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Jay S. Hammond, Governor

Annual Performance Report for

POPULATION STUDIES OF GAME FISH AND EVALUATION OF MANAGED LAKES IN THE SALCHA DISTRICT WITH EMPHASIS ON BIRCH LAKE

by

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ABSTRACT

First year findings are presented of a multi-year study to evaluate and compare newly domesticated strains of Alaskan rainbow trout, Salmo gairdneri Richardson, with long established hatchery strains for growth, survival and contribution to the creel in interior Alaska lakes.

A population estimate showed a survival to early October of 20.8 percent of the 101,314 Ennis-Alaska rainbow trout stocked in Birch Lake. Growth information is presented on these fish.

Creel census on Birch Lake indicated that fishermen spent an estimated 16,324 man hours from May 27 to September 3, to catch 4,473 rainbow trout and 138 coho salmon, Oncorhynchus kisutch (Walbaum). Catch during the period ranged from 0.28 to 0.56 fish per angler hour. Subcatchable rainbow trout planted in May contributed increasingly to the creel as the summer progressed.

A "popeye" condition appeared in the rainbow trout in early August, peaked in the third week of August, and had disappeared by late September. It was apparently related to warm water bacteria.

Life history information is presented on Birch Lake lake chubs, Couesius plumbeus (Agassiz), and on a tapeworm with which they are afflicted.

Limnological data are presented for Birch Lake.

Test netting in Harding Lake indicated low survival for stocked coho salmon.

Data are presented on the test netting and stocking of Lost and Little Harding Lakes, and the sport fishing potential of Koole Lake is discussed.

A relatively high sport take of chinook salmon, O. tshawytscha (Walbaum), on the Salcha River was documented.

A preliminary survey of "Spencer" Lake, a small lake northeast of Harding Lake was conducted and data are presented.

BACKGROUND

Birch Lake

Birch Lake is an 803 surface acre lake located 56 mi southeast of Fairbanks on the Richardson Highway. Its waters are lightly brown-stained, and its maximum depth is 49 feet.

The U.S. Air Force maintains a recreation camp on Birch Lake, which is heavily used during the summer. There is a state parking and boat launching area, and a turnoff and parking area along the highway at the south end of the lake. In addition, about half of the shoreline of the lake is private land with cabins.

The lake has four small inlets and one outlet, which has a fish and water level control structure on it.

Birch Lake was chemically rehabilitated in 1966 to remove whitefish, burbot, sculpins and stunted northern pike and was stocked with fingerling rainbow trout. Since that time, a popular summer and winter sport fishery has been maintained by stockings of rainbow trout and coho salmon fingerlings and sub-catchable rainbow trout.

Table 1 lists the common and scientific names and abbreviations of fish mentioned in this report.

Lake chubs and slimy sculpins have appeared in the lake, probably due to vandalization of the outlet structure in 1967. The chubs have attained such a high population level that they are now a problem.

With a changeover from the Ennis-Alaska strain of rainbow trout to the Swanson strain imminent in the Department's hatcheries, and the possibility of continued availability of rainbow trout for Birch Lake, it was decided to launch an evaluation of the Birch Lake rainbow trout fishery, and a comparison study of the two strains of fish as to survival, growth, and catchability.

Harding Lake

Harding Lake is a 2,470 acre lake located 45 mi southeast of Fairbanks along the Richardson Highway. The water is transparent green, and the lake has a maximum depth of 142 feet. There is no visible outlet, and there are two inlets.

The indigenous fish in the lake include northern pike, burbot, least cisco and slimy sculpins. Lake trout were introduced into the lake in 1939, 1963 and 1965 as adults and in 1967 as fingerlings. Coho salmon were stocked into the lake intermittently from 1968 until 1978, both as fingerlings and as smolts.

Table 1. Scientific and common names of fish mentioned in this report.

Common Name	Scientific Name and Author	Abbreviation
Burbot	Lota lota (Linnaeus)	BB
Coho salmon	Oncorhynchus kisutch (Walbaum)	SS
King salmon	Oncorhynchus tshawytscha (Walbaum)	KS
Lake chub	Couesius plumbeus (Agassiz)	LC
Lake trout	Salvelinus namaycush (Walbaum)	LT
Least cisco	Coregonus sardinella Valenciennes	LCI
Longnose sucker	Catostomus catostomus (Forster)	LNS
Northern pike	Esox lucius Linnaeus	NP
Rainbow trout	Salmo gairdneri Richardson	RT
Slimy Sculpin	Cottus cognatus Richardson	SSC

While stocked coho and lake trout often attain a large size, survival of coho salmon is low and lake trout failed to reproduce. Thus the contribution of stocking to a sport fishery has been negligible (Hallberg, 1979). Pike and burbot remain the basis of sport fishing in the lake.

