REPORT ON THE TEST FISHERY OF THE KUUK RIVER, PRINCE ALBERT SOUND, NORTHWEST TERRITORIES, 1986

by

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RESULTS OF THE TEST FISHERY OF THE KUUK RIVER, PRINCE ALBERT SOUND, N.W.T.

1.0 INTRODUCTION

In the summer of 1985, the Department of Fisheries and Oceans initiated a test fishery to collect 100 Arctic charr (Salvelinus alpinus L.) from each of the Kuuk, Naloagyok and Kagluk Rivers located in the Prince Albert Sound area, near Holman, in the Northwest Territories. The objectives of this study were to determine the mean length, weight, age, condition factor, and to estimate the mortality rates of the harvestable portion of each stock (Kristofferson 1985, unpublished). These data, along with information on the duration of the upstream migrations and relative abundance of each stock, were to be collected in order to determine the feasibility of fishing these stocks commercially. Although the test fishery was partially successful in collecting the prescribed number of samples, the collections were conducted only over a two to three day period at each river and subsequently neither the durations of the migrations nor the relative abundance of the stocks could be determined.

In 1986 the Department of Fisheries and Oceans, Western Division, Winnipeg Manitoba contracted North/South Consultants Inc. to repeat the test fishery. The primary objectives of this study were threefold: 1) to determine the timing and relative abundance of the upstream migration of Arctic charr on the Kuuk, Naloagyok and Kagluk Rivers using catch per unit effort statistics, 2) to evaluate the suitability of these stocks to support a commercial fishery by determining such biological parameters as size, age composition, condition factors and mortality rates, and 3) to evaluate fishing locations as to their physical suitability for conducting a commercial fishery.

Due to the severe sea-ice conditions in both Prince Albert Sound and the immediate vicinity of Holman, the 1986 test fishery was delayed until August 28th. At this time it was decided to concentrate efforts on the Kuuk River which was considered to have the most potential for developing a commercial fishery. As a result, information will not be presented on the Kagluk or Naloagyok Rivers.

2.0 MATERIALS AND METHODS

2.1 LOCATION AND BACKGROUND

The Kuuk (70° 34'N, 112° 38' W), Naloagyok (70° 15'N, 112° 20' W) and Kalgluk (70° 13' N, 112° 58' W) Rivers are located approximately 200 km from Holman at the eastern end of Prince Albert Sound on Victoria Island, Northwest Territories (Fig. 1, Appendix I). Each of these rivers are essentially unexploited and have received only minimal fishing pressure in recent years. Of the total provisional commercial quota of 3000 kg for the three rivers combined, only 627 kg were taken in 1985 and 299 kg in 1986.

2.2 FISHERY ASSESSMENT

The project biologist and two residents of Holman, Mr. Simon Katoagyok and Mr. Donald Notaina, initiated the fishing at the Kuuk River on August 28th. All fishing was performed with a single 50 m monofilament sinking gillnet of 5 1/2" (139 mm) stretched measure. The net was set from shore, obliquely across the river mouth in a downstream direction extending across approximately 1/2 to 2/3 of the river.

Fork length (+/- 1 mm), round weight (+/- 25g), sex and state of maturity were recorded for each fish captured. Maturity codes, determined by gross examination of the gonads, followed that of Kristofferson and McGowan (1981). Saggital otoliths were collected and stored in marked envelopes for subsequent ageing by the Fish and Marine Mammal Management Division, Freshwater Institute. Condition factors (K) for each fish were determined as follows:

$$K = \frac{W \times 10^5}{L^3}$$

where W = weight (g) and L = length (mm).

Analysis of covariance was used to compare the Log_{10} linear relationship between length and weight (Log_{10} Weight = a + b(Log_{10} Length)) between sexes of fish collected during the present study.

An estimate of the instantaneous total mortality rate (Z) of the Kuuk River population was calculated from only fully recruited age classes from the descending limb of a catch curve (Ricker 1975). Age classes used were 14 to 18 years inclusive and the method of least squares regression was used to calculate Z.

Estimates of exploitation rates or yield estimates were not calculated due to the low fishing pressure exerted over only a small time period of the entire run.

3.0 RESULTS AND DISCUSSION

3.1 SITE DESCRIPTION AND EVALUATION - KUUK RIVER

3.1.1 Boat and Aircraft Accessibility

The Kuuk River is easily accessible by either float or tundra wheel equipped aircraft. The mouth of the river is approximately 20 to 30 m wide with a maximum depth of 2.2-2.7 m at low and high tides respectively. The draft is great enough so that the river can easily be approached even at low tide by a small, float equipped aircraft. Tundra wheel equipped aircraft would have little difficulty landing near the river mouth as the terrain is flat and relatively firm with no large boulders.

