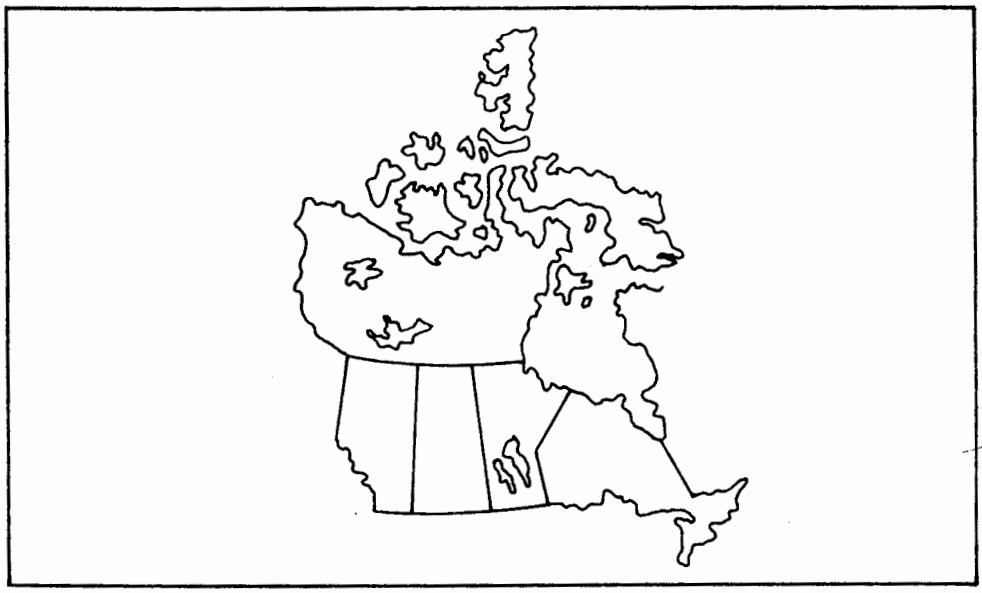
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# The Great Slave Lake Commerical Fishery, Summer, 1973

by
W.A. Bond

Technical Report Series No: CEN/T-74-8

Resource Management Branch
Central Region



DEPARTMENT OF THE ENVIRONMENT

FISHERIES AND MARINE SERVICE

Fisheries Operations Directorate
Central Region

TECHNICAL REPORT SERIES NO. CEN/T-74-8

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Fishery Management Division
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Winnipeg

1974

## ABSTRACT

During summer, 1973, studies were conducted as part of a long range program designed to gather that information considered essential to the proper management of the Great Slave Lake commercial fishery.

Monitoring of the commercial landings at four lake locations resulted in the measurement and weighing of 7,470 whitefish. Age determinations were made on 3,061 of these fish. The mean age of commercial whitefish was 9.6 with age groups 8 - 11 inclusive contributing 76% of the total. Mean weight varied from 2.3 pounds to 2.8 pounds according to sampling site. The total annual mortality rate, based on half-monthly samples varied from 0.46 to 0.79.

Commercial catch data gathered during 1972 and 1973 showed whitefish comprising 37% of the total catch in terms of numbers. The overall catch per unit of effort for whitefish was 26 pounds per net. An estimated 10% of all whitefish caught were culled by the fishermen.

The commercial fishing fleet consisted of 18 fish boats and 56 skiffs operated by 128 fishermen. The total effort expended by the fishery was approximately 74,000 nets. The summer fishery began during the first week of June and finished October 21.

## ACKNOWLEDGEMENTS

The author gratefully acknowledges the cooperation of many commercial fishermen and the staff of the Freshwater Fish Marketing Corporation on Great Slave Lake. Thanks are also due the Fisheries Officers in Hay River and Yellowknife for their assistance.

Mr. T. D. Turnbull, Fishery Technician, directed the field program while Mrs. C. Read did the age determinations and assisted in data compilation. To them I would like to express my sincere appreciation.

Dr. M. C. Healey of Fisheries and Marine Service, Research Directorate, Winnipeg, gave freely of his time both in conversation and in his review of this manuscript. His interest and constructive comments are acknowledged with thanks.

The following served as summer assistants in 1973; Mr. S. Webb, Mr. M. Orr, Mr. R. Brown, Mr. M. Bates, Mr. R. McNeill and Mr. W. Snead.

TABLE OF CONTENTS


| | Page |
|---|---|
| ABSTRACT | ii |
| ACKNOWLEDGEMENTS | iii |
| LIST OF FIGURES | v |
| LIST OF TABLES | vi |
| LIST OF APPENDICES | vii |
| INTRODUCTION | 1 |
| DESCRIPTION OF THE STUDY AREA | 3 |
| MATERIALS AND METHODS | 6 |
| RESULTS AND DISCUSSION | 9 |
| Commercial Production in 1973 | 9 |
| Fishing Effort | 9 |
| Distribution of fishing effort related to weekly landings | 13 |
| Species composition in commercial gill nets | 13 |
| Catch per unit of effort | 17 |
| Cullage by fishermen | 17 |
| Size of commercial whitefish | 20 |
| Age of commercial whitefish | 24 |
| Mortality Rates of whitefish | 27 |
| SUMMARY | 30 |
| RECOMMENDATIONS | 32 |
| LITERATURE CITED | 33 |
| APPENDIX | 35 |

# LIST OF FIGURES


| | | Page |
|---|---|---|
| 1. | Northwestern Canada showing the position of Great Slave Lake ..... | 4 |
| 2. | Map of Great Slave Lake showing major tributary streams plus administrative areas and quotas in effect during 1973 ..... | 5 |
| 3. | Map of Great Slave Lake showing location of fish plants and interview sites ..... | 7 |
| 4. | Number of vessels and weekly whitefish landings for each administrative area ..... | 14 |
| 5. | Length frequency distribution of commercial whitefish from each fish plant, 1973 ..... | 21 |
| 6. | Age composition and mean age of commercial whitefish for each half month period for each fish plant ..... | 26 |

# LIST OF TABLES


| | | Page |
|---|---|---|
| 1. | Total commercial production by species and administrative areas, 1973 ..... | 10 |
| 2. | Production of whitefish and trout from each administrative area for winter and summer seasons, 1973 ..... | 11 |
| 3. | Number of men, boats and gill nets in the summer commercial fishery from 1959 to 1973 ..... | 12 |
| 4. | Species composition of commercial catch and catch per unit of effort for all interviews in 1972 and 1973 ... | 15 |
| 5. | Species composition and catch per unit of effort by area as determined from fishermen interviews in 1972 and 1973 ..... | 16 |
| 6. | Estimated summer fishing effort for Great Slave Lake commercial fishery in 1972 and 1973 in each administrative area ..... | 18 |
| 7. | Whitefish cullage by fishermen on Great Slave Lake related to time nets were in water ..... | 19 |
| 8. | Mean fork lengths of commercial whitefish from each fish plant by half month period ..... | 22 |
| 9. | Mean dressed weights of commercial whitefish from each fish plant by half month period ..... | 23 |
| 10. | Age composition of commercial whitefish from each fish plant in 1973 ..... | 25 |
| 11. | Total annual mortality rates as determined from samples taken at four sampling sites ..... | 28 |
| 12. | Total annual mortality rates as determined from half monthly sub-samples at each sampling site ..... | 29 |

# LIST OF APPENDICES


| | | Page |
|---|---|---|
| 1. | Age composition of commercial whitefish for each half month period at Hay River, 1973 ..... | 35 |
| 2. | Age composition of commercial whitefish for each half month period at Moraine Bay, 1973 ..... | 36 |
| 3. | Age composition of commercial whitefish for each half month period at Wool Bay, 1973 ..... | 37 |
| 4. | Age composition of commercial whitefish for each half month period at Simpson Islands, 1973 ..... | 38 |

(iii) assessment of change in size, growth rate and mortality - especially in whitefish; and

(iv) assessment of the population structure of the various species.

The requirements of the program are met by monitoring the commercial landings, by a system of fishermen interviews and by setting series of experimental gill nets in various parts of the lake. Monitoring of the landings is carried out each year, but interviews and test netting are conducted only in alternate years. This report summarizes the results of work done during 1973.

## DESCRIPTION OF THE STUDY AREA

Great Slave Lake lies in the southwest corner of the District of Mackenzie, Northwest Territories (Fig. 1). It is the fifth largest lake in North America having a surface area of 27,195 $km^2$ and a drainage area of 958,300 $km^2$. Stretching 440 km from its extreme east end to the outlet of the Mackenzie River, the lake straddles two physiographic regions. The northeast shore of the north arm and the east arm lie within the Precambrian shield and have irregular, precipitous margins. The western portion of the lake overlies the alluvial plain known as the Mackenzie lowlands and has few islands and gently sloping shores. The rivers entering the lake from the shield are cold, clear and rapidly flowing while those entering from the south are slow flowing and laden with silt. While the western basin has a maximum depth of about 165 m and a mean depth of 42 m, a depth of 625 m has been recorded in Christie Bay (Fig. 2). Detailed descriptions of the physical and biological characteristics of Great Slave Lake are given by Rawson (1950, 1951, 1953a and 1953b).

A minimum of 25 fish species occur in the lake (Keleher 1972) of which only 5 are of commercial importance. The commercial species include whitefish, *Coregonus clupeaformis* (Mitchill); lake trout, *Salvelinus namaycush* (Walbaum); inconnu, *Stenodus leucichthys* (Pallas); northern pike, *Esox lucius* (Linnaeus) and walleye, *Stizostedion vitreum vitreum* (Mitchill).