Little Harding Lake

Little Harding Lake is a 54 surface acre lake located adjacent to Harding Lake, 45 mi down the Richardson Highway from Fairbanks. The maximum depth is 28.5 feet. The water is brown-stained, the edges of the lake are swampy, and it has a single outlet which empties into Harding Lake. There are control structures at both ends of the outlet to prevent fish movement into or out of Little Harding Lake.

Little Harding Lake was first rehabilitated in 1966 to remove stunted northern pike and then was stocked with coho salmon. Reintroduction of pike into the lake neccessitated rehabilitation again in 1976. Little Harding Lake has produced a popular winter fishery for coho salmon. In the summer of 1978, 9,500 chinook salmon smolts were stocked into the lake.

Lost Lake

Lost Lake is a 102 acre lake located 56 mi southeast of Fairbanks on the Richardson Highway. It is about 0.5 mi southwest of Birch Lake. The waters are brown-stained, and the maximum depth is 39 feet.

There is a single outlet stream and a fish control structure blocks it.

Lost Lake has been rehabilitated three times (last in 1970). Stockings with coho salmon and rainbow trout have produced an intermittently successful sport fishery, but efforts to maintain the lake as a sport fishery have been somewhat thwarted by vandalism of the weir on the outlet stream, which lets out the desirable species and in the undesirable species. In the spring of 1979, the lake was inhabited by lake chubs and longnose suckers.

Koole Lake

Koole Lake is a 320 surface acre, 22 foot deep lake lying in the Tanana flats 8 miles southeast across the Tanana River from Birch Lake. It has a large shoal area, and a maximum depth of 22 feet. The water is transparent brown and much of the shoal area supports lily pads and emergent aquatic vegetation.

Access to the lake is by snowmachine or light aircraft. There is one intermittent outlet, blocked by an old beaver dam. The land surrounding the lake is primarily military land and there are no roads or cabins in the area.

Koole Lake contained no native fish species. It was stocked with rainbow trout in 1974 and has provided a popular fly-in fishery.

RECOMMENDATIONS

Management

1. Birch Lake should be maintained as a sport fishery for rainbow trout.

2. Lost and Little Harding Lakes should be maintained as coho salmon fisheries.

3. Improvements should be made to the parking area of Little Harding Lake to improve public access and to the outlet structure to prevent fish movement into and out of the lake.

Research

1. The survival and catchability of the Swanson River rainbow trout should be compared with the Ennis strain in Birch Lake.

2. Stocking practices and coho salmon growth and survival in Lost Lake and Little Harding Lake should continue to be evaluated.

3. Methods of improving sport fishing in Harding Lake by habitat improvement or improved stocking practices should be investigated and implemented if and when feasible.

4. Efforts to develop control measures for the lake chub infestation in Birch Lake should be continued.

OBJECTIVES

1. To determine limnological conditions that affect survival and growth of stocked game fish in lakes of the district, with emphasis on Birch Lake.

2. To evaluate survival, growth, and contribution to the creel (both winter and summer) of two strains of rainbow trout in Birch Lake and to determine optimum stocking parameters.

3. To evaulate stocks of silver salmon in Birch, Harding, Little Harding and Lost Lakes to determine their population status, growth and interaction with other fish species present in these lakes.

4. To determine the feasibility of controlling an infestation of lake chubs in Birch Lake.

5. To provide recommendations for management of stocked lakes in the Interior and to direct the course of future studies.

TECHNIQUES USED

A boat-mounted electrofishing unit as described by Van Hulle (1968) and Roguski and Winslow (1969) was used for obtaining part of the rainbow trout population estimate in Birch Lake.

Multifilament and monofilament sinking or floating gill nets measuring 125 x 6 ft and consisting of five 25-ft panels of 0.5-2.5 in bar mesh were used to capture fish.

Gill nets were set in Harding, Little Harding and Lost Lakes to monitor fish populations. Gill nets were set at varying depths and habitats on the bottom and surface. In addition midwater sets were made in Harding Lake. As many as three 125 ft gill nets were tied together end to end to make one set.

