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Assessment of Winter Sport Fishery for Lake Whitefish and Northern Pike at Wabamun Lake, Alberta, 2004-2005

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EXECUTIVE SUMMARY

For the past several decades, Wabamun Lake has supported provincially important commercial and sport fisheries for lake whitefish (*Coregonus clupeaformis*) and northern pike (*Esox lucius*). In particular, Wabamun Lake is notable for its winter sport fisheries for these species. In response to angler concerns regarding decreasing fishing success in the lake, the Alberta Conservation Association conducted a creel survey during the winter of 2004-2005 to provide estimates of angler effort and stock yields for lake whitefish and northern pike.

Based on angler interviews conducted from 10 December 2004 to 28 March 2005, an estimated 8,900 anglers (95% CI = 7,425 – 10,503) fished Wabamun Lake for approximately 32,000 h (95% CI = 26,212 - 37,580), with an average of 1.4 lines (rods) per angler, generating approximately 4 angler-h/ha (95% CI = 3.3 – 4.7) and 5.7 rod-h/ha (95% CI = 4.7 – 6.7) of fishing pressure. The majority (86.3%) of lake whitefish anglers (n = 226) used only one line.

Anglers caught 0.108 lake whitefish/h. The estimated angler harvest of lake whitefish was 3,287 fish (95% CI = 2,531 – 4,155), with an estimated mean weight of 0.94 kg/fish (95% CI = 0.91 – 0.96 kg, n = 284). This produced an estimated yield of 0.39 kg/ha (95% CI = 0.30 - 0.49). Few whitefish were released and incidental hooking mortality was inconsequential. Fishery and biological parameters indicated the lake whitefish stock was in a recruitment-overfished state.

The majority (72.2%) of northern pike anglers (n = 122) used two lines (rods). Anglers caught 0.190 pike/rod-h, and reported a release rate of 0.128 fish/rod-h. Estimated angler harvest of northern pike was 3,263 fish (95% CI = 2,381 – 4,077, n = 55). The estimated mean weight of harvested northern pike was 2.99 kg/fish (95% CI = 2.69-3.29), resulting in a yield estimate of 1.23 kg/ha (95% CI = 0.94 – 1.57). Anglers released an estimated 7,240 northern pike (95% CI = 6,045 – 8,535), with assumed 10% incidental hooking mortality, for a total yield estimate (harvested + hooking mortality) of 1.51 kg/ha (95% CI = 1.17-1.89). Fishery and biological parameters indicated the northern pike stock was in a growth-overfished state.

Key words: Wabamun Lake, lake whitefish, northern pike, sport fishery, catch rate, size distribution, harvest, yield, age, growth.

ACKNOWLEDGEMENTS

The Alberta Conservation Association funded this creel survey. Survey technician Kevin Yacyshyn made an essential contribution to this project. Special thanks are extended to Stephen Spencer and Michael Sullivan (Alberta Sustainable Resources Development, Fisheries) for their assistance with survey design and reporting. We also thank the Alberta Sustainable Resources Development, Enforcement Services, for allowing the use of their cabin on Wabamun Lake.

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1.0 INTRODUCTION

1.1 General introduction

Prior to 1995, high fishing pressure, combined with high fish harvests resulted in the over-harvest of many of Alberta's fish populations, including whitefish (*Coregonus clupeaformis*) and northern pike (*Esox lucius,* hereafter referred to as pike) (Sullivan 2003a). Consequently, the Alberta Sustainable Resource Development (ASRD) developed a management strategy in 1999, the Alberta's Northern Pike Management and Recovery Plan (NPMRP) (Berry 1999) to aid in the recovery of pike populations throughout the province. Using strategies identified in the NPMRP, a province-wide pike sport fishing regulation was implemented in 1999. Each pike population was assessed and assigned a management status category. The three management categories are collapsed, vulnerable, or stable and are based on their degree of exploitation. Sport fishing regulations were then altered or justified based on assigned status. As a result of these assessments, the majority of pike populations, including Wabamun Lake, were classified as stable-recreational fisheries (Berry 1999). This classification allowed anglers a daily harvest of three pike > 63 cm (total length (TL)).

No similar province-wide management plan exists for lake whitefish, although this species is the target for commercial and winter sport fisheries on several lakes throughout Alberta. The winter sport fishery for lake whitefish at Wabamun Lake is provincially important and notable for the large number of anglers it attracts (Spencer, pers. comm. ASRD Fisheries Biologist). In April 2004, in response to concerns about the declining lake whitefish population in Wabamun Lake, fishing regulations were changed to lower the daily harvest limit from 10 to 3 fish, with a zero harvest limit (catch-and-release) imposed during the spawning period (1 October to 30 November). No size limit exists for lake whitefish in Wabamun Lake.

1.2 Study rationale

Increasing concern regarding declining winter angler satisfaction at Wabamun Lake (Spencer, pers. comm. ASRD Fisheries Biologist) created the need to assess the status of the lake whitefish and pike populations and winter sport fisheries on the lake. As a

result, a creel survey was jointly conducted by the Alberta Conservation Association (ACA) and ASRD on the lake during the winter of 2004-2005. Creel surveys are a non-invasive technique that can effectively estimate the parameters required for the effective management of sport fisheries (e.g., angler use, sport fish yield, and sport fishery structure).

The purpose of this survey was to provide ASRD with current data describing the population structure and abundance of the lake whitefish and pike and attributes of the sport fisheries (e.g., fishing pressure, catch distribution, catch rate) at Wabamun Lake for the winter of 2004-2005.

2.0 STUDY AREA

Wabamun Lake is located in the North Saskatchewan River drainage, approximately 90 km west of Edmonton, Alberta (Figure 1). The lake has a surface area of approximately 81.8 km^2 and mean and maximum depths of 6.3 and 11 m, respectively (Mitchell and Prepas 1990). The trophic status of the lake is mesotrophic (Mitchell and Prepas 1990). Several small creeks around the lake provide intermittent inflow from the surrounding drainage basin. Given sufficiently high water level, the lake is drained at the east end via Wabamun Creek, which flows into the North Saskatchewan River. The lake is classed as evaporative due to the absence of a permanent outlet (R.L. & L. Environmental Services 1987).

Wabamun Lake is influenced by industrial development. A Canadian National (CN) railway crosses the lake at the mouth of Moonlight Bay on the east end and then runs for approximately 15 km along the north shore (Figure 1). The drainage basin has been modified by coal-mining operations north and south of the lake. Since 1997, the lake also receives water pumped from the North Saskatchewan River via a pipeline, to compensate for industrial water use and increased evaporative loss related to the operation of two adjacent coal-fired electrical generating stations, the Wabamun Power Plant and Sundance Generating Station, both of which also draw lake water for generator cooling (TransAlta 2005). Prior to entering the lake, this water is passed through a chlorination and ozone treatment process at the Sundance Water Treatment

Plant. Spent, warmed cooling water from the power plant is discharged directly into the lake. Cooling water discharged from the Sundance plant flows into an off-lake cooling pond. As a result of the inflow of warmed and treated water, a large portion of the eastern half of the lake is free of ice-cover during the winter.

In addition to the power plants, there is extensive residential development around the lake. Wabamun Lake Provincial Park is located at the east end of the lake, adjacent to Wabamun Indian Reserve (IR 133A; Figure 1). The town of Wabamun is located on the north shore, and the hamlet of Seba Beach is at the west end. Numerous summer villages are located around the lake. Public boat launches are located at the town of Wabamun, the Provincial Park, Sundance plant, and Seba Beach. Winter vehicle and foot access is also provided at numerous road allowances and reserve lands within summer villages. An ASRD Fish and Wildlife Officers' (FWO) cabin is located on the north shore, at Fallis Point. A more complete description of Wabamun Lake can be found in Mitchell and Prepas (1990).

