Stocked Aerated Lake Angler Survey

June – September, 1998

By
David Jackson
Fisheries Habitat Development Technician

October 1999
Peace River, Alberta

Alberta Conservation Association
Northwest Boreal Region

Abstract

The management of stocked aerated lakes is necessary for the production of quality fisheries. Three stocked aerated lakes (Sulphur, Figure Eight and Swan) in the Northwest Boreal Region were surveyed from June 5 to September 13, 1998. This recreational fishery survey was designed to collect information on angler use (effort), harvest and satisfaction. The data collected will assist to evaluate future stocking rates, ensure angler satisfaction and cost effectiveness. At Sulphur and Swan lakes an access point survey was conducted, while at Figure Eight Lake a modified roving access point survey was used. Figure Eight Lake had the highest observed use with 245 anglers surveyed. Sulphur Lake had the highest observed catch (n=558) while Swan lake recorded the highest observed harvest (n=124). The angler satisfaction questionnaire showed 79.7% (n=338) of all anglers surveyed (n=424) rated their trip satisfaction as good, 19.1% (n=81) as fair and 1.2% (n=5) as poor.

Table of Contents

Page

Abstract ii

List of Tables v

List of Figures vi

List of Appendices vii

Acknowledgements viii

1.0 Introduction 1

2.0 Study Area 2

3.0 Methods 7

3.1 Survey Design 7
3.2 Sampling Schedule 7
3.3 Weekends, Weekdays, and A.M./P.M. 7
3.4 Angler Survey Forms 7
3.5 Instantaneous Count Form 8
3.6 Traffic Counter Data 8
3.7 Angler Effort, and Harvest Calculation Methods 9
3.8 Calculations 9

4.0 Results and Discussion 10

4.1 Survey Schedule 10
4.2 Observed Catch and Angler Counts 10
4.3 Total Estimated Angler Use, Effort and Harvest 11
4.4 Traffic Counter Data 11
4.5 Survey components – party numbers, angler totals, hour totals, anglers/party, anglers/vehicle, hours/vehicle. 14
4.6 Age Categories 15
4.7 Shore vs Boat Angling 15
4.8 Target Species 16
4.9 Angler Satisfaction Questionnaire 16
4.10 Angler Residence 18

5.0 Recommendations 19

6.0 References/Literature Cited 20

List of Tables

Table 1. Observed catch and angler count for Sulphur, Figure Eight and Swan lakes..... 10
Table 2. Estimated effort, harvest, anglers and survey length. 11
Table 3. Observed R^2 values combined and individual for the three lakes surveyed. 12
Table 4. Observed survey components. 14
Table 5. Mean number of anglers/party, anglers/vehicle, hours/angler and overall means in each category. 14
Table 6. Estimated harvest for survey period and calendar year. 19

List of Figures

Page

Figure 1. Northwest Boreal Region map indicating surveyed lakes in 1998..... 3
Figure 2. Contour map of Sulphur Lake with camping facilities shown. 4
Figure 3. Contour map of Figure Eight Lake with facilities shown. 5
Figure 4. Contour map of Swan Lake with facilities shown..... 7
Figure 5. Sulphur Lake traffic counter vs effort relationship with Sept 4 outlier removed. 12
Figure 6. Figure Eight Lake traffic counter vs effort relationship with the removal of July 3-survey event, 112 vehicles. 13
Figure 7. Swan Lake traffic counter vs effort relationship with removal of June 21 outlier (36 vehicles, 45 hrs). 13
Figure 8. Age composition of anglers at Sulphur, Figure Eight, and Swan lakes. 15
Figure 9. Breakdown of shore vs boat angling. 15
Figure 10. Angling Satisfaction vs Trip Satisfaction combined for all three lakes. 16
Figure 11. Compared to the past angling question. 18

List of Appendices

Appendix A. Angler survey schedule for Sulphur, Figure Eight, and Swan lakes (June 5 - September 13,1998).

Appendix B. Angler survey forms for Sulphur, Figure Eight and Swan lakes with detailed instructions, 1998.

Appendix C. Fish sampling form with detailed instructions, 1998.

Appendix D. Instantaneous count form with detailed instructions, 1998.

Appendix E. Standard deviation and Confidence interval formulas used in Microsoft's Excel spreadsheet program.

Appendix F. Estimated effort, harvest, and angler calculation tables for Sulphur, Figure Eight and Swan lakes.

Appendix G. Traffic counter readings for Sulphur, Figure Eight, and Swan lakes (June 5 - September 13,1998).

Appendix H. Formula, with examples, for estimating angler numbers, harvest numbers, and effort between angler surveys.

Appendix I. Angler satisfaction questionnaire results for Sulphur, Figure Eight, and Swan lakes (June 5 - September 13,1998).

Appendix J. Angler residence summaries for Sulphur, Figure Eight, and Swan lakes, 1998.

Acknowledgements

I would like to show my appreciation to the following people for their involvement in the 1998 Stocked Lake Angler Survey:

- To Trevor Thera of the Alberta Conservation Association (A.C.A.) for heading me in the right direction and several reviews of this document.
- To Brian Lucko (A.C.A.) for helping me with survey design preparation and answering my many questions.
- To Paul Hvenegaard for the valuable help with the many revisions of the document and MapInfo.
- To Dave Fairless (A.C.A.) in FMIS instruction.
- To Carrie Hildebrandt who donated a number of her weekends to volunteer at Figure Eight Lake.
- To Al Wildeman (A.C.A.) for help on Figure Eight, Swan, and Sulphur lakes.
- To Young's Point Provincial Park for storage of the Rustler trailer, in between the surveys at Swan Lake.
- Last but certainly not least, to all the anglers who endured my A.C.A. speech and provided the valuable data for this survey.

1.0 Introduction

Recreational fishing is a very popular activity in Alberta. Over 300,000 people fish in Alberta each year. When compared to other prairie provinces however, Alberta has precious few lakes and significant pressure on native fish stocks. Manitoba has 110,000 lakes, Saskatchewan 94,000 lakes and an average of less than 2 anglers per lake. Alberta has comparatively limited recreational fishing opportunities with only 800 lakes and an average of 375 anglers per lake (Graham 1995.)

The lake aeration program in the Northwest Boreal Region of Alberta began in 1985, under the Buck for Wildlife Program, which was part of the Fish and Wildlife Trust Fund. In April 1997, the Alberta Conservation Association was formed and acquired the lake aeration program. The objective of the program is to develop and maintain year round fishing opportunities in locations otherwise restricted to summer angling only. These lakes are eutrophic in nature and therefore experience oxygen levels deficient to supporting year round trout fisheries. To overwinter fish in these lakes and ponds, lake aeration is necessary. Lake aeration is the artificial introduction of oxygen into a water body, providing enough oxygen to over winter fish. Presently, the Northwest Boreal Region Lake Aeration program influences 9 lakes or ponds, over 835 acres of water, 2 provincial parks, 3 recreational campgrounds, 4 recreational day-use areas and over 480,000 trout annually.

Proper management of these stocked aerated lakes is necessary for the development and maintenance of quality fisheries. In the Northwest Boreal Region, suitable management has been lacking due to informational deficiencies. Only with accurate angler use and harvest data, can these lakes be managed adequately.

The objective of this recreational fishery survey was to justify the aeration/stocking program by collecting information, mainly on angler use (effort), harvest and satisfaction. Three angler satisfaction questions were asked during the interviews. The aim behind these questions was to identify a relationship, if any, between angler success and trip satisfaction. Other data collected were:

1. traffic counter readings – correlate angler numbers to vehicle numbers for possible future applications
2. age categories – angler age distribution
3. shore vs boat angling – comparisons on effort and harvest between shore and boat fisheries, applications in future lake additions to stocked lake program
4. angler residence – to determine an area of influence for each lake
5. target species – are anglers fishing for a particular species

2.0 Study Area

The three stocked aerated lakes selected for the 1998 angler survey were Swan, Figure Eight, and Sulphur (Figure 1). The lakes were selected based on a combination of overwintering success, productivity (fish growth) and angler usage (Kaleta and Jackson, 1998).

Sulphur Lake (NW 07-89-02-W6) is 53.4 ha in size with a maximum depth of 7.6 m and a mean depth of 3.3 m (Figure 2). The lake is located 110-km northwest of Peace River. Facilities at the lake include 11 camping stalls, a cement ramp boat launch, a fish cleaning stand, a wooden dock, a day use area, an overflow area, 2 toilets and group reservation only area. Sulphur Lake is stocked annually with brook and rainbow trout in alternate years. There is only one access onto the lake via the boat launch and has limited shoreline-fishing opportunities.

Figure Eight Lake (NE 20-84-25-W5) is a 38.6 ha lake with a maximum depth of 6.0 m and a mean depth of 3.0 m. It is located approximately 40-km east of Peace River (Figure 3). The lake is annually stocked with rainbow trout and has had a supplemental stocking of brown trout. Facilities at the lake include, a cement ramp boat launch, 3 fish cleaning stands, a wooden dock, a newly installed fishing walkway, beach area, 20 camping stalls, a day use area, 3 toilets and is the most developed of all our aerated stocked lakes. Most of the shoreline is accessible to fishing as well as the use of the boat launch. Figure Eight Lake has been aerated since 1986 and has not experienced a winterkill since 1991. During this angler survey, a partial summer kill occurred in July.

Swan Lake (SW 13-70-26-W5) is 134 ha in size, with a maximum depth of 5.6 m and a mean depth of 3.2 m (Figure 4). Swan Lake is the newest and largest lake that the Alberta Conservation Association aerates to date. The lake is located 180-km southwest of Peace River, 42-km west of Valley view and 80-km east of Grande Prairie. From 1983-86, the lake had received annual stockings of eastern brook and rainbow trout. Prior to 1986, a beaver dam located in the lake outlet controlled the water levels. In 1987, after the beaver dam washed out, the Buck for Wildlife program funded the installation of a sheet pile weir to facilitate the maintenance of preferred lake levels. Unfortunately, once the water levels reached their normal capacity, the oxygen levels did not support the stocked trout through the winter. Trout stocking was discontinued until a solution could be found to successfully overwinter this fishery.

In 1997, the Alberta Conservation Association formed a partnership with Canadian Forest Products Ltd., installing an aeration system to overwinter the lake. Facilities at the lake are minimal with four over night stalls, three day-use areas, a fish cleaning stand, a crude boat launch and one toilet. Shoreline fishing opportunities are limited as the shoreline is treed. Rainbow trout have been stocked annually since the spring of 1997. Swan Lake has been successfully aerated for one year.

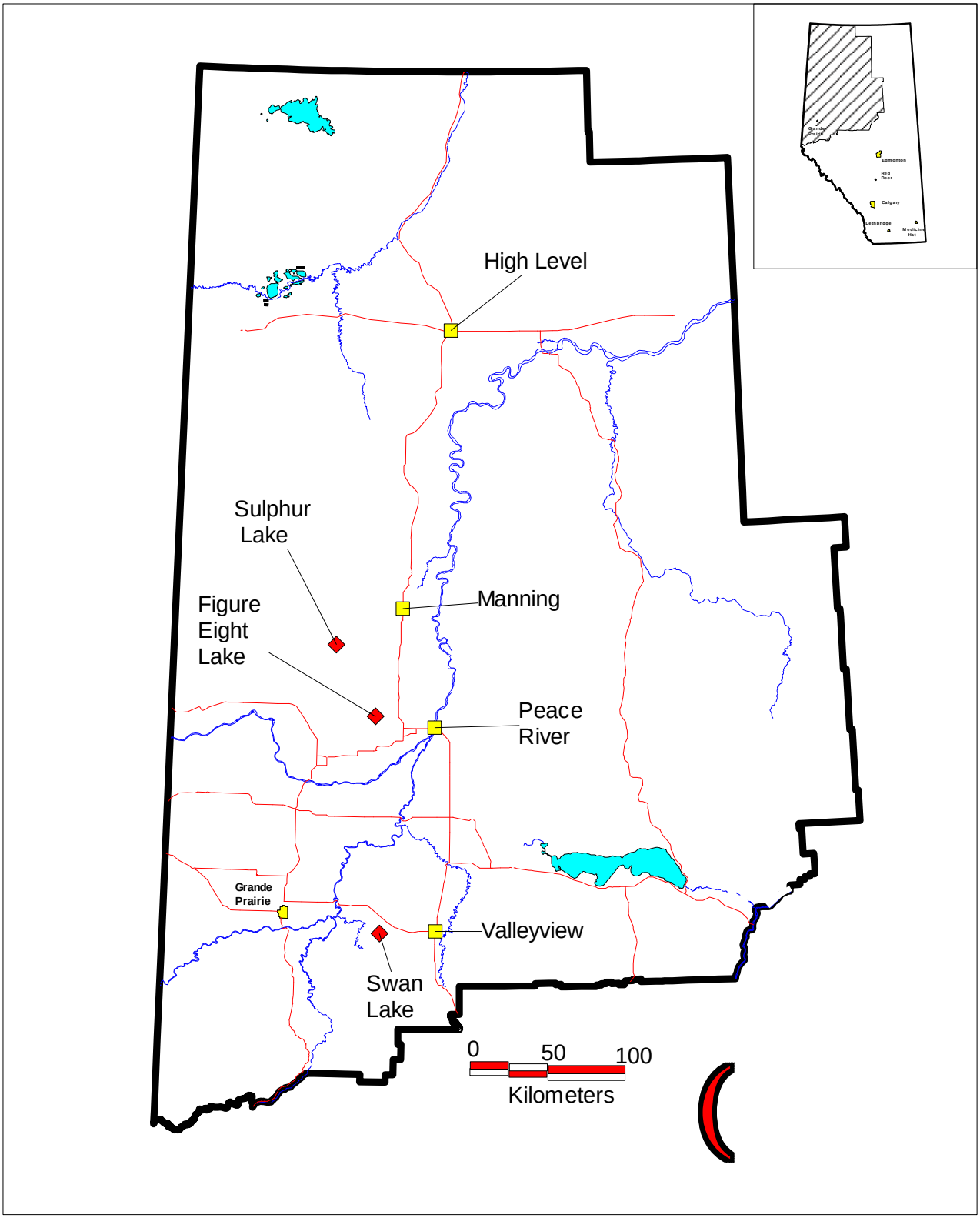


Figure 1. Northwest Boreal Region map indicating surveyed lakes in 1998.

