

**Status of Walleye and Northern Pike
Sport Fisheries at Round Lake,
Alberta, 2004**

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**Status of Walleye and Northern Pike Sport Fisheries
at Round Lake, Alberta, 2004**

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EXECUTIVE SUMMARY

Improved access to lakes in the Red Earth area in northern Alberta has raised concerns about impacts of potential increases in angling pressure on sport fish populations of lakes in the region. However, little quantitative data exist on angling pressure and sport fish harvest on most of these lakes, including Round Lake. A creel survey was conducted on Round Lake to generate quantitative data on angler use and catch rates, as well as population structure and growth, for two species, walleye (*Sander vitreus*) and northern pike (*Esox lucius*). The information collected in this survey can be used to assess the impacts of increased fishing pressure after improvements in access.

An estimated 300 (95% CI = 190 - 480) anglers fished at Round Lake from 21 May to 25 August 2004, resulting in an angling pressure of 2.30 angler-h/ha (95% CI = 1.47 - 3.38). The overall catch rate (expressed as total-catch-per-unit-effort) of walleye was 0.68 fish/h and the total harvest-per-unit-effort (THUE) was 0.053 fish/h. The total estimated walleye harvest was 0.149 kg/ha (95% CI = 0.073 - 0.252 kg/ha). In contrast, the overall catch rate of northern pike was 1.02 fish/h, with a THUE of 0.037 fish/h. The total estimated harvest of northern pike was 0.136 kg/ha (95% CI = 0.082 - 0.229 kg/ha).

Length of walleye harvested by anglers ranged from 500 to 565 mm with a mean (\pm SD) of 524.1 ± 19.41 mm ($n = 9$) and ages ranged from 8 to 15 y with a mean of 11.8 ± 2.25 y ($n = 8$). Length of walleye caught by test anglers ranged from 215 to 562 mm with a mean of 420.0 ± 61.98 mm ($n = 138$) and ages ranged from 2 to 20 y with a mean of 7.6 ± 2.76 y ($n = 131$).

Length of northern pike harvested by anglers ranged from 654 to 990 mm with a mean of 757.8 ± 122.5 mm ($n = 6$) and ages ranged from 7 to 14 y with a mean of 10.9 ± 2.42 y ($n = 9$). Length of pike caught by test anglers ranged from 293 to 779 mm with a mean of 539.5 ± 88.82 mm ($n = 87$) and ages ranged from 2 to 12 y with a mean of 5.2 ± 1.75 y ($n = 72$).

Based on von Bertalanffy growth estimates, walleye in Round Lake should reach harvestable size (> 50 cm TL) in 11.4 years. Northern pike should reach their harvestable size (> 63 cm TL) in 8.3 years.

Results of our study will aid fisheries managers in formulating management guidelines for walleye and northern pike sport fisheries for priority lakes in the Red Earth area. Although our estimated angling pressures at Round Lake may be considered low, improved access and upgrading of facilities at the lake may result in increased fishing pressure in the future. Our data will serve as the baseline for assessing future impacts.

Key words: walleye, northern pike, catch-per-unit-effort, creel survey, Round Lake

ACKNOWLEDGEMENTS

This work was funded by the Alberta Conservation Association (ACA). In addition, the ACA received in-kind support from Alberta Sustainable Resource Development (ASRD), Fisheries Management Division in Peace River. We thank creel clerks, Nathan Carruthers, Clayton James, Kathleen Woodruff, and Kevin Yacyshyn who surveyed Round Lake anglers. We also thank the volunteer test anglers for donating their time and personal expense to this project.

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1.0 INTRODUCTION

Improved access (upgraded and new roads) to lakes in the Red Earth area in northern Alberta has raised concerns about impacts of potential increases in angling pressure on the relatively unexploited sport fish populations of these lakes. However, very little quantitative data exist on angling pressure and sport fish harvest on most of these lakes, including Round Lake. To generate such data on Round Lake, a creel survey was conducted on the lake during the summer of 2004. Provincial sport fishing regulations in 2004 allowed harvesting of three northern pike (*Esox lucius*) > 63 cm total length (TL) and three walleye (*Sander vitreus*) > 50 cm TL (Alberta Sustainable Resource Development (ASRD) 2004) between 21 May and 31 March. The lake is closed from 1 April to 20 May. The purpose of this survey was to describe the current level of angler use and provide data to fisheries managers that will aid them in formulating management guidelines for walleye and northern pike sport fisheries for priority lakes in this area.

2.0 STUDY AREA

Round Lake is located approximately 48 km northeast of Red Earth, Alberta (Figure 1). It has a surface area of 557 ha, an average depth of 5.5 m, and a maximum depth of 8.5 m. A gravel road is used to access the lake. Development at the lake is limited to a few undeveloped campsites. The lake supports natural populations of white sucker (*Catostomus commersoni*), longnose sucker (*Catostomus catostomus*), cisco (*Coregonus artedii*), lake whitefish (*Coregonus clupeaformis*), northern pike, burbot (*Lota lota*), yellow perch (*Perca flavescens*), and walleye.