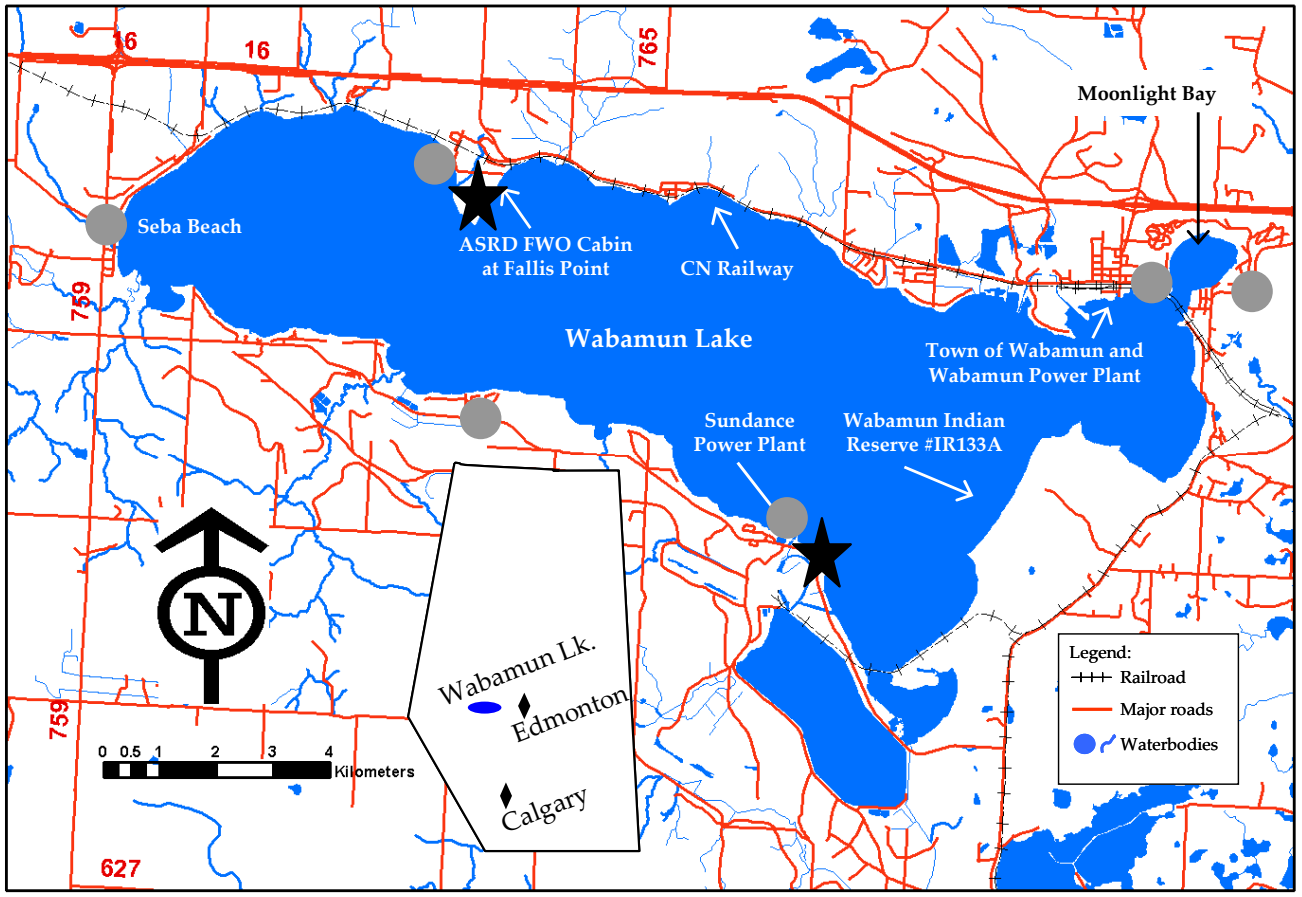

Figure 1. Map of Wabamun Lake, Alberta, showing the 2004-2005 winter creel survey sites (grey dots). Black stars indicate the location of vantage points from which instantaneous counts were conducted. Inset is map of the province of Alberta.

3.0 MATERIALS AND METHODS

3.1 Survey design

From 10 December 2004 to 28 March 2005, a roving-access survey (Pollock et al. 1994) was conducted at Wabamun Lake. Surveys of this type combine instantaneous counts of anglers with information gathered from completed fishing trips. One survey technician interviewed anglers who had completed their fishing activities and were leaving the lake. These access points where the completed-trip-interviews were conducted are indicated on Figure 1. Incomplete fishing trip data was collected also as anglers were encountered. Instantaneous counts, stratified by day and hour of day, were conducted of anglers and tents located on the lake during the survey period. Biological data (e.g., species, length, weight, age sample) were collected from fish harvested by anglers. Test fishing was conducted throughout the survey period to collect additional information about the size and age distribution of the pike population.

3.2 Creel survey

3.2.1 Angler interviews

At random intervals throughout the survey period, the technician interviewed anglers who had completed their fishing activity and either driving or walking off the lake through known access points. All members of fishing parties were interviewed. Anglers were asked a series of questions regarding the number of hours fished, fishing method, targeted species and number of lake whitefish and northern pike, and other species, kept and released. As the use of up to three lines by ice anglers was permitted, the number of lines (or fishing rods) used was also recorded. These data were recorded on a creel survey data form (Appendix 1). This information was used to calculate catch and fishing effort and to quantify angler attributes. Catch includes both harvested and released fish unless otherwise noted. Catch rate (i.e., catch-per-unit-effort, CPUE) is the total number of fish caught divided by the total angler effort (angler-h and rod-h).

3.2.2 Spatial extent of survey

The completed-trip-interviews were conducted at six sites (Figure 1). These sites were chosen because they were located on public land, provided quality access, and were used by a large number of anglers. Access points not surveyed included private lakeshore residences located around the lake.

3.2.3 Temporal extent of sampling

The creel survey was stratified into weekdays (Monday-Friday) and weekend days (Saturday-Sunday and statutory holidays). Each day was surveyed from sunrise (approximately 0700 - 0800) to dark (approximately 1700 - 1800). Survey dates and summary information are listed in Appendix 2. Surveys were conducted for five consecutive days during a 7-day rotation. All weekend days and statutory holidays during the period were surveyed, except Christmas Day, Boxing Day, and New Year Day. The survey was not conducted for two weekdays (generally Monday and Tuesday) per week in lieu of weekend days surveyed; however, holidays occurring on Mondays were included in survey days. The weekly schedule was repeated 11 times throughout the survey period.

3.3 Instantaneous angler counts

Instantaneous angler counts were conducted from observation vantage points that afforded views of the entire lake. Instantaneous whole-lake angler counts were conducted from either the north side of the lake (Fallis Point, Wabamun Point) or on the south shore (Sundance Water Treatment Plant outlet canal) (Figure 1). A typical count lasted 5 to 10 min. The number of anglers and tents was recorded for instantaneous counts. Instantaneous counts were stratified by day and hour of day so that variation in angler's use of Wabamun Lake could be determined. Between 2 and 4 counts were conducted for each stratum. The stratified schedule of instantaneous counts conducted is presented in Appendix 3. This information was used to determine angler effort. For the purpose of calculating the parameters of the sport fishery, the length of a fishing day was 9 h and there were 168 days in the survey period.

3.4 Test fishing

Anglers were required to release pike that were shorter than the minimum size limit i.e., protected-length fish (< 63 cm TL) and therefore, were unable to provide any biological data for this size group. Hence, test fishing was conducted throughout the survey period to collect additional information on the length frequency distribution of the pike population. The test fishing was conducted by the ACA technician using baits and techniques that would normally be used by recreational anglers. The technician recorded the number of hours fished and the fork length (FL) of all fish caught. The first three rays of the left pelvic fin of pike were collected for age determination. All fish caught during the test fishing were released. To reduce handling time, weight measurements were not conducted on fish captured during test fishing. Therefore, weight (W) was estimated using a length-weight regression, $W = 0.00002(FL^{2.8779})$ ($r^2 = 0.96$, df = 262, $P < 0.05$). The ratio of legal-length fish to protected-length fish sampled during test fishing was assumed to be equal to the corresponding ratio from the sport fishery (Sullivan 2003b). These ratios were compared to determine the angler exaggeration rate, which is the extent anglers overstate their catch, and to estimate the total catch rates of pike. Calculated weights of fish caught during test fishing were applied to incidental mortality (i.e., hooking mortality) and total yield (kg/ha) calculations. The catch rate calculated from test fishing was not included in any of the calculations regarding sport angler catch rate, fishing effort, or fishing pressure.

3.5 Biological fish data

When time permitted, the survey technician collected biological data from fish that were harvested by anglers. Fork length (±1.0 mm) and weight (±0.01 kg) were recorded from all harvested fish. Sex and state of maturity of fish were also recorded. For lake whitefish, several scales were removed from below the dorsal fin, while the cleithra was removed from harvested pike for age determinations according to Mackay et al. (1990).

3.6 Data management and analysis

Data were recorded on field data forms by the survey technician and later transcribed into Microsoft Excel files by a professional data entry service using double entry verification. Prior to analysis, frequency distributions of each creel survey parameter

were calculated and the original data sheets and daily journals used to investigate and verify outliers. Scatter plots of weight-length and length-age were generated to identify outliers which were omitted from analyses if measurement or recording error was suspected.