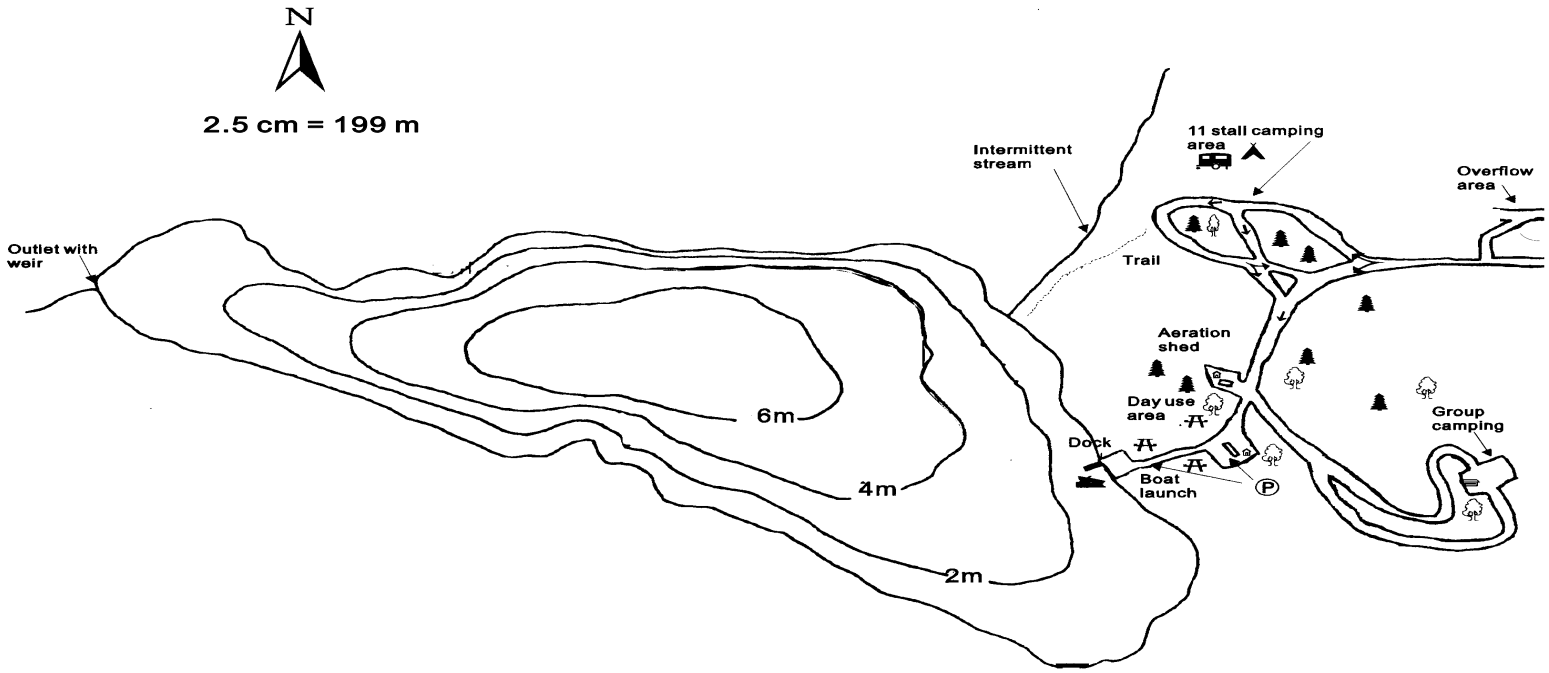


Figure 2. Contour map of Sulphur Lake with camping facilities shown.

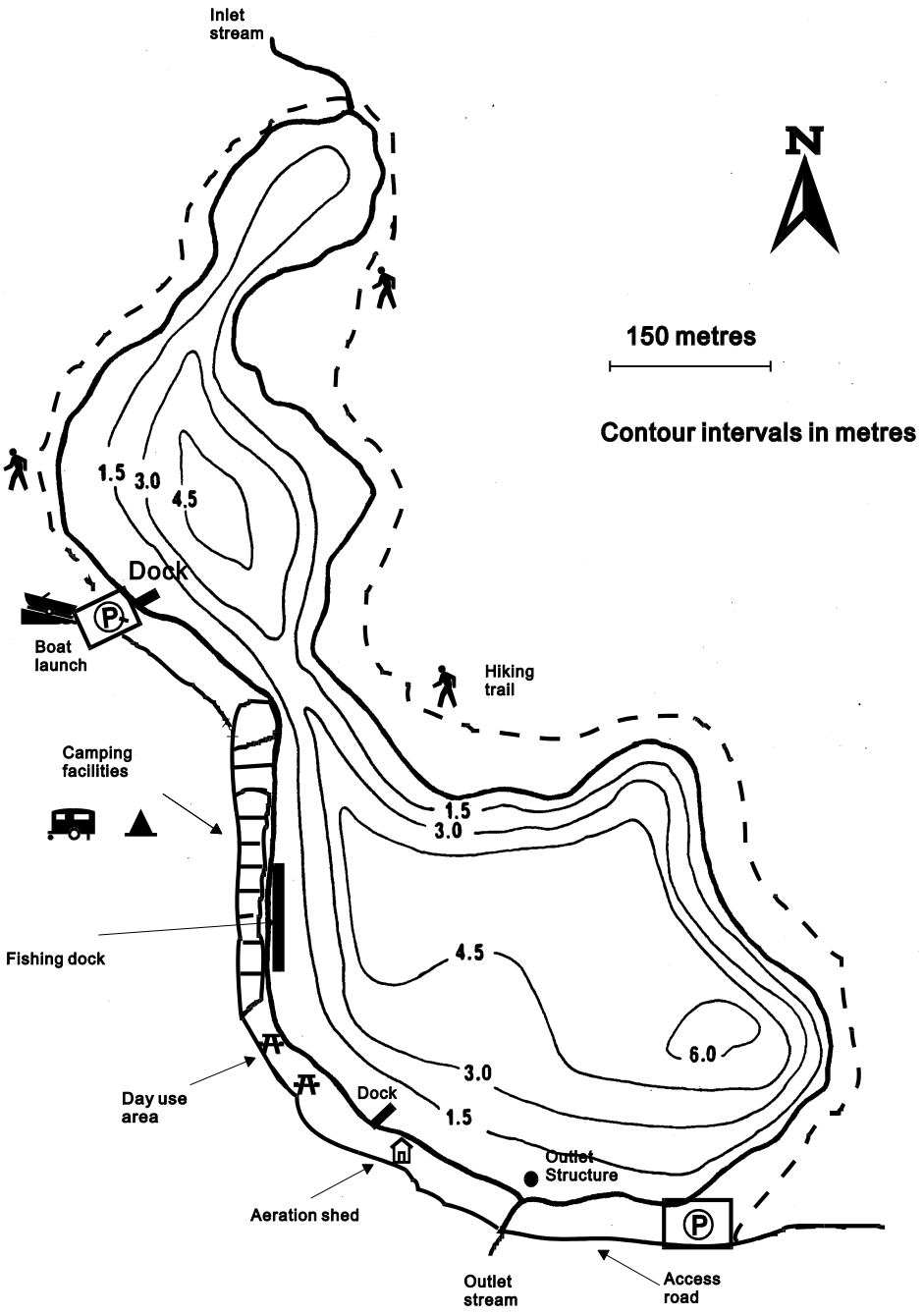


Figure 3. Contour map of Figure Eight Lake with facilities shown.

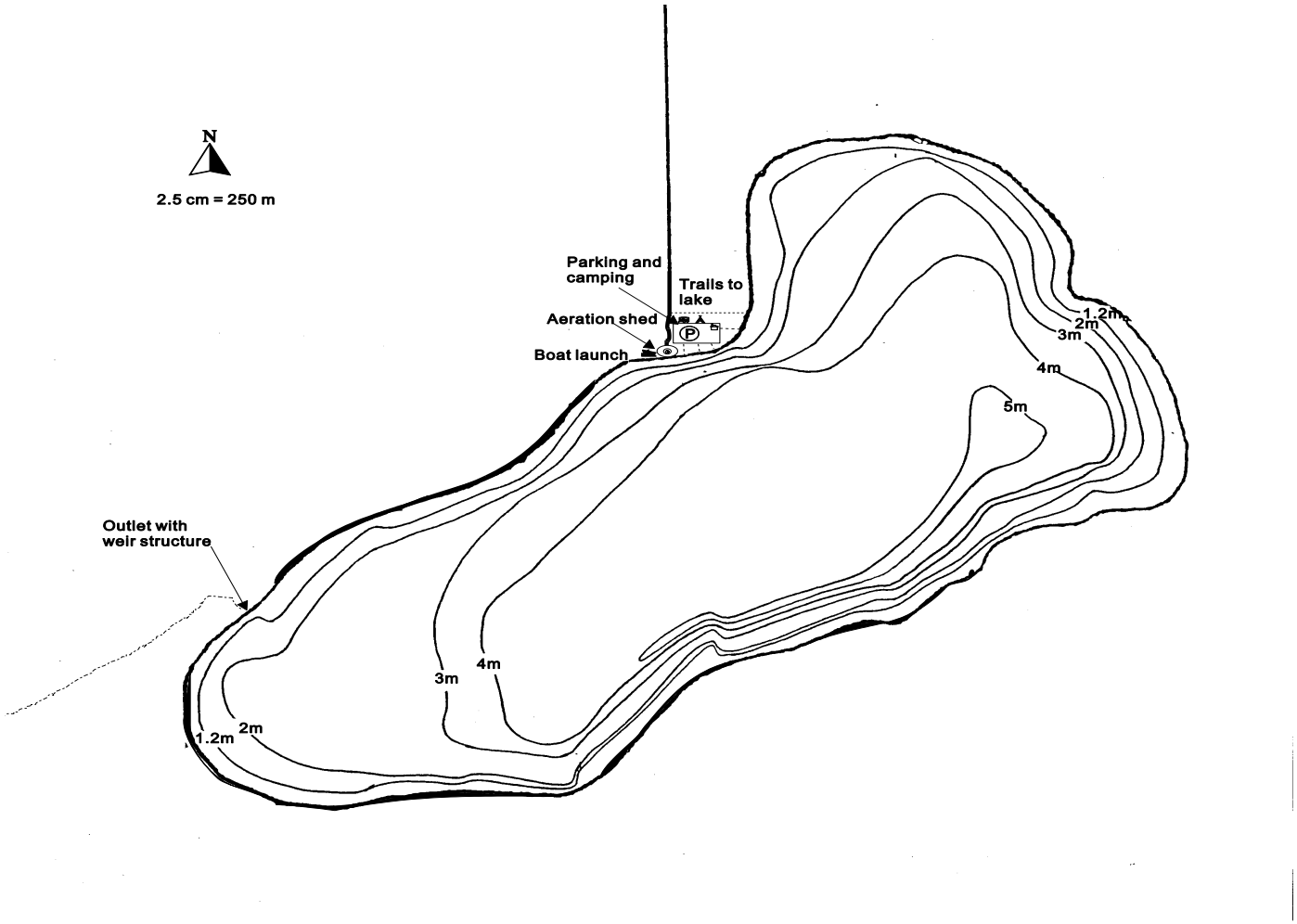


Figure 4. Contour map of Swan Lake with facilities shown.

3.0 Methods

3.1 Survey Design

At Sulphur and Swan lakes, a two-stage sampling access point survey as described by Pollock et al. (1994) was conducted. Each lake has one access point onto the lake (boat launch) and limited shoreline fishing opportunities. At Figure Eight Lake, a modified two-stage access point/roving survey as described by Pollock et al. (1994) was used. This lake has such a well-developed shoreline from which anglers can fish; an access point survey would not be the best method to utilize. The primary sampling unit (PSU) was the day (weekend or weekday) and the secondary sampling unit (SSU) was the time of day (a.m. or p.m.).

3.2 Sampling Schedule

The schedule was set up so that one creel clerk could get to the three lakes as often as possible. Also included, were logistic and monetary considerations as well as scheduled days off and office days. If volunteers were available, they were incorporated into the schedule. Most fishing is performed on weekends and holidays (Pollock et al. 1994). The majority of surveys were conducted on weekends and holidays. Sampling days were selected randomly by computer (Microsoft Excel) using the random number generation table.

3.3 Weekends, Weekdays, and A.M./P.M.

Weekends consisted of Friday, Saturday, and Sunday, as two of three lakes are over 100 km away from Peace River. Each of the three lakes were randomly assigned one of the first three weekends, while the remaining weekend was randomly assigned to one of the three lakes. Each lake was surveyed only on one weekday per month. Survey days were selected randomly. Survey events were further stratified to a.m. (10:00-16:00 hrs) and p.m. (16:00-22:00 hrs). The survey times were assigned randomly.

3.4 Angler Survey Forms

A survey form was to be filled out for each sampling event (Appendix B). Numbers of fish harvested fish were recorded on a fish sample sheet (Appendix C). Three angler satisfaction questions were asked during the interview and were included on the angler survey form. The design behind these questions is to identify a relationship, if any, between the angler success and the trip satisfaction. The questions were:

1) Overall, angling satisfaction? **P**-poor, **F**-fair, **G**-good
   -This question related directly to fishing on that day
2) Overall, trip satisfaction? **P**-poor, **F**-fair, **G**-good
   - This related to the trip, being there, getting to the lake, weather etc.

