Assessment of the Summer Sport Fishery for Walleye (*Sander vitreus*) and Northern Pike (*Esox lucius*) at Graham Lake, Alberta, 2004.

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An essential contribution to this project were the creel clerks, who surveyed Graham Lake anglers. Thanks to all the volunteer test anglers for donating their time and personal expense to this project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

A summer angler survey was completed on Graham Lake in 2004 to quantify angling effort, catch rates and harvest rates of walleye (*Sander vitreus*) and northern pike (*Esox lucius*). An estimated 2240 (95% confidence limits (CL) 1520-3640) anglers fished the lake from 13 May to 23 August 2004. The angling pressure exerted on Graham Lake was 1.19 angler hours per hectare (hours/ha) (95% CL 0.91-1.57 hrs/ha).

The overall catch rate of walleye (expressed as total catch per unit effort (TCUE) was observed to be 0.80 fish/hr, while the total harvest per unit effort (THUE) was 0.13 fish/hr. The total walleye harvest was estimated at 0.29 kg/ha (95% CL 0.20-0.38 kg/ha). In contrast, the overall catch rate of northern pike TCUE was 0.31 fish/hr, while the estimated THUE was 0.03 harvested fish/hr.

The von Bertalanffy growth function resulted in an estimated 9.0 years to produce a harvestable walleye (≥50cm total length) and 6.3 years to produce a harvestable northern pike (≥63cm total length).

Although angling pressure at Graham Lake during the summer may be considered relatively low at the time of this survey. Improved access and upgrading of facilities at this lake may result in an increase in pressure that can now be monitored and compared to previous levels.

1.0 INTRODUCTION

1.1 General Introduction

In recent years, improved access to lakes with populations of walleye (*Sander vitreus*) and northern pike (*Esox lucius*) has raised concerns about increased pressure on relatively unexploited fish populations. Strategies to maintain or recover northern pike and walleye populations have been implemented by Alberta Sustainable Resource Development. Strategies prescribe regulatory measures that can be used to maintain or recover a fishery. Regular evaluation of the sport fishery and regulations are necessary to ensure fisheries management goals are being achieved.

Summer angling pressure and subsequent harvest of fish is largely unknown for several lakes in northern Alberta. Graham Lake fish populations have been assessed using gill netting techniques but the sport fishery has not been formally assessed in previous years. Graham Lake is managed as a quality walleye fishery. Regulations for 2004 stated that one walleye over 50 cm total length (TL), three northern pike over 63 cm TL, fifteen yellow perch (*Perca flavescens)*, ten lake whitefish (*Coregonus clupeaformis*) and ten burbot (*Lota lota*) could be harvested per day (Alberta Sustainable Resource Development 2004). It is also stated that no walleye and northern pike may be kept from 1 March to 31 May. Closures are in effect for tributaries and the outlet from 1 November to 31 May.

Improved access (upgraded and new roads) into lakes in the Red Earth area in recent years has raised concern about the potential for increased angling pressure. The purpose of this survey was to describe the current level of angler use and provide data to fisheries managers to evaluate the status of walleye and northern pike sport fisheries of priority lakes in this area. This report describes the results of the summer angler survey on Graham Lake.

2.0 STUDY AREA

Graham Lake is located in Alberta approximately 45 km East of the town of Red Earth (Figure 1). The Lake has a surface area of 4170 hectares, with an average depth of 8.0 m and a maximum depth of 14.6 m. A gravel road is used to access the lake. Development at the lake consists of a concrete boat launch as well as ample space for camping. The campsites are not maintained but do provide basic amenities.

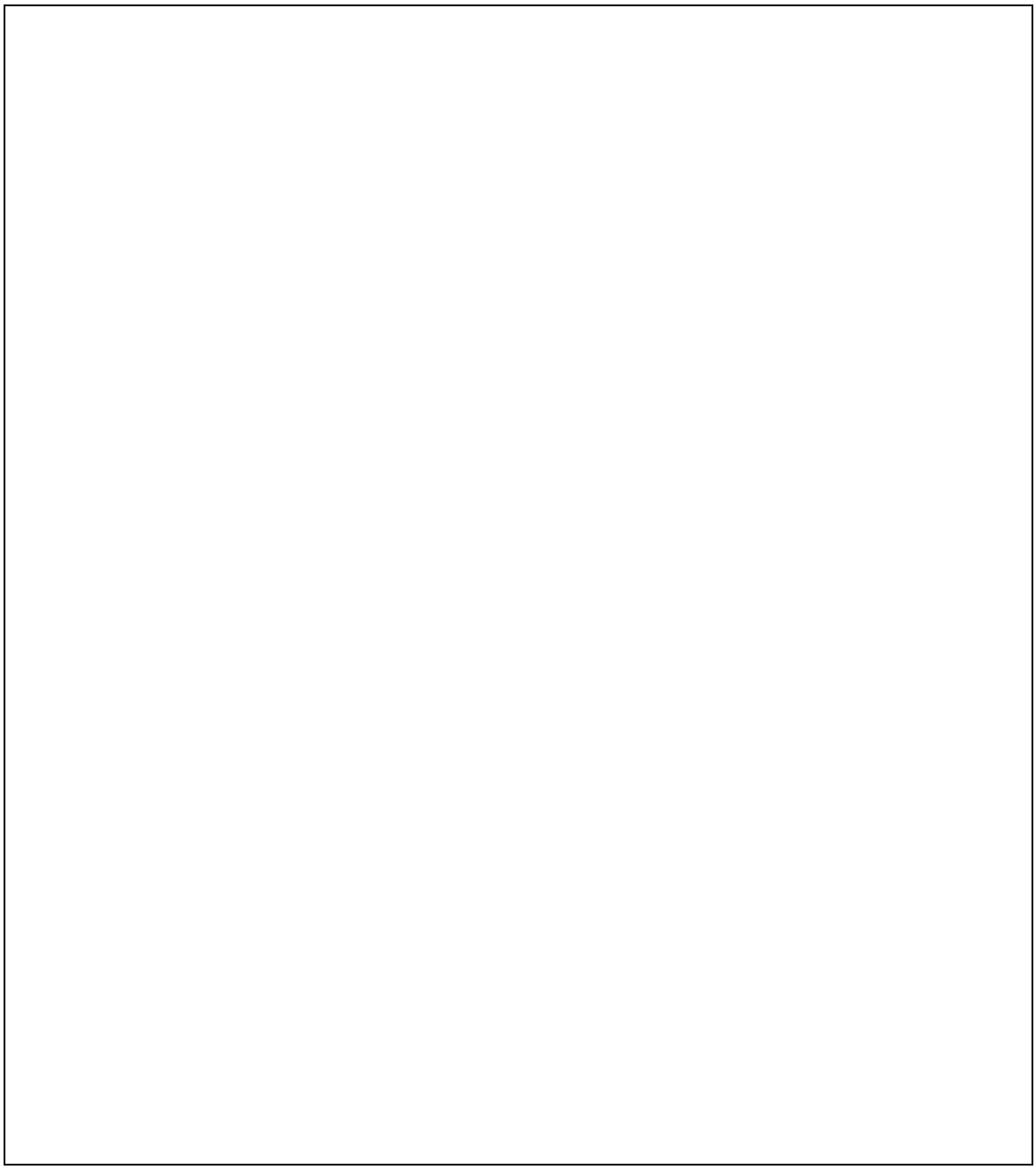

Figure 1. Location of Graham Lake and the 2004 creel survey site.

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 Graham Lake from 13 May to 23 August 2004 to collect angler effort and sport fishery data. Two creel clerks interviewed anglers as they returned from a completed trip of angling between 08:00 and 23:00 on days surveyed. Sampling occurred on a schedule of 10 days on, four days off, surveying every weekend. Survey effort was split with Gods Lake, such that five days of each shift were spent at each lake. The survey site visited first, was switched each shift so that both lakes were sampled equally.

3.2 Angler Interviews

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

3.3 Test Angling

Anglers were required by regulations to release walleye and northern pike that were shorter than the minimum size limit (walleye 50 cm, pike 63 cm; total length), creel clerks could not sample these sub-legal fish. To collect data on size and age structure from fish that could not be legally harvested, test angling was conducted throughout the survey period. Test anglers were comprised of creel clerks, fisheries staff, and volunteers. Test anglers varied in skill level and attempted to catch walleye and northern pike using techniques that anglers would normally use. Test anglers recorded the number of hours fished and the fork and total length, to the nearest millimeter, of all fish caught. The ratio of legal-length fish to protected-length fish sampled during the test fishery was compared to the corresponding ratio from the sport fishery in order to assess the rate of angler exaggeration (Sullivan 2003).

