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REPORT ON THE MONITORING OF THE ARCTIC CHARR FISHERY AT THE HORNADAY RIVER 1990

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DATA COLLECTED BY:
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PROJECT FOR:
Fisheries Joint Management Committee
Inuvik, N.W.T.
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Fisheries Joint Management Committee
Report #90-002

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LIST OF FIGURES

ACKNOWLEDGEMENTS

Sampling and recording of the domestic fishery at the Hornaday River was conducted by members of the Paulatuk Hunters and Trappers Committee. Noel Green and Judy Firth set up the base camp and began monitoring the fishery. Adam Ruben and Joe Illasiak Jr. did the bulk of the sampling after initial set up. Peter Green administered contract monies and acted as a liaison person between the sampling crew and DFO. Aging was done by Gary Carder (DFO, Winnipeg) and analysis of the aged samples was conducted by Dale McGowan (DFO, Winnipeg).

1.0 INTRODUCTION

The residents of Paulatuk, N.W.T. have traditionally harvested the local resources of Arctic charr for domestic consumption. The majority of these fish have been taken from the Hornaday River which is located 14km east of Paulatuk. In 1972 a sport fishing lodge was established on the Hornaday River by the Paulatuk Hunters and Trappers Committee. It operated for two years and was closed due to lack of interest. In 1968 a commercial fishery was established with an initial annual quota of 2,300kg. The quota was raised to 4,500kg in 1974 and then to 6,800kg in 1976. Although the commercial fishery produced fairly steadily at first, declining catches in the early 1980's led residents to express concern about the state of their stock. In 1987, the commercial fishery on the Hornaday River was closed.

A number of biological studies have been conducted on the Hornaday River since concern was first expressed on the state of the Arctic charr stock. In 1986 a study was conducted by the Fisheries Joint Management Committee to determine the status of the stock. A weir was erected but collapsed before the end of the upstream run. Based on extrapolation, the upstream migrating population was estimated at about 16,000. A second weir test fishery was repeated in 1987 and again was unsuccessful.

Following the failure at enumerating the Hornaday River population, the community of Paulatuk decided to direct their efforts at alternative sources of charr to meet their domestic needs and to provide some opportunity for commercial harvests. No other significant runs of charr were found in the Darnley/Franklin Bay area. A decision was then made that the Hornaday would again became the focus of all management efforts and that a minimum requirement would be a long term monitoring program of the domestic fishery.

This report is the first of a long-term series which will examine the annual domestic charr fishery on the Hornaday River. It will form the basis upon which management decisions will be made.

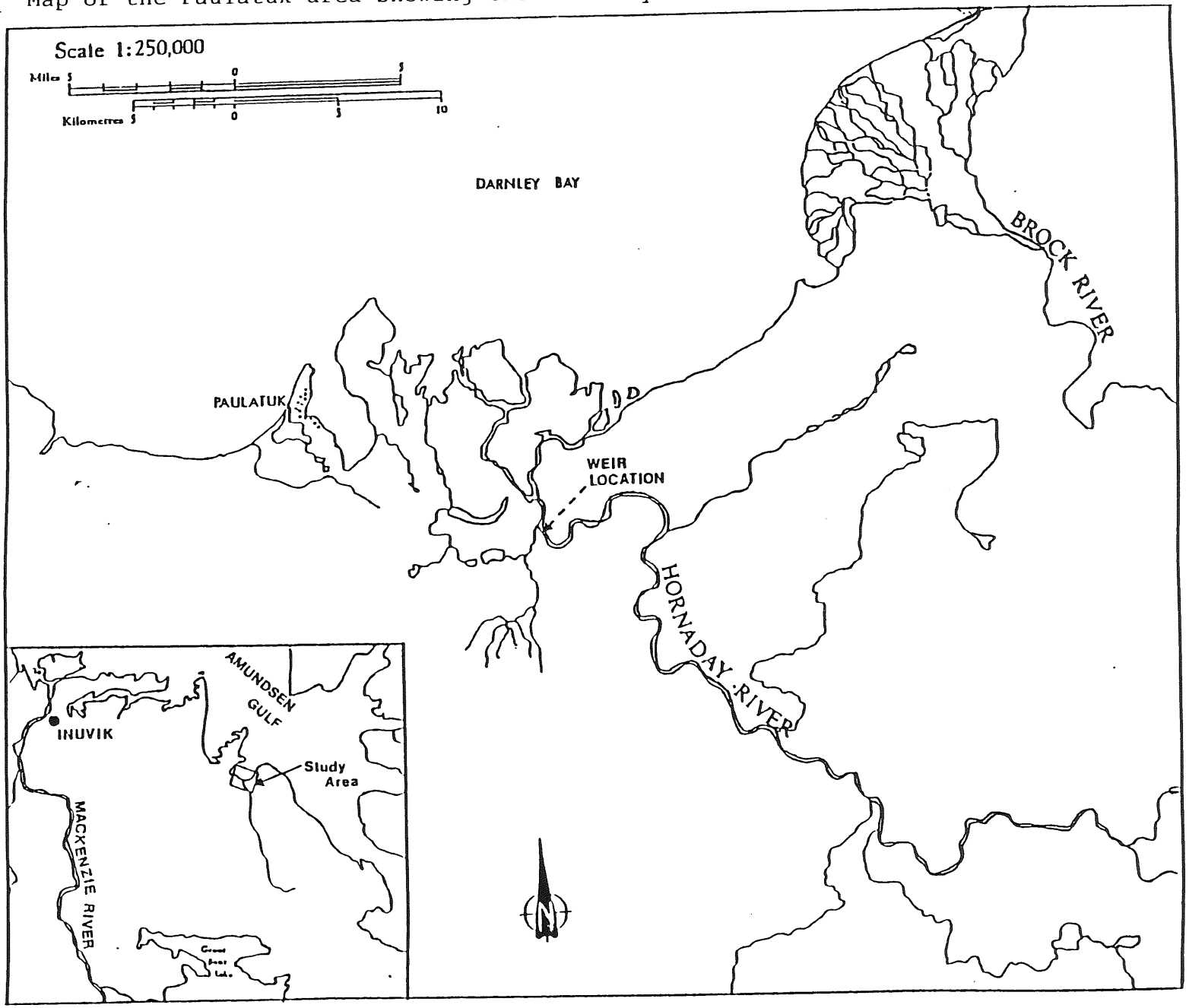
2.0 STUDY AREA

The Hornaday River is approximately 100km long and flows due north out of the Dease Arm of Great Bear Lake, N.W.T. and into Darnby Bay (Fig. 1). During high tide the mouth of the Hornaday River is approximately 40 minutes by boat to the east of Paulatuk. Travelling time increases greatly at low tide as the southern end of Darnly Bay is extremely shallow and contains numerous sand bars.

All of the domestic fishing activities take place near the mouth of the Hornaday River. This area consists of a broad delta that stretches across 7km across and 7km inland. The river bed is predominantly sand and gravel and consists of numerous channels averaging less than one meter in depth. The fishing camps are all located along the eastern most channel. All of the fishing areas are located within 5km of each other.

