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(BIOLOGICAL)

No. 721

TITLE

A Report on Tathlina and Kakisa Lakes - 1946

AUTHORSHIP

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Establishment

Biological Station, London, Ontario

Dated June, 1962.

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INTRODUCTION

Tathlina and Kakisa lakes are located in the Northwest Territories near the northern boundary of Alberta. Tathlina Lake drains into Kakisa Lake which in turn drains into the Mackenzie River. Lady Evelyn Falls, which is 48 feet high, probably prevents any movement of fish from the Mackenzie River to Kakisa Lake.

Until recently the lakes were too remote from the markets for successful exploitation, and prior to the present investigation their fish producing potentialities were unknown. However, with an all-weather road to Hay River under construction, it may become feasible to fish them. The lakes were investigated during the period July 26 to August 9, 1946.

The investigation was undertaken jointly by the Fisheries Research Board of Canada and by the Department of Fisheries. The Fisheries Research Board supplied all scientific equipment including nets, part of the transportation, and the services of the author. The Department of Fisheries supplied food, camping equipment, part of the transportation, the services of two experienced fishermen, and for part of the survey, the services of H. V. Dempsey.

The Department of Lands and Mines in Alberta loaned us a two-way portable radio which was quite useful.

The purpose of the investigation was to determine the advisability of opening the lakes to commercial fishing. If, as the chief, Phillip Simba, claimed, the lakes barely supply enough fish for the Indians who go there,

they would suffer if the lakes were exploited. The fullest possible enquiry was therefore made into the probable fish requirements of these Indians.

INDIAN FISH REQUIREMENTS

There were three Indian families living on Kakisa Lake at the time of the investigation. They expected three more families in for the winter of 1946-47, of which one would be at Tathlina Lake. A family which was on Tathlina Lake at the time of the investigation visit it only rarely, and do not depend on it for any fish. All our enquiries indicate that six families are probably the maximum that winter on the two lakes, and that there are generally less; for instance, in the winter of 1945-46 there were only three. There are fewer families on the lakes in summer than in winter.

Using Dr. Rawson's indices of fish consumption by Indians and dogs, the maximum annual fish requirements of the Indians on these lakes are calculated as less than 20,000 pounds. Most of these fish are taken from Kakisa Lake. Dore and common suckers are the species generally taken.

Contrary to the statements of Chief Phillip Simba, we observed that the three families on Kakisa Lake were filling current requirements, and keeping several drying racks full of fish from less than a total of 100 yards of gill net. They themselves said that they were catching all the fish they could use.

MATERIALS AND METHODS

Since all equipment was moved to and from the lakes by air, the weight had to be kept to a minimum. The investigation was hampered because the boat used was an 18-foot motor canoe -- the largest boat that could be taken

in by air. Both lakes are large, and in moderate winds -- such as prevailed throughout most of the investigation -- the motor canoe was not safe. Nets could only be set near the base camps, sometimes fish had to be discarded to avoid swamping, and only two men could go in the canoe at one time, all because of the limitations of this boat.

The following gill nets were used: three nets treated with copper oleate of 5½-inch mesh, each 100 yards long and 30 meshes deep; two white nets of 4 3/4-inch mesh, each 100 yards long and 30 meshes deep; one white net of 2½-inch mesh, 50 yards long and 30 meshes deep; one white net of 1½-inch mesh, 50 yards long and 40 meshes deep.

Whenever possible, the catches from individual nets were kept separate from one another, although this was not always possible because of the restrictions imposed by the size of the canoe. When fish had to be discarded to lighten the canoe, they were counted. Each fish brought ashore was weighed on a spring balance to the nearest tenth of a pound, the length from the tip of the snout to the fork of the tail was measured to the nearest millimeter, and a few scales were saved for age determination. In some cases stomach contents were noted. A representative sample of whitefish from each lake was examined for cysts of the tapeworm, Triaenophorus crassus. A few dore from Kakisa Lake were similarly examined for Diphyllobothrium latum.

