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DATA ON THE BIOLOGY OF ARCTIC CHAR FROM THE EASTERN ARCTIC, NORTHWEST TERRITORIES

by

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The author expresses his appreciation to the Captain, men and Officers of HMCS Protecteur who assisted by allowing their catch to be sampled; and to Dr. D. Toews and the members of the "Acadia Expedition" who helped in collecting the data. The last names of the anglers are included in appendix tables A-1 and A-3 opposite their respective catches for reference to the data on individual fish if desired. Thanks are also due Commander (N) R.G. Guy of Northern Region Headquarters, Yellowknife, Department of National Defence, and Mr. G. Glazier, District Manager Northwest Territories, Fisheries and Marine Service, both of whom helped make the trip possible.

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* Since this manuscript was completed the staff of Fisheries and Marine Service, Western Region, has been re-organized into a new reporting structure. The affiliations used in this text reflect the organization in vogue during 1973.

ABSTRACT

Peet, R.F. 1978. Data on the biology of Arctic char from the eastern Arctic, Northwest Territories. ~~Can~~. Fish. Mar. Serv. MS Rep.: 43 p. (4)

During August, 1973, small samples of anadromous Arctic char, *Salvelinus alpinus*, were collected from three locales in the Eastern Canadian Arctic: two in Makinson Inlet, Ellesmere Island, and one in Milne Inlet, Northwest Baffin Island. A small sample of non-anadromous Arctic char was also taken from a lake near Pond Inlet, Northwest Baffin Island. Biological information on Arctic char from this area has not been available previously. Data on length, weight, age, stage of maturity, and stomach contents are presented for each sample. Equations for the relationship of weight to fork length and for the conversion of fork, standard and total lengths, each to the other, and for round and gutted weight, each to the other, are also given for the anadromous char samples.

Key words: Fishery surveys, age composition, length weight relationships, sexual maturity, eggs, food organism, length and weight conversion factors.

INTRODUCTION

The main fish species of importance in the eastern Northwest Territories is the Arctic char, Salvelinus alpinus (Linnaeus), which occurs throughout the region in two forms, anadromous and non-anadromous. General details on the life history, systematics, range and distribution of the Arctic char are given by McPhail and Lindsey (1970) and Scott and Crossman (1973). However, with the exceptions of Grainger (1953) and Hunter (1970) there is no published specific information on the species for this area.

Historically, both forms have been one of the main food sources for the Inuit and their dogs. More recently, there has been an increasing demand by residents throughout the territories to develop commercial fisheries in order to utilize the fish resource as a source of income in addition to traditional domestic use. An area economic survey of the Lancaster Sound area by Bissett (1967) gives an account of the people, environment, resources and the prospects for development in the region covered by this report.

During August, 1973, an opportunity was afforded the Fishery Management Division of the Resource Management Branch, Fisheries and Marine Service, Central Region to place an observer on board the Canadian Forces vessel, HMCS Protecteur, during her program of settlement visits in the eastern area of the Northwest Territories. It is the responsibility of the Fishery Management Division to ensure that exploitation of the fish resource in the Northwest Territories is developed on a sound base of biological information pertaining to the stocks involved.

The role of observer was carried out by the author and my objectives during the trip were to:

1) Meet with local representatives and Northwest Territorial government officials where possible, in order to elicit their views on problems in the area concerning the management of fish and marine mammals, and to discuss the Fisheries and Marine Services' rationale in managing fish and marine mammal populations in the Northwest Territories; and

2) Collect data from fish populations, where feasible, to add to the Fishery Management Division's inventory of baseline biological information.

This report summarizes the data collected on Arctic char from four locales (Fig. 1) during the cruise of HMCS Protecteur. The samples were small because of time limitations and the amount of work which could be done by one person; however, the results are presented to give an indication of the size and age characteristics of char populations from an area where such data have not previously been available.

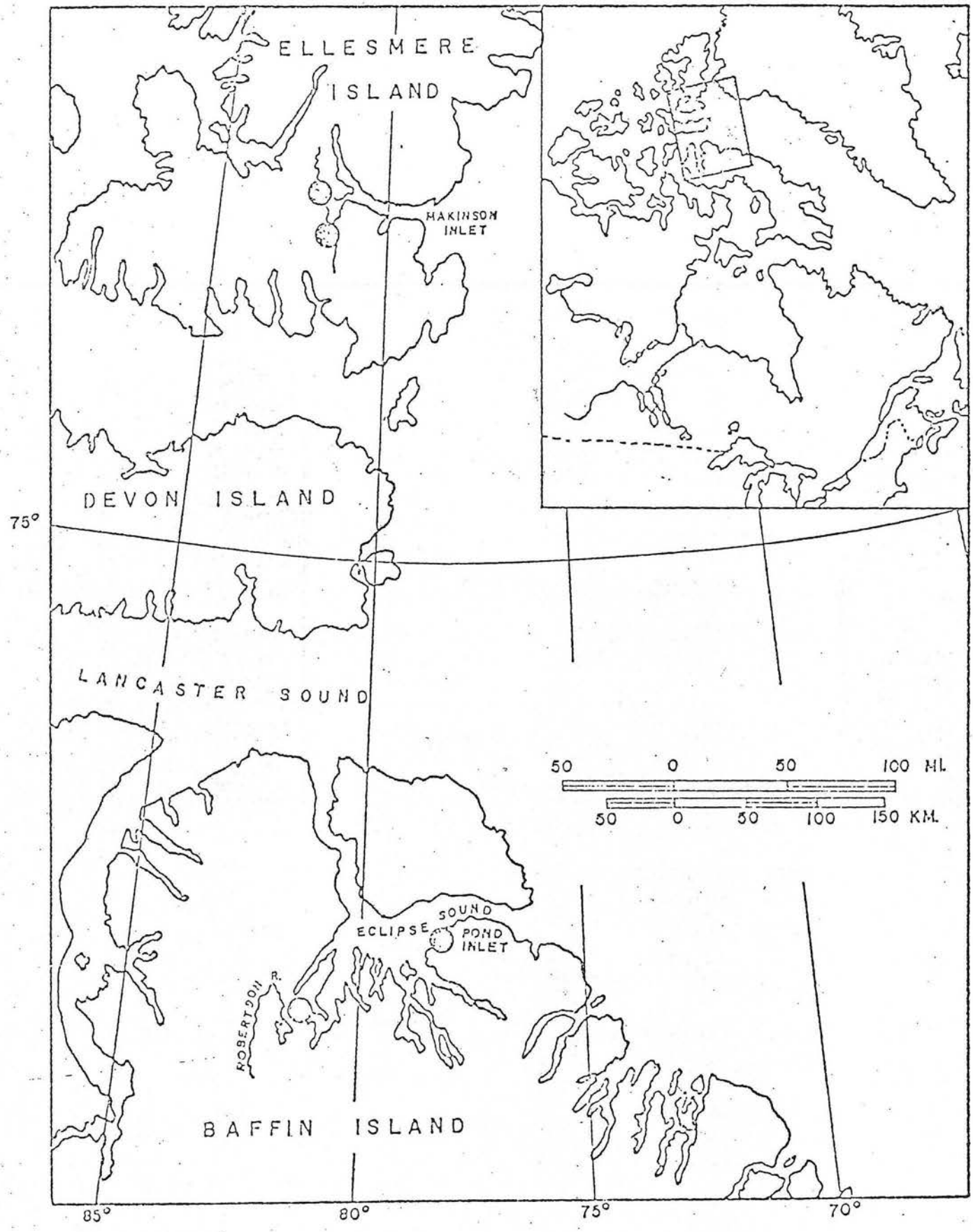


Fig. 1. Map showing general vicinity of sampling locations in 1973.

MATERIALS AND METHODS

Anadromous Arctic char were sampled from two unnamed rivers flowing into Makinson Inlet*, Eastern Ellesmere Island. These are referred to as River A (lat. 77° 18'N, long. 82° 14'W) and River B (lat. 77° 09'N, long. 81° 47'W) in this report (Fig. 2). Anadromous char were also sampled from Robertson River which is located on Northern Baffin Island (lat. 72° 05'N, long. 81° 05'W) and flows into Koluktoo Bay, an inlet of Eclipse Sound (Fig. 3).

In addition, a sample of landlocked char was taken from a small lake (lat. 72° 40'N, long. 78° 05'W) near the settlement of Pond Inlet (Fig. 4).

All samples were obtained by angling (i.e. spin casting using metal, treble hooked lures). The only species caught was the Arctic char (anadromous and landlocked). Fish were sampled for standard, fork and total length to the nearest tenth of a centimeter (definitions according to Lagler, 1966); and weighed to the nearest 20 grams in both the whole (i.e. round) and gutted (i.e. visera and gills removed, head left on) conditions. Also, a girth measurement to the nearest tenth of a centimeter was taken which consisted of measuring the circumference around the body just in front of the dorsal fin with non-stretch twine.

The sex and stage of maturity were noted using the system in Table 1. The criteria used for the stages of maturity for female char are the condensed version of Vladykov (1956-page 824) while the criteria for males are a modification of the stages given by Homans and Vladykov (1954-page 536). Descriptions of these stages are given in the appropriate reference.

Table 1. System used to classify stages of maturity for Arctic char.

Stage		Females	Males
		Stages of Vladykov (1956)	Stages of Homans & Vladykov (1954)
I	Immature	0 & 1	1 & 2
II	Maturing	2 & 3	3
III	Ripe	4 & 5	4 & 5
IV	Spent	6	6

* All place names used in this report are the ones given on Department of Mines and Technical Surveys topographic maps (scale 1: 250,000). Relevant maps are Vendom Fiord - 49 D (Ed. 1) for Makinson Inlet; Milne Inlet - 48A (Ed. 1) for Robertson River; and Pond Inlet - 38B (Ed. 1) for Pond Inlet.

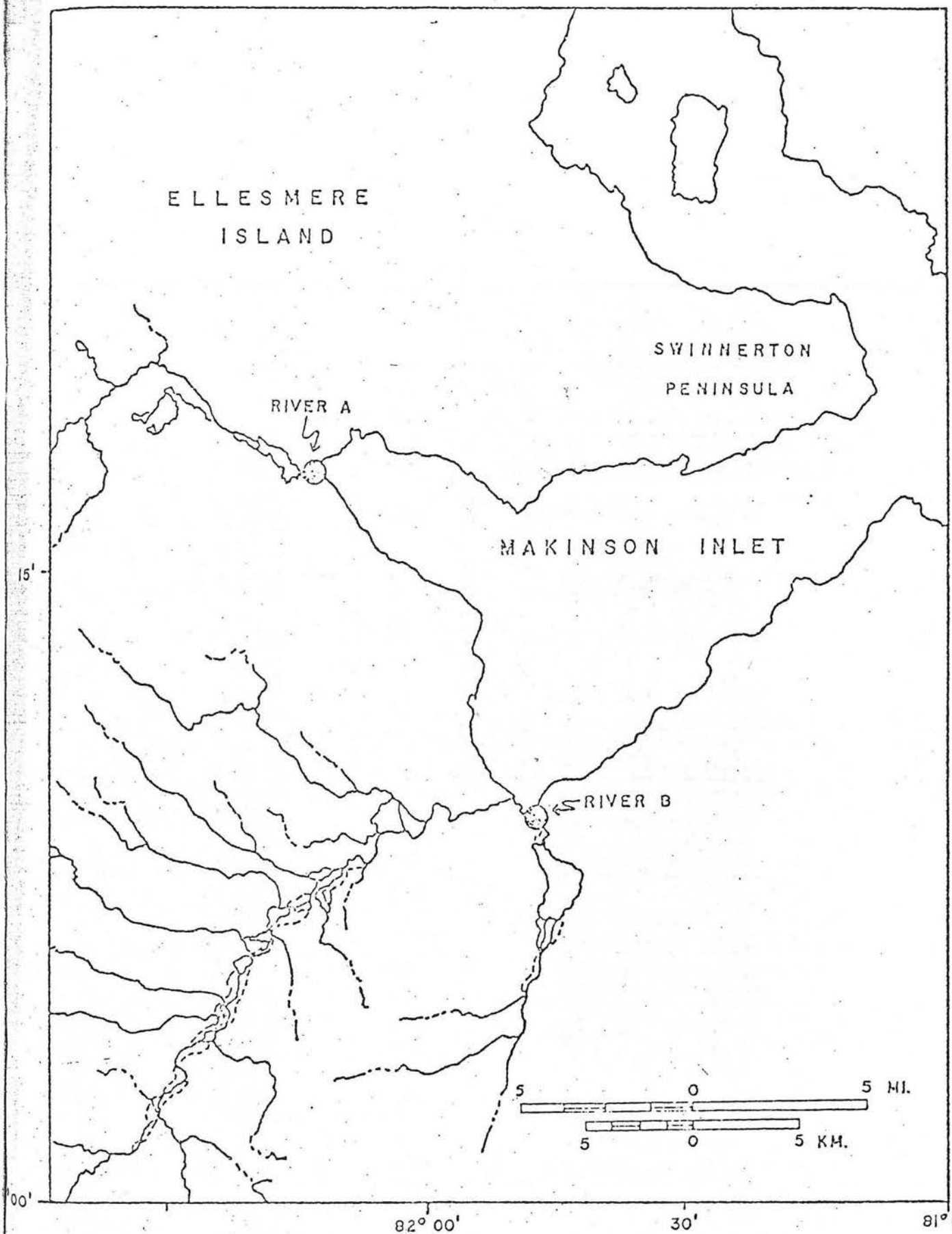


Fig. 2. Sampling locations for anadromous Arctic char taken from Makinson Inlet, Ellesmere Island, 1973.