We used a bootstrap technique to estimate means and associated confidence intervals for number of anglers, number of fishing hour, fishing pressure (h/ha), harvest and yield (kg/ha) of fish. Sullivan (2004) summarized that bootstrapping is a statistical procedure whereby an original sample of the population is subsequently re-sampled and a new mean calculated. Bootstrap samples are assumed to approximate the distribution of values that would have arisen from repeatedly sampling the original population (Haddon 2001). Sullivan (2004) explains that repeating this procedure thousands of times results in a distribution of possible means describing the likelihood of the true (i.e., population) mean being within that distribution. This group of means represents the distribution of possible means from data with the same scale of variation as observed in the original data set. Frequentist parameter estimates (e.g., means) are typically equal to maximum-likelihood estimates (MLE) for the parameter of the specified probability density function (Gotelli 2004). Empirical confidence intervals (95% CI) were calculated following Haddon (2001). The final proportions of the distribution of possible means (i.e., probability densities) were standardized (i.e., Standardized Probability Density (SPD)) to range between 0 and 1 (Paul et al. 2003).

Each parameter obtained from creel survey data (e.g., number of anglers, number of hours, number of fish caught, and yield) was estimated to include spatial and temporal strata that were not surveyed. Parameters and estimates are presented as a likelihood profile, using the simulation procedure described above and combined by multiplying the likelihood profiles. A flow chart describing the steps for calculating estimates for each creel site and for the survey is presented in Figure 2.

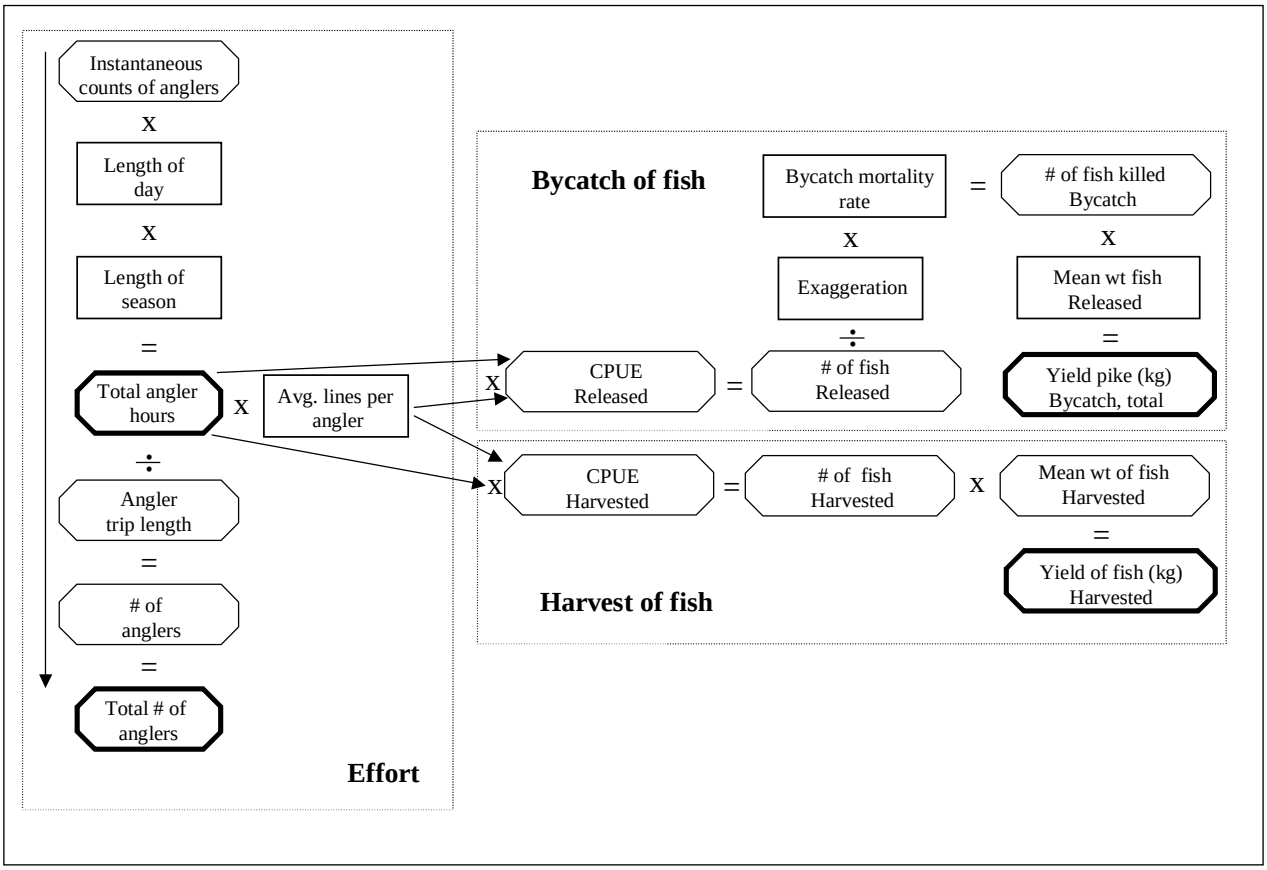

Figure 2. Flow chart outlining the process used for estimating parameters collected from the survey and extrapolated to a survey estimate for Wabamun Lake, winter 2004-2005. Rectangles represent values with no variance (i.e., observed data) and hexagons represent data with variation (i.e., likelihood profiles).

Incidental hooking mortality of angled fish contributes to the overall yield of a sport fishery (Muoneke and Childress 1994). Therefore, hooking mortality was arbitrarily estimated at 10% for both lake whitefish and pike angled during the survey. In Alberta, hooking mortality for walleye was estimated to be 5.3% (95% CI = 4.2 – 6.6, n = 9) (W. Patterson, Unpubl. data). Given the additional stress of being pulled out and put back in the fishing hole during winter it was assumed 10% hooking mortality was reasonable.

The Fulton's condition factor (K) of lake whitefish was calculated using the equation:

$$K = W \times 10^5 / FL^3$$

To quantify catch inequality among pike anglers, Gini coefficients and angler success rates were calculated for pike following procedures in Baccante (1995). A Gini coefficient of 0 indicates all anglers caught an equal number of fish while 1 indicates one person captured all fish.

To quantify size-class parameters for pike, proportional stock density (PSD) and relative stock density (RSD) classifications were calculated following Gablehouse (1984). The PSD is the number of pike caught that are ≥ 530 mm TL, expressed as a proportion of the number of fish ≥ 350 mm TL. A high PSD value indicates a larger portion of mature fish, interpreted as reflecting a stable population. The RSD (stock-quality) is the proportion of pike caught between 350 and 529 mm TL relative to the total number of pike greater than or equal to 350 mm TL.

Analyses were performed using Microsoft Excel 5.0 (Office Pro 2000), using confidence intervals (CI) set at 95%. All data were stored in the Fisheries Management Information System (FWMIS) of Alberta Sustainable Resource Development (ASRD).

4.0 RESULTS

4.1 Fishery survey

During a total of 204 instantaneous counts, 1,781 anglers and 982 tents were observed (Appendix 3). The average number of anglers using an ice-fishing tent was 2.6, resulting in total of 2553 tent anglers. Thus, the overall total number of anglers observed was 4,334. At least 33 counts were conducted for each day-of-week stratum defined as a regular survey day (Wednesday-Sunday). On average, at least twice as many anglers were recorded on weekend days as on weekdays, and the difference between distributions was significant (Figure 3). Approximately one-third of counts

done on weekdays recorded no anglers, whereas the results of weekend counts were similar (Figure 4).

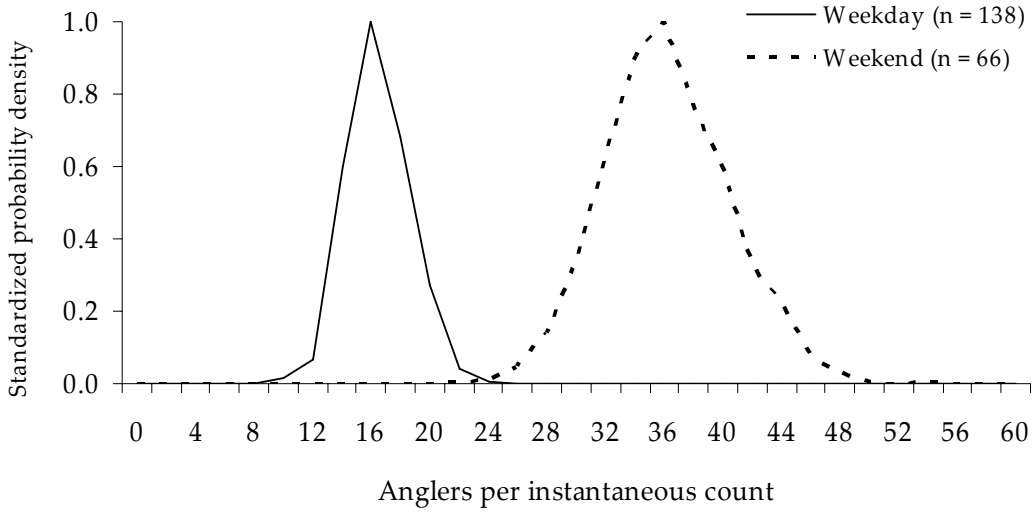

Figure 3. Standardized probability density functions of the number of anglers per instantaneous count on weekdays vs. weekends, at Wabamun Lake, 10 December 2004 – 28 March 2005. The maximum likelihood estimates (MLE) of anglers per count with 95% CI were 15.5 (11.8 – 19.8) for weekdays, and 35.2 (26.8 – 43.6) for weekends.

