2%	3%
Season (night)	128	50%	16%	16%	6%	7%	5%
All Combined	1,761	65%	14%	11%	5%	2%	3%

Northern pike: 10 fish in possession, 22"-26" Protected slot, 2 fish over 26 inches allowed in possession (statewide

Yellow perch: 20 fish daily, 40 in possession, no length limit (statewide regulation).

Walleye: 4 fish in possession, only 1 fish over 20 inches allowed in possession (special regulation).

Table 12. Percent of targeting angling parties who harvested a given number of fish by stratum from Leech Lake, Minnesota, May 11th – September 30th 2019.

Species/stratum	Number Harvested per Angler						
	N	0	0.1-0.9	1.0-1.9	2.0-2.9	3.0-9.9	10+
Northern Pike							
May-June (day)	42	64%	19%	10%	0%	7%	0%
July-Sept. (day)	68	46%	25%	19%	6%	4%	0%
May-June (night)	9	67%	33%	0%	0%	0%	0%
July-Sept. (night)	2	50%	0%	50%	0%	0%	0%
Season (day)	110	53%	23%	15%	4%	5%	0%
Season (night)	11	64%	27%	9%	0%	0%	0%
All Combined	121	54%	23%	15%	3%	5%	0%
Yellow Perch							
May-June (day)	56	36%	43%	14%	5%	0%	2%
July-Sept. (day)	150	31%	31%	23%	10%	2%	4%
May-June (night)	5	20%	80%	0%	0%	0%	0%
July-Sept. (night)	0	0%	0%	0%	0%	0%	0%
Season (day)	206	32%	34%	20%	9%	1%	3%
Season (night)	5	20%	80%	0%	0%	0%	0%
All Combined	211	32%	35%	20%	9%	1%	3%
Walleye							
May-June (day)	519	37%	25%	18%	11%	4%	6%
July-Sept. (day)	401	51%	18%	17%	7%	3%	4%
May-June (night)	67	28%	19%	24%	12%	9%	7%
July-Sept. (night)	42	62%	17%	12%	0%	7%	2%
Season (day)	920	43%	22%	17%	9%	3%	5%
Season (night)	468	48%	18%	18%	7%	4%	5%

Northern pike: 10 fish in possession, 22"-26" Protected slot, 2 fish over 26 inches allowed in possession (statewide regulation).

Yellow perch: 20 fish daily, 40 in possession, no length limit (statewide regulation).

Walleye: 4 fish in possession, 1 fish over 20 inches allowed in possession (special regulation).

Table 13. Extrapolated length-frequency distribution of fish harvested and released fish for Leech Lake, Minnesota, May 11th– September 30th 2019 both day and night anglers.

Estimated Number Harvested (H) and Released (R)						
TL (inches)	Bowfin		Bullhead Spp.		Northern Pike	
	H	R	H	R	H	R
<4.00	-	-	-	-	-	-
4.00-4.99	-	-	-	-	-	-
5.00-5.99	-	-	-	-	-	-
6.00-6.99	-	-	-	-	-	-
7.00-7.99	-	-	-	-	-	45 (0%)
8.00-8.99	-	-	-	-	-	91 (0%)
9.00-9.99	-	-	-	-	-	-
10.00-10.99	-	-	-	-	-	227 (0%)
11.00-11.99	-	-	-	-	-	45 (0%)
12.00-12.99	-	-	-	-	-	1,183 (1%)
13.00-13.99	-	-	-	-	51 (0%)	227 (0%)
14.00-14.99	-	-	-	-	51 (0%)	1,319 (1%)
15.00-15.99	-	-	-	-	51 (0%)	1,364 (2%)
16.00-16.99	-	-	-	-	253 (2%)	2,729 (3%)
17.00-17.99	-	-	-	-	354 (2%)	1,956 (2%)
18.00-18.99	-	-	-	-	1,314 (8%)	9,779 (11%)
19.00-19.99	-	-	-	-	2,679 (17%)	4,275 (5%)
20.00-20.99	-	81 (33%)	-	-	3,033 (19%)	14,509 (16%)
21.00-21.99	-	-	-	-	3,639 (23%)	5,503 (6%)
22.00-22.99	-	-	-	-	1,213 (8%)	8,778 (10%)
23.00-23.99	81 (100%)	-	-	-	152 (1%)	5,367 (6%)
24.00-24.99	-	81 (33%)	-	-	303 (2%)	13,872 (15%)
25.00-25.99	-	81 (33%)	-	-	253 (2%)	6,095 (7%)
26.00-26.99	-	-	-	-	809 (5%)	4,958 (6%)
27.00-27.99	-	-	-	-	607 (4%)	1,774 (2%)
28.00-28.99	-	-	-	-	404 (3%)	2,047 (2%)
29.00-29.99	-	-	-	-	202 (1%)	364 (0%)
30.00-30.99	-	-	-	-	101 (1%)	1,455 (2%)
31.00-31.99	-	-	-	-	303 (2%)	136 (0%)
32.00-32.99	-	-	-	-	51 (0%)	591 (1%)
33.00-33.99	-	-	-	-	51 (0%)	91 (0%)
34.00-34.99	-	-	-	-	51 (0%)	546 (1%)
35.00-35.99	-	-	-	-	-	182 (0%)
36.00-36.99	-	-	-	-	-	227 (0%)
37.00-37.99	-	-	-	-	-	-
38.00-38.99	-	-	-	-	-	1 (0%)
39.00-39.99	-	-	-	-	-	-
40.00-40.99	-	-	-	-	-	-
41.00-41.99	-	-	-	-	-	-
42.00-42.99	-	-	-	-	-	-
43.00-43.99	-	-	-	-	-	-
44.00-44.99	-	-	-	-	-	-
45.00-45.99	-	-	-	-	-	-
46.00-46.99	-	-	-	-	-	-
47.00-47.99	-	-	-	-	-	-
48.00-48.99	-	-	-	-	-	-
49.00-49.99	-	-	-	-	-	-
≥50.00	-	-	-	-	-	-
Total (N)	81 (100%)	170 (100%)	-	-	15,921 (100%)	89,740 (100%)

Table 13 continued. Extrapolated length-frequency distribution of fish harvested and released fish for Leech Lake, Minnesota, May 11th– September 30th 2019 both day and night anglers.

Estimated Number Harvested (H) and Released (R)						
TL (inches)	Muskellunge		Burbot		Rock Bass	
	H	R	H	R	H	R
<4.00	- -	- -	- -	- -	- -	- -
4.00-4.99	- -	- -	- -	- -	- -	332 (2%)
5.00-5.99	- -	- -	- -	- -	- -	1,421 (7%)
6.00-6.99	- -	- -	- -	- -	30 (1%)	1,137 (6%)
7.00-7.99	- -	- -	- -	- -	- -	569 (3%)
8.00-8.99	- -	- -	- -	- -	210 (5%)	2,274 (12%)
9.00-9.99	- -	- -	- -	- -	630 (15%)	2,653 (14%)
10.00-10.99	- -	- -	- -	- -	810 (19%)	4,406 (23%)
11.00-11.99	- -	- -	- -	- -	1,859 (44%)	2,606 (14%)
12.00-12.99	- -	- -	- -	- -	630 (15%)	3,032 (16%)
13.00-13.99	- -	- -	- -	- -	60 (1%)	426 (2%)
14.00-14.99	- -	- -	- -	- -	- -	237 (1%)
15.00-15.99	- -	- -	- -	- -	- -	47 (0%)
16.00-16.99	- -	41 (2%)	- -	- -	- -	- -
17.00-17.99	- -	- -	- -	- -	- -	- -
18.00-18.99	- -	- -	- -	- -	- -	- -
19.00-19.99	- -	- -	- -	- -	- -	- -
20.00-20.99	- -	162 (9%)	- -	25 (50%)	- -	- -
21.00-21.99	- -	- -	- -	- -	- -	- -
22.00-22.99	- -	- -	- -	- -	- -	- -
23.00-23.99	- -	- -	- -	- -	- -	- -
24.00-24.99	- -	41 (2%)	- -	- -	- -	- -
25.00-25.99	- -	41 (2%)	- -	- -	- -	- -
26.00-26.99	- -	41 (2%)	- -	- -	- -	- -
27.00-27.99	- -	41 (2%)	- -	- -	- -	- -
28.00-28.99	- -	- -	- -	- -	- -	- -
29.00-29.99	- -	- -	- -	25 (50%)	- -	- -
30.00-30.99	- -	81 (5%)	- -	- -	- -	- -
31.00-31.99	- -	- -	- -	- -	- -	- -
32.00-32.99	- -	41 (2%)	- -	- -	- -	- -
33.00-33.99	- -	41 (2%)	- -	- -	- -	- -
34.00-34.99	- -	41 (2%)	- -	- -	- -	- -
35.00-35.99	- -	- -	- -	- -	- -	- -
36.00-36.99	- -	81 (5%)	- -	- -	- -	- -
37.00-37.99	- -	41 (2%)	- -	- -	- -	- -
38.00-38.99	- -	41 (2%)	- -	- -	- -	- -
39.00-39.99	- -	162 (9%)	- -	- -	- -	- -
40.00-40.99	- -	41 (2%)	- -	- -	- -	- -
41.00-41.99	- -	81 (5%)	- -	- -	- -	- -
42.00-42.99	- -	162 (9%)	- -	- -	- -	- -
43.00-43.99	- -	- -	- -	- -	- -	- -
44.00-44.99	- -	81 (5%)	- -	- -	- -	- -
45.00-45.99	- -	81 (5%)	- -	- -	- -	- -
46.00-46.99	- -	41 (2%)	- -	- -	- -	- -
47.00-47.99	- -	81 (5%)	- -	- -	- -	- -
48.00-48.99	- -	81 (5%)	- -	- -	- -	- -
49.00-49.99	- -	122 (7%)	- -	- -	- -	- -
≥50.00	- -	81 (5%)	- -	- -	- -	- -
Total (N)	- -	1,742 (100%)	- -	50 (100%)	4,228 (100%)	19,140 (100%)

Table 13 continued. Extrapolated length-frequency distribution of fish harvested and released fish for Leech Lake, Minnesota, May 11th– September 30th 2019 both day and night anglers.

