A Biological Assessment Of Arctic Char (salvelinus Alpinus(l) Stocks In The Gjoa Haven - Pelly Bay Area Of The Northwest Territories Fisheries, Kitikmeot Fishery

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A BIOLOGICAL ASSESSMENT OF ARCTIC CHAR, *Salvelinus alpinus* (L.), STOCKS IN THE GJOA HAVEN - PELLY BAY AREA OF THE NORTHWEST TERRITORIES, 1979-80

by

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ABSTRACT

KRISTOFFERSON, A.H., D.R. LEROUX, and J.R. ORR. 1982. A biological assessment of Arctic char, Salvelinus alpinus (L.), stocks in the Gjoa Haven - Pelly Bay area of the Northwest Territories, 1979-80. Can. Manuscr. Rep. Fish. Aquat. Sci. 1591: vi + 51 p.

A test fishery to assess the Arctic char stocks at twelve locations in the Gjoa Haven - Pelly Bay area of the Northwest Territories was carried out during the open water period, 1979 and 1980. The locations fished included: Murchison River, Back River, Keith Bay, Kingark River, Tourist River, Mangles Bay, Kellett River, Becher River, Tern Lake, Arrowsmith River, Elliot Bay and Kaleet River. Results of the test fishery indicate that the Murchison and Back rivers are lightly exploited at present and a commercial quota of 9 100 kg (round weight) is recommended for each. Keith Bay char show moderate exploitation and it is recommended that the present quota of 4 500 kg remain in effect. The Kingark River char are suspected of being itinerants from other systems so no quota is recommended at present for this site, unless tagging studies are implemented to determine origin of stocks. The Mangles Bay char are also itinerants so no commercial quota is recommended for this location. Stocks at the Tourist, Becher, Kellett and ArrowSmith rivers show signs of heavy exploitation and it is recommended that fishing cease here, until stocks recover. Insufficient data were collected at Tern Lake, Kaleet River and Elliot Bay to assess these stocks.

Key words: catch statistics; commercial fishing; experimental fishing; exploitation; fishing mortality; population structure; size distribution; stock assessment.

RESUME

KRISTOFFERSON, A.H., D.R. LEROUX, and J.R. ORR. 1982. A biological assessment of Arctic char, Salvelinus alpinus (L.), stocks in the Gjoa Haven - Pelly Bay area of the Northwest Territories 1979-80.. Can. Manuscr. Rep. Fish. Aquat. Sci. 1591: vi + 51 p.

Pendant la période d'eau libre de 1979 et de 1980, on a effectué une pêche d'essai à douze endroits clans la région de Gjoa Haven - Pelly Bay, clans les Territoires du Nerd-Ouest, pour évaluer les stocks d'omble chevalier. Figuraient parmi les endroits choisis: les rivières Murchison et Back, la Keith Bay, les rivières Kingark et Tourist, la Mangles Bay, les rivières Kellett et Becher, le Tern Lake, l'Arrowsmith River, Elliot Bay et la Kaleet River. Selon les résultats de la pêche d'essai, les rivières Murchison et 8ack ne sent quē légèrement exploitees à l'heure actuelle, et l'on propose un contingent commercial de 9 100 kg (poids brut à la sortie de l'eau) pour chacune d'elles. L'omble de Keith Bay est modérément exploitée et l'on ne recommande aucune modification de son contingent actuel de 4 500 kg. 11 semblerait que les stocks d'omble de la Kingark River proviennent des eaux avoisinantes, et l'on n'y propose aucune exploitation, à moins d'effectuer l'étiquetage des stocks pour en déterminer l'origine. 11 en serait de même pour l'omble de la Mangles Bay, où l'on recommande l'interdiction de toute exploitation commercial. Comme les données sur les stocks des rivières Tourist, Becher, Kellett et Arrowsmith indiquent une surexploitation de l'omble, on propose d'en interdire la pêche pour permettre à la population de se rétablir. Les données recueillies au Tern Lake, Kaleet River et à l'Elliot Bay furent insuffisantes pour en évaluer les stocks.

Mets-c16s: données sur les prises; pêche commerciale; pêche expérimentale; exploitation; mortalité de la pêche; structure de la population; distribution des tailles; Evaluation des stocks.

INTRODUCTION

The Arctic char, *Salvelinus alpinus*, is the most northerly distributed of all the freshwater fish (Scott and Crossman 1973). It can be found throughout the coastal regions and islands of the Canadian Arctic Archipelago (McPhail and Lindsey 1970) and exists in both the anadromous (searun) and landlocked forms. It has always been an important part of the subsistence economy of Inuit in Canada's Central Arctic, (Balikci 1980). In recent years it has found its way into southern markets as a gourmet food for the restaurant trade (Scott and Crossman 1973), supplied by a number of commercial fisheries along the Labrador coast and the central and eastern Arctic. Commercial fishing for this species first began in the Northwest Territories at Frobisher Bay in 1947 (Hunter 1976), although this particular fishery has ceased to operate. Currently the largest commercial fishery for Arctic char in the Northwest Territories takes place at Cambridge Bay (Kristofferson and Carder 1980) . Approximately 55 000 kg of the anadromous form are marketed annually from this fishery.

Commercial fishing for Arctic char in the Northwest Territories has not been without problems. Since it lives in cold, relatively unproductive waters, the Arctic char grows slowly (McPhail and Lindsey 1970; Scott and Crossman 1973) . Individual stocks do not appear to be able to tolerate heavy exploitation (Johnson 1980) . Past experience has shwn that high levels of exploitation have proven detrimental to the fishery. Examples of overexploitation include the fishery on the Sylvia Grinnell River (Hunter 1966) on Baffin Island, and the Ekalluk River (Barlishen and Webber 1973) on Victoria Island. Hence the rate of fishing for char must be carefully controlled in order to maintain fisheries over the long term.

Individual stocks of Arctic char are scattered along the coastline, many in areas that are difficult to reach. Low productivity of stocks and high transportation costs are two very real problems to be dealt with by commercial fisheries. The success of such fisheries depends upon establishing a difficult compromise between rather severe biological and economic constraints. The commercial fishery at Cambridge Bay appears to have met with some success in this regard. The community is serviced by regularly scheduled jet airline providing economic backhaul transportation to the south. The fishery utilizes a small processing plant with a blast freezer in Cambridge Bay so the product can be stored frozen until transportation is assured. Fisheries take place at the mouths of rivers where fish congregate during migrations to and from the sea, so expensive fishing gear is not necessary to pursue stocks at large. Small, single engine, float-equipped aircraft (Cessna 185, DeHavilland Beaver) are used to transport fresh fish from fishing sites to the plant. This method of operation appears to be economical when balanced against the price received for the char. Since the demand for char exceeds the supply, it can command a good price. Biologically, stocks are monitored closely and regulated to prevent overexploitation.

It is not surprising that residents of surrounding communities would like to follow the Cambridge Bay example. The community of Gjoa Haven, located on the southeast coast of King William Island, approximately 360 km east of Cambridge Bay has considered developing a commercial fishery for char in their area for a number of years. The Department of Economic Development and Tourism, Government of the Northwest Territories, received a request from the Gjoa Haven Settlement Council, in late 1977, for assistance in establishing such a fishery including the construction of a processing plant in their community. Necessarily, the first step towards development of the fishery was to determine whether sufficient stocks of Arctic char were available to justify construction of the processing plant. Two nearby communities, Pelly Bay and Spence Bay also expressed interest in further development of commercial fishing in their areas and were included in subsequent discussions. Commercial fishing for Arctic char in the Pelly Bay area has taken place since at least 1972 when a small blast freezer was moved there from Cambridge Bay. This commercial fishery has not been very successful with production fluctuating annually. Thus, an appraisal of this fishery was planned to coincide with the assessment of the Gjoa Haven area. Meetings took place in each community during fall, 1978 between representatives of the Government of the Northwest Territories, the Federal Department of Fisheries and Oceans, local hunters and trappers associations and interested residents, culminating in the formulation of a two-season test fishery program to assess the anadromous Arctic char resources in the Gjoa Haven, Pelly Bay and Spence Bay area. This report describes the results of the fishing site evaluation and the biological assessment of char stocks carried out during 1979 and 1980 and makes recommendations for future development and management.

The logistics of the test fishery were the responsibility of the Department of Economic Development and Tourism, Cambridge Bay, N.W.T. Biological assessment was supervised by the Fish and Marine Mammal Management Division, Department of Fisheries and Oceans, Winnipeg. Overall funding for the project was provided through the General Development Agreement (GDA), a joint Canada-Northwest Territories interim subsidiary agreement on community economic development.

MATERIALS AND METHODS

THE FISHERY

Possible fishing locations were discussed with each community and sites were selected largely on the recommendation of the local Inuit fishermen. The first year plan included fishing half the sites during the spring downstream char run with the remainder being fished during the fall upstream run. The following year the sequence was to be reversed. Thirteen sites were originally selected, twelve of which were fished during the first year. The thirteenth, the Hayes River, was abandoned after one day of fishing since the fishermen felt the catch would be poor. The plan was modified in 1980 with nine sites being fished, some during both the downstream and upstream runs. The sites fished included the Murchison River, Back River, Keith Bay, Kingark River, Tourist River, Mangles Bay, Kellett River, Becher River, Tern Lake, Arrowsmith River, Elliot Bay and Kaleet River (Fig. 1). During the two year program each location was fished at least once on the downstream run (spring) and once on the upstream run (fall) with the exception of the Tourist and Kellett rivers fished only in spring and Kaleet River and Elliot Bay fished only in fall.

Flat-bottomed wooden boats, approximately 5 m (16′) long, were constructed in Gjoa Haven and Pelly Bay during the winter of 1978-79 and transported by snowmobile to each site prior to the 1979 spring breakup. After fishing was completed in the fall of 1979 the boats were left at each site, to be used the following year.

Local Inuit fishermen from Gjoa Haven, Pelly Bay and Spence Bay were hired to do the fishing. Two fishermen were situated at each site with the exception of the Back, Kingark and Murchison Rivers which had four each in 1979 and four, two and six fishermen, respectively, in 1980. Most of the men and equipment (tents, nets, motors, etc.) were transported to the sites by aircraft. In some cases fishermen took their own boats to the sites close to their settlements.

A number of the sites had been commercially fished for Arctic char since the early 1970′s. At that time the Fisheries and Marine Service, Department of the Environment (now Fisheries and Oceans) assigned quotas somewhat arbitrarily after having taken into consideration the historical subsistence harvests at these locations. The fisheries included the Murchison, Kellett, Becher and Arrowsmith rivers and Keith Bay. For 1979 these quotas in round weight were: Murchison River - 9 072 kg (20 000 pounds), Kellett River - 15 875 kg (35 000 pounds), Becher River - 4 536 kg (10 000 pounds), Arrowsmith River - 13 60B kg (30 000 pounds), Keith Bay - 4 536 (10 000 pounds). For 1980 the quotas for the Arrowsmith and Kellett rivers were reduced to 9 072 kg (20 000 pounds) each. The others remained the same as in 1979. The unfished areas were opened by Test Fishery Permit and each was assigned a provisional quota of 2 948 kg (6 500 pounds). Each pair of fishermen used three gill nets in 1979 and at least four in 1980. Nets were 91 m (100 yd) long with 139 mm (5½ in) mesh size (stretched measure) and 20-24 meshes deep with 210/6 twine type.

Fishermen were instructed to fish daily throughout the fishery. Fishing was discontinued when catches diminished. The catch was dressed (gills and viscera removed) on site and transported daily (if possible) to the freezer plant in Pelly Bay. At the plant, fish were weighed, washed, fast frozen and packed for local sale or export. Records of daily catches per site were kept. The Koomiut Co-operative in Pelly Bay purchased all the char and fishermen were paid $1.10/kg ($0.50 per pound) in 1979 and $1.32/kg ($0.60 per pound) in 1980. Fishermen were instructed to ship incidental species such as lake trout, *Salvelinus namaycush*, to the plant for sale.

Based on the experience of the Cambridge Bay fishery a float-equipped single engine aircraft (Cessna 185) was utilized to transport fish from the sites to the plant in 1979. However, problems with sea ice and low water were encountered at a number of sites. On recommendations from the pilot, a STOL (Shore Take Off and Landing) type aircraft (Helio Courier) equipped with low pressure "tundra" tires was tried in 1980. This was intended to enable the aircraft to land on sand beaches and unimproved tundra eliminating the water hazards. Due to mechanical difficulties this aircraft was replaced by a float-equipped Cessna 185, on August 7, 1980. The Cessna was used for the duration of the fishery.

FISHERY ASSESSMENT

Two contract employees were hired to do a site evaluation and biological investigation of each fishery, under the supervision of the Coastal Fishery Management Biologist, Fish and Marine Mammal Management Division, Department of Fisheries and Oceans. One employee was instructed to visit each site during fishing while the other was based at the freezer plant in Pelly Bay.

