REPORT ON THE TEST FISHERIES CONDUCTED AT THE HORNADAY, BROCK AND HORTON RIVERS IN 1987-88, AND AN EVALUATION OF THE ARCTIC CHAR FISHERY AT PAULATUK, N.W.T.

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ACKNOWLEDGMENTS

Sampling and recording of the domestic fishery at the Hornaday River, enumeration of Arctic charr at the Hornaday River, and test fisheries on the Brock and Horton rivers were conducted by members of the Paulatuk Hunters and Trappers Committee, including: Tony Green, Nelson Green, Charlie Ruben, Noel Green, Sam Green, Jonah Nakimayak, David Green, Ruben Ruben, and Greg Green. Projects were managed and administered by Peter Green. David Ruben and the crew of the MV Arctic Tern transported people and supplies to the test fishery sites. Stefan Himmer (FJMC) and Vic Gillman (DFO) provided technical assistance. Analysis of the data was done by Don MacDonell (North/South Consultants Inc.).

1.0 INTRODUCTION

The community of Paulatuk, N.W.T. is located on the south shore of Darnley Bay, 400 km east of Inuvik (Fig. 1). It supports a population of approximately 200 people, many of whom utilize the local resources of Arctic char for domestic consumption. The majority of char harvested come from the Hornaday River, located 14 km to the east of the community.

During the late 1960's increasing demand for Arctic char in Inuvik led to the establishment of a commercial fishery at the Hornaday River. An initial quota of 6800 kg was set by the Department of Fisheries and Oceans (D.F.O.) and this remained unchanged for the next 16 years. Between 1977 and 1984, the fishery produced an average of 5760 kg annually (Table 1). However, by 1985 less than one half the quota was being harvested (Fig. 2). Reasons for the diminishing catch can be partially explained by decreasing effort. However, evidence of overfishing was apparent as fishermen expressed concern over the paucity and small size of char relative to previous catches.

In response to these concerns the D.F.O., Government of the Northwest Territories (G.N.W.T.) and the Paulatuk Hunters and Trappers Committee (HTC) co-operated in a study to determine the status of the Hornaday River Arctic char stock in 1986. The

study consisted of erecting a conduit weir across the river to enumerate all char migrating upstream. Due to environmental factors, the weir collapsed toward the end of the run and therefore results were therefore inconclusive. However, it was estimated that the Hornaday River Arctic char stock was comprised of just over 16,000 fish. Evidence from previous studies by the D.F.O. (Johnson 1980) indicate that a population of this size could not support a quota of 6800 kg. It was recommended that the Hornaday River be closed to commercial fishing to allow for recovery of the stock. Further recommendations were made to: 1) continue studying the Hornaday River char stock to verify the results of 1986 and 2) conduct test fisheries at other rivers in the vicinity to find alternative char stocks for commercial exploitation.

In response to the 1986 report, the D.F.O. and the Paulatuk HTC invoked a complete closure on commercial fishing at the Hornaday River in 1987. In addition, the Fisheries Joint Management Committee (F.J.M.C.) initiated a study to duplicate the weir effort of 1986. It was intended to verify the estimated population size and further document the population dynamics of the char stock in the Hornaday River. To find alternative char stocks, the Paulatuk HTC conducted gillnet test fisheries on both the Brock River (Fig. 1) in 1987 and the Horton River (Fig. 3) in 1988.

This report contains a compilation of data from the test fisheries conducted in 1987 and 1988. The primary objective was to tabulate the existing data and to determine the effectiveness of each of the projects. Data from each test fishery was compiled and analyzed separately with recommendations for future work provided for each river. An overall assessment of the Arctic char fisheries in the Paulatuk area and suggestions for future direction are presented at the end of the report.

2.0 HORNADAY RIVER

2.1 STUDY AREA

The mouth of the Hornaday River is located approximately 14 km to the east of Paulatuk (Fig. 1). The river originates 260 km to the SE and drains 14,670 sq. km (Sutherland and Golke 1978). As it cuts through the Melville Hills, it drops some 300 m in elevation over the last 40 km to sea level, creating a relatively swift current. About 7 km upstream of Darnley Bay the river breaks into a broad sandy delta of numerous shallow channels. A more detailed physical description of the Hornaday River is provided in Sutherland and Golke (1978) and Gillman et al. (1985).

Arctic char generally run upstream in the Hornaday River from the first week of August until the first week of September. Local fishermen report the peak of the migration usually occurs between August 10 and August 25, as it did during the 1986 study (August 16) (MacDonell 1986). This is when the majority of domestic fishing is conducted at the mouth of the east channel. (Fig. 1). It is unknown where char spawn in the system but it is believed they overwinter in the main channel. There is a 20 m waterfall 45 km upstream, which is thought to block all further upstream fish migrations (Sutherland and Golke 1978).

2.2 METHODS

2.2.1 Test Fishery

Weir test fisheries have been conducted on numerous rivers throughout the arctic with varying results (Gillman and Sparling 1985; Kristofferson et al. 1986; MacDonell, 1986, 1987). The degree of success depends primarily on the terrain of the surrounding area and weather conditions encountered. The 1987 weir test fishery on the Hornaday River was intended to duplicate the effort of 1986. It was assumed that if reasonable weather was encountered and if proper precautions were taken during rising water, the weir might be able to be maintained for the duration of the upstream migration of char.

Assembly of the weir commenced on August 1 with five men participating. Due to high water levels the fence was not fully operational until August 5. The weir was erected approximately 20 m upstream of the 1986 site, in calmer water (Fig. 1). The width of the river at this location was 90 m with a maximum depth of 1.2 m. The fence was 135 m in length with a trap situated 20 m from the east shore. Three individuals stayed on site to run the test fishery.

All char entering the trap were enumerated. A portion of these fish (up to 700) were measured for fork length ($\pm$1 mm),

weighed (±20 g), tagged and released. Up to 100 char were also selected by length, in a stratified manner, to be dead sampled. Fork length, weight, sex and maturity were recorded for each fish. A sagittal otolith was extracted for subsequent age determination in Winnipeg.

From August 2 to August 20 water in the river dropped to such a level that the trap had to be moved to deeper water to provide adequate fish passage. However, between August 22 and August 25 continual precipitation caused the river level to rise by 61 cm. Conduit was removed during this period to relieve the added pressure on the weir. However, despite these precautions, the weir collapsed on the morning of August 25. The site was then abandoned to allow for the water to recede and the subsequent recovery of the weir. On August 30 an attempt was made to gillnet char at the weir location. This proved unsuccessful as the net became fouled with debris and caught few fish. The test fishery at this point was considered complete and focus shifted to extracting the weir from the river.

2.2.2 Data Analysis

Total catch of all species was tabularized. Length-frequency distribution histograms were constructed to display catch composition, both overall and on a daily basis. Mean fork

length (±1 mm), round weight (±20 g) and relative condition factor (K) were calculated by sex, age and length interval. Relative condition factor (K) was determined by the following formula:

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

where: W = round weight in grams
L = fork length in millimetres

Age at length was plotted and growth rates between years and rivers were compared visually. A weight-length relationship was calculated using a least squares regression analysis on logarithmic transformations of fork lengths and round weights. The relationship is described as follows:

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

where: W = round weight in grams
L = fork length in millimetres

All data analysis were performed using the Quattro program on an IBM compatible personal computer.

2.3 RESULTS

2.3.1 Magnitude and Timing of Migration

The weir on the Hornaday River was operational for a period of 20 days (Aug. 5 - Aug. 24). During this time a total of 1270

Arctic char were enumerated migrating upstream. The first char was caught on August 6. However, char were observed above the fence during construction indicating some fish had migrated upstream prior to completion of the weir. The first significant catch occurred on August 18 when 16 char were captured. The daily catch remained relatively low until August 23 when 234 char were enumerated. The peak of the enumerated portion of the migration occurred on the last day of weir operation (August 24) when 935 char passed through the trap. Table 2 provides the daily catch of all fish caught during the test fishery. In 1986 the migration started earlier with over 500 fish enumerated on August 15 and the peak occurring on August 16. Reasons for the delay in the migration in 1987 are unknown, but it is apparent that the timing is quite variable from year to year. Results indicate the peak of the migration in 1987 occurred after August 24, which was at least one week later than in 1986.

Data collected in 1987 were insufficient to make any inferences on total numbers of Arctic char migrating upstream in the Hornaday River.

2.3.2 Tagging

A total of 156 Arctic char were tagged and released at the Hornaday River between August 18 and August 24, 1987. Total

numbers tagged on a daily basis are given in Table 2. A list of the date, fork length, round weight and sex of each fish tagged is presented in Appendix I.

2.3.3 Size, Age and Maturity

A length-frequency distribution of all char caught during the 1987 test fishery is shown in Figure 4. The modal length group was 550-599 mm (Figure 4) and the mean length was 502 mm (N=277) (Table 3). The maximum fork length recorded was 685 mm while the minimum was 198 mm. The mean round weight was 1803 g (N=264) and ranged from 60 g to 4600 g. In 1986 the mean length and weight were both lower at 467 mm and 1188 g, respectively. The modal length group of the 1986 enumeration was 400-499 mm (MacDonell 1986).

The increase in mean size of fish encountered in 1987 as compared to 1986 can be attributed to the portion of the migration that was sampled. Previous studies have shown that larger char tend to migrate upstream earliest followed by a smaller size mode (Johnson 1980, McCart 1980). The 1987 weir fishery sampled only the early portion of the run which likely caused an overestimation of the mean length and weight and pushed the bulk of the total length-frequency distribution (Figure 4) to the right. In 1986 the larger size modes declined significantly toward the

latter part of the enumeration and this appeared to be occurring in 1987 just before collapse of the weir. Daily length-frequencies, illustrated in Figure 5, show a slight shift toward 200-399 mm fish during the last three days of the enumeration. However, no trend toward a decreasing daily mean length was evident (Table 3).

The youngest char encountered in 1987 was 3 years of age and the oldest was 12 (N=50). The average age of the stratified dead sample was 8.0 (Table 4). These results are similar to those obtained in 1986.

Sexually mature char were conspicuously rare in the 1987 fishery (Table 4). Only one char out of 50 sampled (2%) was found to be mature. A similar low ratio of mature char was found in 1986, suggesting that current year spawners in this system might remain in freshwater throughout the year.

2.3.4 Growth and Condition

Mean length and weight by sex and age are provided in Table 4. Mean weight by length interval is shown in Table 5. Mean length and range in length for each age is plotted in Figure 6. This data shows a growth rate similar to that illustrated by the 1986 results (Fig. 7). A comparison of growth rates to other

char stocks in the N.W.T. is shown in Figure 8. Hornaday River char display a growth rate which approximates those in the central and eastern arctic and comparable to that found for the Brock River.

The mean condition factor for all char sampled was 1.28 (N=264) which suggests that char were in slightly better condition than was found in 1986 (K=1.13). This could be due to the lateness of the run in 1987, resulting in an extended period of stay in salt water. Average relative condition factors by sex and age, and length interval, are given in Tables 4 and 5, respectively.

The weight-length relationship calculated from the 1987 test fishery results is as follows:

$$\text{Log}_{10}W = -4.80 + 2.96 \log_{10}L \quad (N=264)$$

This is very similar to the equation calculated from the 1986 results and shows a weight gain with increase in length comparable to other char populations in the arctic.

