RESEARCH PROJECT SEGMENT

State:	Alaska	Name:	Sport Fish Investigations of Alaska
Project No.:	F-9-7		
Study No.:	G-I	Study Title:	INVENTORY AND CATALOGING
Job No.:	G-I-G	Job Title:	Inventory and Cataloging of Interior Alaska Waters - Fairbanks District

Period Covered: July 1, 1974 to June 30, 1975

ABSTRACT

Creel census and angling pressure estimates were conducted on the Chatanika River whitefish, Coregonus spp., harvest from September 1 thru October 4, 1974. Results indicated that 406 fishermen harvested an estimated 1,924 whitefish.

Creel census data for the Salcha River indicated that salmon, Onchorhynchus, spp., fishermen spent a total of 5,344 hours to harvest 137 king salmon, O. tshawytscha, and 187 chum salmon, O. keta. Grayling, Thymallus arcticus, anglers spent an estimated 5,940 hours to harvest an estimated 4,732 grayling.

A Birch Lake creel census, utilizing a voluntary system conducted at the Air Force Recreation Camp, revealed that 145 fishermen fished 554 hours to harvest 124 rainbow trout, Salmo gairdneri.

Population estimates of Arctic grayling were 991 and 551 per km in two 8 km sections of the Salcha River above and below the crossing of the Trans-Alaska pipeline. An index section (Redmond Creek to pipeline crossing) indicated 765 grayling per km compared to an estimate in 1972 of 503 grayling per km.

A population estimate derived from visual counts was conducted prior to the spear fishing season on the Chatanika River. An estimated 24,600 least cisco, C. sardinella, and 4,500 humpback whitefish, C. pidschian, were present.

Basic surveys were performed on three lakes and two gravel pits and winter dissolved oxygen analyses were conducted on fifteen lakes and ponds and one slough in the job area.

Fourteen lakes were test netted to determine species composition and stocking success. Two of these were found to be barren of fish life, probably as a result of winterkill.

Three lakes were stocked with 114,670 coho salmon, O. kisutch, and 227,600 rainbow trout.

ACKNOWLEDGEMENT

This author wishes to acknowledge that the grayling creel census on the Chatanika River and the grayling and salmon creel census on the Salcha River as well as the Lake Minchumina survey work was conducted by Stephen L. Tack as part of his research on the Distribution, Abundance, and Natural History of the Arctic Grayling in the Tanana River drainage but is included in this report for the sake of continuity.

RECOMMENDATIONS

1) Evaluate stocking success of Fairbanks District lakes stocked with rainbow trout, silver salmon, or grayling.

2) Continue creel census efforts on Birch Lake and the Chatanika, Salcha, and Little Salcha rivers.

3) Conduct whitefish population estimates in selected segments of the Chatanika River.

4) Begin cataloging and inventory studies in the Chandalar River Drainage and in the lower Tanana River between the Little Delta River and the mouth of the Tanana River.

OBJECTIVES

1) To determine angler utilization and sport fish harvest of important waters in the district.

2) To continue fish population estimates in various segments of the Salcha and Chatanika rivers.

3) To determine limnological and fish population parameters of stocked and managed lakes in the district.

4) To evaluate fishery management techniques to provide recommendations for stocking, rehabilitation, and enhancement of waters in the district.

TECHNIQUES USED

Creel census of the Chatanika River whitefish fishery was designed to provide 50% coverage.

Angler counts and creel census on Birch Lake were conducted by military personnel at the Eielson Air Force Base Recreation Camp, using a voluntary reporting system.

Estimation of grayling populations was accomplished by the Schnabel tag and recapture method.

An alternating current shocker boat as described by Van Hulle (1968) was used to capture grayling for population and length composition studies. Species composition was also determined from shocker boat samples.

Grayling scales used for age determination were impressed on 20 mil acetate, using a heated press at 35,000 pounds pressure for 20 seconds. The scales were individually cleaned prior to mounting. A Bruning 200 microfiche reader was used to read the scales.

All fish were measured for fork length in millimeters.

Whitefish population estimates were taken visually from a platform mounted on a riverboat.

Water samples were collected using a Kemmerer water sampler and chemical analysis was done with a Hach Model AL-36-WR kit. A Lowrance echo sounder was used along with a conventional sounding line to determine lake depths.

Graduated mesh monofilament gill nets, 125' x 6' (38 x 1.8 m) with five mesh sizes ranging from 1/2 to 2 1/2 inches (12-64 mm) bar measure were used to sample fish populations in lakes.

FINDINGS

Creel Census

Chatanika River:

The fall spear fishery for whitefish, Coregonus spp., was monitored in the Chatanika River for the third straight year. Total harvest was down (1,924) in 1974 from the previous high of 3,032 in 1973. The smaller harvest was influenced by low water and an exceptionally warm fall. The lower water level kept the fish from migrating upstream as far as they had previously, and thus the fish remained less accessible to the fishermen. The warm weather postponed moose hunting and many of the sportsmen indicated they went moose hunting before they started spear fishing. The Chatanika River spear fishery began September 1 and ended with freeze-up on October 4; it is summarized in Table 1.

Table 2 summarizes past whitefish harvests.

Table 1. Chatanika River Whitefish Harvest Summary, September 1 to October 4, 1974.

Whitefish Creel Census Summary:

Calculated number of fishermen	406
Calculated number of angler hours	1,054
Calculated total harvest	1,924
Calculated fish per angler hour	1.82
Calculated fish per angler trip	4.74
Mean hours per angler trip	2.60

Calculated number of fish harvested by species:

	Number	%
Humpback whitefish*	464	24
Least cisco	1,272	66
Round whitefish	188	10

Methods used in harvest:

	No. of Fishermen	% of Fishermen	Total Fish Harvest	% of Total Harvest
Hook and line (snagging)	20	5	124	7
Spear	386	95	1,800	93

*Humpback whitefish - Coregonus pidschian
Least cisco - C. sardinella
Round whitefish - Prosopium cylindraceum

Table 2. Chatanika River Harvest Summary, 1972-1974.

Year	Dates	Angler Hours	Hours Per Trip	Whitefish Per Hour	Total Whitefish Harvested
1972*	Oct. 1-16	302	1.7	2.32	701
1973**	Sept. 1-Oct. 7	1,356	2.5	2.24	3,032
1974	Sept. 1-Oct. 4	1,054	2.6	1.82	1,924

*From Kepler, 1973
**From Kramer, 1974

The Salcha River:

The salmon, Onchorhynchus spp., and grayling, Thymallus arcticus, fisheries on the Salcha River were sampled from July 4 through August 2, 1974. These days encompassed the time that salmon are available to the sport fishery. The salmon fishery is primarily a bank fishery located around the Richardson Highway Bridge. The grayling fishery is primarily a boat fishery carried out over about 60 miles (96 km) upstream from the aforementioned bridge.

The salmon fishery was censused by a technician located at the bridge who counted all visible anglers once each hour and interviewed as many anglers who had completed their trips as possible. A special effort was made to account for every king salmon, O. tshawytscha, harvested. Thus the figure in Table 3 is an actual count rather than an estimate.

The results show the relatively great effort (5,344 angler hours) expended to catch relatively few salmon (324). Most of the effort was directed at king salmon, with chum salmon, O. keta, and grayling caught incidentally. Most anglers were attempting to snag the salmon as they crossed a long riffle just downstream from the highway bridge. The anglers were primarily military personnel.

All data on the grayling fishery were obtained by contacting boat anglers as they returned from up-river trips. An attempt was made to contact all boats, most of which came in Sunday afternoon and evening after spending the weekend up-river. The majority of the boat anglers were residents who owned cabins along the upper Salcha River.

There were 1,543 grayling harvested during 1,937 angler hours for a catch rate of 0.80 grayling per angler hour.

Table 3. Creel Census Results From the Salcha River, July 4-August 2, 1974.

