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Completion Report

Estimating Angling Pressure, Catch Rates, Structure of Catch, Recreation Use, and Walleye Exploitation
on Fish Lake Reservoir, St. Louis County, Minnesota using a Stratified Random, Roving Creel Survey
(May 14th, 2005 to February 26th, 2006).

Influence of Fishing Location Choice on Fishing Success during the Early 2005-06 Ice-fishing Season on
Fish Lake Reservoir.

by

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CHAPTER 1

ANGLER CREEL AND RECREATIONAL USE

INTRODUCTION AND STUDY AREA

Fish Lake Reservoir is the third largest (3,071 acres) of five headwater storage basins in the St. Louis-Cloquet system created by Minnesota Power (MP) in the early 1900's for the purpose of hydroelectric power generation. Fish Lake Reservoir is operated by MP, with maximum power generation occurring from late fall through late winter. The reservoir is typically refilled to full pool (18.5 ft) by June 1st. Seasonal water level fluctuations are common, but since the Federal Energy Regulatory Commission (FERC) relicensing in 1995, the magnitude of drawdown has been less drastic (maximum drawdown elevation of 14 ft) and is most dependent on seasonal rain and snowfall accumulation in the watershed and power generation needs.

Northeast Minnesota rivers and lakes were formed primarily through scouring of Precambrian rock by glacial ice sheets and are typically the most unproductive in Minnesota (Schwartz and Thiel 1954; Moyle 1956); however, man-made reservoirs have accelerated rates of eutrophication and are generally much more fertile. Fish Lake Reservoir is classified as mesotrophic and is one of the most productive water bodies in lower St. Louis County (Carlson's Trophic Index; Citizen Lake-Monitoring Program). Over 75% of the reservoir is littoral (2,303 acres) and depths reach a maximum of 31 feet. Most of the shoreline is owned by MP, which leases out lots to private individuals for development. Currently, about 195 homes or cabins are located along the shoreline of Fish Lake Reservoir.

The Fish Lake Reservoir management plan primarily focuses on preservation of quality angling. Fish Lake Reservoir supports sport fisheries for walleye, northern pike, yellow perch, black crappie, bluegill, and most recently, largemouth bass. Walleye, northern pike, and yellow perch were native to the original Fish Lake and Moose lakes and the interconnecting waterways. Black crappie and bluegill were introduced between 1924 and 1944. Largemouth bass were not identified in any large number

until the fall young-of-the-year (YOY) walleye investigations in 2004 and 2005 when Minnesota Department of Natural Resource (MNDNR) fisheries crews caught numerous age-1 and older fish. No largemouth bass were observed during similar investigations between 1994 and 2003. The source of the introduction of largemouth bass is unknown.

Fish Lake Reservoir has been stocked with over 22 million walleye fry between 1924 and 1989. Minnesota DNR conducted a population assessment in 1989 and found that only 28% of aged fish correlated to fry stocked years. Subsequent surveys and assessments showed similar trends of constant recruitment in the absence of stocking and stocking was deemed unnecessary. Young-of-the-year walleye abundance was annually indexed between 1994 and 2005 via fall electrofishing. Catch rates of YOY walleye were always near the best in the Duluth Area, but abundance did fluctuate in response to environmental conditions in the spring. The age structure of the walleye population in 1993, 1996, 1999, and 2005 also resembled erratic recruitment patterns. Results from a mark-recapture experiment for walleye in 1999 estimated a population of approximately 46,200 walleye (Borkholder and Edwards 2000).

Because of its large size and close proximity to Duluth, Fish Lake Reservoir has been a popular destination for general angling and tournament fishing contests. No creel survey has been done on Fish Lake Reservoir. An aerial recreational use survey of 67 Duluth Area lakes was conducted between 1999 and 2000 and estimated approximately 69,186 total angling hours (Rust 2001). Fishing pressure was categorized as moderate to heavy with 21.2 anglers hours per acre. The lake has historically supported a popular walleye fishery. In addition, a strong 1988 black crappie year class produced several years of excellent angling.

The predaceous exotic zooplankton spiny water flea (*Bythotrephes cederstroemi*) was detected in Fish Lake Reservoir by the University of Wisconsin-Superior in the mid 1990s. The spiny water flea feeds primarily on daphnids and copepods and could reduce the abundance of food items available to planktivorous fish, which could negatively impact gamefish recruitment. However, even when the

spiny water flea occurs in high densities, no impacts to gamefish recruitment were observed in Island Lake Reservoir, St. Louis County (Lindgren 2006).

In 2005-06, Fish Lake Reservoir was included in a joint MNDNR, 1854 Authority and Fond du Lac Division of Natural Resources study of walleye exploitation rates within the 1854 ceded territory of Minnesota. Several years of spring electrofishing investigations suggested that walleye exploitation rates in several Grand Marais Area lakes might be relatively high. Based on age distribution and catch curve analysis, Fish Lake Reservoir walleye population was thought to have somewhere between 29 and 39% annual mortality (unpublished data), which is about average for exploited populations. Therefore, Fish Lake Reservoir was selected as a control so comparisons could be made between lakes thought to have high walleye exploitation and lakes thought to have average walleye exploitation. Other objectives of the study were to estimate specific catch rates, structure of catch, angling pressure, total harvest, and amount of recreational use.

METHODS

Creel Survey Design

A random roving, stratified creel survey was determined to be the best survey method for this reservoir due to the high number of cabins and permanent homes on the lake. The survey was stratified by season (five), day type (two), and time of day (day period; Table 1). Seasonal strata were spring (May 14, 2005 - June 30, 2005), summer (July 1, 2005 - August 31, 2005), fall (September 1, 2005 - October 31, 2005), early winter (December 1, 2005 - January 15, 2006), and late winter (January 16, 2006 - February 26, 2006). Day types were weekends (including holidays) and weekdays. Within each seasonal stratum, all weekends/holidays were sampled and weekdays were selected randomly.

Open water Creel

The open water fishery was sampled from May 14th 2005 to October 31st, 2006. Days were divided into two periods (AM and PM), selected to represent the entire daylight time (Table 1). Five

eight-hour workdays were creeled each week. Each scheduled day started at one of four randomly selected locations (Figure 1) and moved around the lake in a clockwise or counterclockwise direction (determined randomly). The creel clerk performed two instantaneous counts randomly scheduled throughout the workday. At the beginning of a shift, the clerk reported to the assigned start location and interviewed anglers as encountered, moving in the direction assigned. At the scheduled count time, the creel clerk would stop interviewing anglers and circumnavigate the reservoir, counting the total number of bank anglers, dock anglers, boat anglers, and recreational users. Recreational users were defined as those individuals utilizing the reservoir for purposes other than fishing.

Interviews were conducted on a party basis. Information collected relative to the trip included: access used (public, private, resort), activity type (e.g. fishing, pleasure boating), time spent fishing, status of the trip (complete or incomplete), angler type, number of anglers, target species, fishing method, lure type, boat and motor type and size, presence of trolling motor, use of electronics, age, gender, and angler residence (zip code). Information relative to catch included: species and length of harvested fish, and species and number of released fish. The clerk measured all harvested fish to the tenth of an inch. The creel clerk recorded tag numbers from all observed tagged walleye and thoroughly checked other harvested walleye for signs of tag removal or tag loss. When lengths of released and harvested fish were unavailable for measurement, anglers were asked to estimate the size of each fish. Interviews were randomized both temporally and spatially on days when the clerk was unable to interview every party on the reservoir.

To increase the amount of completed-trip interview data collected, most incomplete fishing parties interviewed were given a simple postcard questionnaire (postage-paid) addressed to the area fisheries office. The clerk was required to fill out the date of the interview along with the interview number prior to handing out the postcard questionnaire. Anglers were asked to fill out and mail the questionnaire at the end of the fishing trip. Anglers were asked to provide information on party size

and the duration of fishing trip, number and size of harvested and released fish, and the tag numbers from any fish harvested.

Winter Creel

The winter ice fishery was sampled from December 3rd, 2005 to February 26th, 2006. The survey was stratified by season and day type (Table 1). Angler types identified were ‘open ice’, ‘fish house (portable and permanent)’ and ‘spear’. Pressure and catch statistics were calculated separately for each angler type. Because of decreasing day length, only one day period was used during the winter creel. The creel clerk worked four 10-h days per week; two weekend days and two randomly selected weekdays.

Winter creel interview and count procedures were similar to the open water creel methods except the clerk used a snowmobile or all-terrain vehicle (ATV) to access anglers. The creel clerk counted all open-ice anglers and all occupied permanent fish houses and portable fish houses during two random count times within the 10-hour shift. An ice shelter (inside angler) was determined as occupied if there is a vehicle parked next to it, if there was smoke from a chimney, if there was a noticeable heat source from within or a portable propane tank outside the shelter, or if there were fresh tracks in the snow leading from a nearby cabin. Only occupied fish houses and open-ice anglers were used in the calculation of total fishing pressure. The winter postcard questionnaire resembled that of the postcard used in the open water creel.

Walleye Exploitation

Between April 16-19 2005, Fond du Lac Band and 1854 Authority captured and marked 2,568 walleye (≥ 10 inches) with individually numbered floy tags and then released them back into the lake. Drop boxes and educational signs were placed at five access sites (two public landings and three resorts) to inform the public and collect tags returned voluntarily by anglers over the 2005 fishing season. Harvested tagged walleye information was also gathered by handing out postage-paid postcards to interviewed anglers who had not completed their fishing trip. The creel clerk also recorded any tagged walleye harvested during the scheduled shift. The absolute minimum mortality estimate

was calculated by adding all sources of known harvested tagged walleye (observed during creel, drop boxes, phone calls, mail-ins) and dividing by the number initially tagged (2,568). Estimated exploitation over the entire fishing season was calculated by using the estimated number of tagged walleye harvested in the creel divided by the total number initially tagged.

Analysis

Fishing pressure, catch rates, targeting catch rates, harvest (number of fish), and yield (pounds of fish) for each season and combined open water and winter periods were estimated using the GENCREEL program (Bindman and Mach 1994). Mean lengths and associated standard errors for harvested fish were calculated by pooling data for fish lengths measured by the creel clerk over the entire season. Length frequency distributions for fish harvested and released were expanded by multiplying the ratio of each length group in the measured sample by the estimate of the total harvest. Individual weights were calculated for all measured fish using length-weight relationships determined from fish population investigations conducted between 1993 and 2005 (Table 2). Calculated individual weights were pooled over the entire season and used to estimate mean weights in the same way that mean lengths were determined.

To determine harvest and catch rates for tagged and untagged walleye, untagged walleye were assigned a species code of WAE and tagged walleye were coded as WAT. When estimates for all walleye were required, the GENCREEL program was run using the code WAE for both tagged and untagged walleye.

The mean length of completed fishing trips, the percentage of parties using various accesses and fishing methods, and the percentage of anglers residing in various locales was determined by pooling interview data for both the open water and winter fishing season. Angler residence (city and state) was determined from zip codes reported by anglers using the computer program "Zipkey" (Isaacson 1991).

Returned questionnaires for each season were pooled for the calculation of harvest and release rates and for summarizing return rates. Harvest and release rates were determined by the ratio-of-means

method: dividing the mean number of fish caught per party by the mean hours fished per party (number of anglers times trip length; Murphy and Willis 1996).

RESULTS AND DISCUSSION

Fishing Pressure

Total estimated fishing pressure for Fish Lake Reservoir during the 2005/2006 fishing season was 79,394 hours (Tables 3 and 4). Over 36% of all fishing pressure occurred during the spring and pressure during this period was two to three times higher than all other seasons except summer. Most lakes that have good populations of sport fish have elevated fishing pressure during the spring when fish concentrate in spawning locales and metabolism increases. Lindgren (2004) estimated that over 70% of angling pressure occurred during the spring in the nearby St. Louis Estuary. Although angler effort in Fish Lake Reservoir was high during the spring, significant fishing pressure occurred during all seasons, which is uncommon for many Duluth area lakes (Rust 2001; Lindgren 2004). Fishing pressure in the summer in Fish Lake Reservoir was about one-third less than spring, but was higher than all other seasons. When combined, fishing pressure during the open water period accounted for 72% of all fishing pressure (Table 3). About 22,000 angling hours were spent fishing thru the ice with nearly 60% of this effort occurring during the early winter (Table 4).

Fish Lake Reservoir received approximately 25.8 angler hours per acre during the 2005-06 fishing season (Table 5). The estimated fishing pressure in this study was remarkably similar to what was observed by Rust (2001) during an aerial recreational use survey (21.2 h/acre). Rust (2001) also estimated fishing pressure for other reservoirs within the St. Louis River/Cloquet river system, but fishing pressure in those systems was one-third to one-half less than what Fish Lake Reservoir received. Contrary to most other large lakes or reservoirs in the area, Fish Lake Reservoir supports both a significant summer and winter fishery (Table 5). The only other water body within the Duluth Fisheries Management Area supporting a similar amount of fishing pressure is the St. Louis Bay Estuary, but

almost all of the pressure in the Estuary occurred in the open water season (Lindgren 2001). Fish Lake Reservoir has substantially more open water fishing pressure when compared to other lakes within lake class 7; however, total fishing pressure was about 25% less when compared to statewide averages (Cook and Younk 1998; Table 5).