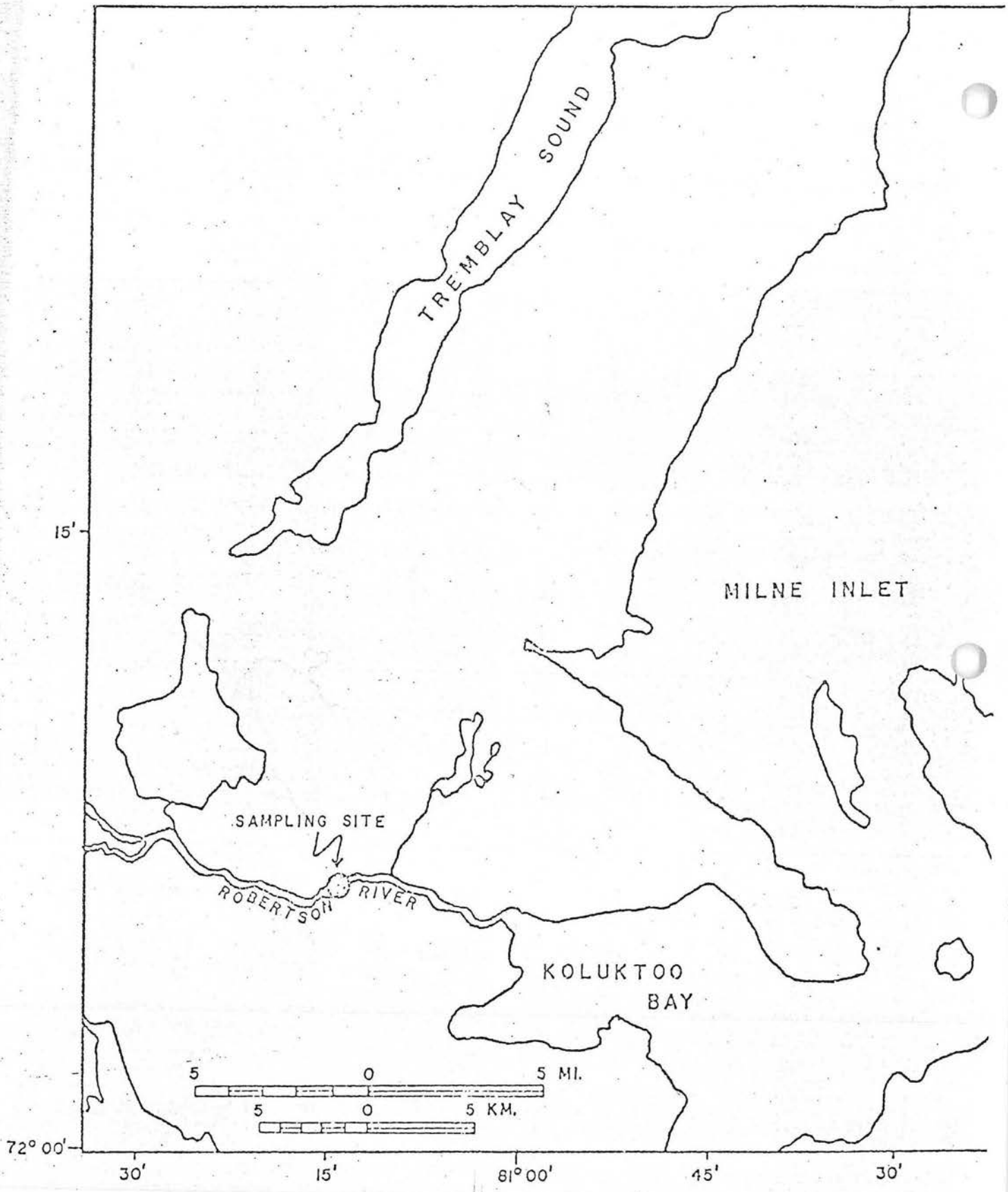


Fig. 3. Sampling location for anadromous Arctic char taken from Robertson River, Northern Baffin Island, 1973.

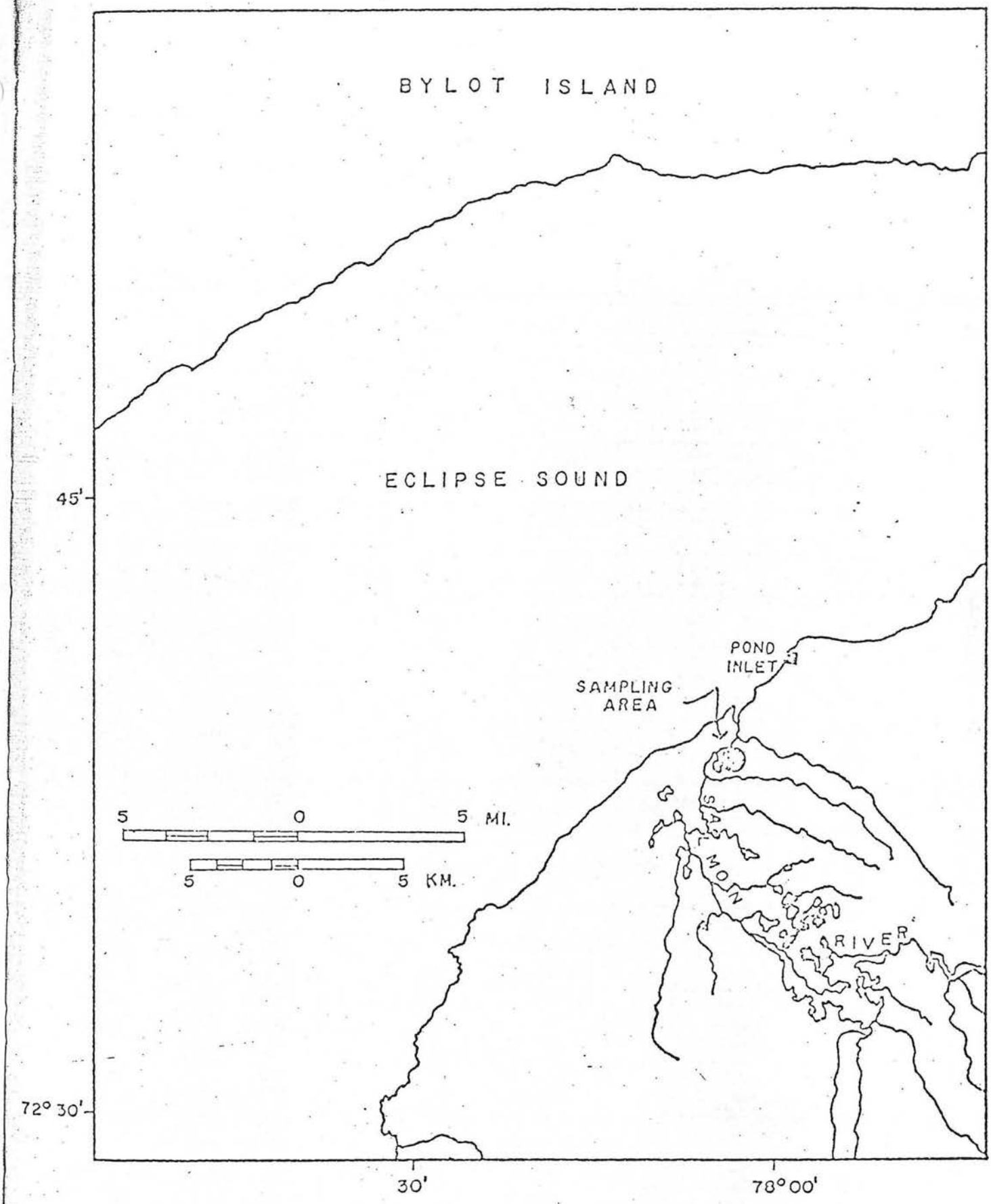


Fig. 4. Sampling location for non-anadromous Arctic char taken from a lake near Pond Inlet, Northern Baffin Island, 1973.

Some gonads representative of different stages of development were taken at each sampling locality for comparison with samples from other areas. Also, all ripe ovaries were preserved in Gilson's fluid and counts of maturing eggs (as opposed to recruitment stock, Vladykov, 1956) were done in the laboratory.

A number of stomachs were preserved in 10 percent formalin for subsequent analysis of their contents. In addition the stomachs of all ungutted fish which were not preserved were opened to see if they contained any food material or recognizable organisms.

The large sagitta otoliths were removed from as many specimens as possible for use in age determination. These were cleaned and preserved dry. In the laboratory, one otolith from each char was prepared for examination by grinding on a carborundum stone and cleared by immersion in a mixture of benzyl benzoate and methyl salicylate (components mixed in a ratio of 3:1 respectively).

Ages were determined by viewing otoliths under reflected light against a black background using a dissecting microscope (15X-30X) and counting the number of annuli. When an otolith is viewed under reflected light, wide (white) opaque bands can be seen to alternate with narrow (dark) hyaline bands. The opaque bands are considered to represent summer growth and the hyaline bands, winter growth. Following the method of Andrews and Lear (1956), the first complete annulus was taken as being the outside edge of the first continuous hyaline ring. Each hyaline winter band was counted and the total expressed as years. The center of the otolith is considered to represent embryonic and early larval growth (Nordeng 1961) and if an otolith showed a hyaline central core, this was ignored in determining the age. Also, the otoliths were read with absolutely no reference to the length-weight data of the specimens involved to eliminate any bias that could be associated with the size of the fish in relation to age, irrespective of the number of rings counted.

The length, weight and age data were analyzed to provide a description of these parameters for each sampling location. Arithmetic means, standard deviations and standard errors were determined for each parameter when the sample size permitted and graphs of length-weight and age-length relationships were prepared with the sex and stage of maturity of specimens indicated. In addition a graph of the relationship of girth to fork length was prepared also with the sex and stage of maturity of individual specimens indicated.

The small sample sizes did not allow meaningful derivation of mortality/survival rates.

Equations for the regression of weight on length were calculated for the anadromous char samples using the logarithmic form of the general relationship:

$$\text{Weight} = a\ \text{Length}^{\,n}$$

where "a" and "b" are constants determined empirically from the data (Tesch, 1968). This equation expressed in logarithmic form is as follows:

$$\text{Log}_{10}W = a + b\ (\text{Log}_{10}L)$$

where for this report: L = fork length (cm.)
W = weight (gms.)
a = Y intercept (expressed in logarithms and derived for the predictive relationship (Ricker, 1973))
b = slope of the regression line (for the predictive relationship of weight from length (ibid)).

The values needed for calculation of the length weight regression equations were derived from the data in appendix tables A-1 and A-2 following the methods and notation of Snedecor and Cochran (1967, 6th. Ed., Chpts. 6 & 7), and are given in appendix table A-4 for ease of reference or comparison with other material.

Notwithstanding the recent recommendation of Ricker (1973, 1975a: pg. 210-214) and subsequent controversy Ricker (1975b), Jolicoeur (1975), regarding the best type of regression line to use (ie. predictive, functional, etc.), I have elected to present the slopes and Y intercepts in this report in the form of the predictive or ordinary regression, to date the most common presentation.

Comparison of the values obtained when calculating weight from length and vice versa over the range of the samples by use of the predictive (both for Y on X and X on Y) and functional regressions showed that there was little difference whatever method was used and that the predictive relationship for weight on length can be used in this instance for the estimate of either weight or length. If desired, the slopes and Y intercepts for the other types of regression can be quickly derived from the length-weight data by reference to the values in appendix table A-4.

The primary stage statistics in appendix table A-4 (ie. 1 to 6) were derived by programme on a Hewlett Packard 9810A calculator. These were rounded to four decimal places and the secondary and tertiary stage statistics (ie. 7 to 11 & 12 to 16) were calculated from values rounded to the fourth decimal place.

Length weight regression lines were compared following the methods of Snedecor and Cochran (1967, 6th. Ed., Chpt. 4, pg. 116-118, Chpt. 14, pg. 432-436) and confidence limits both for the predicted line and samples were calculated following the same reference (ibid, Chpt. 6, pg. 153-157).

Condition factors (Lagler, 1966; Le Cren, 1951) over the range of fork length and age were calculated by use of the equation:

$$\text{Condition factor} = \frac{\text{Average or mean weight (gm)}}{\text{Average or mean fork length (cm)}^3} \times 100$$

Also the relationship of standard, fork and total lengths each to the other, vice versa, and the relationships of gutted weight to round weight, were calculated for the anadromous char following the methods of Snedecor and Cochran (1967) noted above.

