Assessment of the Status of the
Sport Fishery for Pike at Wolf Lake, 1999.

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Conducted as part of the
Alberta Conservation Associations
Sportfisheries Monitoring Program, NE Region

April, 2000

ABSTRACT

To recover or maintain Alberta's northern pike fisheries, a new pike management strategy was implemented in 1999. In 1999, the pike fishery at Wolf Lake was classified as stable-recreational (vulnerable) and a 63 cm (maximum total length) size limit, 3 fish daily limit on pike was implemented in the sport fishery. In order to assess the status of the pike fishery at Wolf Lake, a creel survey was conducted during May to August 1999. During the 1999 survey, the number of anglers interviewed at the survey site was 1,005. The total number of anglers was estimated at 2,476. The angling effort dropped 76% from the survey conducted in 1991 to 2.1 hrs / ha in 1999.

The catch rate on legal-sized pike (>63 cm max TL) was 0.032 fish / hour. The estimated release rate on sub-legal pike was 0.44 fish / hour. The estimated harvest of legal-sized pike was 214.

Historically, the fishery for pike was very good. Respondents to a historical survey reported common catches of pike five to 10 pounds and catches of trophy pike up to 25 pounds

Based on the criteria used to classify pike stocks in Alberta and historical information, the Wolf Lake pike population is vulnerable.

ACKNOWLEDGEMENTS

The creel survey attendants at Wolf Lake, Mark Feldberg, Les Harris, Layla Neufeld and John Tchir deserve full credit for the success of this study. Their dedication to the collection of creel and test fishery data is commendable. The crew members were very grateful to have experienced Wolf Lake. The use of the Fish and Wildlife cabin by the Natural Resources Service only made the summer more memorable.

Volunteer anglers Ross Chow, Dr. Kevin Kimber (visiting from Sumatra, Indonesia), Katherine Park, Nicole Poirier, Jordan and Cat Walker are to be thanked for contributing both time and expense toward the test fishery.

The Alberta Conservation Association (ACA) would also like to acknowledge the co-operation from Alberta Environment, Natural Resources Service (NRS), Northeast Boreal Region, Fisheries Management Section staff that was received throughout the course of the program. The assistance from NRS staff and the use of NRS equipment is greatly appreciated.

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INTRODUCTION

Northern pike (*Esox lucius*) populations in Alberta have been subjected to heavy fishing pressure for many years. Most populations show signs of over-harvest, with many experiencing significant declines. Previous management strategies have focused on province-wide regulations designed to manage the pike harvest at an average fishery. The previous sport fishing regulation was a 10 fish daily bag limit with no size limit. Fisheries receiving heavier than average exploitation have not been adequately protected with these regulations and consequently many have declined or collapsed. To aid the recovery of these fisheries, a new pike management strategy was implemented in 1999. This strategy requires that each pike population be evaluated as to its degree of exploitation and then placed in one of three categories: collapsed, vulnerable, or stable. These categories are based on the classification system used during the walleye management review (Sullivan 1994). The fishery is assigned a standard sport fishing regulation based on this status (Berry 1999). In early 1999, the pike fishery at Wolf Lake was assigned a stable-recreational (vulnerable) status. A 63 cm maximum total length (TL max) minimum size and a 3 fish daily bag limit on pike was therefore implemented at the fishery.

This report describes the creel survey conducted at Wolf Lake during the summer of 1999. The purpose of the survey was to assess the pike sport fishery and verify the status of the population and fishery.

METHODS

Study Site Description

Wolf Lake (TWP 65, RNG 7, W4M) is approximately 70 kilometres north of the Town of Bonnyville or 310 km northeast of the City of Edmonton. Wolf Lake has a surface area of 3150 hectares and a maximum depth of 38.3 metres. Wolf Lake's shoreline is largely undeveloped. A private contractor maintains a low-density Forest Service campground located on the south shore.

The trophic status of Wolf Lake is mesotrophic. The lake is in the Beaver River basin, and is fed and drained by the Wolf River. Several intermittent streams also feed Wolf Lake. A more complete description of the physical, chemical and biological characteristics may be found in Mitchell and Prepas (1990).

Methods of Study

One creel survey crew (two biotechnicians) collected information from both Wolf Lake and Baptiste Lake between 22 May - 22 August 1999. At Wolf Lake, the crew was stationed at the Forest Service campground. They worked from the Fish and Wildlife cabin adjoining the

campground. A schedule of 5 survey days at Wolf Lake (Fridays through Tuesdays) was followed by 5 survey days (Wednesdays through Sundays) at the alternate site (Baptiste Lake) followed by 4 days off. This cycle was repeated 7 times during the study.

The survey technicians interviewed each angler returning to the survey site during all survey days (24 h survey). Anglers were approached and asked a series of questions regarding their time spent angling, the numbers of each species caught, target species, their gear types, residence, and their use of electronic equipment.

A subjective evaluation of their skill level was also made. Children and anglers with little equipment, knowledge or seriousness were considered to be novice anglers. Professional anglers demonstrated clear superiority in equipment and knowledge (and usually had their sponsors emblazoned on their hats, coats and boats). All other anglers were classified as having a moderate skill.

As time permitted during the survey period, sport fish retained by anglers were sampled for biological information. The fork length of each fish was recorded to the nearest millimetre; the weight was recorded to the nearest ten grams; and one or more skeletal structures were removed to determine the age of the fish. For this purpose, the left pelvic fin and cleithrum of pike, the left pelvic fin and operculum of walleye (*Stizostedion vitreum*), and the operculum and or anal fin of yellow perch (*Perca flavescens*) were collected. Ages were determined following Mackay et al. (1990). Sex and state of maturity of each fish was determined following Olynyk (1980). Stomach contents were removed and classified as to number and species of vertebrates, and approximate number and order of invertebrates. The complete biological data set for pike is reported in this study. Biological data for other species are partially reported in the Appendices, with the full data set stored in the Alberta Conservation Association (ACA) Fisheries Section and the Alberta Natural Resources Service (NRS), Fisheries Management Branch files, Edmonton Metropolitan office and in Ryerson (2000).

In the Alberta Guide to Sportfishing Regulations (1999), the size limits for pike are described in terms of maximum total length (TL max) with the tail pinched. A fork length (FL) - maximum total length (TL max) conversion was necessary to determine the number of legal and sub-legal pike in the creel and the test fisheries. This conversion was TL (max) = 1.0303(FL) + 19.05 (lengths in mm, $r^2 = 0.99$, n = 251 pike, Wolf, Touchwood, and Seibert lakes, Patterson, 2000). A length measurement of 630 mm TL (max) was equivalent to 593 mm FL.