3.4 Biological Fish Data

Creel clerks collected biological data from fish that were harvested by anglers, when permitted. Data collected included fork length to the nearest millimeter, total length, weight to the nearest 10 g, ageing structures, sex and state of maturity. Ageing structures collected included the left operculum and the first three rays of the left pelvic fin for walleye, the left cleithrum and the first three rays of the left pelvic fin for northern pike, and the left operculum and the anal fin for yellow perch. Fish were aged according to Mackay et al. (1990).

3.5 Data Management and Analysis

To ensure correct information all data were verified prior to analysis using a series of frequency distributions and plots of each angler survey parameter. Outliers were then compared to original data sheets if a measurement or recording error was suspected it

was omitted from analysis. These data are stored in the provincial database, Fisheries Management Information System (FMIS).

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. Calculation of creel survey estimates followed Sullivan (2004). Samples were stratified by day type into weekdays (Monday-Thursday) and weekend days (Friday-Sunday, including statutory holidays) a flow chart describing the steps is presented in Figure 2.

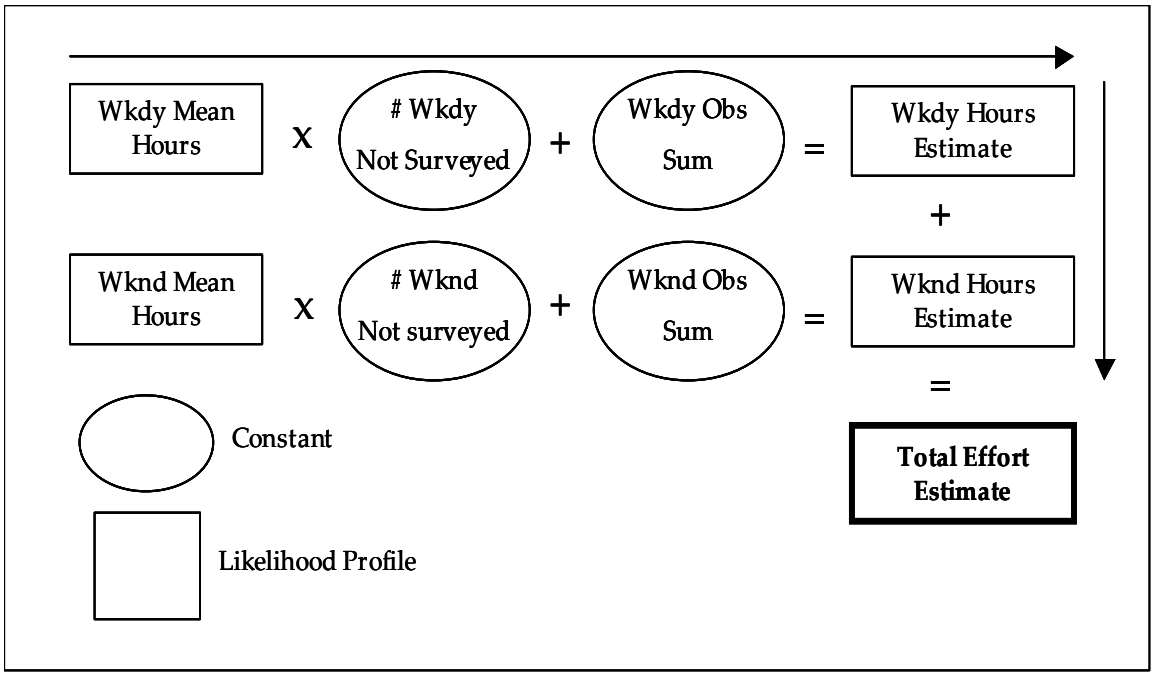

Figure 2. Flow chart outlining the process used for estimating parameters from the sport fishery at Graham Lake 2004. Circles represent values with no variance while rectangles represent values with probability density functions. Bold outline represents derived parameters used in the assessment of the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

Total catch per unit effort (TCUE) and total harvest per unit effort (THUE) were calculated from the total number of fish caught/kept and the total number of hours observed during the survey. Daily totals for catch per unit effort (CPUE) and harvest per unit effort (HPUE) were bootstrapped to estimate monthly means and 95% confidence limits.

Data obtained from index netting (Fortier and Tchir 2005) in September 2004 were used for comparison in length and age distributions. Length distributions for the angler survey, test fishery, and index netting were generated using 20 mm length classes.

Age and length data from the index netting, sport and test fishery were combined and fitted to the von Bertalanffy growth function to assess growth rate. It was assumed that there were no differences in growth rate between the fish captured by the different methods. The von Bertalanffy growth function is a non-linear equation that explains growth using three parameters (von Bertalanffy 1938).

$$L = L_{\infty}(1 - e^{-k(t-t_0)})$$

Length infinity (L_{∞}) represents the asymptotic or theoretical maximum length that can be achieved. This length is often lower than the true maximum size due to small sample sizes of very large fish. The parameter representing growth is k, which is defined as the rate at which the fish approaches L_{∞}. Higher values of k represent faster growth and are usually associated with a lower L_{∞}. The third parameter of the von Bertalanffy growth function is t_0, which is the theoretical age at length zero. 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. Fork length (FL) was used to calculate the growth curve. The estimates for L_{∞} and k were then used to calculate an estimate for the time for a fish to reach a harvestable length.

Relative weight (W_r) is a measure of condition calculated by applying the weight and TL of a fish to a species-specific equation. Total length measurements were not taken during all sampling in order to reduce handling time of live fish captured in the test fishery. Therefore total length was estimated from FL measurements and used for W_r analysis. FL and TL measurements of fish that were sampled in the index netting, sport and test fisheries were fitted to a linear regression equation.

$$\text{Walleye}: TL(mm) = 1.038(FL(mm)) + 10.25;\ R^2 = 0.992;\ n = 377$$

$$\text{Northern pike}: TL(mm) = 1.048(FL(mm)) + 7.962;\ R^2 = 0.991;\ n = 105$$

This was then applied to all fish fork lengths to reduce the variability of the TL measurements. Wege and Anderson (1978) introduced the following formula to calculate W_r:

$$W_r = \left(\frac{W}{W_s}\right) * 100$$

Where W is the measured weight of the fish and W_s is the standard weight of a fish of the same length. Standard weight equations for northern pike and walleye were determined by D.W. Willis (1989) and Murphy et al. (1990), respectively.

W_r varies with such parameters as sex, length, time of year, and maturity. Using a total sample mean W_r is not appropriate without first checking for differences across length classes within that sample (Murphy et al. 1991). The five-cell length class model described by Gablehouse (1984) was used to stratify by total length. Samples were first checked for differences between males and females within each length class using a T-test (α=0.05). If a significant difference was found, the mean W_r and 95% confidence limits were presented separately for male and female data of that length class. Relative weight data from males and females were pooled if no significant differences were found.

4.0 RESULTS

4.1 Angler Survey

Between 13 May and 23 August 2004, 839 anglers were interviewed at Graham Lake. Parameter observations and estimates from angler interviews are presented in Table 1. Although the access was surveyed, no anglers were observed during May. The estimated number of anglers was 2240 (with 95% confidence limits (CL) of 1520 - 3640) (Figure 3) with an estimated effort of 4950 angler-hours (95% CL 3800 - 6550) (Figure 4) or 1.187 angler-hours/hectare (95% CL 0.911 – 1.571).

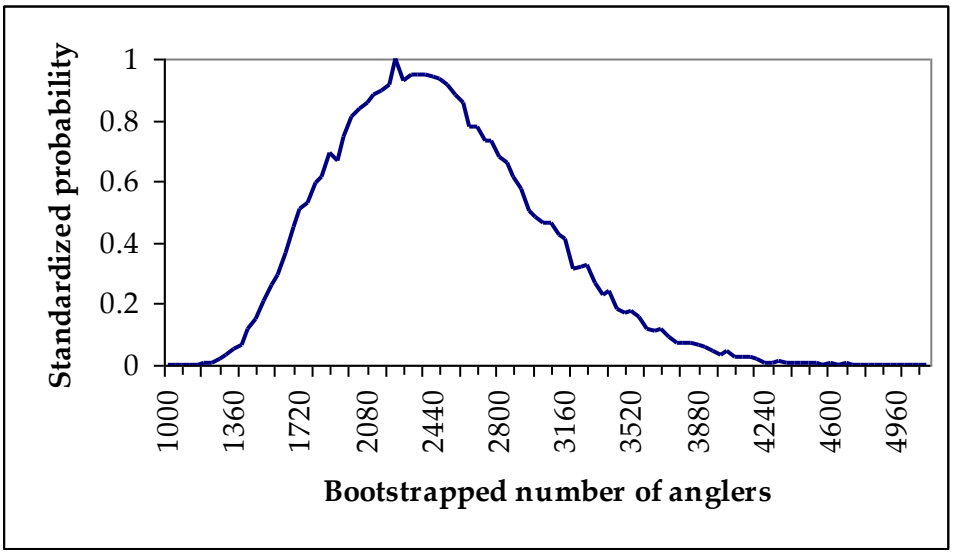

Figure 3. Standardized probability density function for number of anglers at Graham Lake in 2004 (2240 anglers; 95% CL= 1520 - 3640).

