Fishes of the Lower Churchill River, Labrador

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Fisheries and Marine Service
Technical Report 922

February 1980

FISHES OF THE LOWER CHURCHILL RIVER, LABRADOR

by

P. M. Ryan

Research and Resource Services Directorate
Department of Fisheries and Oceans
P.O. Box 5667
St. John's, Newfoundland A1C 5X1

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ABSTRACT

Ryan, P. M. 1980. Fishes of the Lower Churchill River, Labrador. Fish. Mar. Serv. Tech. Rep. 922: vii + 189 p.

The fish populations and water quality of five sections of the Lower Churchill River, Labrador, were surveyed from June to August, 1975-76; prior to the proposed creation of the Gull Island and Muskrat Falls Reservoirs. Overall, the fish habitat was characterized by very soft water having a pH of 6.3, a conductance of 18.9 μmhos/cm, a total hardness of 8 ppm, a total alkalinity of 6 ppm, a calcium concentration of 1.4 ppm, a turbidity of 3.4 JTU, and a chloride concentration of 0.8 ppm. Fish species captured in gillnets during the survey were, in order of relative abundance by weight, northern pike, lake whitefish, longnose suckers, white suckers, brook trout, burbot, lake trout, ouananiche, round whitefish, lake chub, and rainbow smelt. In addition, threespine sticklebacks and a species of sculpin were identified in stomach contents. The relative abundance, growth rates, sex ratios, and stomach contents of species captured varied from section to section throughout the river. Detailed information on the relative abundance and biology of the individual species throughout the river are included in this report. Long-term potential fish yields were estimated to be 1.01 kg/ha/yr or 20,099 kg/yr in the proposed Gull Island Reservoir and 1.26 kg/ha/yr or 12,474 kg/yr in the proposed Muskrat Falls Reservoir. In each reservoir, just over half of the potential yield estimated was comprised of longnose and white suckers. Of greatest potential impact of impoundment upon fish populations in the proposed reservoirs are fluctuating water levels and increased sedimentation.

Key words: abundance, food, growth, maturity, mortality, potential yield, reservoirs, sex ratios

RÉSUMÉ

Ryan, P. M. 1980. Fishes of the Lower Churchill River, Labrador. Fish. Mar. Serv. Tech. Rep. 922: vii + 189 p.

Avant la création des réservoires de Gull Island et Muskrat Falls, la population des poissons et la qualité de l'eau furent examinées dans cinq endroits sur la rivière de Lower Churchill, durant les mois de juin jusqu'au mois d'août 1975-76. L'habitat marine en majorité était caractérisé par l'eau extrêmement douce ayant un pH de 6.3, une conductance de 18.9 μmhos/cm une dureté totale de 8 ppm, une alkalinité totale de 6 ppm, une concentration du calcium de 1.4 ppm, une turbidité de 3.4 JTU, et une concentration du chlorure de 0.8 ppm. Les espèces de poissons pêchées par fillets maillants durant l'étude, énumérées par l'abondance du poid cueilli furent le grand brochet, la grande corrégone, le meunier rouge, le meunier noir, la truite, la lotte, le touladi, l'ouananiche, le ménomini rond, le méné de lac et l'éperlan arc-en-ciel. L'épinoche à trois épines et une espèce de chabot furent identifiés dans le contenu d'estomac. L'abondance relative, le taux de croissance, la proportion des sexes et le contenu des estomacs des espèces capturées varient de section en section le long de la rivière. L'information détaillée sur l'abondance relative et la biologie des espèces individuelles sont inclus dans ce rapport. Le potentielle du rendement au long terme fut estimé à 1.01 kg/ha/an ou 20,099 kg/an pour le réservoir proposé de Gull Island et 1.26 kg/ha/an ou 12,474 kg/an pour le réservoir proposé de Muskrat Falls. Pour chaque réservoir, le meunier rouge et le meunier noir comprenaient plus que la moitié de l'estimé du rendement. L'oscillation du niveau de l'eau et l'augmentation du sédiment dans les réservoirs proposés sont les potentiels d'impact plus prononcés sur la population des poissons internés.

INTRODUCTION

This report is an assessment of the fishery resource of the Lower Churchill River, Labrador.

The Lower Churchill River (Fig. 1) has been proposed as the location of two reservoirs to be used for the development of hydroelectric power. The Gull Island hydroelectric project entails the erection of a dam across the Lower Churchill River near Gull Island approximately 110 km upstream from Happy Valley-Goose Bay. The Muskrat Falls project will derive power from a dam at Muskrat Falls, 30 km upstream from Happy Valley-Goose Bay. The two reservoirs (Table 1) will depend largely on available river discharge for power generation in a run-of-the-river scheme. Detailed descriptions of the two proposed reservoirs and their operating modes have been documented by Thurlow and Associates (1974), Gull Island Power Company Limited (1977), Acres Consulting Services Limited (1978), and Lower Churchill Development Corporation Limited (1979).

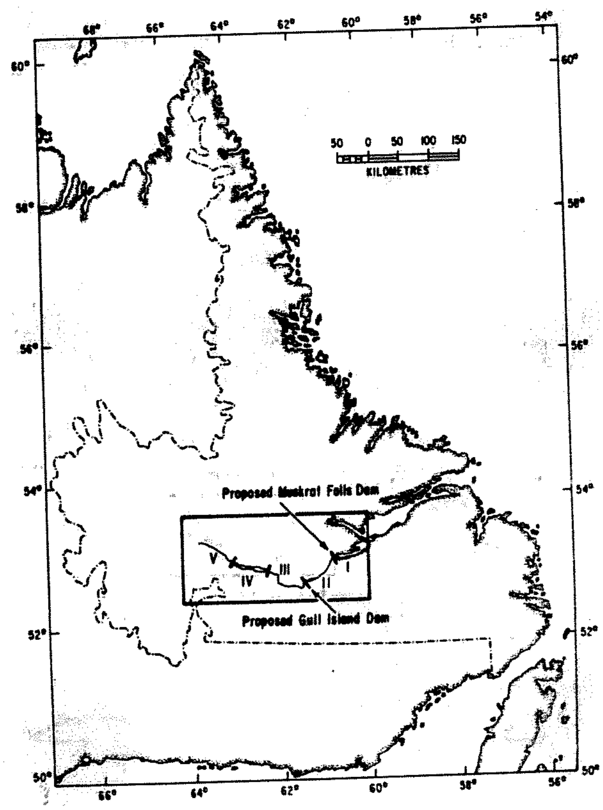

Fig. 1. Location of the Lower Churchill River, Labrador and five river sections considered in the present study.

Table 1. Physical features of the proposed Gull Island and Muskrat Falls Reservoirs.

Feature	Reservoir	
	Gull Island	Muskrat Falls
Volume (total storage $m^3 \times 10^9$)*	4.1	1.3
Mean water flow (m^3/s)*	1770	1833
Surface area (km^2)†	199	99
Maximum drawdown (m)†	6.1	4.0
Maximum depth (m)†	88	36
Mean reservoir depth (m)‡	20.6	13.1

* Acres Consulting Services Limited, 1978.

† Lower Churchill Development Corporation Limited, 1979.

‡ Volume/area

Detailed information on aquatic vegetation, physical features, and habitat classification of the Lower Churchill River have yet to be documented. This information is to be documented by the Lower Churchill Development Corporation as part of the project environmental impact study.

It is accepted among hydrobiologists that it is generally difficult to predict the condition of fishery resources in a proposed reservoir, particularly one obtained by damming a river. This difficulty is primarily due to the complexity of ecological interactions that affect fish and the fact that few impact assessments have been made before and after the creation of a reservoir. In Canada, there is as yet no measure of the accuracy of a pre-impoundment prediction of a fishery resource (Harvey 1976). However, certain similarities have been observed among reservoirs created from rivers.

As reviewed by Geen (1974), the damming of a free-flowing river generally results in:

- lost river fauna
- blocked access to spawning areas
- initial increases in reservoir productivity followed by an eventual decline
- low littoral productivity as a result of drawdown
- decreased turbidity through settling of sediments in the reservoir
- initial increases in total dissolved solids from the leeching of flooded terrain and breakdown of terrestrial plant material
- a little affected plankton production and water chemistry in the long term
- reduced growth rates of littoral feeding fishes
- and an altered abundance of fish and their food organisms

Obviously, it may take many years before a period of biological stability can be attained by a new impoundment. In the Kerelian U.S.S.R., an area similar to western Labrador, stabilization of reservoir ecology begins to take place about 20 years after flooding (Baranov 1961). Thus, the accuracy of pre-impoundment predictions cannot be fully assessed within a short time frame.

It is hoped that the data presented here will assist in the utilization of the available fish resource in the Gull Island and Muskrat Falls Reservoirs and assist in the prediction of effects of other reservoirs. With these objectives in mind, emphasis was placed on the following areas of study:

1. The relative abundance of fish species in the Lower Churchill River. The estimates of relative abundance and the presence or absence of the various species (Table 2) were based on catches obtained during survey work in 1975 and 1976 and on distribution maps of fishes presented by Scott and Crossman (1973).

Table 2. List of fishes occurring in the Lower Churchill River, Labrador. Based on surveys in 1975 and 1976 and on distribution maps presented by Scott and Crossman (1973).

Northern pike	-	*Esox lucius*
Lake whitefish	-	*Coregonus clupeaformis*
Longnose sucker	-	*Catostomus catostomus*
White sucker	-	*Catostomus commersoni*
Brook trout (sea-run and resident)	-	*Salvelinus fontinalis*
Burbot	-	*Lota lota*
Lake trout	-	*Salvelinus namaycush*
Atlantic salmon (sea-run and resident ouananiche)	-	*Salmo salar*
Round whitefish	-	*Prosopium cylindraceum*
Rainbow smelt (sea-run)	-	*Osmerus mordax*
Lake chub	-	*Couesius plumbeus*
Arctic char (sea-run)	-	*Salvelinus alpinus*
Threespine stickleback	-	*Gasterosteus aculeatus*
Ninespine stickleback	-	*Pungitius pungitius*
Mottled sculpin	-	*Cottus bairdi*
Slimy sculpin	-	*Cottus cognatus*
American eel (sea-run)	-	*Anguilla rostrata*
Longnose dace	-	*Rhinichthys cataractae*
Atlantic sturgeon (sea-run)	-	*Acipenser oxyrhynchus*

2. The biology of the fish species in the Lower Churchill River. This information was obtained from analyses of the individuals captured during the surveys and from literature sources. The potential impact of reservoir construction on each species is considered.

3. The potential yield of fishes in the Gull Island and Muskrat Falls Reservoirs. Estimates of maximum sustainable yields were based on catches obtained during the surveys and predictive models previously used.

MATERIALS AND METHODS

STUDY SECTIONS

The Lower Churchill River, from its mouth to the tailrace at Churchill Falls, was divided into five study sections on the basis of physical characteristics and the locations of the proposed dams. Within each section, stations were selected at approximately 8 km intervals (Fig. 1). The five sections chosen and the survey dates are:

I - River Mouth to Muskrat Falls - 28/6/75-4/7/75;
II - Muskrat Falls to Gull Island - 3/8/75-24/8/75;
III - Gull Island to Devil's Hole, Winokapau Lake - 21/6/76-29/7/76;
IV - Winokapau Lake - 31/7/76-5/8/76;
V - Winokapau Lake to the Churchill Falls tailrace - 17/7/75-6/8/75.

WATER CHEMISTRY

Water samples, generally two from each station and one from the mouth of major tributaries, were drawn from the subsurface, stored in polyethylene bottles, and analyzed in the St. John's laboratory. Sample sites are presented in Appendix I. The pH was determined electrometrically. Specific conductance was determined with a Yellow Springs Instruments conductivity bridge. Total hardness, expressed as ppm calcium carbonate, was measured by means of the ethylenediamine tetraacetic acid (EDTA) method (American Public Health Association et al. 1971) with calmagite substituted as an indicator. Total alkalinity was determined by potentiometric titrations (American Public Health Association et al. 1971). The concentration of calcium was determined with a Jarrell-Ash atomic-absorption spectrophotometer. Turbidity was determined with a Hach Chemical Co. laboratory turbidimeter model 2100. Chloride concentrations were measured by means of the mercuric nitrate method (American Public Health Association et al. 1971).

FISH CAPTURE

Each study section of the river was fished with gangs of 47 m long gillnets of stretched mesh size 3.8, 5.1, 7.6, 10.2, or 12.7 cm. Typically each gang of nets was composed of all mesh sizes. In several instances, as a result of space constraints or in an attempt to avoid overfishing, some mesh sizes were deleted. Nets were fished overnight on bottom or, occasionally, on the surface. Gillnet locations are shown in Appendix I. Fish were angled at several locations as well.

CATCHES

Catches were reported as total numbers and weight of gillnetted fish and as numbers and weight per unit effort. A unit of effort was defined as one 47 m gillnet comprised of all mesh sizes fished overnight for an approximate 24 h period. Thus equal emphasis was placed on each mesh size fished so that catches were reported on the basis of an equal period of effort by each mesh size.

GROWTH IN LENGTH

Fork lengths or, in the case of burbot, total lengths to the nearest millimetre were obtained from all fish. Scale samples or, in the case of burbot, otoliths were obtained from the catch or a subsample representative of the fish lengths obtained. Scales were removed from above the lateral line just posterior to the dorsal fin. Scales were examined with a Bausch and Lomb microprojector at a magnification of 43 diameters. Otolith cross-sections were examined with a microscope. An age was assigned to each fish equal to the number of completed annuli as described by Tesch (1971). Fish in their first year of life were considered members of age-group 0 or age 0 while fish in their second year were considered to be members of age-group 1 or age 1 and so on. In the case of burbot and in those instances where only small numbers of fish were captured, growth in length was reported as the mean length of each age group at capture. For the remainder, the following back-calculation procedure was used to compensate for apparent differences in growth resulting from the different times of capture of the fish.

A scale from each aged fish was measured from the focus to the scale margin and to each annulus along the anteriormost radius. With the data on each species separated by study section, the relationships between fish length and magnified scale radius were calculated by least-squares regression. Averages, rather than individual values, of the variates were employed with several data sets to give equal weight to less numerically represented portions of the data. In the case of obvious curvilinearity of a relationship, double logarithmic transformations were employed. The resulting equations (Appendix IV) were then solved for the various annulus measurements to calculate the average lengths of the fish at the end of each full year of life.

GROWTH IN WEIGHT RELATIVE TO LENGTH

Fish were weighed on a triple-beam balance to the nearest gram, or if weights were more than 2000 g, on a chatillion scale to the nearest 10 grams. Length-weight relationships were obtained by least-squares regression of the logarithms of weight on the logarithms of length using all data or a representative (by length) subsample of each species in each study section.

SEX RATIOS AND MATURITY

Sex and maturity were determined by macroscopic examination of the gonads. Sex ratios were calculated for the total catch or a representative subsample (by length) of each species from each river section. Data were combined and an overall sex ratio of each species in the river was calculated. A chi-square (χ^2) test was then applied to test for a significant departure from a 1:1 sex ratio.

The state of sexual maturity of individuals in the total catch or a subsample representative of the lengths obtained was determined for each species in most river sections, depending on the expertise of the surveyors. Maturity was categorized as immature or mature. A mature fish was defined as one that was going to spawn in the year of capture or that had previously spawned. Fish categorized by both sex and maturity were examined with respect to length. No obvious or consistent differences in length at maturity were apparent between fish of different sexes or from different river sections. Accordingly, all available data from each species were grouped by length intervals to obtain an estimate of length at maturity in the Lower Churchill River as a whole. Corresponding ages were than obtained from the age-length relationships.

FOOD STUDIES

Food items in the stomachs of the catch of a particular species (or a random subsample of each species) from each river section were determined. The number of stomachs containing each food item was expressed as a percentage of the number of stomachs examined.

SELECTION BY GEAR

The gillnet mesh size in which each fish was captured was recorded in river sections above Muskrat Falls. Average length, weight, age and catch per unit effort of fish obtained by the different mesh sizes within the individual river sections and in the river as a whole above Muskrat Falls were calculated. Data were also presented by means of length and age-frequency distributions of fish captured in the various mesh sizes above Muskrat Falls.

MORTALITY RATE

Instantaneous (M) and annual (A) mortality rates for the different species were obtained from least-squares regression of $\log_e$ number of fish on age as outlined by Ricker (1975). As sample sizes were inadequate to provide reasonable estimates in most individual river sections, all data obtained by gillnets above Muskrat Falls were combined with the assumption that natural mortality rates were reasonably constant throughout the river. As negligible fishing pressure occurs upstream of Muskrat Falls, it can be assumed that these mortality rates are natural mortality rates.

POTENTIAL FISH YIELDS IN THE PROPOSED RESERVOIRS

Quantitative estimates of potential fish yields in the proposed reservoirs were based on the Ryder (1965) and Gulland (1970) models. Total potential fish yields were estimated using the morphoedaphic index (i.e. total dissolved solids in ppm (TDS) divided by mean reservoir depth in metres ($\overline{Z}$)) according to the relationship outlined by Ryder et al. (1974):

$$\text{Total yield (kg/ha/yr)} \simeq 0.966 \sqrt{\frac{TDS}{\overline{Z}}}$$

The components of this yield were estimated using Gulland's (1970) model relating potential yield to the instantaneous natural mortality rate and the ichthyiomass of exploitable stocks. The computations are similar to those employed by Ryder and Henderson (1975) to estimate long-term fish yields in the Nasser Reservoir, Egypt. Component yields were related to total yield by:

$$\text{Yield of species i (kg/ha/yr)} = \frac{MiBi}{\Sigma MiBi} \times \text{Total yield}$$

where M_i = instantaneous natural mortality rate of species i;

B_i = relative biomass of species i.

Relative biomass of a given species was estimated from the proportion of the weight of that species obtained per unit effort to the total weight obtained per unit effort in Winokapau Lake. Winokapau Lake's fish population was chosen as a model for those of the two proposed reservoirs as Winokapau Lake is that section of the Lower Churchill River which will most closely resemble the two reservoirs in characteristics such as shape, thermal regime, and water quality.

HABITAT DESCRIPTION

PHYSICAL

The Lower Churchill River flows from the Churchill Falls hydroelectric generating station's tailrace through Lake Winokapau over Muskrat Falls, a natural barrier to sea-run fish, and into Lake Melville at Happy Valley, a distance of some 320 km. Prior to the natural flow being regulated by the Churchill Falls hydroelectric development since 1971, the Lower Churchill had "one of the greatest and wildest descents of any stream in eastern America" (Riche 1965).

Detailed biophysical descriptions of the Lower Churchill River valley can be found in Thurlow et al. (1974) and Lopoukhine et al. (1978). In general, the river is comprised of three major physically distinct habitat types: the region downstream of Gull Island (Sections I and II); the regions immediately above and below Winokapau Lake (Sections V and III); and Winokapau Lake (Section IV).

The river bottom is primarily gneiss bedrock with localized outcrops of sandstones and shales. The most readily noticeable feature of Section I below Muskrat Falls is the predominance of sand on the shoreline and river bottom (Fig. 2). Section II, from Muskrat Falls to Gull Island has a sandy bottom but a higher current speed has exposed more rock and gravel (Fig. 3). Sections I and II are the shallowest stretches of the river. With the exception of Winokapau Lake, the river upstream of Gull Island flows rapidly over a rocky bottom. The highest water velocities are found in Section III (Fig. 4), the stretch of river from Winokapau Lake to Gull Island and Section V, below Churchill Falls (Fig. 5). Winokapau Lake, a deep lake some 56 km long, is characterized by an extremely steep rocky shoreline and the lowest water velocity of the five study sections (Fig. 6).

Fig. 2. Section I downstream of Muskrat Falls.

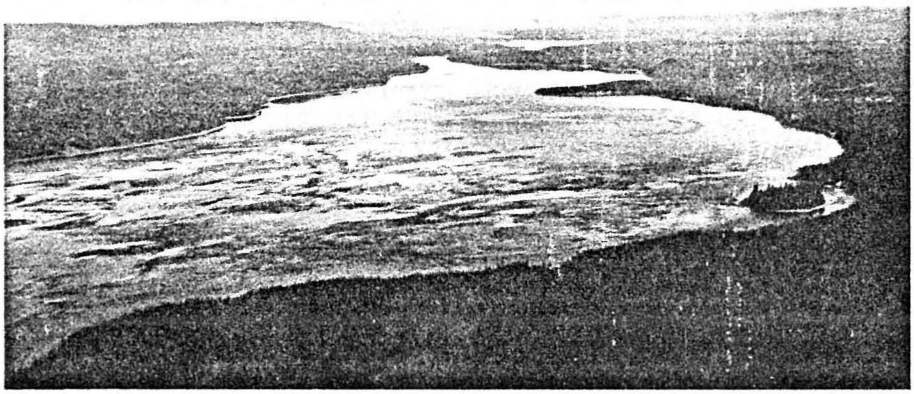

Fig. 3. Section II between Gull Island and Muskrat Falls.

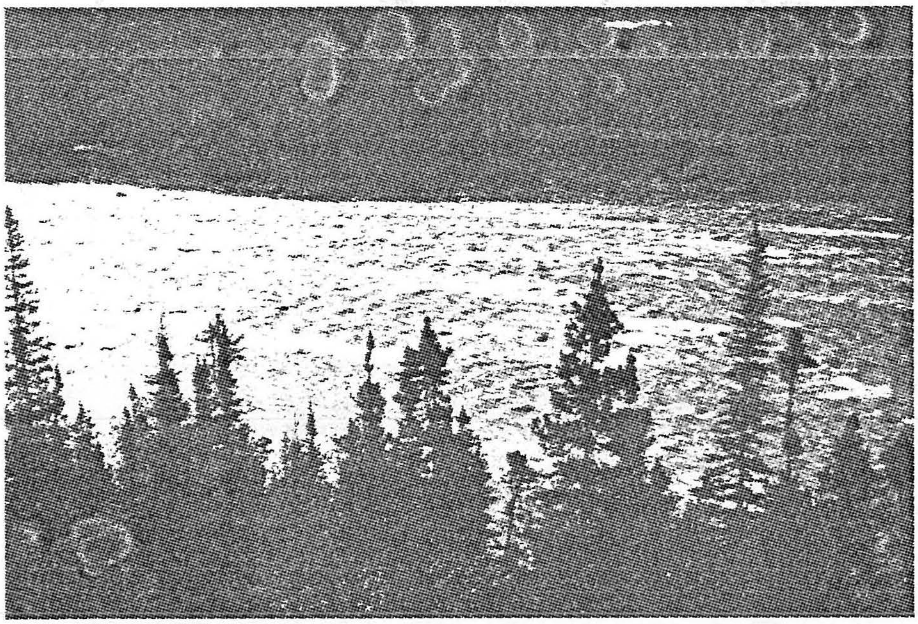

Fig. 4. Section III near Gull Island.

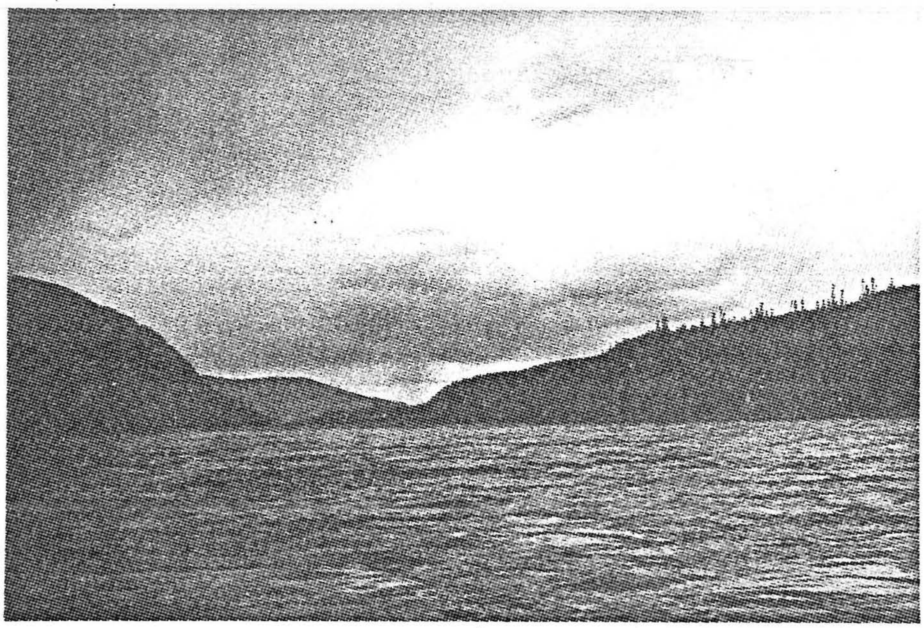

Fig. 5. Section V downstream of Churchill Falls.

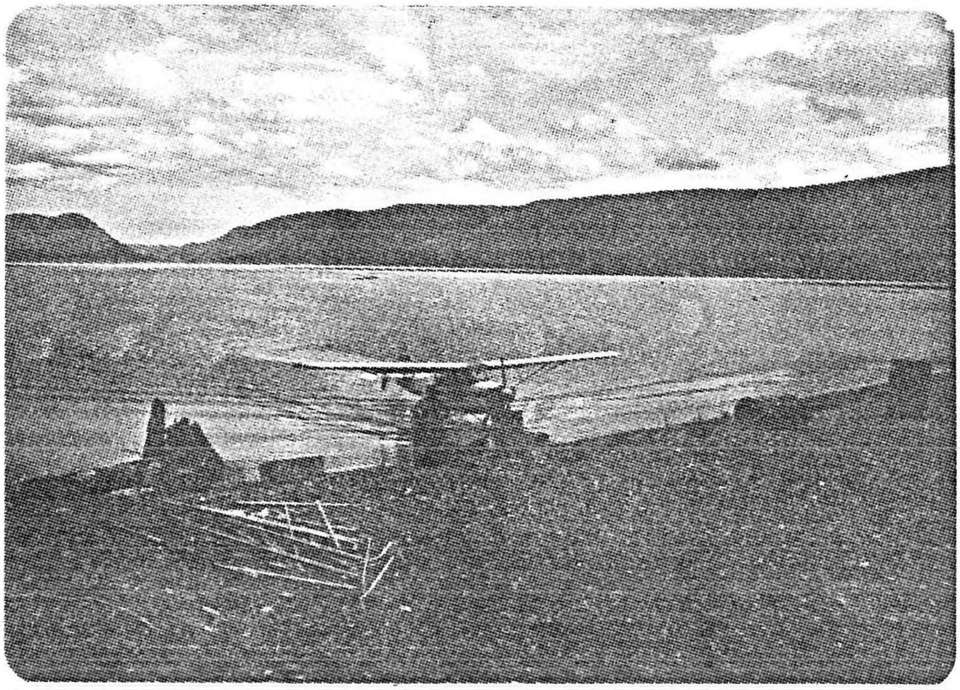

Fig. 6. Winokaupau Lake.

WATER QUALITY

The Lower Churchill River is oligotrophic (Table 3). Its water is similar in chemical composition to lakes of Labrador (Duthie and Ostrofsky 1974, 1975) and to the least biologically productive waters of the world (Wetzel 1975). With calcium concentrations less than 10 ppm, it can be termed calcium deficient (Wetzel 1975).

The tributaries of the Lower Churchill vary in chemical composition, but on the whole are characterized by a greater degree of oligotrophy than the Lower Churchill itself (Table 4).

DISCUSSION

Apart from the previously documented new dimensions of the reservoirs, physical changes are difficult to predict. However, certain generalizations can be made. As a result of the construction of dams at Gull Island and Muskrat Falls, the upstream river-lake complex will be changed into more of a lake-like environment with a probable reduction in habitat diversity. As the rate of flow decreases, or becomes more regular, temperature and chemical stratification will become more evident throughout the system. The increased loading of sediment and detritus after flooding may produce anoxic conditions in the deeper water of the reservoirs. Clear-cutting of the forest prior to flooding may lessen this problem somewhat and speed up biological stabilization of the reservoir.

The proposed reservoirs, in the long term, will likely have a surface water quality similar to their major water source, the Smallwood Reservoir, and the only lentic environment on the river, Winokapau Lake. The Smallwood Reservoir's Lobstick and Sandgirt Lakes were characterized in August of 1974 by a pH of 6.5, a conductance of 20.7 micromhos/cm, a total hardness of 10.6 ppm, a total alkalinity of 8.3 ppm, a calcium concentration of 2.1 ppm, a turbidity of 1.2 JTU, and a chloride concentration of 0.8 ppm (Bruce 1975). Turbidity will likely decline as a result of settling of sediments in the reservoirs after initial increases as was the case with the Smallwood Reservoir (Duthie and Ostrofsky 1975).

The Lower Churchill River below the proposed Muskrat Falls Reservoir will have a similar but more regulated flow. The water chemistry will probably approximate that of the Smallwood and Lower Churchill Reservoirs with the most noticeable change being, in the long term, a reduction in turbidity as solids are precipitated in the reservoirs.

Expected changes in the fish populations as a result of these changes in the physical and chemical environment are described in the following sections.

Table 3. Water quality of the Lower Churchill River, June-August 1975-76. Means and ranges are given. (Individual station measurements are presented in Appendix II).

River section	pH	Conductance (µmhos/cm at 25°C)	Total hardness (ppm)	Total alkalinity (ppm)	Calcium (ppm)	Turbidity (JTU)	Chloride (ppm)
I - River mouth to Muskrat Falls	6.4 6.0-6.8	17.1 14.3-19.1	7 5-10	5 4-6	1.0 0.8-1.4	10.8 3.5-20.0	1.0 1.0-1.0
II - Muskrat Falls to Gull Island	6.2 6.0-6.5	19.0 18.0-20.9	8 6-9	6 3-7	1.3 1.1-1.5	5.6 3.5-9.0	1.1 1.0-2.0
III - Gull Island to Devil's Hole, Winokapau Lake	6.3 6.2-6.6	18.8 17.0-22.0	9 7-10	6 4-8	1.6 1.1-2.0	1.1 0.5-4.0	0.7 0.6-0.8
IV - Winokapau Lake	6.3 6.2-6.5	19.5 18.0-22.0	9 7-10	6 5-7	1.5 1.3-1.8	1.2 0.6-2.2	0.6 0.6-0.7
V - Winokapau Lake to Churchill Falls tailrace	6.4 6.1-6.5	20.4 13.2-26.4	9 6-12	7 4-8	1.4 0.8-2.3	1.5 0.3-3.7	0.7 0.5-1.5
I-V - Entire River	6.3 5.8-6.6	18.9 13.2-26.4	8 5-12	6 3-8	1.4 0.8-2.3	3.4 0.3-20.0	0.8 0.5-2.0

Table 4. Water quality of major tributaries of the Lower Churchill River, August 31, 1976. (Tributaries are listed in order of increasing distance upstream from Goose Bay.)

No.	Tributary Name	Mouth location (river section)	pH	Conductance (µmhos/cm at 25°C)	Total hardness (ppm)	Total alkalinity (ppm)	Calcium (ppm)	Turbidity (JTU)	Chloride (ppm)
1.	Caroline Brook	I	6.1	18.0	10	4	1.3	6.5	1.5
2.	Mackenzie River	I	6.4	15.0	7	4	1.1	1.5	1.5
3.	Lower Brook	II	6.5	15.0	7	3	1.1	4.0	1.5
4.	Upper Brook	II	6.0	15.0	7	3	1.3	5.0	1.5
5.	Pinus River	II	6.3	11.0	7	2	1.2	1.0	1.0
6.	Unnamed	II	6.2	17.0	8	4	1.3	1.2	2.0
7.	Unnamed	II	5.9	12.0	5	1	0.7	1.2	1.5
8.	Minipi River	III	6.3	14.0	7	2	0.7	0.8	1.0
9.	Dominion River	III	6.2	13.0	7	2	1.0	1.0	1.0
10.	Cache River	III	6.0	12.0	6	1	0.9	1.3	1.0
11.	Shoal River	III	6.1	10.0	6	2	1.0	1.2	1.0
12.	Fig River	IV	6.1	11.0	6	3	0.7	1.2	0.9
13.	Elizabeth River	V	6.4	15.0	7	4	1.0	1.5	1.2
14.	Metchin River	V	5.6	12.0	6	1	0.8	1.2	0.4
15.	Unnamed	V	5.8	12.0	7	1	1.8	1.4	1.0
Averaged data			6.1	13.5	6.9	2.5	1.1	2.0	1.2

RELATIVE ABUNDANCE OF FISH

TOTAL CATCHES

In the river as a whole, one unit of gillnet effort yielded 5.5 fish weighing 3.2 kg. Eleven of the 19 species reported present by Scott and Crossman (1973) were captured. These data are similar to comparative catch per unit effort statistics of 5.0 fish weighing 3.3 kg from the main body of the Smallwood Reservoir (Bruce 1975). Nine species were taken in the reservoir. Catch rates and number of species captured varied from section to section within the river (Fig. 7). Total catches and number of species captured were greatest in those river sections upstream of Gull Island and least in Section II, the area of the proposed Muskrat Falls reservoir. Greater catches were associated with the capture of a greater number of species (Appendix III).

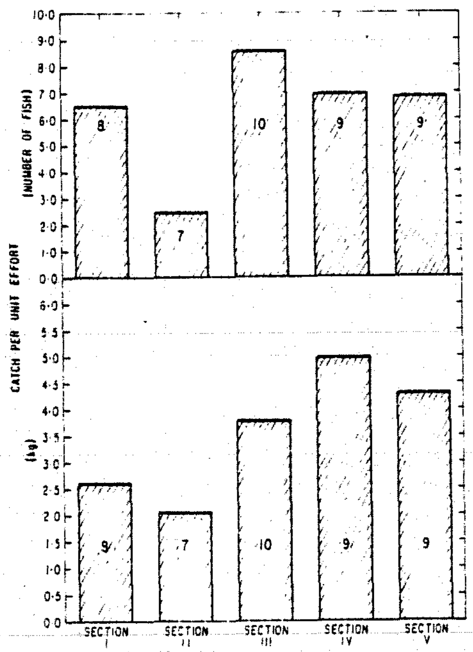

Fig. 7. Catches of all fish species from the Lower Churchill River, June-August, 1975-76. (Number of species captured in each river section is indicated).

SPECIES COMPOSITION

The most numerous species in the catch from the river as a whole were, in order of abundance, longnose suckers, lake whitefish, white suckers, brook trout, and northern pike (Fig. 8). Their relative abundance varied greatly from section to section within the river and each river section was in contrast to the Smallwood Reservoir. In catches from the Smallwood Reservoir, lake whitefish, longnose suckers, lake trout, and round whitefish were most numerous (Bruce 1975).

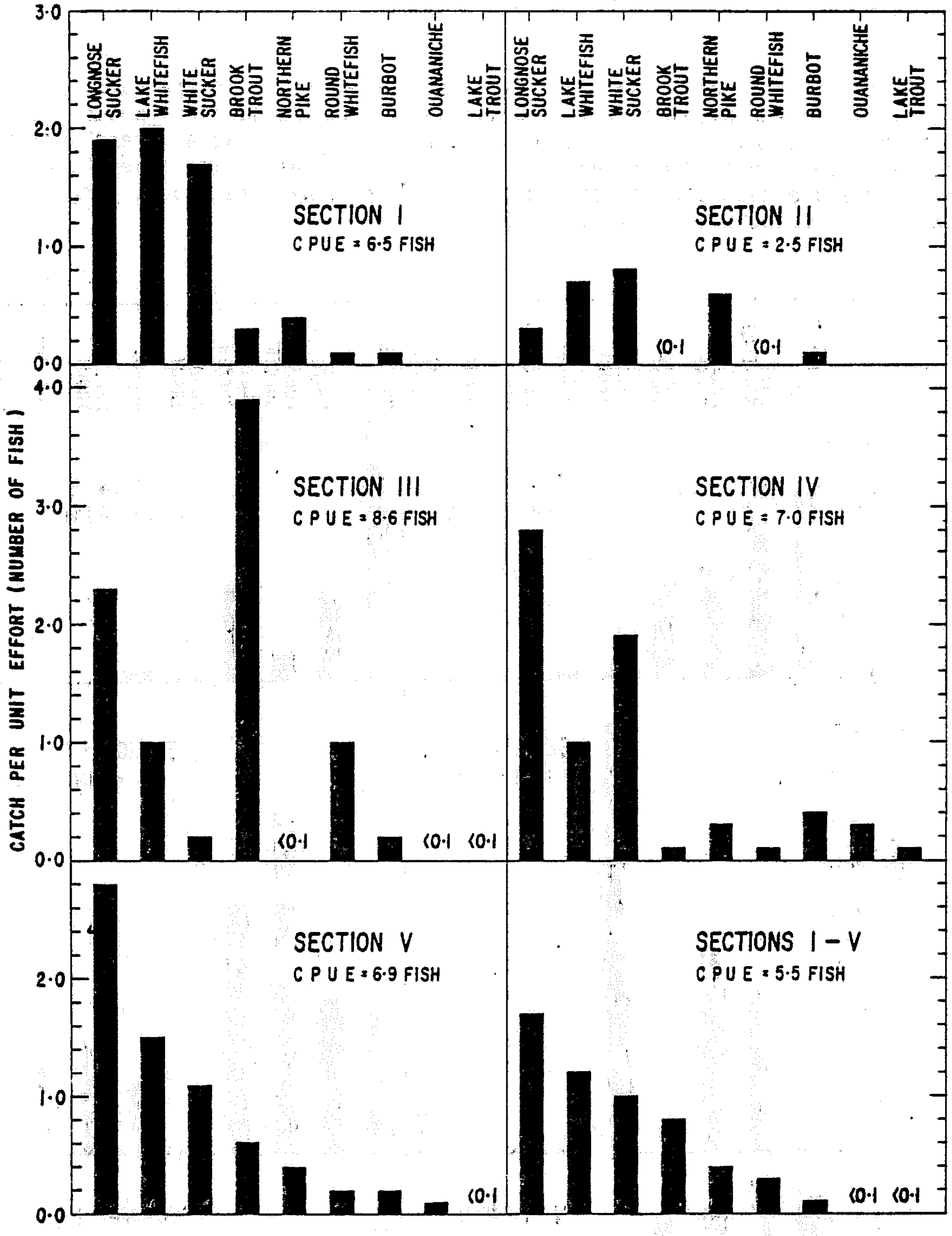

Fig. 8. Catch in numbers of major fish species in the Lower Churchill River, June-August, 1975-76.