2.4 CONCLUSIONS AND RECOMMENDATIONS

2.4.1 Conclusions

It is clear from the results of the 1986 and 1987 test fisheries that it is very difficult to maintain a weir on the Hornaday River for any length of time. The high surrounding elevation causes precipitation to run off quickly creating rapid fluctuations in river levels. Similar difficulties in maintaining weirs in rivers descending from much higher elevations have been encountered by other test fisheries in the western arctic (Gillman and Sparling 1985, MacDonell 1987, Fehr and Archie 1989). Therefore, from past experience, it is unadvisable to attempt any further enumerations of the resident char stock in the Hornaday River using this method. The weir could still be used for a commercial fishery in a partial span configuration. However, this would also be risky in that quite a bit of effort might be expended for little return in the event that a wash-out occurred before the run had started.

Since it is desireable to know the magnitude of a char migration to effectively manage the commercial fishery harvesting it, alternative methods should be considered to obtain a reliable estimate of the Hornaday River stock. One possible option would be to conduct a Schaefer stratified population estimate using gillnets. This method is much more flexible than a weir in that

it is possible to respond to fluctuating weather conditions by removing gillnets from the river. However, the method also relies on tagging a significant number of char at a downstream location. This could prove to be difficult and should be considered thoroughly before attempting this method of enumeration.

The 1987 test fishery produced biological results very similar to those obtained in 1986. The only significant differences occurred in the timing of the migration and the size of the fish encountered. The bulk of the migration in 1987 started one week later than 1986, but apparently still took place during the month of August. The increase in size of fish encountered can be attributed to the portion of the migration which was enumerated and not to a significant change in mean size of the migration. Age, maturity and growth data were almost identical between years.

Results from 1986 and 1987 have provided good baseline data on the biological condition of the Hornaday River char population. The domestic fishery and any further test fisheries should monitor changes in biological parameters within the stock to determine the extent to which the closure of the commercial fishery is having on the recovery of the stock.

2.4.2 Recommendations

1) Commercial fishing on the Hornaday River should remain closed or be severely restricted. Priority should continue to be given to the domestic fishery until the Arctic char population size can be verified.

2) Enumeration of the upstream migration of char in the Hornaday River using a weir is not feasible and efforts to do so should be suspended.

3) A population estimate should be attempted possibly using a Schaefer stratified population estimate.

4) Baseline data is now adequate. The domestic fishery and future test fisheries should be monitored to show changes in population structure to indicate the changing status of the stock.

5) Tagging programs should be continued and tag returns monitored to provide rough Petersen estimates and information on immigration and emigration from the system.

6) A test fishery in the winter or radio tagging could be conducted to determine overwintering locations of char to provide the possibility of conducting a Petersen estimate through the ice.

7) Test fisheries should continue to be conducted at other rivers in the vicinity to provide alternative char populations for exploitation and possible pulse fishing.

3.0 BROCK RIVER

3.1 STUDY AREA

The mouth of the Brock River is situated approximately 20 km to the east of Paulatuk (Fig. 1). It originates a further 70-80 km east and drops approximately 500 m through the Melville Hills to sea level, draining 3000 sq. km into the southeast corner of Darnley Bay. The mouth consists of a broad delta and lagoon stretching approximately 10 km across and 10 km inland. Further descriptions of the physical characteristics of the Brock River are given in Sutherland and Golke (1978) and Gillman et al. (1985).

Residents of Paulatuk report that an upstream migration of Arctic char occurs in the Brock River during August (Sutherland and Golke 1978). However, there has been no commercial and very little domestic fishing conducted at this river in the past. Subsequently, little is known about the timing and magnitude of the upstream migration of the resident char stock.

The 1987 test fishery was conducted to explore the possibility of the Brock River providing the community of Paulatuk with an alternative source of Arctic char for commercial exploitation.

3.2 METHODS

3.2.1 Test Fishery

One fisherman from Paulatuk and his family conducted the test fishery at the Brock River during August, 1987. They set up camp on August 1, approximately 13 km upstream of the mouth, above the forks. One 210-9 monofilament, 139 mm mesh, 24 mesh deep, 29 m long gillnet was set on August 4 at the location indicated in Figure 1. This site was approximately 1 m deep and the bottom consisted of boulders. The net was checked daily using chest waders and was fished 24 hr per day until August 21. On August 22 water levels in the main channel rose to unworkable levels and the net was subsequently moved to the mouth of a blind channel to facilitate picking and eliminate fouling by debris. The net was set at this location until the conclusion of the test fishery on August 29.

All fish captured were sampled for fork length ($\pm$1 mm), round weight ($\pm$20 g), sex and maturity. Sagittal otoliths were extracted for age determination by the D.F.O. in Winnipeg.

3.2.2 Data Analysis

Data were analyzed using the methods described in Section 2.2.2. Stomach content analysis and daily length frequency distributions were not conducted due to the paucity of data collected.

3.3 RESULTS AND DISCUSSION

3.3.1 Magnitude and Timing of Migration

The first Arctic char was captured at the Brock River on August 9. Char were caught virtually everyday thereafter to the conclusion of the test fishery. However, the highest daily catch was only five char and on most days only one or two were caught (Table 6). In total, 32 char were captured between August 9 and August 29.

Between August 9 and August 21 the gillnet was set partway across the main channel. The resulting catches (Table 6) indicate few char ran up the Brock River during this time. However, due to the weather conditions, the net was moved on August 22. It is not known whether the new net placement affected its catchability and therefore it is difficult to say whether the catch of the test fishery after this date was truly

indicative of the run. This is especially true considering the Hornaday River migration peaked at least as late as August 24. If the majority of Brock River char also migrated after this date the bulk of the migration might have been missed.

3.3.2 Size, Age and Maturity

A length-frequency distribution of all Arctic char caught from the Brock River in 1987 is illustrated in Figure 9. The modal length group was 550-649 mm. Char ranged in length from 464 mm to 726 mm. The mean fork length was 587 mm (N=32) (Table 7). The heaviest char caught had a round weight of 4325 g (726 mm) while the smallest char weighed 1025 g (464 mm). The mean weight of all char captured (N=32) was 2278 g (Table 7).

The youngest char captured was 7 years of age while the oldest was 12 (Table 7). One male and three females were found to be sexually mature (9%). These fish were 9 and 10 years of age.

3.3.3 Growth and Condition

Mean length and weight by sex and age are given in Table 7. Mean weight by length interval is presented in Table 8. Mean

length and range of lengths for each age sampled is illustrated in Figure 10. Length at age of Brock River char is compared to other char stocks in the N.W.T. in Fig. 8. Brock River char show a comparable growth rate to char stocks in the central and eastern arctic and to the Hornaday River char stock.

Mean relative condition factors by age and sex, and length interval, are given in Tables 7 and 8, respectively. The mean condition factor for all char sampled from the Brock River was 1.12 (N=32). This indicates a relatively healthy population of char with respect to robustness of the fish and, though slightly lower, compares favourably to the condition calculated for Hornaday River char in 1987.

The weight-length relationship for Brock River char was calculated as:

$$\text{Log}_{10} W = 3.13 + 2.34 \log_{10} L \quad (N=32)$$

This is comparable to many other char populations but differs slightly to that calculated for Hornaday River char.

3.4 CONCLUSIONS AND RECOMMENDATIONS

3.4.1 Conclusions

Results from the 1987 test fishery are inconclusive with respect to the magnitude of the upstream migration of Arctic char in the Brock River. However, the low numbers of char caught precludes the institution of a commercial fishery at this time. A further test fishery is required to verify the paucity of char encountered in 1987.

Mean size of char caught in the Brock River were larger than char from the Hornaday River indicating a somewhat less exploited population. However, sample size was so small (N=32) no definitive statement can be made. It is possible that these two rivers could support fish from the same stock. Kristofferson et al. (1984) found char in Wellington Bay utilized a number of rivers over a period of a couple of years. This situation could occur in Darnley Bay and subsequently exploitation of char in the Brock River should be considered cautiously.

3.4.2 Recommendations

1) Another test fishery should be conducted on the Brock River, utilizing more gillnets than 1987, to determine the magnitude of the upstream migration.

2) A tagging program should be instituted during the test fishery to determine the degree of utilization of the Hornaday River by Brock River char.

4.0 HORTON RIVER

4.1 STUDY AREA

The mouth of the Horton River is located approximately 130 km northwest of Paulatuk on the west coast of Franklin Bay (Fig. 3). It originates only 60 km north of Great Bear Lake and is 400 km in length draining an area of 26,700 sq. km. Sutherland and Golke (1978) report the river is approximately 60 m wide and has a depth of one to three metres. The bottom substrate consists primarily of gravel. Both Sutherland and Golke (1978) and Gillman and Sparling (1985) provide detailed descriptions of the river.

Residents of Paulatuk report a fall migration of Arctic char up the Horton River during August (Sutherland and Golke 1978). However, fishing has rarely been conducted here in the past primarily due to its distance from any population centres. Therefore, little is known about population size or life history characteristics of char in this system.

In response to the demand for an alternative to the Hornaday River char population for the Paulatuk commercial fishery, a test fishery was conducted on the Horton River in August of 1988. The fishery was facilitated by the Arctic Tern, a schooner owned by

the Paulatuk HTC, which provided transportation to and from the Horton River.

4.2 METHODS

4.2.1 Test Fishery

The Horton River test fishery crew left Paulatuk on the Arctic Tern on July 30, 1988. Due to bad weather conditions arrival at the Horton River was delayed until August 8. Two individuals were left at the river with a Zodiac boat to conduct the test fishery. A test net gang of 38, 63, 89, 114 and 139 mm mesh panels was set on August 9, 3/4 km upstream of the mouth at the location indicated in Figure 3. The river at this location was 1-2 m deep and had a bottom substrate of sand and rock. A 114 mm mesh net was also set outside the mouth of the river, however, it is unclear how long this net was fished for. The nets were left in 24 hours per day except when they were removed for cleaning. On August 19 a 139 mm mesh commercial net was also set in the river.

All char caught were enumerated and the majority were dead sampled. Fork length (±1 mm), round weight (±20 g), sex, maturity and stomach contents were recorded for each fish. No

aging structures were taken. A sample of 19 char were sent to Winnipeg for stock identification analysis.

Reconnaissance of the river was conducted on August 10 by zodiac for weir sites to a distance of 9 km upstream. On August 25 the river was flown for 35 to 45 km upstream to look for possible char spawning areas.

4.2.2 Data Analysis

Mean length and weight for all fish caught in each mesh size were calculated and tabularized. All other data were analyzed similar to the methods described in Section 2.2.2. However, no aging structures were collected and therefore no analysis based on age could be performed. Maturity codes were also determined to be inconsistent and subsequently no sexual maturity analysis was conducted. Data were not analyzed on a daily basis due to the small data return.

4.3 RESULTS

4.3.1 Magnitude and Timing of Migration

The total daily catch of all fish caught during the 1988 test fishery is presented in Table 9. The first char were captured on August 9 and char were caught virtually everyday thereafter until conclusion of the project on August 29. A total of 120 Arctic char were captured over the 22 days. Daily catches were generally small (1-13 char) except for on August 24 when 20 char were taken. More than 66% of all char caught were taken after August 20. This increase in catch can be partially attributed to increased effort after August 19, with the addition of the 139 mm commercial gillnet. However, results still suggest that the peak of the migration in 1988 occurred during the fourth week of August.

Data from test fishery at the Horton River gives no indication that a substantial run of char occurred in 1988. Catch per unit effort was generally low compared to catches from test fisheries conducted on other commercially fished rivers in the N.W.T. It is possible that a substantial number of char ran upstream after the conclusion of the fishery. However, this is unlikely as the majority of char migrations in this area of the N.W.T. usually peak in August.

Reconnaissance of the river by fixed wing aircraft found no evidence of char spawning sites upstream. It was also determined that construction of a weir across this river is not feasible.

