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Report on Willow Lake - February 1950

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FISHERIES RESEARCH BOARD  
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## INTRODUCTION

Willow Lake in the North West Territories is located at 62° 20'N, 119° 20'W, and is atop the Horn Mountains at an altitude of about 2,000 feet. It is about 60 square miles in area, and drains about 450 square miles.

On February 18, 1950 a party of four including Mr. Peter Bilenduke, and Mr. Donald Morris, both from the Big Four Fish Packers; Mr. Arthur De Lancey of the Department of Fisheries; and the author few into Willow Lake. Transportation, food, stove, and equipment were supplied by the Big Four Fish Packers, while the Department of Fisheries furnished the tent. Because the aeroplane was so small, no scientific equipment was taken except a spring balance and a measuring board.

The purpose of this trip was to explore the lake, and to determine the advisability of a winter fishery, the idea being that the fish caught would be flown from Willow Lake, to the settlement of Mills Lake on the Mackenzie River. From there the catch would be trucked to the railhead at Grimshaw, Alberta, using a winter truck road to reach the Mackenzie highway.

Because of the heavy snow conditions not much of the lake was surveyed. As indicated on the map (Fig. 1) most operations were centred around Home Island. Not many soundings were taken (actually 23 in number) as each sounding necessitated chopping through  $4\frac{1}{2}$ -5 feet of ice,

Topographical features were difficult to discern because of the heavy snow, but muskeg was found on all the islands explored and boulders were found around the shores. Most of the forests were spruce interspersed with birch and black poplar. Willow was also found.

#### ACKNOWLEDGEMENTS

I would like to take this opportunity to thank the Big Four Fish Packers, who made the survey possible; Mr. De Lancey, who made the whitefish inspection, and whose cutting figures were used; Miss L. Bograd, who read the fish scales for age determination; and Dr. W. A. Kennedy whose advice and criticism were invaluable.

#### DOMESTIC FISHERY

There is no domestic fishery on Willow Lake. This is no doubt because of the rough terrain and the inaccessibility of the lake. It has been reported that the odd trapper has taken fish from the lake, but whether this is true or not is not known.

## MATERIALS

A toboggan was used to transport the nets, etc., to the various locations, and due to the heavy snow, snowshoes were worn when any distance was to be walked. Needle bar shovel and ice chisel were the main tools for making the "basin holes", while the conventional "jigger" was used for setting the nets.

The following gill-nets were used: one nylon net of 5 5/8" mesh, 100 yards long and 24 meshes deep; two white cotton nets of 5 5/8" mesh, each 100 yards long, one 12 meshes deep, the other 30 meshes deep; two white cotton nets of 5 5/8" mesh, one 25 yards long 12 meshes deep, the other 25 yards long, 30 meshes deep; one white cotton net of 6" mesh, 100 yards long, and 24 meshes deep; one white net of 4 1/2" mesh, 100 yards long, and 20 meshes deep; one white net of 3 1/2" mesh, 50 yards long and 30 meshes deep. All the nets were of 36/6 twine except the nylon which had 210/6 cord.

## METHODS

All work was done at the various basin holes, and when possible, each whitefish and trout was weighed on the spring balance to the nearest one-tenth of a pound, the length from the tip of the snout to the fork of the tail was taken to the nearest one-eighth of an inch, and a scale sample was taken for age

determination. The sex was also observed and in some cases the stomach contents examined. The rough fish encountered in the nets were noted and in a few instances weighed and sexed. Most of the whitefish taken were examined for cysts of the tapeworm, Triaenophorus crassus.

The depth of water was observed at each basin hole, and the more important depths have been placed upon the map. (Figure 1). After each sounding the sounding lead was examined to determine the type of bottom. In most cases the bottom proved to be a semi-solid, black muck with little trace of sand or clay, and varied only in color, i.e. from black to dark grey. Once gravel was found, but this was to be expected as the sounding was made close to a gravel spit running off the southeast tip of the island on which we were staying. Another time boulders were found, and again this was to be expected as the sounding was made 100 yards away from a rock pile which is indicated on the map.

#### FISH

The following species of fish were encountered in the various nets: whitefish, Coregonus clupeaformis; lake trout, Cristivomer namaycush; northern sucker, Catostomus catostomus; burbot, Lota lota; and the northern pike, Esox lucius. A fish of the genus Leucichthys was found in the stomach contents of one of the trout.

In the following discussions the percentages quoted are percentages of whitefish and trout only (unless otherwise indicated) as these were considered the most important species, and it was the abundance, etc., of these fish in which we were interested.