In terms of weight, northern pike was most abundant in the catch from the river as a whole, followed by lake whitefish, longnose suckers, white suckers, and brook trout (Fig. 9). Relative abundance by weight varied greatly from section to section in the river. In the Smallwood Reservoir, lake whitefish made up the greatest portion of the catch followed by lake trout, longnose sucker, and northern pike (Bruce 1975).

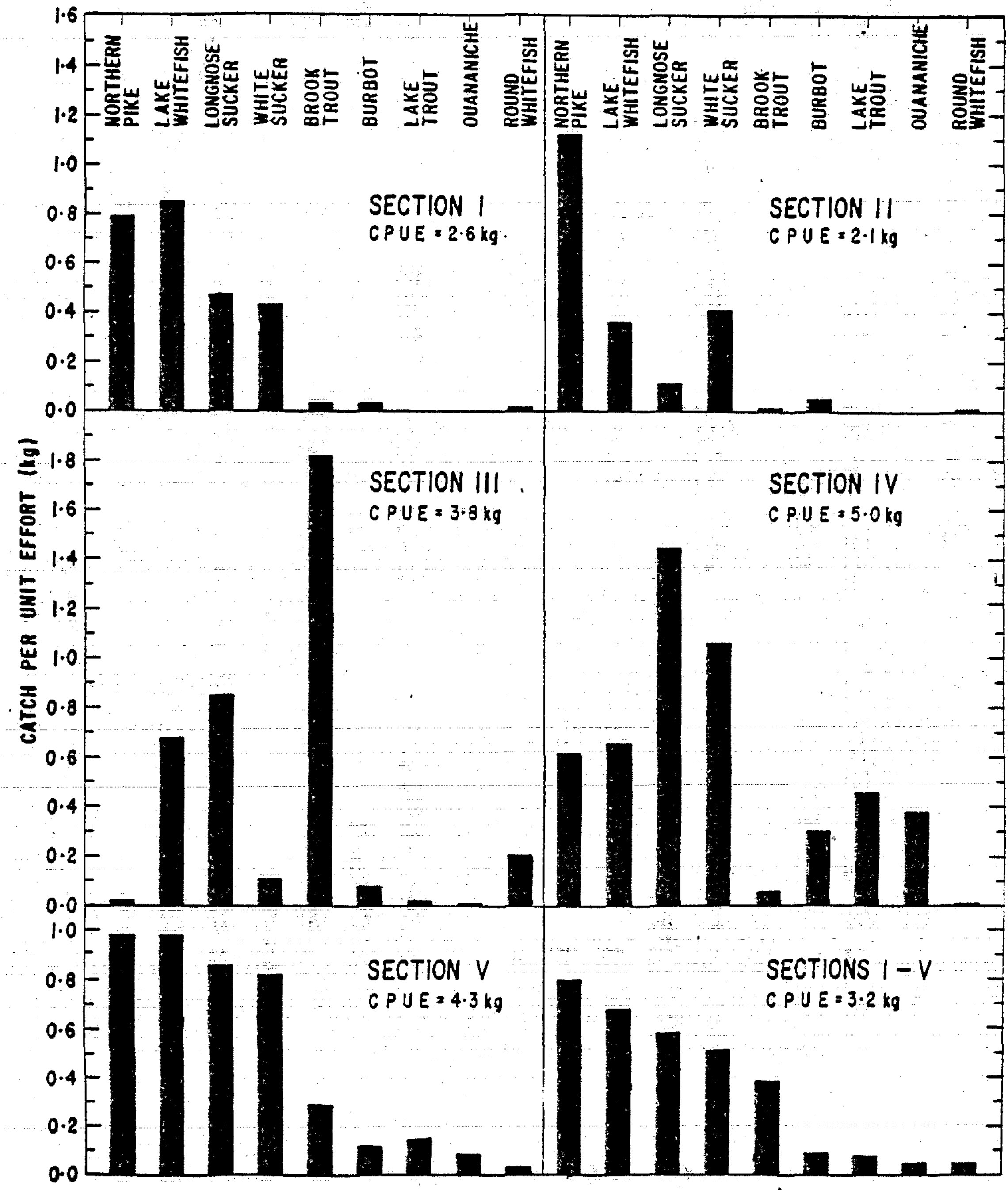

Fig. 9. Catch in weight of major fish species in the Lower Churchill River, June-August, 1975-76.

In addition to the species indicated in Fig. 8 and 9 , two rainbow smelt were captured in Section I. Three lake chub were taken in Section III and identified in the stomachs of fish from Section IV. Threespine sticklebacks were identified in stomach contents from Sections I, IV, and V. Unidentified species of sculpins were found in the stomachs of fish from Sections III and V.

DISCUSSION

There is some evidence that the overall fish production in the proposed reservoirs will be greater than exists, on the average, throughout the Lower Churchill. The greater catches and the greater numbers of species obtained above Gull Island suggest that adequate numbers of viable species will be present to enable colonization of most available habitat in the Gull Island Reservoir. Also, the comparatively large catches and number of species in Winokapau Lake (that area of the Lower Churchill system most closely resembling both reservoirs) suggests that fish biomass and hence production will increase after impoundment.

Several species reported as present in the river by Scott and Crossman (1973) were not identified during the survey. This was likely a result of their small size and resultant non-susceptibility to capture by gillnets or, in the case of sea-run species, their scarcity in the river during the survey.

After impoundment, physical and chemical conditions in the reservoirs will most closely resemble those of Winokapau Lake. This suggests relative abundance and species composition will also resemble those in the lake at the present time. If excessive anomalous environmental conditions are not created and this occurs, the most abundant species in the reservoirs, in terms of numbers and weight, will be longnose suckers followed by white suckers and lake whitefish.

No ouananiche or lake trout were captured in Section II, the area proposed for the Muskrat Falls Reservoir. This suggests that, if optimal use is to be made of this reservoir and all habitats are to be used, these species should be introduced if they do not colonize the reservoir themselves. This should result in a fish community composition in both reservoirs similar to that in Winokapau Lake; again providing that excessive anomalous environmental conditions are not created.

After impoundment, the community structure downstream of the Muskrat Falls Reservoir should not change significantly provided that the flow of water is maintained.

NORTHERN PIKE

CATCHES

In the river as a whole, 689 gillnets fished overnight caught 265 northern pike with a total weight of 549.8 kg (Fig. 10). This corresponds to 0.4 fish weighing 0.80 kg/net night with equal weight being given to each mesh size fished. Captured pike had a mean length of 63.6 cm, a mean weight of 2.08 kg, and a mean age of 8.5 years.

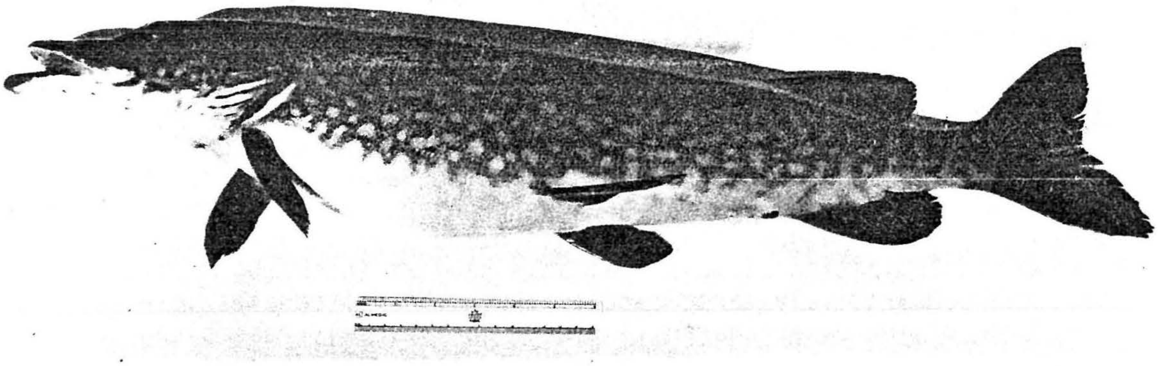

Fig. 10. Northern pike.

Catches were variable from section to section within the river (Fig. 11). In terms of number and weight obtained per net night, Section II was the most productive and Section III the least productive.

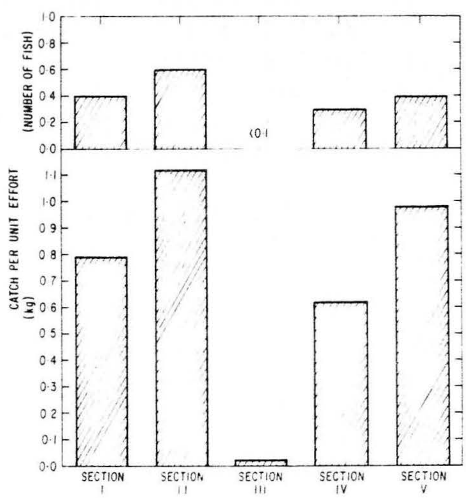

Fig. 11. Catches of northern pike in five sections of the Lower Churchill River, June-August, 1975-76.

GROWTH IN LENGTH

Northern pike in the Lower Churchill River tended to exhibit a declining growth rate until lengths of about 70 cm were reached (Fig. 12 and Appendix V). Fish of this length exhibited an increase in growth rate suggestive of the availability of a new food source to fish of this length. On the whole, growth in length was more rapid than that typically exhibited by pike in northern Canadian waters but slower that than experienced by the usually fast-growing southern populations (Scott and Crossman 1973). The rate of growth in the river as a whole was a little greater than that observed in the Smallwood Reservoir (Bruce 1974, 1975).

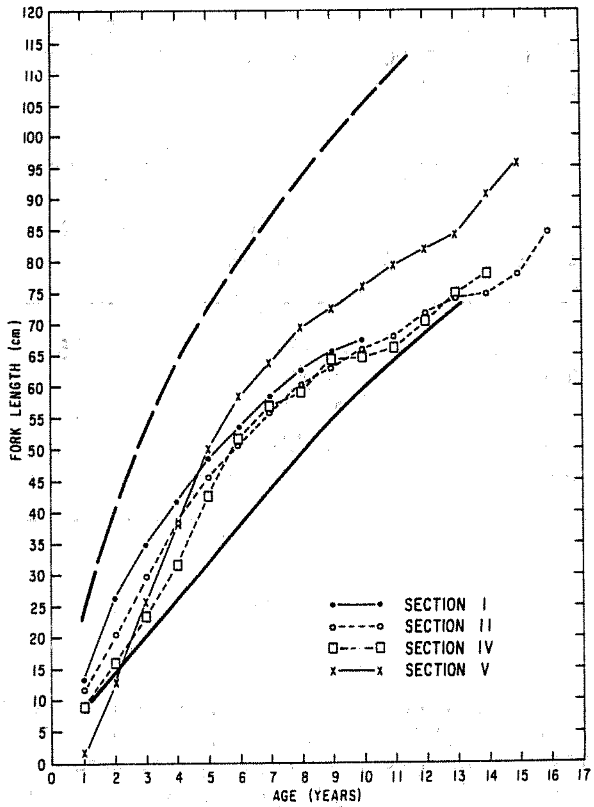

Fig. 12. Growth of northern pike in the Lower Churchill River, 1975-76. Presented for contrast is an approximation of growth in northern Canadian lakes (solid heavy line) (Miller and Kennedy 1948) and Wisconsin lakes (dashed heavy line) (Van Engel 1940).

Growth rates were variable within the river. Growth in the first four year of life was similar in all but Section I which contained the fastest growing young fish. Growth rates in later years were similar in all but Section V which contained the fastest growing older fish. The extremely small calculated length of age-group 1 fish in Section V was likely an artifact of the methods employed.

The longevity of pike in the Lower Churchill was similar to that usually observed in slow-growing northern populations (Miller and Kennedy 1948). The oldest fish was in its 18th year.

GROWTH IN WEIGHT

Exponents in the length-weight relationships of northern pike ranged from 2.68 to 3.17 and had a mean of 3.01 (Table 5); lower than the range of 3.1-3.9 reported by Bruce (1974, 1975) for pike in the Smallwood Reservoir.

Table 5. Least squares linear regressions of $\log_{10}$ weight (g) on $\log_{10}$ fork length (cm) for northern pike from the Lower Churchill River, June-August 1975-76.

River section	Y intercept	Slope	Correlation coefficient	No. of fish
I	-2.30	3.11	0.984	55
II	-2.25	3.07	0.996	131
IV	-2.43	3.17	0.997	18
V	-4.52	2.68	0.980	60
Means	-2.88	3.01		

SEX RATIOS AND MATURITY

The overall sex ratio indicated an equal abundance of the sexes, contrary to the slight relative abundance of females observed in southern Ontario catches over the summer months (Casselman 1975). Numbers of males per female in the five sections were 0.88-1.62 with an overall ratio of 1.19 (Appendix VI).

Of the 265 northern pike examined, 88.3% were mature fish (Appendix VII). Pike matured at approximately 40 cm; the average length attained by fish in their fourth to fifth year of life. This is an age at maturity similar to the usual 2-4 years in the south of Canada, but younger than the usual 5-6 years in the north (Scott and Crossman 1973).

FOOD STUDIES

Northern pike captured in the Lower Churchill were primarily piscivorous as is usual for this species (Scott and Crossman 1973). Suckers and lake whitefish were the most frequently identified food items (Table 6).

Table 6. Percentage occurrence of major food items in the stomachs of northern pike in the Lower Churchill River, June-August 1975-76.

Food Item	River section					
	I	II	III	IV	V	I-V combined
Fish remains	38.2	18.7	100.0	44.4	15.0	26.5
Catostomus sp.	9.1	12.0		33.3	47.5	20.6
Coregonus clupeaformis	14.6				30.0	10.6
Gasterosteus aculeatus	10.9			11.1		4.2
Lota lota		4.0				1.6
Esox lucius		4.0				1.6
Insect remains				16.7		1.6
Detritus				16.7		1.6
Diptera (larvae)				16.7		1.6
Prosopium cylindraceum					5.0	1.1
Ostracoda				5.6		0.5
Cottus sp.					2.5	0.5
Number of stomachs examined	55	75	1	18	40	189
Number of stomachs empty	19	43	0	4	8	74

SELECTION BY GEAR

On the whole, mean lengths, weights and ages of captured pike tended to be greater with increasing mesh size (Fig. 13 and 14; Table 7). These trends were also visible within the individual river sections (Appendices VIII and IX). The most efficient mesh size, in terms of number and weight of fish captured per net night, was 10.2 cm. One net night of fishing with this mesh size yielded 0.6 fish weighing 1.46 kg. Pike captured by this mesh size were all age 5 and over and 50 cm or larger.

MORTALITY RATE

The natural mortality rate (A = 0.26) of pike upstream of Muskrat Falls (Fig. 15) was lower than the 0.38-0.44 annual mortality rate of pike in commercially fished Lake Ontario (Wolfert and Miller 1978).

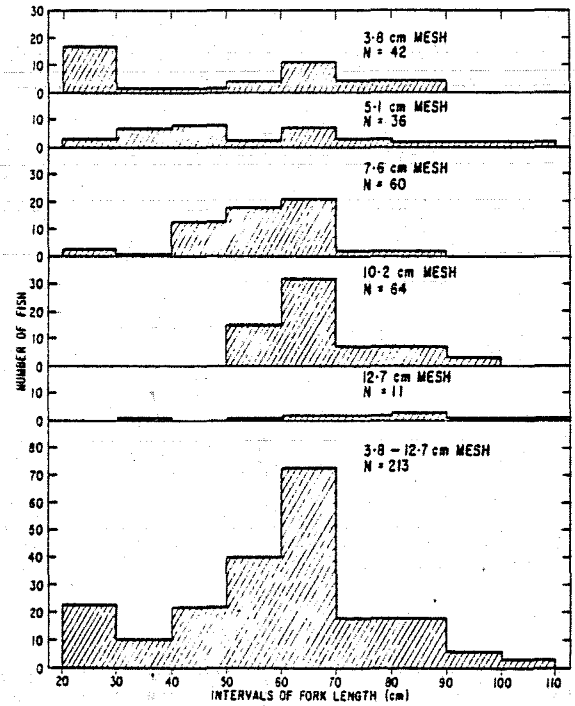

Fig. 13. Length-frequency distribution by gillnet mesh size of northern pike from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

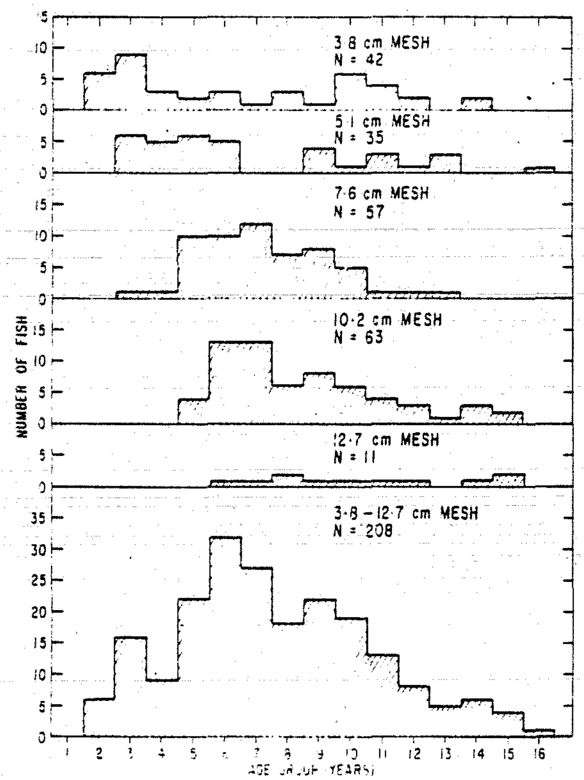

Fig. 14. Age-frequency distribution by gillnet mesh size of northern pike from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Table 7. Catch statistics of northern pike from Sections II-V of the Lower Churchill River, June-August 1975-76.

Mesh size (cm)	No. of net nights	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
3.8	107	42	0.4	49.9	64.1	1.53	0.59	6.1
5.1	107	36	0.3	55.8	71.3	1.98	0.67	6.9
7.6	109	57	0.5	58.4	96.4	1.69	0.88	7.3
10.2	109	64	0.6	66.8	159.2	2.49	1.46	8.3
12.7	107	11	0.1	77.1	40.5	3.68	0.38	10.5

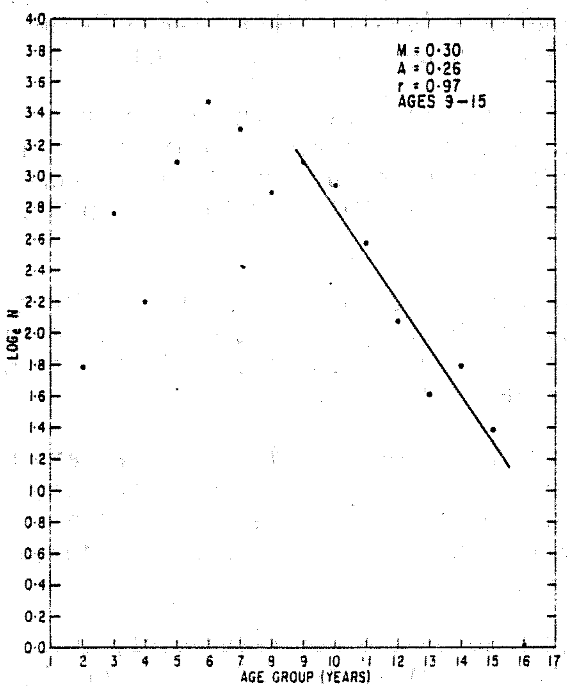

Fig. 15. Catch curve of northern pike from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

DISCUSSION

As reviewed by Machniak (1975a), reproduction, growth, and abundance of northern pike generally improve after the impoundment of waters. Later, reproductive success fluctuates with water level regulation while growth and abundance are dependent upon the supply of forage species.

Northern pike usually spawn on heavily vegetated floodplains and bays, preferring water depths of 50 cm or less. Impoundment of the Lower Churchill may create many new possible spawning sites. However, drawdowns in excess of 50 cm from the time of spawning soon after ice-out to about a month later when the young become mobile will be deleterious. It is likely that spring drawdown will be an important factor limiting pike reproduction in the reservoirs.

Pike growth will likely exhibit greater variation than exists at the present time. While growth below the site of the Muskrat Falls dam should remain the same due to a similar physical, chemical, and biological environment, growth in the areas of the reservoirs will likely improve. The larger bodies of slow-moving water and likely abundance of forage fishes such as whitefish and suckers should produce faster-growing individuals. Pike biomass will likely be made up of faster-growing individuals rather than a larger number of slow growers since reproduction will often be impeded by drawdown.

An additional indication of a faster growth rate in the reservoirs is the comparatively high exponent in the length-weight relationship in Winokapau Lake. As conditions in the river approach those of Winokapau Lake, growth in weight with respect to length should more closely resemble that in the lake and increase.

There is some indication that pike production will increase in the reservoirs. The habitat of pike is usually slow-moving, heavily vegetated rivers or weedy bays of lakes. Also, pike catches in the Lower Churchill were least in the rapid waters of Section III below Winokapau Lake.

Of possible concern to fishermen on the reservoirs is the infestation of pike by the parasite, *Triaenophorus crassus*. This parasite uses the commercially valuable lake whitefish as its intermediate host and renders the flesh less desirable. An increase in the pike population in the reservoirs may heighten the potential for infestation by this parasite.

If a commercial pike fishery is started on the new reservoirs, 10.2 cm may prove to be the most beneficial mesh size for gillnets. Since all of the pike captured by the 10.2 cm mesh were 50 cm or greater, it can be expected that, after the spawning run, this most efficient mesh size would capture relatively few fish that had not spawned at least once.

LAKE WHITEFISH

CATCHES

In the river overall 689 gillnets fished overnight captured 837 lake whitefish with a total weight of 469.0 kg (Fig. 16). Giving equal weight to each mesh size fished, this corresponds to an average of 1.2 fish weighing 0.68 kg/net night. Captured whitefish had a mean length of 32.8 cm, a mean weight of 0.56 kg, and a mean age of 7.0 years.

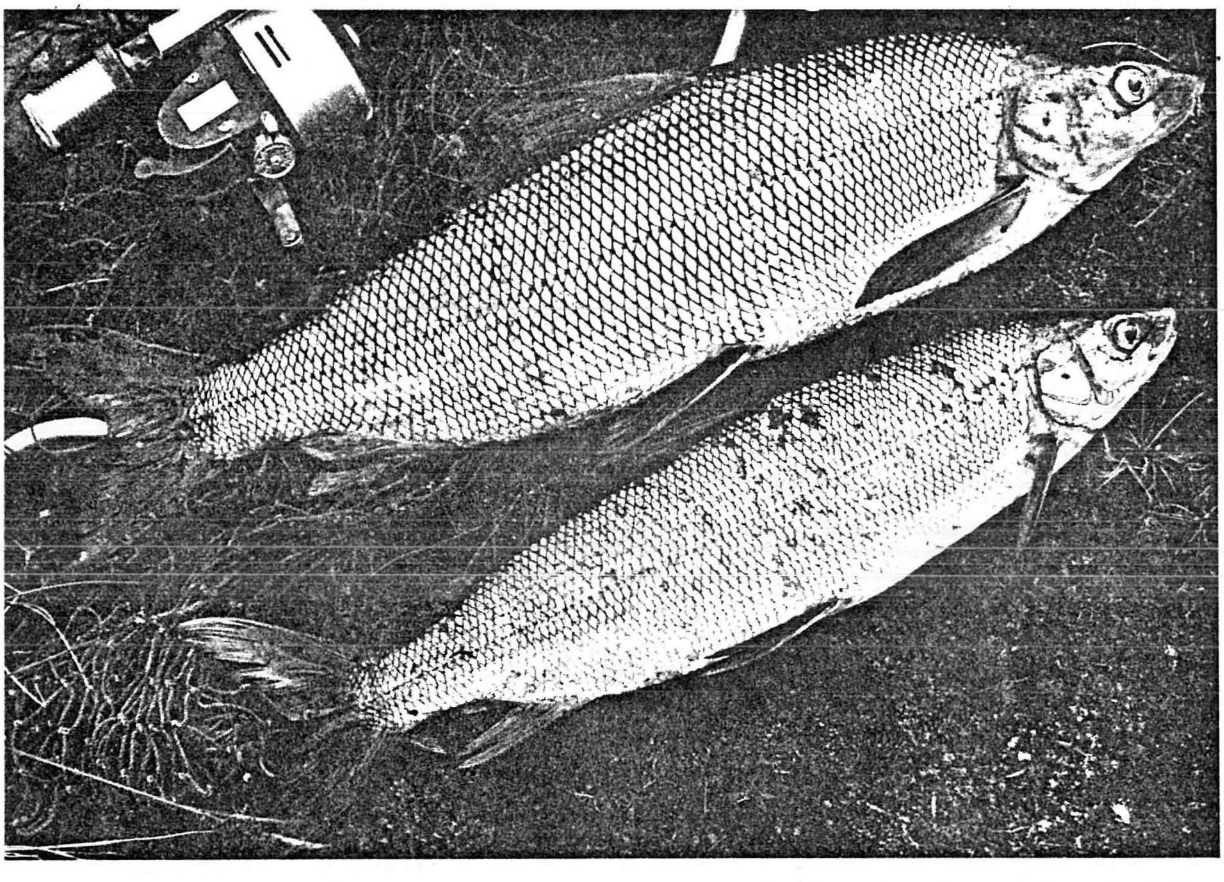

Fig. 16. Lake whitefish.

Whitefish catches within the river ranged from 0.36 kg/net night in the site of the Muskrat Falls Reservoir (Section II) to 0.98 kg/net night at Section V below Churchill Falls (Fig. 17).

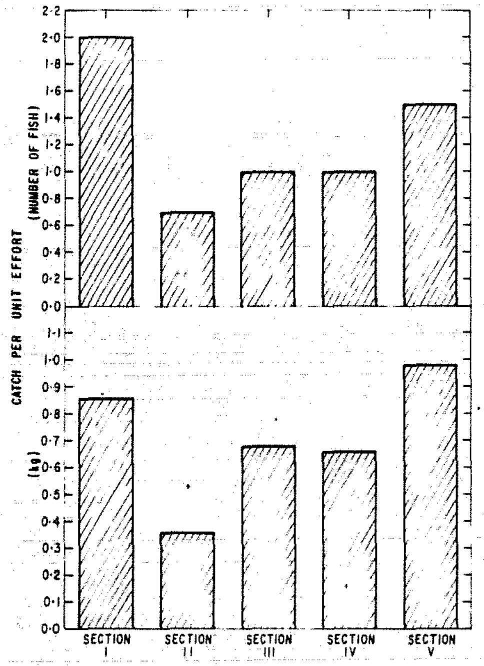

Fig. 17. Catches of lake whitefish in five sections of the Lower Churchill River, June-August, 1975-76.

On the average, catches above the site of the Gull Island dam tended to be greater than those from the two river sections below the dam site.

Mean lengths, weights, and ages of captured fish tended to be similar in all sections except those from below Muskrat Falls (Appendix VIII). Fish from this section tended to be the smallest and youngest fish.

GROWTH IN LENGTH

Lake whitefish in the Lower Churchill River tended to exhibit a declining growth rate with age (Fig. 18 and Appendix V). On the whole, growth in length was within the range previously described for whitefish over the whole of their zoogeographic range and slower than that usually seen in lightly exploited populations (Healey 1975). The rate of growth in the river as a whole was lower than that experienced by whitefish in the Smallwood Reservoir (Bruce 1974, 1975).

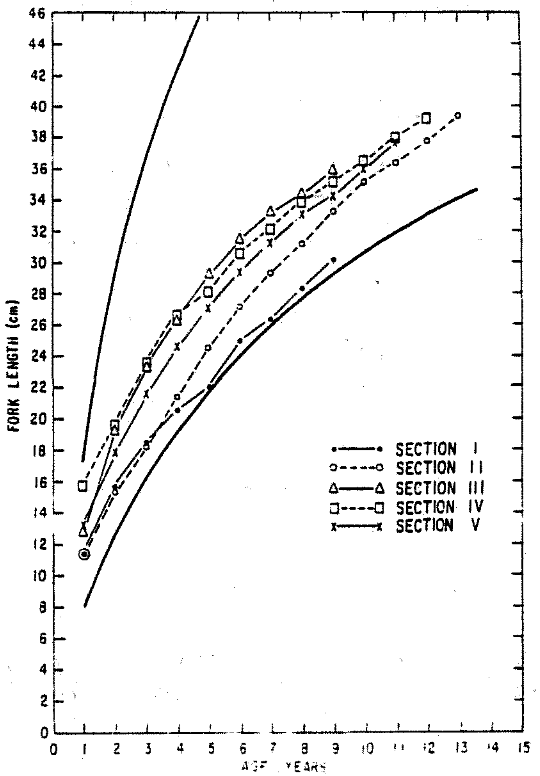

Fig. 18. Growth of lake whitefish in the Lower Churchill River, 1975-76. Presented for contrast is the total range in growth (solid heavy lines) for whitefish over the zoogeographic range (Healey, 1975).

Growth rates were variable within the river. Growth was faster upstream of the proposed Gull Island dam than below. In the three sections above the site of the proposed dam, growth tended to be slower with greater distance upstream. The most rapid growth occurred between Gull Island and Winokapau Lake. Below the Gull Island site, growth was faster with greater distance upstream.

The maximum age of lake whitefish was similar to that usually recorded over the range (Scott and Crossman 1973; Healey 1975); with one fish being in its 18th year and one in its 21st.

GROWTH IN WEIGHT

Exponents in the length-weight relationships of lake whitefish ranged from 2.92 to 3.30 with a mean of 3.11 (Table 8). The average value was at the low end of the usual range of about 3.1-3.5 (Healey 1975) but the same as that of whitefish in the Smallwood Reservoir (Bruce 1974, 1975).

Consistent with growth in length, exponents tended to be lesser with greater distance upstream in the three sections above the Gull Island dam site but greater with greater distance upstream below the dam site.

Table 8. Least squares linear regressions of $\log_{10}$ weight (g) on $\log_{10}$ fork length (cm) for lake whitefish from the Lower Churchill River, June-August 1975-76.

River section	Y intercept	Slope	Correlation coefficient	No. of fish
I	-1.88	2.97	0.986	148
II	-2.33	3.30	0.995	128
III	-2.23	3.23	0.960	119
IV	-2.06	3.11	0.979	58
V	-4.75	2.92	0.976	152
Means	-2.65	3.11		

SEX RATIOS AND MATURITY

The overall sex ratio indicated an equal abundance of the sexes as is usual for this species (Machniak 1975b). Numbers of males per female were 0.57-1.38 with an overall ratio of 0.95 (Appendix VI).

Of 737 lake whitefish examined, 84.3% were mature (Appendix VII). The smallest length interval in which more than 50% of the individuals were mature was 20.0-21.9 cm; having 57.9% mature individuals. This interval corresponded to the length attained by fish in their third to fifth year of life. Some immature individuals were found in each 2 cm interval up to 42 cm. These data are low compared to the wide range in length at maturity of 20-40 cm in other northern populations (Healey 1975) and the usual age of 4 years at which most whitefish spawn (Machniak 1975b).

FOOD

Lake whitefish captured in the Lower Churchill River fed primarily on benthic invertebrates as is usual for this species (Scott and Crossman 1973). Insects were the major food source followed by occasional arachnids, crustaceans, molluscs and fish (Table 9).

SELECTION BY GEAR

Mean lengths, weights, and ages of captured lake whitefish tended to be greater with increasing mesh size when the data were combined (Fig. 19 and 20, Table 10) and in the individual river sections (Appendices VIII and IX). The most efficient mesh size was the 7.6 cm; catching 2.2 fish weighing 1.43 kg/net night. It captured fish over almost the whole range of ages and lengths in the total catch. Ninety-nine percent of the whitefish captured by this mesh size were age 4 and over and 97% were 30 cm or larger.

Table 9. Percentage occurrence of major food items in the stomachs of lake whitefish in the Lower Churchill River, June-August 1975-76.

Food item	River section					
	I	II	III	IV	V	I-V combined
Insect remains	76.0	54.7	37.1	25.7	66.7	52.7
Detritus	34.7	25.3	47.1	38.6	39.7	37.0
Trichoptera		21.3	62.9	4.3	33.3	24.2
Diptera (pupae)	22.7	14.7	14.3	35.7	24.4	22.3
Diptera (larvae)	57.3	22.7	2.9	12.9	12.8	22.0
Plecoptera			38.6	22.9	34.6	19.0
Hydracarina	40.0	9.33		12.9	16.7	16.0
Cladocera		12.0		14.3	29.5	11.4
Ephemeroptera			1.4	7.1	38.5	9.8
Invertebrate eggs			42.9	1.4		8.4
Mollusca			8.5	22.9	1.3	6.3
Ceratopogonidae	18.7			10.0		5.7
Hymenoptera			11.4	2.9	11.5	5.2
Lepidoptera					2.6	0.5
Fish remains			5.7	1.4	5.1	2.5
Coleptera			7.1	2.9	1.3	2.2
Hemiptera				2.9	5.1	1.6
Fish eggs			1.4			1.4
Odonata				5.7		1.1
Copepoda				2.9		0.5
Lota lota				1.4		0.2
Gasterosteus aculeatus				1.4		0.2
Cottus sp.			1.4			0.2
Number of stomachs examined	75	75	70	70	78	368
Number of stomachs empty	5	15	6	18	14	58

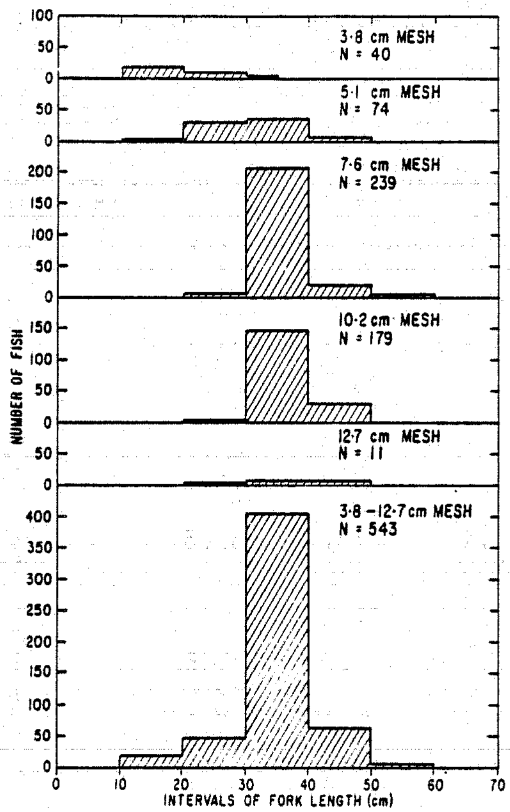

Fig. 19. Length-frequency distribution by gillnet mesh size of lake whitefish from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

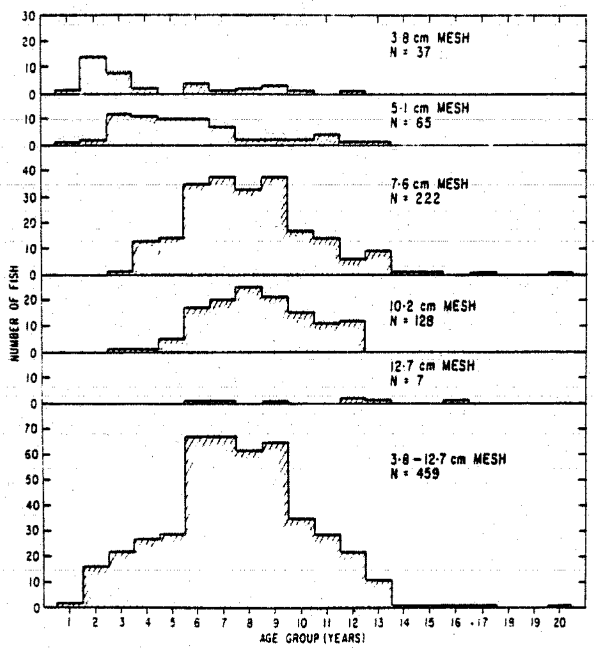

Fig. 20. Age-frequency distribution by gillnet mesh size of lake whitefish from the Lower Churchill River above Muskrat Falls, June-August, 1975-76

Table 10. Catch statistics of lake whitefish from Sections II-V of the Lower Churchill River, June-August 1975-76.