During the open water creel, boat anglers accounted for nearly 88% of all hours spent fishing, of which, 42.2% occurred during the spring and 31.6% during summer (Table 3). Shore angling was popular during the spring along County Road 48 causeway and along the dam. Although numerous lakeshore properties are located along the shore of Fish Lake Reservoir, very few residents fished from their docks during any part of the open water creel (Table 3). Less than 1% of total open water angling hours was spent fishing from docks.

Most anglers that fished during the winter used either a portable or permanent fish house and accumulated an estimated 18,882 hours of fishing effort (Table 4). Over 86% of the fishing pressure was conducted by fish house anglers, followed by open ice anglers (13.7%) and spear anglers (0.3%). Open ice anglers were more frequently observed during the late ice period when ice conditions were safe for driving vehicles, snowmobiles, or ATV's. Spear anglers were rarely interviewed and fishing pressure was very low (Table 4).

Harvest and Yield

Black crappie total harvest and yield was low (1,451 fish and 852 pounds); however, there were noticeable differences in harvest among seasons (Tables 6 and 7). Of all black crappie harvested, 71% were harvested in either fall (48%) or late winter (23%). Angler reports and anecdotal evidence suggested that black crappie harvest might be very high during the fall and winter months, especially during the early 1990's when a large 1988 black crappie year class reached adult size (Duluth Area lake management files). However, results from this study suggest that black crappie do not represent a large proportion of total harvest (7.4%) and yield (4.1%). Marginal year classes since the late 1980's were most likely

responsible for reduced harvest and yield of black crappie since the late 1990's (Duluth Area lake management files).

The mean length of black crappie harvested was 10.1 inches during the open water creel and 9.6 inches during the winter creel (Table 8). Most anglers did not harvest black crappies that were 7 inches or less during either period; however, almost all black crappie over 9 inches were harvested (Tables 9 and 10). Anglers that fished the St. Louis Estuary had similar perceptions of harvestable and released sizes of black crappie (Lindgren 2004). Of the angler parties interviewed, no party harvested more than 10 black crappies during a single fishing trip during any season and only a few harvested a single black crappie (Table 11).

Anglers harvested an estimated 4,167 bluegill during the 2005-06 fishing season, which represented 21.4% of all fish harvested and 7.1% of the yield (Tables 6 and 7). Bluegill harvest was highest during the spring and summer months, lowest in fall and early winter, and then increased in late winter. Over 81% of bluegill were harvested during the open water creel. The mean length of bluegill harvested was similar among the open water (7.9") and winter (8.1") seasons; however, winter anglers released a higher percentage of small fish (< 6.0"; Tables 8-10). Bluegills are colonial nest spawners and males aggressively defend nests (Moyle and Cech 2000); therefore, targeting anglers can easily catch adult bluegill during the spawning period once spawning grounds are found. It is likely that increased harvest and size of bluegill caught during the spring and summer months could be attributed to this event. However, even when fishing was at its peak (e.g. spring and summer), less than 1% of anglers harvested more than 7 bluegill during a fishing trip (Table 12).

Anglers harvested very few (127) largemouth bass during the 2005-06 fishing season (Tables 6 and 7). Most catch or harvest of largemouth bass occurred during the summer and fall (Table 9). Largemouth bass were nearly absent from the winter creel (Table 10). Only during the fall did anglers catch or harvest more than one largemouth bass (Table 13). Although the bass population in Fish Lake Reservoir is relatively new, the size and habitat complexity of the reservoir may be conducive for this

species. At least three year classes have been identified by MNDNR fisheries crews and reproduction since 2003 has been good (Duluth Area Fisheries Management files). Angler awareness coupled with increased population size should increase harvest and yield in the future.

Approximately 13% of fish harvested in 2005-06 were northern pike, which accounted for 36.9% of the total yield (Tables 6 and 7). Although northern pike yield was always high, significant seasonal differences were observed. Northern pike harvest and yield was highest in the spring and winter seasons and lowest during the summer and fall. Fewer anglers targeted northern pike in the spring as opposed to the summer and fall, but much more effort occurred during the spring, therefore increasing harvest and yield. In contrast, anglers more frequently targeted northern during the winter period and even with much less fishing pressure (as opposed to spring), harvest and yield were nearly identical (Tables 6 and 7).

Generally, anglers released all northern pike smaller than 15 inches and harvested fish larger than 22 inches (Tables 9 and 10). Northern pike harvested during the winter period were substantially larger than those harvested during the open water period; however, released northern pike were of similar size (Table 10). One explanation for increased sizes of harvested northern pike during the winter period was that more anglers targeted that species. Northern pike were frequently caught and harvested by anglers as by-catch during the open water period when anglers primarily targeted walleye. Over 3% of anglers harvested three or more northern pike in the spring, compared to 1% in the summer and 0% from fall to late winter (Table 14). However, the percent of anglers harvesting northern pike was much higher during the winter creel, suggesting a preference towards that species.

An estimated 8,738 walleye (9,174 lbs) were harvested during the 2005-06 fishing season representing over 40% of the total catch and yield, which was the highest of any species (Tables 6 and 7). Fifty-six percent of all harvested walleye were caught in the spring; however, walleye did comprise a significant proportion of the harvest in all other seasons except late winter. Anglers began harvesting walleye when they reached 10 inches (Tables 9 and 10). The mean length of walleye harvested in the open water period was about one-half inch less than those harvested in the winter (Table 8); however,

those harvested in the St. Louis Estuary were about 2-3 inches longer in any season (Lindgren 2004). The larger size of harvested walleye was expected in the Estuary because regulations only allow for harvest of two fish with a minimum size limit of 15 inches and walleye growth is faster. Walleye regulations in Fish Lake Reservoir fall under the statewide regulation of a 6 fish daily bag limit and no size limit. Even with these more liberalized bag and size limits, few anglers or angler parties ever harvested six or more walleye during any season in Fish Lake Reservoir (Table 15). Enforcing a minimum size limit similar to that of the St. Louis Bay may increase size structure of caught walleye, but minimum size limits of 15 inches typically do not increase walleye catch rates or growth (Fayram et al. 2001). In order to make a biological impact on the number of walleye caught per trip, daily bag limits would need to be decreased to two fish per day, which may be socially unacceptable.

Nearly 2,400 yellow perch (1,257 pounds) were harvested during the 2005-06 fishing season, representing 12.3% of the total harvest and 6.1% of the yield (Tables 6 and 7). As with most species, seasonal differences in harvest were detected with the highest harvest occurring during the spring (39.6%) and early winter (30.5%). The size of harvested and released yellow perch was larger in the open water period as opposed to the winter period (Table 8), but the size structure of catch was similar among periods (Tables 9 and 10). Winter anglers harvested a higher percentage of smaller (8.0-9.0 inch) yellow perch, thus decreasing mean length at harvest and release (Tables 9 and 10). Yellow perch were rarely targeted by anglers during the open water period, but were often targeted during the winter period. In addition, angler's targeted black crappie and bluegill more frequently in the winter period and yellow perch were often caught as by-catch and frequently included in an angler's daily bag. However, no angler or angler group that was surveyed in this study caught a limit (20 fish) of yellow perch and only a few anglers' harvested more than 3 during a fishing trip (Table 16).

Of all the completed trip interviews that were conducted on Fish Lake Reservoir during the 2005-06 fishing season, few anglers or angler groups harvested a limit of any fish species (Tables 11-16). However, most anglers caught at least one or more fish during a fishing trip, with highest catch potential

occurring in spring (Table 17). In addition, anglers were more harvest oriented during the spring, early winter, and late winter periods.

Harvest, Release, and Catch Rates

Black crappie harvest, release, and catch rates for all anglers were low during all seasons except fall in Fish Lake Reservoir (Tables 18 and 19). Harvest rates generated from angler questionnaires were very similar to what was observed by the creel clerk in both the open water and winter surveys (Table 20). Over 23% of angling parties targeted black crappie during the fall and late winter seasons and harvest rates during those seasons were among the highest observed (Tables 21 and 22). Compared to the St. Louis Estuary and state median values, black crappie harvest rates were much lower for targeting anglers (Cook and Younk 1998; Lindgren 2004; Table 23). Black crappie fishing opportunities in Fish Lake Reservoir are minimal, except for occasional years following strong year-classes.

Bluegill harvest, release, and catch rates in Fish Lake Reservoir were highest in the summer (Tables 18 and 19). Harvest rates of bluegill were also good during the spring and late winter seasons. Anglers that returned questionnaires also had better angling success during the open water period (Table 20). Bluegill catch and harvest rates for targeting anglers were always the highest compared to other targeted fish species, with the highest percentage of anglers seeking bluegill during the summer and late winter seasons (Tables 21 and 22). Harvest rates for anglers targeting bluegill in Fish Lake Reservoir were about one-half the state median, but were higher than the St. Louis Estuary (Table 23).

Harvest and catch rates of largemouth bass in Fish Lake Reservoir were the lowest of any species and were not a significant proportion of anglers catch during any season (Tables 18 and 19). A few anglers did target largemouth bass during the summer and fall, but their catch and harvest rates were also low (Table 21). The largemouth bass fishery in Fish Lake Reservoir appears to be very minimal.

Catch rates of northern pike in Fish Lake Reservoir were generally best in the open water seasons; however, harvest rates were highest during the winter period (Tables 18 and 19). A similar pattern of increased harvest and decreased catch rates during the winter period was observed from

returned questionnaires (Table 20). More anglers targeted northern pike during the winter months, which may have increased harvest rates (Table 22). Harvest rates of northern pike by targeting and non-targeting anglers in Fish Lake Reservoir were higher than the St. Louis Estuary and the state median (Table 23). The northern pike fishery has proven to be a valuable resource to anglers, especially during the ice-fishing season.

Walleye catch rates were highest in the spring and fall, average in the summer and early winter, and lowest in the late winter (Tables 18 and 19). Harvest rates followed a similar trend and were usually about one-half of the total catch rates. According to angler returned questionnaires, walleye harvest and catch rates were about twice as high during the open water period and about four times higher during the ice period when compared to harvest and catch rate estimates using observed creel clerk data (Table 20). Inflated catch estimates are not uncommon when using angler reported data because anglers that catch fish are more likely to report that data than those who catch few or no fish. Interestingly, catch rates for most other species do fall within a similar range when comparing the two different estimates. One explanation for this is that walleye are a much more sought after fish than most other fish species; therefore, the tendency for anglers to correctly fill out other species information is much higher.

Since most anglers that fished during the open water period targeted walleye, few differences were observed among catch or harvest rates for targeting and non-targeting anglers (Tables 18 and 21). Fewer anglers targeted walleye during the winter period, but of those anglers that did target walleye, catch and harvest rates were about one-third higher during early winter and three to four times higher in late winter (Tables 19 and 22). Harvest rates of walleye in Fish Lake Reservoir were similar to the St. Louis Estuary and state median values (Table 23).

Although yellow perch catch rates were high among all seasons, harvest rates were always less than 0.07 fish/hr (Tables 18 and 19). Harvest rates from angler questionnaires were nearly identical to what was observed by the creel clerk in both the open water and ice surveys (Table 20). Less than 0.5% of anglers or angling parties targeted yellow perch during the open water period, while 3-4% of anglers

targeted them during the winter period (Tables 21 and 22). Yellow perch appear to be a more important sport fish during the winter months in both Fish Lake Reservoir and the St. Louis Estuary, but harvest rates were much less than the state median (Table 23).

Angler Demographics

Local residents accounted for 92% of the anglers interviewed on Fish Lake Reservoir in 2005-06 (Table 24). Only 55 anglers (1.0%) were from Superior or other nearby Wisconsin towns. Out-of-state license fees probably deter many Wisconsin anglers, even though the reservoir is located only a few miles from Superior. Anglers residing in the St. Paul – Minneapolis Area were the only other angling group that accounted for a noteworthy proportion of anglers. Fish Lake Reservoir was a top destination choice for the residents surrounding the Duluth Metropolitan Area.

Average party size and trip length was 2.07 anglers and 4.08 hours during the open water period (Table 25). Most of the angling during the open water period was conducted by boat anglers (Table 24). Anglers most frequently used the public access near the dam; however, a fair number of anglers used boat ramps located at resorts (Table 26). Still fishing using a minnow or a mixture of leeches, minnows, or worms was the most popular fishing technique among open water anglers. Nearly 88% of all boat anglers used electronics of some kind to aid in locating fish or fishing sites.

Average party size and trip length was 1.73 anglers and 3.61 hours during the winter period (Table 25). Ice anglers most commonly used portable fish houses; however, numerous anglers fished from permanent fish houses or used no fish house (Table 24). About 60% of ice anglers “still” fished while the remaining 40% used a combination of jigging and tip-ups (Table 26). Anglers that used tip-ups were primarily focused on catching northern pike, but occasionally, walleye were also taken from tip-ups. Anglers used almost exclusively minnows, or a mixture of minnows and wax worms during the ice period. Over 60% of ice anglers used a flasher, camera, or locator when angling. Many anglers commented on the large number of walleye, northern pike, and small yellow perch observed when using a camera device, but few could get those fish to bite. When spring and summer conditions are right, the

high productivity of the reservoir allows for good year classes of forage fish such as shiners and yellow perch. Environmental conditions during the spring and summer of 2005 were favorable for these species, therefore, top-level predators were not as hungry and angling was more difficult.