4.3.2 Size

The length-frequency distribution for all char caught from the Horton River in 1988 is presented in Figure 11. The modal length group was 650-699 mm and the mean length (N=94) was 528 mm (Table 10). The maximum fork length encountered was 786 mm while the smallest char measured 279 mm. Char weight ranged from 200 g (325 mm) to 5800 g (783 mm). The mean weight of all char captured (N=94) was 2075 g (Table 10). Forty-one percent of the char were over 600 mm in length, indicating that this stock has had little exploitation in the past. Test fisheries on the Hornaday River in 1986 and 1987 showed that only 3-16% of that char stock, which has a history of commercial and domestic fishing, was over 600 mm in length.

Table 10 shows the mean length and weight of Arctic char caught in each of the mesh sizes used during the 1988 test fishery. As would be expected, the larger mesh sizes caught larger fish. The 38 mm mesh caught no fish but the 63 mm and 89 mm meshes produced over 50% of the catch. The test fishery crew reported char ripping through the larger mesh of the test gang

which accounts for the low catches in the 114 mm and 139 mm meshes. The highest catch occurred in the 139 mm mesh commercial net which was not used until August 19. Thus, the catchability of larger fish prior to this date is somewhat in question. This might explain the low catches of the test fishery prior to August 20.

4.3.3 Growth, Condition and Stomach Contents

Mean length, weight and relative condition factor by length interval is presented in Table 11. The mean condition factor for all char sampled was 1.15 (N=94). This compares favourably to other char stocks in the vicinity.

The weight-length relationship for Horton River Arctic char was calculated as:

$$\text{Log}_{10}W = -5.09 + 3.05 \log_{10}L \quad (N=94)$$

Stomachs were primarily empty (76%). Insect remains were in 52% of the stomachs containing food items while the other 48% contained fish remains.

No age data were collected and therefore no analysis of growth based on time could be conducted.

4.4 CONCLUSIONS AND RECOMMENDATIONS

4.4.1 Conclusions

Results of the 1988 test fishery at the Horton River suggest that the population of char utilizing this river is unexploited but also relatively small. Catch per unit effort was low indicating that commercial exploitation at this time would not be feasible. However, data was somewhat biased due to the ineffectiveness of the larger mesh gillnets used. A further test fishery should be conducted to verify the 1988 results. Any subsequent test fishery should use commercial gillnets as well as test gangs. A larger number of nets should be used and set in a variety of locations to ensure the upstream migration is properly sampled and not biased by net location. The test fishery crew should also stay on location into September to ensure the entire run has been sampled.

4.4.2 Recommendations

1) Commercial fishing at the Horton River is not recommended at this time due to the low catch per unit effort encountered in 1988.

2) Another test fishery should be conducted to verify the 1988 results using more nets, in more locations and continuing into September.

3) If more char could be captured at the mouth of the river, a Schaefer stratified population estimate could be conducted.

5.0 ASSESSMENT OF THE PAULATUK ARCTIC CHAR FISHERY

Interest remains high in Paulatuk to re-establish a commercial char fishery in the area and supply an extra source of income for the community. Test fisheries on the Hornaday River have indicated that this stock alone cannot sustain a commercial and domestic fishery sizeable enough to satisfy local needs. Furthermore, results from test fisheries conducted at the Brock and Horton Rivers have indicated that neither of these fisheries provide a viable alternative. However, each of these test fisheries have left some doubt as to the size of the migrating populations in each of these rivers. It is therefore recommended that these test fisheries be repeated before changing the commercial fishing policy for each of these systems.

Future test fisheries should employ new or refined methods to provide more conclusive data. This might include:

1) conducting more extensive test fisheries using more nets in a greater variety of locations and for longer periods of time to ensure significant results

2) utilizing mark and recapture experiments to provide population estimates rather than attempting direct enumerations using weirs

3) utilizing new technologies such as bio-acoustics and electric barriers to obtain direct counts.

In 1989, test fisheries will be conducted at the Aniyak River and at Baleana Bay; and the domestic catch will be sampled at the Hornaday River. The former studies will provide data to find alternative char populations for commercial exploitation while the latter will monitor changes of the Hornaday River char population in response to the closure of the commercial fishery. Additional test fisheries could also be conducted in the future at the Roscoe and Croker Rivers.

Test fisheries in the vicinity of Paulatuk might identify a number of rivers that support char populations. However, many of these systems may not be able to support a large sustainable commercial fishery. These stocks could be targeted by a pulse fishery, where sizeable quotas could be taken at each river in alternating years allowing for recovery of the system before exploitation is repeated. This could make a commercial fishery more economically viable by focusing effort on one specific location each year instead of at a number of rivers.

The re-establishment of a commercial fishery in the Paulatuk area would surely benefit the local economy. However, priority should be given to maintaining the domestic fishery which continues to play an important role in the community.

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Table 1. Commercial harvest from the Hornaday River between 1977 and 1986.

Year	Production (kg rnd. wt.)
1977	6341
1978	6023
1979	6795
1980	6427
1981	2721
1982	9072
1983	3400
1984	5300
1985	2764
1986	2402*

* estimated

Table 2. Total daily catch of all species of fish caught in the weir and by angling at the Hornaday River during August, 1987. Numbers in brackets represent the number of char tagged included in the total count.

Date	Arctic char	Broad whitefish	Longnose sucker	Arctic grayling	Arctic cisco
Aug. 5		5	8	1	
Aug. 6	6	6	25		
Aug. 7	1	9	49	1	
Aug. 8		17	37		1
Aug. 9	1	26	61		
Aug.10		10	46		
Aug.11		24	41		
Aug.12		19	26	2	
Aug.13		47	27		
Aug.14	6	17	27		
Aug.15		5	5		
Aug.16		1	6		
Aug.17	1	8	1		
Aug.18	16 (4)	2	7	3	
Aug.19	18 (1)	4			
Aug.20	26 (3)	5	3		
Aug.21	9 (8)	1	17		
Aug.22	17 (8)	2	23		
Aug.23	234 (76)	10	21		
Aug.24	935 (56)	37	17		
Total	1270(156)	255	447	7	1

Table 3. Mean fork length, round weight and relative condition (K) of Arctic char sampled by the 1987 test fishery at the Hornaday River, on a daily basis.

	LENGTH (mm)			WEIGHT(g)		
DATE	N	MEAN	SD	N	MEAN	SD	K
Aug. 7	1	605	-	1	2040	-	0.92
Aug. 9	1	530	-	1	1980	-	1.33
Aug.14	6	556	47.0	6	2056	552.9	1.17
Aug.18	9	495	47.4	9	1714	303.9	1.43
Aug.19	16	554	53.7	16	2271	688.4	1.30
Aug.20	23	547	52.0	18	2116	617.9	1.27
Aug.21	9	538	120.0	9	2178	867.2	1.24
Aug.22	11	478	102.7	11	1513	788.3	1.18
Aug.23	121	528	97.0	114	2003	933.8	1.27
Aug.24	80	433	118.5	79	1332	928.6	1.33
TOTAL	277			264			
MEAN		502	108.2		1803	930.1	1.28

Table 4. Mean fork length (mm), round weight (g) and relative condition factor (K) by age and sex for Arctic char taken by the test fishery at the Hornaday River during August, 1987.

Age (Yr)	Males							Females							Combined						
	N	LENGTH (mm) MEAN	SD	WEIGHT(g) MEAN	SD	K	% MAT	N	LENGTH (mm) MEAN	SD	WEIGHT(g) MEAN	SD	K	% MAT	N	LENGTH(mm) MEAN	SD	WEIGHT(g) MEAN	SD	K	% MAT
3	1	198	-	140	-	1.80	0	-	-	-	-	-	-	-	1	198	-	140	-	1.80	0
4	1	220	-	150	-	1.41	0	2	252	5.0	230	30.0	1.43	0	3	241	15.6	203	45.0	1.42	0
5	1	332	-	420	-	1.15	0	2	265	39.5	210	90.0	1.06	0	3	287	45.3	280	123.3	1.09	0
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	5	503	47.8	1880	292.6	1.49	0	2	475	25.0	1300	300.0	1.19	0	7	495	44.4	1714	394.3	1.41	0
8	8	519	41.5	1796	460.4	1.26	0	10	525	23.2	1832	180.5	1.27	0	18	522	32.7	1816	335.6	1.27	0
9	8	589	34.8	2915	528.3	1.41	0	3	530	7.8	1893	213.1	1.27	0	11	573	40.1	2636	649.9	1.38	0
10	-	-	-	-	-	-	-	3	522	27.2	1922	561.5	1.31	0	3	522	27.2	1922	561.5	1.31	0
11	1	608	-	2250	-	1.00	0	1	605	-	2040	-	0.92	100	2	607	1.5	2145	105.0	0.96	50
12	-	-	-	-	-	-	-	2	590	30.0	2260	440.0	1.08	0	2	590	30.0	2260	440.0	1.08	0
TOTAL	25							25							50						
MEAN		510	111.2	2002	914.4	1.37			487	106.3	1592	691.6	1.24			498	109.3	1797	836.2	1.30	
MEAN AGE	8.0																				

Table 5. Mean round weight and relative condition factor (K) by length interval for Arctic char sampled during the test fishery at the Hornaday River, August 7-24, 1987.

FORK LENGTH (mm)	N	WEIGHT (g)	SD	K
150	1	140	-	1.80
200	8	178	108.7	1.36
250	11	286	61.2	1.45
300	15	419	63.8	1.25
350	11	623	81.8	1.19
400	16	996	218.2	1.25
450	45	1397	257.8	1.29
500	57	1928	283.4	1.30
550	59	2443	291.8	1.29
600	33	2928	460.8	1.23
650	8	3590	728.9	1.19
TOTAL	264			
MEAN		1803	930.1	1.28

Table 6. Daily catch of Arctic char caught by the test fishery at the Brock River during August, 1987.

Date	Arctic char
August 9	1
August 10	1
August 11	2
August 12	1
August 13	1
August 14	-
August 15	2
August 16	2
August 17	5
August 18	4
August 19	-
August 20	2
August 21	1
August 22	2
August 23	1
August 24	-
August 25	1
August 26	2
August 27	1
August 28	2
August 29	1
Total	32

Table 7. Mean fork length, round weight and relative condition factor (K) by age and sex for Arctic char taken by the test fishery at the Brock River during August, 1987.

Age	Males							Females							Combined						
		LENGTH (mm)		WEIGHT(g)			%		LENGTH (mm)		WEIGHT(g)			%		LENGTH(mm)		WEIGHT(g)			%
(Yr)	N	MEAN	SD	MEAN	SD	K	MAT	N	MEAN	SD	MEAN	SD	K	MAT	N	MEAN	SD	MEAN	SD	K	MAT
7	2	470	5.5	1028	2.5	0.99	0	1	470	-	1225	-	1.18	0	3	470	4.5	1093	93.1	1.06	0
8	1	580	-	2025	-	1.04	0	4	541	18.9	2200	248.8	1.42	0	5	549	23.1	2165	233.3	1.34	0
9	1	642	-	3125	-	1.18	0	9	579	30.7	2121	215.8	1.10	22	10	585	34.7	2222	364.2	1.11	25
10	4	643	27.0	2566	479.1	0.98	0	6	595	14.7	2316	344.0	1.10	16	10	614	31.3	2416	421.7	1.05	10
11	1	726	-	4325	-	1.13	0	-	-	-	-	-	-	-	1	726	-	4325	-	1.13	0
12	-	-	-	-	-	-	-	2	618	12.5	2548	452.5	1.07	0	2	618	12.5	2546	452.5	1.07	0
-	1	685	-	3000	-	0.93	100	-	-	-	-	-	-	-	1	685	-	3000	-	0.93	100
TOTAL	10							22							32						
MEAN		614	82.2	2479.5	972.9	1.02			575	38.9	2187	376.1	1.16			587	59.1	2278	641.4	1.12	
MEAN AGE	9.2																				

Table 8. Mean round weight and relative condition factor (K) by length interval for Arctic char sampled during the test fishery at the Brock River, August 9-29, 1987.