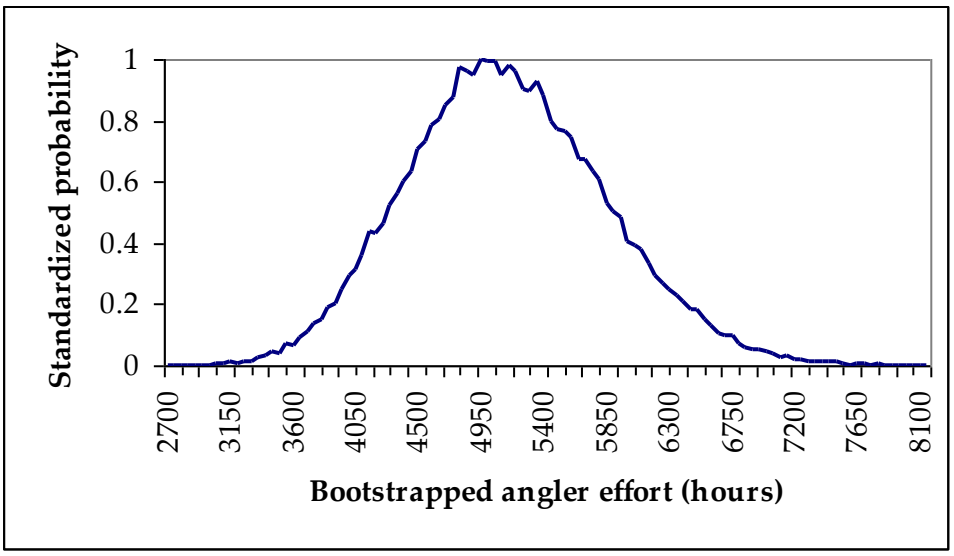

Figure 4. Standardized probability density function of angler-hours at Graham Lake in 2004 (4950angler-hours; 95% CL= 3800- 6550).

Table 1. Summary of observed and estimated parameters, with high and low 95% confidence limits (HCL and LCL), from summer surveys conducted at Graham Lake in 2004. Parameters were calculated for each month as well as all months combined. Combined estimates were obtained by pooling observations from all months. No anglers were observed during the month of May.

	Number of anglers	Effort (angler hours)	Effort (hours/ha)	WALL caught	WALL kept	WALL harvested (kg)	WALL harvested (kg/ha)	NRPK caught	NRPK kept	NRPK harvested (kg)	NRPK harvested (kg/ha)
June											
Observed	590	1320.25	0.317	1186	182	320.50	0.077	446	31	79.02	0.019
Estimate	1670	3220	0.772	2785	464	817.10	0.196	1136	94	239.61	0.057
LCL	1060	2500	0.600	2200	348	612.83	0.147	819	52	132.55	0.032
HCL	2580	3960	0.950	3325	586	1031.95	0.247	1398	130	331.37	0.079
July											
Observed	208	603	0.145	406	76	133.84	0.032	185	24	61.18	0.015
Estimate	470	1200	0.288	870	162	285.28	0.068	391	48	122.35	0.029
LCL	320	890	0.213	530	106	186.67	0.045	251	30	76.47	0.018
HCL	640	1850	0.444	1420	248	436.73	0.105	565	76	193.72	0.046
August											
Observed	41	91.5	0.022	17	5	8.81	0.002	1	0	0.00	0.000
Estimate	150	280	0.067	55	16	28.18	0.007	3	-	-	-
LCL	60	130	0.031	15	4	7.04	0.002	0	-	-	-
HCL	190	430	0.103	95	28	49.31	0.012	6	-	-	-
Combined											
Observed	839	2014.75	0.483	1609	263	463.14	0.111	632	55	140.20	0.034
Estimate	2240	4950	1.187	4000	690	1215.09	0.291	1580	142	361.96	0.087
LCL	1520	3800	0.911	2850	480	845.28	0.203	1120	92	234.51	0.056
HCL	3640	6550	1.571	5200	910	1602.51	0.384	2140	216	550.58	0.132

Anglers that visited Graham Lake were primarily from Edmonton and area (35.9%) (Figure 5). Anglers reported a rate of 53.4% for the use of bait. Anglers also reported a compliance rate of 99.0% for mandatory barbless hook regulations.

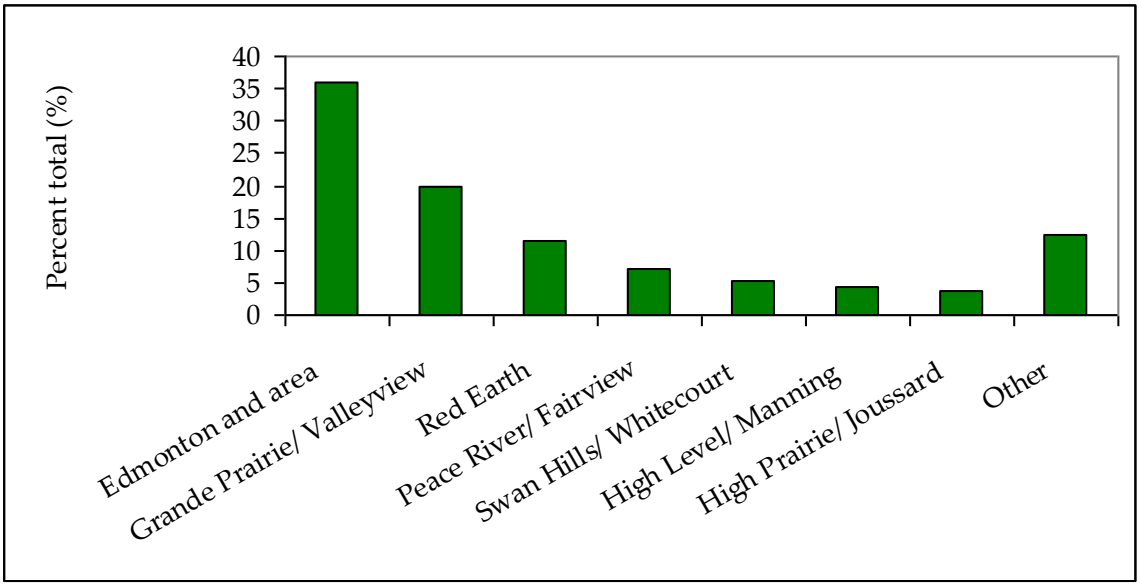

Figure 5. Residence of anglers interviewed during the angler survey at Graham Lake, Alberta 2004 (n =582).

4.2 Walleye Catch and Harvest

The total walleye catch rate (TCUE) reported by sport anglers from Graham Lake in 2004 was 0.80 walleye/hour. The total reported harvest rate (THUE) of legal-length walleye was 0.13 kept/hour, while the TCUE for legal-length fish (>50cm TL) was 0.33 walleye/hour. A TCUE of 0.42 walleye/hour was reported for the test fishery. June showed the highest walleye catch rate (CPUE) and harvest rate (HPUE) for the sport fishery. While the highest CPUE for the test fishery was in July (Table 2). Monthly observed and estimated catch and harvest data are shown in Table 1.

Table 2. Catch per unit effort (CPUE) and harvest per unit effort (HPUE) values observed and estimated by bootstrapping, with high and low confidence limits (HCL and LCL), for each month at Graham Lake, Alberta, 2004.