Site evaluation

The on-site employee was required, through observation and consultation with the aircraft pilot and fishermen, to evaluate each site using the following criteria:

1. aircraft accessibility
2. suitability for setting nets (fast water, shallow water, etc.)
3. suitability for landing catch on shore
4. fishing effort
5. other problems

Biological evaluation

Age, length and maturity: Random samples of char were taken at each site and fork length (± 1 mm), round weight (± 50 g), sex and maturity were recorded for each fish sampled. The relative state of maturity was determined by gross examination of the gonads. A description of maturity stages and codes is provided in Appendix 61.

In addition to the on-site sample, a random sample of the catch from each location was obtained at the processing plant where fork length (± 1 mm) and dressed weight (± 50 g) were taken. This was done for three reasons:

1) Since fish are dressed on site before shipment to the freezer plant, round weight must be recorded on site;
2) Since removal of otoliths for age determination is time consuming and the on-site sampler did not have much time to spend at each site, as fishing was simultaneous, otoliths were removed from fish at the plant, and
3) Plant sampling would ensure that, in the event the on-site sampler failed to reach any sites, biological data would

still be collected from each location fished. In fact, this happened at the Tourist River, hence no data on round weight or condition factor are available from that site.

Saggital otoliths were removed for aging purposes. The otoliths were stored dry in envelopes marked with the sample information. In the laboratory, the convex surface of the otoliths was ground on a Carborundum stone. The otoliths were then immersed in a 3:1 solution of benzyl-benzoate and methyl salicylate on a depression slide and the annual growth rings were counted using a dissecting microscope. Char were aged according to the method of Grainger (1953), where the dark central core is considered representative of the first winter's growth.

Age- and length-frequency histograms were constructed to display catch composition at each location by seasons and years. Samples were compared to determine homogeneity of stocks.

Growth: Length-weight relationships were calculated using least squares regression analysis on logarithmic transfonnations of fork lengths and round weights. Samples were initially compared between years/seasons at each location. Samples from different years/seasons were then pooled for each location and compared between locations.

The relationship is described as follows:

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

where: W = weight in grams
L = fork length in millimeters

Mean fork length at age was plotted from samples taken at each location and growth rates were compared visually. Again, samples from different years/seasons were pooled for each location. Where growth rates did not appear to differ, samples from locations in geographic proximity were pooled.

Relative condition factor (K), a measure of the plumpness or robustness of the fish, was determined by the following formula:

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

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

Condition factor was compared between seasons and between years (t-test) where data were available.

Mortality: Instantaneous total mortality (Z) was calculated from least squares regression lines fitted to the descending limb of catch curves. Catch curves themselves were fitted by eye and only that portion of the 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 modal age since the modal age in the catch curve will often lie quite close to the first year in which recruitment can be considered effectively complete (Ricker 1975). Age compositions from both years/seasons were combined for each location to eliminate fluctuations that Ricker (1975) states can result from variable recruitment of fish to the fishable population. Age groups representing variable recruitment were ignored in the catch curve analysis.

Annual survival rate (S) and annual mortality rate (A) were calculated from 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.

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

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

after Ricker (1975), assuming that fishing and natural mortality do not operate concurrently.

Where estimates of potential yield were made, the Baranov catch equation (Ricker 1975) was used as follows:

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

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

Exploitation rates were compared with those from two established commercial char fisheries in the Cambridge Bay area, one of which is believed to be heavily exploited while the other is believed to be lightly exploited. The heavily exploited fishery at the Ekalluk River (Fig. 1), began in 1960 (Barlishen and Webber 1973). It collapsed in 1970 after a period of heavy fishing. The fishery has since recovered and has been sustained since 1973 (Kristofferson and Carder 1980). The lightly exploited fishery, at the Jayco River (Fig. 1), began in 1975 (Kristofferson and Carder 1980) and has continued since, with little difficulty. Exploitation rates were calculated for these two fisheries, and a rate mid-way between the two was chosen as that which would probably be safe to apply to the new char fisheries, assuming that the factors which influence population dynamics of the stocks are similar between the Cambridge Bay fisheries and those included in this study.

Using Baranov's catch equation, stock size at the lightly exploited Cambridge Bay char fishery (Jayco River) was estimated. To provide a conservative estimate of yield from the test fisheries evaluated, it was assumed that their stock size was at least half that of the Jayco River char fishery. Using this estimate of stock size, estimation of potential yield was calculated using the following equation:

$$C = \frac{FAN}{Z}$$

where: F = instantaneous rate of fishing mortality mid-way between that calculated for the heavily exploited and the lightly exploited char fishery in the Cambridge Bay area.

Strength and timing of char runs: Daily production from each site, as recorded on sales receipts tabulated at the Koomiut Co-operative freezer plant in Pelly Bay, is presented graphically as an indication of the strength and timing of char runs.

Data analyses: Data were analyzed using an Amdahl 70/V7 Computer. Programs from the Statistical Analysis System (1979) were used for regression, analysis of covariance and t-tests.

RESULTS AND DISCUSSION

SITE EVALUATION

Aircraft accessibility

The Murchison and Back rivers and Tern Lake proved excellent for access by both float- and wheel-equipped aircraft under most conditions. Tides and rough water made operations at Mangles Bay difficult at times for float-equipped aircraft, although wheel-equipped aircraft could land under most conditions. A suitable landing site for wheel-equipped aircraft was available at the Kingark River, although caution was needed when operating the float-equipped aircraft due to the rocky shoreline. Sea ice was at times a hazard. Tidal fluctuations, sea ice and mud flats presented problems for both float- and wheel-equipped aircraft at Keith Bay. The wheel-equipped Helio Courier was mired in mud at one time and damaged on landing after striking a rock at this location. The Tourist River proved hazardous to float-equipped aircraft, since it was shallow and rocky and the wheel-equipped aircraft sustained minor damage while operating there. Float-equipped aircraft could operate with little difficulty at the Becher and Kaleet rivers and Elliot Bay. The wheel-equipped aircraft was not available when these areas were fished. The Arrowsmith and Kellett rivers were accessible only by float-equipped aircraft, and only during high tide. Sea ice at times presented problems.

Suitability for setting nets

Slow currents and adequate depth of water allowed nets to be set and tended easily at the Murchison and Back rivers. Little difficulty was experienced handling nets at the Becher, Tourist and Kaleet rivers, Elliot Bay and Tern Lake. Tides influenced net handling at the Arrowsmith and Kellett rivers and Keith Bay. Sea ice presented some problems for net tending at Kingark River as did rough water in windy weather at Mangles Bay.

Suitability for landing catch on shore

Good campsite and docking facilities were available at most sites. Low tides made docking and landing the catch difficult at the Arrowsmith and Kellett rivers as well as at Mangles and Keith bays.

Fishing effort

A summary of fishing effort and production is shown in Table 1. The fisheries are arranged in descending order of production. Crews were small (usually two men) except at the Murchison, Back and Kingark rivers in 1979 and the Murchison and Back rivers in 1980. This may have contributed to the higher production at these locations compared with the others.

Site evaluations were not possible at the Tourist or Kaleet rivers due to time constraints. Site assessments were based on interviews with the aircraft pilot. Production at the Kaleet River was very poor. As a result no biological data were collected and this site was excluded from further assessment.

Initially, plans were made to fish the Inglis River, adjacent to the Murchison River, and the Hayes River, adjacent to the Back River. However, fishermen located at the Murchison River believed there were few char in the Inglis River and could not be persuaded to fish there. Fishermen at the Back River claimed there were few fish in the Hayes, which was too fast and shallow for nets and boats in many locations. Only one overnight set was made there in 1979 and the area was abandoned.

At most locations, during both years of test fishing, the attitude of the fishermen was good, and most were hard-working and interested in the project. Varying levels of expertise were noted with fishermen from Spence Bay and Pelly Bay being most experienced. However, fishermen from Gjoa Haven showed no lack of enthusiasm.

Other problems

Most problems encountered were associated with operating fisheries during spring (July 1-30) when sea ice was a problem both with aircraft and nets. Significant tidal fluctuations (3-4 m) and poor weather (fog and drizzle), especially in the Pelly Bay area, hampered the program. Inclement weather during fall fishing (August 10 - September 15) presented problems in the Pelly Bay area.

BIOLOGICAL EVALUATION

Age, length and maturity

The oldest and largest char (mean age and mean fork length) were captured at the Kingark River (14.9 years, 68.4 cm), followed by the Murchison River (14.2 years, 64.4 cm), Mangles Bay (13.8 years, 68 cm), 8ack River (13.8 years, 64.6 cm), Elliot Bay (12.6 years, 63.1 cm), Tern Lake (12.1 years, 63.2 cm) and Keith Bay (11.7 years, 56.2 cm); the youngest and smallest char were taken at the Tourist (11.0 years, 61.3 cm), Becher (9.8 years, 56.3 cm), Arrowsmith (9.8 years, 55.2 cm) and Kellett (9.7 years, 55.0 cm) rivers (Table 2). Some fluctuations in mean age and mean length between samples taken at different times are evident at the Murchison, Back and Tourist rivers, Keith Bay, and Tern Lake. Differences in age and size distributions between samples from these locations are further illustrated in Fig. 2 and 3. These observed differences cannot be due to exploitation by the test fishery, since fishing was uniform and light (Table 1). In some cases, such as Keith Bay, mean size and age increased from one year to the next. The differences may be due to the timing and duration of the fisheries, which varied between years (Table 1). Char runs are often made up of groups of like-sized fish (Johnson 1980). Larger individuals usually run downstream before smaller individuals and usually return first in fall (Johnson 1980). The size composition of the catch can, therefore, be influenced by the timing of the fishery during the run.

The mean age and length of char taken in the commercial fishery at Cambridge Bay is about 14 years and 64 cm, respectively (Kristofferson and Carder 1980). Mean dressed weight is about 2.6 kg. Char taken at the Murchison (2.5 kg), Back (2.8 kg) and Kingark (2.7 kg) rivers, Mangles Bay (2.9 kg), Tern Lake (2.4 kg) and Elliot Bay (2.3 kg)(Table 2) compare favorably with those taken by the Cambridge 8ay fishery. Most of these char would be graded as medium size, that is 1.8 to 3.2 kg in weight. Char from Keith 8ay (2.0 kg) are somewhat smaller, but would still be commercially acceptable. Most of the char taken at the Tourist (2.1 kg), Becher (1.9 kg), Arrowsmith (1.5 kg) and Kellett (1.6 kg) rivers would be graded as small, that is 0.9 to 1.8 kg In weight. In comparison with char produced by the other fisheries, these would be less attractive to the market. The Freshwater Fish Marketing Corporation, the marketing agency for Arctic char in the N. W. T., considers char under 0.9 kg as unmarketable, those 0.9 to 1.8 kg as less desirable, and those greater than 1.8 kg as the prime product (B. Popko, pers. comm.).

Of great concern to the proper management of these fisheries is the size and age of maturity of char, and the abundance of mature fish in the stock. The importance of the relationship between recruitment and the abundance of older fish, particularly spawners, in the stock is a key question (Ricker 1977). As Johnson (1980) states, one of the most difficult factors to estimate in all anadromous char stocks is that of recruitment. Understanding this relationship is complicated by the fact that spawning behavior of Arctic char is quite complex. Johnson (1980) has observed that anadromous char using the Nauyuk Lake system on the Kent Peninsula, showed considerable variation in spawning from year to year. The number of spawners was small, sometimes only 2% of the larger size mode in the total migratory stock. Apparently the condition in which the char return from the sea may influence the number of fish spawning the following year. Hence, the size of the spawning stock in a given year may be related to previous climatic conditions (Johnson 1980).

Ricker (1977) points out that stocks under stress from a fishery are less capable of reacting positively to environmental stress, so that recovery from such stress will take longer and may never be complete. Given the existence of environmental stress, char stocks with adequate numbers of spawners, or potential spawners, will be in a better position to recover than those with few. Thus, the fishery, as it affects the spawning stock, can be a contributing cause of recruitment failure. Unlike the environment, it is the only one which can be controlled (Ricker 1977) .

The size and age of maturity of Arctic char varies considerably between populations. Generally char grow faster in the more southerly portions of their distribution (Scott and Crossman 1973). Along the west coast of Hudson Bay, mature char nine years old have been taken (Sprules 1952). Char in the Sylvia Grinnell River on Baffin Island are believed to spawn first at age 12 (Grainger 1953) at a length of about 46 cm (Hunter 1966). Johnson (1980) noted that the spawning stock at Nauyuk Lake was much larger (62-77 cm) than the non-spawning, sea-going stock (60-64 cm). From a previous study, we found that the youngest anadromous spawner in a sample of 50 taken in August 1980 from a lake 65 km northeast of Cambridge Bay, was 13 years old. The oldest was 23 and the mean age was 16 years. One hundred and five spawners from the same lake ranged in fork length from 51 to 85 cm with a mean of 60 cm. Since the locations fished during this test fishery are similar in geographic latitude to the Cambridge Bay and Nauyuk Lake populations, it is reasonable to assume that size and age at maturity of char follow a similar pattern here.