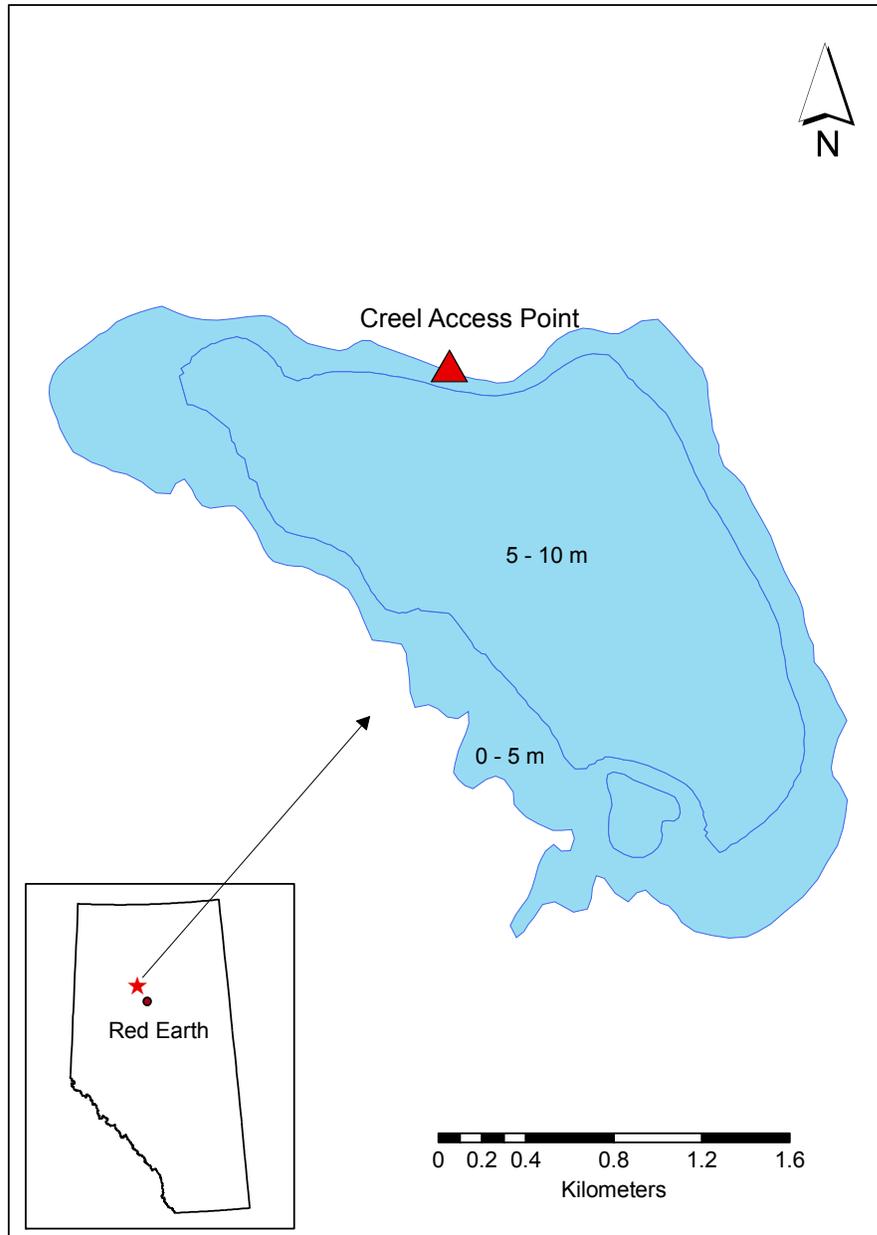


Figure 1. Map of Round Lake showing the 2004 creel survey site (red triangle). Inset is a map of the province of Alberta showing the location of Round Lake.

3.0 MATERIALS AND METHODS

3.1 Survey design

A reduced effort creel survey (Pollock et al. 1994) was conducted from a single access point at Round Lake from 21 May to 25 August 2004 to collect angler effort and sport fishery data. Two creel clerks interviewed anglers between 0800 and 2300 hours as they returned from completed trips. Surveys were conducted on a schedule of 10 days on and 4 days off. The 10-day shift was split with parallel studies on Long Lake and Vandersteene Lake, such that either three or four consecutive days of each 10-day shift were spent at each lake. The lake surveyed first was switched each shift so that all three lakes were sampled equally.

Upon returning to the survey access point, all angling parties were asked a series of questions regarding the number of anglers, number of hours fished, number of each fish species kept and released, use of bait, use of barbless hooks, and angler residence.

3.2 Biological fish data

When permitted, creel clerks collected biological data from fish that were harvested by anglers. Data collected included fork length (FL) and TL (± 1 mm), weight (± 10 g), ageing structures, sex, and state of maturity. Fish were dissected to determine sex and maturity through inspection of the gonads. Fish were aged according to Mackay et al. (1990) using the left operculum and left cleithrum for walleye and northern pike, respectively, as well as the first three rays of the left pelvic fin for both species. All data on sport fish as well as non-sport fish species (number caught, FL, and weight) were entered into the provincial government Fisheries Management Information System (FMIS), Project Location ID 6350. Data obtained from gill netting surveys on the lake in June 2004 (FMIS Project Location ID 6276) were used to supplement length and age distributions.

3.3 Test angling

To collect data on size and age of fish that could not be legally harvested by anglers (i.e., walleye < 50 cm TL and northern pike < 63 cm TL), test angling was conducted throughout the survey period. Test anglers included creel clerks, fisheries staff, and

volunteers, with varying skill levels, attempting to catch walleye and northern pike using techniques that anglers would normally use. Test anglers recorded the number of hours fished and FL of all fish caught. To minimize handling time, only FL was measured on all fish; TL was measured on representative samples only. In order to assess the rate of angler exaggeration (inaccurate reporting of released fish by anglers) the ratio of legal-length fish to protected-length fish sampled during the test angling was compared to the corresponding ratio reported by anglers (Sullivan 2003). The ratio of legal-length fish to protected-length fish from the test angling was used to extrapolate to the sport fishery using the number of legal-length fish captured by anglers. This estimate of protected-length fish was then compared to what was reported by anglers.

3.4 Data management and analysis

Bootstrap methods (Haddon 2001) were used to calculate the standardized probability of means for the following parameters: number of anglers, angling effort, and the catch and harvest of walleye and northern pike. Estimation of angler survey parameters followed Sullivan (2004). Samples were stratified by day type into weekdays (Monday-Thursday) and weekend days (Friday-Sunday, including statutory holidays). Each parameter (e.g., number of anglers) was bootstrapped (50,000 estimates) to obtain estimates for each day type. The estimates were then multiplied by the number of days missed (not surveyed) to produce estimates for all the days that were missed. The sum of all observed values of the parameter from each day type collected during the entire survey was then added to each of the 50,000 estimates. Weekday and weekend day estimates were then summed to produce combined estimates of each parameter for the entire study period. The maximum likelihood method was then used to estimate a total (\pm 95% CI) for each parameter for the entire study period. A flow chart describing these steps is presented in Figure 2.