Persistent sea-ice conditions could prevent boat travel such as was experienced this year. This could be overcome by flying into the river, thereby ensuring the fishery takes place.

3.1.2 Fishing Suitability

The Kuuk River provides a good camping area with easy access and landing. Water currents are slow and depth adequate enough to allow easy setting and tending of nets. The area is sufficiently sheltered so that it would be possible to tend the nets even in poor weather. The small tides (0.5 m) do not pose any problems.

Approximately 100 m upstream the river widens (40 to 50 m across) and becomes shallower (0.5 m deep) with a moderate current. This area would be an ideal location for the construction of a weir due to its shallow depth and moderate current which would allow the holding of fish. Evidence also exists that this area was used in the past as a weir fishery due to the abundant remains of camp sites and stone weirs.

3.1.3 Attitude of Fishermen

Generally, the level of interest of the Holman Hunters and Trappers Association in performing the test fishery and developing a commercial fishery was high and a desire to continue the work was expressed. However, the general community seemed unaware that a test fishery was being performed, where or why it was being performed or even what a test fishery is.

Due to the abundance of employment available in Holman during August, some difficulty was encountered in obtaining the participation of a second guide to assist in the fishery. This situation however was unusual and it is felt that during subsequent years there would be no lack of interest in commercial fishing. The attitude and interest shown by the guides during the present test fishery was excellent.

3.1.4 Other Problems

Heavy sea-ice or rough water conditions could significantly affect transportation and the success of the fishery. As there are no aircraft in Holman, aircraft would have to be chartered from Inuvik or Cambridge Bay, which would significantly escalate the cost of transportation. In addition, there are no freezer facilities in Holman for storing large quantities of fish.

3.2 BIOLOGICAL EVALUATION

Ninety-eight Arctic charr weighing a total of 298.8 kg were captured on the Kuuk River between 28 August and 2 September, 1986. All fish captured were sampled for fork length (mm), weight (g), sex and maturity. In most cases otoliths were collected for ageing. Arctic charr made up 100% of the total catch.

Mean length (671 mm) and mean weight (3203 g) of males was significantly greater ($P<0.05$) than mean length (652 mm) and mean weight (2891 g) of females captured (Table 1, Appendix II; Fig. 2, Appendix I). The sex ratio was equal at 1:1 with no significant difference ($P>0.05$) in condition factor ($K=1.00$) between sexes. Mean age of the population was 14.3 years and ranged between 10 and 23 years (Table 2, Appendix II; Fig. 3, Appendix I). The length-weight relationships for charr collected during 1985 and 1986 are presented in Table 3, Appendix II. Analysis of covariance showed that in the present study there was no significant difference in the length-weight relationship, or in adjusted mean weights between sexes

(P=0.21). Mean lengths, weights and mean age was significantly lower than in the 1985 sample (Table 4, Appendix II). This was due to the fact that fish from the present study were collected later in the year than in 1985 and represent the end of the run which, according to Johnson (1980) and others, is composed generally of smaller, immature fish. Despite the greater proportion of smaller individuals observed in the present study (Fig. 2, Appendix I), the range of ages and mean lengths and weights (+/-s.d.) was greater than in 1985.

The biological parameters of the Kuuk River charr compare favourably with those from other commercial charr fisheries. Mean weights and ages of the Kuuk River charr were at least as great as those observed for charr from the Ekalluk and Jayco Rivers in the Cambridge Bay area (Table 4, Appendix II), and the Baffin Island region (Kristofferson and McGowan 1981), and greater than charr from the Pelly Bay-Gjoa Haven area (Kristofferson et al. 1982). The large mean weight and presence of old fish in the population are indicative of an unexploited stock.

Condition factors of charr from the Kuuk River in 1985 and 1986 were lower than those recorded for most other commercial fisheries (Table 4, Appendix II). Whether a relatively lower condition factor is characteristic of the stock or whether the late springs and cold summers experienced during 1985 and 1986 contributed to a leaner fish is not known.

3.3 MATURITY

The proportion of mature individuals in the upstream migration of anadromous Arctic charr varies considerably between populations, as well as between years within stocks (Johnson 1980). The majority of mature, current year spawners tend to remain in freshwater over the summer, or only go down to the ocean for a short time (Johnson 1980). This has also been observed for charr in the Cambridge Bay area (Kristofferson et al. 1982) and is likely the case for charr of the Kuuk River. There are however, usually a few ripe fish which occur in the upstream run (Johnson 1980, Kristofferson et al. 1982), the present study being no exception.

One 17 year old male, 75.3 cm in fork length which was captured was ripe. The remainder of the fish were either immature or virgin fish. The age or size of first maturity is not known for charr of the Kuuk River but a 10 year old female of 44.3 cm fork length was observed with small but very distinct eggs. If this fish spawned the following year, the age of first maturity could possibly be as low as 11 years, with a round weight of less than 1 kg. This would be considerably smaller than the youngest mature fish observed by Kristofferson et al. (1982) in the Cambridge Bay area.