Estimated Number Harvested (H) and Released (R)						
TL (inches)	Sunfish		Smallmouth Bass		Largemouth Bass	
	H	R	H	R	H	R
<4.00	- -	- -	- -	- -	- -	- -
4.00-4.99	55 (1%)	638 (5%)	- -	54 (2%)	- -	57 (0%)
5.00-5.99	- -	1,914 (15%)	- -	54 (2%)	- -	- -
6.00-6.99	- -	2,826 (22%)	- -	54 (2%)	- -	113 (0%)
7.00-7.99	1,421 (15%)	1,458 (12%)	- -	- -	- -	- -
8.00-8.99	1,858 (20%)	3,373 (27%)	- -	109 (4%)	- -	57 (0%)
9.00-9.99	5,028 (54%)	2,188 (17%)	- -	- -	- -	170 (0%)
10.00-10.99	929 (10%)	182 (1%)	86 (22%)	- -	- -	- -
11.00-11.99	- -	- -	43 (11%)	217 (8%)	- -	113 (0%)
12.00-12.99	- -	- -	43 (11%)	163 (6%)	62 (3%)	2,204 (6%)
13.00-13.99	- -	- -	43 (11%)	109 (4%)	125 (6%)	1,357 (4%)
14.00-14.99	- -	- -	43 (11%)	271 (9%)	374 (17%)	5,483 (16%)
15.00-15.99	- -	- -	86 (22%)	54 (2%)	125 (6%)	5,991 (17%)
16.00-16.99	- -	- -	- -	760 (26%)	623 (29%)	6,896 (20%)
17.00-17.99	- -	- -	- -	271 (9%)	374 (17%)	3,900 (11%)
18.00-18.99	- -	- -	43 (11%)	271 (9%)	374 (17%)	5,030 (15%)
19.00-19.99	- -	- -	- -	217 (8%)	125 (6%)	2,317 (7%)
20.00-20.99	- -	- -	- -	271 (9%)	- -	509 (1%)
21.00-21.99	- -	- -	- -	- -	- -	339 (1%)
22.00-22.99	- -	- -	- -	- -	- -	113 (0%)
23.00-23.99	- -	- -	- -	- -	- -	- -
24.00-24.99	- -	- -	- -	- -	- -	- -
25.00-25.99	- -	- -	- -	- -	- -	- -
26.00-26.99	- -	- -	- -	- -	- -	- -
27.00-27.99	- -	- -	- -	- -	- -	- -
28.00-28.99	- -	- -	- -	- -	- -	- -
29.00-29.99	- -	- -	- -	- -	- -	- -
30.00-30.99	- -	- -	- -	- -	- -	- -
31.00-31.99	- -	- -	- -	- -	- -	- -
32.00-32.99	- -	- -	- -	- -	- -	- -
33.00-33.99	- -	- -	- -	- -	- -	- -
34.00-34.99	- -	- -	- -	- -	- -	- -
35.00-35.99	- -	- -	- -	- -	- -	- -
≥ 36.00	- -	- -	- -	- -	- -	- -
Total (N)	9,290 (100%)	12,579 (100%)	388 (100%)	2,876 (100%)	2,180 (100%)	34,648 (100%)

Table 13 continued. Extrapolated length-frequency distribution of fish harvested and released fish for Leech Lake, Minnesota, May 11th– September 30th 2019 both day and night anglers.

Estimated Number Harvested (H) and Released (R)				
TL (inches)	Black Crappie		Yellow Perch	
	H	R	H	R
<4.00	- -	- -	- -	794 (0%)
4.00-4.99	- -	- -	43 (0%)	87,631 (23%)
5.00-5.99	- -	- -	346 (0%)	67,952 (17%)
6.00-6.99	275 (3%)	- -	1,559 (2%)	124,784 (32%)
7.00-7.99	138 (1%)	- -	1,515 (2%)	32,873 (8%)
8.00-8.99	1,032 (10%)	638 (12%)	8,919 (9%)	47,831 (12%)
9.00-9.99	825 (8%)	1,594 (29%)	33,295 (34%)	15,091 (4%)
10.00-10.99	1,101 (11%)	531 (10%)	24,073 (24%)	7,148 (2%)
11.00-11.99	1,857 (18%)	744 (14%)	21,086 (21%)	2,339 (1%)
12.00-12.99	1,307 (13%)	319 (6%)	5,499 (6%)	1,809 (0%)
13.00-13.99	3,027 (30%)	1,063 (20%)	1,862 (2%)	132 (0%)
14.00-14.99	275 (3%)	531 (10%)	563 (1%)	88 (0%)
15.00-15.99	206 (2%)	- -	- -	- -
16.00-16.99	- -	- -	- -	- -
17.00-17.99	- -	- -	- -	- -
18.00-18.99	- -	- -	- -	- -
19.00-19.99	- -	- -	- -	- -
20.00-20.99	- -	- -	- -	- -
21.00-21.99	- -	- -	- -	- -
22.00-22.99	- -	- -	- -	- -
23.00-23.99	- -	- -	- -	- -
24.00-24.99	- -	- -	- -	- -
25.00-25.99	- -	- -	- -	- -
26.00-26.99	- -	- -	- -	- -
27.00-27.99	- -	- -	- -	- -
28.00-28.99	- -	- -	- -	- -
29.00-29.99	- -	- -	- -	- -
30.00-30.99	- -	- -	- -	- -
31.00-31.99	- -	- -	- -	- -
32.00-32.99	- -	- -	- -	- -
33.00-33.99	- -	- -	- -	- -
34.00-34.99	- -	- -	- -	- -
35.00-35.99	- -	- -	- -	- -
≥ 36.00	- -	- -	- -	- -
Total (N)	10,043 (100%)	5,419 (100%)	98,760 (100%)	388,472 (100%)

Table 13 continued. Extrapolated length-frequency distribution of fish harvested and released fish for Leech Lake, Minnesota, May 11th– September 30th 2019 both day and night anglers.

Estimated Number Harvested (H) and Released (R)				
TL (inches)	Walleye ¹		Cisco/ Whitefish	
	H	R	H	R
<4.00	- -	- -	- -	- -
4.00-4.99	- -	542 (1%)	- -	- -
5.00-5.99	- -	497 (1%)	- -	- -
6.00-6.99	- -	1,762 (2%)	- -	- -
7.00-7.99	43 (0%)	452 (1%)	- -	- -
8.00-8.99	- (0%)	1,355 (2%)	- -	- -
9.00-9.99	43 (0%)	2,620 (3%)	- -	- -
10.00-10.99	342 (0%)	4,924 (6%)	- -	- -
11.00-11.99	428 (0%)	6,279 (7%)	- -	- -
12.00-12.99	727 (1%)	9,216 (11%)	- -	- -
13.00-13.99	3,466 (4%)	7,363 (9%)	- -	- -
14.00-14.99	10,868 (12%)	6,550 (8%)	- -	- -
15.00-15.99	13,991 (15%)	4,608 (5%)	- -	- -
16.00-16.99	13,906 (15%)	5,692 (7%)	- -	- -
17.00-17.99	12,322 (13%)	2,756 (3%)	- -	- -
18.00-18.99	10,568 (11%)	2,394 (3%)	- -	- -
19.00-19.99	8,728 (9%)	2,394 (3%)	- -	- -
20.00-20.99	4,321 (5%)	3,253 (4%)	- -	- -
21.00-21.99	4,364 (5%)	3,298 (4%)	- -	- -
22.00-22.99	3,722 (4%)	3,433 (4%)	- -	- -
23.00-23.99	2,011 (2%)	3,840 (4%)	- -	- -
24.00-24.99	1,754 (2%)	4,020 (5%)	- -	- -
25.00-25.99	1,155 (1%)	2,665 (3%)	- -	- -
26.00-26.99	813 (1%)	4,201 (5%)	- -	- -
27.00-27.99	171 (0%)	678 (1%)	- -	- -
28.00-28.99	171 (0%)	632 (1%)	- -	- -
29.00-29.99	43 (0%)	136 (0%)	- -	- -
30.00-30.99	- -	45 (0%)	- -	- -
31.00-31.99	- -	- -	- -	- -
32.00-32.99	- -	- -	- -	- -
33.00-33.99	- -	- -	- -	- -
34.00-34.99	- -	- -	- -	- -
35.00-35.99	- -	- -	- -	- -
≥ 36.00	- -	- -	- -	- -
Total (N)	93,959 (100%)	85,605 (100%)	- (0%)	- (0%)

Table 14. Estimated catch statistics for the summer open water daytime creel season on Leech Lake, Minnesota, 1991-2019.

	1991	1992	1998	1999	2004	2005 ^a	2008 ^a	2009 ^a	2010 ^a	2011 ^a	2014 ^b	2016 ^b	2019 ^c	1991-2016 Mean
<i>Number of Fish Caught</i>														
Northern pike	120,220	67,718	215,742	214,634	84,758	43,105	51,015	63,003	55,958	65,563	75,338	83,291	100,597	95,457
Muskellunge	1,960	1,290	2,953	3,275	1,106	970	1,117	724	956	1,843	2,720	1,274	1,742	1,687
Largemouth Bass	7,676	5,360	6,770	11,749	27,096	12,493	9,796	13,066	17,294	9,769	14,592	26,605	36,828	15,315
Yellow Perch	423,757	513,840	1,058,291	1,099,143	204,411	441,826	448,117	465,724	565,022	506,118	405,956	292,505	474,263	530,690
Walleye	247,937	100,416	224,402	229,930	43,816	9,582	162,806	263,814	149,271	160,345	138,728	130,766	162,374	155,707
Smallmouth							68	267	100	51	1,132	2,261	3,264	1,020
<i>Catch per Angler Hour (all anglers)</i>														
Northern pike	0.1000	0.0720	0.1780	0.2040	0.1450	0.1000	0.0870	0.0809	0.0836	0.0950	0.1060	0.1178	0.1164	0.1141
Muskellunge	0.0010	0.0010	0.0030	0.0030	0.0020	0.0020	0.0020	0.0009	0.0014	0.0030	0.0038	0.0018	0.0020	0.0021
Largemouth Bass	0.0060	0.0060	0.0090	0.0100	0.0400	0.0290	0.0170	0.0168	0.0279	0.0140	0.0206	0.0376	0.0426	0.0195
Yellow Perch	0.3500	0.5490	0.8800	0.9730	0.0560	1.0280	0.7660	0.5977	0.8589	0.7700	0.5722	0.4137	0.5489	0.6512
Walleye	0.2200	0.1070	0.1630	0.1620	0.0560	0.0220	0.2783	0.3386	0.2069	0.2320	0.1955	0.1849	0.1879	0.1805
<i>Catch per Angler Hour (targeting anglers)</i>														
Northern pike	0.3370	0.2260	0.4290	0.4560	0.2290	0.1980	0.2759	0.2710	0.3117	0.2516	0.3568	0.3037	0.3061	0.3040
Muskellunge	0.0180	0.0130	0.0270	0.0270	0.0080	0.0090	0.0156	0.0071	0.0206	0.0168	0.0393	0.0180	0.0163	0.0181
Largemouth Bass	0.4720	0.3310	0.2320	0.4440	0.5540	0.3790	0.4748	0.5187	0.5994	0.5226	0.4567	0.5603	0.6096	0.4734
Yellow Perch	2.8600	3.8300	4.2280	4.7610	1.5760	2.1870	2.1457	2.4973	4.0056	2.6385	3.0333	2.9616	2.8898	3.0472
Walleye	0.3320	0.1860	0.2870	0.3380	0.0820	0.0460	0.3993	0.4141	0.2648	0.3636	0.2816	0.2706	0.2556	0.2708

^a Walleye 18-26" protected slot limit, possession limit 4

^b Walleye 20-26" protected slot limit, possession limit 4

^c Walleye - one over 20" allowed in possession, possession limit 4

Table 15. Angler survey question responses for the summer open water creel season Leech Lake, Minnesota 2019. (N=3070).

