

**ANGLER HARVEST SURVEYS OF KATHLEEN LAKE
AND RIVER, YUKON TERRITORY
1991 & 1995**

Clive Osborne

Progress Report


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ANGLER HARVEST SURVEYS OF KATHLEEN LAKE AND RIVER
YUKON TERRITORY
1991 & 1995.

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1996

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ABSTRACT

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Kathleen Lake and Kathleen River through Lower Kathleen Lake and Rainbow Lake are receiving increasing levels of angling activity since the early 1990s. This system provides excellent fishing opportunities to visitors of Kluane National Park, to travellers of the Haines Road and to local residents of the towns of Haines and Haines Junction. Kathleen Lake is the largest lake located wholly within Kluane National Park. A late winter - spring ice fishery for lake trout and kokanee has become very popular among local anglers, accounting for a substantial portion of the annual fish harvest for the system

During the spring ice fishing season (March - April) of 1991 and the summer season (June - September) of 1990 and 1995, the Fisheries section of the Department of Renewable Resources conducted angler harvest surveys to assess the level of sport fishing on Kathleen Lake and on Kathleen River downstream of Kathleen Lake.

These access surveys were designed as stratified random samples. The sample units (full day or half day) were stratified by month, day - type (week day / weekend day) and by period (morning / evening).

During the spring ice fishing season of 1991, Haines Junction and Whitehorse residents made up 63 and 29 percent of the angling population. The summer survey of 1995 of Kathleen Lake shows Haines Junction and Whitehorse participation at 18 and 49 percent with the balance of 33 percent non resident anglers mostly split between U.S. and European visitors. However, the participation of non resident anglers alone jumps to 57 percent in the Kathleen River fishery.

The spring ice fishing survey of 1991 yielded an angler effort estimate of 126 angler days and 494 angler hours which represents 8 and 15 percent of the summer survey estimate of 1995. The estimated number of fish caught by species was: lake trout - 69, kokanee - 8. The number (and weight in kilograms) of fish harvested by species was: lake trout 63(76.3), kokanee - 8(5.2). The live release rates of lake trout was 9 percent.

The 1995 summer survey yielded an estimated total of 1496 angler days and 3230 angler hours fished on Kathleen Lake, which represents an 18 percent increase over a 1981 estimate.

The estimated number of fish caught by species on Kathleen Lake was: lake trout - 152, kokanee - 133, arctic grayling - 122. The number (and weight in kilograms) of fish harvested

by species on Kathleen Lake was: lake trout 91(95.0), kokanee - 125(99.9), arctic grayling - 63(35.0). The catch and harvest of all three species have decreased significantly since the early 1980's. Live release rates for Kathleen Lake for lake trout, kokanee and arctic grayling were 36, 9 and 55 percent. while for Kathleen River they were 82, 96 and 99 percent for lake trout, arctic grayling and rainbow trout.

An estimated total of 2744 angler days and 6054 angler hours were fished on Kathleen River during the 1995 summer survey. This represents a 488 and 565 percent increase over 1990 estimates. The estimated number of fish caught by species was: lake trout - 996, arctic grayling - 6208, rainbow trout - 376. The number (and weight in kilograms) of fish harvested by species was: lake trout 188, arctic grayling - 244(142.3), rainbow trout - 20. The catch of arctic grayling and rainbow trout have increased significantly while the harvest of arctic grayling and rainbow trout have decreased slightly since 1990. Live release rates for Kathleen River for lake trout, arctic grayling and rainbow trout were 82, 96 and 99 percent.

The high harvest and live release levels for lake trout for the Kathleen River suggest that this fishery has become very popular. When harvest levels of lake trout for the spring (1991), summer (1995) lake and river fisheries are totalled,

they approach 14 percent of the maximum sustained yield (MSY) estimate for Kathleen Lake. The MSY may be under estimated as lake trout are known to utilize Lower Kathleen, Rainbow and Crescent Lakes for a substantial part of the year. If the popularity of the Kathleen system continues to increase, the quality of lake trout angling will likely diminish. Although kokanee are less vulnerable to exploitation than lake trout, current harvest levels (47% of MSY) on Kathleen Lake may not be sustainable.

ACKNOWLEDGEMENTS

Parks Canada provided funding to support this project and the author would like to thank Ray Breneman for his support and encouragement. The author would like to express his appreciation to various field personnel who conducted the field surveys: to Lorne Laroque and Aaron Foos who collected the data in 1991 and 1995 respectively and to Lorelee Laberge who supervised and assisted in the field work. Advice on data analysis and editorial comments on the text were provided by Nick de Graff and Don Toews and were much appreciated.

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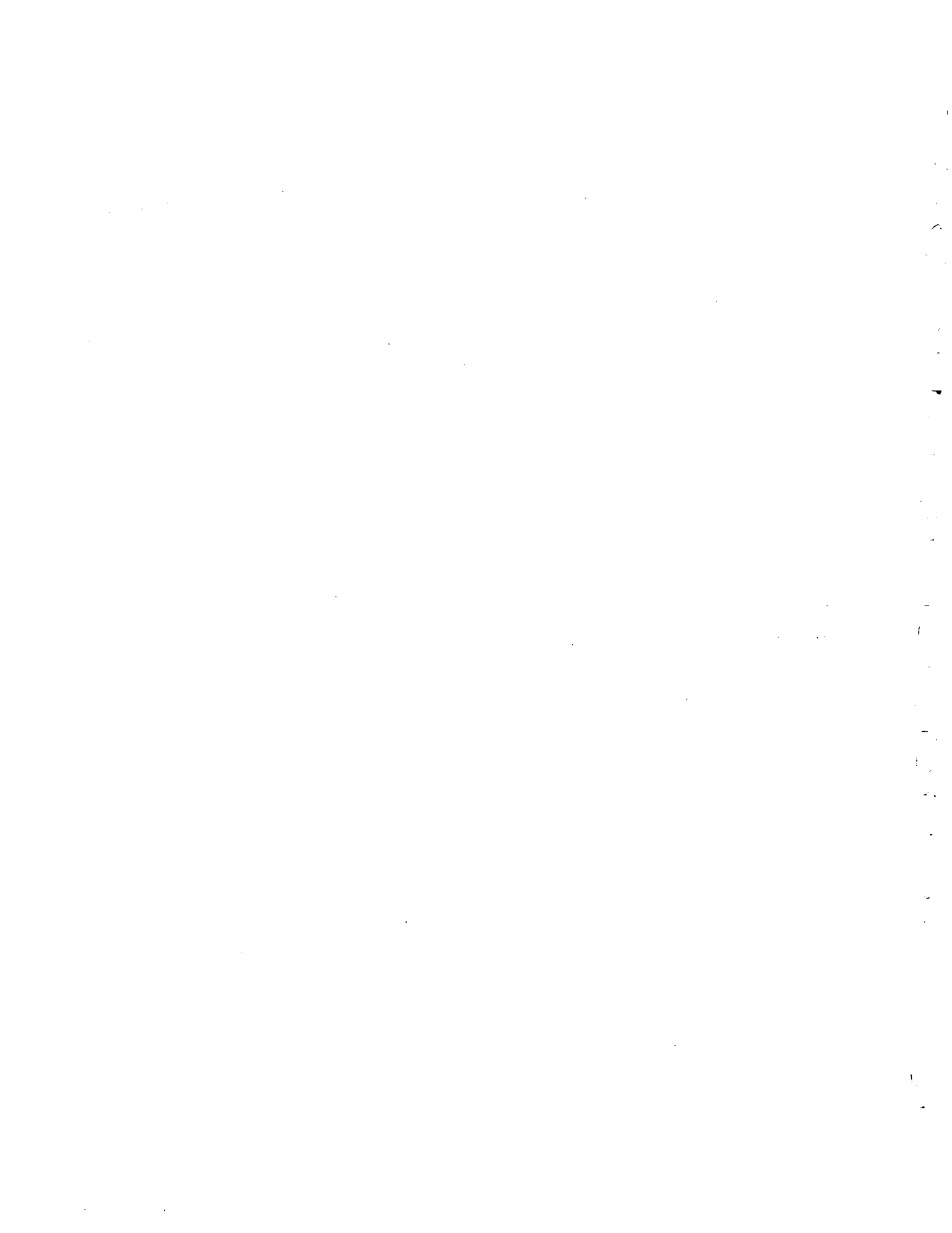
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1 INTRODUCTION

Kathleen Lake, Kathleen River, Lower Kathleen Lake, Rainbow Lake and Crescent Lakes provide excellent fishing opportunities for travellers of the Haines Road. Kathleen Lake is the largest lake located wholly within Kluane National Park. The lake supports populations of lake trout (*Salvelinus namaycush*), rainbow trout (*Onchorynchus mykiss*), kokanee salmon (*Onchorynchus nerka*), northern pike (*Esox lucius*), arctic grayling (*Thymallus arcticus*), lake whitefish (*Coregonus clupeaformis*), round whitefish (*Prosopium cylindricum*), pygmy whitefish (*Prosopium coulteri*) and burbot (*Lota lota*). The fisheries section of the Department of Renewable Resources conducted angler harvest surveys to assess the level of sport fishing on Kathleen Lake and on Kathleen River between Kathleen Lake and Rainbow Lake during the summers of 1990 and 1995 and on Kathleen Lake alone during the late winter ice fishery of 1991. The results of the 1990 survey are reported in a Renewable Resources report (SR-91-1) entitled 'Creel Census of Kathleen Lake and River, Haines Junction, Yukon Territory, 1990.' The findings of the 1991 and 1995 surveys are reported here.