Angler Hours Highway Bridge Fishery

	6 a.m.-10 a.m.	11 a.m. - 12 p.m.	1 a.m.-5 a.m.	Total
Weekdays	298	3,278	512	4,088
Weekends & Holidays	64	1,099	93	1,256
				5,344

Fishery Statistics:

	Number
Number of anglers interviewed	827
Mean duration of angler trip	3.40
Total king salmon taken	137
King salmon per angler hour	0.025
Total chum salmon taken	187
Chum salmon per angler hour	0.035
Grayling caught and kept	134

Boat Fishery

Number of boats contacted	199
Mean number of anglers per boat	2.52
Total angler hours	1,937
Mean hours fished per trip	3.86
Total grayling caught	2,885
Grayling kept	1,543
Grayling kept per angler hour	0.80

Results Expanded to Cover June, July, and August:

	Sampled	Expansion
Number of days	30	92
Angler hours expended by boat anglers	1,937	5,940
Expanded total of bank and boat anglers		11,284
Total grayling caught and kept	1,543	4,732

Table 4. Results of Chatanika River Creel Census, 1974.

Anglers Hours:

Period	Weekdays	Weekends & Holidays	Total
May	646	3,420	4,066
June	1,546	2,672	4,218
July	2,198	4,608	6,806
August	5,104	7,056	12,160
Total Angler Hours			27,250

Fishery Statistics:

	May	June	July	August	Overall
No. anglers interviewed	61	218	81	48	408
Mean hr. fished/angler interviewed	1.66	2.26	2.08	0.84	1.97
Total Grayling caught by anglers interviewed	40	840	486	115	1,481
Total Grayling kept by anglers interviewed	27	503	235	56	821
Grayling kept/angler hour	0.27	1.02	1.39	1.39	1.02
Total grayling harvest	1,098	4,302	9,460	16,092	31,762
Angler Composition:					
Local resident	54%	57%	62%	52%	57%
Military	30%	19%	15%	15%	19%
Tourist	16%	24%	23%	33%	24%

The results of the grayling fishery were expanded to represent June, July, and August (Table 3) giving about 6,000 angler hours of effort and a harvest of about 5,000 grayling. This expansion assumes that fishing pressure and success were approximately the same during the three months, but this assumption was not tested. The total effort during these three months was approximately 11,284 angler hours when the salmon fishery is included.

Upper Chatanika River:

The upper Chatanika River fishery occurs along the Steese Highway from 31 mile to about 80 mile. There are numerous access points but by far the most important is at the state campground at 40 mile.

The sample design involved only one count per day because of the long rough section of road to be covered. The time that the count was begun was randomized and the count took about two hours to complete. On the return trip following a count, the technician contacted anglers and encouraged them to stop at the check station at 31 mile for an interview when leaving the area.

Results of the upper Chatanika River creel census (Table 4) show 31,762 grayling taken in 27,250 angler hours of fishing. The average capture rate for grayling kept was 1.02 per hour. The fishery consisted of 57% local residents, 19% military personnel, and 24% tourists.

Although angler hours are believed to be representative, bias may have entered the catch per hour statistics. Anglers were encouraged to stop at the check station upon completion of fishing, and more successful anglers than non-successful anglers may have stopped, thus inflating the catch figures.

Birch Lake:

A voluntary creel census on Birch Lake was conducted at the Air Force Recreation Camp (Table 5). Only military personnel and dependents were involved.

Table 5. Voluntary Birch Lake Creel Census (Air Force Recreation Area) May 25 to July 13, 1974.

	Anglers Censused	Angler Hours	Rainbow Trout Taken	Rainbow Trout/ Angler Hour
May	51	211	31	0.15
June	56	187	47	0.25
July	38	156	46	0.29
Total	145	554	124	0.22

The census period was May 25 to July 13. Reports were received from 145 fishermen who had fished 554 hours to harvest 124 rainbow trout, Salmo gairdneri, for a fish per angler hour rate of 0.22. This catch per unit effort is down from 1973 (0.24) but higher than the 1972 figure of 0.12. A summary of past Birch Lake creel census totals is found in Table 6.

Table 6. Birch Lake Creel Census Totals, 1969-1974.

Year	Dates	Anglers Censused	Angler Hours	Rainbow Trout/ Angler Hour	Rainbow Trout Taken	Mean Length (mm)
1969	May & June	376	1,007	0.36	366	...
1970	May-Sept	1,293	5,305	0.17	928	400
1971	May-Sept	1,123	4,037	0.15	589	406
1972	May-Aug	1,597	4,462	0.12	531	381
1973	May-Aug	398	1,484	0.24	361	304
1974	May-July	145	554	0.22	124	384

Coho salmon were introduced to Birch Lake for the first time in 1974. These fish began entering the fishery soon after freeze-up and fishing activity has increased as a result.

Salcha River Studies

Population Estimates:

Grayling population estimates were conducted in a section of the Salcha River extending 5 miles (8 km) on either side of the Trans-Alaska pipeline crossing and in a 3 mile (4.8 km) index section from the mouth of Redmond Creek to the pipeline crossing (Table 7). The pipeline will cross at river mile 14 (22.4 km).

Table 7. Grayling Population Estimates, Salcha River, 1974.

River Section	Date	Number Marked	Schnabel Estimates GR*/km	(GR/mi)	90% Confidence Limits GR/km
Redmond Cr. to pipeline crossing	July 10-22	216	765	(1,224)	490-5,032
Pipeline Crossing to 5 mi. (8 km) above	July 10-22	392	991	(1,586)	690-2,595
Pipeline Crossing to 5 mi. (8 km) below	July 10-22	330	551	(882)	397-1,174

*GR - Grayling

The index section was established by Tack (1973) to monitor grayling population dynamics and provide a basis for future comparisons in that area of the river. This section was enlarged to provide continued monitoring of grayling populations both above and below the oil pipeline crossing.

In the index section there were an estimated 765 grayling/km in 1974.

A population estimate made in 1972 showed 503 grayling/km. No estimate was made on young-of-the-year fish. The water in the Salcha was very clear and shocking had to be done early in the day and late at night to be productive.

Length Frequency:

The length frequencies obtained while conducting population estimates in the Salcha River indicate a predominance of immature grayling (fork length less than 270 mm) from the upper sampling area limit at 30.4 km to the lower sampling area limit at 14.4 km (Figure 1).

Age and Growth:

Two hundred scale samples were randomly chosen from a sample of 746 grayling captured from the lower Salcha River (Table 8). Age class III, which is usually the predominate age class sampled by shocker boat in Interior streams, was drastically reduced in numbers; though the reason for such an occurrence is not clear at this time. There was an exceptionally large snowpack during the winter of 1971-1972 but no flooding occurred during the spring runoff. Age class III was also reduced in other Tanana River drainages in 1974 (Tack, 1975).

Table 8. Length and Age Composition of 200 Grayling Randomly Sampled from 746 Fish Taken by Electrofishing From 8 km Above to 8 km Below the Oil Pipeline Crossing on the Salcha River, 1974.

Length Group (mm)	Age Class I	II	III	IV	V	VI	Total
110-119	4						4
120-129	2						2
130-139		9					9
140-149		16					16
150-159		16					16
160-169		19	1				20
170-179		21	2				23
180-189		6	17				23
190-199		1	13				14
200-209			16				16
210-219			9	3			12
220-229			1	14			15
230-239			2	1			3
240-249				3	2		5
250-259				3			3
260-269				2	1		3
270-279					3		3
280-289					6		6
290-299					3		3
300-309					1		1
310-319							
320-329							
330-339						1	1
340-349							
350-359						2	2
Total	6	88	61	26	16	3	200
Mean Fork Length (mm)	116.7	154.7	196.0	231.2	277.8	345.0	