An angling test-fishery was used to collect additional information regarding the size frequency distribution of pike in the population. Data from sport-harvested pike could not provide this information, due to the large minimum size limit for pike at this lake. Creel survey technicians, volunteer anglers, and fisheries staff participated in the collection of these data. Test fisheries

occurred during creel survey days from 22 May to 22 August 1999. The test fishery catch rate (CUE) was not used in the calculation of angler effort or CUE.

All field data were recorded in pencil on field data forms (Appendix 6). These data were transcribed into computer files (Microsoft Excel format) by a commercial keypunch service using double entry verification. Prior to analysis, all data were again subjected to verification procedures. These involved calculating frequency distributions of all creel survey parameters and using field diaries and notes to verify outlying values. Biological samples were verified by plotting weight measurements against the dependent variable of length, and length measurements against the dependent variable of age. Outlying values were investigated and eliminated if measurement error was suspected.

To determine sport fishery parameters specific to the creel survey site, the following equations were modified from Sullivan 1984:

Equation (1)

Hp = (Hwe) + (Hwd) + (#weekend days missed (mean Hwe)) + (#weekdays missed (mean Hwd))

Hp (se) = SQRT (((Hwe, se^2) x (#weekend days missed^2)) + ((Hwd, se^2) x (#weekday missed^2)))

Hp = estimated primary site harvest

Hp (se) = standard error of estimated harvest

Hwe = observed weekend day harvest

Hwd = observed weekday harvest

(Hwe, se) = standard error of mean daily harvest on weekends

(Hwd, se) = standard error of mean daily harvest on weekdays

At many surveyed lakes, anglers could access the lake from sites other than the creel survey site. In these instances, an estimate of the total use of the fishery was extrapolated from the proportion of angler numbers using the creel survey site compared to those observed during entire-lake surveys. These entire-lake surveys were conducted over several time periods and consisted of driving a boat over the entire lake and interviewing all anglers encountered. Total use estimators of the fishery were then calculated by simple extrapolation. Variances of these combined estimates were calculated following Pollock et al. (1994).

The total harvest was estimated using:

Equation (2)

He = Hp x R

(He, se) = SQRT (((Hp^2) x (R, se^2)) + ((Hp, se^2) x (R^2)))

He = estimated total harvest

R = mean ratio of use

R, se = standard error of mean ratio of use

The 95% confidence intervals for the total harvest were calculated as follows:

He ±95% CI = He +-T 0.05 (df) x (He, se)

df = (n – 1)

n = number of days surveyed

Gini coefficients and associated Lorenz curves were calculated using an excel macro based on Baccante (1995). All Proportional Stock Density (PSD %) and Relative Stock Density (RSD stock - quality) classifications were calculated using fork lengths and the size categories suggested by Gablehouse (1984).

All statistical analyses and graphics were done on an IBM - type personal computer (Intel Pentium-II, 300 MHz) using Microsoft Office Professional. All data and analyses are stored in spreadsheet format on the ACA and NRS Edmonton Metropolitan office, Fisheries computers, on recordable compact discs (650 MB), and in Ryerson (2000).

RESULTS

Angler Survey

During 22 May - 22 August 1999, 1,005 anglers were interviewed (Table 1 and Appendix 1). The total number of anglers was estimated at 2,476, with an estimated effort of 2.1 angler-hours / ha. Anglers were observed harvesting 96 pike; 8 sub-legal pike (8 anglers) and 88 legal pike (84 anglers). Anglers reported releasing 215 sub-legal pike (625 anglers). Only one angler was observed to harvest the legal limit of 3 pike (Appendix 1.2). Based on these observations, the number of sub-legal pike estimated caught during the survey period was 941. The estimated harvest of legal-sized pike was 214 fish (Table 2). The estimated number of released sub-legal pike was 2,928. The yield of legal-sized pike was estimated at 552.1 kg or 0.175 kg / ha. Assuming 10% release mortality, the yield of released, but dead pike was 207.0 kg or 0.066 kg / ha (2,928 pike*0.1 mortality*0.707 kg mean weight/3150 ha). The total sport yield of pike during the period of this survey was therefore 0.241 kg / ha, of which 27% (0.066/0.241*100) was released, dead pike.

The distributions of harvests and catches for pike are shown in Appendices 1.2 and 1.3. Biological samples were collected from 516 pike (77 sport harvest, 439 test fishery sample)

Table 1. Observed catch rates of anglers; Wolf Lake, 1999.

CREEL DATA	1991	1992	1993	1994	1999
# days surveyed	58	61	22	36	32
# anglers interviewed	6747	7,734	2,153	2,124	1,005
# angling hours reported	17,869.5	21,068.8	5,747.5	5,554.7	2,734.75
NORTHERN PIKE DATA					
Pike kept / angler-hour	0.28	0.27	0.28	0.31	0.035
Pike rel. / angler-hour	0.39	0.39	0.37	0.39	0.80
WALLEYE DATA					
Walleye kept / angler-hour	0.04	0.037	0.029	0.01	N/A
Walleye released / angler-hour	0.029	0.014	0.019	0.008	0.09
YELLOW PERCH DATA					
Perch kept / angler-hour	0.0058	0.003	0.002	0.001	0.000
Perch released / angler-hour	0.037	0.007	0.001	0.001	0.004

Table 2. Angler survey summary; Wolf Lake, 1999.

	1991 WHOLE LAKE ESTIMATE (95% CI)	1992 WHOLE LAKE ESTIMATE (95% CI)	1993 WHOLE LAKE ESTIMATE (95% CI)	1994 WHOLE LAKE ESTIMATE (95% CI)	1999 WHOLE LAKE ESTIMATE (95% CI)
# Anglers	10,405 (+-8.3%)	10,534 (+-6.4%)	5,464 (+-11%)	4,952 (+-11%)	2475.6 (+-16.5%)
# Hours	27,428 (+-8.8%)	28,661 (+-6.6%)	14,057 (+-11.6%)	12,770.5 (+-10%)	6684 (+-16.5%)
Hours / hectare	8.71 (+-8.8%)	9.1 (+-6.6%)	4.46 (+-11.6%)	4.05 (+-10%)	2.12 (+-16.5%)
# pike (legal-size) harvested	7,636 (+-8.0%)	7,718 (+-8.2%)	4,123 (+-14%)	4009 (+-15%)	214 (+-20%)

(Appendix 2 and 3), 68 walleye (test fishery sample) (Appendix 4) and 10 perch (test fishery sample) (Appendix 5). There was no sport harvest of perch observed.