A 270 ft bag seine composed of several 30 to 100 ft x 6 ft seines and one 50 x 8 ft bag seine tied end to end was used to seine rainbow trout in Birch Lake. The seine was pulled out from shore in a circle and back to shore by boat, then pulled in by hand.

Fyke nets measuring 20 ft in length by 4 ft diameter with 3/8 in knotless nylon webbing and 50 to 100 ft x 4 ft center leads were set along the shoreline of Birch Lake to capture fish for population estimates and other studies.

Water depths were determined and fish were located in Harding Lake using a Lowrance model LRG-610A recording fathometer.

An indicator of biological productivity, the morphoedaphic index (MEI), was calculated for Birch Lake from the formula MEI=T/D where T= total dissolved solids and D= mean depth in feet (Ryder et al. 1974).

Conductivity was measured with a Hach MDL 2510 conductivity meter.

Water chemistry data were collected using a Hach AL-36B field test kit.

Dissolved oxygen and temperature profiles were collected using a YSI MDL. 54 APB dissolved oxygen and temperature meter.

For growth studies, fish were collected monthly, measured to the nearest millimeter of fork length and weighed to the nearest gram on a triple beam balance or Chatillon IN-2 spring scale. Larger fish were weighed on a Chatillon IN-25 spring scale.

For the Birch Lake rainbow trout population estimate, fish were captured using seines, fyke nets and the electrofishing boat. Captured fish were marked by fin clips and released. Different fin clips were used in different areas of the lake to determine the degree of mixing, and different clips were used at different times of the summer to separate fish temporally.

Population estimates and confidence limits were determined using Schnabel multiple mark and recapture estimates.

A creel census program was set up at Birch Lake. Weeks were stratified according to predicted intensive use periods on Fridays, Saturdays, Sundays and holidays, and predicted light use periods on weekdays. Fisherman counts were taken five random times during weekend intensive use periods and at least once a week at random during light use periods.

Random fisherman counts were taken twice during holiday intensive use periods. During or immediately after most fisherman counts, fisherman on the lake were interviewed to determine the number, species and size composition of their catch and the length of time they had been fishing. Notes were also taken on whether they were fishing from the shore or from a boat, whether they were military or civilian, and on weather conditions.

A brief creel census was conducted on the Salcha River during the chinook salmon run. A riverboat was used for transportation and fisherman counts, and interviews were conducted while walking the bank.

Scales used for age determination were individually cleaned and mounted between glass slides or were mounted on 20 mil acetate using a Carver press at 20,000 psi, heated to 200°F for 30 seconds. The scales were read on a Bruning 200 microfiche reader.

FINDINGS

Birch Lake

Creel Census:

Creel census was conducted from May 27 to September 3. After September 3, angler pressure on Birch Lake dropped to low levels until after freeze-up.

In the data analysis, catch per unit effort (CPUE) was used to describe fish caught and kept only. In the course of the summer 664 parties of fishermen (1,435 anglers) were interviewed. Expanded man hours, CPUE, and numbers and percentages of large (Age II or older) and yearling rainbow trout and coho salmon that entered the creel are shown in Table 2.

Of the fishermen interviewed, 1,075 (76%) were fishing from boats and 331 (24%) were fishing from the bank. These 1,406 fishermen had 896 fish at the time they were interviewed. Of the 896 fish, the boat fishermen had 708 fish, or 79% of the catch. Bank fishermen had 188 fish, or 21% of the catch. For bank fishermen, the CPUE was 0.26 fish per hour, and for boat fishermen was 0.30 fish per hour.

Military fishermen (as indicated primarily by recreation camp boats or other military equipment) made up a minimum of 34% of the anglers on the lake. They caught only 24% of the fish, and their success rate was 0.26 fish per hour, as opposed to 0.31 fish per hour for civilians.

Table 2. Birch Lake summer creel census, 1979.