3) Compared to the past is the fishing – **D**-declining, **S**- same, **I**-improving
- was asked to anglers who had fished the lake in the past (years)

The first two questions were asked at all three lakes and the third question was asked at Sulphur and Figure Eight lakes only as Swan Lake has been aerated for only one season. Creel clerks were asked not to interview the anglers too often, as it disturbed their angling time.

3.5 Instantaneous Count Form

Because of Figure Eight Lake's accessible shoreline for fishing, the creel clerk will not be able to contact every angler during his or her scheduled survey period. Estimates of effort were calculated by instantaneous count results (Hoeing et al. 1993). The survey clerk conducted an instantaneous count of all anglers at certain times during each survey event, both on shore as well as in boats. The a.m. counts (10 a.m. – 4 p.m.) were completed at 11a.m. 1p.m., and 3 p.m. The p.m. counts (4 p.m. – 10 p.m.) were completed at 5 p.m., 7 p.m., and 9 p.m. The counts were averaged for the ½ day survey events then multiplied by 12 (hrs) to get the total estimated effort for that day. The instantaneous count form is presented in Appendix D.

The counts were taken at two points: 1) the boat launch to cover the two smaller north basins and 2) from the long dock near the aeration shed to cover the south basin (Figure 3). Which ever instantaneous count point the creel clerk was nearest to is where the count began. The travel time between the two count sites was less than three minutes. Binoculars were used to count the number of boats with the number of anglers and non-anglers in each. This data was recorded on the Instantaneous Count Form.

At Sulphur and Swan lakes, with a single access point, instantaneous counts were not completed, as the survey clerk was able to contact all boats during the survey period as anglers completed their fishing day.

3.6 Traffic Counter Data

Traffic was measured using a traffic counter made by Streeter Amet A Saratec Company, Model 161-2 JR Traficounter. The unit was installed under the access road into each lake. Traffic counter readings were taken daily at the beginning and the end of the scheduled survey events. The readings were recorded on the survey form, under the appropriate heading(s). These vehicle numbers are to be added up, each survey event and divided by two (vehicles in and out) to get the total number of vehicles during the survey times (Appendix G). This data will also be used, in combination with estimated effort results, to determine if traffic counter readings have a strong relationship with effort. If so, future determinations of effort at these lakes could be calculated directly from traffic counter readings. This method would save time and money as compared to an angler survey. To calculate for a relationship comparison, Microsoft's Excel regression data analysis tool was used.

3.7 Angler Effort, and Harvest Calculation Methods

Sulphur and Swan lakes

Effort and **Harvest**- For each stratum (weekend and weekday), the mean effort and harvest for each full day were calculated. To calculate the full day (12 hr) estimates, the actual half-day survey results (6 hr) were multiplied by two. Standard deviation (STDEV) and 95% confidence intervals (CI) formulas (Microsoft Excel) were calculated to get the estimated full day totals (Appendix E). A full day mean total is determined then multiplied by the number of days, throughout the survey, in each stratum to get estimated total effort, anglers and harvested fish. Again, Standard deviation (STDEV) and Confidence intervals (CI) formulas (Microsoft Excel) were applied. The total estimated angler effort, and harvest for each lake were calculated by combining the weekend and weekday estimate totals of anglers, angler hours (effort) and harvested fish.

Figure Eight Lake

Effort - For each stratum (weekend and weekday), the mean anglers for the survey event were determined through instantaneous counts. These numbers are multiplied by 12 (hrs) to determine an estimated total effort for that day. All the weekday totals and weekend totals are compiled to calculate the estimated total effort for each stratum. A full day mean total was determined then multiplied by the number of days, throughout the survey, in each stratum to get estimated effort. Total effort for the entire survey is estimated by adding the weekend and weekday estimate totals together. Standard deviation (STDEV) and Confidence intervals (CONFIDENCE) formulas (Microsoft Excel) were applied throughout the calculations.

Harvest - To calculate the full day (12 hr) estimates, the actual half-day survey results (6 hr) were multiplied by two. Standard deviation (STDEV) and Confidence intervals (CI) formulas (Microsoft Excel) were applied to get the estimated full day totals. A full day mean total was calculated then multiplied by the number of days, throughout the survey, in each stratum to get estimated number of anglers and harvested fish. The total estimated number of anglers and harvested fish were calculated by combining the weekend and weekday estimate totals of anglers and harvested fish.

3.8 Calculations

Calculations for the following were completed for each lake. These totals are the actual ½ day survey results for the entire survey at each lake.

Anglers/party – total number of anglers divided by the total number of parties/groups
Anglers/vehicle – total number of anglers divided by the total number of vehicles
Hours/angler – total number of hours divided by the total number of anglers

4.0 Results and Discussion

4.1 Survey Schedule

Combined angler survey events totaled 57. Sulphur Lake had 16 survey events throughout the angler survey from June12 to September 6, 1998. Seventy-five percent of sampling days were on weekends. Twenty-five percent of sampling days were on weekdays. The a.m. time slot was sampled seven days and the p.m. timeslot was sampled nine days (Appendix A).

Figure Eight Lake's schedule was 19 survey events, from June 5 to September 1,1998. Seventy-nine percent of the survey events were on weekend days, while 21% of the survey events occurred on weekdays. The a.m. time slot was sampled nine days and the p.m. timeslot was sampled ten days.

Swan Lake was scheduled to have 22 sampling events over the course of the angler survey, June 19 to September 13, 1998. The schedule was reduced by four sampling events, to eighteen, with so few anglers later in the survey. The survey of Swan Lake was completed on the 30th of August. Sampling days consisted of 17% weekdays and 83% weekend days. The am time slot was sampled seven days and the p.m. time slot was sampled 11 days.

4.2 Observed Catch and Angler Counts

Sulphur Lake had the highest catch (558 fish) of the three lakes but the lowest harvest at 18.3% (Table 1). Swan Lake had a lower catch (172 fish) than Sulphur but the highest harvest at 72.1%. Figure Eight Lake had the lowest catch at 164 fish and a 48.8% harvest.

Figure Eight Lake by far had the highest number of anglers with Swan and Sulphur second and third respectively (Table 1). The difference in angler numbers may be due to the accessible shoreline for fishing at Figure Eight Lake and the close proximity of the lake to several communities. At Sulphur and Swan lakes, the shoreline access for fishing is limiting and there are not many communities in close vicinity to these two lakes.

Table 1. Observed catch and angler count for Sulphur, Figure Eight and Swan lakes.

Lake	Catch	Released	Harvest	Anglers
Sulphur	558	456 **(81.7%)**	102 **(18.3 %)**	138
Figure Eight	164	84 **(51.2%)**	80 **(48.8%)**	245
Swan	172	48 **(27.9%)**	124 **(72.1%)**	141

4.3 Total Estimated Angler Use, Effort and Harvest

Total angler effort for Sulphur Lake during the angler survey (86 days) was estimated at 3386.4 ± 257.1 angler hours (Table 2). Total usage was estimated at 1070 ± 102 anglers. Total estimated harvest was 808 ± 63.

The total effort (hours) on Swan Lake was estimated at 2949.1 ± 107.2 over a 72-day period and the total estimated harvest was 632 ± 69 fish. Total estimated usage was 954 ± 25 anglers (Table 2).

The total estimated effort at Figure Eight Lake during the angler survey was 3770.8 ± 363.9 angler hours. Total usage was estimated at 1633 ± 118 anglers (Table 2). This effort was incurred over 89 days. The total harvest at Figure Eight Lake was estimated at 420 ± 62 fish. Additional effort, harvest and angler numbers would have been expected if the lake had not partially summer killed in July.

The estimated effort and usage at Figure Eight Lake was the highest of the three lakes surveyed, indicating a very high use lake, despite the harvest was the lowest of the three lakes. As indicated in 4.2, shoreline accessibility for angling and proximity to communities are the difference.

Table 2. Estimated effort, harvest, anglers and survey length.

Lake	Estimated			Survey
	Effort (hours)	Harvest	Anglers	Length
Sulphur	3386.4 ± 257.1	808 ± 63	1070 ± 102	86 days
Figure Eight	3770.8 ± 363.9	420 ± 62	1633 ± 118	89 days
Swan	2949.1 ± 107.2	632 ± 69	954 ± 25	72 days

These numbers Calculation tables to determine at the estimated effort, harvest and anglers at each lake are presented in Appendix F.

4.4 Traffic Counter Data

In total, 838 vehicles were recorded during the survey period at Sulphur Lake, of which 105 (12.5%) occurred during the survey events.

In total, 4600 vehicles were recorded during the entire survey at Figure Eight Lake. Five hundred and forty vehicles (11.7%) were recorded during the survey events. Seventy-five percent of the vehicles (n=405) were recorded before the partial summerkill and 25% (n=135) of the vehicles crossed over the traffic counter after the July partial summerkill.

A total of 2452 vehicles were recorded over the entire survey at Swan Lake. One hundred and ninety - three (7.9%) vehicles were recorded during the survey events at Swan Lake.

The second goal of collecting the traffic counter data was to define the strength of correlation between counter readings and effort to determine the effectiveness of traffic counter data as a potential management tool.

Table 3. Observed R^2 values combined and individual for the three lakes surveyed.

Lake	R Squared
Sulphur	0.11
Figure Eight	0.64
Swan	0.39
Combined	0.29

The above table indicates a negative relationship between the traffic counter and effort for Sulphur and Swan lakes and the three lakes combined catagory. Figure Eight Lake had positive relationship.

The three lakes were looked at individually and outliers were removed from each lake. Outliers are extreme values in a data set (Weiss and Hassett, 1987). At Sulphur Lake, a poor relationship at between the traffic counter and angler effort was observed but when the outlier at 30 vehicles and 25 hrs effort is removed (Figure 5), the relationship improves greatly. The removed outlier is from the Friday of the September long weekend (4-6th). This was the only long weekend scheduled to be surveyed at Sulphur Lake. The traffic counter is located before the campground and the lake is past the camping area, so on a Friday evening anglers are coming in for the weekend. Higher traffic counts and lower effort. During the weekends (Sat & Sun) those anglers who arrived on Friday do not cross the traffic counter again until they leave, normally on Sunday. Higher effort with less traffic.

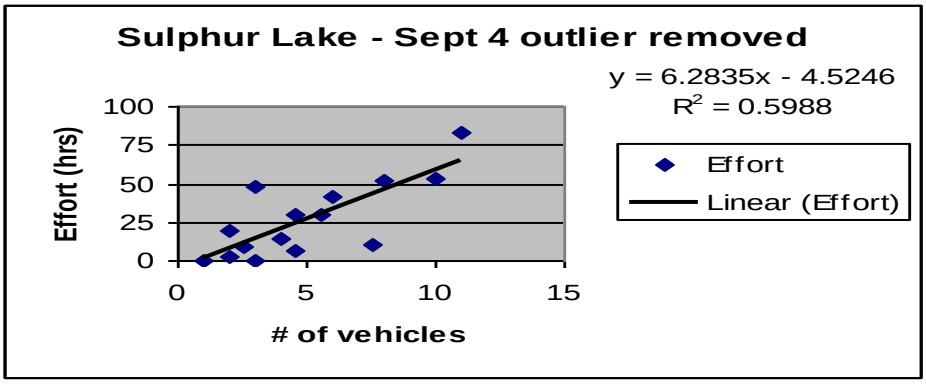


Figure 5. Sulphur Lake traffic counter vs effort relationship with Sept 4 outlier removed.

Figure Eight Lake had a strong relationship but observing at the raw data on July3 (Friday) a considerable higher number (112) of vehicles crossed the traffic counter. This number was so high when it was removed (Figure 6) the relationship increased to very strong.

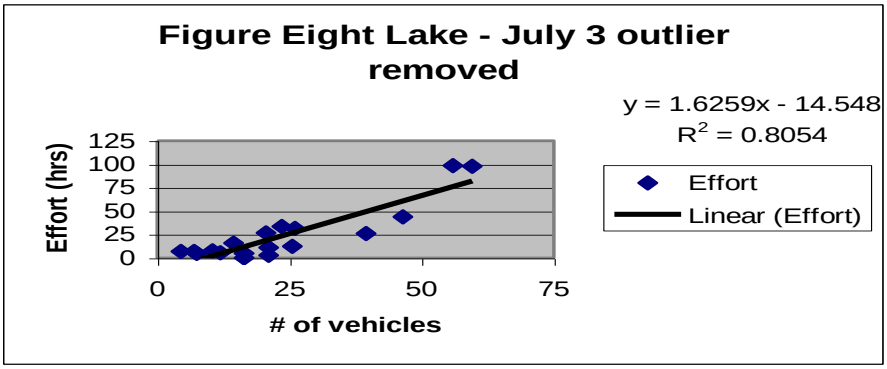


Figure 6. Figure Eight Lake traffic counter vs effort relationship with the removal of July 3-survey event, 112 vehicles.

Swan Lake shows a generally negative relationship. Heavier angling pressure in May was missed and the June 19-21 weekend survey event caught the latter end of that heavier pressure. Swan Lake was surveyed in June once and not again until mid July. 1998 was a tough year with very dry and hot conditions. These factors played a major role in the heavy algae blooms in the lake. The aesthetics of the lake dropped which may have contributed to lower effort, traffic and harvest. When only the June 21outlier was removed the R-squared value increased to .57315 (Figure 7) indicates a positive relationship.