Test Angling

Test fisheries were conducted on 25 days, from 22 May to 22 August. A total of 282.75 hours were spent test angling. Four hundred and thirty-nine (439) pike were caught and

measured. Of these, 409 were sub-legal (less than 63 cm TL max) and 30 were legal (63 cm TL max and larger).

Status of the Pike Fishery

The metrics associated with reference points for classifying pike fisheries are shown in Table 3.

Historical information indicates that Wolf Lake had a reputation as a very good pike fishery. Respondents to a historical survey (Valastin and Sullivan 1996) reported that the pike were "all sizes", but that the average was under ten pounds. Fishing for pike was described as "couldn't cast without getting a pike", "cast in the reed bed and get five to six pounders every time".

1. Biological Metrics

The observed harvest rate on legal-sized pike was 0.032 kept / hour. The reported release rate on sub-legal pike was 0.79 released / hour. Based on the test fishery, the estimated release rate was 0.44 pike released / hour. The estimated total CUE on all sizes of pike would therefore be 0.47 fish / hour (0.032 + 0.44). The test fishery sampled strong densities of sub-legal sized pike (Figure 1). Year-classes 1993 to 1997 were significantly represented (Figure 2). The length-at-age of pike is relatively slow (Figure 3). The length-at-age of the young pike (age 5 and younger) has slowed since the previous 1994 survey. Pike are first reaching the 630 mm TL (593 mm FL) size limit by age 6. Approximately 93% of pike in Wolf Lake are protected by the minimum size limit (63 cm TL max). According to Cushing (1981), Wolf Lake pike are a growth overfished population; both the catch and stock density of large pike has been reduced while the remaining adult population has maintained or increased the recruitment of pike into the population. These parameters indicate that the pike in Wolf Lake are in a vulnerable state.

2. Social Metrics

Sixty percent of all anglers were successful in catching 1 or more legal-sized pike. Only 1 angler harvested 3 pike of which one was sublegal in size. There was a moderate degree of inequality in the catch of pike. These parameters indicate that the pike population in Wolf Lake is likely in a vulnerable state.

Table 3. Assessment of the status of the pike fishery; Wolf Lake, 1999.
(from Sullivan 1998)

METRIC	STABLE	VULNERABLE (No Risk)	VULNERABLE (Low Risk)	COLLAPSED
CUE kept (>63 cm TL) **Wolf Lake, 1999**	> 0.1	> 0.02 **0.032**	> 0.01	< 0.01
CUE (estimated total) **Wolf Lake, 1999**	1 – 2	0.5 - 1	0.2 - 0.5 **0.47**	< 0.2
# MEASURABLE AGE-CLASSES (> 0.02 / h) INCLUDES TEST FISHERY DATA **Wolf Lake, 1999**	7 – 12	3 – 7 **5**	1 – 2	Almost none
GROWTH RATE INCLUDES TEST FISHERY DATA **Wolf Lake, 1999**	Slow **Young pike have slowed**	Increasing	Increasing	Fast
MEAN WT (kg) (>63 cm TL) INCLUDES TEST FISHERY DATA **Wolf Lake, 1999**	1 – 2	< 1	0.5 – 1.5 **0.788 kg**	0.5 – 3.5
PSD (%) INCLUDES TEST FISHERY DATA **Wolf Lake, 1999**	> 40	< 40 **35**	Variable (> 0.1 / h)	Variable (< 0.1 / h)
RSD (stock – quality) INCLUDES TEST FISHERY DATA **Wolf Lake, 1999**	< 50	> 50 **60**	Variable (> 0.1 / h)	Variable (< 0.1 / h)
SUCCESS (total CUE) (% anglers catching >= 1 legal-size pike) **Wolf Lake, 1999**	> 70	< 70 **60**	< 40	< 20
GINI (total CUE) **Wolf Lake, 1999**	0.3	0.5 – 0.7 **0.58**	0.7 – 0.9	> 0.9

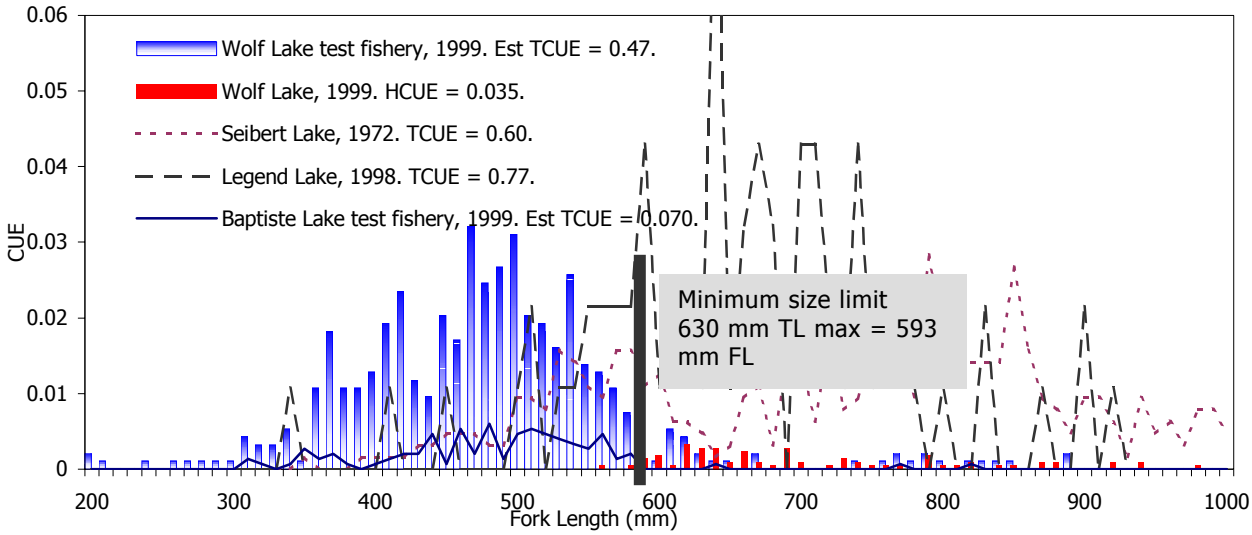

Figure 1. Fork length distribution of pike; Wolf lake, 1999.