Inspection of the scatter diagrams of the various relationships (Figs. 12 & 13) indicated that the regressions were linear and that simple linear equations would be sufficient to describe them. These were derived by the method of least squares from untransformed data. "F" tests for homogeneity (Snedecor and Cochran, 1967) indicated that the data was normally distributed and homoscedastic which justified the use of untransformed data in deriving the regression equations (Sokal and Rohlf, 1969, Chpt. 13, pg. 380-382, Chpt. 14, pg. 476-481).

The equation used took the form:

$$Y_{cal.} = a + bX$$

where: $Y_{cal.}$ = value to be calculated

a = Y intercept (for the predictive relationship of Y from X (Ricker, 1973))

b = slope of the regression line (for the predictive relationship of Y from X (Ricker, 1973)).

X = independent variable

and: "a" and "b" are determined empirically from the data on X and Y (for this report appendix tables A-1 and A-2).

The Makinson Inlet and Robertson River samples were combined in these latter analyses after comparison of the various relationships following the methods of Snedecor and Cochran (1967).

RESULTS

MAKINSON INLET

In Makinson Inlet, 20 Arctic char from River A and four from River B were taken by angling and sampled (Fig. 2) between August 21-23, 1973. All were caught in fresh water, a short distance (ie. within one mile/1.6 km) from salt water, in streams with no physical barriers to the migration of anadromous fish between the site of capture and the sea. Both streams were quite shallow (ie. average depth not over 2 feet/0.61 meters) and drained from small lakes. The accessibility of the streams above these lakes to anadromous fish was not determined.

All char sampled from River A were caught at the downstream outlet of the closest lake to salt water. None were caught by angling in the marine estuary of this river and no schools of char were noted over approximately a three-day period at different tidal levels. In the author's experience, schools of char can usually be seen at a river's mouth if they are actively migrating but this did not seem to be the case in the Makinson Inlet area. This has also been noted by other observers, among them Grainger (1953), Soper (1928) and Manning (1942).

In River B, the two largest fish were taken from a small pool in the river; the others were captured at the outlet of the lake. No angling was attempted at the mouth because of the shallow nature of the estuary and the absence of fishing pools. This also made visual observations impossible.

All the char sampled in Makinson Inlet were considered to be anadromous, with the possible exception of one male 37.0 cm. in fork length discussed below. This opinion is held because of the accessibility of the sampling location to the sea, and because all the fish examined exhibited the livery which, in the author's experience, is characteristic of sea-run char, although such colouration is quite variable throughout the range of the species. Also, the range in sizes in the sample was indicative of anadromy as char in the Canadian Arctic which are not anadromous are usually under 50 cm. in length and 1.0 kg. in weight.

The sampling data for Makinson Inlet are given in appendix table A-1. The char were combined from both rivers in the length-weight analysis because of the small number sampled. Tables 2 and 3 summarize the data for fork length, weight and age. Figure 5 shows the length-weight relationship with individual data plotted for all fish sampled and the stage of maturity noted. The

Table 2. Summary of length and weight data, and weight data over the range of fork lengths, for anadromous Arctic char taken by angling from two rivers in Makinson Inlet, Ellesmere Island, Aug. 21-23, 1973.

Length group (cm.)	Combined Sample					
	Number* of fish	Av. fork length (cm)	Weight (gms)			Condition*** factor
			Cal.**	Average	Range	
35.0-39.9	3(13.0)****	37.6	469	493	430- 525	0.9274
40.0-44.9	2(8.7)	44.2	781	842	760- 925	0.9751
45.0-49.9	7(30.4)	47.1	954	944	850-1030	0.9035
50.0-54.9	4(17.4)	53.1	1393	1306	1200-1425	0.8723
55.0-59.9	1(4.4)	59.5	1996	1850		0.8783
60.0-64.9	0	-	-	-		-
65.0-69.9	4(17.4)	67.6	2986	2920	2480-3450	0.9452
70.0-74.9	1(4.4)	70.5	3409	3800		1.0845
75.0-79.9	1(4.4)	76.3	4376	5200		1.1707

Parameter	Fork length			Weight		
	Combined	Male	Female	Combined	Male	Female
Number of fish*:	24	11(45.8)**	7(29.2)	23	11(47.8)	7(30.4)
Range:	37.0-76.3	37.0-76.3	37.5-59.5	430-5200	430-5200	525-1850
Mean :	52.6	58.4	46.3	1632	2261	979

* Not all fish were identified by sex, nor were all fish sampled for round weight, thus the discrepancy in sample sizes within and between categories (appendix table A-1).

** The calculated values were derived from the equation:

$$\text{Weight(gms)} = (0.0050)(\text{Fork length(cm)})^{3.1570}$$

and represent the calculated weight for each average fork length per length group.

***Condition factor was calculated by the formula:

$$\text{Condition factor} = \frac{\text{Average weight (gms)}}{\text{Average fork length (cm)}^3} \times 100$$

****Bracketed figures indicate percent of number sampled by category.

Table 3. Summary of age data and length and weight data over the range of age classes for anadromous Arctic char taken by angling from two rivers in Makinson Inlet, Ellesmere Island, Aug. 21-23, 1973.

Age (no. of annuli)	Combined Sample					
	Number of* fish	Fork Length(cm)		Weight(gm)		Condition**
		Mean	Range	Mean	Range	Factor
12	3(20.0)***	43.1	37.5-46.3	750	525- 875	0.9368
13	2(13.3)	41.0	38.4-43.6	643	525- 760	0.9330
14	2(13.3)	48.5	47.0-49.9	1000	850-1150	0.8765
15	1(6.7)	48.0		1030		0.9314
16	5(33.3)	54.0	44.7-68.5	1615	925-3150	1.0256
21	2(13.3)	72.9	69.5-76.3	4325	3450-5200	1.1164

Parameter	Age		
	Combined	Male	Female
Number of fish*	15	7(46.7)***	7(46.7)
Range	12-21	13-21	12-16
Mean	15.1	16.7	14.0

* One fish (6.7%) was not identified by sex but was included in the combined sample.

** Condition factor was calculated by the formula:

$$\text{Condition factor} = \frac{\text{mean weight (gms)}}{\text{mean fork length (cm)}^3} \times 100$$

*** Bracketed figures indicate percent of number sampled by category.

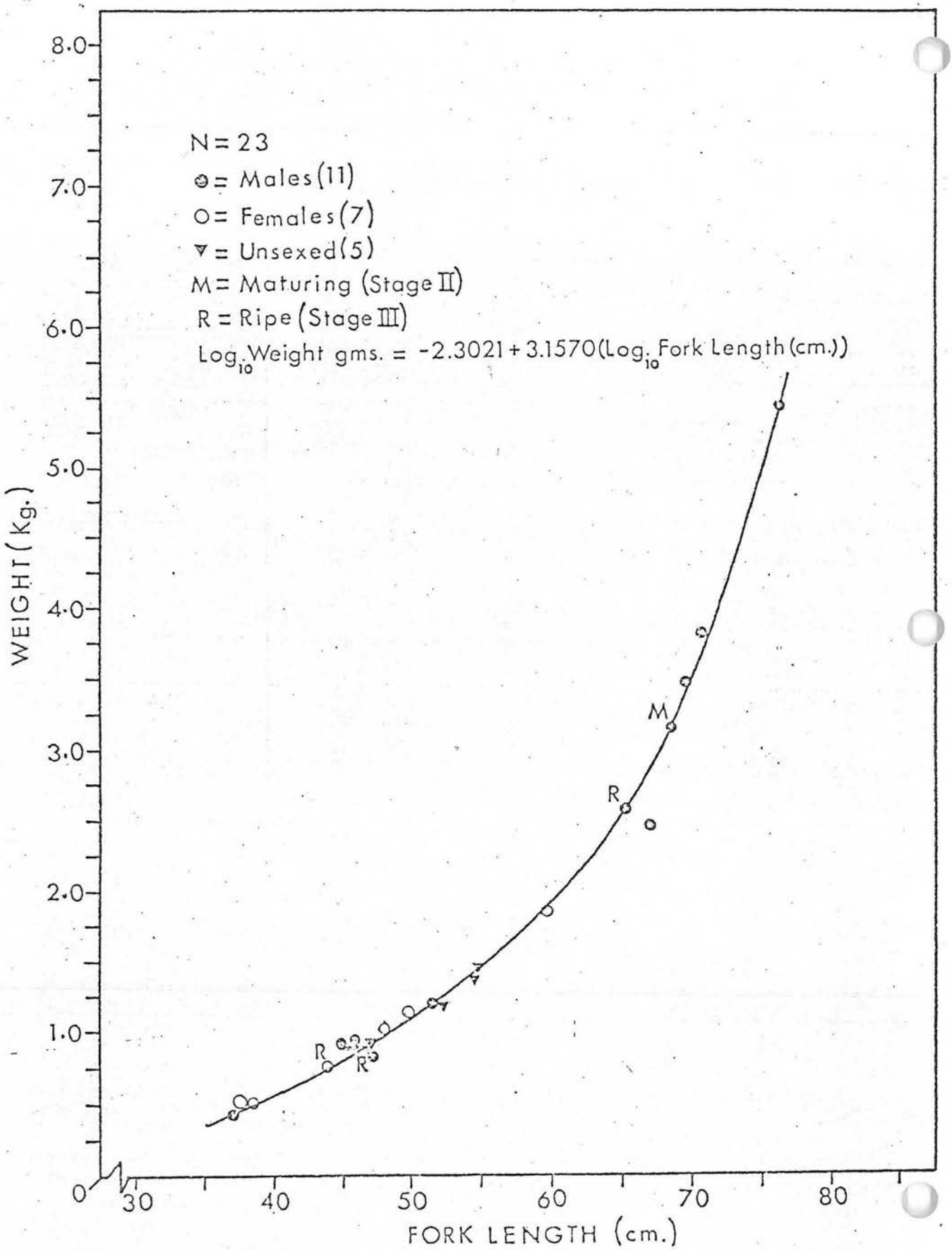


Fig. 5. Length-weight relationship for anadromous Arctic char from two rivers in Makinson Inlet, Ellesmere Island, 1973. Ripe and maturing fish are indicated, the rest were considered to be immature or Stage 1 (Table 1).

regression equation for weight on fork length was calculated to be:

$$\text{Log}_{10} \text{ weight (gms.)} = -2.3021 + 3.1570 \ (\log_{10} \text{fork length (cm.)})$$

Other statistics relevant to the calculated length-weight relationship for the Makinson sample are given in appendix table A-4.

Because of the small sample size, confidence limits for the sample and the predicted regression line were not calculated.

Inspection of the scatter diagram in figure 5 indicates that there was no difference in the ratio of weight to fork length by sex for the few fish sampled. Only males were caught in the larger size categories (in this case over 65 cm.). These observations are in agreement with larger samples from other anadromous char populations in the Northwest Territories (Peet, unpublished data).

The relationship of girth to fork length is shown in Figure 6, in combination with the data from Robertson River.

Figure 7 shows the age-length relationship and the age-frequency distribution. The points plotted are the average fork lengths per year class.

Comparison of the regressions of weight on length (appendix table A-4) for the Makinson Inlet and Robertson River samples showed that there was a significant difference at the 0.05 probability level between them.

Of the 20 fish sampled in River A, the sex and stage of maturity were noted for 14. The sex ratio was 9 males to 5 females.

Ten were considered to be Stage 1 or immature fish (Table 1) which would not spawn that season. However, one of these, an immature male (37.0 cm. fork length), exhibited the bright red belly colouration usually associated with mature gonads in anadromous char, especially the male. An examination of the testes did not suggest that this specimen had recently spawned and was a "spent" fish. One other possibility is that this fish was a non-anadromous char because of its bright colouration. Other authors since Fabricius (1780) have noted that non-anadromous char show such bright colouration in and out of the breeding season. With the exception of this fish and the only ripe male taken (noted below) all the rest showed typically sea-run colouration.