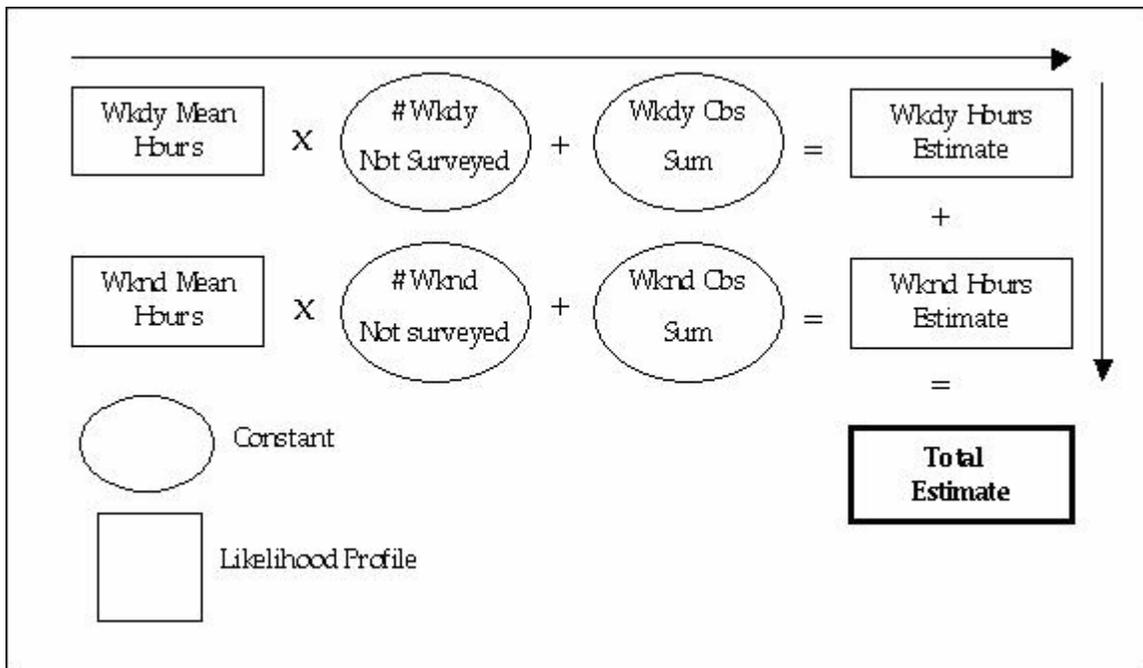


Figure 2. Flow chart outlining the process used for estimating parameters from the sport fishery at Round Lake in 2004. Circles represent values with no variance and rectangles represent values with probability density functions. Bold outline represents derived parameters used in the assessment of the sport fishery (e.g., number of anglers, total effort). Wkdy = weekday; Wknd = weekend and Obs Sum = Sum of Observed value. (Adapted from Patterson 2004)

Total catch-per-unit-effort (TCUE) was calculated by dividing the total number of fish caught by recreational anglers (both kept and released) by the total number of hours spent angling (angler-hours, i.e., total amount of effort applied by surveyed anglers). Total harvest-per-unit-effort (THUE) was calculated by dividing the total number of fish kept by anglers by the total number of angler hours. Daily totals for catch-per-unit-effort (CPUE) and harvest-per-unit-effort (HPUE) were bootstrapped to estimate monthly means and 95% confidence limits. Estimated total harvest (kg/ha) was calculated by multiplying the observed harvest by the mean weight (kg) of fish harvested and then dividing this value by the area of the lake (ha).

Length-frequency distributions were used to examine population structure of fish captured by anglers, test anglers, and in gill nets. Because TL was not measured for all

fish, it was estimated using the following linear regression relationships established with samples for which both TL and FL was measured:

$$\begin{array}{ll} \text{Walleye:} & \text{TL} = 1.052 \text{ FL} + 5.788; (R^2 = 0.996, n = 282) \\ \text{Northern pike:} & \text{TL} = 1.036 \text{ FL} + 12.834; (R^2 = 0.996, n = 216) \end{array}$$

Age and length (FL) data from gill netting and from sport and test angling were combined to assess growth rate using the von Bertalanffy growth function (von Bertalanffy 1938).

$$L_t = L_\infty (1 - e^{-K(t-t_0)})$$

where:

L_t = length at age t

L_∞ = the asymptote or final maximum size,

K = the rate at which the growth curve approaches the asymptote, and

t = age

t_0 = a time scaler, the hypothetical time when the fish was size zero

The von Bertalanffy growth function is a non-linear equation that explains growth using three parameters (von Bertalanffy 1938). The parameter used to estimate growth is K , i.e., the rate at which the fish approaches maximum size (L_∞). Higher values of K represent faster growth and are usually associated with a lower L_∞ . Due to small sample sizes of small fish t_0 was fixed at zero to reduce bias in the growth function. As with L_∞ , t_0 can be highly variable due to small sample sizes of small fish. In addition, application of age at length zero has very little practical application and was therefore fixed at zero. Growth curve parameters were estimated through iteration using Sigma Plot 8.0. In addition, 95% prediction intervals were also generated showing the range in which 95% of individual fish observations from that population would occur. The estimates for L_∞ and K were then used to calculate an estimate for the time for a fish to reach a harvestable length.

4.0 RESULTS

4.1 Angler survey

Between 21 May and 25 August 2004, 92 anglers were interviewed at Round Lake. The estimated number of anglers was 300 (95% CI = 190 - 480) with an estimated effort of 1280 angler-h (95% CI = 820 - 1880) or 2.298 angler-h/ha (95% CI = 1.472 - 3.375). Parameter observations and estimates from angler interviews are presented in Table 1.

Table 1. Summary of observed and estimated angler parameters, with 95% CI, from summer surveys conducted at Round Lake in 2004.

	Observed	Estimated	95% CI
Number of anglers	92	300	190 - 480
Effort (angler hours)	378.75	1280	820 - 1880
Effort (hours/ha)	0.680	2.298	1.472 - 3.375

Anglers that visited Round Lake were primarily from the Peace River or Fairview areas (28.8%) (Figure 3). Large numbers of anglers also came from the Red Earth (26.3%) and the Grande Prairie or Valleyview (22.5%) areas. Overall, 30.4% of anglers used bait and 100% of anglers used barbless hooks as mandated by ASRD.