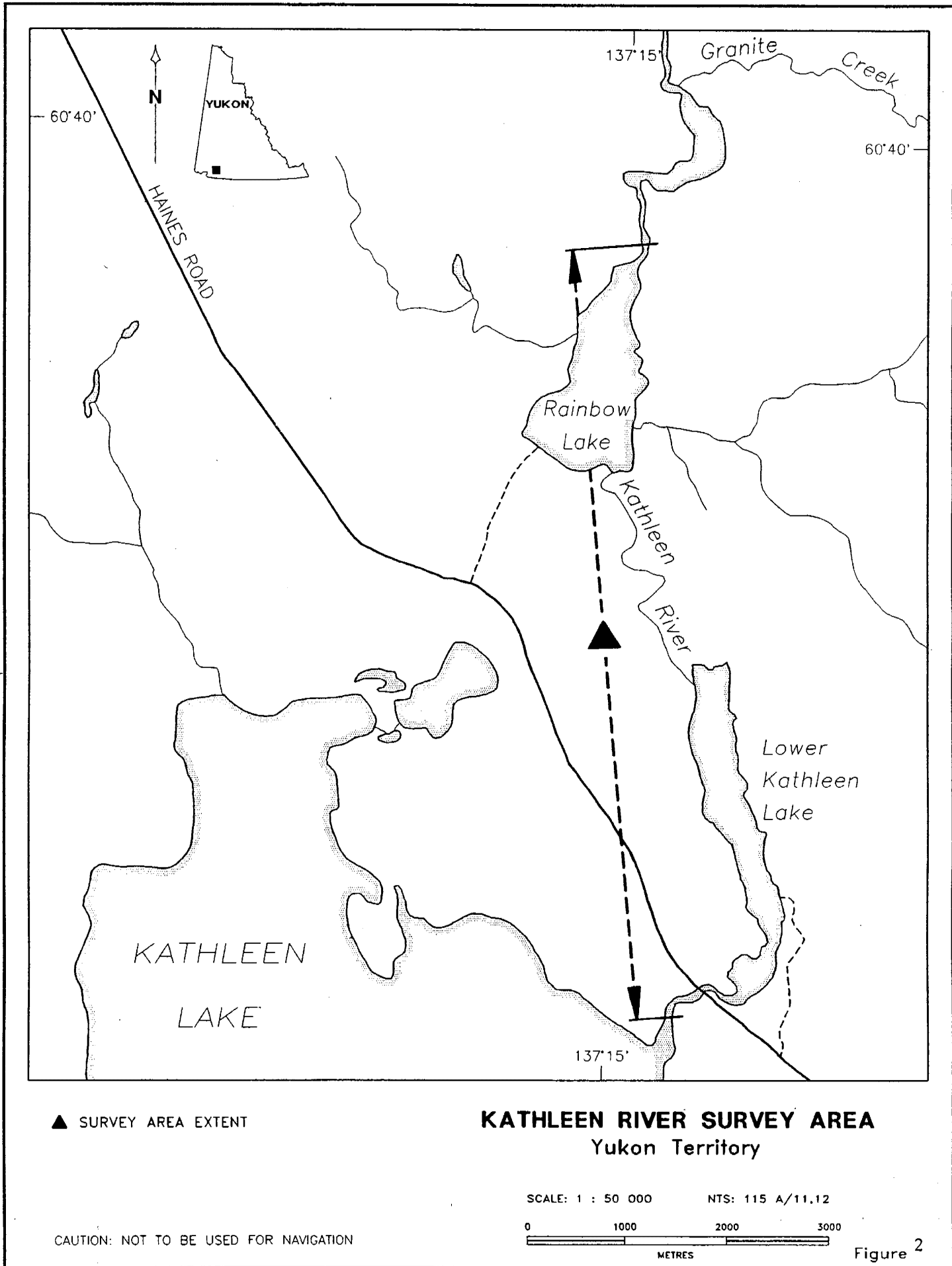
The specific objectives of these surveys were to:

- 2.) Estimate total angling effort (angler days)
- 3.) Determine relative angling quality (catch per angler hour)
- 4.) Collect baseline biological data from angler harvest
- 5.) Evaluate the effect of regulation changes, introduced on the Kathleen system in 1991, on angler effort, catch and harvest and on fish stocks
- 6.) Formulate a strategy for the maintenance of fish stocks through estimates of sustainable yields

1.1 Description of the Study Area

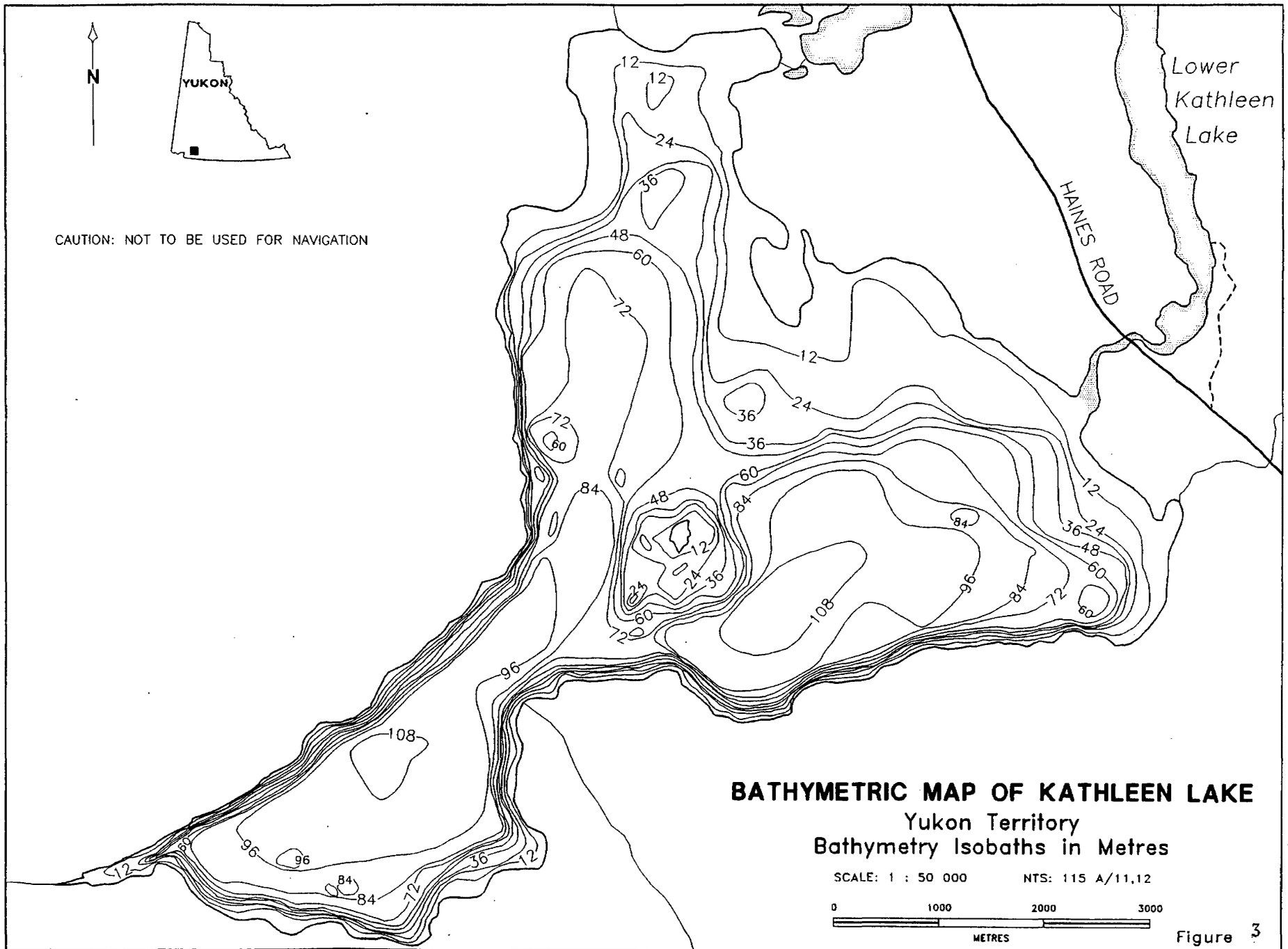
The following description of the Kathleen River drainage has been summarised from Osborne (1991). Kathleen Lake ($60^{\circ} 35'N$, $137^{\circ} 18'W$) is located within the boundaries of Kluane National Park (figure 1). The Haines highway joining Haines Junction, Yukon with Haines, Alaska forms the eastern boundary of the park. Kathleen Lake receives flow from Kathleen River draining Louise and Sockeye Lakes approximately 2 and 12 kilometres upstream. Lower Kathleen and Rainbow Lakes are situated approximately 1 and 12 kilometres downstream and the river enters the Dezadeash River approximately 30 kilometres downstream (figure 2). The Kathleen and Dezadeash Rivers are tributaries of the Alsek River drainage. Kathleen Lake, the largest lake within the park boundaries, is located at an

elevation of 681 meters, has a surface area of 3376 ha., and mean and maximum depths of 52.2 and 111 meters. The lake is roughly triangular in shape with a smaller western basin. The north eastern bay is shallow relative to the south shore and western basin (figure 3).





CAUTION: NOT TO BE USED FOR NAVIGATION



BATHYMETRIC MAP OF KATHLEEN LAKE
Yukon Territory
Bathymetry Isobaths in Metres

SCALE: 1 : 50 000 NTS: 115 A/11,12
0 1000 2000 3000
METRES

Figure 3

1.2 The Fishery

Kokanee are taken most often in the spring while lake trout are caught a little later in the season. Louise, Sockeye and Kathleen Lakes appear to have their own resident populations of Kokanee which come together in late summer to spawn at the outlet of Sockeye Lake (Wickstrom 1983). Kokanee do not appear to extend downstream of Kathleen Lake. Lake trout make spring and late summer migrations between Kathleen Lake and the lower river to Crescent Lake probably to seek warmer water temperatures and food for optimum growth. Arctic grayling are commonly taken along the lake margin near stream inlets and outlets. Round whitefish are abundant in the lake but are rarely taken by anglers (Wickstrom 1983). Burbot and pygmy whitefish have been caught in test netting but occur in low numbers. Rainbow trout have been caught in the lake but seasonal catches are typically very low.

Arctic grayling, lake trout, rainbow trout and round whitefish are taken in the Kathleen River. Arctic grayling is the most plentiful and popular species taken in the river downstream of the lake. The river downstream of Kathleen Lake contains one of the few remaining endemic populations of rainbow trout in Yukon. Most of the fishing effort on the Kathleen River takes place from shore between Kathleen Lake and Lower Kathleen

Lake. Access to the lower lakes may be gained by canoe and jet boat and by a poor road to Rainbow Lake.