Bottom fauna were collected with an Ekman dredge and plankton was collected by means of a plankton tow net. Water temperatures in degrees Fahrenheit were taken by means of a maximum-minimum thermometer. The indicators were set, the thermometer was lowered to the required depth, left for a minute and then pulled up. The minimum temperature as indicated was taken to be the required water temperature.

TATHLINA LAKE

Tathlina Lake is roughly kite shaped, of which the greatest dimensions are about 30 and 15 miles respectively. It is about 220 square miles in area and drains approximately 4,000 square miles. The shore line is regular, and most of the lake is bordered by muskeg whose water is in communication with the lake, although there is higher ground along the northwest and northeast shores. Figure 1 is a map of the lake on which depths are shown in feet. Most of the lake is a few inches over 5 feet deep. Depths of 12 feet were found in the Kakisa River just west of the lake.

Most of the lake was quite muddy so that a secchi disk disappeared at 4 inches below the surface. However, in the extreme west end of the lake the water, although brown, was clear enough that objects could be seen on the bottom at 6 feet. The transition from muddy to clear water was gradual and occurred over approximately one mile. The approximate place where the transition took place is indicated by a dotted line in Figure 1. A rough calculation indicates that enough water was entering the region west of the dotted line to fill it in approximately ten days. This probably explains why the west end was clear while the remainder -- as the result of windy weather -- was so muddy.

In the main body of the lake the bottom is a firm sandy mud, except near the outlet where it is rocky. In the west end the bottom is a soft black muck.

One of the members of the party aptly described Tathlina Lake as "a stretch of muskeg with the top blown off". There was considerable evidence near the base camp that the muskeg is being eroded relatively quickly. Probably much of the south and east shoreline is being similarly eroded so that

