Sport Fish Stock Assessment of Gods Lake, Alberta 2004

Greg Fortier, John Tchir[1]

[1] Alberta Conservation Association, Bag 900-26, Peace River, Alberta, Canada T8S 1T4

Disclaimer:
This document is an independent report prepared by the Alberta Conservation Association. The authors are solely responsible for the interpretations of data and statements made within this report.

Suggested citation:

Fortier G.N., Tchir J.P. 2005. Lake Monitoring Program: Gods Lake Stock Assessment. Data report, Report code number, produced by Alberta Conservation Association Bag 900-26, Peace River, Alberta, Canada.

Digital copies of this and other conservation reports can be obtained from:

www.ab-conservation.com

ACKNOWLEDGEMENTS

We acknowledge the following individuals, agencies, and corporations for their contributions and assistance in delivering the project and reviewing this report.

Alberta Conservation Association employees: Tyler Johns, Paul Hvenegaard, and Kathleen Woodruff. As well as Alberta Sustainable Resource Development employees: Dave DeRosa and Travis Ripley.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 EXECUTIVE SUMMARY

In recent years, improved access to lakes with populations of walleye (*Sander vitreus*) and northern pike (*Esox lucius*) has raised concern 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 (Berry 1995, 1999). These 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.

Improved access (upgraded and new roads) into lakes in the Red Earth area, including Gods Lake, in recent years has raised concern about the potential for increased angling pressure. The purpose of this stock assessment conducted from 12 to 16 September 2004 was to describe the size and age structure as well as growth of walleye (*Sander vitreus*), northern pike (*Esox lucius*), lake whitefish (*Corregonus clupeaformis*) and yellow perch (*Perca flavescens*).

Walleye accounted for 16.6% of the total catch. The total catch per unit effort (TCUE) was 1.75 fish/100 m^2/24 hrs. Of all walleye sampled where sex could be determined, 59.5% (n=22) were female. Fork lengths ranged from 278 mm to 679 mm (n=37, mean=485.2 mm). Ages ranged from two to 18 years (n=37, mean=8.4).

Northern pike accounted for 29.1% of the total catch. The total catch per unit effort (TCUE) was 3.07 fish/100 m^2/24 hrs. Of all northern pike sampled where sex could be determined, 47.7% (n=31) were female. Fork lengths ranged from 464 mm to 941 mm (n=65, mean=619.4 mm). Ages ranged from four to 13 years (n=65, mean=7.0).

Lake whitefish accounted for 9.0% of the total catch. The total catch per unit effort (TCUE) was 0.95 fish/100 m^2/24 hrs. Of all lake whitefish sampled where sex could be determined, 55.6% (n=10) were female. Fork lengths ranged from 448 mm to 618 mm (n=20, mean=497.4 mm). Ages ranged from six to 17 years (n=20, mean=12.5).

Yellow perch accounted for 30.5% of the total catch. The total catch per unit effort (TCUE) was 3.22 fish/100 m^2/24 hrs. Of all yellow perch sampled where sex could be determined, 61.8% (n=42) were female. Fork lengths ranged from 131 mm to 172 mm (n=68, mean=144.3 mm). Ages ranged from two to five years (n=64, mean=3.1).

The stock assessment conducted provides information for fisheries managers to track potential effects of increased pressure on priority fish populations into the future. Increased monitoring of fish populations at Gods Lake and other lakes in the Red Earth

area will become more important with the development of the proposed highway extending from Red Earth to Fort McMurray.

2.0 INTRODUCTION

In recent years, improved access to lakes with populations of walleye (*Sander vitreus*) and northern pike (*Esox lucius*) has raised concern 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. These 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.

Improved access (upgraded and new roads) into lakes in the Red Earth area, including Gods Lake, in recent years has raised concern about the potential for increased angling pressure. Index netting was conducted from 12 to 16 September 2004 to describe the size, age structure and growth of sport fish including: walleye (*Sander vitreus*), northern pike (*Esox lucius),* lake whitefish (*Corregonus clupeaformis*) and yellow perch (*Perca flavescens*). Although, data collections included these four species the focus was mainly on northern pike and walleye.

3.0 STUDY AREA

Gods Lake is located in Alberta approximately 66 km Northeast of Red Earth (Figure 1). According to the provincial fisheries database, the Lake has a surface area of 680 hectares, an average depth of 13 m and a maximum depth of 25 m. A gravel/earth road is used to access the lake. Site locations of gill nets are shown in Table 1.

Table 1. Universal Transverse Mercator (UTM) coordinates (NAD 83, UTM zone 11) of test-netting locations for Gods Lake, Alberta 2004.

Depth Interval (m)	UTM Easting	UTM Northing
	664802.807	6299738.224
	666358.264	6298368.745
	664075.8	6300600.488
0-5	666096.203	6301107.702
5-10	666620.325	6298799.877
	666265.275	6299163.381
10-15	664828.168	6301665.638
	665377.65	6299467.709
	665529.814	6301090.795
15-20	664819.714	6300194.716
	664684.457	6300727.291
>20	665090.228	6301141.516