One male (68.5 cm. fork length) was considered to be Stage II (ie. a fish whose gonads were in process of maturing and would probably spawn that season). Three fish, one male (65.4 cm. fork length, belly colour bright red) and two females (46.3 cm. and 44.7 cm. fork length)

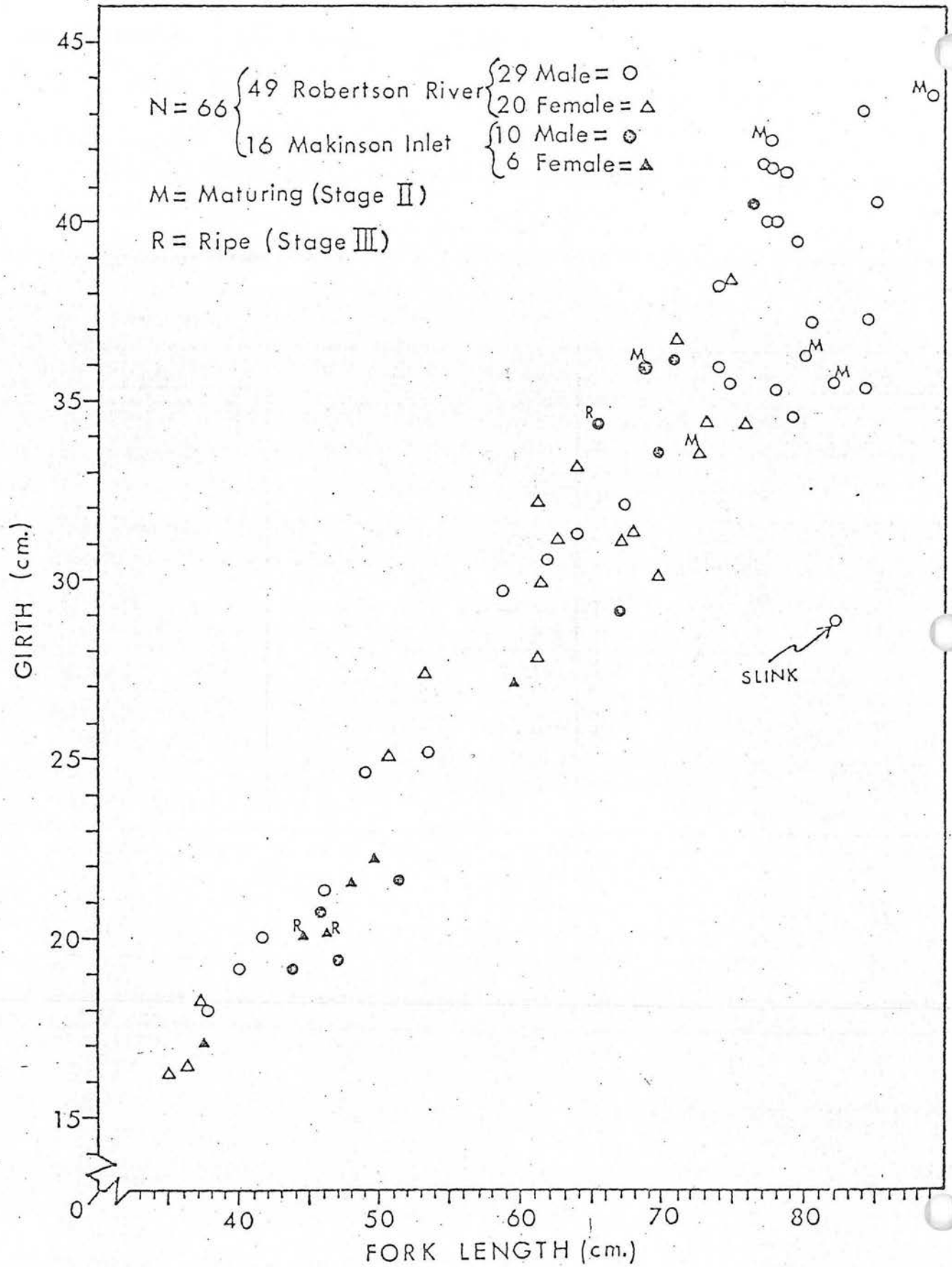


Fig. 6. Relationship of girth to fork length for anadromous Arctic char, Eastern Arctic area, 1973. Ripe and maturing fish are indicated, the rest were considered to be immature or Stage 1 (Table 1).

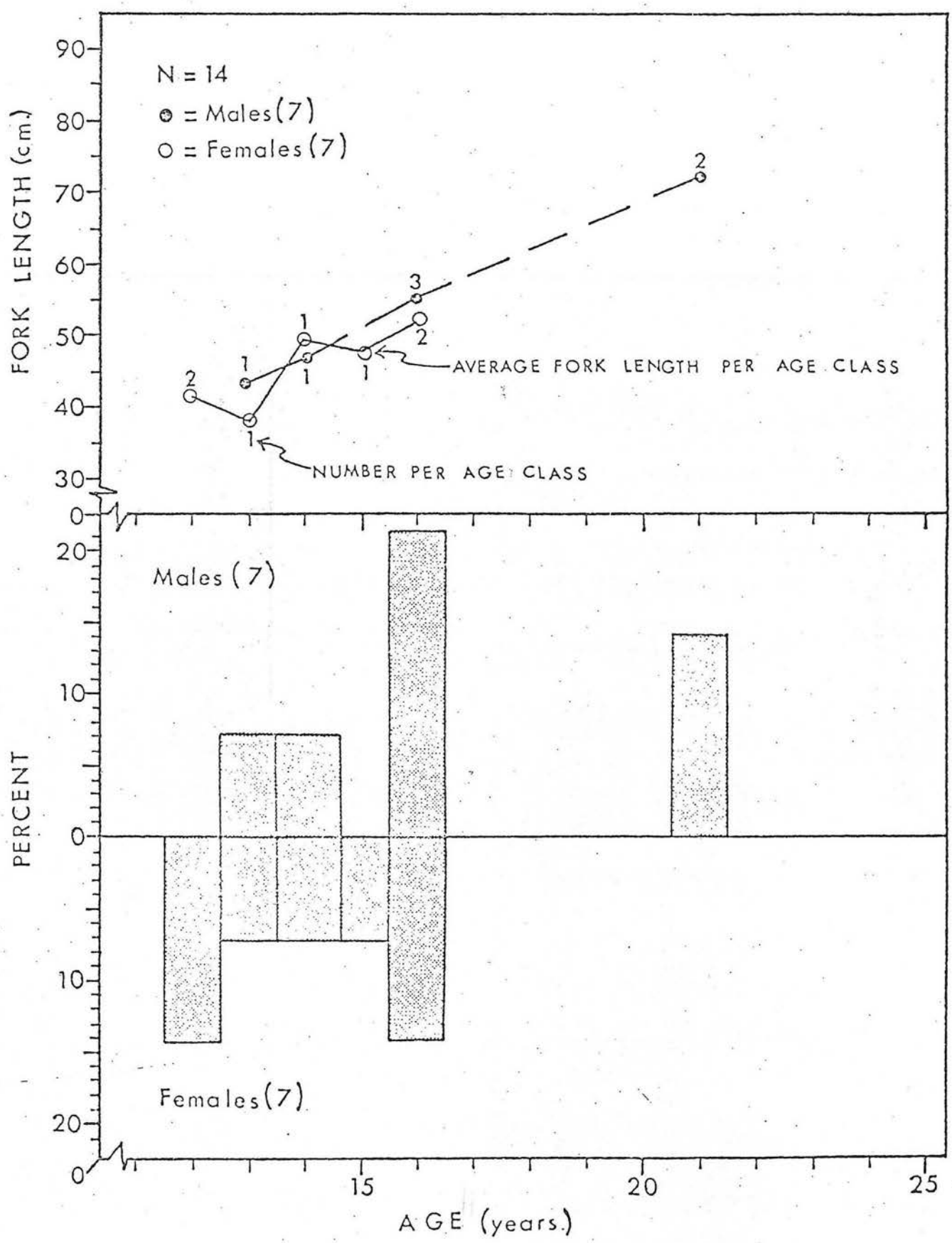


Fig. 7. Age-length relationship and age frequency distribution for a anadromous Arctic char, Makinson Inlet, Ellesmere Island, 1973.

were considered to be Stage III (ie. fish whose gonads were developed to a stage of ripeness where spawning was imminent). These fish (ie. maturing and ripe) are indicated on Figures 5 and 6 showing the relationships of weight to fork length and girth to fork length respectively.

Comparison of preserved male and female gonads with samples collected by the author from rivers in the Pelly Bay area and along the west coast of Hudson's Bay showed that the identification of the stages of maturity were consistent between samples.

The ovaries of the two Stage III females were examined in the laboratory and the mature eggs counted. The results are given in Table 4. In the case of the female (46.3 cm. fork length) which showed the most advanced stage of maturity, the ovarian tissue had ruptured and the eggs were hanging in sheets from the ovary, although the eggs were not sufficiently free to be loose in the body cavity.

Table 4. Maturity data for female anadromous Arctic char taken by angling from two rivers in Makinson Inlet, 1973.

Fork Length (cm)	Round Weight (gms)	Age (yrs)	Total Number Eggs	Number Eggs Per 100 gms	Average Egg Size (mm)
46.3	850	12	1711	201	4.62
44.7	925	16	1465	152	4.98

All four fish sampled in River B were maturity Stage I, two were male and two were female. All showed the silvery colouration characteristic of sea-run fish.

The stomachs of 19 of the sampled char were examined in the laboratory. Nine were empty while 10 contained food material. The results of this analysis is given in Table 5 together with size data on the individual fish. The most important food items by weight and volume were various unidentified species of marine amphipoda.

ROBERTSON RIVER

At Robertson River, 49 fish were sampled on August 26, 1973. The fish were angled from an area on the main river located

Table 5. Stomach contents of anadromous Arctic char sampled in Makinson Inlet, Ellesmere Island, August 21-23, 1973.

Fork length (cm.)	Round Weight (gms.)	Sex*	Age	Contents by volume (ml.) & wet weight (gms)									
				Total		Amphipod sp.		Isopod sp.		Fish remains		Unidentified	
				Vol.	Wt.	Vol.	Wt.	Vol.	Wt.	Vol.	Wt.	Vol.	Wt.
37.0	430	M(I)	-	0.002	0.08			0.002	0.08				
37.5	525	F(I)	12	empty									
38.4	525	F(I)	13	0.025	0.18	0.025	0.18						
43.6	760	M(I)	13	0.086	1.14			0.017	0.36	0.069	0.73	-	0.05
44.7	925	F(III)	16	0.082	1.87	0.078	1.84					0.004	0.03
45.5	875	-	12	0.409	5.72	0.406	5.71					0.003	0.01
45.8	950	M(I)	16	empty									
46.3	850	F(III)	12	empty									
47.0	850	M(I)	14	0.005	0.14			0.003	0.10	0.001	0.02	0.001	0.02
48.0	1030	F(I)	15	0.079	1.43	0.079	1.43						
49.9	1150	F(I)	14	empty									
51.5	1200	M(I)	16	0.215	3.67	0.215	3.67						
59.5	1650	F(I)	16	0.021	0.34	0.021	0.34						
65.4	2600	M(III)	-	empty									
70.5	3600	M(I)	-	empty									
76.3	5200	M(I)	21	3.628	38.60	3.412	37.57			0.216	1.03		
Total				4.552	53.17	4.215	50.40	0.043	0.88	0.286	1.78	0.008	0.11
Average				0.455	5.32	0.422	5.04	0.004	0.09	0.029	0.18	0.001	0.01

* M means Male, F means Female, and bracketed figures indicate stage of maturity (Table 1).

approximately 4 to 5 miles (6.4 to 8.1 km) upstream from the mouth (Fig. 3). All were considered to be anadromous because of their size, colouration and accessibility of the sampling area to fish migrating from the sea. At the time the sample was taken the upstream run of char was probably at its peak, judging from the number of fish visible to an observer standing on the shoreline. In the space of ¼ mile (0.4 km.) the water was quite literally black with fish. It is not possible to quantify the numerical size of the anadromous population running into the Robertson River from these observations. However, the system is much larger than the Diana River near Rankin Inlet and the anadromous run there based on fence counts has been in the order of 45,000 to 50,000 fish over a two year period (Peet, unpublished data).

The sampling data for Robertson River are given in appendix table A-2. Table 6 summarizes the data for fork length and weight by sex and Table 7 summarizes the length-weight data by sex over the range of ages. The logarithmic equation which describes the regression of round weight on fork length was calculated to be:

$$\text{Log weight}_{10}(\text{gms.}) = -1.8034 + 2.9014\ (\log_{10}\text{fork length (cm.)})$$

Other statistics relevant to the calculated length-weight relationship are given in appendix table A-4. Confidence limits for the sample and for the calculated regression line were derived from the statistics in appendix table A-4 and are given in appendix table A-5. The equation for the regression line above is for both sexes combined because a comparison of the calculated regression lines for male and female char showed there was no significant difference between them at the 0.05 probability level. The results of this comparison are given in appendix table A-4 together with the regression statistics calculated from the length-weight data by sex.

Figure 8 shows the length-weight relationship (scatter diagram, calculated line and confidence limits sample and line) and Figure 6 shows the relationship of girth to length in combination with the Makinson Inlet data. Like the Makinson Inlet sample there was no difference in the ratio of weight to fork length between sexes and only males were caught in the larger size categories (ie. over 80 cm.).

Figure 9 shows the age-length relationship and the age-frequency distribution. The points plotted are the average fork lengths per age class. Even though the sample is quite small, there is an indication that males and females are evenly distributed throughout the age classes (Table 7), and that there is no predominance of one sex in the older age classes. However, at approximately age 15, a difference in growth rate occurs (Fig. 9), with

nd weight data, and weight data over the range of fork lengths by sex and combined, for
har taken by angling from Robertson River, Northern Baffin Island, August 26, 1973.