Walleye	June	July	August
Sport fishery CPUE			
Observed	0.898	0.673	0.186
Estimate	0.960	0.500	0.140
LCI	0.000	0.360	0.020
HCI	1.260	0.680	0.270
Sport fishery HPUE			
Observed	0.138	0.126	0.055
Estimate	0.160	0.125	0.040
LCI	0.125	0.070	0.000
HCI	0.200	0.200	0.075
Test fishery CPUE			
Observed	0.372	0.421	0.000
Estimate	0.290	0.600	-
LCI	0.040	0.320	-
HCI	0.630	0.860	-

Total angler catch of walleye during the 2004 Graham Lake survey was estimated at 4000 fish (95% CL 2850 - 5200) (Figure 6). Angler harvest of walleye during the survey was estimated at 690 fish (95% CL 480 - 910) (Figure 7). This results in a total estimated harvest of 1215.09 kg of walleye (95% CL 845.28 – 1602.51) or 0.291 kg/ha (95% CL 0.20 - 0.38).

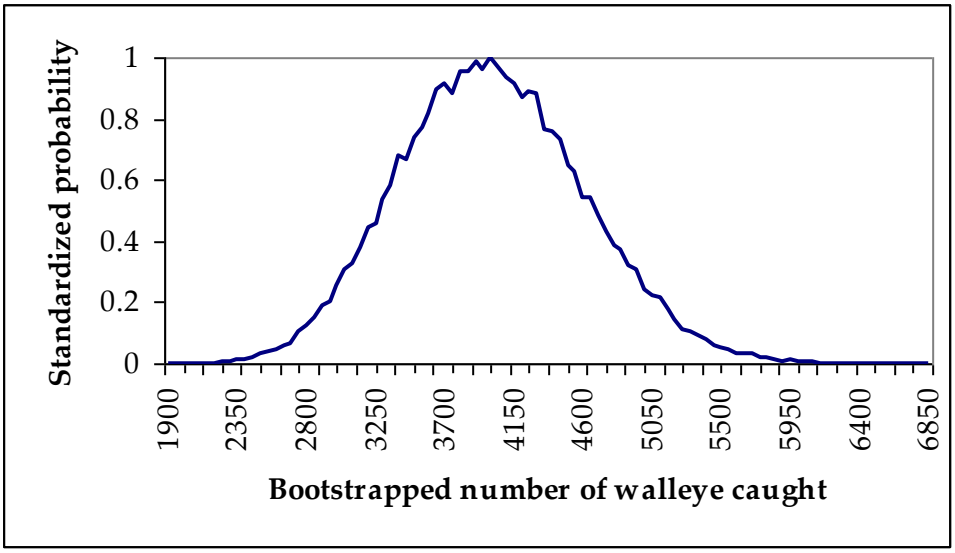

Figure 6. Standardized probability density function of the number of walleye caught during the summer angler survey at Graham Lake in 2004 (4000 walleye; 95% CL= 2850 - 5200).

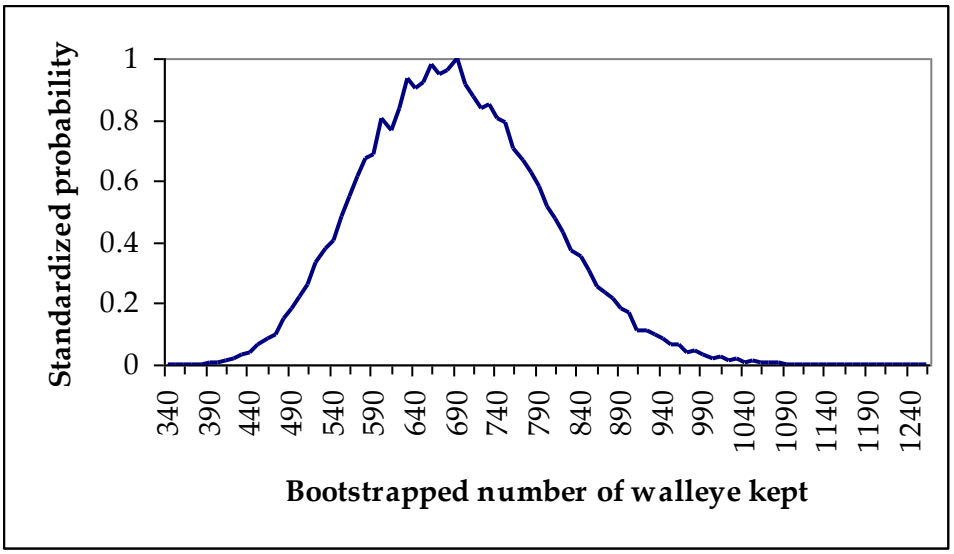

Figure 7. Standardized probability density function of the number of walleye harvested during the summer angler survey at Graham Lake in 2004 (690 walleye; 95% CL= 480 - 910).

Anglers reported a release rate of 0.67 walleye/hour, resulting in an estimated release of 3310 walleye (i.e., total harvest estimate subtracted from total catch estimate). Angler exaggeration was assessed by comparing the proportion of legal-length walleye to protected-length walleye caught in the test fishery to the reported proportion of legal to sub-legal walleye from anglers (Sullivan 2003). Not all legal walleye were harvested therefore it was assumed that anglers did not exaggerate their catch of these fish. The estimated number of protected-length walleye released differed from the reported

number by 43.9% (485 estimated, 337 reported). This suggests that angler exaggeration was prevalent.

4.3 Northern Pike Catch and Harvest

The total northern pike catch rate (TCUE) reported by sport anglers in Graham Lake in 2004 was 0.31 northern pike/hour. The total reported harvest rate (THUE) was 0.027 northern pike/hour, while the TCUE for legal-length fish (>63cm TL) was 0.269 northern pike/hour. A TCUE of 0.094 northern pike/hour was observed from the test fishery. June showed the highest observed CPUE for the sport fishery (Table 3) while July was the only month that northern pike were captured in the test fishery. Monthly observed and estimated catch and harvest data are shown in Table 3.

Table 3. Catch per unit effort (CPUE) values observed and estimated through bootstrapping, with high and low confidence limits (HCL and LCL), for each month at Graham Lake, Alberta, 2004.

Norhern Pike	June	July	August
Sport fishery CPUE			
Observed	0.338	0.307	0.011
Estimate	0.355	0.220	0.010
LCI	0.245	0.115	0.000
HCI	0.485	0.405	0.020
Sport fishery HPUE			
Observed	0.023	0.040	0.000
Estimate	0.026	0.024	-
LCI	0.010	0.010	-
HCI	0.052	0.038	-
Test fishery CPUE			
Observed	0.000	0.103	0.000
Estimate	-	0.290	-
LCI	-	0.050	-
HCI	-	0.680	-

Total angler catch of northern pike during the 2004 Graham Lake survey was estimated at 1580 fish (95% CL 1120 - 2140) (Figure 8). Angler harvest of northern pike during the survey was estimated at 142 fish (95% CL 92 - 216) (Figure 9). This results in a total estimated harvest of 361.96 kg of northern pike (95% CL 234.51 – 550.58) or 0.087 kg/ha (95% CL 0.056 – 0.132).

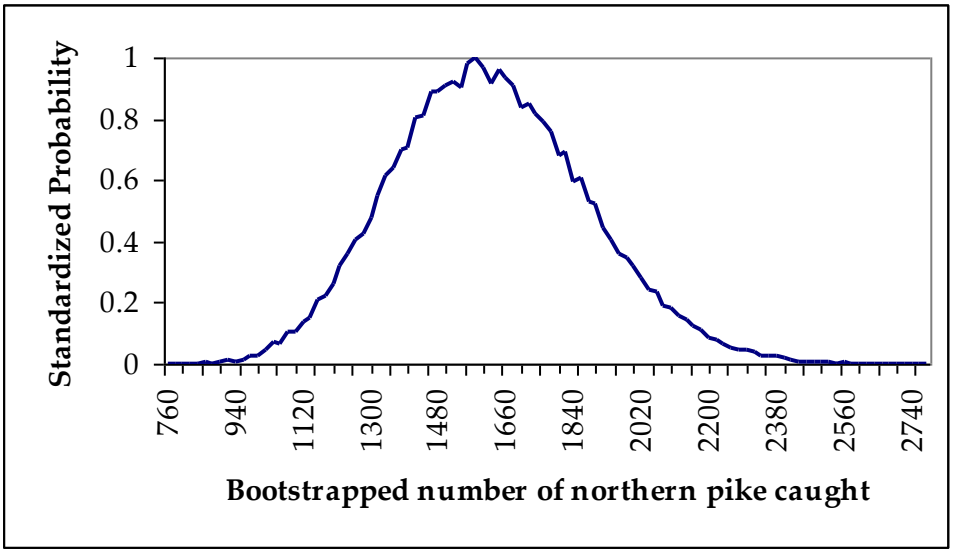

Figure 8. Standardized probability density function of the number of northern pike caught during the sport fishery at Graham Lake in 2004 (1580 northern pike; 95% CL= 1120 - 2140).