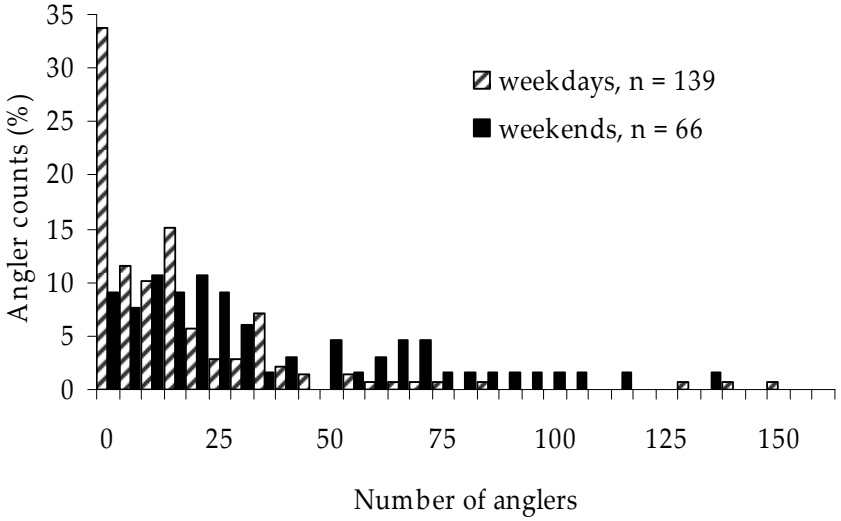

Figure 4. Frequency distribution of number of anglers per instantaneous count on weekend vs. weekdays, Wabamun Lake, 10 December 2004 – 28 March 2005.

A total of 59 days were surveyed from 10 December 2004 to 28 March 2005. Of the 394 anglers interviewed during the survey, the majority (57.4%) indicated they targeted lake whitefish, 31% targeted pike, with the remainder 11.7% indicating no species-specific preferences. The majority of pike anglers (72.2%, n = 122) chose to use two lines (Table 2). Only 13.7% (n = 226) of anglers targeting whitefish used more than one line. Two anglers (0.5%) who targeted pike reported using 3 lines. The majority of anglers targeting lake whitefish used artificial lures (82.3%, n = 226) while anglers targeting pike and those with no specific target most commonly used bait fish. Daily summaries of angler interviews can be found in Appendix 4.

The maximum likelihood estimates (MLE) of number of anglers and fishing effort for the survey period were 8,900 (95% CI = 7,425 – 10,503, n = 394; Figure 5), and 32,000 angler-h (95% CI = 26,212 – 37,580, n = 1,412; Figure 6), respectively. Estimated fishing pressure (Figure 7) was 4.0 angler-h/ha (95% CI = 3.3 – 4.7) or 5.7 rod-h/ha (95% CI = 4.7 – 6.7).

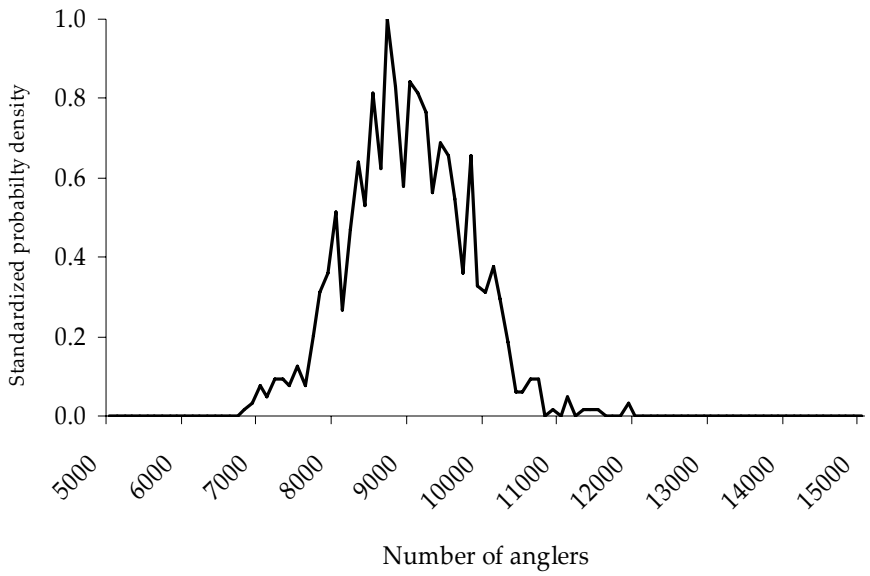

Figure 5 Standardized probability density function of number of angler at Wabamun Lake, 10 December 2004 – 28 March 2005. The maximum likelihood estimate was 8900 anglers (95% CI = 7,425 – 10,503, n = 394).

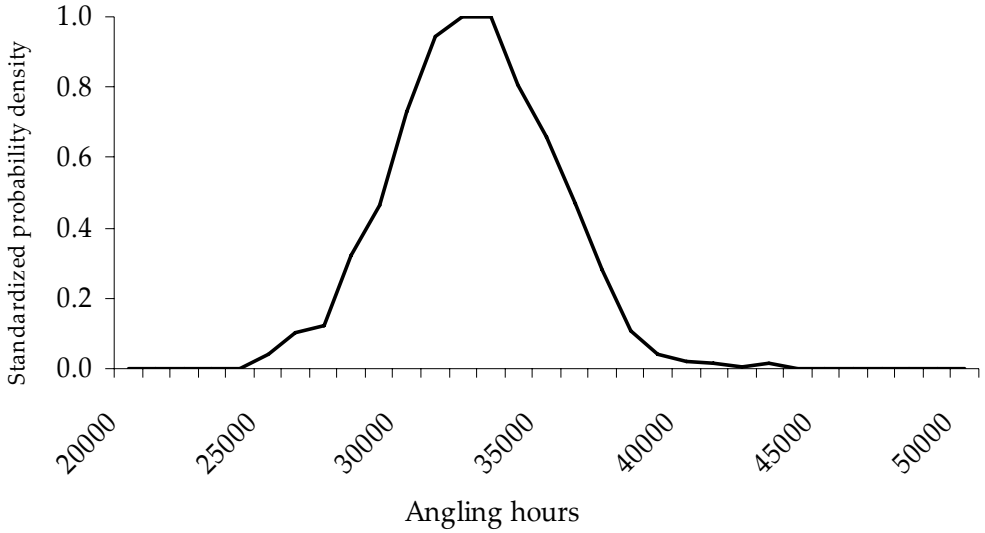

Figure 6 Standardized probability density function of angler-hours at Wabamun Lake, 10 December 2004 – 28 March 2005. The maximum likelihood estimate was 32,000 h (95% CI = 26,212 – 37,580, n = 1,411.5).

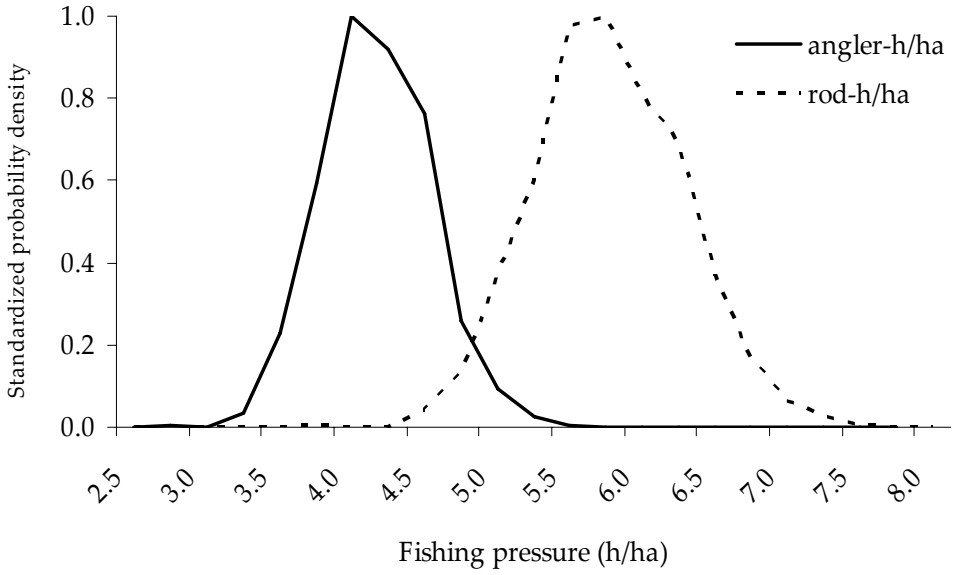

Figure 7. Standardized probability density functions of fishing pressure at Wabamun Lake, 10 December 2004 – 28 March 2005. The maximum likelihood estimates were 4.0 angler-h/ha (95% CI = 3.3 – 4.7) and 5.7 rod-h/ha (95% CI = 4.7 – 6.7).

