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A study of the commercial fishery of Great Slave Lake during the winter season of 1948-49 with comparative data on unexploited fish populations

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INTRODUCTION

A study of the winter commercial fishery on Great Slave Lake was begun during the winter of 1948-49. All the data were gathered by the junior author. This study is complementary to the study of the summer fishery which has been pursued since 1946 by the Central Fisheries Research Station of the Fisheries Research Board of Canada. Lake trout, Cristivomer namaycush lake whitefish, Coregonus clupeaformis, and inconnu, Stenodus leucichthys mackenzii were the principle commercial species although inconsequential numbers of pike, Esox lucius and of yellow pike-perch, Stizostedion vitreum vitreum were sold.

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FISHING METHODS

Gill nets were used exclusively in the fishery. The nets used were invariably 100 yards long of 5½-inch mesh (stretched measure), and in general were of 30/6 twine although some were

of 36/6 twine and a few of even finer twine were used. A careful study indicates that no nets of smaller mesh were fished illegally. The nets ranged from 20 meshes to 120 meshes deep with 82 per cent between 30 and 40 meshes deep and the average was 39 meshes deep.

The fishing methods on Great Slave Lake are essentially the same as those used in any winter fishery in western Canada. The initial step in setting a net is to get a length of rope under the ice. This is done by using the jigger for which details of construction and operation are given by Sprules (1949). The length of rope is then used to pull the net under the ice. Marker lines are attached to the net and it is allowed to sink to the bottom of the lake. The marker lines are attached to short stakes which are set vertically in such a way that they freeze in at the edge of the ice and enable the fishermen to find the nets again.

After a few days the holes are reppened and the net is hauled out through one of them. As the net is hauled out, it pulls a line under the ice so that is can be reset without using the jigger. The fish are removed from the net as it is hauled out before they can freeze. In the Great Slave Lake winter fishery the average interval between lifts was 2.6 days. Five per cent were left for one day, 82 per cent for two or three days and 13 per cent for four or more days. The time interval varied little with time and place.

The fish which were kept unfrozen and sold as fresh fish (for which there was a higher price) were generally removed from the ice daily. Otherwise they were allowed to freeze and were piled on the ice to be removed whenever it might be convenient to do so.

SIZE COMPOSITION OF THE CATCH

A few trout and whitefish taken at random from the catch were weighed individually on small spring scales. The recorded weights are considered to be samples of the fish caught in the vicinity of Hay River. Average values for these samples with their standard errors are recorded in Table I. The samples came partly from Area A and partly from Area D in about the same proportion as the respective commercial catches from each.

There was no outstanding change in size during the winter, although the average size of trout may have decreased slightly. The overall average size of each species was slightly less than the average size (13.3 lbs. for lake trout and 3.1 lbs. for whitefish) taken by experimental nets of $5\frac{1}{2}$-inch mesh that were used during the previous summer by Fisheries Board personnel.

CATCH

No attempt was made to determine total catch. The total catches of the three important commercial species as reported by the

Fisheries Officers are shown in the first line of Table II. This total includes a few fish that were caught in other parts of the lake. The last line of Table IV indicates that in our estimation all the fish that were landed were sold, i. e. none were wasted.

It was not possible to make reasonable estimates of the amount of rough fish caught.

EFFORT

In contrast with the summer fishery in which nets are normally lifted daily, the interval between lifts was typically two or three days. It seems unwise to assume that the conversion factors which can be used to make availabilities in the summer fishery comparable with one another are applicable to the winter fishery. Therefore, the unit of fishing effort for the winter fishery is a net-lift which is the fishing effort exerted by one net during the interval between lifts whatever that interval may be. Most of the nets were lifted after either two or three days, and in any case the average time interval was practically constant regardless of time or place.

Although the range of depths of the nets was considerable the average was practically constant regardless of time and place. Since the fish tended to be caught in the lower part of the net, the depth of the net probably had a minor effect on fishing effort.

Table III shows the fishing efforts for which reliable records were obtained. The increase in recorded effort represents increasing success in getting the co-operation of fishermen to keep reliable records.

AVAILABILITY

It was impossible to interview more than one per cent of the fishermen on any given day. Certain dependable and co-operative fishermen who were randomly distributed throughout the fishing area were requested to keep records of fishing effort and, in the case of frozen fish, of the catches made by specific fishing efforts. These records were collected as often as possible and were supplemented where necessary by interviews with the fishermen. Any records which were not considered to be reliable were discarded. The quantities of fresh fish taken daily were determined from the records kept by the buyers who weighed them in at Hay River. Table II indicates that our estimates of availability are based on approximately 10 per cent of the catch that was landed.

In analysing the data, the same arbitrary subdivisions of the lake were used as those used in connection with the summer fishery. The time was divided into one-half month intervals except that the interval February 16 to March 4 was used since fishing ended on the latter date. The recording of data began on January 1 although there had been some fishing in the last

week in December. A negligible amount of fishing was done in Areas E and F on which no data were collected. The fishing in Area A was almost entirely in the western half of that area. The fishing in Area D was spread along most of the shoreline of that area.