Mesh size (cm)	No. of net nights	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
3.8	107	40	0.4	25.3	11.6	0.29	0.11	4.5
5.1	107	74	0.7	30.7	32.4	0.44	0.30	5.6
7.6	109	240	2.2	36.2	155.7	0.65	1.43	8.0
10.2	109	178	1.6	37.5	131.8	0.74	1.21	8.3
12.7	107	11	0.1	40.1	10.4	0.95	0.09	10.3

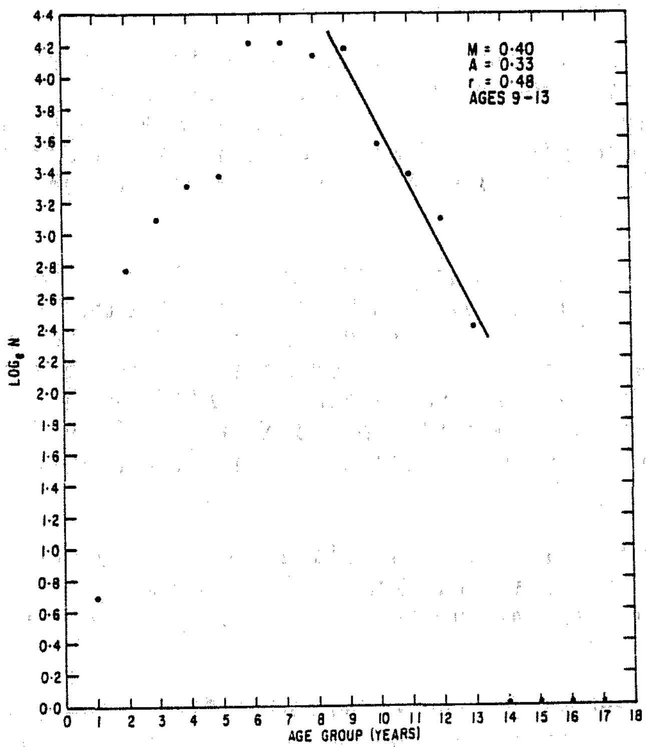

Fig. 21. Catch curve of lake whitefish from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

MORTALITY RATE

The natural mortality rate (M = 0.40) of whitefish taken above Muskrat Falls (Fig. 21) was slightly less than the 0.49 average of unexploited northern whitefish populations (Healey 1975).

DISCUSSION

In his review of the literature on lake whitefish in reservoirs, Machniak (1975b) has written, "....river reservoirs will probably develop sizeable whitefish populations provided conditions are fairly amiable...."

There are indications that the growth rate of lake whitefish will improve in the Lower Churchill if the river is impounded. The facts that overall growth is slow in the Lower Churchill and slower than in the Smallwood Reservoir suggest that as conditions in the river approach those of the reservoir, growth rates will increase. Also, the comparatively rapid growth of whitefish from Winokapau Lake suggests that as the river becomes more of a lake-like environment, growth rates will increase.

Catch per unit effort of whitefish in the Smallwood Reservoir was greater, by a factor of about 4-7 times, than in the Lower Churchill River (Bruce 1975). Although it is more difficult to fish a river, this large difference suggests that production will improve after impoundment. This suggestion is supported by the usually higher density of benthic food organisms found in rivers after impoundment (Machniak 1975b).

The attainment of potential whitefish production may be impaired by several factors. Lake whitefish in Labrador usually spawn in October or November (W. Bruce, pers. comm.). Although they utilize a variety of habitats for spawning, they generally spawn in shallow water over clean, hard or stony bottom less than 8 m deep. Young usually hatch in April or May and remain in shallow water until early summer. Thus, after a reservoir has been flooded, bank instability, high water turbidity, offshore sedimentation and drawdowns may have deleterious effects on reproduction and yield.

A potential problem for any commercial whitefish fishery on the reservoirs is an increase in the population of the parasite, *Triaenophorus crassus*. This may cause marketing problems. These problems may be eliminated by exploiting northern pike, a final host of the parasite.

If a commercial fishery is started on the Lower Churchill River, there may be difficulties in harvesting only commercial-size whitefish. The generally accepted commercial size of 0.9 kg (Scott and Crossman 1973) is greater than the average weight of fish caught in all but the 12.7 cm mesh size. This was the least efficient mesh size used in the present study. Most of the fish caught in the 7.6 cm mesh, the most efficient, would have spawned at least once. However, the average weight of individuals taken in this mesh size was only 0.74 kg.

LONGNOSE SUCKER

CATCHES

Overall, 689 gillnets fished overnight caught 1191 longnose suckers with a total weight of 401.5 kg (Fig. 22). A single net night averaged 1.7 fish weighing 0.58 kg. Captured fish had a mean length of 29.6 cm, a mean weight of 0.34 kg, and a mean age of 8.8 years.

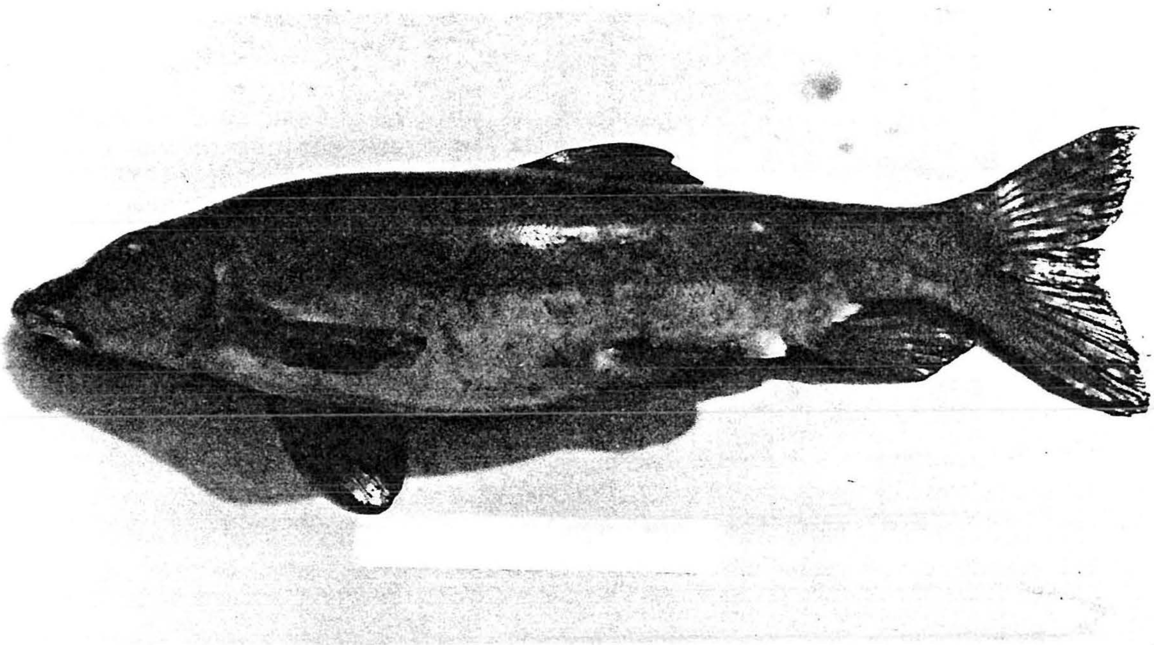

Fig. 22. Longnose sucker.

Within the river, catches per net night varied from 0.10 kg in Section II to 1.44 kg in Section IV (Fig. 23). Catches tended to be less downstream of Gull Island than they were upstream.

GROWTH IN LENGTH

Ages assigned to longnose suckers age 5 and over are, as in the case of white suckers, liable to underestimation when scales are employed (Scott and Crossman 1973). Bruce and Parsons (1979) found no significant differences between the growth of longnose suckers in western Labrador indicated by scales and that indicated by fin rays. As determined from scales, longnose sucker growth in the river as a whole appeared linear (Fig. 24 and Appendix V). The rate of growth was similar to that in the Smallwood Reservoir (Bruce 1974, 1975) and near the low part of the range exhibited by this species (Rawson and Elsey 1950; Reed 1962).

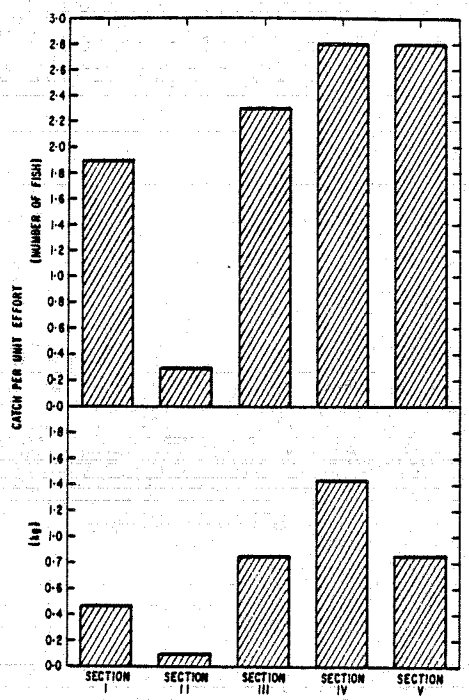

Fig. 23. Catches of longnose suckers in five sections of the Lower Churchill River, June-August, 1975-76.

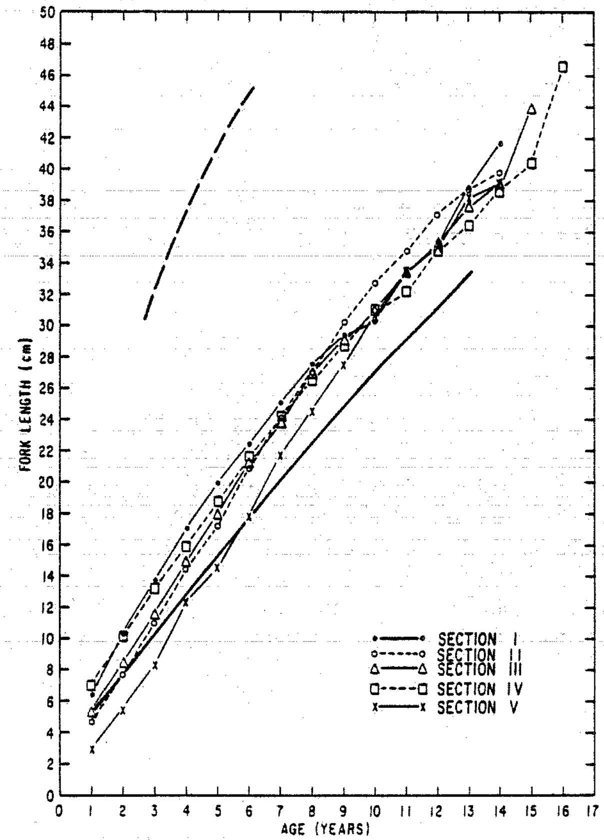

Fig. 24. Growth of longnose suckers in the Lower Churchill River, 1975-76. Presented for contrast is growth in the Northern Saskatchewan River (heavy dashed line) (Reed 1962) and Pyramid Lake, Alberta (solid heavy line) (Rawson and Elsey 1950).

Growth rates were variable within the river. Growth was slowest in the rapid waters of Section V below Churchill Falls and fastest in the slow-moving waters downstream of Muskrat Falls (Section I) and in Winokapau Lake (Section IV).

The maximum age of longnose suckers was similar to that obtained from scales by other workers. One fish was in its 20th year as compared to the maximum age of about 22-24 years (Scott and Crossman 1973).

GROWTH IN WEIGHT

Exponents in the length-weight relationship ranged from 3.08 to 3.35 with a mean of 3.17 (Table 11). This was the value reported by Bruce (1974) for longnose suckers from Jacopie Lake in the Smallwood Reservoir but higher than the value of 2.8 for fish from Lobstick and Sandgirt lakes in the Smallwood Reservoir (Bruce 1975).

Table 11. Least squares linear regressions of $\log_{10}$ weight (g) on $\log_{10}$ fork length (cm) for longnose suckers from the Lower Churchill River, June-August 1975-76.

River section	Y intercept	Slope	Correlation coefficient	No. of fish
I	-2.01	3.08	0.968	157
II	-2.09	3.11	0.997	55
III	-2.17	3.14	0.992	268
IV	-2.24	3.18	0.976	171
V	-5.48	3.35	0.985	150
Means	-2.80	3.17		

SEX RATIOS AND MATURITY

Sex ratios in the individual river sections ranged from 0.24 to 0.75 (Appendix VI). The overall ratio, 0.49 males per female, indicated an overall relative abundance of the longer-living females.

Of 698 longnose suckers examined, 87.4% were mature. On the average, longnose suckers matured at about 20 cm, the length attained by fish in their sixth or seventh year of life.

FOOD

Longnose suckers from the Lower Churchill River fed primarily on benthic invertebrates (Table 12), the usual food of this species (Scott and Crossman 1973).

Table 12. Percentage occurrence of major food items in the stomachs of longnose suckers in the Lower Churchill River, June-August 1975-76.

Food item	River section					
	I	II	III	IV	V.	I-V combined
Diptera (larvae)	49.3	100.0	64.0	72.0	69.3	68.4
Detritus	77.3	100.0	80.0	53.3		57.6
Insect remains	45.3	94.3	33.3	37.3	62.7	49.9
Diptera (pupa)	13.3	68.6	48.0	6.7	90.7	42.7
Trichoptera		45.7	36.0	5.3	20.0	18.5
Plecoptera			18.7	5.3	16.0	9.0
Hydracarina			1.3	5.3	32.0	8.7
Invertebrate eggs		22.9	1.3	5.3		3.9
Ephemeroptera			5.3	9.3		3.4
Mollusca				10.7		2.4
Coleoptera			5.3			1.2
Hirudinea		8.6				0.9
Copepoda				4.0		0.9
Cladocera				4.0		0.9
Certopogonidae				2.7		0.6
Hemiptera				1.3		0.3
Algae				1.3		0.3
Fish eggs				1.3		0.3
Number of stomachs examined	75	35	75	75	75	335
Number of stomachs empty	8	0	3	6	3	20

SELECTION BY GEAR

Overall, mean lengths, weights and ages of captured longnose suckers tended to be greater with greater mesh size (Fig. 25 and 26, Table 13). These trends were also obvious within the individual river sections (Appendices VIII and IX). The most efficient mesh size, 7.6 cm, yielded 3.9 fish weighing 1.99 kg/net night. All fish captured by this mesh were age 7 and over and 98% were 30 cm or larger.

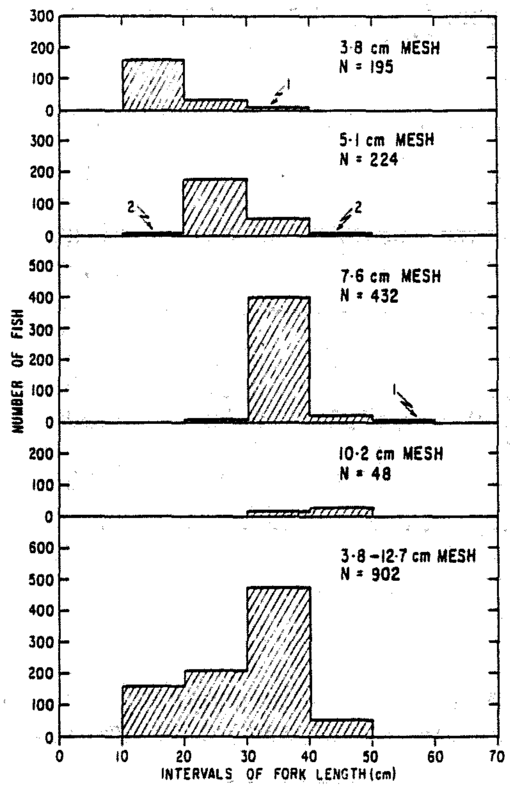

Fig. 25. Length-frequency distribution by gillnet mesh size of longnose suckers from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

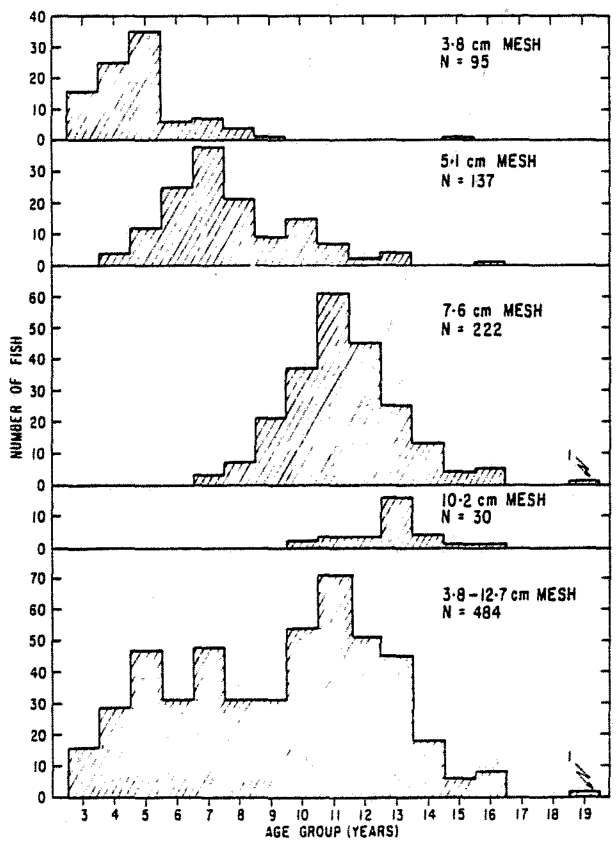

Fig. 26. Age-frequency distribution by gillnet mesh size of longnose suckers from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Table 13. Catch statistics of longnose suckers from Sections II-V of the Lower Churchill River, June-August 1975-76.

Mesh size (cm)	No. of net nights	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
3.8	107	195	1.8	18.9	16.0	0.08	0.15	4.7
5.1	107	224	2.1	27.3	54.1	0.24	0.51	7.7
7.6	109	432	3.9	34.9	216.6	0.50	1.99	11.3
10.2	109	48	0.4	40.9	41.4	0.86	0.38	13.0
12.7	107	3	<0.1	44.0	3.0	1.0	0.03	14.0

MORTALITY RATE

The instantaneous mortality rate (M = 0.57) of longnose suckers in the Lower Churchill River (Fig. 27) was similar to the 0.55 observed in Great Slave Lake (Harris 1962).

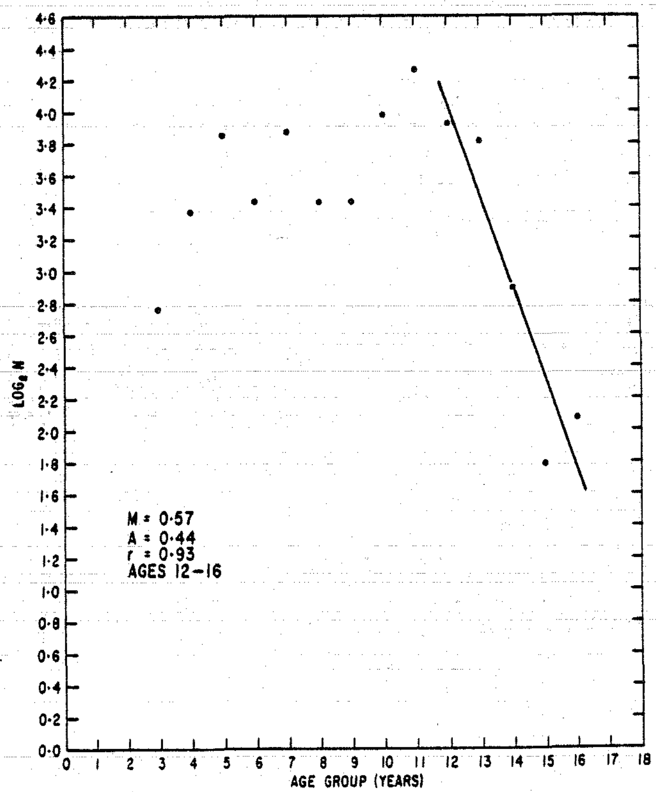

Fig. 27. Catch curve of longnose suckers from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

DISCUSSION

The longnose sucker is an adaptable fish widespread over Canada's north. A relatively abundant fish in the Lower Churchill River, it should do well in the new reservoirs.

Upstream of Muskrat Falls, growth rates of longnose suckers should improve after impoundment as suggested by the faster growth in the two slower velocity sections at present. If conditions downstream of the dam remain similar, it is to be expected that growth rates will also.

Production of longnose suckers is likely to increase if the usual increase in benthic invertebrates occurs after impoundment. Longnose suckers will likely form the bulk of sucker biomass in the reservoirs since they are, at present, more abundant than white suckers in the river and in the north as a whole.

Spring drawdowns may impair production of longnose suckers in the reservoirs. Longnose suckers in Labrador spawn usually in June (W. Bruce, pers. comm.) in streams or shallow lake areas. Drawdowns from that time until about a month later when fry move to deeper waters may cause mortalities.

WHITE SUCKER

CATCHES

Overall, 689 gillnets fished overnight caught 711 white suckers with a total weight of 353.4 kg (Fig. 28). Giving equal weight to each mesh size, a single net night averaged 1.0 fish weighing 0.51 kg. Captured fish had a mean length of 32.2 cm, a mean weight of 0.50 kg, and a mean age of 7.5 years.

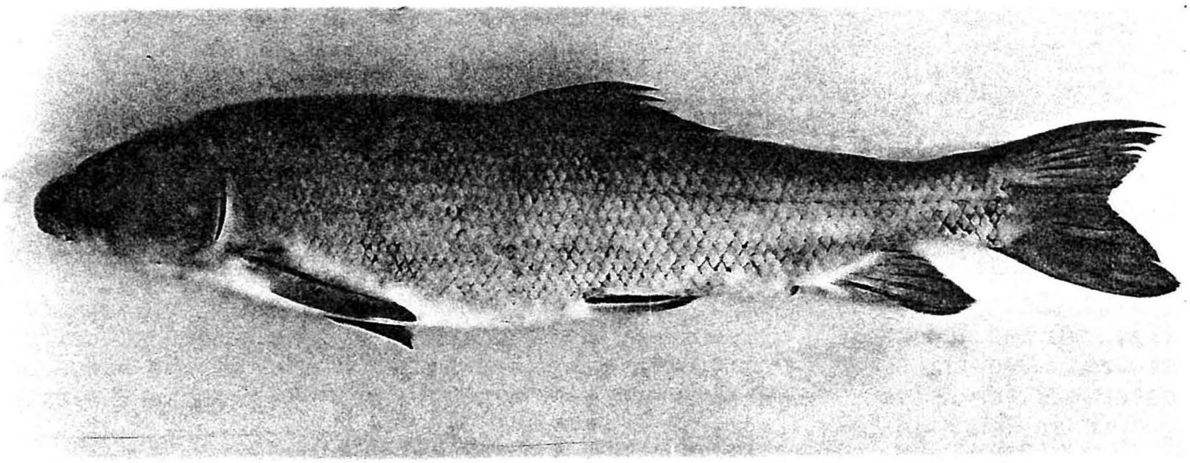

Fig. 28. White sucker.

Catches per net night in different river sections varied from 0.11 kg in Section III to 1.06 kg in Section IV (Fig. 29). Yields tended to be greater upstream of Gull Island.

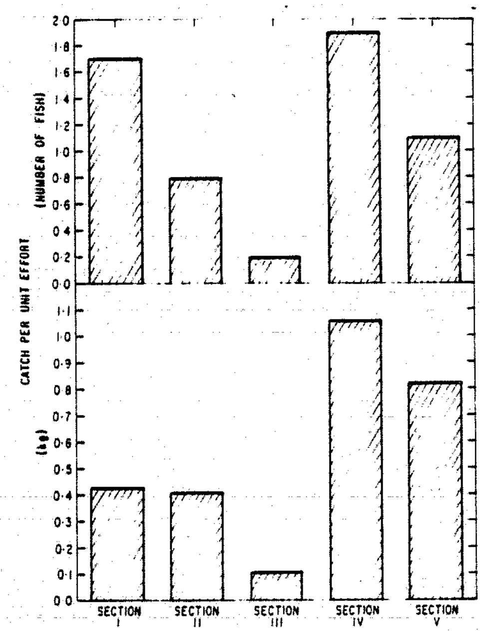

Fig. 29. Catches of white suckers in five sections of the Lower Churchill River, June-August, 1975-76.

GROWTH IN LENGTH

The ages of white suckers age 5 and over are usually underestimated from scales (Beamish and Harvey 1969). As a result, the obtained age-length relationships (Fig. 30 and Appendix V) may portray a faster rate of growth than actually occurs. Overall the rate of growth was close to the middle of the range previously described for white suckers (Beamish 1973) and slightly lower than the rate of growth in Ten Mile Lake, Labrador (Parsons 1975).

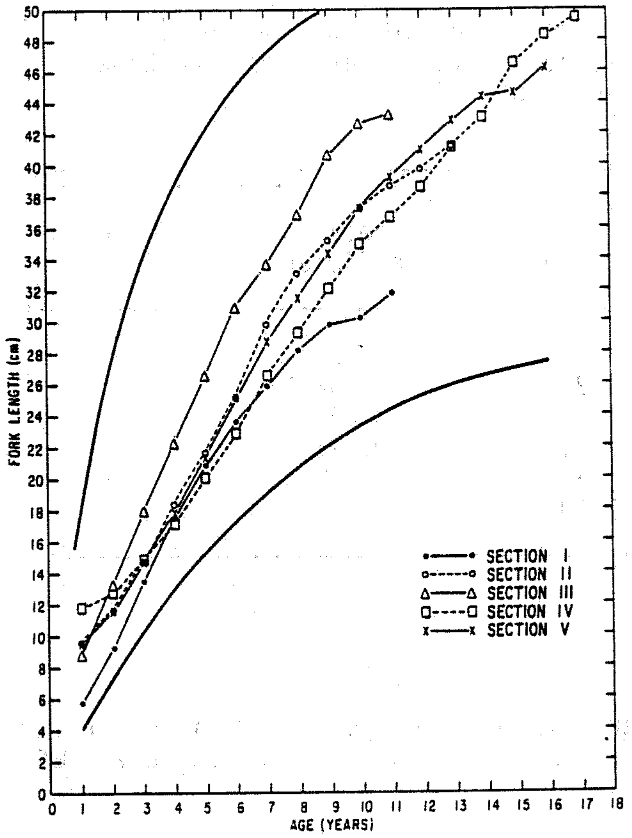

Fig. 30. Growth of white suckers in the Lower Churchill River, 1975-76. Presented for contrast is the total range in growth (solid heavy lines) of white suckers over the zoogeographic range (Beamish 1973).

Within the river, growth was most rapid in Section III downstream of Winokapau Lake and slowest in Section I downstream of Muskrat Falls. Little variation was evident in the remaining three sections.

The maximum age of white suckers in the Lower Churchill River, 18 years, was similar to the usual maximum age of this species obtained from scales (Scott and Crossman 1973).

GROWTH IN WEIGHT

Exponents in the length-weight relationship of white suckers from the Lower Churchill River ranged from 3.13 to 3.60 and had a mean of 3.30 (Table 14); higher than the values of 2.4-2.5 observed in other areas of Labrador (W. Bruce, pers. comm.).

Table 14. Least squares linear regressions of $\log_{10}$ weight (g) on $\log_{10}$ fork length (cm) for white suckers from the Lower Churchill River, June-August 1975-76.

River section	Y intercept	Slope	Correlation coefficient	No. of fish
I	-2.16	3.18	0.974	199
II	-2.19	3.23	0.996	171
III	-2.79	3.60	0.982	20
IV	-2.09	3.13	0.995	113
V	-5.46	3.37	0.987	150
Means	-2.94	3.30		

SEX RATIOS AND MATURITY

The overall sex ratio (males per female) of white suckers in the river indicated an equal abundance of the sexes (Appendix VI). Ratios were 0.86-1.22 with an overall ratio of 1.01.

Of 550 white suckers examined, 76.4% were mature (Appendix VII). On the average, white suckers matured at about 22 cm; the length attained by fish in their fifth to sixth year of life. The age at maturity over the range varies from 3 to 8 years (Scott and Crossman 1973).

FOOD

White suckers from the Lower Churchill River fed primarily on benthic invertebrates (Table 15), the usual food of this species (Scott and Crossman 1973).

Table 15. Percentage occurrence of major food items in the stomachs of white suckers in the Lower Churchill River, June-August 1975-76.

Food item	River section					
	I	II	III	IV	V	I-V combined
Detritus	62.7	77.3	100.0	80.3	86.1	77.6
Diptera (larvae)	42.7	74.7	86.7		76.4	49.8
Insect remains	76.0	65.3	6.7	28.9	23.6	49.5
Diptera (pupae)	24.0	34.7	13.3	25.0	55.6	33.5
Hirundinea	25.3	21.3	26.7	14.4	27.8	22.4
Mollusca			26.7	29.5	52.8	23.0
Trichoptera		24.0		30.3	8.3	15.0
Invertebrate eggs	16.0	10.6		6.6	5.6	9.3
Copepoda				25.0		6.0
Plecoptera	14.7			1.3	6.9	5.4
Coleptera				17.1		4.2
Ephemeroptera				10.5		2.6
Hydracarina				5.3	11.1	3.8
Ceratopogonidae				3.9		1.0
Cladocera				3.9		1.0
Amphipoda				2.6		0.6
Hymenoptera					2.8	0.6
Arachnida					1.4	0.3
Number of stomachs examined	75	75	15	76	72	313
Number of stomachs empty	8	5	0	0	10	23

SELECTION BY GEAR

Mean lengths, weights, and ages of captured white suckers tended to be greater with greater mesh size in the river as a whole (Fig. 31 and 32, Table 16) and in the individual river sections (Appendices VIII and IX).

The most efficient, in terms of weight, was the 10.2 cm mesh size. This mesh captured 1.3 fish weighing 1.28 kg/net night. All fish captured in the 10.2 cm mesh were age 7 and over and 30 cm or larger.

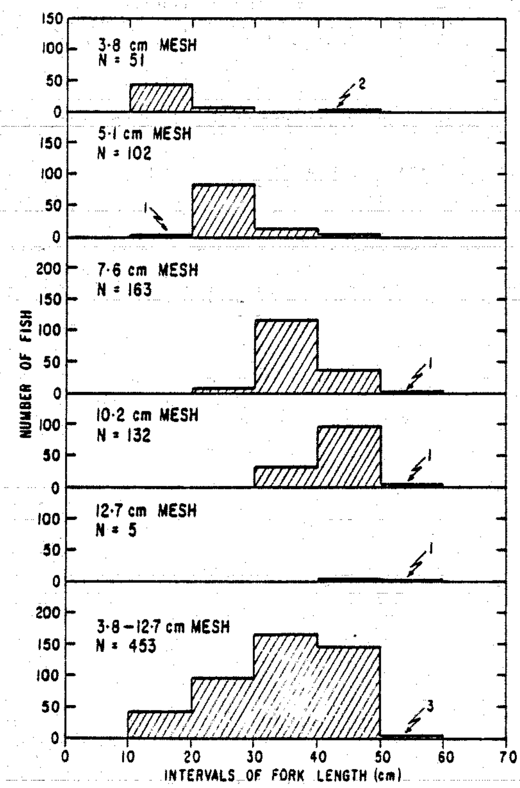

Fig. 31. Length-frequency distribution by gillnet mesh size of white suckers from the Lower Churchill River above Muskrat Falls, June-August, 1975-76

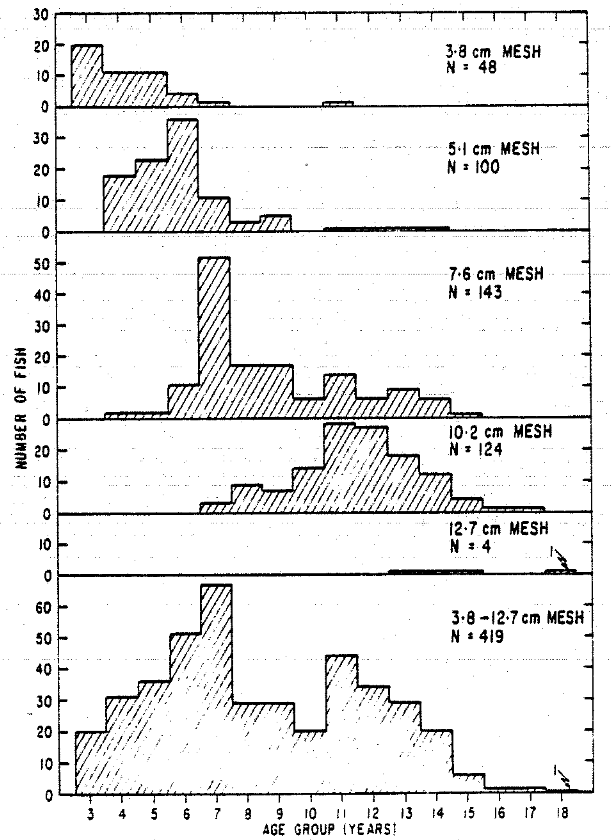

Fig. 32. Age-frequency distribution by gillnet mesh size of white suckers from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Table 16. Catch statistics of white suckers from Sections II-V of the Lower Churchill River, June-August 1975-76.

Mesh size (cm)	No. of net nights	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
3.8	107	51	0.5	19.4	5.8	0.11	0.05	4.2
5.1	107	102	0.9	26.4	23.7	0.23	0.22	5.9
7.6	109	163	1.5	36.1	112.7	0.69	1.03	8.5
10.2	109	138	1.3	41.6	139.5	1.01	1.28	11.3
12.7	107	5	<0.1	47.9	6.8	1.36	0.06	15.0

MORTALITY RATE

The total instantaneous mortality rate of white suckers (Fig. 33) at M = 0.56 was nearly identical to that of longnose suckers and may have been overestimated as a result of age underestimation.

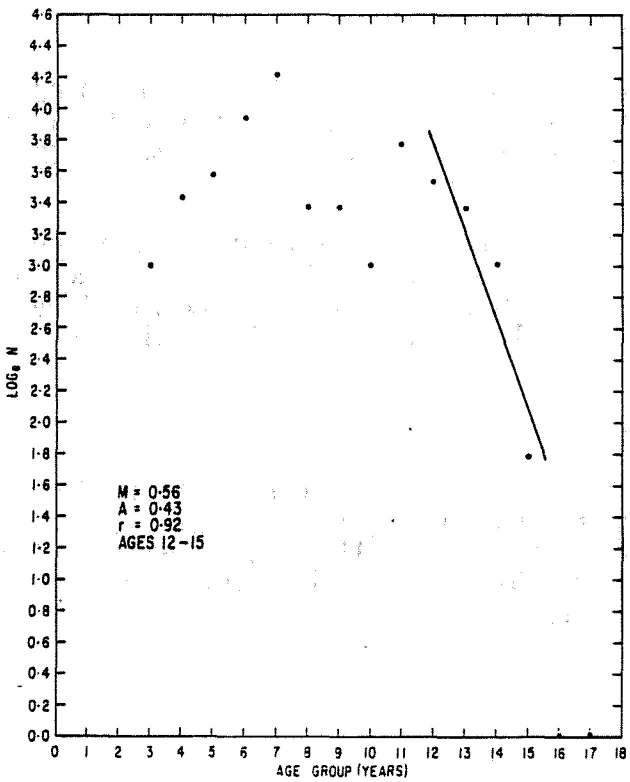

Fig. 33. Catch curve of white suckers from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

DISCUSSION

The white sucker is an adaptable fish widespread throughout Canadian waters. These facts and its present levels of abundance in the Lower Churchill River suggest that white suckers will be abundant in the new reservoirs.

It is not expected that growth rates will change significantly in the long term after construction of the reservoirs. The likely similarity of chemical and physical conditions below the site of the Muskrat Falls dam suggests that white sucker growth will remain similar in this area. The lack of a marked variation in the growth of younger fish above the dam site at present, in spite of varied habitats, suggests that growth will not change markedly in the future.

White sucker production should increase after impoundment with the usual increase in benthic food organisms. This is also indicated by the greatest catches being obtained from Winokapau Lake, that part of the river system most resembling the reservoirs.

Fluctuating water levels in the spring may prevent white suckers from attaining their potential production. White suckers usually spawn in June in Labrador in or near streams or on lake margins in shallow water (W. Bruce, pers. comm.). Drawdowns from that time until about a month later when the fry move to deeper water will likely be deleterious.

BROOK TROUT

CATCHES

Overall, 689 gillnet nights of fishing yielded 579 brook trout weighing 261.6 kg; corresponding to a catch per unit effort of 0.8 fish weighing 0.38 kg/net night (Fig. 34). Captured trout had a mean length of 30.6 cm, a mean weight of 0.45 kg, and a mean age of 3.7 years.

Catches were highly variable within the river. In terms of numbers and weight, catch per unit effort was highest in Section III and lowest in Section II (Fig. 35). Catches were greater above the dam site at Gull Island than they were below and greatest in the two fastest-flowing river sections, III and V.

GROWTH IN LENGTH

Brook trout growth in the Lower Churchill River was nearly linear (Fig. 36, and Appendix V). On the whole, growth in length was more rapid than that on the Avalon Peninsula of Newfoundland (Whelan and Wiseman 1977) but slower than that in Ten Mile Lake, Labrador (Parsons 1975), the Smallwood Reservoir (Bruce 1974), and Lake Anne Marie, Labrador (Flick 1977).