4.2 Lake whitefish sport fishery

As no species management plan exists for lake whitefish in Alberta, the following subsections are presented according to parameter commonly used to describe fisheries and fish populations.

Age determination was not conducted for lake whitefish. Age determination of Wabamun Lake whitefish is not considered reliable due to inconsistencies in annuli formations attributable to the influence of warm water discharged into the lake by adjacent coal-mining operations (Michael Sullivan, pers. comm. ASRD Biologist).

4.2.1 Catch rate

The catch rate of lake whitefish kept by anglers was 0.103 fish/h, and the reported release rate was 0.005 fish/h, giving a total catch rate of 0.108 fish/h. This catch rate is considerably lower than the total catch rate of 0.6 fish/h reported by Lane (1970) during an angler survey conducted at Wabamun Lake during the winter of 1968-1969.

4.2.2 Harvest and yield

Anglers harvested an estimated 3,287 lake whitefish (95% CI = 2,531 – 4,155, n = 145; Figure 8) at Wabamun Lake during the 2004 - 2005 winter survey. Harvested whitefish had an MLE mean weight of 0.94 kg/fish (95% CI = 0.91 – 0.96 kg/fish, n = 284), which produced a yield of 0.39 kg/ha (95% CI = 0.30 - 0.49; Figure 9). Anglers released an estimated 159 lake whitefish (95% CI = 130 - 189, n = 394).

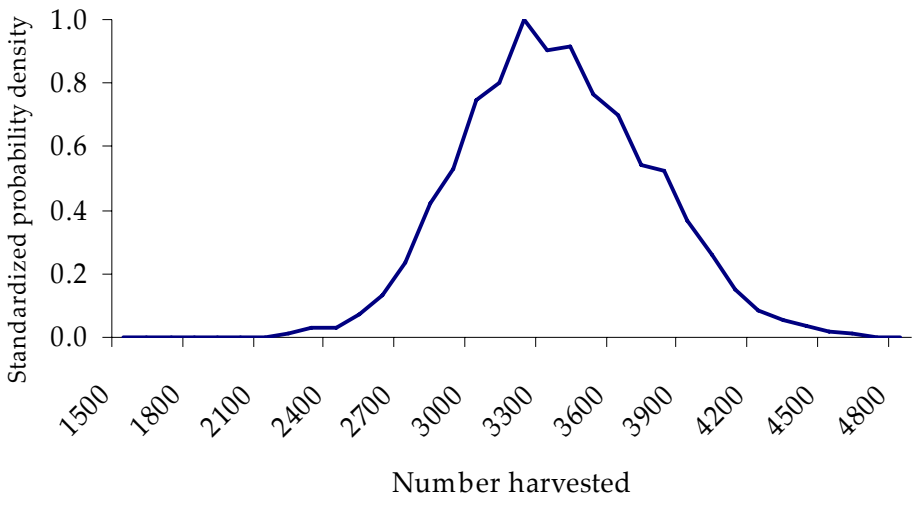

Figure 8. Standardized probability density function of the number of lake whitefish harvested during the sport fishery at Wabamun Lake, 10 December 2004 – 28 March 2005 (MLE = 3,287 whitefish; 95% CI = 2,531 – 4,155).

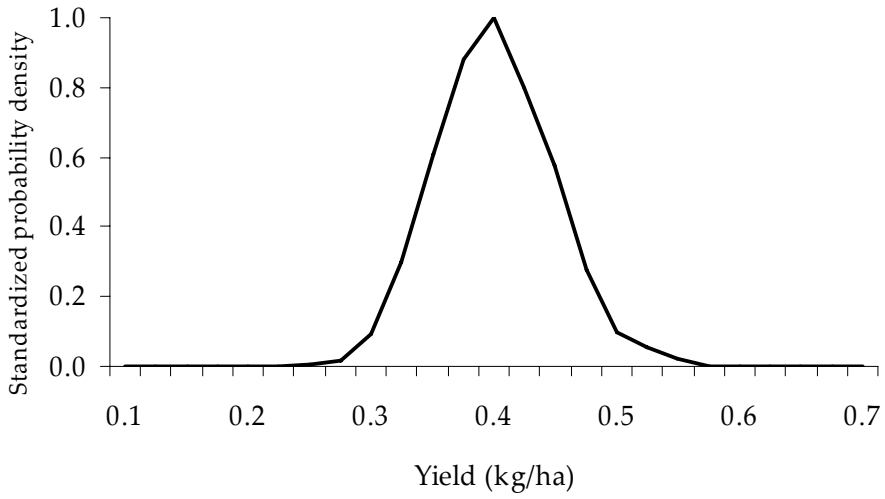

Figure 9. Standardized probability density function of the yield of lake whitefish harvested during the sport fishery at Wabamun Lake, 10 December 2004 – 28 March 2005 (MLE = 0.39 kg/ha; 95% CI = 0.30 - 0.49).

By applying an incidental mortality of 10% and a mean weight of 0.94 kg for released whitefish, the estimated incidental mortality of whitefish released by anglers was 16 fish or 0.002 kg/ha, an inconsequential increase over the harvested yield.

4.2.3 Size-class distribution

The angler-harvested lake whitefish from Wabamun Lake comprised a narrow size-class distribution, with a mean FL of 394 mm (Figure 10). No whitefish under 300 mm FL was harvested during our study, and very few were less than 350 mm. However, this distribution is relatively broad compared to the size distribution of sport-harvested whitefish collected from Wabamun Lake (Lane 1970).

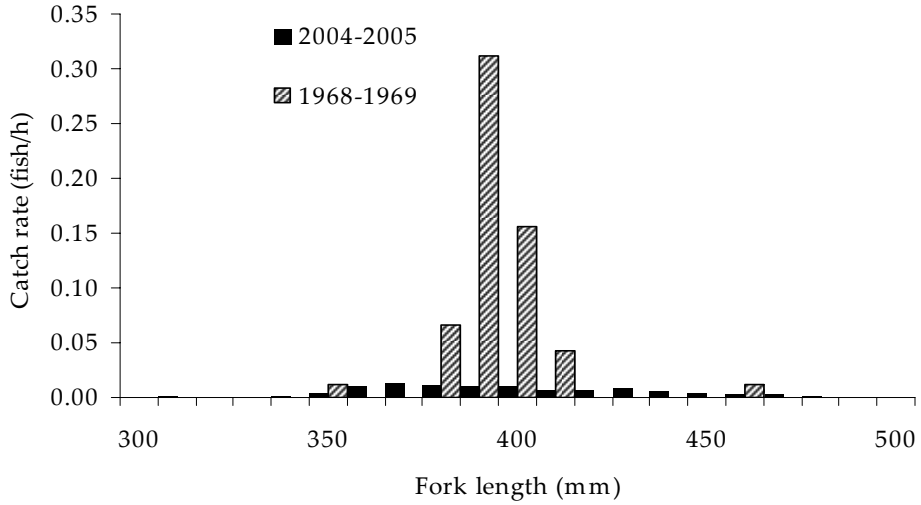

Figure 10. Comparison of length-frequency distributions of lake whitefish harvested during the sport fishery at Wabamun Lake in the winters of 2004-2005 and 1968-1969 (from Lane 1970).

4.2.4 Length-at-maturity

Anglers harvested very few immature lake whitefish (Figure 11). Mature female lake whitefish were first harvested at 307 mm FL, and all female whitefish > 390 mm FL were mature. All male whitefish harvested were mature, with the smallest being 331 mm FL. The average length of mature male and female walleye was 393 and 398 mm FL, respectively.