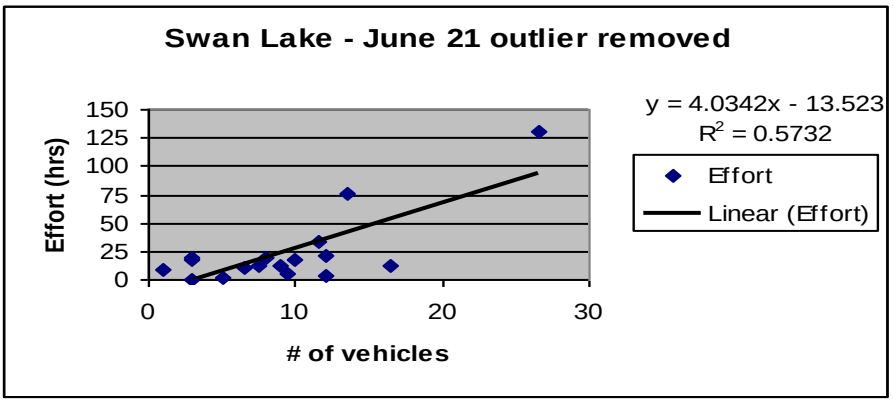


Figure 7. Swan Lake traffic counter vs effort relationship with removal of June 21 outlier (36 vehicles, 45 hrs).

These data indicate that there is a positive relationship between effort and traffic counter numbers when the extreme values are removed. Improved data on vehicle numbers and

effort could be obtained by reducing the number of lakes surveyed and increasing the number of survey events at each lake.

Traffic counters could become viable management tool, along with regular test netting, between angler surveys. From the 1998 Stocked Aerated Lake Angler Survey, data gathered on each lake resulted in the calculation of total number of anglers surveyed, number of anglers per vehicle, number of vehicles, number of fish harvested, number of fish per angler, and number of hours (effort) per angler. The formula and examples in Appendix H will allow estimated number of anglers, estimated number of fish harvested, and estimated number of hours (effort), to be calculated between angler surveys. The formula can be used a couple of times a year or monthly. When the next angler survey is complete new numbers can be introduced into the formula until the following survey.

4.5 Survey components – party numbers, angler totals, hour totals, anglers/party, anglers/vehicle, hours/vehicle.

During the ½ day (6 hr) angler survey events at Sulphur Lake, 58 parties, 138 anglers, 71 vehicles and 428 angler hours were recorded (Table 4). Of the 105 vehicles that crossed the traffic counter during the angler survey, 71 (67.6%) vehicles were recorded as containing anglers. There was a mean of 2 anglers/party, 2 anglers/vehicle, and 3.1 hours/angler during the survey periods at Sulphur Lake (Table 5).

At Figure Eight Lake 128 parties, 245 anglers, 137 vehicles and 502.5 hours were recorded (Table 4). One hundred and thirty-seven (25.4%) of the 540 vehicles that crossed the traffic counter were recorded as containing anglers. The mean anglers/party was 2, the mean anglers/vehicle was 2, and the hours /angler was 2.1 (Table 5).

During the survey events at Swan Lake, 65 parties, 141 anglers, 73 vehicles and 450.5 hours were recorded. Seventy-three (37.8%) of 193 vehicles that crossed the traffic counter were recorded as containing anglers. The mean anglers/party was 2, the mean anglers/vehicle was 2, and the mean hours/angler was 3.2 (Table 5).

The average of all three lakes in the categories of mean anglers/party, anglers/vehicle and hours/ angler was 2, 2, 2.8 respectively (Table 4).

Table 4. Observed survey components.

Lake	# of Parties	# of Anglers	Total hours	# of vehicles all survey events	# of vehicles had surveyed anglers	% of vehicles with anglers
Sulphur	58	138	428.0	105	71	67.6
Figure Eight	128	245	502.5	540	137	25.4
Swan	65	141	450.5	193	73	37.8

Table 5. Mean number of anglers/party, anglers/vehicle, hours/angler and overall means in each category.

Lake	Mean # of anglers in each party	Mean # of anglers in each vehicle	Mean # of hours for each angler
Sulphur	2	2	3.1
Figure Eight	2	2	2.1
Swan	2	2	3.2
Combined	2	2	2.8

4.6 Age Categories

Figure 8 details the age composition of the anglers surveyed at Sulphur, Figure Eight and Swan lakes during the 1998 Stocked Aerated Lake Angler Survey. Non – licensed anglers (<16 yrs and >64 yrs) made up 42.8% (n= 59), 44.1% (n= 108), and 24.8% (n= 35) at Sulphur, Figure Eight and Swan lakes respectively. Overall, non-licensed anglers comprised 38.5% (n=202) of the anglers surveyed while 61.5% (n=322) were licensed anglers.

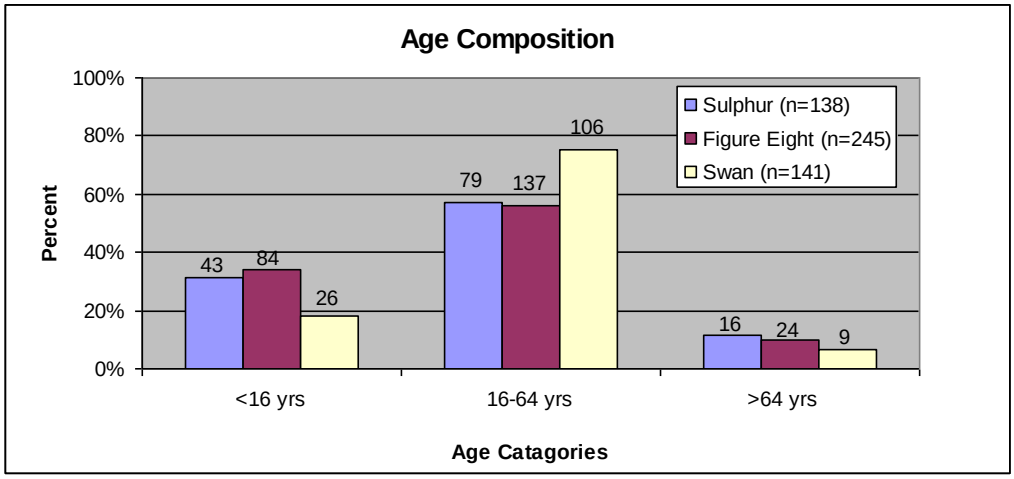
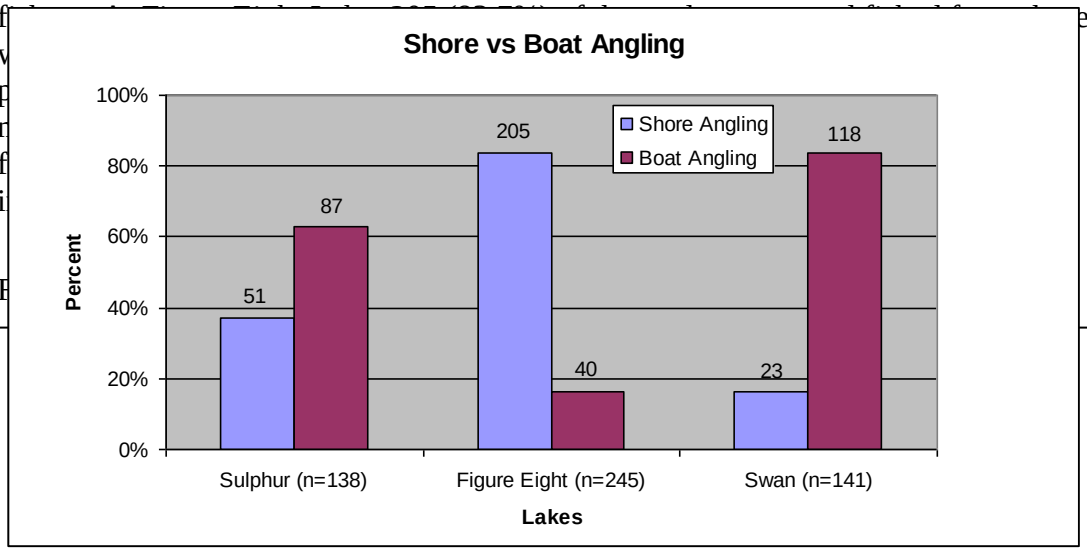


Figure 8. Age composition of anglers at Sulphur, Figure Eight, and Swan lakes.

4.7 Shore vs Boat Angling

Figure 9 shows that 87 (63%) of the anglers at Sulphur Lake fished from boats. This also includes rubber rafts, canoes and bellyboats. The other 51 (37%) fished from the shoreline generally around the dock area. These results show a predominately boat



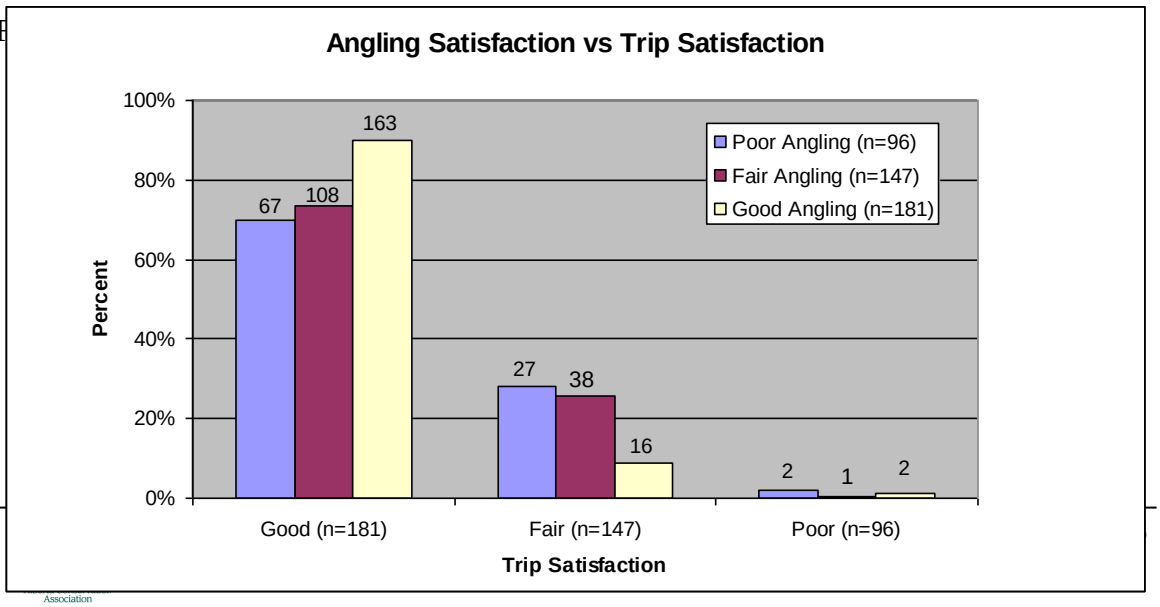
Both Sulphur and Swan lakes are mainly boat fisheries due to inaccessible shoreline. A boat fishery is a fishery, which the anglers mainly use boats to move around the water body, which likely increases the chances of contacting more fish than a shore fishery (i.e. Figure Eight Lake). Figure Eight Lake is mainly a shore fishery due to the fact the shoreline is well developed for this purpose. For anglers that do not own any water craft (boats, canoes etc.) this lake is a good lake to angle at, therefore should receive more angling pressure. Recorded data from this survey shows harvest rates were lower at Figure Eight Lake as compared to Sulphur and Swan lakes (Table 2, pg. 11) and the effort at Figure Eight Lake was higher than Sulphur and Swan lakes.

4.8 Target Species

Sulphur Lake is a multi-species lake containing both rainbow (*Oncorhynchus mykiss*) and brook (*Salvelinus fontinalis*) trout. The majority (98%) indicated no preference species. Figure Eight Lake is mainly a rainbow trout fishery and has had a supplemental stocking of brown (*Salmo trutta*) trout. Ninety –nine percent of the surveyed anglers indicated no preference to a species. Swan Lake is managed as a single species lake so the target species question was not asked.

4.9 Angler Satisfaction Questionnaire

Of the 507 anglers surveyed for the satisfaction questions, 424 (83.6%) were interviewed for both the angling satisfaction and trip satisfaction questions. Eighty-three anglers were not asked the trip satisfaction question due to the late implementation of the question at Figure Eight and Sulphur lakes (71 & 12 missing anglers, respectively). The missing anglers were from the Poor, Fair, and Good angling satisfaction categories (23, 22, 38 anglers, respectively).
Figure 10 shows a strong relationship between angling satisfaction and trip satisfaction for anglers who rated their angling as Fair – Good. Anglers who rated their angling as Poor still had a Good trip satisfaction at 69.8% (n=67).



The compared to the past fishing question asked at Sulphur Lake resulted in 21.9% of anglers (n=21) rating fishing as improving, 70.8% (n=68) indicated the same fishing and 7.3% (n=7) were noted as saying fishing was declining (Figure 11).

At Figure Eight Lake overall, 16.5% of anglers (n=20) said fishing was improving, 57.9% (n=70) rated the fishing as the same, while 25.6% (n=31) indicated declining fishing (Figure 11). Before the summer kill, 21.3% of the surveyed anglers (n=20) reported improved fishing, 66.0% (n=59) said the fishing was the same and 12.7% (n=12) noted declining fishing (Appendix H). 63.3% of the anglers (n=19) surveyed after the summerkill, noticed declining fishing, 36.7% (n=11) noted the same fishing, and no one rated the fishing as improving.