Walleye Exploitation

An estimated total of 490-tagged walleye were harvested from Fish Lake Reservoir during the 2005-06 fishing season (Table 27). Walleye fishing mortality was low at only 19.1%, with most (18.4%) mortality occurring during the open water period. Based on age distribution catch curves from walleye netting in 1996, 1999, and 2005, total annual walleye mortality in Fish Lake Reservoir ranged from 29 to 39% (unpublished data). Using these estimates of annual and fishing mortality, annual natural mortality for walleye ranges from 10-20%, which is within the range of mortality rates for adult walleye in North America (13-80%) reported by Colby et al. (1979) and similar to those observed from Kansas Reservoirs and several Wisconsin lakes (Beard et al. 2003; Quist et al. 2004). A total of 341 tags from harvested walleye were recovered from either drop boxes (179), observed by the creel clerk (73), or phoned or mailed-in (89), which resulted in an absolute minimum mortality estimate of 13.3%. This estimate is low since not all anglers were anticipated to cooperate with tag returns, however, an absolute minimum mortality estimate may be useful when modeling population effects because mortality is known at some level of certainty.

Conclusions

The open water and winter fishery on Fish Lake Reservoir has proved to be substantial. Fishing during the 2005-06 fishing season was generally considered to be good. Angler pressure was near the highest in the Duluth Area, but still below the state median values for lake class 7 lakes. A significant seasonal difference in fishing pressure was observed, with the highest pressure during the open water period, especially spring. Walleye and northern pike contributed the most to annual yield, but several other species were seasonally important to anglers. Walleye fishing mortality was 19.1% and was considered low to average compared to other reservoirs and area lakes.

CHAPTER 2

INFLUENCE OF FISHING LOCATION CHOICE ON FISHING SUCCESS DURING THE EARLY 2005-06 ICE-FISHING SEASON ON FISH LAKE RESERVOIR

ABSTRACT

Random-roving fisheries creel surveys are designed to collect information on catch, harvest, fishing pressure, and human demographics. Although creel clerks often encounter anglers while in the act of fishing, information regarding choice of fishing location as it relates to angler success is usually ignored. Using creel survey data along with GPS data obtained during the early 2005-06 ice-fishing season, success of anglers concentrated within distinct fishing locales (i.e. cluster anglers) was compared to that of isolated anglers (i.e. anglers fishing alone or in small groups). The objective of the study was to quantify and compare differences in catch and harvest rates, species composition, and size of fish caught between the two groups. Anglers that fished in isolated areas caught 56% more and harvested 21% more fish than anglers fishing in clusters. Isolated anglers harvested more and larger walleye and caught substantially more northern pike than cluster type anglers did, but harvest rates and size of northern pike were similar. Yellow perch and black crappie were caught at similar rates between angling groups; however, more and larger yellow perch were harvested from cluster areas. Bluegills were more often targeted by isolated anglers and catch and harvest rates were 31 to 34 times higher than for those anglers fishing in clusters.

INTRODUCTION

The Minnesota Department of Natural Resources (MNDNR) has conducted creel surveys on over 1,000 water bodies to estimate recreational harvest (Cook et al. 1997). Many of these surveys were conducted as random-roving creel survey's, where creel clerks often interview anglers and record their catch during the anglers fishing trip. Many variables may influence fishing success in terms of catch and harvest rates at any given time (i.e., angler skill, fishing location, weather patterns, bait/lure type, etc.),

making the prediction of fishing success difficult. Correlations between fishing site location and fishing success have been observed in several coastal and inland fisheries (Kangas 1995; Hutton et al. 2004; Smith 2005). In any water body that receives a fair amount of winter ice fishing pressure, two angler types are usually found: those that fish in groups and those that avoid large congregations of anglers. Variables that may influence an angler's daily choice of fishing location include accessibility, past success, remoteness or affinity to crowds, and amount of allotted fishing time. The objective of this study was to quantify and compare differences in catch and harvest rates, species composition, and size of fish caught between anglers concentrated within distinct fishing regions (i.e. cluster anglers) to that of isolated anglers (i.e. anglers fishing alone or in small groups) during the early ice fishing season (December 3, 2005-January 16, 2006) on Fish Lake Reservoir.

METHODS

A standard stratified random-roving creel survey was conducted during the early winter ice-fishing season (December 3, 2005 to January 16, 2006). In addition to time fished and catch statistics, creel clerks recorded angler location after each "on-ice" interview using a Garmin Map76 GPS unit and waypoints were downloaded using the DNR Garmin program. Anglers were classified as cluster type anglers based on the following criteria.

- Five or more permanent ice fishing shelters were observed in the same location (within a 70 m radius) throughout the duration of the study
- Anglers were interviewed from a specific area at least 80% of the total creel days (N = 27).

Estimation of catch, release, and harvest per hour were calculated for both angler types using the Mean-of-Ratios Estimator (Murphy and Willis 1996). One-way Analysis of Variance (ANOVA) was used to test differences in mean lengths of harvested and released fish. Significance level was determined at $P < 0.05$. Waypoints were converted to shapefiles and maps were made using ArcView.

RESULTS AND DISCUSSION

Four distinct cluster groups were identified during the early ice fishing season on Fish Lake Reservoir (Figure 2). Most fishing activity occurred near public and resort access areas on the north shore, however, some anglers did travel over 500 m to reach certain fishing locales.

Based on differences in average catch rates, isolated anglers caught 29% more and harvested 33% more walleye than anglers fishing in clusters (Table 28). Isolated anglers also harvested and released larger walleye than cluster anglers (Table 29). Length frequency distribution of harvested walleye for both groups peaked near 375 mm (Figure 3). Isolated anglers harvested 7 walleye over 20 inches compared to only 2 over 20 inches harvested by cluster anglers. In addition, cluster anglers released fewer walleye between 275 and 325 mm than did isolated anglers. The findings from this study suggest that anglers who prefer harvesting more and larger walleye should avoid congregations of anglers and seek more distant, isolated areas.

Anglers that fished in isolated areas caught 51% more northern pike than their counterparts did; however, harvest rates and size of fish harvested differed only slightly (Table 28 and 29). According to the length frequency distribution, the minimum size that either type of angler would harvest northern pike was somewhere near 550 mm (Figure 4). The size structure of northern pike harvested and released for both groups was nearly identical up to 700 mm, but the largest fish were more commonly caught by isolated anglers (Figure 4). Although isolated anglers may catch more fish than those fishing in clusters, the opportunity to harvest quality fish was similar, regardless of angler location choice.

Isolated and cluster type anglers caught yellow perch at similar rates; however, isolated anglers harvested fewer and smaller yellow perch than did cluster anglers (Table 28 and 29). The length frequency of yellow perch harvested and released was also highly skewed to favor cluster type anglers (Figure 5). One possible explanation for the increased size and harvest rates for cluster anglers is that more isolated anglers targeted bluegill and used smaller, more sensitive fishing gear, thus small yellow

perch were more easily caught as by-catch than cluster type anglers that primarily targeted top-level predators.

Few black crappie were caught or harvested by isolated or cluster type anglers during the study and no significant differences were detected; however, there was a significant difference in bluegill catch and harvest between the two groups (Tables 28 and 29; Figure 7 and 8). Bluegills were more often targeted by isolated anglers and catch and harvest rates were 31 to 34 times higher than for those anglers fishing in clusters.

When combining all species catch and harvest statistics, anglers that fished in isolated areas caught 56% more and harvested 21% more fish than anglers fishing in clusters (Table 28). The size structure of harvested and released fish was rather similar between the two groups, with fish ranging from 100 to nearly 900 mm (Figure 8). The results from this study demonstrate that an angler's choice of fishing location during the early ice-fishing season can impact what that angler catches and harvests during an angling trip.

Table 1. Description of strata used in the creel of Fish Lake Reservoir, St. Louis County, Minnesota, May 14th, 2005 – February 26th, 2006.

	Spring	Summer	Fall	Early Winter	Late Winter	Total
Start date	5/14/2005	7/1/2005	9/1/2005	12/3/2005	1/16/2006	5/14/2005
End date	6/30/2005	8/31/2005	10/31/2005	1/15/2006	2/26/2006	2/26/2006
Hours Covered	0630-2030	0630-2030	0700-1900	0830-1730	0830-1730	
Day length (hr)	14.0	14.0	12.0	9.0	9.0	
<i>Weekdays</i>						
number	33	43	42	30	29	177
number sampled	20	25	25	11	11	92
number of interviews	274	297	180	157	91	999
<i>Weekend days</i>						
number	15	19	19	16	13	82
number sampled	15	19	19	16	13	82
number of interviews	509	320	268	452	246	1,795
<i>All days</i>						
number	48	62	61	46	42	259
number sampled	35	44	44	27	24	174
number of interviews	783	617	448	609	337	2,794
<i>Day Periods</i>						
AM						
times	0630-1330	0630-1330	0700-1300	0830-1730	0830-1730	
PM						
times	1331-2030	1331-2030	1301-1900			

Table 2. Length – weight factors (a and b) for the relationship $W=aL^b$ (W = weight in grams, L = length in millimeters) used to estimate weights of fish harvested from Fish Lake Reservoir during the 2005 creel survey.

Species	Factor a	Factor b
Black crappie	-5.1608	3.1517
Bluegill	-5.1700	3.2428
Largemouth bass	-6.1590	3.5506
Northern pike	-5.2620	3.0032
Pumpkinseed	-4.7651	3.0794
Rock bass	-4.5522	2.9508
Walleye	-5.4801	3.1720
White sucker	-5.0712	3.0655
Yellow perch	-5.1102	3.0851

Table 3. Estimated fishing pressure (angler-h and angler-h/acre) by angler type during the spring, summer, and fall sampling periods for Fish Lake Reservoir, St. Louis County, Minnesota, May 14, 2005 –October 31, 2005 (standard error provided in parentheses).

Season	Angler Type			
	Boat	Shore	Dock	All
<i>Spring</i>				
angler-h	24,295 (2,797)	4,298 (637)	377 (164)	28,971 (3,296)
angler-h/acre	7.91 (0.91)	1.40 (0.21)	0.12 (0.12)	9.43 (1.07)
<i>Summer</i>				
angler-h	16,803 (1,932)	1,363 (221)	84 (36)	18,250 (2,036)
angler-h/acre	5.47 (0.63)	0.44 (0.07)	0.03 (0.01)	5.94 (0.66)
<i>Fall</i>				
angler-h	9,415 (1,145)	863 (118)	12 (8)	10,290 (1,203)
angler-h/acre	3.07 (0.37)	0.28 (0.04)	0.00 (0.00)	3.35 (0.39)
<i>All Open Water</i>				
angler-h	50,513 (3,587)	6,524 (685)	473 (168)	57,510 (4,056)
angler-h/acre	16.45 (1.17)	2.12 (0.22)	0.15 (0.05)	18.73 (1.32)

Table 4. Estimated fishing pressure (angler-h and angler-h/acre) by angler type during the early and late winter sampling periods for Fish Lake Reservoir, St. Louis County, Minnesota, December 03, 2005 – February 26, 2006 (standard error provided in parentheses).

Season	Angler Type			
	Fish House	Open Ice	Spear	All
<i>Early Winter</i>				
angler-h	11,478 (1,269)	1,470 (332)	trace	12,949 (1491)
angler-h/acre	3.74 (0.41)	0.48 (0.11)	trace	4.22 (0.49)
<i>Late Winter</i>				
angler-h	7,404 (2,406)	1,531 (484)	trace	8,935 (2,873)
angler-h/acre	2.41 (0.78)	0.50 (0.16)	trace	2.91 (0.94)
<i>All Winter</i>				
angler-h	18,882 (2,720)	3,002 (586)	trace	21,884 (3,237)
angler-h/acre	6.15 (0.89)	0.98 (0.19)	trace	7.13 (1.05)

Table 5. Comparison of fishing pressure (angler-h/acre) from recreational use and creel surveys conducted on various St. Louis County reservoirs^a, the St. Louis Estuary^b, lakes from across Minnesota^c, and lake class 7 averages^c.

	Fishing Pressure (angler hrs/acre)		
	Open	Ice	Annual
Fish Lake Reservoir			
2005-06 Creel	18.7	7.1	25.8
1999-00 Rec. use survey	16.9	4.4	21.2
Island Lake Reservoir ^a	9.5	0.5	10.0
Whiteface Reservoir ^a	13.6	0.6	14.2
Boulder Lake Reservoir ^a	5.9	0.9	6.8
Wild Rice Reservoir ^a	10.3	1.2	11.4
St. Louis Estuary	25.7	1.0	26.7
Lake Class 7 Average	11.5	8.4	19.9
State Average	31.7	4.5	34.6

^aRecreational use pressure estimates from Rust (2001).

^bSt. Louis Estuary pressure estimates from Lindgren (2004).

^cNumbers generated by Cook and Younk (1998).