Combined Sample					Males					Females				
. Fork ngth(cm)	Weight (gms) Cal.**	Average	Range	Condition factor***	Number of fish	Av. Fork length(cm)	Weight (gms) Cal.**	Average	Range	Number of fish	Av. Fork length(cm)	Weight (gms) Cal.**	Average	Range
16.5	536	535	450- 600	1.1002	1(3.6)**	37.7	582	600		3(15.0)**	36.0	523	513	450- 560
10.8	741	715	640- 790	1.0528	2(7.1)	40.8	733	715	640- 790	0	-		-	
17.5	1152	1145	1000-1290	1.0664	2(7.1)	47.5	1143	1145	1000-1290	0	-		-	
12.4	1531	1530	1330-1750	1.0634	1(3.6)	53.3	1599	1510		2(10.0)	51.9	1459	1540	1330-1750
18.5	2108	2090		1.0439	1(3.6)	58.5	2098	2090		0	-		-	
22.1	2507	2606	2220-3150	1.0582	2(7.1)	62.8	2560	2555	2420-2690	5(25.0)	61.9	2459	2626	2220-3150
17.9	3248	3100	2900-3140	0.9903	1(3.6)	67.0	3116	3100		3(15.0)	68.1	3276	3013	2900-3140
13.2	4039	4229	3800-4800	1.0782	2(7.1)	74.2	4197	4425	4050-4800	5(25.0)	72.8	3970	4150	3800-4710
17.7	4802	5147	3850-5900	1.0972	6(28.6)	77.9	4837	5390	4320-5900	2(10.0)	76.8	4631	4175	3850-4550
12.4	5695	5092	4650-6380	0.9101	6(21.4)	82.4	5698	5092	4650-6380	0	-		-	
17.1	6689	6525	5900-7150	0.9875	2(7.1)	87.1	6698	6525	5900-7150	0	-		-	

length	Weight	Fork length	Weight	Fork length	Weight
48	48	28(58.3)****	28	20(41.7)****	20
0-69.2	480-7150	37.7-69.2	600-7150	35.0-77.8	480-4710
7.7	3492	70.4	3589	62.2	2795
4.92	1616	15.25	1971	13.35	1327
2.15	262	2.83	373	2.99	297

Table 7. S
A

Age (No. of annuli)	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	

Number of fi
Range in age
Mean Age:
Standard Dev
Standard Err

* Condition

** Bracketed

ength but only 3400 gms. in weight (Table A-2) was not included in the calculations for this table.

s derived from the following equations; for the combined sample: $\text{Weight(gms)} = (0.0157)(\text{Fork length(cm)})^{2.9014}$

; for the males: $\text{Weight(gms)} = (0.0147)(\text{Fork length(cm)})^{2.9168}$

; for the females: $\text{Weight(gms)} = (0.0173)(\text{Fork length(cm)})^{2.8788}$

ed weight for each average fork length per length group.

lated by the formula: $\text{Condition factor} = \frac{\text{Average weight(gms)}}{\text{Average fork length(cm)}^3} \times 100$

percent of number sampled by category.

Table 7. Summary of age data and length and weight data by sex and combined over the range of age classes for anadromous Arctic char taken by angling from Robertson River, August 26, 1973.

Age (No. of annuli)	Combined Sample						Males						Females					
	Number of fish	Fork length(cm) Mean	Range	Weight (gms) Mean	Range	Condition factor*	Number of fish	Fork length(cm) Mean	Range	Weight (gms) Mean	Range		Number of fish	Fork length(cm) Mean	Range	Weight (gms) Mean	Range	
11	1(2.8)**	55.0		480		1.1195	0	-		-			1(5.3)**	55.0		480		
12	4(11.1)	42.0	36.1-53.3	900	480-1750	1.2148	1(5.9)**	41.5		790			3(15.8)	42.1	36.1-53.3	937	480-1750	
13	1(2.8)	37.7		600		1.1196	1(5.9)	37.7		600			0	-		-		
14	1(2.8)	46.0		1600		1.6274	1(5.9)	46.0		1600			0	-		-		
15	4(11.1)	53.5	49.0-61.0	1725	1290-2770	1.1265	2(11.8)	51.2	49.0-53.3	1400	1290-1510		2(10.5)	55.8	50.5-61.0	2050	1330-2770	
16	3(8.3)	72.7	63.6-77.4	4750	3150-5550	1.2062	2(11.8)	77.2	77.0-77.4	5550	5550-5550		1(5.3)	63.6		3150		
17	6(16.7)	68.2	58.5-79.2	3518	2090-5400	1.1090	4(23.5)	69.0	58.5-79.2	3558	2090-5400		2(10.5)	66.5	62.5-70.5	3440	2630-4250	
18	0	-		-		-	0	-		-			0	-		-		
19	2(5.6)	75.2	61.2-89.2	4755	2360-7150	1.1181	1(5.9)	89.2		7150			1(5.3)	61.2		2360		
20	2(5.6)	79.2	74.6-83.8	5545	4710-6380	1.1162	1(5.9)	83.8		6380			1(5.3)	74.6		4710		
21	4(11.1)	70.2	61.0-85.0	3540	2220-5900	1.0233	1(5.9)	85.0		5900			3(15.8)	65.3	61.0-67.8	2753	2220-3140	
22	4(11.1)	76.8	73.0-81.8	4290	3810-4850	0.9471	2(11.8)	80.4	79.0-81.8	4565	4320-4850		2(10.5)	73.3	73.0-73.5	3995	3810-4160	
23	2(5.6)	74.1	72.5-75.7	3825	3800-3850	0.9401	0	-		-			2(10.5)	74.1	72.5-75.7	3825	3800-3850	
24	1(2.8)	84.2		4650		0.7790	1(5.9)	84.2		4650			0	-		-		
25	1(2.8)	77.8		4500		0.9556	0	-		-			1(5.3)	77.8		4500		
Number of fish:	36						17(47.2)**						19(52.8)					
Range in age:	11-25						12-24						11-25					
Mean Age:	17.8						17.5						18.1					
Standard Deviation:	3.90						3.39						4.37					
Standard Error:	0.65						0.82						1.00					

* Condition factor was calculated by the formula: Condition factor = $\frac{\text{Mean weight (gms)}}{\text{Mean fork length(cm)}^3} \times 100$

** Bracketed figures indicate percent of number sampled by category.

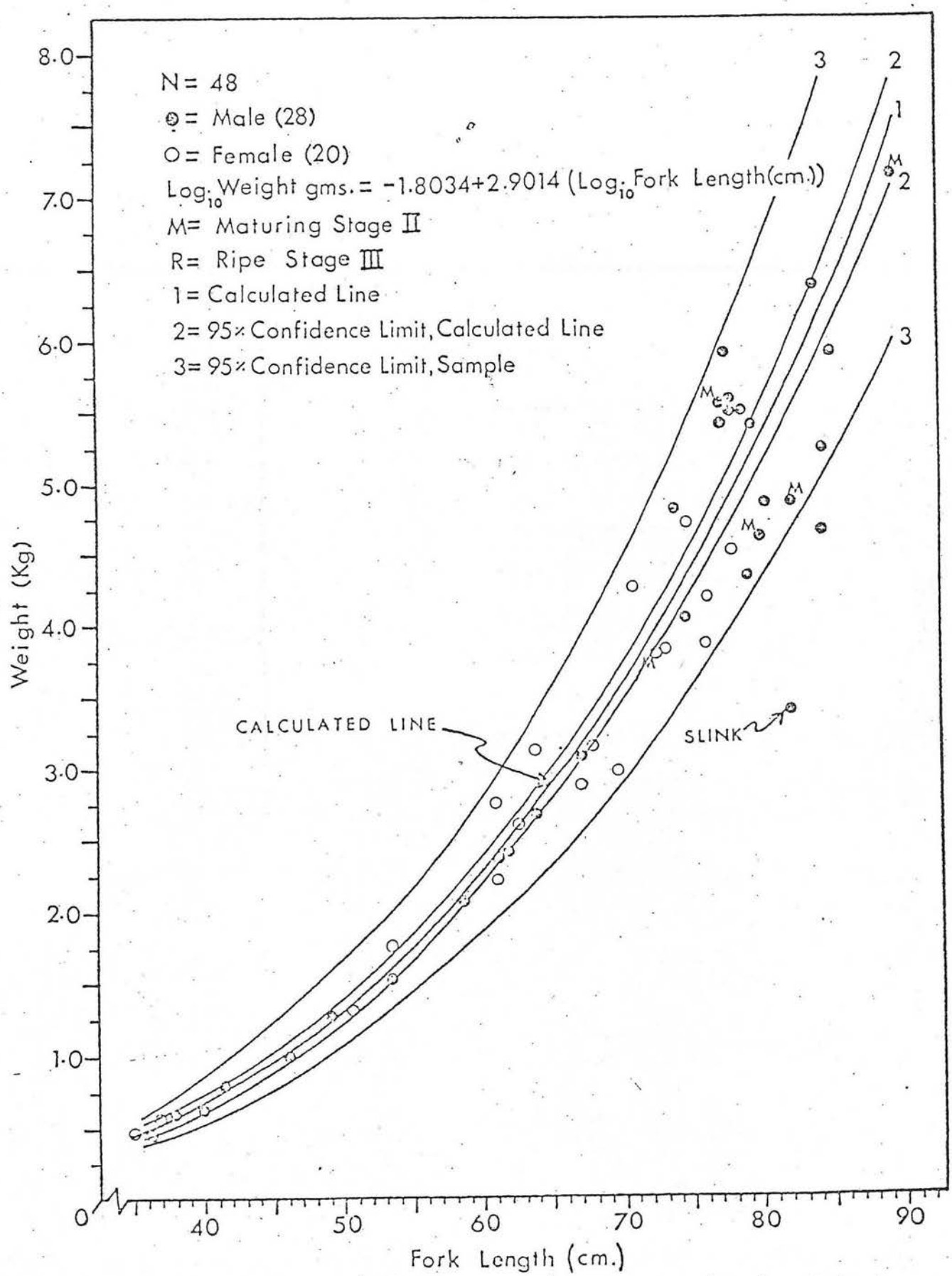


Fig. 8. Length-weight relationship for anadromous Arctic char from Robertson River, Northern Baffin Island, 1973. Maturing fish are indicated, the rest were considered to be immature or Stage 1 (Table 1).

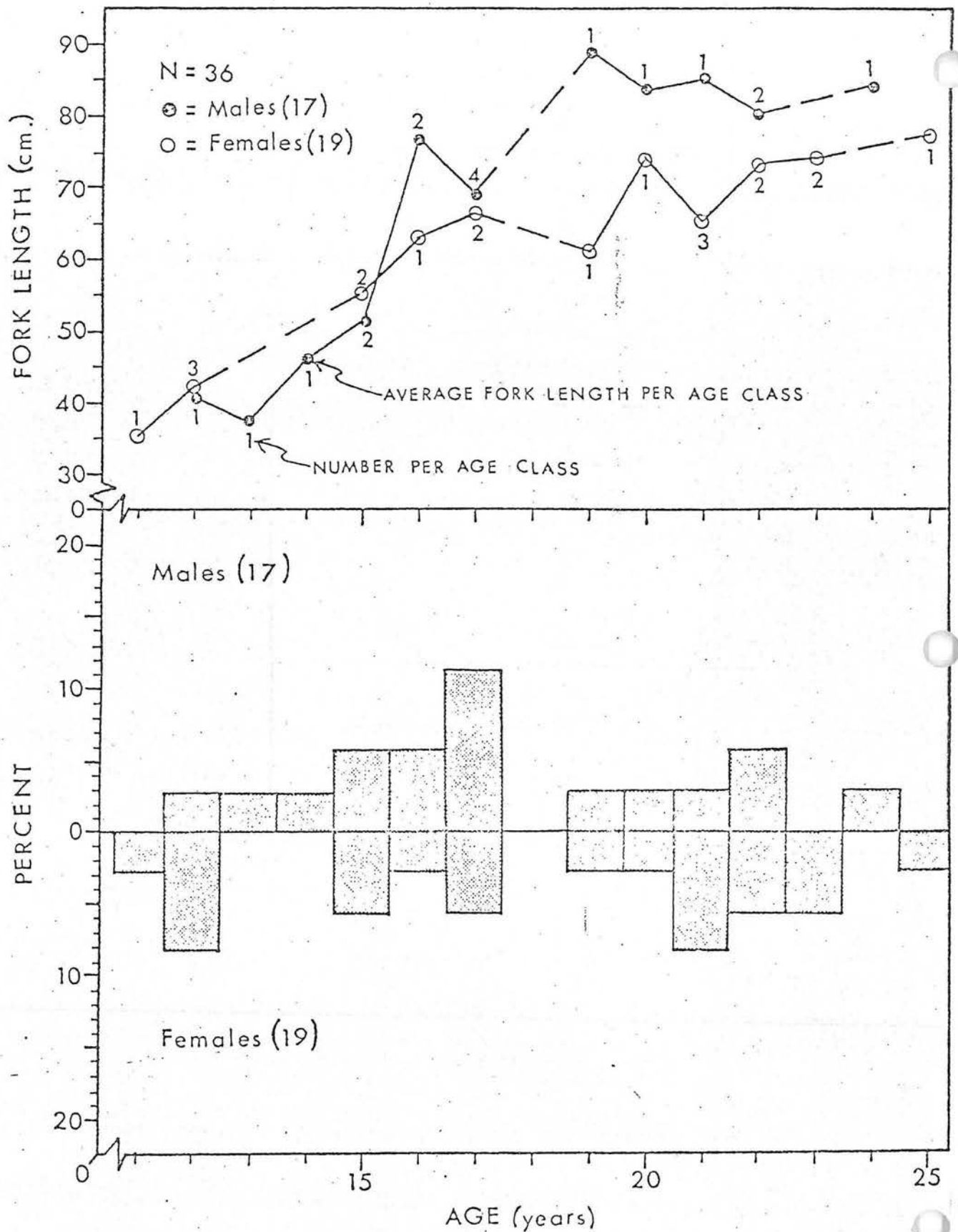


Fig. 9. Age-length relationship and age frequency distribution for anadromous Arctic char, Robertson River, Northern Baffin Island, 1973.

females exhibiting slower growth than males. This has been noted for other char populations by various investigators, among them Grainger (1953), Lee (1969), and Peet (unpublished data on Diana and Sandy Point Rivers). Although the age at which this difference in growth rate occurs is variable between populations, it is always the females which show the slower growth rate. This is probably indicative of the average age of first sexual maturity for females in a given population (Grainger, 1953).