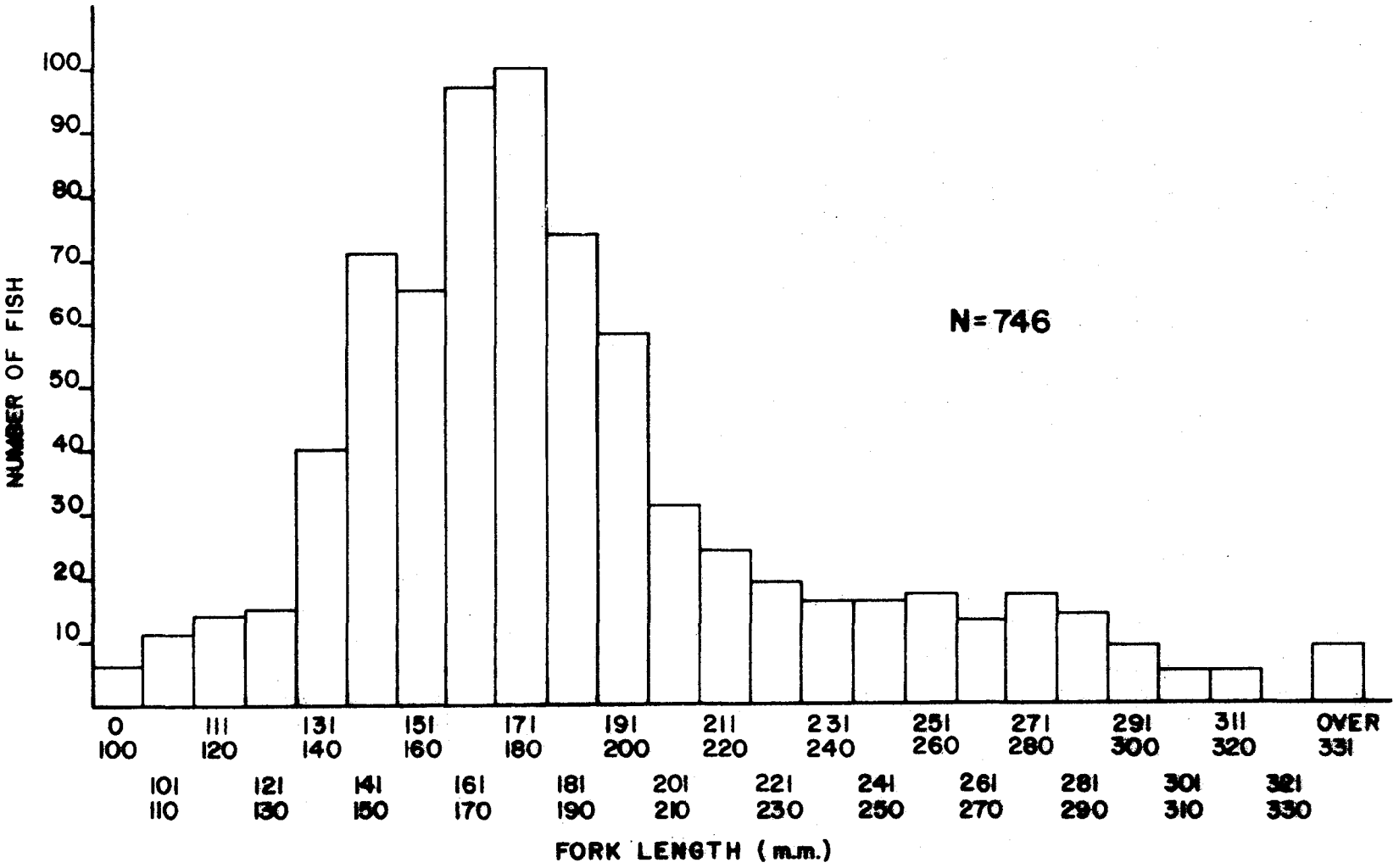

Figure 1. Length Frequency of Grayling Captured by Electroshocking From 8 km Above to 8 km Below the Oil Pipeline Crossing on the Salcha River, 1974.

Capture Rates:

The capture rates for all species encountered were recorded along with the population estimates to further assess their use as indices of abundance and as a means of expressing the relative abundance of fish captured. Catch rates for the various species were similar in all sample areas in the 10 mile (16 km) section (Fig. 2 and Table 9).

Table 9. Capture Rate by Electrofishing of Grayling and Associated Fish Species in Selected Sections of the Salcha River, 1974.

Area	Fish Per Hour*				Hours Shocked
	GR	RWF	S	BB	
Pipeline Crossing to 5 mi (8 km) above	34.2	25.2	13.5	1.4	13.55
Redmond Cr. to pipeline crossing	33.8	27.0	14.5	2.4	7.45
Pipeline Crossing to 5 mi (8 km) below	34.0	19.8	16.4	0.5	11.5

*GR - Grayling
RWF - round whitefish
S - Sucker, Catostomus catostomus
BB - Burbot, Lota lota

Chatanika River Studies

Population Estimates:

A population estimate of humpback whitefish and least cisco was conducted on the Chatanika River from August 13 to 17 by visual counts utilizing a platform mounted on the bow of a flat bottom boat. It has been found (Kramer, 1974) that visual counts of whitefish in this river closely correlate with Schnabel tag and recapture estimates.

An estimated population of 24,600 least cisco and 4,500 humpback whitefish was found in the area from 10 miles (16 km) below the Elliott Highway bridge to 12 miles (19.3 km) above the bridge. The majority of least cisco (23,600) were below the bridge, while the majority of humpback whitefish (2,800) were found above the bridge. Approximately 5,000-8,000 whitefish were counted from the Trans-Alaska Pipeline crossing (6 miles downstream of the Elliot Highway Bridge) to approximately 2.5 miles (4 km) downstream. Table 10 summarizes whitefish population estimates from 1972 to 1974.

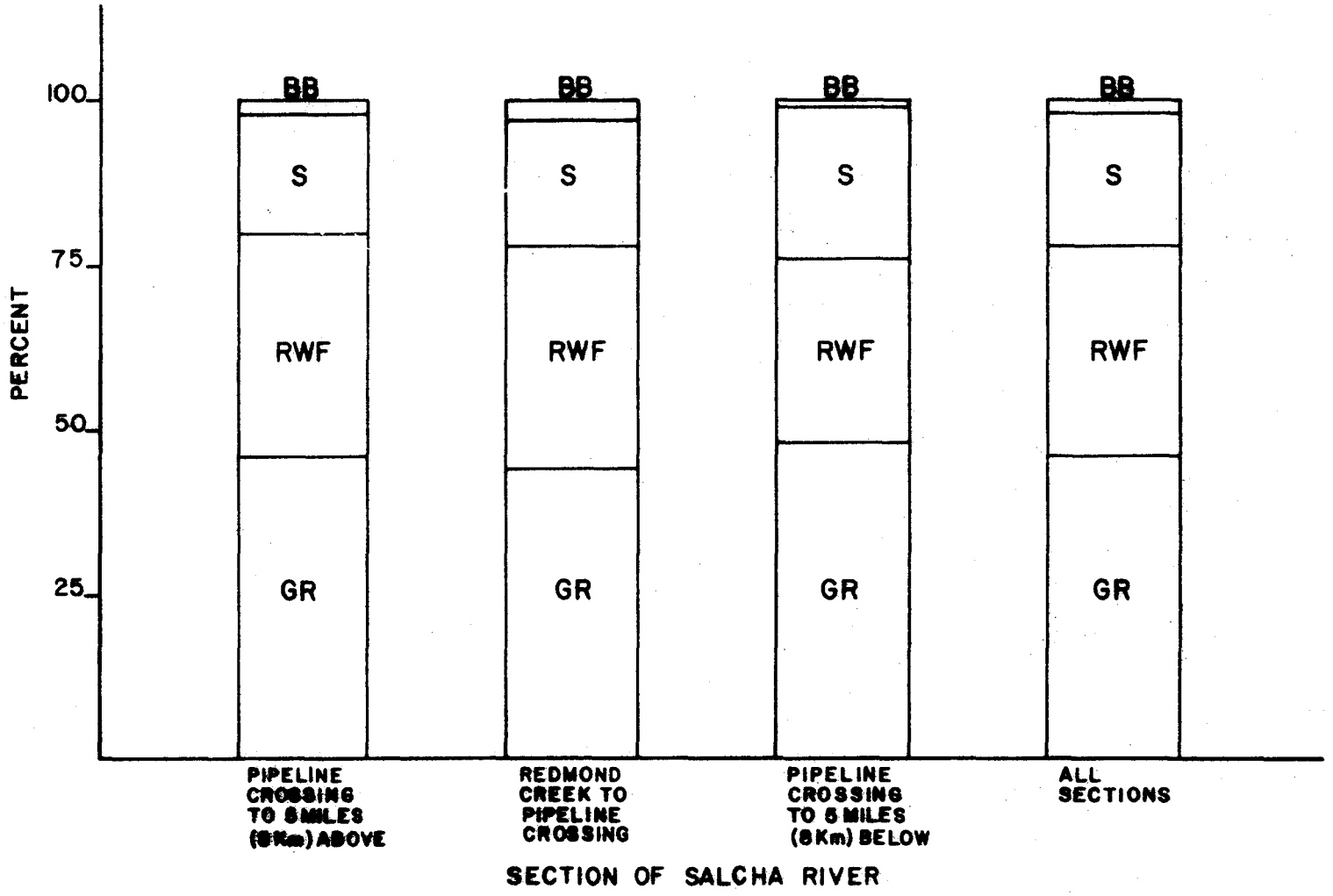

Figure 2. The Relative Abundance of Grayling (GR), Round Whitefish (RWF), Suckers (S), and Burbot (BB) in Three Sections of the Salcha River, 1974.