Once they reach maturity, char do not spawn every year (Sprules 1952; Grainger 1953; Johnson 1980). In fact most char returning to freshwater in the upstream migrations appear to have immature gonads, even though many are older than the age of first maturity. If most char stocks in the central Arctic behave similar to the one studied by Johnson (1980) at Nauyuk Lake, the spawners will have spent the summer in freshwater, and will not have been part 'of that year's seaward migration. This is apparently the case near Cambridge Bay since we have found spawners in freshwater in mid-August, well before the fall upstream run commenced. However, there are always a few ripe fish observed in the upstream run (Johnson 1980) as there were in this study (see Appendices). None were under 55 cm in fork length and most were 60-65 cm. If Arctic char in these locations spawn on average at a size of 60 cm and age 12-13 years, re-examination of the age and size distributions shown in Fig. 2 and 3 suggests that stocks at the Murchison, Back and Kingark rivers as well as at Mangles Bay, Elliot Bay, and Tern Lake have relatively large numbers of potential spawners. That is, char that have reached the size/age of first maturity, but are not spawning during the current year. Those at Keith Bay, Arrowsmith, Kellett, Becher and Tourist rivers have relatively few potential spawners. At the latter sites, with the exception of the Tourist River, commercial fishing has taken place for some time. It is possible that these fisheries have been a contributing factor in the disappearance of larger, older char at these locations. A similar situation developed at the Ekalluk River in 1969, necessitating the closure discussed earlier.

As discussed previously, the relationship between spawning stock size and successful recruitment to Arctic char fisheries is not well known. However, small spawning stock size, coupled with marginal growth conditions known to exist in the Arctic (Johnson 1980), could significantly reduce the ability of these char stocks to return to a state where they are able to support a commercial fishery that produces an attractive product. This appears to apply particularly to the char stocks in the Becher, Kellett, Arrowsmith and Tourist rivers.

Growth

Length-weight relationships from each sample were examined visually and compared between years at each location. Apparently 1979 was a poor year for growth since, in each case, char taken in fall, 1979 did not weigh as much for a given length as they did in fall, 1980 (Fig. 4).

Increases in weight for a given length were noticed between spring and fall samples in the same year. As Johnson (1980) states, the difference is a reflection of summer growth. The weight of char generally increases over the summer as a result of feeding, but decreases over the winter. Length increases occur in both summer and winter, the latter occuring at the expense of nutritional reserves.

A comparison of length-weight relationship data, pooled by location, is shown in Table 3. Weights corrected for length were compared by analysis of covariance. Means at all locations were significantly different ($p<.001$ in most cases) with the exception of the following pairs: Keith Bay and Back River, Elliot Bay and Kingark River, and Arrowsmith Bay and Kellett River. Similar increases in weight with length between locations may indicate growth takes place in similar environments. Differences may reflect different environments and/or genetic differences between stocks. The similarities between Mangles Bay and Murchison River, and Arrowsmith River and Kellett River may have some biological significance since these locations are geographically close. The similarity may represent similar environments or mixing of stocks. The similarity of age and length distributions between the Arrowsmith and Kellett rivers (Fig. 2, 3) supports the assumption of a mixed stock. Both samples were taken in spring, 1979.

Since the Tourist River was not sampled on-site, round weights were not collected and a length-weight relationship could not be calculated. A length-dressed weight relationship,

$$\log_{10} W = -4.54 + 2.81 (\log_{10} L)$$

was calculated. Round weight can be calculated from this equation by applying a conversion factor of 1.16, N = 1814 to the calculated dressed weight for a given length.

Mean length at age of char is shown in Fig. 5. For most locations, increase in length with age is similar with the exception of Keith Bay where growth appears to be slower. This location is somewhat isolated from the others and growing conditions may differ here. Growth of char at the Murchison and Back rivers is somewhat slower than at the Tourist, Kellett, Becher and Arrowsmith rivers but similar at the remainder of locations in the Chantry Inlet area.

Included in the growth comparison shown in Fig. 5 are age-length data from the Ekalluk and Jayco rivers, Cambridge Bay area. Growth of char from this area appears similar to that at most locations test-fished providing support for the assumption that char taken in the test fisheries probably mature at a size and age similar to those near Cambridge Bay.

Mean condition factor (K) was calculated for each sample, by season and year, at each location (Table 2). Samples of char taken at Kingark River and Keith Bay in spring 1979 and 1980 showed no significant difference (t-test) in mean condition factor between years (Table 4). Char are often in poor condition in the spring, since little feeding takes place over the winter (Johnson 1980). Mean condition factor of char taken at the Murchison (K=1.23) and Back (K= 1.26) rivers during fall 1980 was significantly ($P< 0.001$) greater than that calculated for fall 1979 (Murchison, K=1.01; Back, K=1.04) (Table 4) indicating, as discussed previously, that growth can vary significantly from year to year.

Char captured in fall 1980 at Keith Bay (K=1.34) and Mangles Bay (K=1.25) showed a significantly ($P<0.001$) better mean condition than those captured in spring 1980 (Keith Bay, K=1.11; Mangles Bay, K=1.01) (Table 4). Hence, the char captured in fall were much more "plump" than those taken in spring, due to an increase in weight while feeding in the sea in summer. It is probably better to conduct fisheries in fall since the fish will be more attractive to market, and fewer individuals will be needed to fill a given quota.

Mortality

For most locations catch curve analysis indicated a good fit for the regression line applied along that portion of the descending limb considered, by observation, to be linear (Fig. 6). The paucity of old char in samples taken from the Arrowsmith, Becher, Kellett and Tourist rivers, required that only a few age groups, considered fully recruited to the fishery, be used to determine mortality rate. The 15-year-old age group from the Murchison River and Mangles Bay was ignored in the analysis since it probably represents variable recruitment. It was felt that sufficient representation was available from the other age groups to calculate relatively accurate mortality rates without the inclusion of this age group.

Comparisons of instantaneous total mortality (Z) (Table 5) shows lowest mortality at Mangles Bay (0.34), Elliot Bay (0.35), Murchison (0.41), Kingark (0.42) and Back (0.46) rivers and Tern Lake (0.53). Highest mortality appears to take place among char at the Tourist River (0.60), Keith Bay (0.67), and the Arrowsmith (0.89), Becher (0.91) and Kellett (1.06) rivers. High mortality at the latter three locations is well illustrated by the steeply descending limbs of their catch curves (Fig. 6) and the virtual nonexistence of older char in the catch.

Total mortality rates at the Arrowsmith, Becher and Kellett rivers exceed that of the Ekalluk (Table 5) and total mortality rates at Mangles Bay, Elliot Bay and the Murchison, Kingark and Back rivers appear to be similar to that at Jayco River (Table 5). Tern Lake, Tourist River and Keith Bay appear to fall in between these levels (Table 5).

Due to the long natural agespan and low level of predation Johnson (1980) expects natural mortality of char stocks to be low. He noted that mortality in the sea-going stock at Nauyuk Lake was comparatively low with tag returns of 80% recorded for mid-sized fish. However, more significant mortality occurred amongst the emaciated postspawners on their return to the sea after spawning. If natural mortality is assumed to be 0.17 (see Material and Methods) fishing mortality (F) can be calculated from instantaneous total mortality (Z) as shown in Table 5.

Fishing mortality appears to be high at the Arrowsmith (0.72), Becher (0.74) and Kellett (0.89) rivers which have histories of heavy subsistence and commercial exploitation. Keith Bay (0.50) and Tourist River (0.43) have relatively high fishing mortality. Commercial fishing has taken place at Keith Bay for a number of years. The other areas show varying rates of fishing mortality from a low of 0.18 at Elliot Bay to 0.36 at Tern Lake. None of these locations, with the exception of Murchison River, has supported a commercial fishery in the past. It is assumed that calculated fishing mortality at these locations results from an unknown level of subsistence fishing on these stocks.

Fishing mortality at the Murchison River (0.24) is low. This is to be expected since the commercial fishery has been sporadic over the years and production has been low. Fishing mortality appears to be greater at the Back River (0.29), where no commercial fishery operates. However, Inuit from Gjoa Haven harvest an unknown quantity of char annually in a subsistence fishery at this location (A. Helmer, pers. comm.). A sport fishery here takes some char as well.

Rate of exploitation and estimation of yield

Relatively little information exists on the capacity of Arctic char to yield a harvest under exploitation (Johnson 1980). Since the population dynamics of Arctic char stocks is extremely complex, the development of management plans to assure annual harvest is exceptionally difficult (Johnson 1980). Probably the most effective strategy at present is to apply rates of fishing to new fisheries that have shown through experience to be tolerable by char stocks. Estimations of yield from new fisheries should purposely be conservative and new fisheries should be monitored closely from the onset of fishing to determine if the selected rate of fishing can be sustained by the stock. This procedure was followed in this assessment.

Calculated exploitation rates from the established char fisheries at the Jayco River (0.20) and the Ekalluk River (0.44) (Table 5) provide a range within which to determine fishing rates for the new char fisheries. The primary assumption is that the new stocks will respond to exploitation in a manner similar to the stocks that are used as the guide. There is evidence that growth (Fig. 5) and maturity between these exploited and test-fished stocks is similar.

Char from Elliot Bay and Mangles Bay apparently have the lowest rate of exploitation (0.16), followed by those at the Murchison (0.21), Kingark (0.22) and Back (0.25) rivers and Tern Lake (0.30) (Table 5). Probably exploitation could be increased at these locations. Exploitation rates are higher at the Tourist River (0.35) and Keith Bay (0.39). Since these rates already lie within the upper end of the range discussed earlier, an increase in exploitation at these locations would be questionable. The highest exploitation rates were recorded at the Arrowsmith (0.51), Becher (0.52) and Kellett (0.59) rivers. These rates exceed the upper limit of the range (0.44) thus a reduction in exploitation is probably necessary here.

Although stocks at Tern Lake and Elliot 8ay do not appear heavily exploited (Table 5), insufficient data are available to allow estimating yield at these locations. The existence of discrete stocks at Kingark River and Mangles Bay is questionable, hence no estimation of yield was made for these locations. Given the geographic proximity of the Tourist River to the Arrowsmith, Becher and Kellett rivers, and the complexities of char movement and behavior, the establishment of a commercial fishery at this site at present may hinder the recovery of stocks at the latter three rivers so no estimation of yield was made here either. These reasons are discussed in detail in the following section.

Stocks at the Murchison and Back rivers are probably being underexploited at present. Calculated exploitation rates at these locations are similar to that calculated at Jayco River (Table 5). However, the 1980 yield at Jayco River was 14 470 kg (Carder 1981) whereas the yield at the Murchison and Back Rivers was less, being limited to a small sporadic commercial harvest at the Murchison and a subsistence and sport harvest at the Back (A. Helmer, pers. comm.). If similar exploitation rates produce a smaller yield at the latter two locations, their stocks may be less abundant than at Jayco River.

The Baranov catch equation and harvest data from Jayco River (Carder 1981) were used to estimate the size of this stock (Appendix 62). Assuming that stocks at the Murchison and Back rivers are at least half the size of the Jayco stock, this estimate was substituted into the Baranov catch equation to determine expected yield. Using the rate of exploitation mid-way between the upper and lower limits discussed earlier (μ = 0.32, F = 0.40), an annual yield of 12 000 kg was calculated (Appendix 62) for both the Back and Murchison rivers. Since the existing quota at the Murchison River is 9 100 kg the recommended quota at these two rivers was reduced to 9 100 kg as a conservative measure.

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.

Strength and timing of char runs

Catch per unit of effort can provide a measure of the relative abundance of fish (Ricker 1975) but the utility of the method is questionable when a "run" of fish is involved. Catch per unit of effort during a run will be heavily dependent on the timing of the fishery. Average catch per unit of effort was calculated for each fishery (Table 1). These values may be more highly correlated with the timing of the fishery than with stock size. Since effort was constant throughout most of the fishery, daily production recorded as it arrived at the Koomiut Co-operative processing plant in Pelly Bay, should provide a measure of the relative daily strength of the run (Fig. 7).

The Murchison and Back rivers displayed peaks in daily production during both years fished. Both fisheries took place in fall and fishing sites were well upstream from the mouths of the rivers. These peaks are evidence of returning runs of char. Fishing until the provisional quotas were taken (Table 1) would have provided some measure of the strength of the run. However, this was not accomplished at any location during the two year test fishery.