Further upstream, the channels converge and the river cuts through an escarpment which rises to over 200m in height. Large cobble, rocks and boulders and alternating rapids and deep holes become more predominant further upriver. Approximately 45km upstream a 20m waterfall exists which is thought to block all further upstream migrations (Sutherland and Golke, 1978).

Figure 1. Map of the Paulatuk area showing the Hornaday River.



3.0 METHODS

A contract was awarded to the Paulatuk HTC to carry out the monitoring program. Noel Green and Judy Firth were hired to set up the base camp and begin the sampling. They were later replaced by Adam Ruben and Joe Illasiak Jr. who carried on with the monitoring program to the end of the fishery.

To analyze the catch statistics accurately, catches were recorded by location. To facilitate this task, the area at the mouth of the Hornaday utilized by the fishermen was divided up into three zones. Zone 1 begins on the oceans where a few nets are set and extends upstream to the entrance sandbar. Zone 2 starts at the sandbar and extends towards the mainland up to the base at the willows. Finally, Zone 3 covers off the section between the base camp and the old weir site.

3.1 Catch Data

All of the fish caught during this domestic fishery were recorded. Catch per unit effort (CPUE) was also determined for each net set. CPUE data was converted to number of fish per 100m of net per 24hrs. Since three mesh sizes were also utilized by the fishermen (ie. 4 1/2", and 5 1/2") CPUE data was calculated for each mesh size.

3.2 Biological Sampling

A total of 787 Arctic charr taken from the catches throughout the entire duration of the run were sampled for fork lengths (+/-2mm) and round weights (+/-25g). Daily sample sizes were relative to the total daily catches (ie. approximately 50 percent of the daily catch was sampled).

An additional 192 Arctic charr chosen randomly were subjected to more detailed sampling for the following parameters:

1) Fork lengths (+/-2mm)
2) Round weight (+/-25g)
3) Age (by otolith)
4) Sex
5) Stomach content

3.3 Data Analysis

Length - frequency distribution histograms were constructed to display catch composition on a seasonal basis. Histograms were divided into 50mm length intervals (ie. 500-550mm) and designated by the upper limit (ie. 550mm). There was no need to weight the samples on the basis of daily strength of the run since daily sample sizes were directly proportional to the total daily catch. Relative condition factor (k) was determined by the following formula:

$$K = \frac{W \times 10^2}{L^3}$$

where W = round weight in grams
L = fork length in centimetres

Lengths at age was plotted. A weight-length relationship was calculated using a least squares regression analysis on logarithmic transformation of fork lengths and round weights. The relationship is described as follows:

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

where: W = round weight in grams
L = fork lengths in centimetres

A catch curve was constructed by plotting the running average of three age frequencies against age. Mortality rate was then calculated from the regression for the fully recruited age classes (ie. 8-12 yrs).

The age-frequency distribution was constructed from the random sample of aged fish. Mean lengths, weights and condition factor was determined from the larger sample of 787 charr.

4.0 RESULTS

4.1. Present and Historical Catches

A total of 1,383 Arctic charr were caught in the 1990 domestic fishery on the Hornaday River. As shown in Figure 2 values from the domestic fishery since 1987 have remained relatively constant ranging from 1,081 in 1987 to an estimated 1,600 in 1989 with a mean of 1,341. If we assume that the 1986 population estimate of 16,000 is accurate and that the population has not changed significantly since, we can say that the population is being exploited at about the 8-10 percent level.

Records of the commercial harvest prior to 1987 demonstrate that the population was very heavily exploited (assumed to have peaked above the 20% level). When examining Figure 2, it is important to remember that the values prior to 1987 do not include the domestic harvest so that in fact the bars should be significantly higher.

4.2 Strength and Timing of Migration

The 1990 domestic charr fishery on the Hornaday River began on August 9 and ended September 3. The migration peaked for a 7 day period beginning August 14 and ending August 21 (Figure 2). By the 10th of September, few fish were being caught.

The catch per unit effort (CPUE) curve shown in Figure 3 resembles the daily catch curve. The small inconsistencies between the two are due to changes in the fishing effort. CPUE for all of the mesh sizes were combined as there were no significant differences between them. As illustrated in Figure 3 CPUE values tend to fall in two general ranges; 0-30 during the slow periods of the run and 70-90 during the peak of the run. As shown in Table 1, the mean CPUE for the 1990 fishery is 40.08 charr/100m/24hrs.

With regards to the fishing locations, it was found that Area 2 had the highest CPUE effort at 50.55, then Area 3 at 30.27 and finally Area 3 at 27.0. Area 2 is the preferred location, consequently, is where most of the Fishery effort is concentrated.

Figure 2. Historical catches of Arctic charr from the Hornaday River. Values up to 1986 which was the last year for commercial fishing, include only the values from the commercial fishery. It is believed that at least 1000 additional fish were caught each year by the domestic fishery. Values from 1987 on are reported from the Inuvialuit Harvest Study and represented the total domestic catch.