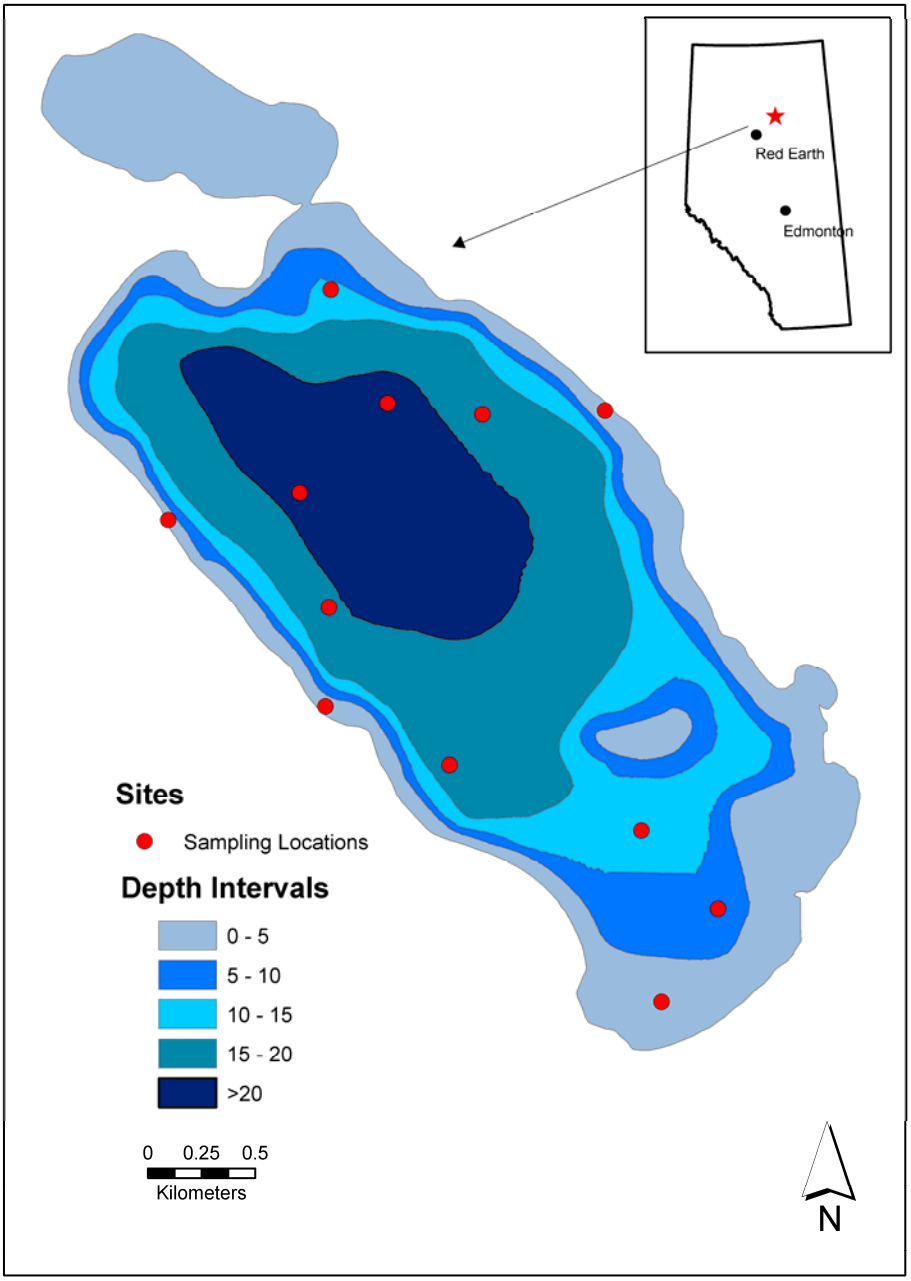

Figure 1. Map showing Gods Lake and gill net sample site locations for 2004, Alberta inset.

3.1 Fish Communities

The lake supports natural populations of white sucker (*Catostomus commersoni*), longnose sucker (*Catostomus catostomus*), cisco (*Corregonus artedi*), lake whitefish (*Corregonus clupeaformis*), northern pike (*Esox lucius*), burbot (*Lota lota*), yellow perch (*Perca flavescens*), and walleye (*Sander vitreus*).

4.0 MATERIALS AND METHODS

4.1 Materials

Multi-mesh benthic gill nets were used to capture fish. One net consisted of five panels each of a different mesh size. Mesh sizes of panels were 38, 63, 89, 114, and 140 mm (stretch measure) and were connected by bridals in sequential order. The dimensions of each panel were 15.2 m long by 2.4 m high.

4.2 Methods

Sampling design

A stratified random sampling design was employed. The lake was stratified by depth and sampling effort was allocated proportionately to surface area of the depth stratum. Table 2 shows the stratification and the proportion of the lakes surface area represented by each stratum. Sample sites were randomly selected with a minimum distance of 500 m between all sites. Nets were set over night for approximately 24 hours. Nets were set perpendicular to the shoreline where possible, without crossing depth intervals. The orientation of the largest or smallest mesh in relation to the shore was random. Nets were set at a minimum depth of two meters.

Sample size

Power analysis was used to determine the number of sites required to reach the desired level of precision for catch per unit effort (CPUE) focusing on walleye and northern pike. Sustainable Resources Development, fisheries managers suggested that precision should be sufficient to detect a change of 10 fish/100 m^2/24 hrs. This was performed using catch data from index netting in 2001 (Lucko 2001) for walleye (*Sander vitreus*), northern pike (*Esox lucius*), and lake whitefish (*Coregonus clupeaformis*). Power analysis was also used during the course of the index netting in 2004 to ensure the minimal number of nets were set to reach precision levels adequate for fisheries management. The total number of sampled sites is shown in Table 2.

Table 2. Stratified sampling proportional to stratum surface area for index netting of Gods Lake, Alberta 2004.

Depth Interval	Proportional area (%)	# sites
0-5 m	29.2	4
5-10 m	10.8	1
10-15 m	15.3	2
15-20 m	27.7	3
>20 m	17.0	2
Whole lake	**100**	**12**

Data collection

Biological data collected from all captured fish included: fork length (FL), total length (TL), weight, sex, maturity, and stomach contents. Ageing structures were also removed and aged in accordance with MaKay et al. (1990). Data on non-sport fish species collected and weight and stomach contents of all fish species can be found in the Fisheries Management Information System[1].

4.3 Data analyses

Catch per unit effort

Catch per unit effort (CPUE) was calculated as fish/100 m^2/24 hrs. This was calculated for each species caught at each sample site. The CPUE and confidence intervals of each depth stratum were reported as well as the overall mean. Total catch per unit effort (TCUE) was also reported (fish/100 m^2/24 hrs).

Length and age distributions

Fork lengths (FL) were separated into 20 mm length classes to display the length distribution of fish captured, 10 mm classes were applied to yellow perch. Length and age distributions were displayed as catch per unit effort (CPUE) for each length or age class.