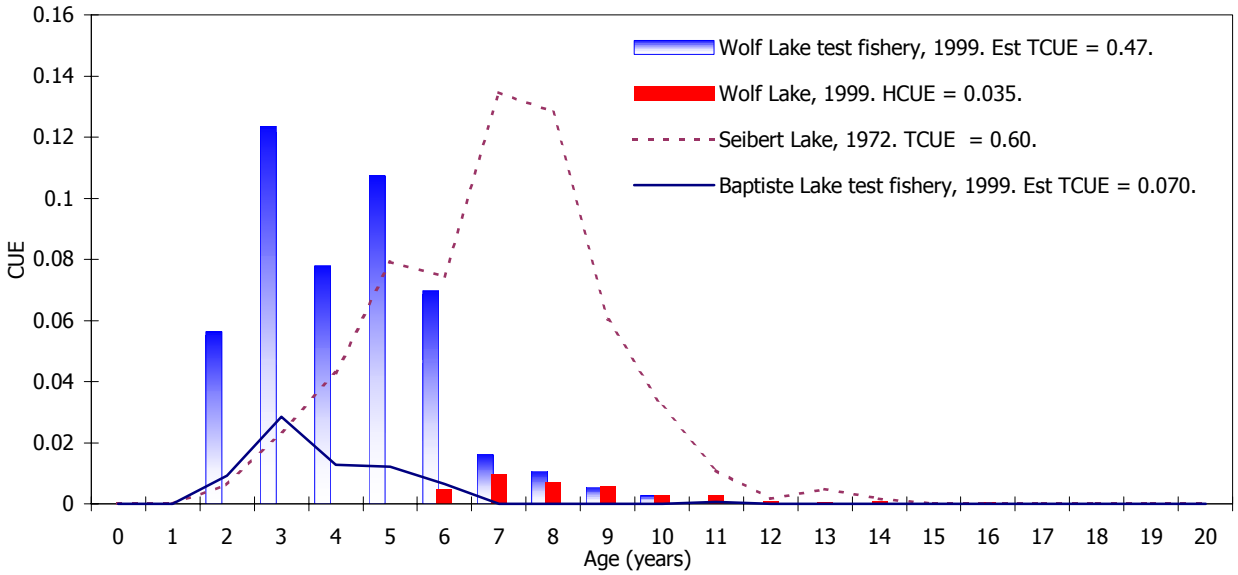

Figure 2. Age-class distribution of pike; Wolf Lake, 1999.

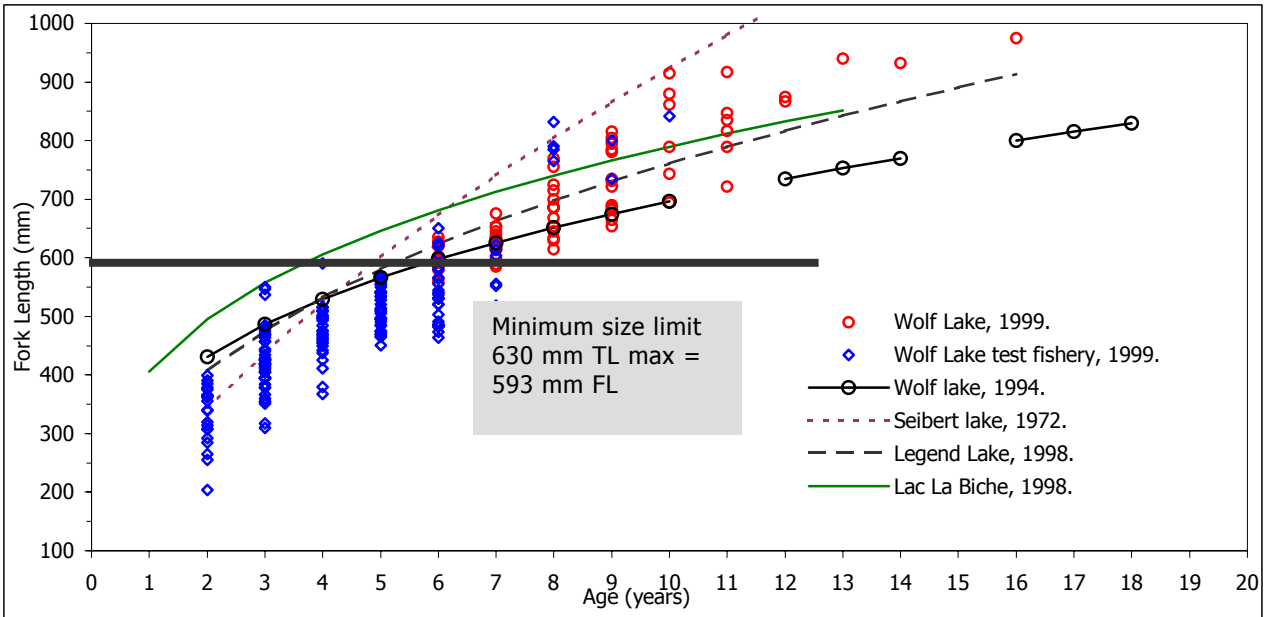

Figure 3. Length-at-age of pike; Wolf Lake, 1999.

DISCUSSION

Historical information indicates that Wolf Lake had a reputation of being a very good pike fishery. Most of the respondents to the historical survey noted that the fishery has declined in recent years. A conservative estimate of release mortality suggests that 27% of the harvest was released, dead pike. The harvest rate on legal-sized was 0.032 fish / hr. The total catch rate for pike has been relatively constant during the 1990 surveys of Wolf Lake. The minimum size limit for pike, implemented in1999, reduced the harvest rate of pike by approximately 90%. Angling effort peaked in 1992 and has declined by 76% to 2.1 hrs / ha in 1999. The 5 significant age-classes are protected by the minimum size limit. The mean weight of pike in the fishery is moderate. The majority of the pike are of stock – quality size. Sixty percent of anglers were successful in harvesting a legal-sized pike. There was a moderate degree of inequality in the catch of pike.

These parameters suggest that the Wolf Lake pike population is in a vulnerable state. The 1990's walleye fishery collapse, the subsequent decline of angling effort and pike release mortality has likely increased the recruitment of young pike into the fishery producing a growth overfished population.