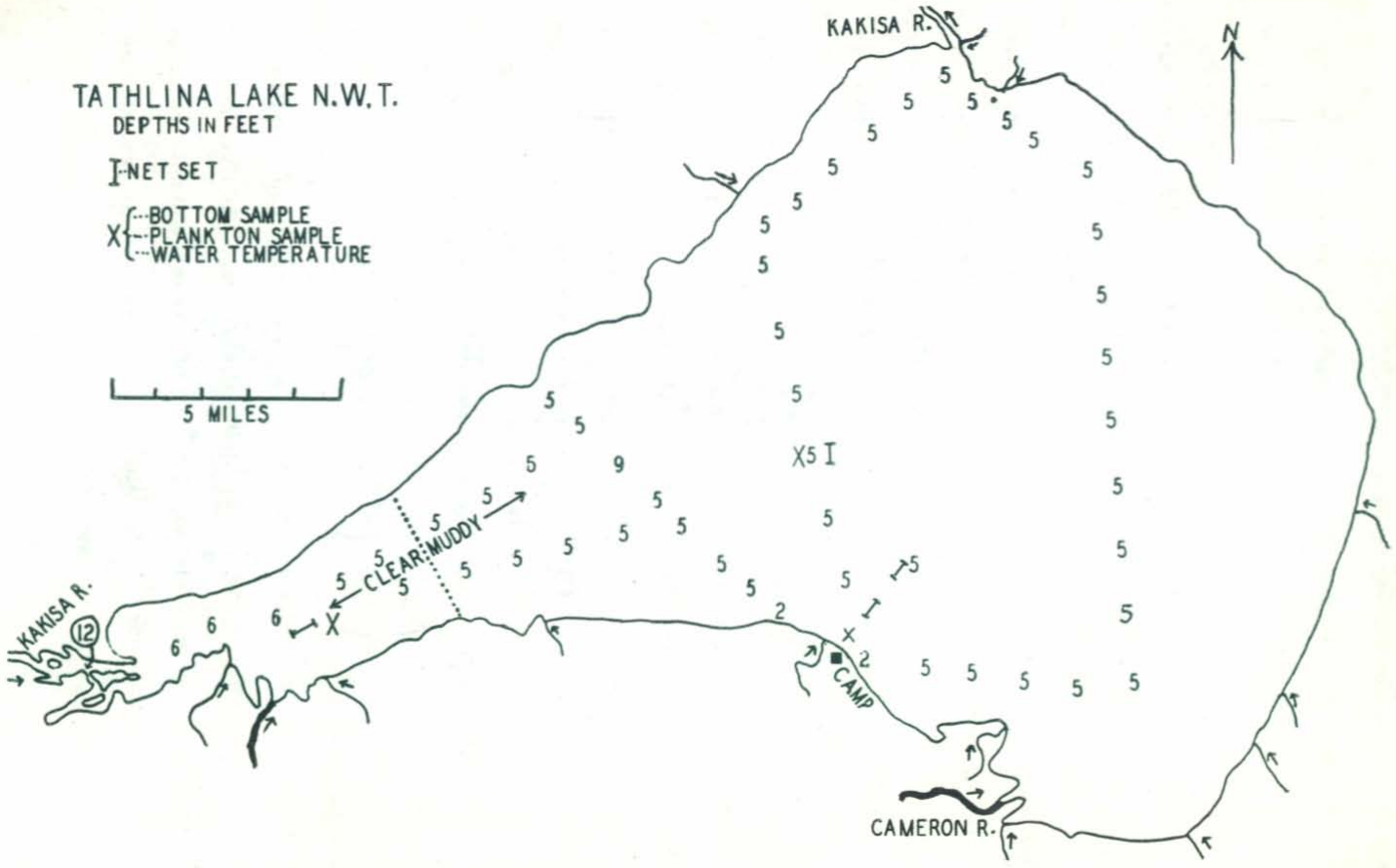

Fig. 1. Map of Tathlina Lake.

the lake is continually increasing in area. Possibly the original condition was a river along what is now the northwest shore of the lake, which, by erosion of the muskeg to the south and east, has formed the lake as it now appears.

Surface temperatures inshore varied considerably. An inshore surface temperature of 54°F was found at the end of an overcast and windy day. Three days later, after a hot and comparatively calm day, it was 75°F inshore and 70°F three-quarters of a mile offshore. The water temperatures at other depths offshore were as follows: one foot deep 68°F; two feet deep 64°F; three feet deep 60°F; four feet deep 59°F; and five feet deep 59°F. The following morning the inshore surface temperature was 61°F and by evening of that day it was 69°F.

Because of the limited time available only a few samples of plankton and of bottom fauna were taken. These samples are not sufficient to justify quantitative determinations. However, it was obvious that the lake was rich in plankton and in bottom fauna. On one calm day during which a good deal of the lake was seen, mayflies were emerging in such numbers that throughout the day there was approximately one on every two square yards of water surface. At the same time, the bow wave was definitely light green with phytoplankton instead of white.

Winter Kill

It is common knowledge in Hay River that "two years ago" the fish disappeared from Tathlina Lake. Phillip St. Pierre, who has lived near the lake for fifty years, said that in the spring of 1943 large quantities of fish were found dead on the shores. He said that 1943 was the only year that he remembered in which dead fish were found.

Net Sets

Tathlina Lake was so shallow that the 5½-inch mesh nets and the 4 3/4-inch mesh nets were not fully extended when fished. When the lead-line was on the bottom and the cork line on the surface, part of the web would be lying on the bottom. Even the 2½- and the 1½-inch mesh nets extended almost from surface to bottom.

The places where nets were set are indicated in Figure 1. All but one set was near the base camp. A total of four net-sets of 5½-inch mesh, two of 4 3/4-inch mesh, three of 2½-inch mesh, and one of 1½-inch mesh for one night each, were made in that area. In addition, one 5½-inch mesh net, two 4 3/4-inch mesh nets, and one 2½-inch mesh net were set at the west end of the lake for one night. Whitefish, Coregonus clupeaformis, dore, Stizostedion vitreum, common suckers, Catostomus commersonni, northern suckers, Catostomus catostomus, northern pike, Esox lucius, and burbot, Lota lota, were caught. Catch per unit effort is shown in Table I.

One 5½-inch mesh net and one 2½-inch mesh net were set in the neighbouring muskeg for one night each. The 2½-inch mesh net caught 15 northern pike and the 5½-inch mesh net caught nothing. These data were not used for compiling Table I.