Table 6. Estimated harvest and yield (standard error in parentheses) from Fish Lake Reservoir during the spring, summer, fall, and all open water periods during the 2005 creel survey.

Season and Species	Harvest		Yield	
	Total Number	Number Per Acre	Total Pounds	Pounds Per Acre
SPRING				
Black crappie	184 (45)	0.06 (0.01)	130 (65)	0.04 (0.02)
Bluegill	1,697 (520)	0.55 (0.17)	509 (183)	0.17 (0.06)
Largemouth Bass	6 (5)	0.00 (0.00)	7 (9)	0.00 (0.00)
Northern pike	918 (179)	0.30 (0.06)	2,182 (529)	0.71 (0.18)
Walleye	4,920 (616)	1.60 (0.20)	5,123 (891)	1.67 (0.29)
no tag	4,564 (578)	1.49 (0.19)	4,755 (841)	1.55 (0.27)
tagged	355 (75)	0.12 (0.02)	369 (95)	0.12 (0.03)
Yellow perch	949 (200)	0.31 (0.07)	613 (217)	0.20 (0.07)
All Species	8,716 (827)	2.84 (0.27)	8,578 (1418)	2.79 (0.45)
SUMMER				
Black crappie	89 (36)	0.03 (0.01)	44 (19)	0.01 (0.01)
Bluegill	1,530 (295)	0.50 (0.10)	459 (129)	0.15 (0.04)
Largemouth Bass	43 (26)	0.01 (0.01)	38 (38)	0.01 (0.01)
Northern pike	298 (54)	0.10 (0.02)	700 (299)	0.23 (0.10)
Walleye	1,472 (238)	0.48 (0.08)	1,446 (426)	0.47 (0.14)
no tag	1,408 (227)	0.46 (0.07)	1,384 (405)	0.45 (0.13)
tagged	63 (25)	0.02 (0.01)	66 (28)	0.02 (0.01)
Yellow perch	244 (68)	0.08 (0.02)	120 (71)	0.04 (0.02)
All Species	3,780 (386)	1.23 (0.13)	2,859 (527)	0.93 (0.17)
FALL				
Black crappie	698 (228)	0.23 (0.07)	423 (247)	0.14 (0.08)
Bluegill	168 (70)	0.05 (0.02)	51 (23)	0.02 (0.01)
Largemouth Bass	51 (25)	0.02 (0.01)	68 (50)	0.02 (0.02)
Northern pike	209 (45)	0.07 (0.01)	604 (246)	0.20 (0.08)
Walleye	1,275 (178)	0.42 (0.06)	1,300 (452)	0.42 (0.15)
no tag	1,221 (173)	0.40 (0.06)	1,244 (451)	0.40 (0.15)
tagged	54 (18)	0.02 (0.01)	56 (21)	0.02 (0.01)
Yellow perch	179 (50)	0.06 (0.02)	70 (55)	0.02 (0.02)
All Species	2,593 (304)	0.84 (0.10)	2,523 (575)	0.82 (0.19)
ALL OPEN WATER				
Black crappie	971 (235)	0.32 (0.08)	596 (256)	0.19 (0.08)
Bluegill	3,396 (602)	1.11 (0.20)	1,019 (225)	0.33 (0.07)
Largemouth Bass	100 (36)	0.03 (0.01)	113 (63)	0.04 (0.02)
Northern pike	1,425 (192)	0.46 (0.06)	3,487 (570)	1.14 (0.17)
Walleye	7,667 (684)	2.50 (0.22)	7,869 (1,086)	2.56 (0.35)
no tag	7,194 (644)	2.34 (0.21)	7,383 (1,036)	2.40 (0.34)
tagged	473 (81)	0.15 (0.03)	491 (102)	0.16 (0.03)
Yellow perch	1,372 (217)	0.45 (0.07)	802 (235)	0.26 (0.08)
All Species	15,089 (962)	4.91 (0.31)	13,960 (1,126)	4.55 (0.41)

Table 7. Estimated harvest and yield (standard error in parentheses) from Fish Lake Reservoir during the early winter, late winter, and all winter periods during the 2005-06 creel survey.

Season and Species	Harvest		Yield	
	Total Number	Number Per Acre	Total Pounds	Pounds Per Acre
EARLY WINTER				
Black crappie	147 (44)	0.05 (0.01)	69 (23)	0.02 (0.01)
Bluegill	216 (171)	0.07 (0.06)	110 (144)	0.04 (0.05)
Largemouth Bass	2 (2)	0.00 (0.00)	3 (3)	0.00 (0.00)
Northern pike	564 (205)	0.18 (0.08)	2,052 (917)	0.67 (0.31)
Walleye	982 (222)	0.32 (0.06)	1,199 (602)	0.39 (0.19)
no tag	965 (217)	0.31 (0.07)	1,178 (593)	0.38 (0.19)
tagged	17 (10)	0.01 (0.00)	21 (14)	0.01 (0.00)
Yellow perch	732 (170)	0.24 (0.06)	331 (125)	0.11 (0.07)
All Species	2,647 (321)	0.86 (0.10)	3,749 (298)	1.22 (0.33)
LATE WINTER				
Black crappie	334 (126)	0.11 (0.04)	187 (168)	0.06 (0.05)
Bluegill	556 (171)	0.18 (0.06)	328 (148)	0.11 (0.05)
Largemouth Bass	25 (14)	0.01 (0.00)	49 (77)	0.02 (0.02)
Northern pike	471 (95)	0.15 (0.04)	2,057 (913)	0.67 (0.30)
Walleye	89 (35)	0.03 (0.01)	107 (60)	0.03 (0.02)
no tag	89 (35)	0.03 (0.01)	107 (60)	0.03 (0.02)
tagged	0 (0)	0 (0)	0 (0)	0 (0)
Yellow perch	293 (79)	0.10 (0.03)	124 (68)	0.04 (0.02)
All Species	1,768 (230)	0.58 (0.07)	2,852 (262)	0.93 (0.23)
ALL WINTER				
Black crappie	480 (133)	0.16 (0.04)	256 (169)	0.08 (0.06)
Bluegill	771 (241)	0.25 (0.08)	438 (207)	0.14 (0.07)
Largemouth Bass	27 (14)	0.01 (0.00)	52 (77)	0.02 (0.02)
Northern pike	1,035 (136)	0.34 (0.04)	4,110 (1,024)	1.34 (0.33)
Walleye	1,071 (224)	0.35 (0.07)	1,305 (602)	0.42 (0.20)
no tag	1,054 (220)	0.34 (0.07)	1,285 (596)	0.42 (0.19)
tagged	17 (10)	0.01 (0.00)	20 (10)	0.01 (0.01)
Yellow perch	1,025 (188)	0.33 (0.06)	455 (149)	0.15 (0.08)
All Species	4,415 (423)	1.44 (0.14)	6,601 (415)	2.15 (0.35)

Table 8. Estimated mean length (in) and weight^a (lb) for fish species harvested and released from Fish Lake Reservoir, St. Louis County, Minnesota, during the 2005 open water and 2005-06 winter creel survey. Mean lengths and weights of harvested fish based on clerk measurements. Mean lengths for released fish based on angler-reported lengths.

	Harvested					Released				
	N	Length		Weight		N	Length		Weight	
		Mean	SE	Mean	SE		Mean	SE	Mean	SE
OPEN WATER										
Black crappie	81	10.1	4.6	0.61	0.29	222	7.8	4.7	0.32	0.21
Bluegill	84	7.9	3.9	0.30	0.08	574	6.5	2.4	0.15	0.03
Largemouth bass	19	13.0	8.1	1.13	0.74	73	10.2	4.1	0.66	0.75
Northern pike	127	21.9	5.2	2.45	0.97	1,050	17.7	5.9	1.30	0.44
Walleye	866	14.5	2.3	1.03	0.17	882	10.9	2.2	0.45	0.67
Yellow perch	109	10.2	3.2	0.58	0.19	1,540	7.3	0.4	0.22	0.10
WINTER										
Black crappie	99	9.6	6.9	0.53	0.38	26	7.6	15.5	0.25	0.56
Bluegill	148	8.1	4.6	0.57	0.31	95	5.9	18.8	0.20	0.48
Largemouth bass	6	14.4	19.3	1.91	2.75	2	11.0	11.5	0.74	0.77
Northern pike	217	26.2	6.9	3.97	1.10	262	17.8	6.3	1.34	0.45
Walleye	212	15.1	7.4	1.22	0.61	133	10.5	4.0	0.39	0.15
Yellow perch	221	9.4	2.3	0.44	0.04	533	6.8	2.2	0.17	0.07

^a Weights for individual fish were estimated using the formula $W = 10^a L^b$.

Table 9. Expanded length frequency distributions of black crappie (BLC), bluegill (BLG), largemouth bass (LMB), northern pike (NOP), walleye (WAE) and yellow perch (YEP) harvested (H) and released (R) during the open water creel on Fish Lake Reservoir, St. Louis County, Minnesota, May 14, 2005 – October 31, 2005.

Length (in)	<u>BLC</u>		<u>BLG</u>		<u>LMB</u>		<u>NOP</u>		<u>WAE</u>		<u>YEP</u>	
	H	R	H	R	H	R	H	R	H	R	H	R
<5.0		39		234								726
5.0-5.9		72		344		30			14	13		576
6.0-6.9	36	100	162	1,792		18			14	13		1,929
7.0-7.9	12	406	1,496	1,558		24		7	150	38		2,849
8.0-8.9	120	239	1,455	234		66		14	341	202		1,728
9.0-9.9	264	128	283	15	5	48		27	525	328		1,290
10.0-10.9	252	133		15	11	72		75	106	1,452	453	307
11.0-11.9	192	89		7	16	42		41	371	1,302	239	232
12.0-12.9	84	17			11	42	11	240	1,077	1,377	63	19
13.0-13.9	12				27	48		151	1,862	436	25	
14.0-14.9		11			21	12		439	1,659	218		
15.0-15.9					5	18	34	679	1,050	61		
16.0-16.9						6	56	940	538	20		
17.0-17.9						6	22	1,187	353	41		
18.0-18.9							90	1,276	291	7		
19.0-19.9						6	168	590	177	7		
20.0-20.9							123	597	44			
21.0-21.9							168	226	88	27		
22.0-22.9							123	206		7		
23.0-23.9							168	69	9			
24.0-24.9							168	254	18	14		
25.0-25.9							101	89				
26.0-26.9							67	14				
27.0-27.9							22	27				
28.0-28.9								21				
29.0-29.9							34	7				
30.0-30.9								22				
31.0-31.9								11				
32.0-32.9								11	7			
33.0-33.9												
34.0-34.9								11				
35.0-35.9												
> 35.9									21			
N	972	1,234	3,396	4,198	101	436	1,425	7,203	7,644	6,012	1,373	9,663
Sample Size ^a	81	222	84	574	19	73	127	1,050	866	882	109	1,543

^a Number of fish measured by the creel clerk or for which anglers reported lengths.

Table 10. Expanded length frequency distributions of black crappie (BLC), bluegill (BLG), largemouth bass (LMB), northern pike (NOP), walleye (WAE) and yellow perch (YEP) harvested (H) and released (R) during the winter creel on Fish Lake Reservoir, St. Louis County, Minnesota, December 3, 2005 – February 26, 2005.

Length (in)	<u>BLC</u>		<u>BLG</u>		<u>LMB</u>		<u>NOP</u>		<u>WAE</u>		<u>YEP</u>	
	H	R	H	R	H	R	H	R	H	R	H	R
<5.0				13								262
5.0-5.9		10	26	276					5			266
6.0-6.9		10	94	33					5	28		657
7.0-7.9	34	10	177	63					10	79		735
8.0-8.9	87	97	256	8					44	265		367
9.0-9.9	208		214	4					141	302		51
10.0-10.9	107		5				5	20	170	237		37
11.0-11.9	29					8		24	61	107	65	41
12.0-12.9	10							72	111	97	32	23
13.0-13.9	5				5			43	197	44	19	5
14.0-14.9					14		10	100	248	24		5
15.0-15.9					9			91	136			
16.0-16.9							5	177	96			
17.0-17.9							14	120	61			
18.0-18.9							10	243	35			
19.0-19.9							19	57	30			
20.0-20.9							38	110				
21.0-21.9							19	53	40			
22.0-22.9							48	24	15			
23.0-23.9							43	29	5			
24.0-24.9							143	62	15			
25.0-25.9							76					
26.0-26.9							143	10				
27.0-27.9							138	14				
28.0-28.9							119	5				
29.0-29.9							72					
30.0-30.9							29	5				
31.0-31.9							43	5				
32.0-32.9							33	5				
33.0-33.9							10					
34.0-34.9							19					
35.0-35.9												
> 35.9							5					
N	480	126	772	397	27	8	1,035	1,253	1,071	646	1,026	2,447
Sample Size ^a	99	26	148	95	6	2	217	262	212	133	221	533

^a Number of fish measured by the creel clerk or for which anglers reported lengths.

Table 11. Percentage of completed trip anglers^a that harvested or released no black crappie and one or more black crappie during the 2005-06 Fish Lake Reservoir open water and winter creel surveys.