Results shown in Fig. 7 suggest that the tail end of a run was taken at Keith Bay in the spring of 1979 and 1980. However, this is rather late for the downstream run and could represent a concentration of char moving along the shore while feeding in the Bay. There is little evidence of a fall run in 1980.

Production in 1979 at Kingark River suggests a run peaking in mid-July. However, this is rather late for a downstream run, many of which begin as early as mid-May when the surface of rivers is still frozen, as Moore (1975) observed in Cumberland Sound. This peak may represent a concentration of char passing by the fishing site. Production was poor through 1980 and provides little indication of a run other than a small-peak on July 18. Particular attention should be paid to this site. Nets were set in the sea, not in the river mouth and the fishermen claimed that few fish enter this river. They suspected these char could have been from the Back River system. Studies suggest that while at sea, the distance travel led by char from the parent stream is directly proportional to the length and age of the fish (Moore 1975). From tagging studies Johnson (1980) has determined that it is not unusual for char to travel 40 to 50 km and sometimes as far as 400 km. The largest, oldest fish taken in the test fishery during both 1979 and 1980, were taken at Kingark River (Table 2). Whether these char are from the Kingark River or other systems is not known.

A single peak in production was noted on July 26, 1979 (Fig. 7) at the Tourist River. This may have been an isolated group of char passing through the area, since this is late for a downstream run. Production was poor in 1980.

Production at Mangles Bay increased at the end of August in 1979 and 1980. However, since there is no large river in the vicinity the char passing this location are thought to be itinerants. During both years, peak production at Mangles Bay preceded the peak at the Back River (40 km away; Fig. 1) by approximately one week (Fig. 7). As char have been known to travel 6 to 9 km daily (Johnson 1980) they could have travelled from Mangles to the Back River in the elapsed time. The Mangles Bay samples are very similar in age and length frequency distributions to the Back River samples (Figs. 2,3).

Two peaks in production at the Kellett River in July 1979 (Fig. 7) probably represent groups of char moving along the shore during summer feeding. A small peak followed by a decline in production in September, 1979, may represent the end of an upstream migration.

The peaks in production noted at the Becher River in mid-summer 1979 and 1980 and mid-summer 1979 at Arrowsmith River (Fig. 7) could also represent itinerant char migrating while feeding along shore.

Tern Lake showed declining production at the end of August, 1979, possibly indicating the end of a run (Fig. 7).

A slight increase in daily production at Elliot Bay in early September, 1979, may represent a returning run of char (Fig. 7) although production was very poor (Table 1).

SUMMARY ASSESSMENT

Recommendations for commercial fishing quotas are given in Table 6.

MURCHISON RIVER

Results of the test fishery suggest that the Murchison River is capable of sustaining a commercial fishery. There is evidence that a fall upstream migration of char takes place at this site and samples from the catch indicate a relative abundance of marketable sized char in the population. The present exploitation rate suggests that the stock can withstand an increase in fishing pressure. The calculated yield from this stock is 12 000 kg. Since the present quota is 9 100 kg (20 000 pounds) it is recommended that it remain as such, as a conservative measure especially since there may be an undetermined subsistence harvest at times. This level of harvest has not been sustained here in recent years due to fluctuating effort; however, it is felt that the stock can sustain it. Annual monitoring of the catch is recommended initially, if the fishery proceeds.

The location is ideal for a commercial fishing camp providing easy access for both aircraft and boats, and handling of nets is not difficult here.

One problem encountered during this test fishery was the incidental take of lake trout. Since the trout are of less market value than the char, they were often culled. Trout were often taken prior to the char run. Further experience will enable fishermen to determine accurately the onset of the char run, and less fishing effort prior to the run could reduce the numbers of trout taken. Those that are unavoidably taken should be marketed as they are of some value locally.

BACK RIVER

Catch statistics from the Back River test fishery provide evidence of an annual upstream migration of char in this river. Large, marketable char appear to be present in quantity and the present estimated level of subsistence and sport harvest does not appear to have overexploited the stock. In fact, the stock is presently assumed to be underexploited and the calculated yield is 12 000 kg annually. Because of the undetermined harvest by the sport and subsistence fisheries at this site, a commercial quota of 9 100 kg is recommended.

Annual monitoring is recommended if the fishery proceeds and the extent of the sport and subsistence harvest should be determined.

Logistically, the site is ideal for a commercial fishing camp.

Similarly to the Murchison River, an abundance of lake trout was taken here and subsequently culled. Since a sport fishing lodge is established on the Back River, and lake trout are the sought after species, it is very important that the commercial fishery attempt to reduce the lake trout harvest in order to avoid a resource use conflict. This can probably be achieved through accurate determination of the onset of the char run by using minimum fishing effort prior to the run.

KEITH BAY

Samples from the harvest at Keith Bay suggest that char taken in this fishery are presently being moderately exploited. In comparison to other fisheries such as at the Murchison and Back rivers, there appear to be fewer large char in this population. Growth at this site appears slower than at the other sites investigated. As such, an increase in the present quota of 4 500 kg is not recommended. The harvest should not exceed this level and annual monitoring of the catch is recommended to determine if the present level of fishing can be sustained.

The location is less than ideal for a fishing camp. Tides and sea ice present difficulties at times for aircraft, boats and net handling.

KINGARK RIVER

Data from this test fishery suggest that an abundance of large char are available at this site. However, the fishermen involved in this fishery believed few char enter this river. Production figures can provide no evidence of a run into this river since fishing took place in July while char are still at sea. There is a strong suspicion that char taken here may be itinerants from other systems, hence no commercial quota is recommended for this site. If, however, sufficient interest exists to pursue a fishery at this location, a provisional quota of 4 500 kg (10 000 pounds) can be set, provided fishing takes place at the mouth of the river in late August and early September to catch the upstream run of char, if it exists. A tagging program, coincident with the fishery would be appropriate to determine whether mixing of stocks takes place between this and other systems.

MANGLES BAY

Biological data collected from char taken at this site suggest they are lightly exploited. However, since access to freshwater is not available here, these are itinerant fish that belong to another system, possible to the Murchison or Back river stocks. It is recommended, therefore, that no commercial fishing take place here at present. If necessary, a tagging program should be undertaken in future to determine the origin of Mangles Bay char.

TERN LAKE

The char population at Tern Lake is apparently not heavily exploited at present and the samples from the catch reveal that marketable char are available here hence there may be potential for a fishery. This fishery is isolated from the others investigated during this program, and as such the stock is probably homogeneous. However, insufficient information is available at present to assess the potential for commercial fishing in this area. Since access to this area is not difficult with either float- or wheel-equipped aircraft and the location is suitable for a commercial fishing camp, it is recommended that this area be investigated more thoroughly in future, if interest exists to fish it.

ELLIOT BAY

Similarly to Tern Lake, biological data gathered suggest that exploitation of char at

Elliot Bay is light. Production was poor overall with little evidence of an actual run of char. There was some indication that production was increasing at this site just before the fishery ceased operating in early September. Insufficient data were collected to determine the potential for commercial char fishing at this location. It is recommended that a thorough investigation of this site be undertaken in future, if interest exists to fish here, since the location is logistically suitable for a commercial fishing camp.

TOURIST, KELLETT, BECHER AND ARROWSMITH RIVERS

Results of the test fisheries at the Kellett, Becher and Arrowsmith rivers indicate that few large char of market value are available from these stocks. The lack of potential spawners suggests these stocks will have a difficult time recovering if recruitment is closely related to spawning stock size. Exploitation rates for these three fisheries exceed the rate at the Ekalluk River, Cambridge Bay area where the char stock is believed to be heavily exploited at present. Each has a long history of heavy subsistence and commercial fishing. Biological data from samples taken at the Tourist River suggest the char here are not as heavily exploited as they are at the Kellett, Becher and Arrowsmith rivers. However, in comparison to other stocks assessed during this test fishery, the Tourist River stock shows obvious signs of exploitation. There has never been a commercial fishery at this site, but subsistence fishing probably takes place here. Presently it is not known whether a separate stock of char inhabits each of these four rivers. All are in close proximity to one another and if separate stocks exist there is probably mixing in salt water during summer. Hence, it is recommended that a complete closure to fishing be effected on the Kellett, Becher, Tourist and Arrowsmith rivers to allow recovery of the stocks. Annual monitoring is recommended to determine the rate of recovery.

Since the people of Pelly Bay depend upon char for food and an effective recovery strategy precludes any fishing in this area for a number of years, alternate means for the residents to secure fish will have to be investigated. In order to implement this recovery strategy, the present status of these stocks and the potential consequences of a total closure must be thoroughly discussed with the residents of Pelly Bay. Rapid recovery of the stocks will only be possible if the cooperation of the community is secured.

The inclement weather, tides, rocky shorelines and sea ice encountered at these locations make transportation of the char to the processing plant by aircraft a difficult and expensive operation. If the recovery strategy is adopted alternate means of transportation, such as a large, freezer-equipped vessel, should be investigated for future fishing. Such an operation has met with success along the coast of Hudson Bay in the Rankin Inlet area.

SPRING VS FALL FISHING

The results of this test fishery indicate that the optimum time to conduct a commercial fishery for char in the Gjoa Haven - Pelly Bay area is after mid-August, when fishing can concentrate on upstream migrations. Drifting sea ice after break-up presented a problem at many sites for aircraft, boats and nets. Fishermen had to be flown to spring camps at great expense, while they could travel by boat to many sites in fall. Inclement weather, particularly fog and rain, is more frequent in spring and hampered flying operations during the test fishery.

Condition of char is better in fall than in spring so fish will be more attractive to the market. Because individual fish will be heavier, fewer individuals will have to be taken to fill a given quota. Fall upstream migrations may represent discrete stocks, so fishing the runs provides an opportunity to manage each stock individually. Less effort will be necessary fishing for char as they concentrate during upstream migrations. It may be impossible to fish discrete stocks on downstream runs since they can take place prior to or during break-up. Fishing during mid-season probably results in harvesting mixed stocks.

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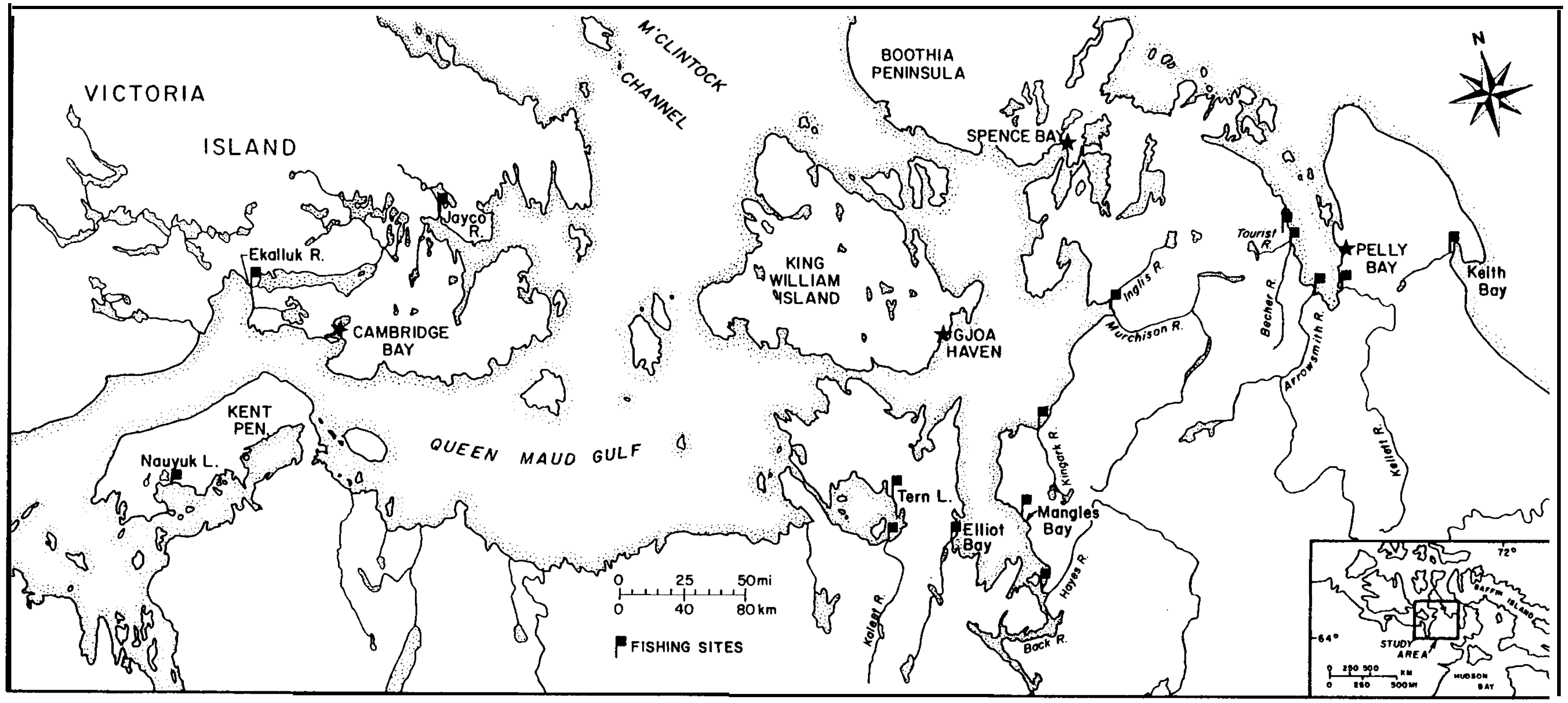


Fig. 1. Map of the Gjoa Haven-Pelly Bay area showing locations test fished for Arctic char during 1979-80. Also shown are the locations of the commercial char fisheries at the Ekalluk and Jayco rivers and the research site at Nauyuk Lake.