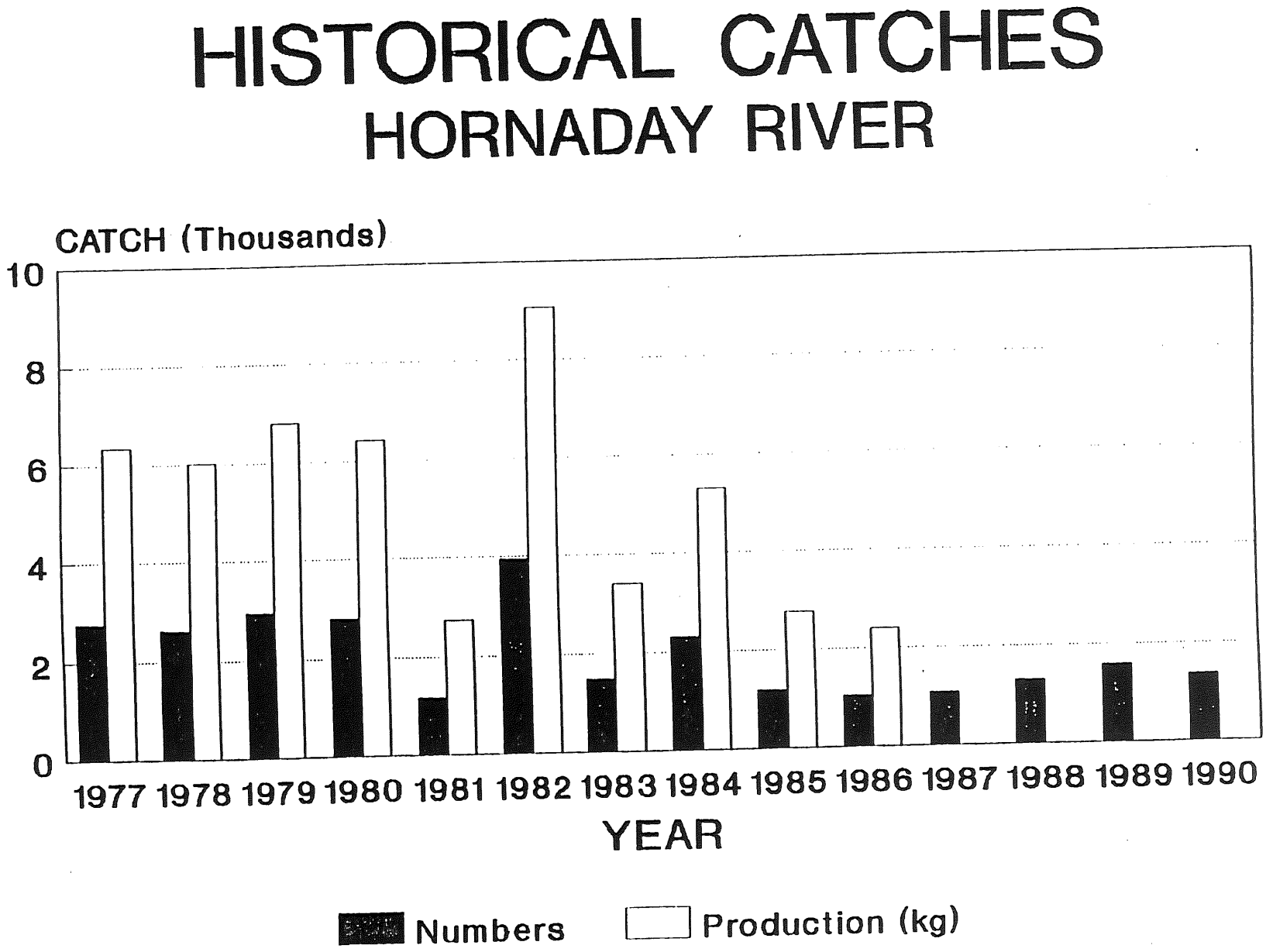


Figure 3. Catch distribution for Arctic charr from the 1990 Hornaday River domestic fishery. Value indication on the graph represent total daily catches.

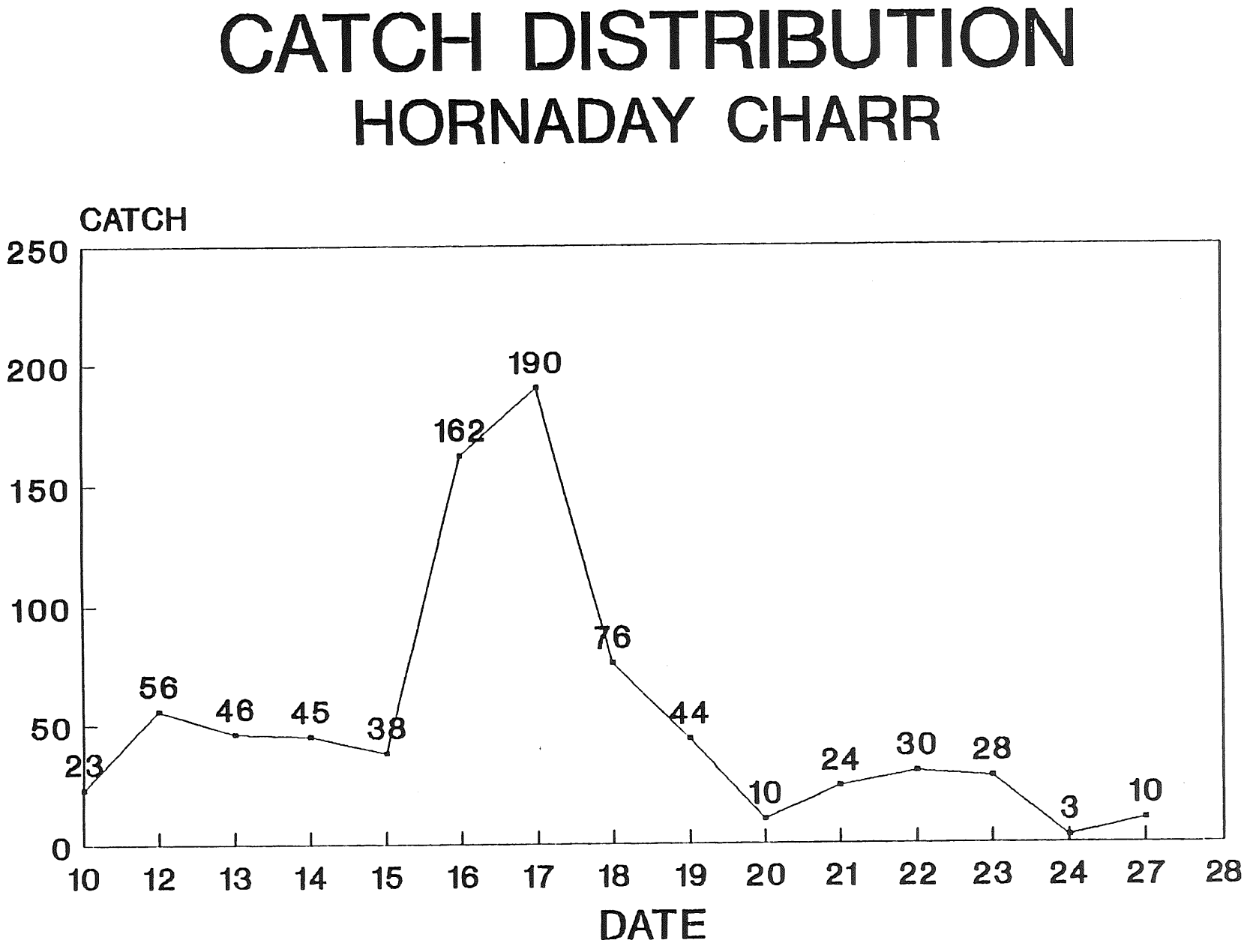


Figure 4. Catch-per-unit-effort calculated on a daily basis for the 1990 Hornaday River charr run. CPUE is expressed in # of fish/100m of net/24hrs.