For the purpose of the commercial fishery, the lake has been divided into administrative areas. The total quota of 4.985 million pounds (round weight) of whitefish and trout is apportioned among the administrative areas and between the winter and summer seasons (Fig. 2). Although area VI has an annual quota of 400,000 pounds of whitefish and lake trout, a subquota of 100,000 pounds has been placed on the trout. Under this system, all fishing in area VI ceases when the trout subquota is reached, regardless of the whitefish catch.

During its history almost the entire lake has been open to commercial fishing although certain areas have been closed to protect sport and domestic fishing (Sinclair et al., 1967; Fig. 1). Gill nets of 5½" (13.9 cm) stretched measure have been the sole means of exploitation and there has been no restriction on yardage since 1961. The methods used by the fishermen have been described by Kennedy (1956).

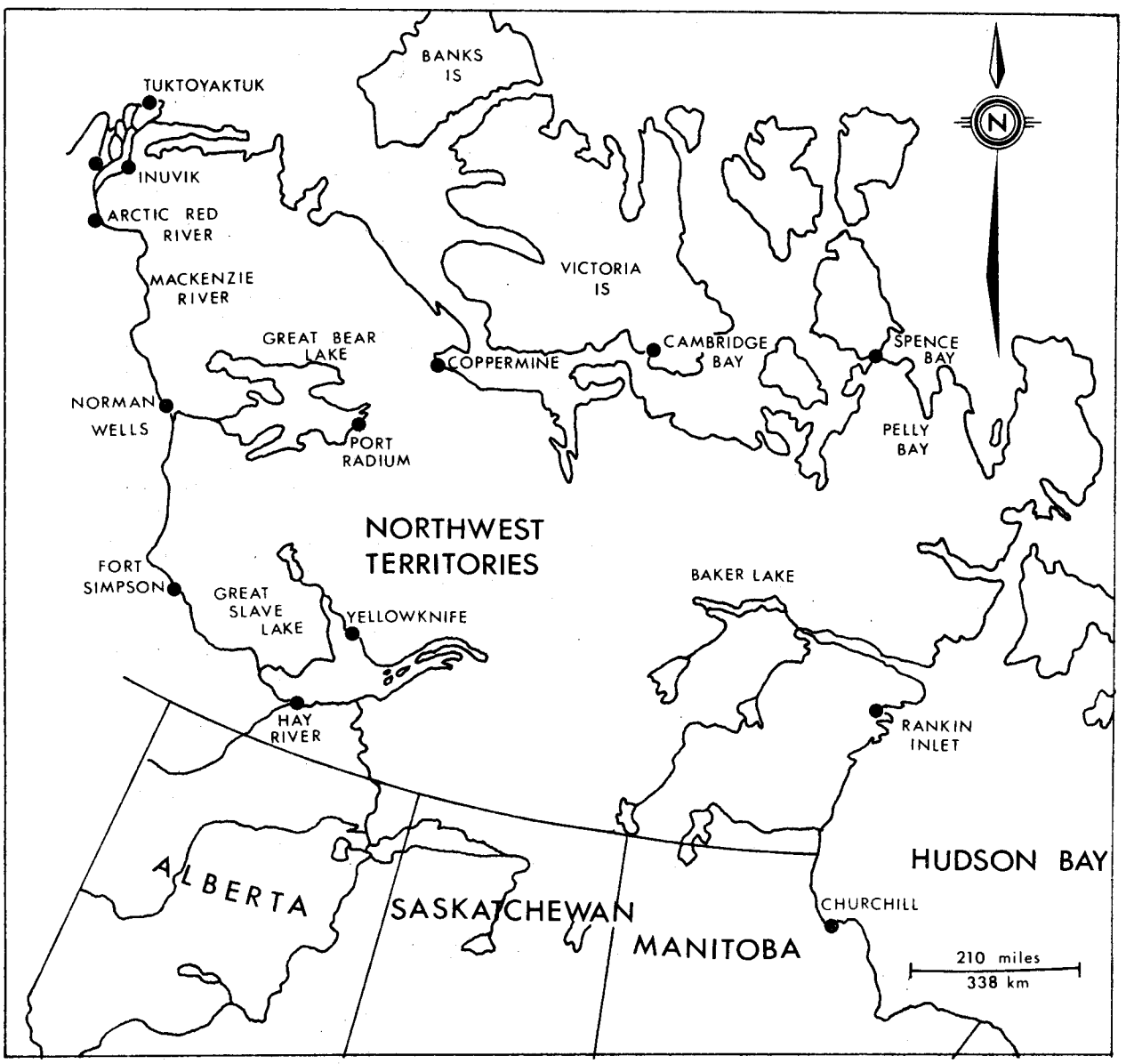



Figure 1. Northwestern Canada showing the position of Great Slave Lake.

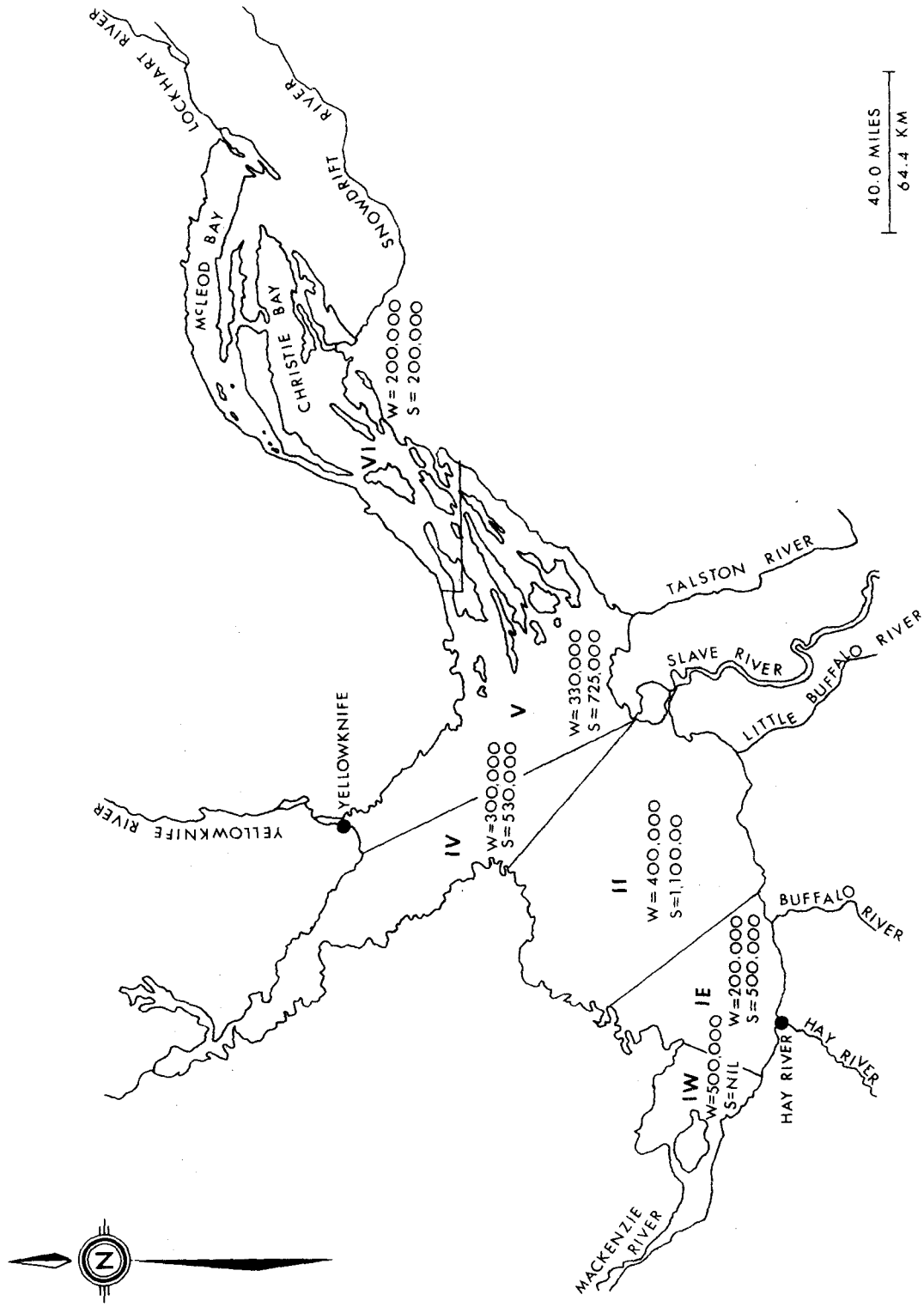



Figure 2. Map of Great Slave Lake showing major tributary streams plus administrative areas and quotas in effect during 1973. (W = winter, S = summer)

## MATERIALS AND METHODS

During 1973, data were collected by sampling whitefish in the commercial landings and by fishermen interviews. From sales slips issued to the fishermen by the Freshwater Fish Marketing Corporation, weekly summaries were compiled of the commercial landings by administrative area. It was also possible from these sales slips to determine which fishermen were fishing in each area and, therefore, how many vessels and how much gill net were involved in making the catch.