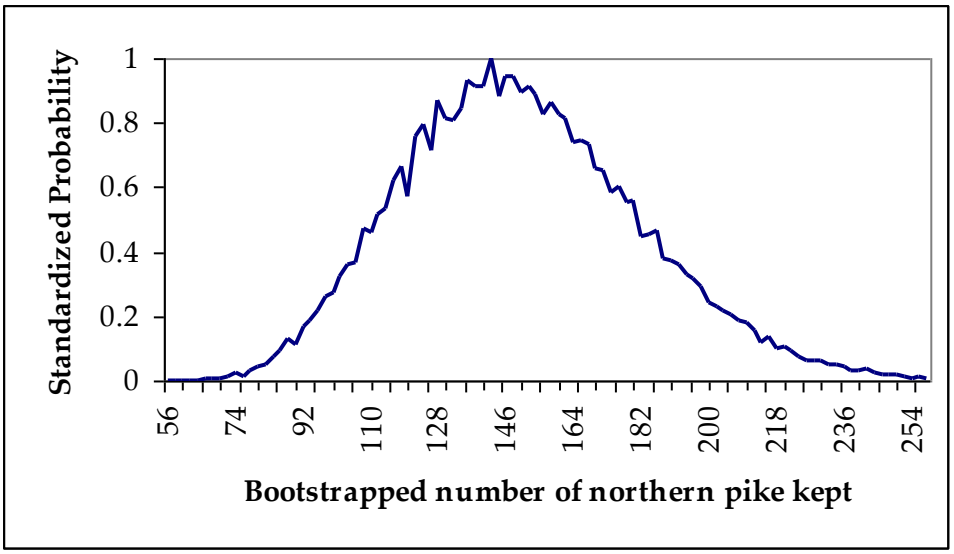

Figure 9. Standardized probability density function of the number of northern pike kept during the sport fishery at Graham Lake in 2004 (142 northern pike; 95% CL= 92 - 216).

Anglers reported a release rate of 0.29 northern pike/hour, resulting in an estimated release of 1438 northern pike (i.e., total harvest estimate subtracted from total catch estimate). Angler exaggeration was assessed by comparing the proportion of legal-length northern pike to protected-length northern pike caught in the test fishery to the reported proportion of legal to sub-legal northern pike from anglers (Sullivan 2003). Not all legal northern pike were harvested therefore it was assumed that anglers did not exaggerate their catch of these fish. The estimated number of protected-length northern

pike released differed from the reported number by 14.5% (258 estimated, 302 reported). This suggests that angler exaggeration may have occurred.

4.4 Walleye Sport Fishery Assessment

Length-Class Distribution

Harvested walleye ranged in size from 49 mm to 707 mm TL with a mean of 579.7 mm TL (n=226) (Figure 10). Walleye captured in the test fishery ranged from 314 mm to 665 mm TL with a mean of 520.9 mm (n=63) (Figure 10). Walleye captured during the September 2004 index netting ranged from 116 mm to 682 mm with a mean of 500.1 mm (n=88) (Figure 10).

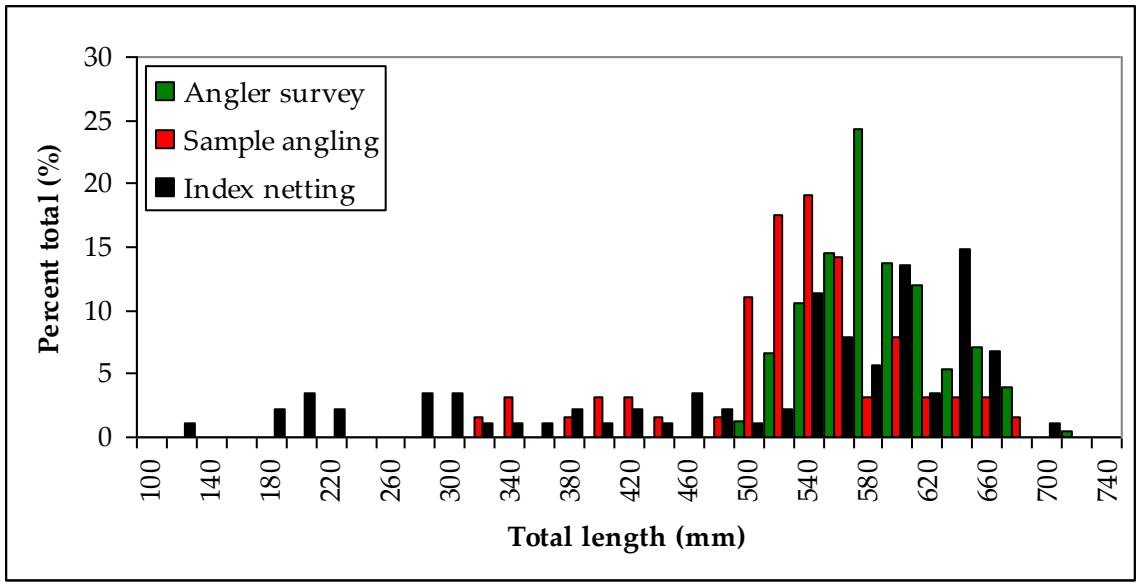

Figure 10. Length-class distributions of walleye captured during the summer creel survey, summer test fishery, and index netting at Graham Lake in 2004 (mean length: angler survey = 579.7 mm, n= 226; test fishery = 520.9 mm, n=63; index netting = 500.1 mm, n=88).

Age- Class Distribution

Harvested walleye ranged in age from 9 to 21 years with a mean of 13.3 years (n=224) (Figure 11). Walleye captured in the test fishery ranged in age from 4 to 18 years with a mean of 11.0 years (n=57) (Figure 11). Fish sampled from index netting ranged in age from 1 to 17 years with a mean of 10.4 years (n=83) (Figure 11).

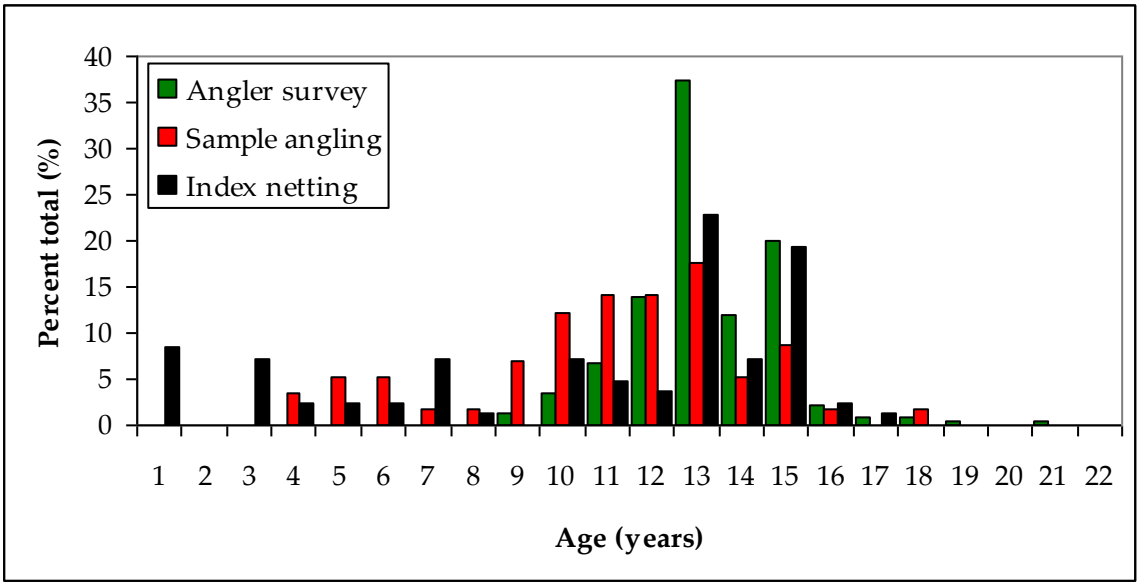

Figure 11. Age-class distributions of walleye observed in the angler survey, test fishery, and index netting at Graham Lake in 2004 (mean age: angler survey = 13.3, n= 224; test fishery = 11, n=57; index netting = 10.4, n=83).

Growth

Length and age data from fish sampled from the angler survey, test fishery, and index netting were combined to produce a von Bertalanffy growth curve (Figure 12). The theoretical maximum length (L_∞) of walleye was found to be 636.3 mm FL (672.7 mm TL) with a growth coefficient (K) of 0.1496. With these growth characteristics it would take 9.0 years to produce a harvestable walleye (>50 cm).