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APPENDICES

Appendix 1.1. Daily summary of angler survey data. [Wolf Lake, 1999]

Month Survey Days 32	Date	# Anglers	# Hours	# Walleye Kept	# Walleye Released	# Pike Kept	# Pike Released < 63 cm TL max	# Pike Released > 63 cm TL max	# Perch Kept	# Perch Released
	Totals	**1005**	**2734.75**	**0**	**244**	**96**	**2154**	**44**	**1**	**12**
5	22	52	113	0	0	2	11	3	0	0
5	23	42	112	0	1	2	86	0	0	0
5	24	23	75	0	0	2	17	0	1	1
5	25	3	13	0	0	0	4	2	0	1
6	5	15	33	0	0	2	5	0	0	0
6	6	17	66.5	0	2	4	97	0	0	0
6	7	0	0	0	0	0	0	0	0	0
6	8	12	35	0	0	2	47	1	0	0
6	18	11	19.5	0	1	3	29	0	0	0
6	19	50	133	0	6	4	88	7	0	0
6	20	44	129.5	0	2	4	198	1	0	0
6	21	4	14	0	1	4	19	0	0	0
6	22	0	0	0	0	0	0	0	0	0
7	1	29	98.5	0	17	2	112	0	0	0
7	2	83	269.5	0	112	14	265	6	0	0
7	3	25	44	0	4	4	48	1	0	0
7	4	10	23	0	3	0	20	0	0	0
7	5	4	9	0	1	0	10	2	0	0
7	6	18	57.5	0	1	1	44	1	0	0
7	17	44	131.5	0	10	1	101	5	0	0
7	18	58	161.75	0	2	6	151	2	0	0
7	19	48	94	0	4	3	101	0	0	0
7	20	24	48	0	2	4	33	0	0	0
7	31	76	176.5	0	0	6	135	0	0	3
8	1	96	288.75	0	4	8	198	1	0	0
8	2	43	119.5	0	7	2	67	8	0	3
8	3	25	53.75	0	22	1	32	0	0	0
8	13	19	56	0	5	3	56	0	0	0
8	14	23	60.5	0	3	2	35	3	0	0
8	15	32	71	0	4	2	14	1	0	0
8	16	33	98.5	0	9	2	47	0	0	0
8	17	42	130	0	21	6	84	0	0	4

Appendix 1.2. Catch frequency distribution of harvested pike. [Wolf Lake, 1999]

# Pike Kept	# Anglers	% Anglers	Harvest	% Pike Harvested	Cumulative % Pike Harvested
0	919	91.4	0	0.0	0.0
1	77	7.7	77	80.2	80.2
2	8	0.8	16	16.7	96.9
3	1	0.1	3	3.1	19.8
4	0	0.0	0	0.0	3.1
5	0	0.0	0	0.0	
>5	0	0.0	0	0.0	
Totals	1005	100.0	96	100.0	

Appendix 1.3. Catch frequency distribution of released pike. [Wolf Lake, 1999]

# Pike Released	# Anglers	% Anglers	# Pike Released	% Pike Released
0	372	37.0	0	0.0
1	196	19.5	196	8.9
2	140	13.9	280	12.7
3	96	9.6	288	13.1
4	51	5.1	204	9.3
5	49	4.9	245	11.1
6	27	2.7	162	7.4
7	15	1.5	105	4.8
8	11	1.1	88	4.0
9	13	1.3	117	5.3
10	6	0.6	60	2.7
>10	29	2.9	453	20.6
Totals	1005	100.0	2198	100.0

Appendix 1.4. Methods of anglers and catch statistics for pike [Wolf Lake, 1999]

METHOD	# Anglers	% Anglers	# Hours	Pike Kept	Pike Rel.	Kept CUE	Rel. CUE
Artificial	933	92.8	2507.00	91	2070	0.036	0.826
Commercial Baitfish	39	3.9	142.25	2	76	0.014	0.534
Seined Baitfish	0	0.0	0.00	0	0		
Leeches	18	1.8	43.00	1	15	0.023	0.349
Dewworms	4	0.4	14.00	1	11	0.071	0.786
Scent baits	6	0.6	12.50	0	15	0.000	1.200
Miscellaneous	5	0.5	16.00	1	11	0.063	0.688
Totals	1005	100	2734.75	96	2198		

Appendix 1.5. Skill levels of anglers and catch statistics for pike. [Wolf Lake, 1999]

SKILL	# Anglers	% Anglers	# Hours	Pike Kept	Pike Rel.	Kept CUE	Rel. CUE
Novice	64	6.4	158.00	2	32	0.013	0.203
Average	940	93.5	2571.75	94	2154	0.037	0.838
Professional	1	0.1	5.00	0	12	0.000	2.400
Totals	1005	100	2734.75	96	2198		

Appendix 1.6. Target species of anglers and catch statistics for pike. [Wolf Lake, 1999]

TARGET	# Anglers	% Anglers	# Hours	Pike Kept	Pike Rel.	Kept CUE	Rel. CUE
Walleye	15	1.5	43.00	0	56	0.00	1.302
Northern Pike	934	92.9	2547.75	94	2011	0.04	0.789
Yellow Perch	2	0.2	5.00	0	0	0.00	0.000
Any species	54	5.4	139.00	2	131	0.01	0.942
Totals	1005	100	2734.75	96	2198		

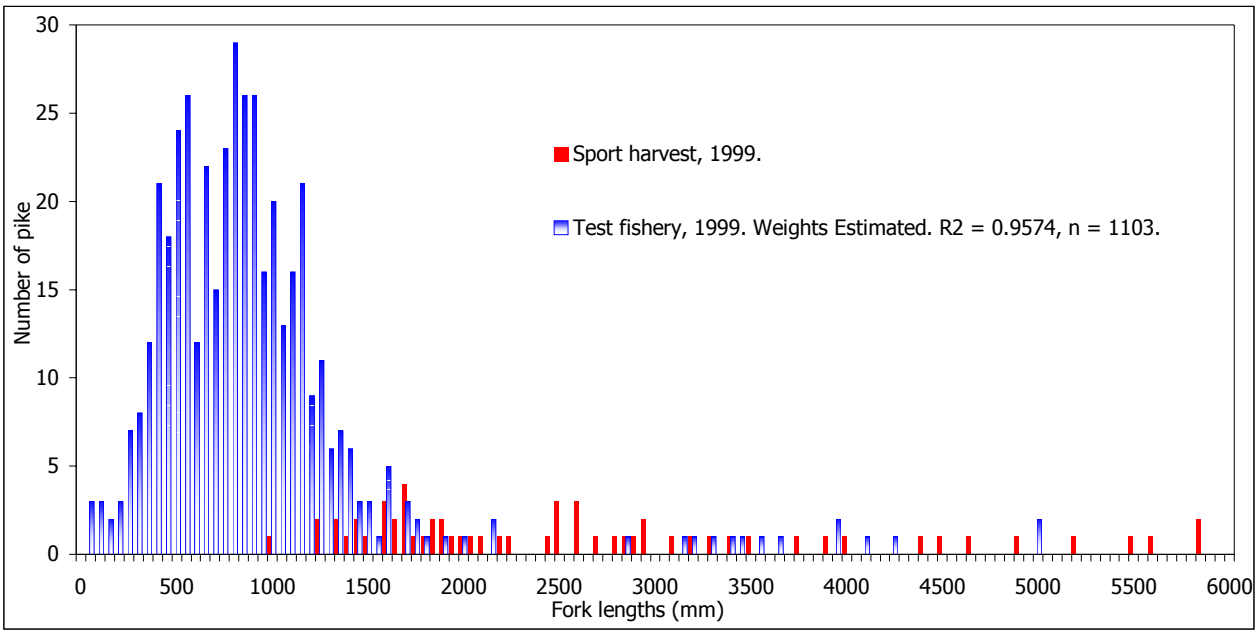
Appendix 1.7. Angler's use of electronic gear and catch statistics for pike. [Wolf Lake, 1999]