The sex and stage of maturity were noted on all 49 fish sampled. The sex composition was 28 males to 20 females for a ratio of 1.4 (58.3%) males to 1 (41.7%) female. None of the fish examined were observed to be in the ripe condition, but 5 fish (4 males and 1 female) were considered to be Stage II maturing fish that would probably spawn during the fall. The size and age data on these fish are given in appendix table A-2 and they are indicated in Figures 6 and 8. The other 44 char were all considered to be immature Stage I fish. Comparison of preserved gonads with specimens from other char populations, sampled by the author from rivers in Pelly Bay and the west coast of Hudson's Bay, confirmed a consistency between samples in identification of the maturity stages adopted.

One immature fish of 82.0 cm. fork length indicated in Fig. 8 was noticeably lower in weight than other fish of the same size. This specimen was at first termed a "slink" or "kelt" and thought to be a fish which had just finished spawning and had not recovered its full condition. However, examination of the testes showed that they did not fit the criteria descriptive of the spawned-out condition (ie. they were not shrunken with a large vas deferens, nor wrinkled and stringlike). Rather, the testes were the same as those found in other immature males. Two possible explanations are either that the specimen was a spawner from the previous fall which had remained in fresh water over the summer, whose testes had recovered to the immature state but whose weight had not regained to the level of an immature fish which had fed in the sea that summer; or that it was a "sport" whose condition is not typical of the normal type.

The stomachs of all 49 char were examined for content. Only 3 (6.1%) contained any food items; the rest were empty. Empty stomachs are normal for char which have recently moved into fresh water from the sea as feeding virtually ceases during the upstream migration and does not resume for some time after entry into fresh water. This has been noted by the author for several char populations from both the southern Labrador and western Hudson Bay coasts (unpublished data) which were sampled by means of counting fences during their upstream migration. The stomachs containing food were preserved and examined in the laboratory. The results are given in Table 8.

Table 8. Stomach contents of anadromous Arctic char sampled at Robertson River, Northern Baffin Island, August 26, 1973.

Fork Length (cm)	Round Weight (gms)	Sex*	Age	Stomach content by volume (ml) and wet weight (gms)					
				Total		Amphipoda		Unidentified	
				Volume	Weight	Volume	Weight	Volume	Weight
46.0	1000	M(1)	14	0.019	0.30	0.019	0.30		
61.0	2220	F(1)	21	0.010	0.03	0.010	0.03		
63.6	3150	F(1)	16	0.306	4.28			0.306	4.28

*Bracketed figures indicate stage of maturity (Table 1).

LANDLOCKED LAKE NEAR POND INLET

A sample of 13 non-anadromous Arctic char was taken from a small lake located near the settlement of Pond Inlet (Fig. 4). The limited sample size precluded any detailed analysis; however, the length, weight and age data are summarized in Table 9. The sampling data is given in appendix table A-3. Figure 10 shows a plot of individual weights against lengths with a line fitted by eye to indicate the probable relationship. Ripe and maturing fish are identified in this figure, the rest were considered to be maturity Stage I (Table 1).

Table 9. Summary of length, weight and age data for non-anadromous Arctic char, Pond Inlet Area, Northern Baffin Island, August 26, 1973.

double

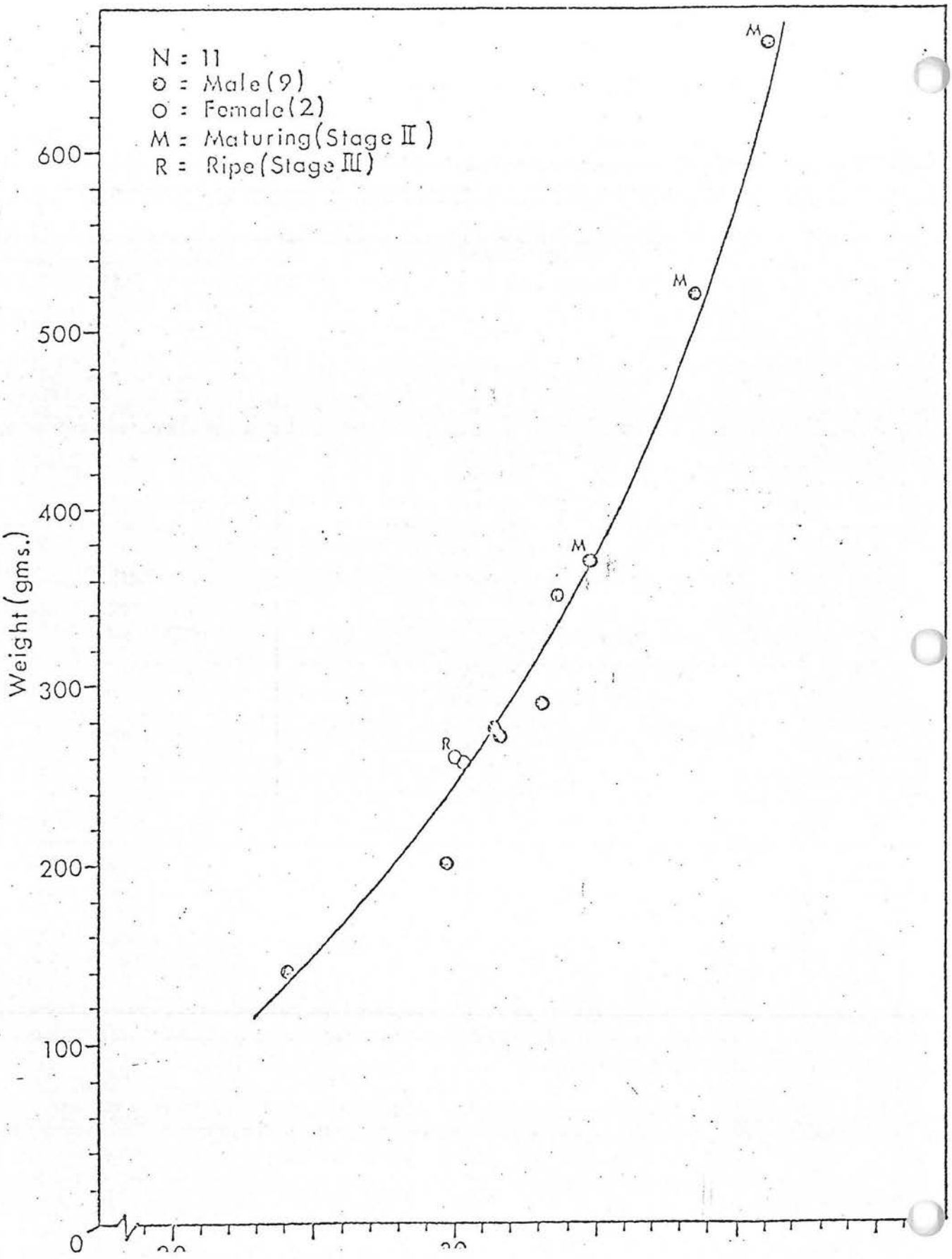
Parameter	Number* Sampled	Mean	Range
Fork length (cm.)	13	32.8	24.3- 41.2
Round weight (gms.)	11	326.0	140.0-660.0
Age (years)	11	13.3	9.0- 17.0

* Not all fish were sampled for weight or otoliths, thus the difference in sample size between parameters (Table A-3).

Figure 11 shows the age-length relationship. Points plotted in the age-length graph are the average lengths per year class.

Of the 13 fish sampled, the sex was noted on 12, and the ratio was found to be 9 males to 3 females. Seven fish (6 males and 1 female) were maturity Stage II, and 1 female fish was maturity Stage III. The size and age data on these fish are given in appendix table A-3 and the ripe and maturing fish are indicated in Fig. 10. Examination of the ovary of the Stage III fish in the laboratory showed a count of 558 mature eggs (85 eggs per 100 gms. of weight) with an average egg size of 4.43 mm.

No stomach contents were preserved from this sample. However, field examination of the gut showed all fish sampled had some food organisms in their stomachs, predominantly larva of unidentified Trichoptera species.


N : 11
Θ : Male (9)
O : Female (2)
M : Maturing (Stage II)
R : Ripe (Stage III)
Weight (gms.)
600
500
400
300
200
100
0
M
M
M
R

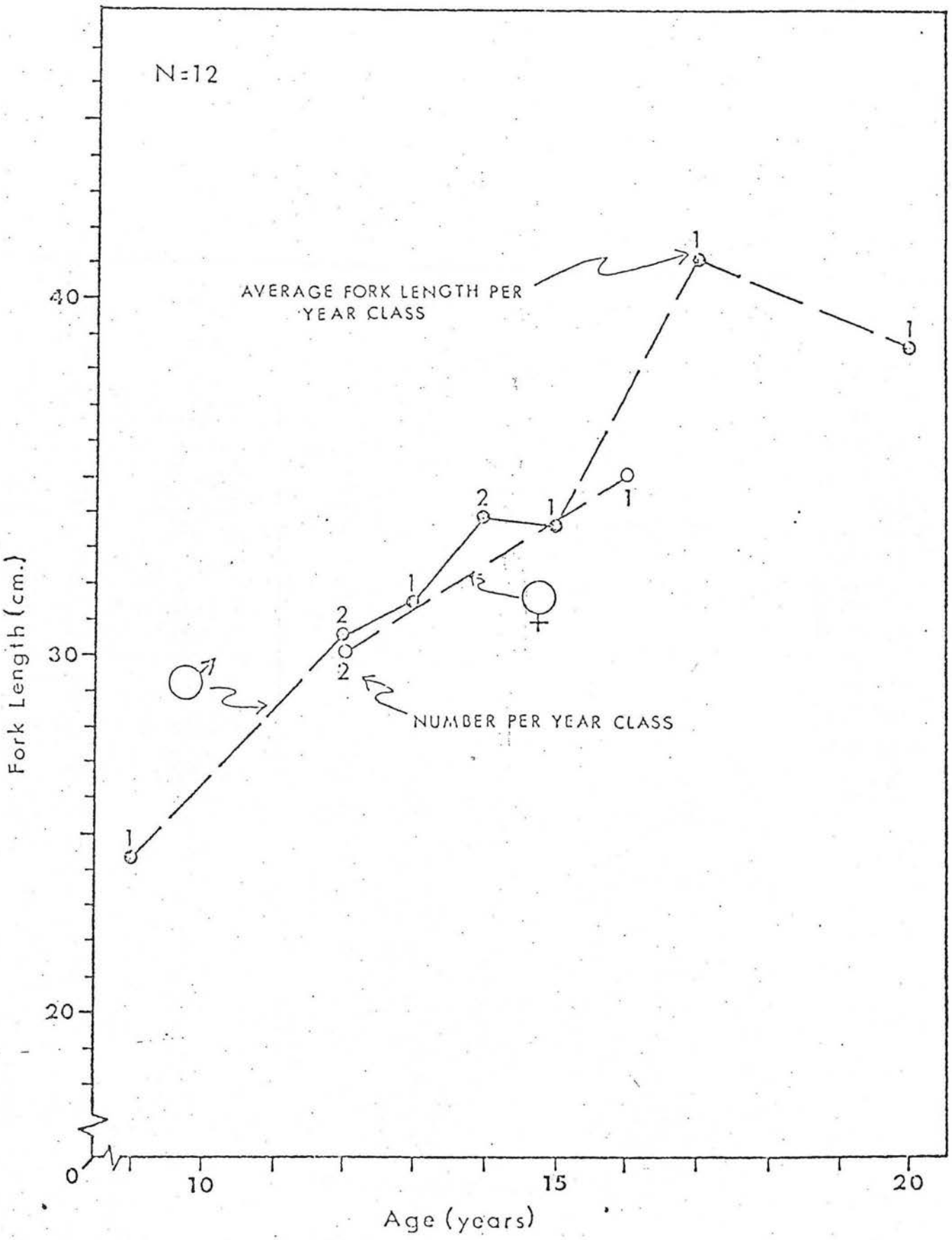


Fig. 11. Age-length relationship for non-anadromous Arctic char, Pond Inlet area, Northern Baffin Island, 1973.