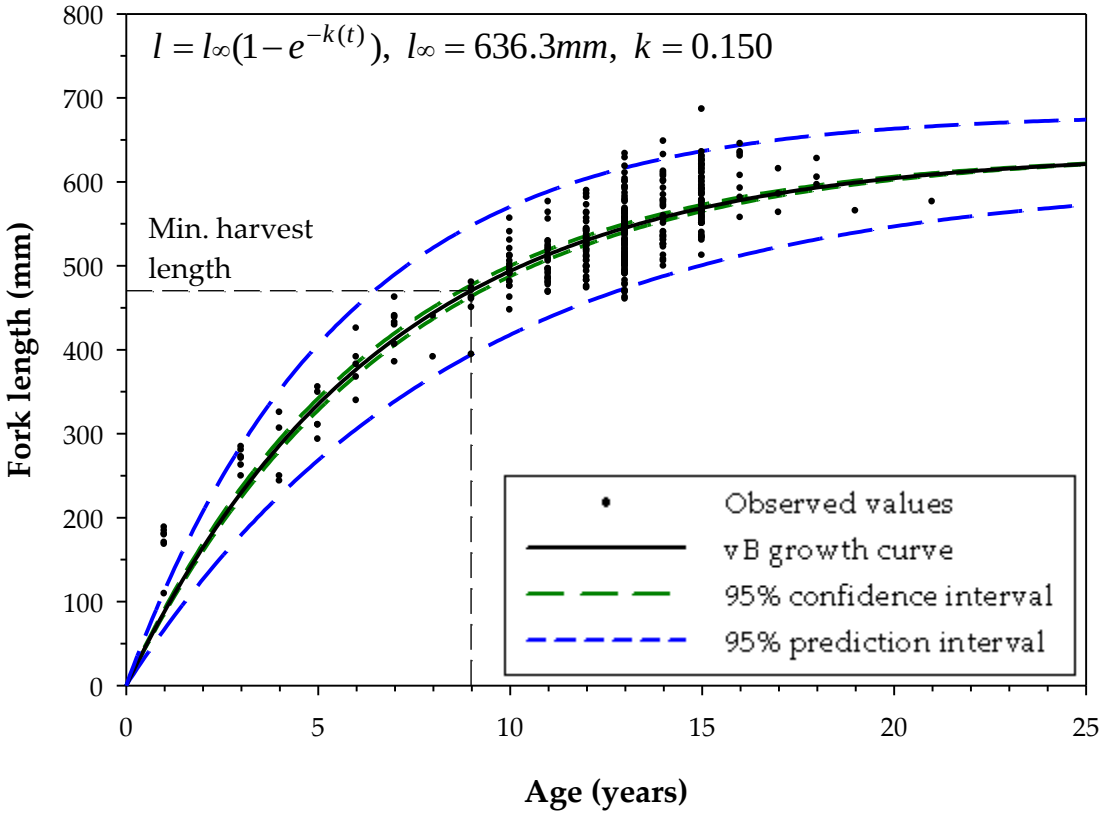

Figure 12. von Bertalanffy growth function, confidence, and prediction intervals (95%) of the regression for walleye observed in the angler survey, test fishery, and index netting at Graham Lake in 2004 (n=363). Confidence intervals describe the range where the regression line values will fall 95% of the time for repeated measurements. Prediction intervals describe the range where the data values will fall 95% of the time for repeated measurements.

Condition

Data from the angler survey, test fishery, and index netting in 2004 were compiled in order to assess the relative weight (W_r) of walleye. No significant differences were found between male and female W_r in each of the length classes (sub-stock, stock, quality, preferred, and memorable) (T-test: $P>0.05$). Therefore, weight data from males and females were pooled. Mean W_r and 95% confidence limits of each length class are shown in Figure 13.

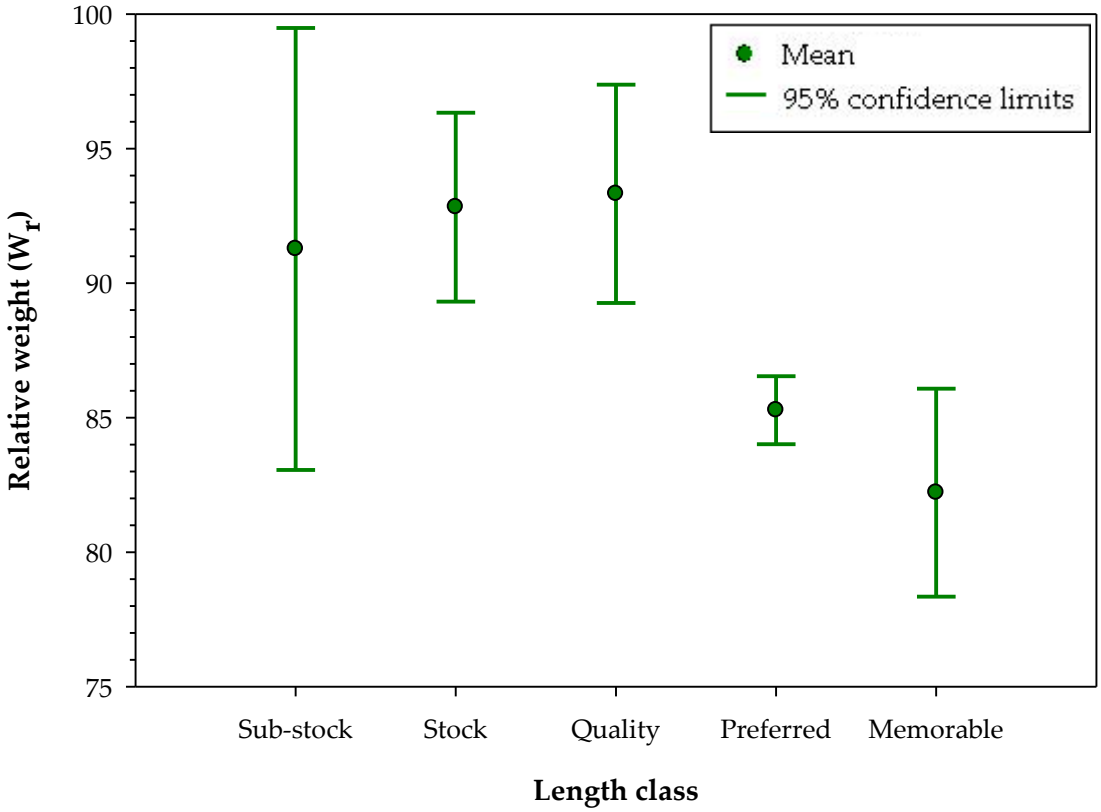

Figure 13. Walleye relative weight and 95% confidence limits for different length classes at Graham Lake 2004 (angler survey, test fishery, and index netting). Sub-stock (<250 mm total length), Stock (250-379 mm total length), quality (380-509 mm total length), preferred (510-629 mm total length), and memorable (630-759 mm total length).

Summary of sport fishery parameters

A summary of several factors describing the walleye sport fishery is provided in Table 4.

Table 4. Summarized walleye sport fishery parameters.

Metric	Data value
Fish harvested/ hr (HPUE) (>50 cm TL)	0.13
Fish caught /hr (TCUE)	0.80
# Measurable Age-classes from index netting	15
Age at 50 cm TL	9.0
Mean Weight (kg) (> 50 cm TL)	1.76
PSD (% walleye >379 mm TL max) (Test-angling DATA)	94%
RSD (% walleye 250-379 mm TL stock) (Test-angling DATA)	6%
% Success (% anglers catching 1 or more legal-size walleye)	40%

4.5 Northern Pike Sport Fishery Assessment

Length-Class Distribution

Harvested northern pike ranged in size from 640 mm to 1020 mm TL with a mean of 744.3 mm TL (n=61) (Figure 14). Northern pike captured in the test fishery ranged from 580 mm to 1033 mm TL with a mean of 675.6 mm (n=18) (Figure 14). Northern pike captured during the September 2004 index netting ranged from 444 mm to 929 mm with a mean of 720.4 mm (n=27) (Figure 14).