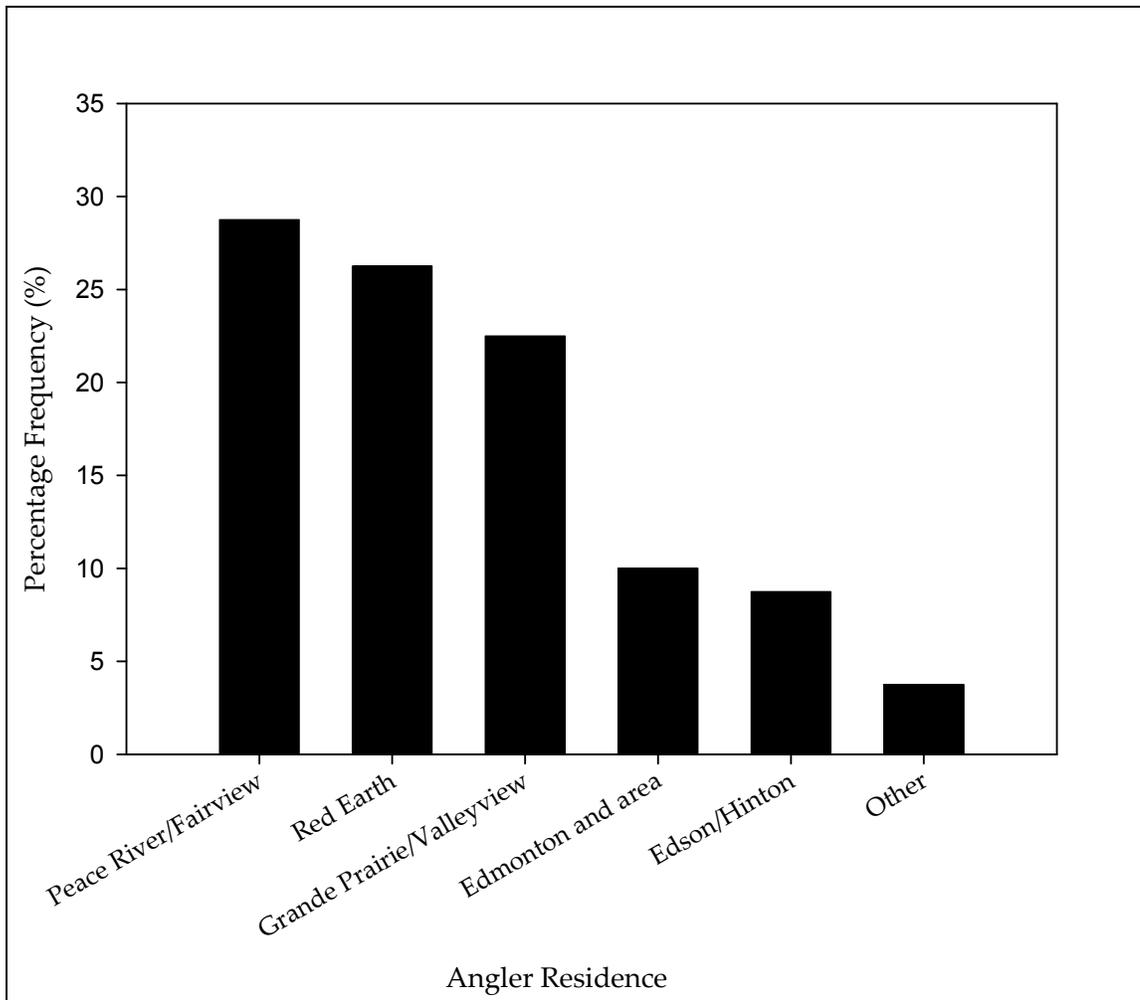


Figure 3. Residence of anglers interviewed during the angler survey at Round Lake in 2004 (n = 80).

4.2 Walleye catch and harvest

The total catch rate (TCUE) for walleye reported by sport anglers was 0.68 fish/h; TCUE for test anglers was 0.92 fish/h. Total harvest rate (THUE) and TCUE of legal-length walleye (> 50 cm TL) were 0.053 fish/h and 0.055 fish/h, respectively. The mean daily CPUE (\pm SD) of sport anglers was 0.90 ± 0.87 fish/h (n = 12), whereas the mean daily HPUE was 0.060 ± 0.078 fish/h (n = 12). Of the 25 days that Round Lake was surveyed, anglers were only observed on 12 days.

Estimated total angler catch of walleye during the 2004 survey was 900 fish (95% CI = 520 - 1400). Estimated total angler harvest was 70 fish (95% CI = 34 - 118). The mean weight of harvested walleye was 1.19 kg/fish (95% CI = 1.07 - 1.30) resulting in an estimated total harvest of 83.23 kg (95% CI = 40.43 - 140.3) or 0.149 kg/ha (95% CI = 0.073 - 0.252). Observed and estimated totals are shown in Table 2.

Table 2. Summary of walleye catch and harvest estimates, with 95% CI, from summer surveys conducted at Round Lake in 2004.

	Observed	Estimated	95% CI
Walleye caught	259	900	520 - 1400
Walleye kept	20	70	34 - 118
Walleye harvested (kg)	23.78	83.23	40.43 - 140.30
Walleye harvested (kg/ha)	0.043	0.149	0.073 - 0.252

Estimated number of protected-length walleye released differed from the reported number by 36.7% (149.5 estimated, 236 reported). This result suggests that angler exaggeration was prevalent and anglers may have been overstating their catch.

4.3 Walleye population structure and growth

Walleye harvested by anglers ranged in size from 500 to 565 mm TL with a mean (\pm SD) of 524.1 ± 19.41 mm ($n = 9$), whereas those captured by test anglers ranged from 215 to 562 mm with a mean of 420.0 ± 61.98 mm ($n = 138$) (Figure 4). Walleye captured in gill nets in June 2004 ranged from 185 to 734 mm with a mean of 457.4 ± 98.57 mm ($n = 144$) (Figure 4). The length distribution of fish captured through gill netting shows a broader number of age classes when compared to that from test angling. The distribution generated from gill net fish also shows much stronger representation of larger fish.