For fishing the nets were set in water varying in depth from 14 feet to 81 feet. Using 40 feet as an arbitrary dividing line between deep water and shallow water, and using the number of fish caught in nets of the same mesh size it would seem that there were more fish caught in the shallow portions of the lake (i.e. under forty feet) than in the deeper portions of the lake (i.e. over forty feet). In the shallow water trout formed the greatest percentage of the catch by weight. This was reversed in the deep water with the whitefish forming the greatest percentage of the catch by weight.

#### WHITEFISH

In Willow Lake the whitefish were the most abundant comprising 77.8% of the number of whitefish and trout caught. This number constituted 39.6% of the catch by weight.

The fish averaged 1.5 pounds in weight and 14.6 inches in length. They were quite dark along the back, but this color disappeared along the sides. All the fish examined were mature and the ratio of female to male was 1.27 to 1.0.

The availability (catch in pounds of fish per net-night) of the fish varied with the different mesh sizes as did the average weight of the fish as shown in Table I. A net-night is defined as one hundred yards of net (regardless of depth) in the water for one night. It should be pointed out that a net-night does not mean that the net involved is cleared every night. In this case the term is used as a comparison for the various nets that were in the water the same number of nights, but were lifted irregularly.

From Table I it will be seen that since the whitefish are small, a small mesh net would be required for exploitation. Small nets would not be the most efficient for trout as will be shown later.

The growth rate of whitefish in Willow Lake is slower than the rate of growth in Great Slave Lake. There is a steady rate of growth (0.1 pounds per year) until the fish is about eight years old, after which there is a slight increase in rate of growth. Age and weight comparisons are as follows:

<u>VIII</u> years - 0.8 pounds	<u>XIV</u> years - 2.0 pounds
<u>X</u> years - 1.1 pounds	<u>XVI</u> years - 2.8 pounds
<u>XII</u> years - 1.4 pounds	

A break-down of weight composition by age groups is shown in Table II, and a break-down of length composition by

age groups is shown in Table III. The Roman numerals of the age groups indicate the fish is in the year denoted by the numeral; e.g. VII means the fish is in its seventh year, i.e. it has 6 annuli plus some marginal growth. In the case of these fish the next annulus will be formed before any more growth takes place, as the fish were taken late in the winter.

One hundred and seven whitefish were inspected for cysts of Triacnophorus crassus, and the infestation was found to be 119.72 cysts per 100 pounds of fish. This proved to be equivalent to 1.58 cysts per fish.

#### LAKE TROUT

The lake trout found in Willow Lake were very dark in color. This color was quite intense along the back, diminished slightly on the sides leaving the belly with a grey color compared to the white belly found on most trout. These fish made up 22.2% of the catch by number, and 60.4% of the catch by weight.

The average weight of the trout was 7.9 pounds and the average length was 26.5 inches. The average weight varied from 9.0 pounds in the 6-inch mesh to 3.6 pounds in the  $3\frac{1}{4}$ -inch mesh.

The availability of the trout also varied with the mesh sizes, and this variation is shown in Table IV. It may be noted that although the availability is the same for the 5  $\frac{5}{8}$ -

inch and 6-inch nets as far as numbers are concerned, the average weight in the 6-inch net is lower. This could mean that a 6-inch net is too large a mesh for maximum efficiency. The reason the 3 $\frac{1}{2}$ -inch mesh catches so many fish is attributed to the fact that the net is exploiting the younger fish which are presumably more numerous than the older fish.

The growth rate of the trout is similar to that on Great Slave Lake. It is quite slow until the 12th year and then it shows an acceleration. Some age and weight comparisons are as follows:

VII years - 2.0 pounds	XIII years - 8.0 pounds
XI years - 4.0 pounds	XIV years - 10.0 pounds
XII years - 6.0 pounds	

Table V shows weight composition by age groups, and Table VI shows length composition by age groups.

The trout were not inspected for infestation of Triacnophorus crassus, but an infestation of another type was quite evident. The viscera, especially the intestine, was covered with semi-solid yellow bumps about 2 millimeters in diameter. These bumps were evident in all of the trout, and one or two whitefish. Because of the lack of equipment no samples of this parasite were taken.

Cannibalism was evident as small trout were found in the stomachs of about 50 per cent of the fish examined. No significance can be attached to this as trout are known to be cannibalistic, but its prominence is mentioned in passing.

#### OTHER FISH

Only four northern suckers were caught during the whole week's fishing, and three of these were caught in the 4 $\frac{1}{2}$ -inch mesh, the other one coming from the 6-inch mesh. Seven burbot were taken, six caught in the 5  $\frac{5}{8}$ -inch mesh and one in the 6-inch mesh. The one northern pike was taken in the 5  $\frac{5}{8}$ -inch nylon net which had been in the water 5 nights.

The suckers averaged approximately 1.8 pounds. The burbot ran between three and four pounds, while the pike weighed 13.0 pounds.

