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A PRELIMINARY ASSESSMENT OF FOUR ANADROMOUS ARCTIC CHAR STOCKS IN THE CHESTERFIELD INLET AREA

PREPARED BY

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FOREWORD

Funding programs initiated under the auspices of the Economic Development Agreement (EDA) and the Special ARDA program resulted in the injection of capital and operational dollars to the commercial Arctic char fishery of the Chesterfield Inlet area. These programs allowed for the construction of a small (estimated 1000 kg./day freezing capability with 5000 kg holding capacity) fish processing plant and consistent with the requirement for data on the resource for management purposes, provided funding for a two year test fishery on four river systems in the area. Funding was provided to 851859 (N.W.T.) Ltd. incorporated early in 1985.

A series of meetings attended by representatives of the Department of Fisheries and Oceans (DFO), Economic Development and Tourism (Government of the Northwest Territories) and the community of Chesterfield Inlet, were organized to discuss various aspects of the test fishery. As a result of these meetings four river systems were selected for testing and equipment required to operate the test fishery was authorized for purchase.

Keewatin Environmental Consulting Services Ltd., Rankin Inlet, was contracted by 851859 (N.W.T.) Ltd. to collect, analyze and report biological data gathered from the test fishery. This report presents data collected over the two seasons of the test fishery. In addition, some comment is provided on other aspects of the fishery, such as performance of equipment and maintenance of product quality.

INTRODUCTION

The Arctic char, Salvelinus alpinus, is present in the most northern of freshwaters. It exists as both a freshwater and searun (anadromous) form and its life history is complex. Throughout its range, the Arctic char is of considerable economic importance both as a food source and commercial fish. Thus, sound management of the resource is critical to its long term survival.

Within the range of searun Arctic char, many populations have become landlocked and isolated from the sea following deglaciation. In some water bodies connected to the sea, non-migratory Arctic char coexist with the migratory searun form. The searun Arctic char was the species of interest to the test fishery. Further reference to char is thus to the searun form unless otherwise specified.

It is well known that the char inhabits cold, relatively unproductive waters and consequently exhibits very slow growth. Individual stocks do not appear to be able to tolerate sustained heavy fishing pressure (Johnson 1980). Examples of overexploitation include the fishery on the Sylvia Grinnell River near Frobisher Bay (Hunter 1966) and the Ekalluk River near Cambridge Bay (Barlishen and Webber 1973). These examples indicate the need for stock assessment in developing fisheries and controlled rates of harvest in order to maintain fisheries over the long term. Low productivity of stocks, high transportation and operational costs and the lack of marketing alternatives are problems which must be dealt with by the commercial fishery. Severe operating conditions often impact the fishery, particularly with respect to maintenance of product quality. It is imperative that product quality be the highest achievable in order to maintain demand by the southern customer where must less expensive alternatives, such as Pacific salmon are readily available.

Construction of a fish processing plant was commenced during the summer of 1985 and was ongoing during the first season of test fishing. In spite of this lack of freezing facilities, the fishery was reasonably successful in delivering a good quality fresh product to the Issatik Food Plant in Rankin Inlet. During 1986, the second season of test fishing, the fish processing plant was fully operational with both fresh and frozen char being processed through the plant and forwarded to Rankin Inlet for delivery to markets, including the Freshwater Fish Marketing Corporation (FFMC) in Winnipeg. Shipments of fresh Arctic char were very well received and were of top quality (Alex Drobot, FFMC, pers. comm.).

The Chesterfield Inlet Fish Plant operates independently from the Rankin Inlet facility. Product from the Chesterfield Inlet fishery will continue to flow through the Issatik Food Plant as direct scheduled air transportation to Winnipeg is available at reasonable rates.

MATERIALS AND METHODS

THE TEST FISHERY

The choice of possible test fishing locations was discussed with the Board of 851859 (N.W.T.) Ltd. and the community early in 1985. Based on these discussions the following locations were selected for test fishing:

1) Sagvaqjuac River
   63°39'N 90°41'W

2) Kangiqsurjuk River
   63°34'N 90°41'W

3) Steep Bank" Bay
   63"36'N 91°37'W

4) Merle Harbour
   63°42'N 92°24'W

Fishing sites and camp locations are shown in Figure 1.

The test fishery was authorized to commence on August 1 in each year. As no commercial quotas presently exist for these river systems, Provisional Quotas of 1000 kg were assigned to each location under a Test Fishery Permit issued to 851859 (N.W.T.) Ltd. by DFO. For each fishing location, pairs of fishermen were hired to do the actual fishing and were briefed on the rationale and methodology of the fishery. Fishermen were provided with at least three gillnets at each location. Nets were 46 m (50 yd.) long with 139 mm (5½ in.) mesh sized (stretched measure) and 24 meshes deep.

Fishing occurred on a daily basis throughout the fishery whenever possible. Occasional delays due to weather and equipment problems were encountered. Table 1 provides a summary of total production (kg round weight), the dates fished in each year and catch per unit effort (CPE) as kg round weight per 100 m of net per day.

In 1985, start up of the test fishery was delayed until August 14 by the late arrival of required equipment. Fishing was discontinued at Steep Bank Bay on August 28, with 808 kg of the Provisional Quota taken. Discontinuation of this fishery was due to the need for a replacement canoe at the Merle Harbour location, where a canoe was lost on August 26, 1985. Fishing at the remaining locations was discontinued when catches diminished.

In 1986, fishing commenced on August 2 at all locations with the exception of the Merle Harbour location where fishing was delayed until August 12 due to equipment problems. Fishing continued at each location until catches diminished. The rationale of the test fishery was to provide data on individual populations of char as they entered "home" rivers on their upstream run from the sea to overwintering and spawing waters. Nets were set at river mouths and in the rivers to ensure char taken were on an actual upstream run and not itinerants from other populations.

The catch was dressed (gills and viscera removed) on site and stored on ice in insulated fish boxes awaiting arrival of the 8m (26 ft) collector boat, Arctic Char Express (ACE). Occasionally, the catch was transported to the ice house in Chesterfield Inlet by the fishermen in 7 m (22ft) canoes assigned to individual fishing locations. On arrival at the ice house fresh fish were weighed, washed, re-packed on fresh ice and flown to the Issatik Food Plant in Rankin Inlet or were frozen and held to build suitable loads for shipment.

Records of daily production were kept at each fishing site and records of dressed weights were kept at the ice house in Chesterfield Inlet. Any incidental species taken such as lake trout, Salvelinus namaycush, were weighed and recorded on site.

The logistics of the test fishery were coordinated from Chesterfield Inlet by the Fishplant Manager. Six high frequency (HF) radios were supplied for communication purposes. Consumables were delivered to each camp when the collector vessel made trips to pick up the catch.

SITE EVALUATION

An evaluation of each fishing site was made based on the following criteria:

1) accessibility
2) suitability for fishing (tides, currents, etc.)
3) suitability for landing catch on shore
4) suitability as a camp location (potable water, waste disposal, etc.)
5) fishing effort
6) other problems affecting the fishery

BIOLOGICAL INVESTIGATION

A Statement of Work for the biological investigation was supplied by A.H. Kristofferson, DFO, Winnipeg as Scientific Authority for the project.

Two full-time Keewatin Environmental staff and two trainees from Chesterfield Inlet were involved in the field program. Biological data were mainly gathered at the fishing locations. Near the end of the test fishery in 1985, the catch from each location was sent directly to Chesterfield Inlet in round condition on a daily basis, to allow sampling from each location. Problems in reaching the various fishing locations due to weather (August 23 to 30, 1985) necessitated this action. The fishermen at each site maintained daily records of fishing effort and catch. Weigh scales ordered for each fishing camp did not arrive in time for use in 1985, necessitating the recording of catch in numbers of fish as opposed to weight of fish. Daily production (kg round weight) was calculated from mean round weight derived from the samples from each fishing location. These were correlated with dressed weights recorded at the ice house. Catch per unit effort (CPE) statistics are reported in two forms, number of fish per unit effort and weight of fish per unit effort.

Random samples of the catch were taken at each site and included the recording of fork length (± 1mm), round weight (± 50g), dressed weight (± 50g), sex and maturity by gross examination of gonads, gross examination of stomach contents and gross examination for disease and parasites.

Sagittal otoliths for aging purposes were removed from each fish sampled. The otoliths were cleaned and stored dry in envelopes marked with the pertinent sample information. Otoliths were ground to remove surface irregularities and then immersed in a 3:1 solution of benzyl-benzoate and methyl salicylate in a depression slide. Using a dissecting microscope, the otoliths are viewed under reflected light and the annual growth rings counted, with the dark central core being considered representative of the first winters growth (Grainger 1953).

Age-frequency and length-frequency histograms were constructed to graphically display the catch at each fishing location for each year. Length-weight relationships were calculated using least-squares regression analysis on logarithmic transformations of fork lengths and round weights. The relationship is described by the equation:

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

where: W = weight in grams

L = fork length in millimeters

and a and b are constants

Samples were initally compared between locatons. After the second season samples from different years were then pooled and compared between locations.

Mean fork length at age was plotted from samples taken at each location and growth rates were compared visually. Again, samples from each year were pooled for each location.

The relative condition faction (K) was calculated with the objective of expressing the condition of char in numerical terms. Essentially an indicator of robustness or plumpness, the relative condition factor (K) was determined as follows:

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

where: W = weight in grams

and L - fork length in millimeters

Condition factor was compared between locations and between years.

Instantaneous total mortality (Z) was calculated from least squares regression lines fitted to the descending limb of the catch curves from data pooled for the two seasons. Only that portion of the catch curve that appeared linear was included in the analysis. Only fully recruited age groups were used. This was achieved by using the next older age groups from the ❑odal age since the modal age in the catch curve will often lie quite close to the first year in which recruitment can be considered complete (Ricker 1975). Age compositions were prepared from data pooled between years to eliminate fluctuations resulting from variable recruitment.

Annual survival rate (S) and annual mortality rate (A) were calculated from instantaneous total mortality rate (Z). Instantaneous natural mortality (M) was assumed to be 0.17 after Moore (1975) and Dempson (1978). Instantaneous fishing mortality (F) was calculated from Z - F + M.

The rate of exploitation (u) was calculated from the estimate of (F) using the relationship :

$$u = 1 - e^{-F}$$

after Ricker (1975). The rate of exploitation was compared with those from other fisheries in the Cambridge Bay area.

An estimate of potential yield was made for theSagvaqjuac system using the Baranov catch equation (Ricker 1975):

$$N = \frac{CZ}{FA}$$ where:

Z = instantaneous rate of total mortality
A = annual rate of mortality
F = instantaneous rate of fishing mortality (Z - 0.17)
C = catch in numbers (including an estimate of domestic harvest)
N = stock size

Stock size at Sagvaqjuac was estimated based on enumerations carried out using a fish fence during 1977-1979. Though stock size varied between a high of 11,400 fish in 1977 and a low of 8,422 in 1979 these data provide the best estimate for current stock size in the system. The low of 8,422 fish was used as a conservative estimate of present stock. Based on CPE the stock size in the Steep Bank Bay system was estimated to be at least twice that at Sagvaqjuac. All other systems were considered to have a stock size similar to that of Sagvaqjuac.

Daily production and CPE as number of fish/100 m of net/day were presented graphically as an indication of the timing, strength and duration of the upstream run in each system.

Data were analysed using acceptable statistical techniques on a programmable Texas Instruments (TI-66) calculator. Programs within the TI-66 were used for regression analysis.

RESULTS AND DISCUSSION

SITE EVALUATION

Accessibility

Boat access to the various fishing locations did not create problems for the knowledgeable boat operators during periods of good weather. When traveling to the Kangiqsurjuk location via the collector vessel, access to the upper reaches of the inlet was difficult at ebb (low) tide. The camp at this fishing site was moved seaward of the obstruction soon after the start of the fishery. Boat access to the fishing sites was occasionally impossible for extended periods due to poor weather. For example, travel to and from the camps was impossible between August 23 and August 29, 1985. During this period high winds, rain, snow and near blizzard conditions were encountered. At the Merle Harbour location a properly anchored canoe broke loose from its mooring and was blown away. The fishermen had been checking on the canoe every 10 to 15 minutes. Later that day a 6-man tent (supposedly tested on Mount Everest) was destroyed by wind. Travel in the area is totally weather dependent.

Local knowledge of the Inlet is necessary due to the presence of numerous rocks and shoals. At certain times of the year, particularly in the spring and early summer, ice and fog can present hazards but these situations were not encountered during 1985. Weather records from Chesterfield Inlet (1953-1980), indicate that in any given year reduced visibility (less than 5/8 mile) due to fog can be expected 7 days per month in August and September.

Aircraft accessibility was not considered as it is not economically viable for the present fishery.

Suitability For Fishing

Slow currents and adequate water depths generally allowed nets to be easily tended. Extreme tidal ranges occasionally left nets partially out of water at the river mouth near the Merle Harbour site. Winds and bad weather occasionally affected fishing at each location.

Suitability For Landing Catch On Shore

Good landing locations were available at each fishing site although tidal flats were exposed at low tide at Merle Harbour.

Suitability As A Camp Location

Excellent camp locations were available at all fishing sites. Potable water was available in supply at each site. Spring water was available at the Merle Harbour site. **The Merle Harbour campsite was the most exposed to winds. Excellent shelter was available at the other campsites. Tent frames with floors would provide more comfortable conditions and still allow portability.**

Fishing Effort

All fishermen involved in the—project were extremely interested in the overall operation and success of the fishery. Nets were efficiently tended and regularly cleaned. Daily records of catch and effort were well maintained over the duration of the fishery. Fishing crews consisted of one older fishermen paired with a younger person and was an efficient way to operate the camps.

Other Problems

A polar bear had to be destroyed at the Merle Harbour camp after several disturbing encounters. The defense kill was properly reported to the Wildlife Service via HF radio. The camp was maintained in clean condition and garbage was burned and buried on a regular basis. It is assumed that the bear destroyed was the same animal that was chased out of camp on several occasions.

Insulated fish boxes (see Appendix 2) were used to store and transport the catch. While the containers were a vast improvement over uninsulated open tubs, the insulated containers proved unwieldly when loaded near the 228 kg (500 lb) capacity. Handle positions on the boxes did not allow four people to maneuver easily into lifting position. Alterations (or a yoke system) should be considered prior to next season. A vehicle (truck or ATV and trailer) is required to transport gear and fish in Chesterfield Inlet.

Occasionally when the collector boat arrived at the fishing camp or the community, no boats were available for access from the anchored collector boat to shore. A small inflatable or portable boat transported on the collector vessel would eliminate this problem.

While the collector vessel utilized was found to be very well suited to the fishery, minor modifications are being considered to relieve the problems encountered with spray. A set of windshield wipers are required. A canvas top capable of extending from the windshield back to the stern would improve operator comfort and eliminate the effect of salt spray on instrumentation and electrical components.

Other problems encountered can be considered typical of any northern fishery.

BIOLOGICAL EVALUATION

The parameters involved in fish stock assessment cannot be measured throughout the entire stock. A sample of the population is therefore examined on the assumption that the sample is representative of the whole population. A basic objective in achieving a representative sample is to ensure a random sample is taken.' The aim of a random sample is to ensure that all members of the population have the same chance of occuring in the sample. The test fishery utilizes the same fishing gear (139 mm [5 1/2 inch] stretched mesh size gillnet) as the commercial fishery. Since the fishing gear is selective the sample is representative of only the "catchable" portion of the stock.

The test fishery attempts to gather information on discrete Arctic char populations. The rationale of the fishing method is to take char returning from summer feeding in the sea to "home" river systems where ripe fish will spawn and the population will overwinter. While char have been known to undertake lengthy movements this behaviour is the exception rather than the rule. Johnson (1980) found a high degree of returns to the "home" river amongst intermediate sized char. Only amongst larger char was homing diminished.

After the downstream run in the spring, char disperse to feeding locations in the sea. Generally char disperse and feed along the coastline. Moore (1975) estimated that the distance travelled from the home stream is directly proportional to the length and age of the fish, with larger and older char traveling greater distances than smaller fish. On the basis of length frequency characteristics, Moore felt there was very little intermingling of stocks in the feeding area. Other studies (Grainger 1953; Sekerak et al 1976) indicate that char do not travel great distances from the home stream. As mentioned early in this report, the life history of char is complex. Management of the species in the Arctic is based on the assigning of quotas to areas (and thus stocks), which serves to distribute fishing pressure. The test fishery method provides a pragmatic approach, which allows biological data collection and fishing to take place concurrently. As the fishery develops the management approach may change. It is necessary to sample discrete stocks as interpretation of data from samples of mixed stocks is near impossible. Further, the optimum time to harvest char is in the fall when they make their upstream run. At this time, the product is in prime condition after a summer of feeding in the sea. The fisherman does not have to expend time and energy pursuing the char; he can await their arrival at home rivers. Economically this makes good sense and is good from a management perspective, as the harvest of heavier fish means fewer individuals will be required to fill a quota.

Strength and Timing of Char Runs

When a single population of fish is subjected to fishing effort in proportion to the rate of fishing, catch per unit effort (CPE) is proportional to the stock present at the time fishing takes place (Ricker 1940,1975). Catch per unit effort during a run of fish is dependent on the timing of the fishery in relation to the timing of the run. A graphic presentation of catch per unit effort data can be used to show the onset, duration and strength of an upstream run. Where fishing effort is consistent throughout the fishery, daily production can also provide information on the status of the upstream run. Catch per unit effort data however, accounts for any variation in the number of nets used each day or in the time spent fishing each day, thus providing a more comprehensive assessment of the status of the upstream run. A summary of production and effort is presented in Table 1 for the two seasons of the test fishery.

Steep Bank Bay

In 1985, fishing commenced on August 18 and continued until August 28. As fishing effort was relatively consistent throughout this period, the graphic presentations of daily production and catch per unit effort are similar (Figure 2). From these records it appears that the Steep Bank Bay fishery (1985), concentrated on the latter portions of the upstream run. In other words, the peak of the run had passed prior to the start of the test fishery. An earlier start of fishing at this location would likely have provided evidence of the start of the upstream run and extended fishing was required to provide information on the duration of the run. Prior to terminating the fishery, 808 kg (round weight) of char were taken indicating a fairly strong run of fish entered the system.

In 1986, fishing commenced on August 2 and continued until September 1. Again, fishing effort was consistent and the graphic presentation of daily production and catch per unit effort are comparable (Figure 3). This fishery appeared to take the early entrants to the system. Prior to terminating the fishery 768 kg round weight was taken.

Merle Harbour:

In 1985 the graphic presentation of daily production and catch per unit effort data (Figure 4) provided no conclusive evidence of the existance of a strong upstream run in this system. Char are known to overwinter in lakes on this system and a small amount of domestic fishing concentrates on the seaward movement of Arctic char in the spring (John Tugak, pers. comm.). Production in 1985 was only 196 kg.