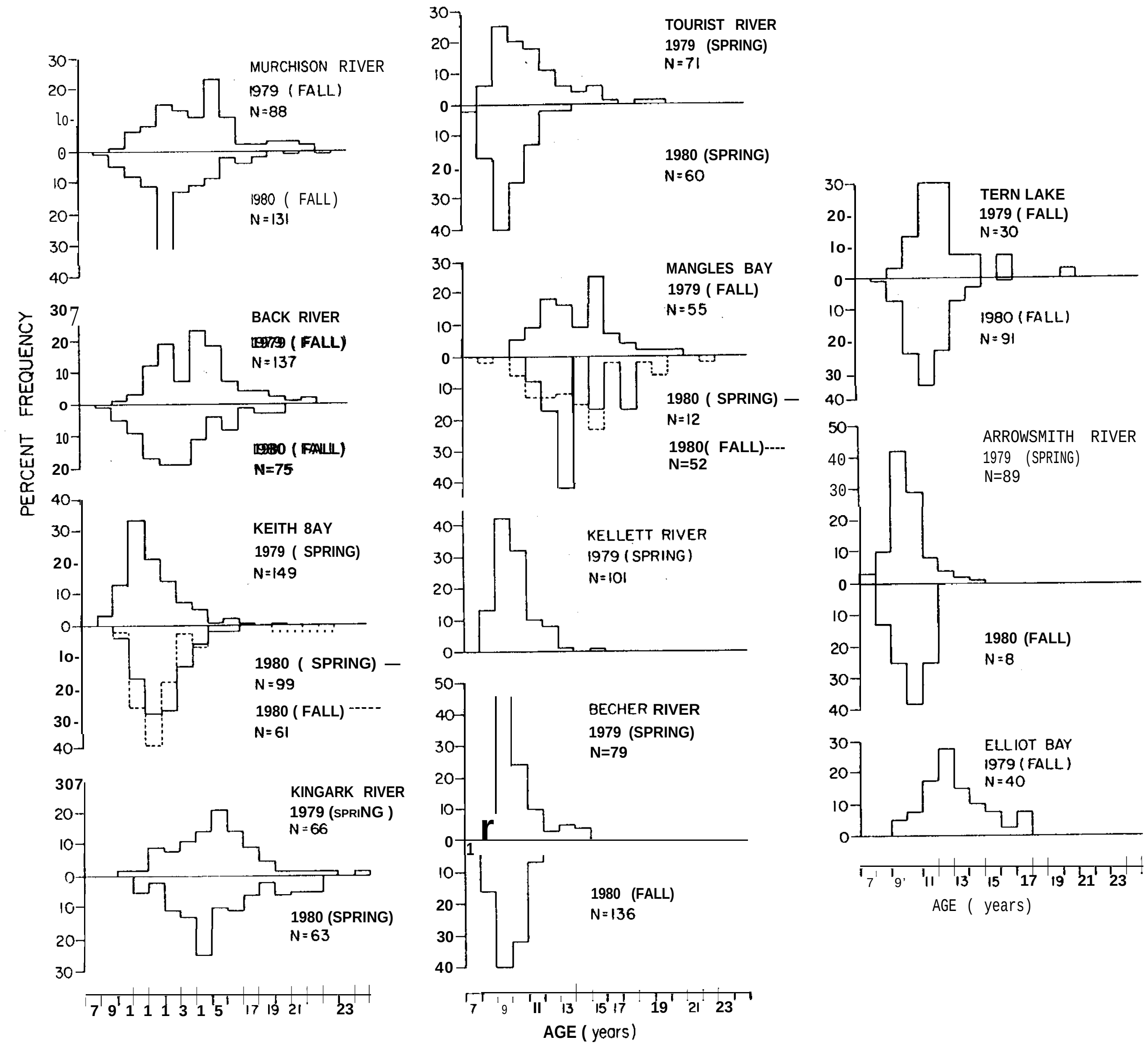


Fig. **2.** Age frequency distributions of samples of Arctic char taken by the Gjoa Haven - Pelly Bay test fishery during 1979-80.

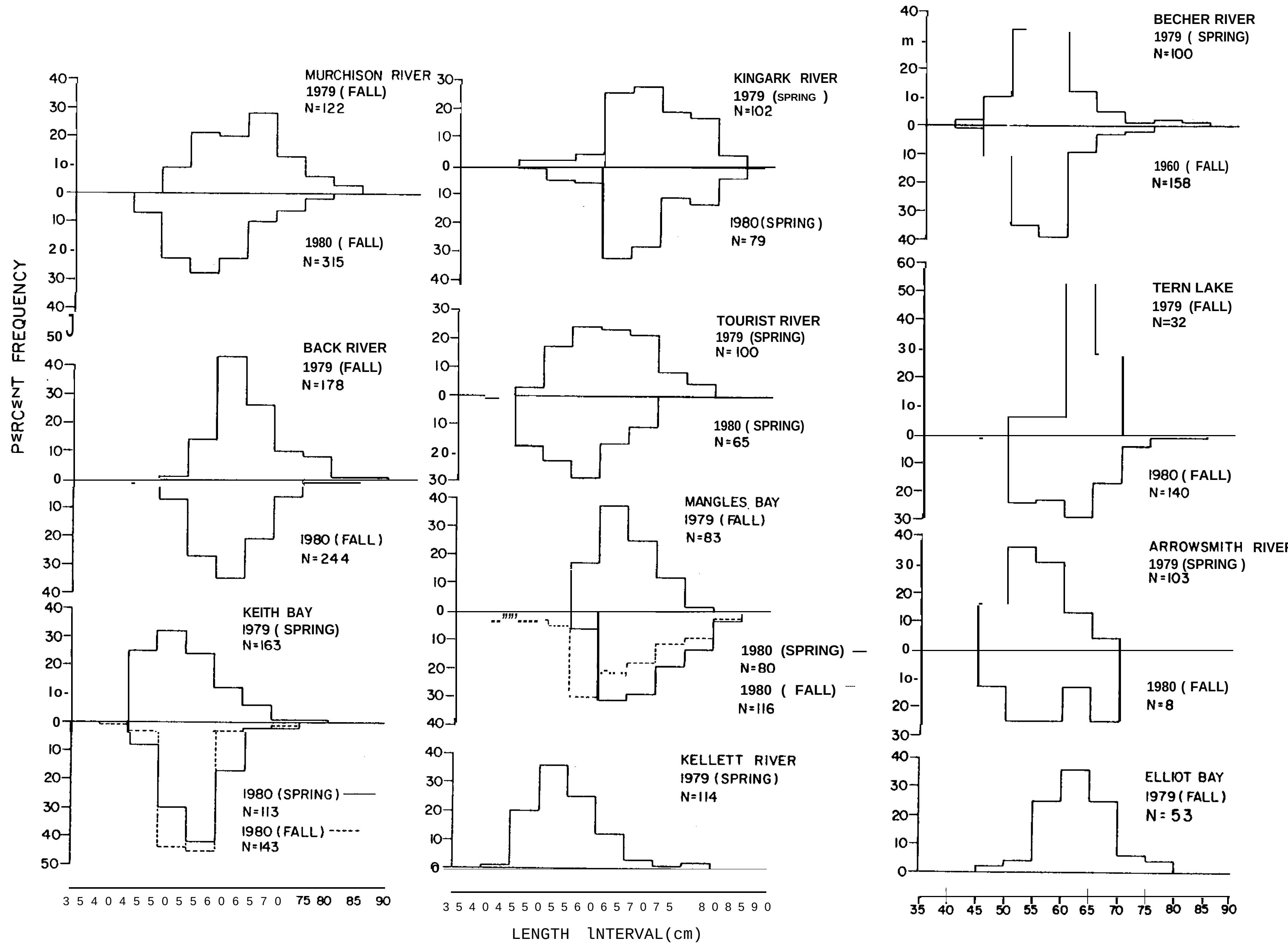
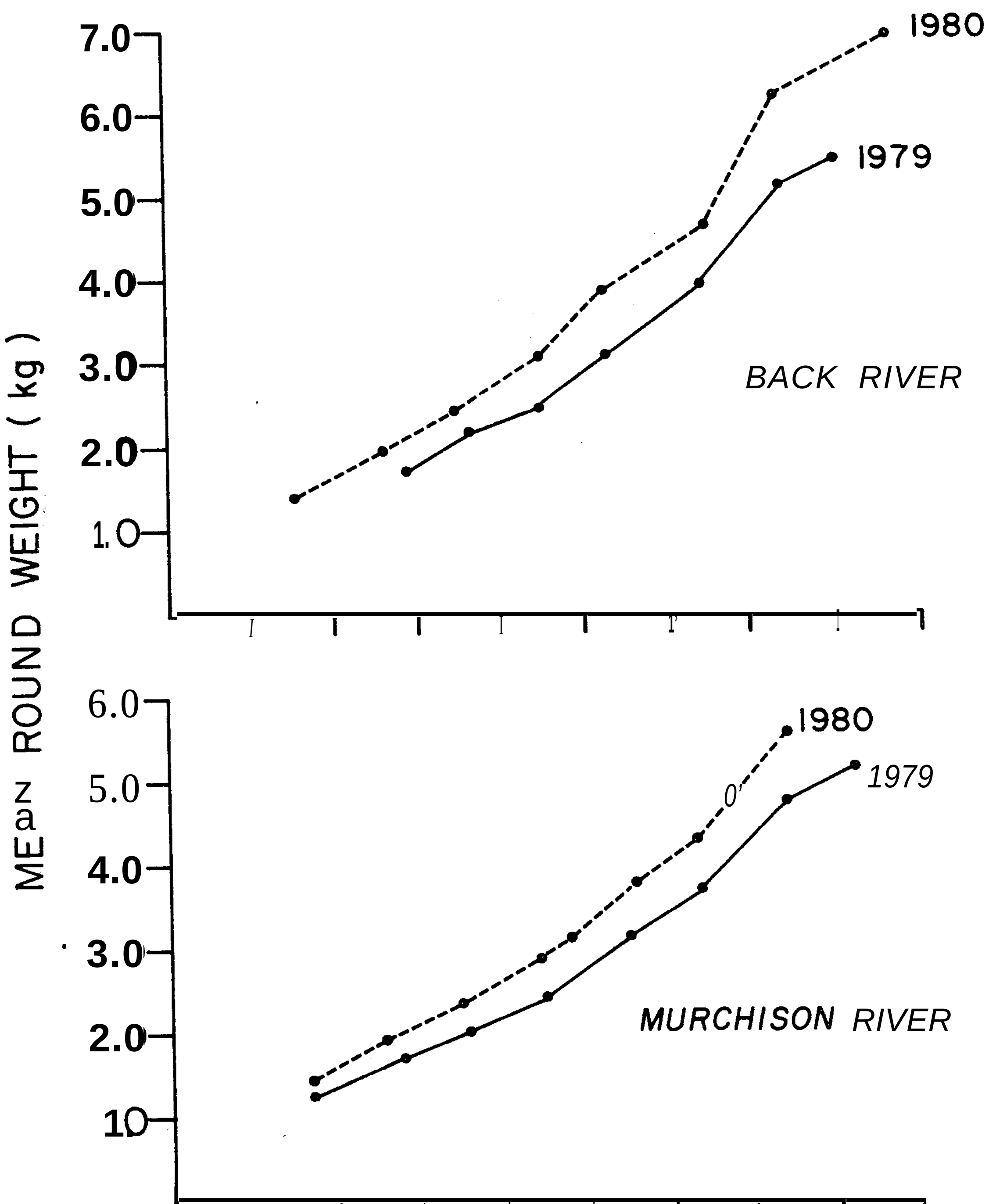


Fig. 3. Length frequency distributions of samples of Arctic char taken by the Gjoa Haven - Pelly Bay test fishery during 1979-80.