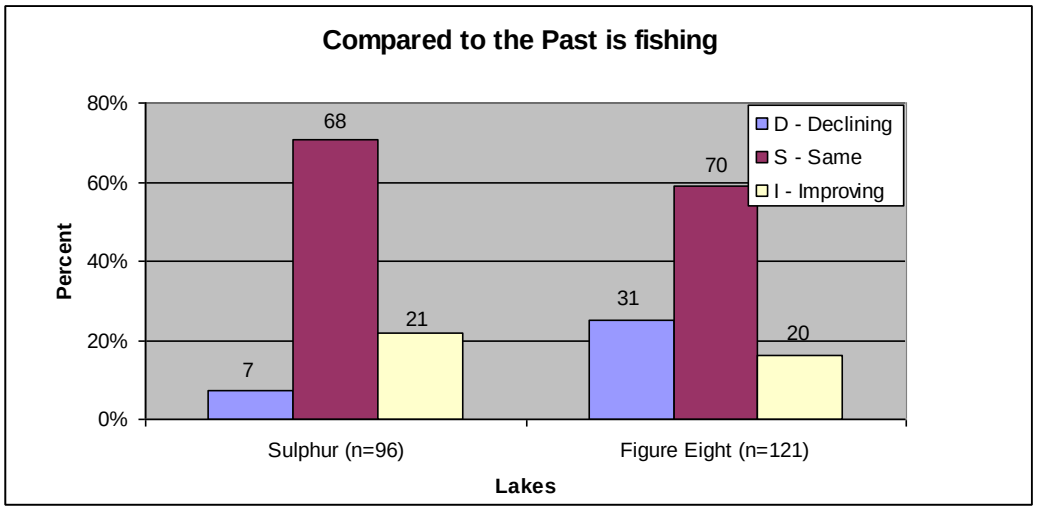


Figure 11. Compared to the past angling question.

At Swan Lake the compared to the past fishing question was not asked as aeration has only been completed for one season.

4.10 Angler Residence

The 138 anglers surveyed at Sulphur Lake were from 19 locations (Appendix I). Seventeen of the 19 residence locations were from within Alberta. One angler was from out of Province (Rosetown, Saskatchewan) and one was from outside of Canada (England). 41.3% of all anglers were from Peace River/Grimshaw and 70% of the anglers resided within a 100 km radius of the lake.

Two hundred and four of the 245 anglers were surveyed before the partial summerkill at Figure Eight Lake, while only 41 anglers were surveyed after partial summerkill. Of the anglers surveyed, 40.5% were from Grimshaw and Peace River (27.8% and 12.7%, respectively). Of the 245 anglers, 64.8% resided from within a 100-km radius.

At Swan Lake, 75% of the anglers interviewed during the angler survey events resided within a 100-km radius. Grande Prairie recorded 52.5% of the surveyed anglers, while Valleyview had 10.6% of the surveyed anglers. A few anglers came from as far away as Edmonton and Millet.

These data on angler residency indicate that the majority of the anglers surveyed (65 – 75%) reside within a 100-km radius of the lakes.

5.0 Recommendations

1. Current stocking rates at Sulphur, Figure Eight and Swan lakes should be re-evaluated. Harvest estimates from this study indicated this resource is extremely under-utilized assuming that there is 100% survival of the stocked fish (Table 6).

   Table 6. Estimated harvest for survey period and calendar year.

Lake	Survey Period (days)	Est. harvest survey period	Est. harvest calender year	Percent (%)	1998 stocking rate
Sulphur	86	808	3390	16.9	20,000
Figure Eight	89	420	1723	11.5	15,000
Swan	72	632	3160	6.3	50,000

   The above estimated calendar year extrapolated numbers are high. The catch rates during the angler survey were used to estimate harvest for the calendar year. All the stocked lakes in the Northwest Boreal Region should have their stocking rates re-evaluated. Reducing the number of stocked trout will reduce stocking costs, provide consistent growth rates for longer periods of time, producing larger trout, while providing the angler with continued quality year round fisheries.

2. Each lake population should be monitored annually with a rigorous test – netting program to provide statistically valid and comparable results. These data should be complimented with a creel survey every 5 years.

6.0 References/Literature Cited

Graham L. 1995. 1994 Alberta resident angling survey. AEP, NRS, Fisheries Management Division, Edmonton.

Hoeing, J.M., D.S. Robson, C.M. Jones, and K.H. Pollock 1993. Scheduling counts in the Instantaneous and Progressive Count Methods for Estimating Sport-fishing Effort. North American Journal of Fisheries Management, Volume 13, Number 4, 645 – 823 PG.

Kaleta, T.D. and D.S. Jackson, 1998 Draft. Stocked Lake Censusing 1995 Buck for wildlife – Habitat Project. Environmental Protection, Natural Resources Service.

Pollock, K.H., Jones, C.M., Brown, T.L.1994. Angler Survey Methods and Their Applications in Fisheries Management, American Fisheries Society, 371pp., illustrated.

Weiss, Neil A., Hassett, Mathew J.1987. Introductory Statistics. Second Edition, 672pp.

APPENDIX A

ANGLER SURVEY SCHEDULE

1998 Stocked Aerated Lake Angler Survey Schedule

LAKE	DATE	A.m./p.m.
Figure Eight Lake	June 5	p.m.
Figure Eight Lake	June 6	a.m.
Figure Eight Lake	June 7	p.m.
Figure Eight Lake	June 10	p.m.
Sulphur Lake	June 12	a.m.
Sulphur Lake	June 13	p.m.
Sulphur Lake	June 14	p.m.
Sulphur Lake	June 15	a.m.
Swan Lake	June 19	p.m.
Swan Lake	June 20	p.m.
Swan Lake	June 21	a.m.
Swan Lake	June 22	p.m.
Figure Eight Lake	June 26	a.m.
Figure Eight Lake	June 27	a.m.
Figure Eight Lake	June28	p.m.
Figure Eight Lake	July 3	p.m.
Figure Eight Lake	July 4	a.m.
Figure Eight Lake	July 5	p.m.
Sulphur Lake	July 10	p.m.
Sulphur Lake	July 11	a.m.
Sulphur Lake	July 12	p.m.
Sulphur Lake	July 13	a.m.
Swan Lake	July 16	p.m.
Swan Lake	July 17	a.m.
Swan Lake	July 18	p.m.
Swan Lake	July 19	a.m.
Figure Eight Lake	July 23	a.m.
Swan Lake	July 24	p.m.
Swan Lake	July 25	p.m.

LAKE	DATE	A.m./p.m.	COMMENTS
Swan Lake	July 26	p.m.	
Figure Eight Lake	July 31	a.m.	
Figure Eight Lake	August 1	p.m.	
Figure Eight Lake	August 2	p.m.	
Sulphur Lake	August 6	p.m.	
Sulphur Lake	August 7	a.m.	
Sulphur Lake	August 8	p.m.	
Sulphur Lake	August 9	p.m.	
Figure Eight Lake	August 12	p.m.	
Swan Lake	August 14	p.m.	
Swan Lake	August 15	a.m.	
Swan Lake	August 16	a.m.	
Swan Lake	August 19	a.m.	
Figure Eight Lake	August 21	a.m.	
Figure Eight Lake	August 22	a.m.	
Figure Eight Lake	August 23	p.m.	
Swan Lake	August 28	a.m.	
Swan Lake	August 29	p.m.	
Swan Lake	August 30	p.m.	
Figure Eight Lake	September 1	a.m.	
Sulphur Lake	September 2	p.m.	
Sulphur Lake	September 4	p.m.	
Sulphur Lake	September 5	a.m.	
Sulphur Lake	September 6	a.m.	
Swan Lake	September 8	p.m.	
Swan Lake	September 11	p.m.	
Swan Lake	September 12	p.m.	
Swan Lake	September 13	p.m.	

APPENDIX B

ANGLER SURVEY FORMS

Sulphur Lake
Figure Eight Lake
Swan Lake

SULPHUR LAKE

General Instructions (Sulphur Lake)

1. Arrive at lake before the allotted time and take traffic counter reading. The traffic counter is located on the right hand side of the road about 65 meters from the overflow camping turn off. It is marked by a short piece of orange flagging. A small dull silver box will be the counter. The viewing window will allow you to read the numbers. Record this on the Stocked Lake Creel Survey Form both at the start and at end of the shift. Please ensure that you **DO NOT** stop your vehicle near the counter as it may add a few numbers to the counter.
2. Pick a spot you can access the angler(s) where you are not interfering with the removal of the boat(s) or parking. Explain your helping with an angler survey for the Alberta Conservation Association and if the angler would mind providing information about his/her fishing day. The data collected: Catch rates (numbers of fish kept and released), Harvest rates (numbers of fish kept), angler effort (number of hour's fished/angler), sizes of fish kept will all contribute to the better management of the lake. The angler does not have to participate in the survey but most will.
3. Proceed with the questions on the Stocked Lake Creel Survey Form (see example form). If fish have been kept (harvested), ask if you could sample them by weight and length. Most anglers are agreeable to this, as they like to know exactly what each fish weighs. Record data on Fish Sampling Form. That is all that is needed from this angler, on you go to the next.
4. Continue with the survey until no more anglers are available at the time or your shift has ended. At the end of your shift record the number of boats and anglers in each that are still out fishing. Also record anglers on shore and put in the comment section of the Stocked Lake Creel Survey Form. Take traffic counter reading and record this as well.
5. Scale, measuring board, angler survey forms etc. will be provided and should be taken home at end of stay.
6. If anyone is over the number of fish limit, report the violators to Natural Resources Service in Peace River (624-6405) or 1-800-642-3800 (Report-a-Poacher number). Write down the license number, vehicle make, model color and a description of the person(s).

Please bring food, sunglasses, sunscreen, chair, books and anything that will make your shift comfortable.

Contact Numbers for myself (David Jackson) if there's problems or questions.

General Instructions
(Figure Eight Lake)

1. Arrive at lake before the allotted time and take traffic counter reading. The traffic counter is located on the right hand side of the road in a white box on a 4x4 post, next to the lake aeration shed. **BE CAREFUL** as there are young swallows in a nest inside the white box. Inside this white box is the counter. The viewing window will not allow you to read the numbers so you have to lift the lid of the counter to read the numbers. Record this on the Stocked Lake Creel Survey Form both at the start and at end of the shift. Please ensure that you **DO NOT** stop your vehicle near the counter as it may add a few numbers to the counter.

2. Pick a spot you can access the angler(s) where you are not interfering with the removal of the boat(s) or parking. At this lake you will have to walk around along the south and west ends of the lake to get the shore anglers and some boat anglers as they park their boats on the west end of the lake. Explain your helping with an angler survey for the Alberta Conservation Association and if the angler would mind providing information about his/her fishing day. The data collected: Catch rates (numbers of fish kept and released), Harvest rates (numbers of fish kept), angler effort (number of hour's fished/angler), sizes of fish kept will all contribute to the better management of the lake. Rainbow and brown trout are in Figure Eight Lake. The angler does not have to participate in the survey but most will.

3. Proceed with the questions on the Stocked Lake Creel Survey Form (see example form). If fish have been kept (harvested), ask if you could sample them by weight and length. Most anglers are agreeable to this, as they like to know exactly what each fish weighs. Record data on Fish Sampling Form. That is all that is needed from this angler, on you go to the next angler.

4. Continue with the survey until no more anglers are available at the time, an instantaneous count time has arrived or your shift has ended. Walk around 3 to 4 times and survey anglers along the shore to not annoy the anglers. At the end of your shift record the number of boats and anglers in each that are still out fishing. Also record anglers on shore and put in the comment section of the Stocked Lake Creel Survey Form. Take traffic counter reading and record this as well.

5. Scale, measuring board, angler survey forms etc. will be stored in the shed and a set of keys are under the shed.

6. If anyone is over the number of fish limit, report the violators to Natural Resources Service in Peace River (624-6405) or 1-800-642-3800 (Report-a-Poacher number). Write down the license number, vehicle make, model color and a description of the person(s).

Please bring food, sunglasses, sunscreen, chair, books and anything that will make your shift comfortable.

Contact Numbers for myself (David Jackson) if there's problems or questions.

Stocked Lake Creel Survey Form Instructions

(Sulphur and Figure Eight)

1) Date - self-explanatory
2) AM/PM – circle the correct one
3) Lake – circle which lake you're at: Sulphur, or Figure Eight
4) Weather – fill in the blanks, wind e.g. "Y" for yes, "N" for no, precip e.g. light rain, cloud e.g. 75%, temp e.g. 5+ C
5) Recorder – that's you
6) Page #'s, 1of 1, 2 of 3, 2 of 4
7) Circle the AM or PM time slot you are working
8) Traffic counter reading taken at the start and end of the shift

Party & Angler # - e.g. 1-4, party 1 with 4 anglers, 2-1, party 2 with 1 angler. Each of these anglers is to be interviewed so with party 1 you would have 1-1, 1-2, 1-3, 1-4 and each of their information next to this number across the form, from left to right.

# of vehicles per party – The number of vehicles/party e.g. 4 anglers, 2 vehicles, 1 party = number in column is 2 at the space next to the last interviewed person in that party.

Fishing Shore or Boat – Circle appropriate one

Age Group - < 16 years old, the number 1 goes in, between 16-65 the number 2, etc.

Residence – where the person's place of permanent residence is.

Angling Start Time - What time did the angler begin fishing, today?

Interview Time – What time did you interview the angler. Total Time (hrs) – round to nearest quarter hour. e.g. 1.25 hrs

Completed Trip – If their finished for the day circle "Y" for yes, "N" for …..

Target Species – circle one or two of the fish the angler are after. BN – brown trout, RN - rainbow trout, BK – brook trout. Of course this depends what lake your at. Swan – rainbows only, Sulphur – rainbow and brook trout, Figure Eight Lake – rainbow and brown.

Species kept and released, fill in appropriate row

Overall Angling Satisfaction – P for poor, F for fair,….., circle one of the three. This question directly relates to the fishing.