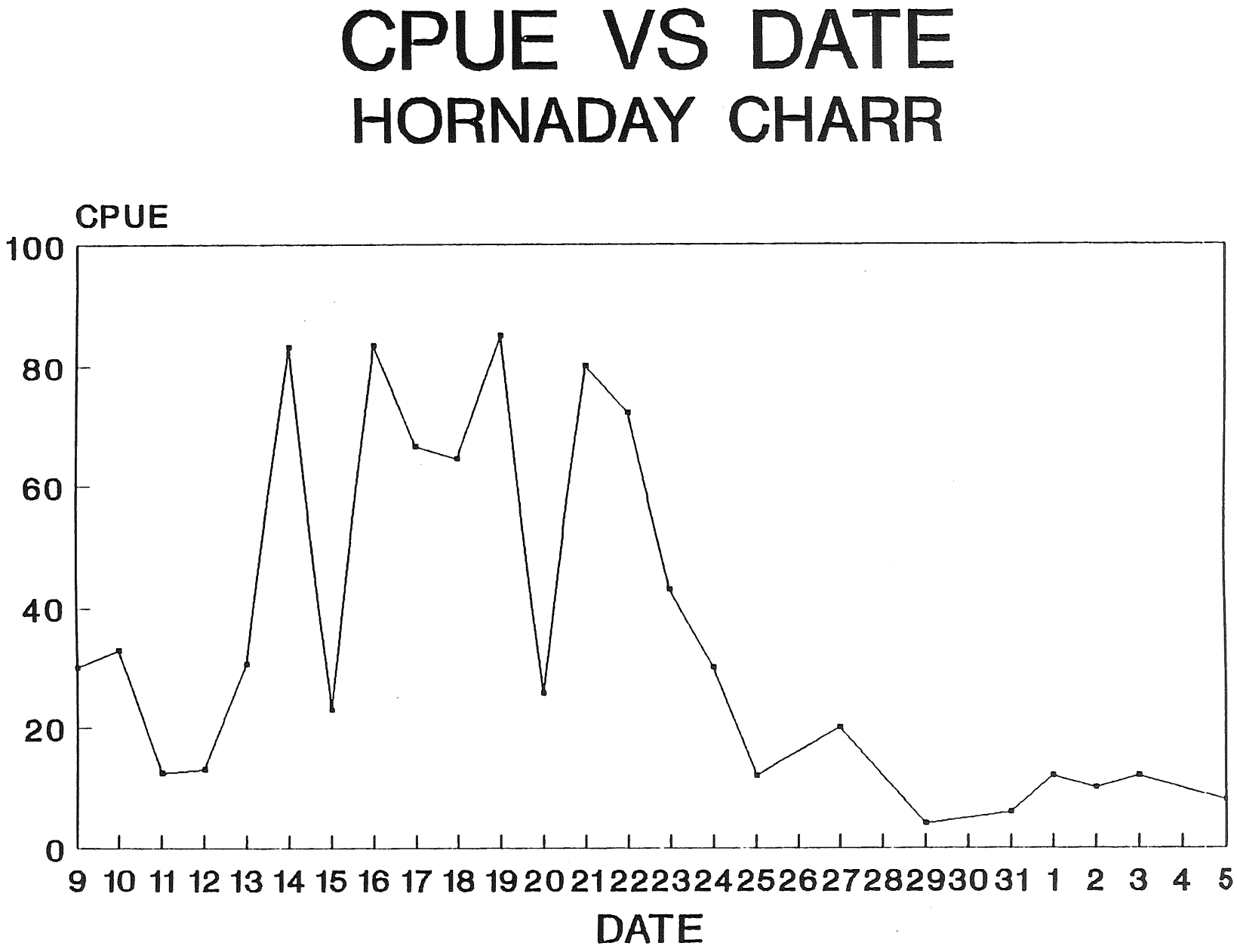


Table 1. Catch per unit effort by date and mesh size for the 1990 Hornaday River charr run. CPUE is expressed in #/100m net/24hrs.

SAMPLE NUMBER	DATE	LOCATION	MESH	LENGTH	MORNING CATCH	EVENING CATCH	TOTAL CATCH	CPUE
1	08/08/90	1	4.5	50	0	0	0	
2	09/08/90	2	4.5	50	12	3	15	30
3	10/08/90	2	4.5	50	16	6	22	44
4	10/08/90	1	5	50	7	4	11	22
5	11/08/90	1	4.5	50	7	0	7	14
6	11/08/90	1	5	50	5	0	5	10
7	11/08/90	2	5.5	50	10	2	12	24
8	11/08/90	2	5.5	50	1	3	4	8
9	11/08/90	2	4.5	50	1	3	4	8
10	12/08/90	2	5.5	50	12	1	13	26
11	12/08/90	2	5.5	50	3	2	5	10
12	12/08/90	2	4.5	50	1	2	3	6
13	12/08/90	2	4.5	50	3	2	5	10
14	13/08/90	2	5.5	50	20	0	20	40
15	13/08/90	2	4.5	50	11	0	11	22
16	13/08/90	1	5	50	9	6	15	30
17	14/08/90	2	5.5	50	12	11	23	46
18	14/08/90	2	4.5	50	17	49	66	132
19	14/08/90	1	5	50	16	20	36	72
20	15/08/90	2	5.5	50	13	3	16	32
21	15/08/90	2	4.5	50	14	5	19	38
22	15/08/90	2	4.5	50	6	0	6	12
23	15/08/90	2	5.5	50	5	0	5	10
24	16/08/90	2	5.5	50	49	24	73	146
25	16/08/90	2	4.5	50	44	21	65	130
26	16/08/90	1	4.5	50	15		15	30
27	16/08/90	2	5.5	50	9	5	14	28
28	17/08/90	2	5.5	50	18		18	36
29	17/08/90	2	5.5	50	73		73	146
30	17/08/90	3	5.5	50	10	0	10	20
31	17/08/90	2	4.5	50	24	36	60	120
32	17/08/90	1	5.5	50	4	25	29	58
33	17/08/90	2	4.5	50	8	2	10	20
34	18/08/90	2	4.5	50	25	0	25	50
35	18/08/90	3	5.5	50	7	10	17	34
36	18/08/90	2	5.5	50	31	22	53	106
37	18/08/90	2	5.5	50	15	19	34	68
38	19/08/90	2	5.5	50	35	36	71	142
39	19/08/90	1	5	50	0	9	9	18
40	19/08/90	1	5	50	0	18	18	36
41	19/08/90	1	5	50	0	49	49	98
42	19/08/90	2	4.5	50	36	30	66	132
43	20/08/90	1	5	50	18		18	36
44	20/08/90	1	5	50	15		15	30
45	20/08/90	1	5	50	10		10	20
46	20/08/90	2	5.5	50				0

SAMPLE NUMBER	DATE	LOCATION	MESH	LENGTH	MORNING CATCH	EVENING CATCH	TOTAL CATCH	CPUE
								0
47	20/08/90	2	5.5	50				
48	20/08/90	2	4.5	50	24		24	48
49	20/08/90	2	5.5	50	16		16	32
50	20/08/90	2	4.5	50	20	0	20	40
51	21/08/90	2	4.5	50	24	0	40	80
52	22/08/90	2	4.5	50	30	7	37	74
53	22/08/90	1	5.5	50	25	10	35	70
54	23/08/90	2	4.5	50	10	28	38	76
55	23/08/90	1	5.5	50	0	5	5	10
56	24/08/90	2	4.5	50	13		13	26
57	24/08/90	1	5.5	50	0	15	15	30
58	24/08/90	1	5	50	0	17	17	34
59	25/08/90	1	5.5	50	0	5	5	10
60	25/08/90	1	5	50	0	7	7	14
61	27/08/90	1	5	50	10	0	10	20
62	29/08/90	1	5	50	0	2	2	4
63	31/08/90	2	4.5	50	3	0	3	6
64	01/09/90	2	4.5	50	6	0	6	12
65	02/09/90	2	4.5	50	5	0	5	10
66	03/09/90	2	4.5	50	6	0	6	12
67	05/09/90	2	4.5	50	4	0	4	8

4.3 Size, Age and Mortality

A length-frequency distribution of all charr caught during the 1990 domestic fishery is shown in Figure 5. The modal length group is 550-600mm and the mean length is 553mm. The maximum length recorded was 795mm and the minimum was 280mm. There are no significant differences in the sizes of fish between the 1989 and 1990 samples (Table 2). The increase in mean size in 1990 and 1989 as compared to 1986 and 1987 can be attributed to the fact that the former samples are based on the domestic gill net catch which is selective for the largest fish whereas the latter samples are taken from a fish weir which is unselective.