Period	Man Hours	Fish/ Hour	Rainbow Trout				Coho Salmon		Total Fish Caught & Kept
			Age II & Older Percent	Age II Number	Age I Percent	Age I Number	Age III Percent	Age III Number	
May 27 thru July 1	7,394	0.28	88	1,822	6.95	144	5.05	105	2,071
July 2 thru July 31	4,359	0.25	61.74	673	35.57	388	2.68	29	1,090
Aug 1 thru Aug 30	4,112	0.29	40.11	478	59.89	714	0	0	1,192
Aug 31 thru Sept 3	459	0.56	31.17	80	68.83	174	1.49	4	258
Totals	16,324		66.21	3,053	30.80	1,420	2.99	138	4,611

After late August fishing success increased greatly, especially after freeze-up, and limited December census data indicate a CPUE ranging from 0.91 fish per hour to 2.59 fish per hour. Effort was relatively low.

The total number of fish entering the creel per angler hour remained fairly consistent through the summer (Table 3) showing a slight decline in July. However, further analysis and field observations revealed some trends.

The catch per angler hour of larger (Age II or older) rainbow trout declined from 0.25 fish per hour in the June period to 0.12 fish per hour in August. Total CPUE held up, however, due to the increasing catch per hour of the smaller (Age I) fish and to the increasing percentage of those Age I fish which were retained by anglers. The number of Age I fish retained was probably influenced by:

a. The apparent decrease in availablity of larger fish to anglers.

b. The increase from month to month in the total number of Age I fish captured.

c. The growth of the Age I fish to a size more acceptable to anglers.

The apparent decrease in availability of larger fish to anglers may have been more a result of the distribution and feeding habits of the fish than a significant reduction in their population through the summer, since our capture results with nets did not indicate a drop in the relative abundance of these larger fish.

In June, the yearling rainbow trout ranged in fork length from 115 to 195 mm (4.75 to 8.25 in. total length) with a mean fork length of 164 mm (6.75 in. total length). In that period, 22% of the yearlings landed were retained. By the end of August, almost all of the yearlings caught were being kept. Their fork length range at that time was 152 to 242 mm (6.5 to 10 in. total length) and the mean fork length was 215 mm (9 in. total length) (Table 3).

Population Estimate:

A total of 101,214 yearling Ennis-Alaska strain rainbow trout at 18 per pound was stocked into Birch Lake in late May. In order to evaluate stocking survival, attempts to obtain a population estimate were begun on June 12, and continued throughout the summer. From June 12 to 15, up to five fyke nets were set in different areas of the lake. Nets which produced no fish were moved, and different center lead lengths and positionings were tried. In 12 net nights of effort, only 35 of the target yearling rainbows were captured. Large numbers were seen surface feeding, however.

From June 19 to 26, seining was tried with better results. Thirty hauls with a 270 ft bag seine produced a total of 1,653 yearling rainbow trout (recaptures added into total). The recapture rate rose steadily, however; on June 26, after 1,044 marked yearling rainbows had had 4 days to mix,

Table 3. Ratio of Age I Birch Lake rainbow trout kept and released by anglers through the summer of 1979, and length data.

Month	Ratio Kept/Released	% Kept	Fork Length mm (TL in) Mean	Fork Length mm (TL in) Range	Sample Size
June	1:3.5	22	164 (6 3/4)	115-195 (4 3/4-8 1/4)	19
July	1.08:1	52	186 (7 3/4)	145-220 (6 1/4-9 1/4)	46
August	2.20:1	68	215 (9)	152-242 (6 1/2-10)	28
September	1:0	100	215 (9)	152-242 (6 1/2-10)	28

initial hauls in two areas which had not been previously seined produced no recaptures out of catches of 73 and 54 yearling rainbows. Subsequent hauls at these areas produced recaptures, but only of fish which had just been marked and released.

On the same day, two hauls at a place that had had fish marked and released regularly from June 19 to 22 produced 94 yearlings, of which 32 (34%) were recaptures. Thus it became apparent that the fish were not mixing throughout the lake, and one of the prerequisites for a valid population estimate was not being met.

Extensive efforts continuing throughout the summer to obtain a population estimate by seining, electrofishing, and fyke-netting were thwarted by the failure of the marked fish to mix with the unmarked population.

From mid-September to early October a combination of electrofishing and fyke netting produced a population estimate for the yearling rainbow trout in Birch Lake.

From September 13 to October 4, three fyke nets were run in the lake, and on September 25, 26, and 27, night shocking was conducted. Fin clip patterns were changed to separate the fish marked in September from those in August.

From September 13 to 21, fyke nets yielded 376 yearlings for marking, and only one of these was recaptured. The low recapture rate was judged to be a more accurate representation of what was happening in the lake, and an indication that the fish were finally mixing.