<i>Period</i>	Number of Fish Harvested or Released											
	0	1	2	3	4	5	6	7	8	9	10	>10
<i>Spring</i>												
Harvest	99.0	1.0										
Release	95.8	3.2			1.0							
<i>Summer</i>												
Harvest	98.1	1.9										
Release	97.1	1.0	1.9									
<i>Fall</i>												
Harvest	88.5	3.8	3.2	1.3	1.3		1.3			0.6		
Release	91.8	5.7	1.3				1.9					
<i>Early Winter</i>												
Harvest	94.1	2.2	1.5	1.5	0.7							
Release	100.0											
<i>Late Winter</i>												
Harvest	77.8	6.7	13.3	2.2								
Release	100.0											

^a A total 95, 104, 157, 135, and 45 angler parties that had completed their trips were interviewed during the spring, summer, fall, early winter, and late winter, respectively.

Table 12. Percentage of completed trip anglers^a that harvested or released no bluegill and one or more bluegill during the 2005-06 Fish Lake Reservoir open water and winter creel surveys.

<i>Period</i>	Number of Fish Harvested or Released											
	0	1	2	3	4	5	6	7	8	9	10	>10
<i>Spring</i>												
Harvest	86.3	5.3	2.1	1.0			2.1		1.0			
Release	99.0											1.0
<i>Summer</i>												
Harvest	88.5	2.9	1.9	1.9		1.0						
Release	87.5	5.8	1.9	2.9			1.9					
<i>Fall</i>												
Harvest	96.2	1.9			1.3					0.6		
Release	94.9	1.9	1.3	1.3				0.6				
<i>Early Winter</i>												
Harvest	98.5			0.7								0.7
Release	99.3											0.7
<i>Late Winter</i>												
Harvest	88.9		2.2		2.2	2.2	2.2		2.2			
Release	97.8			2.2								

^a A total 95, 104, 157, 135, and 45 angler parties that had completed their trips were interviewed during the spring, summer, fall, early winter, and late winter, respectively.

Table 13. Percentage of completed trip anglers^a that harvested or released no largemouth bass and one or more largemouth bass during the 2005-06 Fish Lake Reservoir open water and winter creel surveys.

<i>Period</i>	Number of Fish Harvested or Released											
	0	1	2	3	4	5	6	7	8	9	10	>10
<i>Spring</i>												
Harvest	100.0											
Release	99.0	1.0										
<i>Summer</i>												
Harvest	99.0	1.0										
Release	99.0	1.0										
<i>Fall</i>												
Harvest	98.9	0.6				0.6						
Release	92.4	5.7	0.6	0.6	0.6							
<i>Early Winter</i>												
Harvest	99.3	0.7										
Release	100.0											
<i>Late Winter</i>												
Harvest	95.6	4.4										
Release	100.0											

^a A total 95, 104, 157, 135, and 45 angler parties that had completed their trips were interviewed during the spring, summer, fall, early winter, and late winter, respectively.

Table 14. Percentage of completed trip anglers^a that harvested or released no northern pike and one or more northern pike during the 2005-06 Fish Lake Reservoir open water and winter creel surveys.

<i>Period</i>	Number of Fish Harvested or Released											
	0	1	2	3	4	5	6	7	8	9	10	>10
<i>Spring</i>												
Harvest	93.7	2.1	1.0	2.1	1.0							
Release	63.2	14.7	7.4	5.3	3.2		3.2	1.0				2.1
<i>Summer</i>												
Harvest	89.4	7.7	1.9	1.0								
Release	82.1	12.5	6.7	4.8		1.0						
<i>Fall</i>												
Harvest	91.7	5.1	2.5									
Release	65.6	11.5	7.0	7.0	1.9	1.9	1.3	1.3				2.6
<i>Early Winter</i>												
Harvest	78.5	14.1	6.7				0.7					
Release	71.1	19.3	6.7	2.2	0.7							
<i>Late Winter</i>												
Harvest	80.0	13.3	4.4			2.2						
Release	93.3	2.2	2.2	2.2								

^a A total 95, 104, 157, 135, and 45 angler parties that had completed their trips were interviewed during the spring, summer, fall, early winter, and late winter, respectively.

Table 15. Percentage of completed trip anglers^a that harvested or released no walleye and one or more walleye during the 2005-06 Fish Lake Reservoir open water and winter creel surveys.

<i>Period</i>	Number of Fish Harvested or Released											
	0	1	2	3	4	5	6	7	8	9	10	>10
<i>Spring</i>												
Harvest	52.6	13.7	9.5	8.4	3.2	5.3	1.0	1.0	1.0	1.0		3.2
Release	74.7	7.4	6.3	5.3		1.0	3.2					3.2
<i>Summer</i>												
Harvest	68.3	13.5	7.7	4.8	1.9	1.9	1.0	1.0				
Release	75.0	12.5	3.8	5.8			1.9		1.0			
<i>Fall</i>												
Harvest	70.7	9.6	10.2	4.5	3.2				1.3			0.6
Release	71.3	12.1	5.7	3.8	2.6	1.9	1.3		0.6		0.6	
<i>Early Winter</i>												
Harvest	77.8	4.4	6.7	5.9	4.4	0.7						
Release	87.4	8.2	3.0	0.7	0.7							
<i>Late Winter</i>												
Harvest	91.1	6.7		2.2								
Release	100.0											

^a A total 95, 104, 157, 135, and 45 angler parties that had completed their trips were interviewed during the spring, summer, fall, early winter, and late winter, respectively.

Table 16. Percentage of completed trip anglers^a that harvested or released no yellow perch and one or more yellow perch during the 2005-06 Fish Lake Reservoir open water and winter creel surveys.

<i>Period</i>	Number of Fish Harvested or Released											
	0	1	2	3	4	5	6	7	8	9	10	>10
<i>Spring</i>												
Harvest	84.2	3.2	2.1	4.2		2.1	1.0	1.0		1.0		
Release	61.0	11.6	6.3	9.5	4.2	1.0	2.1		1.0			3.2
<i>Summer</i>												
Harvest	94.2	1.9	1.9	1.0	1.0							
Release	69.2	8.6	3.8	6.7	4.8	1.9	1.9				1.0	1.9
<i>Fall</i>												
Harvest	96.8	2.6					0.6					
Release	69.4	9.6	2.6	7.6		1.3	4.5	0.6			0.6	3.8
<i>Early Winter</i>												
Harvest	77.0	5.2	8.2	7.4	2.2							
Release	74.0	8.9	5.9	5.2	4.4		0.7					0.7
<i>Late Winter</i>												
Harvest	77.8	4.4	8.9	8.9								
Release	68.9	2.2	4.4	8.9	13.3			2.2				

^a A total 95, 104, 157, 135, and 45 angler parties that had completed their trips were interviewed during the spring, summer, fall, early winter, and late winter, respectively.

Table 17. Percentage of completed trip anglers^a that harvested, released, or caught (harvested or released) no fish and one or more fish during the 2005-06 Fish Lake Reservoir open water and winter creel surveys.

<i>Period</i>	Number of Fish Harvested or Released											
	0	1	2	3	4	5	6	7	8	9	10	>10
<i>Spring</i>												
Harvest	42.1	7.4	9.5	7.4	8.4	6.3	2.1	5.3	1.0	1.0		8.4
Release	36.8	8.4	9.5	10.5	5.3	8.4	3.2	4.2	1.0		1.0	12.6
Catch	8.4	8.4	9.5	9.5	10.5	13.7	2.1	7.4	5.3	2.1	1.0	22.1
<i>Summer</i>												
Harvest	61.5	9.6	8.7	3.9	5.8	1.0	1.0	2.9			1.9	3.9
Release	39.4	16.4	9.6	8.7	3.9	2.9	5.8	5.8	2.9	1.0	1.0	2.9
Catch	21.2	17.3	10.6	8.7	6.7	1.0	8.7	9.6	1.9	1.9	3.9	8.7
<i>Fall</i>												
Harvest	59.2	9.6	14.0	3.2	3.8	1.9	3.8	1.3		1.3	0.6	1.3
Release	35.0	11.5	8.9	10.8	6.4	3.8	3.8	5.7	2.6	1.3	1.3	8.9
Catch	19.7	9.6	12.7	8.9	8.9	3.8	5.1	5.1	4.5	3.8	5.7	11.5
<i>Early Winter</i>												
Harvest	46.7	9.6	11.9	14.1	8.9	4.4	2.2	1.5				0.7
Release	42.2	23.7	17.0	8.2	5.9	0.7		1.5				0.7
Catch	20.0	14.1	17.0	14.8	9.6	12.6	2.2	5.9	0.7	1.5		1.5
<i>Late Winter</i>												
Harvest	42.2	6.7	13.3	20.0		8.9	6.7			2.2		
Release	62.2	4.4	2.2	13.3	15.6			2.2				
Catch	33.3	4.4	6.7	8.9	6.7	13.3	11.1	8.9	2.2	4.4		

^a A total 95, 104, 157, 135, and 45 angler parties that had completed their trips were interviewed during the spring, summer, fall, early winter, and late winter, respectively.

Table 18. Estimated harvest, release, and catch rates (fish/angler-hour; standard error in parentheses), by species and sampling period for the 2005 open water creel survey for Fish Lake Reservoir, St. Louis County, Minnesota.

Species and sampling period	Harvest Rate	Release Rate	Total Catch Rate
Black crappie			
Spring	0.01 (0.002)	0.01 (0.002)	0.01 (0.003)
Summer	0.00 (0.002)	0.02 (0.008)	0.02 (0.010)
Fall	0.07 (0.022)	0.07 (0.024)	0.14 (0.040)
Open Water Season	0.02 (0.004)	0.02 (0.005)	0.04 (0.008)
Bluegill			
Spring	0.06 (0.014)	0.06 (0.009)	0.12 (0.014)
Summer	0.08 (0.017)	0.12 (0.016)	0.21 (0.021)
Fall	0.02 (0.008)	0.03 (0.014)	0.05 (0.022)
Open Water Season	0.06 (0.009)	0.07 (0.007)	0.13 (0.010)
Largemouth bass			
Spring	0.00 (0.000)	0.00 (0.001)	0.00 (0.002)
Summer	0.00 (0.001)	0.01 (0.004)	0.01 (0.005)
Fall	0.01 (0.003)	0.01 (0.004)	0.02 (0.002)
Open Water Season	0.00 (0.001)	0.01 (0.002)	0.01 (0.002)
Northern pike			
Spring	0.03 (0.006)	0.15 (0.016)	0.18 (0.010)
Summer	0.02 (0.001)	0.07 (0.006)	0.09 (0.005)
Fall	0.02 (0.004)	0.15 (0.012)	0.17 (0.013)
Open Water Season	0.02 (0.003)	0.13 (0.008)	0.15 (0.005)
Walleye			
Spring	0.17 (0.005)	0.12 (0.014)	0.29 (0.032)
Summer	0.08 (0.011)	0.07 (0.011)	0.15 (0.021)
Fall	0.12 (0.011)	0.11 (0.023)	0.23 (0.028)
Open Water Season	0.14 (0.008)	0.10 (0.007)	0.24 (0.018)
Yellow perch			
Spring	0.03 (0.006)	0.13 (0.015)	0.17 (0.021)
Summer	0.01 (0.003)	0.18 (0.007)	0.20 (0.034)
Fall	0.02 (0.004)	0.24 (0.011)	0.25 (0.005)
Open Water Season	0.02 (0.003)	0.17 (0.015)	0.19 (0.018)

Table 19. Estimated harvest, release, and catch rates (fish/angler-hour; standard error in parentheses), by species and sampling period for the 2005-06 winter creel survey for Fish Lake Reservoir, St. Louis County, Minnesota.

Species and sampling period	Harvest Rate	Release Rate	Total Catch Rate
Black crappie			
Early Winter	0.01 (0.004)	0.00 (0.001)	0.01 (0.004)
Late Winter	0.04 (0.011)	0.01 (0.009)	0.05 (0.021)
All Winter	0.02 (0.005)	0.01 (0.004)	0.03 (0.009)
Bluegill			
Early Winter	0.02 (0.003)	0.02 (0.019)	0.04 (0.025)
Late Winter	0.06 (0.027)	0.01 (0.004)	0.07 (0.030)
All Winter	0.04 (0.005)	0.02 (0.018)	0.05 (0.017)
Largemouth bass			
Early Winter	0.00 (0.000)	0.00 (0.000)	0.00 (0.000)
Late Winter	0.00 (0.001)	0.00 (0.001)	0.00 (0.002)
All Winter	0.00 (0.000)	0.00 (0.000)	0.00 (0.001)
Northern pike			
Early Winter	0.04 (N/A)	0.07 (N/A)	0.12 (N/A)
Late Winter	0.05 (0.017)	0.04 (0.009)	0.09 (0.006)
All Winter	0.05 (0.003)	0.06 (0.008)	0.10 (0.010)
Walleye			
Early Winter	0.07 (0.014)	0.05 (0.009)	0.12 (0.020)
Late Winter	0.01 (0.005)	0.00 (0.002)	0.01 (0.007)
All Winter	0.05 (0.011)	0.03 (0.007)	0.08 (0.016)
Yellow perch			
Early Winter	0.06 (0.010)	0.13 (0.031)	0.19 (0.032)
Late Winter	0.03 (0.009)	0.09 (0.048)	0.12 (0.058)
All Winter	0.05 (0.008)	0.11 (0.014)	0.16 (0.013)

Table 20. Percent return of completed trip questionnaires and questionnaire-generated harvest and release rates (fish/anger-h; SE in parenthesis) by species, May 14, 2005 –February 26, 2006.