Sizes of the Arctic charr caught from the fishery did not show any significant increasing or decreasing tendencies (Regression analysis, $P>0.25$, $DF = 14$) over the duration of the run (Figure 6).

The age frequency distribution shown in Figure 7 illustrates the modal age of 8 years. The mean age of the random sample of 192 charr was 8.3 years. Table 3 and 4 summarizes the age and length data for that sample of fish. A catch curve was constructed from the random sample of 192 fish (figure 8). Based on this curve, the total Instantaneous Mortality (Z) is 0.61. This value is higher than that of 1989, 1987 and 1986 and may be an indication of heavy exploitation.

4.4 Growth and Condition

Mean length and weight by sex and age are provided in tables 3 and 4. Figure 9 shows the age-length relationship which is similar to previous year as well as to the populations in central and eastern arctic (MacDonnell, 1989).

The mean condition factor for all 787 charr sampled was 1.28 which suggests that charr have been in very similar condition over the past 3 to 4 years (Table 1). It seems as though in 1986, however, charr were in poorer condition. This could be due to the differences in the relative duration of the growing season between 1986 and subsequent years.

Figure 5. Length-frequency distribtion of all Arctic charr caught during the 1990 domestic fishery on the Hornaday River. Actual values are indicated on top of each of the bars.

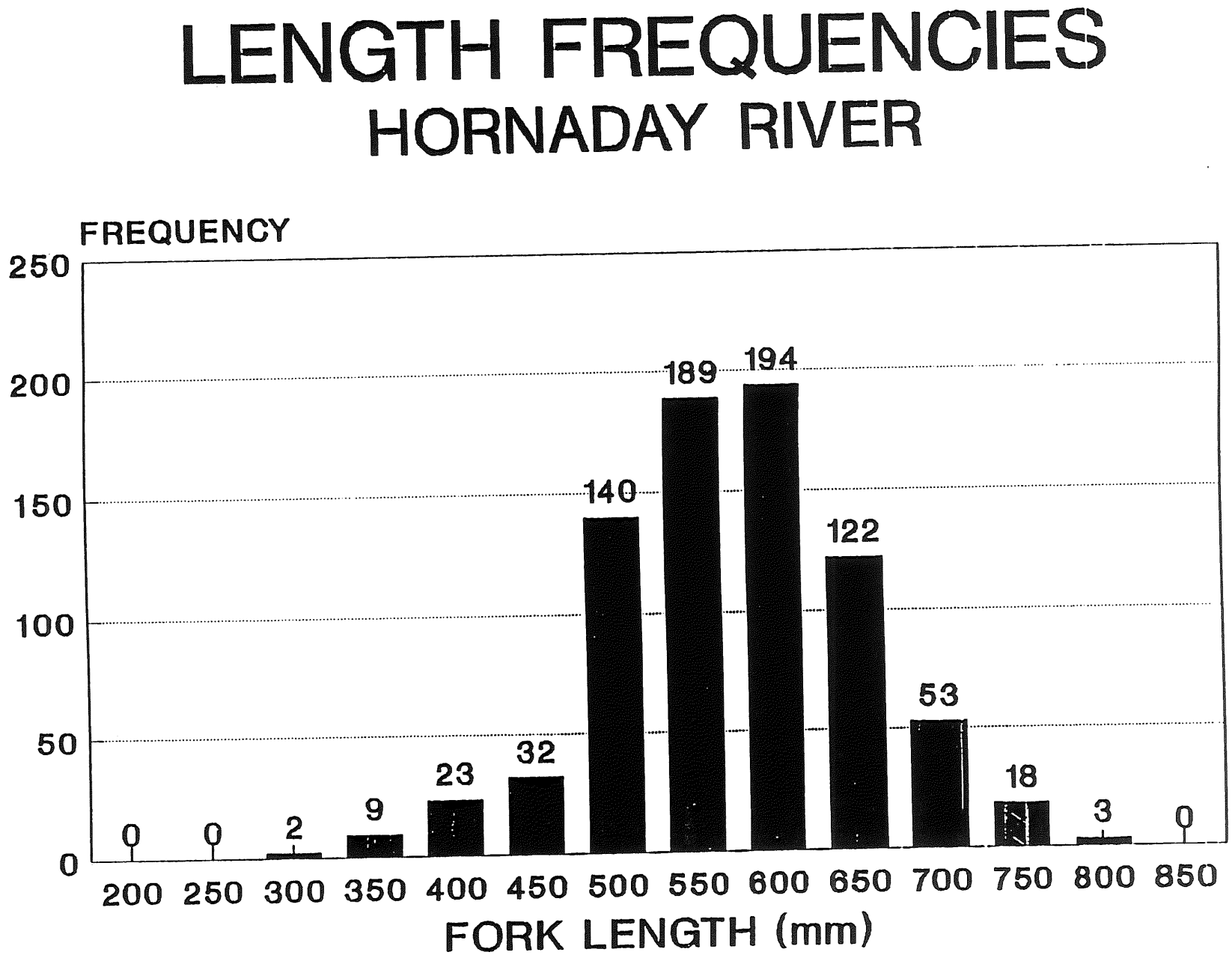


Table 2. Summary of biological data from the Hornaday River from 1986 to 1990. Data from 1986 and 1987 were obtained from the weir test fishery. Recent data is from the monitoring of the domestic fishery.

Year	Mean Length (mm)	Modal Length (mm)	Mean Age (yrs)	Modal Age (yrs)	% Females	Condition Factor (k)	Mortality (z)	CPUE (#/100m/24hr)
1986	467	500	7.1	7.0	___	1.13	0.40	___
1987	498	550	8.0	8.0	50	1.28	___	___
1989	566	600	8.2	7.0	53	1.30	0.48	___
1990	543	550	8.3	8.0	54	1.23	0.61	40.08

Figure 6. Daily mean of Arctic charr over the duration of the Hornaday River migration, means taken from the daily catches.