3.4 MORTALITY

Instantaneous total mortality (Z) was calculated from the descending limb of a catch curve constructed by plotting mean $\log_{10}$ frequency versus age (Fig. 4, Appendix I). Z (+/-2 S.E.) was calculated for fish between the age classes of 14 and 18 inclusive (N=45) and found to be -0.17 (+/-0.0) with an r value of 95.

Fish of ages 19 or greater were not included in the analysis because the small sample size does not accurately reflect the true abundance of older fish.

An instantaneous total mortality rate of -.17 (annual relative mortality rate (A) = 0.16) is typical of an unexploited stock of Arctic charr.

Due to the limited amount of data which was collected over a short time period, it was not possible to calculate a reasonable estimate of stock size and therefore no reliable rates of exploitation or yield estimates could be calculated.

3.5 CATCH PER UNIT EFFORT

Catch per unit effort (kg round weight/100m/24 hr.) of fish was highest at 1744 kg on the first day of fishing (28 August) and declined to a low of zero on the final day of fishing on 2 September (Fig. 5, Appendix I). Average CPUE from 28 August until 2 September was 542 kg. This compares with a CPUE of 414 kg of fish during mid August in the 1985 test fishery. Both values are substantially higher than most CPUE values reported for test fisheries in the Baffin region (Kristofferson and McGowan 1981) and Gjoa Haven - Pelly Bay area (Kristofferson et al. 1982).

It appears that the upstream migration of charr in the Kuuk River ends in early September, which is slightly earlier than other charr fisheries at similar latitudes (Johnson 1980).

4.0 CONCLUSIONS

Only the Kuuk River was investigated to determine the potential for a commercial Arctic charr fishery. Unfortunately, due to unfavorable ice conditions, the study was not conducted over the entire duration of the upstream migration. As a result insufficient data was collected to allow definitive statements to be made concerning the size and duration of the run, or on such biological parameters as mean age, length and condition factor of the harvestable portion of the run. However, the biological information that was collected is useful as baseline data and compares favourably with data collected from Arctic charr fisheries in other areas of the Arctic.

The charr population of the Kuuk River appears to be essentially unexploited, judging from the relative abundance of large, old fish. In general the river provides easy access by boat or plane and is an ideal fishing location.

Of greatest concern may be the difficulties related to poor weather or sea-ice conditions which could prevent access to the fishing location.

5.0 RECOMMENDATIONS

1) It is recommended that the test fishery on each of the Kuuk, Kagluk and Naloagyok Rivers be repeated in the fall of 1987 and that the provisional quota remain at 1000 kg for each river.

2) It is recommended that the feasibility of using a weir to fish commercially on the Kuuk or the Kagluk and Naloagyok Rivers be investigated. This would reduce risk of spoilage of fish and reduce charter costs.

3) Future test fishery budgets should include an emergency contingency fund to be devoted towards the chartering of an aircraft in the event that sea-ice conditions prevent boat travel. In this way the test fishery would be ensured of being completed.

6.0 ACKNOWLEDGEMENTS

I would like to thank Mr. Donald Notaina and Mr. Simon Katoagyok for their considerable contribution and assistance in carrying out the test fishery. I would also like to thank the members of the Holman Hunters and Trappers Association for their support and co-operation. Additional thanks are due Suzy and Alan Sim for the support and friendship which was provided me during my stay in Holman.

Considerable thanks are also due Mr. A. H. Kristofferson of the Department of Fisheries and Oceans, Winnipeg for his assistance and advice during this study.

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APPENDIX I

Figure 1. Map of Prince Albert Sound, Victoria Island, N.W.T., showing locations of proposed test fisheries.