CONVERSION FACTORS, ANADROMOUS ARCTIC CHAR

In order to facilitate comparison of data from the area surveyed with size data from other locales not expressed in the same units of length measurement, nomographs of the relationships of standard, fork and total lengths, each to the other, were prepared, and equations of the various relationships calculated. Figure 12 shows the length nomographs with individual points plotted for the Makinson Inlet and Robertson River samples combined.

Comparison of the various relationships between sexes for the Robertson sample, and with sexes combined between the Makinson and Robertson samples showed no significant difference at the 0.10 probability level for the categories compared except for the relationship of standard length to fork length between the Makinson and Robertson samples. In the latter instance there was a significant difference ($F = 25.5486$, degrees freedom 1 and 65, $P = 0.10$) in the elevations of the calculated lines. This was checked by comparing calculated values between the samples over the range of length measurements and their difference (ie. at 40 and 80 cm. standard length, calculated fork lengths of 42.9 and 86.1 cm. for Makinson Inlet, 42.1 and 85.9 cm. for Robertson River) was not considered to be practically significant. On the basis of this comparison the equations given below were derived from the combined data from Makinson Inlet and Robertson River.

The following are the equations derived from the data on the relationships between standard, fork and total lengths for the combined samples. Justification for the use of untransformed data is given under the Materials and Methods section.

A) Fork and Total length (N = 68)

Fork length (cm.) = (Total length (cm.))(0.9714) - 1.3189

Total length (cm.) = (Fork length (cm.))(1.0287) + 1.4046

B) Fork and Standard Length (N = 68)

Fork length (cm.) = (Standard length (cm.))(1.0828) - 0.7720

Standard length (cm.) = (Fork length (cm.))(0.9225) + 0.7787

C) Standard and Total Length (N = 68)

Standard length (cm.) = (Total length (cm.))(0.8964) - 0.4573

Total length (cm.) = (Standard length (cm.))(1.1141) + 0.5972

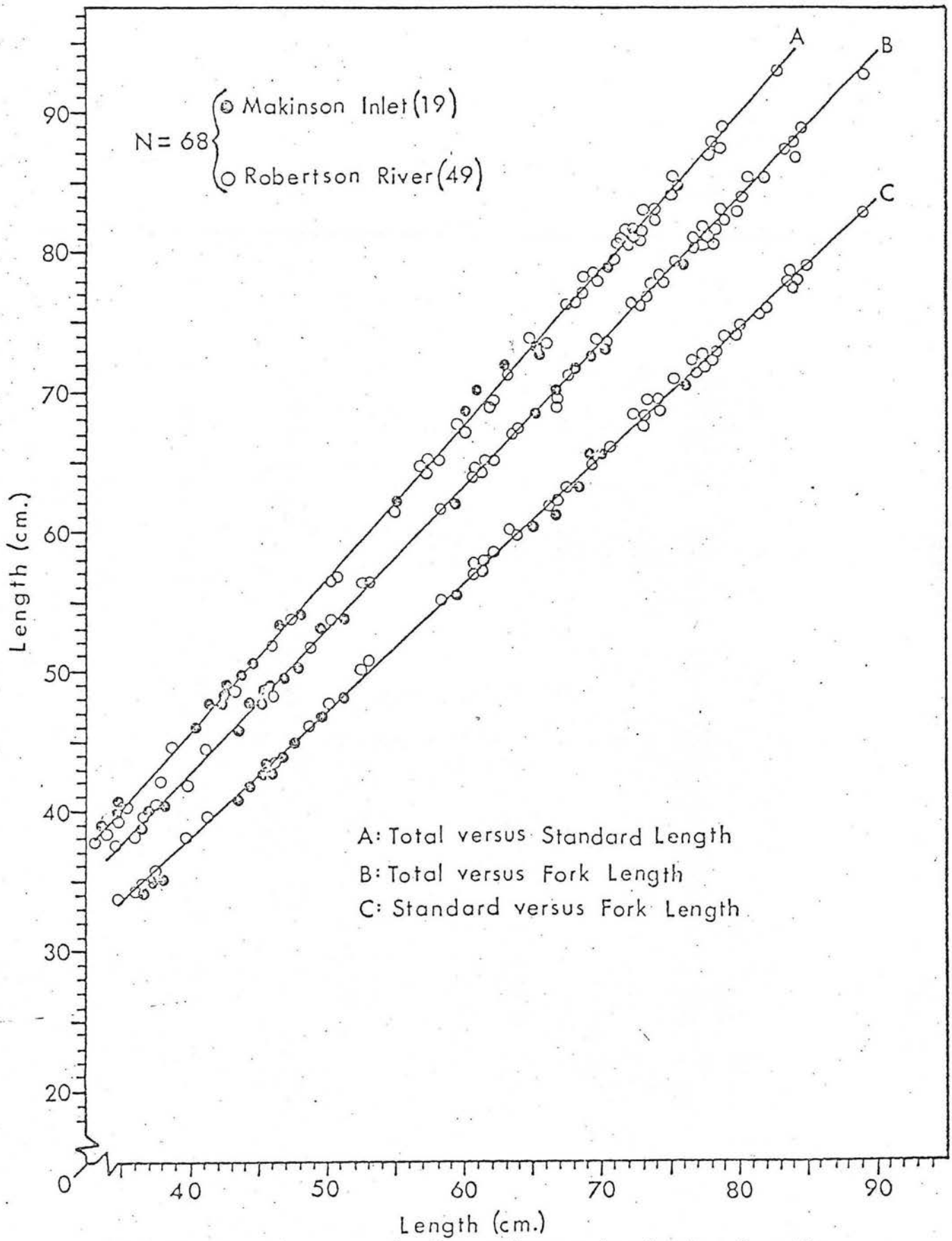


Fig. 12. Length nomographs for anadromous Arctic char from the Eastern Arctic area, 1973.

Frequently the weight data on char populations from various areas are available only from commercial landings on fish which have been gutted. The usual method of gutting is to remove the viscera and gills leaving the head attached* so that the fish can be easily hung in a freezer. In order that data collected from commercial fisheries in the area covered by this report can be converted to round weight, or conversely to estimate the gutted poundage available from an individual round fish or quota set in round pounds, data were collected on individual fish in both the round and gutted head-on state. Figure 13 shows the graph of gutted weight head-on, plotted against round weight for both the Makinson Inlet and Robertson River samples.

Comparison of the relationship of gutted to round weight between sexes for the Robertson River data showed no significant difference at the 0.025 probability level. Comparison of the Robertson sample with sexes combined and the Makinson sampled showed a significant difference until one fish (76.3 cm. fork length) was removed from the Makinson data. The regressions then showed no difference between areas at the 0.025 probability level and the data were combined to derive the equations given below which describe the relationship of gutted to round weight for the anadromous char from Makinson Inlet and Robertson River.

Round weight (gms.) = (Gutted weight (gms.)) (1.0732) + 27.9

Gutted weight (gms.) = (Round weight (gms.)) (0.9307) - 22.9

For these samples, the ratio of the weight of the viscera and gills to the whole weight of the fish decreased with size. A whole fish weighing 1000 gms. would have 9.2% of its body weight made up of viscera and gills in comparison to 7.3% for a 7000 gm. fish. The average ratio over this range in weight was calculated to be 7.8%.

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* This condition is referred to as "gutted weight head-on" in this report.

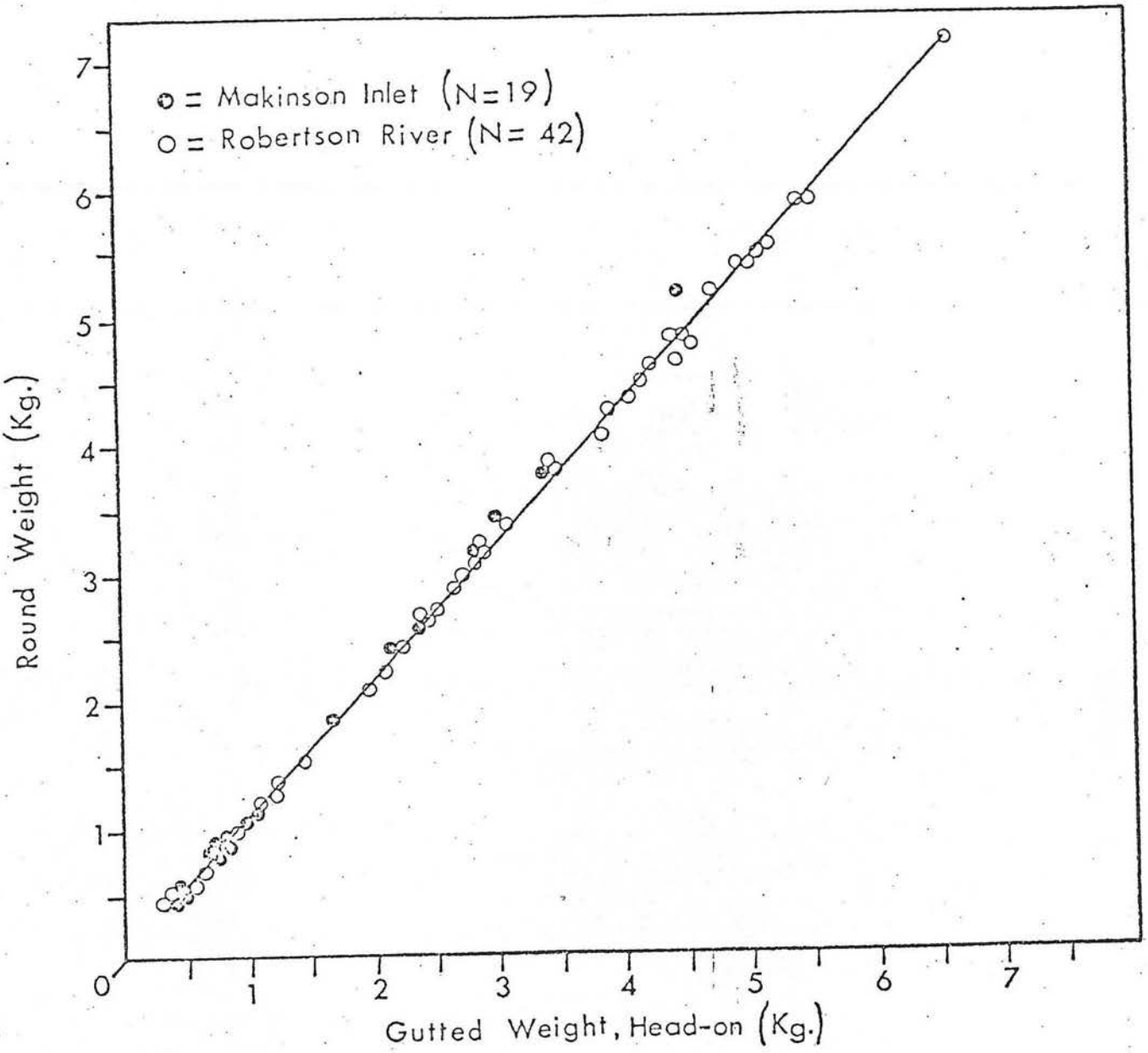

Fig. 13. Relationship of round to gutted weight (head-on) for anadromous Arctic char, Eastern Arctic area, 1973.

SUMMARY

1. Twenty-four anadromous Arctic char were sampled in the Makinson Inlet area and 49 at Robertson River during a voyage by the Canadian Forces vessel, H.M.C.S. Protecteur. In addition, 13 non-anadromous char were sampled from a small lake near Pond Inlet.

2. The char at Makinson Inlet ranged in fork length from 37.0 to 76.3 cm. with a mean of 58.4 cm.; in weight from 430 to 5200 gms. with a mean of 2261 gms.; and in age from 13 to 21 years with a mean of 16.7 years.

3. At Robertson River, the range in fork length was 35.0-89.2 cm. with a mean of 67.7 cm.; in weight from 480 to 7150 gms. with a mean of 3492 gms.; and in age from 11-25 years with a mean of 17.8 years.