FORK LENGTH (mm)	N	WEIGHT (g)	SD	K
450	3	1093	93.1	1.06
500	5	2101	272.5	1.40
550	10	2151	147.5	1.10
600	10	2512	458.8	1.07
650	3	2722	444,0	0.89
700	1	4325	-	1.13
TOTAL	32			
MEAN		2278	641.4	1.12

Table 9. Total daily catch of all species of fish caught in gillnets set in the Horton River during August, 1988.

Date	Arctic char	Broad whitefish	Longnose sucker	Inconnu	Arctic cisco	Arctic Lamprey
Aug. 8	2				14	
Aug. 9	2					
Aug.10	5					
Aug.11	4				8	
Aug.12					4	
Aug.13	3	1			1	
Aug.14	5			1	20	
Aug.15	1		1		2	
Aug.16	2				47	
Aug.17	5				15	
Aug.18	1				2	
Aug.19	3					
Aug.20	6					
Aug.21	10				2	
Aug.22	6					
Aug.23	8					
Aug.24	20					
Aug.25	13					1
Aug.26	12					
Aug.27	10					
Aug.28						
Aug.29	2					
Total	120	1	1	1	115	1

Table 10. Mean fork length and round weight of Arctic char taken in each mesh size of the nets used for the Horton River test fishery in August, 1988.

Net(mm)	N	Length (mm)	Sd	Weight (g)	Sd
63	27	463	160.1	1456	1480.4
89	24	482	111.9	1375	1002.7
114	3	519	111.6	1567	679.9
139	2	615	0.5	2770	70.0
114*	7	415	97.1	1081	659.9
139*	30	653	67.0	3485	1037.7
-	1	303	-	350	-
Total	94				
Mean		528	146.5	2075	1509.7

* Commercial Net

Table 11. Mean fork length, round weight and relative condition factor (K) by length interval and sex for Arctic char taken by the test fishery at the Horton River during August, 1988.

Length Interval (mm)	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
250	4	290	5.2	325	25.0	1.34	-	-	-	-	-	-	6	287	5.9	295	47.9	1.24
300	6	323	11.1	325	99.0	0.97	2	332	11.0	350	100.0	0.99	9	323	13.1	333	94.3	1.00
350	5	375	16.0	778	146.8	1.41	3	390	7.3	527	163.6	0.89	8	383	14.4	684	195.7	1.21
400	4	415	7.4	838	290.2	1.16	6	422	19.0	1027	333.8	1.33	11	418	15.1	933	320.3	1.25
450	4	473	19.6	1033	385.4	0.97	4	487	12.1	1198	270.2	1.02	8	480	17.8	1115	342.9	1.00
500	5	513	6.6	1620	449.0	1.19	1	514	-	1600	-	1.18	7	517	10.0	1529	436.6	1.11
550	1	564	-	2380	-	1.33	5	585	8.3	2332	346.0	1.16	6	582	11.0	2340	316.4	1.19
600	3	629	3.7	3240	316.7	1.30	10	628	14.7	2662	488.6	1.08	13	628	13.0	2795	525.1	1.13
650	4	666	11.8	3150	622.5	1.08	10	673	16.6	3785	421.8	1.24	14	671	15.7	3604	569.0	1.19
700	7	725	10.8	4351	421.4	1.14	2	713	8.0	3900	200.0	1.07	9	722	11.3	4251	426.9	1.13
750	3	774	14.9	5267	684.8	1.14	-	-	-	-	-	-	3	774	14.9	5267	684.8	1.14
TOTAL	46						43						94					
MEAN		513	162.2	2037	1699.3	1.17		562	114.2	2297	1244.2	1.14		528	146.5	2075	1509.7	1.15

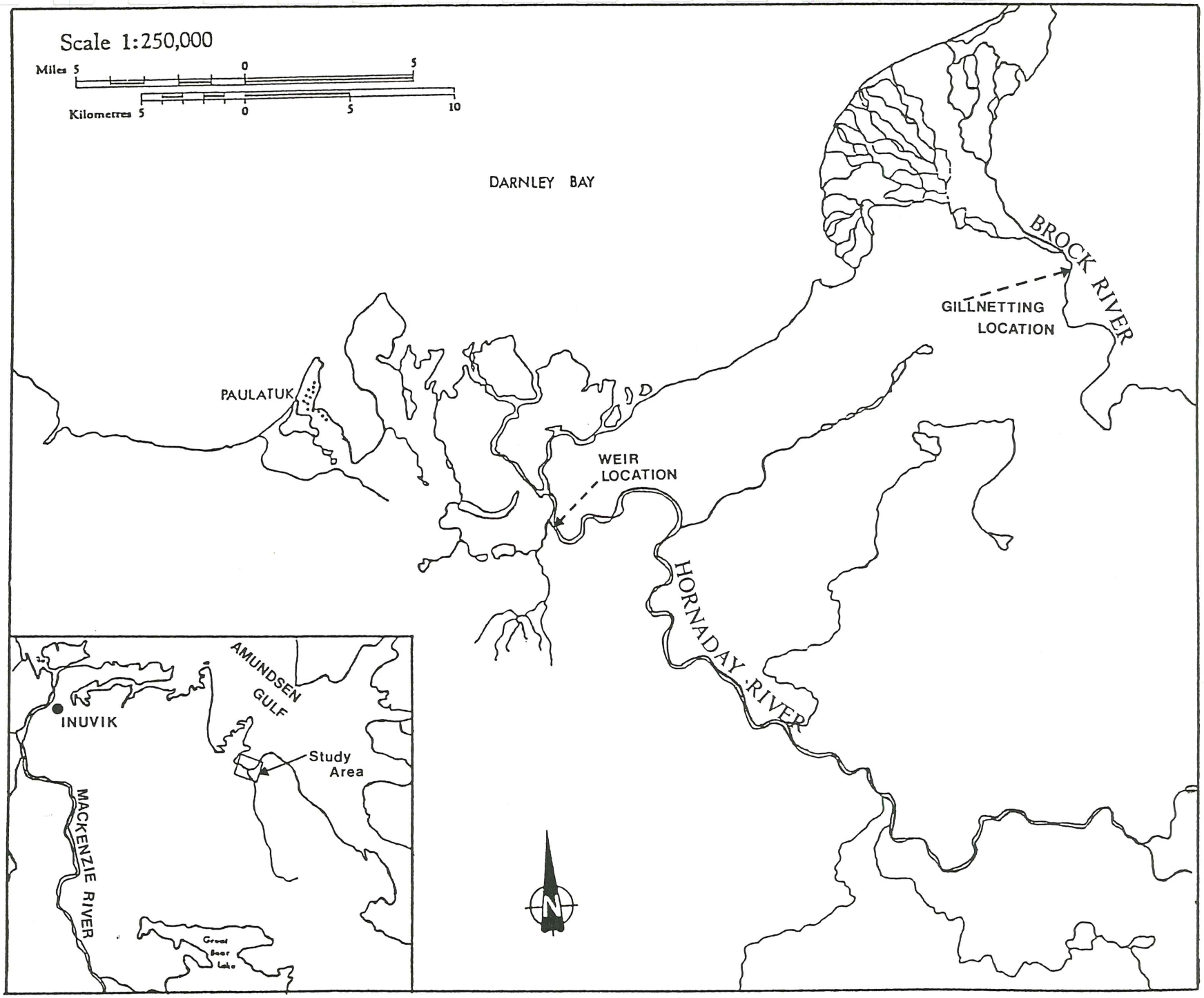

Fig. 1. Map of the Paulatuk area showing the Hornaday and Brock rivers. Weir and gillnetting sites utilized during the 1987 test fisheries are indicated.

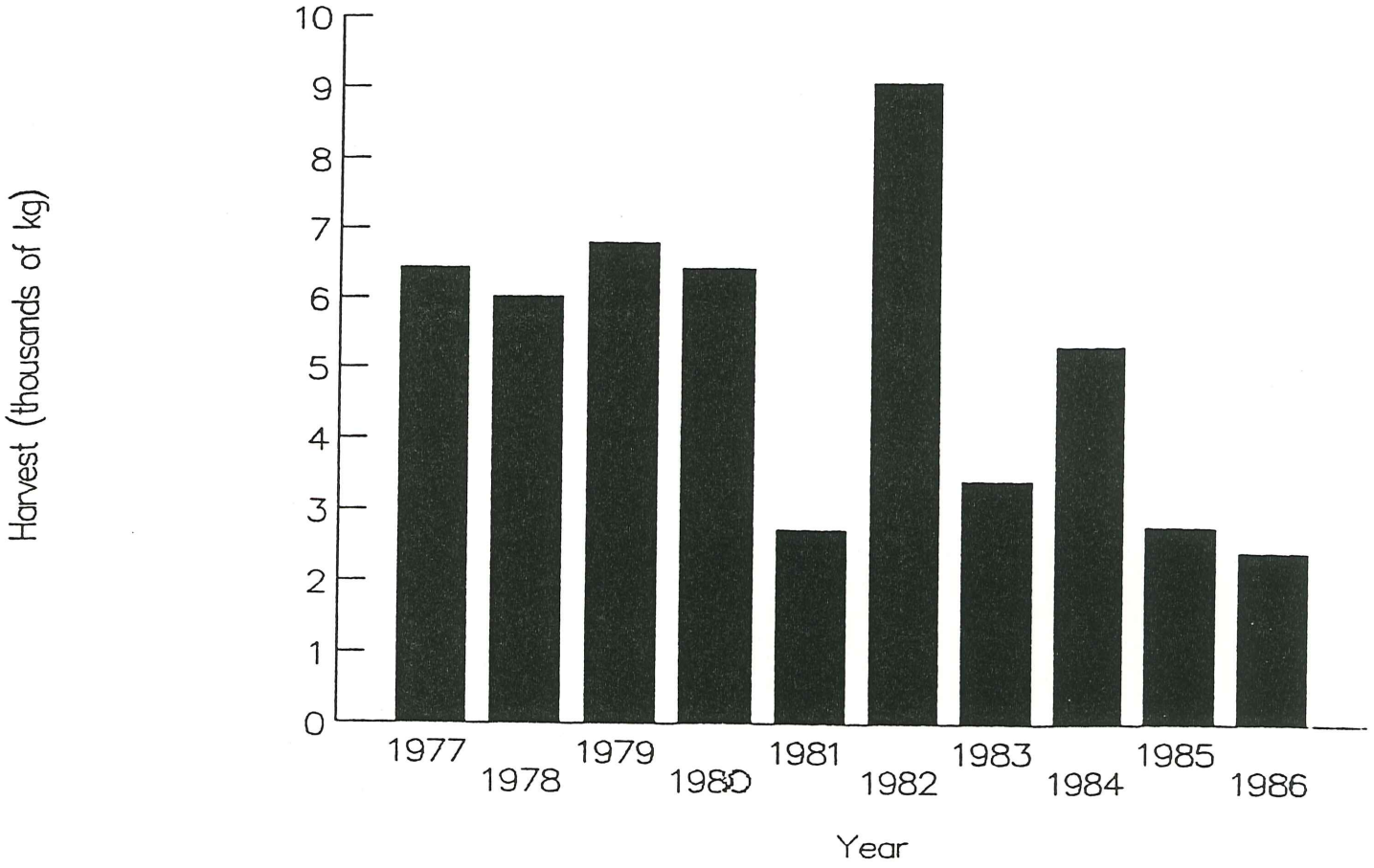

Fig. 2. Commercial harvest of Arctic char from the Hornaday River from 1977 to 1986.