Q1. (2019) On a scale of 1-5, how would you rate your fishing success today? 1 is low and 5 is high.					
	1	2	3	4	5
Percent	28.2%	14.5%	22.2%	17.0%	18.2%
Number	319	164	251	192	206

Q1. (2016) On a scale of 1 to 5, with 5 being the highest, how satisfied were you with your fishing experience today?						
	1	2	3	4	5	No opinion
Percent	16.4%	11.2%	19.3%	18.3%	32.8%	2.0%
Number	594	407	701	662	1188	71

Q2. Script A. On a scale of 1 to 5, how much would you support or oppose changing the statewide walleye bag limit from 6 fish to 4, but keeping the possession limit at 6? 1 is strongly oppose and 5 is strongly support.					
	1	2	3	4	5
Percent	8.2%	3.0%	21.7%	26.2%	40.9%
Number	50	18	132	159	248

Q2. Script B. On a scale of 1 to 5, how much would you support or oppose changing the statewide walleye bag limit from 6 fish to 4? 1 is strongly oppose and 5 is strongly support.					
	1	2	3	4	5
Percent	5.0%	5.2%	21.9%	16.5%	51.5%
Number	23	24	101	76	238

FIGURES

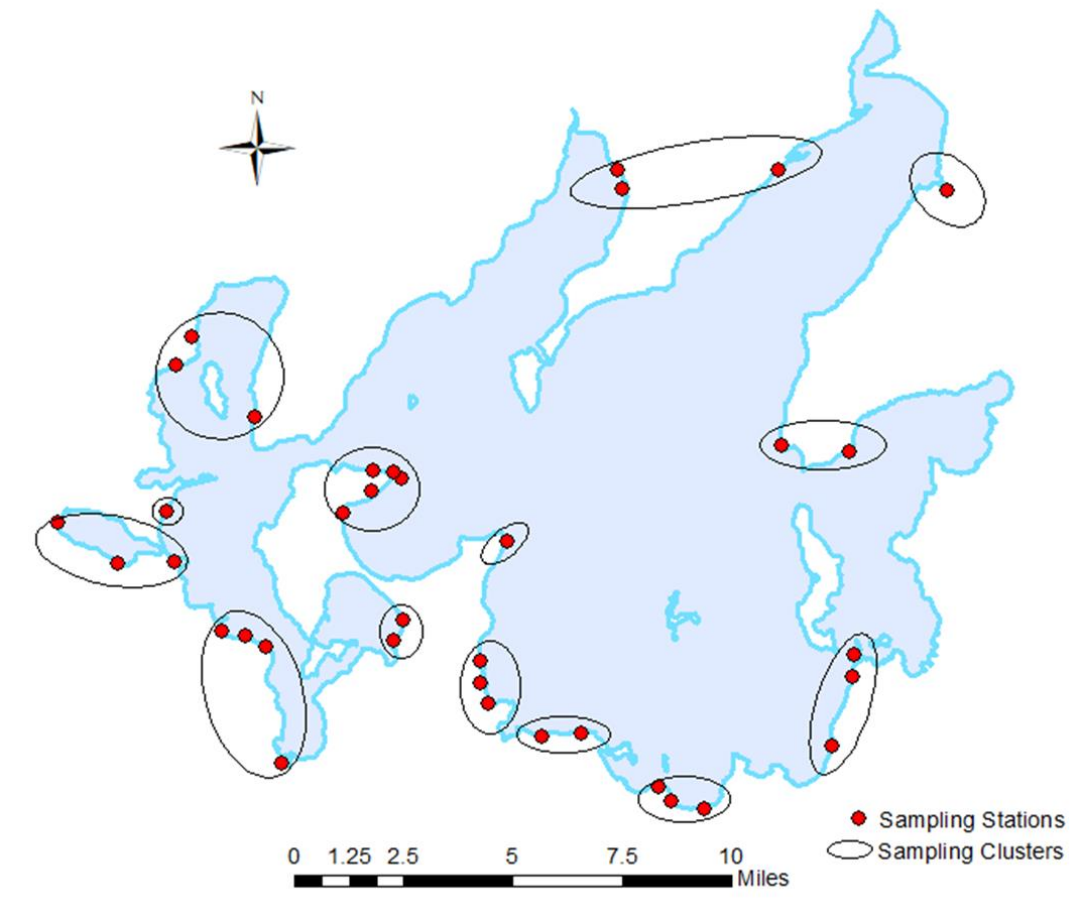


Figure 1. Creel survey sampling clusters (circles) and stations (dots) on Leech Lake, Minnesota.

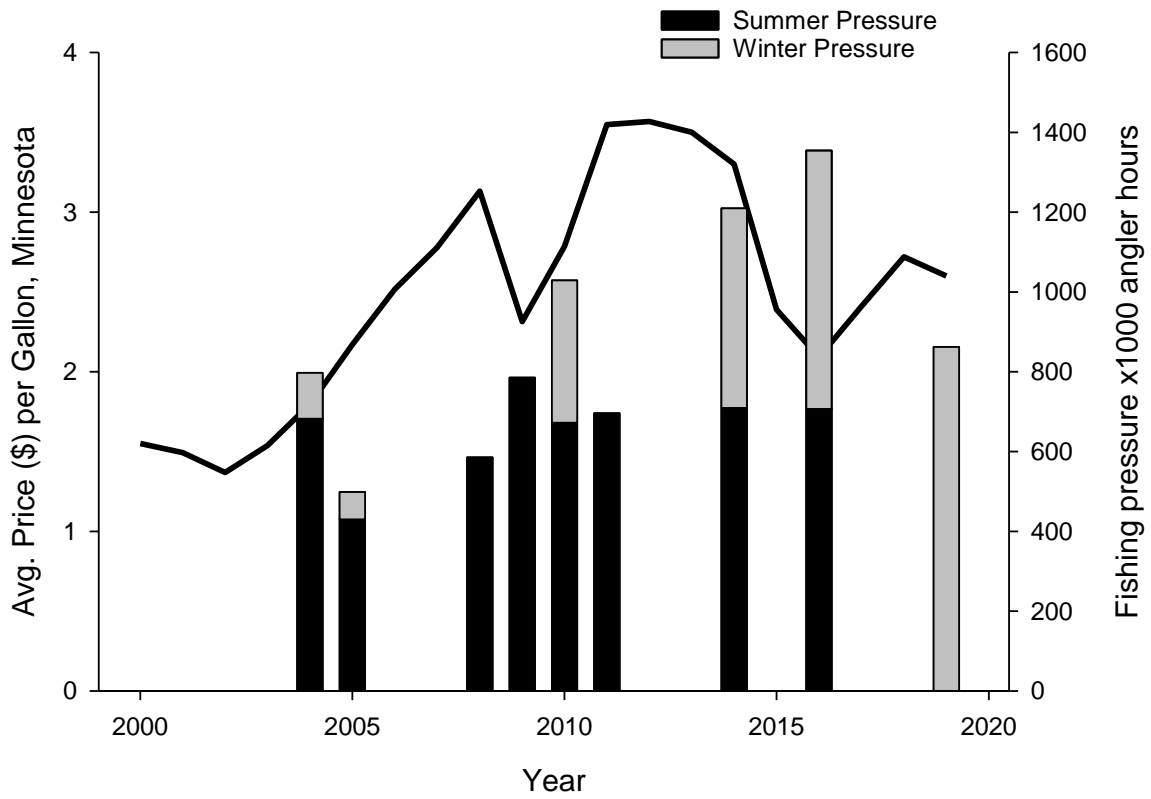


Figure 2. Average annual price (\$) per gallon of regular gasoline in Minnesota, 2000 - 2019 (EIA 2019) and angling pressure.

Median Distance Traveled by Leech Lake Anglers, 2019

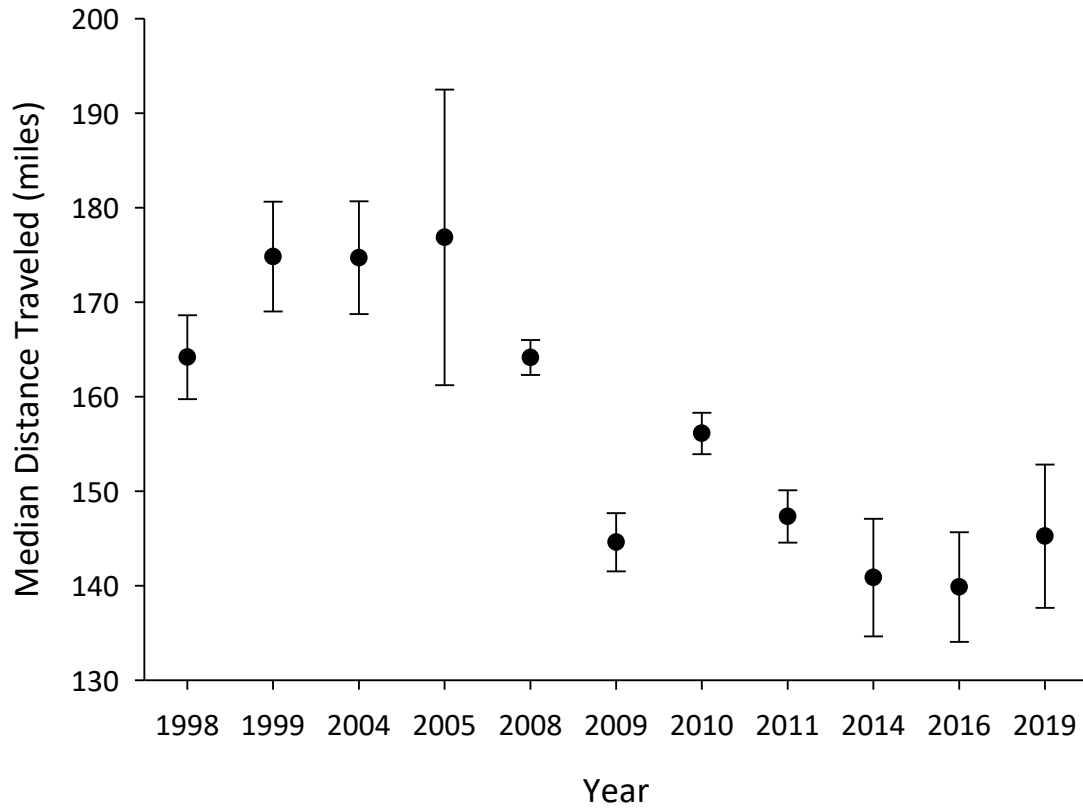


Figure 3. Median distance (miles \pm 95% CI) traveled by Leech Lake anglers interviewed during summer creel surveys, 1998-2019.

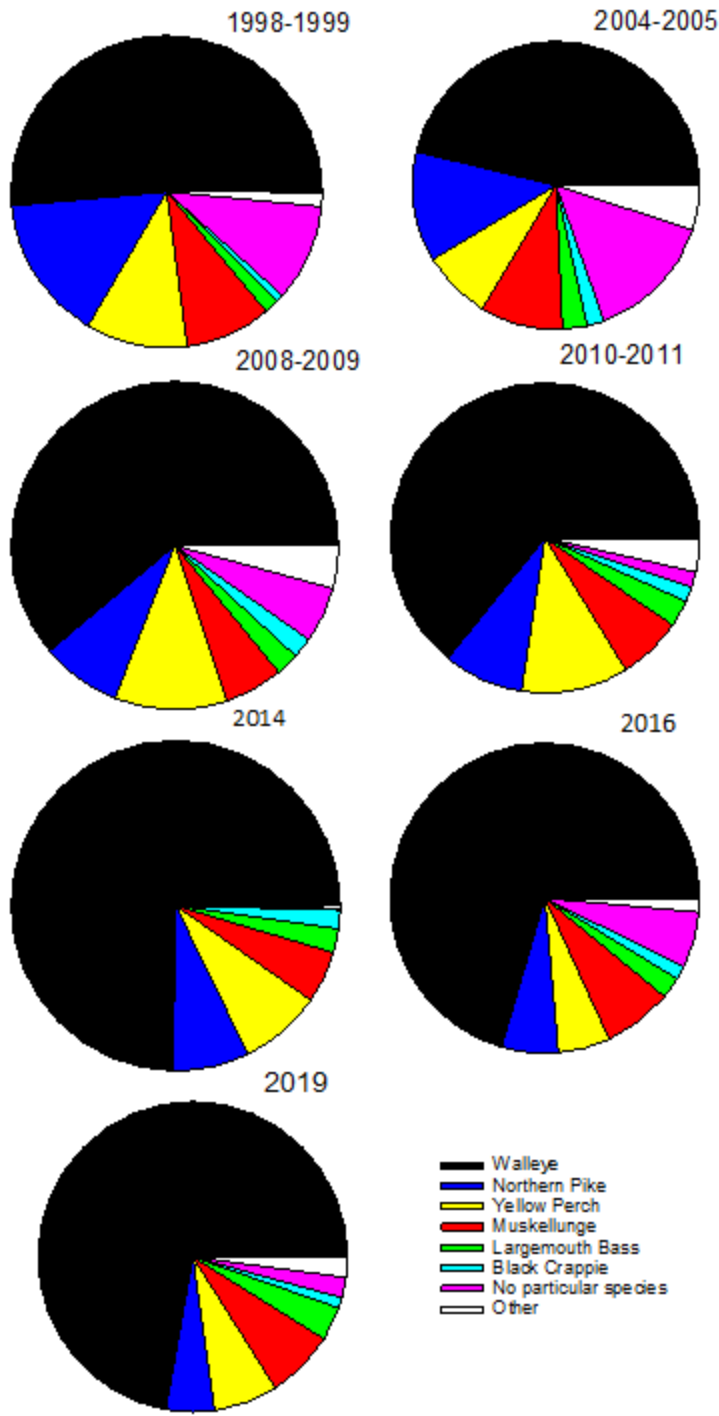


Figure 4. Mean distribution of species targeted by angling parties interviewed during summer creel surveys on Leech Lake, 1998-2019.