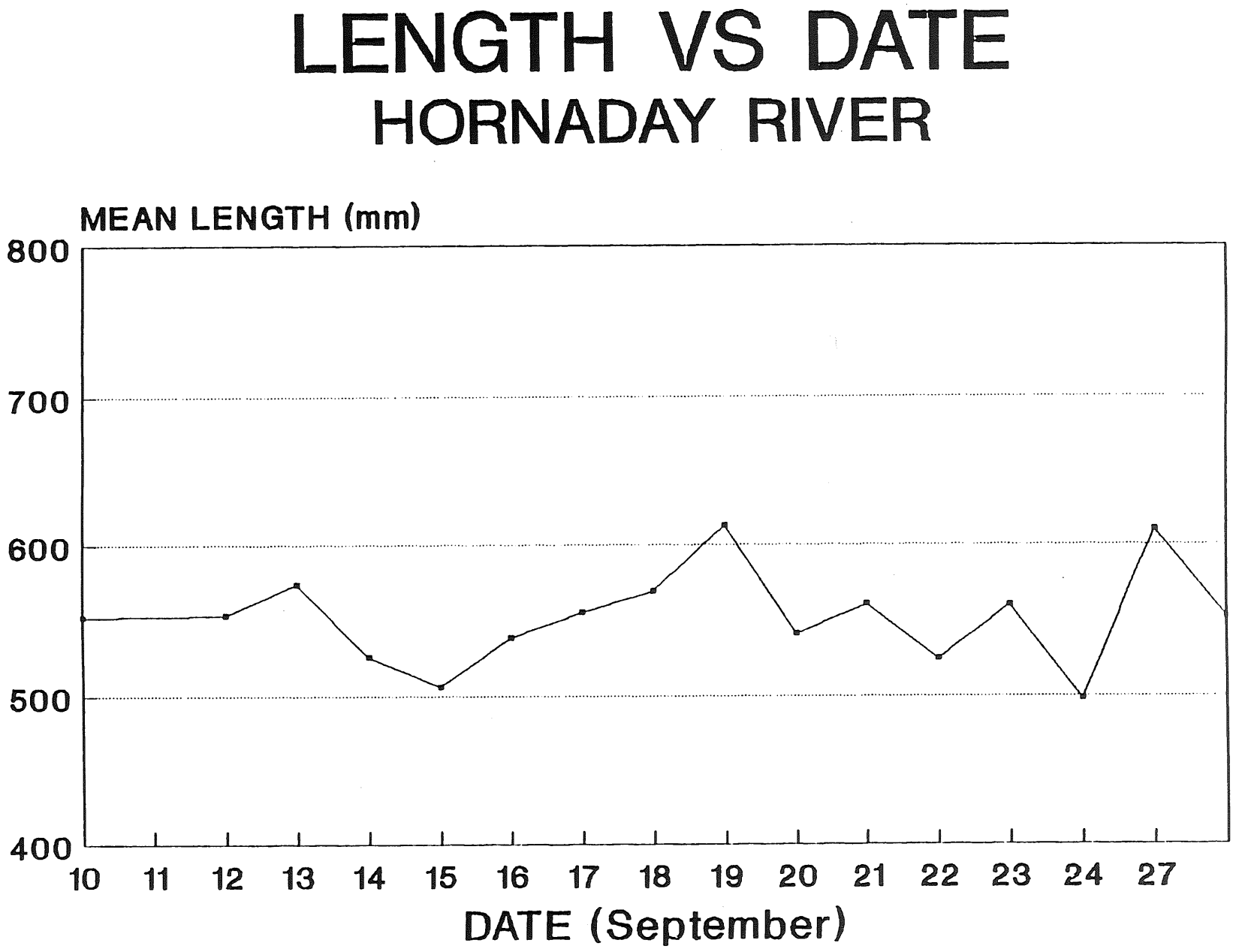


Figure 7. Age-frequency distribution of a random sample of Arctic charr caught during the 1990 domestic fishery on the Hornaday River. Actual values are indicated on the top of each of the bars.

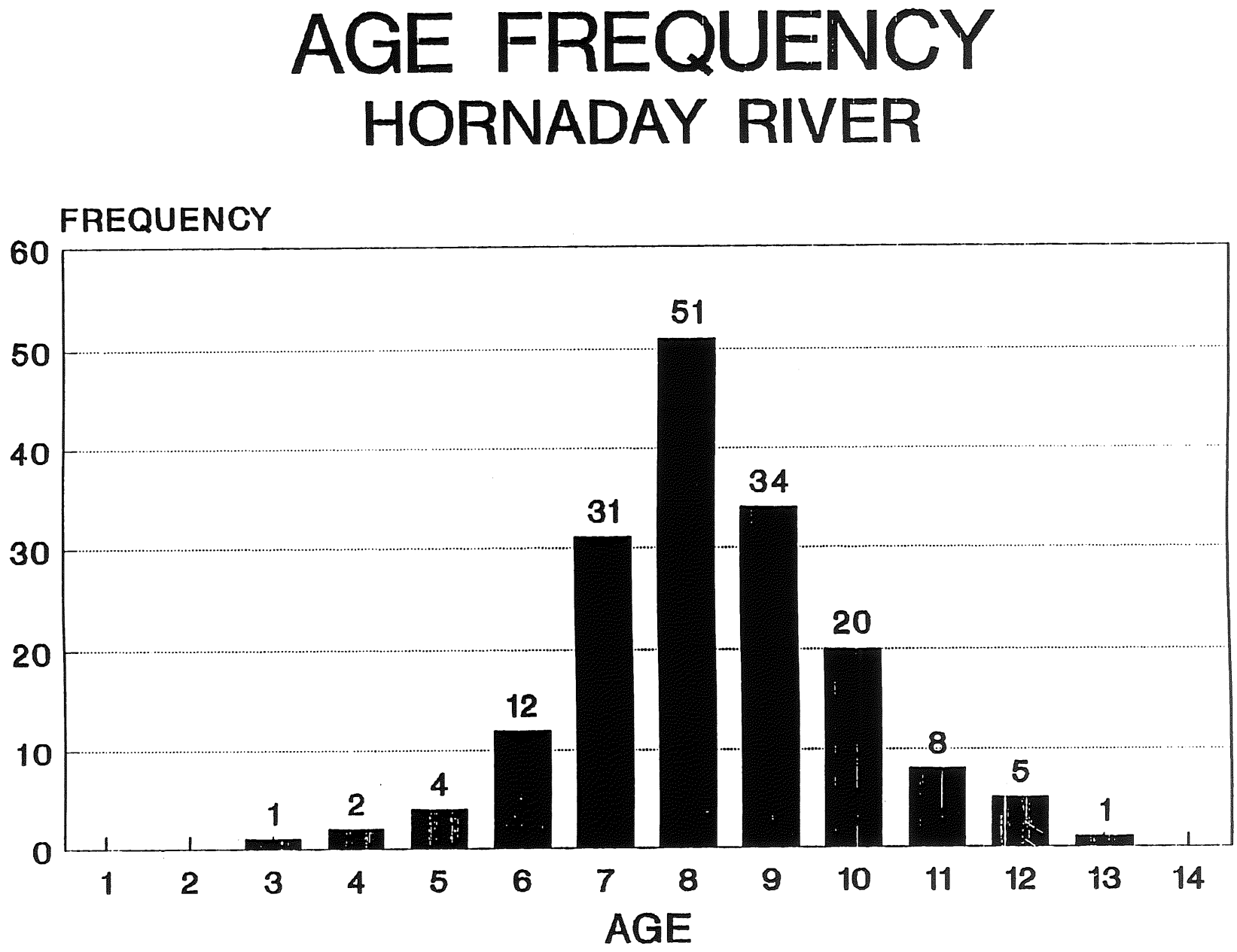


Table 3. Age composition of Arctic charr taken by test gillnets at Hornaday River, 1990.