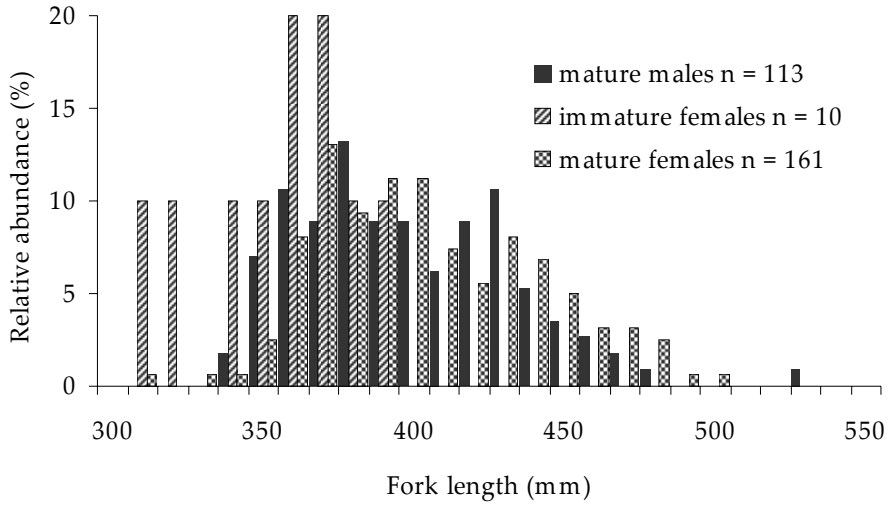

Figure 11. Histogram of fork lengths of lake whitefish, showing length-at-maturity, of 284 lake whitefish harvested from Wabamun Lake, 10 December 2004 – 28 March 2005

4.2.5 Weight-length relationship

The traditional management benchmark for desired average Fulton's condition factor (K) of Wabamun Lake whitefish is 1.2 (Watters, pers. comm.). The average K of angler-harvested whitefish in 2004-2005 was 1.51 (95% CI = 1.17 – 1.88, n = 284). Only 3.2% of harvested whitefish were below a K of 1.2 (Figure 12).

4.3 Northern pike sport fishery

The pike fishery assessment parameters presented herein correspond to the classification metrics described in the NPMRP (Berry 1999) and criteria listed in Sullivan (1998). In addition to those metrics, the size-class distribution of pike is also presented.

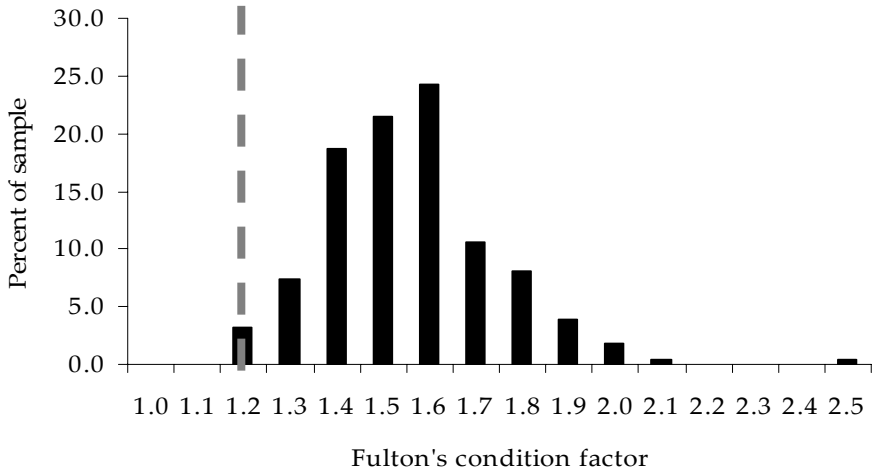

Figure 12. Histogram of Fulton's condition factors (K) of 284 angler-harvested lake whitefish from Wabamun Lake, 10 December 2004 – 28 March 2005. The dashed vertical line indicates the minimum desired average K value for Wabamun Lake.

4.3.1 Catch rate

Catch rates for pike are reported for rod-hour (rod-h) and are assumed to relate to the angler-hour-based catch rates (obtained from open-water angler surveys) used to classify pike fisheries in Alberta. The total reported catch rate of northern pike during the creel survey was 0.190 fish/rod-h. The observed harvest of 96 pike was associated with a catch rate of 0.028 fish/rod-h. Eight of 96 pike sampled during the creel survey were protected-length fish (<63 cm TL). The observed harvest of 88 legal-length pike was associated with a catch rate of 0.026 fish/rod-h. The reported release rates of legal and protected-length pike were 0.035 and 0.128 fish/rod-h, respectively, for a total reported release rate of 0.163 pike/rod-h. Based on the NPMRP guideline, the 0.026 fish/rod-h catch rate for fish ≥ 63 cm that were kept corresponds to a catch rate characteristic of a vulnerable (no risk) pike fishery (Berry 1999). Sullivan (2003b) warns that low catch rates reported by anglers are exaggerated. Following Sullivan and using the protected-length to legal-length ratio from test fishing, we estimated a release rate of 0.042fish/hour. Therefore, the estimated total catch rate for pike was 0.070 fish/h.

4.3.2 Harvest and yield

Based on catch/rod-h, anglers harvested an MLE of 3,263 pike (95% CI = 2,381 – 4,077, n = 55; Figure 13) with a mean weight of 2.99 kg/fish (95% CI = 2,691 – 3,289 kg), resulting in an estimated yield of 1.23 kg/ha (95% CI = 0.94 - 1.57; Figure 14).

The MLE for the number of pike released was 7,240 (95% CI = 6,045 – 8,535, n = 323). By applying an incidental mortality rate of 10% and a mean weight of 1.50 kg/fish, the incidental mortality for pike was 724 or 0.27 kg/ha (95% CI = 0.23 – 0.32). Therefore, the total sport yield of pike during the 2004 survey was estimated to be 3,987 fish and 1.51 kg/ha (95% CI = 1.17 - 1.89).

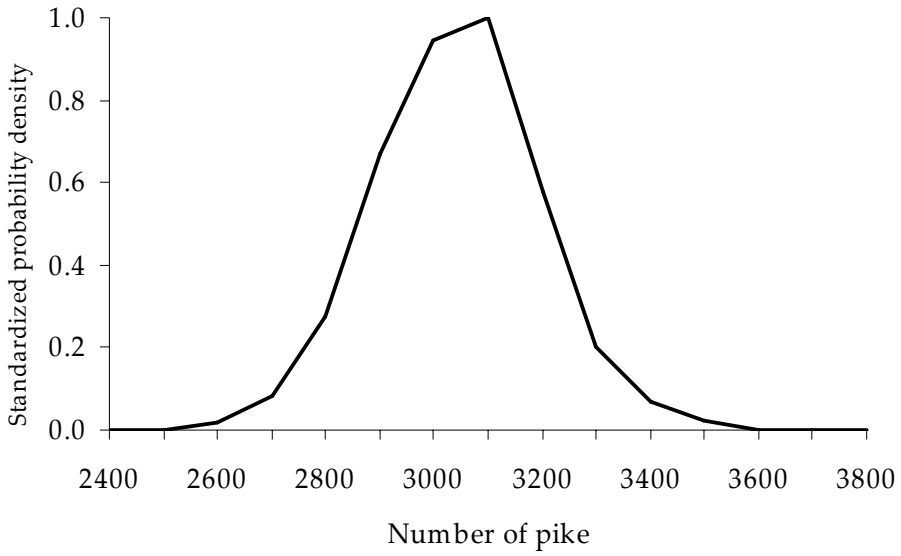

Figure 13. Standardized probability density function of the number of northern pike harvested during the sport fishery at Wabamun Lake, 10 December 2004 – 28 March 2005 (MLE = 3,263 pike; 95% CI = 2,381 – 4,077).

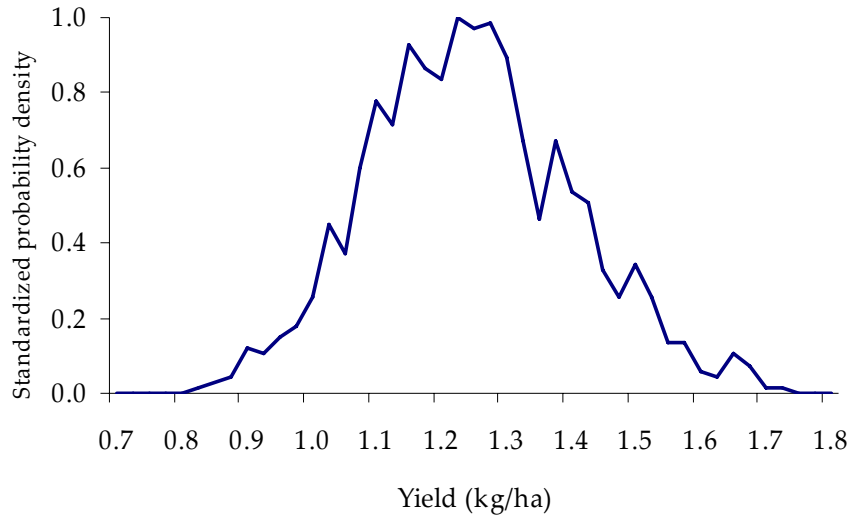

Figure 14. Standardized probability density function of the yield of northern pike harvested during the sport fishery at Wabamun Lake, 10 December 2004 – 28 March 2005 (MLE = 1.23 kg/ha; 95% CI = 0.94 – 1.57).