High Quality Management regulations were implemented on Kathleen Lake and River in 1991. These regulations limit the harvest of lake trout to 2 fish per day and in possession (down from 3 fish per day and 6 in possession) and the mandatory live release of fish within a slot size. Harvest limits for arctic grayling are 4 fish per day and in possession (down from 5 fish per day and 10 in possession) and a slot size restriction. The slot sizes for lake trout and arctic grayling are 65cm.(26'') to 100cm.(39'') and 40cm.(16'') to 48cm.(19''). Live release only regulations for Rainbow Trout were implemented at the same time. To facilitate the live release of fish, a single barbless hooks only regulation was adopted.

2 MATERIALS AND METHODS

2.1 Angler Harvest Survey

Angler harvest surveys documented in this report were conducted during the following periods:

Kathleen Lake - March 1 - April 30, 1991

Kathleen Lake - June 1 - September 30, 1995

Kathleen River - June 1 - September 30, 1995

All three surveys were designed as access surveys where anglers were intercepted returning from a day's fishing. The single access point for Kathleen Lake was the beach / parking area and boat launch at the east end of the lake. The access points for the river were the highway pull-out at the river crossing where the great majority of anglers gain access to the river and the road to Rainbow Lake.

A stratified random sampling design using temporal strata was implemented on all surveys. The sample unit for the spring survey in 1991 was a 14 hour day (08:00 - 22:00) whereas for the 1995 surveys, a 7 hour half day was implemented (08:00 - 15:00, 15:00 - 22:00). The spring survey was stratified by month and day - type (week day - weekend day) while the summer surveys were stratified by month, day - type and period (morning half day - evening half day). An attempt was made to intercept all anglers that fished during sample unit periods. Sample units were selected at random from the entire survey period. Catch, harvest, angling effort and biological data (length, weight, sex etc.) were collected from anglers interviewed.

The following information was obtained through an interview with each angler party:

1. Number of anglers in the party.
2. Place of residence.
3. Method of fishing and number of rods used.
4. Number of hours spent fishing.
5. Number of fish caught and harvested.

Greater sampling effort was distributed to weekend days for all surveys. Sampling effort was allocated optimally to each stratum for the 1995 surveys using variance data from 1990. Sampling effort for the 1991 ice fishing survey was applied based on suspected angler patterns.

Catch, harvest and total effort estimates were determined using the CREESYS computer program developed by the Ontario Ministry of Natural Resources.

In order to assess the impact of angler harvest on the health of the fish stocks of Kathleen Lake, an estimate of the maximum sustained yield (MSY) was calculated. The equation used for the MSY estimate is:

$$\log(10)MSY = 0.050(TEMP) + 0.280 \log(10)MEI + 0.236$$

as derived from Schlesinger and Regier (1982). Values of 3.11 for the MEI (Wickstrom, 1983) and -3.2 for the mean annual air temperature over a thirty year period (Environment Canada, 1982) were used.

The health of the river population was assessed by trend analysis of catch per unit effort (angler hour) data.

Supplemental information to characterise the river fishery was collected during the 1995 surveys. Data on hook type usage, and knowledge of live release methods was collected.

2.2 Biological Sampling

If anglers were agreeable, fish were sampled for biological information. Otoliths were taken for age determination and sex / maturity were determined for all fish retained. Sample fish were measured for fork length (± 0.1 mm.) and round weight (± 10 gms.) Gonadal maturation was assessed according to the following categories:

Immature - no gonad development

Mature - gonads filling greater than 2/3 of the body
cavity

- Ripe - gonads filling body cavity, milt or eggs
free in body cavity, eggs completely round,
testes white, fish in spawning condition
- Spent - gonads collapsed and flaccid
- Unknown - little gonad development but size of fish
indicates that the fish may have spawned
in past years

Otoliths were sectioned with a low speed isomet saw and annuli
were counted under a microfiche reader.

3 RESULTS

3.1 Morphometry

Kathleen Lake is a large open area with a shallow bay on the north shore. The lake is almost perpetually swept by winds generated by the nearby icefields which significantly limit fishing effort. Basic morphometric data for Kathleen Lake is presented in Table 1.

Table 1 Morphometric Data for Kathleen Lake

Variable	Kathleen Lake
Surface Area (km ²)	33.76
Volume (km ³)	1.76
Mean Depth (m)	52.2
Maximum Depth (m)	111

3.2 Angler Catch, Harvest and Effort

The number of anglers interviewed over the course of the surveys and their origin of residence is presented in Table 2. Angler interview catch / effort data by species are summarised in Table 3. Estimates of angler effort and harvest over the survey period are presented in Table 4. Mean daily effort and catch statistics are presented in Appendix 1, Table 1.

Table 2: Number of Anglers Interviewed and their Origin During Harvest Surveys of Kathleen Lake and River, 1991 (spring) and 1995 (summer).

Year	No. of Anglers Contacted	Origin (As percentage of Total)					
		Local	Whitehorse	Yukon	Canada	U.S.A.	Other
Kathleen Lk. /91 (spring)	102	63	29	3	0	2	3
Kathleen Lk /95 (summer)	210	18	49	1	5	16	12
Kathleen R. /95 (summer)	273	9	34	0	15	20	22

Table 3: Summary of Interview Catch / Effort Data from Angler Harvest Surveys of Kathleen Lake and River, 1991 (spring) and 1995 (summer)

Survey / Species	Catch	Harvest	Percent Live Released	Catch per Angler Hour	Harvest per Angler Hour
<u>Kathleen Lake / 91 (spring)</u>					
Lake Trout	43	40	7	0.14	0.14
Kokanee	7	7	0	0.02	0.02
<u>Kathleen Lake / 95 (summer)</u>					
Lake Trout	36	23	36	0.08	0.05
Kokanee	23	21	9	0.05	0.05
Arctic Grayling	20	9	55	0.04	0.02
Rainbow Trout	1	0	100	0.00	0.00
<u>Kathleen River / 95 (summer)</u>					
Lake Trout	115	21	82	0.19	0.03
Arctic Grayling	612	27	96	1.01	0.04
Rainbow Trout	175	2	99	0.29	0.00
Round Whitefish	32	1	97	0.05	0.00

Table 4: Estimates of Total Angling Effort, Catch and Harvest for the Kathleen Lake and River Harvest Surveys, 1991 and 1995

Survey	No. of Angler Days	No. of Angler Hours	Species	Catch Estimate (No. of Fish)	Harvest Estimate (No. of Fish)	Harvest Estimate (Kgms)
<u>Kathleen Lk. / 91</u> (spring)	126 +/- 40	494 +/- 137	Lake Trout	69 +/- 39	63 +/- 33	76.3 +/- 43.1
			Kokanee	8 +/- 2	8 +/- 2	5.2 +/- 1.3
<u>Kathleen Lk. / 95</u> (summer)	1496 +/- 632	3230 +/- 1364	Lake Trout	152 +/- 112	91 +/- 63	95.0 +/- 65.7
			Kokanee	133 +/- 88	125 +/- 78	99.9 +/- 62.3
			A. Grayling	122 +/- 59	63 +/- 33	35.0 +/- 18.3
			Rainbow Tr.	7 +/- 12	0	
<u>Kathleen R. / 95</u> (summer)	2744 +/- 714	6054 +/- 1576	Lake Trout	996 +/- 512	188 +/- 110	*
			A. Grayling	6208 +/- 2264	244 +/- 161	142.3 +/- 93.9
			Rainbow Tr.	376 +/- 364	20 +/-	*
			R. Whitefish	1658 +/- 1055	5 +/-	*

* Species not sampled

3.3 Seasonal Timing of Angler Effort and Catch

Angler effort and catch by month is presented graphically in figure 4. Angler effort on Kathleen Lake during the spring survey was roughly equal for the months of March and April.

For the summer survey of 1995, angler effort is greatest in June, drops by half in July, increases again for August and then falls off drastically in September. Angler effort for the Kathleen river survey of 1995 was lowest in June, doubles in July and increases by four times for both August and September at approximately 2200 angler hours per month.

Lake trout is the target species during the spring ice fishery on Kathleen Lake, with March showing greater than twice the catch of April. Few kokanee are caught during this time of year. However, almost all of the kokanee caught during the summer months are taken in June with a low numbers being taken in each of the other months. The greatest number of lake trout are taken in August and June.

Arctic grayling are caught in nearly equal numbers from June through August. For Kathleen River, arctic grayling and rainbow trout were taken from June through September with the highest numbers being taken in late summer. Lake trout and round whitefish were taken only in late summer with highest numbers caught in September.