[1] FMIS is a provincial database containing comprehensive information on fish and fish habitat data. It was developed by Alberta Sustainable Resource Development (ASRD) to meet the data storage and data requirements of fisheries managers. As a requirement of a fisheries research licence fish information collected must be sent to SRD for inclusion in the database.

von Bertalanffy Growth Function

Age and length data for males and females were fitted separately to the von Bertalanffy growth function. If sample sizes were inadequate for male and female data to be fitted separately they were combined. The von Bertalanffy growth function is a non-linear equation that explains growth using three parameters. Length infinity ($L\infty$) represents the asymptote or the 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. Fork length (FL) was the measurement used to describe length. The parameter representing growth is K, which is defined as the rate at which the fish approaches $L\infty$. Higher values of K represent faster growth and are usually associated with a lower $L\infty$. The third parameter of the von Bertalanffy growth function is t_0, which is the theoretical age at length zero. Due to small sample sizes of small fish t_0 was fixed at zero to reduce bias in the growth function.

4.0 RESULTS

4.1 Walleye (*Sander vitreus*)

Walleye accounted for 16.6% of the total catch, 37 individuals. The total catch per unit effort (TCUE) was 1.75 fish/100 m²/24 hrs. Mean catch per unit effort (CPUE), sample size, and 95% confidence intervals calculated from index netting in 2004 are shown for each depth interval in Table 3.

Table 3. Mean catch per unit effort (fish/100 m²/24 hrs), 95% confidence interval, and sample size for walleye from 2004 index netting at Gods Lake, Alberta.

Depth	Mean CPUE	95% confidence interval (+/-)	n
0-5 m	1.15	0.93	4
5-10 m	8.81	N/A	1
10-15 m	4.29	8.41	2
15-20 m	0.00	N/A	3
>20 m	0.00	N/A	2
Total	1.83	1.86	12

Only one immature walleye was observed in 2004. The immature walleye was two years old with a fork length of 278 mm. The next youngest walleye captured was seven years old with a fork length of 406 mm but was mature. Of all walleye sampled where sex could be determined, 59.5% (n=22) were female. Male fork lengths ranged from 406 mm to 578 mm (n=15, mean=462.5 mm) while female fork lengths ranged from 278 mm to 679 mm (n=22, mean=500.7 mm). The mean fork length of all walleye sampled was 485.2 mm (n=37). Figure 2 shows the fork length distributions from 2004. Total length can be estimated from fork length using the following regression equation.

$$TL = 1.044(FL) + 7.71$$

Equation 1. Regression equation to estimate walleye total length (TL) from fork length (FL) as determined from fish sampled from index netting at Gods Lake, Alberta 2004 (n=37, R^2=0.999).

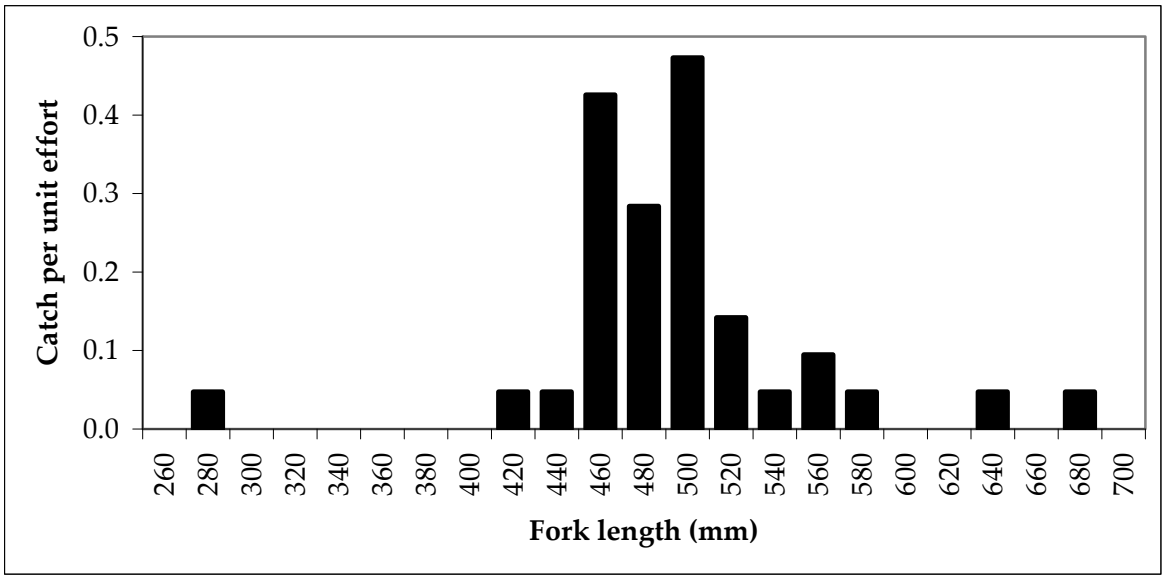

Figure 2. Fork length distributions of walleye as determined from fish sampled from index netting at Gods Lake, Alberta 2004 (n=37). Y-axis is catch per unit effort (i.e., fish/100 m²/24 hrs).

Males ranged in age from seven to 18 years (n=15, mean=8.0). Females ranged in age from two to 17 years (n=22, mean=8.7). The mean age of all walleye sampled in 2004 was 8.4 years (n=37). Figure 3 shows the age distribution from 2004.

Figure 3. Age distribution of walleye as determined from fish sampled from index netting at Gods Lake, Alberta 2004 (n=37). Y-axis is catch per unit effort (i.e., fish/100 m²/24 hrs).

The von Bertalanffy growth function was used to describe growth of walleye. Figure 4 shows female and male data from 2004 fitted to the von Bertalanffy growth function.