#### DISCUSSION

In order to exploit Willow Lake profitably, fishermen would have to concentrate on the species of fish which demand high prices, namely whitefish and trout. Because the whitefish are small and highly infested a commercial fishery for this species is improbable. The only other alternative is a trout fishery.

Rawson (1947), in making an estimate for the possible production of Great Slave Lake, used information regarding other lakes similar in size, and having much in common with Great Slave Lake. From this information and data collected from Great Slave Lake he calculated the potential output for the lake to be 0.75-1.0 pounds of fish per acre for a sustained yield. This cannot be done for Willow Lake, but using Rawson's calculations as a yardstick, it may be assumed that the potential productivity for Willow Lake is roughly one pound of fish per acre for a sustained yield. Thus the potential output for the whole lake would be about 40,000 pounds of fish annually. As trout comprise 55% of the total catch of fish by weight this would mean that the lake would produce about 20,000 pounds of trout annually.

This last figure coupled with the fact that there was a general paucity of trout (only 300 pounds of trout were taken out during the whole survey) would indicate that a commercial fishery for trout would not be profitable.

#### LITERATURE CITED

Rawson, D. S.

Estimating the fish production of Great Slave Lake.  
Reprint Volume 77 (1947), Transactions of American Fisheries Society.

Table I. Availability of whitefish in Willow Lake, per net during the winter season of 1949-50.

Mesh size	Average number of whitefish per net night	Average weight of whitefish (lbs.)
6"	.66	2.3
5 5/8"	.87	2.4
4 1/4"	11.00	1.5
3 1/2"	16.33	1.2

Table II. Weight composition by age groups of whitefish from Willow Lake, during the winter season of 1949-50.

Wt. in pounds	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI
0.6 - 0.7	-	1	1	-	-	-	-	-	-	-
0.8 - 0.9	1	4	2	3	1	-	-	-	-	-
1.0 - 1.1	1	1	2	9	9	2	-	-	-	-
1.2 - 1.3	-	-	4	10	11	10	-	-	-	-
1.4 - 1.5	-	-	-	2	5	6	1	-	-	-
1.6 - 1.7	1	-	-	-	3	2	6	2	-	-
1.8 - 1.9	-	-	-	-	2	4	2	-	-	1
2.0 - 2.1	-	-	-	-	-	1	3	-	2	-
2.2 - 2.3	-	-	-	-	-	-	1	1	-	-
2.4 - 2.5	-	-	-	-	-	1	1	2	-	-
2.6 - 2.7	-	-	-	-	-	-	-	-	1	-
2.8 - 2.9	-	-	-	-	-	1	2	-	-	-

Table III. Length composition by age groups of whitefish from Willow Lake, during the winter season of 1949-50.

Length in inches	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI
11 - 11 $\frac{3}{4}$	-	-	-	1	-	-	-	-	-	-
12 - 12 $\frac{3}{4}$	2	5	2	2	1	-	-	-	-	-
13 - 13 $\frac{3}{4}$	1	1	4	7	9	2	-	-	-	-
14 - 14 $\frac{3}{4}$	-	-	3	11	13	13	2	-	-	-
15 - 15 $\frac{3}{4}$	-	-	-	3	6	6	4	2	-	-
16 - 16 $\frac{3}{4}$	-	-	-	-	2	4	5	-	2	1
17 - 17 $\frac{3}{4}$	-	-	-	-	-	1	2	3	-	-
18 - 18 $\frac{3}{4}$	-	-	-	-	-	1	3	-	1	-

Table IV. Availability of trout in Willow Lake, during the winter season of 1949-50.

Mesh size	Average no. of trout per net-night	Average weight of trout (lbs.)
6"	1.4	9.0
5 5/8"	1.4	9.2
4 $\frac{1}{2}$ "	.66	5.5
3 $\frac{1}{2}$ "	2.0	3.5



Table VI. Length composition by age groups of trout from Willow Lake, during the winter season of 1949-50.

Length in inches	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI
18 - 19 $\frac{1}{2}$	1	-	-	-	-	-	-	-	-
20 - 21 $\frac{1}{2}$	-	1	1	1	-	-	-	-	-
22 - 23 $\frac{1}{2}$	-	-	4	3	2	-	-	-	-
24 - 25 $\frac{1}{2}$	-	-	-	-	2	-	-	-	-
26 - 27 $\frac{1}{2}$	-	-	-	-	-	-	-	-	-
28 - 29 $\frac{1}{2}$	-	-	-	-	-	1	-	-	-
30 - 31 $\frac{1}{2}$	-	-	-	-	1	-	1	1	-
32 - 33 $\frac{1}{2}$	-	-	-	-	1	-	1	-	1
34 - 35 $\frac{1}{2}$	-	-	-	-	-	1	-	1	-
36 - 37 $\frac{1}{2}$	-	-	-	-	-	-	1	1	-