AGE	MALES							FEMALES							COMBINED							
			LENGTH(MM)		WEIGHT(G)					LENGTH(MM)		WEIGHT(G)					LENGTH(MM)		WEIGHT(G)			%
(YR)	N	%	MEAN	SD	MEAN	SD	K	N	%	MEAN	SD	MEAN	SD	K	N	%	MEAN	SD	MEAN	SD	K	FEMALE
3	1	1	290	-	200	-	0.82	-	-	-	-	-	-	-	1	1	290	-	200	-	0.82	-
4	1	1	388	-	650	-	1.11	1	1	465	-	1300	-	1.29	2	1	427	54	975	460	1.20	50
5	1	1	500	-	1700	-	1.36	3	3	488	23	1600	100	1.38	4	2	491	19	1625	96	1.37	75
6	7	9	440	84	1143	594	1.21	5	5	504	38	1710	596	1.29	12	7	467	74	1379	638	1.25	42
7	13	17	534	39	1954	320	1.30	18	20	525	35	1756	314	1.21	31	18	529	36	1839	327	1.25	58
8	24	31	581	58	2446	828	1.22	27	30	557	60	2160	671	1.23	51	30	568	60	2295	755	1.22	53
9	15	19	595	62	2677	828	1.24	19	21	580	52	2405	725	1.20	34	20	587	56	2525	772	1.22	56
10	9	12	657	88	3678	1044	1.31	11	12	603	52	2750	614	1.26	20	12	627	74	3168	939	1.28	55
11	3	4	733	29	4533	404	1.15	5	5	622	22	2510	321	1.05	8	5	664	61	3269	1096	1.09	63
12	3	4	663	126	3850	1899	1.23	2	2	660	28	3000	849	1.03	5	3	662	90	3510	1483	1.15	40
13	1	1	695	-	3500	-	1.04	-	-	-	-	-	-	-	1	1	695	-	3500	-	1.04	-
TOTAL	78							91							169							
MEAN			575	98	2520	1156	1.24			561	60	2188	681	1.22			567	80	2341	943	1.23	54
MEAN AGE	8.3							8.3							8.3							

Table 4. Length composition of Arctic charr taken by test gill nets at Hornaday River, 1990.

LENGTH	MALES							FEMALES							COMBINED							
INTERVAL			LENGTH(MM)		WEIGHT(G)					LENGTH(MM)		WEIGHT(G)					LENGTH(MM)		WEIGHT(G)			%
(MM)	N	%	MEAN		MEAN	SD	K	N	%	MEAN		MEAN	SD	K	N	%	MEAN		MEAN	SD	K	FEMALE
250	1	1	290		200	-	0.82	-	-	-		-	-	-	1	1	290		200	-	0.82	-
300	2	2	325		400	0	1.17	-	-	-		-	-	-	2	1	325		400	0	1.17	-
350	1	1	388		650	-	1.11	-	-	-		-	-	-	1	1	388		650	-	1.11	-
400	3	3	420		900	100	1.21	2	2	435		1300	424	1.57	5	3	426		1060	313	1.36	40
450	8	9	485		1575	292	1.39	14	13	477		1393	193	1.28	22	11	480		1459	244	1.32	64
500	22	25	525		1916	432	1.32	28	27	526		1867	326	1.28	50	26	525		1888	373	1.30	56
550	21	24	570		2245	233	1.21	32	31	566		2161	298	1.19	53	28	567		2194	275	1.20	60
600	8	9	617		2775	430	1.18	17	16	624		2850	398	1.18	25	13	622		2826	401	1.18	68
650	9	10	681		3756	375	1.19	10	10	665		3395	250	1.16	19	10	672		3566	357	1.17	53
700	10	11	721		4440	428	1.19	1	1	730		4500	-	1.16	11	6	721		4445	406	1.18	9
750	2	2	760		5100	283	1.16	-	-	-		-	-	-	2	1	760		5100	283	1.16	-
800	1	1	800		6300	-	1.23	-	-	-		-	-	-	1	1	800		6300	-	1.23	-
TOTAL	88							104							192							
MEAN			575		2536	1227	1.24			561		2216	697	1.23			567		2362	986	1.23	54

Figure 8. Catch curve for Arctic charr from the domestic catch on the Hornaday River. Relationship based on the random sample of 192 charr.