4.3.3 Age and size distributions

The age distribution of pike harvested during the sport fishery ranged from 3 to 12 years (Figure 15), and the population was primarily represented by four measurable (>0.002 pike/h) cohorts (ages 6 – 9, year-classes 1996 – 1999).

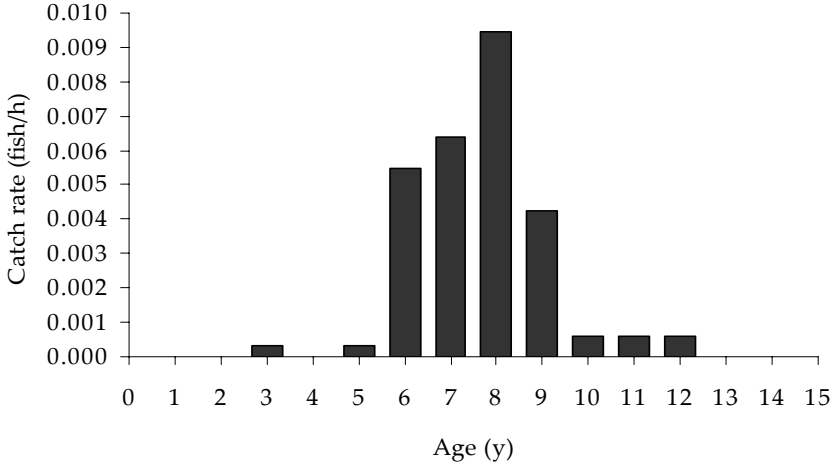

Figure 15. Age-class distribution of northern pike harvested by anglers (mean age = 7.6, n = 92) during the creel survey at Wabamun Lake, 10 December 2004 – 28 March 2005.

The size of pike sampled by test fishing indicates a comparatively strong representation of protected-length pike (< 593 mm FL or 630 mm TL) (Figure 16). The distribution of pike lengths in the angler harvest is broad, although numbers are low.

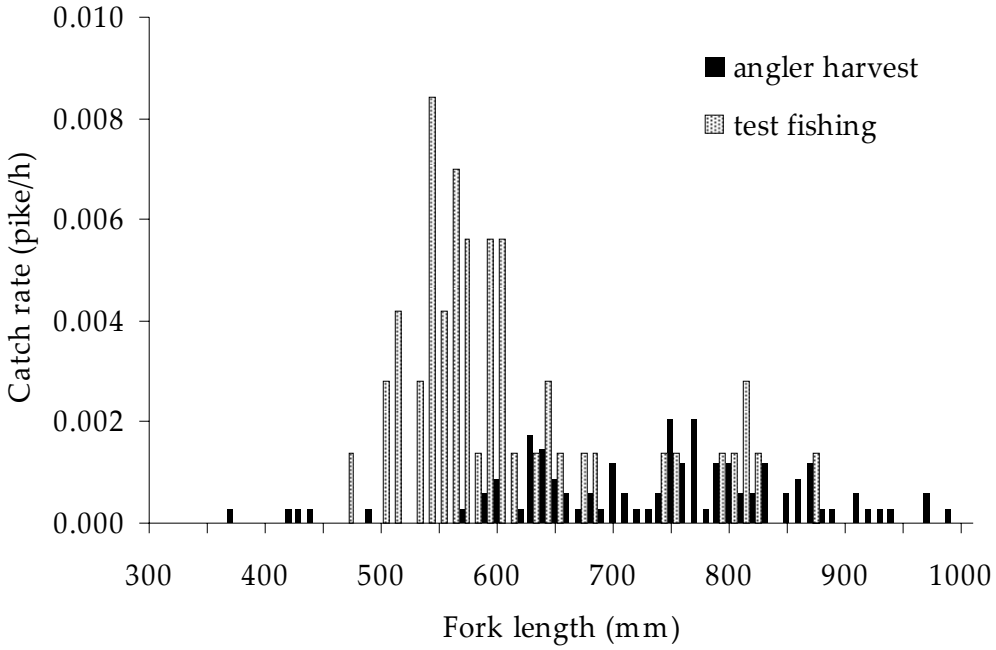

Figure 16. Histogram of fork lengths of pike harvested by anglers (catch rate = 0.028 pike/hr, n = 96) and test fishing (n = 50) during the creel survey at Wabamun Lake, 10 December 2004 – 28 March 2005.

Based on the guidelines suggested by the NPMRP, the growth rate (length-at-age) of pike harvested by anglers was moderately fast, reaching 630 mm TL (593 mm FL) by age-6 (Figure 17). The length-at-age of pike captured by ASRD index netting in September 2004 indicated that this legal-length threshold was reached in five years by some fish.

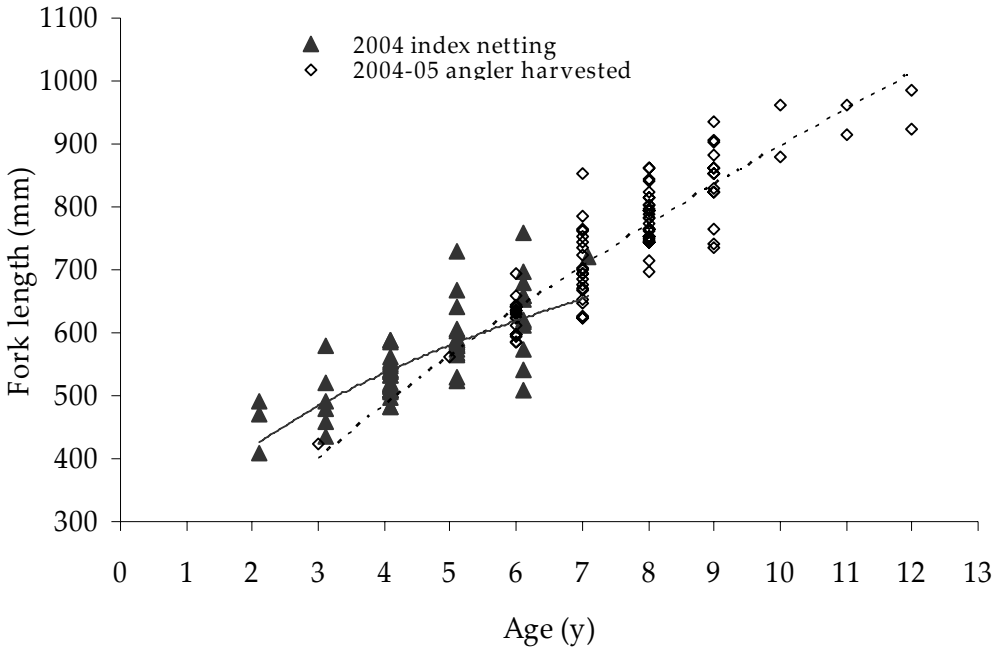

Figure 17. Length-at-age (with lines-of-best-fit) of northern pike captured at Wabamun Lake by index-netting (n = 69) in September 2004 and by angler-harvest (n = 92) during the creel survey, 10 December 2004 – 28 March 2005. Index netting: FL = 190.88 x $(Age)^{0.672}$; R^2 = 0.82, n = 69. Angler harvest: FL = 327.6 x $(Age)^{0.366}$; R^2 = 0.57, n = 92.

The mean weight of pike > 63 cm TL observed during the 2004 creel survey and test fishing was 3.0 kg/fish (95% CI = 2.7 – 3.3, n = 96) and 1.5 kg per fish (n = 50), respectively.

For the test fishing samples collected (n = 50), the RSDs (using size categories from Gablehouse 1984) for pike were as follows: 16.0 % were considered "stock-size" (35-52 cm FL), 68.0% were considered "quality-size" (53-70 cm FL), 14.0% were considered "preferred-size" (71-85 cm FL), and 2.0% were considered "memorable" (86-119 cm FL). No "trophy-size" (>120 cm FL pike were caught. The PSD for pike 35-120 cm FL) was 84%. The RSD's indicates a strong representation of pike near the size limit and weaker representation of pike much larger than the size limit; the RSD provides a basic description of the length distribution of pike in Wabamun Lake.