In 1986 fishing at Merle Harbour did not start until August 12. Figure 5 compares daily production and CPE. Again a strong run of fish was not encountered. From the data gathered and observations made in the field it would appear the peak of the upstream run was missed. Production in 1986 was 539 kg round weight.

Kaniqsurjuk:

In 1985 daily CPE data and daily production records (Figure 6) provide evidence of an upstream run. Production, however, was low at 339 kg round weight. The peak of the run may have passed prior to the start of the test fishery.

In 1986, fishing commenced on August 2. Figure 7 presents daily production and catch per unit effort data. Catches diminished after the end of August. Field observations noted the extremely low water levels in the system making it difficult for char to negotiate upstream. Water levels were raised somewhat by rain on August 6 and 14. It would appear that the test fishery managed to concentrate on the main run although production in 1986 was low at 674 kg.

Sagvaqjuac:

DFO counted the numbers of char migrating upstream at this location using a fish fence over three seasons (1977-1979), providing accurate information on the existance of an upstream run in this sytem (Welch, unpublished data). Numbers of char in the run declined in each of the three seasons monitored. Figure 8 shows the results of the program.

In 1985 fishing effort at Sagvaqjuac was variable, thus daily CPE data was used to assess the timing and duration of the upstream run in 1985 (Figure 9). From this graph, it appears that the test fishery was concentrated on the run after the peak had passed. This would indicate that the peak of the run occurred almost one week earlier than recorded in any of the years monitored by Welch. As production from this fishery was low, no estimate of the strength of the run can be provided. No fishing occurred at this location between August 28 and September 8, 1985. Welch's data suggest a second and possibly a third peak in numbers of fish running upstream may have entered the system during this time period. After the 1985 season, discussions with the community of Chesterfield Inlet, indicated a desire to set aside the Sagvaqjuac fishery for domestic and sport fishing purposes. To date no sport fishing trips have been sold through the marketing initiatives undertaken by the Keewatin Chamber of Commerce. Through the winter of 1985-1986 discussions at the community level resulted in a continued desire to commercially fish Sagvaqjuac. Low production levels from other area quotas may be responsible for the desire to fish Sagvaqjuac in order to support the fish plant in Chesterfield Inlet. The Board of 851859 (N.W.T.) Ltd. has indicated fishing will not occur in the area of sport fishing, if any sport fishing trips are eventually sold. Any reduction in domestic fishing effort remains to be seen but at present has been proposed by the community.

In 1986, fishing commenced on August 2 and was terminated on August 28. Figure 10 presents daily production and CPE. It would appear that the main peak of the run occured around August 12. Production in 1986 was 813 kg. Fishing was discontinued on August 28 due to budget constraints. Further fishing may have demonstrated a continuation of the run, but it would appear the main run of fish was complete.

Age, Length and Maturity

The basic knowledge of how a fish population functions is gained from information on the frequency with which fish of various sizes and ages occur within the population. Further assessment provides knowledge on the changes in these frequency distributions over time. In any given stock of char the weight of a fish at any given length is subject to considerable change over the course of the life cycle as well as over the course of the year. (Johnson 1980). The test fishery commences the collection of important baseline data. Large sample sizes are required to confidently define the age and size structure of the population. A summary of biological data gathered in 1985 is shown in Table 2. Table 3 presents a summary for 1986 and Table 4 provides a summary of data pooled between years.

The oldest and largest char (mean age and mean fork length) were taken at Sagvaqjuac (10.6 years and 61.1 cm), followed by Kaniqsurjuk (9.7 years and 57.4 cm) and Merle Harbour (9.6 years and 57.5 cm). The youngest and smallest char were taken at Steep Bank Bay (9.1 years and 54.9 cm).

For individual years, the oldest and largest char were again taken at Sagvaqjuac (1985 - 10.2 years and 58.8 cm; 1986 - 10.6 years and 61.4 cm) followed by Kaniqsurjuk (1985 - 9.3 years and 57.7 cm; 1986 - 9.8 years and 57.3 cm) and Merle Harbour (1985 - 9.6 years and 58.4 cm; 1986 - 9.6 years and 57.2 cm). The youngest and smallest char were taken each year at Steep Bank Bay (1985 - 8.8 years and 54.0 cm; 1986 - 9.3 years and 55.6 cm). A comparison of age-frequency distributions for the catch taken at each location in 1985 is shown in Figure 11 and for 1986 in Figure 12. Length-frequency distributions for the catch taken in 1985 are compared in Figure 13 and for 1986 in Figure 14.

The mean age and length of char sampled in 1986 increased from 1985 at each location, with the exception of Kaniqsurjuk where mean age increased between 1985 and 1986 from 9.3 years to 9.8 years but mean fork length decreased from 57.7 cm in 1985 to 57.3 cm in 1986 and at Merle Harbour where mean age was 9.6 years in both 1985 and 1986 with a decrease in mean fork length from 58.4 cm in 1985 to 57.2 cm in 1986. These observed differences are attributed to the variation in representative sample sizes between years and the timing of the test fishery in relation to the upstream runs. Char runs are often made up of groups of similar-sized fish with larger individuals usually running before smaller individuals (Johnson 1980).

The mean age and length of Arctic char taken by the commercial fishery at Rankin Inlet (Carder 1982) is about 10.9 years and 63.8 cm. Mean dressed weight is about 2.5 kg. Char taken at Sagvaqjuac had a mean dressed weight of 2.4 kg a mean fork length of 61.1 cm and a mean age of 10.6 years comparing favorably with those taken by the Rankin Inlet commercial fishery. Char from the other locations are somewhat smaller ranging from a mean dressed weight of 2.2 kg at Merle Harbour down to a mean dressed weight of 1.9 kg at Steep Bank Bay. These char would be graded as medium sized (1.8 to 3.2 kg). The FFMC considers char under 0.9 kg as unmarketable. Those char with a dressed weight greater than 1.8 kg are considered prime banquet trade (Alex Drobot, FFMC, pers. comm.).

Of major concern to the resource manager is the size and age of maturity of char and the relative abundance of mature, potential spawners in the population (Kristofferson et al 1982). The spawning behaviour of char is complex. Studies at Nauyuk Lake on the Kent Peninsula (Johnson 1980) show considerable variation in numbers of spawning fish from year to year. Once char reach maturity, they do not spawn every year and show a wide range of variation with respect to their age at first spawning (Johnson 1980). In the Nauyuk Lake system, Johnson found that in the spring most of the nonspawning fish run downstream to the sea. Those fish destined to spawn that year move upstream to spawning grounds. At the same time, the postspawners from the previous year move downstream to the sea. There is some indication that the condition n which the char return from the sea influences the number of spawners in the following year. The number of spawners in any given year was found to be small, often only 2% of the larger size mode of the total migratory stock.

Based on the sampling program results from the Chesterfield Inlet test fishery significantly more spawners were observed at each fishing location than encountered at Nauyuk Lake. Data pooled between years to increase sample sizes show 4.5% (9 of 199) char sampled at Merle Harbour were about to spawn, at Kangiqsurjuk 7.5% (11 of 147) spawners, 10.4% (17 of 143) spawners at Sagvaqjuac and 10.8% (26 of 241) spawners at Steep Bank Bay. Rather than increased productivity, these results may show different behaviour, with current year spawners venturing out to sea in the summer rather than remaining in fresh water as observed by Johnson at Nauyuk Lake. The relationship between recruitment and the abundance of mature fish and ratio of spawners is a key question. Understanding this relationship is complicated by the complex spawning behaviour of Arctic char (Johnson 1980). Further research on a regional basis is required to better understand the spawning behaviour and productivity of the Arctic char in the Keewatin region.

The size and age of maturity of Arctic char varies considerably between populations. Generally, char grow and mature faster in the southern portions of their range (Scott and Crossman 1973). Along the west coast of Hudson Bay mature char nine years old have been taken (Sprules 1952). The youngest current year spawners sampled during the Chesterfield Inlet test fishery were 8 years of age (N=2). The mean age of current year spawners sampled was 10.4 years (N=49). The oldest current year spawner sampled was 15 years. Current year spawners ranged in fork length from 47.2 cm to 75.0 cm with a mean fork length of 61.4 cm (N=63). If Arctic char at the locations fished spawn for the first time at an average age of 9-11 years and at an average fork length of about 55 cm to 65 cm, then it would appear that the stocks at all locations have relatively large numbers of potential spawners. However, as the relationship between the size of the spawning stock and successful recruitment to the fishery is not well understood and as productivity may be influenced by uncontrollable environmental factors, such as climate (Johnson 1980), the ability of char stocks to sustain fishing pressure must be approached in a cautious manner.

Further, small spawning stock size coupled with slow growth rates could sigifnicantly reduce the ability of char stocks to respond to management efforts aimed at rejuvenating over-exploited stocks. This could particularly apply to the accessible fisheries at Kaniqsurjuk and Sagvaqjuac.

Growth

For the population analysis it is desirable to express the growth of fish in a mathematical expression, which will give the size (in terms of length or weight) of fish at any given age and which agrees with the observed data. Length-weight relationships were calculated from each sample and are compared between locations for 1985 (Table 5) and 1986 (Table 6). A comparison of weight at length of Arctic char sampled at each location between years is presented in Figure 13. At each location char taken in the fall of 1986 weighed slightly less for a given length than did those char sampled in the fall of 1985, indicating a possible poor season of growth in 1986 (Figure 13). Observations made at the fishing sites indicate char spent less time in the sea feeding in 1986 due to a late spring run downstream and an early run upstream in the fall. As Johnson (1980) states, the weight of char increased during the summer feeding season and often decreases over the winter. Length increases occur in both summer and winter, with the increase in winter being made at the expense of nutritional reserves.

A comparison of growth as length at age for each location is presented in Figure 14. The figure seines to show the comparable rates of growth between the populations sampled. This is to be expected as growth takes place in similar environments. A smoothed growth curie as length at age is shown in Figure 15. The curve has been derived from data pooled between' years and locations. The sample size used to determine mean fork length at age are shown.

Mean condition factor (K) was calculated for each location by year. Condition factor (K) provides a coefficient of plumpness or robustness at the time of capture. Mean condition factors were lower at all locations in 1986 than those 'condition factors determined in 1985, further reflecting the summer season feeding opportunity in 1986 as compared with the summer of 1985. A comparison of mean condition factor (K) between years for each location (Steep Bank Bay, 1985 K=1.33, 1986 K=1.21; Merle Harbour, 1985 K=l.32, 1986 K=1.21; Kaniqsurjuk, 1985 K=1.29, 1986 K=l.20; Sagvaqjuac, 1985 K=1.31, 1986 K=1.19) indicate the fishery still provided a prime product if we assume a (K) factor greater than 1.00 indicates a product in prime condition.

Mortalitv

Catch curves were prepared for each location using data pooled between years to decrease the effect of variable recruitment of fish to the catchable portion of the population (Ricker 1975). The catch curves are presented in Figure 16. Analysis of the catch curves indicate a good fit to the regression line applied along that portion of the descending limb considered to be linear.

The comparison of instantaneous total mortality (Z) shows lowest mortality at Sagvaqjuac (0.4646) followed by Merle Harbour (0.4630). Highest mortality takes place at Kaniqsurjuk (0.7573) followed by Steep Bank Bay (0.6101).

Natural mortality of char stocks is assumed to be low due to the long natural lifespan and low predation (Johnson 1980). Natural mortality is assumed to be 0.17 (after Moore 1975). Fishing mortality (F) has been calculated from instantaneous total mortality (Z) as shown in Table 7.

Fishing mortality is highest at the Kaniqsurjuk fishery (0.5873) followed by Steep Bank Bay (0.4401), Sagvaqjuac (0.2946) and Merle Harbour (0.2930). Kaniqsurjuk supports a domestic fishery and Steep Bank Bay has been commercially fished in the past (1977-harvest level unknown). Fishing mortality is low at Merle Harbour, supporting an occasional spring domestic fishery. Fishing mortality is surprisingly low at Sagvaqjuac given its proximity to Chesterfield Inlet, however, while the test fishery was ongoing, no domestic fishing was observed at Sagvaqjuac (August and September 1985 and August 1986). Some domestic fishing is carried out" at Sagvaqjuac in the early winter.

Rate of Exploitation and Estimation of Yield

The capacity of Arctic char to yield a harvest under exploitation is not well understood (Johnson 1980). In the Sylvia Grinnell River (Hunter 1976) estimated that the optimum yield of anadromous Arctic char is about 10% of the existing stock in a given year; however the basis for the estimate of existing standing stock was not clarified. As stated earlier, the complex population dynamics of Arctic char populations compound the managers attempts to estimate a proper level of yield from a population. Regionally, these efforts are further compounded by the lack of detailed harvest data particularly with respect to domestic fisheries. Probably the most effective strategy at present is to apply rates of fishing to new fisheries that have been shown through experience to be tolerable by char stocks (Kristofferson 1982). Estimations of yield from new fisheries should be initially consecrative and closely monitored from the onset of fishing to determine if the selected rate of fishing can be sustained. Given the lack of data on present harvest levels from the fisheries evaluated through the test fishing process, a conservative approach has been taken in the estimation of yield and setting of a commercial quota for the fisheries in question.

The calculated rate of exploitation (u) ranged from a low of 0.2540 at Merle Harbour to a high of 0.4442 at Kaniqsurjuk. Exploitation rate (u) at Steep Bank Bay was 0.3560 and 0.2552 at Sagvaqjuac. Kristofferson (1982) provides calculated exploitation rates from established char fisheries at the Jayco River (0.20) and the Ekalluk River (0.44) in the Cambridge Bay area, however, growth and maturity rates between the established fisheries mentioned and the locations tested in 1985 and 1986 are not similar. As stated earlier, anadromous Arctic char tend to display earlier maturity and faster growth in the southern portions of their range. The established exploitation rates stated should provide conservative guidelines for setting preliminary yield estimates for the systems tested. On going monitoring of the commercial harvest should be implemented to determine if the selected rate of fishing can be sustained.

As the best estimates of population size are available for Sagvaqjuac (Welch, unpublished) we start our yield assessment with that location. Harvest data for Sagvaqjuac were estimated based on available data and the catch taken by the test fishery. The report A Preliminary Study of the Native Harvest of Wildlife in the Keewatin Region, Northwest Territories (Gamble 1984) provides a reported and estimated Arctic char domestic harvest for the community of Chesterfield Inlet for a 12 month period (October 1982-Sept. 1983). The reported harvest for the community during this period was only 146 char. The actual harvest was estimated at 152 char. These figures appear to significantly underestimate the harvest for the community and we have rejected the estimate.

The catch reported by the test fishery at Sagvaqjuac was 402 char. If we assume the domestic harvest at four times the test fishery harvest, we estimate an additional 1608 individual char were taken over the course of the test fishery. Using this estimate of harvest and the Baranov catch equation we arrive at the estimated population size of 8530 char. This estimate compares with the 1979 enumeration of 8422 char. However, our estimate of the harvest can only be considered to be arbitrary.

Using the Baranov catch equation and an estimated population size of 10,174 derived from the three year mean enumerated population size at Sagvaqjuac we calculate a present yield of 2397 char. This would represent an annual harvest of 23.6% of the standing stock, a level likely to be unsustainable based on experience with other fisheries. Discussions with fishermen involved in the test fishery in recent years, providing more and larger individual char. We cannot support or refute these statements with existing data.

We feel the best estimate of yield can be calculated using the Baranov equation and the lower population enumeration for 1979 (8422 Arctic char). From this stock size we calculate present yield to be 1984 individual char. Using a mean round weight of 2821 g (Table 4) the present yield is calculated at 5596 kg.

As discussed earlier, Sagvaqjuac has historically provided an important domestic fishery for Chesterfield Inlet. Presently the community is prepared to reduce domestic harvest in the system in order to provide a product for the fish plant, which did not have sufficient throughput in 1986 to turn a profit. While the present exploitation rate (u=0.2552) is considered to be low, when compared to other established fisheries, the level of domestic harvest in the future is as yet in question. In order to provide some level of commercial harvest the recommended quota for Sagvaqjuac should be intentionally conservative. Continued monitoring of the commercial harvest and detailed survey of domestic harvest will be required to determine if the selected rate of harvest is sustainable. For that reason we suggest a commercial quota of 1000 kg round weight for Sagvaqjuac until the effects of this level of harvest can be determined. In the interim, the 1000 kg quota provides an accessible quota for the commercial fishery and will allow continued monitoring of the stock.

The present rate of exploitation at Merle Harbour (u=0.2540) is low. We feel the harvest at this location was hampered by problems with equipment and the system is more difficult to fish than the Sagvaqjuac system. We assume the stock size at this location to be similar to that at Sagvaqjuac. However, as the system is less utilized as a domestic fishery, we feel the recommended commercial quota of 2300 kg round weight provides a conservative yield and will allow for continued monitoring of the fishery.

At Steep Bank Bay the present level of exploitation is moderatley low (u=0.3560). Based on CPE data we assume the stock size to be twice that at Sagvaqjuac (2x8422=16,884). Assuming a harvest level of 10% of the stock to be sustainable, we calculate the yield to be 1,688 x 2375 kg (Table 4) or 4009 kg round weight. We recommend an annual commercial quota of 4500 kg round weight, but strongly suggest the stock be monitored to determine the effect of this level of harvest.

At Kaniqsurjuk the present rate of exploitation was the highest of all locations (u=0.4442). The system is readily accessible to the community and supports a spring domestic fishery. Catch per unit effort data indicate Arctic char are less abundant in this system an the Sagvaqjuac River, however the system is more difficult to fish. In order to allow a small commercial harvest and continued monitoring of the stock we suggest a 1000 kg round weight quota for 1987, provided monitoring of the stock is continued.

A summary of the proposed quotas is shown in Table 5. As stated by Kristofferson (1982) the limitations of the Baranov catch equation as it applies to the relationship of equilibrium yield to size of the stock and rate of fishing, are recognized and are explained in detail by Ricker (1975). The equation is at best, approximate but is used here as a first attempt to calculate an estimation of yield using the available data. It must be remembered that these estimates are designed to be conservative and are based, as much as possible, on past experience with other char fisheries. Effort should now be made to harvest the stocks at the recommended level. Close monitoring will reveal the reaction of these stocks to this rate of exploitation and allow managers to adjust fishing intensity accordingly.

Care of the Catch

Arctic char taken by the test fishery were cleaned (gills and viscera removed) on site and packed on ice in insulated fish boxes awaiting transfer to the icehouse in Chesterfield Inlet. With the exception of periods of poor weather when travel was impossible, the catch was transported to the icehouse approximately every second day. On receipt in Chesterfield Inlet fish were graded, weighed , washed and re-packed on ice for transport to the Issatik Food Plant via scheduled airline. This system proved quite successful and was cost effective at the rates (.15/lb) negotiated with the airline prior to the start of the fishery.