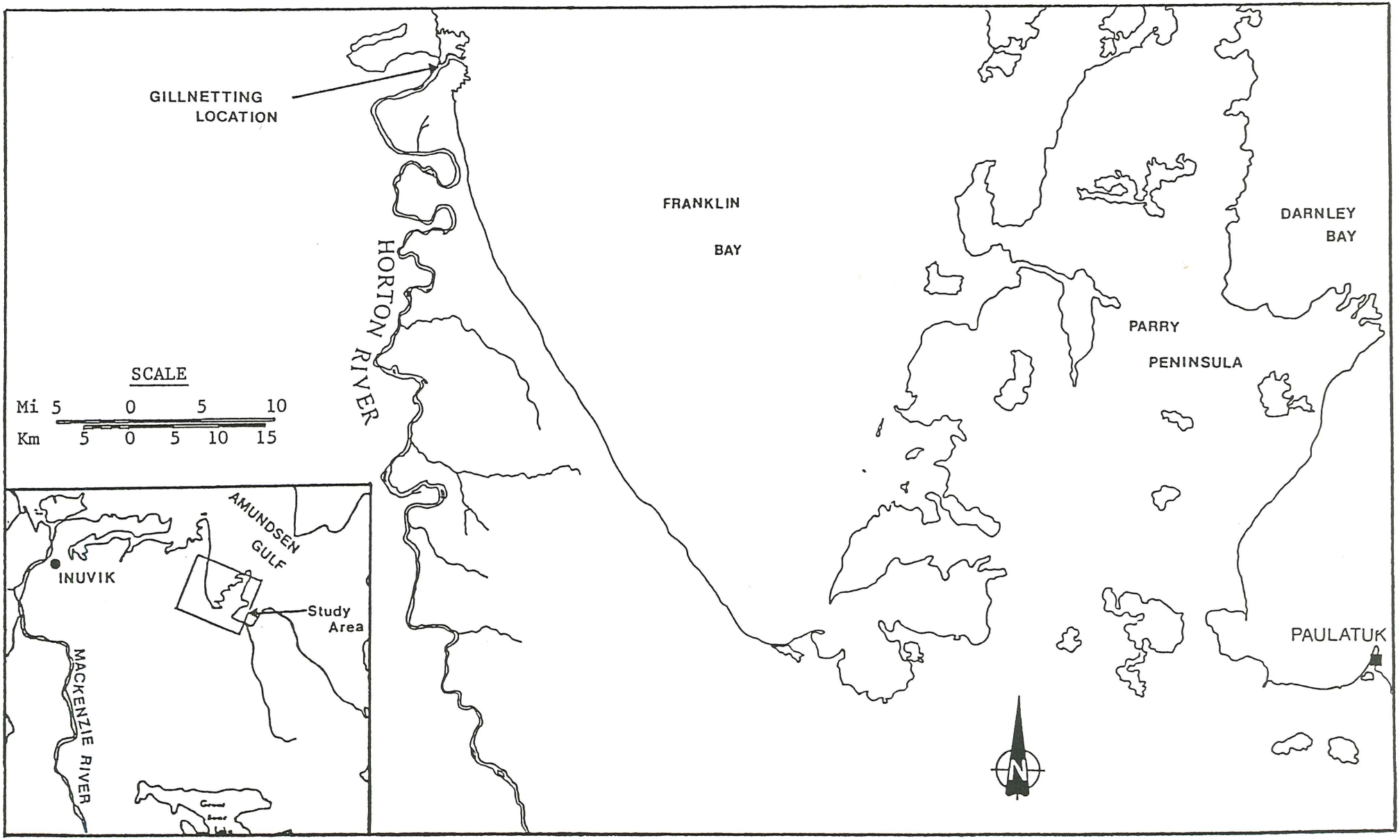

Fig. 3. Map of the area northwest of Paulatuk showing the gillnetting location of the 1988 Horton River test fishery.

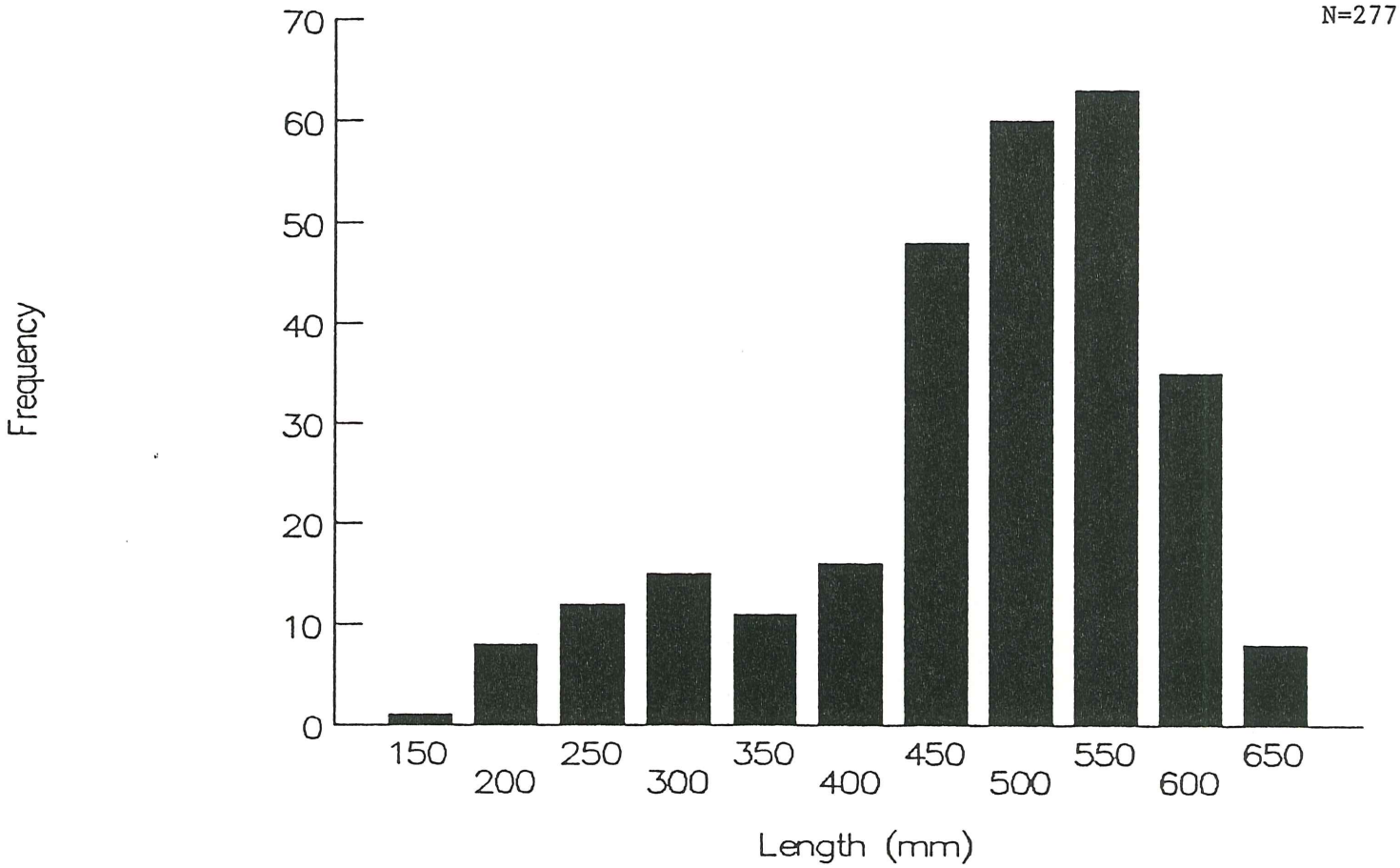

Fig. 4. Total fork length-frequency distribution of Arctic char taken by the test fishery at the Hornaday River between August 7 and August 24, 1987.

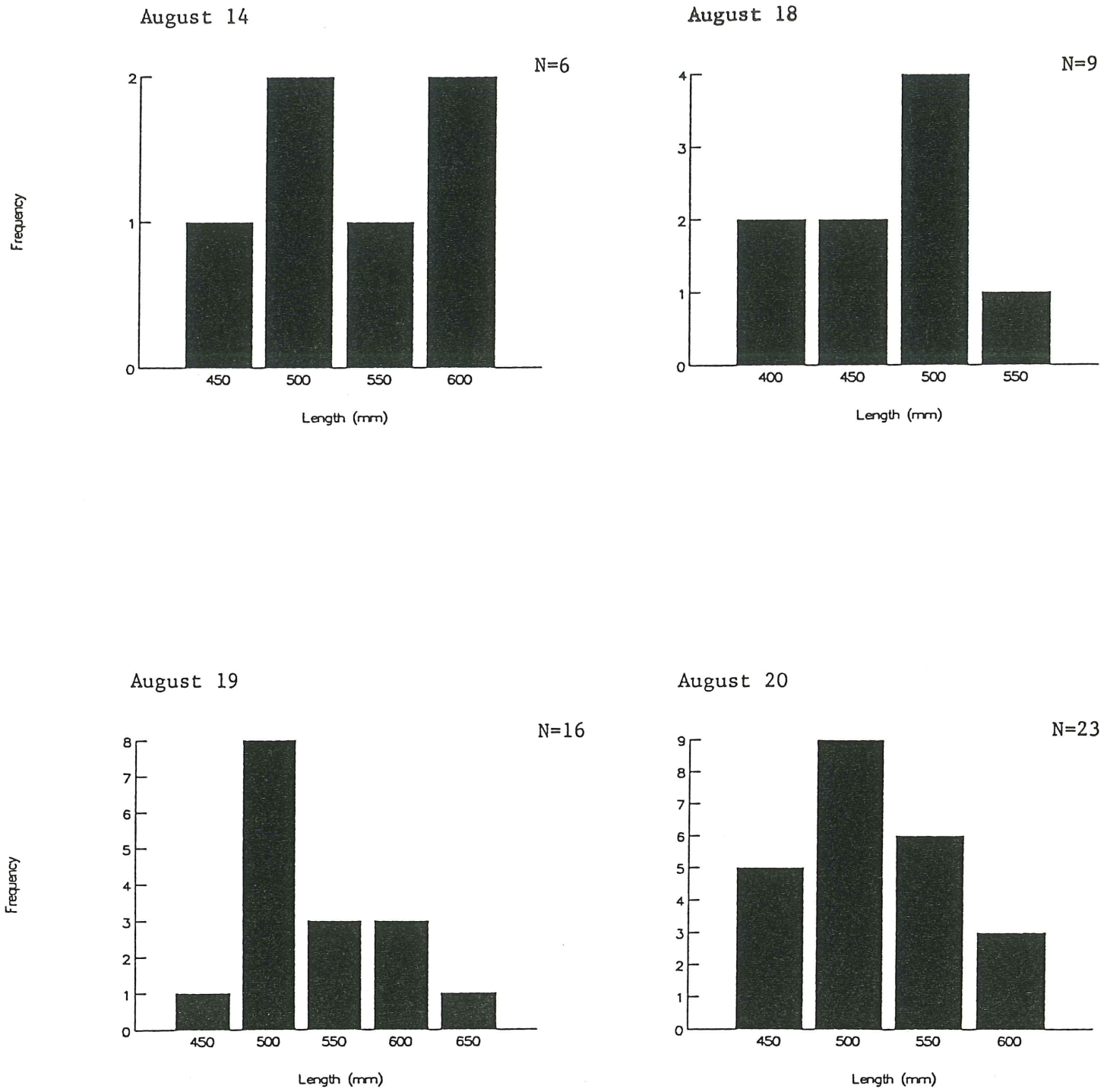

Fig. 5. Daily fork length-frequency distributions of Arctic char taken by the test fishery at the Hornaday River during August, 1987.