### FISH PLANTS

After lifting their nets the fishermen dressed the fish and delivered them to one of the four Freshwater Fish Marketing Corporation plants located on the lake (Fig. 3). Summer assistants stationed at the plants sampled the catch by selecting boxes of fish at random from the landings. In each box selected, all the whitefish were sampled. For each fish, fork length was recorded to the nearest 1.0 mm, dressed weight was determined to the nearest 50 g and a scale sample was obtained for age determination. At each plant approximately 400 whitefish were sampled in each half month period. At Hay River, landings were sampled from June 6 to August 13; at Moraine Bay sampling was done between June 20 and August 13. The Wool Bay plant was sampled from June 25 to August 13 while at Simpson Island sampling occurred between June 24 and August 14.

### FISHERMEN INTERVIEWS

Fishermen interviews were conducted by placing observers aboard the commercial fishing vessels. These observers accompanied the fishermen when they left port in the morning and returned with them at night. During the interview, information was gathered concerning net location, number of nets lifted, depth fished, twine size, mesh depth and length of time the nets had been in the water. As the nets were lifted, a record was kept of the number of fish of each species caught and culled. Where available, a maximum of ten fish of each non-commercial species was retained for sampling. For these fish, length and weight were recorded and either scales or otoliths taken for age determination. Sex was determined by examination of the gonads. The data relevant to non-commercial species will be incorporated into a separate report [Bond MS 1974 (In prep.)]. Interviews were conducted in four areas of the lake as shown in Figure 3.

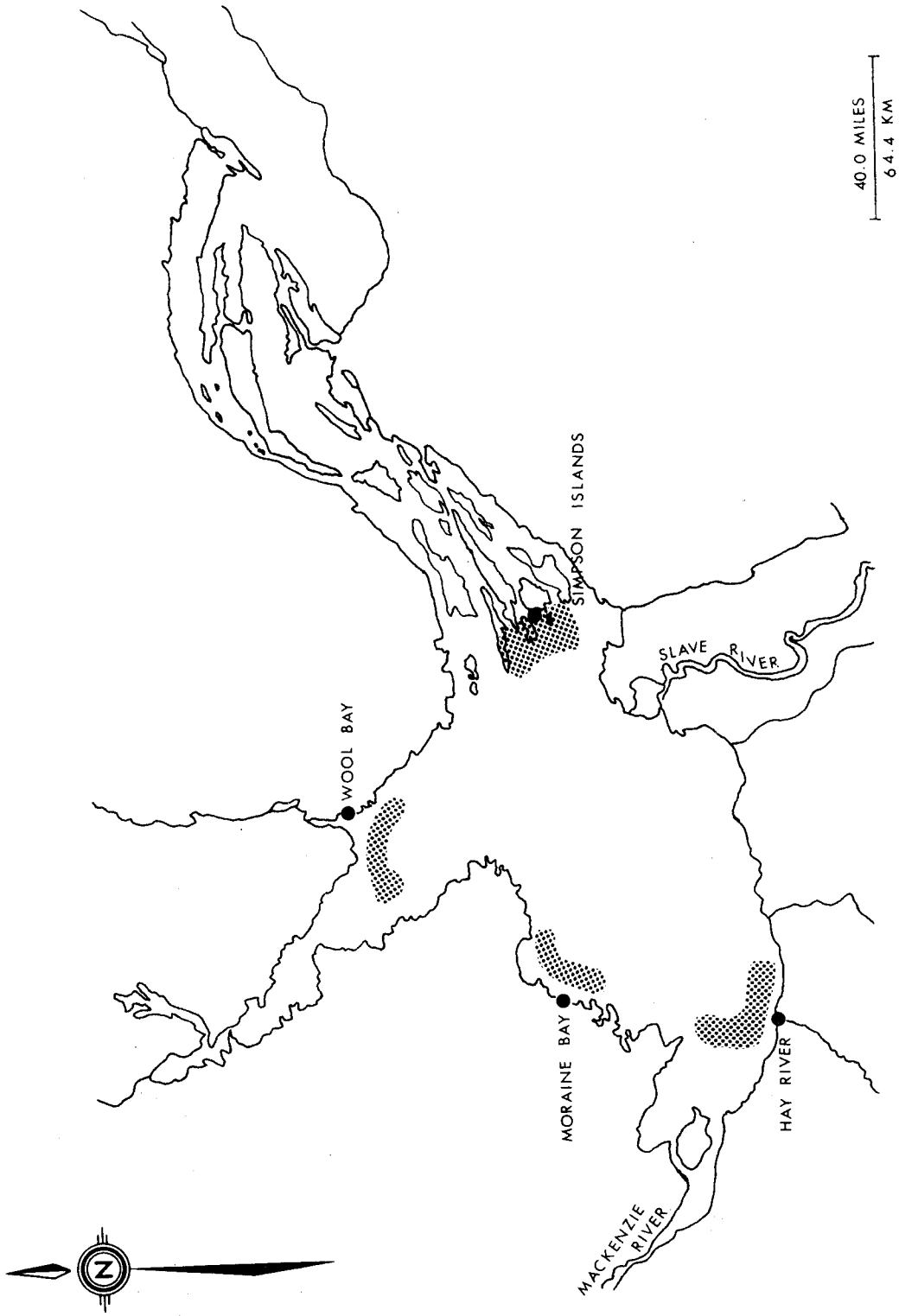



Figure 3. Map of Great Slave Lake showing location of fish plants and interview sites in 1973.

## AGE DETERMINATIONS

Ages of whitefish and ciscoes were determined by counting annuli on the scales. Scales were mounted between two glass slides and the annuli counted on the image produced by a microprojector (Mag. 20x - 50x). The scale age recorded was equal to the number of completed annuli. Thus an age 10 fish was in its eleventh year. For burbot and lake trout, age was determined from otoliths. Otoliths were ground by hand on a carborundum and cleared using a 3:1 mixture of benzyl-benzoate and methyl salicylate. Annual growth zones were counted by examining the cleared otoliths with a dissecting microscope (Mag. 10x - 20x) using reflected light and a black background. Suckers were not aged. Age determinations were made on a minimum of 150 whitefish for each half month period for each fish plant.

# RESULTS AND DISCUSSION

## COMMERCIAL PRODUCTION IN 1973

Commercial production of the five marketable species was 3,022,199 pounds round weight (Table 1). While this represents an increase of 3.3% over 1972, the difference is largely the result of increased production of the three minor species. Inconnu, pike and walleye increased by 31.9%, 73.9% and 144.9% respectively over 1972 to account for 20.1% of total production. Whitefish production, which has been on the decrease, continued to fall. After decreasing by 22.4% from 1971 to 1972, production dropped an additional 5.8% in 1973 to comprise 73.2% of total commercial production. Of possible significance is the fact that whitefish production from area I was the lowest since the area quota was increased in 1963. Landings in area I west were down 32.2% over 1972 while in I east the decrease was 29.5%. In all other administrative areas, whitefish production was up slightly from 1972.

The area VI trout subquota was exceeded by 8,931 pounds and this area was closed to commercial fishing on July 12. Area VI accounted for 53.7% of the total trout production for the whole lake but only 6.9% of total whitefish production.

Of the total whitefish and trout, 76.8% was taken during the summer season (Table 2). The summer fishery accounted for 78.6% of the total whitefish production and 56.4% of the total trout production for the year.

## FISHING EFFORT

From sales slips and from our interviews it was possible to obtain a crude estimate of the effort involved in the summer fishery in terms of numbers of fishing vessels, number of fishermen and quantity of gear.

In 1973 the Great Slave Lake fishing fleet consisted of 18 fish boats and approximately 56 skiffs. These boats are basically as described by Keleher and Saunders (MS 1964). Since skiffs are usually operated by one man and fish boats are usually manned by a crew of about four men, the number of fishermen involved in the fishery was approximately 128. A skiff fisherman may carry from 10 to 40 gill nets but the average is about 15 nets, all of which are usually lifted daily. Fish boats, on the other hand, carry from 60 to 90 nets, with the average being about 80 nets. A fish boat operator usually lifts half his nets each day. Applying average values of 15 nets per skiff and 80 nets per fish boat, it

Table 1. Total commercial production by species and administrative areas, 1973 (pounds round weight).

| Species | Production from each administrative area | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | IW | IE | II | IV | V | VI | |
| Whitefish | 314,496 | 356,283 | 494,909 | 220,039 | 674,619 | 152,194 | 2,212,540 |
| Trout | 7,096 | 19,169 | 5,139 | 449 | 62,018 | 108,931 | 202,802 |
| Pike | 177,594 | 44,741 | 9,743 | 8,119 | 91,406 | 10,358 | 341,961 |
| Inconnu | 36,328 | 138,459 | 2,738 | 614 | 47,382 | 2,569 | 228,090 |
| Walleye | 10,175 | 3,171 | 2,423 | 555 | 20,453 | 29 | 36,806 |
| TOTAL | 545,689 | 561,823 | 514,952 | 229,776 | 895,878 | 274,081 | 3,022,199 |

Table 2. Production of whitefish and trout from each administrative area for winter and summer seasons, 1973 (pounds round weight).