The insulated fish boxes used proved very efficient allowing only minimal ice loss. The drainage system built into the containers allowed for effective drainage of melt water, eliminating pooling in the bottom of the container. Additional insulated boxes should be purchased for the fishery.

Initial quality of the product harvested was very good. Smaller fish full of food at the time of capture tended to deteriorate more quickly than larger fish-with empty stomachs if held in the nets for any period of time.

Fishermen conscientiously cleaned all fish tubs and canoes on a regular basis. Proper tarps were available to cover fish held in tubs.

Operation of the fish plant is now ongoing and will allow for building of economical loads of fish for transport to market.

RECOMMENDATIONS

1) A community based domestic harvest study should be implemented to gather a wide range of data required to support the fishery over the long-term. Information gathered should include sufficient data to allow for the determination of catch/effort statistics, annual and monthly harvest by fishing location and certain biological data required to monitor the affects of applied rates of fishing.

2) Further training should be provided to allow personnel involved in the sampling program (ie Roger Sammurtok) to continue monitoring the commercial fishery.

3) Funding should be provided to allow for the ongoing biological assessment required to monitor the affects of the rate of fishing proposed for the test fishing locations.

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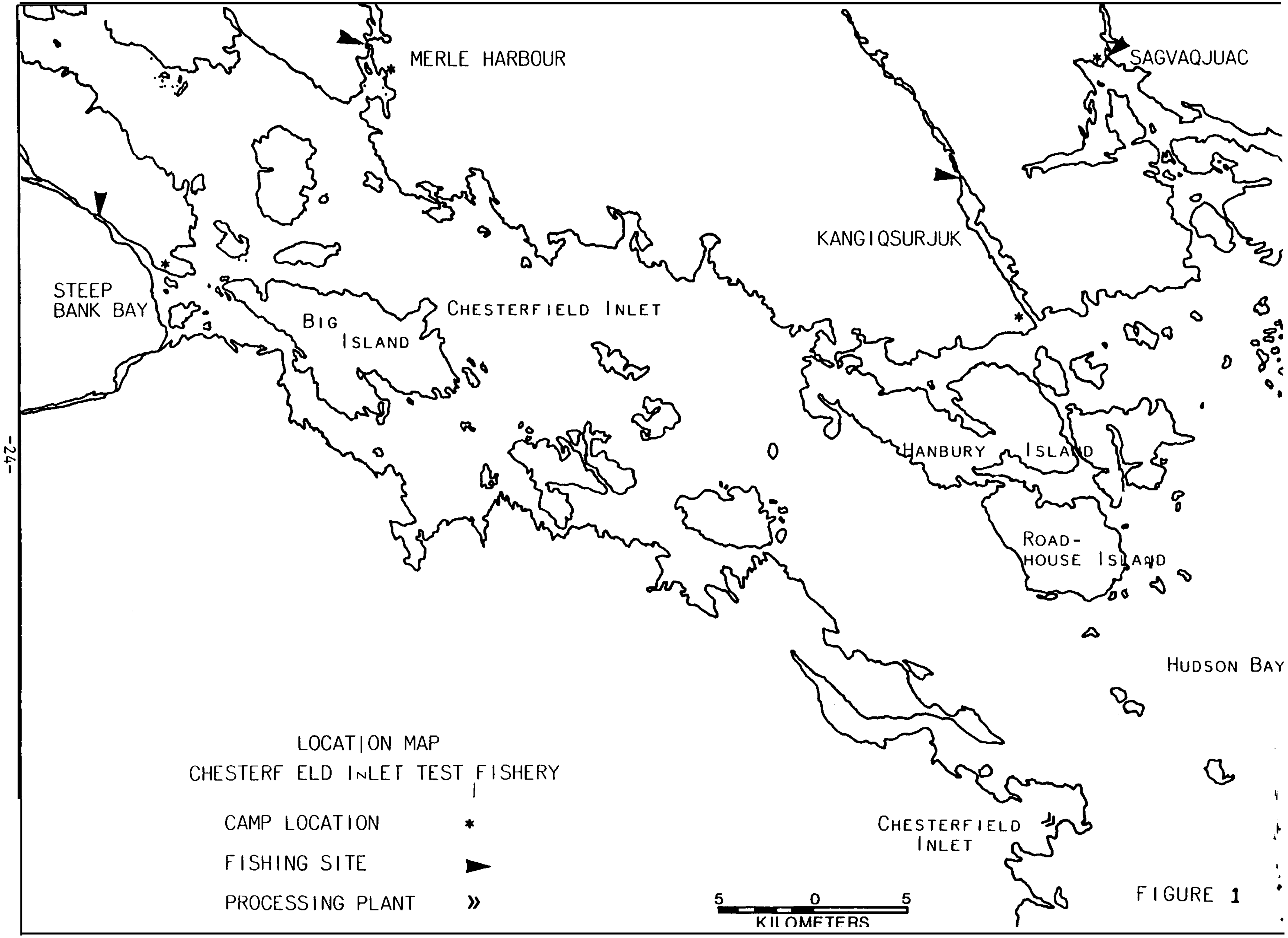

MERLE HARBOUR
SAGVAQJUAC
KANGIQSURJUK
STEEP BANK BAY
BIG ISLAND
CHESTERFIELD INLET
HANBURY ISLAND
ROAD-HOUSE ISLAND
HUDSON BAY
CHESTERFIELD INLET
LOCATION MAP
CHESTERF ELD INLET TEST FISHERY
CAMP LOCATION *
FISHING SITE
PROCESSING PLANT »
5 0 5
KILOMETERS

FIGURE 1

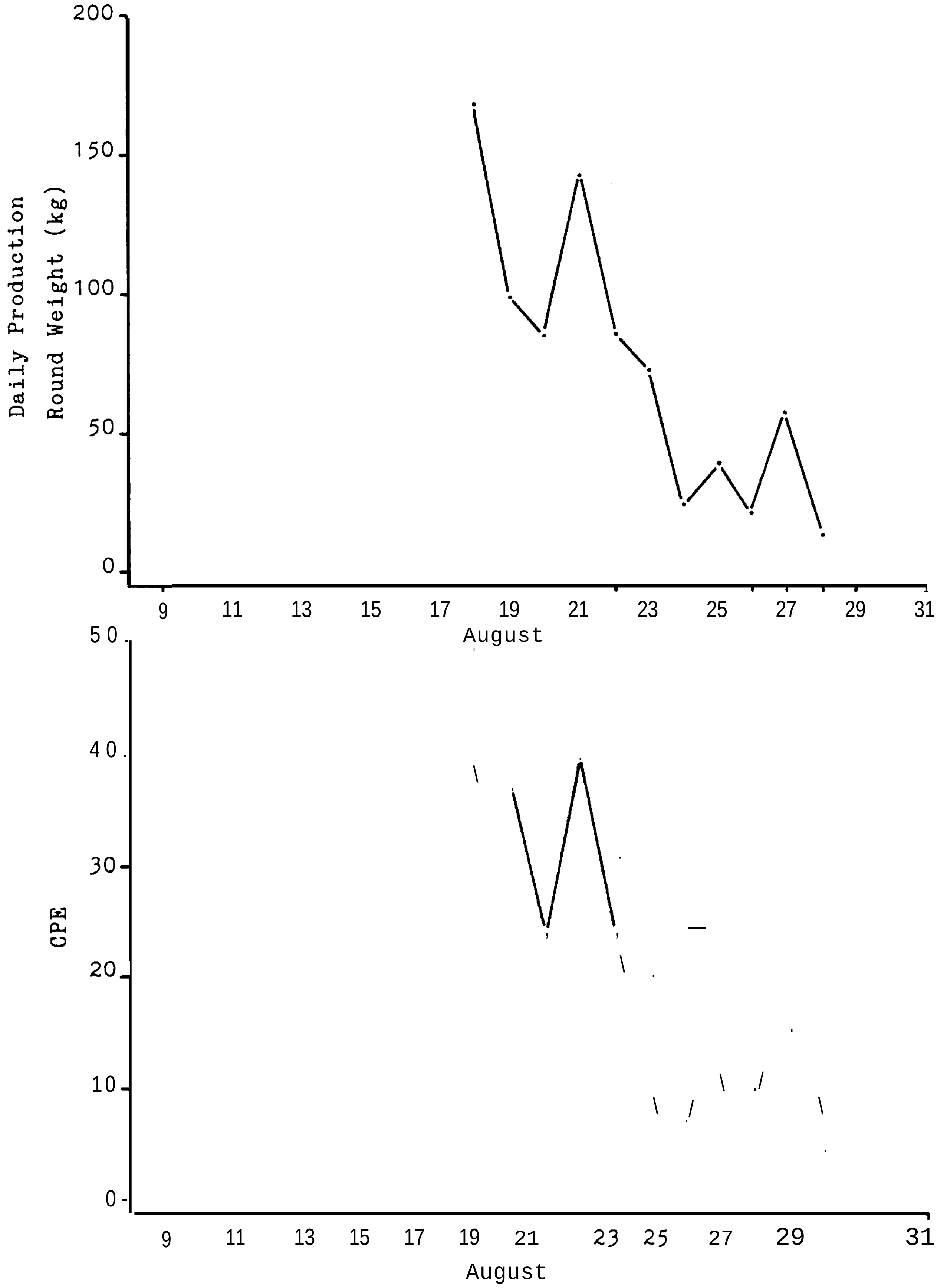


Figure 2. A comparison of daily production (kg round weight) and catch per unit effort (# of fish/day) taken by the test fishery at Steep Bank Bay in 1985.

CPE = number of fish/100 m of net/24 hours

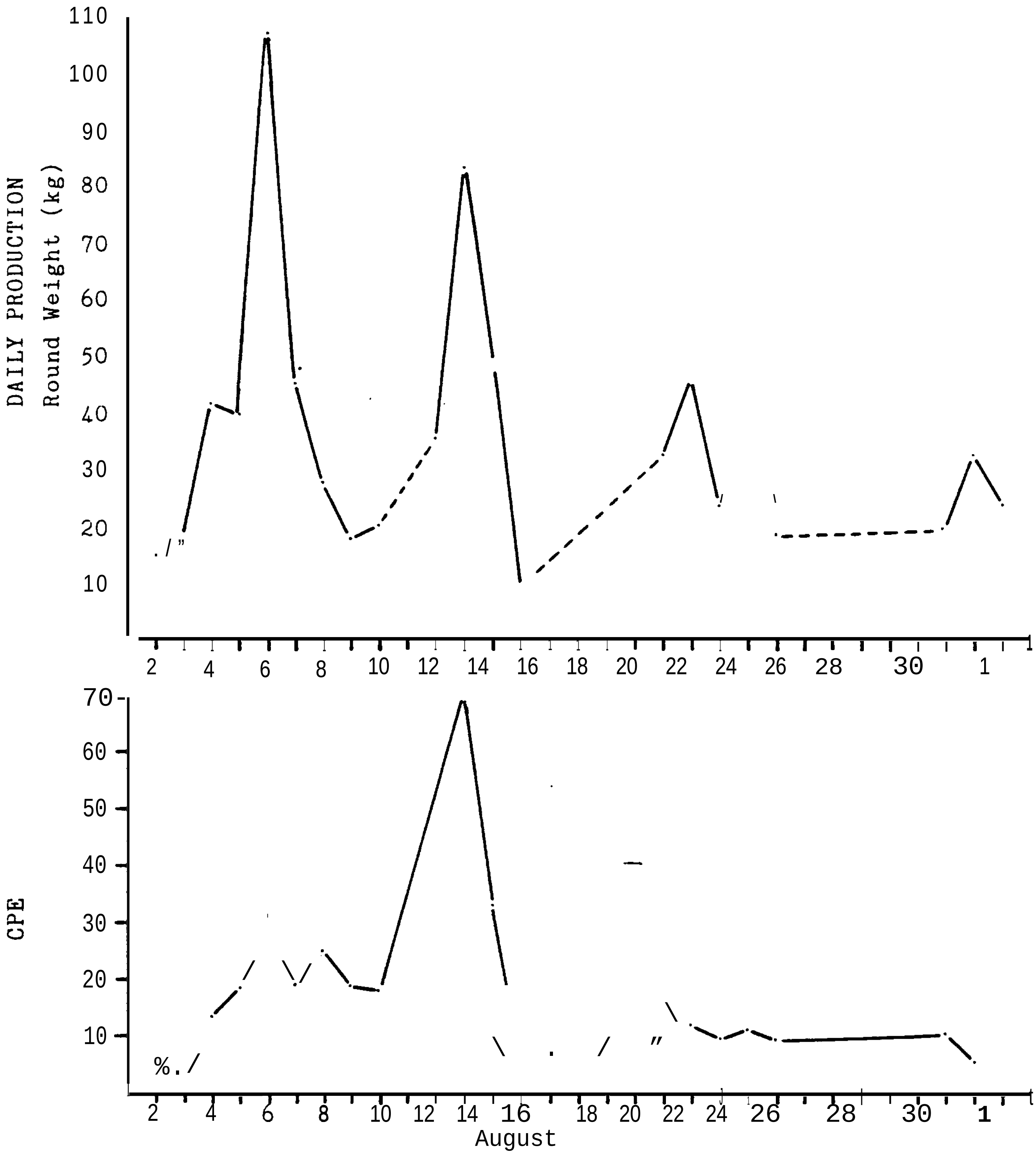


Fig. 3 A comparison of daily production (kg round weight) and catch per unit effort (# of fish/day) taken by the test fishery at Steep" Bank Bay during the fall of 1986.

CPE = number of fish/100 m of net/24 hours

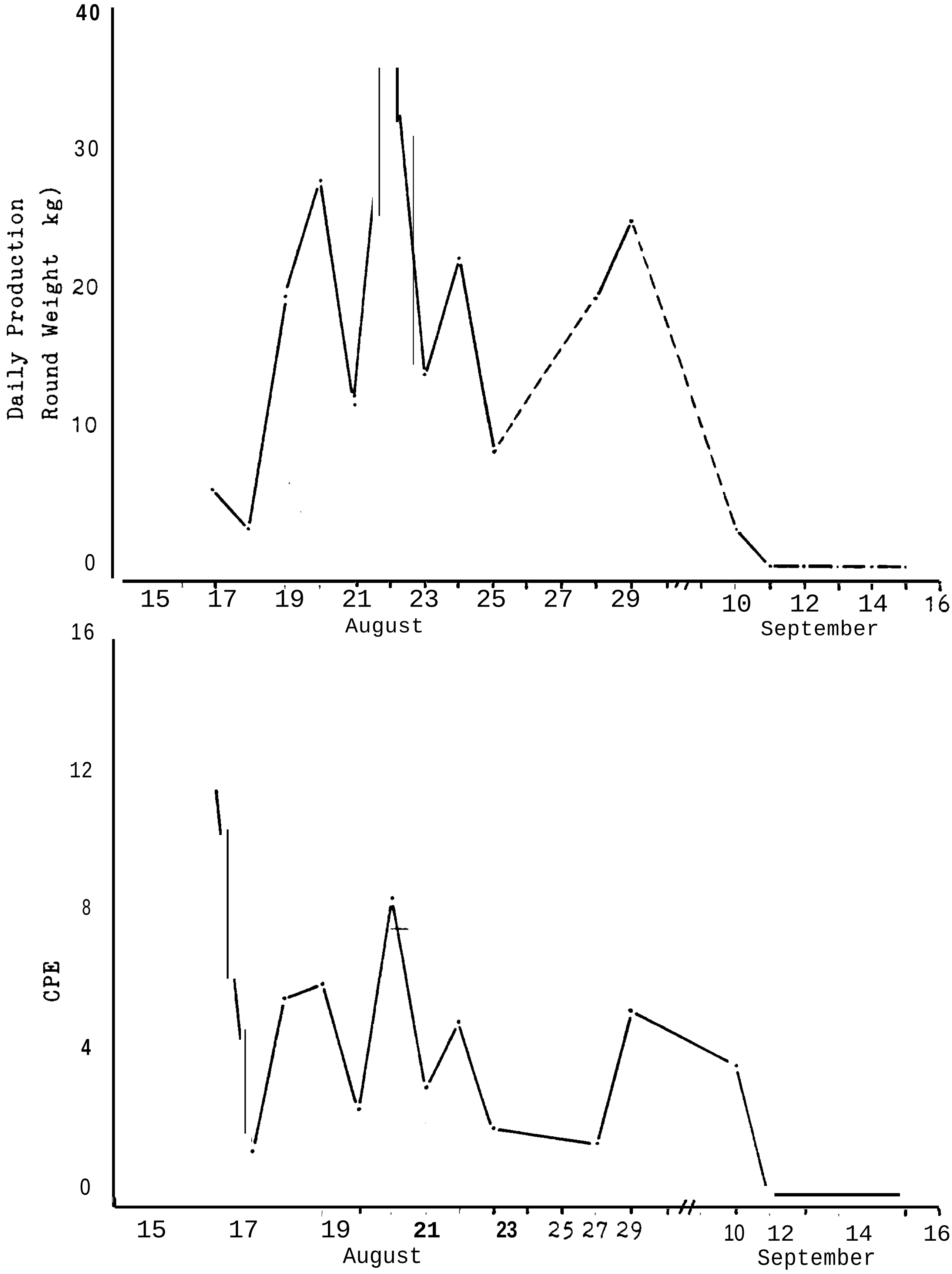


Figure 4. A comparison of daily production (kg round weight) and catch per unit effort (CPE) taken by the test fishery at Merle Harbour during the fall of 1985.