4. The non-anadromous char ranged in fork length from 24.3 to 41.2 cm. with a mean of 32.8 cm.; in weight from 140 to 660 gms. with a mean of 326 gms.; and in age from 9 to 17 years with a mean 13.3 years.

5. A logarithmic equation describing the regression of weight on length for the Makinson Inlet sample was calculated to be:

$$\log_{10} \text{Weight(gms.)} = -2.3021 + (3.1570)(\log_{10}\text{Fork Length (cm.)})$$

and for the Robertson River sample:

$$\log_{10} \text{Weight (gms.)} = -1.8034 + (2.9014)(\log_{10}\text{Fork Length (cm.)})$$

6. At Makinson Inlet two ripe female char were taken. A count of mature eggs showed 1711 for a 12 year old specimen 46.3 cm. in fork length and 850 gms. in weight. The other fish, 44.7 cm. in fork length, 925 gms. in weight and 16 years old contained 1465 mature eggs. No ripe fish were taken at Robertson River but 5 fish were considered to be ripening to spawn during the fall.

7. One ripe female non-anadromous char was also taken. This fish was 30.2 cm. in fork length, 260 gms. in weight, 12 years old and contained 558 mature eggs.

8. Approximately 53% of the char stomachs examined at Makinson Inlet contained food. Analysis of the contents showed the main item of food to be marine amphipoda. Only 6.1% of the Robertson River char contained food, the bulk of which was unidentified. All the non-anadromous char stomachs examined contained food, predominantly larval Trichoptera.

9. The relationships of gutted weight (head-on) to round weight and vice versa were calculated to be:

   Gutted weight (gms.) = (Round Weight (gms.))(0.9307) - 22.9

   Round weight (gms.) = (Gutted Weight (gms.))(1.0732) + 27.9

   In addition, equations for the relationships of standard fork and total length, each to the other, were calculated.

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Table A-1. Sampling data for anadromous Arctic char collected by angling from two rivers in Makinson Inlet, Ellesmere Island, August 21-23, 1973 (asterisked notes at end of table).

Date	Length (cm) Standard	Fork	Total	Girth (cm)	Weight (gms) Round	Gutted	Sex and Stage of Maturity*	Age (yrs)	Collector
A) SAMPLES COLLECTED FROM RIVER A, FIG. 2.									
Aug. 21	65.7	69.5	72.8	33.5	3450	3000	M-1	21	MacLean
	34.0	37.0	39.2		430	400	M-1		Baxter
	55.5	59.5	62.2	27.0	1850	1700	F-1	16	Baxter
Aug. 22	42.8	46.3	49.0	20.1	850	675	F-11I	12	Mitchel
	44.8	48.0	50.5	21.5	1030	950	F-1	15	Cummings
	40.6	43.6	46.0	19.1	760	720	M-1	13	Cummings
	35.4	38.4	40.5		525	480	F-1	13	O'Leary
	61.3	67.0	70.4	29.0	2480	2200	M-1		Blair
		42.7				500			Bouther
		54.5			1400				Bouther
		54.5			1425				Bouther
		47.0			900				Bouther
		51.9			1200				Bouther
Aug. 23	60.2	65.4	68.8	34.4	2600	2430	M-111		Bouther
	63.2	68.5	72.0	36.0	3150	2850	M-11	16	Spence
	42.7	45.8	48.6	20.7	950	825	M-1	16	Andrews
	48.2	51.5	54.0	21.6	1200	1100	M-1	16	McNeil
	44.0	47.0	49.6	19.4	850	825	M-1	14	Sabean
	42.6	45.5	47.9	19.3	875	800		12	Sabean
	41.8	44.7	47.9	20.0	925	750	F-111	16	Sabean

Table A-1. (Cont'd)

Date	Length (cm)			Girth (cm)	Weight (gms)		Sex and Stage of Maturity*	Age (yrs)	Collector
	Standard	Fork	Total		Round	Gutted			
B) SAMPLES COLLECTED FROM RIVER B, FIG. 2.									
Aug. 21	46.8	49.9	53.4	22.2	1150	1075	F-1	14	Weltz
	35.0	37.5	40.0	17.0	525	475	F-1	12	MacKeren
	70.8	76.3	79.4	40.5	5200	4450	M-1	21	Peet
	65.6	70.5	73.2	36.1	3800	3400	M-1		Currie

* For an explanation of stages of maturity see Table 1.

Table A-2. Sampling data for anadromous Arctic char collected by angling from Robertson River, Northern Baffin Island, August 26, 1973 (asterisked notes at end of table).

Date	Length (cm)			Girth	Weight (gms)		Sex and Stage	Age
	Standard	Fork	Total	(cm)	Round	Gutted	of Maturity*	(yrs)
Aug. 26	75.8	81.8	85.5	35.5	4850	4500	M-11	22
	78.4	84.1	88.0	37.2	5222	4750	M-1	
	43.6	46.0	48.5	21.3	1000	925	M-1	14
	68.5	72.5	76.7	33.5	3800	3480	F-11	23
	74.2	79.2	82.5	39.5	5400	5070	M-1	17
	75.2	80.4	84.3	37.2	4850	4450	M-1	
	72.0	77.7	81.6	40.0	5500	5200	M-1	
	74.2	80.0	83.0	36.2	4600	4250	M-2	
	34.3	36.1	38.2	16.3	480	440	F-1	12
	33.7	35.0	37.5	16.2	480	430	F-1	11
	71.6	77.0	80.6	41.6	5400	4950	M-1	
	66.0	70.5	73.5	36.7	4250	3900	F-1	17
	72.1	77.4	81.0	42.3	5550		M-2	16
	62.5	67.0	69.7	31.0	2900	2700	F-1	21
	72.0	77.0	81.2	40.0	5550	5220	M-1	16
	63.3	67.8	71.5	31.2	3140	2850	F-1	21
	83.0	89.2	93.0	43.5	7150	6600	M-2	19
	38.2	40.0	42.0	19.1	640	610	M-1	
	65.0	69.6	74.0	30.0	3000	2750	F-1	
	57.0	61.0	64.9	27.8	2220	2100	F-1	21
	60.3	63.6	67.2	33.1	3150	2850	F-1	16
	39.2	41.5	44.6	20.0	790	730	M-1	12
	75.8**	82.0	85.5	28.8	3400	3050	M-1	
	35.6	37.7	40.2	18.0	600	575	M-1	13
	71.0	75.7	79.5	34.3	3850	3430	F-1	23
	73.0	77.5	81.5	41.5	5900	5450	M-1	

Table A-2. (Cont'd)

Date	Length (cm)			Girth (cm)	Weight (gms)		Sex and Stage of Maturity*	Age (yrs)
	Standard	Fork	Total		Round	Gutted		
Aug. 26	73.2	79.0	83.2	34.5	4320	4070	M-1	22
	62.1	67.0	69.0	32.0	3100	2850	M-1	
	73.0	78.5	81.9	41.4	5500	5150	M-1	
	46.4	49.0	51.8	24.6	1290	1220	M-1	15
	35.0	37.0	39.5	18.3	580	510	F-1	12
	79.0	85.0	89.0	40.6	5900	5500	M-1	21
	55.3	58.5	61.6	29.6	2090	1950	M-1	17
	47.9	50.5	53.8	25.0	1330	1250	F-1	15
	58.5	62.5	65.4	31.1	2630	2440	F-1	17
	57.7	61.0	64.4	32.2	2770	2550	F-1	15
	69.0	74.5	78.5	35.5	4050	3850	M-1	17
	72.7	77.8	81.0	35.2	4500	4150	F-1	25
	69.9	73.8	78.0	38.2	4800	4550	M-1	
	60.0	63.9	67.5	31.3	2690	2430	M-1	17
	78.2	84.2	87.0	35.3	4650	4420	M-1	24
	57.9	61.6	65.1	30.5	2420	2210	M-1	
	50.6	53.3	56.5	25.1	1510	1410	M-1	15
	67.8	73.0	76.5	34.4	3810		F-1	22
	68.9	73.5	77.0	35.9	4180		F-1	22
	50.6	53.3	56.5	27.3	1750		F-1	12
	57.3	61.2	64.5	29.9	2360		F-1	19
	69.4	74.6	78.1	38.3	4710		F-1	20
	78.8	83.8	87.6	43.1	6380		M-1	20

* For an explanation of stages of maturity see Table 1.

** This fish was unique in comparison to the other fish relative to the ratio of body weight to length and was not considered in calculating the relationship of weight to length.

Table A-3. Sampling data for non-anadromous Arctic char collected by angling from a lake near Pond Inlet, Northern Baffin Island, August 26, 1973.

Date	Length (cm)			Girth	Weight (gms)		Sex and Stage	Age	Collector
	Standard	Fork	Total	(cm)	Round	Gutted	of Maturity*	(yrs)	
Aug. 26	32.4	34.9	37.1	15.2	370	310	M-11	14	Stark
	28.1	29.7	31.7	12.5	200		M-1	12	Stark
	22.7	24.3	26.2	11.2	140		M-1	9	Stark
	31.1	33.7	35.9	15.1	350		M-1	15	Spence
	31.3	33.1	35.5	14.3	280		M-1	14	Spence
	29.8	31.5	34.0	13.6	275		M-1	13	Spence
	28.5	30.0	32.3	13.0	260		F-1	12	Spence
	28.6	30.2	32.6	13.0	260		F-111	12	Spence
	38.4	41.2	43.9	20.0	660		M-11	17	Rice
	36.3	38.6	41.0	18.5	520		M-11		Rice
	29.6	31.5	33.5	13.7	275		M-1	12	Rice
	30.5	32.9	35.6			350			Rice
	31.8	35.1	37.6			375	F-11	16	Rice

* For an explanation of stages of maturity see Table 1.

Table A-4. Summary of quantities calculated from the empirical data on length and weight for anadromous Arctic char, by sex and combined, for the Robertson River sample, and with sexes combined for the Makinson Inlet sample, for the regression of weight(gms) on fork length(cm).

Statistic*	Category			
	Robertson River			Makinson Inlet
	Sexes Combined	Males	Females	Sexes Combined
1.) N	48	28	20	23
2.) ΣX	86.9490	51.3116	35.6374	39.4487
3.) ΣX^2	158.0851	94.3594	63.7257	67.8463
4.) ΣY	165.7064	98.3752	67.3312	71.5939
5.) ΣY^2	577.0550	348.4894	228.5656	224.7326
6.) ΣXY	301.8566	181.2349	120.6217	123.3804
7.) $\bar{X}$	1.8114	1.8326	1.7819	1.7152
8.) $\bar{Y}$	3.4522	3.5134	3.3666	3.1128
9.) Σx^2	0.5824	0.3280	0.2245	0.1854
10.) Σy^2	5.0006	2.8580	1.8911	1.8767
11.) Σxy	1.6898	0.9567	0.6463	0.5853
12.) a	-1.8034	-1.8319	-1.7631	-2.3021
13.) b	2.9014	2.9168	2.8788	3.1570
14.) $S_{y.x}$	0.0461	0.0510	0.0412	0.0371
15.) S_b	0.0604	0.0890	0.0869	0.0862
16.) r	0.9902	0.9881	0.9919	0.9923

F** tests	Comparison of regressions					
	Robertson, Male/Female(N=48)			Makinson Comb/Robertson Comb(N=7		
	Result	Deg. Free.	Sig. at 0.05	Result	Deg. Free.	Sig.at 0.0
A) Homogen. of var.	1.5323	26,18	no	1.5440	46,21	no
B) Slopes	0.0860	1,44	no	4.8562	1,67	yes
C) Elevations	0.0005	1,45	no	19.3582	1,68	yes

* The statistics listed follow the notation of Snedecor and Cochran(1967, 6th. I Chpt. 6, pg. 135-171; Chpt. 7, pg. 172-198) and were derived following their methods.

** The comparison of regressions also follow the notation and methods of Snedecor and Cochran(ibid, Chpt. 4, pg. 116-118; Chpt. 14, pg. 432-436).

Table A-5. Confidence limits for the regression of weight (gms.) on fork length (cm.) for the combined sample of anadromous Arctic char from Robertson River, Aug. 26, 1973.

Fork length (cm.)	Calculated* Weight(gms.)	95% confidence limits** For calculated line	for individual weights
35	475	438- 515	378- 597
40	700	655- 747	559- 875
45	985	933-1039	790-1227
50	1337	1279-1397	1075-1662
55	1762	1699-1828	1419-2189
60	2268	2197-2342	1828-2816
65	2862	2775-2951	2306-3551
70	3548	3436-3664	2858-4404
75	4334	4183-4491	3490-5382
80	5227	5022-5440	4206-6496
85	6232	5957 6520	5009-7753
90	7356	6994-7736	5906-9162

* Calculated weights were derived from the equation:

$$\log_{10}\text{Weight (gms.)} = -1.8034 + 2.9014(\log_{10}\text{Fork length(cm.)})$$

** Confidence limits were derived following the methods of Snedecor and Cochran (1967, 6th. Ed., Chpt. 6, pg. 153-157).