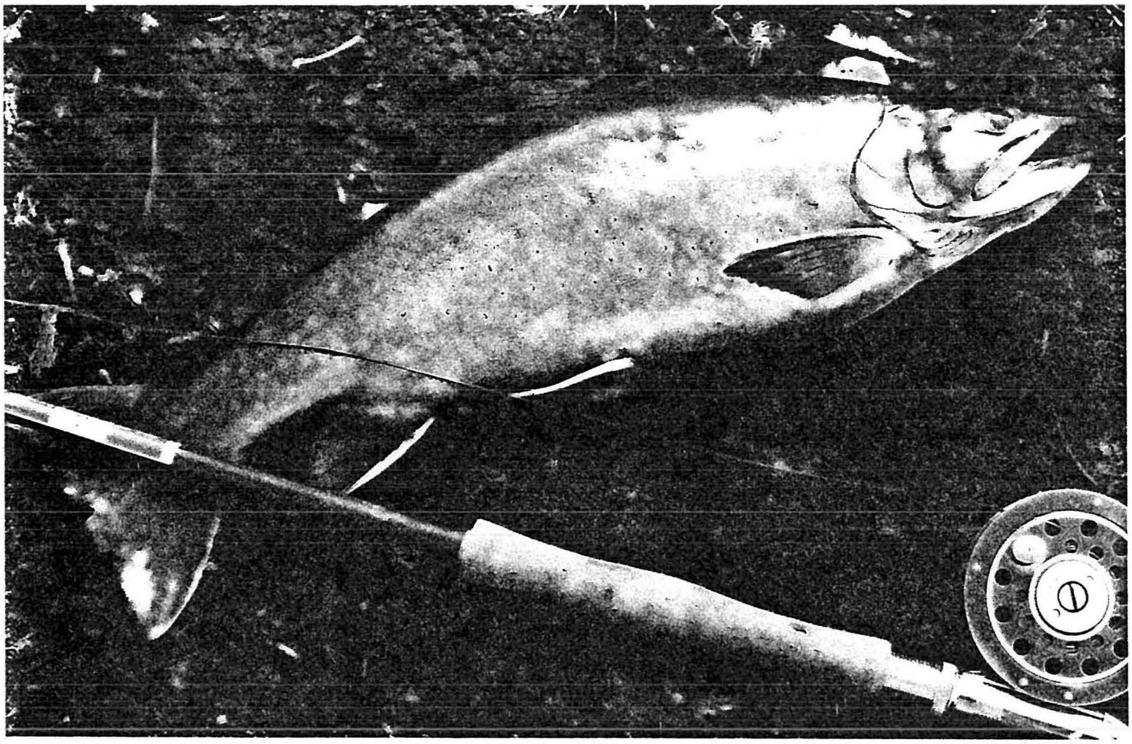

Fig. 34. Brook trout.

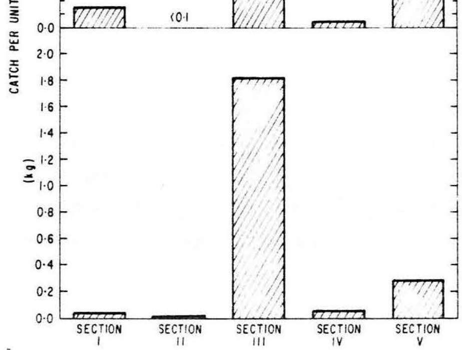

Fig. 35. Catches of brook trout in five sections of the Lower Churchill River, June-August, 1975-76.

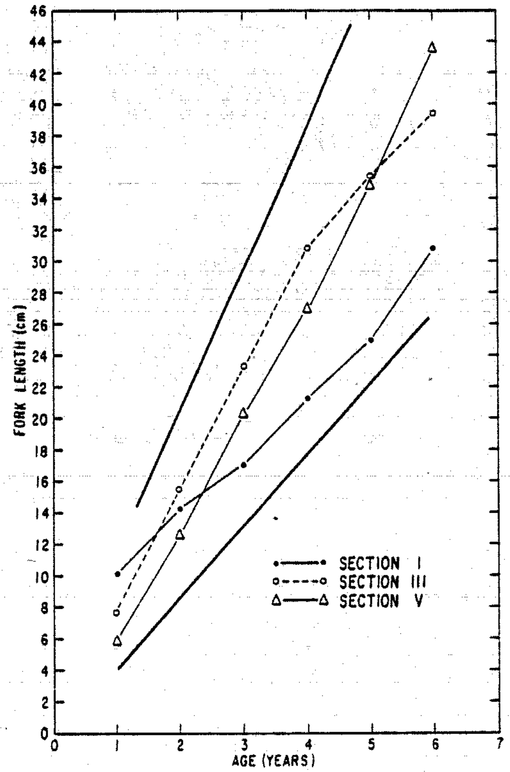

Fig. 36. Growth of brook trout in the Lower Churchill River, 1975-76. Solid heavy lines approximate the greatest (Flick 1977) and lowest (Whelan and Wiseman 1977) rates of growth reported for Newfoundland and Labrador.

Within the river, growth was most rapid in the fast waters of Section III downstream of Winokapau Lake and slowest in Section I below Muskrat Falls.

The longevity of brook trout from the Lower Churchill, 6 years, was within the 5-8 years usually observed in wild brook trout populations (Scott and Crossman 1973).

GROWTH IN WEIGHT

Exponents in the length-weight relationships of brook trout ranged from 2.69 to 3.23 and had a mean of 2.99 (Table 17); lower than the 3.2-3.3 reported for other Labrador populations (Bruce 1974; Parsons 1975).

Table 17. Least squares linear regressions of $\log_{10}$ weight (g) on $\log_{10}$ fork length (cm) for brook trout from the Lower Churchill River, June-August 1975-76.

River section	Y intercept	Slope	Correlation coefficient	No. of fish
I	-1.57	2.69	0.964	35
III	-2.04	3.06	0.987	183
V	-5.28	3.23	0.990	87
Means	-2.96	2.99		

SEX RATIOS AND MATURITY

The overall sex ratio indicated an equal abundance of the sexes. Numbers of males per female in the five sections were 0.67-2.00 with an overall ratio of 1.07 (Appendix VI).

Of 695 brook trout examined, 91.9% were mature (Appendix VII). The smallest length interval in which more than 50% of the individuals were mature was 16.0-17.9 cm; having 63.0% mature fish. This length interval corresponded to the length attained by fish in their third to fourth year of life; the usual age of brook trout at maturity (Scott and Crossman 1973). There were a few immature individuals in most length intervals up to 46 cm.

FOOD

Brook trout from the Lower Churchill River fed primarily on benthic invertebrates, the usual food of medium-size trout (Scott and Crossman 1973). Fish also comprised a part of the diet (Table 18).

Table 18. Percentage occurrence of major food items in the stomachs of brook trout in the Lower Churchill River, June-August 1975-76.

Food item	River Section					
	I	II	III	IV	V	I-V combined
Insect remains	61.8		42.7	75.0	48.6	46.4
Plecoptera	23.5		56.0	25.0	35.7	39.2
Diptera (pupae)			84.0		12.9	37.1
Detritus			56.0	50.0	38.6	36.6
Coleoptera	38.2	50.0	34.7	50.0	25.7	30.9
Fish remains	41.2		14.7		22.9	21.1
Trichoptera			24.0	75.0	21.4	18.6
Hymenoptera	14.7		16.0	50.0	20.0	17.0
Ephemeroptera			4.0		15.7	7.2
Odonata			1.3		18.6	7.2
Diptera (larvae)	17.7		4.0	25.0		5.2
Diptera (adult)					14.3	5.2
Arachnida			2.7	50.0	2.9	3.1
Gasterosteus aculeatus				25.0	5.7	2.6
Invertebrate eggs			2.7		2.9	2.1
Hemiptera					5.7	2.1
Lota lota					5.7	2.1
Cladocera					4.3	1.6
Lepidoptera					4.3	1.6
Catostomus sp.			1.3			0.5
Fish eggs			1.3			0.5
Homoptera				25.0		0.5
Orthoptera					1.4	0.5
Cottus sp.					1.4	0.5
Number of stomachs examined	34	2	75	4	79	194
Number of stomachs empty	1	1	0	0	9	11

SELECTION BY GEAR

Overall, mean lengths, weights, and ages tended to increase with increasing mesh size; but these trends were not very strong (Fig. 37 and 38, Table 19). These trends were less pronounced within the individual river sections (Appendices VIII and IX). The most efficient mesh size, 7.6 cm, captured 2.5 fish weighing 1.31 kg/net night. Ninety-eight percent of the trout taken in this mesh size were age 3 and over and 93% were 30 cm or larger.

Table 19. Catch statistics of brook trout from Sections II-V of the Lower Lower Churchill River, June-August 1975-76.

Mesh size (cm)	No. of net nights	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
3.8	107	84	0.8	20.8	10.5	0.13	0.09	2.4
5.1	107	87	0.8	27.6	22.6	0.26	0.21	3.1
7.6	109	270	2.5	35.0	142.6	0.53	1.31	3.9
10.2	109	93	0.9	40.2	75.3	0.81	0.69	3.9
12.7	107	7	0.1	37.0	5.6	0.80	0.05	4.1

MORTALITY RATE

The mortality rate of brook trout from the Lower Churchill River, M = 1.18 (Fig. 39), was slightly lower than the value of 1.21 from Jacopie Lake, Smallwood Reservoir, and the value of 1.49 from Valley River, Labrador (W. Bruce, pers. comm.).

DISCUSSION

There are indications that the growth rate and production of brook trout in the Lower Churchill River will decrease after the river is impounded. The more rapid growth in length and weight and the greater catches of trout from the faster-flowing river sections suggest that, after impoundment, growth rates and production will decrease in these sections.

It is possible that much of the variation in the catch from section to section is attributable to migrations of the trout to preferred locations. Usually, however, brook trout tend to move from streams and rivers to larger bodies of water when temperatures rise.

It is likely that the reproductive success of brook trout will decrease after the impoundment of the river. At the present time, brook trout probably utilize the river itself as well as its tributaries for spawning. Slower

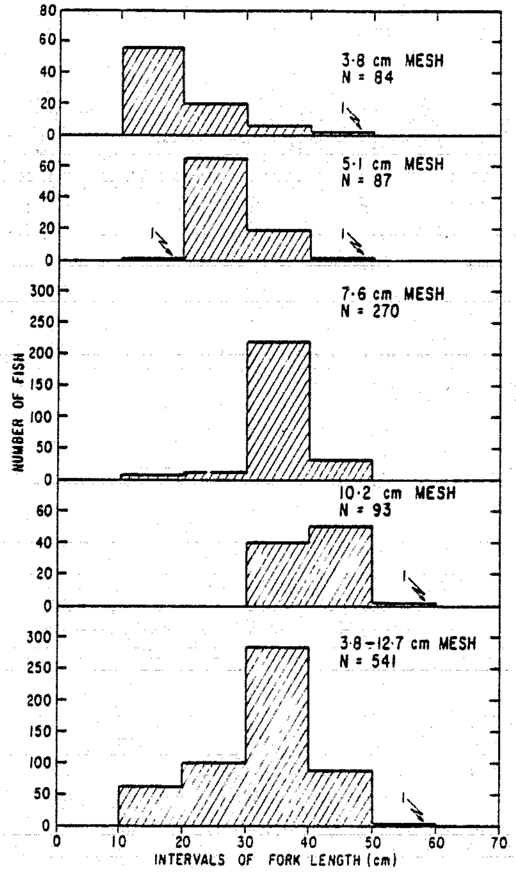

Fig. 37. Length-frequency distribution by gillnet mesh size of brook trout from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

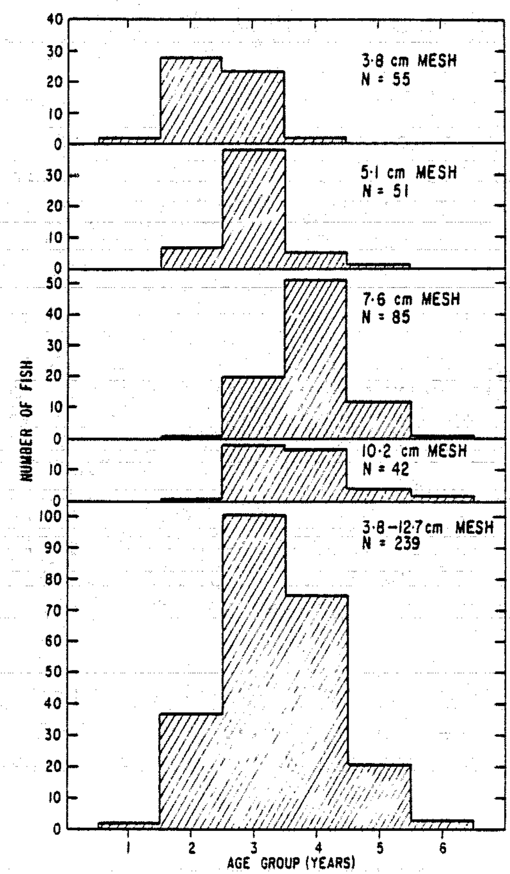

Fig. 38. Age-frequency distribution by gillnet mesh size of brook trout from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

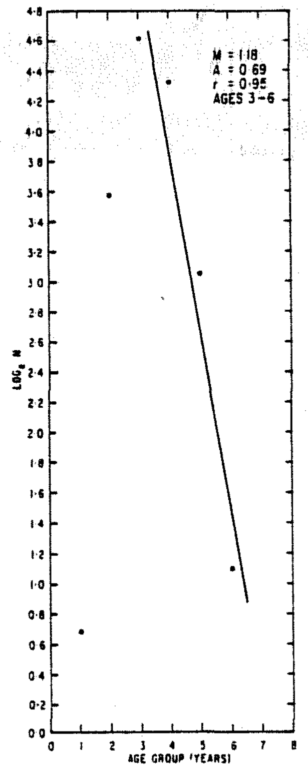

Fig. 39. Catch curve of brook trout from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

water velocities in these favorable locations and drawdown from fall spawning until fry emergence in spring will probably be detrimental. In addition, increased sediment loads on spawning beds and greater water depths over present spawning areas may be harmful.

BURBOT

CATCHES

Overall, 689 gillnet nights of fishing yielded 85 burbot weighing 59.9 kg or 0.1 fish weighing 0.09 kg/net night (Fig. 40). Captured burbot had a mean length of 44.6 cm, a mean weight of 0.70 kg and a mean age of 7.4 years.

Catches varied from 0.03 kg net/night in Section I to 0.30 kg/net night in Section IV (Fig. 41). Catches tended to be greater above the site of the Gull Island dam than below and, with one exception, greater with greater distance upstream.

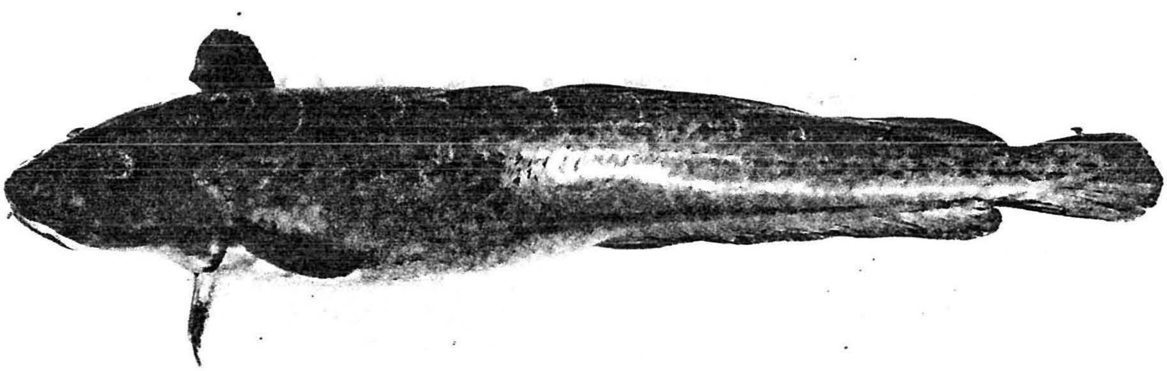

Fig. 40. Burbot.

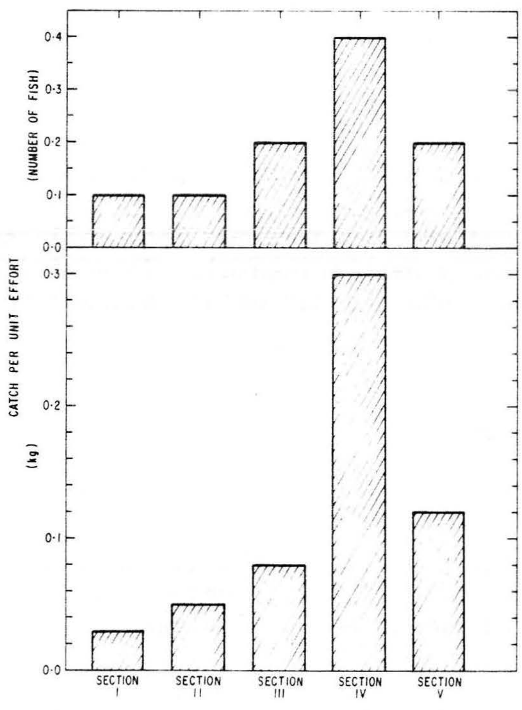

Fig. 41. Catches of burbot in five sections of the Lower Churchill River, June-August, 1975-76.

GROWTH IN LENGTH

The growth of burbot from the Lower Churchill River (Fig. 42 and Appendix V) tended to be midway between the extremes reported for Canadian waters (McCrimmon and Devitt 1954; Beamish et al. 1976).

Within the river, mean lengths of the age groups tended to be the least in Section V and greatest in Section III. Sample sizes were, however, small in all sections and negated the back-calculation of growth.

The age of the oldest burbot, 14 years, was within the probable maximum age in Canada of 10-15 years (Scott and Crossman 1973).

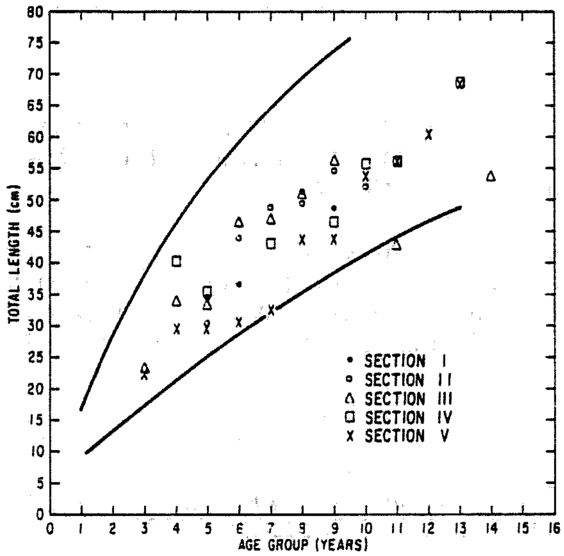

Fig. 42. Growth of burbot in the Lower Churchill River, June-August, 1975-76. Solid heavy lines approximate the greatest (McCrimmon and Devitt 1954) and lowest (Beamish et al. 1976) rates of growth in Canada.

GROWTH IN WEIGHT

Length-weight relationships of burbot from the Lower Churchill had exponents of 3.14-3.28 with a mean of 3.19 (Table 20).

Table 20. Least squares linear regressions of $\log_{10}$ weight (g) on $\log_{10}$ total length (cm) for burbot from the Lower Churchill River, June-August 1975-76.

River section	Y intercept	Slope	Correlation coefficient	No. of fish
III	-2.44	3.14	0.989	18
IV	-2.69	3.28	0.988	23
V	-5.42	3.14	0.998	24
Means	-3.52	3.19		

SEX RATIOS AND MATURITY

The overall sex ratio of the 84 burbot examined, 0.68, did not indicate a differential abundance of the sexes. Within river sections, the number of males per female ranged from 0.18 to 5.00 (Appendix VI).

Of 79 burbot examined, 86.1% were mature (Appendix VII). On the average, burbot were mature at a length of about 33 cm; corresponding to fish in their fifth year of life. This is similar to the usual attainment of maturity in the third or fourth year at lengths of 28-48 cm (Scott and Crossman 1973).

FOOD

Burbot from the Lower Churchill River fed on fish and aquatic invertebrates (Table 21) as is usual for this species (Scott and Crossman 1973).

SELECTION BY GEAR

Mean lengths, weights, and ages of captured burbot tended to increase with increasing mesh size when the data were combined (Fig. 43 and 44, Table 22) and in the individual river sections (Appendices VIII and IX). The most efficient mesh size in terms of weight was the 10.2 cm; catching 0.2 fish weighing 0.22 kg/net night. Ninety-five percent of burbot taken in this mesh size were 40 cm or larger and 93% were age 9 or over.

Table 21. Percentage occurrence of major food items in the stomachs of burbot in the Lower Churchill River, June-August 1975-76.

Food item	River section I	II	III	IV	V	I-V combined
Fish remains	85.7	30.8	20.0	15.4	41.7	32.5
Insect remains	57.1	53.9	80.0	11.5		27.5
Detritus		30.8	50.0	19.2		17.5
Plecoptera	57.1			11.5	25.0	16.3
Trichoptera			40.0		33.3	15.0
Lota lota		7.7		3.8	25.0	10.0
Gasterosteus aculeatus	57.1			7.7		7.5
Diptera (pupae)		23.1	20.0	3.8		7.5
Diptera (larvae)	28.6	7.7		3.8		5.0
Invertebrate eggs			10.0	3.8		2.5
Ephemeroptera			20.0			2.5
Coregonus clupeaformis			10.0			1.3
Cottus sp.			10.0			1.3
Couesuis plumbius				3.8		1.3
Catostomus sp.				3.8		1.3
Odonata				3.8		1.3
Number of stomachs examined	7	13	10	26	24	80
Number of stomachs empty	0	2	0	12	10	24

Table 22. Catch statistics of burbot from Sections II-V of the Lower Churchill River, June-August 1975-76.

Mesh size (cm)	No. of net nights	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
3.8	107	2	<0.1	22.5	0.1	0.05	<0.01	3.0
5.1	107	13	0.1	30.9	2.3	0.18	0.02	5.1
7.6	109	33	0.3	44.1	17.6	0.53	0.16	7.2
10.2	109	22	0.2	53.3	23.5	1.07	0.22	9.9
12.7	107	8	0.1	55.1	12.1	1.51	0.11	9.4

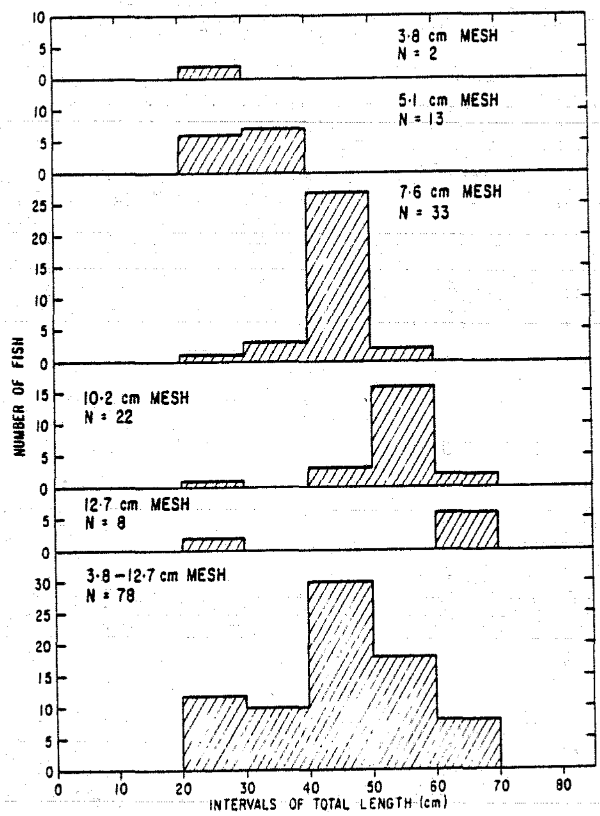

Fig. 43. Length-frequency distribution by gillnet mesh size of burbot from the Lower Churchill River above Muskrat Falls, June-August, 1975-76

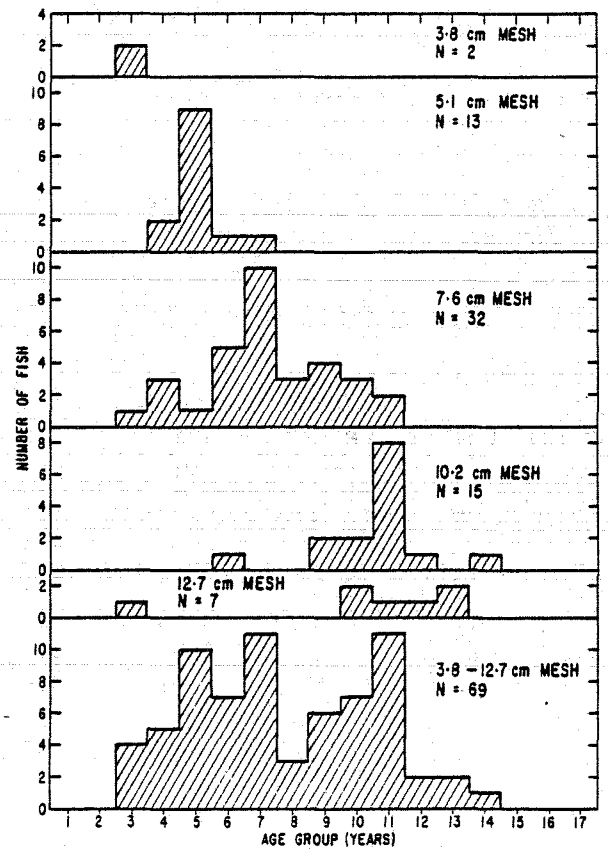

Fig. 44. Age-frequency distribution by gillnet mesh size of burbot from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

MORTALITY RATE

The instantaneous mortality rate of burbot above Muskrat Falls was 0.72 (Fig. 45); slightly lower than the value of M =1.00 for burbot from Heming Lake, Manitoba (calculated from data of Lawler 1963).

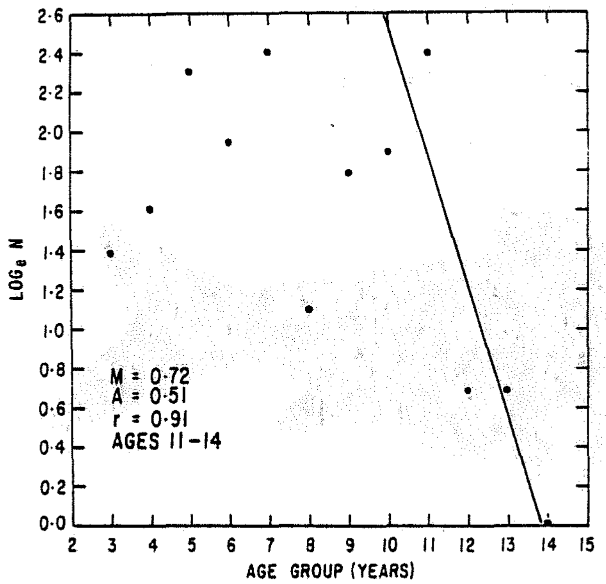

Fig. 45. Catch curve of burbot from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

DISCUSSION

Data collected to date suggest that burbot production in the Lower Churchill River will increase after the river is impounded. The fact that the greatest length-weight exponent and the greatest catch were observed in Winokapau Lake suggest that, as the river becomes more of a lake-like environment, burbot production in the river will approach that of Winokapau Lke.

Increases in burbot production will be assisted if the usual increase in benthic invertebrates occurs after impoundment. Burbot production may be impaired by excessive drawdown. Burbot usually spawn under the ice from January to March in Canada at depths of about 0.3-3.0 metres and the young usually appear from late February to June (Scott and Crossman 1973). Drawdowns over this period will kill the eggs.

LAKE TROUT

CATCHES

Lake trout (Fig. 46) were captured only in three sections upstream of Gull Island (Fig. 47). Overall, 689 gillnet nights of fishing yielded 15 lake trout weighing 51.8 kg. Captured trout had a mean length of 57.0 cm, a mean weight of 3.45 kg, and a mean age of 10.3 years.

Catches were greatest in Winokapau Lake (Section IV).

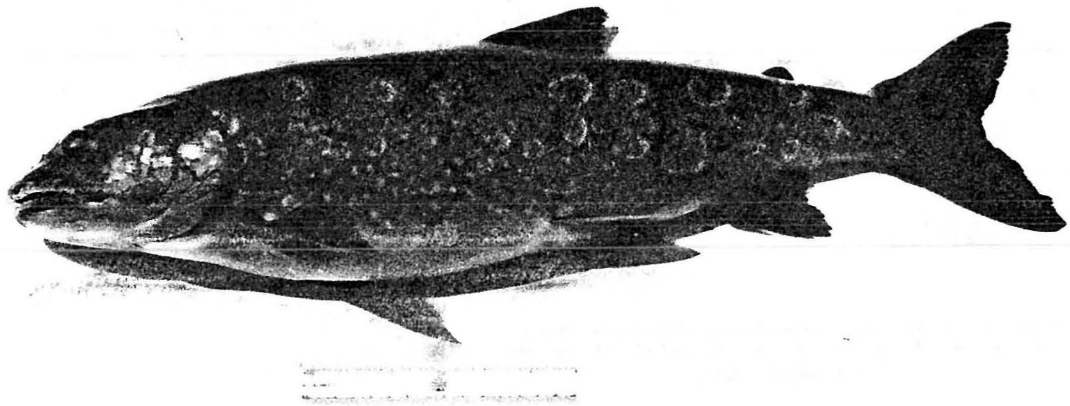

Fig. 46. Lake trout.

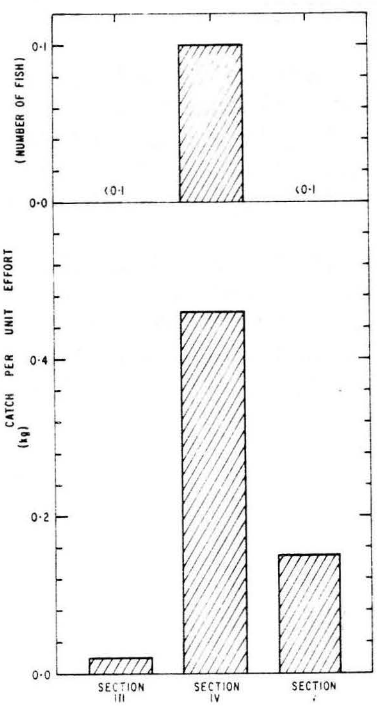

Fig. 47. Catches of lake trout in three sections of the Lower Churchill River, June-August, 1975-76.

GROWTH IN LENGTH

The small sample of lake trout prevented back-calculation of growth. However, the mean lengths of the fish in each age group indicated an overall rate of growth similar to that in the Smallwood Reservoir (Bruce 1974, 1975) (Fig. 48 and Appendix V) and within the extremes reported over the zoogeographic range (Healey 1978).

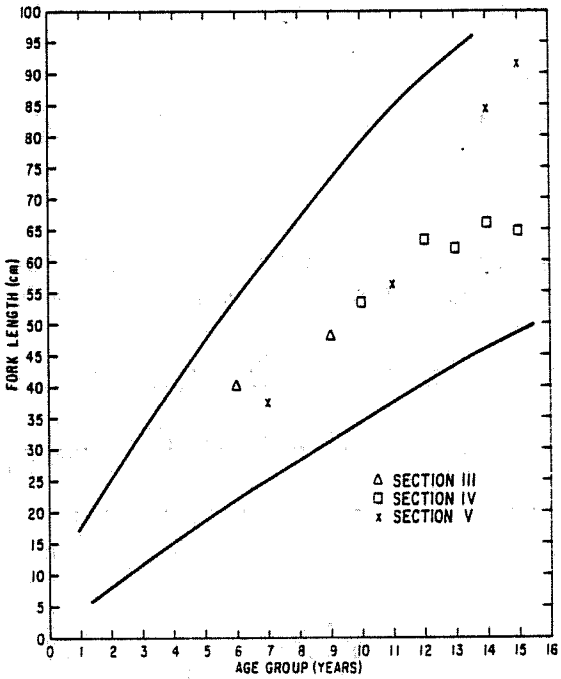

Fig. 48. Growth of lake trout in the Lower Churchill River, June-August, 1975-76. The solid heavy lines approximate the variation in growth over the zoogeographic range (Healey 1978).

No marked variation in growth within the river was apparent, possibly due to the small sample size.

The maximum age of lake trout captured, 15 years, was similar to that recorded in Labrador by Bruce (1974, 1975) and Parsons (1975) but less than the 20-25 years of the largest North American lake trout (Scott and Crossman 1973).

GROWTH IN WEIGHT

Sample sizes were too small for computation of length-weight relationships. Exponents in the length-weight relationships of Labrador lake trout generally have ranged from 2.9 (Bruce 1974, 1975) to 3.2 (Parsons 1975).

SEX RATIOS AND MATURITY

Numbers of males per female in the three sections of river ranged from 0.50 to 3.00 (Appendix VI). The overall ratio, 0.88, did not indicate a differential abundance of the sexes.

Of 15 lake trout examined, only one was immature (Appendix VII). The small sample suggested that, on the average, maturity was achieved at a length of about 35 cm; a length corresponding to fish in their seventh year. Sexual maturity is usually attained at age 6 or 7 (Scott and Crossman 1973).

FOOD

Fishes, followed by insects, were the principal food items in the stomachs of captured lake trout (Table 23).

Table 23. Percentage occurrence of major food items in the stomachs of lake trout in the Lower Churchill River, June-August 1975-76.

Food item	River section			
	III	IV	V	I-V combined
Fish remains	100.0		100.0	55.6
Gasterosteus aculeatus		50.0		22.2
Insect remains		50.0		22.2
Detritus		50.00		22.2
Coregonus clupeaformis			25.0	11.1
Number of stomachs examined	1	4	4	9
Number of stomachs empty	0	0	0	0

SELECTION BY GEAR

Captured lake trout were all between 30 and 100 cm (Fig. 49). The small sample was irregularly distributed with respect to age (Fig. 50). No consistent variation in length, weight, or age with mesh size was evident in the river as a whole (Table 24) or in the individual river sections (Appendices VIII and IX).

The most efficient mesh size, in terms of weight and numbers, was the 10.2 cm; yielding 0.1 fish weighing 0.21 kg/net night.

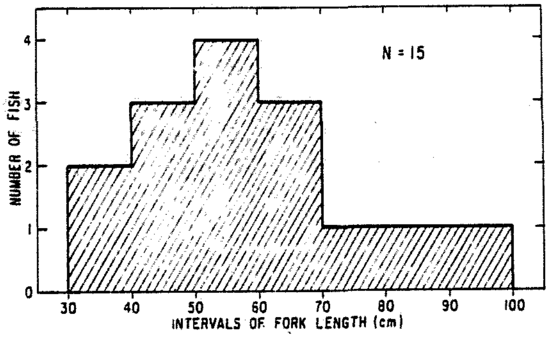

Fig. 49. Length-frequency distribution of gillnetted lake trout from the Lower Churchill River above the site of the proposed Gull Island dam, June-August, 1975-76.

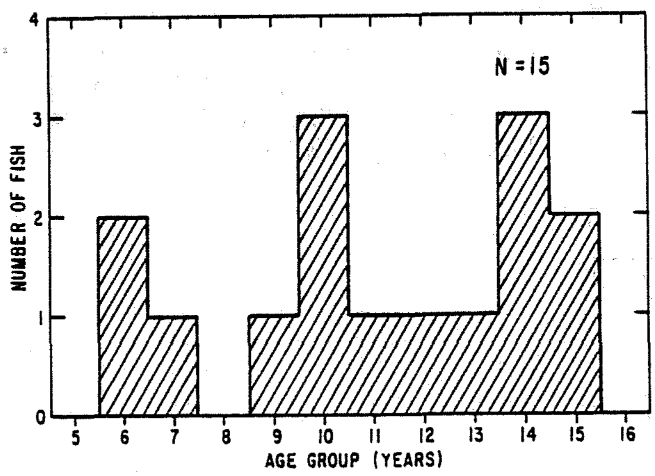

Fig. 50. Age-frequency distribution of gillnetted lake trout from the Lower Churchill River above the site of the proposed Gull Island dam, June-August, 1975-76.

Table 24. Catch statistics of lake trout from Sections III-V of the Lower Churchill River, June-August 1975-76.

Mesh size (cm)	No. of net nights	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
3.8	107	1	<0.1	92.0	10.4	10.40	0.09	15.0
5.1	107	1	<0.1	37.4	0.8	0.80	0.01	7.0
7.6	109	1	<0.1	56.5	2.1	2.13	0.02	11.0
10.2	109	9	0.1	54.2	22.8	2.53	0.21	10.5
12.7	107	3	<0.1	69.3	15.7	5.23	0.15	12.7

MORTALITY RATE

The natural mortality rate (M = 0.41) of Lower Churchill River lake trout (Fig. 51), obtained from very few data, was higher than the 0.20-0.30 instantaneous rate typical of unexploited populations (Healey 1978), but lower than the 0.55 instantaneous rate of unexploited Smallwood Reservoir fish aged by scales (W. Bruce, pers. commm.).

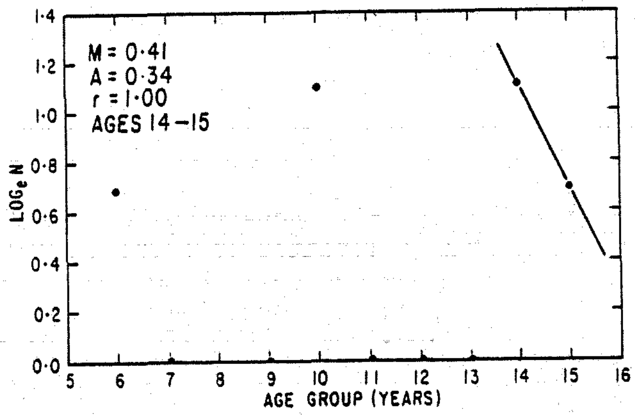

Fig. 51. Catch curve of lake trout from the Lower Churchill River above the site of the proposed Gull Island dam, June-August, 1975-76.