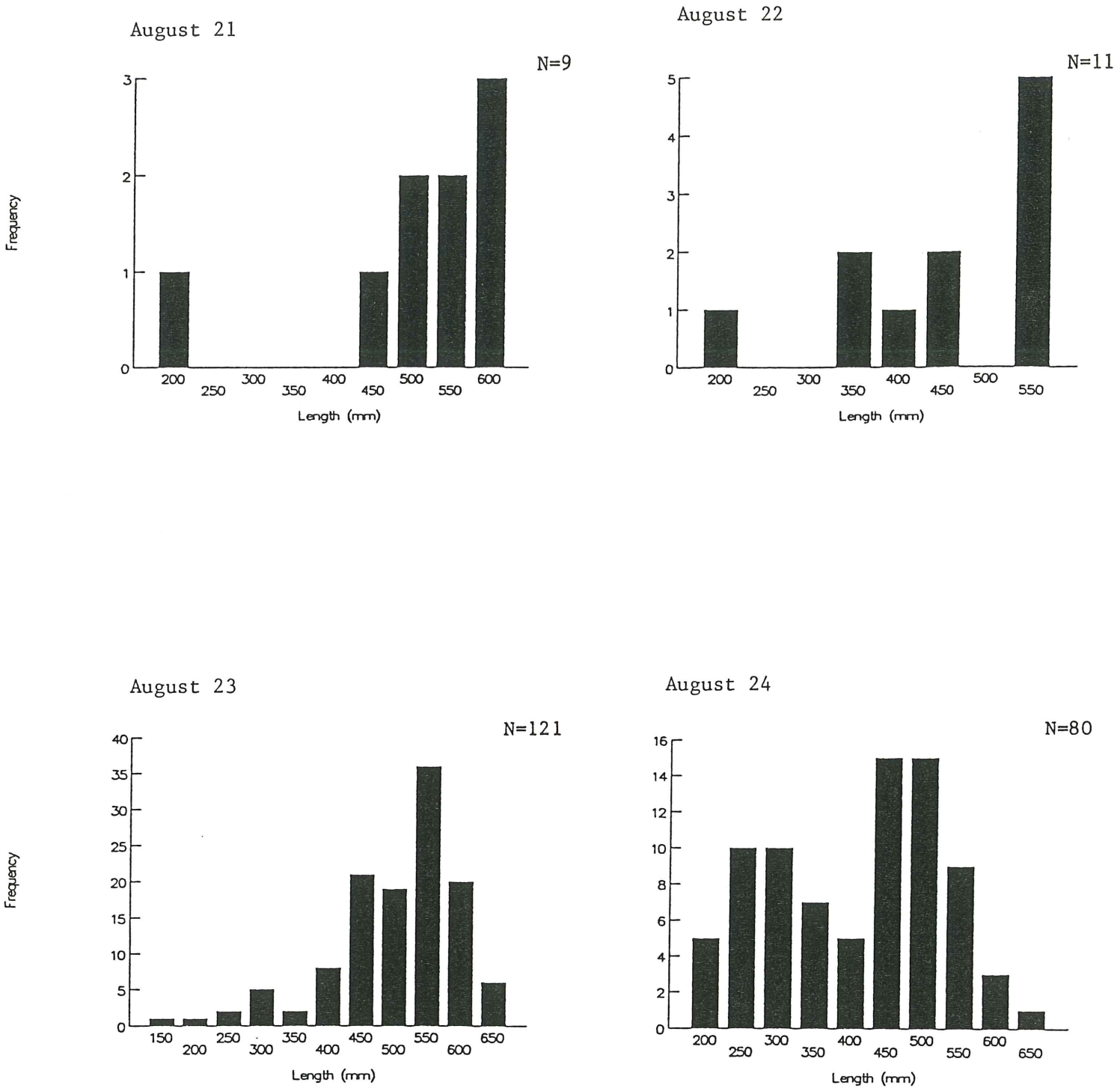
August 21
N=9
Frequency
Length (mm)
August 22
N=11
Length (mm)
August 23
N=121
Frequency
Length (mm)
August 24
N=80
Length (mm)

Fig. 5. (cont'd.)

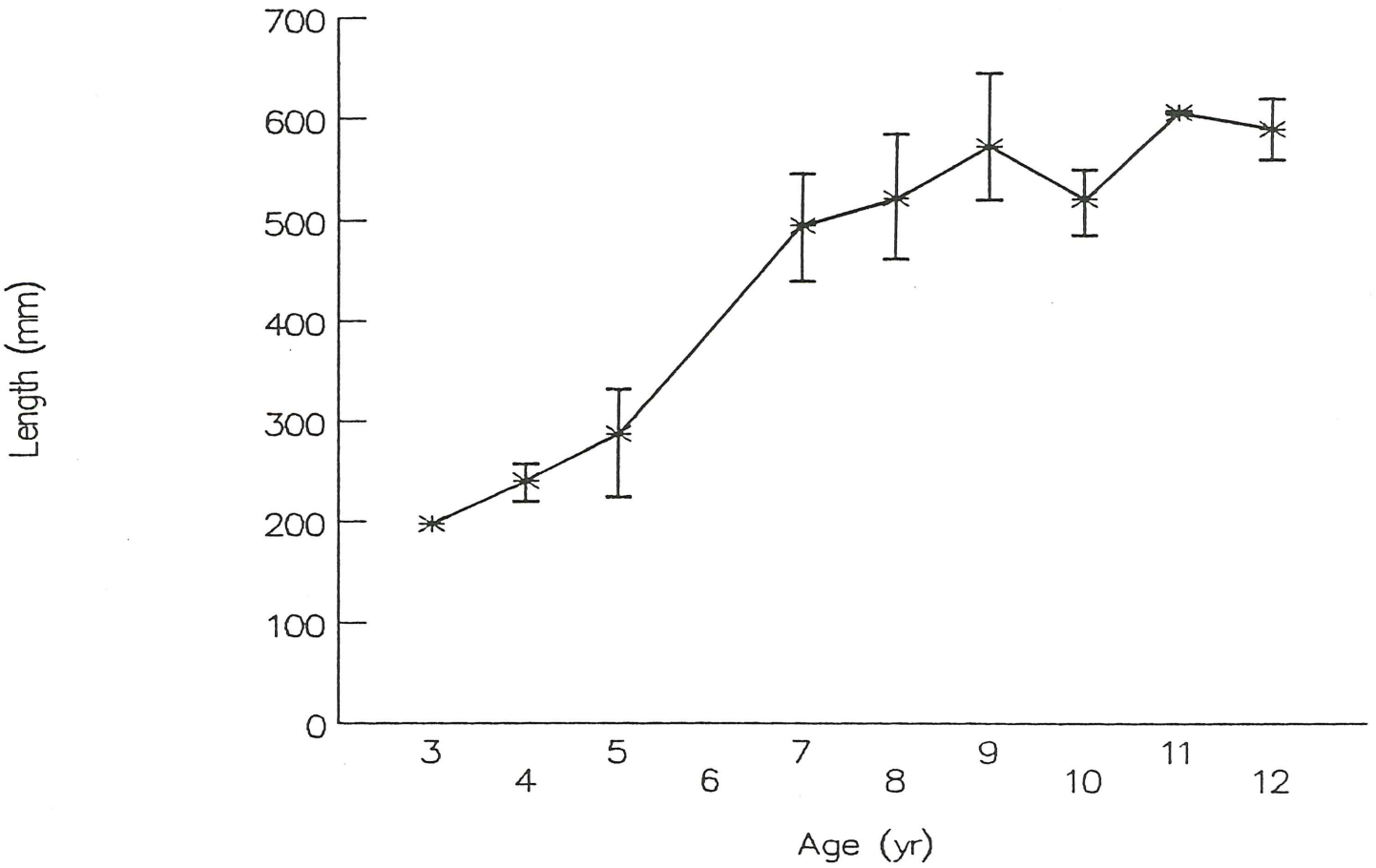

Fig. 6. Mean fork length and range of lengths for each age of Arctic char sampled by the test fishery at the Hornaday River between August 7 and August 24, 1987.

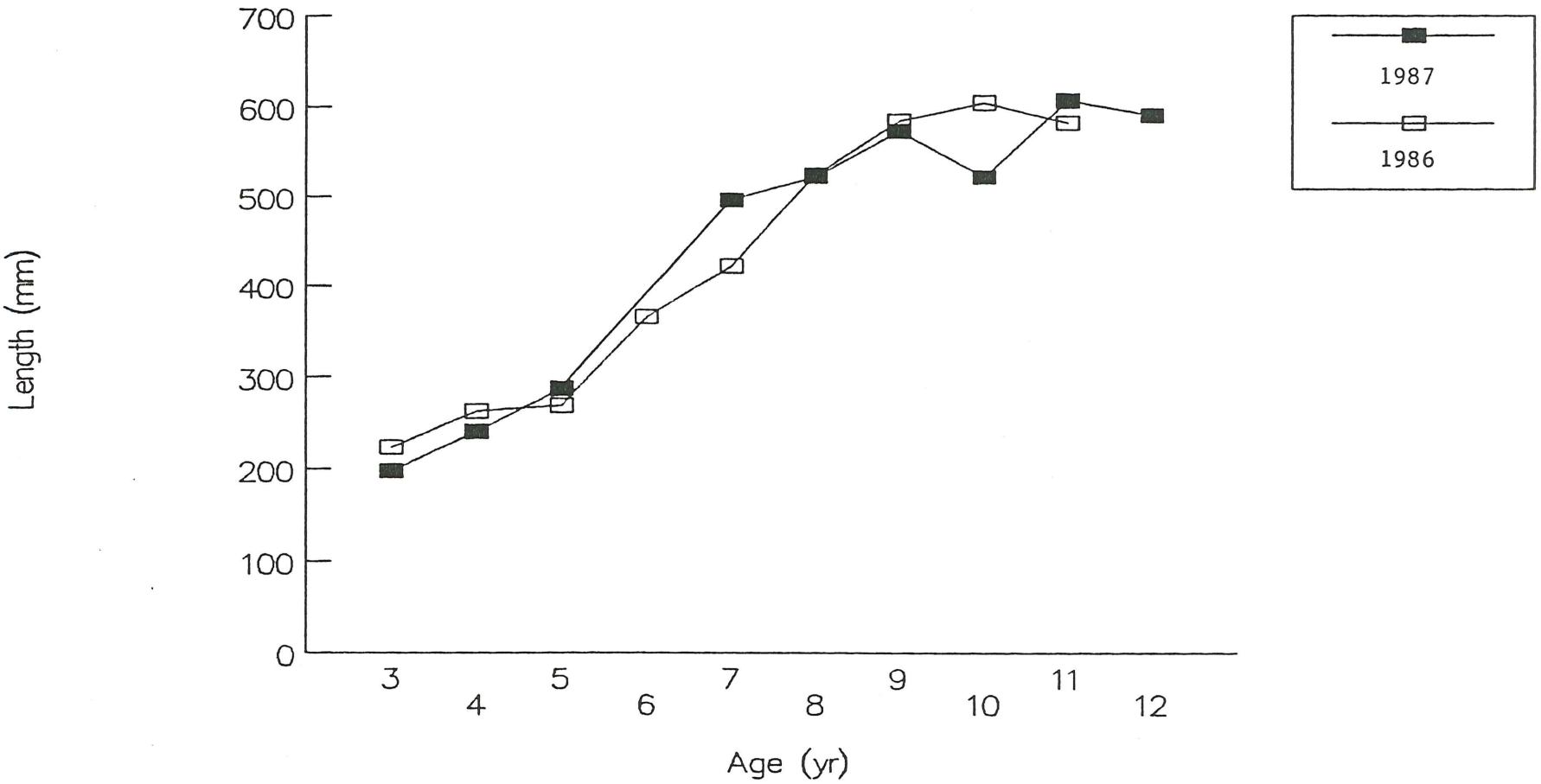

Fig. 7. Comparison of growth rates (fitted by eye) of Arctic char taken from the Hornaday River as determined by test fisheries conducted in 1986 and 1987.