During the last week of September fyke netting success increased greatly, and 496 yearlings were taken in four net nights. Night shocking was increasingly successful, and during 3 nights 768 yearlings were added to the catch. The total catch for the week was 1,264 yearling rainbow trout.

The fish were allowed to mix for 4 days, and then 2 more days of fyke netting were conducted to monitor the recapture rate. Five hundred sixty-six fish were caught and released without marking in those 2 days; the recapture rates were 4.73% and 7.35% respectively.

The Schnabel estimate showed a population of 21,113 yearling rainbows with a 95% confidence interval of 17,791 to 26,631. This represented a survival to October of 20.80% of the 101,314 rainbow trout stocked in late May.

Twelve percent of the fyke net recaptures of yearlings marked in September had crossed the lake, indicating substantial mixing. Other indicators of population mixing were the movement across the lake by late September of seven yearling fish that had been marked in August, and this same movement noted for a few (7.5%) of the larger fish that had been marked during August and September.

The successful shocking in September was probably influenced by darkness and seasonal water conditions. The water temperature on September 19 was 52°F and a temperature and dissolved oxygen profile indicated that the lake had not yet turned over.

During the shocking on September 25, 26, and 27, however, the shallows of the lake became increasingly turbid, which may have indicated that the lake was turning over. There were no windstorms during that time period of sufficient intensity to muddy the water. The turbidity may have affected the fishes' ability to see the fyke nets, and thus improved netting success. By October 3, a dissolved oxygen and temperature profile indicated that the lake had turned over.

Rainbow Trout Growth:

Fish from the 1979 stocking were sampled for length and weight five times from May 21 to November 29. Means and ranges of the lengths and weights are shown in Table 4. The data show that the fish grew steadily in length until September and then leveled off. Examination of length-weight relationships and condition factors (K=W'FL3 x 105) show that the weight at a given length increased from late May to late July, decreased slightly in August, increased in September, and had decreased dramatically by late November (Table 4).

Popeye Disease:

On August 1, an abnormal condition was noted in a rainbow trout that had been captured in a fyke net. The fish's body was swollen, the scales were raised, giving the skin a sandpapery texture, and the eyes protruded from the head. On August 9, several fish in this condition were noted and on August 14, 11.5% of a catch of 125 rainbows showed symptoms.

The symptoms ranged from a slightly popeyed appearance and small areas of raised scales to an extreme popeyed appearance and extremely turgid, swollen body with large areas of raised scales. There was some hemorrhaging in the skin of extreme cases, and the sick fish were so listless that they could be easily picked out of a group of healthy fish in the holding pen.

Two of the sick fish were autopsied, and the body cavity was full of a thin, reddish fluid. After the sick fish had been dead for an hour or two, some of the obvious symptoms disappeared, the swelling decreased, and the scales did not stand out as much.

We also noticed that when we handled some of the live fish with extremely turgid bodies, some of the reddish fluid squirted from the anal vent.

From August 21 to 24, the incidence of fish showing discernible external symptoms ranged from 16% to 27% in samples ranging from 45 to 190 fish. The most reliable estimate of the percentage of the population that showed visible symptoms that week was 21%, which occurred in the two largest samples (117 and 190 fish).

The percentage of yearling rainbow trout that showed visible symptoms was consistently higher (range 20 to 34%) during the week of August 21, than the percentage of larger, older fish so afflicted (5 to 14%).

Table 4. Rainbow trout lengths, weights, and condition (K) factors, Birch Lake 1979 stocking.

Date	No. In Sample	Length (mm)		Weight (g)		Condition (K) Factor
		Mean	Range	Mean	Range	
5/21	6	127	80-160	27.8	7.5-47.5	1.2294
6/20	19	164	115-195			
7/23	46	186	145-220	83	40-150	1.2518
8/22	28	215	152-242	126	40-155	1.2485
10/3	33	206	181-242	121	76-212	1.3689
11/29	33	225	190-250	128	109-169	1.1170

By the end of August, the disease was tapering off, and some fish were noted that appeared to be recovering. Two samples of 84 and 113 fish showed 10% and 14% sick respectively. On September 14, 6% of a sample of 80 fish had the symptoms and many fish were seen that appeared to have recovered. By the end of September, the disease had all but disappeared.