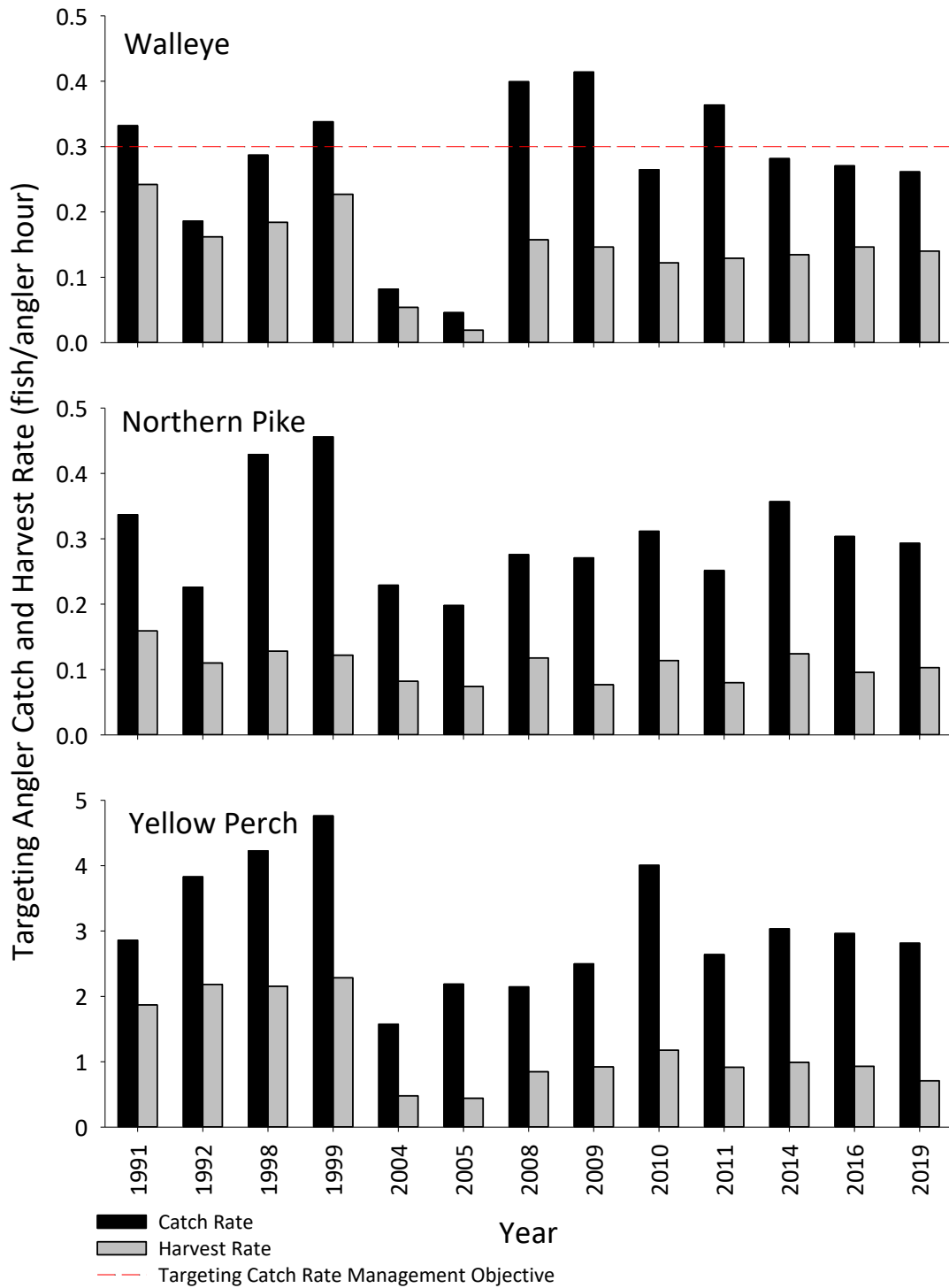


Figure 5. Walleye, Northern Pike and Yellow Perch targeting angler catch and harvest rates by Leech Lake daytime anglers by species targeted, 1991-2019. The dashed line represents the 2016-2020 management plan objective of a targeting catch rate of 0.30 Walleye/hour or higher.

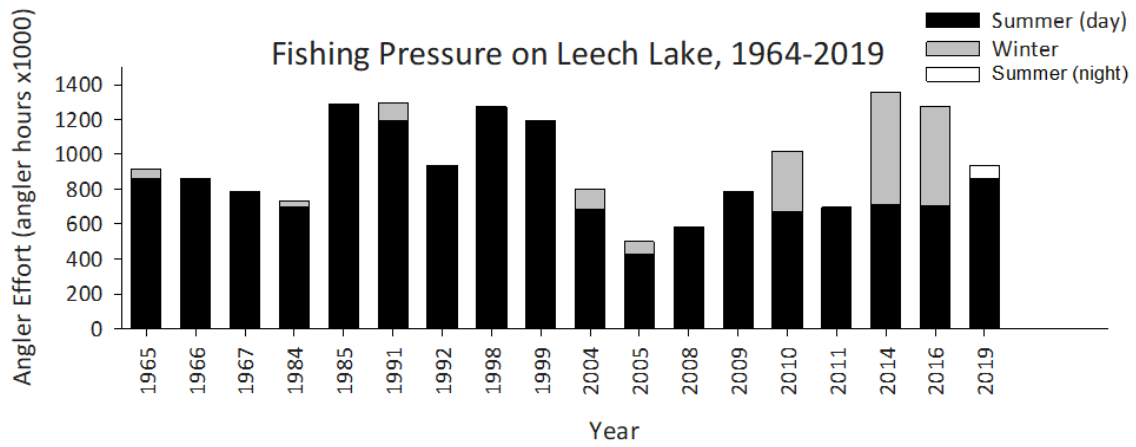


Figure 6. Total fishing pressure (angler-hours x 1,000) by Leech Lake anglers throughout the summer and winter seasons, 1965-2019. No winter creel surveys occurred on years where no winter data is provided.

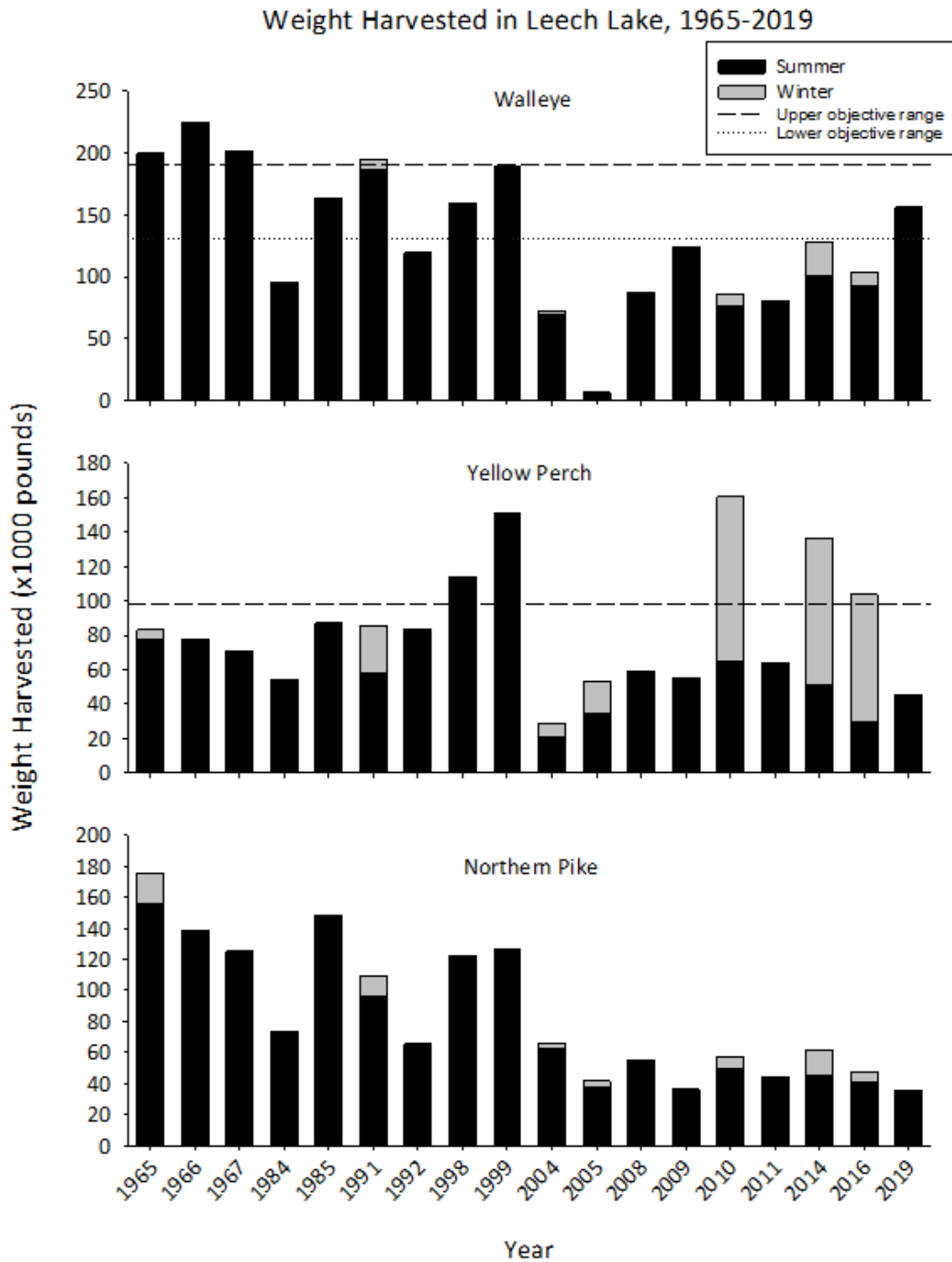


Figure 7. Total harvest (pounds x 1,000) of Walleye, Yellow Perch, and Northern Pike by Leech Lake daytime anglers throughout the summer and winter seasons, 1965-2019. Horizontal lines represent respective management plan objectives.