Dore

Next to whitefish, dore appeared to be the mos t common fish in Tathlina Lake. None were taken in larger than 2½-inch mesh. The largest taken was 10.6 inches long and weighed 0.4 pounds. The average taken in the 2½-inch mesh was 8.7 inches long and weighed 0.2 pounds. Males and females were approximately the same size and there were 0.7 males per female. No mature dore were taken.

The length composition by age groups of all the dore from which scales were available are shown in Table II. Only one fish -- in its fifth year, i.e., a V -- was taken which was over 4 years old, which suggests that most of the dore were killed during the winter of 1942-43. A few adults must have survived to provide the young II's, III's and IV's.

Whitefish

Whitefish seemed to be the most abundant fish in the lake. No whitefish were taken in any mesh larger than 2½ inches. The largest whitefish was 11.6 inches long and weighed 0.9 pound. The average whitefish taken in the 2½-inch mesh was 8.7 inches long and weighed 0.3 pound. The average size of males and females was approximately the same and there were 0.7 males per female.

The length composition by age groups of all the whitefish from which scales were available are shown in Table III. More fish were taken in their fourth year than at any other age, and none were taken which were older, which suggests that most of the whitefish were killed during the winter of 1942-43, although the eggs deposited during the fall of 1942 appeared to survive in numbers. A few adults must have survived to provide the young II's and III's. Forty-three per cent of the III's were mature, which suggests that these whitefish belong to a "dwarf" race and probably do not grow much larger than those taken.

Twenty-five whitefish were examined for cysts of T. crassus. This sample weighed a total of 9.5 pounds. Forty-four per cent were infested, with a total of 191 cysts, i.e., an infestation of 2,010 cysts per hundred pounds.

Other Species

Common suckers averaged 12 inches and 1.3 pounds. Six of them were in their fourth year, though a VI and a IX were taken, indicating greater escapement from the winter kill than in the case of dore and whitefish.

Northern suckers averaged 12 inches and 1.0 pound. The sample consisted of one III, eighteen IV's and one V, indicating an almost complete winter kill in the winter of 1942-43.

Northern pike averaged 16 inches and 1.1 pounds. The age distribution indicates no heavy winter kill such as the other species suffered. This species was the only one which appeared to be more abundant in the west than in the rest of the lake.

Only 3 burbot were taken, which averaged 13 inches, and of these none were mature which suggests that only the youngest members of this species survived the winter kill.

KAKISA LAKE

Kakisa Lake is roughly oval, about 23 by 7 miles with a regular shoreline. It is about 130 square miles in area and drains about 5,400 square miles. Figure 2 is a map of the lake on which soundings in feet are given. The maximum depth found was 24 feet.

There is a boulder beach around most of the lake, and for approximately 100 yards offshore around the perimeter of the lake the bottom is stoney. The rest of the bottom is a firm sandy mud.

Approximately three-quarters of the water which enters Kakisa Lake passes through Tathlina Lake first, and is quite muddy. As it enters the