The obvious question is whether the disease disappeared because the fish recovered from it, or because most of the fish that had it died. As noted above, some of the fish captured late in the season appeared to have recovered. This is a subjective judgement, based on external appearance. Four sick yearlings, one sick Age II fish, and four healthy yearlings were held in a holding pen in warm water near a beach for 5 days. One sick yearling died. None of the apparently healthy fish showed any symptoms.

During the high point of the disease, several sick fish were released which appeared to be in such a poor condition that it was judged they would die. However, in the course of the work on the lake which required extensive boat travel, almost no dead or dying fish were seen.

Analysis of a sample of 60 fish sent to the Department's fish disease laboratory in Anchorage indicated that high water temperatures (up to 70°F) may have allowed high temperature related bacteria to invade the fish. This theory is reinforced by the catch from two gill nets on August 22. Of 35 rainbows caught in a net set in shallow, warmer water, twelve (34%) showed visible symptoms. Of 37 rainbows caught in a net set in deeper (8 ft) cooler (64°F) water, none showed external symptoms. The F.R.E.D. Division Pathology Section indicated that the sick fish would probably recover as the water cooled.

Coho Salmon:

The coho salmon population in Birch Lake was in its terminal year and contributed very little to the sport catch (2.99% of all fish caught and kept). A sample of 29 fish measured on June 14 had a mean fork length of 290 mm (range 245-370 mm). Twelve of these fish were weighed, and the mean weight was 232 g (1/2 lb). Most of the coho salmon were taken by sport fishermen in June. They virtually disappeared in July, and a very few were taken in August and September.

Fyke netting produced results similar to angler catches.

Lake Chubs:

Large numbers of lake chubs were occasionally taken in fyke nets set in zones of nearshore aquatic vegetation. The largest catches were made in June and from late August to mid-September. Chubs were observed spawning in late June. Some life history observations were made from a sample of 64 chubs taken in mid-June.

The fork length range of the entire sample was 40 to 139 mm (mean length 80 mm).

The weight range of the entire sample was 1.0 to 31 g with a mean weight of 8.0 g. The length range of the males (n=30) was 49 to 95 mm, (mean length 73 mm), weight range of the males (n=28) was 1.5 to 10 g (mean weight 5.6 g). The length range of the females (n=33) was 40 to 139 mm (mean length 86 mm), weight range of the females (n=33) was 1 to 31 g (mean weight 10 g). The male to female ratio was 1:1.1 (48% male and 52% female).

Maturity began at Age II, and in the sample both sexes were 100 % mature by Age IV. The age range of males was 1-3 years, and of females, 1-5 years. Females grew faster and lived longer than males.

Eight percent of the mid-June sample of chubs had plerocercoid larvae of the tapeworm Ligula intestinalis in their abdominal cavity. This percentage may be low, as large numbers of infected chubs were seen later in the summer.

Dr. R. L. Zarnke, Game Division, Fairbanks assisted in the identification of the parasite and in obtaining the following information:

Ligula intestinalis has as its definitive host fish-eating birds, and a copeopod is the intermediate host for the egg and procercoid. The chub is infected by ingesting the copeopod. The infestation in the chub is always fatal. If the chub is not eaten by a bird, it dies approximately 1 1/2 years after infection. The parasite occupies a large part of the abdominal cavity, and causes reproductive disfunction, as well as other difficulties for the chub. A typical example of the size of a full sized plerocercoid was a 96 mm, 1.5 g specimen removed from an 87 mm, 9.5 g chub. The sex of this chub was impossible to determine, as the reproductive tract had atrophied and virtually disappeared.

No Ligula intestinalis were seen in rainbow trout or coho salmon in Birch Lake.

Limnological Survey:

The following limnological data are presented for future comparison and to delineate some environmental conditions in Birch Lake (Table 5).

There are several major habitat zones in Birch Lake. Most of the lake bottom is overlain by decaying organic matter. Most of the lake is deep water without aquatic vegetation. In some areas, the unvegetated zone extends almost to shore, where there may be some reeds and emergent grasses. There are, however, dense zones of aquatic vegetation along most of the shoreline out to a depth of about 15 feet, covering about 30% of the surface area of the lake.

These vegetated areas consist predominately of a zone of lily pads which inhabit depths from 2 ft out to 10-12 ft, and a relatively narrow band of deep weedbeds along the outer edge of the lily pads, from about 10 ft out to a depth of 15 ft. The lily pads start coming up shortly after the lake becomes ice-free, reach their peak of density in late July and early August, and start dying and thinning out in late August.