MEAN ROUND WEIGHT (kg)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
1980
1979
BACK RIVER
6.0
5.0
4.0
3.0
2.0
1.0
1980
1979
MURCHISON RIVER

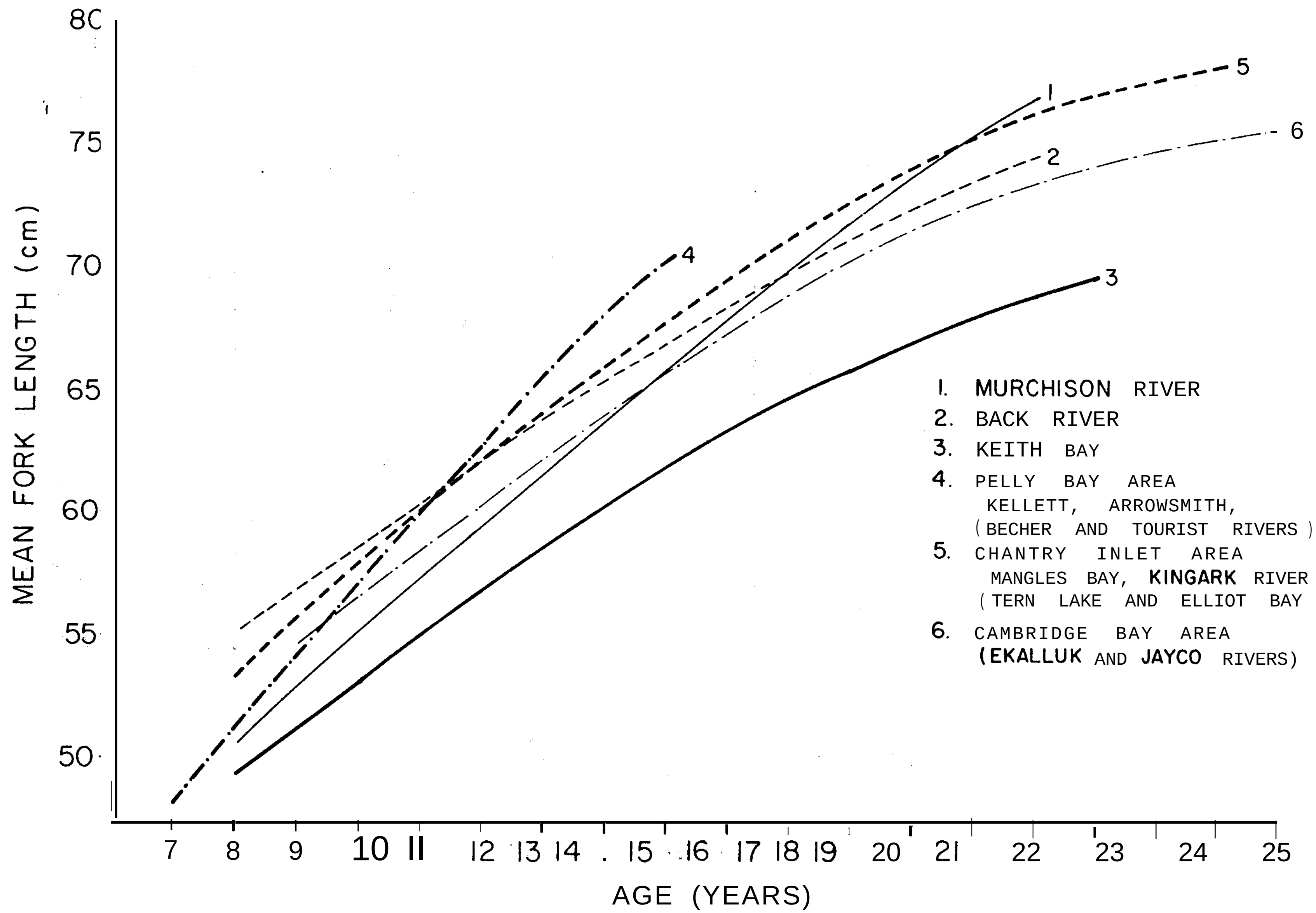


Fig. 5. A comparison of growth rates of Arctic char taken at the test fishery sites during the Gjoa Haven-Pelly Bay test fishery with those of char taken by commercial fisheries in the Cambridge Bay area.

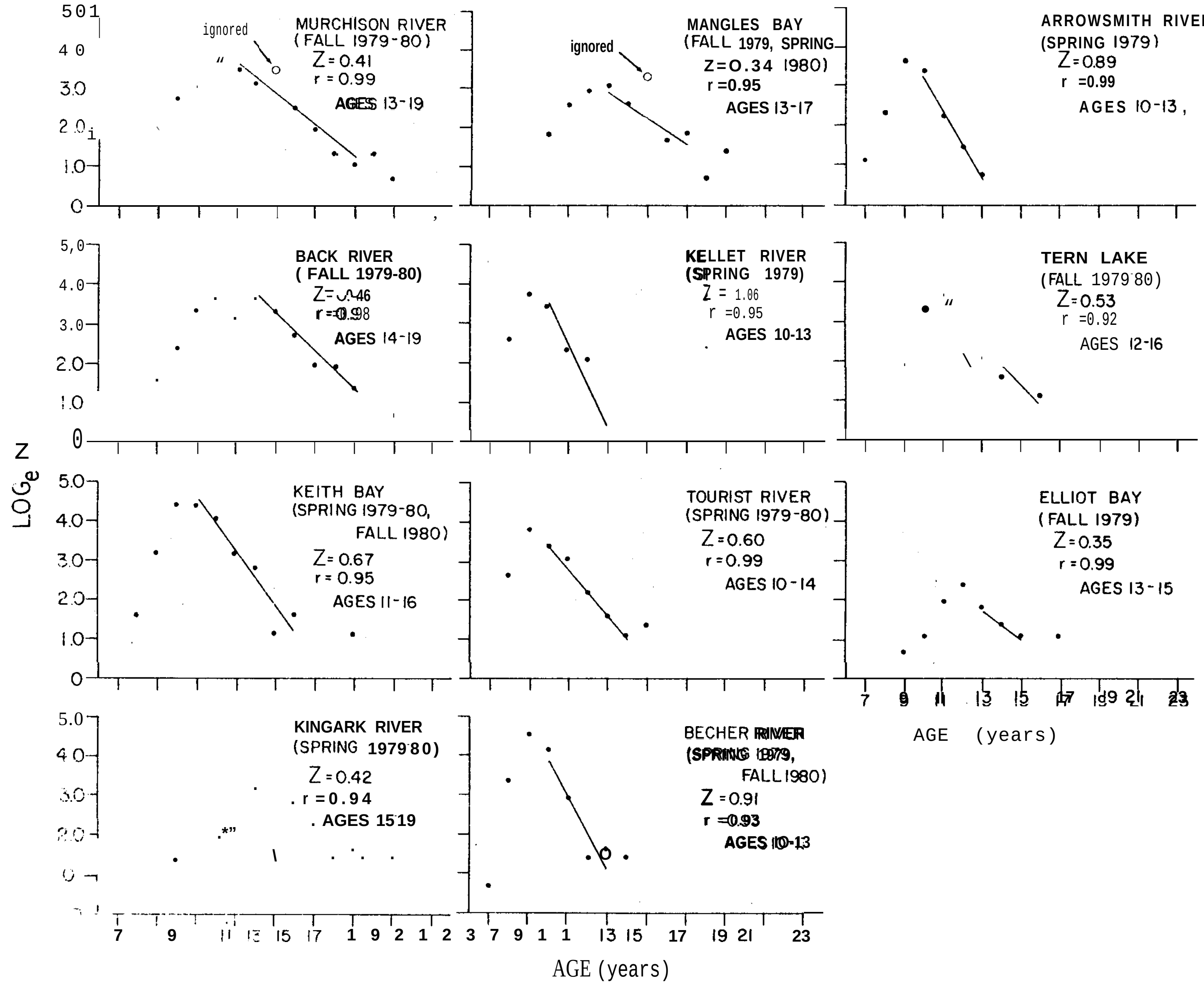


Fig. 6. Catch curves and instantaneous total mortality rates for Arctic char taken at the locations fished during the Gjoa Haven - Pelly Bay test fishery, 1979-80.

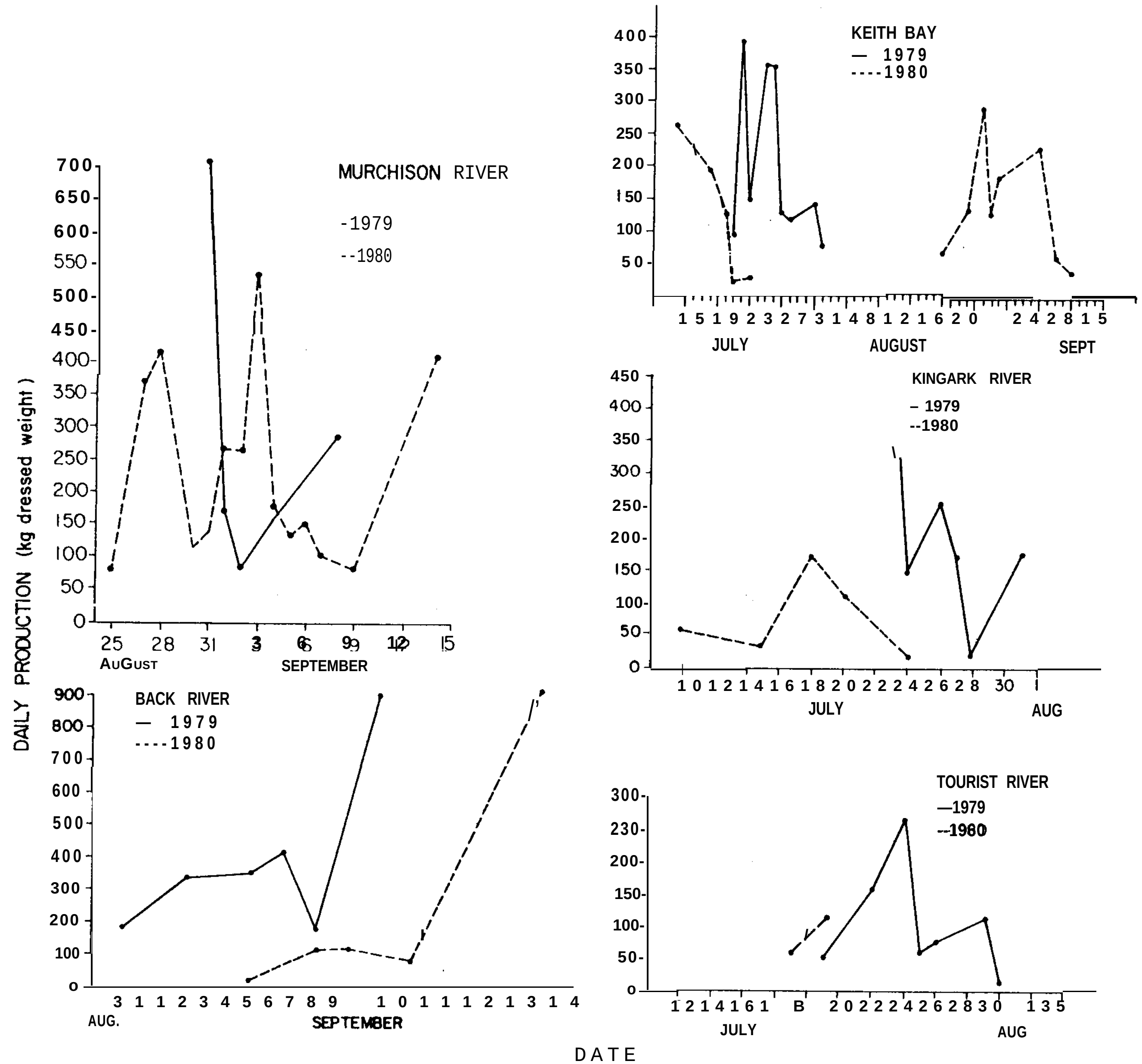


Fig. 7. Daily production of Arctic char (landed weight) from the locations fished during the Gjoa Haven - Pelly Bay test fishery, 1979-80.