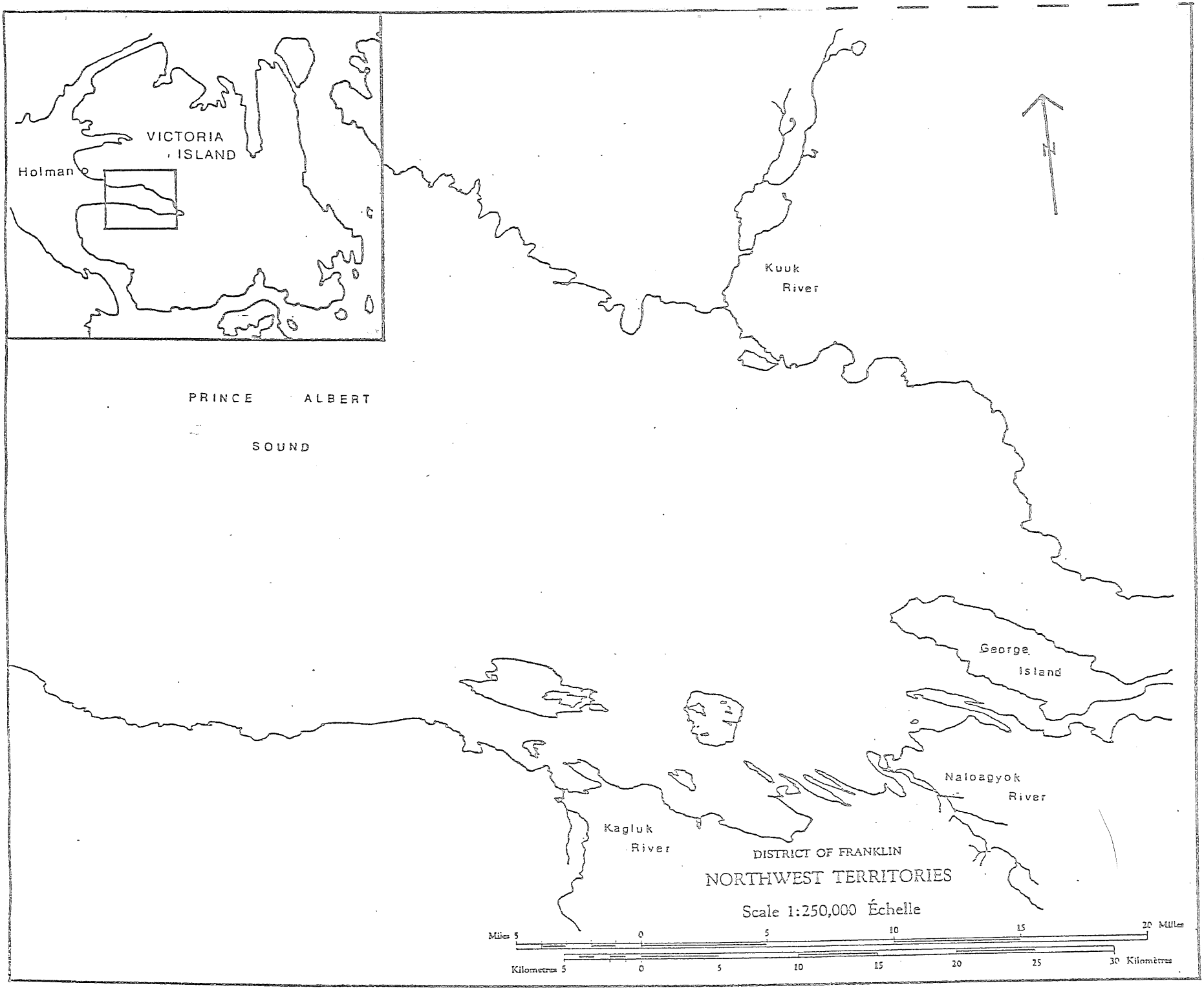

VICTORIA
ISLAND
Holman
PRINCE ALBERT
SOUND
Kuuk
River
George
Island
Naloagyok
River
Kagluk
River
DISTRICT OF FRANKLIN
NORTHWEST TERRITORIES
Scale 1:250,000 Échelle
Miles 5 0 5 10 15 20 Milles
Kilometres 5 0 5 10 15 20 25 30 Kilomètres

Figure 2. Length-frequency distribution (%) of gillnetted Arctic charr from the Kuuk River, Prince Albert Sound, between 28 August and 2 September, 1986.