CPE = number of fish/100 m of net/24 hours

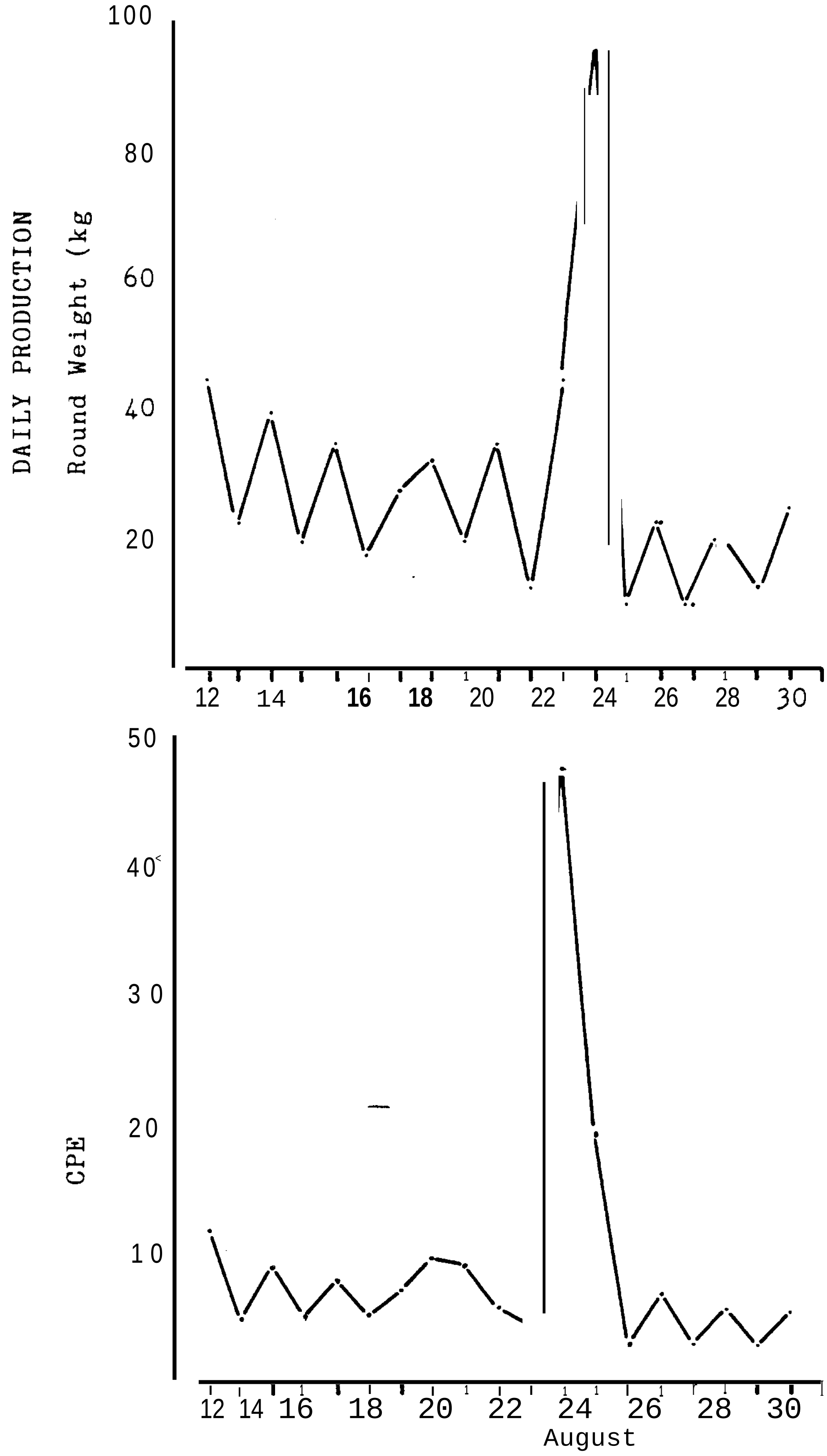


Fig. 5. A comparison of daily production (kg round weight) and catch per unit effort (# of fish/day) taken by the test fishery at Merle Harbour during the fall of 1986.

CPE = number of fish/100 m of net/24 hours

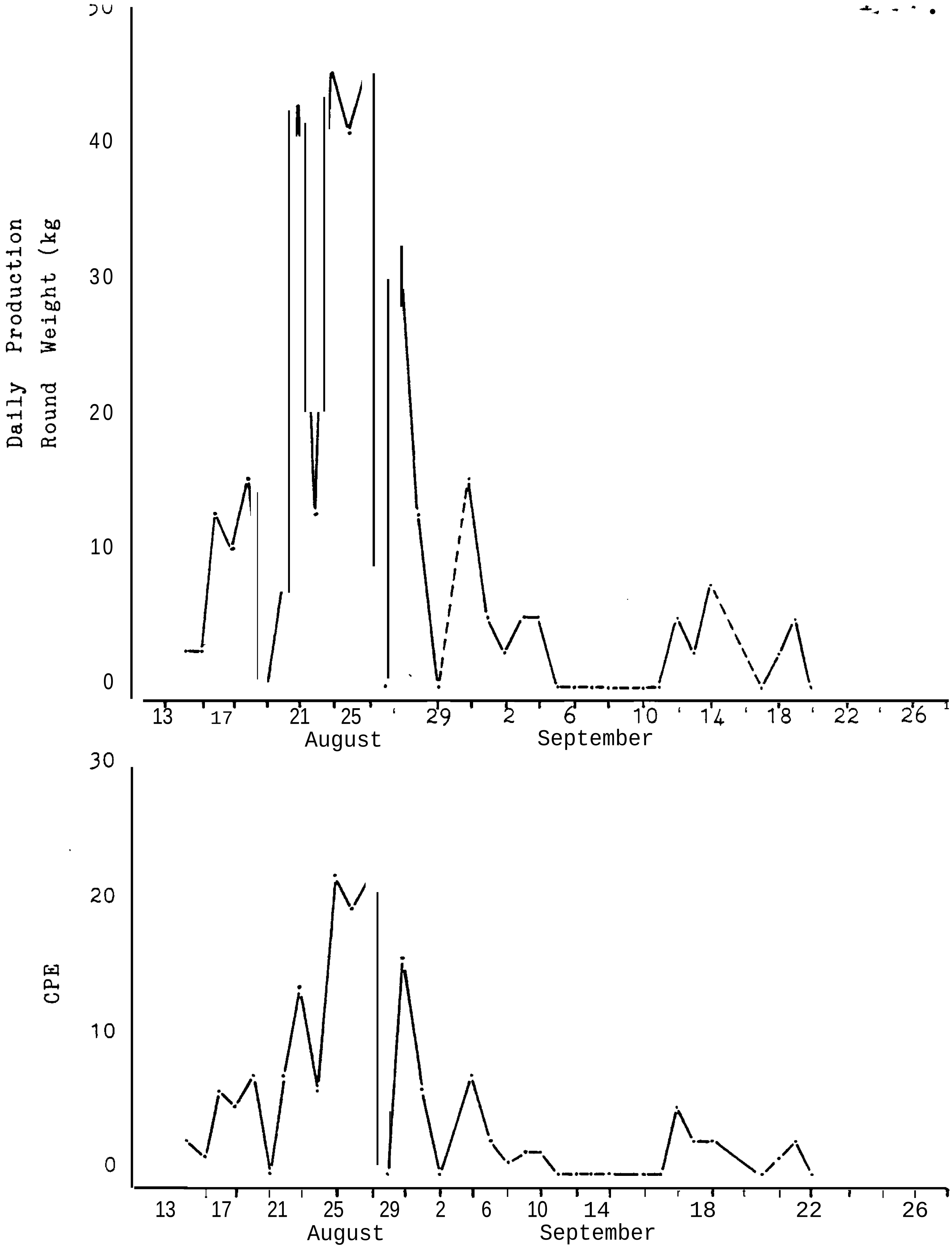


Figure 6. A comparison of daily production (kg round weight) and catch per unit effort (CPE) taken by the test fishery at Kangiqsurjuk during the fall of 1985.

CPE = number of fish/100 m of net/24 hours

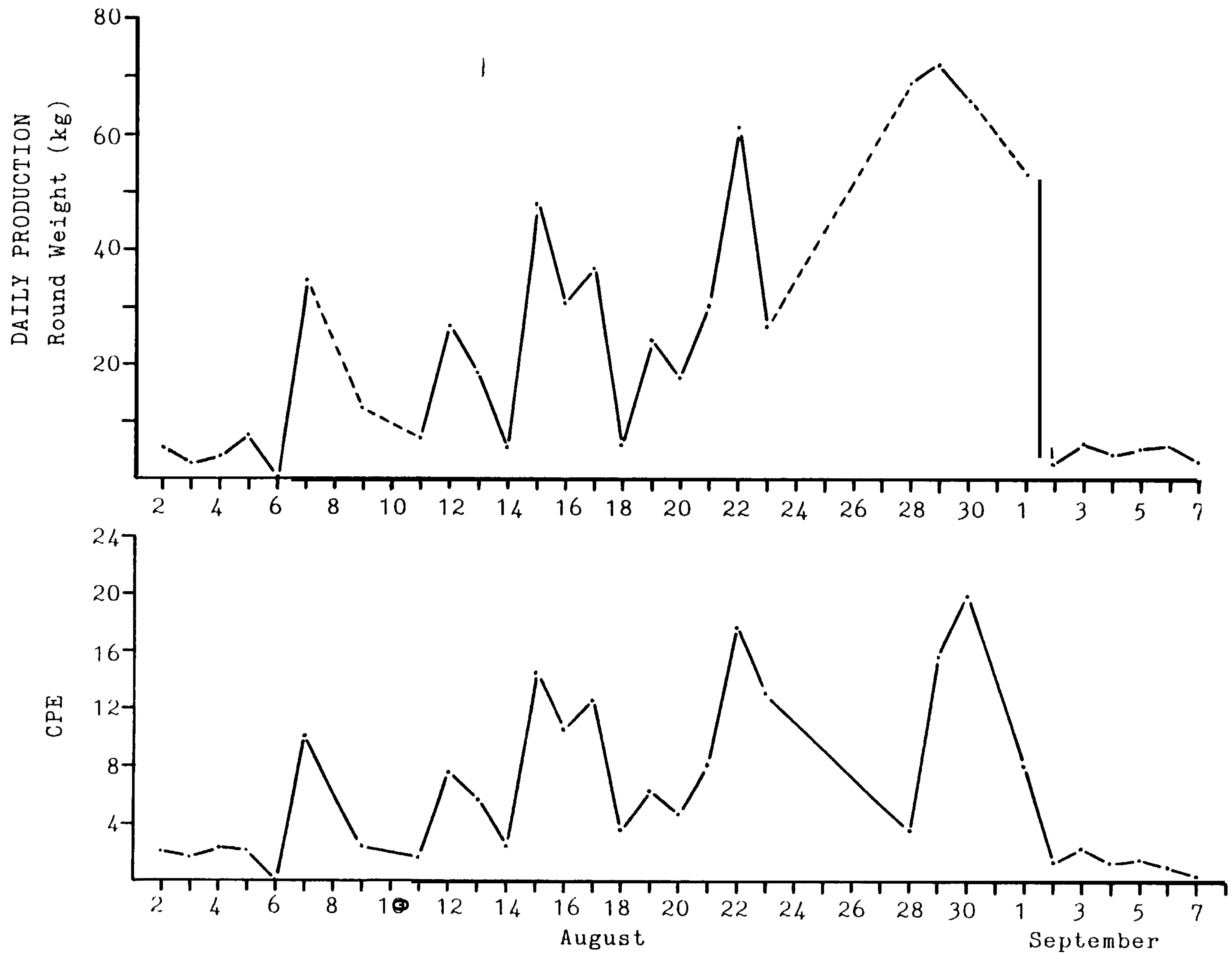


Fig. 7. A comparison of daily production (kg round weight) and catch per unit effort (# of fish/day) taken by the test fishery at Kaniqsurjuk during the fall of 1986.

CPE = number of fish/100 m of net/24 hours

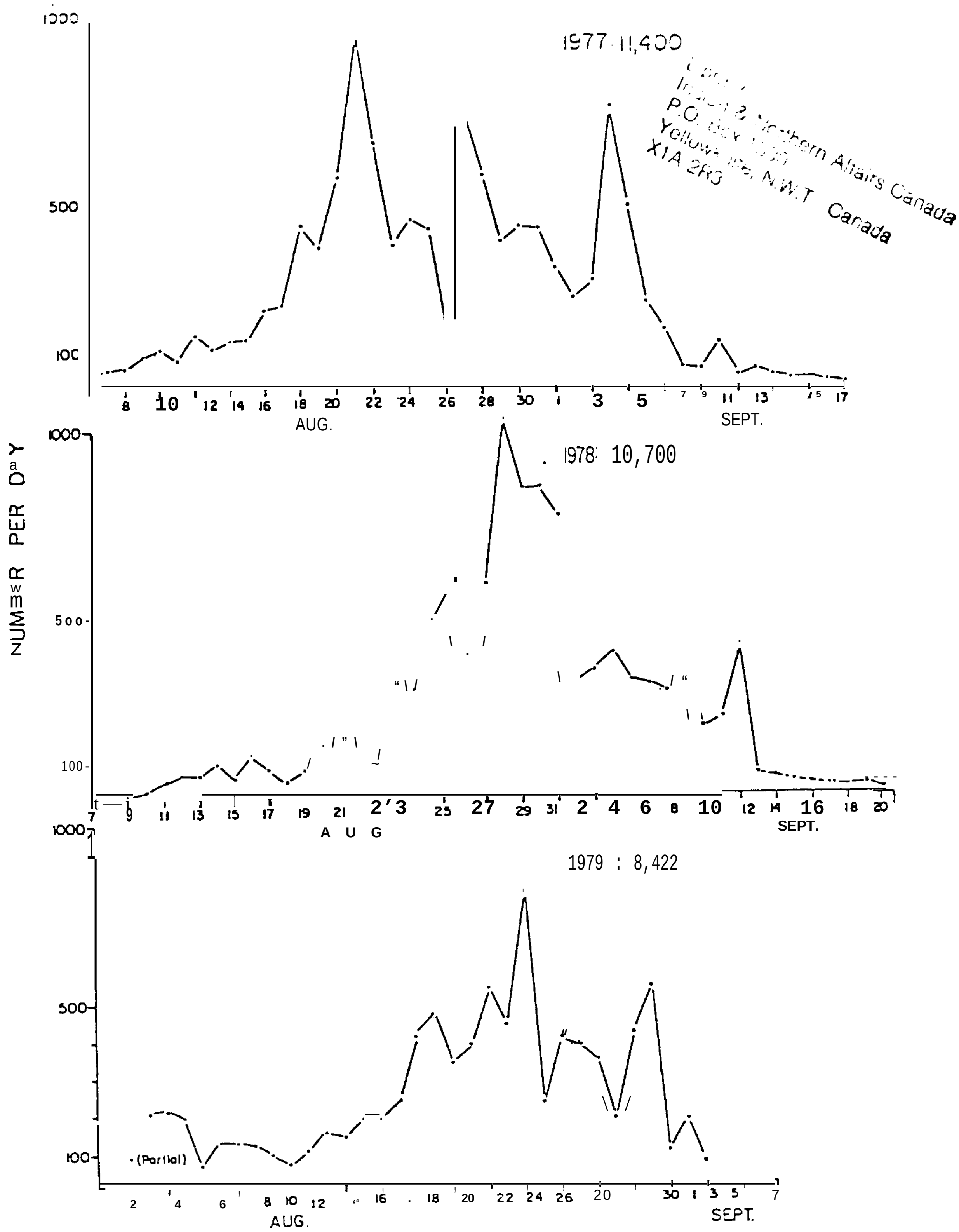


Figure 8. A comparison of the timing, strength and duration of the upstream run of Arctic char in the Sagvaq J uac River 1977 - 1979 (Welch unpublished data) ·

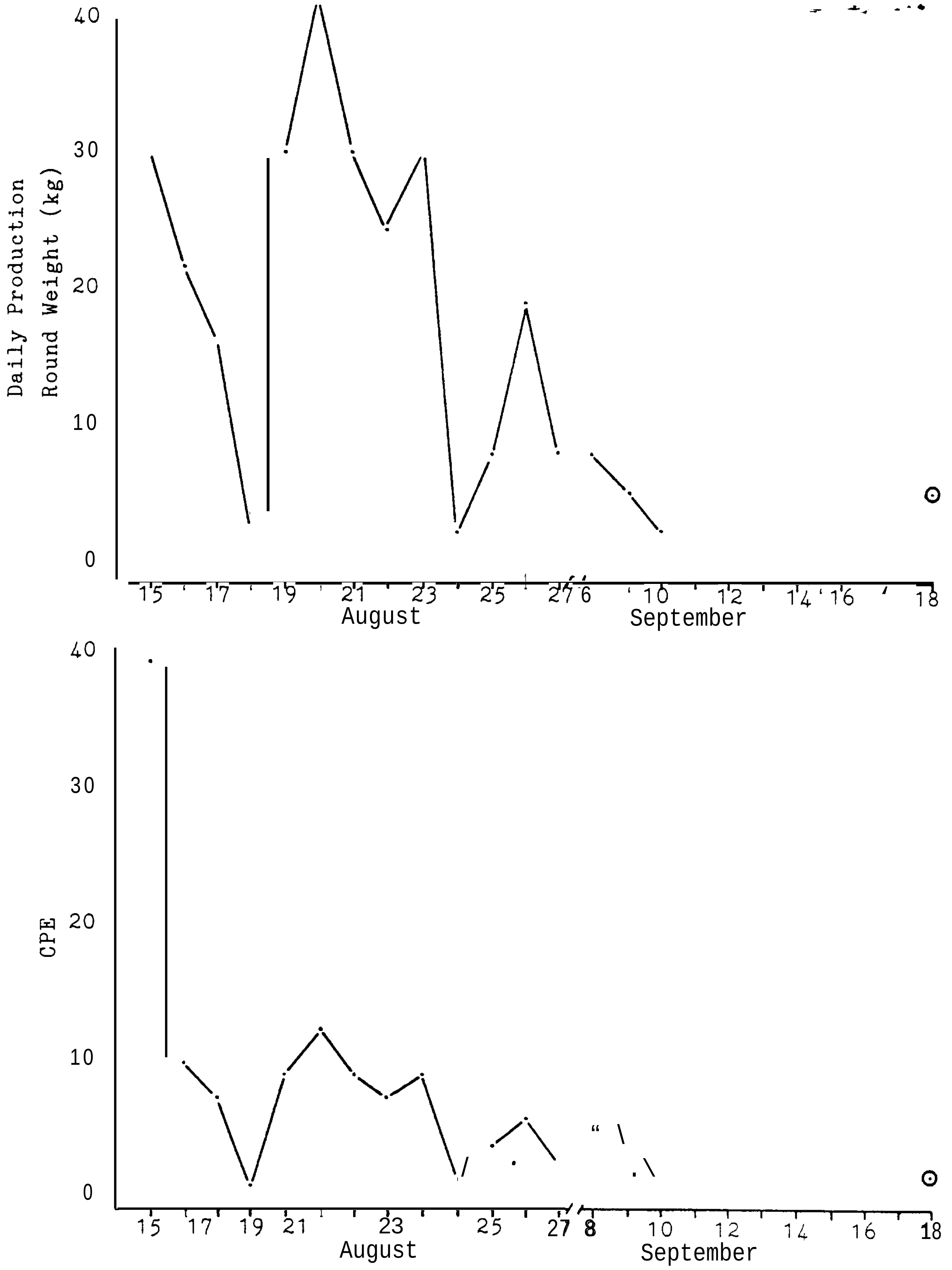


Figure 9. A comparison of daily production (kg round weight) and catch per unit effort (CPE) taken by the test fishery at Sagvaqjuac during the fall of 1985.