Table 10. Whitefish Population Estimates for the Chatanika River, 1972-1974.

Location	Year	Dates	Estimated Number of HWF*	Estimated Number of LCI*	Total	Combined Totals HWF & LCI Above & Below Bridge
Elliott Hwy Bridge to 12 mi (19.3 km) above bridge	1972	Aug 6-12	5,000	6,000	11,000	
	1973	Aug 17-18	5,000	1,000	6,000	
	1974	Aug 13-17	2,800	1,000	3,800	
						1972-24,000 1973-19,000 1974-29,100
Elliott Hwy Bridge to 10 mi (16 km) below bridge	1972	Aug 6-12	3,000	10,000	13,000	
	1973	Aug 17-18	2,000	11,000	13,000	
	1974	Aug 13-17	1,700	23,600	25,300	

*HWF - humpback whitefish
LCI - Least cisco

Age and Growth:

One hundred humpback whitefish (50 males, 50 females) were taken by electroshocking in the Chatanika River during the spawning run between September 12-18, 1974. The females ranged in length from 348 to 495 mm with mean of 431.6 mm. The males ranged in length from 334 to 517 mm with a mean of 421.7 mm.

No females less than 4 years old were found and no males were older than 9. The mean age of females was 6 years and the mean age for males was 5 years (Table 11).

Minto Flats sheefish, Stenodus leucichthys, also use the Chatanika River for spawning. Visual counts of sheefish are difficult due to it's preference for deeper water, and no population estimate was attempted, however, a total of 23 sheefish was counted while conducting the whitefish counts.

Lake Surveys

Basic surveys were performed on three lakes and two gravel pits in the Fairbanks District in 1974. The two gravel pits are adjacent to the Richardson Highway and the three lakes are all remote from the road system. The lakes were analyzed to determine species present and the potential for rehabilitation and stocking.

Johnson Road Pit #1:

Johnson Road Pit #1 (T4S R4E Sec. 19 Fairbanks C-1) has a maximum depth of 15 feet (4.6 m) and a surface area of approximately 6 acres. One gill net was set overnight but caught no fish.

Johnson Road Pit #2:

Johnson Road Pit #2 (T4S R4E Sec. 19 Fairbanks C-1) was found to have a maximum depth of 24 feet (7.3 m) and a surface area of approximately 6 acres. Pit #2 has the capacity to overwinter fish since both grayling and burbot were caught in the test net. Winter dissolved oxygen levels will be monitored on both pits.

Rex Trail Lakes:

Two lakes adjacent to the Rex Trail were surveyed on August 8 and 9 to determine fish composition and sport fish potential. Little Lake (149° 48'N, 64° 10'W) with 90 surface acres drains into Big Lake (149° 48'N, 64° 11'W) which has 134 surface acres. The connecting stream had a volume of 0.2 cfs.

Only pike were captured in test nets and by sport angling. Sport angling produced three pike per hour; however, most of them were small (mean length 455 mm). Both lakes are used mainly as a base camp for moose hunters. It would be unfeasible to consider either of these fly-in lakes for salmonid management since the entire watershed would have to be rehabilitated and a system of dikes built to keep floodwaters out. Water chemistry is presented in Table 12.

Table 11. Length and Age Composition of 100 Humpback Whitefish (50 males, 50 females) Taken By Electrofishing From the Chatanika River, 1974.

Fork Length (mm)	Age Class III ♂	III ♀	IV ♂	IV ♀	V ♂	V ♀	VI ♂	VI ♀	VII ♂	VII ♀	VIII ♂	VIII ♀	IX ♂	IX ♀	X ♂	X ♀	XI ♂	XI ♀	Total
331-340	3																		3
341-350				1															1
351-360	1				1														2
361-370	1									1									2
371-380	3		1	1		3	2												10
381-390			1			2	1												4
391-400			1		1	1				1									4
401-410	1			2	2	4	1												10
411-420				1	2	3				1									7
421-430			1		1	2		2		1		1							8
431-440			1		3	1	1		1		1	1	1	1					11
441-450					2	1	1		1	1		2							8
451-460					1	1	1	1	1		2			1					8
461-470								1	2				1						4
471-480			1				1	1	1	3							1		8
481-490								1			1			1		1			4
491-500								1	1	1				1		1			5
501-510																			
511-520											1								1
Total	9		6	5	13	18	8	7	7	9	5	4	2	4		2	1		100
Mean Length	361		405	390	425	408	418	461	462	440	471	437	451	469		491			

Table 12. Water Chemistry of Surveyed Lakes, August, 1974.

Lake	Water Temp.	pH	Total Hardness ppm	Total Alkalinity ppm	Dissolved Oxygen ppm	Total Acidity ppm	CO_2 ppm
Big Lake (Rex Trail)	18°C	7.0	51	51		5.6	5
Little Lake (Rex Trail)	18°C	7.5	68	51		5.6	5
Nenana Pond		8.0	150	135			20
Minchumina							
W.C.* 1 Mid-Lake		7.5	137	154	13		
W.C. 2 Foraker R.		7.8	137	137	10		
W.C. 3 Inlet		7.5	120	85	15		
W.C. 4 Inlet		7.0	68	51	15		
W.C. 5 Deep Creek		7.5	102	103	9		
W.C. 6 West Bay		10.0	103	103	17		

*W.C. - Water chemistry site; see map Figure 3.

Lake Minchumina:

Lake Minchumina is located about 66 miles NNW of Mt. McKinley at 63° 53'N, 152° 14'W at an elevation of 642 feet. The large lake (15,000 acres) is the dominant body of water in an extensive flats area dotted with hundreds of lakes. The flats area is situated at the headwaters of the Kantishna and Kuskokwim rivers and is partially drained by both. Lake Minchumina drains into the Kantishna River by way of the Muddy River.

The heavily silt laden Foraker River is the primary inlet. The silty water circulates through all but the western-most end of the lake, giving the water a gray color. At survey time the Foraker River was flowing 3.6 fps and the water temperature was 11°C. The average depth in a uniform section was 45" and the width was estimated at 100' for an estimated discharge of 1,620 cfs.

Deep Creek is the second largest inlet, probably less than one-fourth the size of the Foraker River. This stream drains the flats west of the lake and its brown-stained water enters the shallow west end of Lake Minchumina. Deep Creek, along with several other small streams entering the west end of the lake, keeps the water clear enough for sunlight penetration, resulting in lush growth of aquatic macrophytes which choke the west bay by early August.

Only the channels cut by Deep Creek and Old Woman Creek were navigable when this survey was done.

The surface level of Lake Minchumina varies widely both seasonally and from year to year. The seasonal fluctuation is due to the highly variable flow of the glacier-fed Foraker River. The year to year variation is not well understood but may involve the pattern of silt built up around the head of the outlet (Muddy River) which is adjacent to the mouth of the Foraker River at the east end of the lake. At survey time the lake was 1.8 m below high water mark and according to residents was about 1 m higher than it had been in June when the whole West Bay was dry. The surface level of the lake was determined as 226.2 cm below the top of a benchmark located about 7/8 of the way down the lower runway from the BLM station.

The shoreline is primarily rocky except in the west end and south side where the banks were boggy. There was also some sandy beach at the tip of the North Bay and silt banks in the East Bay. The rocky shoreline occurs adjacent to hills that rise abruptly from the lake. The lake bottom usually drops off quickly adjacent to the hills and little aquatic vegetation occurs in these areas.

Two prominent shoreline features are the gravel spits. One spit extends in a southerly direction from the point on which the landing strips are located. The other spit extends north from Yutokh Hill. Freshwater clam shells are abundant along this spit.

The lake is relatively shallow with a maximum depth of 11.9 m. The depth contours in Figure 4 were determined from a series of timed transects (Fig. 3). The bottom of the lake is relatively flat and silt covered except in the extreme west end where organic material is the primary constituent.

Two temperature profiles (Table 13) taken in the deep part of the lake (Figure 3) revealed the absence of a thermocline but temperatures were 4 to 5°C cooler at the bottom than at the surface.