4.3.4 Angler success rate and Gini coefficient

Twenty percent (79/394) of the anglers interviewed during the survey were successful in catching one or more legal-length pike. The Gini coefficient was 0.71, indicating a moderate level of inequality in the catch of northern pike (Baccante 1995). Both percent success and Gini metrics include the anglers' reported released pike, and indicate a vulnerable (low risk) status, based on the NPMRP criteria. Since the catch was likely exaggerated, percent success is likely lower than calculated and the Gini coefficient is likely higher than calculated.

4.4 Stock status summary

Assessments of fishery status are based on the classifications described by Cushing (1988), which are universally applied in current fisheries management. Management strategies in Alberta are ultimately referenced to these classifications (Sullivan 1998).

The catch rates of whitefish were low and the condition factor was relatively high, indicating low fish density. The size-class distribution was relatively broad in comparison with historical data, but cohorts were weakly represented. The relative weakness of size-classes of whitefish < 350 mm may indicate a decline in recruitment. Generally, the lake whitefish stock appeared to be in a "recruitment-overfished" (Cushing 1988) state.

The catch rate of pike > 63 cm TL was moderate. Relatively few anglers were successful and they reported a catch that had a moderate level of inequality. The age-class distribution was primarily represented by four measurable age-classes. Growth was moderately fast and most pike caught were relatively large. This is indicative of a pike stock in a "growth-overfished" state.

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6.0 APPENDIX

Appendix 1. Creel survey field form, Wabamun Lake, winter 2004-2005.

WABAMUN LAKE WINTER CREEL '04-'05

Page ______

Alberta Conservation Association

Date	Day	Time				Anglers				Vehicle Type									Species Caught							
Month / Date	Day Code	Time of day (24 hr clock)	Time of day (1/4 hrs = 0, 25, 5, 75)	Site location (nearest access to interview location)	Incomplete trip= 1, Completed trip= 2	100s	10s Daily interview # e.g. 017	1s	# Anglers in party	Vehicle Type (Truck, Car, Quad, Snowmobile, Walk)	# Anglers per vehicle	Ice fishing tent? If YES...how many anglers in tent?	Number of fishing lines used	Hours fishing (10s)	Hours fishing (1s)	1/4 hours fishing (1/4 hrs = 0, 25, 5, 75)	Target	Method	# LKWH kept	# LKWH released	# NRPK kept	# NRPK protected-length released	# NRPK legal-length released	# YLPR kept	# YLPR released
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20 interviews/page

SHEET RULES
- NO blank spaces
- ALL spaces must have #s
- NO french 7s
- NO closed 4s
- BE LEGIBLE

DAY CODE
1 = Monday
2 = Tuesday
3 = Wednesday
4 = Thursday
5 = Friday
6 = Saturday
7 = Sunday
8 = Holiday

TARGET
1 = LKWH
2 = NRPK
3 = BRBT
4 = YLPR
5 = ANYTHING
6 = SUCKERS
7 = WALL

METHOD
1 = Artificial
2 = Bait fish
3 = Dewworms
4 = Scentbaits
5 = Leeches
6 = Maggots
7 = Other

SKILL
1 = Novice
2 = Average
3 = Professional
4 = Test angling

Appendix 2. Number of instantaneous counts performed per day of the week and time of the day (24-h clock), Wabamun Lake, winter 2004-2005.

Time of day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
8			1	4	4	3	4
9	1		4	4	4	3	3
10	1	2	4	4	4	4	4
11	1	1	4	4	5	4	4
12			4	4	4	3	4
13	1	1	4	4	4	4	4
14	2	2	4	4	4	4	3
15	1	1	4	4	5	3	4
16	2	2	4	4	4	3	3
17			3	4	4	1	
18				2		1	
Total	9	9	36	42	42	33	33

Appendix 3. Number of anglers counted during instantaneous counts per day of the week and time of day (24-h clock), Wabamun Lake, 2004-2005.

Time of day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
8			51.6	44.6	45.64	42	74.8
9	0		91.4	51.4	57	81	110.2
10	125	10.8	99.6	51.2	31.8	152.2	84.2
11	40	0	65.2	88.6	82.6	237.8	208.4
12			67.2	101.2	75.2	84	324.2
13	33	14.4	47	28.4	39.4	132.2	99.6
14	145	7.2	38.8	69.4	82	206.8	137
15	34	14.4	49.8	46.6	65.4	78.8	189.2
16	137	0	3.6	11.2	7.2	26.2	29
17			102	57.4	27.6	19	
18				4.6		4.6	
Total	514	46.8	616.2	554.6	513.84	1064.6	1256.6

Appendix 4. Daily summaries of angler effort and catch, Wabamun Lake, winter 2004-2005. Codes are LKWH = lake whitefish, NRPK = northern pike, YLPR = yellow perch and Rel. = released.

Month	Date	# Anglers	# Rod h	LKWH Kept	LKWH Rel.	NRPK Kept	NRPK <63 cm TL Rel.	NRPK >63 cm TL Rel.	YLPR Kept	YLPR Rel.
12	10	2	2	0	0	0	0	0	0	0
12	11	9	21.5	0	0	0	0	0	0	0
12	16	0	0	0	0	0	0	0	0	0
12	17	2	8	0	0	0	0	0	0	0
12	19	4	14	0	0	0	0	0	0	0
12	20	0	0	0	0	0	0	0	0	0
12	21	1	1.5	0	0	0	0	0	0	0
12	29	11	36	0	0	1	0	0	0	0
12	30	0	0	0	0	0	0	0	0	0
12	31	4	21	0	0	2	0	0	0	0
1	4	2	8	0	0	0	0	1	0	0
1	5	8	37	0	0	3	3	0	0	0
1	6	4	9.5	3	0	0	0	2	0	0
1	7	2	16	0	0	2	0	0	0	0
1	8	8	18.5	1	1	1	1	0	0	0
1	9	3	24	0	0	1	2	0	0	0
1	13	5	29.5	2	1	0	1	0	0	0
1	14	0	0	0	0	0	0	0	0	0
1	15	5	18.5	2	0	1	2	1	0	0
1	16	10	58	2	0	0	9	0	0	0
1	19	5	35.5	7	0	0	1	1	0	0
1	20	1	3.5	0	0	0	0	0	0	0
1	21	2	16	0	0	0	1	0	0	1
1	22	10	43	3	0	3	4	2	0	0
1	23	13	90	3	0	8	22	0	0	0
1	26	3	20	0	0	0	4	2	0	0
1	27	1	2.5	0	0	0	0	0	0	0
1	28	2	1	0	0	0	0	0	0	0
1	29	28	247	2	1	7	38	3	0	0
1	30	5	48	0	0	2	0	10	0	0
2	2	3	9	2	0	0	4	2	0	0

Month	Date	# Anglers	# Rod h	LKWH Kept	LKWH Rel.	NRPK Kept	NRPK <63 cm TL Rel.	NRPK >63 cm TL Rel.	YLPR Kept	YLPR Rel.
2	3	4	22	0	0	0	6	1	0	0
2	4	2	7	0	0	0	2	0	0	0
2	5	15	64	3	0	2	23	7	0	0
2	6	4	15	0	0	0	5	1	0	0
2	9	9	32	4	0	0	2	0	0	0
2	10	3	11.5	1	0	0	2	0	0	0
2	11	4	24	0	0	0	6	3	0	0
2	21	23	117	17	0	4	6	0	0	0
2	22	3	47	4	0	0	5	0	0	0
2	23	8	27	0	0	1	9	0	0	0
2	24	26	112	13	0	5	3	0	0	0
2	25	4	11	0	0	0	2	0	0	0
2	26	13	89.5	1	0	4	12	4	0	0
2	27	10	52	13	0	0	6	2	0	0
3	2	2	12	0	0	0	3	1	0	0
3	3	1	4	0	0	0	0	0	0	0
3	4	10	72	14	2	1	4	4	0	0
3	5	8	46.5	0	0	0	13	4	0	0
3	6	10	37	0	0	0	2	0	0	0
3	9	2	4	0	0	0	1	0	0	0
3	10	4	16	5	0	0	1	0	0	0
3	11	2	16.5	1	0	1	4	2	0	0
3	12	5	28	2	0	2	0	0	0	0
3	13	8	25.5	0	0	0	3	0	0	0
3	16	0	0	0	0	0	0	0	0	0
3	17	1	3	3	0	0	1	0	0	0
3	18	2	6	6	1	0	1	0	0	0
3	19	9	34	4	0	0	7	0	0	0
3	20	0	0	0	0	0	0	0	0	0
3	24	6	15.5	7	0	0	1	0	0	0
3	25	13	84	8	0	4	17	5	0	0
3	26	10	27.5	0	0	0	8	1	0	0
3	27	12	57.5	1	1	0	7	10	0	0
3	28	8	32	11	0	0	0	0	0	0

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Alberta

Alberta Conservation Association