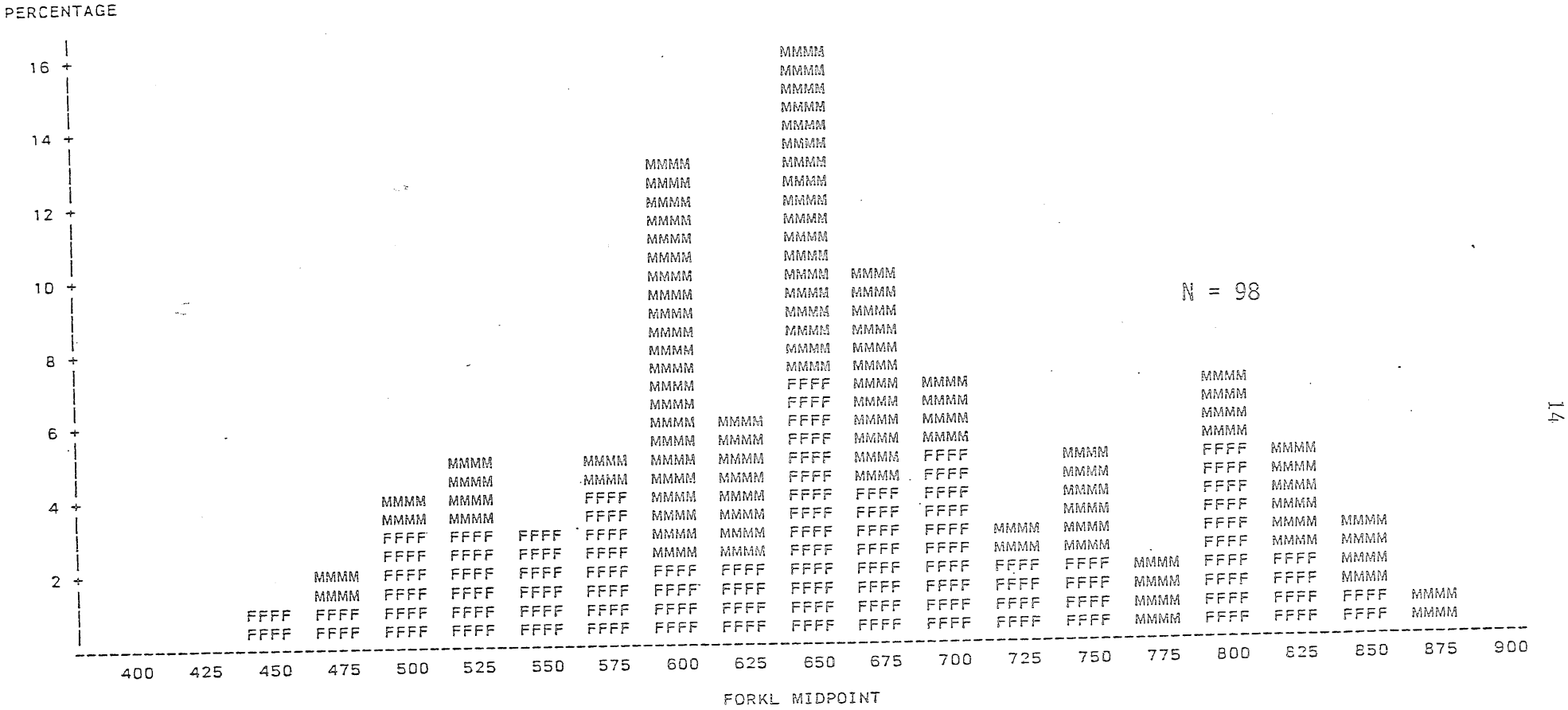

PERCENTAGE
16
14
12
10
8
6
4
2
N = 98
400
425
450
475
500
525
550
575
600
625
650
675
700
725
750
775
800
825
850
875
900
FORKL MIDPOINT

Figure 3. Age-frequency distribution of gillnetted Arctic charr from the Kuuk River, Prince Albert Sound, between 28 August and 2 September, 1986.