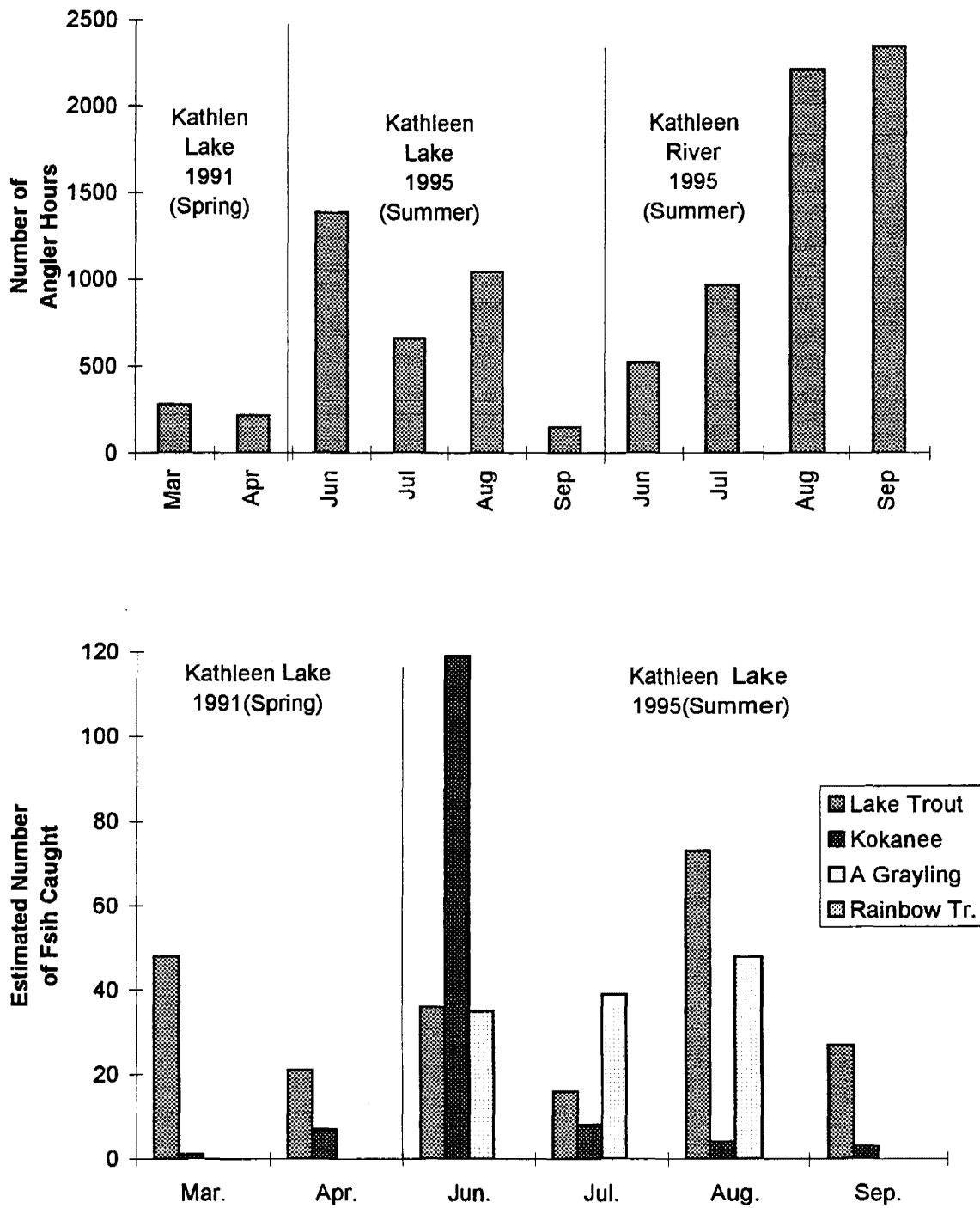


Figure 4 Angler Effort and Catch Distribution by Month for Kathleen Lake and River, 1991 and 1995

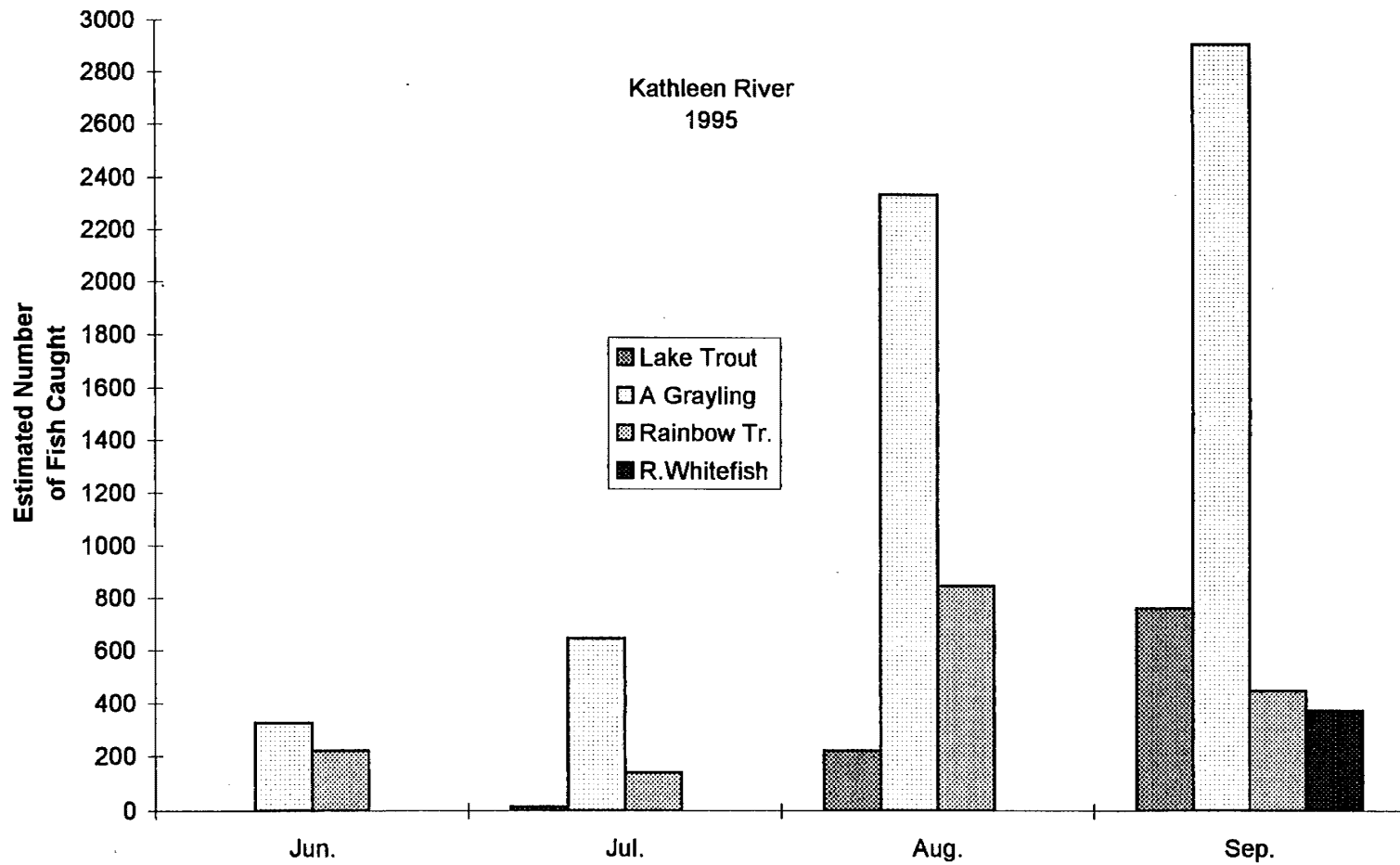


Figure 5 Angler and Catch Distribution by Month for Kathleen River, 1995

3.4 Biological Data

Biological data detailing, fork length, weight, sex, maturity and condition for all fish sampled during the angler harvest survey conducted on Kathleen Lake and River are summarised in Appendix 1, Table 2 and are fully presented in Appendix 2.

3.5 Supplementary Data

Supplementary information was collected from river anglers only. Of the 19 parties sampled, 100% knew how to release the fish they were targeting without significant injury. All but one of these parties released fish the same day they were being interviewed. Twenty out of twenty-four (83%) parties fished with single hooks and 100% of these parties fished with barbless hooks.

4 DISCUSSION

4.1 Angler Catch, Harvest and Effort

4.1.1 Kathleen Lake

Results from the harvest surveys reported here are compared with surveys conducted by the Fisheries section in 1990 and by Wickstrom in 1980 and 1981 are presented in Tables 5-7 and in Appendix 2, Figures 1 and 2.

Angling effort on Kathleen Lake appears to have remained at a constant level over the past 15 years. The low levels of angler effort in 1990 may have resulted from poor weather (higher than normal levels of wind and precipitation) and deficiencies in survey design and execution. Table 6 shows that harvest levels of lake trout, kokanee and arctic grayling on Kathleen Lake have decreased significantly (87, 67 and 70 percent) since 1981.

Table 5: Angler Effort Comparisons Among Open Water Surveys

	Year			
	1980	1981	1990	1995
<u>Kathleen Lake</u>				
Angler Days	1228	1270	131	1496
Angler Hours	2771	3287	468	3230
<u>Kathleen River</u>				
Angler Days	-	-	562	2744
Angler Hours			1071	6054

Table 6: Angler Catch (Harvest) Comparison Among Open Water Surveys

	Year			
	1980	1981	1990	1995
<u>Kathleen Lake</u>				
Lake Tr.	384 (190)	730 (587)	90 (53)	152 (91)
Kokanee	164 (145)	382 (327)		133 (125)
A Grayling	294 (294)	210 (143)	109 (10)	122 (63)
Rainbow Tr.	17 (17)	13 (13)	13 (3)	0
<u>Kathleen River</u>				
Lake Tr.	-	-	122 (68)	996 (188)
A Grayling			1733 (285)	6208 (244)
Rainbow Tr.			166 (19)	376 (20)

Table 7: Angler Catch per Unit Effort (Fish per Angler Hour) Comparison Among Open Water Surveys

	Year			
	1980	1981	1990	1995
<u>Kathleen Lake</u>				
Lake Tr.	0.14	0.22	0.19	0.05
Kokanee	0.06	0.12	0.04	0.04
A Grayling	0.11	0.06	0.23	0.04
Rainbow Tr.	0.006	0.004	0.03	0.002
<u>Kathleen River</u>				
Lake Tr.			0.11	0.16
A Grayling			1.62	1.03
Rainbow Tr.			0.155	0.06

Adult kokanee in their fourth and fifth years cease to feed sometime in July in preparation for a short run upstream to the spawning grounds at the outlet of Sockeye Lake. The 1995 survey results show that kokanee harvest falls off dramatically in July and August, as was found in earlier surveys (Wickstrom, 1982). Netting surveys in the 1970s found that kokanee tended to concentrate along the east shore of the lake during the summer months making them less vulnerable to the visiting angler (Wickstrom, 1982). Parks Canada has conducted enumeration surveys of spawning kokanee from 1976 to 1995. Numbers have fluctuated from a low of approximately 1100 in 1985 to a high of 8100 in 1995 (R. Breneman, pers.comm.). A five year moving average trendline applied to the data indicates that the spawning population has remained stable over the years.

Angler effort and catch statistics for lake trout and arctic grayling gathered from other harvest surveys on Yukon lakes of similar size to Kathleen Lake are compared with the present study (Figure 6 and Appendix 1, Table 3).