	Open Water Creel	Ice Creel	Total Creel
Questionnaire returns			
Number handed out	1,419	730	2,149
Number returned	366	87	453
Percent return	25.8	11.9	21.0
Harvest and release rates			
<i>Black crappie</i>			
harvest	0.04	0.02	0.04
release	0.09	0.00	0.08
catch	0.14	0.02	0.11
<i>Bluegill</i>			
harvest	0.09	0.00	0.08
release	0.17	0.01	0.14
catch	0.26	0.01	0.11
<i>Northern pike</i>			
harvest	0.02	0.03	0.02
release	0.12	0.09	0.11
catch	0.14	0.12	0.14
<i>Walleye</i>			
harvest	0.18	0.14	0.17
release	0.23	0.22	0.23
catch	0.41	0.36	0.40
<i>Yellow Perch</i>			
harvest	0.02	0.04	0.02
release	0.16	0.08	0.14
catch	0.18	0.12	0.17
<i>All Species</i>			
harvest	0.39	0.25	0.36
release	0.92	0.45	0.83
catch	1.31	0.70	1.19

Table 21. Percentage of interviewed angling parties seeking various fish species, with their harvest, release and catch rates^a (fish/angler –hour) for the 2005 Fish Lake Reservoir open water creel survey.

Period and Species Sought	Percent Seeking ^b	Harvest Rate	Release Rate	Catch Rate
<i>Spring</i>				
Black crappie (N = 17) ^c	2.2	0.01	0.52	0.53
Bluegill (N = 22)	2.8	0.96	0.30	1.26
Largemouth bass (N = 0)	0.0	.	.	.
Northern pike (N = 49)	6.3	0.08	0.43	0.51
Walleye (N = 640)	81.7	0.23	0.14	0.36
Yellow perch (N = 3)	0.4	0.34	0.00	0.34
<i>Summer</i>				
Black crappie (N = 43) ^c	7.0	0.03	0.32	0.35
Bluegill (N = 65)	10.6	0.53	0.47	1.00
Largemouth bass (N = 5)	0.8	0.00	0.06	0.06
Northern pike (N = 52)	8.4	0.02	0.30	0.32
Walleye (N = 457)	74.2	0.10	0.09	0.19
Yellow perch (N = 1)	0.2	0.00	0.63	0.63
<i>Fall</i>				
Black crappie (N = 125) ^c	28.0	0.25	0.24	0.50
Bluegill (N = 16)	3.6	0.50	1.01	1.51
Largemouth bass (N = 8)	1.8	0.04	0.06	0.10
Northern pike (N = 54)	12.1	0.10	0.16	0.26
Walleye (N = 318)	71.1	0.16	0.15	0.31
Yellow perch (N = 0)	0.0	.	.	.

^a Based on GENCREEL estimates for each season.

^b Percentages do not add to 100 due to parties seeking more than one species or no particular species.

^c N = number of parties interviewed.

Table 22. Percentage of interviewed angling parties seeking various fish species, with their harvest, release and catch rates^a (fish/angler –hour) for the 2005-06 Fish Lake Reservoir winter creel survey.

Period and Species Sought	Percent Seeking ^b	Harvest Rate	Release Rate	Catch Rate
<i>Early Winter</i>				
Black crappie (N = 66) ^c	10.8	0.03	0.00	0.03
Bluegill (N = 11)	1.4	0.29	0.40	0.69
Largemouth bass (N = 0)	0.0	.	.	.
Northern pike (N = 79)	10.1	0.13	0.09	0.22
Walleye (N = 384)	49.0	0.12	0.07	0.18
Yellow perch (N = 32)	4.1	0.27	0.03	0.30
<i>Late Winter</i>				
Black crappie (N = 80) ^c	23.7	0.11	0.00	0.11
Bluegill (N = 35)	10.4	0.73	0.15	0.87
Largemouth bass (N = 0)	0.0	.	.	.
Northern pike (N = 72)	21.4	0.25	0.04	0.30
Walleye (N = 85)	25.2	0.03	0.01	0.04
Yellow perch (N = 10)	3.0	0.31	0.46	0.77

^a Based on GENCREEL estimates for each season.

^b Percentages do not add to 100 due to parties seeking more than one species or no particular species.

^c N = number of parties interviewed.

Table 23. Comparison of black crappie (BLC), bluegill (BLG), northern pike (NOP), walleye (WAE), and yellow perch (YEP) harvest rates (number of fish per hour) for targeting anglers and all anglers from open water and winter creels in Fish Lake Reservoir and St. Louis Estuary^a and the state median^b harvest rate.

	Fish Lake Reservoir				St. Louis Bay				State Median	
	Open Water		Winter		Open Water		Winter		Targeting	All
	Targeting	All	Targeting	All	Targeting	All	Targeting	All		
BLC	0.11	0.02	0.07	0.02	1.08	0.01	0.67	0.32	0.43	0.03
BLG	0.64	0.06	0.50	0.04	.	0.00	0.14	0.01	1.34	0.31
NOP	0.06	0.02	0.19	0.05	0.05	0.00	0.04	0.01	0.10	0.03
WAE	0.16	0.14	0.08	0.05	0.11	0.15	0.05	0.02	0.15	0.08
YEP	0.09	0.02	0.29	0.05	.	0.00	0.90	0.23	1.53	0.07

^aSt. Louis Bay Estuary harvest rate estimates from Lindgren (2004).

^bMedian harvest rates provided by Cook and Younk (1998).

Table 24. Residence, gender and angler type statistics (N = number of anglers; % = percentage) from interviews conducted on Fish Lake Reservoir, St. Louis County, Minnesota, May 14, 2005 – February 26, 2006.

	N	%
Residence		
Local	5,096	92.0
Superior - WI	55	1.0
North Shore	39	0.7
St. Paul - Minneapolis Area	191	3.5
Out-state Minnesota	93	1.7
Non-Minnesota	66	1.2
Gender		
Male	4,682	83.9
Female	901	16.1
Angler Type		
<i>Open</i>		
Boat	1607	87.1
Shore	228	12.4
Dock	11	0.6
<i>Ice</i>		
Permanent Fish House	299	31.0
Portable Fish House	393	40.8
Open Ice	264	27.4
Spear	8	0.8

^aDuluth, Cloquet, and other towns residing in Carlton and lower St. Louis Counties.

^bTwo Harbors, Silver Bay, Beaver Bay, Finland, Grand Marais.

Table 25. Mean number of anglers and hours fished per party (trip length) for creeled completed daily trips and returned questionnaires for Fish Lake Reservoir, St. Louis County, Minnesota, May 14, 2005 – February 26, 2006.

	Mean Number of Anglers per Party	SE	Mean Number of Hours Fished per Party	SE	Sample Size
Open Water					
Spring	2.39	0.10	4.21	0.22	95
Summer	2.32	0.10	4.12	0.22	104
Fall	1.71	0.06	3.99	0.16	157
All Open Water	2.07	0.05	4.08	0.11	356
Returned Questionnaires	2.13	0.06	4.71	0.14	330
Winter					
Early Winter	1.71	0.05	3.59	0.13	135
Late Winter	1.78	0.09	3.67	0.26	45
All Winter	1.73	0.05	3.61	0.12	180
Returned Questionnaires	2.05	0.13	5.22	0.22	80

Table 26. Access use, boat motor use, fishing methods, and electronic use statistics (N = number of fishing parties; % = percentage) from interviews conducted on Fish Lake Reservoir, St. Louis County, Minnesota, May 14, 2005 – February 26, 2006.

	Open Water		Ice	
	N	%	N	%
Access used				
Public (Dam)	1009	63.6	380	40.1
Public (west arm)	148	9.3	33	3.5
Resort	290	18.3	463	48.8
Private	139	8.8	72	7.6
Outboard size				
none used	45	2.8	.	.
1.0 - 5.0	7	0.4	.	.
5.1 - 10	20	1.2	.	.
10.1 - 25	437	27.2	.	.
25.1 - 50	671	41.8	.	.
50.1 - 100	313	19.5	.	.
> 100	114	7.1	.	.
Trolling motor used				
none used	372	25.1	.	.
gas-powered	2	0.1	.	.
electric	1,111	74.8	.	.
Fishing method				
casting	89	4.9	.	.
drifting	101	5.5	.	.
still	917	50.2	548	58.7
trolling	535	29.3	.	.
mixed	185	10.1	378	40.5
fly-fish	1	0.1	.	.
tip-up	.	.	7	0.8
Bait used				
leeches	201	11.0	.	.
minnows	533	29.2	750	81.3
worms	277	15.2	26	2.8
artificial	195	10.7	.	.
mixed	621	34.0	147	15.9
Electronics				
none used	181	12.5	351	36.9
locator	1,249	86.0	6	0.6
flasher	13	0.9	516	54.3
camera	0	0.0	77	8.1
GPS	9	0.6	0	0.0

Table 27. Length frequency distributions for walleye tagged in the spring of 2005 and estimated numbers of tagged and untagged walleye harvested (H) and released (R) by anglers, by length range, on Fish Lake Reservoir, St. Louis County, Minnesota, May 14, 2005 – February 26, 2006.

Length (in)	Tagged Spring 2005	Open Water Creel				Ice Creel				Total Creel			
		Untagged H	Untagged R	Tagged H	Tagged R	Untagged H	Untagged R	Tagged H	Tagged R	Untagged H	Untagged R	Tagged H	Tagged R
< 10.0			1,044				204			0	1,248	0	0
			0										
10.0-10.9	7	98	1,453			20	170			118	1,623	0	0
11.0-11.9	23	365	1,303			61	107			426	1,410	0	0
12.0-12.9	279	1,060	1,378	25		111	97			1,171	1,475	25	0
13.0-13.9	568	1,763	437	110		193	44	5		1,956	480	115	0
14.0-14.9	515	1,522	218	144		248	24			1,770	243	144	0
15.0-15.9	317	988	61	68		132		4		1,120	61	72	0
16.0-16.9	264	516	20	25		96				613	20	25	0
17.0-17.9	235	294	41	59		56		4		350	41	63	0
18.0-18.9	188	267	7	25		30		4		298	7	29	0
19.0-19.9	93	160	7	17		30				191	7	17	0
			0										
20.0-20.9	32	45	0							45	0	0	0
21.0-21.9	19	89	27			41				130	27	0	0
22.0-22.9	8	0	7			15				15	7	0	0
23.0-23.9	9	9	0			5				14	0	0	0
24.0-24.9	3	18	14			15				33	14	0	0
25.0-25.9	4												
26.0-26.9	2												
27.0-27.9	1												
28.0-28.9	1												
29.0-29.9													
Total	2,568	7,194	6,018	473	16	1,054	646	17	0	8,248	6,664	490	0
Sample Size ^a		808	882	56	0	208	133	4	0	1,016	1,015	60	0

^aNumber of fish measured by the creel clerk or for which anglers reported lengths.

Table 28. Walleye, northern pike, yellow perch, bluegill, black crappie, and all species catch, harvest, and release rates (per hour) for cluster and isolated type ice fishing anglers during the early 2005-06 winter creel in Fish Lake Reservoir, St. Louis County, Minnesota. Standard errors are provided in parentheses.

Species	Cluster Type Anglers			Isolated Type Anglers		
	Catch/hr	Harvest/hr	Release/hr	Catch/hr	Harvest/hr	Release/hr
Walleye	0.119 (0.019)	0.064 (0.012)	0.055 (0.012)	0.153 (0.029)	0.085 (0.025)	0.068 (0.013)
Northern Pike	0.110 (0.015)	0.040 (0.010)	0.070 (0.013)	0.166 (0.021)	0.045 (0.009)	0.121 (0.019)
Yellow Perch	0.164 (0.020)	0.062 (0.013)	0.102 (0.016)	0.178 (0.030)	0.035 (0.009)	0.143 (0.028)
Bluegill	0.004 (0.002)	0.001 (0.001)	0.003 (0.002)	0.123 (0.064)	0.035 (0.014)	0.088 (0.060)
Black Crappie	0.010 (0.005)	0.009 (0.005)	0.001 (0.001)	0.015 (0.004)	0.012 (0.004)	0.003 (0.002)
All Species	0.406 (0.032)	0.175 (0.022)	0.231 (0.024)	0.634 (0.085)	0.211 (0.031)	0.423 (0.075)

Table 29. Number and average size of fish harvested and released by cluster and isolated type anglers during the early 2005-2006 winter creel in Fish Lake Reservoir, St. Louis County, Minnesota. N = sample size; TL = Total Length; SE = Standard Error; * indicates significant differences among groups ($P < 0.05$).