| | Winter | | Summer | | Total | |
|---|---|---|---|---|---|---|
| | Whitefish | Trout | Whitefish | Trout | Whitefish | Trout |
| IW | 314,496 | 7,096 | - | - | 314,496 | 7,096 |
| IE | 11,683 | 212 | 344,600 | 18,957 | 356,283 | 19,169 |
| II | 31,965 | 123 | 462,944 | 5,016 | 494,909 | 5,139 |
| IV | 3,120 | 36 | 216,919 | 413 | 220,039 | 449 |
| V | 30,196 | 228 | 644,423 | 61,790 | 674,619 | 62,018 |
| VI | 81,348 | 80,751 | 70,846 | 28,180 | 152,194 | 108,931 |
| TOTAL | 472,808 | 88,446 | 1,739,732 | 114,356 | 2,212,540 | 202,802 |

Table 3. Number of men, boats and gill nets in the summer commercial fishery from 1959 to 1973 (Number of men in parentheses).

| Year | Number of Skiffs | Number of Fish Boats | Total Number of Men | Number of Nets on Vessels |
|---|---|---|---|---|
| 1959 | 14 (14) | 56 (182) | 196 | 1840 |
| 1960 | 21 (21) | 53 (145) | 166 | 2700 |
| 1961 | 25 (30) | 40 (130) | 160 | 2070 |
| 1962 | 55 (55) | 39 (148) | 203 | 3005 |
| 1963 | 46 (50) | 37 (147) | 197 | 2685 |
| 1964 | 38 (41) | 38 (150) | 191 | 2950 |
| 1965 | 31 (31) | 39 (139) | 170 | 3710 |
| 1966 | 55 (55) | 39 (141) | 196 | 3840 |
| 1967 | 40 (40) | 31 (108) | 148 | 3180 |
| 1968 | 23 (26) | 31 (122) | 148 | - |
| 1969 | 25 (25) | 29 (116) | 141 | 3800 |
| 1970 | 58 (60) | 37 (154) | 214 | 3802 |
| 1971 | 50 (60) | 34 (134) | 194 | 3647 |
| 1972 | 40 (40) | 24 (96) | 136 | 2520 |
| 1973 | 56 (56) | 18 (72) | 128 | 2280 |

was calculated that in 1973 fishing vessels carried an approximate total of 2,280 gill nets (each 100 yards in length). For purposes of comparison, Table 3 shows the number of skiffs, fish boats, men and nets on boats for each year from 1959 to 1973 inclusive. All data shown in Table 3 up to 1971 were obtained from reports submitted by personnel of Fisheries and Marine Service District Office in Hay River. The figures for 1972 were produced in the same way as those already described for 1973.

The important thing of course is how many nets were lifted to account for the total landings and as will be shown later, this number was an estimated 74,000 nets during the 1973 summer season. This degree of effort is considerably greater than that expended in the summer fishery in any year prior to 1954 but is less than that for any year between 1954 and 1964 (Keleher MS 1972).

## DISTRIBUTION OF FISHING VESSELS RELATED TO WEEKLY LANDINGS, SUMMER 1973

Figure 4 shows the number of fish boats and skiffs that sold fish to the F.F.M.C. each week. Also shown are the weekly whitefish landings in thousands of pounds. The data are shown for the whole lake as well as broken down by administrative area. The landings data are accurate and those for individual areas sum to produce the graph for the total lake. The data concerning number of boats as shown by area do not add, however, to produce the graph for the total lake. This discrepancy arises out of the fact that during some weeks, some vessels landed fish from more than one area. A further problem in the data stems from the fact that fishermen at Wool Bay fish in both area IV and area V. Thus the number of boats and the landings shown for area V in Figure 4 represent combined data for Wool Bay and Simpson Islands.

The 1973 commercial fishery began operation during the first week of June and finished on about October 21. However, the fishery was not fully geared up until July 1 and by September 30, the majority of operators had shut down. As a percentage of the total whitefish landings for the summer season monthly landings were: June - 13%, July - 22%, August - 37%, September - 26% and October - 2%.

## SPECIES COMPOSITION IN COMMERCIAL GILL NETS

Interviews in 1973 yielded fish counts from 1,756 commercial gill nets as they were lifted. When these counts are added to those done on 638 nets in 1972 (Bond and Turnbull MS 1973), the results

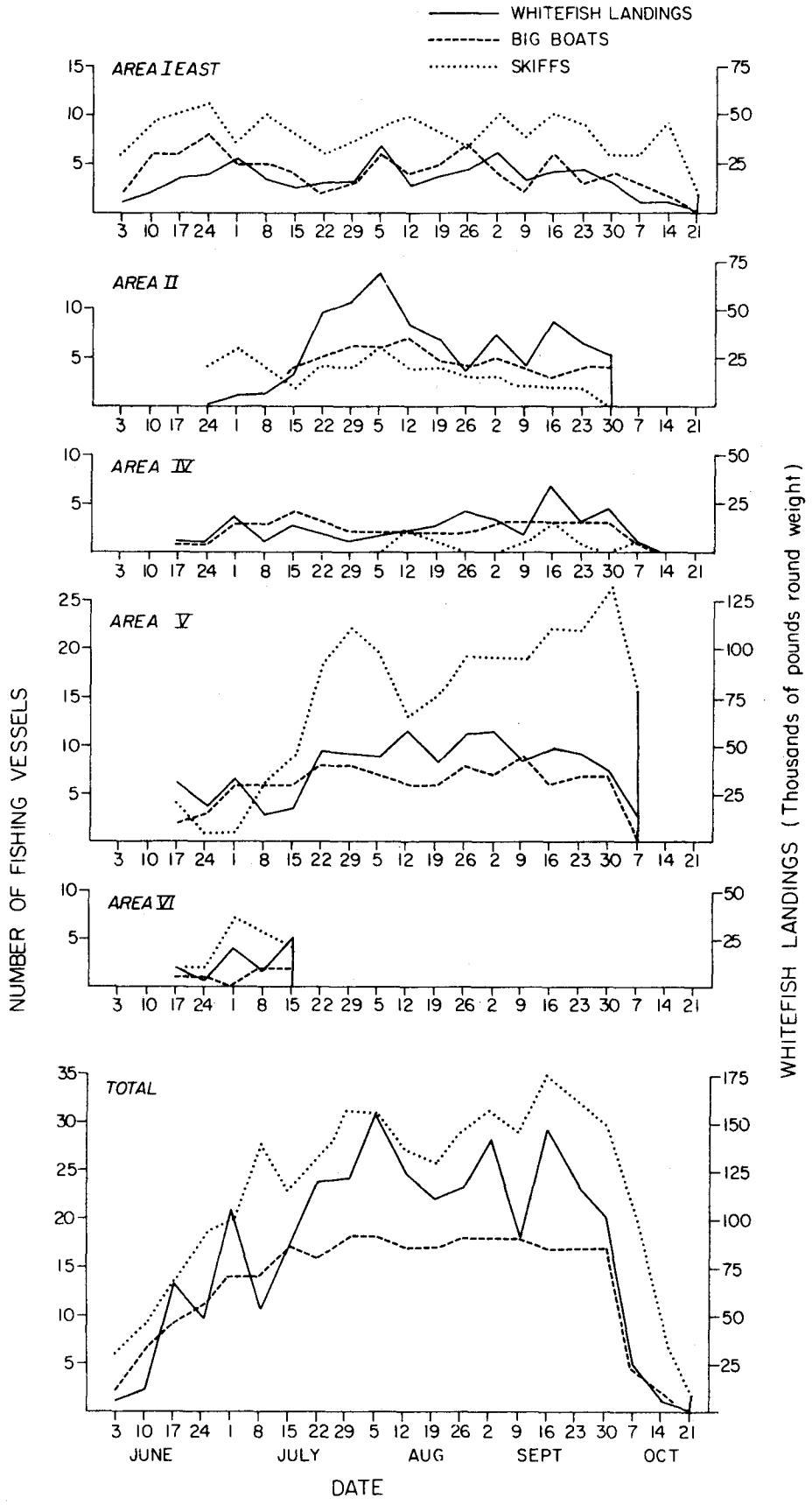



Figure 4. Number of vessels and weekly whitefish landings for each administrative area.

Table 4. Species composition of commercial catch and catch per unit of effort for all interviews in 1972 and 1973*.

| Species | Number of Fish | Percent of Total | Number per net | CPE (pounds per net) |
|---|---|---|---|---|
| Whitefish | 25,555 | 37.3 | 10.7 | 25.7 |
| Cisco | 30,641 | 44.7 | 12.8 | 12.8 |
| Burbot | 6,861 | 10.0 | 2.9 | 10.2 |
| Suckers | 4,756 | 6.9 | 2.0 | 6.0 |
| Inconnu | 320 | 0.5 | 0.1 | + |
| Lake trout | 305 | 0.4 | 0.1 | + |
| Pike | 119 | 0.2 | + | + |
| Walleye | 18 | + | + | + |
| Round whitefish | 3 | + | + | + |
| Grayling | 1 | + | + | + |
| TOTAL | 68,579 | | | |

* For purposes of this report, a unit of effort is 100 yards of 5½" gill net. Catch per unit of effort figures were calculated without regard to the depth of the net or the interval between lifts.