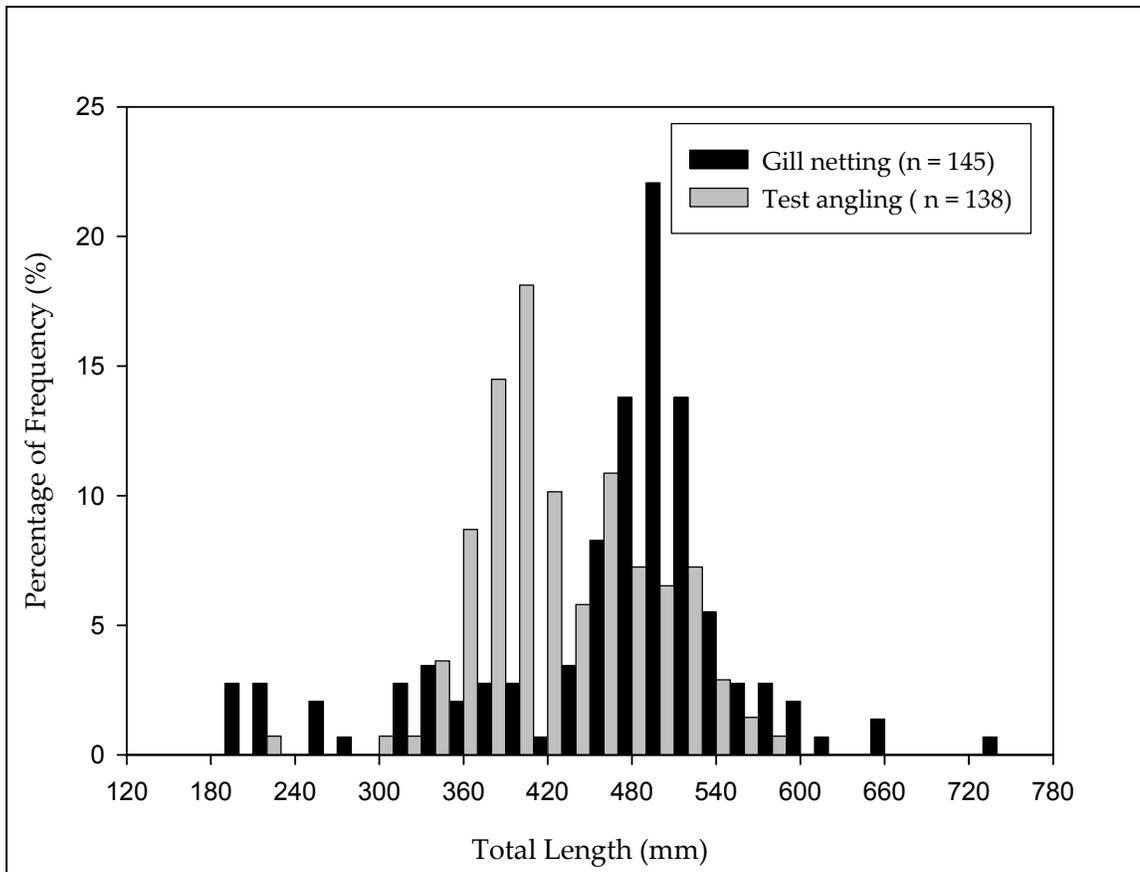


Figure 4. Length-frequency distributions of walleye captured during the 2004 survey of Round Lake using gill netting and test angling.

Age of walleye harvested by anglers ranged from 8 to 15 y with a mean of 11.8 ± 2.25 y ($n = 8$), whereas those captured by test anglers ranged from 2 to 20 y with a mean of 7.6 ± 2.76 y ($n = 131$) (Figure 5). Fish sampled from gill netting ranged in age from 2 to 22 y with a mean of 10.5 ± 3.92 y ($n = 156$) (Figure 5).

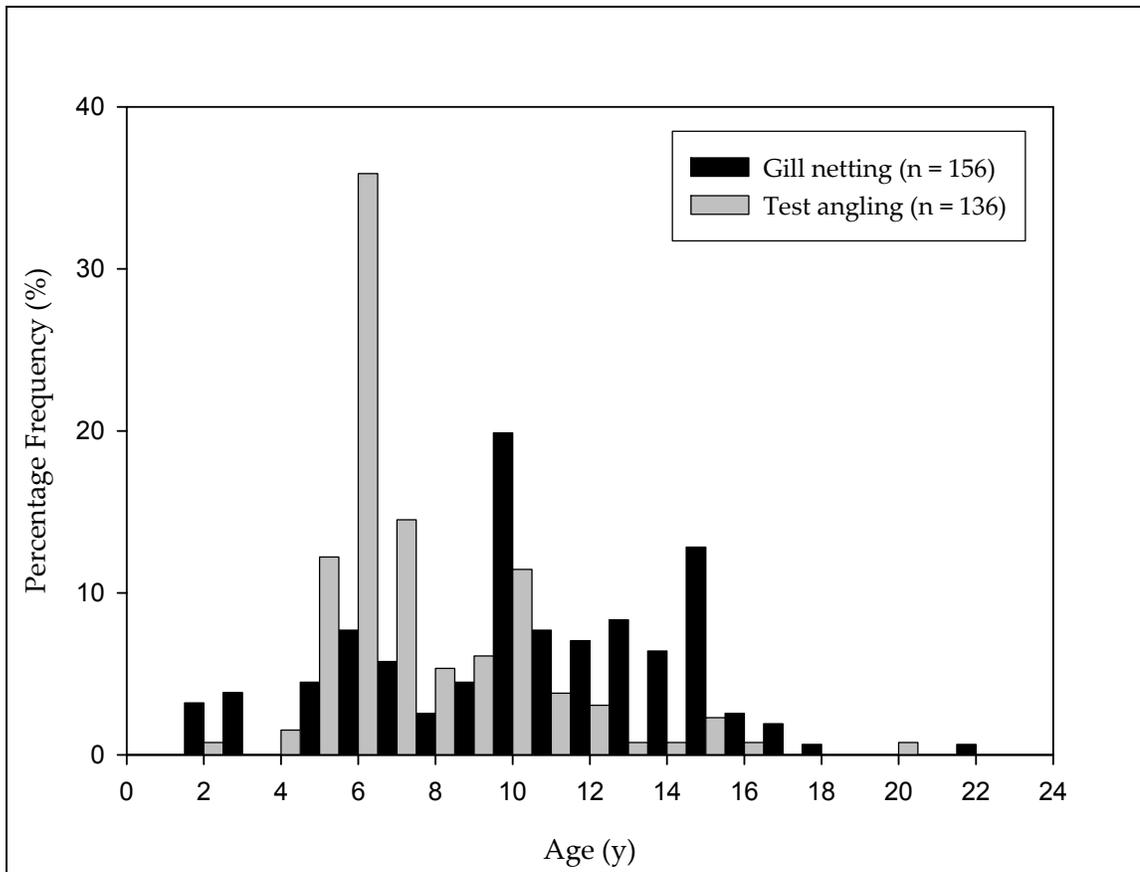


Figure 5. Age distributions of walleye captured during the 2004 survey of Round Lake using gill netting and test angling.