Overall Trip Satisfaction – P for poor, F for fair,….., circle one of the three. This question relates to the overall trip, e.g. weather, facilities, fishing

Compared to the past – is the fishing Declining, Same, or Improving

Lake Angler Survey

STOCKED LAKE CREEL SURVEY FORM-SUMMER 1998

Page

Day/Month/Year
Date: _____ **AM / PM** **Lake:** ___ Sulphur Figure Eight **Weather:** wind:_____ precip:___ **Recorder:** _____
cloud:_____% temp:____C

1 - <16
2 - 16-65
3 - >65

AM= 10am-4pm
PM= 4pm-10pm

Traffic Counter Reading
Start:_____ **Finish:**_____

P-poor
F-fair
G-good

P-poor
F-fair
G-good

Party & Angler #	# of vehicles per party	Fishing Shore or Boat	Age Group	Residence	Angling Start Time	Interview Time	Total Time (hrs)	Completed Trip	Target Species	BRO WN # Kept	BRO WN # Rel.	RAIN NBOW # Kept	RAIN NBOW # Rel.	BROOK # Kept	BROOK # Rel.	Overall Angling Satisfaction	Overall Trip Satisfaction
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G

COMMENTS: _____

_____

_____

Alberta Conservation Association

General Instructions
(Swan Lake)

1. Arrive at lake before the allotted time and take traffic counter reading. The traffic counter is located on the right hand side of the road. The large Canfor sign is on left, just past the sign on your right is a trail, the next large tree on your right is where the counter is located. A small dull silver box will be the counter. A small viewing window will allow you to read the numbers. Record this on the Stocked Lake Creel Survey Form both at the start and at end of the shift. Please ensure that you **DO NOT** stop your vehicle near the counter as it may add a few numbers to the counter.

2. Pick a spot you can access the angler where you are not interfering with the removal of the boat(s). I park my vehicle next to the shed so I do not miss anyone. Explain your helping with an angler survey for the Alberta Conservation Association and if the angler would mind providing information about his/her fishing day. The data collected: Catch rates (numbers of fish kept and released), Harvest rates (numbers of fish kept), angler effort (number of hour's fished/angler), sizes of fish kept will all contribute to the better management of the lake. The angler does not have to participate in the survey but most will.

3. Proceed with the questions on the Stocked Lake Creel Survey Form (see example form). If fish have been kept (harvested), ask if you could sample them by weight and length. Most anglers are agreeable to this, as they like to know exactly what each fish weighs. Record data on Fish Sampling Form. That is all that is needed from this angler, on you go to the next angler.

4. Continue with the survey until no more anglers are available at the time or you shift has ended. At the end of your shift record the number of boats and anglers in each that are still out fishing. Also record anglers on shore and put in the comment section of the Stocked Lake Creel Survey Form. Take traffic counter reading and record this as well.

5. Store scale, measuring board, angler survey forms etc. in shed. A key will be hidden underneath shed on a nail, on the right hand side of the door.

6. If anyone is over the number of fish limit, report the violators to Natural Resources Service in Valleyview. The office # is 524-3605. Officer Rob Lamont cell # is 524-8002. Officer Lewis Watson cell # is 524-8605.

Please bring food, water, sunglasses, sunscreen, chair, books and anything that will make your shift comfortable.

Contact Numbers for myself (David Jackson) if there's problems or questions.

Stocked Lake Creel Survey Form Instructions (Swan Lake)

Date - self-explanatory
AM/PM – circle the correct one
Weather – fill in the blanks, wind e.g. "Y" for yes, "N" for no, precip e.g. light rain, cloud e.g. 75%, temp e.g. 5+ C
Recorder – that's you
Page #'s, 1of 1, 2 of 3, 2 of 4
Circle the AM or PM time slot you are working
Traffic counter reading taken at the start and end of shift

Party & Angler # - e.g. 1-4, party 1 with 4 anglers, 2-1, party 2 with 1 angler. Each of these anglers is to be interviewed so with party 1 you would have 1-1, 1-2, 1-3, 1-4 and each of their information next to this number across the form, from left to right.

# of vehicles per party – The number of vehicles/party e.g. 4 anglers, 2 vehicles, 1 party = number in column is 2 at the space next to the last interviewed person in that party.

Fishing Shore or Boat – Circle appropriate one

Age Group - < 16 years old, the number 1 goes in, between 16-65 the number 2, etc.

Residence – where the person's place of permanent residence is.

Angling Start Time - What time did the angler begin fishing, this day.

Interview Time – What time did you interview the angler.

Total Time (hrs) – round to nearest quarter hour. e.g. 1.25 hrs

Completed Trip – If their finished for the day circle "Y" for yes, "N" for…

Target Species – circle one or two of the fish the angler are after. BN – brown trout, RN - rainbow trout, BK – brook trout. Of course this depends what lake your at. Swan – rainbows only, Sulphur – rainbow and brook trout, Figure Eight Lake – rainbow and brown.

Species kept and released, fill in appropriate row

Overall Angling Satisfaction – P for poor, F for fair… circle one of the three. This question directly relates to the fishing.

Overall Trip Satisfaction – P for poor, F for fair… circle one of the three. This question relates to the overall trip, e.g. weather, facilities, fishing

Day/Month/Year
Date: _____ **AM / PM** **Lake:** Swan **Weather:** wind:_____ precip:___ **Recorder:** _____
cloud:_____% temp:____ C

1 - <16
2 - 16-65
3 - >65

AM= 10am-4pm
PM= 4pm-10pm

Traffic Counter Reading
Start:_____ **Finish:**_____

P-poor F-fair G-good

Party & Angler #	# of vehicles per party	Fishing Shore or Boat	Age Group	Residence	Angling Start Time	Interview Time	Total Time (hrs)	Completed Trip	Target Species	BRO # Kept	WN # Rel.	RAIN # Kept	NBOW # Rel.	BROOK # Kept	# Rel.	Overall Angling Satisfaction	Overall Trip Satisfaction
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G
		S B						Y N	BN RN BK							P F G	P F G

COMMENTS: _____

APPENDIX C

Fish Sampling Form

Fish Sampling Form

1. Fill in lake or stream, date, species, and recorder. See sample next page
2. Enter as RNTR for rainbow, BNTR for brown, and BKTR for brook trout
3. Fork Length as millimeters (mm)
4. Weight as grams (gms)
5. Any notable remarks
6. Mark pages 1 of 1, 2 of 3, etc.

Harvested fish sample form.

Alberta
ENERGY AND NATURAL RESOURCES

Form WFR ;
SAMPLE RECORD CARD
Fish and Wildlife Division

♀			♂
1	Immature		6
2	Maturing		7
3	Mature		8
4	Ripe		9
5	Spent		10

Lake or Stream _____ Date _____
Species _____ Time _____
Mesh Size _____ Depth of Set _____
Location of Set _____
Sample _____ Recorder _____

NUMBER	SAMPLE NUMBER	FORK LENGTH Inch. ☐ Mm. ☐	WEIGHT Oz. ☐ Gms. ☐	AGE	MATURITY	CYST COUNT	REMARKS
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							

Alberta Conservation Association

APPENDIX D

INSTANTANEOUS COUNT FORM

Instantaneous Count Form

1. Fill in lake and date
2. Evening counts (4pm-10pm) should be completed at 5pm, 7pm, and 9pm. Insert proper time over each column. Morning counts (10am-4pm) should be completed at 11am, 1pm, and 3pm. Insert proper time over each column.
3. Party 1 has only 2 anglers, Party 2 has 1 angler and 1 non-angler. Record this as example shows, and so on with the other columns

Instantaneous Count Form

Lake:________________ Date:____________________

Time: ________

Party #	No. of Anglers	No. of Non-Anglers

Time: ________

Party #	No. of Anglers	No. of Non-Anglers

Time: ________

Party #	No. of Anglers	No. of Non-Anglers

Appendix E

Standard deviation and Confidence interval Formulas

STDEV

See Also

Estimates standard deviation based on a sample. The standard deviation is a measure of how widely values are dispersed from the average value (the mean).

Syntax

STDEV(number1,number2,...)

Number1,number2,... are 1 to 30 number arguments corresponding to a sample of a population. You can also use a single array or a reference to an array instead of arguments separated by commas.

· Logical values such as TRUE and FALSE and text is ignored. If logical values and text must not be ignored, use the STDEVA worksheet function.

Remarks

· STDEV assumes that its arguments are a sample of the population. If your data represents the entire population, then compute the standard deviation using STDEVP.
· The standard deviation is calculated using the "nonbiased" or "n-1" method.
· STDEV uses the following formula:
·

Example

Suppose 10 tools stamped from the same machine during a production run are collected as a random sample and measured for breaking strength. The sample values (1345, 1301, 1368, 1322, 1310, 1370, 1318, 1350, 1303, and 1299) are stored in A2:E3, respectively. STDEV estimates the standard deviation of breaking strengths for all the tools.

STDEV(A2:E3) equals 27.46

CONFIDENCE

See Also

Returns the confidence interval for a population mean. The confidence interval is a range on either side of a sample mean. For example, if you order a product through the mail, you can determine, with a particular level of confidence, the earliest and latest the product will arrive.

Syntax

CONFIDENCE(alpha,standard_dev,size)

Alpha is the significance level used to compute the confidence level. The confidence level equals 100*(1 - alpha)%, or in other words, an alpha of 0.05 indicates a 95 percent confidence level.

Standard_dev is the population standard deviation for the data range and is assumed to be known.

Size is the sample size.

Remarks

· If any argument is nonnumeric, CONFIDENCE returns the #VALUE! error value.
· If alpha £ 0 or alpha ³ 1, CONFIDENCE returns the #NUM! error value.
· If standard_dev £ 0, CONFIDENCE returns the #NUM! error value.
· If size is not an integer, it is truncated.
· If size < 1, CONFIDENCE returns the #NUM! error value.
· If we assume alpha equals 0.05, we need to calculate the area under the standard normal curve that equals (1 - alpha), or 95 percent. This value is ± 1.96. The confidence interval is therefore:

Example

Suppose we observe that, in our sample of 50 commuters, the average length of travel to work is 30 minutes with a population standard deviation of 2.5. We can be 95 percent confident that the population mean is in the interval:

or:

CONFIDENCE(0.05,2.5,50) equals 0.692951. In other words, the average length of travel to work equals 30 ± 0.692951 minutes, or 29.3 to 30.7 minutes.

APPENDIX F

Estimated Effort, Harvest, and Angler Calculation Tables

Swan Lake
Sulphur Lake
Figure Eight Lake

Swan Lake Estimated Effort, Harvest and Angler Calculation Tables

Weekday Calculations

The actual ½ day (6 hr) survey period results are in Table 1. The angler hours are recorded as total hours for the number of anglers.

Table 1.

1/2 day

Weekdays	Anglers	Hours	Harvested Fish
June 22 (M)	5	18.0	1
July 16 (Th)	5	17.0	1
Aug 19 (W)	5	8.0	2
Total	**15**	**43.0**	**4**

To calculate the full day (12 hr) estimates each of the columns are multiplied by 2. Then Microsoft Excel standard deviation (STDEV) and confidence interval (CONFID) formulas were employed (Table 2). Now the mean for the sampled weekdays in all three categories is calculated.

Table 2.

fullday

Weekdays	Anglers	Hours	Harvested Fish
June 22 (M)	10.0	36.0	2.0
July 16 (Th)	10.0	34.0	2.0
Aug 19 (W)	10.0	16.0	4.0
Total	**30**	**86.0**	**8**
STDEV	0.0	11.0	1.2
CONFID	#NUM!	12.5	1.3

To calculate the estimated mean in each column, the full day results are divided by the number of weekdays (3) sampled in the survey.

Mean hours/weekday= 86(12.5)/3=28.6(4.2) hours
Mean anglers/weekday= 30(0.0)/3= 10(0.0) anglers
Mean fish/weekday= 8 (1.3)/3=2.6(0.4) fish

The numbers in brackets are the confidence interval (95%). The length of the survey was June 19 to August 30, 1998. Forty (40) of those days were weekdays. To calculate for the estimated total weekday stratum the above numbers are multiplied by the number of days in the entire survey - 40 (Table 3).

Table 3.

Weekdays Total	Effort (Angler Hours)	Number of Anglers	Harvested Fish
Mean/day	28.6 ± 4.2	10.0 ± 0.0	2.6 ± 0.4
Total days*	40.0	40.0	40.0
Total	1144 ± 168.0	400.0 ± 0.0	104.0 ± 16.0

* Number of weekdays total in survey period

The same calculations are made for the weekend day stratum. Only the tables are shown.
Table 4.

1/2 day

Weekend	Date	Anglers	Hours	Harvested Fish
Friday	19-Jun	3	5.50	0
Saturday	20-Jun	33	131.25	24
Sunday	21-Jun	12	44.00	39
Friday	17-Jul	2	2.00	0
Saturday	18-Jul	11	34.00	6
Sunday	19-Jul	9	22.00	2
Friday	24-Jul	4	13.00	3
Saturday	25-Jul	22	76.75	8
Sunday	26-Jul	3	3.75	0
Friday	14-Aug	3	12.00	15
Saturday	15-Aug	6	24.25	6
Sunday	16-Aug	5	11.00	9
Friday	28-Aug	0	0.00	0
Saturday	29-Aug	7	19.50	2
Sunday	30-Aug	6	11.50	6
15 days	**Total**	**126**	**410.50**	**120**

Table 5.

full day

Weekend	Date	Anglers	Hours	Harvested Fish
Friday	19-Jun	6	11.00	0
Saturday	20-Jun	66	262.50	48
Sunday	21-Jun	24	88.00	78
Friday	17-Jul	4	4.00	0
Saturday	18-Jul	22	68.00	12
Sunday	19-Jul	18	44.00	4
Friday	24-Jul	8	26.00	6
Saturday	25-Jul	44	153.50	16
Sunday	26-Jul	6	7.50	0
Friday	14-Aug	6	24.00	30
Saturday	15-Aug	12	48.50	12
Sunday	16-Aug	10	22.00	18
Friday	28-Aug	0	0.00	0
Saturday	29-Aug	14	39.00	4
Sunday	30-Aug	12	23.00	12
15 days	**Total**	**252**	**821.0**	**240**
	STDEV	17.4	69.8	21.6
	CONFID	8.8	35.3	10.9

Mean Hours/weekend day = 821(35.3)/15= 54.7(2.4) hours
Mean anglers/weekend day = 252(8.8)/15= 16.8(0.6) anglers
Mean fish/weekend day = 240(10.9)/15 =16(0.7) fish

Length of survey June 19 - August 30
weekend days = 33

Table 6.