Table 5. Species composition and catch per unit of effort by area as determined from fishermen interviews in 1972 and 1973.

| Species | Area 1E (91,000 yds) (Hay River | | | Area II (47,800 yds) (Moraine Bay) | | | Area IV & V (84,400 yds) (Wool Bay) | | | Area V (16,200 yds) (Simpson Islands) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. of fish | % of total | CPE (pounds per net) | No. of fish | % of total | CPE (pounds per net | No. of fish | % of total | CPE (pounds per net | No. of fish | % of total | CPE (pounds per net |
| Whitefish | 10,951 | 32.3 | 28.9 | 6,244 | 46.6 | 31.4 | 7,007 | 38.1 | 19.9 | 1,353 | 45.6 | 20.0 |
| Cisco | 14,032 | 41.4 | 15.4 | 6,018 | 45.0 | 12.6 | 10,144 | 55.2 | 12.0 | 447 | 15.1 | 2.8 |
| Burbot | 4,233 | 12.5 | 16.3 | 952 | 7.1 | 7.0 | 1,124 | 6.1 | 4.7 | 552 | 18.6 | 11.9 |
| Suckers | 4,029 | 11.9 | 13.3 | 133 | 1.0 | 0.8 | 24 | 0.1 | 0.1 | 570 | 19.2 | 10.6 |
| Trout | 291 | 0.9 | + | 6 | + | + | 8 | + | + | - | - | - |
| Inconnu | 288 | 0.9 | + | 6 | + | + | 7 | + | + | 19 | 0.6 | + |
| Pike | 22 | 0.1 | + | 26 | 0.2 | + | 58 | 0.3 | + | 13 | 0.4 | + |
| Round Whitefish | 3 | + | + | - | - | - | - | - | - | - | - | - |
| Grayling | 1 | + | + | - | - | - | - | - | - | - | - | - |
| Walleye | 4 | + | + | - | - | - | - | - | - | 14 | 0.5 | + |
| TOTAL | 33,854 | - | - | 13,385 | - | - | 18,372 | - | - | 2,968 | - | - |

are as indicated in Table 4. Ciscoes (44.7%) and whitefish (37.3%) dominated the total catch. Burbot and longnose suckers accounted for 10.0% and 6.9% of the catch respectively.

It is interesting that although a total of 68,579 fish were caught in the 2,394 gill nets, only 305 of these were lake trout.

The data in Table 4, when broken down by area (Table 5) provide a fairly representative sample of the commercial catch in four distinct parts of the lake (Fig. 3). Whitefish, ciscoes, burbot and suckers dominated the catch in area I east and area V near Simpson Islands. Burbot were less abundant near Moraine Bay and Wool Bay and very few suckers were taken in the latter two areas.

## CATCH PER UNIT OF EFFORT

The catch per unit of effort (CPE) figures shown in Tables 4 and 5 were calculated using average weights for each species as determined from 1972 data (Bond and Turnbull MS 1973). These values are as follows: whitefish - 2.4 pounds; ciscoes - 1.0 pound; burbot - 3.5 pounds and suckers - 3.0 pounds. CPE was calculated without regard to the number of nights the nets were in the water or to the depth of the nets. However, of 1,327 nets used to determine cullage, 14.2% were lifted after one night; 48.2% after two nights; 25.5% after three nights and 11.0% after four nights.

The highest CPE for whitefish was at Moraine Bay (31.4 pounds) followed closely by Hay River (28.9 pounds). At Wool Bay and Simpson Islands values of 20.0 pounds per net were obtained. In 1972 a CPE of 15.0 pounds of whitefish was obtained near Union Island to the east of Simpson Islands (Bond and Turnbull MS 1973). These CPE values compare very closely with those shown by Keleher (1972) for comparable areas of the lake between 1955 and 1964.

Although catch per unit of effort usually varies throughout a fishing season I have used the above two-year CPE values as average figures in order to determine the total fishing effort required to account for the summer whitefish production for 1972 and 1973. This procedure gives a total estimated summer fishing effort for 1972 and 1973 of 68,666 and 74,457 gill nets respectively (Table 6).

## CULLAGE BY FISHERMEN

The commercial catch (i.e. the total of all fish removed from the nets) usually differs from the quantity of fish which is

Table 6. Estimated summer fishing effort for Great Slave Lake commercial fishery in 1972 and 1973 in each administrative area.

| Area | Two-year CPE (pounds per net) | 1972 Whitefish Landings (pounds) | 1972 Effort (Number of nets) | 1973 Whitefish Landings (pounds) | 1973 Effort (Number of nets) |
|---|---|---|---|---|---|
| I East | 28.9 | 382,359 | 13,230 | 344,600 | 11,924 |
| II | 31.4 | 341,331 | 10,870 | 462,944 | 14,743 |
| IV | 20.0 | 180,478 | 9,024 | 216,919 | 10,846 |
| V | 20.0 | 605,499 | 30,275 | 644,423 | 32,221 |
| VI | 15.0 | 79,003 | 5,267 | 70,846 | 4,723 |
| TOTAL | | 1,588,670 | 68,666 | 1,739,732 | 74,457 |

Table 7. Whitefish cullage by fishermen on Great Slave Lake related to time nets were in water.

| Nights down | Nets counted | No. Whitefish caught | No. Whitefish culled | % Whitefish culled |
|---|---|---|---|---|
| 1 | 189 | 1,215 | 38 | 3.1 |
| 2 | 640 | 7,207 | 375 | 5.2 |
| 3 | 338 | 4,258 | 295 | 6.9 |
| 4 | 146 | 3,181 | 216 | 6.8 |
| 5 | 6 | 38 | 19 | 50.0 |
| 6 | - | - | - | - |
| 7 | - | - | - | - |
| 8 | 8 | 1,187 | 773 | 65.4 |
| TOTAL | 1,327 | 17,086 | 1,716 | 10.0 |

delivered to the fish plants (i.e. the commercial landings). This difference exists because some fish in the catch are considered to be unmarketable, either by virtue of their small size or their poor condition, and are discarded (culled) by the fishermen. In the case of whitefish most culled fish are dead and, therefore, removed from the stock. As such it is important to have an estimate of the extent of cullage so that the total commercial catch is known.

During 1972 and 1973, 2,394 commercial gill nets were censused during fishermen interviews. Reliable cullage estimates, however, were obtained from only 1,327 nets. In some cases the investigator forgot to enter the culls on his summary sheet while in others he simply failed to count them. The cullage data obtained from 1,327 nets are summarized in Table 7. Of a total of 17,086 whitefish caught, 10% were culled. For a large percentage of the nets (99%) cullage was considerably less than this, being only 6% for nets left for four nights or less. However, accidents do occur so the actual figure is likely close to 10% of the total number of whitefish caught. In converting these numbers to biomass, it is necessary to consider that culled fish are generally smaller than the average. Most fishermen are reluctant to discard a fish which the buyer might (by accident) accept. Thus the majority of fish culled by fishermen are undersized specimens which they know have no chance of being accepted.

If culled whitefish average from 1.5 to 2.0 pounds, then cullage of 10% of the total number of whitefish caught would represent from 6.3% to 8.4% of the total weight of the catch. Applying these values to the whitefish landings for the 1973 summer fishery produces cullage estimates of from 116,972 to 159,539 pounds of whitefish (round weight). Thus, while the commercial landings for whitefish were given as being 1,739,732 pounds, the actual total catch was between 1,856,704 and 1,899,271 pounds, round weight.

## SIZE OF COMMERCIAL WHITEFISH

A total of 7,470 commercial whitefish were measured and weighed. Length frequency diagrams for the samples from each fish plant are shown in Figure 5. The pattern was similar to that described in 1972 (Bond and Turnbull MS 1973). While the range in fork length was from about 300 to about 600 mm, 77.6% of the total sample were between 380 and 450 mm and only 10.3% were shorter than 380 mm.

For the samples from each fish plant, mean fork lengths and mean dressed weights were calculated for each half month period