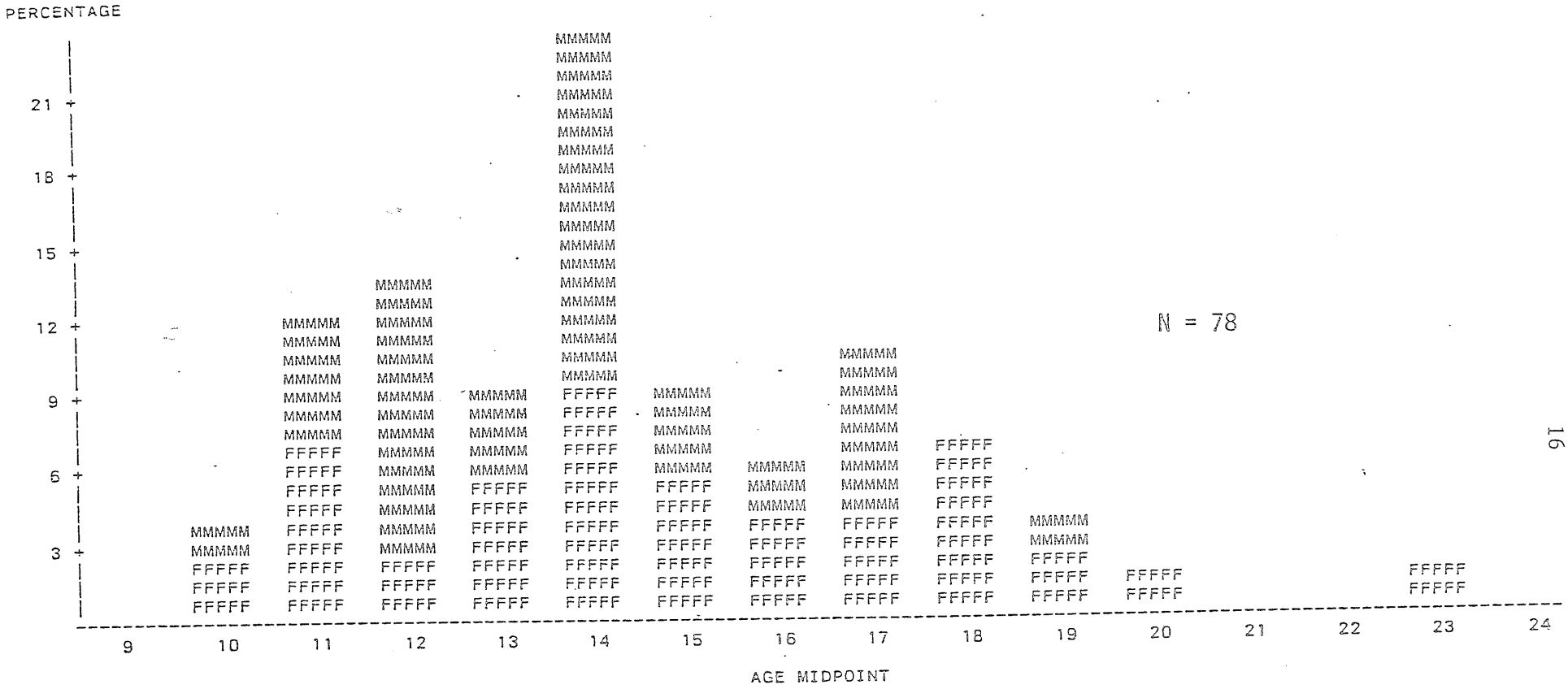

PERCENTAGE
21
18
15
12
9
6
3
N = 78
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
AGE MIDPOINT

Figure 4. Catch curve and instataneous total mortality rate (Z) for Arctic charr collected from the Kuuk River, Prince Albert Sound, between 28 August and 2 September, 1986.