Figure 8. Fishing pressure on Leech Lake (1998-2019) by angler groups based on hometown distance (Local= 0-99 miles; Metro= 100-249 miles; Destination = 250+ miles)

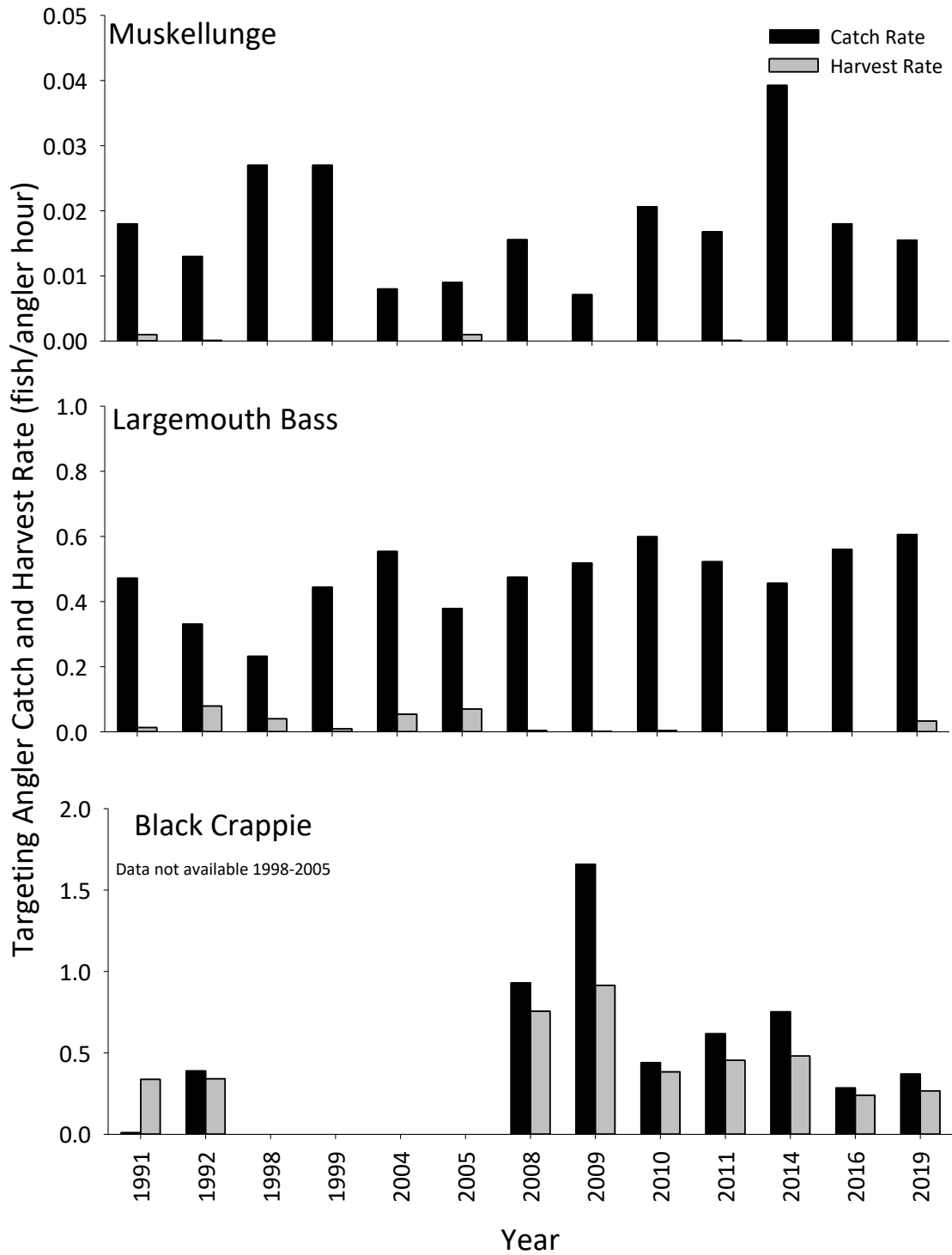


Figure 9. Muskellunge, Largemouth Bass and Black Crappie targeting angler catch and harvest rates by Leech Lake anglers targeting specific species, 1994-2019.

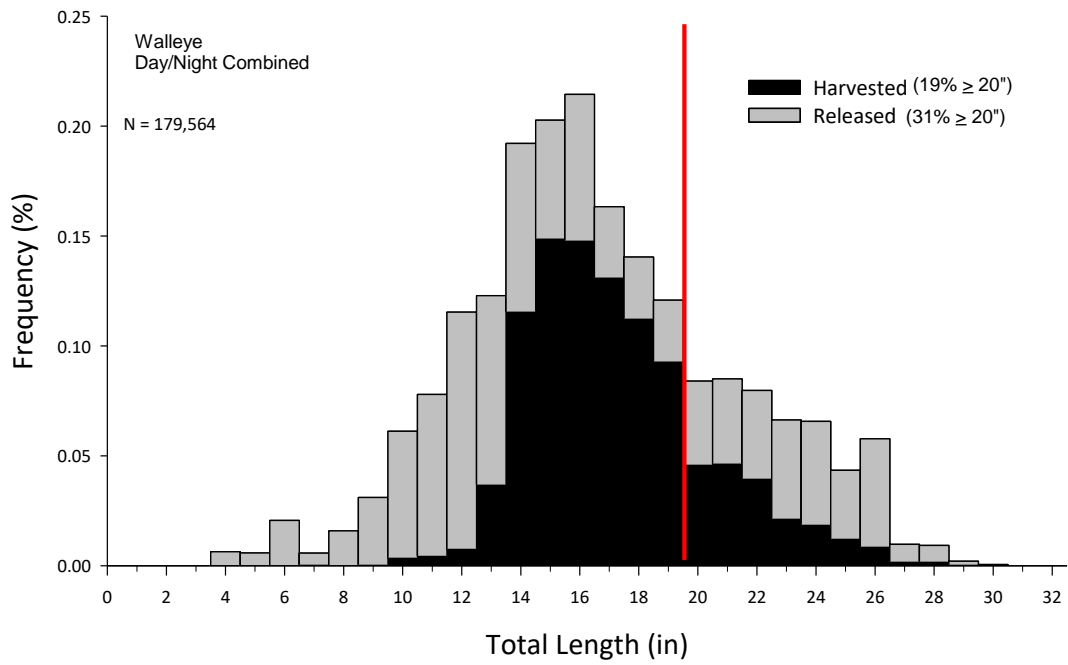


Figure 10. Length frequency distribution (% of observed catch) of harvested and released Walleye on Leech Lake, MN during 2019 summer creel season. Box includes protected slot limit (20-26") which is 31% of the total catch.

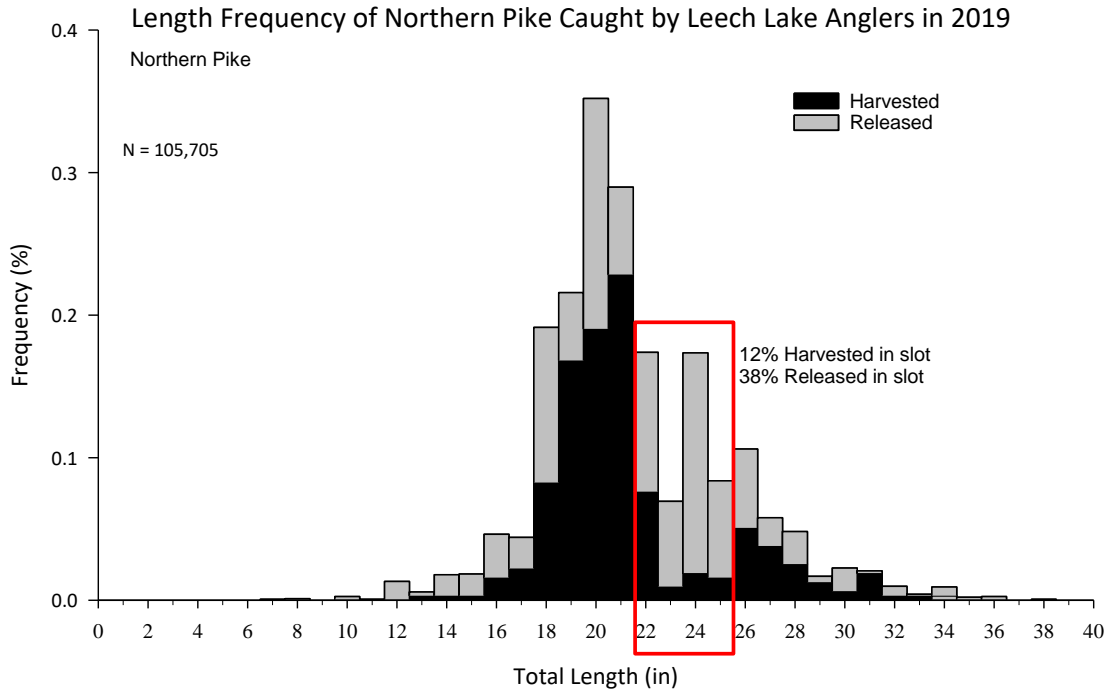


Figure 11. Length frequency distribution (% of observed catch) of harvested and released Northern Pike on Leech Lake, MN during 2019 summer creel.

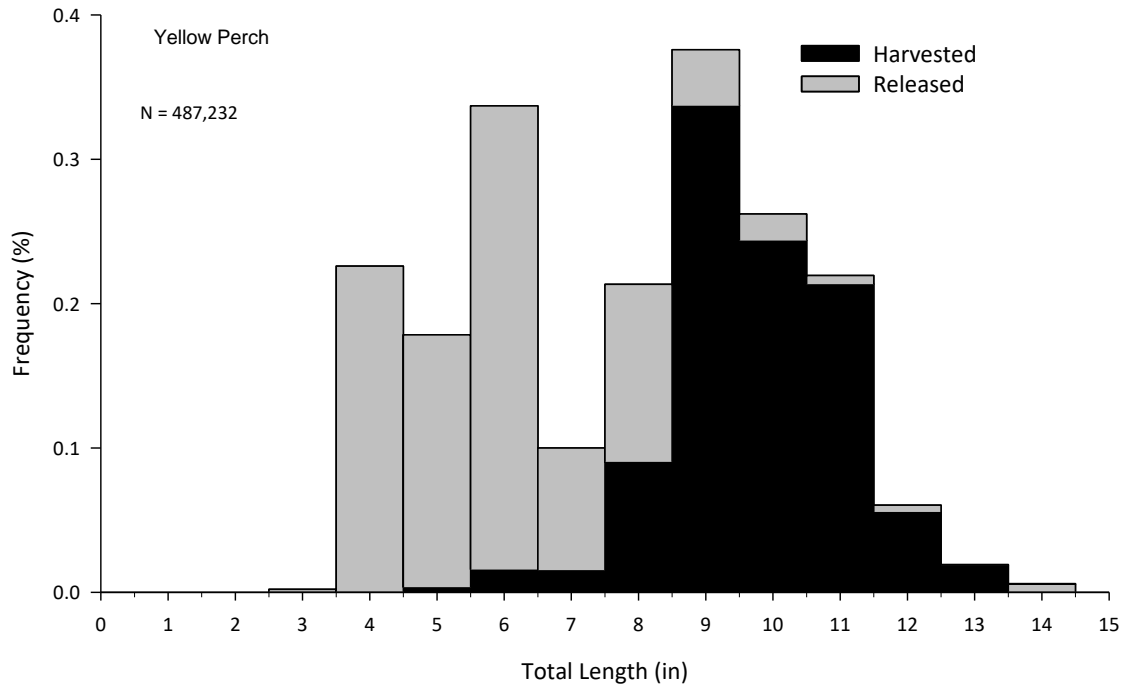


Figure 12. Length frequency distribution (% of observed catch) of harvested and released Yellow Perch on Leech Lake, MN during 2019 summer creel.