Estimates of availability based on these records are biased in that fishermen who will keep such records are generally comparatively successful fishermen. Poor fishermen are generally disgruntled and unco-operative. The availabilities based on our records therefore represent availabilities to the average successful fishermen rather than to the average fisherman. Availabilities to the successful fishermen are probably the most useful values since the other will no doubt either become successful fishermen as their experience increases or be eliminated by competition. In any case, the information will probably always come from the same type of fishermen so that any apparent change in availability on the basis of the data will represent a real change in availability.

Tables IV, V, VI, and VII show the respective availabilities of lake trout, whitefish, inconnu and of the three combined. Availabilities were consistently higher in Area A than in Area D mainly because of a greater availability of lake trout and of inconnu. Availability tended to decrease throughout the season, although an increase in the availability of whitefish during the last half-month in Area A tended to reverse the trend for that time and place.

It is interesting to note that in a biological survey undertaken in the summer of 1948 in the vicinity of Hay River (approximately the same grounds as covered by the winter fishery) the following values were found for availability in pounds per net-lift based on 16 net-lifts where the average interval between lifts was 2.0 days: for trout 54; for whitefish 76; for inconnu 6; and for all combined 136. The apparent close agreement between this value of 136 for the combined species and the value 134 based on the winter fishery is somewhat misleading since the summer value is based more on fishing effort in Area A while the winter value is based more on fishing effort in Area D. The availabilities found in the summer predict the success of the winter fishery reasonably well. The experimental nets used were only 15 meshes deep which further emphasizes the opinion expressed above that most of the fish are caught near the bottom of the net so that the depth of a net is a negligible factor.

Lake trout were apparently comparatively less plentiful during the winter than during the summer.

DEPTHS FISHED

Table VIII shows the average depths fished at various times and places based on a random sample of about 5 per cent of the fishermen. They fished in deeper water in Area D than in Area A and in both areas they fished at slightly greater depths towards the end of the season.

SUMMARY

1. The winter fishery on Great Slave Lake was studied for the first time.

2. The fishing methods are described.

3. The average size and availability corresponded closely to the values found by experimental netting during the previous summer.

RECOMMENDATIONS

The data analysed above do not suggest any recommendations other than those that have been made in previous reports.

REFERENCES

Sprules, W. S. The Prairie Ice Jigger. Amer. Soc. Limn. and Oc. Special Publication 20. 1949.

Table I. The average size of lake trout and of whitefish in pounds round weight and its standard error in samples taken at random from the fish landed by commercial fishermen in the vicinity of Hay, River, Great Slave Lake during the winter season of 1948-49. The number of fish in each sample is shown in brackets.

	Jan. 1-15	Jan. 16-31	Feb. 1-15	Feb. 16-28	March 1-15
Trout	11.9 ± 0.6 (122)	-	11.4 ± 0.4 (218)	9.8 ± 0.7 (32)	10.4 ± 0.3 (400)
Whitefish	2.7 ± 0.05 (156)	-	3.1 ± 0.08 (24)	-	-

Table II. An analysis of estimated catches in calculated round weights taken by the commercial fishery in Great Slave Lake during the winter season of 1948-49.

	Trout	Whitefish	Inconnu	Combined
Estimated total catch in thousands of pounds.....	731	3,650	324	4705
Percentage landed by fishermen the location and number of whose nets were known.....	9.2	9.5	10.2	9.5
Percentage landed by other fishermen.....	90.8	90.5	89.8	90.5
Percentage caught but not landed.....	0.0	0.0	0.0	0.0

Table III. The fishing effort in net-lifts exerted in Great Slave Lake by the fishermen who were interviewed during the winter season of 1948-49.

Area	Jan. 1-15	Jan. 16-31	Feb. 1-15	Feb. 16-March 4	All winter
A	197	351	269	732	1549
D	0	590	712	764	2066
Whole lake	197	941	981	1496	3615

Table IV. The availability of lake trout in pounds round weight caught per net-lift to the Great Slave Lake fishermen who were interviewed during the winter season of 1948-49.

Area	Jan. 1-15	Jan. 16-31	Feb. 1-15	Feb. 16-March 4	All winter
A	34	24	23	20	23
D	-	21	15	11	15
Whole lake	34	22	12	25	29

Table V. The availability of whitefish in pounds round weight caught per net-lift to the Great Slave Lake fishermen who were interviewed during the winter season of 1948-49.

Area	Jan. 1-15	Jan. 16-31	Feb. 1-15	Feb. 16-March 4	All winter
A	92	98	98	124	109
D	-	109	83	71	86
Whole lake	92	105	87	97	96

Table VI. The availability of inconnu in pounds round weight caught per net-lift to the Great Slave Lake fishermen who were interviewed during the winter season of 1948-49.