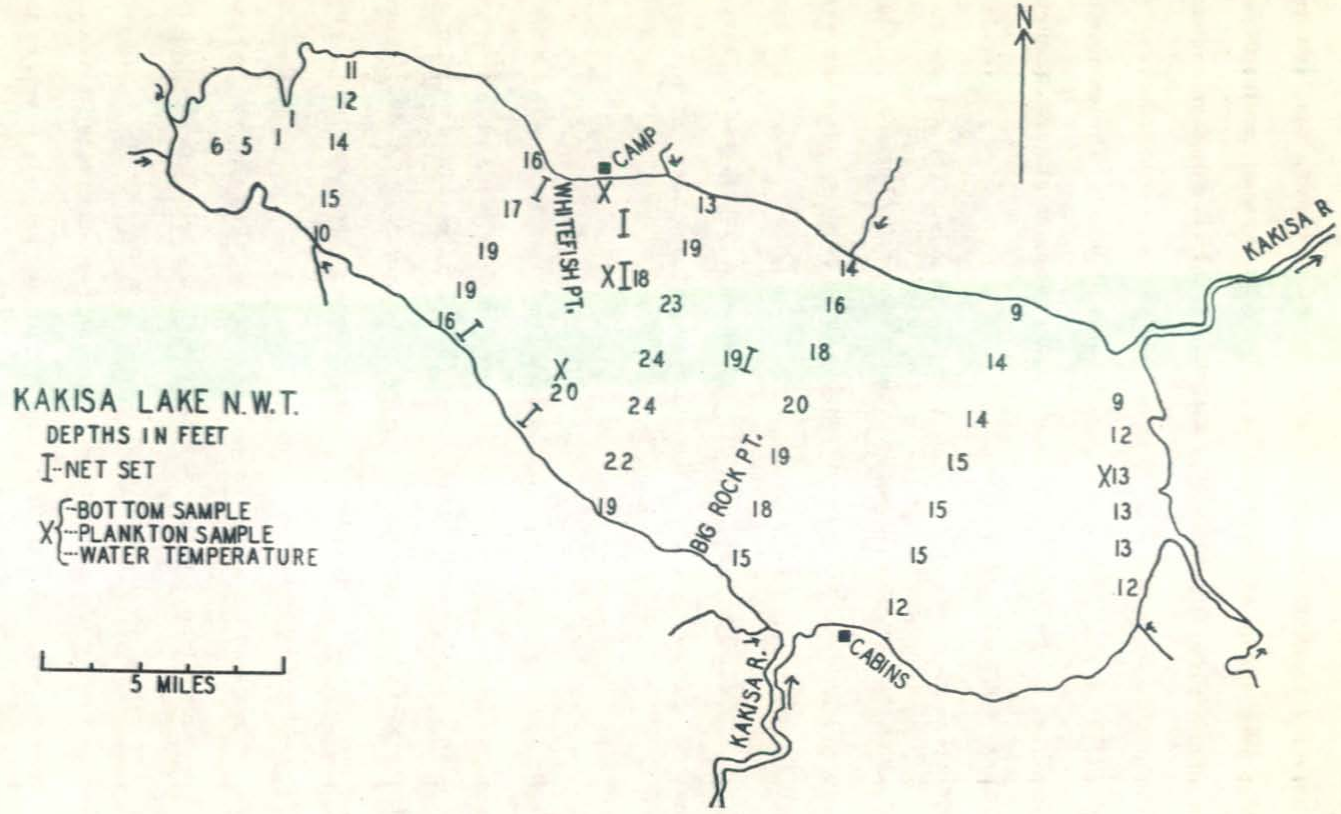

Fig. 2. Map of Kakisa Lake.

lake it is deflected eastward by a bar across the mouth of the Kakisa River, and appears to move across the east end of the lake to the outlet without thoroughly mixing with the water in the rest of the lake. Hence, along the south shore just east of the river mouth, the secchi disk disappeared at 1½ feet while along the north shore, about 10 miles west of the outlet, it disappeared at 4 feet.

Water Temperatures

Unlike Tathlina Lake, the water temperature in Kakisa Lake remained constant during the investigation. The surface temperature was 63°F and the temperature in 19 feet of water was 61°F.

The samples of plankton and bottom fauna were not sufficient to justify quantitative determinations. Plankton and bottom fauna were present in quantities. One noticeable feature was the enormous numbers of mollusk shells of several species, which lay in windrows along the shore typically to the depth of a foot or so.

Net Sets

The leads and corks on the 4 3/4-inch mesh nets were adjusted so that one of them -- referred to as "floating" -- fished with the cork line at the surface, while the other -- referred to as "sunken" - fished with the lead line on the bottom. Only one of the 5½-inch mesh nets was used and it was fished with the lead line on the bottom. The 2½-inch mesh and the 1½-inch mesh nets fished with the cork line at the surface, but since they were generally set in about 5 feet of water, they practically went from surface to bottom.

The localities in which nets were set are shown in Figure 2. The 2½-

inch mesh net was set twice near camp and the 1½-inch mesh net was set three times near camp. The 5½-inch mesh net and the two 4 3/4-inch mesh nets were set together four times, once about 2 miles off the base camp, twice near the southwest shore, and once approximately in the middle of the lake. Availabilities are shown in Table IV. In addition, the 5½-inch mesh net and the two 4 3/4-inch mesh nets on one occasion, and the sunken 4 3/4-inch mesh alone on another occasion, drifted because of strong winds and became tangled in such a way that they were not fishing properly. These sets were not used in calculating availability.