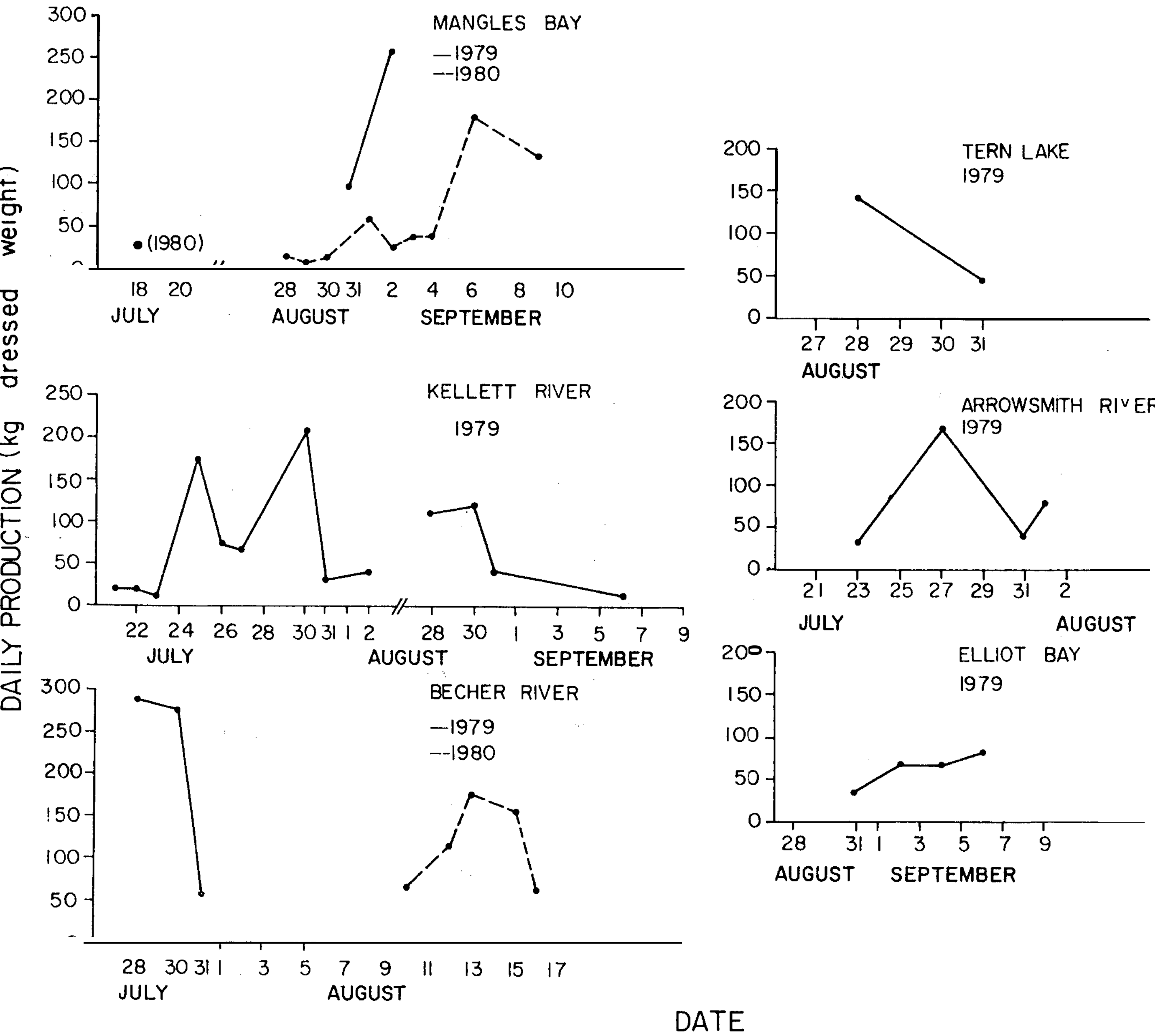


Fig. 7. Continued.

Catch statistics for Arctic char from locations test fished in the Gjoa Haven - Pelly Bay area during 1979 and 1980. Al weights are dressed weight, gills and viscera removed. Locations arranged according to highest production.

Fished	Quota (kg) (pounds in brackets)	Production (kg) (pounds in brackets)	Dates Fished	Number Days Fished	Number Fishermen	Number Nets	Catch per Unit Effort (kg/100m/24 hr
River-Fall 79	7260[a] (16,000)	1393 (3071)	Aug 28-Sept 9	13	4	6	20
River-Fall 80	7260[a] (16,000)	3269 (7191)	Aug 5-Sept 14	41	6	12	7
-Fall [illegible]	2360 (5200)	2347 (5174)	Aug 28-Sept 10	14	4	10[b]	26
-Fall 80	2360 (5200)	1221 (2687)	Aug 28-Sept 15	19	4	2-10	15[c]
Spring 79	3630[a] (8000)	1805 (3980)	Jul 21-Aug 2	13	2	1	153
Spring 80	3630[a] (8000)	634 (1395)	Jul 10-Jul 24	15	2	[illegible]	23
Fall 80	3630[a] (8000)	1097 (2414)	Aug 6-Sept 1	27	2	2	22
ver-Spring [illegible]	2360 (5200)	1220 (2687)	Jul 23-Jul 31	8	4	6	28
ver-Spring 80	2360 (5200)	389 (856)	Jul 7-Jul 23	17	2	3	8
ver-Spring 79	2360 (5200)	749 (1652)	Jul 21-Aug 2	13	2	3	21
ver-Spring 80	2360 (5200)	285 (628)	Jul 10-Jul 22	3	2	3	8
y-Fall 79	2360 (5200)	359 (792)	Aug 28-Sept 2	6	2	3	22
y-Spring 80	2360 (5200)	364 (801)	Jul 9-Jul 20	12	2	3	
y-Fall 80	2360 (5200)	731 (1610)	Aug 22-Sept 10	20	2	3	13
ver-Spring 79	12,700[a] (28,000)	645 (1422)	Jul 21-Aug 2	13	2	3	18
er-Spring 79	3630[a] (8000)	623 (1374)	Jul 23-Aug 2	11	2	3	21
er-Fall 80	3630 (8000)	526 (1148)	Aug 6-Aug 16	11	2	3	7
Fal 79	2360 (5200)	214 (471)	Aug 28-Sept 10	14	2	3	6
Fal 80	2360 (5200)	600 (1320)	Aug 6-Aug 20	15	2	3	15
River-Spring [illegible]	10,900[a] (24,000)	314 (692)	Jul 23-Aug	10	2	2	17[d]
River-Fal 80	7260 (16,000)	31 (69)	Aug 22-Aug 24	5	[illegible]	2	6[c]
-Fall 79	2360 (5200)	288 (634)	Aug 28-Sept 10	14	2	3	8
er-Fall [illegible]	2360 (5200)	34 (76)	Aug 28-Sept 10	14	2	3	1[c]

fied in the Variation Notice for that year, Northwest Territories Fishery Regulations, Schedule V.

were 69 m and four were 91 m.

d.

imated as approximately 200 kg were culled due to damage by invertebrates while fish were in nets.

Table 2. Summary of biological data collected from Arctic char taken in the Gjoa Haven - Pelly Bay test fishery during 1979 and 1980. Sample numbers are in brackets.

Locations Fished	Mean Age (yr)	Mean Fork Length (cm)	Mean Round Weight (g)	Mean Dressed Weight (g)	Mean Condition Factor (K)
Murchison River-Fall 79	14.2(88)	64.4(122)	2939(101)	2452(122)	1.01(101)
Murchison River-Fall 80	12.7(131)	59.2(315)	2629(315)	2247(315)	1.23(315)
Back River-Fall 79	13.8(137)	64.6(178)	2982(108)	2552(178)	1.04(108)
Back River-Fall 80	12.7(75)	62.2(244)	3106(244)	2756(244)	1.26(244)
Keith Bay-Spring 79	10.9(149)	54.7(163)	2043(105)	1604(163)	1.08(105)
Keith Bay-Spring 80	11.6(99)	55.5(143)	1860(15)	1680(113)	1.11(15)
Keith Bay-Fall 80	11.7(61)	56.2(61)	2313(143)	1952(143)	1.34(143)
Kingark River-Spring 79	14.8(66)	68.4(102)	2780(70)	2447(70)	1.01(70)
Kingark River-Spring 80	14.9(63)	67.0(63)	2819(44)	2687(79)	1.00(44)
Tourist River-Spring 79	11.0(71)	61.3(100)		2124(100)	
Tourist River-Spring 80	9.4(60)	56.2(60)		1642(65)	
Mangles Bay-Fall 79	13.8(55)	63.9(83)		2392(83)	
Mangles Bay-Spring 80	13.7(12)	63.0(80)	3199(80)	2857(80)	1.01(80)
Mangles Bay-Fall 80	13.8(52)	68.1(116)	3266(116)	2831(116)	1.25(116)
Kellett River-Spring 79	9.7(101)	55.0(114)	2002(44)	1601(114)	1.15(44)
Becher River-Spring 79	9.8(79)	56.3(100)		1691(100)	
Becher River-Fall 80	9.4(136)	55.8(141)	2427(141)	1890(158)	1.36(141)
Tern Lake-Fall 79	12.1(30)	63.2(32)		2219(32)	
Tern Lake-Fall 80	11.1(91)	60.1(140)	2840(140)	2434(140)	1.28(140)
Arrowsmith River-Spring 79	9.6(89)	55.2(103)	1843(103)	1545(103)	1.14(103)
Arrowsmith River-Fall 80	9.8(8)	51.9(8)		2256(8)	
Elliot Bay-Fall 79	12.6(40)	63.1(53)	2762(45)	2309(53)	1.01(45)

Table 3. Length-weight relationship, $\log_{10} W = a + b (\log_{10} L)$, for on-site-sampled Arctic char taken in the Gjoa Haven - Pelly Bay test fishery during 1979-80.

Location	N	Y-intercept (a)	Slope (b)	Standard Error of b (S_b)	95% C.I. of b
Murchison River	416	-3.64	2.54	.05	2.44-2.64
Back River	352	-4.26	2.76	.07	2.62-2.90
Keith Bay	263	-4.06	2.69	.09	2.51-2.87
Kingark River	114	-5.17	3,06	.09	2.88-3.24
Mangles Bay	196	-3.77	2.58	.09	2.40-2.76
Kellett River	4 4	-5.41	3.17	.11	1.95-3.39
Becher River	141	-4.31	2.80	.09	2.62-2.99
Tern Lake	140	-4.26	2.77	.06	2.65-2.89
Arrowsmith River	103	-5.05	3.04	.09	2.86-3.22
Elliot Bay	45	-4.99	3.00	.14	2.72-3.28

Table 4. Comparison of mean condition factor (K) of Arctic char taken by the Gjoa Haven - Pelly Bay test fishery during 1979 and 1980. Comparisons are made by location between seasons of different years and seasons within a year.

LOCATION		COMPARISON	MEAN CONDITION FACTOR (K)	SIGNIFICANCE LEVEL (T-TEST)
Spring Between Years	Kingark River	Spring 79 vs Spring 80	1.01 Vs 1.00	p >.05 (not significant)
	Keith Bay	Spring 79 vs Spring 80	1.08 VS 1.11	p >.05 (not significant)

Table 5. Instantaneous total mortality, annual mortality, instantaneous fishing mortality and exploitation rates of Arctic char taken by the Gjoa Haven - Pelly Bay test fishery during 1979 and 1980. Data from different seasons and years are combined for each location. For comparative purposes two fisheries from the Cambridge Bay area are included.

LOCATION	INSTANTANEOUS TOTAL MORTALITY (CATCH CURVE) Z	ANNUAL MORTALITY A	ANNUAL SURVIVAL (S=1-A) S	INSTANTANEOUS FISHING MORTALITY (Z-0.17) F	EXPLOITATION RATE $(u=1-e^{-F})$ u
Test Fishery:					
Murchison River	.41	.34	.66	.24	.21
Back River	.46	.37	.63	.29	.25
Keith Bay	.67	.49	.51	.50	.39
Kingark River	.42	.34	.66	.25	.22
Tourist River	.60	.45	.55	.43	.35
Mangles Bay	.34	.29	.71	.17	.16
Kellett River	1.06	.65	.35	.89	.59
Becher River	.91	.60	.40	.74	.52
Tern Lake	.53	.41	.59	.36	.30
Arrowsmith River	.89	.59	.41	.72	.51
Elliot Bay	..35	.30	.70	.18	.16
Cambridge Bay:					
Ekalluk River	.75	.53	.47	.58	.44
Jayco River	.39	.32	.68	.22	.20

Table 6. Recommended commercial fishing quotas for anadromous Arctic char, based on results of the test fishery conducted in the Gjoa Haven - Pelly Bay area during 1979 and 1980. Quotas are in kg (round weight) with pounds in brackets.

LOCATION	PRESENT QUOTA (kg)	RECOMMENDED QUOTA (kg)	COMMENTS
Murchison River	9100 (20,000)	9100 (20,000)	presently underexploited
Back River	nil	9100 (20,000)	presently underexploited
Keith Bay	4500 (10,000)	4500 (10,000)	moderately exploited
Kingark River [a]	nil	nil	possibly no resident stock
Mangles Bay	nil	nil	no resident stock
Tourist River	nil	nil	presently heavily exploited
Kellett River	9100 (20,000)	nil	presently overexploited
Becher River	4500 (10,000)	nil	presently overexploited
Arrowsmith River	9100 (20,000)	nil	presently overexploited
Tern Lake	nil	nil	insufficient data
Elliot Bay	nil	nil	insufficient data

[a] A provisional quota of 4 500 kg could be set here pending determination of the origin of this stock.