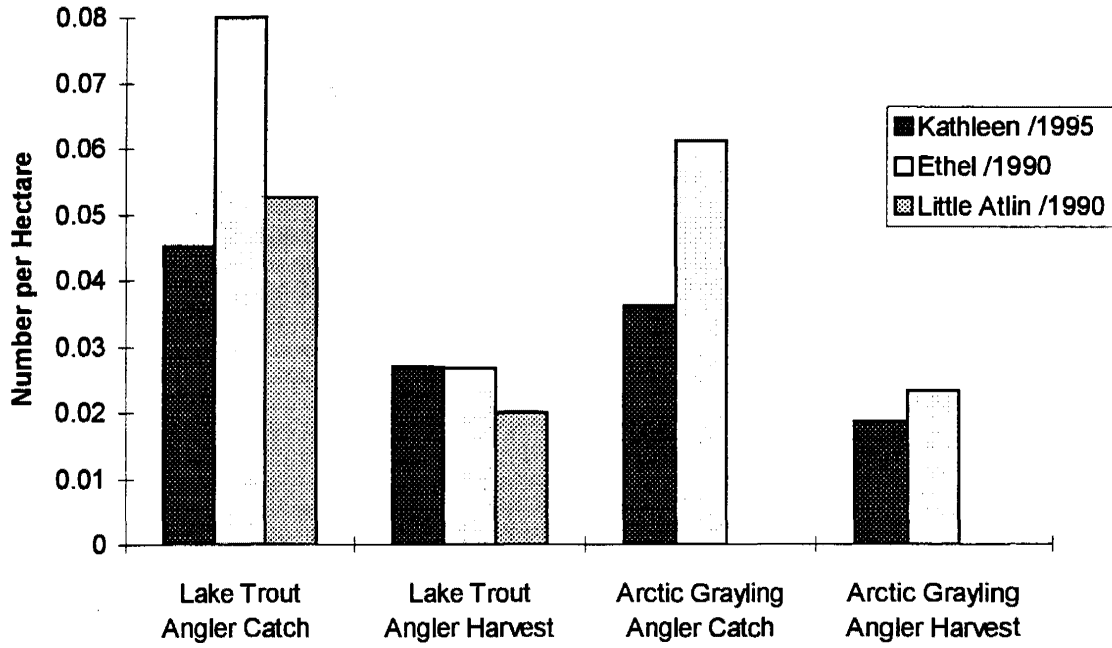
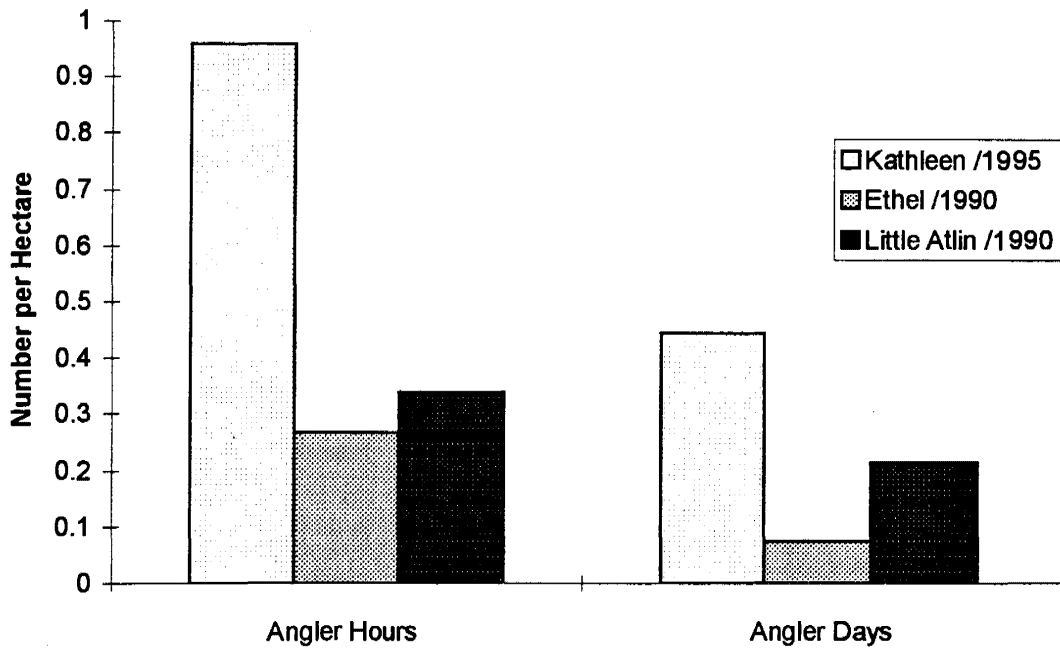


Figure 6 Comparison of Angler Effort, Catch and Harvest Levels with Other Yukon Lakes of Similar Size

It is apparent that Kathleen Lake receives a significantly greater level of angler effort than other lakes of comparable size. Catch rates for both lake trout and arctic grayling are lower for Kathleen Lake than these other lakes.

4.1.2 Kathleen River

The popularity, as reflected by the angler effort levels, of Kathleen River has increased to a level that is almost twice that of Kathleen Lake. This increase in effort has resulted in an increase of 8.1 times in catch levels of lake trout over the 1990 level even with more restricted harvest levels. Arctic grayling and rainbow trout catch levels have increased by 3.6 and 2.3 times. As word of the excellent lake trout fishing opportunity in the river spreads, anglers have targeted more on that species than on arctic grayling as indicated by the sharp decline in the harvest per angler hour (0.26 to 0.04) and very high release rates for arctic grayling (96%). Regulation changes in 1991 requiring the live release of all rainbow trout caught in the river and the use of single barbless hooks seems to have attracted anglers skilled in live release techniques and resulted in much greater numbers of lake trout and arctic grayling being released.

4.2 Management Implications

4.2.1 Kathleen Lake

4.2.1.1 Sustained Yield

Yields of angler caught fish from Kathleen Lake may be estimated by summing the figures for the spring survey in 1991 with those for the 1995 summer survey. Yields for Kathleen Lake and River are presented in Table 8.

Table 8 Estimated Yields of Angler Caught Fish from Kathleen Lake and River, 1991 and 1995

Survey	Species	Estimated Yield (Kgms. Harvested)
Kathleen Lake Spring / 1991	Lake Trout	76
	Kokanee	5
	Arctic Grayling	-
Kathleen Lake Summer / 1995	Lake Trout	95
	Kokanee	100
	Arctic Grayling	35
Kathleen Lake Total	Lake Trout	171
	Kokanee	105
	Arctic Grayling	35
Kathleen River Summer / 1995	Lake Trout	196*
	Arctic Grayling	140
Total	Lake Trout	367
	Kokanee	105
	Arctic Grayling	175

* Mean Weight of lake fish used because river caught fish were not sampled

The maximum sustained yield (MSY) estimate for all lake species for Kathleen Lake is 1.64 Kgms/ha. (5,537 Kgms.) A species specific MSY may be obtained using catch composition by weight data obtained from the lake test netting program conducted during 1973 (Wickstrom, 1979). The catch composition and allocation of the total MSY to component species is presented in Table 9.

TABLE 9 Maximum Sustained Yields for Kathleen Lake

Species	Percent Composition	MSY (Kilograms)	MSY (Kilograms / Hectare)
Lake Trout	47.8	2647	0.78
Kokanee	5.0	222	0.07
Arctic Grayling	4.0	277	0.08
Round Whitefish	42.8	2325	0.71

As a species adapted to cold, oligotrophic waters, lake trout is considered an indicator species to assess the health of freshwater fish stocks in Yukon lakes. O'Connor (1978) has suggested a figure of 15% of the maximum sustained yield as an optimum sustained yield (OSY) of lake trout for a high quality sport fishery. Using the MSY figures from table 9, the lake trout target OSY for Kathleen Lake would be 397 kilograms.

It is assumed that lake trout in the river and Lower Kathleen and Rainbow Lakes move to and from Kathleen Lake on a periodic

basis. Lake trout from each of these areas are considered part of the Kathleen Lake population. The combined estimated harvest of 367 kilograms of lake trout from Kathleen River and Lake represents angling pressure at 92 percent of the optimum sustained yield. It should be clarified that this calculation is based on catch composition data that is 22 years old. It is probable that the percentage composition of lake trout has decreased in the interim and that angling pressure on that species now may exceed the 15 percent OSY.

Total yield estimates for kokanee and arctic grayling for Kathleen Lake given in table 8 represent levels at 47 and 13 percent of their respective maximum sustained yields. The stable numbers of spawning kokanee suggests that the current species composition in the lake has not changed significantly since 1973.

4.2.1.2 Regulation

Klaune Park adopted the same High Quality Lake Management regulations for Kathleen Lake in 1991 as the Territorial government implemented for the Kathleen River system and on selected lakes outside park boundaries. These regulations require that fish whose lengths fall within the slot limit (65 cm. - 100 cm. for lake trout, 40 cm. - 48 cm. for arctic grayling), are required to be released alive to the water.

The combined harvest of lake trout from the river and the lake approaches the optimum sustained yield for Kathleen Lake. The high and increasing level of lake trout harvest in Kathleen Lake is a management concern. However, when the added productivity of the lower lakes is considered, it would appear that further conservation measures for lake trout may be premature at this time. Kokanee harvest levels at 47 percent of their MSY in Kathleen Lake may contribute to a further decrease in angling quality in the future.

The maximum sustained yields reported in this paper are based on dated information. There is a need for a limited netting program to determine the current species composition and for current water chemistry data to derive a more precise morphoedaphic index of the maximum sustained yields

4.2.2 Kathleen River

4.2.2.1 Catch Per Unit Effort (CPUE)

Low mean depths and warm water temperatures make the small lakes and the river downstream of Kathleen Lake areas of high productivity. Fluctuating flow rates and migration into and out of the system make it difficult to calculate sustained yields for lentic (flowing water) environments. Therefore, changes in catches per angler hour (CPUE) were used to assess changes in fish densities and angling quality. With only one year of previous data, trends are difficult to establish.

Lake trout CPUE has changed little between the surveys of 1990 and 1995. However, arctic grayling CPUEs show a decline while rainbow trout CPUEs show a significant increase.

Observations made by survey technicians during the summer survey revealed that there was good angler knowledge of effective release techniques such that live release rates are much higher than in other fisheries in the territory. The highest numbers of arctic grayling were caught in the months of August and September at a time when the greatest number of lake trout and rainbow trout are being caught (Figure 4). Arctic grayling are apparently being caught incidentally by Yukon resident anglers targeting lake trout and rainbow trout (Appendix 1, Figure 3).