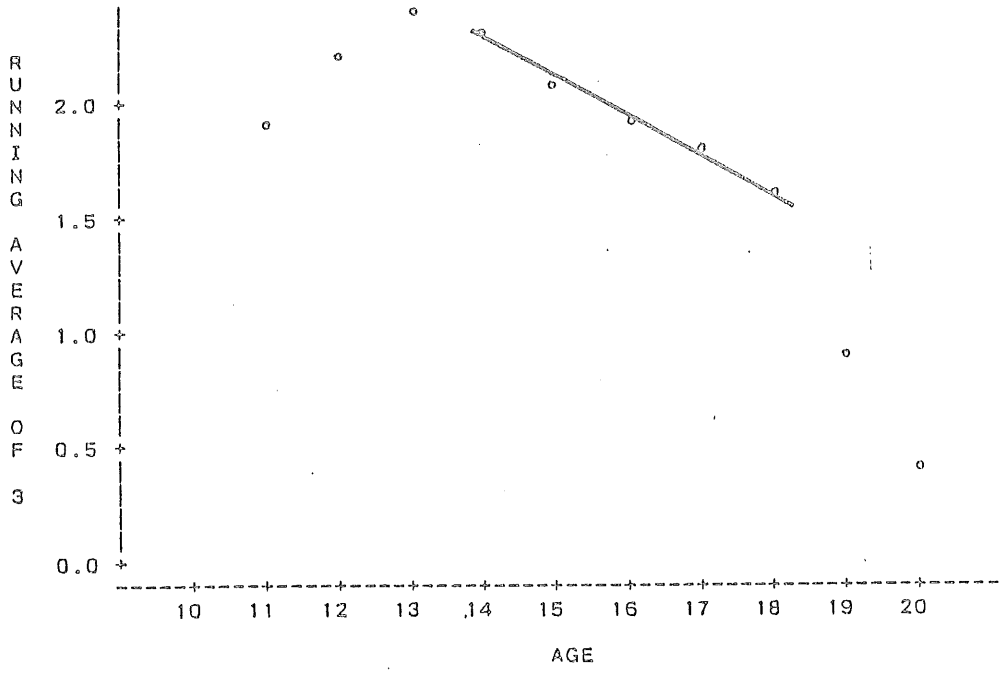
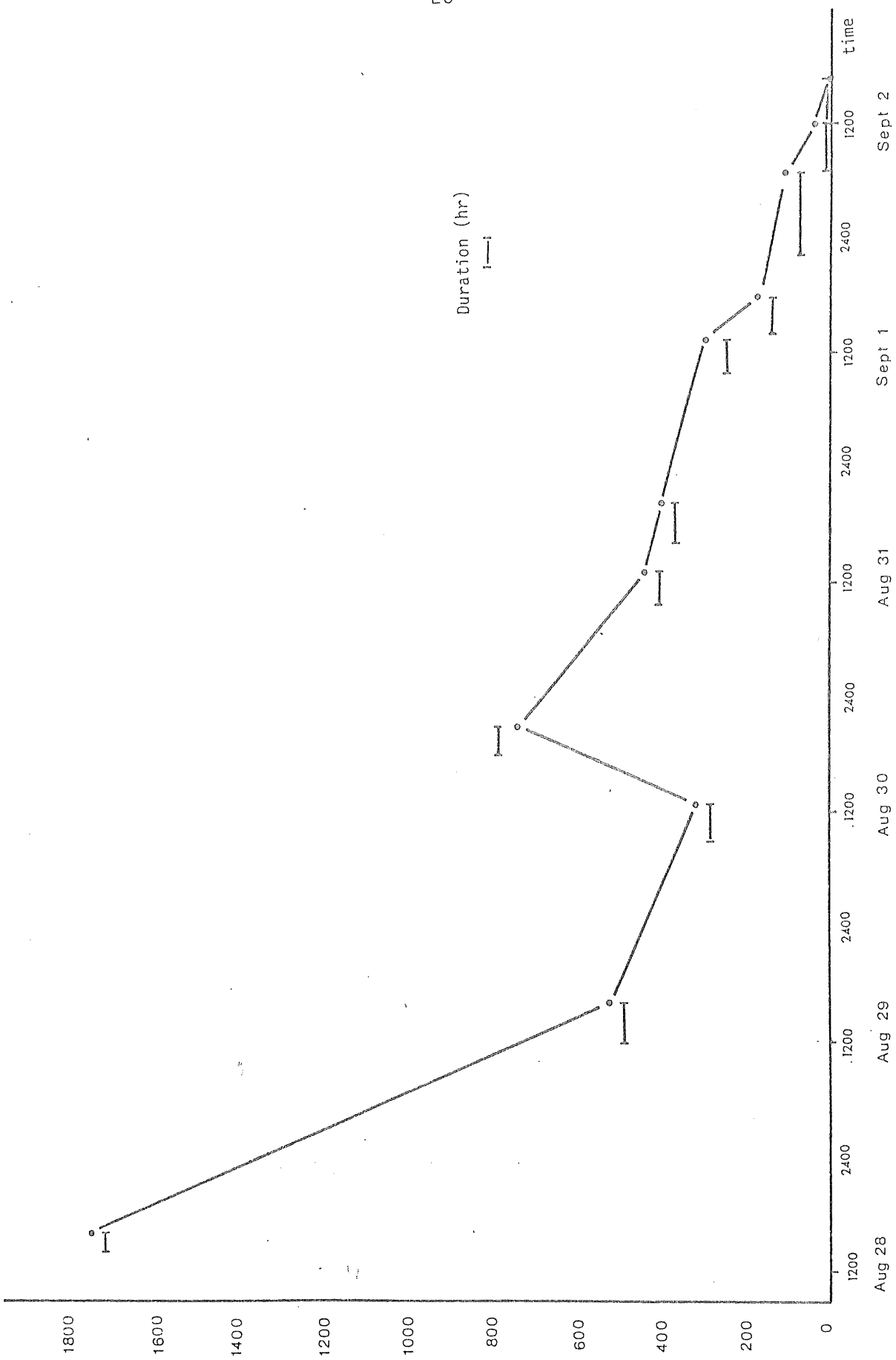

RUNNING AVERAGE OF 3
2.0
1.5
1.0
0.5
0.0
10
11
12
13
14
15
16
17
18
19
20
AGE

Figure 5. Catch per unit effort (CPUE) over time for Arctic charr collected from the Kuuk River, Prince Albert Sound, between 28 August and 2 September, 1986.


CPUE (kg fish/100 m/24 hr)
1800
1600
1400
1200
1000
800
600
400
200
0
Duration (hr)
1200
2400
1200
2400
1200
2400
1200
2400
time
Aug 28
Aug 29
Aug 30
Aug 31
Sept 1
Sept 2
DATE

APPENDIX II

Table 1. Mean fork length, mean round weight and condition factor (K) by sex and length interval for Kuuk River Arctic charr, 1986.

LENGTH INTERVAL (MM)	MALES					FEMALES					COMBINED				
		LENGTH(MM)	WEIGHT(G)				LENGTH(MM)	WEIGHT(G)				LENGTH(MM)	WEIGHT(G)		
	N	MEAN	MEAN	SD	K	N	MEAN	MEAN	SD	K	N	MEAN	MEAN	SD	K
400	-	-	-	-	-	1	443	750	-	0.86	1	443	750	-	0.86
450	2	487	1088	53	0.94	3	490	1133	58	0.96	5	489	1115	55	0.95
500	2	523	1500	141	1.05	5	529	1440	115	0.97	7	527	1457	114	0.99
550	4	590	2006	327	0.97	6	572	2017	284	1.07	10	579	2013	283	1.03
600	17	621	2487	230	1.04	7	631	2596	226	1.03	24	624	2519	229	1.04
650	10	666	2923	330	0.99	10	670	3080	192	1.02	20	668	3001	275	1.01
700	3	717	3867	336	1.05	6	718	3575	446	0.97	9	717	3672	417	0.99
750	6	768	4475	598	0.98	6	787	4417	733	0.90	12	778	4446	638	0.94
800	5	826	5349	205	0.95	2	822	5350	566	0.96	7	825	5349	285	0.95
850	2	860	6725	1414	1.06	1	860	4825	-	0.76	3	860	6092	1484	0.96
TOTAL	51					47					98				
MEAN		671	3203	1380	1.01		652	2891	1213	0.99		662	3054	1305	1.00