APPENDIX

Table A1. Creel survey sampling summary and angling pressure estimates by month and basin for Leech Lake, Minnesota, May 11th – September 30th, 2019. Standard errors appear in parentheses.

<i>Western Bays</i>	Stratum						Combined
	May-June (day)	July-Sept. (day)	May-June (night)	July-Sept. (night)	Season (day)	Season (night)	
N Interviews	162	372	21	35	534	56	590
Mean anglers/boat	2.24 (0.16)	2.24 (0.11)	2.40 -	2.20 -	2.24 (0.09)	2.28 -	2.25 (0.07)
Mean trip length	4.21 (0.41)	4.06 (0.32)	4.55 -	3.96 -	4.11 (0.25)	4.20 -	4.14 (0.19)
Total angler hours	76,050 (4356)	172,133 (15685)	12,205 (3095)	19,119 (5126)	248,164 (16279)	31,324 (5988)	279488 (17346)
<i>Main Lake</i>							
N Interviews	576	523	54	18	1099	72	1171
Mean anglers/boat	2.41 -	2.45 (0.02)	2.32 -	2.26 -	2.44 (0.01)	2.30 -	2.39 (0.01)
Mean trip length	5.20 -	5.25 (0.05)	4.19 -	3.92 -	5.27 (0.03)	4.09 -	4.88 (0.02)
Total angler hours	331,904 (36495)	283,933 (21795)	32,551 (7291)	12,479 (2075)	615,838 (42508)	45,029 (7580)	660867 (43178)

Table A2. Catch and harvest estimates by month in the western bays basin (17,927 acres) of Leech Lake, May 11th – September 30th 2019.

Species	May-June (day)	July-Sept. (day)	May-June (night)	July-Sept. (night)	Season (day)	Season (night)	Combined
<i>Number Caught per Acre</i>							
Bowfin	---	0.002 ---	---	---	0.002 ---	---	0.002 ---
Bullhead spp.	---	---	---	---	---	---	---
Northern Pike	0.294 (0.057)	0.472 (0.076)	0.021 (0.006)	0.010 ---	0.766 (0.095)	0.032 (0.006)	0.797 (0.095)
Muskellunge	0.001 (0.001)	0.009 (0.002)	---	0.000 ---	0.010 (0.003)	0.000 ---	0.010 (0.003)
Burbot	---	---	---	---	---	---	---
Rock Bass	0.121 (0.053)	0.234 (0.026)	0.034 (0.017)	0.008 ---	0.355 (0.059)	0.042 (0.017)	0.397 (0.061)
Sunfish spp.	0.199 (0.026)	0.150 (0.086)	0.003 (0.002)	0.007 ---	0.350 (0.090)	0.009 (0.002)	0.359 (0.090)
Smallmouth Bass	0.002 ---	0.014 (0.002)	0.006 ---	---	0.015 (0.002)	0.006 ---	0.022 (0.002)
Largemouth Bass	0.139 (0.008)	0.449 (0.029)	---	0.000 ---	0.588 (0.030)	0.000 ---	0.588 (0.030)
Black Crappie	0.009 (0.005)	0.004 ---	0.008 (0.005)	0.003 ---	0.013 (0.005)	0.011 (0.005)	0.024 (0.007)
Yellow Perch	1.149 (0.303)	6.673 (1.537)	0.015 (0.005)	0.023 (0.007)	7.822 (1.567)	0.038 (0.009)	7.860 (1.567)
Walleye	0.637 (0.101)	1.125 (0.199)	0.123 (0.039)	0.157 (0.018)	1.761 (0.223)	0.280 (0.043)	2.041 (0.227)
Cisco/Whitefish	---	---	---	---	---	---	---
Overall	2.550 (0.381)	9.132 (1.692)	0.209 (0.062)	0.208 (0.029)	11.682 (1.735)	0.417 (0.068)	12.099 (1.736)
<i>Number Harvested per Acre</i>							
Bowfin	---	0.000 ---	---	---	0.000 ---	---	0.000 ---
Bullhead spp.	---	---	---	---	---	---	---
Northern Pike	0.001 (0.001)	0.103 (0.036)	0.000 (0.000)	0.000 ---	0.104 (0.036)	0.000 (0.000)	0.104 (0.036)
Muskellunge	0.000 (0.000)	0.000 (0.000)	---	0.000 ---	0.000 (0.000)	0.000 ---	0.000 (0.000)
Burbot	---	---	---	---	---	---	---
Rock Bass	0.060 (0.041)	0.062 (0.011)	0.000 (0.000)	0.000 ---	0.121 (0.042)	0.000 (0.000)	0.121 (0.042)
Sunfish spp.	0.040 (0.020)	0.077 (0.063)	0.003 (0.002)	0.000 ---	0.117 (0.066)	0.003 (0.002)	0.119 (0.066)
Smallmouth Bass	0.002 ---	0.003 (0.002)	0.000 ---	---	0.004 (0.002)	0.000 ---	0.004 (0.002)
Largemouth Bass	0.005 (0.001)	0.017 (0.003)	---	0.000 ---	0.022 (0.003)	0.000 ---	0.022 (0.003)
Black Crappie	0.009 (0.005)	0.000 ---	0.008 (0.005)	0.000 ---	0.009 (0.005)	0.008 (0.005)	0.017 (0.007)
Yellow Perch	0.281 (0.083)	1.437 (0.377)	0.004 (0.004)	0.000 (0.000)	1.718 (0.386)	0.004 (0.004)	1.722 (0.386)
Walleye	0.360 (0.062)	0.434 (0.083)	0.061 (0.020)	0.083 (0.007)	0.794 (0.103)	0.145 (0.021)	0.939 (0.105)
Cisco/Whitefish	---	---	---	---	---	---	---
Overall	0.758 (0.116)	2.132 (0.448)	0.076 (0.024)	0.083 (0.007)	2.890 (0.463)	0.159 (0.025)	3.049 (0.464)

Table A3. Catch and harvest estimates by month in the main lake basin (93,914 acres) of Leech Lake, May 11th – September 30th 2019.

Species	May-June (day)	July-Sept. (day)	May-June (night)	July-Sept. (night)	Season (day)	Season (night)	Combined
<i>Number Caught per Acre</i>							
Bowfin	0.001 ---	0.002 ---	--- ---	--- ---	0.002 ---	--- ---	0.002 ---
Bullhead spp.	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---
Northern Pike	0.444 0.058	0.480 (0.055)	0.046 (0.005)	0.003 (0.001)	0.924 (0.080)	0.049 (0.005)	0.973 (0.080)
Muskellunge	0.001 0.001	0.016 (0.004)	--- ---	0.000 ---	0.017 (0.004)	0.000 ---	0.017 (0.004)
Burbot	0.000 ---	0.000 ---	--- ---	--- ---	0.001 ---	--- ---	0.001 ---
Rock Bass	0.080 0.020	0.039 (0.005)	0.027 (0.001)	0.003 ---	0.119 (0.020)	0.029 (0.001)	0.149 (0.020)
Sunfish spp.	0.016 0.001	0.128 (0.084)	0.006 (0.007)	--- ---	0.143 (0.084)	--- ---	0.143 (0.084)
Smallmouth Bass	0.016 0.004	0.009 (0.001)	--- ---	--- ---	0.025 (0.005)	0.006 (0.007)	0.031 (0.008)
Largemouth Bass	0.112 0.036	0.134 (0.028)	--- ---	--- ---	0.246 (0.046)	--- ---	0.246 (0.046)
Black Crappie	0.035 0.018	0.123 (0.065)	0.013 (0.000)	--- ---	0.158 (0.067)	0.013 (0.000)	0.170 (0.067)
Yellow Perch	0.655 0.148	2.439 (0.400)	0.096 (0.047)	0.042 ---	3.094 (0.427)	0.137 (0.047)	3.232 (0.429)
Walleye	0.851 0.123	0.484 (0.057)	0.103 (0.024)	0.011 (0.003)	1.334 (0.136)	0.113 (0.024)	1.448 (0.138)
Cisco/Whitefish	--- ---	--- ---	--- ---	--- ---	0.000 ---	--- ---	0.000 ---
Overall	2.210 0.313	3.855 (0.486)	0.289 (0.075)	0.058 (0.006)	6.065 (0.579)	0.347 (0.075)	6.412 (0.583)
<i>Number Harvested per Acre</i>							
Bowfin	0.000 ---	0.001 ---	--- ---	--- ---	0.001 ---	--- ---	0.001 ---
Bullhead spp.	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---
Northern Pike	0.047 0.016	0.098 (0.022)	0.006 (0.000)	0.001 (0.001)	0.144 (0.027)	0.007 (0.001)	0.151 (0.027)
Muskellunge	0.000 0.000	0.000 (0.000)	--- ---	0.000 ---	0.000 (0.000)	0.000 ---	0.000 (0.000)
Burbot	0.000 ---	0.000 ---	--- ---	--- ---	0.000 ---	--- ---	0.000 ---
Rock Bass	0.007 0.004	0.003 (0.002)	0.001 (0.000)	0.000 ---	0.011 (0.004)	0.001 (0.000)	0.012 (0.004)
Sunfish spp.	0.012 0.001	0.059 (0.032)	--- ---	--- ---	0.071 (0.032)	--- ---	0.071 (0.032)
Smallmouth Bass	0.001 0.001	0.002 (0.000)	0.000 (0.000)	--- ---	0.003 (0.001)	0.000 (0.000)	0.003 (0.001)
Largemouth Bass	0.005 0.000	0.014 (0.008)	--- ---	--- ---	0.018 (0.008)	--- ---	0.018 (0.008)
Black Crappie	0.027 0.011	0.071 (0.029)	0.013 (0.000)	--- ---	0.098 (0.032)	0.013 (0.000)	0.110 (0.032)
Yellow Perch	0.185 0.051	0.414 (0.077)	0.017 (0.004)	0.000 ---	0.600 (0.093)	0.017 (0.004)	0.616 (0.093)
Walleye	0.478 0.067	0.239 (0.033)	0.074 (0.022)	0.005 (0.002)	0.717 (0.074)	0.080 (0.022)	0.796 (0.077)
Cisco/Whitefish	--- ---	0.000 ---	--- ---	--- ---	0.000 ---	--- ---	0.000 ---
Overall	0.762 0.111	0.901 (0.128)	0.111 (0.024)	0.007 (0.003)	1.662 (0.169)	0.117 (0.024)	1.780 (0.171)

Table A4. Monthly estimates of catch and harvest rates of all anglers in the western bays basin of Leech Lake, May 11th – September 30th 2019.