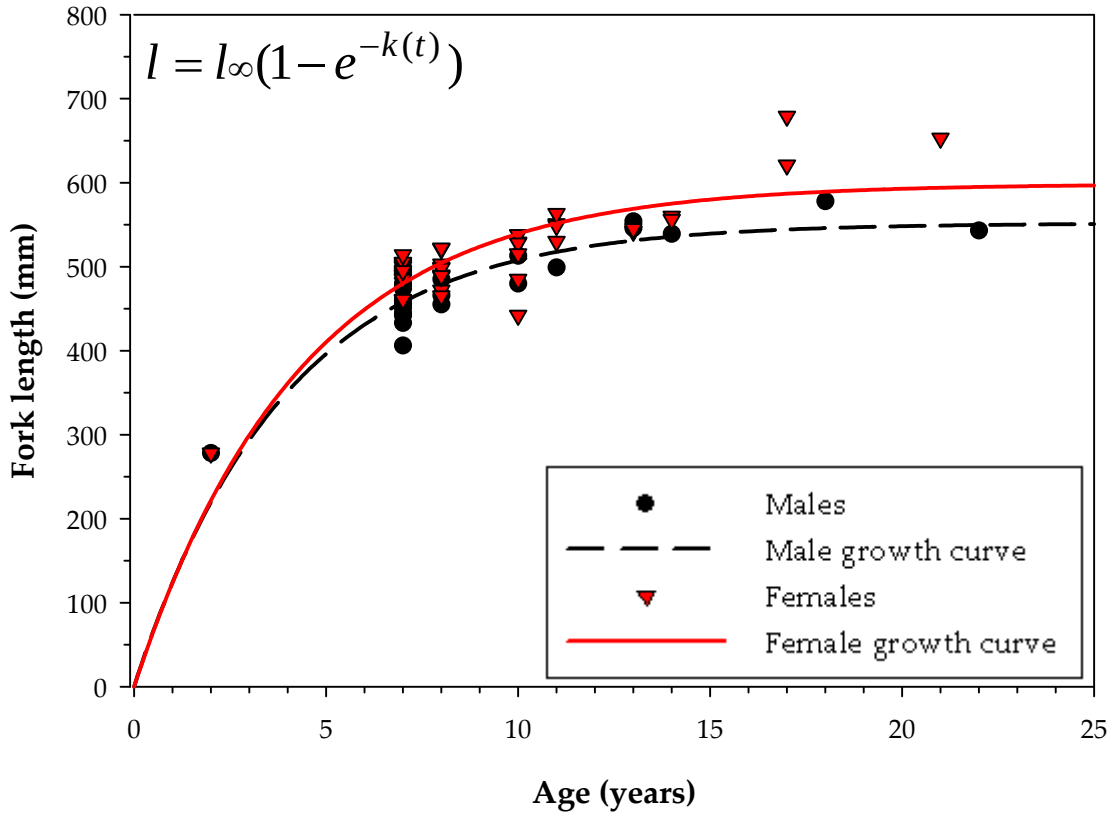

Figure 4. von Bertalanffy growth function as fitted to male and female walleye sampled from index netting at Gods Lake, Alberta 2004 (Males: n=25, L_∞=551.7, k=0.253; Females: n=45, L_∞=598.6, k=0.231).

Data collected on weight and stomach contents of walleye can be found in FMIS, Inventory Project ID 6276.

4.2 Northern pike (*Esox lucius*)

Northern pike accounted for 29.1% of the total catch, 65 individuals. The total catch per unit effort (TCUE) was 3.07 fish/100 m^2/24 hrs. Mean catch per unit effort (CPUE), sample size, and 95% confidence intervals calculated from index netting in 2004 are shown for each depth interval in Table 4.

Table 4. Mean catch per unit effort (fish/100 m²/24 hrs), 95% confidence interval, and sample size for northern pike from 2004 index netting at Gods Lake, Alberta.

Depth	Mean CPUE	95% confidence interval (+/-)	n
0-5 m	6.82	1.67	4
5-10 m	5.38	N/A	1
10-15 m	2.57	0.97	2
15-20 m	0.00	N/A	3
>20 m	0.00	N/A	2
Total	3.15	1.86	12

No immature northern pike were observed in 2004. Of all northern pike sampled where sex could be determined, 47.7% (n=31) were female in 2004. Male fork lengths ranged from 464 mm to 809 mm (n=34, mean=597.7 mm) while female fork lengths ranged from 479 mm to 941 mm (n=31, mean=642.4 mm). The mean fork length of all northern pike sampled was 619.4 mm (n=65). Figure 5 shows the fork length distributions from 2004. Total length can be estimated from fork length using the following regression equation.

$$TL = 1.047(FL) + 10.43$$

Equation 2. Regression equation to estimate northern pike total length (TL) from fork length (FL) as determined from fish sampled from index netting at Gods Lake, Alberta 2004 (n=63, R^2=0.999).

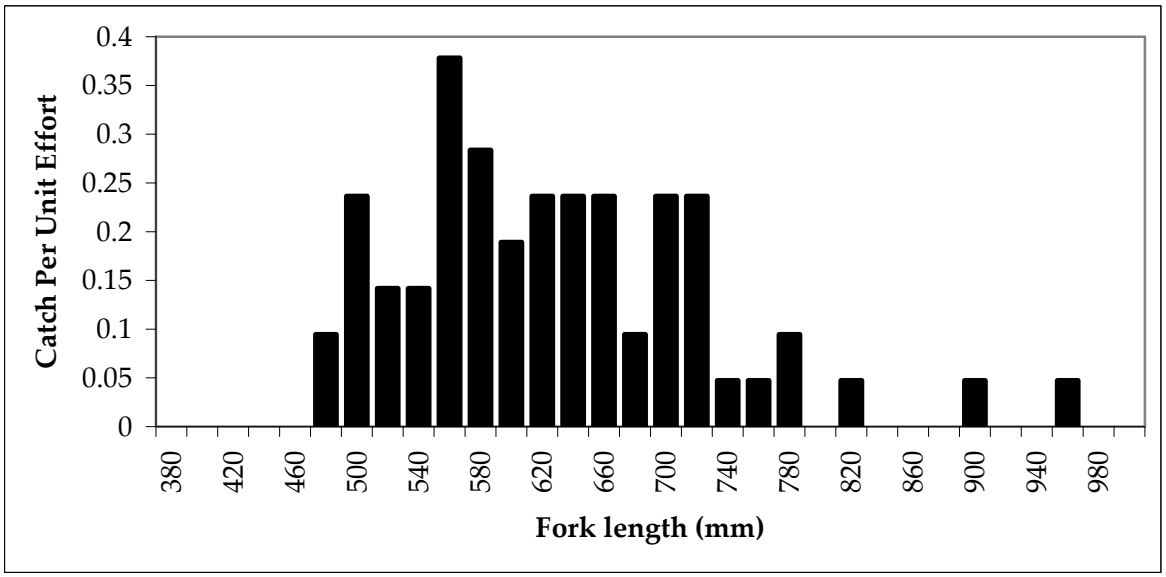

Figure 5. Fork length distributions of northern pike sampled from index netting from Gods Lake, Alberta 2004 (n=65). Y-axis is catch per unit effort (i.e., fish/100 m²/24 hrs).