Weekends Total	Effort (Angler Hours)	Number of Anglers	Harvested Fish
Mean/day	54.7 ± 2.4	16.8 ± 0.6	16.0 ± 0.7
Total days*	33.0	33.0	33.0
Total	1805.1 ± 79.2	554.4 ± 19.8	528 ± 23.1

Number of weekend days total in survey period

Now that the totals for both strata are complete, total estimated effort, harvest and anglers for the entire survey is calculated by combing the two strata. Standard deviation and confidence interval formulas are applied to produce total estimated effort, harvest and anglers (Table 7).

Table 7.

Weekdays	Weekends	Total Survey (Estimated)
1144 ± 168.0	1805.1± 79.2	2949.1 ± 107.2 Hours (Effort)
400.0 ± 0.0	554.4 ± 19.8	954.4 ± 25.0 Anglers
104.0 ± 16.0	528.0 ± 23.1	632.0 ± 68.8 Harvested Fish

Sulphur and Swan lakes had the same design (access-point survey). In the Sulphur lake Calculation tables only the tables are shown.

Sulphur Lake Estimated Effort, harvest and Anglers Calculation Tables

Weekday calculations

Sulphur Lk

1/2 day actual

Weekdays	Anglers	Hours	Harvested Fish
June 15 (M)	0	0.0	0
July 13 (M)	0	0.0	0
Aug 6 (Th)	4	14.5	0
Sept 2 (W)	4	20.0	8
Total	**8**	**34.5**	**8**

full day estimated

Weekdays	Anglers	Hours	Harvested Fish
June 15 (M)	0	0.0	0
July 13 (M)	0	0.0	0
Aug 6 (Th)	8	29.0	0
Sept 2 (W)	8	40.0	16
Total	**16**	**69.0**	**16**
STDEV	4.6	20.4	8.0
CONFID	4.5	20.0	7.8

Mean Hours/weekday =69(20)/4 =17.25(5)
Mean Anglers/wd = 16(4.5)/4 = 4(1.1)
Mean H fish/wd = 16(7.8)/4 = 4(1.9)

Length of survey June 12 - Sept 6
weekdays = 48

Weekdays Total	Effort (Angler Hours)	Number of Anglers	Harvested Fish
Mean/day	17.25 ± 5.0	4.0 ± 1.1	4.0 ± 1.9
Total days*	48.0	48.0	48.0
Total	828.0 ± 240.0	192.0 ± 52.8	192.0 ± 91.2

* Number of weekdays total in survey period
June 12 - Sept 6, 1998

1/2 day actual

Weekend	Date	Anglers	Hours	Harvested Fish
Friday	12-Jun	3	2.25	0
Saturday	13-Jun	3	11.00	0
Sunday	14-Jun	11	29.50	8
Friday	10-Jul	11	53.25	2
Saturday	11-Jul	14	48.00	22
Sunday	12-Jul	3	6.50	1
Friday	7-Aug	6	9.00	4
Saturday	8-Aug	10	29.75	14
Sunday	9-Aug	19	52.00	8
Friday	4-Sep	10	27.75	10
Saturday	5-Sep	13	41.50	10
Sunday	6-Sep	32	83.00	16
Total		**135**	**393.50**	**95**

ful day estimated

Weekend	Date	Anglers	Hours	Harvested Fish
Friday	12-Jun	6	4.50	0
Saturday	13-Jun	6	22.00	0
Sunday	14-Jun	22	59.00	16
Friday	10-Jul	22	106.50	4
Saturday	11-Jul	28	96.00	44
Sunday	12-Jul	6	13.00	2
Friday	7-Aug	12	18.00	8
Saturday	8-Aug	20	59.50	28
Sunday	9-Aug	38	104.00	16
Friday	4-Sep	20	55.50	20
Saturday	5-Sep	26	83.00	20
Sunday	6-Sep	64	166.00	32
12Days	**Total**	**270**	**787.00**	**190**
	STDEV	16.4	48.0	13.9
	CONFID	9.3	27.1	7.9

Mean hours/weekend day = 787(27.1)/12 =65.6(2.26)hours/weekend da
Mean anglers/weekend day = 270(9.3)/12 = 22.5(0.8) anglers
Mean fish/weekend day = 190(7.9)/12 = 15.8(0.7) fish

Length of survey June 12 - Sept 6th
weekend days = 39

Weekends Total	Effort (Angler Hours)	Number of Anglers	Harvested Fish
Mean/day	65.6 ± 2.3	22.5 ± 0.8	15.8 ± 0.7
Total days*	39.0	39.0	39.0
Total	2558.4 ± 89.7	877.5 ± 31.2	616.2 ± 27.3

Number of weekend days total in survey period
June 12 - Sept 6, 1998

Weekdays	Weekends	Total Survey (Estimated)
828.0 ± 240.0	2558.4 ± 89.7	3386.4 ± 257.1 Hours (Effort)
192.0 ± 52.8	877.5 ± 31.2	1069.5 ± 101.9 Anglers
192.0 ± 91.2	616.2 ± 27.3	808.2 ± 63.0 Harvested Fish

Figure Eight Lake Estimated Effort Calculation Tables

Estimated effort calculations for Figure Eight Lake were determined by taking instantaneous counts during the survey periods.

Table 1 details the calculations for the survey periods during the weekdays.

Date	Instantaneous Count Totals	Mean # of anglers (6hr)	Fishing Day (12 hours) Estimated effort
June 10 (W)	4	1.3	15.6
July 23 (Th)	4	1.3	15.6
Aug 12 (W)	2	0.7	8.4
Sept (1)*	0	0.0	0
Total	**10**	**3.3**	**39.6**
STDEV		0.4	4.2
CONFID		0.4	4.7

* Instantaneous count not completed

The instantaneous count totals column is the total number of anglers counted during the instantaneous counts for that survey period. The next column is the mean number of anglers during the ½ day 6-hour survey period. To calculate this, the first column is divided by number of counts done that survey period. Total estimated effort for that day is determined by multiplying the number in the second column by 12 (full day).

The next step is to determine mean estimated effort for each day. The third column in Table 1 is divided by the number of days surveyed during the weekdays. 39.6/3 = 13.2 Standard deviation and confidence interval formulas were applied.

Mean/day	13.2	7.2	8.2	13.2 ± 8.2

The number of weekdays is 49. To calculate total estimated effort for entire survey, multiply 13.2 by 49 (Table 3).

The same calculations are completed to determine total estimated effort for the weekend days (Table 2). Mean/ day is determined and extrapolated over the weekend days surveyed during the entire survey.

Table 2.

Date	Instantaneous Count Totals	Mean # of anglers (6hr)	Fishing Day (12 hours) Estimated effort
June 5 (F)*	9	3.0	36.0
June 6 (S)	37	12.3	147.6
June 7 (Su)	50	16.7	200.4
June 26 (F)	4	1.3	15.6
June 27(S)	7	2.3	27.6
June 28 (Su)	23	7.7	92.4
July 3 (F)	36	12.0	144.0
July 4 (S)	28	9.3	111.6
July 5 (Su)	38	12.7	152.4
July 10-12	partial	summerkill	
July 31 (F)**	0	0.0	0.0
Aug 1 (S)	3	1.0	12.0
Aug 2 (Su)	11	3.7	44.4
Aug 21 (F)	4	1.3	15.6
Aug 22 (S)	3	1.0	12.0
Aug 23 (Su)	10	3.3	39.6
Total		**84.7**	**1015.2**
STDEV		5.5	66.3
CONFID		3.0	36.0

* only 2 counts

** instantaneous count not completed

Mean/day	78.1	46.0	25.0	78.1 ± 25.0

Table 3.

Weekdays Total	**Effort (Angler Hours)**	**Weekends Total**	**Effort (Angler Hours)**
Mean/day	13.2 ± 8.2	Mean/day	78.1 ± 25.0
Total days*	49.0	Total days**	40.0
Total	646.8 ± 401.8	Total	3124.0 ± 1000.0

* Number of weekdays total in survey period

** Number of weekend days total in survey

Table 4 combines the weekday and weekend day totals to determine total estimated effort for the entire survey.

Table 4.

Weekdays Total	Weekends Total	Total Effort (Angler Hours)
646.8 ± 401.8	3124.0 ± 1000.0	3770.8 ± 363.9

Figure Eight Lake Estimated harvest and anglers calculation Tables

Total estimated harvest and angler numbers for Figure Eight lake were calculated the same as Sulphur and Swan Lakes. Only the tables will be shown.

1/2 day

Weekdays	Anglers	Harvested Fish
June 10 (W)	10	0
July 23 (Th)	2	0
Aug 12 (W)	3	0
Sept 1 (T)	2	0
Total	**17**	**0**

full day

Weekdays	Anglers	Harvested Fish
June 10 (W)	20	0
July 23 (Th)	4	0
Aug 12 (W)	6	0
Sept 1 (T)	4	0
Total	**34**	**0**
STDEV	7.7	0
CONFID	7.6	#NUM!

'eekday = 34(7.6)/4 = 8.5(1.9)
Mean Harvested Fish = 0

Weekdays Total	Number of Anglers	Harvested Fish
Mean/day	8.5 ± 1.9	0.0
Total days*	49.0	49.0
Total	416.5 ± 93.1	0.0

* Number of weekdays total in survey peri

1/2 day

Weekend	Date	Anglers	Harvested Fish
Friday	5-Jun	12	2
Saturday	6-Jun	16	8
Sunday	7-Jun	35	22
Friday	26-Jun	2	0
Saturday	27-Jun	11	2
Sunday	28-Jun	27	3
Friday	3-Jul	26	13
Saturday	4-Jul	25	14
Sunday	5-Jul	43	15
Friday	31-Jul	7	0
Saturday	1-Aug	6	0
Sunday	2-Aug	9	0
Friday	21-Aug	2	0
Saturday	22-Aug	0	0
Sunday	23-Aug	10	0
Total		**231**	**79**

full day

Weekend	Date	Anglers	Harvested Fish
Friday	5-Jun	24	4
Saturday	6-Jun	32	16
Sunday	7-Jun	70	44
Friday	26-Jun	4	0
Saturday	27-Jun	22	4
Sunday	28-Jun	54	6
Friday	3-Jul	52	26
Saturday	4-Jul	50	28
Sunday	5-Jul	86	30
Friday	31-Jul	14	0
Saturday	1-Aug	12	0
Sunday	2-Aug	18	0
Friday	21-Aug	4	0
Saturday	22-Aug	0	0
Sunday	23-Aug	20	0
Total		**462**	**158**
	STDEV	25.9	14.5
	CONFID	13.1	7.4

mean anglers/weekend day = 462(13.1)/15 = 30.8(0.9) anglers
Mean fish/weekend day = 158(7.4)/15 = 10.53(0.5) fish

Weekends Total	Number of Anglers	Harvested Fish
Mean/day	30.8 ± 0.9	10.5 ± 0.5
Total days*	40.0	40.0
Total	1232.0 ± 36.0	420.0 ± 20.0

Weekdays	Weekends	Total Survey (Estimated)
416.5 ± 93.1	1232.0 ± 36.0	1648.5 ± 119.8 Anglers
0.0	420.0 ± 20.0	420.0 ± 61.7 Harvested Fish

APPENDIX G

TRAFFIC COUNTER READINGS

Sulphur Lake
Figure Eight Lake
Swan Lake

Sulphur Lake Traffic Counter				
Date (a.m./p.m.)	Start	Finish	Total	Comments
12/6/98 (a.m.)	549	553	2.0	Friday
13/6/98 (p.m.)	594	609	7.5	Sat
14/6/98 (p.m.)	633	644	5.5	Sun
15/6/98 (a.m.)	649	651	1.0	Mon
10/7/98 (p.m.)	1142	1162	10.0	Friday
11/7/98 (a.m.)	1166	1172	3.0	Sat
12/7/98 (p.m.)	1214	1223	4.5	Sun
13/7/98 (a.m.)	1225	1231	3.0	Mon
6/8/98 (p.m.)	1628	1636	4.0	Thurs
7/8/98 (a.m.)	1638	1645	2.5	Friday
8/8/98 (p.m.)	1662	1673	4.5	Sat
9/8/98 (p.m.)	1689	1705	8.0	Sun
2/9/98 (p.m.)	2121	2125	2.0	Wed
4/9/98 (p.m.)	2107	2167	30.0	Long weekend Sept
5/9/98 (a.m.)	2172	2184	6.0	Sat
6/9/98 (a.m.)	2203	2225	11.0	Sun
Total			105	

Figure Eight Lake Traffic Conuter				
Date (a.m./p.m.)	Start	Finish	Total	Comments
5/6/1998 (p.m.)	146528	146575	23.5	
6/6/1998 (a.m.)	146590	146669	39.5	
7/6/1998 (p.m.)	146899	147018	59.5	
10/6/1998 (p.m.)	147160	147189	14.5	
26/6/98 (a.m.)	148641	148655	7.0	
27/6/98 (a.m.)	148705	148746	20.5	
28/6/98 (p.m.)	148874	148926	26.0	
3/7/1998 (p.m.)	149762	149986	112.0	
4/7/1998 (a.m.)	150033	150126	46.5	
5/7/1998 (p.m.)	150314	150426	56.0	B4-405 vehicles
12/7/98	Partial summerkill occurred			75%
23/7/1998 (a.m.)	152705	152747	21.0	
31/7/1998 (a.m.)	153588	153609	10.5	
1/8/1998 (p.m.)	153665	153698	16.5	was done am
2/8/1998 (p.m.)	153794	153845	25.5	
12/8/1998 (p.m.)	154575	154599	12.0	
21/8/98 (a.m.)	155074	155083	4.5	
22/8/1998 (a.m.)	155138	155171	16.5	
23/8/1998 (p.m)	155277	155319	21.0	
1/9/1998 (a.m.)	155714	155729	7.5	After-135 vehicles
Total 19 days			540	25%