CPE = number of fish/100 m of net/24 hours

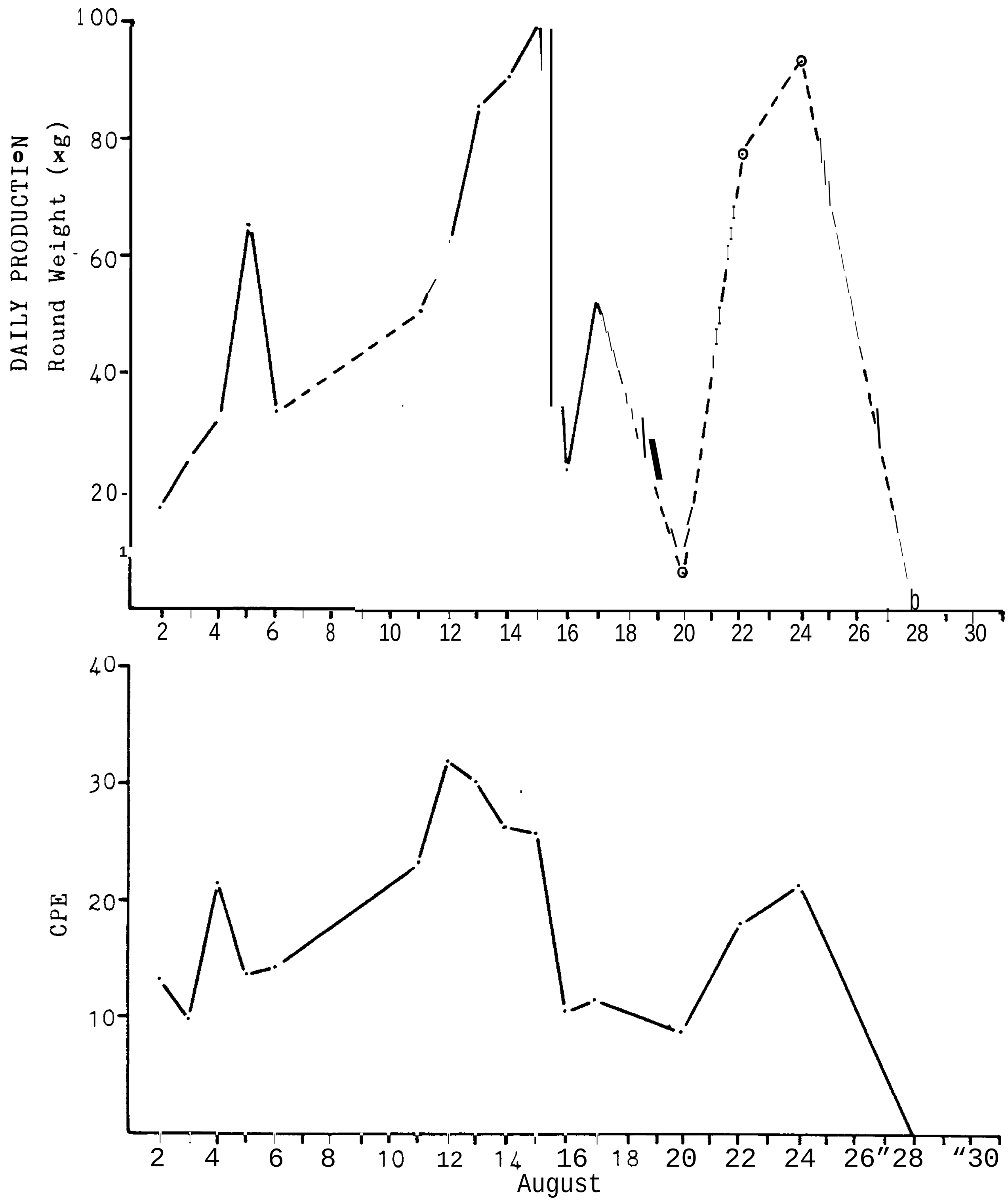


Fig. 10. A comparison of daily production (kg round weight) and catch per unit effort (# of fish/day) taken by the test fishery at Sagvaqjuac during the fall of 1986.

CPE = number of fish/100 m of net/24 hours

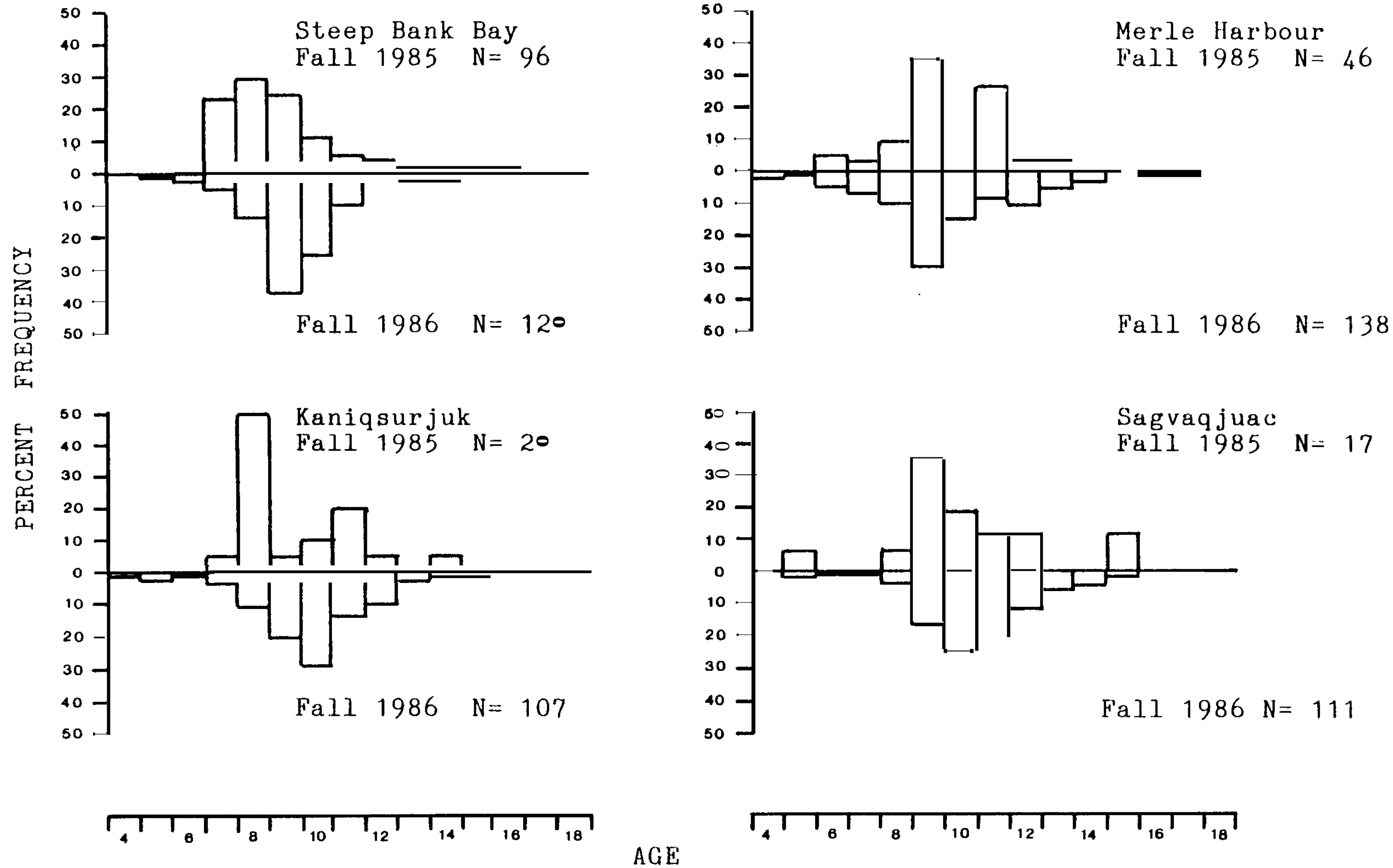


Fig. 11. A comparison of Age Frequency Distributions of Arctic char samples taken during 1985 and 1986.

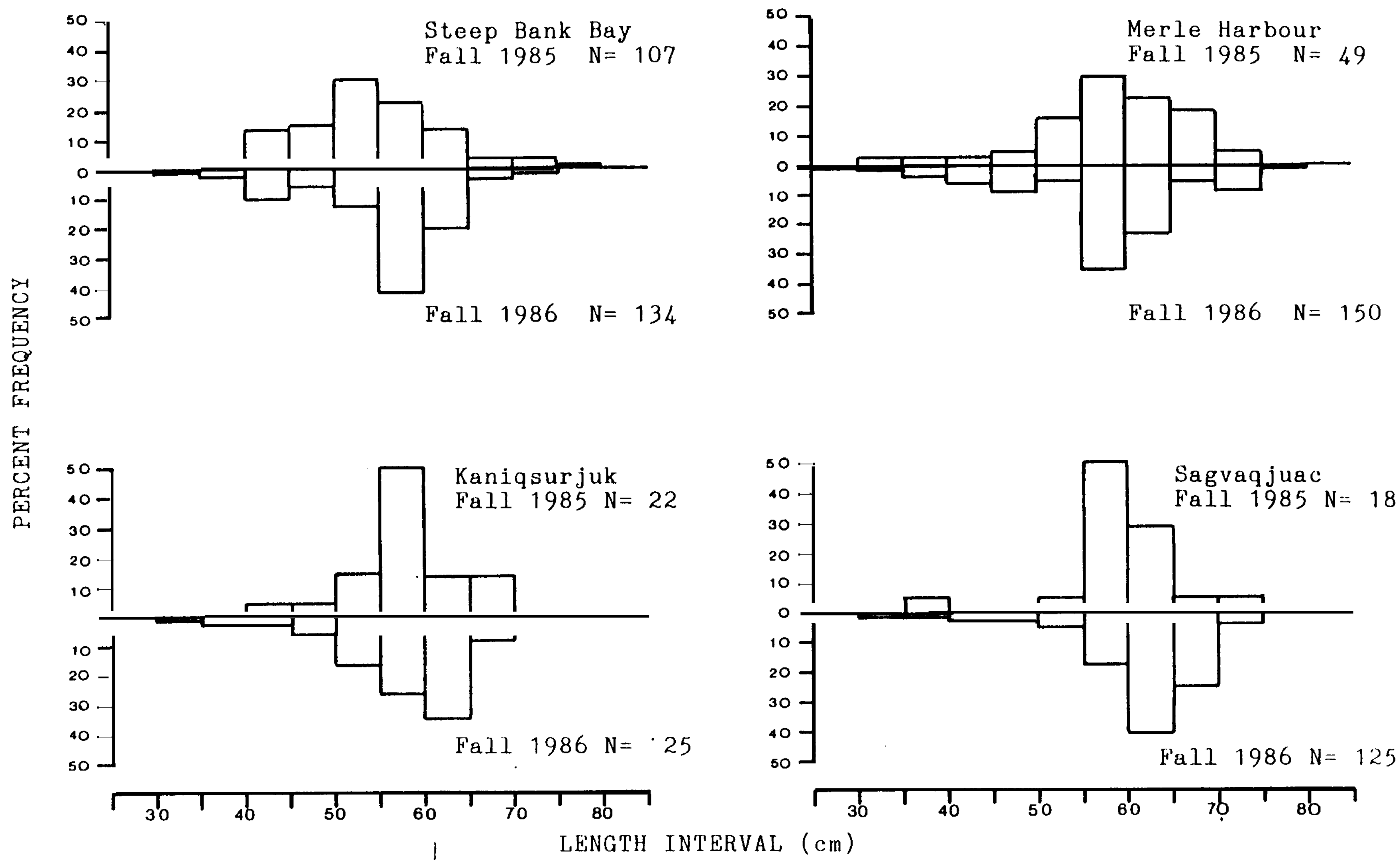


Fig. 12. A comparison of Length Frequency Distributions of Arctic char samples taken during 1985 and 1986.

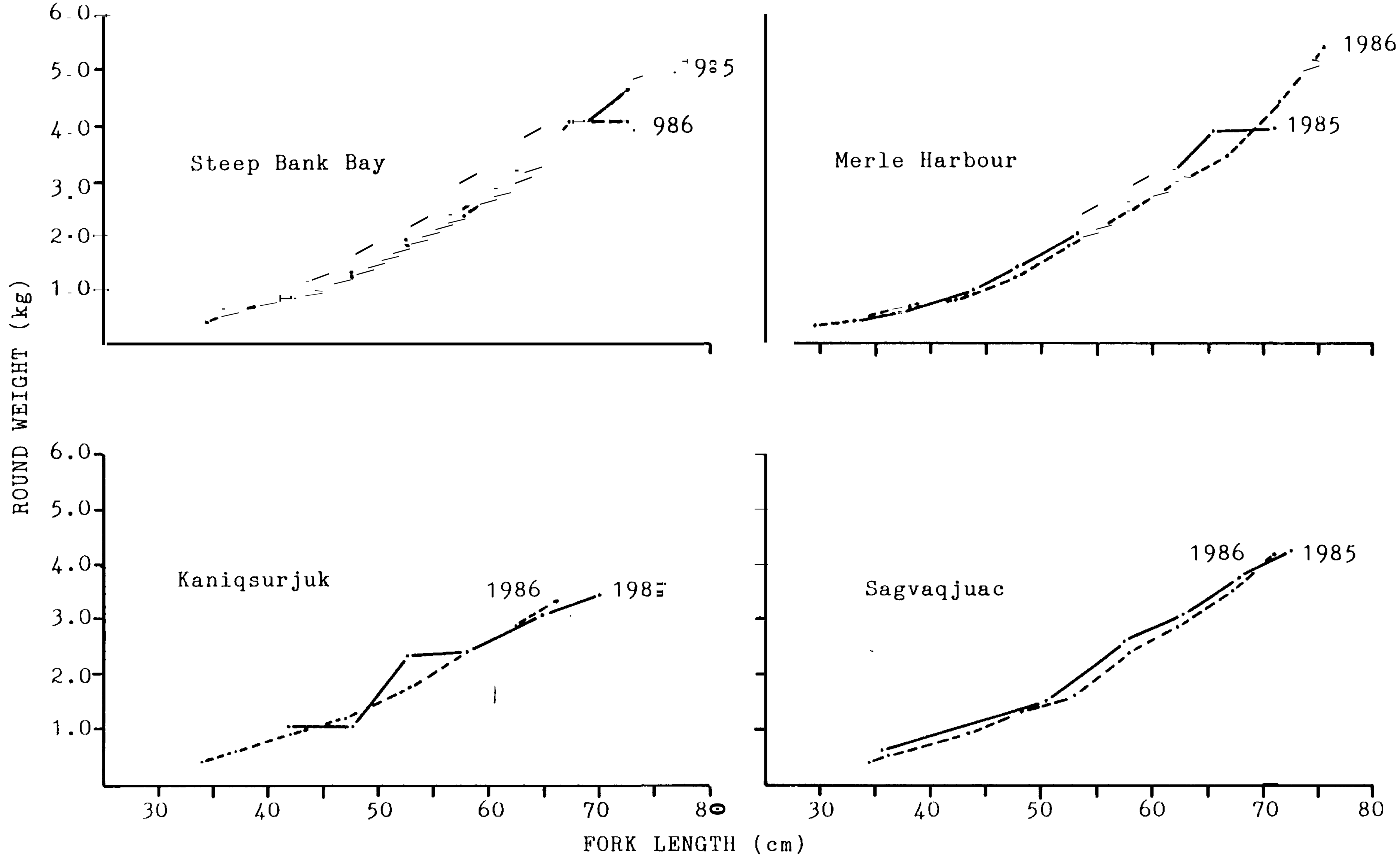


Fig. 13. A comparison of weight at length of Arctic char sampled during the fall of 1985 with weight at length of those sampled in the fall of 1986.

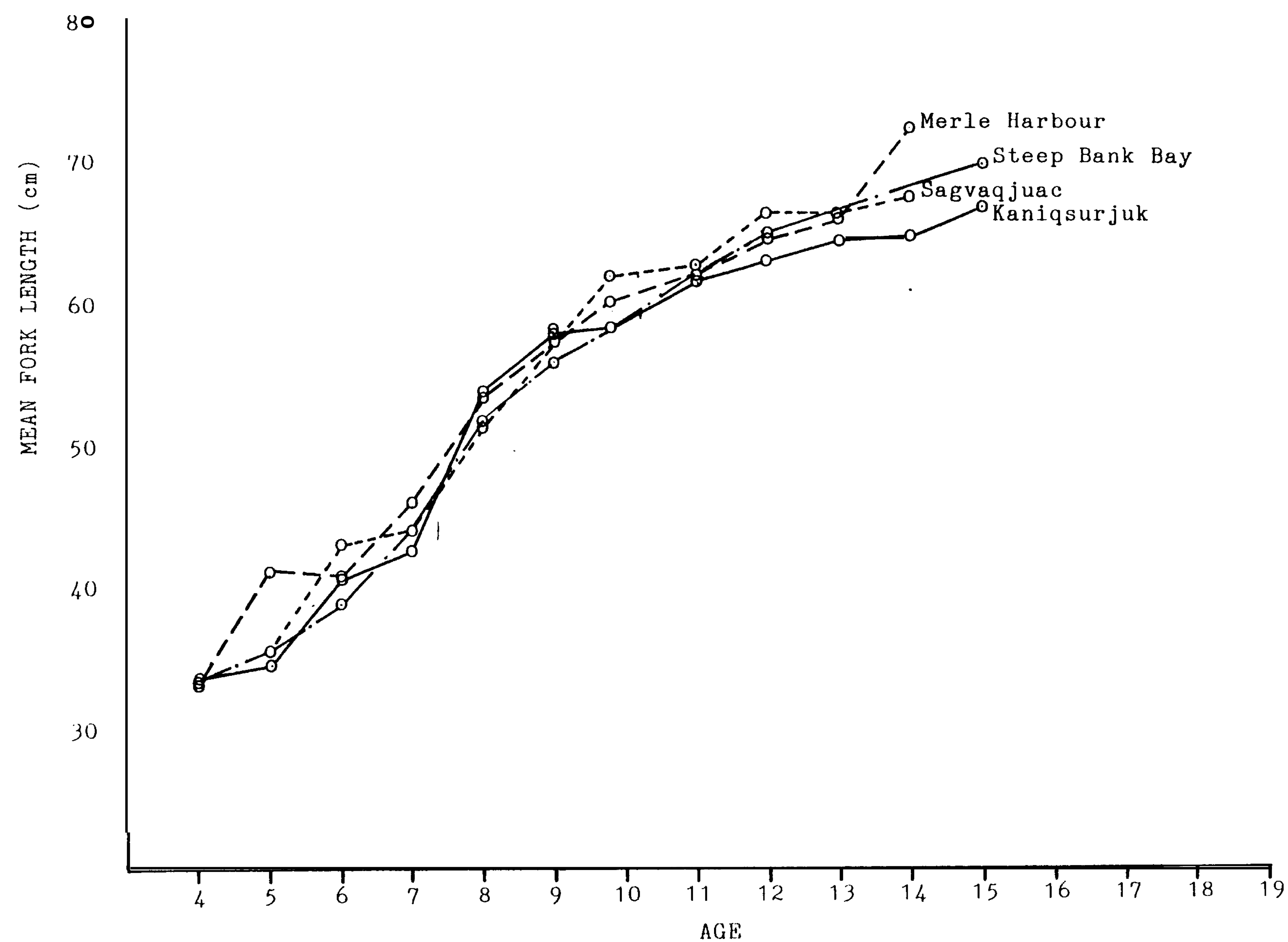


Fig. 14 A comparison of(unsmoothed)growth rates of Arctic char sampled at the Chesterfield Inlet test fishery locations. Though complex, the figure serves to show comparable growth rates between the locations fished.