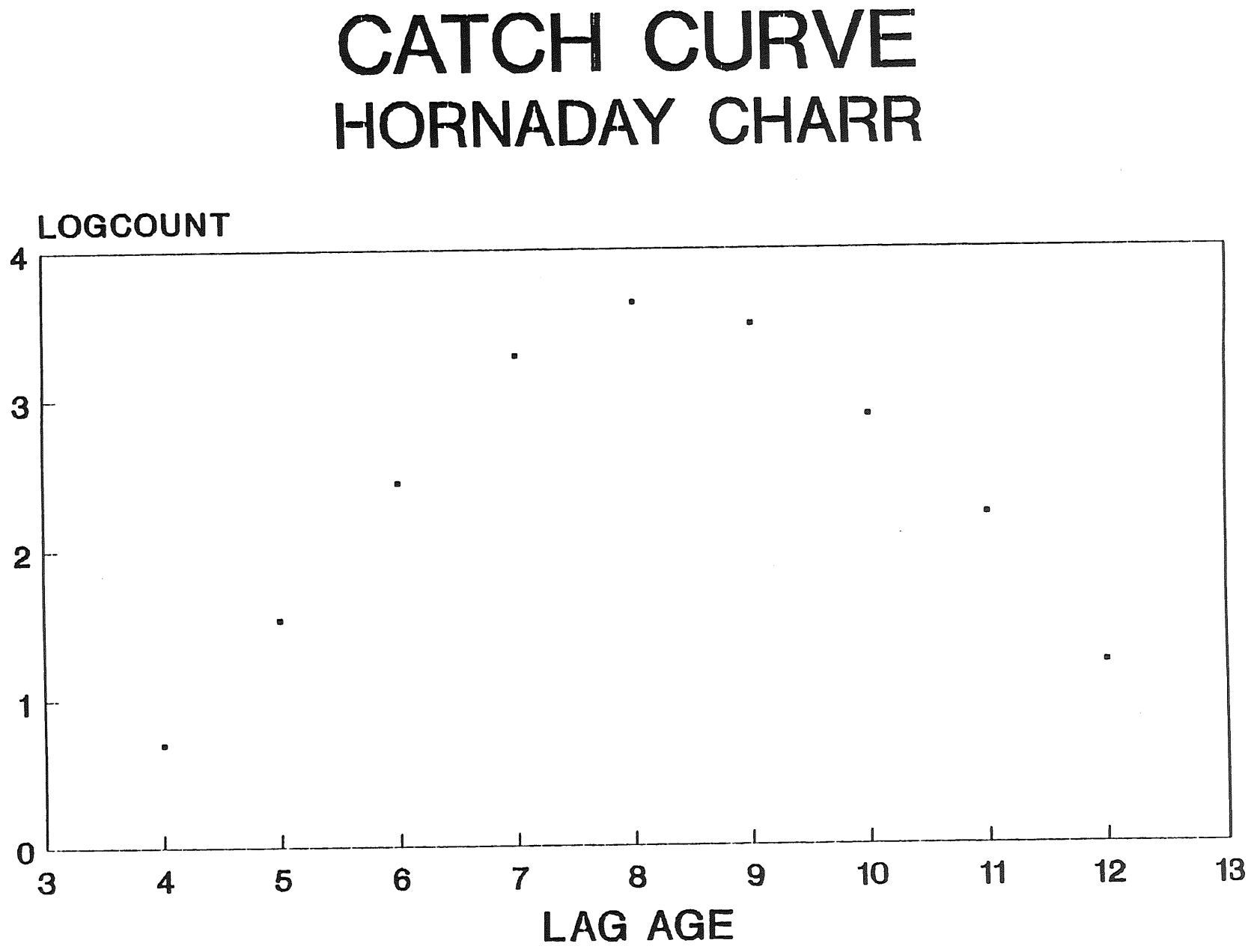
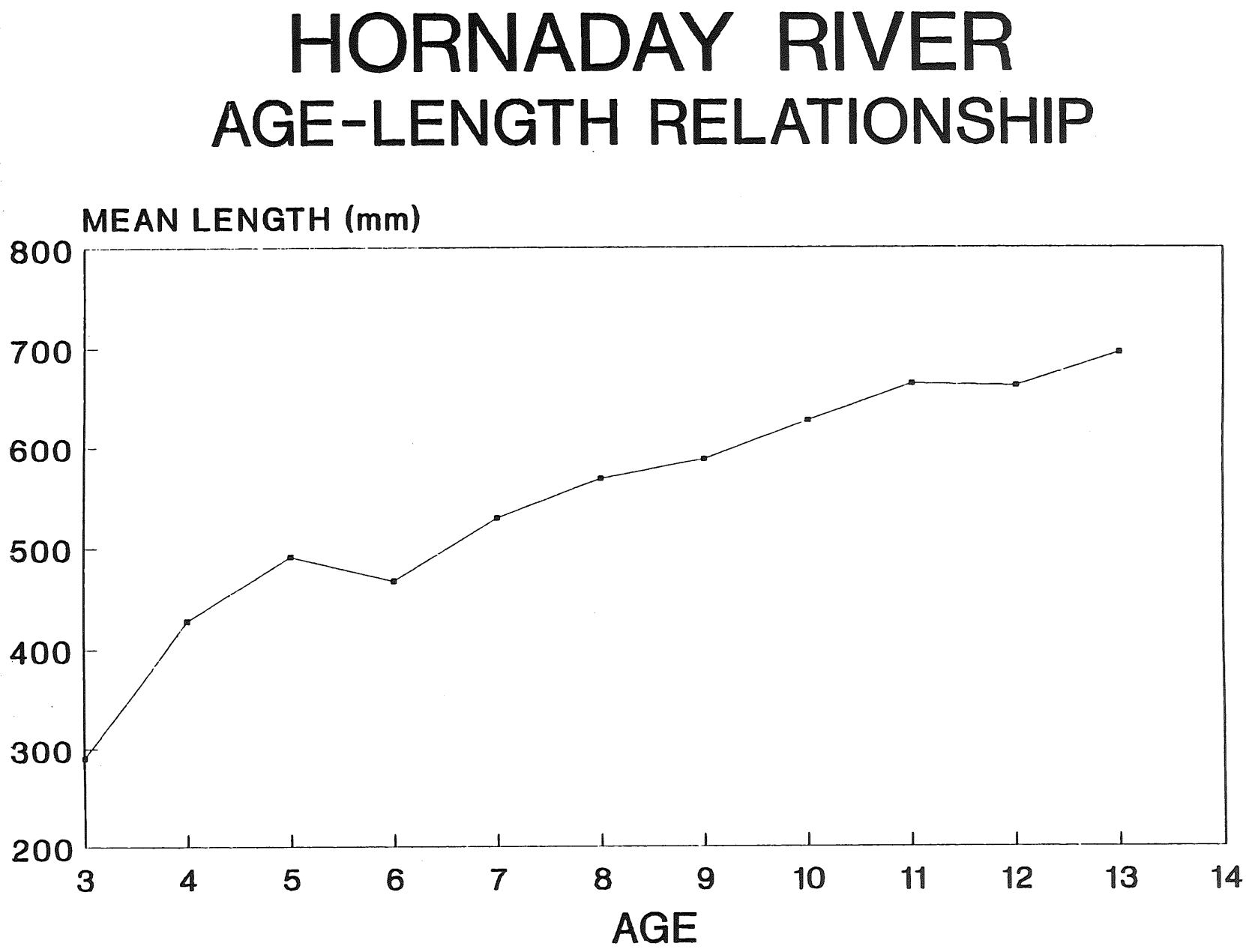


Figure 9. Age-length relationship for Arctic charr taken from the 1990 domestic fishery on Hornaday River. Total sample size is 787 charr.



5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Due to the lack of consistency in the monitoring efforts of the Hornaday River Arctic charr domestic fishery, it is difficult to determine with a high degree of confidence, whether the population has recovered following the closure of the commercial fishery in 1987. Interpretation of the data that does exist and presented in the report neither suggest that the population has recovered nor that the population has declined.

It is believed that if the present monitoring is conducted on a yearly basis in a consistent manner, it will provide an effective means of determining any trends in the Hornaday River charr population.

5.2 Recommendations

1) The Hornaday River should remain closed to commercial fishing.

2) The domestic harvest should continue to be sampled and monitored on an annual basis.

3) Sampling and monitoring of the domestic fishery should be carried out in a standardized manner so as to allow for annual comparisons between results.

4) Should a weir enumeration be conducted in 1992 or 1993, the monitoring program should also be conducted so as to establish a relationship between actual run strength and CPUE. Running both programs together for 2 to 3 years would be preferable.

5) The community of Paulatuk should consider setting a TAC on the Fishery based on their subsistence needs.

6) To avoid overexploiting the population during years of poor recruitment into the fishery consideration should also be given to setting a limit on total allowable fishing effort.

LITERATURE CITED

MacDonell, D. S. 1989. Report on the test fisheries conducted at the Hornaday, Brock and Horton Rivers and at Tom Cod Bay from 1987 to 1989; and an evaluation of the Arctic charr fishery at Paulatuk, N.W.T. A report submitted to the Fisheries Joint Management Committee by North/South Consultants Inc., Winnipeg, Manitoba. FJMC Rep. No. 89-003. 107 pp.

Sutherland, B. G. and W. R. Golke, 1978. A summary of Fisheries data collected for the land use information map series during 1975 and 1976. North of 60. Environmental Studies No. 5. D.I.A.N.D., Ottawa. IV + 97 p.