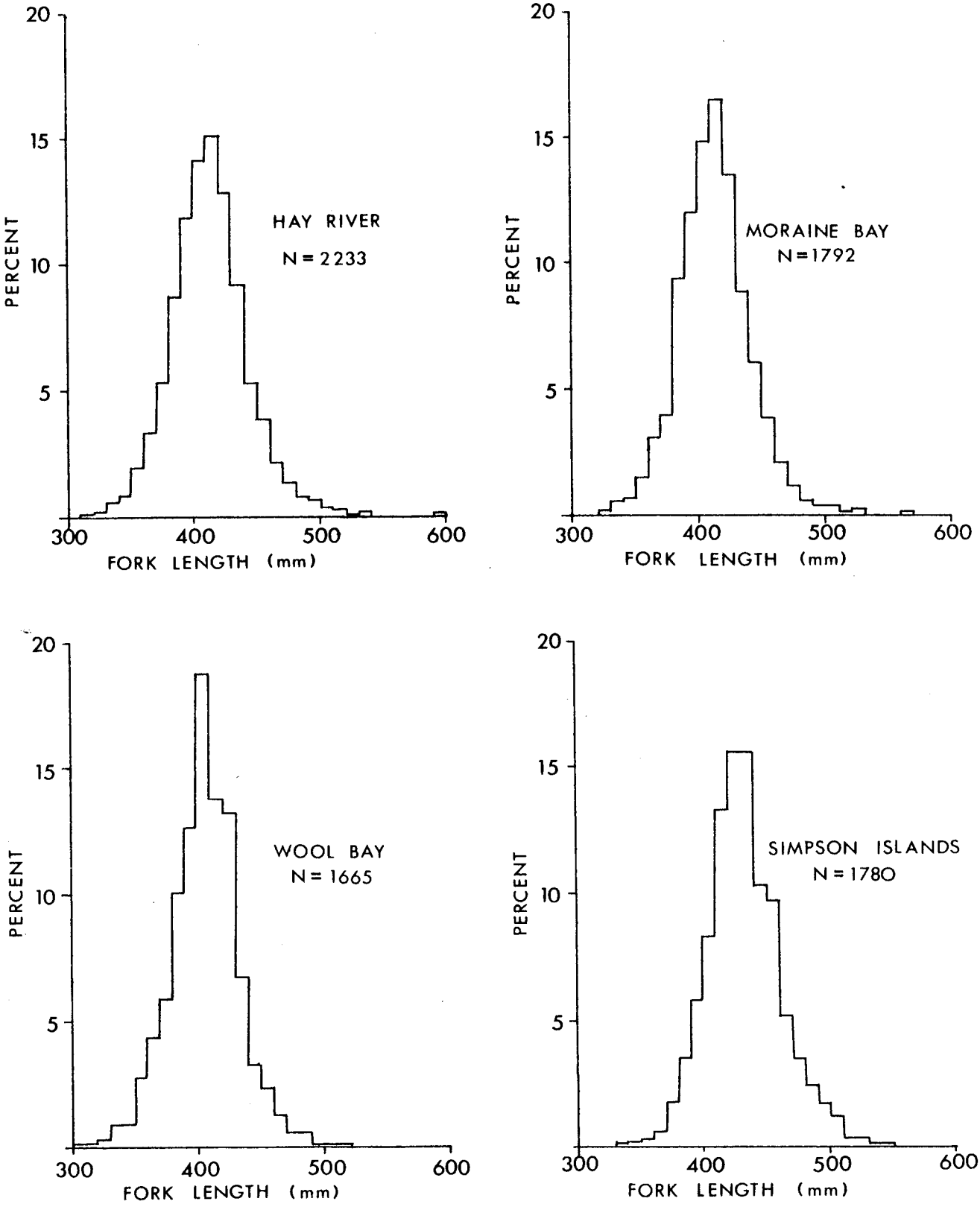



Figure 5. Length frequency distribution of commercial whitefish from each fish plant, 1973.

Table 8. Mean fork lengths of commercial whitefish from each fish plant by half-month period.

| | June 1-15 | June 16-30 | July 1-15 | July 16-31 | Aug 1-15 | Total |
|---|---|---|---|---|---|---|
| Hay River | | | | | | |
| Mean fork length (mm) | 401.40 | 405.67 | 409.65 | 423.39 | 415.51 | 412.26 |
| Standard deviation | 40.62 | 30.48 | 25.25 | 33.00 | 31.68 | - |
| Standard error | 2.03 | 1.52 | 1.27 | 1.36 | 1.51 | - |
| Number of fish | 399 | 400 | 400 | 590 | 444 | 2233 |
| Moraine Bay | | | | | | |
| Mean fork length (mm) | - | 405.15 | 407.10 | 417.97 | 419.13 | 412.14 |
| Standard deviation | - | 24.83 | 25.69 | 30.11 | 31.09 | - |
| Standard error | - | 1.24 | 1.12 | 1.39 | 1.56 | - |
| Number of fish | - | 400 | 523 | 472 | 397 | 1792 |
| Wool Bay | | | | | | |
| Mean fork length (mm) | - | 387.38 | 400.77 | 410.95 | 407.94 | 404.85 |
| Standard deviation | - | 24.09 | 24.25 | 27.13 | 26.96 | - |
| Standard error | - | 1.72 | 1.22 | 1.11 | 1.25 | - |
| Number of fish | - | 199 | 399 | 600 | 467 | 1665 |
| Simpson Island | | | | | | |
| Mean fork length (mm) | | 440.77 | 436.89 | 423.85 | 425.83 | 431.03 |
| Standard deviation | | 27.36 | 29.48 | 27.93 | 26.92 | - |
| Standard error | | 1.45 | 1.40 | 1.24 | 1.24 | - |
| Number of fish | | 359 | 442 | 505 | 474 | 1780 |

Table 9. Mean dressed weights of commercial whitefish from each fish plant by half-month period.

| | June 1-15 | June 16-30 | July 1-15 | July 16-31 | Aug 1-15 | Total |
|---|---|---|---|---|---|---|
| Hay River | | | | | | |
| Mean dressed weight (g) | 866.74 | 928.63 | 919.77 | 1022.33 | 976.87 | 952.12 |
| Standard deviation | 164.30 | 203.78 | 184.34 | 229.30 | 226.96 | - |
| Standard error | 8.23 | 10.19 | 9.25 | 9.44 | 10.78 | - |
| Number of fish | 399 | 400 | 400 | 590 | 444 | 2233 |
| Moraine Bay | | | | | | |
| Mean dressed weight (g) | - | 874.26 | 891.95 | 999.89 | 1067.85 | 937.52 |
| Standard deviation | - | 156.04 | 166.23 | 233.76 | 254.74 | - |
| Standard error | - | 7.80 | 7.28 | 10.78 | 12.74 | - |
| Number of fish | - | 400 | 523 | 472 | 367 | 1792 |
| Wool Bay | | | | | | |
| Mean dressed weight (g) | - | 797.96 | 886.93 | 931.15 | 937.51 | 906.42 |
| Standard deviation | - | 142.49 | 160.89 | 199.20 | 186.20 | - |
| Standard error | - | 10.18 | 8.06 | 8.15 | 8.63 | - |
| Number of fish | - | 199 | 399 | 600 | 467 | 1655 |
| Simpson Islands | | | | | | |
| Mean dressed weight (g) | | 1119.80 | 1139.92 | 1050.02 | 1000.54 | 1073.24 |
| Standard deviation | | 231.80 | 234.04 | 420.59 | 197.55 | - |
| Standard error | | 12.25 | 11.13 | 18.73 | 9.06 | - |
| Number of fish | | 359 | 442 | 505 | 474 | 1780 |

(Tables 8 and 9). Whitefish from Wool Bay were consistently smaller than those from other areas both in length and weight. The largest fish were those landed at Simpson Islands. At Hay River, Moraine Bay and Wool Bay, whitefish tended to increase in mean size as the summer progressed. At Simpson Islands, on the other hand, the reverse was true. This is probably because between June 16 and July 15, many of the whitefish delivered to the Simpson Islands plant were being caught in area VI, a relatively lightly exploited area. This area was closed to commercial fishing on July 12. Subsequent to this date, all whitefish delivered to the plant had been taken in area V.

The dressed weights shown in Table 9 may be converted to round weights by multiplying by 1.173 (Keleher MS 1964). When this is done the mean round weights (in pounds) for each fish plant are as follows: Hay River - 2.5; Moraine Bay - 2.4; Wool Bay - 2.3 and Simpson Islands - 2.8. These weights are consistent with those reported from comparable areas of the lake in the early 1960's (Keleher 1972).

## AGE OF COMMERCIAL WHITEFISH

Age determinations were made on 3,061 commercial whitefish. The mean age for the entire sample was 9.6 years while the means for the samples at each plant varied from 8.6 years at Moraine Bay to 10.8 at Simpson Islands. Considering the sample as a whole (Table 10) the fishery relied most heavily on four age groups (8 to 11 inclusive) with age 9 fish being the most abundant. Only 14.8% of the total were age 12 or older.

The age composition of commercial whitefish varied from one fish plant to another (Table 10). At Hay River and Wool Bay age 9 was the most common age while age groups 8 to 11 inclusive made up 83.4% and 80.5% of the sample respectively. Age 9 fish were also the most abundant in the Moraine Bay sample but here 86.5% of the total consisted of age groups 7 to 10 inclusive. Whitefish from the Simpson Islands plant were considerably older than those from the other stations and age groups 9 to 13 inclusive made up 82.2% of the sample.

Figure 6 shows the age composition and mean age of commercial whitefish sampled at each fish plant by half month periods. The data on which figure 6 is based are presented in Appendices 1-4. In The Hay River sample the age composition and mean age remained remarkably constant throughout the summer. In all periods, age 9 fish were the most abundant although age 8 fish were equally abundant during the last half of July.

Table 10. Age composition of commercial whitefish from each fish plant in 1973.

| Age Group | Hay River | | Moraine Bay | | Wool Bay | | Simpson Islands | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % | Number | % | Number | % |
| 5 | - | - | 4 | 0.6 | 1 | 0.1 | | | 5 | 0.2 |
| 6 | 7 | 0.7 | 32 | 4.5 | 10 | 1.5 | 2 | 0.3 | 51 | 1.7 |
| 7 | 36 | 3.7 | 109 | 15.5 | 48 | 7.1 | 28 | 4.0 | 221 | 7.2 |
| 8 | 159 | 16.3 | 190 | 27.0 | 121 | 18.0 | 38 | 5.4 | 508 | 16.6 |
| 9 | 303 | 31.0 | 227 | 32.2 | 173 | 25.7 | 115 | 16.3 | 818 | 26.7 |
| 10 | 217 | 22.2 | 83 | 11.8 | 151 | 22.5 | 149 | 21.1 | 600 | 19.6 |
| 11 | 136 | 13.9 | 38 | 5.4 | 96 | 14.3 | 134 | 19.0 | 404 | 13.2 |
| 12 | 80 | 8.2 | 15 | 2.1 | 49 | 7.3 | 110 | 15.6 | 254 | 8.3 |
| 13 | 24 | 2.5 | 4 | 0.6 | 14 | 2.1 | 72 | 10.2 | 114 | 3.7 |
| 14 | 11 | 1.1 | 2 | 0.3 | 8 | 1.2 | 38 | 5.4 | 59 | 1.9 |
| 15 | 4 | 0.4 | - | - | 1 | 0.1 | 14 | 2.0 | 19 | 0.6 |
| 16 | 1 | 0.1 | - | - | - | - | 7 | 1.0 | 8 | 0.3 |
| TOTAL | 978 | | 704 | | 672 | | 707 | | 3061 | |
| Mean age | 9.7 | | 8.6 | | 9.5 | | 10.8 | | 9.6 | |