The theoretical maximum length (L_{∞}) of walleye was 561.2 mm TL with a growth coefficient (K) of 0.193 (Figure 6). With these growth characteristics it would take 11.4 years to produce a harvestable walleye (> 50 cm TL).

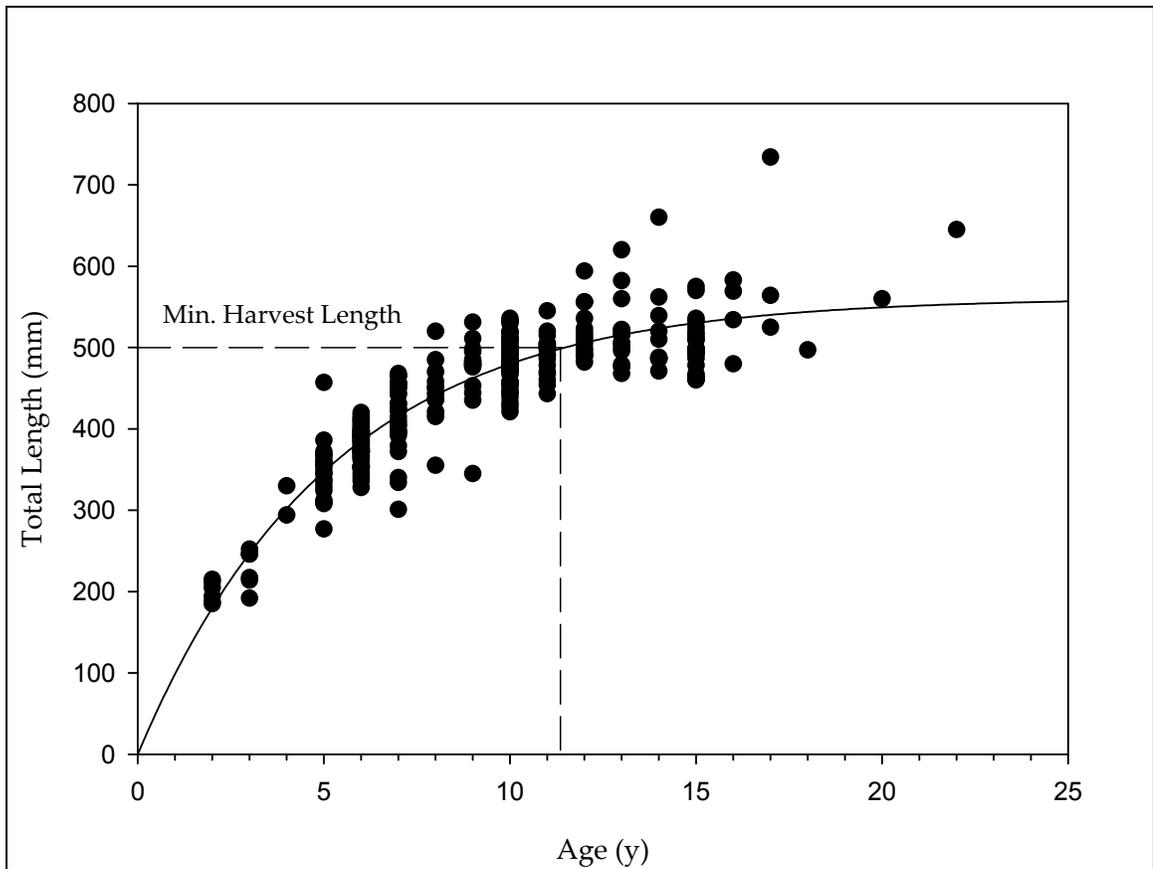


Figure 6. von Bertalanffy plot for walleye from Round Lake, Alberta 2004. $n = 282$, $L_{\infty} = 561.2$, $K = 0.193$.

4.4 Northern pike catch and harvest

The total catch rate (TCUE) reported for northern pike by sport anglers was 1.02 fish/h; TCUE for the test fishery was 0.48 fish/h. Total harvest rate (THUE) and TCUE of legal-length northern pike (> 63 cm TL) were 0.037 fish/h and 0.066 fish/h, respectively. The mean daily CPUE (\pm SD) of sport anglers was 1.14 ± 0.759 fish/h ($n = 12$) and the mean daily HPUE was 0.032 ± 0.228 fish/h ($n = 12$). Of the 25 days that Round Lake was surveyed, anglers were only observed on 12 days.

Estimated total angler catch of northern pike during the 2004 survey was 1350 fish (95% CI = 825 - 1975). Estimated total angler harvest was 38 fish (95% CI = 23 - 64) corresponding to a total estimated harvest of 75.8 kg (95% CI = 45.9 - 127.7) of northern

pike or 0.136 kg/ha (95% CI = 0.082 - 0.229). Observed and estimated totals are shown in Table 3.

Table 3. Summary of northern pike catch and harvest estimates, with 95% CI, from summer surveys conducted at Round Lake in 2004.

	Observed	Estimated	95% CI
Northern pike caught	385	1350	825 - 1975
Northern pike kept	14	38	23 - 64
Northern pike harvested (kg)	27.93	75.81	45.89 - 127.68
Northern pike harvested (kg/ha)	0.05	0.136	0.082 - 0.229

The estimated number of protected-length northern pike released differed from the reported number by 52.0% (172.7 estimated, 360 reported). This result suggests that anglers may have exaggerated their release of protected-length fish.

4.5 Northern pike population structure and growth

Northern pike harvested by anglers ranged from 654 to 990 mm TL with a mean of 757.8 ± 122.5 mm ($n = 6$), whereas those captured by test anglers ranged from 293 to 779 mm TL with a mean of 539.5 ± 88.82 mm ($n = 87$) (Figure 7). Northern pike captured in gill nets in June 2004 ranged in length from 217 to 956 mm with a mean of 587.8 ± 111.53 mm ($n = 130$) (Figure 7). The distributions from test angling and gill netting are similar, but the distribution from gill netting shows slightly greater representation of larger fish.