ELECTRONICS	# Anglers	% Anglers	# Hours	Pike Kept	Pike Rel.	Kept CUE	Rel. CUE
None	456	45.4	1200.50	40	966	0.033	0.805
Depth Sounder	533	53.1	1484.75	53	1203	0.036	0.810
G.P.S.	3	0.3	6.00	1	2	0.167	0.333
Depth Sounder + G.P.S.	12	1.2	39.00	2	24	0.051	0.615
Other	0	0.0	0.00	0	0		
Totals	1004	100	2730.25	96	2195		

Appendix 1.8. Residence of anglers and catch statistics for pike. [Wolf Lake, 1999]

RESIDENCE	# Anglers	% Anglers	# Hours	Pike Kept	Pike Rel.	Kept CUE	Rel. CUE
Local (50 km radius)	91	9.1	209.00	4	117	0.019	0.560
Edmonton	228	22.7	615.25	12	490	0.020	0.796
Ft. McMurray	9	0.9	17.00	0	9	0.000	0.529
Lac La Biche	0	0.0	0.00	0	0		
Peace River	13	1.3	56.00	3	30	0.054	0.536
St. Paul / Bonnyville	242	24.1	680.75	30	658	0.044	0.967
Edson / Hinton	4	0.4	8.50	1	16	0.118	1.882
Vegreville / Lloydminster	325	32.3	869.25	33	578	0.038	0.665
Red Deer and west	25	2.5	81.00	2	83	0.025	1.025
Rocky Mtn. House / Nordegg	1	0.1	6.00	0	4	0.000	0.667
South east slopes	0	0.0	0.00	0	0		
Calgary and west	44	4.4	142.50	10	185	0.070	1.298
Southern Alberta	7	0.7	23.00	0	8	0.000	0.348
Out of province	16	1.6	26.50	1	20	0.038	0.755
Totals	1005	100	2734.75	96	2198		

Appendix 2.1. Weight distribution of pike. [Wolf Lake, 1999]



Appendix 2.2. Biological data from sport-caught pike. [Wolf Lake, 1999]

Sample #	Weight (g)	Fork Length (mm)	Age (yrs)	Sex 1 = immature 5 = mature female 10 = mature male	Month	Day
mean =	2666.67	702.28	8.45			
n =	60	77	77			
1	2050	654	9	10	5	22
2	2500	668	8	5	5	22
3	1950	665	9	5	5	23
4	2500	685	9	10	5	24
5	2800		14	10	5	24
6	1250	588	7	5	6	5
7	2250	685	8	10	6	6
8	5600	915	10	5	6	7
9	2600	690	9	10	6	7
10	4500	880	10	5	6	7
11	2700	700	8	5	7	7
12	1700	630	8	5	6	8
13	1900	686	8	10	6	18
14	1000	620	7	5	6	19
15	1350	635	6	5	6	19
16	1600	635	7	5	6	19
17	1700	614	8	5	6	20
18	1450	580	6	5	6	20
19	5500	940	13	5	6	20
20	1650	629	7	5	6	20
21	3400	795	9	10	6	21
22	2950	735	9	5	6	21
23	5850	975	16	5	6	21
24	4000	835	11	5	6	21
25	1750	633	7	10	7	1
26	2500	715	8	5	7	1
27		789	11	10	7	2
28		694	10	10	7	2
29		597	6	10	7	2
30		559	6	10	7	2
31		682	9	10	7	2
32		654	8	5	7	2
33	3900	817	11	5	7	2
34	3200	815	9	5	7	2
35	2900	770	8	5	7	3
36	3300	789	10	5	3	7
37		781	9		3	7
38	1800	615	7	5	7	17
39	1850	640	7	5	7	17
40	1450	805	9	5	7	18
41		731	9	5	7	18
42	2950	755	8	5	7	18

Appendix 2.2. Biological data from sport-caught pike, con't. [Wolf Lake, 1999]

Sample #	Weight (g)	Fork Length (mm)	Age (yrs)	Sex	Month	Day
43	3500	785	9	5	7	18
44	3750		7	5	7	18
45	2000	654	7	5	7	19
46	1350	602	6	5	7	19
47	4900	917	11	5	7	20
48	1600	595	6	5	7	20
49	1850	613	7	5	7	20
50	4650	867	12	5	7	20
51		589	7	5	7	31
52	2600	722	11	5	7	31
53		621	7	10	7	31
54	1600	615	7	5	7	31
55	2850	721	9	10	8	1
56		585	7	10	8	1
57	2600	633	8	5	8	1
58		599	7	5	8	1
59		685	8	10	8	1
60	2100	633	7	5	8	1
61	5200	874	12	5	8	1
62		592	6	5	8	1
63	5850	932	14	5	8	2
64	2200	628	6	5	8	3
65	4400	861	10	5	8	13
66	1250	645	7	5	8	13
67	1500	654	8	5	8	13
68	3100	743	10	10	8	14
69		653	7		8	14
70		847	11	5	8	16
71		725	8	5	8	16
72	1900	624	6	5	8	16
73	1650	614	7	10	8	16
74	1700	645	8	5	8	17
75	2450	676	7	5	8	17
76	1400	622	7	5	8	17
77	1700	620	6	5	8	17

Appendix 3. Biological data from test-caught pike. [Wolf Lake, 1999]