Water chemistry of four inlet streams and two sites in the lake (Figure 3) showed the lake to be slightly alkaline (Table 12) except in the West Bay where the water was very alkaline due to springs along the north side of the Bay. The small bog streams (water chemistry stations 3 and 4) had reduced alkalinity but were neutral to slightly alkaline.

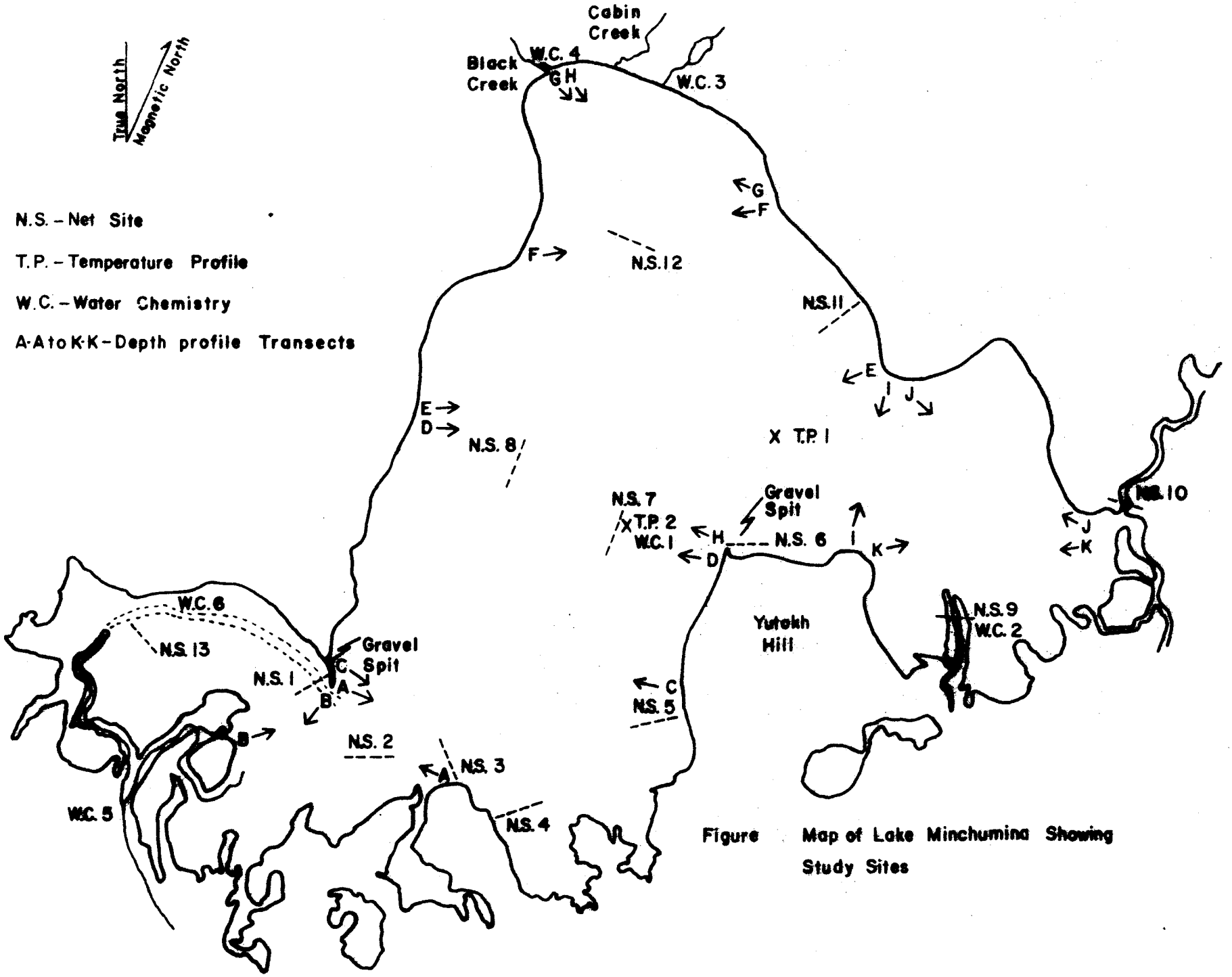

Figure Map of Lake Minchumina Showing Study Sites

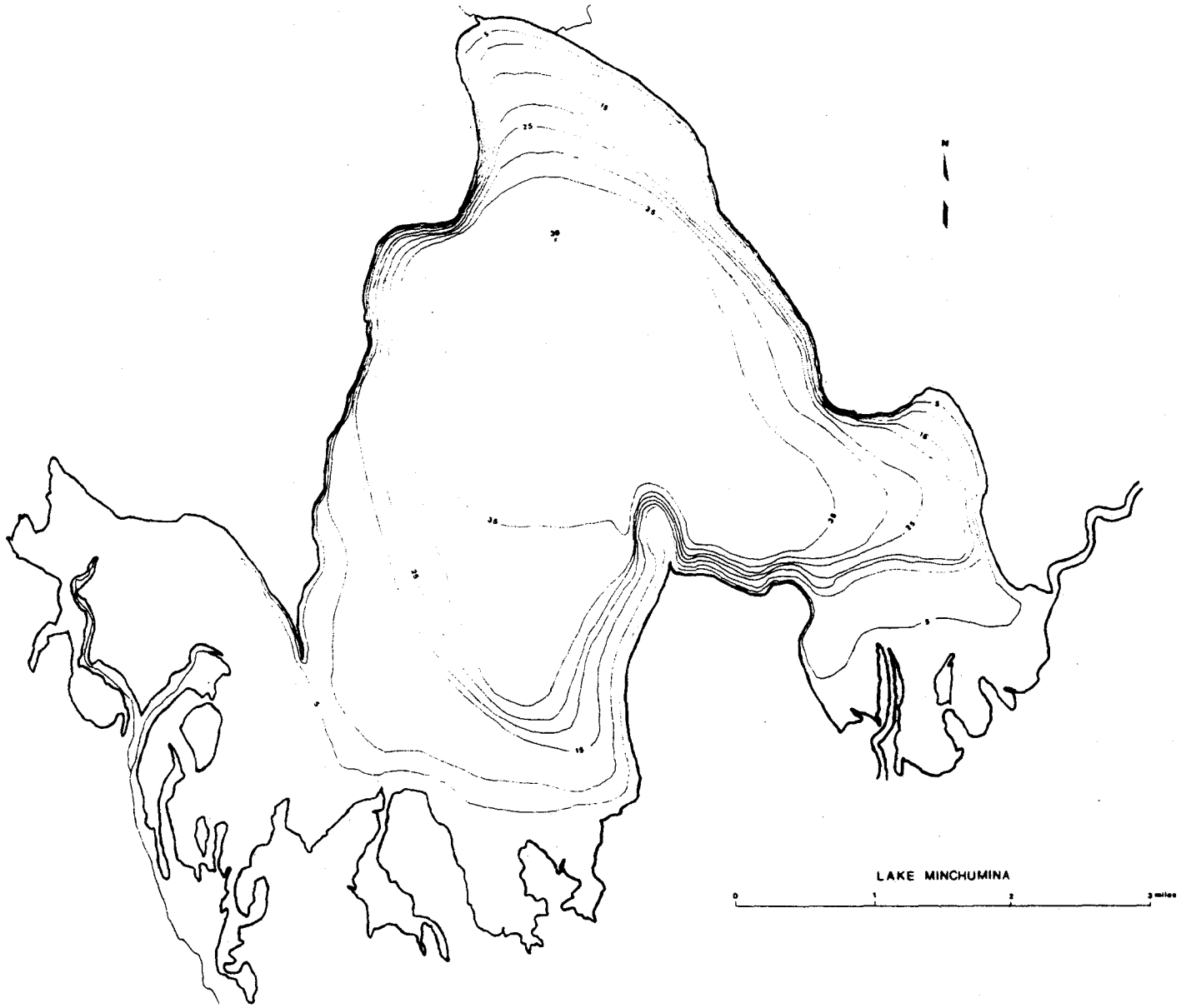

Figure 4. Hydrographic Map of Lake Minchumina, 1974. Depth Contours in Feet.

Table 13. Lake Minchumina Temperature Profile, August, 1974.