4.2.2.2 Regulation

The absence of change in the CPUE for lake trout indicates that its population is relatively stable. Lake trout are heavily harvested in the fall and this component of the fishery will require continued monitoring. Rainbow trout numbers appear to be increasing. As there is still good quality arctic grayling fishing on Kathleen River as indicated by the very high catch numbers and good catches per unit effort, further regulatory measures are not recommended. However, measures to educate anglers of the biological and ethical concerns of excessive live release fishing are needed

given the current and increasing rate of catch and live release of arctic grayling.

If the popularity of the river fishery continues to increase at similar rates seen in recent years, the depletion of lake trout and arctic grayling stocks will be a concern. Another harvest survey is recommended within three years to monitor changes in this quite dynamic fishery.

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APPENDIX 1

Table 1 Mean Daily Effort and Catch for Kathleen Lake and River, 1991 and 1995

Survey	No of Sample Days	Mean Hours Fished / Sample Day	Mean Hours Fished / Angler Day	Species	Mean Daily Catch	Mean Catch / Angler Day
Kathleen Lake / 91 (spring)	27	14.7	3.9	Lake Trout	1.59	0.42
				Kokanee	0.26	0.07
Kathleen Lake / 95 (summer)	33	13.9	2.2	Lake Trout	1.09	0.16
				Kokanee	0.70	0.11
				A. Grayling	0.61	0.09
Kathleen River / 95 (summer)	39	15.5	2.2	Lake Trout	2.95	0.42
				A. Grayling	15.7	2.22
				Rainbow Tr.	4.49	0.63
				L. Whitefish	0.82	0.12

Table 2 Summary of Biological Characteristics of Fish Caught in Harvest Surveys of Kathleen Lake and River, 1991 and 1995

Species	Mean Fork Length (mm)	Mean Weight (gms.)	No in the Sample
<u>Kathleen Lake / 91 (Spring)</u>			
Lake Trout	435.4	1105.5	35
Kokanee	380.0	650.0	7
<u>Kathleen Lake / 95 (Summer)</u>			
Lake Trout	458.3	1044.0	8
Kokanee	404.6	799.3	16
Arctic Grayling	390.0	555.0	2
<u>Kathleen River / 95 (Summer)</u>			
Arctic Grayling	371.7	583.3	3

Table 3: Comparison of Effort and Catch Statistics from Selected Yukon Lakes

Lake / Survey Year	Size (Ha.)	Estimated Number of Angler Hours	Estimated Angler Catch (No. of Fish)		Estimated Angler Harvest (No. of Fish)	
			Lake Trout	Arctic Grayling	Lake Trout	Arctic Grayling
Kathleen /1995	3376	3230	152	122	91	63
Ethel /1990	4730	1262	378	290	126	110
Little Atlin /1990	3790	1283	199	-	76	-

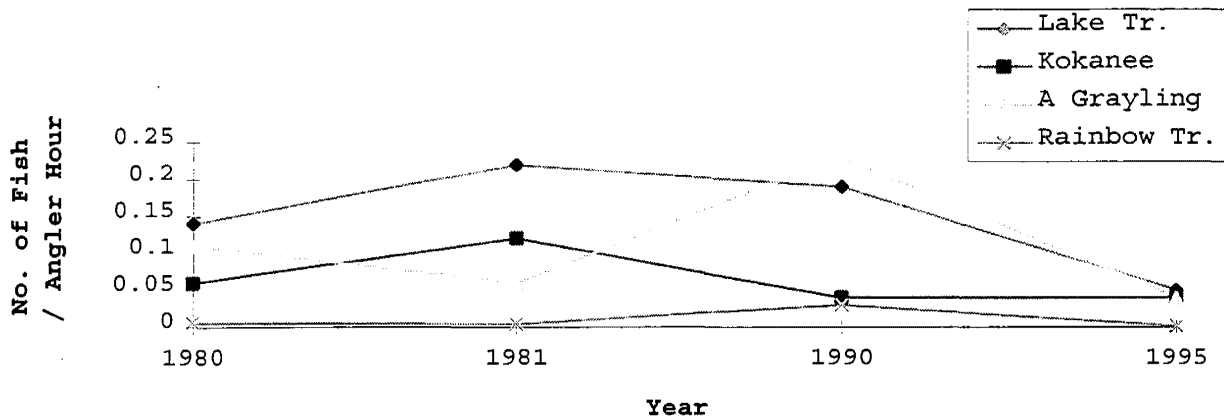
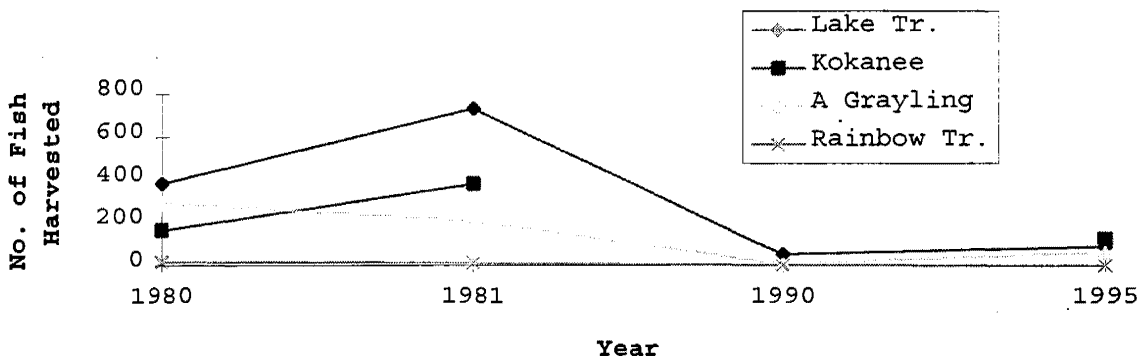
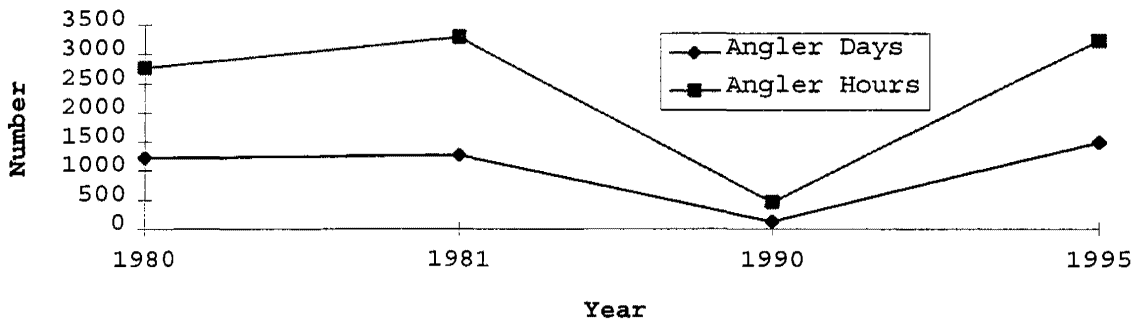


Figure 1: Angler Effort and Harvest from Summer Angler Harvest Surveys of Kathleen Lake

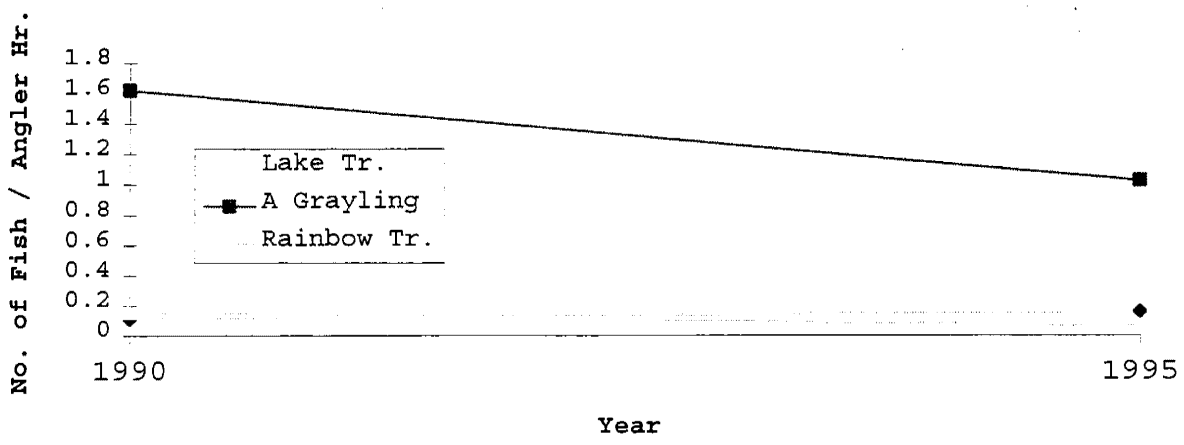
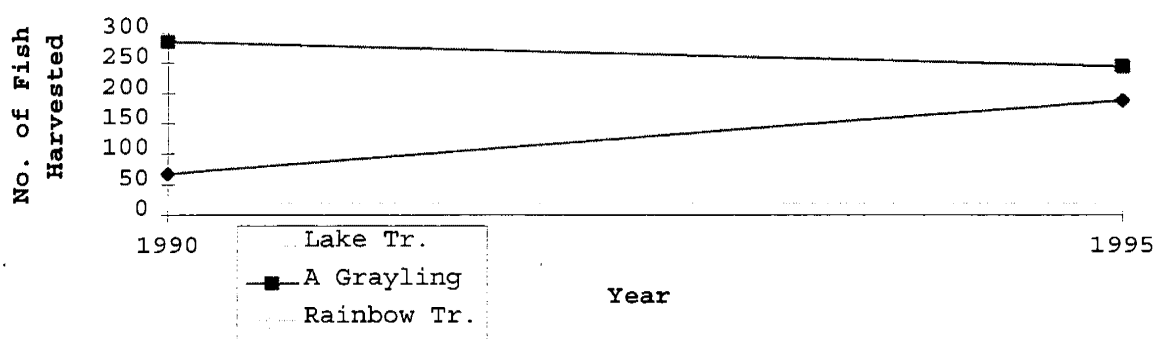
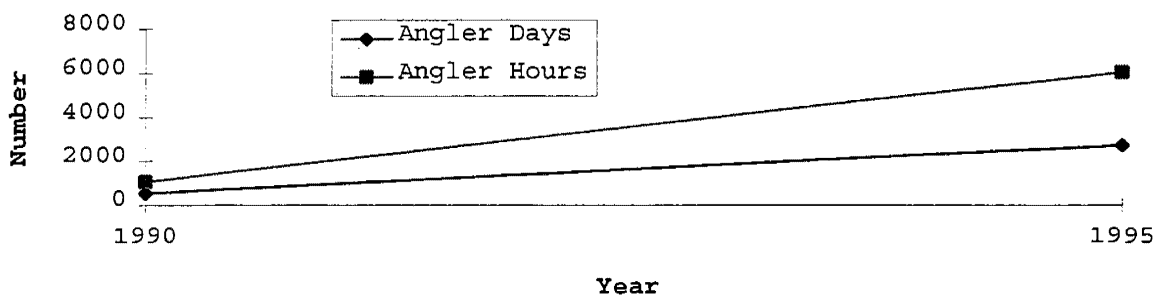
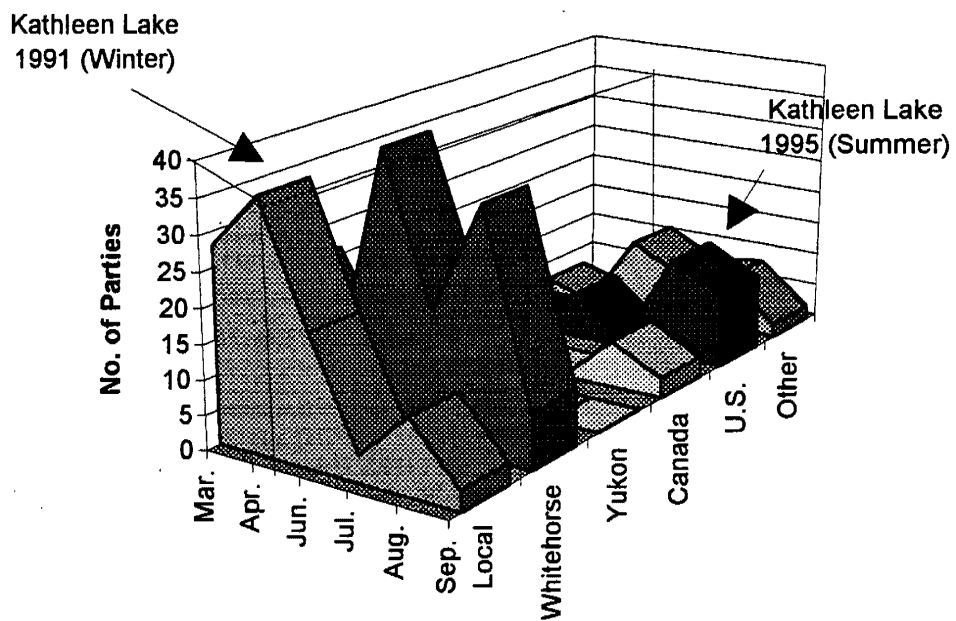