Sample #	Fork Length (mm)	Age (yrs)	Month	Day
mean =	476.25	3.80		
n =	439	175		
1	604	7	5	23
2	480		5	23
3	384	3	5	23
4	475		5	23
5	554	5	5	24
6	604		5	24
7	475	3	5	24
8	451		5	24
9	520	6	5	24
10	467		5	24
11	540	5	5	24
12	601		5	24
13	510	4	5	24
14	590		5	24
15	308	2	5	24
16	405		5	24
17	500	4	5	24
18	475		5	24
19	314	2	5	24
20	525		5	24
21	509	4	5	24
22	540		5	24
23	420	3	5	24
24	370		5	24
25	650	6	5	24
26	617		5	25
27	565	5	5	25
28	369		5	25
29	480	3	5	25
30	450		5	25
31	515	4	5	25
32	356		5	25
33	510	5	5	25
34	415		5	25
35	179		5	25
36	426	3	5	25
37	484	3	5	25
38	517		5	25
39	445		5	25
40	498	5	5	25
41	475	4	5	25
42	495		5	25
43	540	5	5	25
44	403		5	25
45	459	4	5	25
46	410		5	25
47	324		5	25
48	365	2	5	25
49	417	3	5	25

Appendix 3. Biological data from test-caught pike, con't. [Wolf Lake, 1999]

Sample #	Fork Length (mm)	Age (yrs)	Month	Day
50	430		5	25
51	317	3	5	25
52	370		5	25
53			5	25
54	467	3	5	25
55	310	3	5	25
56	420		5	25
57	570	5	5	25
58	387		5	25
59	395	3	5	25
60	510		5	25
61	470	3	5	25
62	435		5	25
63	405	3	5	25
64	540		5	25
65	320	2	5	25
66	379		5	25
67	415		5	25
68	355	3	5	25
69	410	3	5	25
70	470		5	25
71	465	4	5	25
72	407		5	25
73	513	5	5	25
74	370		6	5
75	470	4	6	5
76	399		6	5
77	580	6	6	5
78	435		6	5
79	395	3	6	5
80	460		6	5
81	394	3	6	5
82	307		6	5
83	364	2	6	5
84	385		6	5
85	434	3	6	6
86	357		6	6
87	204	2	6	6
88	441		6	6
89	605	6	6	6
90	439		6	6
91	765	8	6	6
92	395		6	6
93	469	3	6	6
94	376		6	6
95	331		6	6
96	425	3	6	6
97	375	2	6	6
98	324		6	6
99	455	4	6	6
100	531		6	6
101	425	3	6	6

Appendix 3. Biological data from test-caught pike, con't. [Wolf Lake, 1999]

Sample #	Fork Length (mm)	Age (yrs)	Month	Day
102	470		6	6
103	475	5	6	6
104	361		6	6
105	391	2	6	7
106	353		6	7
107	620	6	6	7
108	548		6	7
109	366	3	6	7
110	510		6	7
111	508	5	6	7
112	406		6	7
113	427	3	6	7
114	388		6	7
115	356	2	6	7
116	490		6	7
117	339	2	6	7
118	460		6	7
119	444	3	6	7
120	487		6	7
121	465		6	7
122	429	3	6	7
123	399	2	6	7
124	393		6	7
125	379	2	6	7
126	487		6	7
127	497	4	6	7
128	445		6	7
129	541	5	6	7
130	546		6	7
131	364	2	6	7
132	511		6	7
133	560	5	6	8
134	556		6	8
135	482	6	6	8
136	494		6	8
137	476	4	6	8
138	500		6	8
139	625	6	6	8
140	595		6	8
141	735	9	6	8
142	484		6	8
143	528	5	6	8
144	441		6	8
145	503	6	6	8
146	535		6	8
147	465	5	6	8
148	371		6	8
149	292	2	6	8
150	405		6	8
151	505	5	6	8
152	533		6	17
153	470	5	6	18

Appendix 3. Biological data from test-caught pike, con't. [Wolf Lake, 1999]

Sample #	Fork Length (mm)	Age (yrs)	Month	Day
154	370		6	18
155	379	3	6	18
156	436		6	18
157	832	8	6	18
158	486		6	18
159	491	6	6	18
160	568		6	18
161	537	6	6	18
162	538		6	18
163	584	6	6	18
164	470		6	18
165	380	4	6	18
166	334		6	18
167	483	6	6	18
168	577		6	18
169	255	2	6	18
170	517		6	18
171	499		6	18
172	542	5	6	18
173	550	3	6	18
174	326		6	18
175	537	3	6	18
176	486		6	18
177	556	7	6	18
178	493		6	18
179	514	5	6	18
180	414		6	18
181	554	5	6	18
182	477		6	18
183	479	3	6	18
184	822		6	18
185	466	5	6	18
186	364		6	18
187	385	2	6	18
188	499		6	19
189	457	3	6	19
190	345		6	19
191	448		6	19
192	307	2	6	19
193	504		6	19
194	842	10	6	19
195	402		6	19
196	402		6	19
197	667		6	19
198	590		6	19
199	534		6	19
200	421		6	19
201	574		6	19
202	557		6	19
203	578		6	19
204	668		6	19
205	603		6	19

Appendix 3. Biological data from test-caught pike, con't. [Wolf Lake, 1999]

Sample #	Fork Length (mm)	Age (yrs)	Month	Day
206	454		6	19
207	523		6	19
208	450		6	19
209	463		6	19
210	362	2	6	19
211	544		6	19
212	547	3	6	19
213	489		6	19
214	414		6	19
215	393		6	19
216	474		6	19
217	474		6	19
218	425		6	19
219	435		6	19
220	520	5	6	19
221	531	6	6	19
222	613	7	6	19
223	441	3	6	19
224	411	4	6	19
225	420	3	6	19
226	367		6	19
227	410		6	19
228	459		6	19
229	572		6	19
230	474	6	6	20
231	444		6	20
232	388		6	20
233	235		6	20
234	382		6	20
235	511	5	6	20
236	455		6	20
237	530	6	6	20
238	285	2	6	20
239	484	5	6	20
240	464	6	6	20
241	265	2	6	20
242	445		6	20
243	486	5	6	20
244	480		6	20
245	395	3	6	20
246	530		6	20
247	360	3	6	20
248	412		6	20
249	550	5	6	20
250	510		6	20
251	340	2	6	20
252	408		6	20
253	510	4	6	20
254	430		6	20
255	535	5	6	20
256	482		6	20
257	530	6	6	20