Species	May-June (day)	July-Sept. (day)	May-June (night)	July-Sept. (night)	Season (day)	Season (night)	Combined
<i>Catch per Angler Hour</i>							
Bowfin	---	0.000	---	---	0.000	---	0.000
Bullhead spp.	---	---	---	---	---	---	---
Northern Pike	0.101 (0.020)	0.072 (0.042)	0.045 (0.018)	0.014	0.081 (0.031)	0.026 (0.007)	0.075 (0.027)
Muskellunge	0.000 (0.000)	0.001 (0.000)	---	0.000	0.001 (0.000)	0.000	0.001 (0.000)
Burbot	---	---	---	---	---	---	---
Rock Bass	0.042 (0.018)	0.036 (0.008)	0.073 (0.041)	0.011	0.037 (0.008)	0.035 (0.016)	0.037 (0.007)
Sunfish spp.	0.069 (0.009)	0.023 (0.013)	0.005 (0.004)	0.009	0.037 (0.010)	0.008 (0.002)	0.034 (0.009)
Smallmouth Bass	0.001	0.002 (0.000)	0.013	---	0.002 (0.000)	0.005	0.002 (0.000)
Largemouth Bass	0.048 (0.004)	0.068 (0.008)	---	0.000	0.062 (0.005)	0.000	0.055 (0.005)
Black Crappie	0.003 (0.002)	0.001	0.016 (0.012)	0.004	0.001 (0.001)	0.009 (0.005)	0.002 (0.001)
Yellow Perch	0.395 (0.109)	1.014 (0.283)	0.032 (0.014)	0.032 (0.013)	0.824 (0.192)	0.032 (0.009)	0.735 (0.168)
Walleye	0.219 (0.072)	0.171	0.263 (0.107)	0.214 (0.062)	0.186	0.233 (0.057)	0.191
Cisco/Whitefish	---	---	---	---	---	---	---
Overall	0.877 (0.177)	1.387 (0.330)	0.448 (0.174)	0.285 (0.086)	1.231 (0.230)	0.348 (0.088)	1.132 (0.202)
<i>Harvest per Angler Hour</i>							
Bowfin	---	---	---	---	---	---	---
Bullhead spp.	---	---	---	---	---	---	---
Northern Pike	0.000 (0.000)	0.016 (0.010)	0.000 (0.000)	---	0.011 (0.006)	0.000 (0.000)	0.005 (0.007)
Muskellunge	0.000 (0.000)	0.000 (0.000)	---	---	0.000 (0.000)	0.000	0.000 (0.000)
Burbot	---	---	---	---	---	---	---
Rock Bass	0.021 (0.014)	0.009 (0.003)	---	---	0.013 (0.005)	0.000 (0.000)	0.004 (0.006)
Sunfish spp.	0.014 (0.007)	0.012 (0.010)	0.005 (0.004)	---	0.012 (0.007)	0.002 (0.001)	0.006 (0.008)
Smallmouth Bass	0.001	0.000 (0.000)	---	---	0.000 (0.000)	0.000	0.000 (0.000)
Largemouth Bass	0.002 (0.000)	0.003 (0.001)	---	---	0.002 (0.000)	0.000	0.000 (0.000)
Black Crappie	0.003 (0.002)	0.000	0.016 (0.012)	---	0.001 (0.001)	0.006 (0.004)	0.001 (0.001)
Yellow Perch	0.097 (0.028)	0.218 (0.064)	0.009 (0.008)	---	0.181 (0.044)	0.003 (0.003)	0.039 (0.050)
Walleye	0.124 (0.049)	0.066 (0.022)	0.132 (0.054)	0.114 (0.032)	0.084 (0.021)	0.121 (0.029)	0.019 (0.025)
Cisco/Whitefish	---	---	---	---	---	---	---
Overall	0.260 (0.079)	0.324 (0.077)	0.162 (0.066)	0.114 (0.032)	0.304 (0.059)	0.133 (0.033)	0.052 (0.067)

Table A5. Monthly estimates of catch and harvest rates of all anglers in the main lake basin of Leech Lake, May 11th–September 30th 2019.

Species	May-June (day)	July-Sept. (day)	May-June (night)	July-Sept. (night)	Season (day)	Season (night)	Combined
<i>Catch per Angler Hour</i>							
Bowfin	0.000 ---	0.000 ---	--- ---	--- ---	0.000 ---	--- ---	0.000 ---
Bullhead spp.	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---
Northern Pike	0.117 (0.035)	0.148 (0.031)	0.123 (0.030)	0.023 (0.011)	0.131 (0.024)	0.095 (0.019)	0.128 (0.022)
Muskellunge	0.000 (0.000)	0.005 (0.001)	--- ---	0.000 ---	0.002 (0.001)	0.000 ---	0.002 (0.001)
Burbot	0.000 ---	0.000 ---	--- ---	--- ---	0.000 ---	--- ---	0.000 ---
Rock Bass	0.021 (0.004)	0.012 (0.002)	0.072 (0.016)	0.019 ---	0.017 (0.003)	0.057 (0.010)	0.020 (0.002)
Sunfish spp.	0.004 (0.002)	0.039 (0.026)	--- ---	--- ---	0.020 (0.012)	--- ---	0.019 (0.011)
Smallmouth Bass	0.004 (0.001)	0.003 (0.001)	0.015 (0.019)	--- ---	0.004 (0.001)	0.011 (0.014)	0.004 (0.001)
Largemouth Bass	0.029 (0.009)	0.041 (0.009)	--- ---	--- ---	0.035 (0.006)	--- ---	0.032 (0.006)
Black Crappie	0.009 (0.005)	0.038 (0.020)	0.033 (0.008)	--- ---	0.022 (0.010)	0.024 (0.004)	0.022 (0.009)
Yellow Perch	0.172 (0.052)	0.749 (0.168)	0.256 (0.190)	0.291 ---	0.438 (0.080)	0.266 (0.140)	0.426 (0.075)
Walleye	0.223 (0.065)	0.149 (0.016)	0.275 (0.094)	0.075 (0.027)	0.189 (0.033)	0.219 (0.063)	0.191 (0.032)
Cisco/Whitefish	--- ---	0.000 ---	--- ---	--- ---	0.000 ---	--- ---	0.000 ---
Overall	0.580 (0.148)	1.184 (0.210)	0.774 (0.323)	0.408 (0.079)	0.859 (0.131)	0.673 (0.223)	0.846 (0.122)
<i>Harvest per Angler Hour</i>							
Bowfin	0.000 ---	0.000 ---	--- ---	--- ---	0.000 ---	--- ---	0.000 ---
Bullhead spp.	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---
Northern Pike	0.012 (0.005)	0.030 (0.009)	0.016 (0.003)	0.008 (0.007)	0.020 (0.005)	0.013 (0.003)	0.020 (0.004)
Muskellunge	0.000 (0.000)	0.000 (0.000)	--- ---	0.000 ---	0.000 (0.000)	0.000 ---	0.000 (0.000)
Burbot	0.000 ---	0.000 ---	--- ---	--- ---	0.000 ---	--- ---	0.000 ---
Rock Bass	0.002 (0.001)	0.001 (0.001)	0.003 (0.001)	--- ---	0.002 (0.001)	0.002 (0.000)	0.002 (0.000)
Sunfish spp.	0.003 (0.002)	0.018 (0.010)	--- ---	--- ---	0.010 (0.005)	--- ---	0.009 (0.005)
Smallmouth Bass	0.000 (0.000)	0.001 (0.000)	0.000 (0.000)	--- ---	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Largemouth Bass	0.001 (0.000)	0.004 (0.002)	--- ---	--- ---	0.003 (0.001)	--- ---	0.002 (0.001)
Black Crappie	0.007 (0.003)	0.022 (0.009)	0.033 (0.008)	--- ---	0.014 (0.005)	0.024 (0.004)	0.015 (0.004)
Yellow Perch	0.049 (0.016)	0.127 (0.028)	0.045 (0.013)	--- ---	0.085 (0.016)	0.033 (0.009)	0.081 (0.014)
Walleye	0.126 (0.039)	0.073 (0.013)	0.198 (0.077)	0.038 (0.018)	0.101 (0.020)	0.154 (0.052)	0.105 (0.020)
Cisco/Whitefish	--- ---	0.000 ---	--- ---	--- ---	0.000 ---	--- ---	0.000 ---
Overall	0.200 (0.057)	0.277 (0.051)	0.296 (0.096)	0.046 (0.023)	0.235 (0.040)	0.227 (0.062)	0.235 (0.038)



Table A6. Monthly estimates of catch and harvest rates of targeting anglers in the western bays basin of Leech Lake, May 11th – September 30th 2019.

Species	May-June (day)	July-Sept. (day)	May-June (night)	July-Sept. (night)	Season (day)	Season (night)	Combined
<i>Catch per Angler Hour</i>							
Northern Pike	1.202 (0.236)	0.700 (0.114)	0.310 (0.033)	0.800 ---	0.822 (0.104)	0.522 (0.019)	0.789 (0.092)
Muskellunge	0.000 (0.000)	0.011 (0.006)	--- ---	0.000 ---	0.009 (0.004)	0.000 ---	0.007 (0.004)
Rock bass	2.824 ---	--- ---	--- ---	--- ---	2.824 ---	--- ---	2.824 ---
Sunfish spp.	0.958 (0.326)	1.651 (0.202)	--- ---	1.500 ---	1.517 (0.175)	1.500 ---	1.516 (0.163)
Largemouth Bass	1.439 (0.958)	1.648 (0.651)	--- ---	0.000 ---	1.594 (0.543)	0.000 ---	1.474 (0.502)
Black Crappie	0.070 (0.062)	0.538 ---	0.188 ---	2.000 ---	0.315 (0.030)	1.384 ---	0.702 (0.019)
Yellow Perch	3.985 (1.110)	8.105 (0.764)	0.214 ---	--- ---	6.654 (0.630)	0.214 ---	6.421 (0.608)
Walleye	0.477 (0.090)	0.411 (0.066)	0.836 (0.124)	1.151 (0.374)	0.434 (0.053)	1.003 (0.206)	0.567 (0.063)
<i>Harvest per Angler Hour</i>							
Northern Pike	0.000 (0.000)	0.183 (0.063)	0.000 (0.000)	0.000 (0.000)	0.139 (0.047)	0.000 (0.000)	0.124 (0.042)
Muskellunge	0.000 (0.000)	0.000 (0.000)	--- ---	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Rock bass	0.000 (0.000)	--- ---	--- ---	--- ---	0.000 (0.000)	--- ---	0.000 (0.000)
Sunfish spp.	0.824 (0.395)	0.967 (0.336)	--- ---	0.000 (0.000)	0.939 (0.282)	0.000 (0.000)	0.873 (0.262)
Largemouth Bass	0.193 (0.195)	0.196 (0.131)	--- ---	0.000 (0.000)	0.195 (0.109)	0.000 (0.000)	0.180 (0.101)
Black Crappie	0.070 (0.075)	0.000 (0.000)	0.188 (0.433)	0.000 (0.000)	0.034 (0.036)	0.064 (0.147)	0.045 (0.058)
Yellow Perch	1.305 (0.298)	2.533 (0.334)	0.214 (0.463)	--- ---	2.100 (0.241)	0.214 (0.463)	2.032 (0.232)
Walleye	0.270 (0.095)	0.191 (0.043)	0.491 (0.258)	0.655 (0.212)	0.219 (0.044)	0.578 (0.166)	0.303 (0.051)

Table A7. Monthly estimates of catch and harvest rates of targeting anglers in the main lake basin of Leech Lake, May 14th – September 30th 2019.