Figure 2: Angler Effort, Harvest and Harvest per Unit Effort from Summer Angler Harvest Surveys of Kathleen River



Kathleen River
1995 (Summer)

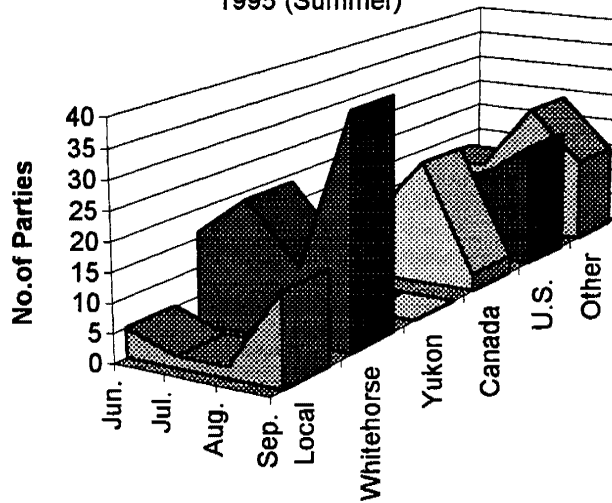


Figure 3: Origin and Seasonal Timing of Angler Effort on Kathleen Lake and River, 1991 and 1995

APPENDIX 2

KATHLEEN LAKE 91 HARVEST SURVEY KOKANEE BIOLOGICAL DATA

DATE	SAMPLE NUMBER	FORK LENGTH (mm.)	WEIGHT (gms)	AGE	SEX	MATURITY	STOMACH CONTENT S
31/3/1995	7	340	550		2		
07/4/1995	8	390	750		1	6	Stoneflies
13/4/1995	9	370	600		1	6	algae
13/4/1995	10	395	700		1	6	algae
13/4/1995	11	355	500		2	1	algae
13/4/1995	12	405	700		1	6	pygmy wfish
14/4/1995	13	405	750		1	6	algae
Mean		380.00	650.00				
S.D.		25.50	100.00				
Var		650.00	10000.00				

KATHLEEN LAKE 91 HARVEST SURVEY LAKE TROUT BIOLOGICAL DATA

DATE	SAMPLE NUMBER	FORK LENGTH (mm.)	WEIGHT (gms)	AGE	SEX	MATURITY	STOMACH CONTENTS
10/3/91	1	460	1000		1	6	empty
10/3/91	2	460	800		1	6	shrimp
10/3/91	3	355	500		2	1	empty
10/3/91	4	420	750		1	6	empty
10/3/91	5	435	900		1	6	empty
10/3/91	6	370	500		2	1	empty
17/3/91	7	455	900		1	6	empty
17/3/91	8	435	1050		1	6	empty
19/3/91	9	415	750		1	6	shrimp
19/3/91	10	470	1050		2	2	sculpins
19/3/91	11	515	1400		2	2	snails
19/3/91	12	410	700		1	6	shrimp
19/3/91	13	370	500		2	1	empty
19/3/91	14	440	900				
23/3/91	15	435	950		2	2	empty
24/3/91	16	900	7300		2	2	empty
31/3/91	17	340	550		2	1	empty
31/3/91	18	410	1050		1	6	empty
31/3/91	19	400	1050		2	1	
31/3/91	20	390	900		2	1	
31/3/91	21	385	700		1	6	
01/4/91	22		1100				snails
01/4/91	23	425	950		2	1	
01/4/91	24	510	1600		2	2	
01/4/91	25	420	1050		2	1	
01/4/91	26	385	900		1	6	
01/4/91	27	345	650		1	6	
01/4/91	28	380	750		1	6	
06/4/91	29	470	1250		2	2	empty
07/4/91	30	450	950		2	2	empty
07/4/91	31	430	850		1	6	empty
07/4/91	32	460	1125		2	2	algae
21/4/91	33	390			1		empty
21/4/91	34	460			1		empty
21/4/91	35	410			2		empty
Mean		435.44	1105.47				
S.D.		92.44	1157.27				
Var		8544.50	1339263.48				

KATHLEEN LAKE 95 HARVEST SURVEY KOKANEE BIOLOGICAL DATA

DATE	SAMPLE NUMBER	FORK LENGTH (mm.)	WEIGHT (Kgms)	AGE	SEX	MATURIT Y	STOMACH CONTENTS
06/6/95	1	420					
17/6/95	2	423	780		2	3	Y
17/6/95	3	409	810		1	8	Y
17/6/95	4	408	770		1	8	Y
17/6/95	5	329	375		2		Y
17/6/95	6	437	890		1	8	Y
17/6/95	7	398	720		2	3	Y
17/6/95	8	397	890		1	8	Y
17/6/95	9	411	850		1	8	Y
17/6/95	10	392	810		1	8	Y
17/6/95	11	406	840		2	3	N
17/6/95	12	396	805		2	3	Y
17/6/95	13	397	820		1	8	Y
17/6/95	14	453	930		1	8	Y
17/6/95	15	398	900		1	8	Y
20/8/95	16	400	800				
Mean		404.63	799.33				
S.D.		26.09	129.87				
Var		680.92	16867.38				

KATHLEEN LAKE 95 HARVEST SURVEY LAKE TROUT BIOLOGICAL DATA

DATE	SAMPLE NUMBER	FORK LENGTH (mm.)	WEIGHT (Kgms)	AGE	SEX	MATURITY	STOMACH CONTENTS
11/06/95	1	492					
11/06/95	2	442					
11/06/95	3	385					
11/06/95	4	489	1420		2	3	Y
11/06/95	5	510	1600		2	1	Y
11/06/95	6	458	1200		1	6	Y
11/06/95	7	423	600		1	6	Y
11/06/95	8	467	400		1	6	Y
Mean		458.25	1044.00				
S.D.		40.90	521.23				
Var		1673.07	271680.00				

KATHLEEN LAKE 95 HARVEST SURVEY ARCTIC GRAYLING BIOLOGICAL DATA

DATE	SAMPLE NUMBER	FORK LENGTH (mm.)	WEIGHT (Kgms)	AGE	SEX	MATURITY	STOMACH CONTENTS
17/06/95	1	386	530		1	8	Y
11/06/95	2	394	580		1	8	Y
Mean		390.00	555.00				
S.D.		5.66	35.36				
Var		32.00	1250.00				

KATHLEEN RIVER 95 HARVEST SURVEY ARCTIC GRAYLING BIOLOGICAL DATA

DATE	SAMPLE NUMBER	FORK LENGTH (mm.)	WEIGHT (Kgms)	AGE	SEX	MATURITY	STOMACH CONTENTS
10/6/95	1	372	600				
10/6/95	2	370	550		1	7	
10/6/95	3	373	600		2	2	
Mean		371.67	583.33				
S.D.		1.53	28.87				
Var		2.33	833.33				