Males ranged in age from four to 11 years (n=34, mean=6.8). Females ranged in age from four to 13 years (n=31, mean=7.3). The mean age of all northern pike sampled in 2004 was 7.0 years (n=65). Figure 6 shows the age distributions from 2004.

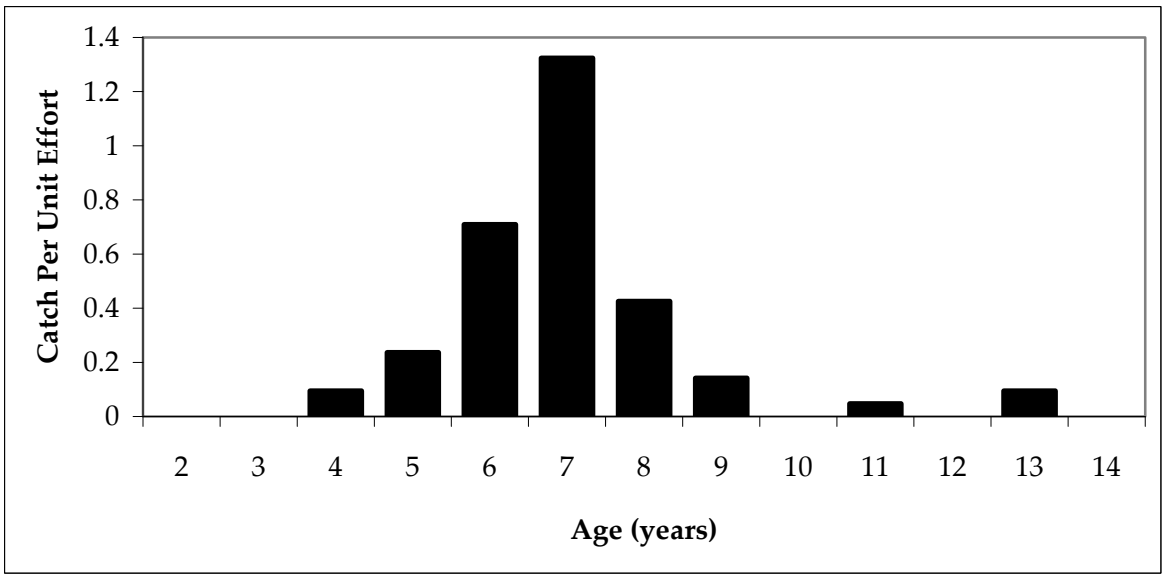

Figure 6. Age distributions of northern pike as determined from fish sampled by index netting at Gods Lake, Alberta 2004 (n=65). Y-axis is catch per unit effort (i.e., fish/100 m²/24 hrs).

The von Bertalanffy growth function was used to describe growth of northern pike. Figure 7 shows female and male data fitted to the von Bertalanffy growth function.

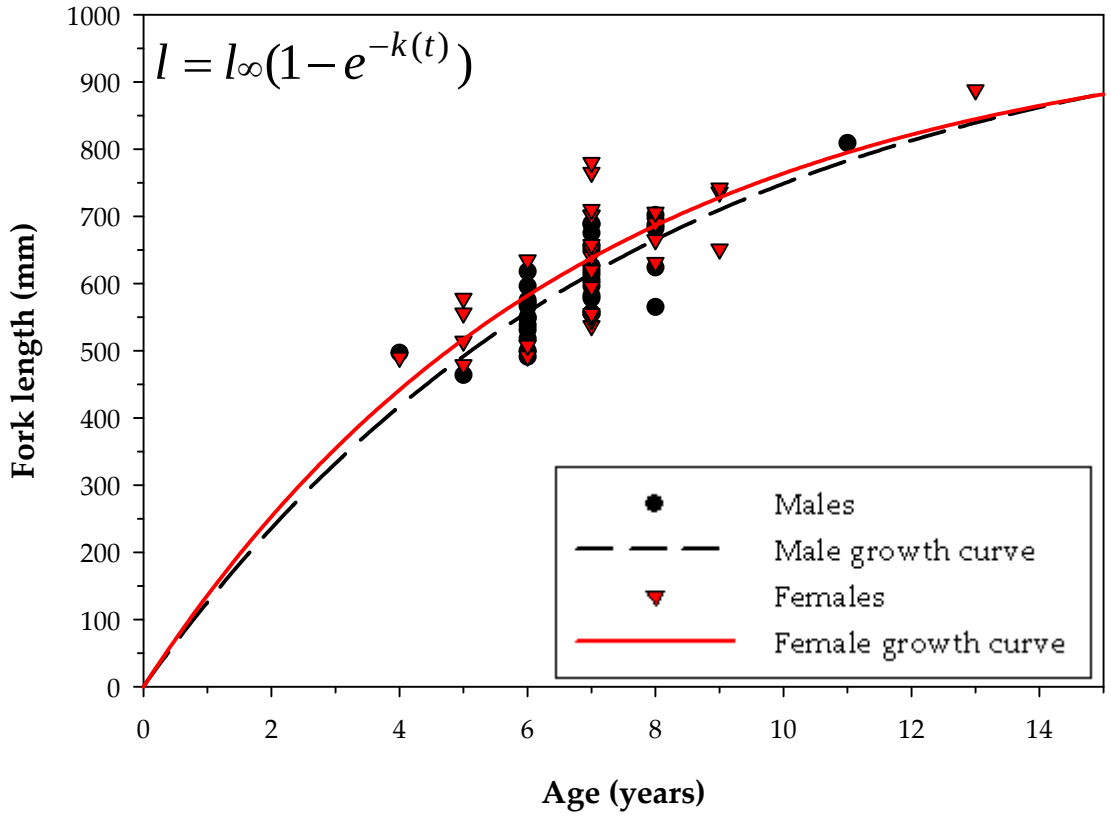

Figure 7. von Bertalanffy growth function as fitted to male and female northern pike sampled from index netting of Gods Lake, Alberta 2004 (Males: n=34, L_∞=1029.0, k=0.130; Females: n=30, L_∞=989.5, k=0.148).