Species	May-June (day)	July-Sept. (day)	May-June (night)	July-Sept. (night)	Season (day)	Season (night)	Combined
<i>Catch per Angler Hour</i>							
Northern Pike	0.809 (0.163)	0.970 (0.083)	0.600 (0.194)	0.221 ---	0.913 (0.079)	0.434 (0.109)	0.837 (0.088)
Muskellunge	0.015 (0.000)	0.032 (0.007)	--- ---	0.000 (0.000)	0.029 (0.006)	0.000 (0.000)	0.031 (0.006)
Rock bass	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---
Sunfish spp.	0.923 ---	2.317 (0.598)	--- ---	--- ---	2.057 (0.486)	--- ---	2.234 (0.490)
Largemouth Bass	0.741 (0.104)	1.105 (0.378)	--- ---	--- ---	0.990 (0.261)	--- ---	0.993 (0.149)
Black Crappie	0.353 (0.132)	1.454 (0.240)	5.532 ---	--- ---	1.041 (0.158)	5.532 ---	0.977 (0.282)
Yellow Perch	1.641 (0.331)	7.810 (1.022)	0.500 (0.051)	--- ---	5.649 (0.674)	0.500 (0.051)	5.805 (1.025)
Walleye	0.638 (0.058)	1.038 (0.277)	0.786 (0.105)	0.448 (0.106)	0.897 (0.181)	0.672 (0.079)	0.701 (0.073)
<i>Harvest per Angler Hour</i>							
Northern Pike	0.320 (0.104)	0.394 (0.164)	0.090 (0.081)	0.221 (0.398)	0.368 (0.113)	0.147 (0.180)	0.293 (0.059)
Muskellunge	0.000 (0.000)	0.000 (0.000)	--- ---	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Rock bass	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---
Sunfish spp.	0.923 (0.555)	0.850 (0.365)	--- ---	--- ---	0.864 (0.315)	--- ---	1.032 (0.361)
Largemouth Bass	0.046 (0.048)	0.106 (0.070)	--- ---	--- ---	0.087 (0.050)	--- ---	0.076 (0.046)
Black Crappie	0.235 (0.131)	1.063 (0.428)	5.532 (1.058)	--- ---	0.753 (0.272)	5.532 (1.058)	0.703 (0.141)
Yellow Perch	0.776 (0.163)	1.605 (0.299)	0.253 (0.220)	--- ---	1.315 (0.203)	0.253 (0.220)	1.185 (0.137)
Walleye	0.365 (0.042)	0.438 (0.087)	0.579 (0.117)	0.219 (0.132)	0.412 (0.058)	0.459 (0.090)	0.369 (0.034)

Appendix 2 Creel survey summary for Leech Lake, Minnesota.

 Minnesota Department of Natural Resources Section of Fisheries 		
Creel Survey Summary for Leech Lake, Minnesota		
Fish Management Area: Walker		
Year Surveyed: May 11th – September 30th, 2019 Day and Night		
Angling Pressure		
Angler-hours	940,355	
Angler-hours/acre	8.30	
Anglers/boat	2.33	
Mean Trip Length (h)	4.57	
Catch (number)		
Species	Total N N/acre	
Bowfin	251 0.00	
Bullhead spp.	- -	
Northern Pike	105,705 0.93	
Muskellunge	1,742 0.02	
Burbot	49 0.00	
Rock bass	23,368 0.21	
Sunfish spp.	21,869 0.19	
Smallmouth Bass	3,264 0.03	
Largemouth bass	36,828 0.32	
Black Crappie	15,462 0.14	
Yellow Perch	487,232 4.30	
Walleye	179,564 1.58	
Cisco/Whitefish	- -	
All species	875,335 7.72	
Harvest (number)		
	N/acre	
	81 0.00	
	- -	
	15,921 0.14	
	- -	
	- -	
	4,228 0.04	
	9,290 0.08	
	388 0.00	
	2,180 0.02	
	10,043 0.09	
	98,760 0.87	
	93,959 0.83	
	- -	
	234,851 2.07	
Harvest (pounds)		
	Total lbs. lbs./acre	
	- -	
	- -	
	36,816 0.32	
	- -	
	- -	
	4,136 0.04	
	5,299 0.05	
	- -	
	5,260 0.05	
	10,273 0.09	
	46,533 0.41	
	169,068 1.49	
	- -	
	277,384 2.45	
Catch Rate (fish/hour)		
Species	Angler Type	
	All	Targeting
Bowfin	0.000	-
Bullhead spp.	-	-
Northern Pike	0.112	0.784
Muskellunge	0.002	0.017
Burbot	0.000	-
Rock Bass	0.025	6.011
Sunfish spp.	0.023	1.661
Smallmouth Bass	0.003	0.051
Largemouth Bass	0.039	1.160
Black Crappie	0.016	1.414
Yellow Perch	0.518	5.964
Walleye	0.191	0.711
Cisco/Whitefish	0.000	-
Harvest Rate (fish/hour)		
Species	Angler Type	
	All	Targeting
Bowfin	0.000	-
Bullhead spp.	-	-
Northern Pike	0.017	0.236
Muskellunge	0.000	0.000
Burbot	-	-
Rock Bass	0.004	1.270
Sunfish spp.	0.010	0.814
Smallmouth Bass	0.000	0.000
Largemouth Bass	0.002	0.120
Black Crappie	0.011	1.024
Yellow Perch	0.105	1.559
Walleye	0.100	0.372
Cisco/Whitefish	-	-

Appendix 2 continued. Creel survey summary for Leech Lake, Minnesota

Creel Survey Summary for Leech Lake, Minnesota								
Length Frequency Summary for the estimated number of fish harvested (inch groups)								
Species	0.0-4.9	5.0-8.9	9.0-12.9	13.0-16.9	17.0-20.9	21.0-24.9	25.0-29.9	≥30.0
Bowfin	-	-	-	-	-	81	-	-
Bullhead spp.	-	-	-	-	-	-	-	-
Northern Pike	-	-	-	404	7,379	5,307	2,274	556
Muskellunge	-	-	-	-	-	-	-	-
Burbot	-	-	-	-	-	-	-	-
Rock Bass	-	240	3,988	-	-	-	-	-
Sunfish spp.	55	3,279	5,957	-	-	-	-	-
Smallmouth Bas	-	-	172	172	-	-	-	-
Largemouth Bas	-	-	62	1,246	872	-	-	-
Black Crappie	-	1,445	5,090	3,508	-	-	-	-
Yellow Perch	43	12,340	83,952	2,425	-	-	-	-
Walleye	-	43	1,540	42,230	35,941	11,852	2,353	-
Cisco/Whitefish	-	-	-	-	-	-	-	-
Comments:								
Citation: Pedersen, C., and Schultz, D. 2020. Summer creel survey for Leech Lake, 2019. Minnesota Department of Natural Resources, Section of Fisheries, Study 4, Job 1078.								

Appendix 3. Flight reduction work.

The 2019 Leech Lake summer creel survey was an unscheduled survey added to evaluate the removal of the Walleye protected slot limit that had been in place in various forms since 2005. Since this was an unscheduled survey additional funding would need to be secured. There were concerns that with recent increases in costs associated with flights used to get boat counts and instantaneous pressure that the flights would be cost prohibitive and result in the creel proposal being rejected. An analysis of how a reduction in flights would affect pressure estimates and confidence intervals using previous creel data was completed with results in the attached table. Previous Leech Lake creel surveys had divided the summer season into strata by smaller time periods such as opening weekend, half month and month. Creel surveys on other large lakes in Minnesota such as Kabetogema simply split the summer season into 2 strata, May-June and July-September. Doing this on Leech Lake would allow for a reduction in flights and resulting cost savings. Using data from the 2016 creel survey, flights were randomly removed in increments of 5, analysis was rerun to determine how a reduction in flights would affect calculated results. Results from this analysis are included in the table below. A reduction in flights was not determined to significantly alter overall results so the reduced flight schedule was written into 2019 proposal.

(Number of Flights)	Month ¹	Observed				Total			
		P	SE	80% CI	95% CI	P	SE	80% CI	95% CI
All (30)	M, J	151,050.75	8,757.09	11,226.59	17,163.90	358,196.28	20,366.39	26,109.71	39,918.12
All (38)	JY, A, S	148,770.00	5,314.56	6,813.27	10,416.55	349,354.34	12,856.33	16,481.81	25,198.40
All (68)	Season	299,820.75	10,243.59	13,132.29	20,077.45	707,550.63	24,084.75	30,876.64	47,206.10
Minus 5(25)	M, J	157,217.55	11,730.02	15,037.89	22,990.85	370,812.88	26,201.49	33,590.31	51,354.92
Minus 5(33)	JY,A,S	152,864.86	5,784.96	7,416.32	11,338.52	358,988.56	14,100.56	18,076.91	27,637.09
Minus 5(58)	Season	310,082.41	13,078.96	16,767.23	25,634.77	729,801.44	29,754.73	38,145.56	58,319.26
Minus 10 (20)	M, J	178,500.00	8,821.69	11,309.41	17,290.51	417,324.63	21,051.51	26,988.04	41,260.96
Minus 10 (28)	JY,A,S	154,362.23	6,510.86	8,346.92	12,761.29	361,389.56	16,077.32	20,611.13	31,511.55
Minus 10 (48)	Season	332,862.22	10,964.19	14,056.10	21,489.82	778,714.19	26,488.61	33,958.39	51,917.67
Minus 15 (15)	M, J	170,277.33	7,406.15	9,494.68	14,516.05	399,303.22	17,773.20	22,785.25	34,835.48
Minus 15 (23)	JY,A,S	143,735.33	5,354.06	6,863.90	10,493.96	336,123.25	13,221.74	16,950.28	25,914.62
Minus 15 (38)	Season	314,012.66	9,138.76	11,715.89	17,911.98	735,426.50	22,151.78	28,398.58	43,417.48
Minus 20 (10)	M, J	146,790.00	6,010.55	7,705.53	11,780.68	342,190.34	14,504.17	18,594.35	28,428.18
Minus 20 (18)	JY,A,S	147,117.50	6,129.92	7,858.56	12,014.65	343,501.19	14,744.79	18,902.82	28,899.79
Minus 20 (28)	Season	293,907.50	8,585.03	11,006.00	16,826.65	685,691.56	20,682.84	26,515.40	40,538.36

M-May¹
 J-June
 JY-July
 A-August
 S-September

Appendix 4. Method for correction of catch and harvest rates of targeting anglers in CAS.

Using standard analyses in CAS, targeting catch/harvest rates may be summed across work period, day type, zone, and type of fishing instead of averaging. In order to avoid targeting rates being summed across strata, which inflates targeting catch rates relative to other creel surveys completed by MN DNR, the data need to be pooled into a singular stratum.

1. Create two copy databases to be used solely for calculating targeting rates (one for seasonal; one for work period strata).
2. Open the CAS database in Microsoft Access.
3. Using the Access database with the interview table change these fields
 - a. Day Type Code- all interviews should be DayType = 1
 - b. Work Period- if calculating catch rates for entire season all interviews should be Work Period = 1; if calculating catch rates for each work period make no change.
 - c. Zone- all interviews should be Zone = 1
 - d. Type of Fish- all interviews should be 1 if calculating rates across all angler types, otherwise make no change.
4. Within CAS, make the following changes using the code editor only if calculating catch/harvest rates for entire season:
 - a. Station-Work Period- change work period to Work Period = 1, set dates to encompass entire creel season. Delete all other work periods.
 - b. Analysis Specific Codes- Work Shift Probability- Delete all work shift codes for all work periods except work period 1.
 - c. Analysis Specific Codes- Work Period Days and Hours- Change number of days for rows 1-3 so that they encompass the number of weekend/holiday days, week days, and all days during the creel season. Delete all other rows.
 - d. Make sure to use output table 4.07 for the entire season otherwise catch rates will be incorrect.