Dore, whitefish, common suckers, northern suckers, northern pike and ciscoes, Leucicthys sp., were caught. A burbot was found in a dore stomach and Couesius plumbeus were taken in seine hauls. Although the Indians reported that grayling, Thymallus signifer, were present, none were observed.

Dore

Dore seem to be the most common species in Kakisa Lake. The 5½-inch mesh nets and the two 4 3/4-inch mesh nets caught dore of approximately the same size. The sunken 4 3/4-inch mesh caught approximately twice as many fish as the floating 4 3/4-inch mesh, which indicates that the dore tended to be near the bottom, and approximately five times as many as the 5½-inch mesh, which indicates that it is too large for the dore in Kakisa Lake.

The availability varied significantly from day to day. However, since these differences may be related to differences in weather from day to day, rather than to differences in locality, they are disregarded in preparing Table IV.

The average female dore caught in the large mesh nets was significantly

larger than the average male, i.e., 18.9 inches and 2.7 pounds compared with 17.4 inches and 2.2 pounds. There were 9 females for every male, and this, with the difference in average size, suggests that most of the males may have been too small to be taken in the 4 3/4-inch mesh in quantity. Ninety-eight per cent of the fish taken in the large mesh nets were mature. These facts are obscure in Table V because fish caught in the smaller mesh nets are mixed with the others, but they are brought out in Table VI.

For both sexes combined, the average fish caught in the large mesh nets was 18.7 inches long and weighed 2.66 pounds. The largest dore taken was 21 inches long and weighed 3.5 pounds. Since the average catch in one hundred yards of 4 3/4-inch mesh net, when set on the bottom, was 32 fish, 32 x 2.66 = 85 pounds per hundred yards is an approximate estimate of what can be caught by setting at random. Fishing experience on the lake would doubtless result in greater availability.

The size distribution by age groups indicates that the fish grow rapidly for the first 6 years, but after that they grow slowly. This may be associated with the fact that most of them become mature during the seventh year. A comparison of the size of fish taken in the large mesh nets only, with the size taken in all the nets combined, indicates that probably an appreciable proportion of the fish which have reached the size at which growth is slow are too small to be taken by the 4 3/4-inch mesh.

The stomach contents of 141 dore were examined of which 37 contained food. No food, other than fish, was found. Of the 13 stomachs in which the species of the fish eaten was recognized, 8 contained ciscoses, 3 contained whitefish, 1 contained a burbot, and 1 contained a common sucker.

Of 18 dore examined, one had 2 parasites in the back muscle, another

had 1. These parasites have been identified by Dr. R. B. Miller as Diphyllobothrium, probably latum. Three parasites in 18 fish is approximately 6 per 100 pounds, since the average weight was about 2.7 pounds.

Whitefish

Next to dore, whitefish appeared to be the most abundant fish in Kakisa Lake. The 5½-inch mesh net and the two 4 3/4-inch mesh nets all caught fish of about the same size. The two 4 3/4-inch mesh nets caught approximately the same number of fish per net, which indicates that there were approximately as many whitefish at the surface as near the bottom, while the 5½-inch mesh caught less than half as many, which indicates that it is too large for maximum efficiency. The availability varied significantly from day to day, but this is disregarded in preparing Table IV.

The males and females taken in the large mesh nets were essentially the same size. The largest was 17.7 inches long and weighed 3.0 pounds, while the average whitefish was 15.9 inches long and weighed 2.2 pounds. There were approximately equal numbers of males and females, and 85 per cent of them were mature.

The length composition by age groups of all the whitefish from which scales were available is shown in Table VII. The whitefish appear to grow rapidly for 5 years after which growth is slow.

Cysts were found in the muscles of some of the whitefish. Samples of these cysts have been identified as Triaenophorus crassus by Dr. R. B. Miller. A total of 54 whitefish were examined of which 47, i.e., 87 per cent, were infested. This sample weighed 115.9 pounds and contained 340 cysts, i.e., 293 cysts per 100 pounds.