Data collected on weight and stomach contents of northern pike can be found in FMIS, Inventory Project ID 6276.

4.3 Lake Whitefish (*Coregonus clupeaformis*)

Lake whitefish accounted for 9.0% of the total catch, 20 individuals. The total catch per unit effort (TCUE) was 0.95 fish/100 m²/24 hrs. Mean catch per unit effort (CPUE), sample size, and 95% confidence intervals calculated from index netting in 2004 are shown for each depth interval in Table 5.

Table 5. Mean catch per unit effort (fish/100 m²/24 hrs), 95% confidence interval, and sample size for lake whitefish from 2004 index netting at Gods Lake, Alberta.

Depth	Mean CPUE	95% confidence interval (+/-)	n
0-5 m	2.42	2.95	4
5-10 m	0.49	N/A	1
10-15 m	0.61	1.20	2
15-20 m	0.00	N/A	3
>20 m	0.00	N/A	2
Total	0.95	1.10	12

No immature lake whitefish were observed in 2004. Of all lake whitefish sampled where sex could be determined, 55.6% (n=10) were female. Male fork lengths ranged from 500 mm to 558 mm (n=8, mean=529.5 mm) while female fork lengths ranged from 448 mm to 618 mm (n=10, mean=534.8 mm). The mean fork length of all lake whitefish sampled was 497.4 mm (n=20). Figure 8 shows the fork length distribution for 2004.

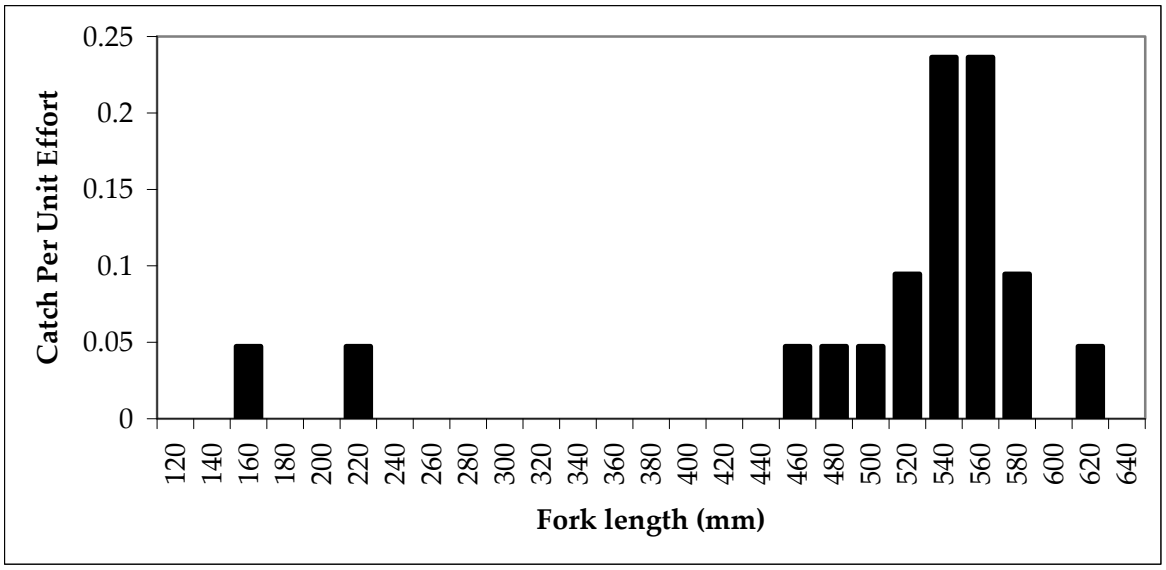

Figure 8. Fork length distribution of lake whitefish sampled from index netting at Gods Lake, Alberta 2004 (n=20). Y-axis catch per unit effort (i.e., fish/100 m²/24 hrs).

Males ranged in age from 10 to 16 years (n=8, mean=13.5). Females ranged in age from six to 17 years (n=10, mean=12.8). The mean age of all lake whitefish sampled in 2001 was 12.5 years (n=19). Figure 9 shows the 2004 lake whitefish age distribution.

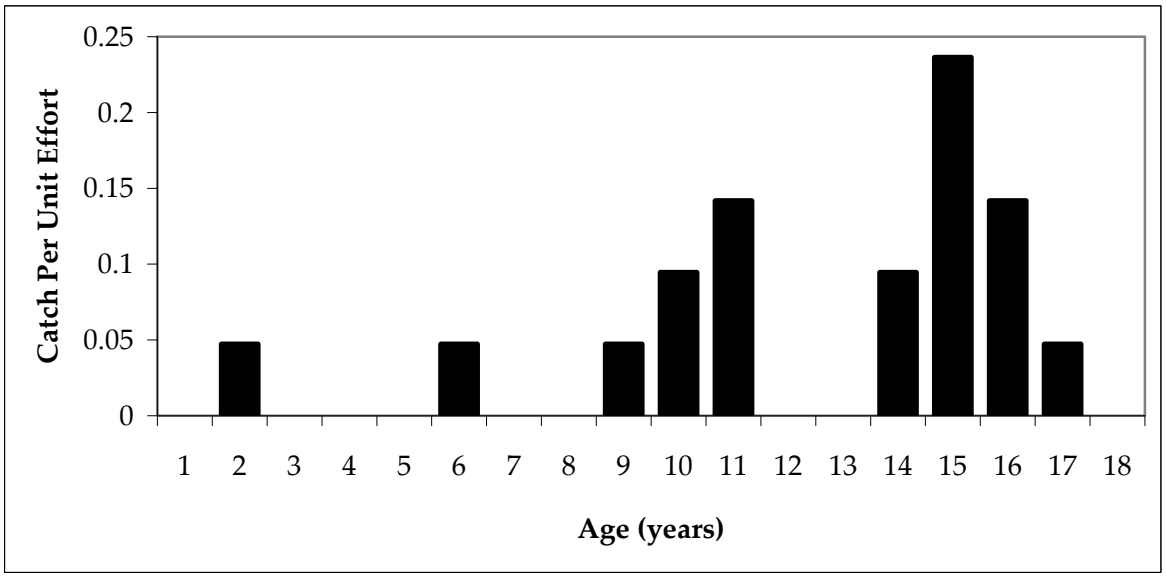

Figure 9. Age distribution of lake whitefish as determined from fish sampled by index netting at Gods Lake, Alberta 2004 (n=19). Y-axis is catch per unit effort (i.e., fish/100 m²/24 hrs).