DISCUSSION

There is some indication that lake trout production in the Lower Churchill River will improve after impoundment. In his literature review, Machniak (1975c), has concluded that lake trout in reservoirs may do well if flooding doesn't upset predator-prey relationships and spawning.

As previously discussed, whitefish, suckers and benthic invertebrates can be expected to be abundant in the reservoirs. These should provide adequate forage for lake trout.

The comparative relative abundance of lake trout above the site of the Gull Island dam as compared to below and the greatest catch in Winokapau Lake also suggest that, as the river is impounded, trout production will increase.

The absence of lake trout in catches obtained from the site of the Muskrat Falls Reservoir suggests that, if available habitat in that reservoir is to be fully used, lake trout must be introduced after construction is finished. In the following discussion it is assumed that this will be done.

Drawdowns may be detrimental to lake trout production in the reservoirs. Machniak (1975c) has reported that water level fluctuations may be overcome by changes in spawning locations. However, there is a period of about 5 months or more in Labrador when eggs, especially those on shallow bars and reefs, are liable to die during drawdown. In Maine, the policy has been to suggest that no drawdowns should occur between September 15 and late April to ensure that the loss of lake trout spawn is minimized.

Siltation of spawning areas in the reservoirs is likely to be harmful to lake trout. Once created, the reservoir will act as a settling basin for silt, thus impairing egg and fry survival.

OUANANICHE (LANDLOCKED SALMON)

CATCHES

Overall, 689 gillnet nights of fishing yielded 30 ouananiche weighing 35.3 kg (Fig. 52). Captured fish had a mean length of 41.7 cm, a mean weight of 1.18 kg and a mean age of 6.2 years.

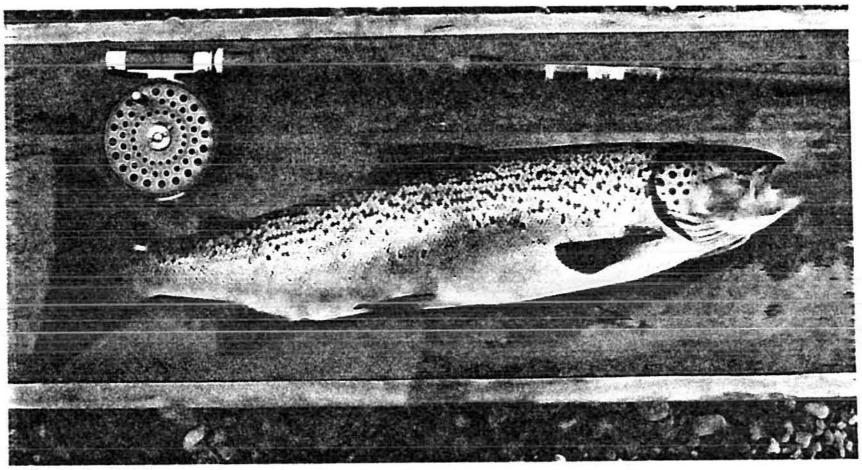

Fig. 52. Ouananiche.

No ouananiche were caught downstream of the site of the Gull Island dam (Fig. 53). Upstream of the dam site, catches were highest in Winokapau Lake (Section IV) and lowest in Section III just above the site of the Gull Island dam.

GROWTH IN LENGTH

The rate of growth of landlocked salmon in Section IV of the Lower Churchill River (Fig. 54 and Appendix V) was similar to the maximum previously reported for Newfoundland and Labrador (Bruce 1974). The large calculated lengths at younger ages were most likely artifacts of the small sample size. Little variation in growth rates was apparent within the river, likely as a result of the small

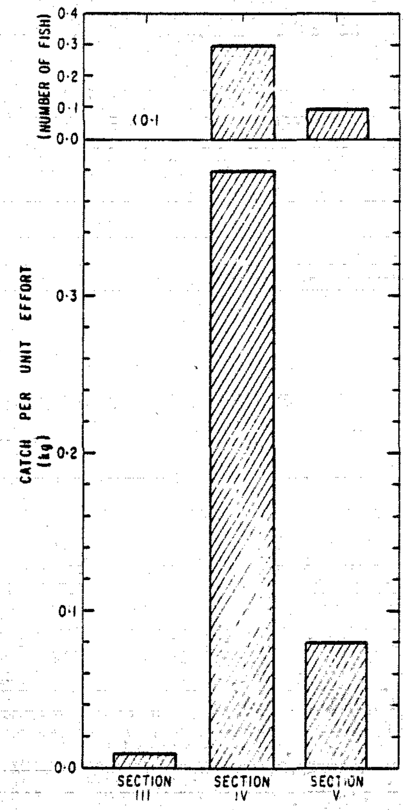

Fig. 53. Catches of ouananiche in three sectionsof the Lower Churchill River, June-August, 1975-76.

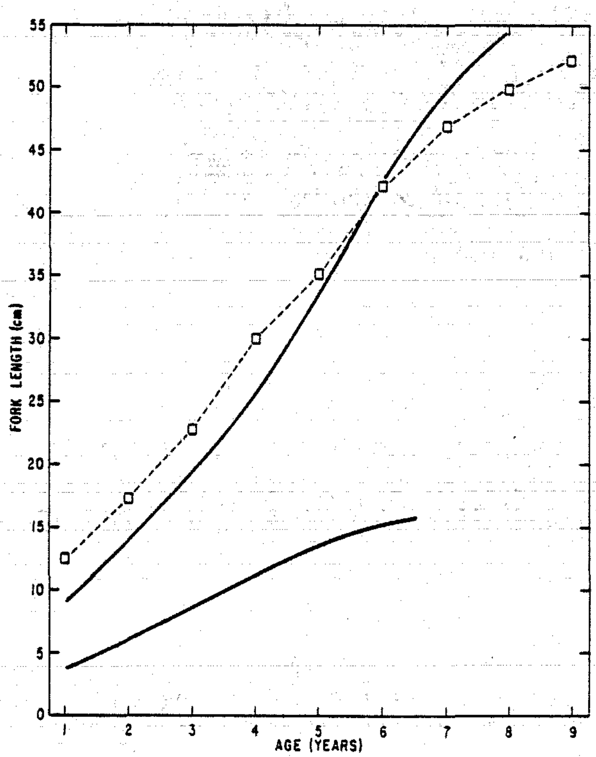

Fig. 54. Growth of ouananiche in Section IV of the Lower Churchill River, 1976. Solid heavy lines approximate previously reported minimum (Bruce 1976) and maximum (Bruce 1974) rates of growth in Newfoundland and Labrador.

samples obtained from Sections III and V (Appendix V). The small amounts of data from these sections prevented back-calculation.

The maximum age of landlocked salmon from the Lower Churchill River, 9 years, was usual for eastern Canadian salmon (Scott and Crossman 1973) but less than the 14 years reported by Pippy (1966) for Long Lake, Newfoundland.

GROWTH IN WEIGHT

The mean length-weight exponent of Lower Churchill ouananiche (Table 25) was nearly indentical to the 3.18 of ouananiche from Red Indian Lake, Newfoundland (Morry and Cole 1977) but greater than the 2.62 of fish from Thomas Pond Reservoir, Newfoundland (Wiseman 1971).

Table 25. Least squares linear regressions of $\log_{10}$ weight (g) on $\log_{10}$ fork length (cm) for ouananiche from the Lower Churchill River, June-August 1975-76.

River section	Y intercept	Slope	Correlation coefficient	No. of fish
IV	-4.67	2.82	0,984	22 22
V	-5.81	3.56	0.957	11
Means	-5.24	3.19		

SEX RATIOS AND MATURITY

The overall sex ratio of ouananiche, 0.90 (Appendix VI), did not indicate a differential abundance of the sexes.

Of 35 ouananiche examined, 82.9% were mature (Appendix VII). No length at maturity was evident in the small sample. Age at maturity of Newfoundland landlocked salmon has been reported at 2-3 years of age (Leggett and Power 1969).

FOOD

Ouananiche from the Lower Churchill were primarily piscivorous (Table 26). This likely produced their comparatively rapid growth in length and weight.

Table 26. Percentage occurrence of major food items in the stomachs of ouananiche in the Lower Churchill River, June-August 1975-76.

Food item	River section III	IV	V	III-V combined
Gasterosteus aculeatus		72.2		40.6
Fish remains		22.2	54.5	28.1
Plecoptera	66.7	27.8		21.9
Detritus		33.3		18.8
Hymenoptera		27.8		15.6
Insect remains	66.7	16.7		15.6
Trichoptera	100.0	5.6		12.5
Catostomus sp.			36.4	12.5
Invertebrate eggs	66.7	5.6		9.4
Coregonus clupeaformis and *Prosopium cylindraceum*			27.3	9.4
Diptera (larvae)		16.7		9.4
Hemiptera		11.1		6.3
Ephemeroptera		5.6		3.1
Diptera (pupae)		5.6		3.1
Esox lucius		5.6		3.1
Coleoptera	33.3			3.1
Number of stomachs examined	3	18	11	32
Number of stomachs empty	0	1	1	2

SELECTION BY GEAR

All ouananiche captured were between 10 and 70 cm with 83% being 40 cm or greater (Fig. 55). Ages ranged from 3 to 9 years with 93% being 5 and over (Fig. 56). There were no consistent relationships between length, weight, or age and mesh size in the river as a whole (Table 27) or in the individual river sections (Appendices VIII and IX). This was probably due to the small sample size.

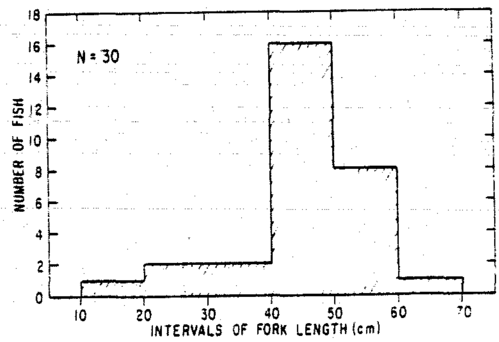

Fig. 55. Length-frequency distribution of gillnetted ouananiche from the Lower Churchill River, above the site of the proposed Gull Island dam, June-August, 1975-76.

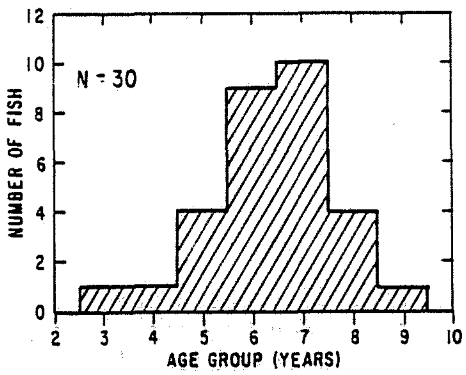

Fig. 56. Age-frequency distribution of gillnetted ouananiche from the Lower Churchill River above the site of the proposed Gull Island dam, June-August, 1975-76.

Table 27. Catch statistics of ouananiche from Sections III-V of the Lower Churchill River, June-August 1975-76.

Mesh size (cm)	No. of net nights	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
3.8	107	9	0.1	44.9	9.6	1.1	0.09	6.0
5.1	107	7	0.1	43.4	8.1	1.2	0.08	6.0
7.6	109	4	<0.1	44.8	4.5	1.1	0.04	6.5
10.2	109	8	0.1	45.4	9.9	1.2	0.09	6.8
12.7	107	2	<0.1	50.7	3.0	1.5	0.03	8.0

The most efficient mesh sizes were the 3.8 and 10.2 cm; each yielding 0.1 fish weighing 0.09 kg/net night.

MORTALITY RATE

The annual mortality rate (A) of ouananiche from the Lower Churchill River was 0.68 (Fig. 57). Although based on few data, the estimate was similar to the approximate 0.60 annual rate in Gambo Pond, Newfoundland (calculated from data of Leggett and Power 1969) and the 0.62 annual statewide average in Maine (Havey and Warner 1970).

DISCUSSION

The greater catches of ouananiche from the lake portion as opposed to the river portions, of the Lower Churchill, their comparatively rapid growth in length and weight in Winokapau Lake, and their utilization of a variety

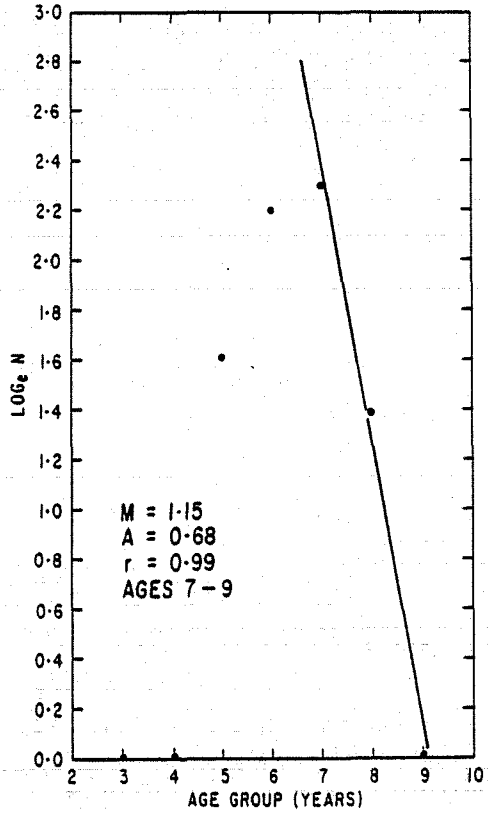

Fig. 57. Catch curve of ouananiche from the Lower Churchill River above the site of the proposed Gull Island dam June-August, 1975-76.

of food sources suggest that landlocked salmon will do well after the river is impounded.

Reservoir drawdown and siltation may pose a problem for ouananiche. Fluctuating water levels from the time of spawning in September or October until the fry emerge from the gravel in May or June may kill the eggs and young of shore-spawning ouananiche. Fluctuations in water levels may prevent access to some spawning streams. Siltation of spawning areas will impair egg and fry survival.

The absence of ouananiche in catches made on the site of the proposed Muskrat Falls Reservoir suggests that ouananiche should be stocked in the reservoir to utilize all habitat types. This may be assisted by a natural colonization.

ROUND WHITEFISH

CATCHES

In the river as a whole, 689 gillnet nights of fishing yielded 169 round whitefish weighing 32.8 kg (Fig. 58). Captured fish had a mean length of 26.4 cm, a mean weight of 0.19 kg, and a mean age of 5.8 years.

Catches within the river varied from a high of 0.21 kg/net night in Section III to a low of 0.01 kg/net night in Sections I, II, and IV (Fig. 59). Catches tended to be greater upstream of the site of the Gull Island dam.

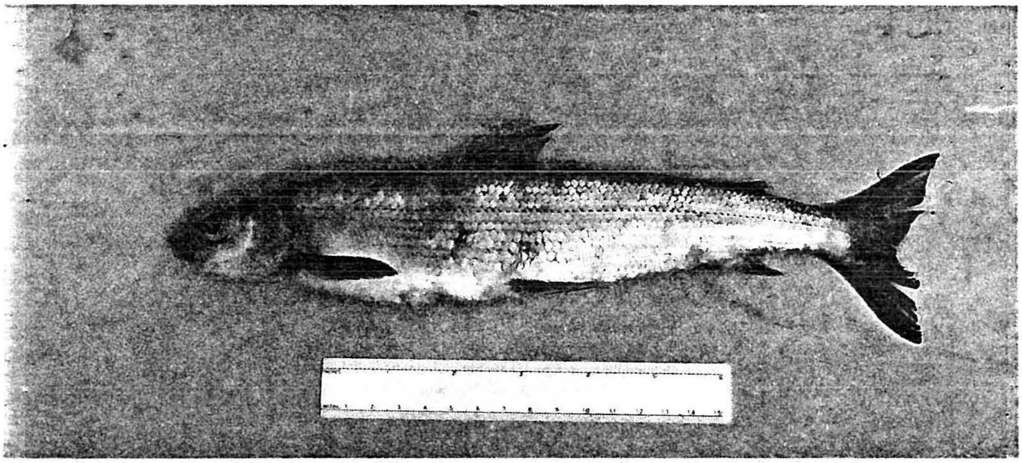

Fig. 58. Round whitefish.

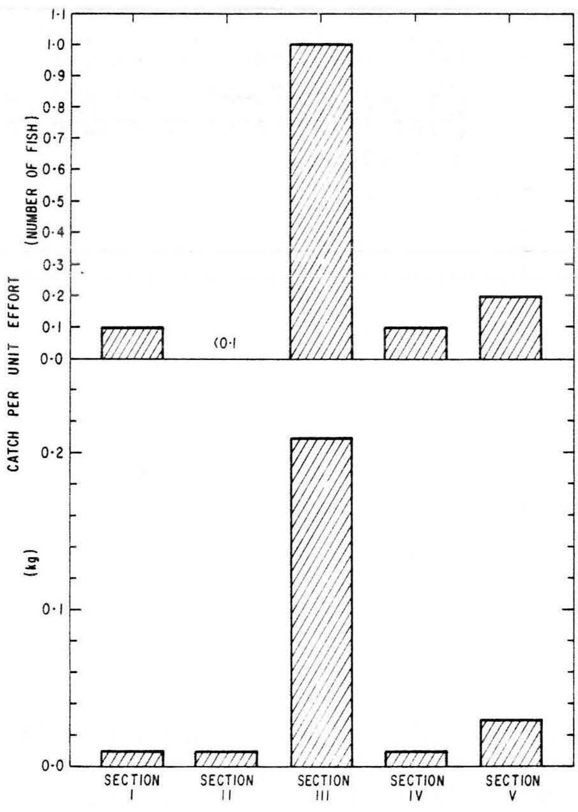

Fig. 59. Catches of round whitefish in five sections of the Lower Churchill River, June-August, 1975-76.

GROWTH IN LENGTH

Round whitefish growth in the Lower Churchill was suggestive of a tendency towards a maximum ultimate size (Fig. 60 and Appendix V). On the whole, growth was slightly more rapid than growth in the Smallwood Reservoir (Bruce 1975) and intermediate to the range previously reported for North America (Mraz 1964; Mackay and Power 1968).

Growth in the river was most rapid in Section III (between Winokapau Lake and the site of the Gull Island dam) and slowest below Muskrat Falls (Section I).

The age of the oldest round whitefish captured, 13 years, was similar to that previously reported (Scott and Crossman 1973).

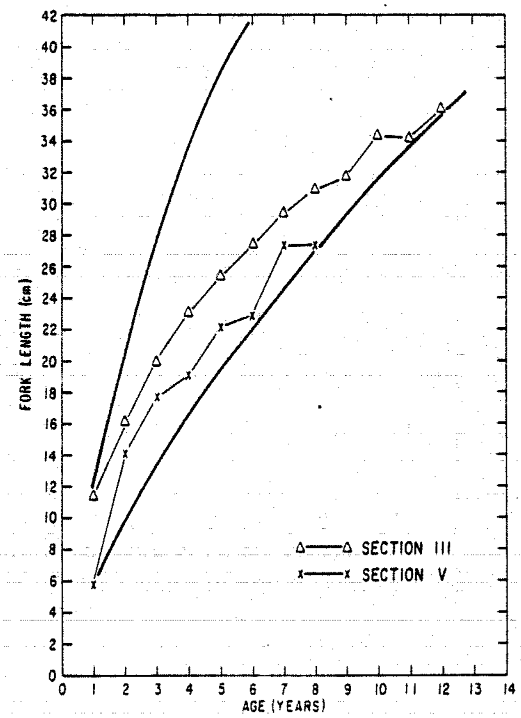

Fig. 60. Growth of round whitefish in the Lower Churchill River, 1975-76. Solid heavy lines approximate minimum (MacKay and Power 1968) and maximum (Mraz 1964) rates of growth in North America.

GROWTH IN WEIGHT

Exponents in the length and weight relationships of round whitefish ranged from 2.62 to 3.19 and had a mean of 2.91 (Table 28); higher than the value of 2.3 reported from the Smallwood Reservoir (Bruce 1975), but lower than the 3.4 value from Ten Mile Lake, Labrador (Parsons 1975). Consistent with growth in length, round whitefish tended to gain weight faster with increasing length in Section III where they were longer at a given age.

Table 28. Least squares linear regressions of $\log_{10}$ weight (g) on $\log_{10}$ fork length (cm) for round whitefish from the Lower Churchill River, June-August 1975-76.

River section	Y intercept	Slope	Correlation coefficient	No. of fish
III	-2.27	3.19	0.989	116
V	-4.48	2.62	0.870	30
Means	-3.38	2.91		

SEX RATIOS AND MATURITY

The overall sex ratio of captured round whitefish, 1.06, did not indicate a differential abundance of the sexes (Appendix VI). Sex ratios within river sections ranged from 0.00 to 3.29 males per female.

Of 169 round whitefish examined, 84.0% were mature (Appendix VII). Each 2 cm length interval from 16 to 44 cm contained more than 50% mature fish. The largest interval containing immature fish was 32.0 to 33.9 cm. In the Great Lakes, round whitefish usually mature in their third or fourth year (Armstrong et al. 1977).

FOOD

Round whitefish captured in the Lower Churchill were primarily benthic insectivores (Table 29) as is usual for this species (Scott and Crossman 1973).

SELECTION BY GEAR

Round whitefish captured above Muskrat Falls were between 10 and 50 cm and had a modal length of between 20 and 30 cm (Fig. 61). Ages were from 2 to 13 and had a mode of 3 (Fig. 62).

With all available data combined, mean lengths, weights, and ages tended to increase with increasing mesh size (Table 30). These trends were less evident within the individual river sections (Appendices VIII and IX).

The most efficient mesh size, in terms of weight, was the 7.6 cm; capturing fish with a mean length of 34.9 cm, a mean weight of 0.49 kg, and a mean age of 7.7 years.

Table 29. Percentage occurrence of major food items in the stomachs of round whitefish in the Lower Churchill River, June-August 1975-76.

Food item	River section			
	III	IV	V	III-V combined
Trichoptera	88.0	100.0	69.2	83.7
Detritus	48.0	100.0		37.5
Plecoptera	41.3		7.7	31.7
Insect remains	22.7	33.3	26.9	24.0
Diptera (pupae)	13.3			9.6
Diptera (larvae)	9.3		23.1	12.5
Invertebrate eggs	9.3			6.7
Ephemeroptera	8.0			5.8
Coleoptera	2.7			1.9
Fish remains	2.7			1.9
Hymenoptera	2.7			1.9
Gastropoda	1.3			1.0
Arachnida	1.3		3.8	1.0
Number of stomachs examined	75	3	26	104
Number of stomachs empty	3	0	4	7

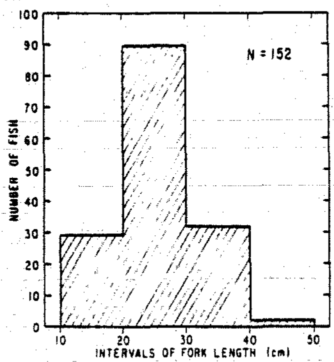

Fig. 61. Length-frequency distribution of round whitefish from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

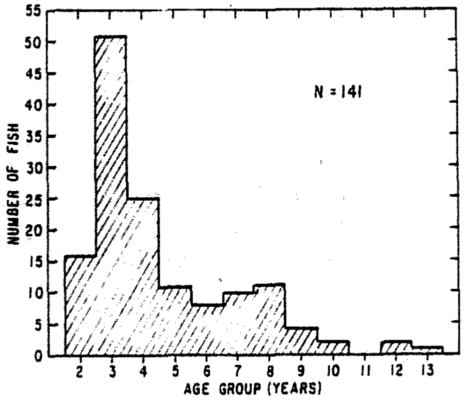

Fig. 62. Age-frequency distribution of round whitefish from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Table 30. Catch statistics of round whitefish from Sections II-V of the Lower Churchill River, June-August 1975-76.

Mesh size (cm)	No. of net nights	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
3.8	107	68	0.6	21.0	6.3	0.09	0.06	3.0
5.1	107	57	0.5	26.9	11.1	0.19	0.10	4.5
7.6	109	23	0.2	34.9	11.3	0.49	0.10	7.7
10.2	109	3	<0.1	36.1	2.1	0.70	0.02	9.7
12.7	107	1	<0.1	29.4	0.3	0.30	<0.01	7.0

MORTALITY RATE

The mortality rate of fish captured above Muskrat Falls (Fig. 63) at $M = 0.33$ was slightly lower than the 0.45 value for round whitefish from the Northwest River, Labrador (W. Bruce, pers. comm.).

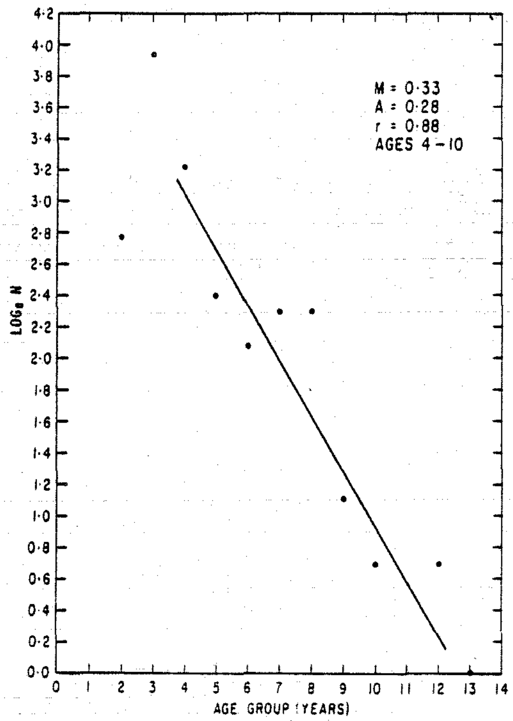

Fig. 63. Catch curve of round whitefish from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

DISCUSSION

There are indications that round whitefish growth and production will decrease in the Lower Churchill River after impoundment.

The slightly more rapid growth of round whitefish in the Lower Churchill River as opposed to the Smallwood Reservoir suggests that, as conditions in the Lower Churchill approach those of the Smallwood Reservoir, growth rates will lessen.

The fact that round whitefish catches were greater in rapid-flowing Sections III and V than they were in Winokapau Lake suggests that, as the river becomes more of a lake environment, round whitefish production will decrease.

These expected decreases in growth rate and production may be compounded by a relative abundance of lake whitefish, a potential competitor of round whitefish.

The scarcity of round whitefish in the river below the site of the Muskrat Falls dam and the expected similarity of conditions in that sector after impoundment suggest that round whitefish will remain scarce downstream of the impounded area of the Lower Churchill River.

Of potential harm to round whitefish, as is the case with lake whitefish, are sedimentation, turbidity, and drawdown; particularly in the early stages of the reservoirs.

LAKE CHUB

CATCHES

Three lake chub were captured in Section III (Fig. 64, Table 31). All were mature females and taken in the 3.8 cm mesh.

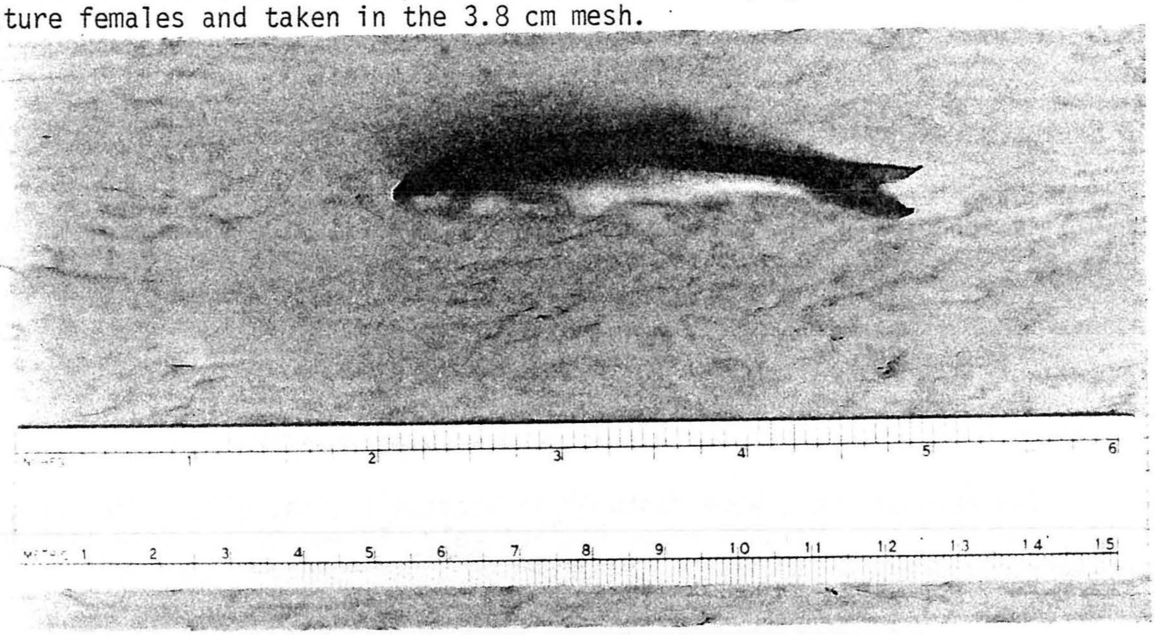

Fig. 64. Lake chub.

Table 31. Lake chub captured in Section III of the Lower Churchill River, June-July 1976.

Fork length (cm)	Weight (kg)	Age-group (yr)
14.8	0.047	5
15.2	0.043	6
16.5	0.052	8

FOOD

All three fish contained insect remains. Trichoptera and plecoptera were identified in two.

DISCUSSION

As a result of the large mesh sizes employed and the small sample obtained, the data cannot be considered representative of populations in the Lower Churchill River. The lake chub is potentially valuable as forage for other species. Its utilization of streams for spawning and its apparent preference for lakes as opposed to faster waters (Scott and Crossman 1973) suggest that lake chub production will increase after the Lower Churchill is impounded.

RAINBOW SMELT

CATCHES

Two rainbow smelt were captured in Section I (Fig. 65). Fork lengths were 17.8 and 19.4 cm. Weights were, respectively, 53 and 61 g. Both fish were mature age-group 3 females.

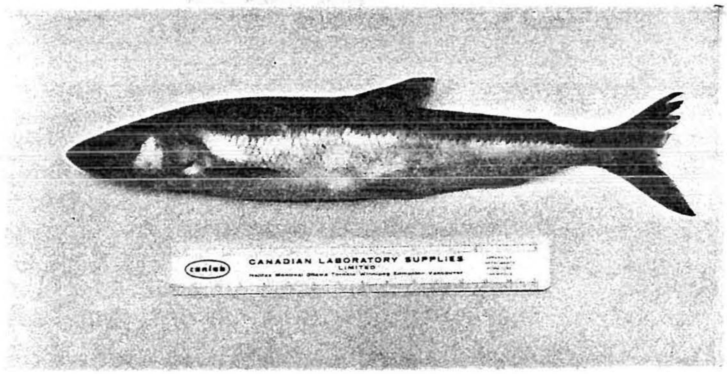

Fig. 65. Rainbow smelt.

FOOD

Both fish contained insect remains and detritus.

DISCUSSION

Apparently, the only smelt in the Lower Churchill are anadromous ones downstream of Muskrat Falls. It is unlikely that this stock will be harmed by the creation of the reservoirs provided that conditions downstream of the Muskrat Falls dam remain fairly similar.

OTHER SPECIES

The presence of the following fishes in the Lower Churchill River is indicated by distribution maps for Canadian fishes presented by Scott and Crossman (1973).

Arctic char, American eel and Atlantic sturgeon, three sea-run species not captured during the survey, are apparently confined to waters downstream of the obstruction at Muskrat Falls as are sea-run brook trout and Atlantic salmon. These economically valuable species are not likely to be affected by the presence of the reservoirs providing that an adequate flow of water is maintained downstream of the reservoir area to allow migration.

Threespine and ninespine sticklebacks, both potentially valuable forage species, usually spawn in the summer in nests constructed in shallow water over sandy or weedy bottom. The young remain near the nest for about two months after hatching. These species prefer lake rather than river environments and hence have a potential to increase in abundance after the river is impounded. However, drawdown will adversely affect their reproduction and thus alter predator-prey relationships in the reservoirs.

Longnose dace, generally a stream inhabitant and a potentially valuable forage fish, usually begin spawning in May-July in riffles over a gravelly bottom. The young remain in quiet areas near shore for about 4 months. The preference of the longnose dace for fast waters suggests that it will not be abundant in the reservoirs. Drawdown and siltation may impair reproductive success.

Slimy and mottled sculpin are potentially valuable forage fish. They prefer habitats similar to those of brook trout; suggesting that they will not become more abundant after the river is impounded. Both species spawn in shallow water in the spring. Drawdown and siltation will be detrimental to eggs and young.

FISH HARVESTS FROM THE GULL ISLAND AND MUSKRAT FALLS RESERVOIRS

POTENTIAL FISH YIELDS

The specific conductance of the Gull Island and Muskrat Falls Reservoirs will likely be similar to the 20.7 micromhos/cm measured in the Smallwood Reservoir; corresponding to a value of total dissolved solids of about 22 ppm (based on equations of Lennon 1959). This figure, divided by mean reservoir depths, results in a morphoedaphic index of 1.1 for the Gull Island Reservoir and 1.7 for the Muskrat Falls Reservoir. These values indicate, for large, north-temperate lakes, maximum sustainable fish yields of, respectively 1.01 and 1.26 kg/ha/yr. In the Gull Island Reservoir, this represents a potential annual fish harvest of 20,099 kg. In the Muskrat Falls Reservoir, this represents a potential annual fish harvest of 12,474 kg.

The use of Gulland's (1970) model to estimate the components of these potential yields (Table 32) indicates that just over half of the annual potential harvest in each reservoir would be made up of the two sucker species. The remaining portion of the harvest would be comprised of the five most economically valuable species and burbot (Fig. 66). These estimates are based on the assumption that lake trout and ouananiche, two species not captured on the site of the proposed Muskrat Falls Reservoir, colonize the area after construction or are stocked.

Table 32. Data used in estimating long-term potential fish yield for the Gull Island Reservoir and the Muskrat Falls Reservoir. Based on the Ryder (1965) and the Gulland (1970) models and the assumption that relative fish biomass in the reservoirs will approximate that in Winokapau Lake.

Species	Mortality rate (M_i)	Relative biomass (Bi)	MiBi	Yield (kg/ha/yr) Gull Island $\frac{MiBi}{\Sigma MiBi} \times 1.01$*	Muskrat Falls $\frac{MiBi}{\Sigma MiBi} \times 1.26$†
Longnose sucker	0.57	0.289	0.16473	0.299	0.373
White sucker	0.56	0.212	0.11872	0.215	0.269
Ouananiche	1.15	0.076	0.08740	0.159	0.198
Lake whitefish	0.40	0.132	0.05280	0.096	0.120
Burbot	0.72	0.060	0.04320	0.078	0.098
Northern pike	0.30	0.124	0.03720	0.068	0.084
Lake trout	0.41	0.092	0.03772	0.068	0.085
Brook trout	1.18	0.012	0.01416	0.026	0.032
Round whitefish	0.33	0.002	0.00066	0.001	0.002
Totals		1.000	0.55659	1.01	1.26

*Predicted potential total fish yield based on a morphoedaphic index (Ryder 1965) of 1.1 for the Gull Island Reservoir.

†Predicted potential total fish yield based on a morphoedaphic index of 1.7 for the Muskrat Falls Reservoir.

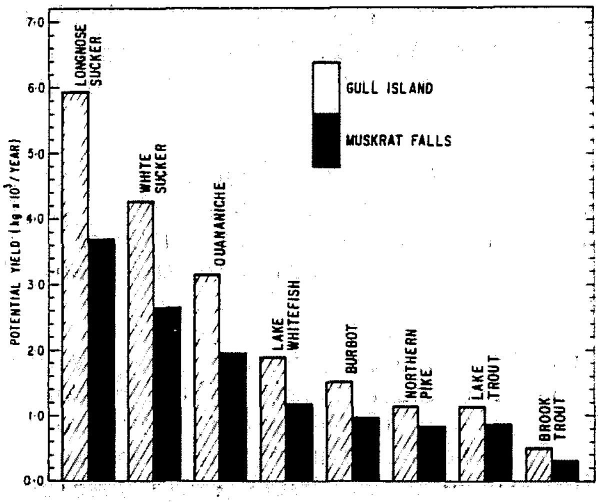

Fig. 66. Estimated long-term potential fish yield from the Gull Island and Muskrat Falls Reservoirs.

DISCUSSION

The estimates of potential fish yields in the reservoirs should only be considered as preliminary guidelines to be used until data are acquired after impoundment. The estimates of total yield are based on the relationship between yield and the morphoedaphic index in large, north-temperate lakes. Anomalous environmental conditions such as frequent drawdowns will decrease the potential harvest. Also, as pointed out by Henderson et al. (1973), it can be expected that the potential yield predicted by the morphoedaphic index may be exceeded before a reservoir has attained biotic stability and afterwards may not be met unless fishing effort is moderately intense and constant.