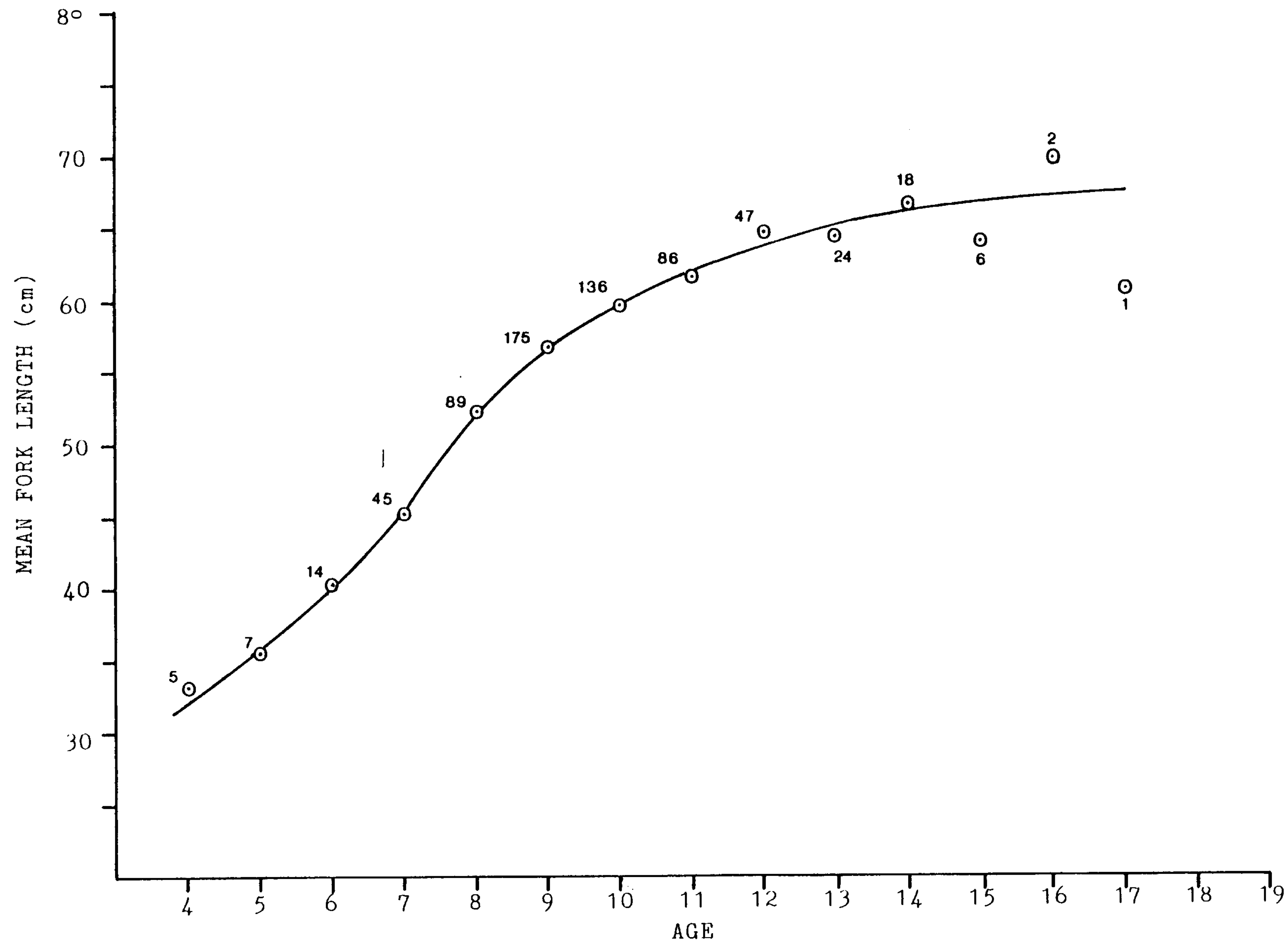


Fig. 5 The growth curve (smoothed) for Arctic char samples taken during the Chesterfield Inlet test fishery. Data was pooled from all test fishing locations. The sample size used to determine mean fork length at age is shown.

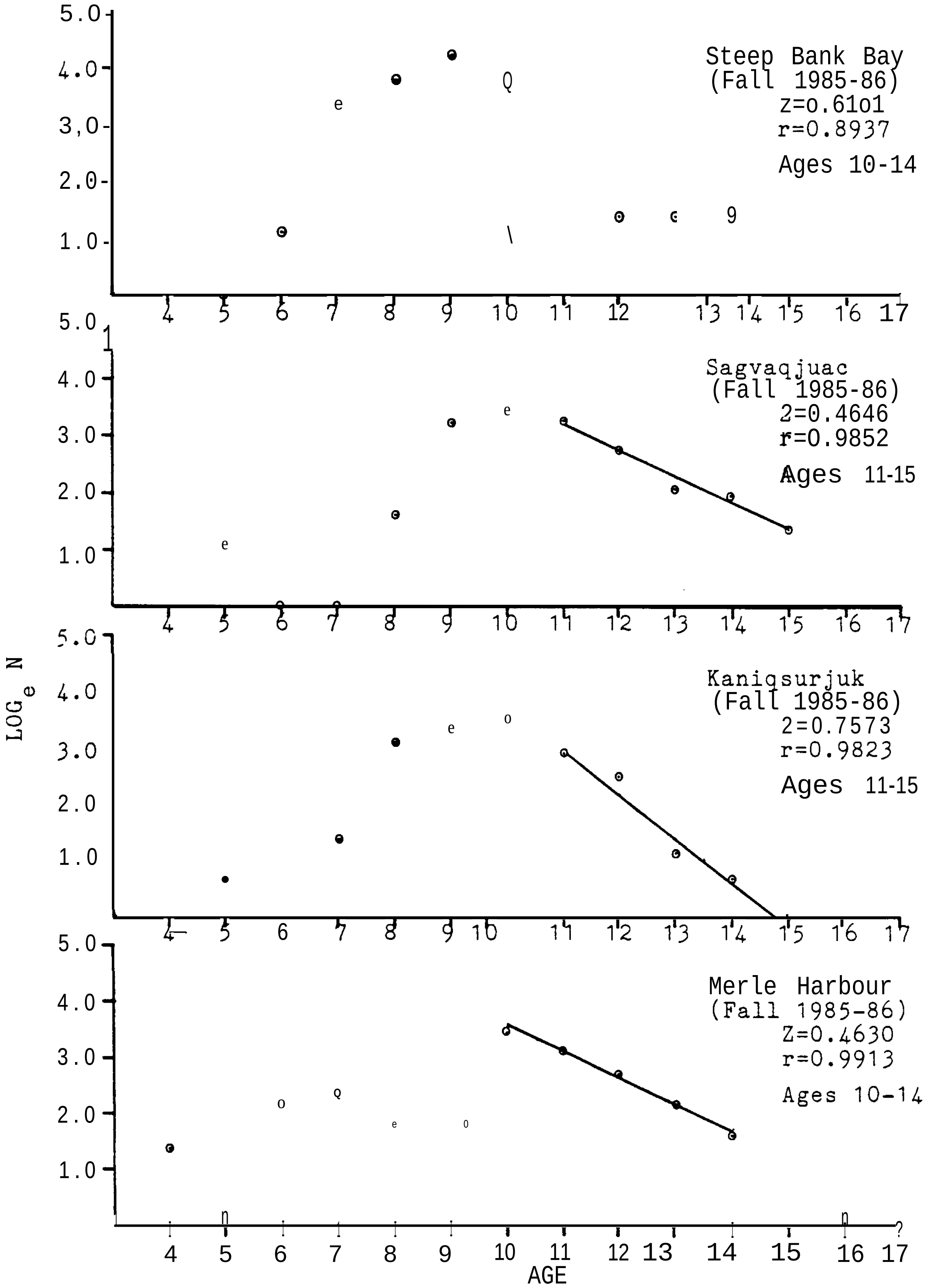


Fig. 16. Catch curves and instantaneous mortality rates for Arctic char taken at the test fishing locations during the fall of 1985 and 1986.

Location Fished	Provisional Quota (kg)	Total Production (kg round weight)	Dates Fished 1985	CPE (kg/100 m/24 hr)
Sagvaqjuac River	1000	279.2	Aug 15-Sep 18	15.0
Kangiqsurjuk River	1000	338.8	Aug 14-Sep 20	11.6
Merle Harbour	1000	196.1	Aug 17-Sep 15	6.1
Steep Bank Bay	100	808.0	Aug 18-Aug 28	43.2

Location Fished	Provisional Quota (kg)	Total Production (kg round weight)	Dates Fished 1986	CPE (kg/100 m/24 hr)
Sagvaqjuac	1000	813.4	Aug 2-Aug 28	18.7
Kangiqsurjuk	1000	673.9	Aug 2-Sep 7	6.2
Merle Harbour	1000	539.4	Aug 12-Aug 30	9.1
Steep Bank Bay	1000	767.9	Aug 2-Sep 1	17.4

Table 1. A summary of production and effort at the locations fished during the fall of 1985 (upper) and 1986 (lower).

Location Fished	Mean Age (yr)	Mean Fork Length (mm)	Mean Round Weight (g)	Dressed Weight (g)	Mean Condition Factor
Sagvaqjuac River	10.2	587.8	2738	2408	1.31
	(17)	(18)	(18)	(18)	(18)
Kangiqsurjuk River	9.3	577.2	2528	2216	1.29
	(20)	(22)	(22)	(22)	(22)
Merle Harbour	9.6	584.2	2762	2377	1.32
	(46)	(49)	(49)	(49)	(49)
Steep Bank Bay	8.8	540.0	2192	1893	1.33
	(96)	(107)	(107)	(107)	(107)

Table 2. A summary of biological data from Arctic char samples taken during the fall of 1985. Sample sizes (N) in brackets.

Location Fished	Mean Age (yr)	Mean Fork Length (cm)	Mean Round Weight (g)	Dressed Wei (g)	Mean Condition Factor
Sagvaqjuac River	10.6	6 [illegible]	2832	2418	1.19
	(111	(25)	(25)	(125)	(125)
Kaniqsurjuk River	9.8	572.9	2348	2051	1.2[illegible]
	(07)	(25)	(25)	(125)	(125)
Mer e Harbour	9.	572.2	2452	11	1.2[illegible]
	(138)	(50)	(50)	(50)	(5[illegible])
Steep Bank Bay	9.3	556.3	2200	1857	2
	(120)	(34)	(134)	(134)	(34)

Table 3. A summary of biological data from Arctic char samples taken during the fa o[illegible] 1986. Samp e size (N) in brackets.

	Mean Age (yr	Mean Fork Length (cm)	Mean Round Weight (g)	Dressed Weight (g)	Mean Condi[illegible]ion Factor
Sagvaq[illegible]uac River	10.6	61.1	2821	2417	1.20
	([illegible]28)	(143)	(143)	([illegible]3)	(43)
Kaniqsurjuk River	9.7	57.[illegible]	2[illegible]	2076	.21
	([illegible]27)	(147)	(147)	([illegible]47)	(47)
Merle Harbour	9.6	57.5	2528	2[illegible]75	.24
	(184)	(199)	(199)	([illegible]99)	(99)
Steep Bank Bay	9.	5[illegible].9	2196	1873	.26
	(216)	(241)	(241)	(241)	(24)

Table 4 A summary of biological data from Arct[illegible]c char taken by the test fishery. Data are pooled between years for each location. Samp[illegible]e s[illegible]ze (N) in brackets.

Location	N	Y-Intercept (a)	Slope (b)	Correlation Coefficient
Sagvaqjuac River	18	-4.04	2.70	.984
Kaniqsurjuk River	22	-3.66	2.55	.919
Merle Harbour	49	-5.24	3.13	.979
Steep Bank Bay	107	-4.54	2.88	.986

Table 5. A comparison of length-weight relationships derived from samples of Arctic char taken by the test fishery during the fall of 1985.

Length-weight relationship = $Log_{10}W = a+b\ (Log_{10}L)$

Location	N	Y-Intercept (a)	Slope (b)	Correlation Coefficient
Sagvaqjuac River	125	-4.85	2.97	0.956
Kaniqsurjuk River	125	-4.75	2.94	0.948
Merle Harbour	150	-5.34	3.15	0.967
Steep Bank Bay	134	-5.51	3.22	0.959

Table 6. A comparison of length-weight relationships derived from samples of Arctic char taken by the test fishery during the fall of 1986.

Length-weight relationship = $Log_{10}W = a+b\ (Log_{10}L)$

LOCATION	INSTANTANEOUS TOTAL MORTALITY (CATCH CURVE) Z	ANNUAL MORTALITY A	ANNUAL SURVIVAL (S = l-A) S	INSTANTANEOUS FISHING MORTALITY (z - 0.17) F	EXPLOITATION RATE ($u = 1 - e^{-F}$)
STEEP BANK BAY	0.6101	0.4567	0.5433	0.4401	0.3560
SAGVAQJUAC	0.4646	0.3716	0.6284	0.2946	0,2552
KANIQSURJUK	0.7573	0.5310	0.4690	0.5873	0.4442
MERLE HARBOUR	0.4630	0.3706	0.6294	0.2930	0.2540

Table 7, Instantaneous total mortality, annual mortality, instantaneous fishing mortality, annual survival and exploitation rates of Arctic char taken at the test fishing locations during the fall of 1985 and 1986. Data from different years are pooled for each locational

Location	Present Quota (kg)	Recommended Quota (kg)
Steep Bank Bay	nil	4,500 (10,000)
Merle Harbour	nil	2,300 (5,000)
Kaniqsurjuk	nil	1,000 (2,200)
Sagvaqjuac	nil	1,000 (2,200)

Table 8. Recommended commercial fishing quotas for anadromous Arctic char, based on results of the test fishery conducted in the Chesterfield Inlet area in 1985 and 1986. Quotas are kg (round weight) with pounds in brackets.

APPENDIX ONE

LENGTH INTERVAL (cm)	NO.	FORK LENGTH (cm) MEAN	FORK LENGTH (cm) SD	ROUND WEIGHT (g) MEAN	ROUND WEIGHT (g) SD	DRESSED WEIGHT (g) MEAN	DRESSED WEIGHT (g) SD	MEAN CONDITION FACTOR	MALES NO.	MALES % MATURE	FEMALES NO.	FEMALES % MATURE	MALE/ FEMALE RATIO
35.0-39.9	1	35.6		650.0	-	570.0		1.44			1	0.0	
40.0-44.9				-	-								
45.0-49.9				-	-								
50.0-54.9	1	50.3		1550.0	-	1350.0		1.22	1	0.0	-	-	
55.0-59.9	9	57.5	1.64	2606.7	216.0	2287.8	196.7	1.37	8	100	1	100	8:1
60,0-64.9	5	62.8	1.70	3116.0	185.6	2750.0	155.4	1.26	4	100	1	0.0	4:1
65.0-69.9	1	67.8		3790.0	-	3400.0		1.22	1	100	-	-	
70.0-74.9	1	72.5		4250.0	-	3680.0		1.12	1	100	-	-	
TOTAL	18								15	14	3	1	5:1
MEAN		58.8	7.69	2737.8	787.6	2407.8	695.4	1.31					

Appendix l(a). Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for Arctic char sampled at Sagvaqjuac during the fall of 1985.

LENGTH INTERVAL (cm)	NO.	FORK LENGTH (cm) MEAN	SD	ROUND WEIGHT (g) MEAN	SD	DRESSED WEIGHT (g) MEAN	SD	MEAN CONDITION FACTOR	MALES NO.	% MATURE	FEMALES NO.	% MATURE	MALE/ FEMALE RATIO
40.0-44.9	1	41.7		1090.0	-	920.0		1.50	-	-	1	0.0	
45.0-49.9	1	47.6		1090.0	-	960.0		1.01	1	100	-	-	
50.0-54.9	3	52.6	1.81	2366.7	215.0	2086.7	180.4	1.62	3	33.3	-	-	
55.0-59.9	11	57.9	1.36	2420.9	219.5	2150.9	189.1	1.26	10	70.0	1	100	10:1
60.0-64.9	3"	62.3	1.11	3100.0	516.4	2746.7	405.0	1.28	2	50.0	1	100	2:1
65.0-69.9	3	66.9	1.35	3470.0	425.7	2906.7	482.2	1.15	2	100	1	100	2:1
TOTAL	22								18	12	4	3	4.5:1
MEAN		57.7	6.13	2528.2	671.0	2216.4	571.0	1.29					

Appendix l(b). Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex **ratio by length interval for Arctic char sampled at Kangiqsurjuk during the fall of 1985.**

LENGTH INTERVAL (cm)	NO.	FORK LENGTH (cm) MEAN	SD	ROUND WEIGHT (g) MEAN	SD	DRESSED WEIGHT (g) MEAN	SD	MEAN CONDITION FACTOR	MALES NO.	% MATURE	FEMALES NO.	% MATURE	MALE/ FEMALE RATIO
30.0-34.9	1	33.1	-	420.0	-	361.0	-	1. 6	1	0.0	-	-	-
35.0-39.9	1	37.	-	580.0	-	490.0	-	1. 4	1	0.0	-	-	-
40.0-44.9	1	43.7	-	990.0	-	880.0	-	1 9	1	0.0	-	-	-
45.0-49.9	2	47.8	1.34	405.0	77.8	1195.0	91.9	1.29	2	0.0	-	-	-
50.0-54.9	8	53.2	1.58	2026.3	310.3	1740.0	266.2	.34	[illegible]	25.0	[illegible]	25.0	1:1
55.0-59.9	14	57.9	1.56	2656.4	404.8	230 .4	361.8	.39	12	33.3	2	100	6:1
60.0-64.9	1	62.0	1.08	3 29.1	248.0	2720.0	230.0	1.32	6	83.3	5	60.0	1.1:1
65.0-69.9	9	65.9	0.77	3878.9	453.0	33 5.6	383.7	1.34	6	100	3	100	2:1
70.0-74.9	2	70.8	0.71	39 5.0	233.3	3240.0	268.7	.	2	[illegible]	-	-	-
TOTAL	49								35	8	14	9	2.5:1
MEAN		58.4	7.65	2762.5	935.9	2376.6	799.8	.32					

Appendix 1(c Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for Arctic char sampled at Merle Harbour during the fall of 1985.