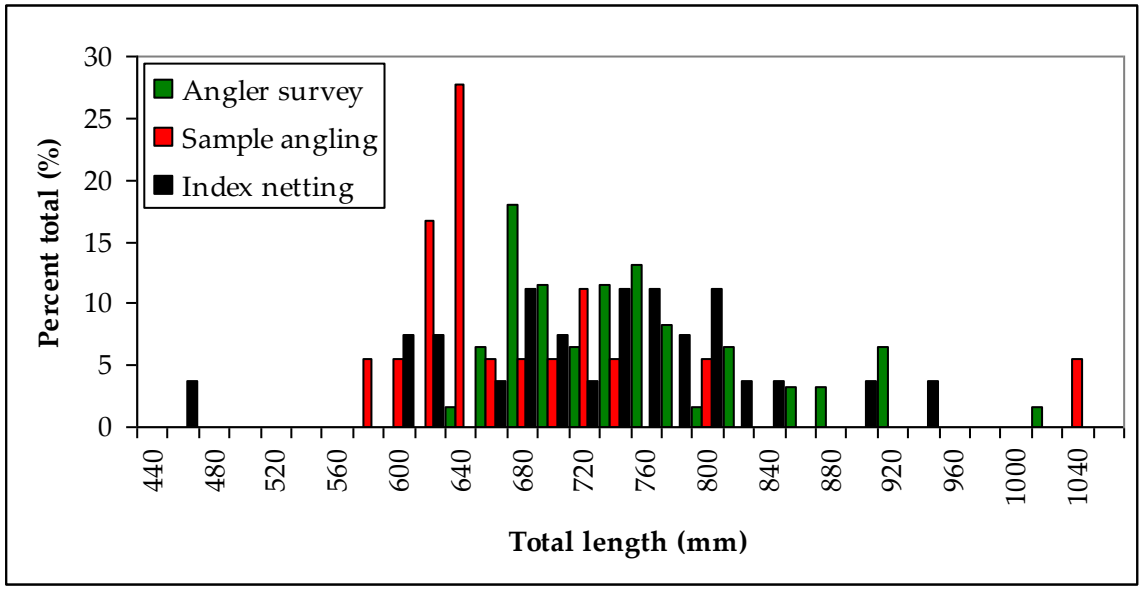

Figure 14. Length-class distributions of northern pike observed in the angler survey, test fishery, and index netting at Graham Lake in 2004 (mean length: angler survey = 744.3 mm, n=61; test fishery = 675.6 mm, n=18; index netting = 720.4 mm, n=27).

Age- Class Distribution

Harvested northern pike ranged in age from 6 to 14 years with a mean of 9.3 years (n=56) (Figure 15). Northern pike captured in the test fishery ranged in age from 3 to 13 years with a mean of 7.6 years (n=19) (Figure 15). Fish sampled from index netting ranged in age from 3 to 16 years with a mean of 9.2 years (n=25) (Figure 15).

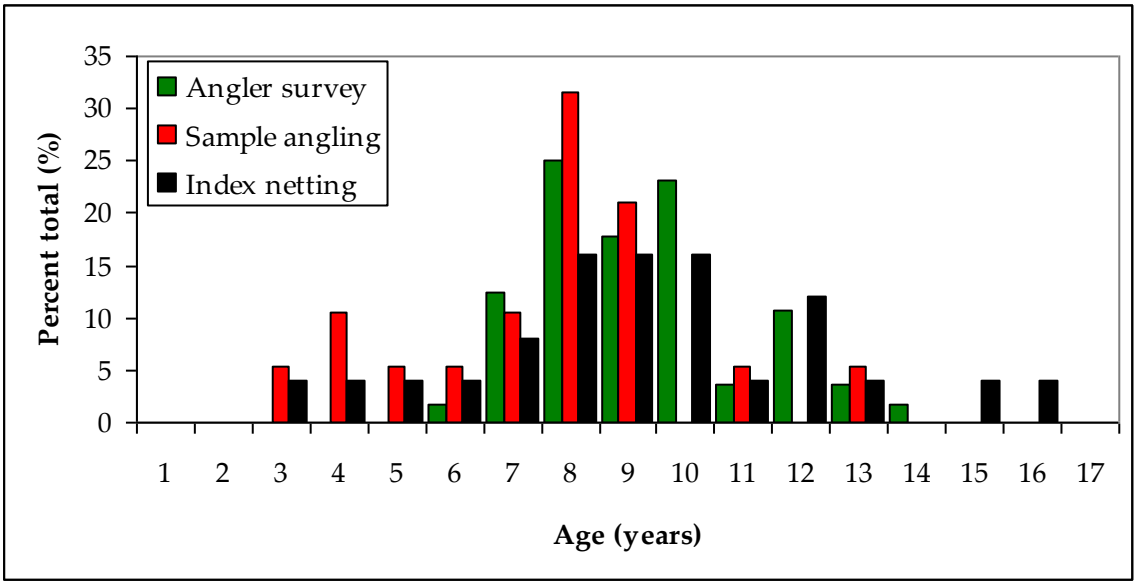

Figure 15. Age-class distributions of northern pike observed in the angler survey, test fishery, and index netting at Graham Lake in 2004 (mean age: angler survey = 9.3, n= 56; test fishery = 7.6, n=19; index netting = 9.2, n=25).

Growth

Length and age data of fish sampled from the angler survey, test fishery, and index netting were combined to produce a von Bertalanffy growth curve (Figure 16). The theoretical maximum length (L_∞) was found to be 817.5 mm FL (857.3 mm TL) with a growth coefficient (K) of 0.219. With these growth characteristics it would take 6.3 years to produce a harvestable northern pike (>63 cm).

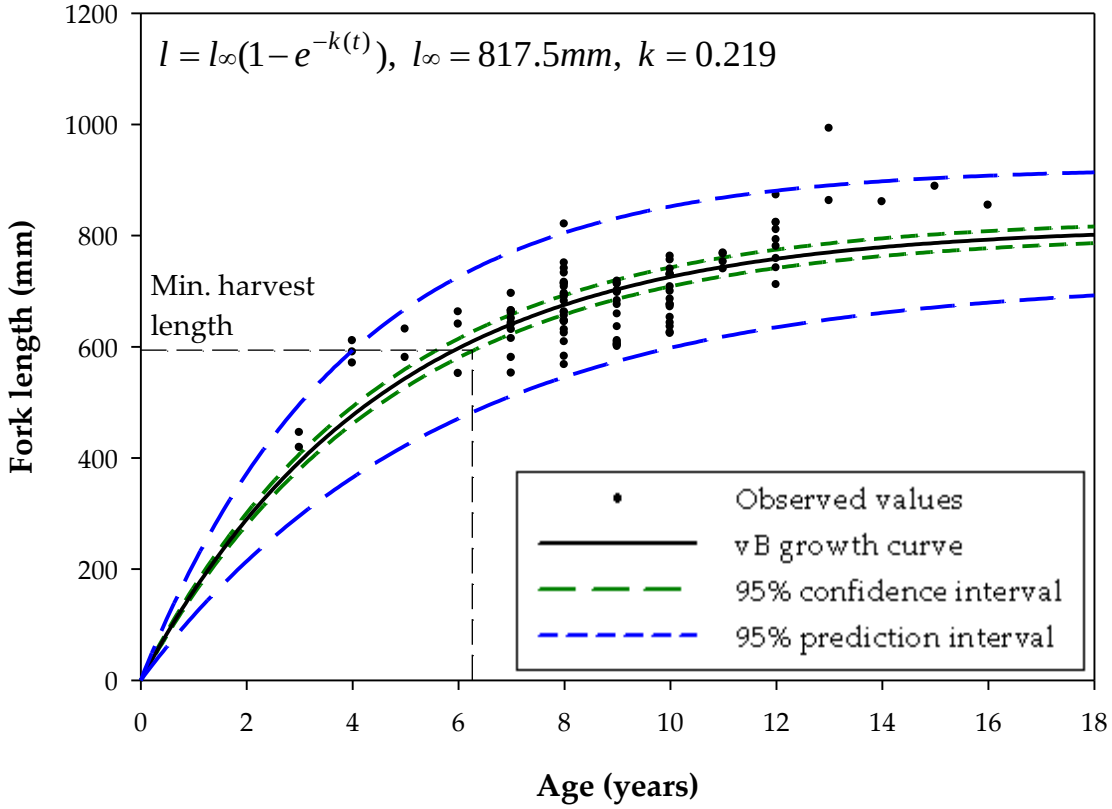

Figure 16. von Bertalanffy growth function, confidence, and prediction intervals (95%) of the regression for northern pike sampled from the test-fishery and index netting at Graham Lake in 2004 (n=97). Confidence intervals describe the range where the regression line values will fall 95% of the time for repeated measurements. Prediction intervals describe the range where the data values will fall 95% of the time for repeated measurements.