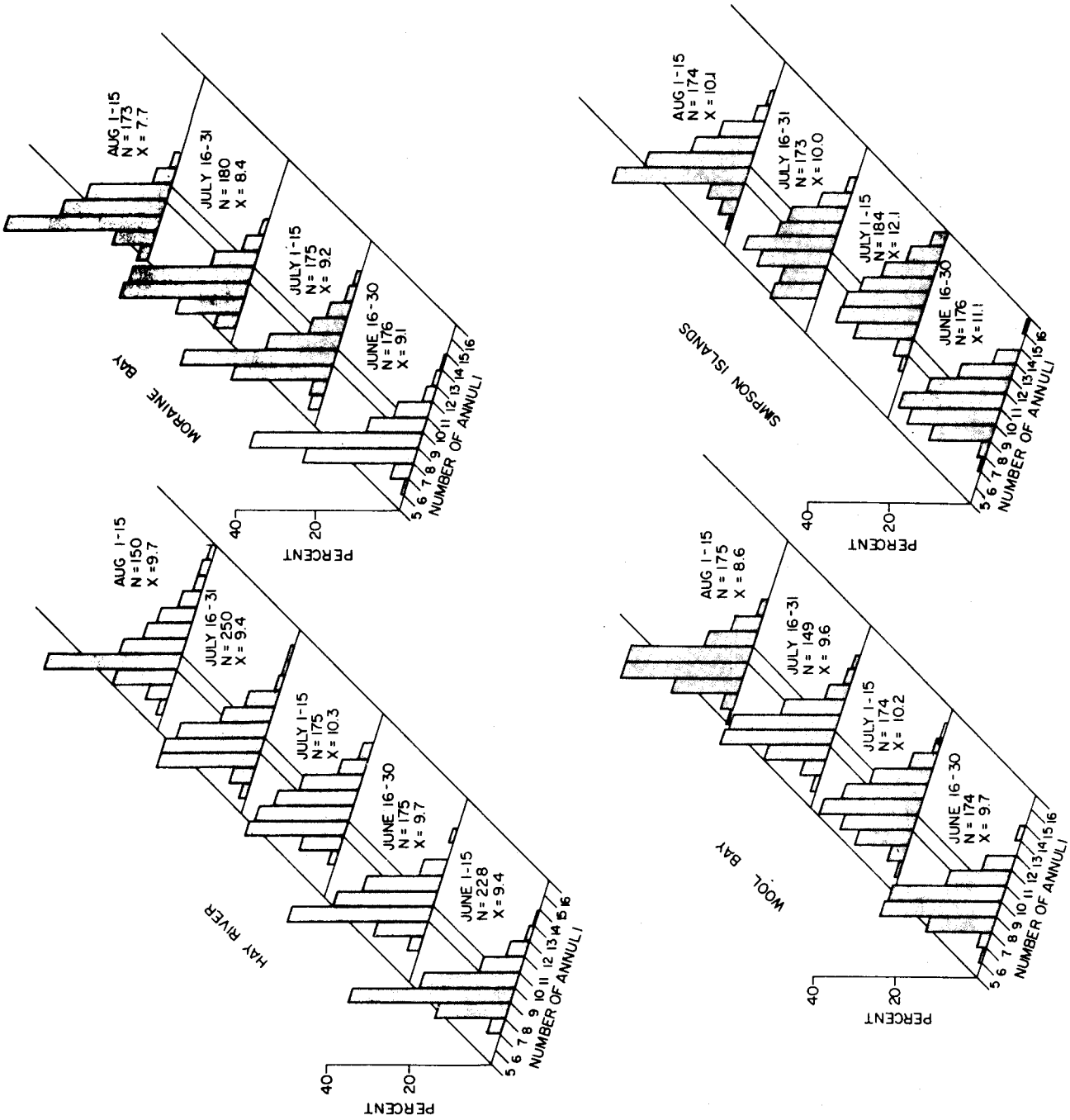



Figure 6. Age composition and mean age of commercial whitefish for each half month period for each fish plant.

As mentioned previously, many Simpson Islands fish came from area VI during the first two time periods but thereafter all fish delivered to this plant were taken in the more heavily fished area V. This change was reflected in the size of whitefish in the sample (Tables 8 and 9) and a similar picture obtained with respect to age composition. Prior to July 15, the mean age of Simpson Islands whitefish was 11.6 while after July 15 the mean age was 10.0 years.

At Moraine Bay the age composition and mean age were similar for the first two time periods. In both cases the bulk of the sample consisted of 8 and 9 year olds, the mean age was 9.2 and there was good representation from ages 10 ro 14 inclusive. After mid-July, fish of age 10 and older began to disappear from the sample and there was a trend toward dependence on younger age groups, the mean age being 7.7 years during the first half of August. A similar picture appears to have been developing at Wool Bay in last time period.

A decrease of this magnitude in the mean age in such a short period of time seems rather startling. Certainly the decrease results from the recruitment of 6 and 7 year old fish into the fishery beginning in late July combined with a reduction in the abundance of age 9 and older fish. However, whether this reduced abundance of older fish is the result of their removal by the fishery or of their migration out of the area is a matter of speculation and one that should be carefully watched.

## MORTALITY RATES OF WHITEFISH

Total annual mortality estimates for whitefish were made by applying Ricker's (1958) methods to the age composition data for each fish plant (Table 10). These estimates and the age groups used in the calculations are shown in Table 11.

These figures seem to indicate a higher mortality rate at Hay River. However, differences of this magnitude can easily result from normal variation and are not considered important. If the Hay River mortality estimate is recalculated to include 11 year old fish, then the value drops from .66 to .53.

It was pointed out by Kennedy (1953) that considerable variation in mortality rate may be found among subsamples taken at different times during the same year at any given sampling station. Kennedy did not elaborate on this matter, however, and gave no indication of the degree of variability that might be expected.

Table 11. Total annual mortality rates as determined from samples taken at four sampling sites.

| Location | Age Groups Used in Mortality Calculations | Estimated Total Annual Mortality Rate |
|---|---|---|
| Hay River | 12 - 16 | 0.66 |
| Moraine Bay | 10 - 14 | 0.58 |
| Wool Bay | 11 - 15 | 0.57 |
| Simpson Islands | 13 - 16 | 0.52 |

To examine this matter in more detail I calculated mortality rates for each half-monthly subsample for each fish plant. The data used in these calculations are those used in constructing Figure 6 (Appendices 1-4). As before, Ricker's technique was employed. The results of the calculations are shown in Table 12. Mortality rates varied from .46 during the first half of July at Simpson Islands to .79 during the first half of August at Moraine Bay. For the most part, however, the mortality rates calculated from half-monthly subsamples fell between .52 and .65.

Table 12. Total annual mortality rates as determined from half-monthly sub-samples at each sampling site.

| Location | Time Period | Age Groups Used In Mortality Calculations | Estimated Total Annual Mortality Rate |
|---|---|---|---|
| HAY RIVER | June 1 - 15 | 11 - 14 | 0.59 |
| | June 16 - 30 | 11 - 14 | 0.70 |
| | July 1 - 15 | 12 - 14 | 0.58 |
| | July 16 - 31 | 11 - 15 | 0.53 |
| | Aug. 1 - 15 | 12 - 16 | 0.52 |
| MORAINE BAY | June 16 - 30 | 10 - 14 | 0.52 |
| | July 1 - 15 | 10 - 14 | 0.54 |
| | July 16 - 31 | 10 - 12 | 0.65 |
| | Aug. 1 - 15 | 9 - 11 | 0.79 |
| WOOL BAY | June 16 - 30 | 11 - 14 | 0.60 |
| | July 1 - 15 | 12 - 15 | 0.61 |
| | July 16 - 31 | 11 - 14 | 0.59 |
| | Aug. 1 - 15 | 9 - 12 | 0.58 |
| SIMPSON ISLANDS | June 16 - 30 | 13 - 16 | 0.69 |
| | July 1 - 15 | 14 - 16 | 0.46 |
| | July 16 - 31 | 12 - 14 | 0.53 |
| | Aug. 1 - 15 | 12 - 14 | 0.68 |

## SUMMARY


1. During 1973, the Great Slave Lake fishing fleet consisted of 18 fish boats and approximately 56 skiffs.

2. Approximately 128 fishermen participated in the summer fishery.

3. The estimated total fishing effort for the 1973 summer fishery was 74,457 gill nets.

4. The summer fishery began about June 1 and continued until October 21. However, 85% of the whitefish landings were made during July (22%), August (37%) and September (26%).

5. Four species viz. ciscoes (44.7%), whitefish (37.3%), Burbot (10.0%) and longnose suckers (6.9%) dominated the commercial catch in terms of numbers although their relative abundance varies between different areas of the lake.

6. Based on 2,394 commercial gill nets assessed during 1972 and 1973, the overall catch per unit of effort in the commercial fishery was 25.7 pounds of whitefish. Values varied from 31.4 pounds per net at Moraine Bay to 20.0 pounds per net at Wool Bay and Simpson Islands.