	Swan Lake			
Date (a.m./p.m.)	**Start**	**Finish**	**Total**	**Comments**
19/6/98(p.m.)	0	19	9.5	
20/6/98 (p.m.)	78	131	26.5	
21/6/98 (a.m.)	145	217	36.0	
22/6/98 (p.m.)	301	307	3.0	
16/7/98 (p.m.)	1233	1253	10.0	
17/7/98 (a.m.)	1261	1271	5.0	
18/7/98 (p.m.)	1317	1340	11.5	
19/7/98 (a.m.)	1351	1375	12.0	
24/7/98 (p.m.)	1520	1535	7.5	
25/7/98 (p.m.)	1556	1583	13.5	
26/7/98 (p.m.)	1613	1637	12.0	
14/8/98 (p.m.)	2082	2100	9.0	over T.C.3x
15/8/98 (a.m.)	2105	2121	8.0	2x over T.C.
16/8/98 (a.m.)	2146	2159	6.5	3x over T.C.
19/8/98 (a.m.)	2245	2247	1.0	2x over T.C.
28/8/98 (a.m.)	2393	2399	3.0	
29/8/98 (p.m.)	2410	2416	3.0	
30/8/98 (p.m.)	2419	2452	16.5	
Total 18 days			194	

APPENDIX H

Formula, with examples, for estimating angler numbers, harvest numbers and effort between angler surveys

Monthly	total # of vehicles		% of vehicles		total # of anglers		**A**	**B**	**C**
		X	containing anglers	**X**	per vehicle	**=**	est. total # of anglers	est. # of harvested fish	est. # of hours (effort)
			from last survey		from last survey				

EXAMPLE

Month	**Lake**									
June										
30	**Sulphur**	**175**	**X**	**0.676**	**X**	**2**	**=**	**237**	**177**	**733.5**
		for June		from last survey		from last survey		for June	**0.75** fish/angler	**3.1**mean hrs/angler
									from last survey	from last survey
	Figure 8	**580**	**X**	**0.254**	**X**	**2**	**=**	**295**	**77**	**618.7**
		for June		from last survey		from last survey		for June	**0.26** fish/angler	**2.1** mean hrs/angler
									from last survey	from last survey
	Swan	**487**	**X**	**0.378**	**X**	**2**	**=**	**368**	**243**	**1178.2**
		for June		from last survey		from last survey		for June	**0.66** fish/angler	**3.2** mean hrs/angler
									from last survey	from last survey

Monthly	total # of vehicles		% of vehicles		total # of anglers		**A**	**B**	**C**
		X	containing anglers	**X**	per vehicle	**=**	est. total # of anglers	est. # of harvested fish	est. # of hours (effort)
			from last survey		from last survey				

EXAMPLE

Month	**Lake**									
June								**Anglers**	**Harvested Fish**	**hours (effort)**
30	**Sulphur**	**175**	**X**	**0.676**	**X**	**2**	**=**	**237**	**177**	**733.5**
		for June		from last survey		from last survey		for June	**0.75** fish/angler	**3.1**mean hrs/angler
July		**155**	**X**	**0.676**	**X**	**2**	**=**	**210**	**157**	**649.6**
31								for July		
August		**205**	**X**	**0.676**	**X**	**2**	**=**	**277**	**208**	**859.2**
31								for August		
		535				**TOTALS**		**723**	**542**	**2242.3**

A number of	total # of vehicles		% of vehicles		total # of anglers		**A**	**B**	**C**
times a year	divided by	**X**	containing anglers	**X**	per vehicle	**=**	est. total # of anglers	est. # of harvested fish	est. # of hours (effort)
	number of days		from last survey		from last survey				

EXAMPLE

Month	**Lake**									
June - August								**Anglers**	**Harvested Fish**	**hours (effort)**
92 days	**Sulphur**	**535**	**X**	**0.676**	**X**	**2**	**=**	**723**	**542**	**2242.3**
		92		from last survey		from last survey		for June - August	**0.75** fish/angler	**3.1**mean hrs/angler
									from last survey	from last survey

for a 3 month total

APPENDIX I

ANGLER SATISFACTION QUESTIONNAIRE RESULTS

Sulphur Lake
Figure Eight Lake
Swan Lake

Sulphur Lake Angler Satisfaction Results

Date	Overall	Angling	Satisfaction	Overall	Trip	Satisfaction	Compared	to past is	fishing	Comments
	P-poor	F-fair	G-good	P-poor	F-fair	G-good	D-declining	S-same	I-improving	
12/6/98	0	0	3							
13/6/98	0	2	1	these	two	questions	were added	15/6/98		
14/6/98	0	2	4	missed	12	anglers				
15/6/98	0	0	0	0	0	0	0	0	0	no anglers
10/7/98	4	5	2	0	0	11	0	10	1	
11/7/98	0	6	8	0	4	10	0	5	2	7-1st time
12/7/98	2	1	0	0	0	3	0	3	0	
13/7/98	0	0	0	0	0	0	0	0	0	no anglers
6/8/98	0	1	3	2	0	2	0	3	0	1-1st time
7/8/98	0	4	2	0	0	6	0	6	0	
8/8/98	0	4	6	0	1	9	1	3	1	5-1st time
9/8/98	3	5	8	0	3	13	2	1	5	8-1st time
2/9/98	0	0	4	0	0	4	0	4	0	
4/9/98	0	3	4	0	2	5	0	2	5	
5/9/98	3	3	7	0	6	7	0	8	2	3-no data
6/9/98	1	12	18	0	10	21	4	23	4	
Total	13	48	71	2	26	92	7	68	21	
Percent	9.8%	36.4%	53.8%	1.7%	21.6%	76.7%	7.3%	70.8%	21.9%	

Figure Eight Lake Angling and Trip Satisfaction Results

Date	Overall P-poor	Angling F-fair	Satisfaction G-good	Overall P-poor	Trip F-fair	Satisfaction G-good	Compared D-declining	to past is S-same	fishing I-improving	Comments
5/6/98	0	2	10							
6/6/98	3	6	7							
7/6/98	13	9	11	These two questions were added 26/6/98						
10/6/98	7	1	2	missed 73 anglers from last 4 survey events						
26/6/98	1	1	0	0	0	2	1	1	0	
27/6/98	2	3	6	0	0	11	3	3	1	4-1st time
28/6/98	0	13	9	0	0	22	1	12	6	3- 1st time
3/7/98	9	10	4	0	4	19	2	9	2	10-1st time
4/7/98	1	13	11	0	3	22	3	7	7	8- 1st time
5/7/98	4	18	20	0	1	41	2	27	4	9- 1st time
subtotal	40	76	80	0	8	117	12	59	20	
Percent	20.4%	38.8%	40.8%	0.0%	7.0%	93.0%	12.7%	66.0%	21.3%	
10 -12/7/1998	Partial summerkill occurred									
23/7/1998	1	0	1	0	0	2	1	1	0	
31/7/1998	7	0	0	1	6	0	5	2	0	
1/8/98	0	2	4	0	1	5	0	5	0	1- 1st time
2/8/98	3	5	1	0	0	9	3	1	0	5- 1st time
12/8/98	1	2	0	0	2	1	0	0	0	3- 1st time
21/8/98	2	0	0	0	0	2	0	2	0	
22/8/1998	0	0	0	0	0	0	0	0	0	
23/8/1998	7	3	0	0	7	3	10	0	0	
1/9/98	2	0	0	0	2	0	used old she et missing question			
subtotal	23	12	6	1	18	22	19	11	0	
Percent	56.1%	29.3%	14.6%	2.4%	43.9%	53.7%	63.3%	36.4%	0.0%	
Total	63	88	86	1	26	139	31	70	20	
Total Percent	26.6%	37.1%	36.3%	0.6%	16.0%	83.4%	25.0%	58.9%	16.1%	

Swan Lake Angler Satisfaction and Trip Satisfaction Results

Date	Overall	Angling	Satisfaction	Overall	Trip	Satisfaction	Comments
	P-poor	F-fair	G-good	P-poor	F-fair	G-good	
19/6/98	1	2	0	0	1	2	
20/6/98	9	4	20	0	4	29	
21/6/98	2	2	8	0	0	12	
22/6/98	4	1	0	0	2	3	
16/7/98	4	0	1	0	0	5	
17/7/98	0	0	2	0	0	2	
18/7/98	1	6	4	0	0	11	
19/7/98	4	3	2	0	5	4	
24/7/98	0	0	4	0	0	4	
25/7/98	8	5	7	0	6	14	2-too young
26/7/98	2	0	1	0	1	2	
14/8/98	0	0	3	0	0	3	
15/8/98	2	0	3	0	0	5	1-too young
16/8/98	0	0	5	0	0	5	
19/8/98	4	0	1	0	0	5	
28/8/98	0	0	0	0	0	0	no anglers
29/8/98	0	7	0	0	7	0	
30/8/98	2	2	2	0	4	2	
Total 18 days	43	32	63	0	30	108	
Percent	31.2%	23.2%	45.6%	0.0%	21.7%	78.3%	

APPENDIX J

ANGLER RESIDENCE SUMMARIES

SULPHUR LAKE
FIGURE EIGHT LAKE
SWAN LAKE

Residence location of anglers surveyed at Sulphur Lake, during the 1998 Stocked Aerated Lake Angler Survey.

Residence Location	Number of Anglers	Percent of Total
Peace River	40	29.0%
Grimshaw	19	13.8%
Fairview	13	9.4%
Grande Prairie	10	7.2%
Manning	10	7.2%
Dixonville	9	6.5%
North Star	8	5.8%
Brownvale	6	4.3%
Berwyn	3	2.2%
Bluesky	3	2.2%
Edmonton	3	2.2%
Eureka River	3	2.2%
Worsley	3	2.2%
England	2	1.4%
Hines Creek	2	1.4%
Hythe	1	0.7%
Medicine Hat	1	0.7%
Rosetown Sask.	1	0.7%
Zama	1	0.7%
Total	138	100.0%

Figure Eight Lake surveyed angler residence locations, before and after partial summer kill.

Residence Location	Before partial	July summerkill	After partial	July summerkill	Total Anglers	Total Percent
B.C.	2	1.0%	0	0.0%	2	0.8%
Barhead	1	0.5%	0	0.0%	1	0.4%
Beaverlodge	1	0.5%	0	0.0%	1	0.4%
Berwyn	13	6.4%	5	12.2%	18	7.3%
Bluesky	5	2.5%	0	0.0%	5	2.0%
Brownvale	8	3.9%	0	0.0%	8	3.3%
Calgary	1	0.5%	1	2.4%	2	0.8%
Chetwyn, B.C.	1	0.5%	0	0.0%	1	0.4%
Cochrane	4	2.0%	0	0.0%	4	1.6%
Dawson Creek B.C.	4	1.9%	0	0.0%	4	1.6%
Deadwood	1	0.5%	0	0.0%	1	0.4%
Deerhill	0	0.0%	5	12.2%	5	2.0%
Dixonville	2	1.0%	0	0.0%	2	0.8%
Edmonton	3	1.5%	0	0.0%	3	1.2%
England	2	1.0%	0	0.0%	2	0.8%
Fairview	11	5.2%	10	24.4%	21	8.6%
Ft. Alice, B.C.	0	0.0%	1	2.4%	1	0.4%
Grande Prairie	17	8.3%	7	17.1%	24	9.8%
Grimshaw	62	30.4%	6	14.6%	68	27.8%
Hawk Hills	2	1.0%	0	0.0%	2	0.8%
High Prairie	0	0.0%	1	2.4%	1	0.4%
Inuvik, N.W.T.	1	0.5%	0	0.0%	1	0.4%
Kamloops B.C.	1	0.5%	0	0.0%	1	0.4%
La Crete	3	1.4%	0	0.0%	3	1.2%
Manning	9	4.4%	0	0.0%	9	3.7%
Medicine Hat	1	0.5%	0	0.0%	1	0.4%
Nampa	5	2.4%	0	0.0%	5	2.0%
Paddle Prairie	1	0.5%	0	0.0%	1	0.4%
Peace River	26	12.7%	5	12.2%	31	12.7%
Red Deer	1	0.5%	0	0.0%	1	0.4%
St. Isadore	1	0.5%	0	0.0%	1	0.4%
Vancouver, B.C.	1	0.5%	0	0.0%	1	0.4%
Warrensville	3	1.4%	0	0.0%	3	1.2%
Whitelaw	11	5.2%	0	0.0%	11	4.4%
Total 33	**204**	**99.1%**	**41**	**100.0%**	**245**	**99.4%**

Swan Lake surveyed angler residence locations, during the 1998 Stocked Lake Angler Survey.

Residence Location	Number of Anglers	Total Percent
Alberta Beach	4	2.8%
Beaverlodge	1	0.7%
Bezanson	2	1.4%
Crooked Creek	6	4.3%
Debolt	3	2.1%
Edmonton	2	1.4%
Grande Prairie	74	52.5%
Grimshaw	6	4.3%
High Prairie	2	1.4%
La Glace	4	2.8%
Millet	1	0.7%
Peace River	1	0.7%
Peers	2	1.4%
Sexsmith	4	2.8%
Sturgeon Heights	2	1.4%
Sunset House	4	2.8%
Swan Hills	1	0.7%
Valleyview	15	10.6%
Wembley	7	5.0%
Total 19	141	100.0%