Condition

Data from the angler survey, test fishery, and index netting in 2004 were compiled to assess the relative weight (W_r) of northern pike. A significant difference in W_r between males (mean = 93.48; n = 14) and females (mean = 86.10; n = 16) was found for the quality length class of 2004 (T-test: P = 0.0144) but no differences were found between males and females for other length classes. Pooled (i.e., both sexes combined) mean W_r and 95% confidence limits of each length class are shown in Figure 17. While W_r means and confidence limits for the quality length class (530-709 mm TL) are shown separately for males and females in Figure 18.

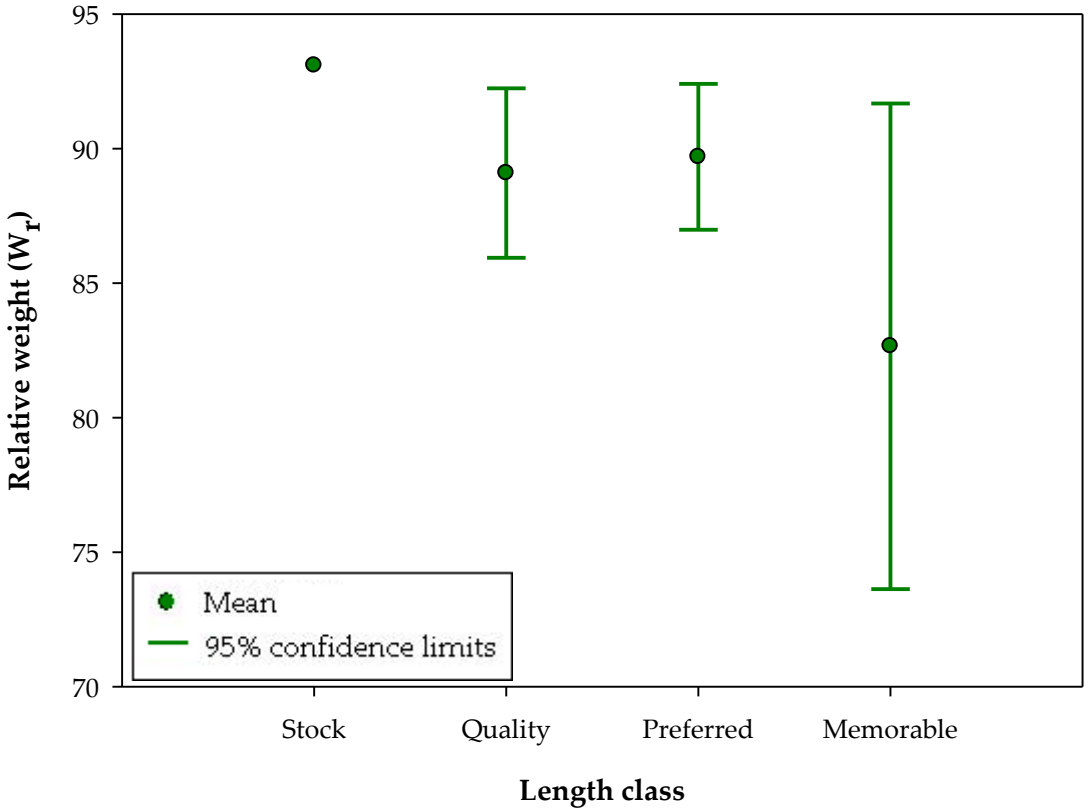

Figure 17. Northern pike relative weight and 95% confidence limits for different length classes from Graham Lake 2004 (angler survey, test fishery, and index netting). Stock (350-529 mm total length), quality (530-709 mm total length), preferred (710-859 mm total length), and memorable (860-1119 mm total length).

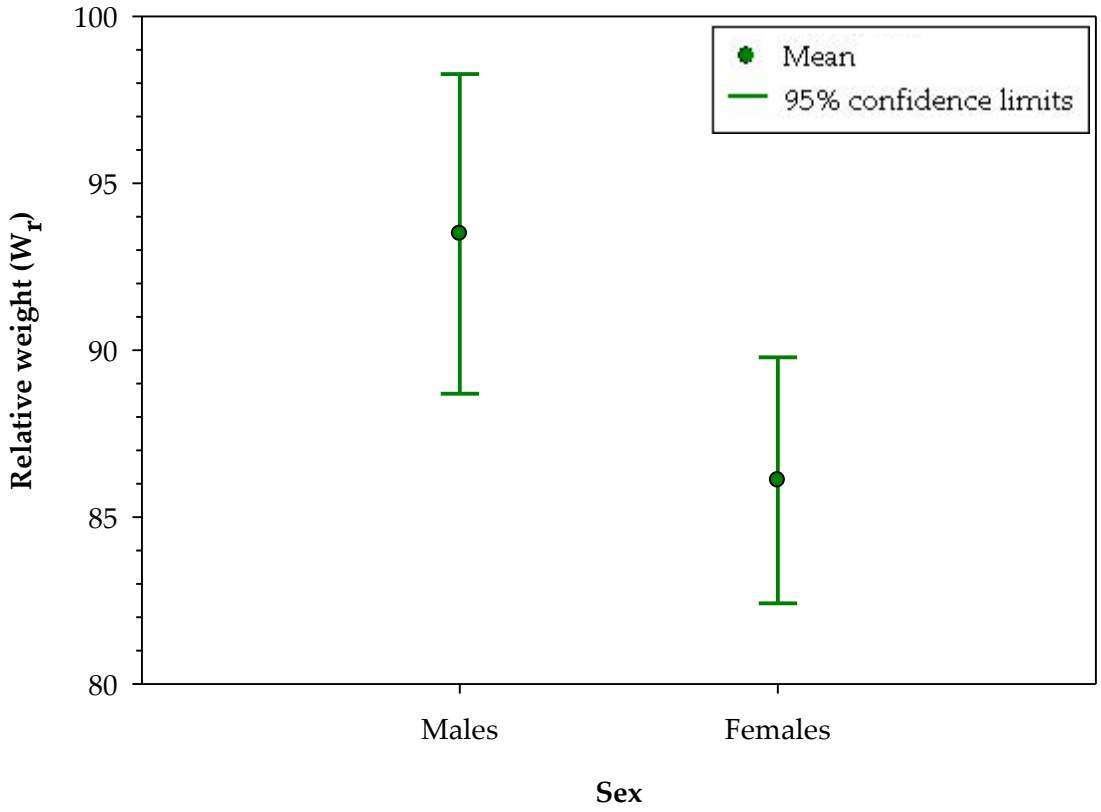

Figure 18. Male and female northern pike relative weight and 95% confidence limits for the quality length class (530-709 mm total length) from Graham Lake 2004 (angler survey, test fishery, and index netting).

Summary of sport fishery parameters

A summary of several factors describing the northern pike sport fishery is provided in Table 5.

Table 5. Summarized northern pike sport fishery parameters.

Metric	Data value
HPUE fish harvested/ hr (>63 cm TL)	0.03
TCUE fish caught /hr	0.31
# Measurable Age-classes from index netting data	13
Age at 63 cm TL	6.3
Mean Weight (kg) (> 63 cm TL)	2.55
PSD (% northern pike >529 mm TL max) (Test-angling DATA)	100%
RSD (% northern pike 350-529 mm TL stock) (Test-angling DATA)	0%
% Success (% anglers catching 1 or more legal-size pike)	28%

5.0 Summary

An estimated 2240 (95% confidence limits (CL) 1520-3640) anglers fished the lake from 13 May to 23 August 2004. The angling pressure exerted on Graham Lake was 1.19 angler hours per hectare (hours/ha) (95% CL 0.91-1.57 hrs/ha).

The total catch per unit effort of walleye (TCUE) observed from the survey was 0.80 fish/hr, while the total harvest per unit effort (THUE) was 0.13 fish/hr. The total walleye harvest (yield) was estimated at 0.29 kg/ha (95% CL 0.20-0.38 kg/ha). In contrast, the overall catch rate of northern pike TCUE was 0.31 fish/hr, while the estimated THUE was 0.03 harvested fish/hr.

The von Bertalanffy growth function resulted in an estimated 9.0 years to produce a harvestable walleye (≥50cm total length) and 6.3 years to produce a harvestable northern pike (≥63cm total length).

Although angling pressure at Graham Lake during the summer may be considered low at the time of this survey. Improved access and upgrading of facilities at this lake may result in an increase in pressure that can now be monitored and compared to previous levels.

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