Table 5. Limnological data - Birch Lake, summer 1979.

Date	Habitat	Depth (ft)	Temperature (°F)	D.O. (ppm)	Remarks
5/21	Nearshore	Surface	49		Conductivity at outlet 97 µmhos.
5/23	Nearshore	Surface	52		
5/31	Nearshore	Surface	63		
6/6	Nearshore	Surface	63		
6/21	Nearshore	Surface	57		Had been cool and rainy.
7/26	Deep water in center of lake	Surface	65		
		5	65		
		10	65		
		15	65		
		20	65		
		25	50		
		30	46		
		35	44		
		40	42		
		45	41		
7/31	Deep water unvegetated	Surface	68	8.8	
		5	67	8.5	
		10	65	8.2	
		15	64	7.6	
		20	56	4.5	
		25	50	3.0	
		27 (bottom)	48	0.9	

Table 5. (Cont.) Limnological data - Birch Lake, summer 1979.

Date	Habitat	Depth (ft)	Temperature (°F)	D.O. (ppm)	Remarks
	10 ft from shore, inner margin of lily pads	Surface	70	9.7	
		1.5	68	10.0	
8/30	Nearshore	Surface	57		
9/13	Nearshore	Surface	53		
9/17	Nearshore	Surface	50		
9/19	Edge of lily pads (outer)	Surface	52	8.8	
		5	52	8.5	
		10	51	8.6	
		(bottom)			
10/3	Outer edge of lily pads	Surface	46	9.8	Violent wind just previously.
		5	46	9.6	
		10	45	9.9	
		(bottom)			

Table 5. (Cont.) Limnological data - Birch Lake, summer 1979.

Date	Habitat	Depth (ft)	Temperature (°F)	D.O. (ppm)	Remarks
7/31	Outer edge of lily zone, over deep weed beds	Surface	68	8.6	
		5	66	8.1	
		10	65	7.5	
		10-12 (bottom)	65	2.0	
7/31	Middle of lily pad zone	Surface	70	8.5	
		2.5	68	8.6	
		4-5 (Just off bottom)	68	9.5	
7/31	Inside margin of lily pads 25 ft from shore	Surface	71	9	
		1.5	71	9.8	
		2.5 (bottom)	71	10.3	
8/21	Nearshore	Surface	63		
8/24	Outer edge of lily pad zone over deep weedbeds	Surface	68	8.0	Bringing probe up 4 in from bottom, muck raised D.O.
		5	64	8.5	
		10	64	7.9	
		11 (bottom in muck)	63	1.2	
	Middle of lily pad zone	Surface	70	7.2	
		2	66	7.4	
		5	64	8.9	
		6 (Bottom)	64	9.4	

Field observations and catch results indicate that while rainbow trout are dispersed throughout the lake, the zones of aquatic vegetation contained the greatest concentrations of fish through the summer. Dissolved oxygen and temperature profiles, then, were usually taken to sample and compare portions of vegetated areas.

The highest dissolved oxygen readings were found near the lake bottom, in the warm, shallow, nearshore areas of the weedbeds.

A water chemistry profile was run in a nearshore area on August 27, and the following results were obtained:

Free acidity: 0
Total acidity: 5.6-11.2 ppm
Phenolpthalein alkalinity: 0
Total alkalinity: 68.4 - 85.5 ppm
CO^2: 5-10 ppm
Total Hardness: 68.4 ppm
pH: 8

A conductivity of 97 µMhos at the outlet on May 21 yielded a morphoedaphic index (MEI) of 6.6. This compares with a conductivity of 110 µMhos and a MEI of 7.5 determined from data obtained by U.S.G.S. on May 27, 1975.

Harding Lake

From mid-July to mid-August, 24 net-nights of effort in mid-water and deep water habitats produced small numbers of pike, burbot, lake trout and least cisco.

In an effort to capture coho salmon, nets were suspended in mid-water areas after fathometer runs with a recording fathometer indicated fish at those depths. No coho salmon were captured. An attempt was made to avoid northern pike summer habitats.

In October netting, 18 net-nights of effort produced results similar to the mid-summer efforts but eight coho salmon were captured. Seven of the fish were Age II, ranging in length from 341 to 372 mm ($\bar{x}$=362 mm) with a weight range from 520 to 640 g ($\bar{x}$=606 g). Four of them had least cisco remains in their guts.