Area	Jan. 1-15	Jan. 16-31	Feb. 1-15	Feb. 16-March 4	All winter
A	32	25	13	9	16
D	-	6	3	3	4
Whole lake	32	13	6	6	9

Table VII. The availability of lake trout, whitefish and inconnu combined in pounds round weight caught per net-lift to the Great Slave Lake fishermen who were interviewed during the winter season of 1948-49.

Area	Jan. 1-15	Jan. 16-31	Feb. 1-15	Feb. 16-March 4	All winter
A	158	147	134	153	148
D	-	136	101	85	105
Whole lake	158	140	105	128	134

Table VIII. The average depth of water at which nets were set in Great Slave Lake by a random sample of fishermen during the winter season of 1948-49.

Area	Jan. 1-15	Jan. 16-31	Feb. 1-15	Feb. 16-March 4
A	52	56	53	65
D	-	77	86	82

A P P E N D I X A

Comparative Data on Unexploited Fish Populations

APPENDIX A

Comparative Data on Unexploited Fish Populations

In 1944, 1945, 1946 and 1947 Dr. Rawson was in charge of field parties who explored and reported on the fisheries resources of Great Slave Lake. As part of this program "standard gangs" of gill nets, consisting of nets of various mesh sizes were set in all parts of the lake. The 5½-inch mesh nets in these standard gangs were essentially the same as the commercial gill nets in use from 1945 to the present. The fact that they were not as deep is considered to be relatively unimportant since we have observed that few fish are caught in the top half of the commercial nets.

Since the commercial fishermen generally fish in water that is 25 to 150 feet deep, then the 5½-inch mesh nets in standard gang sets which were set within this depth range probably sampled the fish populations in a way comparable with the commercial nets. Data from such fishing are of interest for comparison with data subsequently derived from the commercial fishery on the same grounds. Exploitation by experimental nets is not strictly comparable with exploitation by commercial nets since the former are set more or less at random while the latter tend to be set at places and depths where experience indicates that the greatest value of fish can be taken.

Only those cases where the experimental nets were set on previously unexploited grounds are included in the following

analyses. A fishing round is considered to have been unexploited if, to the best of our knowledge, commercial nets have never been set within 50 miles of it.

The amount of data which can be used for purposes of comparison is disappointingly small. Such as it is, all suitable data on average weights of trout and whitefish are shown in Table IX while all suitable data on catch per net are shown in Table X.

Although the data are meagre, each of the four cases where comparisons are possible (using data from commercial catches up to 1949) indicate a greater average size of trout prior to exploitation by the commercial fishery than now prevails. Only once in 16 times would such an event be expected on the basis of chance alone, so it seems likely that there was a real difference. The average difference would be about five pounds. Whitefish show no apparent change.

In three cases out of four where comparisons are possible, the average catch per net of commercial fish (trout and whitefish) in the experimental nets was less than that in the commercial nets (average less than one-half as great) and in the remaining case the two were about the same. This could be the result of chance alone but it seems more likely that there was a real difference. A small part of this difference could have arisen because the experimental nets were not as many meshes deep as the commercial nets,

but most of it was probably the result of fishing at random with the experimental nets in contrast with the commercial nets which were set in selected localities. The latter might explain the apparent difference in size of trout, since such data as we have indicate that larger trout are generally caught in deeper water and since the average depth at which experimental nets were set was greater than that at which the commercial nets were set.

We conclude that as far as can be determined from these comparisons, exploitation has not changed the fish population appreciably with the possible exception of a small change in the average size of trout.

Table IX. The average size of trout and whitefish in pounds round weight and its standard error in all the suitable sets with $5\frac{1}{2}$-inch mesh nets by Fisheries Research Board personnel in Great Slave Lake under conditions comparable with the commercial fishery and prior to exploitation by the commercial fishery. The number of fish in each sample is shown in brackets.

Area	Trout	Whitefish
A	15.7 ± 2.1 (6)	3.4 ± 0.13 (15)
F	11.6 ± 3.6 (5)	3.2 ± 0.21 (9)
K	13.8 ± 2.2 (5)	2.5 ± 0.02 (4)
L	8.8 ± 1.0 (16)	4.1 ± 0.07 (16)
N	8.6 ± 1.5 (8)	4.7 ± 0.53 (3)
O	5.3 ± 1.2 (3)	-

Table X. The availability of fish caught in all the suitable one-night sets with $5\frac{1}{2}$-inch mesh by Fisheries Research Board personnel in Great Slave Lake under conditions comparable with the commercial fishery and prior to exploitation by the commercial fishery.

Area	Effort in yard-nights	Availability in pounds round weight per hundred-yard-nights						
		trout	whitefish	inconnu	cisco	burbot	pike	sucker
A	500	38	14	2	0	11	0	4
B	100	15	30	0	0	0	0	0
E	100	24	24	0	0	0	0	0
F	600	7	19	0	1	12	3	3
K	200	47	5	0	1	2	0	0
L	150	82	46	0	0	0	0	0
M	300	44	19	0	0	0	0	0
N	300	37	11	0	0	0	0	0
O	150	11	0	0	0	0	0	0