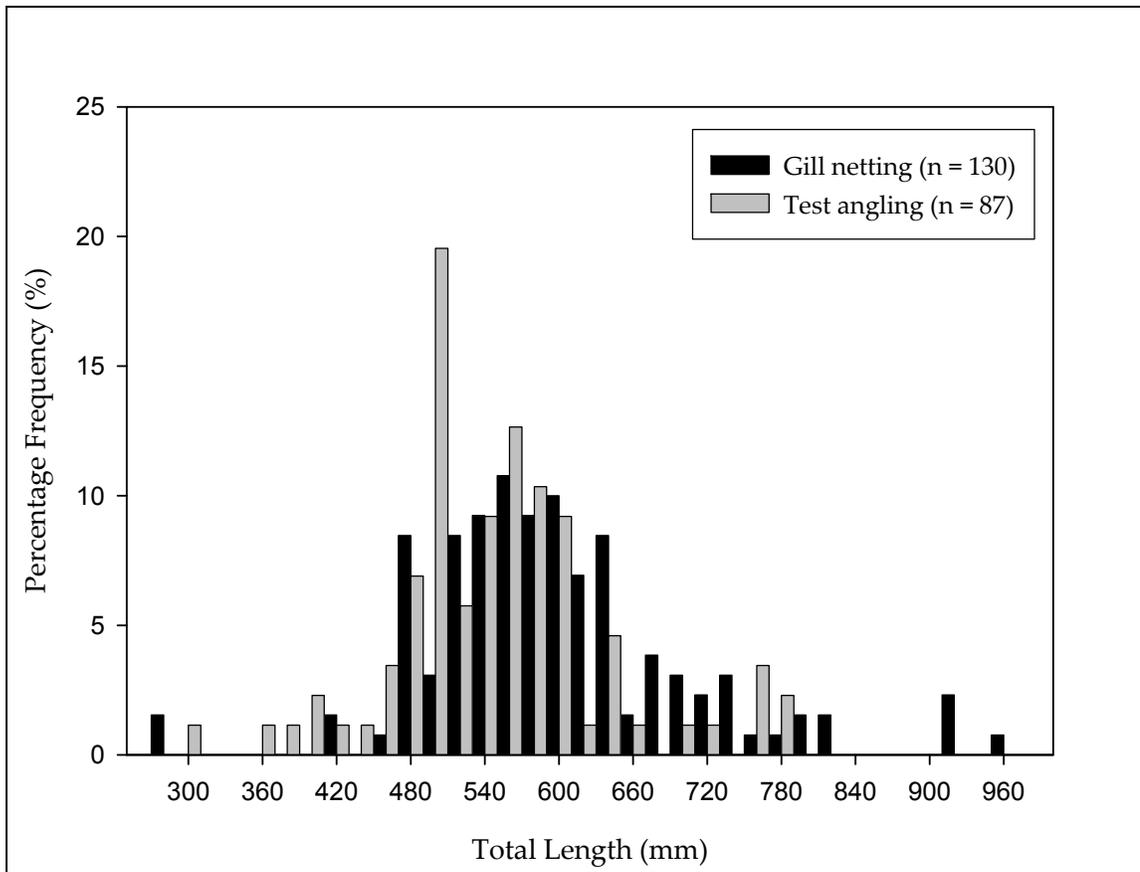


Figure 7. Length-frequency distributions of northern pike captured during the 2004 survey of Round Lake using gill netting and test angling.

Age of northern pike harvested by anglers ranged from 7 to 14 y with a mean of 10.9 ± 2.42 y (n = 9), whereas those captured by test anglers ranged from 2 to 12 y with a mean of 5.2 ± 1.75 y (n = 72) (Figure 8). Fish sampled in gill nets ranged from 2 to 16 y with a mean of 8.5 ± 3.04 y (n = 138) (Figure 8).

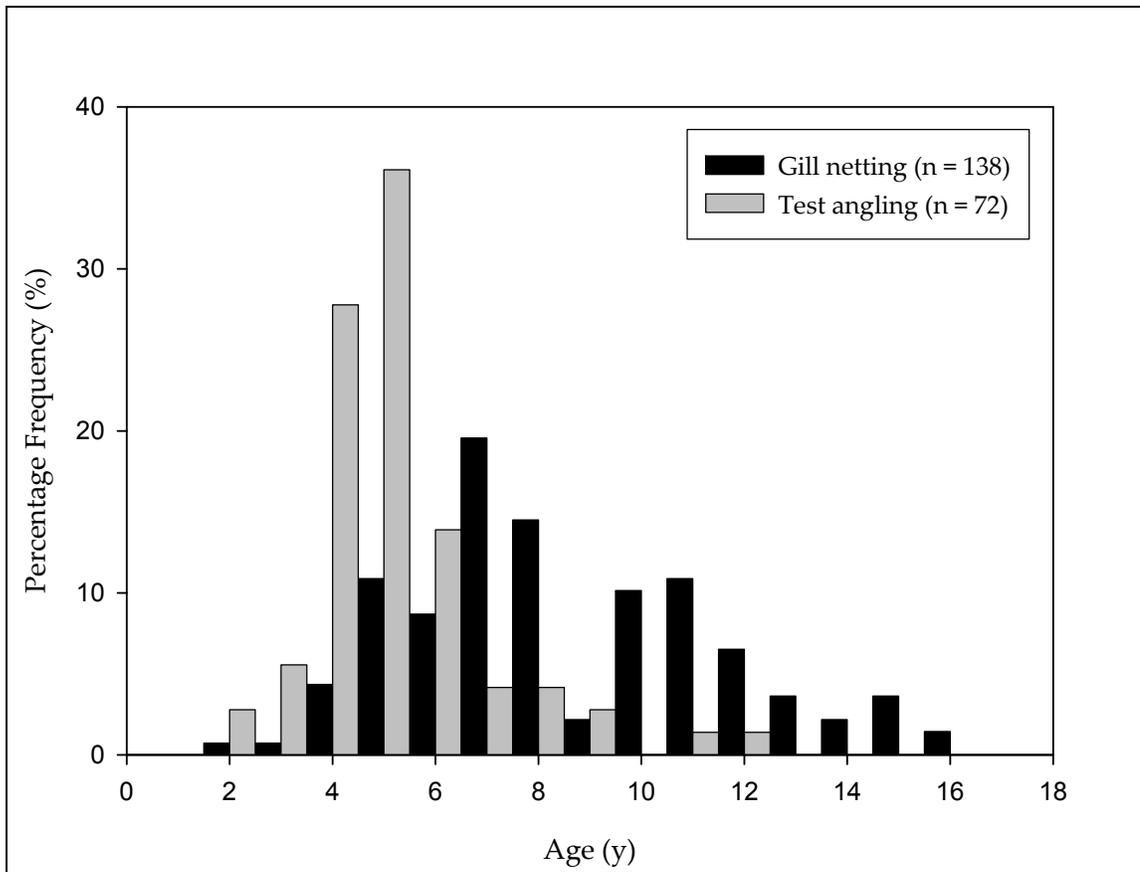


Figure 8. Age distributions of northern pike captured during the 2004 survey of Round Lake using gill netting and test angling.