Species	Cluster Type Anglers						Isolated Type Anglers					
	Harvested			Released			Harvested			Released		
	N	Mean TL	SE	N	Mean TL	SE	N	Mean TL	SE	N	Mean TL	SE
Walleye	83	14.0*	0.28	52	10.1*	0.22	64	15.5*	0.32	65	10.9*	0.20
Northern Pike	38	24.1	0.63	79	17.5	0.47	59	25.2	0.50	111	16.8	0.40
Yellow Perch	75	9.6*	0.16	103	7.6*	0.19	35	8.8*	0.24	211	6.3*	0.14
Bluegill	2	7.7	0.57	1	.	.	68	8.2	0.10	80	5.9	0.11
Black Crappie	7	9.4	0.38	3	7.7	0.87	16	9.6	0.25	5	6.8	0.67

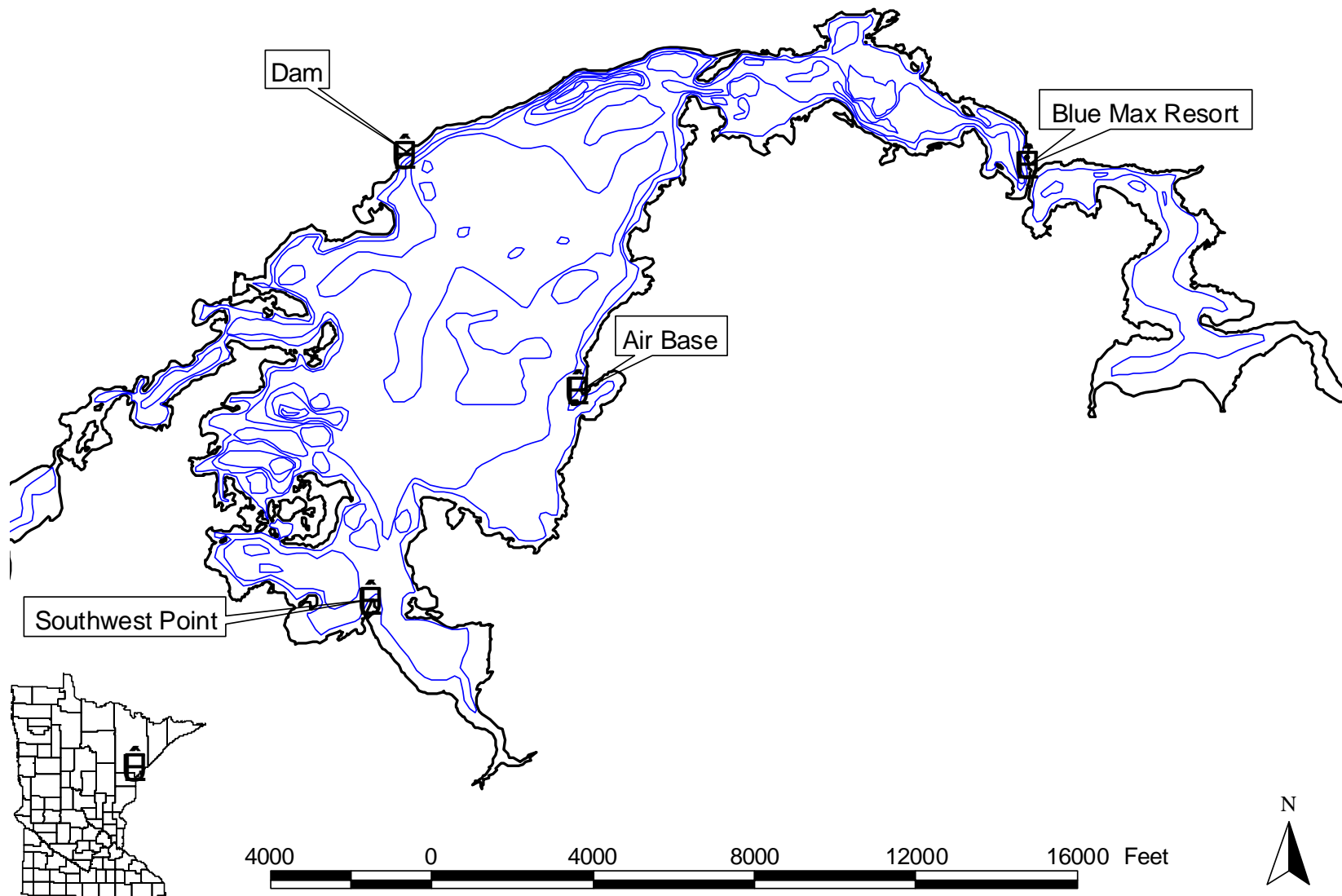


Figure 1. Randomly selected start locations assigned to creel clerks during the 2005-06 creel survey on Fish Lake Reservoir, St. Louis County, Minnesota.

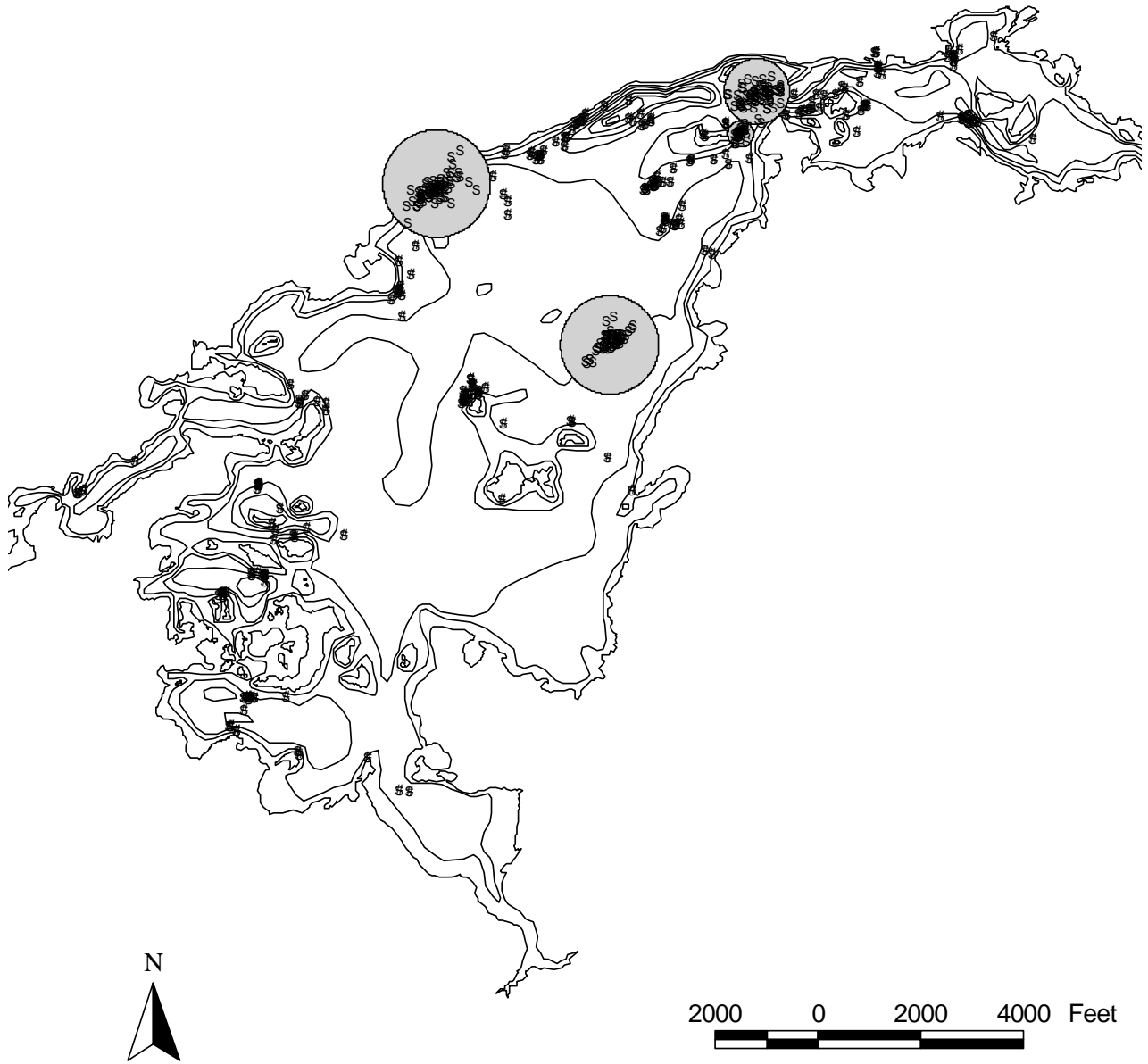


Figure 2. Location of interviewed anglers and cluster boundaries during the early ice-fishing season (December 3, 2005 to January 16, 2006) on Fish Lake Reservoir.

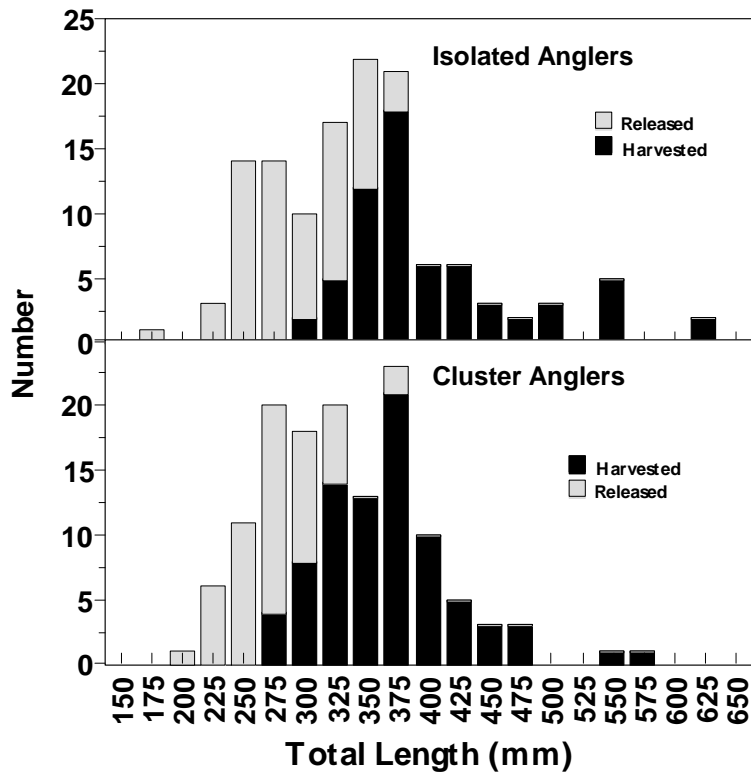


Figure 3. Comparison of harvested and released walleye length frequency distributions for isolated and cluster type anglers recorded from December 3, 2005 to January 16, 2006 in Fish Lake Reservoir.

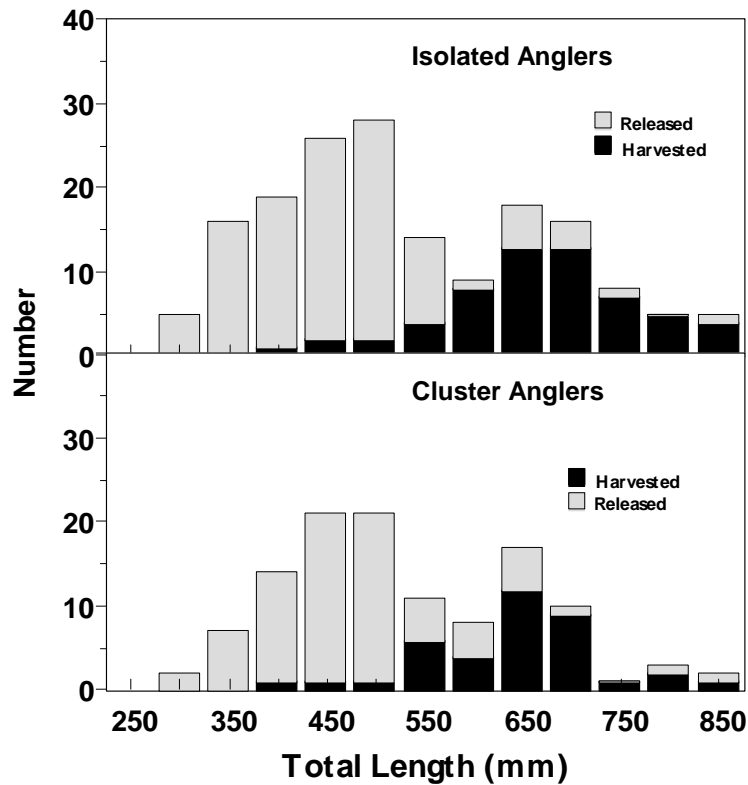


Figure 4. Comparison of harvested and released northern pike length frequency distributions for isolated and cluster type anglers recorded from December 3, 2005 to January 16, 2006 in Fish Lake Reservoir.