Temperature Profile #1*			Temperature Profile #2		
Depth			Depth		
Feet	Meters	Temp (°C)	Feet	Meters	Temp. (°C)
Surface	Surface	17	Surface	Surface	17
5	1.5	16.5	5	1.5	16
10	3.0	16	10	3.0	16
15	4.6	16	15	4.6	16
20	6.1	16	20	6.1	16
25	7.6	16	25	7.6	15.75
30	9.1	16	30	9.1	15.5
35	10.7	14	35	10.7	14.5
37	11.3	12.25	37	11.3	13.25

*See Map, Figure 3

Graduated mesh gill nets were set at 13 sites (Figure 3) around the lake representing nearly every habitat type. Six species of fish were taken (Table 14) with least cisco being the most abundant. All but five of the 287 least cisco were taken in deep water. Northern pike, Esox lucius, humpback whitefish, and broad whitefish, C. nasus, were found at all depths whereas suckers were primarily in shallow water and the one burbot was captured in deep water. Catches were about equally good on rocky shores and weedy shores. The length frequency of the five most numerous fish species is shown in Table 15, revealing the absence of small humpback and broad whitefish and suckers. The mean length and weight by sex of the four most prevalent species is given in Table 16.

Age and growth data for the three species of whitefish appear in Tables 17, 18, and 19. Only 22 least cisco were used in age determinations because of the uniform size of the sample (Table 15); however, four age classes were represented. This species is apparently very slow growing in Lake Minchumina and may also be short lived, though it is possible that larger least cisco leave the lake, at least during August. Some of the small females (under 159 mm) were gravid, futher indicating a stunted population.

Table 14. Lake Minchumina Test Netting Results, August, 1974.

Net Site Number*	Depth of set (ft.)	Hours Fished	Fish Species Captured**					
			HWF	BWF	LCi	NP	S	BB
1	5	24	23	5	4	14		
2	6	24	22	17		6	1	
3	5	8	12	2		2	1	
4	4	8	5			7	1	
5	6	24	11	4	1	9	1	
6	10	24	11	8		11	7	
7	36	24	1	8	66	5	1	1
8	34	24	7	4	71			
9	5	24						
10	6	24				1	3	
11	8	24	15	11		2		
12	37	24	15	29	145	3		
13	5	24	12	4		6		
Total Catch			134	92	287	66	15	1

*See mpa, Figure 1

**HWF - Humpback whitefish
LCi - Least Cisco
S - Longnose sucker
BWF - Broad whitefish
NP - Northern pike
BB - Burbot

Table 15. Length Frequency of Five Fish Species From Lake Minchumina, August 1974.

Fork Length (mm)	Number of Fish Measured				
	Broad Whitefish	Humpback Whitefish	Least Cisco	Northern Pike	Longnose Sucker
100-119			4		
120-139			12	1	
140-159			6	1	
160-179				1	
180-199	6			0	
200-219	11			0	
220-239	4			0	
240-259	3	4		1	
260-279	1	3		0	
280-299	1	3		0	
300-319	3	4		1	
320-339	2	4		0	
340-359	3	8		0	
360-379	6	6		2	
380-399	7	8		1	1
400-419	7	14		1	
420-439	11	27		4	1
440-459	14	31		3	4
460-479	8	18		2	5
480-499	1	3		9	3
500-519				6	
520-539	1			7	
540-559				4	
560-579				8	
580-599				6	
600-619				5	
620-639				6	
640-659				4	
660-679				0	
680-699				0	
700-719				1	
720-739				2	
n	89	133	22	76	14
Mean Length	356 mm	411 mm	127 mm	536 mm	457 mm

Table 16. Length and Weight by Sex of Four Fish Species From Lake Minchumina, August, 1974.

Species	Sex	n	Fork Length (mm) Mean	Fork Length (mm) Range	Weight in kg. Mean	Weight in kg. Range
Humpback Whitefish	M	57	426	245-486	1.2	1.3-1.9
	F	64	415	285-475	1.2	1.3-1.9
Total	M, F, Imm*	133	407	245-486	1.1	1.2-1.9
Broad Whitefish	M	33	422	310-534	1.2	0.5-2.2
	F	31	380	192-465	0.9	0.1-1.8
Total	M, F, Imm.*	89	353	185-534	0.8	0.1-2.2
Northern Pike	M	23	492	252-614	1.0	0.2-1.8
	F	49	543	362-715	1.3	0.4-2.6
Sucker		14	456	385-492	1.3	0.7-1.5

*Includes immature fish that could not be sexed.

Table 17. Growth and Age Frequency of 22 Least Cisco Captured by Graduated Mesh Gill Net in Lake Minchumina, August, 1974.

Age Class	n	Mean Fork Length (mm)	Annual Increment (mm)	Age Frequency (%)
I	1	108		4.5
			4	
II	3	112		13.7
			17	
III	11	129		50.0
			6	
IV	7	135		31.8
	Σ=22	$\bar{x}$=127	$\bar{x}$=9	

The age distribution of both humpback and broad whitefish is extremely skewed toward the older age groups. This may indicate an unexploited mature population or it may result from the younger age groups rearing somewhere other than in Lake Minchumina. This is a question that must be resolved before extensive exploitation is allowed. Length-weight curves for humpback and broad whitefish are shown in Figures 5 and 6 respectively.

Both species weigh 1 pound (.47 kg) at about 300 mm fork length and 2 pounds (.94 kg) at 400 mm fork length. From Tables 18 and 19 we see that it presently requires six years to produce a 1 pound (.47 kg) humpback or broad whitefish and eight to nine years to produce a 2 pound (.94 kg) fish.

Table 18. Growth and Age Frequency of 121 Humpback Whitefish Captured by Graduated Mesh Gill Net in Lake Minchumina, August, 1974.

Age Class	n	Mean Fork Length (mm)	Annual Increment (mm)	Age Frequency (%)
III	1	245		0.8
IV	1	248		0.8
V	8	281		6.6
			29	
VI	4	310		3.3
			35	
VII	10	345		8.3
			34	
VIII	10	379		8.3
			20	
IX	10	399		8.3
			26	
X	20	425		16.6
			24	
XI	33	449		27.3
			6	
XII	17	455		14.0
XIII	5	448		4.1
XIV	2	470		1.6
	Σ=121	$\bar{x}$=411	$\bar{x}$=25	