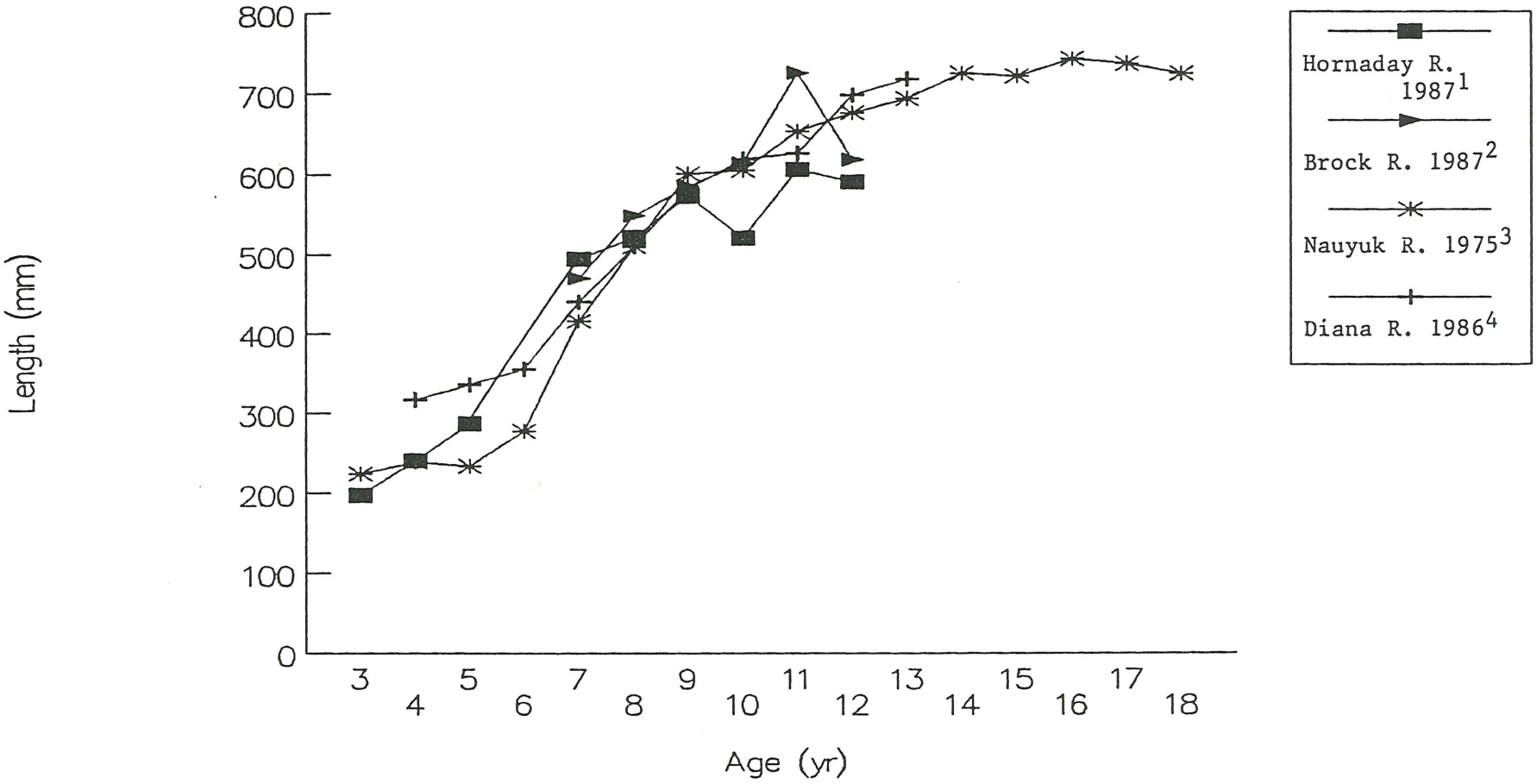

Fig. 8. Comparison of the growth rates (fitted by eye) of Arctic char from the Brock and Hornaday Rivers with those from Nauyuk and Diana Rivers. [1], [2] - Present study; [3] - Johnson 1980; [4] - McGowan 1986.

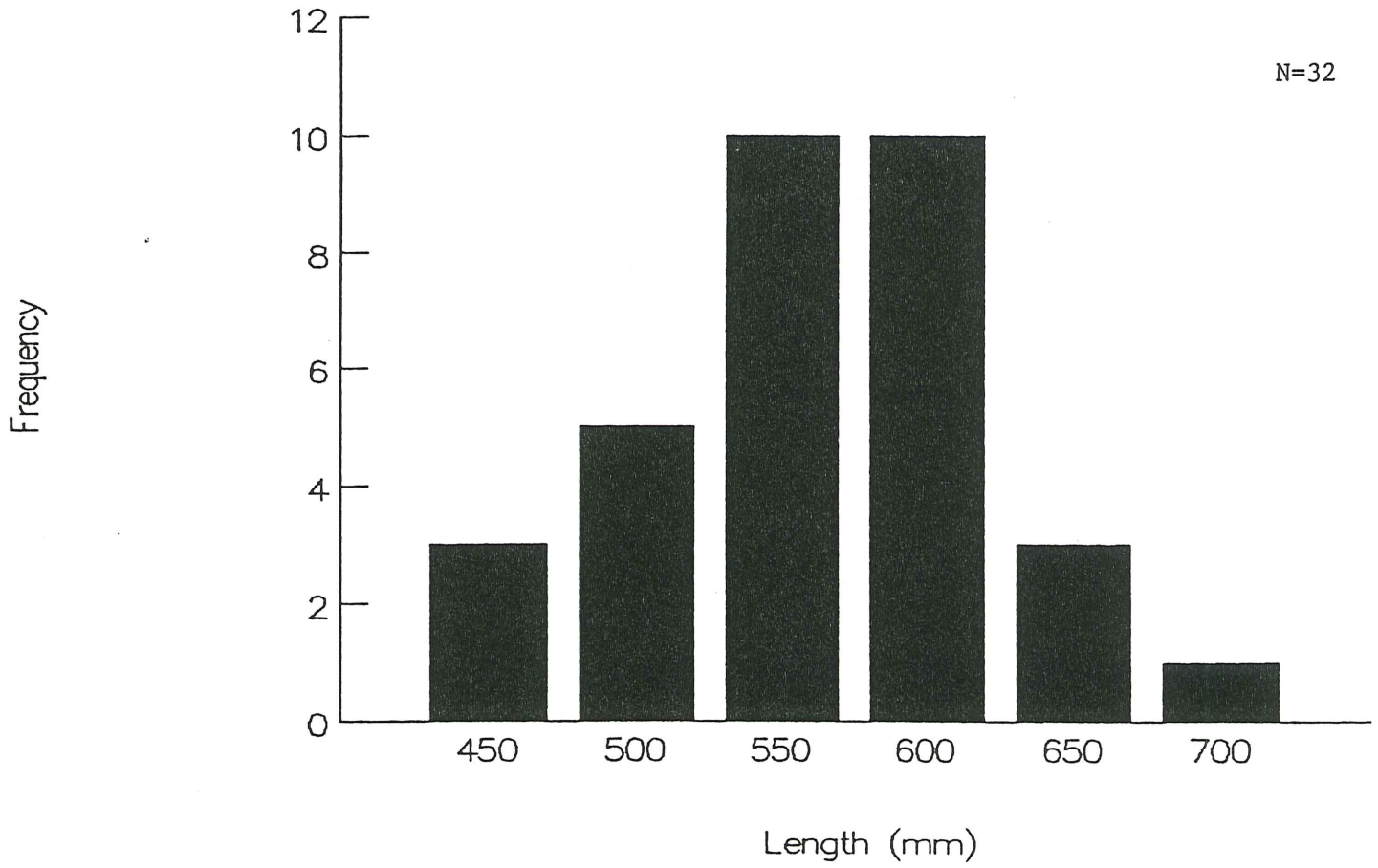

Fig. 9. Total fork length-frequency distribution of Arctic char taken by the test fishery at the Brock River between August 9 and August 29, 1987.

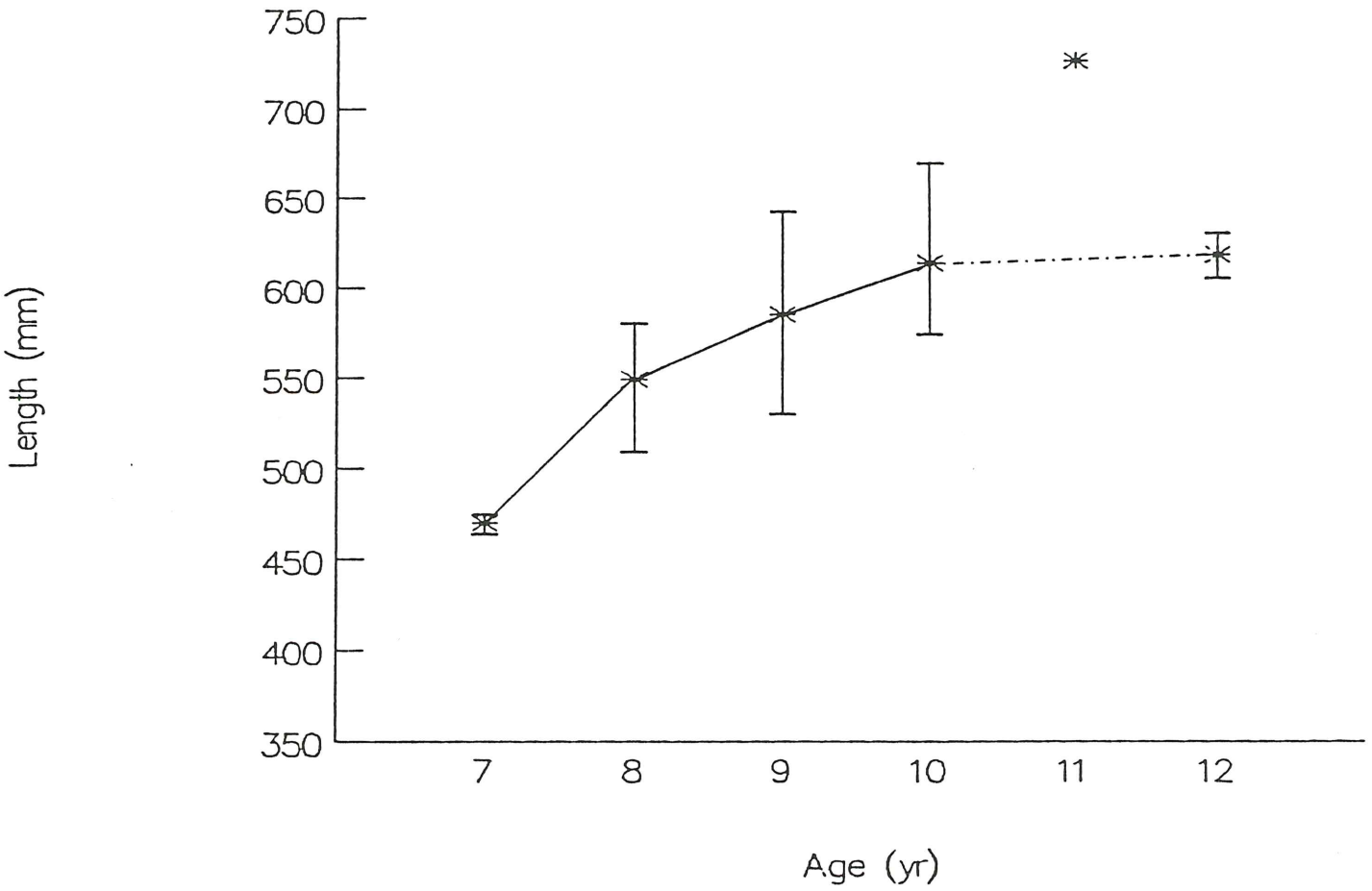

Fig.10. Mean fork length and range of lengths for each age of Arctic char sampled by the test fishery at the Brock River between August 9 and August 29, 1987.