The method employed to estimate the component yields required the assumptions that mortality rates did not change significantly from one portion of the river to another, that the exploitable species were caught in proportion to their abundance, and that the relative abundance and population dynamics of a given species in Winokapau Lake are not significantly different from what they will be in the proposed reservoirs. This latter assumption will be invalid if excessive drawdowns and siltation occur causing mortality rates to increase and community stability to decrease or if lake trout and ouananiche do not inhabit the Muskrat Falls Reservoir.

For the above reasons and for the purpose of accurately quantifying the effect of the impoundment of Labrador rivers, it is desirable to undertake a continuous monitoring of the fishery of the Gull Island and Muskrat Falls Reservoirs.

It is unlikely that the estimated annual yields of fishes from the proposed reservoirs could support an economically viable commercial fishery. However, if a fishery is undertaken, consideration should be given to problems posed by infestations of species of the parasite *Triaenophorus* and excessively high levels of mercury as were found in fish flesh in the Smallwood Reservoir and Winokapau Lake (Bruce et al. 1979). Both of these will affect the marketability of the product.

SUMMARY

1. The fish populations and water quality of the Lower Churchill River, Labrador, were surveyed from June to August, 1975-76; prior to the proposed creation of the Gull Island and Muskrat Falls Reservoirs to be used for hydroelectric power.

2. Overall, the Lower Churchill River is characterized by a pH of 6.3, a conductance of 18.9 µmhos/cm, a total hardness of 8 ppm, a total alkalinity of 6 ppm, a calcium concentration of 1.4 ppm, a turbidity of 3.4 JTU, and a chloride concentration of 0.8 ppm. Tributaries of the Lower Churchill tend to be more dilute waters.

3. Eleven of the 19 fish species whose presence is indicated by distribution maps (Scott and Crossman 1973) were captured with gillnets during the survey. These were: northern pike, lake whitefish, longnose sucker, white sucker, brook trout, burbot, lake trout, ouananiche, round whitefish, lake chub, and rainbow smelt. Threespine sticklebacks and a species of sculpin were identified in stomach contents. All species identified, except rainbow smelt, were obtained upstream of the impassable barrier to fishes, Muskrat Falls. All species identified, except lake trout, ouananiche, lake chub and the species of sculpin, were obtained downstream of Muskrat Falls.

4. The most numerous of the species captured in the river as a whole were, respectively, longnose sucker, lake whitefish, white suckers, brook trout, and northern pike. In terms of weight, northern pike was most abundant followed by lake whitefish, longnose suckers, white suckers and brook trout.

5. The relative abundance, growth rates, sex ratios and stomach contents of the species captured varied from section to section throughout the river.

6. In the river as a whole, northern pike growth is rapid compared to that in other northern Canadian waters including the Smallwood Reservoir. Pike mature at about 40 cm and 3-4 years of age. They are primarily piscivorous. Pike were caught most efficiently in 10.2 cm mesh gillnets. Pike taken in this mesh size were all age 5 and over and 50 cm or larger.

7. Lake whitefish in the river are slow growing in comparison to those in other Canadian waters including the Smallwood Reservoir. They mature at about 21 cm and 2-4 years of age. They are primarily benthic insectivores. Nearly all of the fish captured in the most efficient mesh size, 7.6 cm, were age 4 and over and 30 cm or larger.

8. Longnose suckers in the Lower Churchill grow at a rate similar to that in the Smallwood Reservoir and are comparatively slow growing. They mature at about 20 cm and 5 or 6 years of age. They feed primarily on benthic invertebrates. Nearly all of the fish captured in the most efficient mesh size, 7.6 cm, were age 7 and over and 30 cm or larger.

9. White suckers in the Lower Churchill grow at a rate close to the middle of the range in Canadian waters. They mature at about 22 cm and 4-5 years of age. They feed primarily on benthic invertebrates. The most efficient mesh size, 10.2 cm, captured fish age 7 and over and 30 cm or larger.

10. Brook trout in the Lower Churchill River grow at a rate intermediate to the range in Newfoundland and Labrador and slower than those in the Smallwood Reservoir. They mature at about 17 cm and 2-3 years of age and feed primarily on benthic invertebrates. Brook trout were caught most efficiently in 7.6 cm mesh gillnets. Nearly all of the fish taken in this mesh size were age 3 and over and 30 cm or larger.

11. Burbot in the Lower Churchill River grow at a rate within the range previously documented for this species in Canada and mature at about 20 cm and 5-6 years of age. They feed primarily on benthic invertebrates. Nearly all of the fish captured in the most efficient mesh size, 10.2 cm, were age 7 and over and 30 cm or larger.

12. Lake trout growth rates in the Lower Churchill River are intermediate to the overall range and similar to those in the Smallwood Reservoir. On the basis of a small sample size, they mature at about 35 cm and 6 years of age. They are primarily piscivorous and were caught most efficiently in 10.2 cm mesh gillnets.

13. Ouananiche in the Lower Churchill River have relatively high growth rates; similar to those in western Labrador. They are primarily piscivorous. The 3.8 and 10.2 cm mesh gillnets were equally efficient for the capture of ouananiche.

14. Round whitefish in the Lower Churchill River have a growth rate slightly greater than that in the Smallwood Reservoir and intermediate to the North American range. They are primarily benthic insectivores and were most efficiently caught in 7.6 cm mesh gillnets.

15. Long-term potential fish yields in the Gull Island Reservoir were estimated to be 1.01 kg/ha/yr or 20,099 kg/yr with just over half of this potential to be made up of longnose and white suckers. In estimating this yield the author assumed that stress conditions such as excessive drawdown and sedimentation would not occur.

16. Long-term potential fish yields in the Muskrat Falls Reservoir were estimated to be 1.26 kg/ha/yr or 12,474 kg/yr with just over half made up of longnose and white suckers. In estimating the yield the author assumed that stress conditions would not occur and that lake trout and ouananiche would colonize the reservoir or be introduced.

17. Of greatest potential harm to fish populations in the Lower Churchill River as a result of impoundment are fluctuating water levels and increased sedimentation.

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C. Morry and W. Bruce planned and implemented the study and supervised the collection of data.

L. Cole collected and processed much of the data and assisted throughout all phases of the study.

D. Riche processed much of the data; in particular the age and growth data.

R. Parsons collected and processed the large part of the data from study Section V.

A. Jamieson was responsible for laboratory water quality analyses.

P. Downton, G. Furey, D. Scott, C. Walters and J. Wheeler assisted in data collection and processing.

H. Mullett drafted the figures and G. King assisted with photographic reproduction.

J. Lannon, K. Scott and C. Walsh typed the report.

H. Bain, W. Bruce, L. Cole, E.M.P. Chadwick, J. Pippy, and R. J. Wiseman reviewed the manuscript and provided helpful criticisms.

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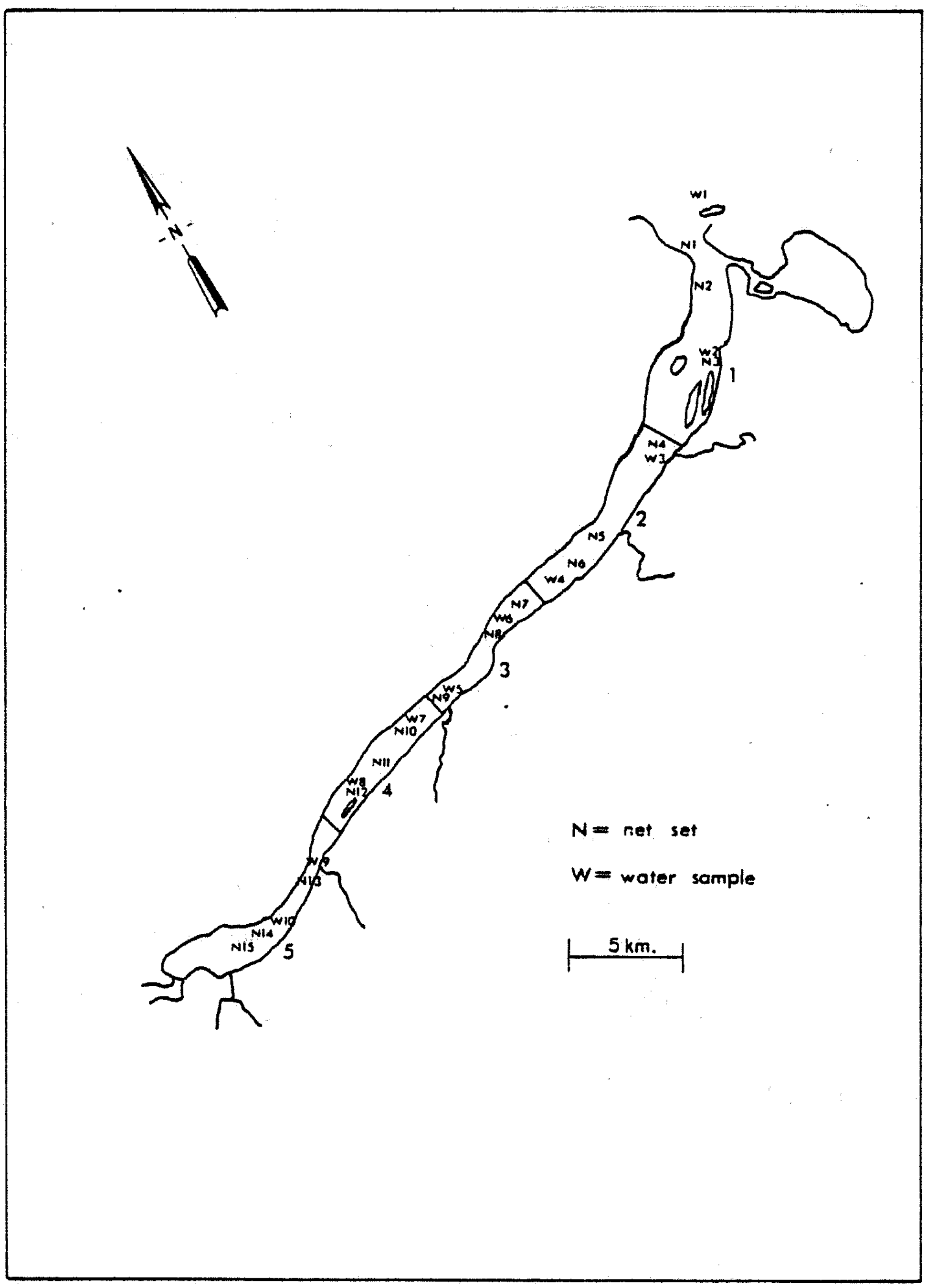
Appendix I

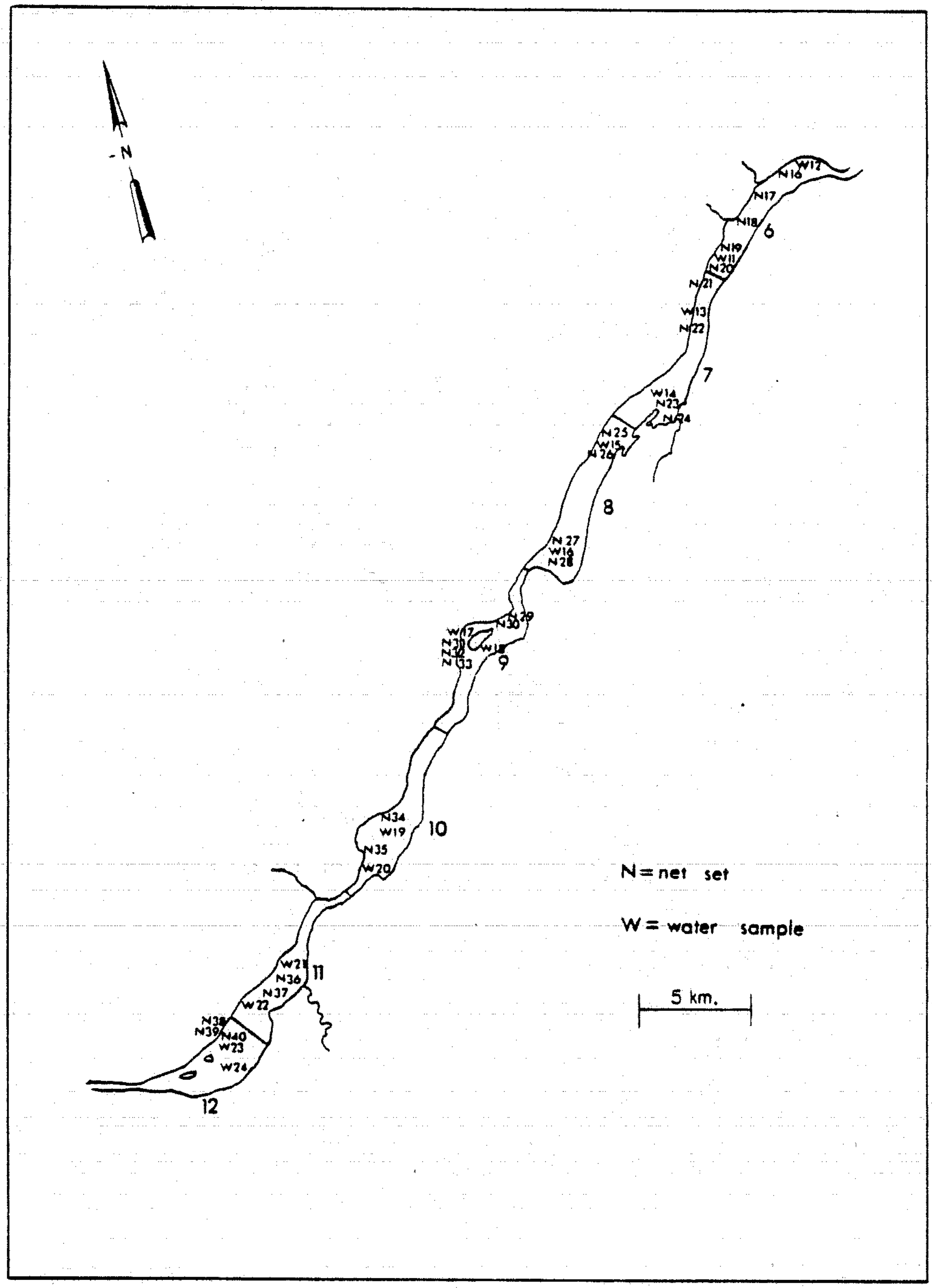
Sample Sites

(i) Section I
(ii) Section II
(iii) Section III
(iv) Section IV
(v) Section V
(vi) The Tributaries

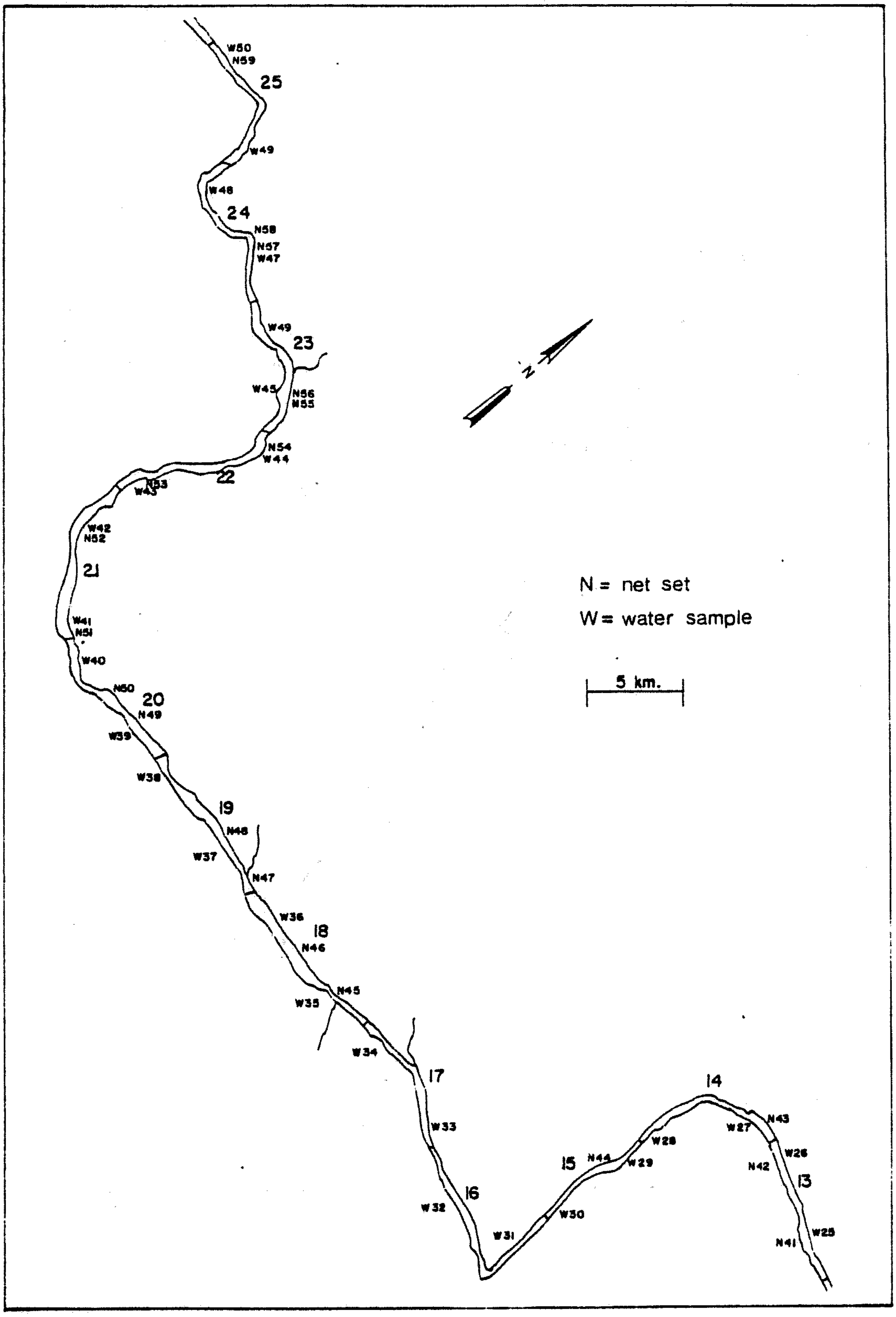
Appendix I(i). Sample sites in Section I of the Lower Churchill River, June 28-July 4, 1975.



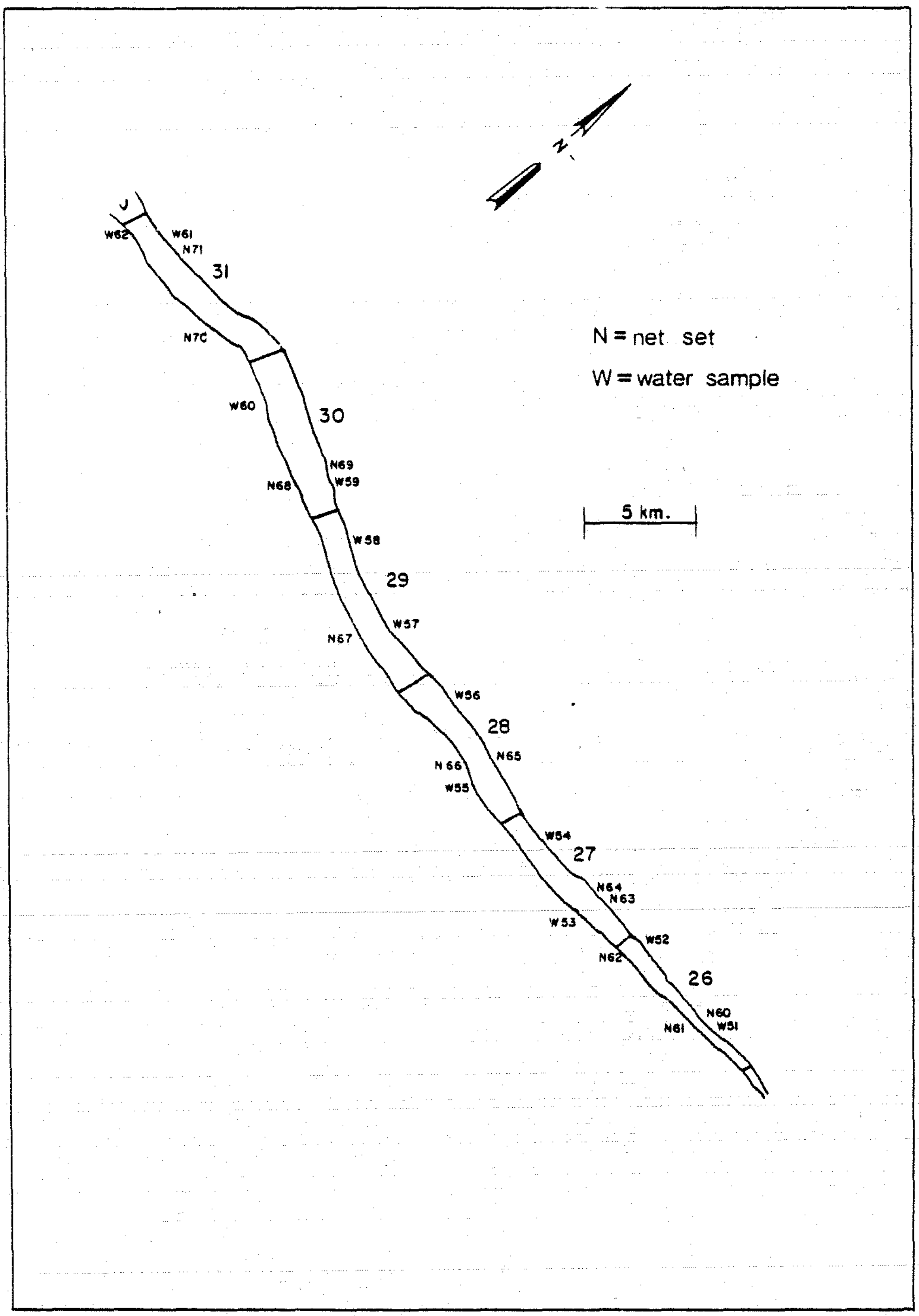
Appendix I(ii). Sample sites in Section II of the Lower Churchill River, August 3-24, 1975.



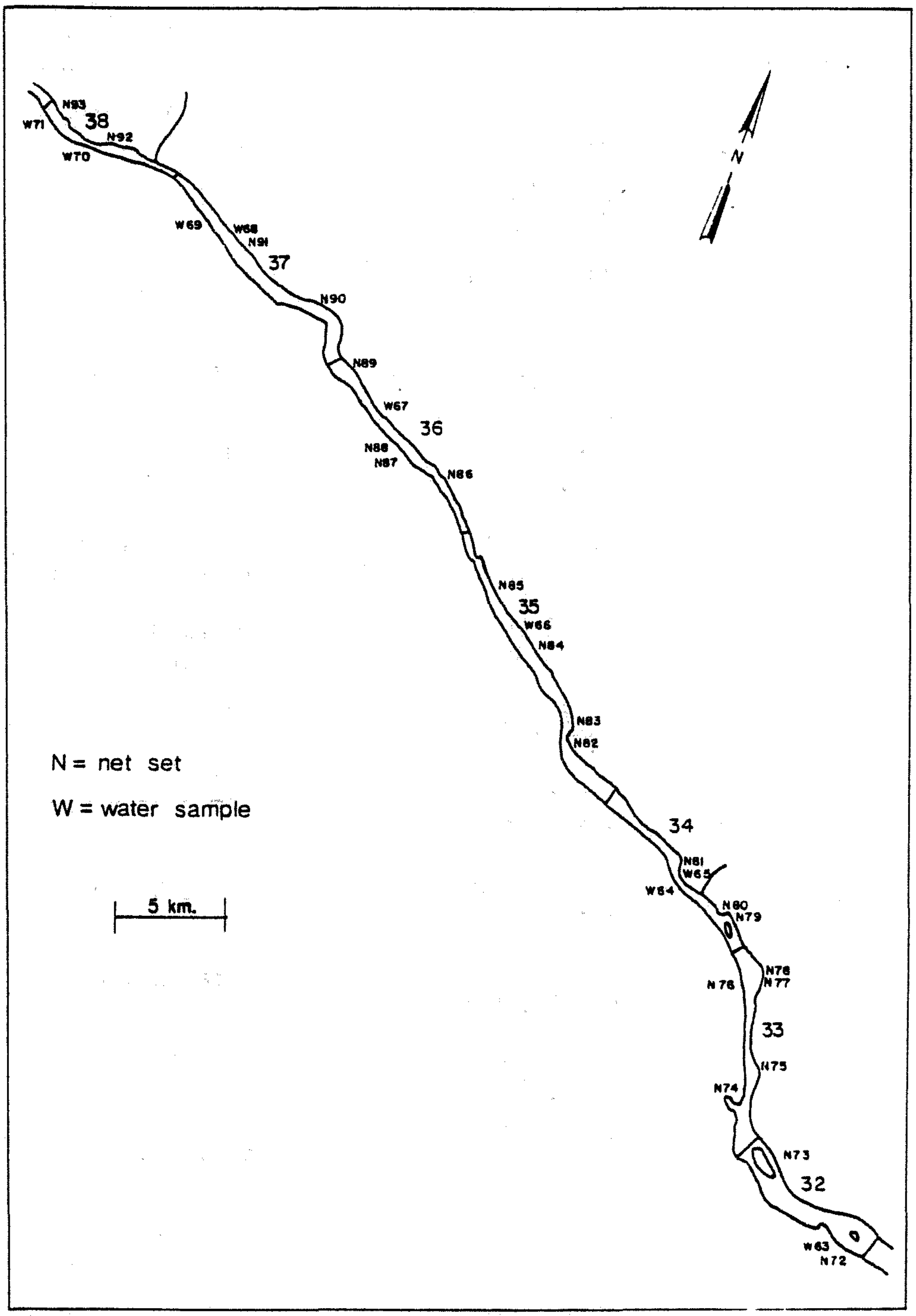
Appendix I(iii). Sample sites in Section III of the Lower Churchill River, June 21-July 29, 1976



Appendix I(iv). Sample sites in Section IV of the Lower Churchill River, July 31-August 5, 1976.



Appendix I(v). Sample sites in Section V of the Lower Churchill River, July 17-August 6, 1975.



Appendix I(vi). Location of the mouths of tributaries to the Churchill River from which water samples were obtained in 1976.

Number	Location	Tributary
1	53°15'40"N 60°31'30"W	Caroline Brook
2	53°14'15"N 60°43'50"W	MacKenzie River
3	53°14'30"N 60°51'45"W	Lower Brook
4	53°10'15"N 60°56'00"W	Upper Brook
5	53°01'00"N 61°15'30"W	Pinus River
6	52°59'00"N 61°16'30"W	Unnamed-south side of the Churchill below Gull Lake
7	52°59'30"N 60°36'40"W	Unnamed-north side of the Churchill at Horseshoe Rapids
8	52°51'30"N 62°37'20"W	Minipi River
9	52°53'40"N 61°50'50"W	Dominion River
10	53°04'30"N 62°13'00"W	Cache River
11	53°06'30"N 62°22'30"W	Shoal River
12	52°12'00"N 63°12'00"W	Fig River
13	53°14'30"N 63°18'00"W	Elizabeth River
14	53°18'45"N 63°22'15"W	Metchin River
15	53°19'40"N 63°25'00"W	Unnamed-north side of the Churcniill above the Metchin

Appendix II

Individual measurements of water quality, Lower Churchill River

Appendix II. Individual measurements of water quality, Lower Churchill River.

Sample date	Sample site	pH	Total hardness (ppm)	Conductance (μmhos/cm at 25°C)	Turbidity (JTU)	Total alkalinity (ppm)	Calcium (ppm)	Chloride (ppm)
28 6 75	W 1	6.6	5	14.3	3.5	4	0.8	1.0
30 6 75	W 2	6.8	5	15.4	4.0	5	0.9	1.0
3 6 75	W 3	6.4	8	15.4	4.0	4	0.9	1.0
5 6 75	W 4	6.3	6	16.5	5.0	5	1.0	1.0
5 6 75	W 5	6.6	7	17.4	20.0	5	1.0	1.0
7 6 75	W 6	6.6	7	17.4	14.0	5	1.0	1.0
10 6 75	W 7	6.1	6	18.0	11.0	5	1.0	1.0
11 6 75	W 8	6.0	10	18.3	16.5	5	1.0	1.0
13 6 75	W 9	6.3	7	19.1	20.0	6	1.1	1.0
14 7 75	W 10	6.2	8	18.8	10.0	6	1.4	1.0
3 8 75	W 11	6.2	8	18.0	6.0	3	1.1	1.0
5 8 75	W 12	6.0	8	19.1	3.5	5	1.4	1.0
6 8 75	W 13	6.1	8	19.7	9.0	4	1.4	1.0
7 8 75	W 14	6.2	6	20.9	4.0	5	1.1	2.0
9 8 75	W 15	6.2	7	18.6	4.5	6	1.4	1.0
10 8 75	W 16	6.1	8	18.1	4.5	6	1.3	1.0
14 8 75	W 17	6.1	7	18.1	5.5	6	1.4	1.0
15 8 75	W 18	6.1	7	18.7	9.0	6	1.4	1.0
17 8 75	W 19	6.1	7	18.7	6.0	5	1.2	1.0
18 8 75	W 20	6.2	8	19.2	3.5	6	1.5	1.0
21 8 75	W 21	6.0	9	20.3	5.5	5	1.1	1.0
21 8 75	W 22	6.5	8	18.7	4.0	7	1.4	1.0
22 8 75	W 23	6.4	8	18.7	5.0	7	1.2	1.0
23 8 75	W 24	6.3	8	18.7	9.0	6	1.1	1.0
20 6 76	W 25	6.3	8	17.0	1.0	5	1.2	0.6
20 6 76	W 26	6.2	7	17.0	0.8	4	1.3	0.7
23 6 76	W 27	6.4	8	18.0	0.8	5	1.3	0.6
22 6 76	W 28	6.3	8	18.0	0.8	5	1.3	0.6
24 6 76	W 29	6.3	8	18.0	0.6	5	1.3	0.6
24 6 76	W 30	6.3	8	19.0	1.2	5	1.2	0.6
27 6 76	W 31	6.4	8	17.0	1.4	5	1.1	0.6
27 7 76	W 32	6.2	8	17.0	0.5	5	1.3	0.6
27 7 76	W 33	6.4	7	17.0	0.6	5	1.3	0.6
27 7 76	W 34	6.3	8	19.0	2.0	5	1.3	0.6
21 7 76	W 35	6.2	10	22.0	1.0	6	2.0	0.6
21 7 76	W 36	6.3	10	20.0	0.7	5	1.6	0.7
23 7 76	W 37	6.5	10	20.0	2.5	7	1.8	0.7
23 7 76	W 38	6.5	10	20.0	1.2	8	1.8	0.6
24 7 76	W 39	6.2	10	19.0	1.0	6	2.0	0.7
24 7 76	W 40	6.3	10	19.0	1.0	6	1.6	0.6
29 7 76	W 41	6.3	10	20.0	0.5	5	1.7	0.7
25 7 76	W 42	6.4	10	19.0	1.1	6	1.6	0.8
26 7 76	W 43	6.2	9	21.0	0.8	7	1.6	0.6
26 7 76	W 44	6.3	10	18.0	1.5	6	1.3	0.8
27 7 76	W 45	6.5	10	18.0	0.5	5	1.4	0.8
27 7 76	W 46	6.5	8	20.0	0.8	8	2.0	0.6
28 7 76	W 47	6.6	8	20.0	0.7	8	2.0	0.6
28 7 76	W 48	6.3	8	19.0	1.5	7	2.0	0.6
29 7 76	W 49	6.4	10	18.0	4.0	5	1.8	0.8
29 7 76	W 50	6.3	10	19.0	0.5	6	1.7	0.7
31 7 76	W 51	6.4	9	21.0	2.2	7	1.8	0.6
31 7 76	W 52	6.4	9	20.0	1.5	7	1.5	0.6
1 8 76	W 53	6.3	8	18.0	1.2	5	1.4	0.6
1 8 76	W 54	6.4	9	21.0	0.7	6	1.7	0.6
2 8 76	W 55	6.5	9	22.0	1.5	6	1.6	0.7
2 8 76	W 56	6.2	10	21.0	0.9	6	1.6	0.6
3 8 76	W 57	6.3	9	19.0	1.0	6	1.3	0.6
3 8 76	W 58	6.3	10	19.0	1.2	7	1.4	0.6
4 8 76	W 59	6.3	7	18.0	0.6	6	1.3	0.6
4 8 76	W 60	6.3	8	18.0	1.4	5	1.3	0.6
5 8 76	W 61	6.4	8	19.0	1.0	6	1.5	0.6
5 8 76	W 62	6.3	8	18.0	0.8	6	1.6	0.7
6 8 75	W 63	6.4	10	20.9	1.5	6	1.1	0.5
5 8 75	W 64	6.4	8	17.1	0.7	6	1.1	0.5
5 8 75	W 65	6.1	6	13.2	0.3	4	0.8	0.5
27 7 75	W 66	6.4	10	20.9	0.9	8	1.1	0.5
30 7 75	W 67	6.5	12	26.4	1.5	8	2.3	0.5
27 7 75	W 68	6.4	10	20.4	1.6	8	1.7	1.0
27 7 75	W 69	6.5	10	20.4	1.7	8	1.3	1.0
25 7 75	W 70	6.5	10	22.0	3.7	8	1.7	1.5
20 7 75	W 71	6.4	8	22.0	1.5	6	1.3	0.5

Appendix III

Composition of the gillnet catch

(i) Numbers

(ii) Number/unit effort

(iii) Weight

(iv) Weight/unit effort

Appendix III(i). Numerical composition of the gillnet catch by species in the Lower Churchill River, June-August, 1975-76. Percentages are shown in brackets.

Species	River section I	II	III	IV	V	I-V
Longnose sucker	289 (30.3)	55 (10.5)	268 (26.9)	170 (41.2)	409 (40.9)	1191 (30.6)
Lake whitefish	294 (30.8)	145 (27.7)	119 (12.0)	58 (14.0)	221 (22.1)	837 (21.5)
White sucker	252 (26.4)	171 (32.7)	20 (2.0)	113 (27.4)	155 (15.5)	711 (18.3)
Brook trout	38 (4.0)	3 (0.6)	446 (44.8)	5 (1.2)	87 (8.7)	579 (14.9)
Northern pike	55 (5.8)	133 (25.4)	1 (0.1)	16 (3.9)	60 (6.0)	265 (6.8)
Round whitefish	17 (1.8)	3 (0.6)	116 (11.6)	3 (0.7)	30 (3.0)	169 (4.3)
Burbot	7 (0.7)	13 (2.5)	18 (1.8)	23 (5.6)	24 (2.4)	85 (2.2)
Ouananiche			2 (0.2)	17 (4.1)	11 (1.1)	30 (0.8)
Lake trout			3 (0.3)	8 (1.9)	4 (0.4)	15 (0.4)
Lake chub			3 (0.3)			3 (0.1)
Rainbow smelt	2 (-)					2 (-)
All species	954	523	996	413	1001	3887

Appendix III(ii). Catch per unit effort (No. fish/net night)[a] of the gillnet catch by species in the Lower Churchill River, June-August, 1975-76. Percentages are shown in brackets.

Species	River section I	II	III	IV	V	I-V
Longnose sucker	1.9 (29.2)	0.3 (12.0)	2.3 (26.7)	2.8 (40.0)	2.8 (40.6)	1.7 (30.9)
Lake whitefish	2.0 (30.8)	0.7 (28.0)	1.0 (11.6)	1.0 (14.3)	1.5 (21.7)	1.2 (21.8)
White sucker	1.7 (26.2)	0.8 (32.0)	0.2 (2.3)	1.9 (27.2)	1.1 (15.9)	1.0 (18.2)
Brook trout	0.3 (4.6)	<0.1 (-)	3.9 (45.4)	0.1 (1.4)	0.6 (8.7)	0.8 (14.5)
Northern pike	0.4 (6.2)	0.6 (24.0	<0.1 (-)	0.3 (4.3)	0.4 (5.8)	0.4 (7.3)
Round whitefish	0.1 (1.5)	<0.1 (-)	1.0 (11.6)	0.1 (1.4)	0.2 (2.9)	0.3 (5.5)
Burbot	0.1 (1.5)	0.1 (4.0)	0.2 (2.3)	0.4 (5.7)	0.2 (2.9)	0.1 (1.8)
Ouananiche			<0.1 (-)	0.3 (4.3)	0.1 (1.5)	<0.1 (-)
Lake trout			<0.1 (-)	0.1 (1.4)	<0.1 (-)	<0.1 (-)
Lake chub			<0.1 (-)			<0.1 (-)
Rainbow smelt	<0.1 (-)					<0.1 (-)
All species	6.5	2.5	8.6	7.0	6.9	5.5

[a]A net night is one 47 metre gillnet of stretched mesh 3.8 - 12.7 cm fished for a 24 hour period. Data are weighted to compensate for different efforts by different mesh sizes.

Appendix III(iii). Weight composition (kg) of the gillnet catch by species in the Lower Churchill River, June-August, 1975-76. Percentages are shown in brackets.