Other Species

Common suckers appear to be about three times as abundant as whitefish, northern suckers about half as abundant and northern pike in small numbers. Although only a few ciscoes were caught, probably they were more abundant than the net catches indicated. Even the 1½-inch mesh net probably took only the largest ones, since 90 per cent of them were mature. It is interesting to note that these mature fish weighed only about 1 ounce. They appear to be an important item in the dore diet.

DISCUSSION

Kakisa Lake

Because of the high rate of infestation -- 340 cysts per 100 pounds -- a fishery for whitefish does not seem desirable. The dore is the only species likely to be exploited.

The average weights attained by fish of different ages given in Table VIII show that Kakisa Lake dore increase in weight only slowly after their seventh year. The small increases must be more than offset by natural mortality, so that the greatest sustained yield from the lake is expected if the fish are harvested in their seventh or eighth year. The 3 3/4-inch mesh net appears to be slightly large for maximum efficiency in taking those year classes, and it therefore seems advisable to use a smaller mesh, probably a 3½-inch.

It might be argued that a heavy exploitation of fish in their seventh year would result in inadequate spawning, since most of them mature during that year and spawn for the first time at the beginning of their eighth year. However, it is evident that it would never be profitable to fish any population

to the point where they would be as scarce as the adult fish in Tathlina Lake appear to be as a result of a winter kill. Yet those few survivors appear to have provided ample young in Tathlina Lake. So if fishing is kept within reasonable limits, there can be no question of interfering with adequate spawning.

It is hard to derive a figure for the quota that should be set for Kakisa Lake, since the pickerel producing capacities of lakes in that latitude are unknown. A quota of 200,000 pounds is suggested, not because biological knowledge indicates that it is a reasonable figure, but because it is the smallest amount likely to attract fishermen to the lake. Even if this figure is two or three times larger than the lake will sustain, no permanent damage will be done since there is an accumulated stock of old fish to draw on. The fish requirements of the Indians are not included in the arbitrary 200,000 pounds.

Statistics should be collected in connection with any commercial fishery on the lake, so that changes in availability and in average size and age composition of the catch may be followed. With such data in hand, a reasonable accurate figure for the maximum yield that the lake is likely to sustain can be derived. It may be desirable to plan to increase the quota during the fishing season, if it appears from current trends that more fish could be safely caught.

Tathlina Lake

As a result of the winter kill in 1942-43, there is no immediate prospect of a fishery in Tathlina Lake. However, there are indications that the fish populations will recover, and that a fishery for dore will become possible.

A comparison of the average weights of young dore in Kakisa and Tathlina lakes shown in Table VIII indicates that they grow at approximately

the same rate in both lakes. If the Tathlina Lake dore continue to grow at the same rate as the Kakisa Lake dore, then probably about 1949 or 1950 there will be a crop of them ready to be harvested. That the crop will be plentiful is suggested by the fact that small fish appear to be relatively more abundant in Tathlina Lake than in Kakisa Lake.

Young whitefish also appear to grow at the same rate in Tathlina Lake as in Kakisa Lake. However, the small size at which they mature there suggests that they are a "dwarf" race and may never reach commercial size.

Table I. Availability of fish in Tathlina Lake, 1946, in numbers of fish per hundred yards of net set for one night only.

Mesh Size	Dore	Whitefish	Common sucker	Northern sucker	Pike	Burbot
Main Lake						
5 1/2"	0	0	0	0	0.5	0
4 3/4"	0	0	0	0.5	0	0
2 1/2"	8	104	2	13	3	2
1 1/2"	26	176	0	2	0	0
West End						
5 1/2"	0	0	0	0	0	0
4 3/4"	0	0	0.5	0	0.5	0
2 1/2"	2	8	6	0	30	0

Table II. Length composition by age groups of dore from Tathlina Lake, 1946.

Length in inches	Age			
	II	III	IV	V
5-6	1	...	...	...
6-7	...	1	...	...
7-8	...	4	...	...
8-9	...	1	9	...
9-10	...	...	7	1
10-11	...	...	2	...
Total	1	6	18	1

Table III. Length composition by age groups of whitefish from Tathlina Lake, 1946.