LENGTH INTERVAL (cm)	NO.	FORK LENGTH (cm) MEAN	SD	ROUND WEIGHT (g) MEAN	SD	DRESSED WEIGHT (g) MEAN	SD	MEAN CONDITION FACTOR	MALES NO.	% MATURE	FEMALES NO.	% MATURE	MALE/ FEMALE RATIO
40.0 -44.9	14*	43.3	1.36	1076.4	125.1	922.9	112.6	1.32	5	0.0	8	0.0	0.6:1
45.0 -49.9	16	47.6	1.49	1411.3	139.4	1218.1	111.4	1.31	10	0.0	6	16.7	1.7:1
50.0 -54.9	32	52.2	1.32	1946.3	164.7	1680.3	160.2	1.37	27	14.8	5	0.0	5.4:1
55.0-59.9	24	56.8	1.11	2417.9	165.0	2087.1	163.6	1.32	21	33.3	3	0.0	7:1
60.0-64.9	14	62.8	1.48	3251.4	356.5	2817.9	274.1	1.31	11	90.9	3	66.7	3.7:1
65.0-69.9	3	68.5	1.78	4043.3	416.7	3470.0	418.7	1.26	3	100	-	-	
70.0-74.9	3	72.5	2.45	4646.7	260.8	4083.3	160.7	1.22	3	100	-	-	
75.0-79.9	1	76.8		4950.0	-	4160.0		1.09	1	100	-	-	
TOTAL	107								81	28	25	3	3.2:1
MEAN		54.0	7.54	2191.6	901.3	1892.9	782.6	1.33					

* One Arctic char in this length group of unknown sex.

Appendix 1(d). Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for arctic char sampled at Steep Bank Bay during the fall of 1985.

AGE (YR)	NO.	FORK LENGTH (cm)		ROUND WEIGHT (g)		DRESSED WEIGHT (g)	
		MEAN	SD	MEAN	SD	MEAN	SD
5	1	35.6		650.0		570.0	
6							
7							
8	1	55.5		2330.0		1980.0	
9	6	57.2	4.43	2548.3	597.5	2266.7	539.0
10	3	59.1	0.98	2730	125.3	2396.7	136.5
11	2	59.8	3.39	2725.0	318.2	2400.0	268.7
12	2	65.9	2.69	3455.0	473.8	3085.0	445.5
13							
14							
15	2	61.3	4.31	3105.0	275.8	2675.0	318.2
TOTAL	17						
MEAN	10. 2*	58.0	7.10	2648.8	712.5	2332.9	637.7

*Mean Age

Appendix 1 (e) . Mean fork length, mean round weight, mean dressed weight at age for Arctic char taken by the test fishery at Sagvaqjuac during the fall of 1985.

AGE (YR)	NO.	FORK LENGTH (cm)		ROUND WEIGHT (g)		DRESSED WEIGHT (g)	
		MEAN	SD	MEAN	SD	MEAN	SD
7	1	41.7		1090.0		920.0	
8	10	57.2	3.06	2517.0	370.4	2258.0	326.7
9	1	59.9		2770.0		2400.0	
10	2	54.5	9.69	1800.0	1004.1	1630.0	947.5
11	4	59.7	5.96	2692.5	859.7	2322.5	712.1
12	1	65.6		3390.0		2960.0	
13	-						
14	1	63.5		3320.0		2850.0	
TOTAL	20						
MEAN	9.3*	57.5	5.98	2505.5	692.7	2213.0	598.2

*Mean Age

Appendix l(f) . Mean fork length, mean round weight, mean dressed weight at age for Arctic char taken by the test fishery at Kangiqsurjuk during the fall of 1985.

AGE (YR)	NO.	FORK LENGTH (cm) MEAN	SD	ROUND WEIGHT (g) MEAN	SD	DRESSED WEIGHT (g) MEAN	SD
6	2	35.1	2.83	500.0	113.1	425.0	91.2
7	1	62.4		3420.0		3060.0	
8	4	52.3	6.38	1995.0	803.2	1715.0	674.3
9	16	56.9	4.20	2533.8	657.0	2199.4	581.6
10	9	60.2	6.47	3005.6	984.1	2553.3	806.5
11	12	63.8	3.68	3335.0	603.3	2870.8	531.4
12	1	65.4		3340.0		2810.0	
13	1	70.8		4080.0		3430.0	
TOTAL	46						
MEAN	9.6*	58.6	7.81	2770.3	949.5	2383.3	811.0

*Mean Age

Appendix l(g) . Mean fok length, mean round weight, mean dressed weight at age for Arctic char taken by the test fishery at Merle Harbour during the fall of 1985.

AGE (YR)	NO.	FORK LENGTH (cm)		ROUND WEIGHT (g)		DRESSED WEIGHT (g)	
		MEAN	SD	MEAN	SD	MEAN	SD
7	22	46.3	4.03	1363.2	400.0	1175.0	354.5
8	28	52.1	4.64	1923.9	499.7	1668.9	439.0
9	23	55.6	4.71	2328.7	601.1	2022.6	542.6
10	10	56.7	5.54	2502.0	669.8	2153.0	546.7
11	5	64.2	5.31	3468.0	885.6	3008.0	779.6
12	4	65.3	9.96	3650.0	1201.1	3167.5	1128.1
13	1	62.1		3110.0		2640.0	
14	1	55.5		2280.0		1870.0	
15	1	69.3		4480.0		3950.0	
16	1	76.8		4950.0		4160.0	
TOTAL	96						
MEAN	8 .8*	53.8	7.60	2179.2	908.4	1885.0	792.8

*Mean Age

Appendix 1 (h). Mean fork length, mean round weight, mean dressed weight at age for Arctic char taken by the test fishery at Steep Bank Bay during the fall of 1985.

LENGTH INTERVAL (cm)	NO.	FORK LENGTH (Cm) MEAN	SD	ROUND WEIGHT (g) MEAN	SD	DRESSED WEIGHT (g) MEAN	SD	MEAN CONDITION FACTOR	MALES NO.	% MATURE	FEMALES NO.	% MATURE	MALE/ FEMALE RATIO
30.0-34.9	1*	34.5		480.0	-	440.0	-	1.17	-	-	-	-	-
35.0-39.9	1*	36.2		530.0	-	480.00	-	1.12	-	-			
40.0-44.9	2	43.4	0.64	960.0	14.1	855.0	21.2	1.18	0	-	2	0.0	-
45.0-49.9	4	48.2	2.04	1350.0	182.9	1155.5	169.9	1.21	1	0.0	3	66.7	0.3:1
50.0-54.9	7	52.9	1.05	1631.4	148.0	1377.1	166.5	1.10	2	0.0	5	80.0	0.4:1
55.0-59.9	22	58.0	1.10	2402.7	169.8	2082.3	136.3	1.23	10	60.0	12	58.3	0.8:1
60.0-64.9	51	62.2	1.48	2895.1	300.9	2474.3	260.3	1.20	35	94.3	16	87.5	2.2:1
65.0-69.9	32	67.3	1.65	3533.1	336.4	2991.9	326.2	1.16	28	100	4	100	7:1
70.0-74.9	5	71.0	0.50	4148.0	319.5	3522.0	289.1	1.16	5	100	0	-	-
TOTAL	125								81	72	42	31	1.9:1
MEAN		61.4	6.54	2832.5	775.9	2417.9	656.6	1.19					

* One Arctic char in this group of unknown sex

Appendix l(i). Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for Arctic char sampled at Sagvaqjuac during the fall of 1986.

LENGTH INTERVAL (cm)	NO.	FORK LENGTH (cm) MEAN	SD	ROUND WEIGHT (g) MEAN	SD	DRESSED WEIGHT (g) MEAN	SD	MEAN CONDITION FACTOR	MALES NO.	MALES % MATURE	FEMALES NO.	FEMALES % MATURE	MALE/ FEMALE RATIO
30.0-34.9	2*	33.7	0.21	450.0	0.0	400.0	0.0	1.19	-	-			
35.0-39.9	3	37.0	1.65	626.7	70.9	556.7	58.6	1.24	0	-	3	0	-
40.0-44.9	3*	41.8	2.57	920.0	208.1	823.3	188.2	1.24	1	0.0	-	-	-
45.0-49.9	8	47.2	1.89	1226.3	179.1	1083.8	163.6	1.16	4	0.0	4	0	1:1
50.0-54.9	22	52.8	1.23	1778.2	245.0	1560.9	215.6	1.20	10	10.0	12	16.6	0.8:1
55.0-59.9	33	57.9	1.46	2400.0	245.3	2107.6	229.1	1.24	21	71.4	12	50.0	1.8:1
60.0-64.9	43	62.4	1.40	2859.5	303.3	2480.7	270.6	1.18	32	96.9	11	90.9	2.9:1
65.0-69.9	11	66.1	0.83	3355.5	362.4	2925.5	354.1	1.16	11	100	-	-	-
TOTAL	125								79	56	42	18	1.9:1
MEAN		57.3	7.25	2348.3	754.6	2050.8	654.7	1.20					

* Two Arctic char in this group of unknown sex

Appendix 1(j). Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for Arctic char sampled at Kaniqsurjuk during the fall of 1986.

LENGTH INTERVAL (cm)	NO	FORK LENGTH (cm) MEAN	SD	ROUND WEIGHT (g) MEAN	SD	DRESSED WEIGHT (g) MEAN	SD	MEAN CONDITION FACTOR	MALES NO.	% MATURE	FEMALES NO.	% MATURE	MALE/ FEMALE RATIO
25.0-29.9	1	29.[illegible]	-	330.0	-	300.0	-	2.30	-	-	1	0.0	-
30.0-34.9	2	33.7	0.49	400.0	14.1	345.0	49.5	1.05	2	0.0	-	-	-
35.0-39.9	5	38.0	1.55	642.0	122.9	558.0	98.8	1.16	3	0.0	2	0.0	1.3:1
40.0-44.9	9	42.3	1.09	801.1	99.6	686.7	90.0	1.06	4	0.0	5	0.0	0.8:1
45.0-49.9	14	47.4	1.48	1222.9	150.8	1057.9	131.8	1.16	8	0.0	6	0.0	1.3:1
50.0-54.9	9	52.5	1.74	1814.4	283.3	1582.2	259.4	1.24	8	25.0	1	0.0	8:1
55.0-59.9	53	57.8	1.46	2438.9	257.4	2095.7	240.2	1.26	31	64.5	22	72.7	1.4:1
60.0-64.9	35	62.3	1.43	2968.3	343.9	2561.7	303.9	1.22	24	83.3	11	100	2.2:1
65.0-69.9	9	66.7	1.13	3448.9	543.0	2956.7	464.4	1.16	5	100	4	100	1.3:1
70.0-74.9	12	71.5	1.09	4432.5	284.7	2970.8	304.3	1.22	12	100	0	-	-
75.0-79.9	1	75.5	-	5400.0	-	4620.0	-	1.25	1	100	-	-	-
TOTAL	150								98	60	52	31	1.9:1
MEAN		57.2	9.0	2451.9	1050.8	2109.7	902.4	1.21					

Appendix 1(k). Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for Arctic char sampled at Merle Harbour during the fall of 1986.

LENGTH INTERVAL (cm)	NO.	FORK LENGTH (cm) MEAN	SD	ROUND WEIGHT (g) MEAN	SD	DRESSED WEIGHT (g) MEAN	SD	MEAN CONDITION FACTOR	MALES NO.	% MATURE	FEMALES NO.	% MATURE	MALE/ FEMALE RATIO
30.0-34.9	1	34.3	–	[illegible]30.0	–	340.[illegible]	–	1.07	[illegible]	–		[illegible]	–
35.0-39.9	3	37.5	2.29	603.3	110.6	503.3	85.0	1.14	1	0.0	2	50.0	0.5:
[illegible]0.0-44.9	1[illegible]	[illegible]2.9	0.97	860.[illegible]	0.4	728.6	95.3	1.[illegible]9	8	0.[illegible]	6	[illegible]	1.3:
50.0-54.9	9	47.6	1.47	1240.0	82.[illegible]	1[illegible]5[illegible].4	161 2	1.15	2	0.0	7	14.3	0.3:
55.0-59.9	18	52.9	1 [illegible]2	1863.3	2 9.0	152[illegible].7	167.2	.26	6	3[illegible].3	12	[illegible]1.7	[illegible] 5:
60.0-64.9	56	57.8	1.[illegible]7	2377.	252.5	2014.5	237.6	.23	[illegible]3	8[illegible]	13	76.9	[illegible].3:1
65.0-69.9	27	62.1	1.25	2897.8	287.1	2[illegible]8.5	278.9	1.2	23	9[illegible].3	4	100	5.[illegible]:1
70.0-7[illegible].9	4	67.3	1.69	4[illegible].0	598.[illegible]	3495.[illegible]	478.4	1.34	4	[illegible]	[illegible]	–	–
75.0-79.9	2	72.7	2.19	4085.[illegible]	[illegible]70.7	3530.[illegible]	735.4	1.[illegible]8	1	00	1	[illegible]	1:1
TOTAL	13[illegible]								88	63	46	22	1.9:1
MEAN		55.6	7.35	22[illegible].4	827.[illegible]	857.4	713.9	1.21					

Appendix [illegible]). Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for Arctic char sampled at Steep Bank Bay during the fall of 1986.

AGE (YR)	NO.	FORK LENGTH (cm)		ROUND WEIGHT (g)		DRESSED WEIGHT (g)	
		MEAN	SD	MEAN	SD	MEAN	SD
5	2	35.4	1.20	505.0	35.4	460.0	28.3
6	1	42.9		950.0		840.0	
7	1	43.8		970.0		870.0	
8	4	49.9	4.99	1482.5	430.1	1285.0	417.3
9	19	57.9	4.18	2423.7	577.4	2111.2	517.1
10	28	61.9	3.92	2943.6	630.4	2535.4	534.2
11	25	62.5	4.18	2906.8	548.2	2506.0	471.9
12	14	66.0	4.54	3420.0	746.8	2903.6	654.5
13	8	65.0	3.87	3212.5	491.4	2706.3	425.3
14	7	66.9	3.52	3325.7	365.3	2748.6	340.6
15	2	62.9	2.05	2855.0	473.8	2365.0	318.2
TOTAL	111						
MEAN	10. 6*	61.4	6.54	2832.4	775.9	2417.9	656.6

*Mean Age

Appendix 1 (m). Mean fork length, mean round weight, mean dressed weight at age for Arctic char taken by the test fishery at Sagvaqjuac during the fall of 1986.

AGE (YR)	NO.	FORK LENGTH (cm) MEAN	SD	ROUND WEIGHT (g) MEAN	SD	DRESSED WEIGHT (g) MEAN	SD
4	1	33.5		450.00		400.0	
5	2	34.5	9.19	500.0	70.7	445.0	63.6
6	1	40.3		810.0		730.0	
7	3	42.6	4.16	1016.7	283.6	906.7	266.3
8	12	50.7	3.29	1605.0	409.8	1426.7	359.9
9	27	57.4	5.31	2431.9	635.4	2140.4	572.2
10	31	58.3	4.27	2469.7	562.0	2168.4	501.3
11	14	61.6	3.52	2787.1	445.3	2433.6	394.9
12	11	63.3	3.46	2926.4	508.3	2498.2	444.0
13	3	64.0	0.87	2876.7	636.1	2493.3	510.1
14	1	65.0		2860.0		2490.0	
15	1	66.3		2920.0		2510.0	
TOTAL	107						
MEAN	9.8*	57.3	7.25	2348.3	754.6	2050.8	654.7

*Mean Age

Appendix l(n). Mean fork length, mean round weight, mean dressed weight at age for Arctic char taken by the test fishery at Kaniqsurjuk during the fall of 1986.

AGE (YR)	NO.	FORK LENGTH (cm) MEAN	SD	ROUND WEIGHT (g) MEAN	SD	DRESSED WEIGHT (g) MEAN	SD
4	4	33.1	2.60	402.5	61.8	352.5	57.4
5	1	41.0,		730.0		620.0	
6	7	42.3	3.73	840.0	247.0	726.7	214.5
7	10	44.3	3.10	1029.0	201.4	896.0	173.3
8	14	53.2	6.22	1906.4	691.0	1634.3	592.1
9	40	57.7	4.18	2485.5	550.7	2160.5	479.2
10	21	60.2	3.67	2792.4	647.0	2417.1	579.4
11	12	59.4	4.96	2595.8	702.1	2215.8	606.4
12	14	64.1	5.40	3140.0	829.1	2687.9	684.7
13	8	65.1	5.04	3343.8	923.6	2870.0	853.6
14	5	72.0	2.55	4474.0	732.7	3838.0	628.9
15							
16	1	62.8		2800.0		2300.0	
17		60.8		2850.0		2420.0	
TOTAL	138						
MEAN	9.6*	57.2	9.01	2451.9	1050.8	2109.7	902.5

*Mean Age

Appendix 1 (o). Mean fork length, mean round weight, mean dressed weight at age for Arctic char taken by the test fishery at Merle Harbour during the fall of 1986.

AGE (YR)	NO.	FORK LENGTH (cm)		ROUND WEIGHT (g)		DRESSED WEIGHT (g)	
		MEAN	SD	MEAN	SD	MEAN	SD
5	1	34.3		430.0	-	340.0	
6	3	38.6	3.93	673.3	226.8	560.0	177.8
7	7	42.5	1.46	811.4	79.5	688.6	72.2
8	16	50.0	6.01	1550.6	675.2	1338.1	583.1
9	44	55.6	4.83	2163.2	526.6	1821.1	474.1
10	31	59.5	4.29	2628.4	609.5	2225.5	551.4
11	12	59.8	3.77	2791.7	795.3	2350.0	668.6
12	-	-					
13	3	59.9	1.85	2253.3	236.9	1860.0	212.8
14	3	62.2	3.29	2900.0	208.1	2313.3	392.1
TOTAL	120						
MEAN	9.3*	55.6	7.35	2200.4	827.4	1857.4	713.9

*Mean Age

Appendix l(p). Mean fork length, mean round weight, mean dressed weight at age for Arctic char taken by the test fishery at Steep Bank Bay during the fall of 1986.