Table 2. Mean fork length, mean weight and condition factor (K) by sex and age for Kuuk River Arctic charr, 1986.

AGE (YR)	MALES						FEMALES						COMBINED					
		LENGTH(MM)		WEIGHT(G)				LENGTH(MM)		WEIGHT(G)				LENGTH(MM)		WEIGHT(G)		
	N	MEAN	SD	MEAN	SD	K	N	MEAN	SD	MEAN	SD	K	N	MEAN	SD	MEAN	SD	K
10	1	519	-	1400	-	1.00	2	511	96.2	1500	1061	1.01	3	514	68.2	1467	752	1.01
11	4	537	58.4	1606	600	0.99	5	522	22.4	1395	159	0.98	9	529	40.0	1489	400	0.99
12	9	608	41.2	2347	475	1.03	2	505	28.3	1263	230	0.97	11	590	56.5	2150	615	1.02
13	3	650	14.8	2933	191	1.07	4	580	20.4	2031	258	1.04	7	610	40.7	2418	527	1.05
14	11	650	29.8	2766	419	1.00	7	650	31.3	2896	402	1.05	18	650	29.4	2817	406	1.02
15	3	607	32.6	2192	591	0.96	4	646	46.3	2794	493	1.04	7	629	43.0	2536	584	1.01
16	2	746	91.2	4110	1428	0.97	3	733	77.1	3733	1061	0.94	5	738	71.4	3884	1056	0.95
17	5	717	47.0	3710	582	1.00	3	732	59.1	3717	888	0.94	8	723	48.1	3713	647	0.98
18	-	-	-	-	-	-	5	745	67.0	4085	1119	0.97	5	745	67.0	4085	1119	0.97
19	1	850	-	7725	-	1.26	2	772	28.3	3938	654	0.85	3	798	49.3	5200	2235	0.99
20	-	-	-	-	-	-	1	796	-	5650	-	1.12	1	796	-	5650	-	1.12
23	-	-	-	-	-	-	1	860	-	4825	-	0.76	1	860	-	4825	-	0.76
TOTAL	39						39						78					
MEAN		641	76	2801	1162	1.02		652	106.0	2903	1263	0.99		646	91.7	2852	1207	1.00
MEAN AGE	14.3																	

Table 3. Length (mm) - Weight (g) relationship ($\log_{10} W = a + b(\log_{10} L)$) for Arctic charr from the Kuuk River and Prince Albert Sound regions near Holman, N.W.T.

Fishery		Sex	N	Y-intercept (a)	Slope (b)	r
Kuuk River	1986	Male	51	-4.57	2.84	0.98
		Female	47	-4.85	2.95	0.98
		Total	98	-4.72	2.90	0.98
	1985*	Male	51	-3.93	2.63	0.94
		Female	50	-4.22	2.73	0.92
		Total	101	-4.14	2.70	0.93
Prince Albert** Sound	1983	Male	57	-6.51	3.58	0.88
		Female	73	-3.14	2.38	0.82
		Total	130	-4.19	2.75	0.84
	1982	Total	137	-5.99	3.38	0.97

* Kristofferson pers. comm.
** McGowan (1985)

Table 4. A comparison of biological parameters for Arctic charr from several test fisheries conducted in the N.W.T.

Fishery		Fork Length (mm)	Weight (g)	Mean Age(yr.)	Condition Factor
Kuuk River	1986	662	3054	14.3	1.00
	1985	731	4098	15.6	1.03
Prince Albert[1] Sound	1982	632	3366	12.0	1.31
Ekalluk River[2]	1984	694	3737*	14.5	1.12**
	1983	684	3263*	13.6	1.02**
Jayco River[2]	1984	649	2964*	15.0	1.08**
	1983	643	2664*	13.2	1.00**
Nauyuk River[3]	1974-77	632	2940	11.0	1.15
Keewatin District[4]	1979-81	621	2705	10.3	1.13
Steensby Inlet[5]	1985	635	3097	18.4	1.16

1 McGowan (1985)
2 Carder and Low (1985)
3 Johnson (1980)
4 Carder and Peet (1983)
5 Kroeker (1985)
* Dressed Weight
** Calculated from dressed weights