Appendix 3. Biological data from test-caught pike, con't. [Wolf Lake, 1999]

Sample #	Fork Length (mm)	Age (yrs)	Month	Day
258	540		6	20
259	457	3	6	20
260	500		6	20
261	495	5	6	20
262	890		6	20
263	275		6	20
264	524		6	20
265	417		6	20
266	790	8	6	20
267	480		6	20
268	540	6	6	21
269	455	4	6	21
270	542		6	21
271	368	4	6	21
272	468		6	21
273	496	4	6	21
274	513		6	21
275	534	5	6	21
276	389		6	21
277	425	4	6	21
278	523		6	21
279	495	5	6	21
280	414		6	21
281	785	8	6	21
282	469		6	22
283	450	4	6	22
284	544		6	22
285	354	3	6	22
286	453		7	2
287	485	5	7	2
288	512		7	2
289	451	5	7	2
290	454		7	2
291	556	6	7	2
292	475		7	2
293	475	5	7	2
294	535		7	2
295	414	3	7	2
296	563		7	2
297	552	7	7	2
298	492		7	4
299	545	6	7	4
300	415		7	4
301	485	6	7	4
302	504		7	4
303	566	6	7	4
304	477		7	4
305	590	4	7	4
306	494		7	4
307	491	5	7	4
308	780		7	4
309	518	7	7	4

Appendix 3. Biological data from test-caught pike, con't. [Wolf Lake, 1999]

Sample #	Fork Length (mm)	Age (yrs)	Month	Day
310	480		7	4
311	502	4	7	4
312	501		7	4
313	487	6	7	4
314	415		7	4
315	379	3	7	5
316	533		7	5
317	468	5	7	5
318	469		7	5
319	555	5	7	5
320	528		7	5
321	484	4	7	5
322	509		6	7
323	491		6	7
324	800	9	6	7
325	468	4	6	7
326	443		6	7
327	475	5	6	7
328	535		7	17
329	541	5	7	17
330	515		7	17
331	499	4	7	17
332	524		7	18
333	405	3	7	18
334	510		7	18
335	493	4	7	18
336	403		7	18
337	418	3	7	19
338	566		7	19
339	470	5	7	19
340	525		7	19
341	540	6	7	19
342	490		7	20
343	464	3	7	20
344	530		8	13
345	351	3	8	13
346	538		8	14
347	564	6	8	14
348	468		8	15
349	442	4	8	15
350	411		8	15
351	437	4	8	15
352	500		8	16
353	496	5	8	16
354	638		8	16
355	419	3	8	16
356	582		8	16
357	520	6	8	16
358	535		8	16
359			8	16
360	406	3	8	16
361	516	4	8	17

Appendix 3. Biological data from test-caught pike, con't. [Wolf Lake, 1999]

Sample #	Fork Length (mm)	Age (yrs)	Month	Day
362	351		8	18
363	484	3	8	18
364	352		8	18
365	622	7	8	18
366	478		8	18
367	528	5	8	18
368	509		8	18
369	462	4	8	18
370	451		8	18
371	402			
372	442			
373	446			
374	528			
375	469			
376	445			
377	770			
378	481			
379	569			
380	517			
381	431			
382	517			
383	461			
384	365			
385	565			
386	362			
387	462			
388	576			
389	493			
390	415			
391	390			
392	469			
393	495			
394	337			
395	532			
396	429			
397	535			
398	482			
399	556			
400	460			
401	507			
402	412			
403	484			
404	475			
405	820			
406	400			
407	492			
408	369			
409	411			
410	502			
411	378			
412	618			
413	476			

Appendix 3. Biological data from test-caught pike, con't. [Wolf Lake, 1999]

Sample #	Fork Length (mm)	Age (yrs)	Month	Day
414	564			
415	495			
416	494			
417	493			
418	399			
419	407			
420	405			
421	489			
422	415			
423	465			
424	191			
425	371			
426	442			
427	554			
428	529			
429	520			
430	559			
431	444			
432	500			
433	574			
434	482			
435	439			
436	545			
437	489			
438	467			
439	760			
440	890			
441	381			

Appendix 4. Biological data from test-caught walleye. [Wolf Lake, 1999]

Sample #	Fork Length (mm)	Age (yrs)	Month	Day
mean =	334.47	4.50		
n =	68	54		
1	506	8	6	5
2	578	15	6	5
3	550	11	6	5
4	371	6	6	5
5	461	9	6	5
6	291	4	6	6
7	496	6	6	8
8	412	6	6	18
9	543	14	6	18
10	499	8	6	19
11	234	3	6	19
12	510	6	6	19
13	449	6	6	19
14	469	6	6	19
15	497	8	6	19
16	235	3	6	19
17	505	8	6	19
18	249	3	6	19
19	342	4	6	19
20	453	8	6	19
21	430	6	6	19
22	285	3	6	20
23	239	3	6	20
24	311	3	6	20
25	281	3	6	20
26	358	4	6	21
27	253	3	7	4
28	311	3	7	4
29	243	3	8	3
30	236	3	8	3
31	173	2	8	3
32	256	3	8	3
33	189	2	8	3
34	229	2	8	3
35	265	3	8	3
36	203	2	8	3
37	265	3	8	3
38	247	3	8	3
39	190	2	8	3
40	274	3	8	3
41	263	3	8	3
42	206	2	8	3

Appendix 4. Biological data from test-caught walleye, con't. [Wolf Lake, 1999]

Sample #	Fork Length (mm)	Age (yrs)	Month	Day
43	264	3	8	3
44	222	3	8	16
45	194	2	8	17
46	531	6	8	17
47	282	3	8	17
48	275	3	8	17
49	255	3	8	17
50	246	3	8	17
51	192	2	8	17
52	309	3	8	17
53	290	3	8	17
54	291	3	8	18
55	358			
56	281			
57	537			
58	495			
59	337			
60	532			
61	469			
62	285			
63	311			
64	239			
65	245			
66	426			
67	246			
68	275			

Appendix 5. Biological data from test-caught perch. [Wolf Lake, 1999]

Sample #	Weight (g)	Fork Length (mm)	Age (yrs)	Month	Day
mean =		196.90			
n =		10			
1		180		6	6
2		220		6	6
3		199		6	6
4		205		6	6
5		257		6	6
6		181		6	6
7		172		6	6
8		205		6	7
9		160		6	8
10		190		6	18

Appendix 6. Creel survey form. [Wolf Lake, 1999]