Length in inches	Age		
	II	III	IV
5-6	16	...	...
6-7	32	...	6
7-8	...	2	2
8-9	...	26	1
9-10	...	5	7
10-11	...	4	40
11-12	...	...	9
Total	48	37	65

Table IV. Availability of fish in Kakisa Lake, 1946, in numbers of fish per one hundred yards of net per set.

Mesh size	Dore	Whitefish	Common sucker	Northern sucker	Pike	Cisco
5 1/2"	6	2	18	2	0.2	0
4 3/4" floating	18	5	11	1	0	0
4 3/4" sunken	32	5	15	2	0.5	0
2 1/2"	38	8	9	0	11	0
1 1/2"	3	7	1	0	3	7

Table V. Length composition by age groups of dore from Kakisa Lake, 1946.

Length in inches	Age								
	IV	V	VI	VII	VIII	IX	X	XI	XII
9-10	...	1	...	...	...	...	...	...	...
10-11	3	...	...	...	...	...	...	...	...
11-12	...	3	2	...	...	...	...	...	...
12-13	...	...	5	...	...	...	...	...	...
13-14	...	1	1	4	1	...	1	...	...
14-15	...	...	2	4	2	...	...	...	...
15-16	...	...	2	3	1	1	...	...	...
16-17	...	...	...	4	2	5	1	...	...
17-18	...	...	...	9	10	5	6	1	...
18-19	...	...	...	10	13	16	11	5	3
19-20	...	...	...	3	17	15	14	4	...
20-21	...	...	...	...	3	3	...	3	...
Total	3	5	12	37	49	45	33	13	3

Table VI. Length composition by age groups and sex of dore caught in large mesh nets in Kakisa Lake, 1946.

Length in inches	Age										
	VII			VIII		IX		X		XI	
	Immature	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
13-14	1	...	...	...	...	...	...	...	...	...	...
14-15	1	...	...	...	...	...	...	...	...	...	...
15-16	...	...	...	...	...	1	...	...	...	...	...
16-17	...	...	...	2	...	...	1	1	...	...	...
17-18	1	2	6	2	8	1	...	...	3	...	1
18-19	...	1	8	...	10	1	11	1	11	...	3
19-20	...	...	3	...	12	1	12	...	12	...	4
20-21	...	...	...	...	2	...	4	...	...	...	3
Totals	3	3	17	4	32	4	28	2	26	0	11
Average weight in pounds		2.4		2.6		2.7		2.8		3.0	

Table VII. Length composition by age groups of whitefish from Kakisa Lake, 1946.

Length in inches	Age								
	II	III	IV	V	VI	VII	VIII	IX	X
5-6	3	...	...	...	...	...	...	...	...
6-7	...	3	...	...	...	...	...	...	...
7-8	...	1	...	...	...	...	...	...	...
8-9	...	2	...	...	...	...	...	...	...
9-10	...	...	1	...	...	...	...	...	...
10-11	...	...	3	2	...	...	...	...	...
11-12	...	...	1	...	...	...	...	...	...
12-13	...	...	...	...	1	...	...	...	...
13-14	...	...	...	...	...	1	...	...	...
14-15	...	...	...	...	4	6	1	1	2
15-16	...	...	...	...	4	5	8	1	...
16-17	...	...	...	...	2	3	7	2	1
17-18	...	...	...	...	...	2	3	4	1
Total	3	6	5	2	11	17	19	8	4

Table VIII. Comparison of the average weights of dore and whitefish in pounds by year class in Tathlina Lake with those in Kakisa Lake.

		II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Dore	Tathlina	...	0.1	0.2	...	...	...	...	...	...	...	...
	Kakisa	...	...	0.2	0.6	0.9	2.1	2.6	2.6	2.7	2.9	3.0
Whitefish	Tathlina	0.1	0.3	0.5	...	...	...	...	...	...	...	...
	Kakisa	0.1	0.2	0.5	0.6	1.9	2.0	2.3	2.3	2.4	...	...