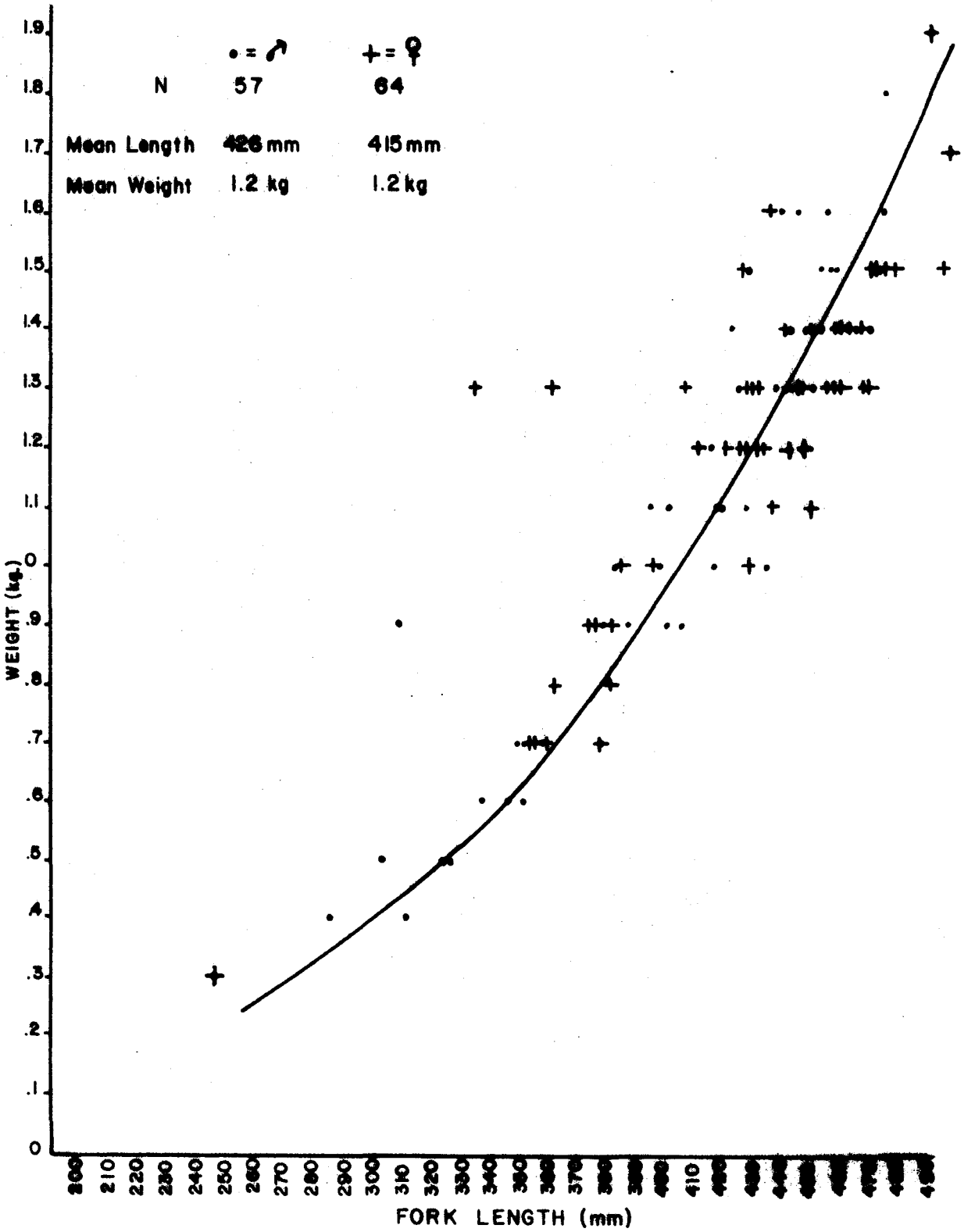

Figure 5. Length-Weight Relationship of 121 Humpback Whitefish from Lake Minchumina, August, 1974

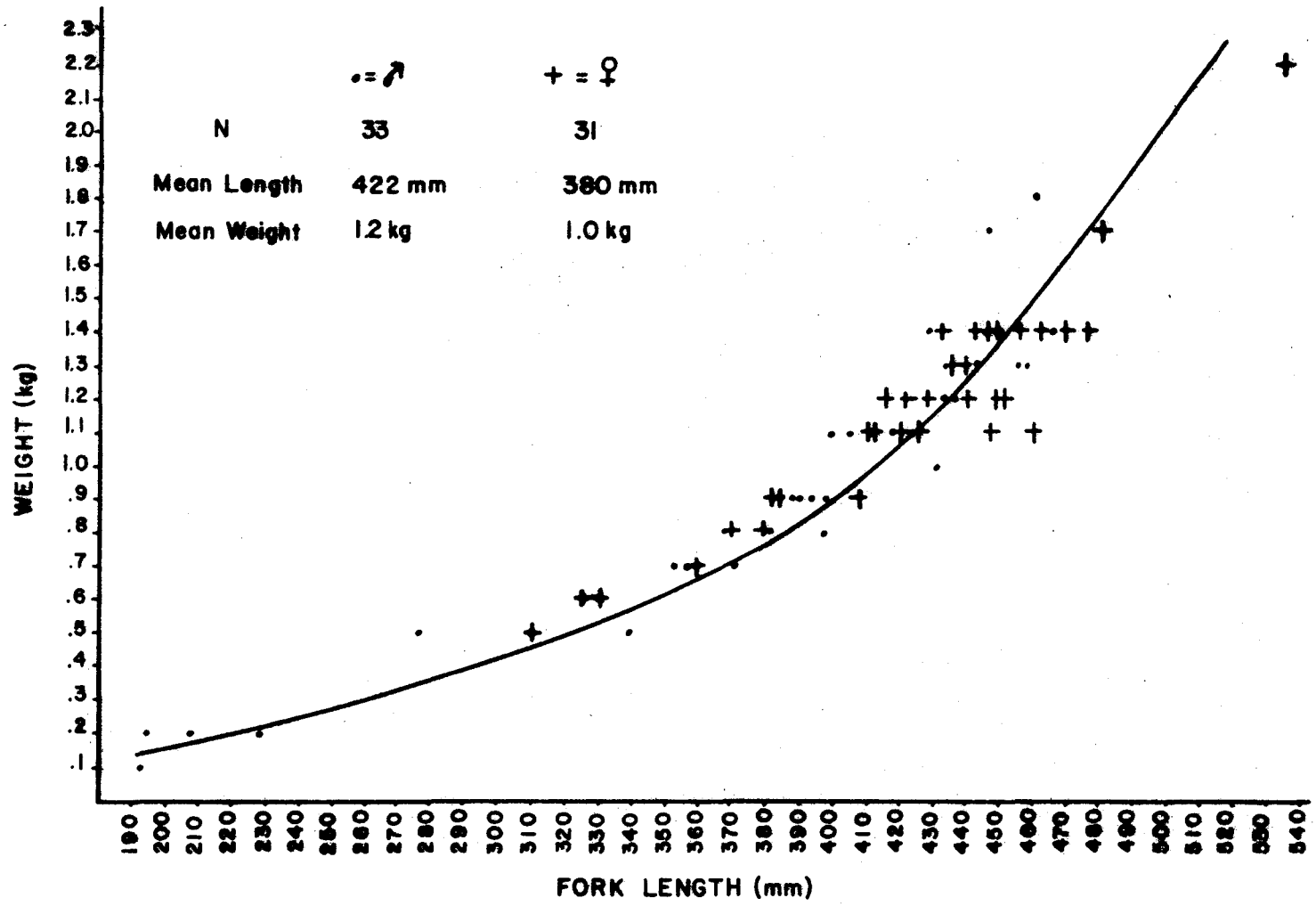

Figure 6. Length – Weight Relationship of 64 Broad Whitefish from Lake Minchumina, August, 1974

Table 19. Growth and Age Frequency of 88 Broad Whitefish Captured by Graduated Mesh Gill Net in Lake Minchumina, August, 1974.

Age Class	n	Mean Fork Length (mm)	Annual Increment (mm)	Age Frequency (%)
II	1	199		1.1
			7	
III	17	206		19.3
			12	
IV	6	218		6.8
			41	
V	2	259		2.3
			71	
VI	7	330		8.0
			63	
VII	9	393		10.2
			19	
VIII	21	412		23.9
			36	
IX	19	448		21.6
			38	
X	5	410		5.7
			23	
XI	1	433		1.1
	Σ=88	$\bar{x}$=353	$\bar{x}$=26	

Age At Maturity:

The age at which humpback and broad whitefish first mature was difficult to determine because of the presence of nonconsecutive spawners. Females of both species had two distinct egg sizes. Immature individuals of both humpback and broad whitefish occurred through age VIII. Humpback whitefish show initial maturity in females at age V and at age VII for males. Initial maturity occurred at age VI for both sexes of broad whitefish.

Least cisco were maturing at age II, and all age III and IV fish were mature. No least cisco older than age IV were found.

Northern Pike:

Northern pike is the only fish species sought by anglers at Lake Minchumina. Most of the fishing is done by people arriving in private aircraft; however, the fire fighters stationed at the Bureau of Land Management station probably account for a substantial portion of the angling pressure. During the three day period, June 22-24, 13 planes brought 40 anglers to the lake.

Eight fire fighters fished during this same period. In 37 hours of fishing these anglers caught 187 pike and kept 98 of them for a harvest rate of 2.65 pike per hour. All of the pike caught were 400-600 mm in length.

During the August sampling 76 pike were captured averaging 536 mm fork length. The ages of a sample of 73 pike were determined from scales (Table 20), and showed a fairly good growth rate for pike in Interior Alaska. The growth rate is nearly identical to that for pike in George Lake near Delta Junction (Cheney, 1972). For the first 5 years Lake Minchumina pike grow nearly as fast as Minto Flats pike but then drop behind (Cheney, 1972).

Table 20. Age and Growth of Northern Pike, by Sex, From Lake Minchumina, August, 1974.

Age	Sex	n	Fork Length (mm) Mean	Range
I	immature	3	146	133-157
II	male	2	280	252-309
	female	1	366	
III	male	0		
	female	2	402	382-423
IV	male	4	468	418-495
	female	5	436	363-489
V	male	6	498	455-588
	female	11	495	422-526
VI	male	1	432	
	female	13	583	515-630
VII	male	8	544	432-614
	female	11	577	435-647
VIII	male	1	568	
	female	4	650	545-715
IX	male	0		
	female	1	631	

Lake Stocking

Three lakes were stocked in the Fairbanks District during 1974 (Table 21). Silver salmon, O. kisutch, were stocked in Birch Lake for the first time in 1974 to provide a winter fishery and to hold down a lake chub, Couesius plumbeus, population that was apparently introduced illegally by fishermen. Nine thousand eight hundred rainbow trout were also stocked in Birch Lake. These trout are native Alaska trout from the Naknek River in southwest Alaska and are the first stage in an attempt by the State of Alaska to become self-sufficient in rainbow trout production. Koole Lake, a fly-in lake located eight miles southeast of Birch Lake, was stocked with rainbow trout for the first time after test netting determined the lake to be barren of fish.