The von Bertalanffy growth function was used to describe growth of lake whitefish. Figure 10 shows female and male data fitted to the von Bertalanffy growth function.

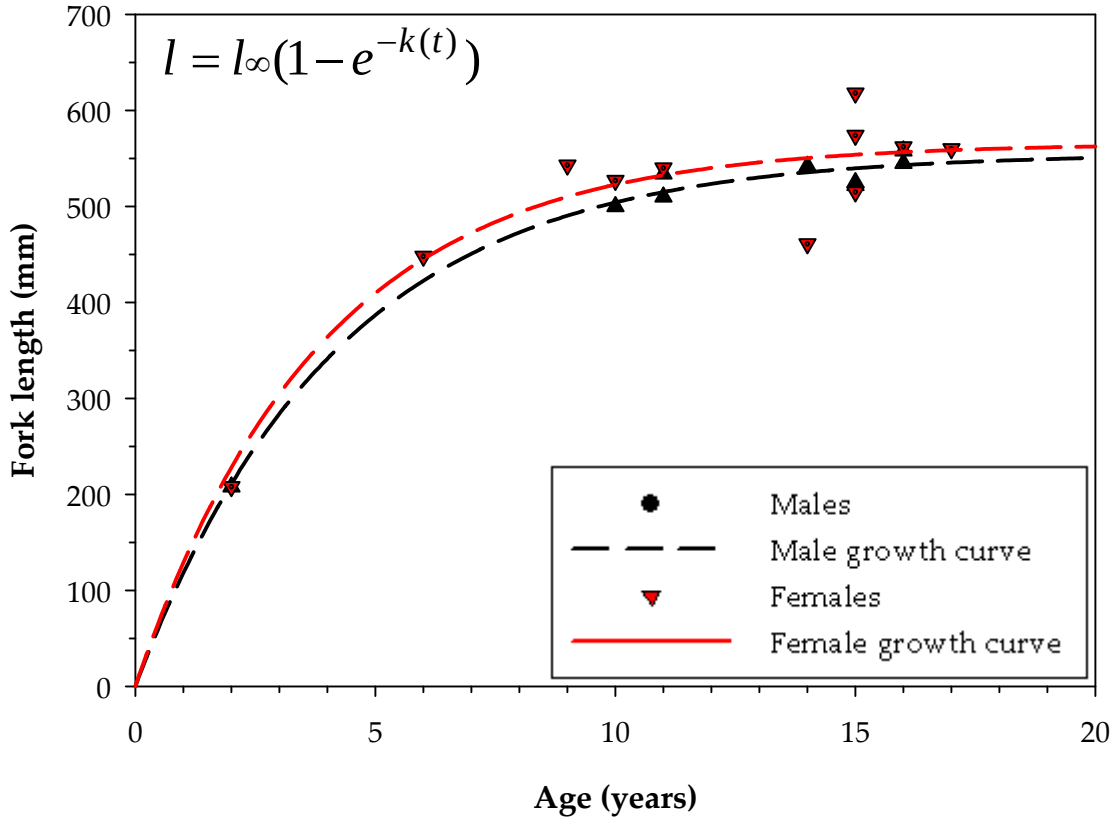

Figure 10. von Bertalanffy growth function as fitted to male and female lake whitefish sampled by index netting of Gods Lake, Alberta 2004 (Males: n=9, L_∞=555.7, k=0.239; Females: n=11, L_∞=565.7, k=0.258).

Data collected on weight and stomach contents of lake whitefish can be found in FMIS, Inventory Project ID 6276.

4.4 Yellow Perch (*Perca flavescens*)

Yellow perch accounted for 30.5% (n = 68) of the total catch. The total catch per unit effort (TCUE) was 3.22 fish/100 m²/24 hrs. Mean catch per unit effort (CPUE), sample size, and 95% confidence intervals calculated from index netting in 2004 are shown for each depth interval in Table 6.

Table 6. Mean catch per unit effort (fish/100 m²/24 hrs), 95% confidence interval, and sample size for yellow perch from 2004 index netting at Gods Lake, Alberta.

Depth	Mean CPUE	95% confidence interval (+/-)	n
0-5 m	4.12	5.66	4
5-10 m	6.36	N/A	1
10-15 m	7.17	9.99	2
15-20 m	0.00	N/A	3
>20 m	0.00	N/A	2
Total	3.10	2.69	12

Of all yellow perch sampled where sex could be determined, 61.8% (n=42) were female in 2004. Male fork lengths ranged from 131 mm to 154 mm (n=26, mean=140.5 mm) while female fork lengths ranged from 136 mm to 172 mm (n=42, mean=146.6 mm). The mean fork length of all yellow perch sampled was 144.3 mm (n=68). Figure 11 shows the fork length distributions from 2004.