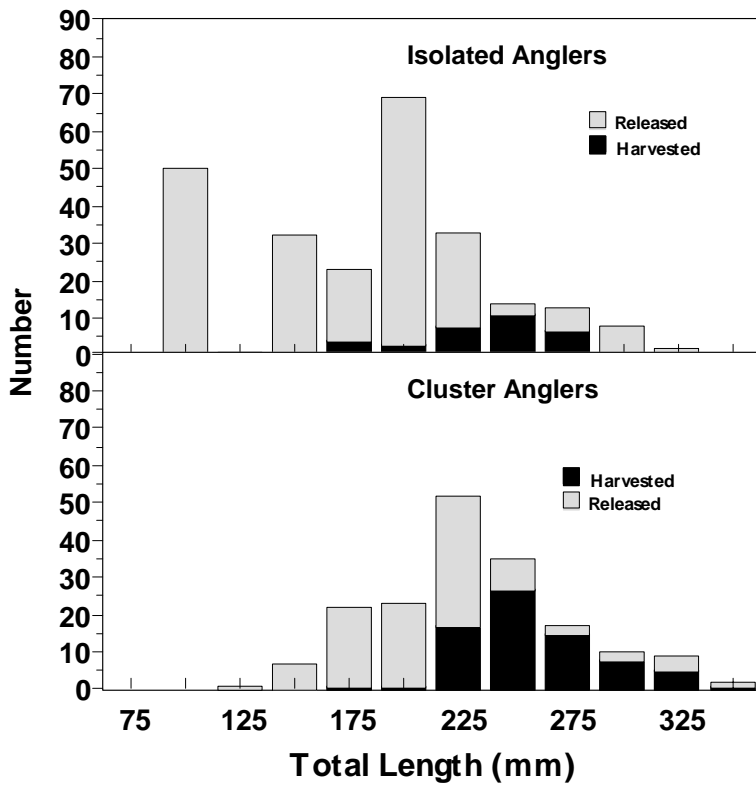


Figure 5. Comparison of harvested and released yellow perch length frequency distributions for isolated and cluster type anglers recorded from December 3, 2005 to January 16, 2006 in Fish Lake Reservoir.

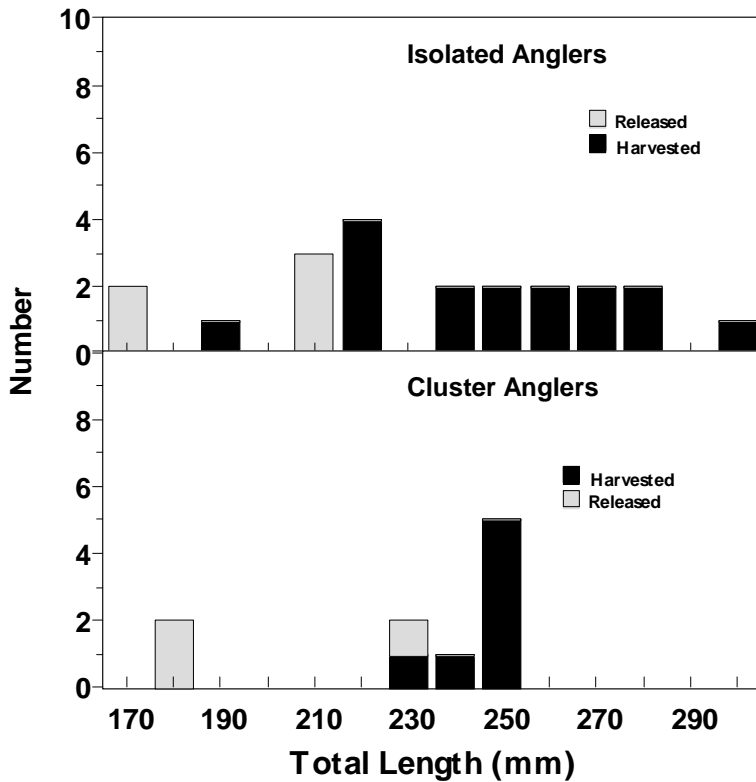


Figure 6. Comparison of harvested and released black crappie length frequency distributions for isolated and cluster type anglers recorded from December 3, 2005 to January 16, 2006 in Fish Lake Reservoir.

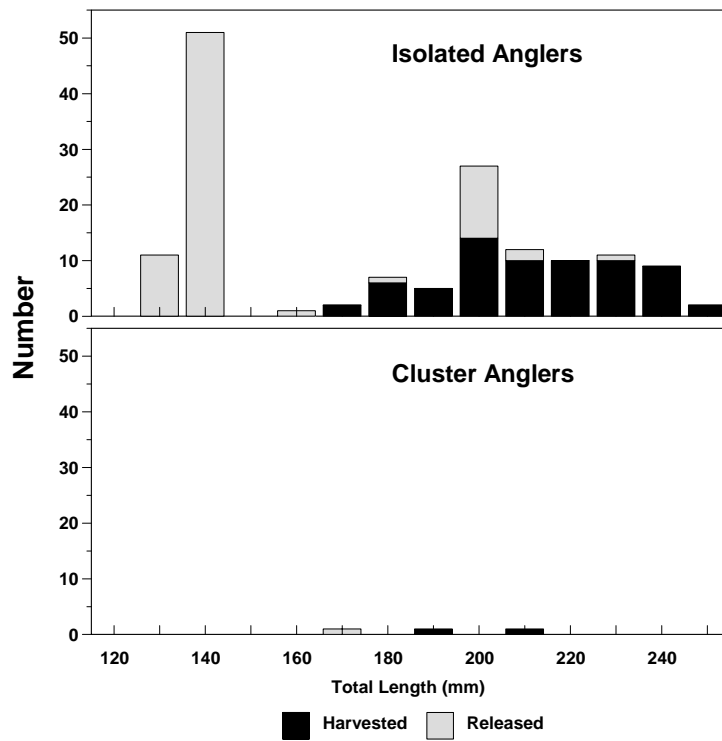


Figure 7. Comparison of harvested and released bluegill length frequency distributions for isolated and cluster type anglers recorded from December 3, 2005 to January 16, 2006 in Fish Lake Reservoir.

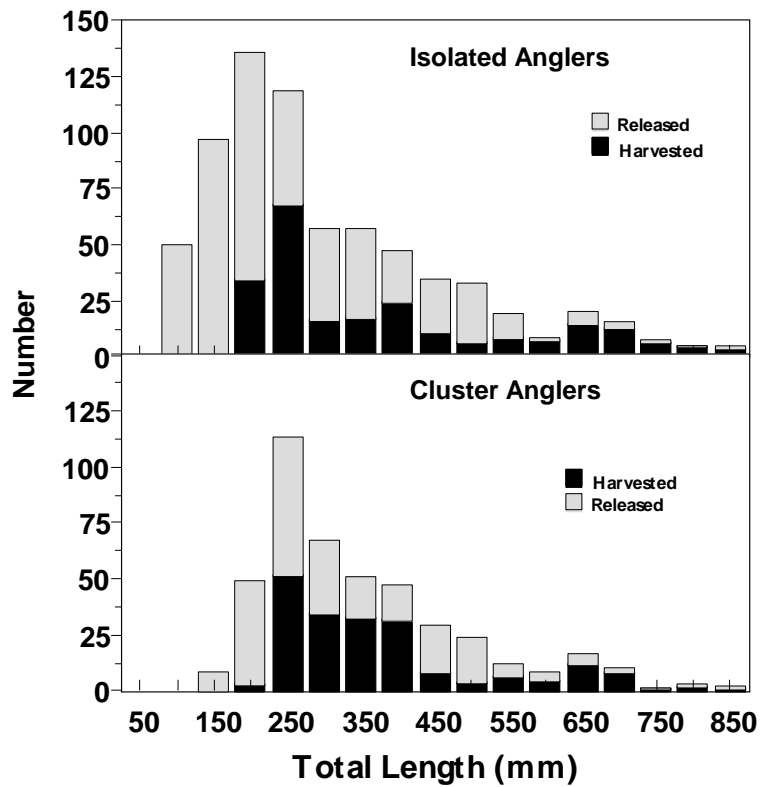


Figure 8. Comparison of all harvested and released fish length frequency distributions for isolated and cluster type anglers recorded from December 3, 2005 to January 16, 2006 in Fish Lake Reservoir.

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APPENDICES

Appendix 1. Activity report form for the 2005 Fish Lake Reservoir open water creel survey.

Minnesota Department of Natural Resources											
<i>Section of Fisheries</i>											
Creel Survey Activity Report											
Lake/DOW	Date			Day Type	Clerk	Start Location	Water Temp	Wind Code	Wind Direct	Weather	Secchi Depth
	Month	Day	Year								
Fish Lake (69-0491)											
Open Water Count 1						Time (Military):					
Count Type		Tally								Total	
Fishing Boat											
Bank Angler											
Dock Angler											
Runabouts											
Sailboats											
Pontoon Boats											
Non-motorized											
Jet Skis											
Comments:											
Open Water Count 2						Time (Military):					
Count Type		Tally								Total	
Fishing Boat											
Bank Angler											
Dock Angler											
Runabouts											
Sailboats											
Pontoon Boats											
Non-motorized											
Jet Skis											
Comments:											

Appendix 2. Interview report form for the 2005 Fish Lake Reservoir open water creel survey.

Minnesota Department of Natural Resources
Section of Fisheries

Creel Survey Interview Report




Lake/DOW	Date			Day Type	Clerk	Interview Number	Start Time (Military)	End Time (Military)	Total Time Fishing (Hours, Tenths)	No. in Party
	Month	Day	Year							
Fish Lake (69-0491)										

Access Type	Species Sought	Complete/Incomplete	Number Lines	Angler Type	Method Fishing	Lure Type	Boat Description	Motor Size	Motor Type	Trolling Motor	Electronics	Gender, Age & ZIP Codes			Refused Interview
												G	A	Zip Code	
	1														
	2														

Species	MNR	Number	Length	Weight	Tag Number	Comments
			(units, tenths)	(units, tenths)		
1			.	.		
2			.	.		
3			.	.		
4			.	.		
5			.	.		
6			.	.		
7			.	.		
8			.	.		
9			.	.		
10			.	.		
11			.	.		
12			.	.		
13			.	.		
14			.	.		
15			.	.		
16			.	.		

Appendix 3. Activity report form for the 2005-06 Fish Lake Reservoir winter creel survey.

Minnesota Department of Natural Resources												
<i>Section of Fisheries</i>												
Creel Survey Activity Report												
Lake/DOW	Date			Day Type	Clerk	Start Location	Wind Code	Wind Direct	Weather	Ice Cond.	Slush Y/N	Secchi
	Month	Day	Year									
Fish Lake (69-0491)												
Ice Count 1						Time (Military):						
Count Type		Tally				Total						
Permanent Ice House												
Portable Ice House												
Open-ice angler												
Other: Specify												
Comments:												
Ice Count 2						Time (Military):						
Count Type		Tally				Total						
Permanent Ice House												
Portable Ice House												
Open-ice angler												
Other: Specify												
Comments:												

Appendix 4. Interview report form for the 2005-06 Fish Lake Reservoir winter creel survey.

Minnesota Department of Natural Resources
Section of Fisheries



Creel Survey Interview Report

Lake/DOW	Date			Day Type	Clerk	Interview Number	Start Time (Military)	End Time (Military)	Total Time Fishing (Hours, Tenths)	No. in Party
	Month	Day	Year							
	Fish Lake (69-0491)									

Access Type	Species Sought	Complete/Incomplete	Number Lines	Angler Type V PO PE	Method Fishing	Lure Type	Electronics	Gender, Age & ZIP Codes			Refused Interview	Waypoint Number	Nearest Angler Group/Individual	Distance Code			
								1	2	3				4	5	G	A
	1																
	2																

Species	MNR	Number	Length (units, tenths)	Weight (units, tenths)	Tag Number	Comments
2			.	.		
3			.	.		
4			.	.		
5			.	.		
6			.	.		
7			.	.		
8			.	.		
9			.	.		
10			.	.		
11			.	.		
12			.	.		
13			.	.		
14			.	.		
15			.	.		
16			.	.		

Appendix 5. Postcard questionnaire given to interviewed anglers that had not completed fishing trip.

Fish Lake Completed Trip Questionnaire

Date: _____ **Interview #** _____

Please answer the following questions. Your answers should apply to your party (the people in your boat or with you on shore), and only to the time your party spent fishing on this lake today. **Thank you for your cooperation!**

How many anglers in your party? _____
 How many hours did your party fish? _____

Please provide as much of the following information as possible:

Species	Number Kept	Number Released	Ave. Size Fish Kept	Ave. Size Fish Released
Walleye (no tag)	_____	_____	_____	_____
Walleye (tagged)	_____	_____	_____	_____
Other	_____	_____	_____	_____
Other	_____	_____	_____	_____

If you kept any tagged walleye, please record the tag numbers from those fish here:

If you'd like information on the tagged walleye, write your return address below: _____

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
SECTION OF FISHERIES

Completion Report

Estimating Angling Pressure, Catch Rates, Structure of Catch, and Recreation Use on Fish Lake Reservoir, St. Louis County, Minnesota using a Stratified Random, Roving Creel Survey (May 14th, 2005 to February 26th, 2006).

Influence of Fishing Location Choice on Fishing Success during the Early 2005-06 Ice-fishing Season on Fish Lake Reservoir.

by

Jonathan R. Meerbeek

Prepared by: Jonathan Meerbeek

Approved by: _____
Area Supervisor Date

Approved by: _____
Regional Supervisor Date

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