Species	River section					
	I	II	III	IV	V	I-V
Northern pike	118.3 (30.2)	246.0 (54.7)	2.3 (0.5)	37.4 (12.5)	145.8 (22.9)	549.8 (24.8)
Lake whitefish	127.1 (32.4)	78.2 (17.4)	78.3 (17.9)	39.3 (13.2)	146.1 (22.9)	469.0 (21.2)
Longnose sucker	70.4 (18.0)	21.1 (4.7)	98.0 (22.4)	86.1 (28.8)	125.9 (19.8)	401.5 (18.1)
White sucker	64.9 (16.6)	90.4 (20.1)	12.1 (2.8)	63.4 (21.2)	122.6 (19.3)	353.4 (16.0)
Brook trout	5.0 (1.3)	1.1 (0.2)	209.5 (47.8)	3.7 (1.2)	42.3 (6.6)	261.6 (11.8)
Burbot	4.3 (1.1)	10.9 (2.4)	9.3 (2.1)	17.8 (6.0)	17.6 (2.8)	59.9 (2.7)
Lake trout			2.7 (0.6)	27.8 (9.3)	21.3 (3.3)	51.8 (2.3)
Ouananiche			1.2 (0.3)	23.0 (7.7)	11.1 (1.7)	35.3 (1.6)
Round whitefish	1.7 (0.4)	1.9 (0.4)	24.6 (5.6)	0.4 (0.1)	4.2 (0.7)	32.8 (1.5)
Lake chub			0.1 (-)			0.1 (-)
Rainbow smelt	0.1 (-)					0.1 (-)
All species	391.8	449.6	438.1	298.9	636.9	2215.3

Appendix III(iv). Catch per unit effort (kg/net night)[a] of the gillnet catch by species in the Lower Churchill River, June-August, 1975-76. Percentages are shown in brackets.

Species	River section					
	I	II	III	IV	V	I-V
Northern pike	0.79 (30.3)	1.12 (54.4)	0.02 (0.5)	0.62 (12.4)	0.98 (22.7)	0.80 (24.8)
Lake whitefish	0.85 (32.6)	0.36 (17.5)	0.68 (17.9)	0.66 (13.2)	0.98 (22.7)	0.68 (21.1)
Longnose sucker	0.47 (18.0)	0.10 (4.9)	0.85 (22.4)	1.44 (28.9)	0.86 (20.0)	0.58 (18.0)
White sucker	0.43 (16.5)	0.41 (19.9)	0.11 (2.9)	1.06 (21.2)	0.82 (19.0)	0.51 (15.8)
Brook trout	0.03 (1.2)	0.01 (0.5)	1.82 (47.9)	0.06 (1.2)	0.29 (6.7)	0.38 (11.8)
Burbot	0.03 (1.2)	0.05 (2.4)	0.08 (2.1)	0.30 (6.0)	0.12 (2.8)	0.09 (2.8)
Lake trout			0.02 (0.5)	0.46 (9.2)	0.15 (3.5)	0.08 (2.5)
Ouananiche			0.01 (0.3)	0.38 (7.6)	0.08 (1.9)	0.05 (1.6)
Round whitefish	0.01 (0.4)	0.01 (0.5)	0.21 (5.5)	0.01 (0.2)	0.03 (0.7)	0.05 (1.6)
Lake chub			<0.01 (-)			<0.01 (-)
Rainbow smelt	<0.01 (-)					<0.01 (-)
All species	2.61	2.06	3.80	4.99	4.31	3.22

[a] A net night is one 47 metre gillnet of stretched mesh 3.8 - 12.7 cm fished for a 24 hour period. Data are weighted to compensate for different efforts by different mesh sizes.

Appendix IV

Body-scale relationships of fishes from the Lower Churchill River

Appendix IV. Linear regressions of fork length (L)(cm) on scale radius (S)(cm x 43) for fishes from the Lower Churchill River, 1975-76.

Species	River Section	Regression	No. of data pairs	Correlation Coefficient
Northern pike	I.	$\log_{10} L = 0.74 \log_{10} S + 0.93$	55	0.923
	II.	$\log_{10} L = 0.84 \log_{10} S + 0.83$	131	0.932
	IV.	$\log_{10} L = 0.88 \log_{10} S + 0.55$	117	0.918
	V.	$L = 4.70 S - 6.10$	60	0.900
Lake whitefish	I.	$L = 1.06 S + 8.78$	150	0.904
	II.	$L = 1.11 S + 8.37$	140	0.936
	III.	$\log_{10} L = 0.46 \log_{10} S + 0.94$	104	0.794
	IV.	$L = 1.10 S + 12.86$	54	0.867
	V.	$L = 2.57 S + 9.07$	10[a]	0.983
Longnose sucker	I.	$\log_{10} L = 0.67 \log_{10} S + 0.78$	148	0.895
	II.	$\log_{10} L = 0.73 \log_{10} S + 0.69$	53	0.926
	III.	$\log_{10} L = 0.72 \log_{10} S + 0.73$	189	0.889
	IV.	$\log_{10} L = 0.57 \log_{10} S + 0.89$	95	0.849
	V.	$L = 2.39 S + 0.41$	7[a]	0.993
White sucker	I.	$\log_{10} L = 0.62 \log_{10} S + 0.69$	182	0.938
	II.	$L = 1.13 S + 7.68$	150	0.900
	III.	$\log_{10} L = 0.54 \log_{10} S + 0.82$	20	0.961
	IV.	$L = 1.05 S + 10.50$	102	0.951
	V.	$L = 2.32 S + 7.66$	9[a]	0.991
Brook trout	I.	$\log_{10} L = 0.58 \log_{10} S + 1.13$	37	0.750
	III.	$\log_{10} L = 0.94 \log_{10} S + 1.03$	183	0.844
	V.	$\log_{10} L = 1.11 \log_{10} S + 0.86$	87	b
Ouananiche	IV.	$L = 2.74 S + 8.66$	22	0.875
Round whitefish	III.	$L = 1.62 S + 8.14$	105	0.929
	V.	$L = 2.65 S - 2.09$	8[a]	0.985

a. Data were averaged by intervals of fork length.
b. Not available.

Appendix V

Age-Length Data

(i) Northern Pike
(ii) Lake Whitefish
(iii) Longnose Suckers
(iv) White Suckers
(v) Brook Trout
(vi) Burbot
(vii) Lake Trout
(viii) Ouananiche
(ix) Round Whitefish

Appendix V(i). Growth of northern pike, *Esox lucius*, in four sections of the Lower Churchill River, Labrador, June-August, 1975-76.

River section[1]	Mean calculated fork length (cm) at age -																No. of fish
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
I	13.1	25.8	34.7	41.7	48.4	53.4	58.3	62.5	65.3	67.1	66.2						55
II	11.8	20.2	29.5	38.1	45.3	50.7	55.9	60.1	63.1	66.1	68.7	71.6	74.1	74.9	78.1	84.6	131
IV	8.7	15.9	23.1	31.6	42.6	50.6	56.8	59.0	64.2	64.6	66.0	70.2	74.0	78.2			16
V	1.7	12.9	25.3	37.9	49.9	58.0	63.7	69.6	72.4	75.9	79.4	81.9	84.0	90.6	95.9		60
I-V Mean of Means	8.8	18.7	28.2	37.3	46.6	53.2	58.7	62.8	66.3	68.4	70.1	74.6	77.4	81.2	87.0	84.6	-

1. Two fish from section III were 65.6 and 68.2 cm and aged 9+ and 11+ respectively.

Appendix V(ii). Growth of lake whitefish, *Coregonus clupeaformis*, in five sections of the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mean calculated fork length (cm) at age -																	No. of fish
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
I	11.4	15.6	18.4	20.6	22.2	25.0	26.2	28.4	30.1	39.1								150
II[a]	11.4	15.2	18.3	21.4	24.3	27.1	29.3	31.2	33.4	35.1	36.4	37.8	39.3					140
III	12.8	19.2	23.3	26.3	29.1	31.4	33.1	34.3	35.8	35.4	36.3	36.8	36.9					104
IV	15.8	19.5	23.4	26.4	28.1	30.6	32.1	33.9	35.1	36.4	38.0	39.1						54
V	13.1	17.7	21.4	24.5	27.1	29.4	31.3	33.1	34.2	35.9	37.6	41.4	43.1	52.3	53.1	54.1	55.6	152
I-V Mean of means	12.9	17.4	21.0	23.8	26.2	28.7	30.4	32.2	33.7	36.4	37.1	38.8	39.8	52.3	53.1	54.1	55.6	-

a. Fish of ages 14-20 were deleted due to insufficient sample size.

Appendix V(iii). Growth of longnose suckers, *Catostomus catostomus*, in five sections of the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mean calculated fork length (cm) at age -																No. of fish
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
I	6.4	10.4	13.7	17.0	19.9	22.4	25.0	27.5	29.3	30.7	33.5	35.4	38.8	41.8			148
II	4.7	7.7	11.0	14.4	17.2	20.8	23.7	26.8	30.2	32.7	34.7	37.1	38.7	39.7			53
III	5.4	8.3	11.4	14.8	17.9	21.0	23.8	26.5	29.0	30.8	33.5	35.3	37.5	38.9	43.9		189
IV[a]	7.0	10.1	13.2	15.9	18.7	21.5	24.1	26.5	29.0	30.8	32.2	34.7	36.3	38.6	40.3	46.6	97
V	3.0	5.4	8.3	11.3	14.5	17.8	21.7	24.5	27.5	30.5	33.2	35.1	38.2	38.9			148
I-V Mean of means	5.3	8.4	11.5	14.7	17.6	20.7	23.7	26.4	29.0	31.1	33.4	35.5	37.9	39.6	42.1	46.6	-

a. One fish in its 19th year was not included.

Appendix V(iv). Growth of white suckers, *Catostomus commersoni*, in five sections of the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mean calculated fork length (cm) at age -																	No. of fish
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
I	5.7	9.2	13.5	17.6	21.0	23.7	25.8	28.1	29.8	30.2	31.8							182
II	9.5	11.6	14.6	18.2	21.7	25.1	29.9	33.1	35.2	37.3	38.7	39.7	41.2					150
III	8.8	13.2	17.9	22.2	26.5	30.8	33.6	36.7	40.5	42.6	43.0							20
IV	11.8	12.7	14.4	17.2	20.0	22.8	26.5	29.3	32.1	34.9	36.6	38.6	41.1	43.0	46.5	48.3	49.5	102
V[a]	9.6	11.6	14.5	17.9	21.4	25.2	28.7	31.5	34.3	37.2	39.2	41.0	42.9	44.4	44.6	46.1		155
I-V Mean of means	9.1	11.7	15.0	18.6	22.1	25.5	28.9	31.7	34.4	36.4	37.9	39.8	41.7	43.7	45.6	47.2	49.5	-

a. One fish in its 19th year was not included.

Appendix V(v). Growth of brook trout, Salvelinus fontinalis, in five sections of the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mean calculated fork length (cm) at age -																No. of fish
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
I	10.1	14.2	17.0	21.2	24.9	30.8											37
II[a]		19.2	23.4	38.2													3
III	7.7	15.5	23.4	30.8	35.3	39.3											183[b]
IV[a]				38.2	39.0												5
V	5.8	12.5	20.2	26.9	34.9	43.5											87
I, III, and V Mean of means	7.9	14.1	20.2	26.3	31.7	37.9											-

a. Lengths are lengths at capture.

b. Includes 41 angled fish.

Appendix V(vi). Growth of burbot, *Lota lota* in five sections of the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mean total length (cm) at capture of fish in age group - 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	No. of fish
I					34.6	36.6	51.2	48.5									7
II					30.5	44.1	48.7	49.4	54.6	52.0							13
III			23.1	33.9	33.2	46.4	46.8	51.0	56.0		42.5			53.5			18
IV				40.1	34.7		43.2		46.5	55.9	56.1		68.7				23
V			22.5	29.7	29.7	30.5	32.5	43.8	43.8	53.8	56.1	60.3	68.9				24
I.-V. Mean of means			22.8	34.6	32.5	39.4	44.5	48.2	50.2	53.9	51.6	60.3	68.8	53.5			

Appendix V(vii). Growth of lake trout, <u>Salvelinus namaycush</u> in three sections of the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mean fork length (cm) at capture of fish in age group -																No. of fish
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
111						40.0			48.2								3
1V										53.4		63.4	61.9	66.2	64.9		8
V							37.4				56.5			84.3	92.0		4
111-V Mean of means						40.0	37.4		48.2	53.4	56.5	63.4	61.9	75.3	78.5		-

Appendix V(viii). Growth of ouananiche, *Salmo salar* in one section of the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mean calculated fork length (cm) at age -																No. of fish
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
III.[ab]					24.1		43.2										3
IV.[c]	12.4	17.2	22.8	28.9	35.1	42.1	46.8	49.8	52.2								22
V.[a]				27.8	39.9	43.3	44.8										11

a. Lengths are lengths at capture.

b. Includes one angled fish.

c. Includes five angled fish.

Appendix V(ix). Growth of round whitefish, <u>Prosopium cylindraceum</u>, in five section of the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mean calculated fork length (cm) at age -																No. of fish
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
I[a]					21.5	20.5	23.7	23.2									14
II[a]								32.9	34.5				40.4				3
III	11.4	16.1	20.0	23.1	25.4	27.4	29.4	30.9	31.7	34.4	34.2	36.0					105
IV[a]				20.5		26.6	26.5										3
V	5.7	14.0	17.7	19.1	22.1	22.9	27.4	27.4									30
III and V mean of means	8.6	15.1	18.9	21.1	23.8	25.2	28.4	29.2	31.7	34.4	34.2	36.0					-

a. Lengths are lengths at capture.

Appendix VI

Sex ratios of fishes from the Lower Churchill River

Appendix VI. Sex ratios (number of males per female) of fishes from the Lower Churchill River, June-August, 1975-76.

Species	River Section	No. Of Fish Examined	Sex Ratio
Northern Pike	I	55	1.62
	II	130	0.88
	III	2	a
	IV	18	1.25
	V	60	1.61
	I-V	265	1.19[b]
Lake Whitefish	I	294	0.57
	II	145	1.38
	III	119	0.95
	IV	58	1.15
	V	221	1.38
	I-V	837	0.95[b]
Longnose Sucker	I	289	0.24
	II	55	0.45
	III	261	0.51
	IV	171	0.75
	V	-	c
	I-V	776	0.43[d]
White Sucker	I	239	1.19
	II	171	0.86
	III	20	1.22
	IV	113	0.88
	V	-	c
	I-V	543	1.01[b]
Brook Trout	I	35	0.84
	II	3	2.00
	III	569	1.10
	IV	5	0.67
	V	87	0.98
	I-V	699	1.07[b]

Appendix VI - Continued.

Species	River Section	No. Of Fish Examined	Sex Ratio
Burbot	I	6	5.00
	II	13	0.18
	III	18	1.57
	IV	23	0.44
	V	24	0.60
	I-V	84	0.68[b]
Lake Trout	III	3	0.50
	IV	8	0.60
	V	4	3.00
	III-V	15	0.88[b]
Ouananiche	III	3	0.50
	IV	22	0.69
	V	11	1.75
	III-V	36	0.90[b]
Round Whitefish	I	17	0.89
	II	3	0.50
	III	116	0.90
	IV	3	0.00
	V	30	3.29
	I-V	169	1.06[b]
Lake Chub	III	3	0.00
Râinbow Smelt	I	2	0.00

a. All males.
b. $x^2 < 3.84$ indicates no departure from 1:1 sex ratio.
c. Not determined.
d. $x^2 > 3.84$ indicates departure from 1:1 sex ratio.

Appendix VII

Length at maturity of fishes from the Lower Churchill River

(i) Northern pike
(ii) Lake whitefish and round whitefish
(iii) White suckers, longnose suckers and brook trout
(iv) Burbot and ouananiche
(v) Lake trout

Appendix VII (i). Length at maturity of northern pike from the Lower Churchill River, June-August, 1975-76.

Fork Length (cm)	Number Examined	% Mature
20.0-24.9	9	0.0
25.0-29.9	11	0.0
30.0-35.9	6	16.7
35.0-39.9	4	50.0
40.0-44.9	7	71.4
45.0-49.9	16	100.0
50.0-54.9	16	87.5
55.0-59.9	37	100.0
60.0-64.9	59	100.0
65.0-69.9	46	100.0
70.0-74.9	20	100.0
75.0-79.9	7	100.0
80.0-84.9	8	100.0
85.0-89.9	10	100.0
90.0-94.9	4	100.0
95.0-99.9	2	100.0
100.0-104.9	3	100.0
105.0-109.9		
Total	265	88.3

Appendix VII (ii). Length at maturity of lake whitefish and round whitefish from the Lower Churchill River, June-August, 1975-76.

	Lake Whitefish		Round Whitefish	
Fork Length (cm)	Number Examined	% Mature	Number Examined	% Mature
12.0-13.9				
14.0-15.9	5	40.0		
16.0-17.9	27	25.9	1	100.0
18.0-19.9	52	38.5	28	64.3
20.0-21.9	38	57.9	33	72.3
22.0-23.9	51	76.5	25	88.0
24.0-25.9	41	92.7	23	91.3
26.0-27.9	32	93.8	14	92.9
28.0-29.9	17	52.9	11	100.0
30.0-31.9	21	76.2	3	100.0
32.0-33.9	45	91.1	14	85.7
34.0-35.9	107	95.3	8	100.0
36.0-37.9	143	97.2	6	100.0
38.0-39.9	91	98.9	1	100.0
40.0-41.9	37	92.3	1	100.0
42.0-43.9	18	100.0	1	100.0
44.0-45.9	6	100.0		
46.0-47.9	2	100.0		
48.0-49.9	1	100.0		
50.0-51.9	3	100.0		
52.0-53.9				
Totals	737	84.3	169	84.0

Appendix VII (iii). Length at maturity of white suckers, longnose suckers, and brook trout from the Lower Churchill River, June-August, 1975-76.

Fork Length (cm)	White suckers Number Examined	% Mature	Longnose suckers Number Examined	% Mature	Brook trout Number Examined	% Mature
10.0-11.9						
12.0-13.9					2	50.0
14.0-15.9	2	0.0	4	0.0	8	50.0
16.0-17.9	46	32.6	46	17.4	27	63.0
18.0-19.9	32	25.0	40	27.5	42	78.6
20.0-21.9	64	43.8	33	81.8	16	87.5
22.0-23.9	71	66.2	80	92.5	32	81.3
24.0-25.9	38	73.7	63	92.1	29	93.1
26.0-27.9	11	90.9	34	100.0	38	80.0
28.0-29.9	13	92.3	19	100.0	35	91.4
30.0-31.9	47	100.0	68	100.0	59	100.0
32.0-33.9	59	100.0	79	100.0	70	94.3
34.0-35.9	41	100.0	89	100.0	77	98.7
36.0-37.9	25	100.0	60	100.0	84	97.6
38.0-39.9	27	100.0	42	100.0	71	95.8
40.0-41.9	31	100.0	16	100.0	46	97.8
42.0-43.9	24	95.8	9	100.0	42	100.0
44.0-45.9	13	100.0	7	100.0	14	92.9
46.0-47.9	3	100.0	3	100.0	1	100.0
48.0-49.9	2	100.0	5	100.0	2	100.0
50.0-51.9			1	100.0		
52.0-53.9	1	100.0			1	100.0
54.0-55.9						
Total	550	76.4	698	87.4	695	91.9

Appendix VII (iv). Length at maturity of burbot and ouananiche from the Lower Churchill River, June-August, 1975-76.

	Burbot		Ouananiche	
Length (cm)[a]	Number Examined	% Mature	Number Examined	% Mature
16.0-17.9			1	0.0
18.0-19.9				
20.0-21.9				
22.0-23.9	5	40.0		
24.0-25.9			1	100.0
26.0-27.9			1	0.0
28.0-29.9	5	20.0		
30.0-31.9	4	25.0		
32.0-33.9	4	75.0		
34.0-35.9	1	100.0		
36.0-37.9			1	100.0
38.0-39.9	3	100.0	3	66.7
40.0-41.9	4	100.0	4	50.0
42.0-43.9	8	100.0	4	100.0
44.0-45.9	7	100.0	4	75.0
46.0-47.9	9	100.0	2	100.0
48.0-49.9	4	100.0	2	100.0
50.0-51.9	3	100.0	2	100.0
52.0-53.9	4	100.0	3	100.0
54.0-55.9	3	100.0	1	100.0
56.0-57.9	5	100.0	2	100.0
58.0-59.9	2	100.0	1	100.0
60.0-61.9	3	100.0	1	100.0
62.0-63.9	1	100.0	1	100.0
64.0-65.9	1	100.0	1	100.0
66.0-67.9	1	100.0		
68.0-69.9	2	100.0		
70.0-71.9				
Totals	79	86.1	35	82.9

a. Lengths are total lengths for burbot and fork lengths for ouananiche.

Appendix VII (v). Length at maturity of lake trout from the Lower Churchill River, June-August, 1975-76.

Fork Length (cm)	Number Examined	% Mature
30.0-39.9	2	50.0
40.0-49.9	3	100.0
50.0-59.9	4	100.0
60.0-69.9	3	100.0
70.0-79.9	1	100.0
80.0-89.9	1	100.0
90.0-99.9	1	100.0
100.0-109.9		
Total	15	93.3

Appendix VIII

Catch statistics of fishes from the Lower Churchill River.

- (i) Northern pike
- (ii) Lake whitefish
- (iii) Longnose suckers
- (iv) White suckers
- (v) Brook trout
- (vi) Burbot
- (vii) Lake trout
- (viii) Ouananiche
- (ix) Round whitefish

Appendix VIII (i). Catch statistics of northern pike from the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mesh size (cm)	No. of net nights[a]	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
I[b]	3.8-12.7	150	55 (100%)	0.4	62.2	118.3 (100%)	2.15	0.79	7.5
II	3.8	44	36 (27.1%)	0.8	46.2	44.2 (18.0%)	1.30	1.01	5.6
	5.1	44	29 (21.8%)	0.7	54.4	55.1 (22.4%)	1.90	1.25	6.9
	7.6	44	34 (25.6%)	0.8	55.2	47.6 (19.3%)	1.40	1.08	7.4
	10.2	44	29 (21.8%)	0.7	69.3	81.2 (33.0%)	2.80	1.85	9.5
	12.7	44	5 (3.8%)	0.1	73.9	17.9 (7.3%)	3.60	0.41	10.4
	3.8-12.7	220	133 (100%)	0.6	56.4	246.0 (100%)	1.85	1.12	7.4
III	12.7	21	1 (100%)	0.1	68.2	2.3 (100%)	2.31	0.11	11.0
	3.8-12.7	113	1 (100%)	<0.1	68.2	2.3 (100%)	2.31	0.02	11.0
IV	3.8	12	3 (18.8%)	0.3	72.5	10.0 (26.7%)	3.30	0.83	10.7
	5.1	12	2 (12.5%)	0.2	52.9	3.3 (8.8%)	1.60	0.28	7.0
	7.6	12	6 (37.5%)	0.5	65.4	13.3 (35.6%)	2.20	1.11	8.3
	10.2	12	5 (31.3%)	0.4	66.0	10.8 (28.9%)	2.20	0.90	8.0
	12.7	12	0 (0.0%)	0.0	-	0.0 (0.0%)	-	0.00	-
	3.8-12.7	60	16 (100%)	0.3	65.4	37.4 (100%)	2.34	0.62	8.5
V	3.8	28	3 (5.0%)	0.1	72.7	9.9 (6.8%)	3.28	0.35	7.7
	5.1	28	5 (8.3%)	0.2	65.0	12.9 (8.9%)	2.58	0.46	7.2
	7.6	30	17 (28.3%)	0.6	62.3	35.5 (24.4%)	1.97	1.18	6.9
	10.2	30	30 (50.0%)	1.0	64.5	67.2 (46.1%)	2.24	2.24	7.1
	12.7	30	5 (8.3%)	0.2	82.1	20.3 (13.9%)	4.07	0.68	10.4
	3.8-12.7	146	60 (100%)	0.4	65.8	145.8 (100%)	2.43	1.00	8.2
I - V	3.8-12.7	689	265	0.4	63.6	549.8	2.08	0.80	8.5

a. A net night is one 47 metre gillnet fished for a 24 hour period.
b. Catch data by mesh size not available.

Appendix VIII (ii). Catch statistics of lake whitefish from the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mesh size (cm)	No. of net nights[a]	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
I [b]	3.8-12.7	150	294 (100%)	2.0	22.7	127.1 (100%)	0.43	0.85	4.3
II	3.8	44	27 (18.6%)	0.6	22.6	5.5 (7.0%)	0.20	0.13	3.8
	5.1	44	27 (18.6%)	0.6	27.8	8.6 (11.0%)	0.32	0.20	5.4
	7.6	44	62 (42.8%)	1.4	35.8	40.6 (51.9%)	0.67	0.92	8.8
	10.2	44	24 (16.6%)	0.6	37.7	19.0 (24.3%)	0.79	0.43	10.0
	12.7	44	5 (3.5%)	0.1	39.2	4.5 (5.8%)	0.89	0.10	11.2
	3.8-12.7	220	145 (100%)	0.7	32.3	78.2 (100%)	0.54	0.36	7.5
III	3.8	23	1 (0.8%)	<0.1	25.0	0.2 (0.3%)	0.17	0.01	4.0
	5.1	23	8 (6.7%)	0.1	31.6	3.9 (5.0%)	0.49	0.17	6.3
	7.6	23	49 (41.2%)	0.4	35.3	29.6 (37.8%)	0.60	1.27	7.5
	10.2	23	61 (51.3%)	0.5	37.4	44.6 (57.0%)	0.73	1.94	8.3
	12.7	21	0 (0.0%)	0.0	-	0.0 (0.0%)	-	0.00	-
	3.8-12.7	113	119 (100%)	1.1	36.0	78.3 (100%)	0.66	0.69	7.8
IV	3.8	12	4 (6.8%)	0.3	40.2	3.2 (8.1%)	0.81	0.27	9.0
	5.1	12	9 (15.5%)	0.8	32.5	4.5 (11.5%)	0.50	0.38	6.0
	7.6	12	25 (43.1%)	2.1	36.4	15.6 (39.7%)	0.62	1.30	8.2
	10.2	12	20 (34.5%)	1.7	39.0	16.0 (40.7%)	0.80	1.33	8.5
	12.7	12	0 (0.0%)	0.0	-	0.0 (0.0%)	-	0.00	-
	3.8-12.7	60	58 (100%)	1.0	37.0	39.3 (100%)	0.68	0.66	8.0
V	3.8	28	8 (3.6%)	0.3	27.0	2.7 (1.8%)	0.34	0.10	4.7
	5.1	28	30 (13.6%)	1.1	32.5	15.4 (10.5%)	0.51	0.55	5.5
	7.6	30	104 (47.1%)	3.5	36.7	69.9 (47.8%)	0.67	2.33	7.6
	10.2	30	73 (33.0%)	2.4	37.1	52.2 (35.7%)	0.72	1.74	7.6
	12.7	30	6 (2.3%)	0.2	40.9	5.9 (4.0%)	0.99	0.20	9.5
	3.8-12.7	146	221 (100%)	1.5	36.0	146.1 (100%)	0.66	1.00	7.3
I- V	3.8-12.7	689	837	1.2	32.8	469.0	0.56	0.68	7.0

a. A net night is one 47 metre gillnet fished for a 24 hour period.
b. Catch data mesh size not available.

Appendix VIII(iii). Catch statistics of longnose suckers from the Lower Churchill River, Labrador, June-August, 1975-76.

River Section	Mesh size (cm)	No. of net nights[a]	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
I [b]	3.8-12.7	150	289 (100%)	1.9	25.5	70.4 (100%)	0.31	0.47	6.9
II	3.8	44	15 (27.3%)	0.3	18.8	1.2 (5.6%)	0.08	0.03	5.0
	5.1	44	19 (34.6%)	0.4	29.2	3.6 (17.0%)	0.19	0.08	7.2
	7.6	44	14 (29.9%)	0.3	35.7	8.1 (38.4%)	0.58	0.18	11.0
	10.2	44	6 (10.9%)	0.1	43.7	6.6 (31.3%)	1.10	0.15	13.0
	12.7	44	1 (1.8%)	0.1	49.1	1.6 (7.6%)	1.60	0.04	14.0
	3.8-12.7	220	55 (100%)	0.3	30.0	21.1 (100%)	0.38	0.10	8.3
III	3.8	23	61 (22.8%)	2.7	19.5	5.3 (5.4%)	0.09	0.23	5.3
	5.1	23	63 (23.5%)	2.7	27.3	14.9 (15.2%)	0.24	0.65	7.7
	7.6	23	121 (45.2%)	5.3	34.8	60.4 (61.6%)	0.50	2.63	10.8
	10.2	23	22 (8.2%)	1.0	39.6	17.1 (17.5%)	0.78	0.74	12.5
	12.7	21	1 (0.4%)	0.1	33.4	0.4 (0.4%)	0.44	0.02	12.0
	3.8-12.7	113	368 (100%)	2.4	30.1	98.0 (100%)	0.37	0.87	9.0
IV	3.8	12	1 (0.6%)	0.1	46.0	1.2 (1.4%)	1.20	0.10	5.0
	5.1	12	13 (7.6%)	1.1	27.4	3.1 (3.6%)	0.20	0.26	9.2
	7.6	12	142 (83.0%)	11.8	34.7	69.5 (80.7%)	0.50	5.79	12.5
	10.2	12	13 (7.6%)	1.1	40.9	11.3 (13.1%)	0.90	0.94	13.7
	12.7	12	1 (0.6%)	0.1	49.5	1.0 (1.2%)	0.10	0.08	16.0
	3.8-12.7	60	170 (100%)	2.8	34.8	86.1 (100%)	0.51	1.44	12.3
V	3.8	28	118 (28.9%)	4.2	18.3	8.3 (6.6%)	0.07	0.30	4.4
	5.1	28	129 (31.5%)	4.6	27.0	32.5 (25.8%)	0.25	1.16	7.6
	7.6	30	155 (37.9%)	5.2	35.1	78.6 (62.4%)	0.51	2.62	10.6
	10.2	30	7 (1.7%)	0.2	42.5	6.4 (5.1%)	0.92	0.21	Not available
	12.7	30	0 (0.0%)	0.0	-	0.0 (0.0%)	-	0.00	-
	3.8-12.7	146	409 (100%)	2.8	27.8	125.9 (100%)	0.31	0.86	7.5
I - V	3.8-12.7	689	1191	1.7	29.6	401.5	0.34	0.58	8.8

a. A net night is one 47 metre gillnet fished for a 24 hour period.
b. Catch data by mesh size not available.

Appendix VIII (iv). Catch statistics of white suckers from the Lower Churchill River, Labrador June-August, 1975-76.

River Section	Mesh size (cm)	No. of net nights[a]	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
I[b]	3.8-12.7	150	252 (100%)	1.7	25.6	64.9 (100%)	0.26	0.43	6.0
II	3.8	44	29 (17.0%)	0.7	17.7	2.0 (2.2%)	0.07	0.05	3.7
	5.1	44	40 (23.4%)	0.9	29.1	10.0 (11.1%)	0.25	0.23	5.3
	7.6	44	72 (42.1%)	1.6	35.0	48.2 (53.3%)	0.67	1.10	7.1
	10.2	44	30 (17.9%)	0.7	40.2	30.2 (33.4%)	1.00	0.69	9.6
	12.7	44	0 (0.0%)	0.0	-	0.0 (0.0%)	-	0.00	-
	3.8-12.7	220	171 (100%)	0.8	31.6	90.4 (100%)	0.53	0.41	6.5
III	3.8	23	3 (15.0%)	0.1	21.4	0.3 (2.4%)	0.10	0.01	3.7
	5.1	23	1 (5.0%)	<0.1	24.5	0.2 (1.7%)	0.15	0.01	4.0
	7.6	23	11 (55.0%)	0.5	35.8	7.1 (58.7%)	0.64	0.31	7.1
	10.2	23	5 (25.0%)	0.2	39.0	4.5 (37.2%)	0.90	0.20	8.2
	12.7	21	0 (0.0%)	0.0	-	0.0 (0.0%)	-	0.00	-
	3.8-12.7	113	20 (100%)	0.2	33.9	12.1 (100%)	0.61	0.11	6.7
IV	3.8	12	9 (8.0%)	0.8	24.6	2.7 (4.2%)	0.30	0.22	6.0
	5.1	12	39 (8.0%)	3.3	23.5	7.2 (11.4%)	0.20	0.60	6.7
	7.6	12	37 (32.7%)	3.1	37.0	26.0 (41.0%)	0.70	2.17	10.4
	10.2	12	27 (23.9%)	2.3	41.9	26.6 (42.0%)	1.00	2.22	12.0
	12.7	12	1 (0.9%)	0.1	49.7	0.9 (1.4%)	0.93	0.08	-
	3.8-12.7	60	113 (100%)	1.9	32.6	63.4 (100%)	0.56	1.06	9.1
V	3.8	28	10 (6.5%)	0.4	18.9	0.8 (0.7%)	0.08	0.03	4.3
	5.1	28	22 (14.2%)	0.8	26.9	6.3 (5.1%)	0.29	0.23	6.1
	7.6	30	43 (27.7%)	1.4	37.1	31.4 (25.6%)	0.73	1.05	9.7
	10.2	30	76 (49.0%)	2.5	42.2	78.2 (63.8%)	1.03	2.61	12.0
	12.7	30	4 (2.6%)	0.1	47.4	5.9 (4.8%)	1.48	0.20	15.0
	3.8-12.7	146	155 (100%)	1.1	37.2	122.6 (100%)	0.79	0.84	9.4
I - V	3.8-12.7	689	711	1.0	32.2	353.4	0.50	0.51	7.5

a. A net night is one 47 metre gillnet fished for a 24 hour period.
b. Catch data by mesh size not available.

Appendix VIII (v). Catch statistics of brook trout from the Lower Churchill River, Labrador, June-August, 1975-76.

River Section	Mesh size (cm)	No. of net nights[a]	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
I[b]	3.8-12.7	150	38 (100%)	0.3	22.8	5.0 (100%)	0.13	0.03	3.8
II	3.8	44	1 (33.3%)	0.1	19.2	0.1 (9.1%)	0.09	0.01	2.0
	5.1	44	1 (33.3%)	0.1	23.4	0.2 (18.2%)	0.15	0.01	3.0
	10.2	44	1 (33.3%)	0.1	38.2	0.8 (72.7%)	0.80	0.02	4.0
	3.8-12.7	220	3 (100%)	0.1	26.9	1.1 (100%)	0.37	0.01	3.0
III[c]	3.8	23	74 (16.6%)	3.2	20.6	9.0 (4.3%)	0.12	0.39	2.4
	5.1	23	61 (13.7%)	2.7	28.1	16.2 (7.7%)	0.27	0.70	3.2
	7.6	23	233 (52.2%)	10.1	35.1	123.2 (58.8%)	0.53	5.36	3.9
	10.2	23	76 (17.0%)	3.3	40.3	60.7 (29.0%)	0.80	2.64	4.6
	12.7	21	2 (0.1%)	0.1	26.7	0.4 (0.2%)	0.21	0.02	3.0
	3.8-12.7	113	446 (100%)	4.0	32.6	209.5 (100%)	0.47	1.85	3.7
IV	3.8	12	1 (20.0%)	0.1	38.8	0.7 (18.9%)	0.74	0.06	4.0
	5.1	12	2 (40.0%)	0.2	39.0	1.7 (50.0%)	0.85	0.14	4.5
	7.6	12	2 (40.0%)	0.2	38.0	1.3 (35.1%)	0.63	0.11	4.5
	3.8-12.7	60	5 (100%)	0.1	38.6	3.7 (100%)	0.74	0.06	4.4
V	3.8	28	8 (9.2%)	0.3	20.4	0.7 (1.7%)	0.09	0.03	2.4
	5.1	28	23 (26.4%)	0.8	25.6	4.5 (10.6%)	0.19	0.16	2.8
	7.6	30	35 (40.2%)	1.2	34.5	18.1 (42.8%)	0.52	0.60	4.0
	10.2	30	16 (18.4%)	0.5	39.7	13.8 (32.6%)	0.86	0.46	4.5
	12.7	30	5 (5.7%)	0.2	41.1	5.2 (12.3%)	1.04	0.17	4.6
	3.8-12.7	146	87 (100%)	0.6	32.2	42.3 (100%)	0.49	0.29	3.7
I - V	3.8-12.7	689	579	0.8	30.6	261.6	0.45	0.38	3.7

a. A net night is one 47 metre gillnet fished for a 24 hour period.
b. Catch data by mesh size not available.
c. Thirteen man hours of angling yielded 123 fish weighing 57.5 kg with a mean length of 34.0 cm and a mean age of 3.8 yrs.