7. Based on 1,327 nets, it was estimated that 10% of all whitefish caught in commercial gill nets are culled by the fishermen. This amounts to between 6.3% and 8.4% of the total mass of the catch. Thus, during the 1973 commercial fishery, it is estimated that cullage by fishermen was between 116,972 and 159,539 pounds of whitefish.

8. In 1973, sampling at the fish plants resulted in the measurement and weighing of 7,470 commercial whitefish. Age determinations were made on 3,061 of these fish.

9. Commercial whitefish ranged in fork length from about 300 mm to 600 mm although 77.6% of the total were between 380 mm and 450 mm in length. Only 10.3% were shorter than 380 mm.

10. The mean round weight of whitefish was 2.5 pounds at Hay River; 2.4 pounds at Moraine Bay; 2.3 pounds at Wool Bay and 2.8 pounds at Simpson Islands.

11. The mean age of commercial whitefish was 9.6 years. The range in age was from 5 to 16 years with four age groups (8 - 11 inclusive) accounting for 76.1% of the total catch. Age 9 was the most abundant age group, contributing 26.7% of the total number.

12. The age composition of commercial whitefish varied between areas and through the summer within areas. The most drastic change occurred at Moraine Bay where the mean age decreased from 9.2 in June to 7.7 in August.

13. Annual mortality rates, based on commercial whitefish were 0.52 at Simpson Islands; 0.57 at Wool Bay; 0.58 at Moraine Bay and 0.66 at Hay River.

14. There may be some cause for concern in the Moraine Bay area where, based on half monthly sub-samples, the mortality rate for whitefish increased from 0.52 in June to 0.79 in August.

# RECOMMENDATIONS

1. Information on the size and age composition of fish landed is basic to the effective management of any commercial fishery. It is recommended, therefore, that monitoring of the fish plants on Great Slave Lake be carried out annually.

2. In 1973, whitefish production from area I was far below normal. In area II, the age structure and mortality rate changed considerably during the summer. It is recommended, therefore, that the test netting program scheduled for 1974 concentrate on these areas.

3. At the present time more than 60 per cent of all fish captured in commercial gill nets are rough fish - burbot, suckers and ciscoes, which are discarded by the fishermen. While these fish are of no immediate commercial value, the Freshwater Fish Marketing Corporation has indicated that they are likely to become commercially important in the near future. If such is to be the case, we will require more information on the biology and potential productivity of these stocks than is currently available.

   It is recommended, therefore, that a study be initiated to investigate the extent, distribution and potential productivity of these rough fish stocks in Great Slave Lake.

4. It is recommended that consideration be given to a whitefish spawning study involving the installation of a counting fence on a suitable stream entering the south side of Great Slave Lake.

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Appendix 1. Age composition of commercial whitefish for each half month period at Hay River, 1973.

| Age Group | June 1-15 | June 16-30 | July 1-15 | July 16-31 | Aug. 1-15 | Total |
|---|---|---|---|---|---|---|
| 5 | - | - | - | - | - | - |
| 6 | - | - | - | 4 | 3 | 7 |
| 7 | 7 | 5 | 3 | 13 | 8 | 36 |
| 8 | 39 | 22 | 16 | 60 | 22 | 159 |
| 9 | 90 | 60 | 43 | 60 | 50 | 303 |
| 10 | 54 | 43 | 40 | 56 | 24 | 217 |
| 11 | 23 | 32 | 33 | 31 | 17 | 136 |
| 12 | 11 | 11 | 25 | 19 | 14 | 80 |
| 13 | 3 | - | 11 | 3 | 7 | 24 |
| 14 | 1 | 2 | 4 | 2 | 2 | 11 |
| 15 | - | - | - | 2 | 2 | 4 |
| 16 | - | - | - | - | 1 | 1 |
| Total | 228 | 175 | 175 | 250 | 150 | 978 |
| Mean age | 9.4 | 9.7 | 10.3 | 9.4 | 9.7 | 9.7 |

Appendix 2. Age composition of commercial whitefish for each half month period at Moraine Bay, 1973.

| Age Group | June 1-15 | June 16-30 | July 1-15 | July 16-31 | Aug. 1-15 | Total |
|---|---|---|---|---|---|---|
| 5 | | - | - | - | 4 | 4 |
| 6 | | 1 | 5 | 9 | 17 | 32 |
| 7 | | 8 | 6 | 30 | 65 | 109 |
| 8 | NO | 49 | 42 | 56 | 43 | 190 |
| 9 | | 73 | 65 | 54 | 35 | 227 |
| 10 | | 24 | 31 | 21 | 7 | 83 |
| 11 | | 14 | 14 | 8 | 2 | 38 |
| 12 | SAMPLES | 4 | 9 | 2 | - | 15 |
| 13 | | 2 | 2 | - | - | 4 |
| 14 | | 1 | 1 | - | - | 2 |
| 15 | | | | | | |
| 16 | | | | | | |
| Total | | 176 | 175 | 180 | 173 | 704 |
| Mean age | | 9.1 | 9.2 | 8.4 | 7.7 | 8.6 |

Appendix 3. Age composition of commercial whitefish for each half month period at Wool Bay, 1973.

| Age Group | June 1-15 | June 16-30 | July 1-15 | July 16-31 | Aug. 1-15 | Total |
|---|---|---|---|---|---|---|
| 5 | | - | - | - | 1 | 1 |
| 6 | | 1 | 2 | 2 | 5 | 10 |
| 7 | | 4 | 7 | 8 | 29 | 48 |
| 8 | NO | 29 | 18 | 22 | 52 | 121 |
| 9 | | 49 | 31 | 41 | 52 | 173 |
| 10 | | 48 | 42 | 40 | 21 | 151 |
| 11 | | 27 | 35 | 22 | 12 | 96 |
| 12 | SAMPLES | 13 | 24 | 9 | 3 | 49 |
| 13 | | - | 11 | 3 | - | 14 |
| 14 | | 3 | 3 | 2 | - | 8 |
| 15 | | - | 1 | - | - | 1 |
| 16 | | - | - | - | - | - |
| Total | | 174 | 174 | 149 | 175 | 672 |
| Mean age | | 9.7 | 10.2 | 9.6 | 8.6 | 9.5 |

# INTRODUCTION

The commercial exploitation of the fish stocks of Great Slave Lake began in 1945 after a survey by Rawson (1947) indicated that a commercial fishery was feasible. In the first three years of operation the fishery expanded slowly, annual production averaging 1.3 million pounds of whitefish and 1.5 million pounds of lake trout. During the late 1940's and early 1950's, however, the fishery underwent a period of rapid growth as the fishermen took advantage of the large accumulated stock. The decade 1948 to 1957 inclusive saw the fishery produce an annual average of 4.4 million pounds of whitefish and 2.7 million pounds of trout. By the mid-1950's the accumulated stock had been largely removed and it was recognized by Scott (MS 1956) that the fishery was over-exploiting some of the lake trout populations.

While commercial production of both species has decreased since the 1950's, the whitefish and lake trout populations have reacted differently to exploitation. The whitefish have reacted in the classic manner of exploited fish populations by increased growth rate and reduced age of maturity. It is felt that the whitefish populations are not being over-exploited at the present time (Bond and Turnbull MS 1973). The lake trout, on the other hand, have been unable to withstand commercial gill netting and have been reduced to the point of commercial extinction in the western part of the lake. There are indications that this process of elimination is progressing eastward (Bond and Turnbull MS 1973).

Because the east end of Great Slave Lake supports a substantial lake trout sport fishery that warrants protection, Fisheries and Marine Service has adopted the position that the east end of the lake should be closed to commercial fishing within two years and managed for lake trout. The west end of the lake is to be exploited by the commercial fishery and managed for whitefish production without regard to trout.

In 1971, Fisheries and Marine Service embarked upon a long term program designed to gather that information deemed essential to the efficient management of the commercial fishery and consistent with the recommendations of the Great Slave Lake Working Party (1969). This work involves:

(i) maintaining a record of the total commercial landings by species, by weight and by administrative area;

(ii) assessment of the catch per unit of effort, cullage and change in abundance of all species through adequate sampling of individual nets as hauled;

Appendix 4. Age composition of commercial whitefish for each half month period at Simpson Islands, 1973.

| Age Group | June 1-15 | June 16-30 | July 1-15 | July 16-31 | Aug. 1-15 | Total |
|---|---|---|---|---|---|---|
| 5 | | - | - | - | - | - |
| 6 | | - | - | - | 2 | 2 |
| 7 | | 1 | - | 20 | 7 | 28 |
| 8 | NO | 3 | 2 | 19 | 14 | 38 |
| 9 | | 22 | 7 | 30 | 56 | 115 |
| 10 | | 39 | 27 | 38 | 45 | 149 |
| 11 | | 44 | 38 | 26 | 26 | 134 |
| 12 | SAMPLES | 34 | 36 | 23 | 17 | 110 |
| 13 | | 23 | 31 | 13 | 5 | 72 |
| 14 | | 9 | 23 | 4 | 2 | 38 |
| 15 | | - | 14 | - | - | 14 |
| 16 | | 1 | 6 | - | - | 7 |
| Total | | 176 | 184 | 173 | 174 | 707 |
| Mean age | | 11.1 | 12.1 | 10.0 | 10.1 | 10.8 |