TAGISH LAKE 96 HARVEST SURVEY LAKE TROUT BIOLOGICAL DATA

DATE	SAMPLE NUMBER	FORK LENGTH (mm.)	WEIGHT (Kgms)	AGE	SEX	MATURITY	CONDITION FACTOR
19/5/96	1	510	2750		2		2.07
31/5/96	2	480	2600		2	2	2.35
09/6/96	3	540	4500		2	2	2.86
09/6/96	4	510	3750		2	2	2.83
09/6/96	5	495	3600		2	3	2.97
06/7/96	6	597	5100		2	2	2.40
07/7/96	7	500	3300		2	2	2.64
07/7/96	8	648	6750		1	6	2.48
07/7/96	9	580	5100		1	8	2.61
07/7/96	10	533	3750		1	6	2.48
07/7/96	11	603	5800		2	3	2.65
07/7/96	12	945	8620				1.02
07/7/96	13	800	4530				0.88
07/7/96	14	660	2500				0.87
20/7/96	15	535	1625		2	2	1.06
20/7/96	16	487	1350		1		1.17
20/7/96	17	472	925		2	1	0.88
20/7/96	18	456	1025		1	7	1.08
20/7/96	19	477	1050		1	7	0.97
20/7/96	20	496	1375		2	2	1.13
20/7/96	21	418	750		1	7	1.03
20/7/96	22	420	750		1	6	1.01
21/7/96	23	590	2850		2	3	1.39
21/7/96	24	560	1950		2	3	1.11
21/7/96	25	508	1450		2	3	1.11
28/7/96	26	560	2075		2	1	1.18
28/7/96	27	495	1450		1	7	1.20
28/7/96	28	505	1425		2	1	1.11
28/7/96	29	418	1425		1	9	1.95
28/7/96	30	440	950		1	8	1.12
06/8/96	31	510	1400		2	2	1.06
06/8/96	32	495	1390		2	3	1.15
06/8/96	33	515	1425		1	8	1.04

TAGISH LAKE 96 HARVEST SURVEY LAKE TROUT BIOLOGICAL DATA cont'd

DATE	SAMPLE NUMBER	FORK LENGTH (mm.)	WEIGHT (Kgms)	AGE	SEX	MATURITY	CONDITION FACTOR
06/8/96	34	485	1300		1	8	1.14
06/8/96	35	472	1150		1	8	1.09
11/8/96	36	512	1360		2	3	1.01
11/8/96	37	496	1360		2	3	1.11
11/8/96	38	446	1130		2	1	1.27
23/6/96	1	595	2000		2	1	0.95
23/6/96	2	600	2100		2	2	0.97
23/6/96	3	360	500				1.07
23/6/96	4	514	1360		1	8	1.00
23/6/96	5	517	1360		1		0.98
23/6/96	6	503	1130		1	6	0.89
23/6/96	7	514	1130		2	2	0.83
23/6/96	8	510	1360		1	8	1.03
23/6/96	9	548	1360		2	1	0.83
23/6/96	10	669	3500		2	4	1.17
Mean		531.23	2320.63				1.08
S.D.		95.38	1713.98				0.19
Var		9097.59	2937735.03				0.44

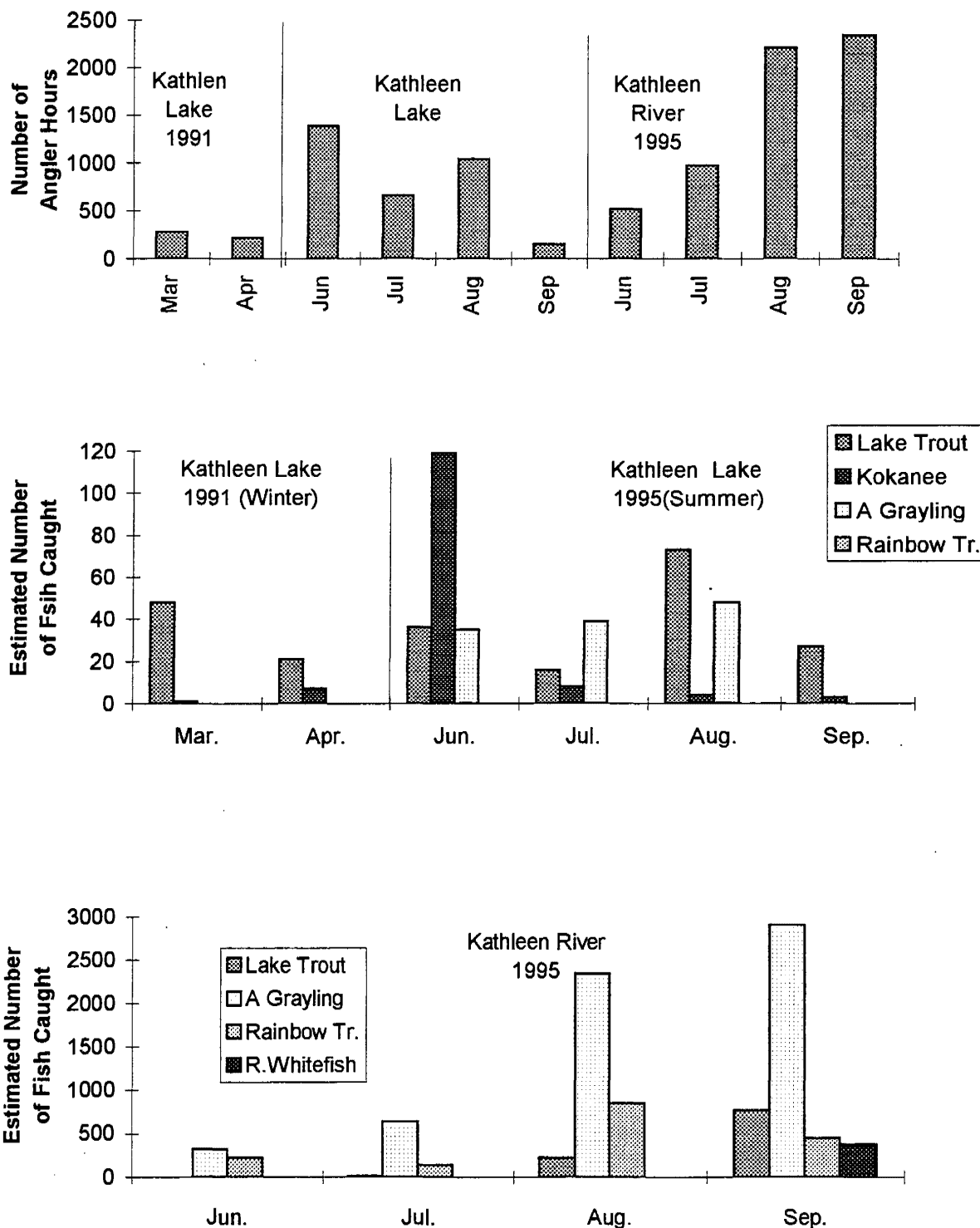


Figure 1 Angler Effort and Catch Distribution by Month for Kathleen Lake and River, 1991 and 1995

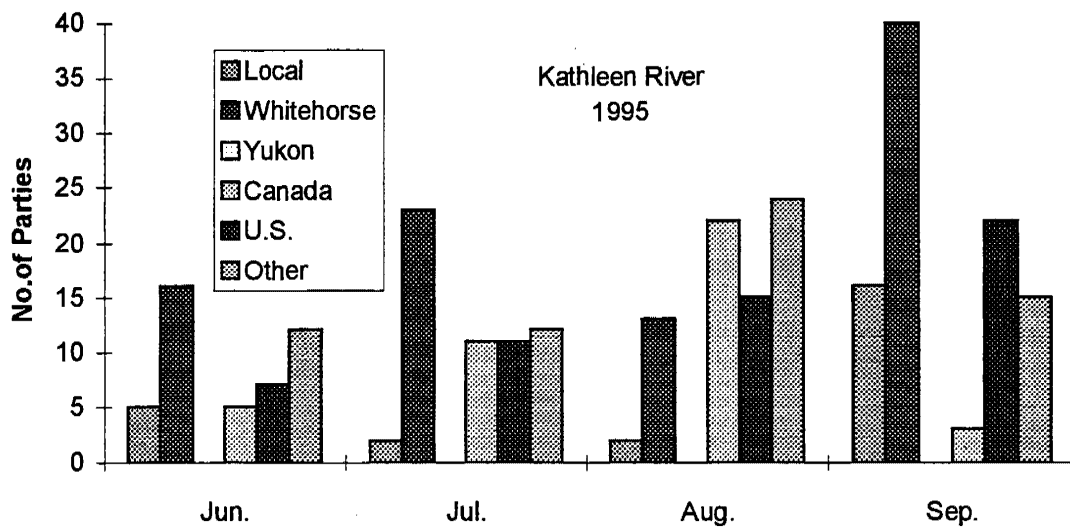
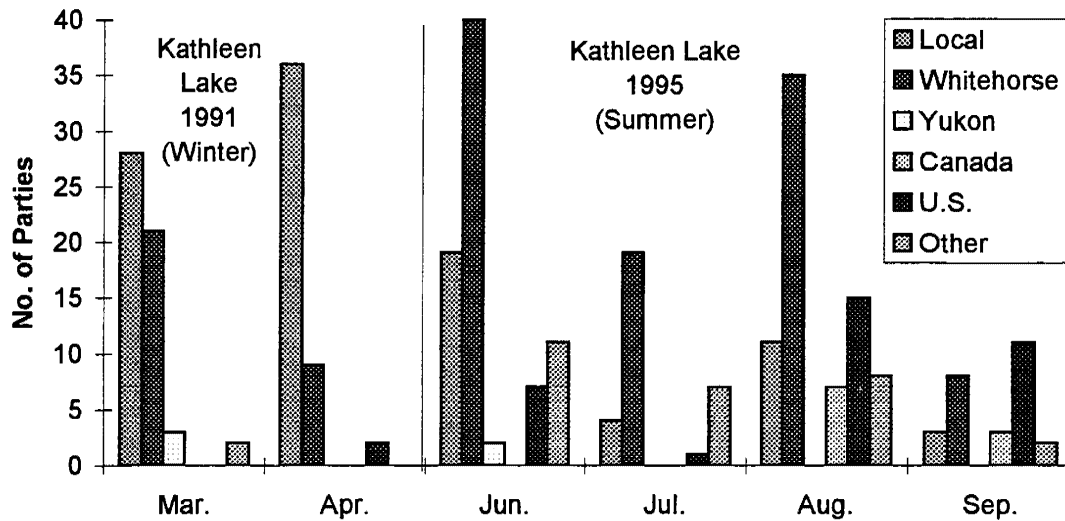


Figure 2 Origin and Seasonal Timing of Angler Effort on Kathleen Lake and River, 1991 and 1995