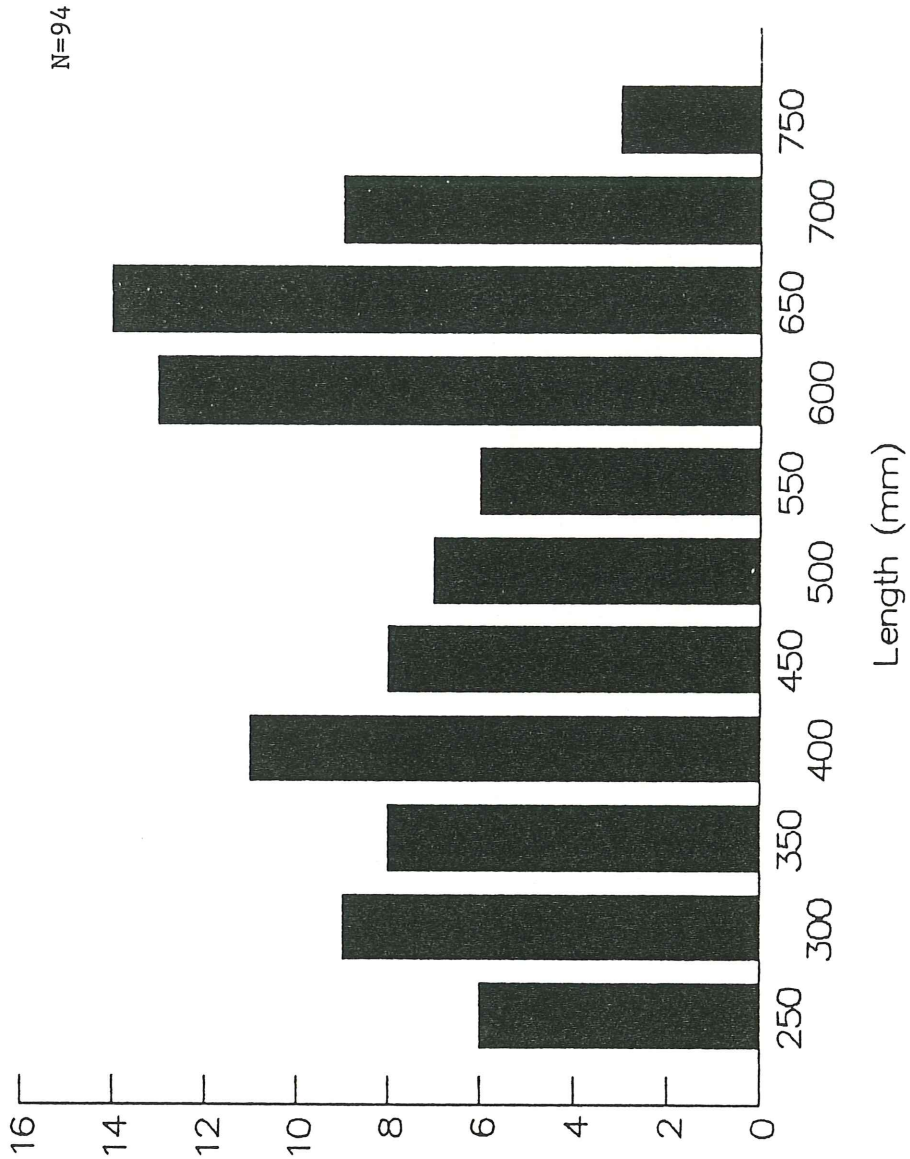

Fig.11. Total fork length frequency-distribution of Arctic char taken by the test fishery at the Horton River between August 9 and August 29, 1988.

APPENDIX I

LIST OF THE FISH TAGGED AT THE HORNADAY RIVER DURING AUGUST 1987.

TAG NO.	DATE	LENGTH	ROUND WEIGHT	SEX
FC30101	Aug.24	498	1720	M
FC63003	Aug.21	628	2640	
FC63004	Aug.21	545	2220	
FC63005	Aug.21	541	2220	
FC63006	Aug.21	599	2600	
FC63007	Aug.21	645	3440	
FC63008	Aug.21	484	1560	
FC63009	Aug.21	607	2580	
FC63010	Aug.21	565	2220	
FC63011	Aug.22	497	1420	
FC63012	Aug.22	560	2380	
FC63013	Aug.22	570	2280	
FC63014	Aug.22	575	2460	
FC63015	Aug.22	430	980	
FC63016	Aug.22	380	720	
FC63017	Aug.22	380	620	
FC63018	Aug.22	567	2400	
FC63020	Aug.23	670	3780	M
FC63021	Aug.23	660	4600	M
FC63022	Aug.23	645	2940	M
FC63023	Aug.23	600	3160	F
FC63024	Aug.23	475	1480	F
FC63025	Aug.23	570	2580	F
FC63026	Aug.23	595	2440	F
FC63051	Aug.23	475	1580	F
FC63052	Aug.23	583	2300	M
FC63053	Aug.23	564	2280	F
FC63054	Aug.23	527	1920	F
FC63055	Aug.23	501	1460	M
FC63056	Aug.23	582	2560	M
FC63057	Aug.23	596	2440	F
FC63058	Aug.23	498	1560	M
FC63059	Aug.23	553	2160	M
FC63060	Aug.23	577	2420	M
FC63061	Aug.23	636	2900	F
FC63062	Aug.23	676	2340	M
FC63063	Aug.23	553	2300	M
FC63067	Aug.23	518	1820	F
FC63068	Aug.23	549	2220	
FC63069	Aug.23	454	1220	F
FC63070	Aug.23	501	1760	F
FC63071	Aug.23	612	2840	M
FC63072	Aug.23	573	2500	F
FC63073	Aug.23	582	2370	F

TAG NO.	DATE	LENGTH	ROUND WEIGHT	SEX
FC63074	Aug.23	606	2790	M
FC63075	Aug.24	565	2280	F
FC63076	Aug.24	536	2120	F
FC63077	Aug.24	529	2920	F
FC63078	Aug.24	489	1520	F
FC63081	Aug.24	617	3200	F
FC63082	Aug.24	537	2260	M
FC63083	Aug.24	561	2360	
FC63084	Aug.24	615	2800	M
FC63085	Aug.24	549	2200	M
FC63086	Aug.24	514	1880	M
FC63087	Aug.24	488	1820	M
FC63088	Aug.24	476	1460	M
FC63090	Aug.24	542	2060	F
FC63091	Aug.24	530	2060	F
FC63092	Aug.24	445	1080	M
FC63094	Aug.24	464	1360	M
FC63095	Aug.24	575	2320	M
FC63096	Aug.24	516	1780	M
FC63097	Aug.24	480	1360	M
FC63098	Aug.24	466	1360	F
FC63099	Aug.24	485	1480	M
FC63100	Aug.24	545	1880	M
FC63102	Aug.24	415	1020	M
FC63103	Aug.24	589	2720	F
FC63104	Aug.24	499	1530	M
FC63105	Aug.24	489	1350	M
FC63106	Aug.24	626	3880	M
FC63107	Aug.24	499	1600	M
FC63108	Aug.24	504	1700	F
FC63109	Aug.24	517	1670	F
FC63110	Aug.24	425	980	M
FC63111	Aug.24	509	1720	M
FC63112	Aug.24	573	2880	M
FC63114	Aug.24	663	3760	M
FC63115	Aug.24	562	2420	F
FC63116	Aug.24	539	2280	M
FC63118	Aug.24	503	1680	M
FC63119	Aug.24	487	1580	F
FC63120	Aug.24	488	1590	M
FC63121	Aug.24	584	2480	F
FC63123	Aug.24	531	2060	F
FC63125	Aug.24	459	1120	M
FC63151	Aug.23	585	2580	F
FC63152	Aug.23	550	1960	F

TAG NO.	DATE	LENGTH	ROUND WEIGHT	SEX
FC63153	Aug.23	510	1720	
FC63154	Aug.23	680	3920	F
FC63155	Aug.23	545	1660	F
FC63156	Aug.23	585	2500	F
FC63157	Aug.23	460	1080	F
FC63159	Aug.23	682	2520	M
FC63160	Aug.23	575	2120	M
FC63161	Aug.23	540	1920	F
FC63164	Aug.23	570	2620	F
FC63167	Aug.23	625	2920	M
FC63168	Aug.23	570	2380	M
FC63170	Aug.23	460	880	F
FC63171	Aug.23	550	1860	M
FC63172	Aug.23	655	3620	M
FC63173	Aug.23	480	1260	F
FC63174	Aug.23	580	2400	F
FC63175	Aug.23	610	2740	F
FC63251	Aug.23	499	1480	M
FC63252	Aug.23	515	2040	F
FC63253	Aug.23	502	1440	M
FC63254	Aug.23	635	3300	M
FC63255	Aug.23	575	2460	M
FC63256	Aug.23	569	2540	M
FC63257	Aug.23	555	2180	M
FC63259	Aug.23	578	2640	F
FC63260	Aug.23	590	2760	F
FC63261	Aug.23	595	3380	F
FC63262	Aug.23	463	1280	F
FC63264	Aug.23	574	2520	F
FC63265	Aug.23	478	1380	F
FC63266	Aug.23	595	2440	F
FC63267	Aug.23	498	1380	F
FC63268	Aug.23	599	2640	F
FC63269	Aug.23	470	1360	F
FC63270	Aug.23	580	3260	F
FC63272	Aug.23	547	2060	F
FC63273	Aug.23	615	2380	F
FC63301	Aug.24	434	1000	F
FC63402	Aug.23	470	1160	F
FC63403	Aug.23	630	2640	M
FC63404	Aug.23	610	3220	M
FC63405	Aug.23	610	2640	F
FC63406	Aug.23	635	2720	M
FC63407	Aug.23	610	2700	M
FC63408	Aug.23	430	740	F

TAG NO.	DATE	LENGTH	ROUND WEIGHT	SEX
FC63409	Aug.23	450	940	F
FC63410	Aug.23	450	1120	F
FC63413	Aug.23	449	1140	F
FC63414	Aug.23	645	3680	F
FC63415	Aug.23	508	1720	F
FC63416	Aug.23	597	2980	F
FC63417	Aug.23	532	2280	F
FC63418	Aug.23	468	1180	F
FC63419	Aug.23	476		F
FC63420	Aug.23	518	1160	M
FC63421	Aug.23	577	2760	M
FC63422	Aug.23	551	2020	M
FC63423	Aug.23	420	940	F
FC63424	Aug.23	506	1600	
45704	Aug.19	685	4180	
45706	Aug.20	645	3360	
45708	Aug.20	585	2700	
45713	Aug.18	545	2100	
45714	Aug.18	460	1180	
45715	Aug.18	505	1800	
45716	Aug.18	445	1400	
45722	Aug.20	630	3260	