The theoretical maximum length (L_{∞}) of northern pike was 735.8 mm TL with a growth coefficient (K) of 0.237 (Figure 9). With these growth characteristics it would take 8.3 years to produce a harvestable northern pike (> 63 cm TL).

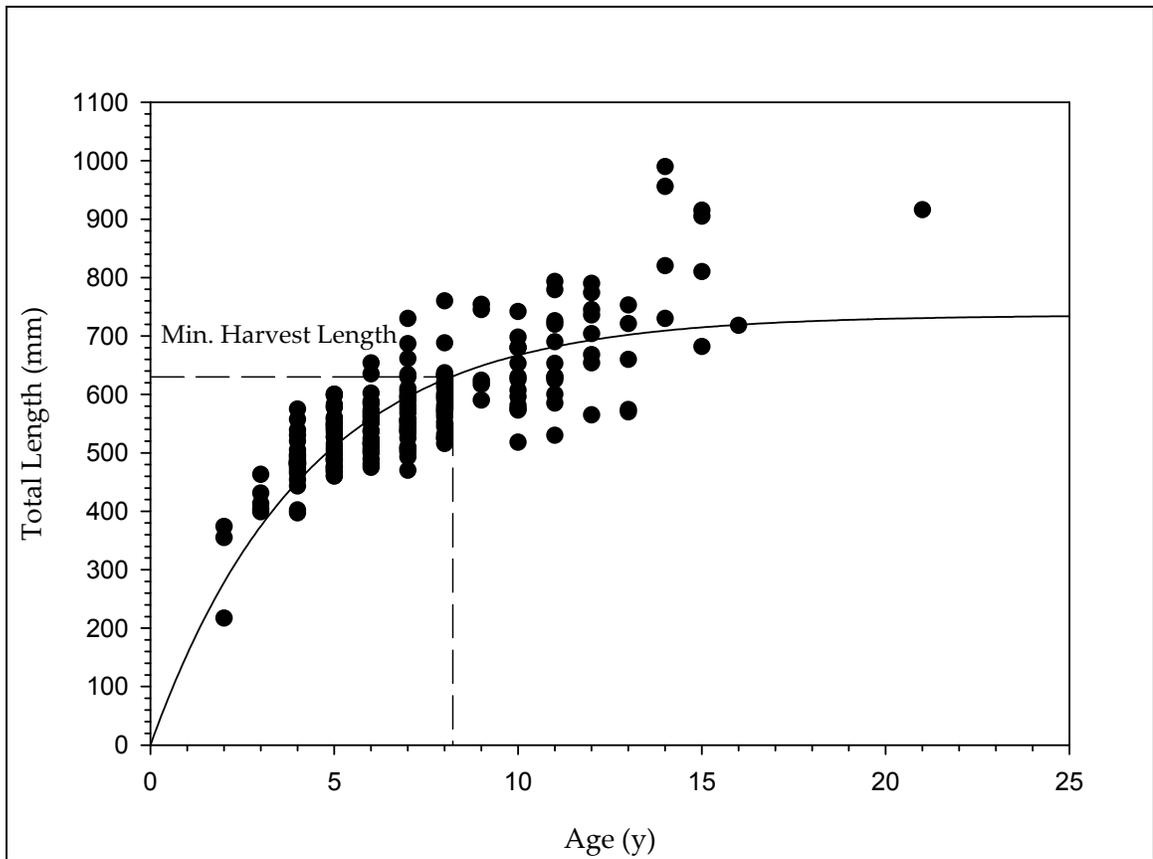


Figure 9. von Bertalanffy plot for northern pike from Round Lake, Alberta 2004. $n = 201$, $L_{\infty} = 735.8$, $K = 0.237$.

4.6 Summary

An estimated 300 anglers (95% CI = 190 - 480) fished at Round Lake from 21 May to 25 August 2004 resulting in an angling pressure of 2.30 angler-h/ha (95% CI = 1.47 - 3.38). The overall catch rate of walleye was 0.68 fish/h, while the total harvest-per-unit-effort was 0.053 fish/h. The total estimated walleye harvest was 0.149 kg/ha (95% CI = 0.073 - 0.252 kg/ha). In contrast, the overall catch rate of northern pike was 1.02 fish/h, with a total harvest rate of 0.037 fish/h. Based on the von Bertalanffy growth estimates, walleye in Round Lake should reach harvestable size (> 50 cm TL) in 11.4 years, whereas northern pike should attain harvestable size (> 63 cm TL) in 8.3 years.

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6.0 APPENDICES

Appendix 1. Summarized walleye parameters from sport fishery, test angling and index netting.

Parameter	Data value
Fish harvested/h (HPUE) (> 50 cm TL)	0.04
Fish caught/h (TCUE)	0.68
Measurable age-classes from index netting	17
Age at 50 cm TL	11.4
Mean weight (kg) (> 50 cm TL)	1.19
% Success (% anglers catching ≥ 1 legal-size walleye)	56.5%

Appendix 2. Summarized northern pike parameters from sport fishery, test angling and index netting.

Parameter	Data value
Fish harvested/h (HPUE) (> 63 cm TL)	0.03
Fish caught/h (TCUE)	1.02
Measurable age-classes from index netting	13
Age at 63 cm TL	8.3
Mean weight (kg) (> 63 cm TL)	1.99
% Success (% anglers catching ≥ 1 legal-size pike)	28.0%

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Alberta



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