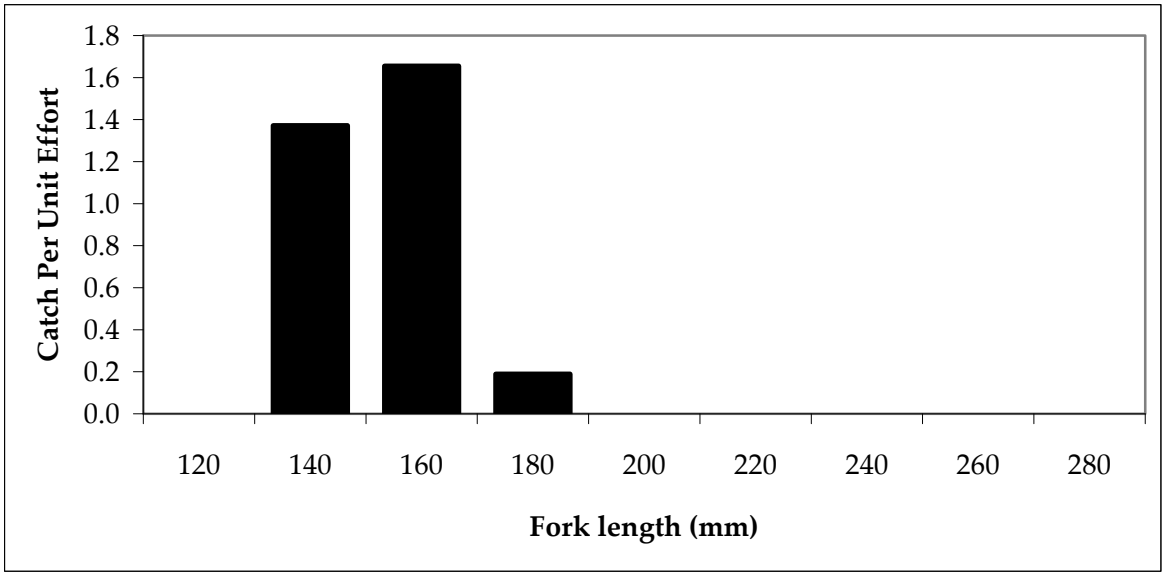

Figure 11. Fork length distributions of yellow perch sampled from index netting at Gods Lake, Alberta 2004 (n=68). Y-axis is catch per unit effort (i.e., fish/100 m²/24 hrs).

Male yellow perch ranged in age from two to four years (n=24, mean=3.0). Females ranged in age from two to five (n=40, mean=3.2). The mean age of all yellow perch sampled in 2004 was 3.1 years (n=64). Figure 12 shows the age distributions from 2004.

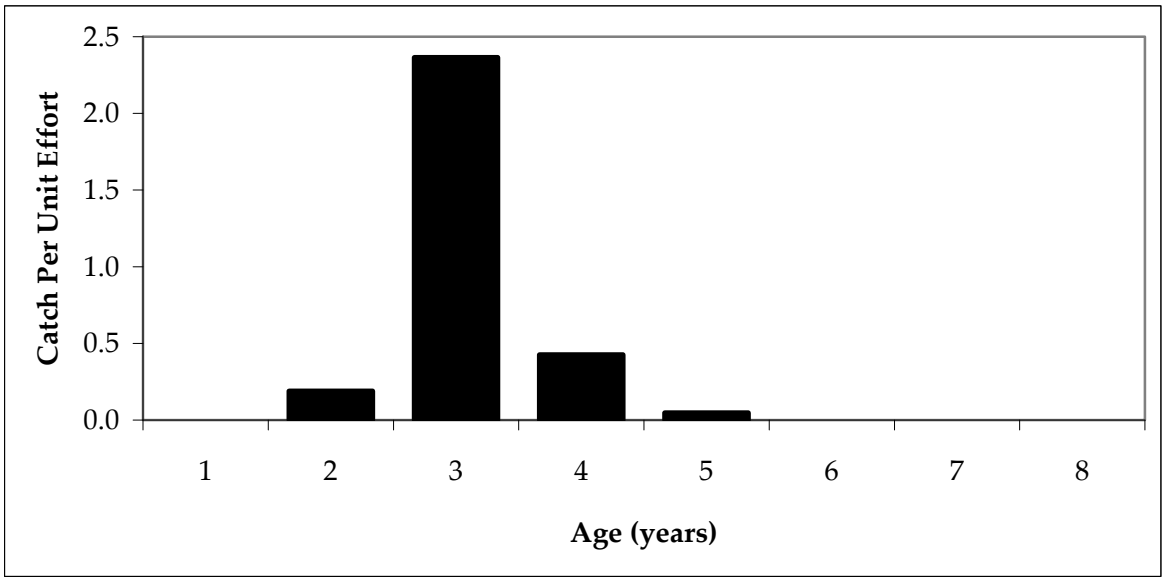

Figure 12. Age distributions of yellow perch as determined from samples collected during index netting of Gods Lake, Alberta 2004 (n=64). Y-axis is catch per unit effort (i.e., fish/100 m²/24 hrs).

A growth function was not applied to yellow perch samples as there were only four age classes sampled with inadequate representation in five year old fish.
Data collected on weight and stomach contents of yellow perch can be found in FMIS, Inventory Project ID 6276.

5.0 SUMMARY

Minimum size limits were implemented across Alberta for walleye and northern pike several years ago. At lakes where fishing pressure is relatively high the size distribution of walleye and northern pike tends to be truncated at or near the minimum size limit for harvest, as fish mortality caused by angling tends to be greatest at or above the size limit. In Gods Lake, mortality of walleye does not appear to have truncated the size distribution at the minimum size limit (50 cm TL). While the size class distribution is not cause for concern the low relative abundance of walleye captured in the test nets should be examined more closely to determine the extent of decline relative to previous levels.

The minimum size limit for northern pike harvest at Gods Lake was 100 cm TL. While no fish of this size or greater were captured in the nets, it is difficult to know whether or not the gear used was effective at capturing fish of this size. Therefore we cannot speculate on the relative density of fish of this size.

Improved access (upgraded and new roads) into lakes in the Red Earth area, including Gods Lake, in recent years has raised concern about the potential for increased angling pressure. The stock assessment conducted provides information for fisheries managers to

track potential effects of increased pressure on priority fish populations into the future. Increased monitoring of fish populations at Gods Lake and other lakes in the Red Earth area will become more important with the development of the proposed highway extending from Red Earth to Fort McMurray.

6.0 LITERATURE CITED

Berry D.K. 1995. Alberta's walleye management and recovery plan. Alberta Environmental Protection, Natural Resources Service. Number T/310. 32 pp.

Berry D.K. 1999. Alberta's northern pike management and recovery plan. Alberta Environmental Protection, Natural Resources Service. Number T/459. 22 pp.

Lucko B. 2001. Lake monitoring program 2001 results Gods Lake. Technical report. Prepared by Alberta Conservation Association, Peace River.

Mackay, W.C., G.R. Ash, and H.J. Norris. 1990. Fish ageing methods for Alberta. R.L. & L. Environmental Services Ltd. In association with Alberta Fish and Wildlife Division and University of Alberta, Edmonton.