Appendix VIII (vi). Catch statistics of burbot from the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mesh size (cm)	No. of net nights[a]	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
I [b]	3.8-12.7	150	7 (100%)	0.1	41.5	4.3 (100%)	0.61	0.03	6.4
II	5.1	44	1 (7.7%)	<0.1	30.5	0.2 (1.8%)	0.16	0.01	5.0
	7.6	44	5 (38.5%)	0.1	45.5	3.1 (28.4%)	0.62	0.07	7.4
	10.2	44	7 (53.9%)	0.2	54.1	7.6 (69.7%)	1.10	0.17	8.6
	3.8-12.7	220	13 (100%)	0.1	49.0	10.9 (100%)	0.84	0.05	7.9
III	5.1	23	2 (11.1%)	0.1	30.8	0.4 (4.3%)	0.17	0.02	4.5
	7.6	23	12 (66.7%)	0.5	43.9	6.5 (69.9%)	0.55	0.28	6.5
	10.2	23	2 (11.1%)	0.1	54.7	2.3 (24.7%)	0.11	0.10	11.5
	12.7	21	2 (11.1%)	0.1	23.6	0.1 (1.1%)	0.07	0.01	3.0
	3.8-12.7	113	18 (100%)	0.2	41.4	9.3 (100%)	0.52	0.08	6.4
IV	5.1	12	3 (13.0%)	0.3	32.1	0.5 (2.8%)	0.10	0.04	5.0
	7.6	12	13 (56.5%)	1.1	43.9	6.5 (36.5%)	0.50	0.54	7.5
	10.2	12	4 (17.4%)	0.3	56.8	4.5 (25.3%)	1.10	0.38	10.3
	12.7	12	3 (13.0%)	0.3	65.8	6.3 (35.4%)	2.10	0.53	11.0
	3.8-12.7	60	23 (100%)	0.4	47.5	17,8 (100%)	0.77	0.30	8.1
V	3.8	28	2 (8.3%)	0.1	22.5	0.1 (0.6%)	0.05	<0.01	3.0
	5.1	28	7 (29.2%)	0.3	30.5	1.2 (6.8%)	0.17	0.04	5.3
	7.6	30	3 (12.5%)	0.1	43.8	1.5 (8.5%)	0.50	0.05	8.7
	10.2	30	9 (37.5%)	0.3	50.9	9.1 (51.7%)	1.01	0.30	10.4
	12.7	30	3 (12.5%)	0.1	65.5	5.7 (32.4%)	1.89	0.19	12.0
	3.8-12.7	146	24 (100%)	0.2	43.5	17.6 (100%)	0.73	0.12	8.3
I - V	3.8-12.7	689	85	0.1	44.6	59.9	0.70	0.09	7.4

a. A net night is one 47 metre gillnet fished for a 24 hour period.
b. Catch data by mesh size not available.

Appendix VIII (vii). Catch statistics of lake trout from the Lower Churchill River, Labrador, June-August, 1975-76.

River Section	Mesh size (cm)	No. of net nights[a]	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
III	10.2	23	3 (100%)	0.1	42.7	2.7 (100%)	0.91	0.12	7.0
	3.8-12.7	113	3 (100%)	<0.1	42.7	2.7 (100%)	0.91	0.02	7.0
IV	10.2	12	6 (75.0%)	0.5	59.9	20.1 (72.3%)	3.35	1.68	12.3
	12.7	12	2 (25.0%)	0.2	61.8	7.7 (27.7%)	3.85	0.64	12.0
	3.8-12.7	60	8 (100%)	0.1	60.4	27.8 (100%)	3.60	0.46	12.2
V	3.8	28	1 (25.0%)	<0.1	92.0	10.4 (48.8%)	10.40	0.37	15.0
	5.1	28	1 (25.0%)	<0.1	37.4	0.8 (3.8%)	0.80	0.03	7.0
	7.6	30	1 (25.0%)	<0.1	56.5	2.1 (9.9%)	2.13	0.07	11.0
	10.2	30	0 (0.0%)	<0.0	-	0.0 (0.0%)	-	0.00	-
	12.7	30	1 (25.0%)	<0.1	84.3	8.0 (37.6%)	7.95	0.27	14.0
	3.8-12.7	146	4 (100%)	<0.1	67.6	21.3 (100%)	5.30	0.15	11.8
I - V	3.8-12.7	689	15	<0.1	57.0	51.8	3.45	0.08	10.3

a. A net night is one metre gillnet fished for a 24 hour period.

Appendix VIII (viii). Catch statistics of ouananiche from the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mesh size (cm)	No. of net nights[a]	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night (kg)	Mean age (yr)
III [b]	5.1	23	1 (50.0%)	<0.1	24.1	0.2 (16.7%)	0.15	0.01	5.0
	10.2	23	1 (50.0%)	<0.1	44.6	1.0 (83.3%)	0.99	0.04	7.0
	3.8-12.7	113	2 (100%)	<0.1	34.4	1.2 (100%)	0.60	0.01	6.0
IV [c]	3.8	12	8 (47.1%)	0.7	44.8	8.5 (37.0%)	1.07	0.71	5.9
	5.1	12	3 (17.7%)	0.3	56.2	5.3 (23.0%)	1.78	0.44	7.0
	7.6	12	1 (5.9%)	0.1	42.5	1.0 (4.4%)	1.00	0.08	7.0
	10.2	12	3 (17.7%)	0.3	51.6	5.1 (22.2%)	1.69	0.43	7.0
	12.7	12	2 (11.8%)	0.2	50.8	3.0 (13.0%)	1.52	0.25	8.0
	3.8-12.7	60	17 (100%)	0.3	48.6	23.0 (100%)	1.35	0.38	6.6
V	3.8	28	1 (9.1%)	<0.1	45.8	1.2 (10.8%)	1.15	0.04	7.0
	5.1	28	3 (27.3%)	0.1	37.2	2.6 (23.4%)	0.87	0.09	5.3
	7.6	30	3 (27.3%)	0.1	45.6	3.5 (31.5%)	1.18	0.12	6.3
	10.2	30	4 (36.4%)	0.1	42.7	3.8 (34.2%)	0.96	0.13	6.5
	3.8-12.7	146	11 (100%)	0.1	42.3	11.1 (100%)	1.01	0.08	6.2
I-V	3.8-12.7	689	30	<0.1	41.7	35.3	1.18	0.05	6.2

a. A net night is one 47 metre gillnet fished for a 24 hour period.
b. One 41.1cm, 0.76 kg, age-group 7 fish was angled.
c. Five fish averaging 48.8cm, 1.20 kg, and 6.4 year old were angled.

Appendix VIII (ix). Catch statistics of round whitefish from the Lower Churchill River, Labrador, June-August, 1975-76.

River section	Mesh size (cm)	No. of net nights[a]	No. of fish caught	No. of fish per net night	Mean length (cm)	Total weight (kg)	Mean weight (kg)	Weight per net night(kg)	Mean age (yr)
I [b]	3.8-12.7	150	17 (100%)	0.1	22.1	1.7 (100%)	0.10	0.01	5.9
II	5.1	44	1 (33.3%)	<0.1	40.4	0.8 (42.1%)	0.80	0.02	13.0
	7.6	44	1 (33.3%)	<0.1	32.9	0.5 (26.3%)	0.47	0.01	8.0
	10.2	44	1 (33.3%)	<0.1	34.5	0.6 (31.5%)	0.63	0.01	9.0
	3.8-12.7	220	3 (100%)	<0.1	35.9	1.9 (100%)	0.63	0.01	10.0
III	3.8	23	47 (40.5%)	2.0	20.9	4.3 (17.5%)	0.09	0.19	3.2
	5.1	23	46 (39.7%)	2.0	26.8	8.6 (35.0%)	0.19	0.37	4.4
	7.6	23	20 (17.2%)	0.9	35.3	9.9 (40.2%)	0.49	0.43	7.7
	10.2	23	2 (1.7%)	0.1	36.9	1.5 (6.1%)	0.75	0.07	10.0
	12.7	21	1 (0.9%)	0.1	29.4	0.3 (1.2%)	0.27	0.01	7.0
	3.8-12.7	113	116 (100%)	1.0	26.1	24.6 (100%)	0.21	0.22	4.6
IV	3.8	12	1 (33.3%)	0.1	20.5	0.1 (25.0%)	0.65	0.01	4.0
	5.1	12	2 (66.7%)	0.2	26.6	0.4 (75%)	0.19	0.02	6.5
	3.8-12.7	60	3 (100%)	0.1	24.6	0.4 (100%)	0.15	0.01	5.7
V	3.8	28	20 (66.7%)	0.7	21.3	1.9 (45.2%)	0.09	0.07	2.5
	5.1	28	8 (26.7%)	0.3	25.8	1.5 (35.7%)	0.18	0.05	3.5
	7.6	30	2 (6.7%)	0.1	33.0	0.9 (21.4%)	0.43	0.03	7.5
	3.8-12.7	146	30 (100%)	0.2	23.3	4.2 (100%)	0.14	0.03	3.1
I - V	3.8-12.7	689	169	0.3	26.4	32.8	0.19	0.05	5.8

a. A net night is one 47 metre gillnet fished for a 24 hour period.
b. Catch data by mesh size not available.

Appendix IX

Age and length-frequency distributions of fishes from the Lower Churchill River.

(i) Northern Pike
(ii) Lake Whitefish
(iii) Longnose Suckers
(iv) White Suckers
(v) Brook Trout
(vi) Burbot
(vii) Lake Trout
(viii) Ouananiche
(ix) Round Whitefish

Appendix IX (i). Age-frequency distribution by gillnet mesh size of northern pike from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2	6					6
3	9	6	1			16
4	3	5	1			9
5	2	6	10	4		22
6	3	5	10	13	1	32
7	1		12	13	1	27
8	3		7	6	2	18
9	1	4	8	8	1	22
10	6	1	5	6	1	19
11	4	3	1	4	1	13
12	2	1	1	3	1	8
13		3	1	1		5
14	2			3	1	6
15				2	2	4
16		1				1
Totals	42	35	57	63	11	208

Appendix IX (i). Length-frequency distribution by gillnet mesh size of northern pike from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
20.0-29.9	17	3	3			23
30.0-39.9	1	7	1		1	10
40.0-49.9	1	8	13			22
50.0-59.9	4	2	18	15	1	40
60.0-69.9	11	7	21	32	2	73
70.0-79.9	4	3	2	7	2	18
80.0-89.9	4	2	2	7	3	18
90.0-99.9		2		3	1	6
100.0-109.9		2			1	3
Totals	42	36	60	64	11	213

Appendix IX (i). Age-frequency distribution by gillnet mesh size of northern pike from the Lower Churchill River, Section II, August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2	6					6
3	9	6	1			16
4	3	5				8
5	2	4	8	1		15
6	1	2	6		1	10
7	1		3	2		6
8	2		6	5	1	14
9	1	3	4	5	1	14
10	5	1	4	4		14
11	3	3	1	4		11
12	2	1	1	3		7
13		2		1		3
14	1			1	1	3
15				2	1	3
16		1				1
Totals	36	28	34	28	5	131

Appendix IX (i). Length-frequency distribution by gillnet mesh size of northern pike from the Lower Churchill River, Section II, August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9	17	3				20
30.0-39.9	1	6	1		1	9
40.0-49.9	1	7	11			19
50.0-59.9	3	2	12	6		23
60.0-69.9	9	4	8	12	1	34
70.0-79.9	3	2	2	3	1	11
80.0-89.9	2	1		7	1	11
90.0-99.9		2		1	1	4
100.0-109.9		2				2
Totals	36	29	34	29	5	133

Appendix IX (i). Age-frequency distribution by gillnet mesh size of northern pike from the Lower Churchill River, Section III, June-July, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11					1	1
12						
13						
14						
15						
16						
Totals					1	1

Appendix IX (i). Length-frequency distribution by gillnet mesh size of northern pike from the Lower Churchill River, Section III, June-July, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9						
30.0-39.9						
40.0-49.9						
50.0-59.9					1	1
60.0-69.9						
70.0-79.9						
80.0-89.9						
90.0-99.9						
100.0-109.9						
Totals					1	1

Appendix IX (i). Age-frequency distribution by gillnet mesh size of northern pike from the Lower Churchill River, Section IV, July-August, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4						
5		1				1
6				1		1
7			2	2		4
8	1					1
9		1	4			5
10	1			2		3
11						
12						
13						
14	1					1
15						
16						
Totals	3	2	6	5		16

Appendix IX (i). Length-frequency distribution by gillnet mesh size of northern pike from the Lower Churchill River, Section IV, July-August, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9						
30.0-39.9		1				1
40.0-49.9						
50.0-59.9	1		1			2
60.0-69.9			5	3		8
70.0-79.9	1	1		2		4
80.0-89.9	1					1
90.0-99.9						
100.0-109.9						
Totals	3	2	6	5		16

Appendix IX (i). Age-frequency distribution by gillnet mesh size of northern pike from the Lower Churchill River, Section V, July-August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4			1			1
5		1	2	3		6
6	2	3	4	12		21
7			7	9	1	17
8			1	1	1	3
9				3		3
10			1		1	2
11	1					1
12					1	1
13		1	1			2
14				2		2
15					1	1
16						
Totals	3	5	17	30	5	60

Appendix IX (i). Length-frequency distribution by gillnet mesh size of northern pike from the Lower Churchill River, Section V, July-August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9						
30.0-39.9						
40.0-49.9		1	2			3
50.0-59.9			5	9		14
60.0-69.9	2	3	8	17	1	31
70.0-79.9				2	1	3
80.0-89.9	1	1	2		2	6
90.0-99.9				2		2
100.0-109.9					1	1
Totals	3	5	17	30	5	60

Appendix IX(ii). Age-frequency distribution by gillnet mesh size of lake whitefish from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1	1	1				2
2	14	2				16
3	8	12	1	1		22
4	2	11	13	1		27
5		10	14	5		29
6	4	10	35	17	1	67
7	1	7	38	20	1	67
8	2	2	33	25		62
9	3	2	38	21	1	65
10	1	2	17	15		35
11		4	14	11		29
12	1	1	6	12	2	22
13		1	9		1	11
14			1			1
15			1			1
16					1	1
17			1			1
18						
19						
20			1			1
Totals	37	65	222	128	7	459

Appendix IX(ii). Length frequency distribution by gillnet mesh size of lake whitefish from the lower Churchill River above Muskrat Falls, June-August, 1975-76.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	18	1				19
20.0-29.9	9	31	7	1	1	49
30.0-39.9	9	37	208	148	5	407
40.0-49.9	4	5	21	30	5	65
50.0-59.9			3			3
Totals	40	74	239	179	11	543

Appendix IX(ii). Age-frequency distribution by gillnet mesh size of lake whitefish from the Lower Churchill River, Section II, August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2	13	1				14
3	8	8		1		17
4		5				5
5		4	1			5
6	2	3	9		1	15
7		1	14	3		18
8			7	1		8
9	3	1	11	2	1	18
10		1	4	4		9
11		2	6	5		13
12			3	8	1	12
13		1	5		1	7
14			1			1
15			1			1
16					1	1
17						
18						
19						
20			1			1
Totals	26	27	63	24	5	145

Appendix IX(ii). Length-frequency distribution by gillnet mesh size of lake whitefish from the Lower Churchill River, Section II, August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	16					16
20.0-29.9	6	17	4	1	1	29
30-0-39.9	4	9	48	16	1	78
40.0-49.9	1	1	8	8	3	21
50.0-59.9			1			1
Totals	27	27	61	25	5	145

Appendix IX(ii). Age-frequency distribution by gillnet mesh size of lake whitefish from the Lower Churchill River, Section III, June-July, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4	1	2	2			5
5		1	6	1		8
6		2	12	6		20
7		3	9	6		18
8		1	4	11		16
9		1	7	12		20
10			5	2		7
11			2	3		5
12			2	2		4
13			1			1
14						
15						
16						
17						
18						
19						
20						
Totals	1	10	50	43		104

Appendix IX(ii). Length-frequency distribution by gillnet mesh size of lake whitefish from the Lower Churchill River, Section III, June-July, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9	1	3				4
30.0-39.9		5	47	55		107
40.0-49.9			2	6		8
50.0-59.9						
Totals	1	8	49	61		119

Appendix IX(ii). Age-frequency distribution by gillnet mesh size of lake whitefish from the Lower Churchill River, Section IV, July-August, 1976.

Age	Mesh size (cm)					
(yr)	3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3		3				3
4		1	4	1		6
5			1	1		2
6	1	2	2	2		7
7		1		3		4
8	1		4	5		10
9			7			7
10	1		3	3		7
11		2	2	3		7
12	1		1	2		4
13			1			1
14						
15						
16						
17						
18						
19						
20						
Totals	4	9	25	20		58

Appendix IX(ii). Length-frequency distribution by gillnet mesh size of lake whitefish from the Lower Churchill River, Section IV, July-August, 1976.

Length class	Mesh size (cm)					
(cm)	3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9		1				1
20.0-29.9		2	1			3
30.0-39.9	1	4	22	13		40
40.0-49.9	3	2	2	7		14
50.0-59.9						
Totals	4	9	25	20		58

Appendix IX(ii). Age-frequency distribution by gillnet mesh size of lake whitefish from the Lower Churchill River, Section V, July-August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1	1	1				2
2	1	1				2
3		1	1			2
4	1	3	7			11
5		5	6	3		14
6	1	3	12	9		25
7	1	2	15	8	1	27
8	1	1	18	8		28
9			13	7		20
10		1	5	6		12
11			4			4
12		1			1	2
13			2			2
14						
15						
16						
17			1			1
18						
19						
20						
Totals	6	19	84	41	2	152

Appendix IX(ii). Length-frequency distribution by gillnet mesh size of lake whitefish from the Lower Churchill River, Section V, July-August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	2					2
20.0-29.9	2	9	2			13
30.0-39.9	4	19	91	64	4	182
40.0-49.9		2	9	9	2	22
50.0-59.9			2			2
Totals	8	30	104	73	6	221

Appendix IX(iii). Age-frequency distribution by gillnet mesh size of longnose suckers from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3	16					16
4	25	4				29
5	35	12				47
6	6	25				31
7	7	38	3			48
8	4	20	7			31
9	1	9	21			31
10		15	37	2		54
11		7	61	3		71
12		2	45	3	1	51
13		4	25	16		45
14			13	4	1	18
15	1		4	1		6
16		1	5	1	1	8
17						
18						
19			1			1
Totals	95	137	222	30	3	487

Appendix IX(iii). Length-frequency distribution by gillnet mesh size of longnose suckers from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	160	2				162
20.0-29.9	34	168	8			210
30.0-39.9	1	52	402	19		474
40.0-49.9		2	21	29	2	54
50.0-59.9			1		1	2
Totals	195	224	432	48	3	902

Appendix IX(iii). Age-frequency distribution by gillnet mesh size of longnose suckers from the Lower Churchill River, Section II, August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4	5	1				6
5	8					8
6		4				4
7	1	7				8
8	1	4	1			6
9		1	3			4
10			1			1
11		1	5			6
12				1		1
13			2	3		5
14			2	1	1	4
15						
16						
17						
18						
19						
Totals	15	18	14	5	1	53

Appendix IX(iii). Length-frequency distribution by gillnet mesh size of longnose suckers from the Lower Churchill River, Section II, August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	13					13
20.0-29.9	2	17				19
30.0-39.9		2	12	1		15
40.0-49.9			2	5	1	8
50.0-59.9						
Totals	15	19	14	6	1	55

Appendix IX(iii). Age-frequency distribution by gillnet mesh size of longnose suckers from the Lower Churchill River, Section III, June-July, 1976.

Age	Mesh size (cm)					
(yr)	3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3	1					1
4	6					6
5	16	4				20
6	4	9				13
7	3	11	2			16
8	2	5	4			11
9		3	13			16
10		8	22	2		32
11		2	20	3		25
12			24	2	1	27
13		1	6	9		16
14			2	2		4
15			1	1		2
16						
17						
18						
19						
Totals	32	43	94	19	1	189

Appendix IX(iii). Length-frequency distribution by gillnet mesh size of longnose suckers from the Lower Churchill River, Section III, June-July, 1976.

Length class	Mesh size (cm)					
(cm)	3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	43	1				44
20.0-29.9	18	45	2			65
30.0-39.9		16	116	12	1	145
40.0-49.9		1	3	10		14
50.0-59.9						
Totals	61	63	121	22	1	268

Appendix IX(iii). Age-frequency distribution by gillnet mesh size of longnose suckers from the Lower Churchill River, Section IV, July-August, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4						
5						
6						
7		1				1
8		3				3
9		2	1			3
10		1	10			11
11		1	17			18
12			20			20
13		1	16	4		21
14			7	1		8
15	1		3			4
16			5	1	1	7
17						
18						
19			1			1
Totals	1	9	80	6	1	97

Appendix IX(iii). Length-frequency distribution by gillnet mesh size of longnose suckers from the Lower Churchill River, Section IV, July-August, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	1					1
20.0-29.9		9	3			12
30.0-39.9		4	128	4		136
40.0-49.9			10	9	1	20
50.0-59.9			1		1	2
Totals	1	13	142	13	2	171

Appendix IX(iii). Age-frequency distribution by gillnet mesh size of longnose suckers from the Lower Churchill River, Section V, July-August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3	15					15
4	14	3				17
5	11	8				19
6	2	12				14
7	3	19	1			23
8	1	8	2			11
9	1	3	4			8
10		6	4			10
11		3	19			22
12		2	1			3
13		2	1			3
14			2			2
15						
16		1				1
17						
18						
19						
Totals	47	67	34			148

Appendix IX(iii). Length-frequency distribution by gillnet mesh size of longnose suckers from the Lower Churchill River, Section V, July-August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	103	1				104
20.0-29.9	14	97	3			114
30.0-39.9	1	30	146	2		179
40.0-49.9		1	6	4		11
50.0-59.9						
Totals	118	129	155	6		408

Appendix IX(iv). Age-frequency distribution by gillnet mesh size of white suckers from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3	20					20
4	11	18	2			31
5	11	23	2			36
6	4	36	11			51
7	1	11	52	3		67
8		3	17	9		29
9		5	17	7		29
10			6	14		20
11	1	1	14	28		44
12		1	6	27		34
13		1	9	18	1	29
14		1	6	12	1	20
15			1	4	1	6
16				1		1
17				1		1
18					1	1
19						
Totals	48	100	143	124	4	419

Appendix IX(iv). Length-frequency distribution by gillnet mesh size of white suckers from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	43	1				44
20.0-29.9	6	84	6			96
30.0-39.9		13	118	34		165
40.0-49.9	2	4	38	97	4	145
50.0-59.9			1	1	1	3
Totals	51	102	163	132	5	453

Appendix IX(iv). Age-frequency distribution by gillnet mesh size of white suckers from the Lower Churchill River, Section II, August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3	16					16
4	6	11	2			19
5	6	17	2			25
6	1	3	9			13
7		6	30	1		37
8			9	6		15
9		2	3	6		11
10				3		3
11			1	5		6
12				2		2
13			1	1		2
14						
15						
16						
17						
18						
19						
Totals	29	39	57	24		149

Appendix IX(iv). Length-frequency distribution by gillnet mesh size of white suckers from the Lower Churchill River, Section II, August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	28					28
20.0-29.9	1	33	5			39
30.0-39.9		6	55	12		73
40.0-49.9		1	11	18		30
50.0-59.9			1			1
Totals	29	40	72	30		171

Appendix IX(iv). Age-frequency distribution by gillnet mesh size of white suckers from the Lower Churchill River, Section III, June-July, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3	1					1
4	2	1				3
5						
6			1			1
7			8	2		10
8			2	2		4
9						
10						
11				1		1
12						
13						
14						
15						
16						
17						
18						
19						
Totals	3	1	11	5		20

Appendix IX(iv). Length-frequency distribution by gillnet mesh size of white suckers from the Lower Churchill River, Section III, June-July, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	1					1
20.0-29.9	2	1				3
30.0-39.9			11	4		15
40.0-49.9				1		1
50.0-59.9						
Total	3	1	11	5		20

Appendix IX(iv). Age-frequency distribution by gillnet mesh size of white suckers from the Lower Churchill River, Section IV, July-August, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4						
5	5	3				8
6	2	29				31
7			2			2
8		3	2			5
9		1	12	1		14
10			2	3		5
11	1		3	5		9
12		1	4	6		11
13		1	3	4		8
14		1	4	2		7
15			1			1
16						
17				1		1
18						
19						
Totals	8	39	33	22		102

Appendix IX(iv). Length-frequency distribution by gillnet mesh size of white suckers from the Lower Churchill River, Section IV, July-August, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	6	1				7
20.0-29.9	1	34				35
30.0-39.9		2	22	7		31
40.0-49.9	2	2	15	20	1	40
50.0-59.9						
Totals	9	39	37	27	1	113

Appendix IX(iv). Age-frequency distribution by gillnet mesh size of white suckers from the Lower Churchill River, Section V, July-August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3	3					3
4	3	6				9
5		3				3
6	1	4	1			6
7	1	5	12			18
8			4	1		5
9		2	2			4
10			4	8		12
11		1	10	17		28
12			2	19		21
13			5	13	1	19
14			2	10	1	13
15				4	1	5
16				1		1
17						
18					1	1
19						
Totals	8	21	42	73	4	148

Appendix IX(iv). Length-frequency distribution by gillnet mesh size of white suckers from the Lower Churchill River, Section V, July-August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	8					8
20.0-29.9	2	16	1			19
30.0-39.9		5	30	11		46
40.0-49.9		1	12	58	3	74
50.0-59.9				1	1	2
Totals	10	22	43	70	4	149

Appendix IX (v). Age-frequency distribution by gillnet mesh size of brook trout from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1	2					2
2	28	7	1	1		37
3	23	38	20	18	2	101
4	2	5	51	17		75
5		1	12	4	4	21
6			1	2		3
TOTALS	55	51	85	42	6	239

Appendix IX (v). Length-Frequency distribution by gillnet mesh size of brook trout from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	57	1	7			65
20.0-29.9	20	66	12		3	101
30.0-39.9	6	19	220	41		286
40.0-49.9	1	1	31	51	4	88
50.0-59.9				1		1
TOTALS	84	87	270	93	7	541

Appendix IX(v). Age-frequency distribution by gillnet mesh size of brook trout from the Lower Churchill River, Section III, June-July, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1	1					1
2	23	1				24
3	21	21	14		1	57
4		3	29	10		42
5			6	11		17
6			1	2		3
Totals	45	25	50	23	1	144

Appendix IX(v). Length-frequency distribution by gillnet mesh size of brook trout from the Lower Churchill River, Section III, June-July, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	51		6			57
20.0-29.9	17	45	12		2	76
30.0-39.9	5	16	186	30		237
40.0-49.9	1		29	46		76
50.0-59.9						
Totals	74	61	233	76	2	446

Appendix IX(v). Age-frequency distribution by gillnet mesh size of brook trout from the Lower Chuchill River, Section IV, July-August, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4	1	1	1			3
5		1	1			2
6						
Totals	1	2	2			5

Appendix IX(v). Length-frequency distribution by gillnet mesh size of brook trout from the Lower Churchill River, Section IV, July-August, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9						
30.0-39.9	1	1	2			4
40.0-49.9		1				1
50.0-59.9						
Totals	1	2	2			5

Appendix IX(v). Age-frequency distribution by gillnet mesh size of brook trout from the Lower Churchill River, Section V, July-August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1	1					1
2	4	6	1			11
3	2	16	6	1	1	26
4	1	1	21	8		31
5			7	5	4	16
6				2		2
Totals	8	23	35	16	5	87

Appendix IX(v). Length-frequency distribution by gillnet mesh size of brook trout from the Lower Churchill River, Section V, July-August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	5	1	1			7
20.0-29.9	3	20			1	24
30.0-39.9		2	32	10		44
40.0-49.9			2	5	4	11
50.0-59.9				1		1
Totals	8	23	35	16	5	87

Appendix IX(vi). Age-frequency distribution by gillnet mesh size of burbot from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
3	2		1		1	4
4		2	3			5
5		9	1			10
6		1	5	1		7
7		1	10			11
8			3			3
9			4	2		6
10			3	2	2	7
11			2	8	1	11
12				1	1	2
13					2	2
14				1		1
Totals	2	13	32	15	7	69

Appendix IX (vi). Length-frequency distribution by gillnet mesh size of burbot from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
20.0-29.9	2	6	1	1	2	12
30.0-39.9		7	3			10
40.0-49.9			27	3		30
50.0-59.9			2	16		18
60.0-69,9				2	6	8
Totals	2	13	33	22	8	78

Appendix IX(vi). Age-frequency distribution by gillnet mesh size of burbot from the Lower Churchill River, Section II, August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4						
5		1				1
6			2			2
7			1	2		3
8			1			1
9				4		4
10			1	1		2
11						
12						
13						
14						
Totals		1	5	7		13

Appendix IX(vi). Length-frequency distribution by gillnet mesh size of burbot from the Lower Churchill River, Section II, August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9						
30.0-39.9		1				1
40.0-49.9			5	2		7
50.0-59.9				4		4
60.0-69.9				1		1
Totals		1	5	7		13

Appendix IX(vi). Age-frequency distribution by gillnet mesh size of burbot from the Lower Churchill River, Section III, June-July 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2			1		1	2
3		1	1			2
4		1				1
5						
6			3			3
7			4			4
8			1			1
9				1		1
10						
11			1			1
12						
13						
14				1		1
Totals		2	11	2	1	16

Appendix IX(vi). Length-frequency distribution by gillnet mesh size of burbot from the Lower Churchill River, Section III, June-July, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9		1	1		2	4
30.0-39.9		1	1			2
40.0-49.9			8			8
50.0-59.9			2	2		4
60.0-69.9						
Totals		2	12	2	2	18

Appendix IX(vi). Age-frequency distribution by gillnet mesh size of burbot from the Lower Churchill River, Section IV, July-August, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4			2			2
5		3	1			4
6						
7			5			5
8						
9			2	1		3
10			2	1	2	5
11			1	2		3
12						
13					1	1
14						
Totals		3	13	4	3	23

Appendix IX(vi). Length-frequency distribution by gillnet mesh size of burbot from the Lower Churchill River, Section IV, July-August, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9						
30.0-39.9		3	2			5
40.0-49.9			11	1		12
50.0-59.9				2		2
60.0-69.9				1	3	4
Totals		3	13	4	3	23

Appendix IX(vi). Age-frequency distribution by gillnet mesh size of burbot from the Lower Churchill River, Section V, July-August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3	2					2
4		1				1
5		4				4
6		1		1		2
7		1				1
8			1			1
9			2			2
10				1		1
11				6	1	7
12				1	1	2
13					1	1
14						
Totals	2	7	3	9	3	24

Appendix IX(vi). Length-frequency distribution by gillnet mesh size of burbot from the Lower Churchill River, Section V, July-August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9	2	5		1		8
30.0-39.9		2				2
40.0-49.9			3			3
50.0-59.9				8		8
60.0-69.9					3	3
Totals	2	7	3	9	3	24

Appendix IX(vii). Age-frequency distribution by gillnet mesh size of lake trout from the Lower Churchill River above the site of the Gull Island dam, June-August, 1975-76.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
6				2		2
7		1				1
8						
9				1		1
10				2	1	3
11			1			1
12				1		1
13				1		1
14				1	2	3
15	1			1		2
Totals	1	1	1	9	3	15

Appendix IX(vii). Length-frequency distribution by gillnet mesh size of lake trout from the Lower Churchill River above the site of the Gull Island dam, June-August, 1975-76.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
30.0-39.9		1		1		2
40.0-49.9				2	1	3
50.0-59.9			1	3		4
60.0-69.9				3		3
70.0-79.9					1	1
80.0-89.9					1	1
90.0-99.9	1					1
Totals	1	1	1	9	3	15

Appendix IX(vii). Age-frequency distribution by gillnet mesh size of lake trout from the Lower Churchill River, Section III, June-July, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4						
5						
6				2		2
7						
8						
9				1		1
10						
11						
12						
13						
14						
15						
Totals				3		3

Appendix IX(vii). Length-frequency distribution by gillnet mesh size of lake trout from the Lower Churchill River, Section III, June-July, 1976

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
30.0-39.9				1		1
40.0-49.9				2		2
50.0-59.9						
60.0-69.9						
70.0-79.9						
80.0-89.9						
90.0.99.9						
Totals				3		3

Appendix IX(vii). Age-frequency distribution by gillnet mesh size of lake trout from the Lower Churchill River, Section IV, July-August, 1976

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4						
5						
6						
7						
8						
9						
10				2	1	3
11						
12				1		1
13				1		1
14				1	1	2
15				1		1
Totals				6	2	8

Appendix IX(vii). Length-frequency distribution by gillnet mesh size of lake trout from the Lower Churchill River, Section IV, July-August, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
30.0-39.9						
40.0-49.9					1	1
50.0-59.9				3		3
60.0-69.9				3		3
70.0-79.9					1	1
80.0-89.9						
90.0-99.9						
Totals				6	2	8

Appendix IX(vii). Age-frequency distribution by gillnet mesh size of lake trout from the Lower Churchill River, Section V, July-August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4						
5						
6						
7		1				1
8						
9						
10						
11			1			1
12						
13						
14					1	1
15	1					1
Totals	1	1	1		1	4

Appendix IX(vii). Length-frequency distribution by gillnet mesh size of lake trout from the Lower Churchill River, Section V, July-August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
30.0-39.9		1				1
40.0-49.9						
50.0-59.9			1			1
60.0-69.9						
70.0-79.9						
80.0-89.9					1	1
90.0-99.9	1					1
Totals	1	1	1		1	4

Appendix IX(viii). Age-frequency distribution by gillnet mesh size of ouananiche from the Lower Churchill River above the site of the Gull Island dam, June-August, 1975-76.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
3	1					1
4		1				1
5	2	1		1		4
6	3	3	2	1		9
7	1	1	2	5	1	10
8	2	1		1		4
9					1	1
Totals	9	7	4	8	2	30

Appendix IX(viii). Length-frequency distribution by gillnet mesh size of ouananiche from the Lower Churchill River above the site of the Gull Island dam, June-August, 1975-76.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	1					1
20.0-29.9		2				2
30.0-39.9	1			1		2
40.0-49.9	4	2	4	5	1	16
50.0-59.9	2	3		2	1	8
60.0-69.9	1					1
Totals	9	7	4	8	2	30

Appendix IX(viii). Age-frequency distribution by gillnet mesh size of ouananiche from the Lower Churchill River, Section III, June-July, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4						
5		1				1
6						
7				1		1
8						
9						
Totals		1		1		2

Appendix IX(viii). Length-frequency distribution by gillnet mesh size of ouananiche from the Lower Churchill River, Section III, June-July, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9		1				1
30.0-39.9						
40.0-49.9				1		1
50.0-59.9						
60.0-69.9						
Totals		1		1		2

Appendix IX(viii). Age-frequency distribution by gillnet mesh size of ouananiche from the Lower Churchill River, Section IV, July-August, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3	1					1
4						
5	2					2
6	3	1		1		5
7		1	1	1	1	4
8	2	1		1		4
9					1	1
Totals	8	3	1	3	2	17

Appendix IX(viii). Length-frequency distribution by gillnet mesh size of ouananiche from the Lower Churchill River, Section IV, July-August, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	1					1
20.0-29.9						
30.0-39.9	1					1
40.0-49.9	3		1	1	1	6
50.0-59.9	2	3		2	1	8
60.0-69.9	1					1
Totals	8	3	1	3	2	17

Appendix IX(viii). Age-frequency distribution by gillnet mesh size of ouananiche from the Lower Churchill River, Section V, July-August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4		1				1
5				1		1
6		2	2			4
7	1		1	3		5
8						
9						
Totals	1	3	3	4		11

Appendix IX(viii). Length-frequency distribution by gillnet mesh size of ouananiche from the Lower Churchill River, Section V, July-August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9		1				1
30.0-39.9				1		1
40.0-49.9	1	2	3	3		9
50.0-59.9						
60.0-69.9						
Totals	1	3	3	4		11

Appendix IX(ix). Age-frequency distribution by gillnet mesh size of round whitefish from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2	15	1				16
3	39	12				51
4	6	19				25
5	1	10				11
6	1	4	3			8
7		2	7		1	10
8	1	2	7	1		11
9			3	1		4
10			2			2
11						
12			1	1		2
13		1				1
Totals	63	51	23	3	1	141

Appendix IX(ix). Length-frequency distribution by gillnet mesh size of round whitefish from the Lower Churchill River above Muskrat Falls, June-August, 1975-76.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	29					29
20.0-29.9	37	51			1	89
30.0-39.9	2	5	22	3		32
40.0-49.9		1	1			2
Totals	68	57	23	3	1	152

Appendix IX(ix). Age-frequency distribution by gillnet mesh size of round whitefish from the Lower Churchill River, Section III, June-July, 1976.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2	1	1				2
3	36	6				42
4	3	19				22
5		8				8
6	1	3	3			7
7		1	6		1	8
8	1	2	5	1		9
9			3			3
10			2			2
11						
12			1	1		2
13						
Totals	42	40	20	2	1	105

Appendix IX(ix). Length-frequency distribution by gillnet mesh size of round whitefish from the Lower Churchill River, Section III, June-July, 1976.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	19					19
20.0-29.9	27	41			1	69
30.0-39.9	1	5	19	2		27
40.0-49.9			1			1
Totals	47	46	20	2	1	116

Appendix IX(ix). Age-frequency distribution by gillnet mesh size of round whitefish from the Lower Churchill River, Section IV, July-August, 1976.

Age	Mesh size (cm)					
(yr)	3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2						
3						
4	1					1
5						
6		1				1
7		1				1
8						
9						
10						
11						
12						
13						
Totals	1	2				3

Appendix IX(ix). Length-frequency distribution by gillnet mesh size of round whitefish from the Lower Churchill River, Section IV, July-August, 1976.

Length class	Mesh size (cm)					
(cm)	3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9						
20.0-29.9	1	2				3
30.0-39.9						
40.0-49.9						
Totals	1	2				3

Appendix IX(ix). Age-frequency distribution by gillnet mesh size of round whitefish from the Lower Churchill River, Section V, July-August, 1975.

Age (yr)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
1						
2	14					14
3	3	6				9
4	2					2
5	1	2				3
6						
7			1			1
8			1			1
9						
10						
11						
12						
13						
Totals	20	8	2			30

Appendix IX(ix). Length-frequency distribution by gillnet mesh size of round whitefish from the Lower Churchill River, Section V, July-August, 1975.

Length class (cm)	Mesh size (cm) 3.8	5.1	7.6	10.2	12.7	3.8-12.7
10.0-19.9	10					10
20.0-29.9	9	8				17
30.0-39.9	1		2			3
40.0-49.9						
Totals	20	8	2			30