One coho salmon was an Age III, terminal year fish. Fork length was 500 mm, weight 1,750 g, and the fish was a female prespawner.

The length range of 13 burbot captured between July 18 and October 19 was 505 to 766 mm ($\bar{x}$=517 mm) and the weight range was from 910 to 2,700 g ($\bar{x}$=1,390 g).

The 42 net nights of effort produced a total of 41 least cisco. They were captured at depths of 25 to 40 ft in mid-summer and in 4 to 40 ft of water in October. This represents an increase over the catch per net night reported by Hallberg in 1979. However, different habitats were sampled, thus the results may not be comparable. In addition, large schools of least cisco fry were seen swimming at the surface of the lake in August.

Little Harding Lake

Little Harding Lake was netted three times during the summer and fall to determine the status of the coho and chinook salmon in the lake. Eight net nights of effort produced 20 mature coho salmon with mean fork lengths ranging from 211 mm in May to 240 mm in August. Three chinook salmon approximately 130 mm in fork length were captured in May. None were captured during subsequent netting efforts. On July 19, 15,000 coho fingerlings were planted. By October, the mean fork length of seven of these fish was 108 mm, with a range of 100 to 115 mm.

Lost Lake

In early June nets were set in Lost Lake to assess the status of the 60,000 coho salmon that had been planted in June of 1977. Six net nights in various habitats produced only suckers and chubs. It is probable that the coho salmon out-migrated through the vandalized weir during spring breakup. The weir was subsequently repaired, and 30,000 fingerling coho salmon were stocked on July 19.

Koole Lake

Koole Lake was sampled briefly on June 7 to assess the status of the rainbow trout population. Two 125 ft experimental gill nets set for 3 hours each yielded four rainbow trout averaging 390 mm in fork length (16 in. total length) with a mean weight of 700 g (1 1/2 lb). Two sport fishermen trolling in a small boat had caught one rainbow trout weighing approximately 3 lbs in 4 hours of fishing. A military helicopter dropped off seven military personnel, who fished for about 2 hours and caught one trout before being picked up and leaving. Many fish were seen surface feeding throughout the lake. Netting, angling, and observation indicates that the trout from the 1974 stocking are providing a population of good sized fish for anglers.

Salcha River

A limited creel census was conducted during the Salcha River chinook salmon run to assess the sport fishery.

During 17 creel census periods from July 4 to July 24, 689 fishermen were interviewed. They had spent 2,197 hours fishing (3.19 hour per fisherman), and had taken 96 chinook salmon for an average of 0.04 fish per hour. An additional total of 136 chinook salmon previously caught was documented during the course of the interviews, bringing the known chinook salmon catch to 232 fish. It is probable that at least another 100 chinook salmon were taken that were not documented by the creel census crew.

Good weather, good water conditions, and a good run (4,789 escapment to upriver spawning beds, pers. comm., Fred Anderson, Commercial Fish Division), resulted in the high catch. Angler pressure was extremely localized, as only the lower 1 1/2 miles of river is accessible by road,

and the success was best just upstream from the confluence of the Tanana and Salcha rivers. Private property along this section of river limits access to three sections of bank totaling approximately 1 mile in length. During one census period, at 2 a.m. on July 14, 135 fishermen were counted in these three areas. At 9 p.m. the same day, 132 fishermen were counted.

"Spencer" Lake

"Spencer" Lake is a small lake lying 3/8 mi east of Harding Lake. A preliminary survey was conducted on August 7, 1979. The lake is approximately 1/4 mi long and 1/8 mi wide. Access is on foot through the woods or by snowmobile. Most of the shoreline is slightly higher than the lake, and walking around the lake is fairly easy. A small, swampy outlet drains away into marshy ground along the eastern shore of Harding Lake, and ultimately into Harding Lake itself. There were no apparent inlets. There is a narrow band of lily pads along approximately half of the shoreline, with a larger area of lily pads along the western end of the lake. About 1/4 of the surface area of the lake is covered by the lily pads. The water was stained a dark brown.

On the day of the survey, the following limnological data were obtained:

Surface temperature: 70°F.
CO^2: 15 mg/1
Hardness: 85.5 mg/1
ph: 6
Total alkalinity: 103 mg/1
Dissolved oxygen at surface: 7 ppm.

Angling produced several strikes and two small northern pike (300-400 mm).

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