Table 21. Lake Stocking, Fairbanks District, 1974.

Lake	Location	Date	Species*	Size	Number
Birch	Richardson Hwy	Aug 23	SS	139/lb.	35,000
		Aug 22	SS	138/lb.	20,500
		May 31-June 12	SS	49/lb.	18,600
		Oct 8	RT	103/lb.	9,800
Harding	Richardson Hwy	Aug 28	SS	120/lb.	40,570
Koole	8 mi southeast of Birch Lake	June 27	RT	1,136/lb.	217,800

*SS - Silver Salmon
RT - Rainbow trout

To determine the feasibility of rearing silver salmon to smolt size in Interior lakes and transplanting them into managed waters, two small lakes were selected and temporary weirs constructed at the outlets to capture silver salmon smolts if they exhibited smolting characteristics.

A brief description of the two lakes is as follows: Little Harding Lake, with 50 surface acres, has a maximum depth of 34 feet. Small northern pike were present in the lake at the time of initial planting.

Lost Lake has 94 surface acres with a maximum depth of 39 feet and had been chemically rehabilitated prior to stocking.

Little Harding Lake was stocked with 78,400 fingerling silver salmon averaging 243 per pound in August of 1972. These silver salmon originated from the Delta Clearwater River near Delta Junction. During May of 1973, 20,207 smolts averaging 106 mm in length and 36.3 per pound were captured in a trap located in the outlet stream and transplanted into Harding Lake (Kramer, 1974).

This exceptionally high return and very favorable growth rate (weight increase of 669%) indicated that the use of small fertile lakes may be an economical and desirable way to enhance salmon production in the Interior.

In 1973, Lost Lake was stocked with 200,820 silver salmon at 440 per pound to check production in a chemically rehabilitated lake. These silver salmon were obtained from the Green River Hatchery in the State of Washington.

During May and June of 1974, 18,600 silver salmon smolts averaging 96 mm in length and 49.3 per pound (weight increase of 892%) were captured in a trap located in the outlet stream and transplanted into Birch Lake. The growth rate of these fish was good, but the number of smolt captured was low due to insufficient flow in the outlet caused by an extremely low water table. A large number of silver salmon remain in Lost Lake and will provide a sport fishery.

Survival rate of the salmon smolts in Harding Lake has not yet been closely assessed, but silver salmon with fork lengths of 285-410 mm and weights of 509-1,075 g were captured in test nets in 1974. The age of these fish ranged from I-III. The age II fish apparently were the transplants from Little Harding Lake and the other age classes were planted as fingerlings directly into Harding Lake. Greatly accelerated growth of salmon of this size can be expected, as they are large enough to forage on the abundant least cisco in Harding Lake.

The silver salmon smolts transferred to Birch Lake in the spring of 1974 began entering the fishery in late summer, providing catches of 225-250 mm fish. At present the experimental stocking and recovery seem to indicate that rearing and recovery of silver salmon may be advantageous in Interior lakes, and a sufficient standing crop can be retained in the nursery lake to provide excellent growth and subsequently provide a desirable sport fishery.

Dissolved Oxygen Testing

Sixteen Interior waters were tested for dissolved oxygen content during the reporting period (Table 22). Olnes Pond at 11 Mile Elliott Highway and Duck Pond #1 on Ft. Wainwright were anoxic, as was a small pond approximately 63 miles from Fairbanks on the Richardson Highway.

Fish Sampling in District Waters

Fourteen lakes and pits were test netted to determine species composition and stocking success. Olnes Pit and Otto Lake were stocked with grayling in 1973 but both were barren of fish during test netting operations and apparently winterkilled due to lack of sufficient oxygen, even though Otto Lake had contained 3 ppm oxygen.

Koole Lake had sufficient oxygen but was also barren of fish (Table 23). Ages of 39 rainbow trout from Birch Lake ranged from age II to age IV. Due to a large number of lake chubs in Engineer Hill Lake, the small mesh panel in the test nets was not fished.

Table 22. District Waters Tested for Dissolved Oxygen, 1974.

Water	Date	Ice Thickness	H_2O Depth	Snow Depth	Sample Depth	D.O. ppm
23 Mi. Slough	Feb. 28	open	2"		surface	7
Koole Lake 146°35'x64°12'	March 23	42"	9'	6"	4'	9
					8'	9
Otto's Lake	March 23	48"	5'	none	4'	3
Big Lake (Rex Trail) 149°48x64°11'	March 23	42"	12'	12"	4'	11
					10'	9
Little Lake (Rex Trail) 149°48'x64°10'	March 23	42"	24'+	12"	4'	10
					10'	7
Carrol Pit	March 26	42"	24'+	12"	4'	13
					10'	13
					15'	13
Nenana Pond	March 27	36"	14'	6"	4'	5
Little Harding	March 30	36"	19'	14"	4'	8
					10'	6
Birch Lake	April 1	48"	22'	3"	5'	14
Lost Lake	April 1	48"	25'+	1"	5'	15
Engineer Hill	April 8	36"	10.5'	15"	4'	5
					6'	4
31 Mile Pit	April 8	36"	13'	15"	4'	1.2
					10'	1.2
Olnes Pond	April 9	48"	19'	4"	10'	0
Duck Pond #1 (Ft. Wainwright)	April 9	36"	17.5'	12"	4'	0
Chatanika Dredge Pond	April 9	36"	24'+	12"	4'	2
					10'	1.2
Pond 3 mi. south of Birch L. on Rich. Hwy.	April 19	36"	4'	0	4'	0

Lake Name	Date	Species*	Number Fish Netted	Range	Mean	Hours	Freq.**	% Comp.
Little Harding	Aug. 2-7	SS	1		380	148	0.006	6
		NP	16	115-555	340.3		0.11	94
Pit No. 2 (Johnson Road)	June 25	BB	2	500-625	562.5	24	0.08	33
		GR	4	330-340	336.2	24	0.17	67
Pit No. 1 (Johnson Road)	June 25	NO FISH				24		
Engineer Hill***	July 2	GR	1		325.0	52	0.02	100***
	Aug. 2	NO FISH				192		
31 Mile Pit	July 2	GR	12	176-182	179.2	20	0.60	100
Birch Lake	June 12-13	RT	17	320-465	401.8	72	0.24	100
	Oct. 1-2	RT	22	345-430	403.9	Electrofishing		
Olnes Pit	July 2	NO FISH				20		
Nenana Pond	Aug. 20	SS	10	210-230	218.8	24	0.42	100
Otto's Lake	Aug. 21	NO FISH				48		
Koole Lake 146°35'x64°12'	June 7	NO FISH				96		
Big Lake (Rex Trail) 149°48' x 64°11'	Aug. 9	NP	9	125-550	396.1	48	0.19	100

Table 23. (cont.) Fish Sampling Summaries, 1974.

Lake Name	Date	Species*	Number Fish Netted	Range	Mean	Hours	Freq.**	% Comp.
Little Lake (Rex Trail) 149°48'x64°10'	Aug. 9	NP	11	155-725	435.4	48	0.23	100
Harding Lake	Aug. 6-9	NP	45	140-635	449.9	576	0.08	51
		LT	2	570-730	650.0		0.003	2
		LCI	28	120-200	155.9		0.05	32
		BB	10	380-655	474.0		0.02	11
		SS	3	335-395	361.7		0.005	4
	Nov. 22-	NP	7	140-580	395.7	552	0.01	21
	Dec. 6	LT	2	495-680	587.5		0.004	6
		BB	17	380-670	580.9		0.03	50
		SS	8	285-410	359.4		0.01	23
Sansing Lake	Aug. 21	RT	39	140-270	226.0	24	1.6	100

*LT - Lake Trout
NP - Northern pike
BB - Burbot
GR - Arctic grayling
LCI - Least cisco
SS - Silver salmon
RT - Rainbow trout

**Frequency is the number of fish per net hour.
***Lake chubs present but not sampled.

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