Maturity Stage	Code	Female	Code	Male
Immature (virgin)	1	-Ovaries granular in texture -hard and triangular in shape -up to full length of body cavity -membrane firm	6	-Testes long and thin -tubular and scalloped shape -up to full body length -putty-like firmness
Mature	2	-Current year spawner -ovary fills body cavity -eggs near full size but not loose -not expelled by pressure	7	-Current year spawner -testes large and lobate -white to purplish color -milt not expelled by pressure
Ripe	3	-Ovaries greatly extended and fill body cavity -eggs full size and transparent -expelled by slight pressure	8	-Testes full size -white and lobate -milt expelled by slight pressure
Spent	[illegible]	-Spawning complete -ovaries ruptured and flaccid -some atretic eggs in body cavity		-Spawning complete -testes flaccid with some milt -blood vessels obvious -testes violet-pink in color
Resting	5	-Ovary 40-50% of body cavity -membrane thin, loose and semi-transparent -healed from spawning -developing eggs apparent with few atretic eggs	10	-Testes tubular, less lobate -healed from spawning. -no fluid in centre -usually full length -mottled and purplish in color
<u>Unknown</u> (virgin)	0	-cannot be sexed -gonads long or short and thin -transparent or translucent		
<u>Unknown</u> (non-virgin)	11	-resting fish -has spawned but gonads regenerated -sexing not possible		

Appendix 1(q). Description of the relative stages of maturity based on examination of char gonads

DETERMINATION OF YIELD

Baranov catch equation: $C = \frac{FAN}{Z}$

where Z = instantaneous rate of total mortality
A = annual rate of mortality
F = instantaneous rate of fishing mortality
C = catch in numbers
N = estimated population size

Sagvaqjuac

F = 0.2946 $\quad C = \frac{FAN}{Z} = \frac{(0.2946)\ (0.3716)\ (8\ 422)}{0.4646} = 1\ 984$ fish
Z = 0.4646
A = 0.3716
N = 8 422 $\quad$ Mean round weight per char = 2.832 kg.

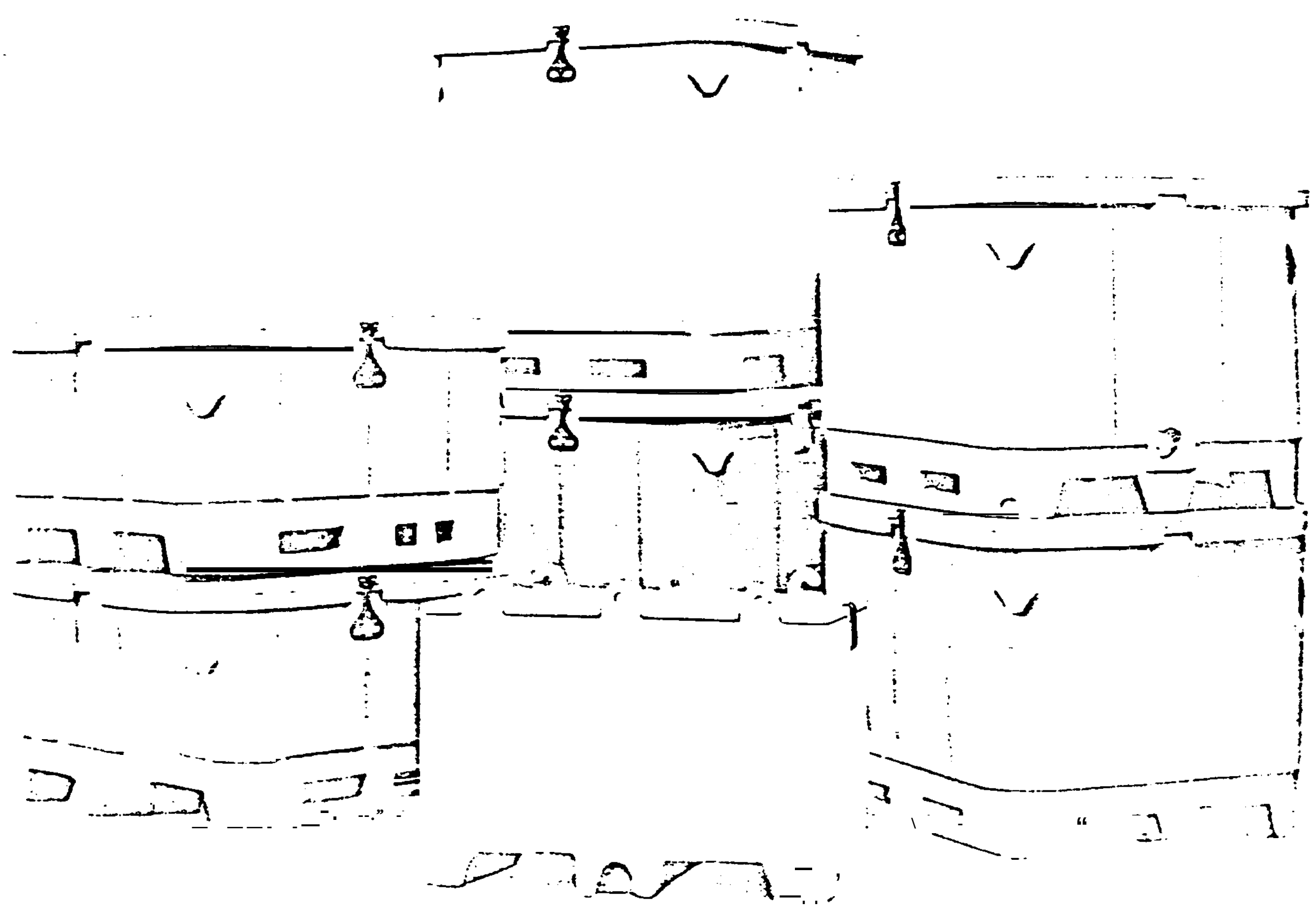
Estimated yield = 1 984 x 2.832 = 5 619 kg

Appendix l(r). Estimated yield of Arctic char at Sagvaqjuac using the Baranov catch equation and data gathered from the test fishery.

APPEND × TWO

Bonar Rosedale Plastics...
Boxes for the fishing industry.

** CONTAINERS USED NOT EXACTLY AS SHOWN



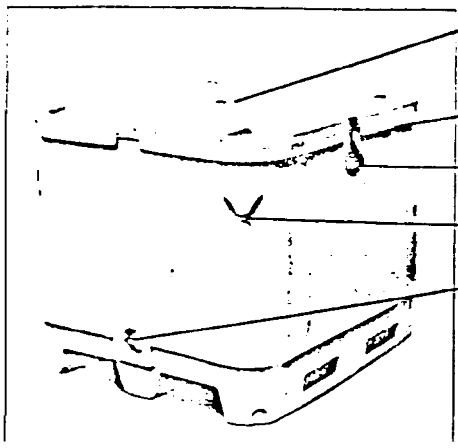
Protect the quality of your catch

INSULATED TRANSPORT BOX

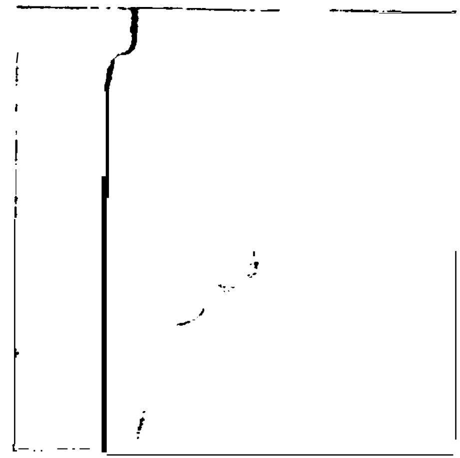
Code No.:	
1668-2	9 CU. ft. -520 lb.capacity 42" x 24" x 27%" stacks 5 high
1745-2	18 cu. ft. -1020 lb. capacity 48" x 43" x 26" stacks 5 high
1545.2	24 cu. ft. -1500 lb. capacity 48" x 43" x 36½"
1645-2	*35* Cu. ft. -2000 lb. capacity 48" x 43" x 47" stacks 3 high

WHARF BOX

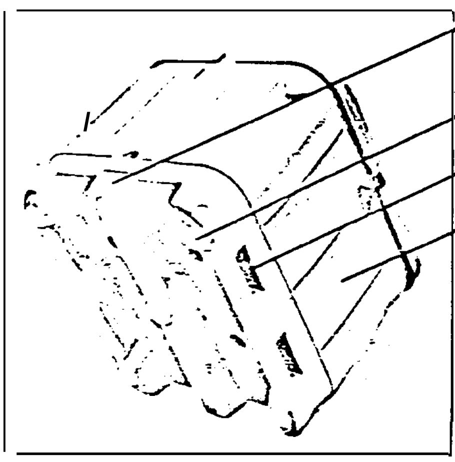
Code No.:	
1491-2	17 cu. ft. - 800 lb. capacity 43" x 43" x22" stacks 5 high



- Recesses in cover locate container for sure stacking - also stacks without cover
- Cover overlaps box and prevents content contamination
- Simple to use rubber straps secure box to cover
- Flush fit corner lifting/tie down lugs - see detail
- Convenient access to side drain plus flat bottom provides complete drainage

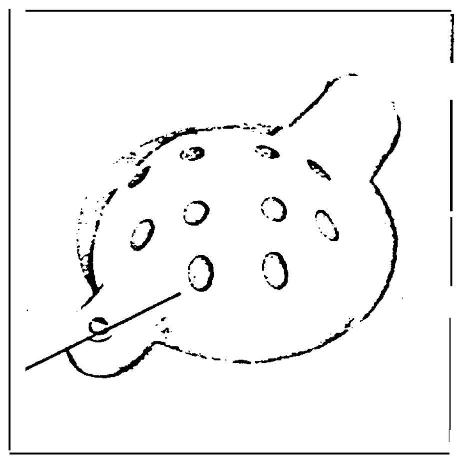


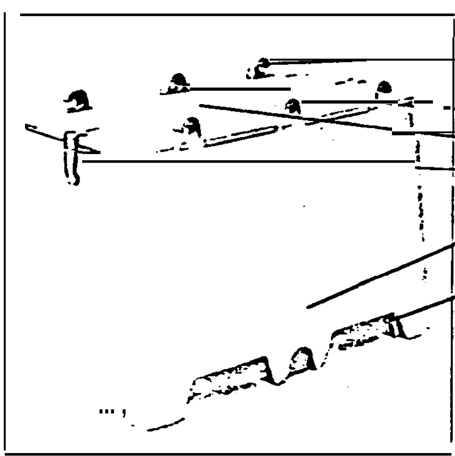
A Lifting lugs have no protrusions to break off



- Moulded centre foam filled roll bar strengthens and locates box on forks for stable rotator dumping
- Five replaceable nylon pads eliminate container bottom wear
- Four way fork/two way pallet entry with integral rotating bars
- Polyethylene inner and outer walls - core insulated with polyurethane foam
- + Easy to clean. food use approved

Bottom-fit, side draining strainer ball prevents drain from clogging



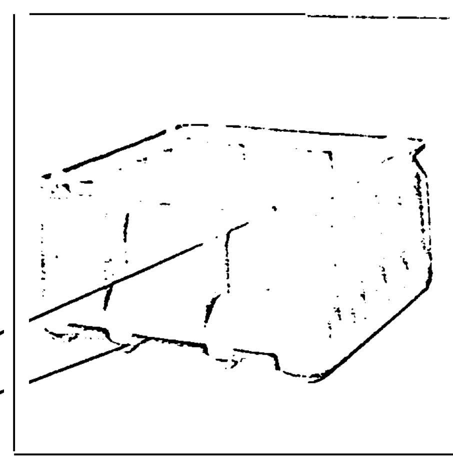


- Four moulded split corner lifting lugs
- Two moulded lifting/dumping lugs
- Stacks with or without cover
- Easy to use fasteners
- Side drain for complete drainage
- Foam filled construction as on larger sizes
- Two way fork/pallet access

A 9 cubic foot

Stacking lip is recessed to prevent breakage

Two way fork entry with aluminum plates for rotating



A Wharf Box

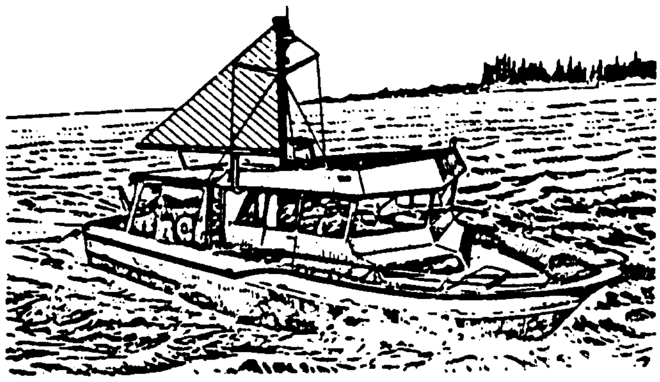
ABCO INDUSTRIES LIMITED

P. O. BOX 1120 LUNENBURG, N.S. B0J 2C0

TEL. (902) 634-8821 TELEX 019-21654

Distributed by:

APPEND x 3



THE DESIGN BOAT COMPANY INC

ARCTIC CHAR EXPRESS—SPECIFICATIONS

* All welded aluminum alloy hull (5086) alloy
  .250 (¼") Bottom
  .187 (3/ 16") Topsides and Decks

*Frames—¼X 3" -flat (6061) alloy
*Longitudinals— 2X2X¼"--T-Bar (6061) alloy
*Keel -- 1X3—Flat Bar (6061) Alloy
*Gunnels—1½" Sched 40 Pipe (6061) AlloY
*Length—25'(27'with aft platform) (7.7 meters)
*Beam—8.34 Ft. (2.57 meters)
*Weight—Approx. 3800 lbs. (1725 kg.)
*Draft—Outdrive up-12"
*Speed 40-45 MPH (64-72 KPH)

*Estimated Maximum Load Capacity—3000lbs. (1360 KG)

Special Equipment
*Pick-up Crane--Load capacity—Maximum capacity 1500 lbs. @ 41"boom
825 lbs. @ 64¼"boom
*Safety glass windscreen
*Engine-- Mercruiser 230 H.P. I/O--Specifications attached.
*Steering—Mercury—Rack and Pinon
*Instruments and Controls --Mercruiser.

BOX 12 GRP 395 RR 3
WINNIPEG MANITOBA
R3C2E7

ALL RIBS ARE ¼" X 4" WIDE AND OUR GUNNELS ARE 1½" SCHEDULE 40 PIPE. TO PROVE THE STRENGTH THE BOTTOM OF THE HULL CAN WITHSTAND THE FORCE OF A 240 GR., .44 MAGNUM BULLET FROM 10 FEET, AND IF THAT'S NOT ENOUGH, WE ALSO ADD 2 KEELSONS (CHANNELS - 3" X 1½" X ¼" THAT SERVE ALSO AS LIFTING STRAKES TO PLANE EASILY EVEN WITH A FULL LOAD).

* THE QUALITY - THESE COMMERCIAL WORKBOATS ARE FINISHED BETTER THAN ANY OTHER ALUMINUM WORKBOAT ON THE MARKET. NO UNFINISHED WELDS TO SNAG NETS ON, NO SHARP EDGES TO CUT LINE.

ALL UNDERWATER WELDS ARE DYE-PENETRANT TESTED FOR WATER-TIGHT DRYNESS.

WE WANT OUR BOATS TO LOOK AS GOOD AS THEY ARE BUILT. OUR BOAT BUILDERS HAVE PROBABLY BUILT MORE WELDED-ALUMINUM BOATS THAN ANYONE ELSE IN CENTRAL CANADA AND PRIDE OF WORKMANSHIP GOES INTO EVERY ONE BUILT.

THEY WOULD BE PROUD TO BUILD ONE FOR YOU. CALL
LEONARD MARCHAK AT: 1 (204) 482-6169 IN SELKIRK, TODAY!!

THE HI-TECH FABRICATOR BOAT...

AN INNOVATION IN DESIGN AND TECHNOLOGY

HERE'S WHY WE AND OUR CUSTOMERS FEEL NOBODY COMES CLOSE TO PRODUCING A BOAT OF OUR **CALIBRE. . . .**

* THE MATERIAL - 3/16" or ¼" 5086 MARINE **ALUMINUM ALLOY IS USED EXCLUSIVELY** FOR THE SIDES, BOTTOM AND TREADPLATE FLOORS. THIS IS THE SAME ALLOY USED FOR ALL SALTWATER VESSEL CONSTRUCTION ON BOTH COASTS AS IT IS VERY RESISTANT TO ALL TYPES OF CORROSION. IT IS ALSO VERY RESISTANT TO STRESS CRACKING AND FATIGUE AND MUCH STRONGER THAN 5052, 5454, OR OTHER UTILITY GRADES OF ALLOY USED IN SOME BOATS.

* THE DESIGN - IN CONSULTATION WITH NAVAL ARCHITECTS AND MANY BIG LAKE COMMERCIAL FISHERMEN IN CENTRAL CANADA, THE DESIGN BOAT COMPANY INC. CREATED THIS UNIQUE, SUPERIOR DESIGN SPECIFICALLY FOR HI-TECH FABRICATORS TO OVERCOME THE SHORTCOMINGS OF EXISTING BOATS ON THE MARKET.

A DEEPER VEE UP FRONT, FOR ROUGH WATER SAFETY AND COMFORT, AND A MODIFIED VEE AT THE STERN FOR GOOD SPEED AND CARRYING CAPACITY, WITH LOWER HORSEPOWER. THE S-SHEER OR GUNNEL LINE IS DESIGNED FOR GOOD FREEBOARD AND DRYNESS IN ROUGH WATER. THE HORIZONTAL FRONT GUNNEL AREA MAKES LIFTING NETS EASIER AS THERE IS A LEVEL SURFACE TO WORK ON WHICH ELIMINATES THE PROBLEM OF THE NET WORKING TOWARDS THE STERN AS IN CONVENTIONAL GUNNEL LINES .

THE FLOOR IS WELDED TO THE SIDES TO FORM AN AIRTIGHT FLOTATION TANK, WITH NO POSSIBILITIES FOR FOAM GETTING WATER-LOGGED UNDER THE FLOOR.

* THE STRENGTH - ALL OUR BOATS ARE DESIGNED AND BUILT FOR LONG-LASTING , MAINTENANCE-FREE USE. ALL COMPONENTS ARE THE BEST AVAILABLE TO ENSURE YEARS OF PROBLEM FREE COMMERCIAL WORK. OUR KEELS ARE 1" THICK AND 3" WIDE. IT ALONE WEIGHS ALMOST 100 LBS . **NOW THAT ' S BACKBONE ! !**

25 FT. CUSTOM SPECIAL JET WITH A MERCRUISER INBOARD COUPLED TO A HAMILTON JET. A SISTER SHIP THE "ARCTIC CHAR EXPRESS" IS OPERATING ON HUDSON BAY WITH A 230 HP MERCRUISER I /0.