Appendix 1. Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at Murchison River, 1979.

Length Interval (cm)	No.	Fork Length (cm) Mean	SD	Round Weight (g) Mean	SD	Dressed Weight (g) Mean	SD	Condition Factor	Males No.	% Mature	Females No.	% Mature	F/M Ratio
45.0 - 49.9	2	48.7	1.4	1250.0	70.7	1075.0	35.4	1.0823	1	-	1		1.0
50.0 - 54.9	4	53.8	1.1	1675.0	210.2	1425.0	184.8	1.0744	1		3		3.0
55.0 - 59.9	20	57.9	1.1	1990.0	165.9	1700.0	154.7	1.0240	10	-	10	10	1.0
60.0 - 64.9	25	62.4	1.5	2456.0	280.0	2066.0	237.5	1.0098	8	13	17	29	2.1
65.0 - 69.9	23	67.4	1.3	3110.9	451.2	2634.8	404.6	1.0145	7	43	16	81	2.3
70.0 - 74.9	14	72.1	1.5	3646.4	482.6	3092.9	459.0	0.9708	13	38	1	100	0.1
75.0 - 79.9	7	76.8	1.1	4771.4	561.9	4028.6	588.7	1.0516	7	86			
80.0 - 84.9	6	81.1	1.0	5066.7	632.2	4350.0	594.1	0.9482	6	67			
Total	101								53	36	48	42	0.9
Mean		65.5	7.6	2938.6	1040.4	2492.1	897.3	1.0115					

Appendix 2. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Murchison River, 1979.

Length Interval (cm)	No.	Fork Length (mm) Mean	SD	Dressed Weight (g) Mean	SD
56.0 - 54.9	11	53.5	1.1	1422.7	176.6
55.0 - 59.9	26	57.5	1.3	1721.1	172.1
60.0 - 64.9	25	62.2	1.2	2066.0	213.5
65.0 - 69.9	34	67.0	1.5	2608.8	278.1
70.0 - 74.9	16	72.5	1.4	3543.8	347.3
75.0 - 79.9	7	76.2	0.6	3985.7	247.8
80.0 - 84.9	3	81.9	2.6	4583.3	293.0
Total	122				
Mean		64.4	7.1	2451.6	844.6

Appendix 3. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Murchison River, 1979.

Age (Yr)	No.	Fork length (cm)		Dressed Weight (9)	
		Mean	SD	Mean	SD
9	1	56.8	0.0	1650.0	0.0
10	5	55.5	2.8	1490.0	181.7
11	6	59.7	3.2	1916.7	204.1
12	13	57.4	5.7	1796.2	553.2
13	11	60.0	3.4	2000.0	413.5
14	10	65.5	3.0	2455.0	436.8
15	20	65.6	5.5	2642.5	849.5
16	10	69.9	5.0	3155.0	658.0
17	2	69.3	10.3	3150.0	1414.2
18	2	72.6	6.3	3500.0	1131.4
19	3	76.3	4.3	4083.3	781.6
20	3	63.3	2.2	2133.3	175.6
21	2	77.3	3.8	4125.0	176.8
Tota 1	88				
Mean	14. 2[a]	63.9	7.1	2444.3	878.8

[a]Indicates mean age.

Appendix 4. Mean fork length, mean round weight, mean dressed weight, condition factor(K), maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at Murchison River, 1980.

LENGTH INTERVAL (CM)	NO,	PERCENT	MEAN FORK LENGTH(CM)	WEIGHT(G)		DRESSED WEIGHT(G)		CONDITION FACTOR(K)	MALES		FEMALES		PERCENT FEMALES
				MEAN	SD	MEAN	so		NO.	% MATURE	NO.	Z MATURE	
35[a]	1	0	37.5	1250		1050		2.37	i	0	0		o
45	21	7	49.6	1431	107	1252	181	1.25	10	0	11	0	52
5o	74	23	52.9	1898	280	1617	245	1.28	38	o	36	0	49
55	89	2a	57.5	2317	236	1996	229	1.22	49	0	40	3	45
60	72	23	62.3	2949	331	2508	286	1.22	28	0	44	0	61
65	31	10	67.3	3657	475	311.3	384	1.20	18	11	13	0	42
70	19	6	71.7	4308	474	3700	445	1,17	16	13	3	33	16
75	7	2	77,0	5536	526	441.4	398	1.21	7	57	0		0
85	1	0	85.2	4000		3350		0.65	1	100	0		0
TOTAL	315								168	5	147	1	47
MEAN			59.2	2629	920	2247	778	1.23					

[a] Length interval from 35.0-39.9 cm, etc.

Appendix 5. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Murchison River, 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	DRESSED WEIGHT(G) MEAN	SD
40	1	1	44.2	850	
45	2	1	47.5	1250	141
50	29	17	52.5	1548	200
55	57	33	57.2	2037	346
60	45	26	62.3	2494	278
65	24	14	66.9	3027	438
70	10	6	72.4	3645	365
75	3	?	78.3	4683	539
TOTAL	171				
MEAN			60.2	2338	?33

Appendix 6. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Murchison River, 1980.

AGE (YR)	NO.	PERCENT	FORK LENGTH(CM) MEAN	SD	DRESSED WEIGHT(G) MEAN	SD
8	1	1	52.7	·	2150	
9	6	5	54.0	5.1	1633	436
10	10	8	55.4	6.0	1840	681
11	15	11	54.1	3.4	1590	326
12	40	31	58.7	3.7	2204	515
13	22	17	60.4	4,0	2345	493
14	14	11	64,6	5.5	2825	761
15	12	9	64,5	6.4	2825	974
16	2	2	60.0	3.?	2225	177
17	5	4	67.7	3.8	3100	578
18	2	?	78.3	0.4	4375	106
20	1	1	65.2		2150	
22	1	1	74.5		2950	
TOTAL	131					
MEAN			59.9	.5*3	2311	742
MEAN AGE	12.7					

Appendix 7. Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at Back River, 1979.

Length Interval (cm)	No.	Fork Length (cm) Mean	SD	Round Weight (g) Mean	SD	Dressed Weight (g) Mean	SD	Condition Factor	Males No.	% Mature	Females No.	% Mature	F/M Ratio
50.0 - 54.9	1	54.4	0.0	1700.0	0.0	1500.0	0.0	1.05613	-		I	-	-
55.0 - 59.9	15	58.3	1.1	2090.0	208.9	1860.0	208.1	1.0524	9		6	-	0.7
60.0 - 64.9	40	62.4	1.5	2490.0	243.4	2228.8	213.3	1.0238	18		22	9	1.2
65.0 - 69.9	27	66.6	1.3	3038.9	311.1	2701.9	283.3	1.0267	21		6		0.3
70:o - 74.9	18	72.3	1.6	3938.9	417.1	3488.9	379.1	1.0406	15	20	3	67	0.2
75.0 - 79,9	5	77.0	1.6	5090.0	505.5	4460.0	420.4	1.1131	5	60	-		
80.0 - 84.9	2	80.4	0.5	5475.0	318.2	4900.0	282.8	1.0561	2	100	-		
Tota 1	108								70	11	38	11	0.5
Mean		65.5	5.7	2981.5	886.0	2651.9	777.8	1.0363					

Appendix 8. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Back River, 1979.

Length Interval (cm)	No.	Fork Length (cm)		Dressed Weight (9)	
		Mean	SD	Mean	SD
40.0 - 44.9	1	41.3	0.0	600.0	0.0
45.0 - 49.9		-	-		-
50.0 - 54.9	2	52.7	0.5	1250.0	70.7
55.0- 59.9	24	58.4	1.0	1893.8	161.7
60.0 - 64.9	76	62.4	1.5	2269.7	250.3
65.0 - 69.9	47	66.9	1.2	2692.6	297.8
70.0 - 74.9	18	71.7	1.2	3500.0	389.2
75.0 - 79,9	8	77.0	1.6	4287.5	597.5
80.0- 84.9	1	81.1	0.0	4300.0	0.0
85.0- 89.9	1	85.0	0.0	5100.0	0.0
Total	178				
Mean		64.6	5.6	2552.2	708.6

Appendix 9. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at the 8ack River, 1979.

Age (Yr)	No.	Fork Length (cm)		Dressed Weight (9)	
		Mean	so	Mean	SD
9	1	41.3	0.0	600.0	0.0
10	4	60.5	4.0	2125.0	533.1
11	16	60.3	2.0	2053.1	229.1
12	26	61.6	3.1	2178.8	349.6
13	10	62.5	5.5	2325.0	682.4
14	31	64.8	3.7	2540.3	486.9
15	24	66.0	3.8	2675.0	528.7
16	9	69.4	3.7	3200.0	607.2
17	6	65.7	5.1	2866.7	830.5
18	5	68.9	6.1	3100.0	777.8
19	2	69.5	2.6	2750.0	636.4
20	1	79.8	0.0	4650.0	0.0
21	2	78.1	4.2	3975.0	459.6
Total	137				
Mean	13.8[a]	64.3	5.4	2513.9	659,2

[a]Indicates mean age.

Appendix 10. Mean fork length, mean round weight, mean dressed weight, condition factor(K), maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at Back River, 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	WEIGHT(G) MEAN	WEIGHT(G) SD	DRESSED WEIGHT(G) MEAN	DRESSED WEIGHT(G) SD	CONDITION FACTOR(K)	MALES NO.	MALES % MATURE	FEMALES NO.	FEMALES % MATURE	PERCENT FEMALES
45	3	1	47.8	1383	306	1217	189	1.26	1	0	2	0	67
50	18	7	53.0	1919	292	1695	206	1.28	10	0	8	0	44
55	65	27	57.6	2412	193	2145	162	1.26	25	4	40	5	62
60	86	35	62.4	3033	323	2709	283	1.25	33	9	53	21	62
65	52	21	66.9	3831	477	3391	413	1.28	29	45	23	52	44
70	15	6	72.5	4660	703	4090	608	1.22	7	71	8	88	53
75	3	1	76.6	6200	656	5450	606	1.38	3	100	0	-	0
80	2	1	83.2	6900	283	5975	247	1.20	2	100	0	-	0
TOTAL	244								110	25	134	24	55
MEAN			62.2	3106	950	2756	826	1.26					

Appendix 11. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Back River, 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	DRESSED WEIGHT(G) HEAN	DRESSED WEIGHT(G) SD
50	2	2	54.3	1775	106
55	19	19	58.1	2092	187
60	38	38	62.3	2662	263
65	27	27	67.0	3285	286
70	8	8	72.2	4275	713
75	3	3	76.4	4233	810
80	3	3	82.5	5817	407
85	1	1	86.9	7700	-
TOTAL	101				
MEAN			64.7	3022	996

Appendix 12. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Back River, 1980.

AGE (YR)	NO.	PERCENT	FORK LENGTH(CM) MEAN	FORK LENGTH(CM) SD	DRESSED WEIGHT(G) MEAN	DRESSED WEIGHT(G) SD
8	1	1	54.3		1850	
9	4	5	61.3	3.8	2425	675
10	7	9	5s.0	2.7	2100	379
11	13	17	61.3	3.6	2515	479
12	1'4	19	43,4	3.3	2818	486
13	14	19	62.7	3.3	2739	541
14	S	11	46.3	4.7	3263	853
15	3	4	68.9	4.7	4057	103?
16	6	S	67.1	4.1	3233	589
17	1	1	70.5		3400	
1s	2	3	65.3	0.2	3000	71
19	2	3	79.2	5.9	5450	778
TOTAL	75					
MEAN			63.6	5.2	2863	816
MEAN AGE	12.7					

Appendix 13. Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at Keith Bay, 1979.

Length Interval (cm)	No.	Fork Length (cm) Mean	SD	Round Weight (g) Mean	SD	Dressed Weight (g) Mean	SD	Condition Factor	Males No.	% Mature	Females No.	% Mature	F/M Ratio
45.0 - 49.9	13	48.9	1.0	1250.0	104.1	1100.0	93.5	1.0665	6	N/A	7	N/A	1.2
50.0 - 54.9	34	52.8	1.5	1602.9	214.6	1394.1	177.0	1.0865	15		19		1.3
55.0 - 59.9	31	57.2	1.5	2087.1	221.3	1793.5	182.0	1.1145	22		9		0.4
60.0 - 64.9	13	61.7	1.5	2492.3	214.9	2111.5	193.8	1.0623	7		6		0.9
65.0 - 69.9	11	67.7	1.4	3277.3	326.6	2740.9	240.6	1.0532	4		7		1.8
70.0 - 74.9	3	70.9	0.4	3533.3	104.1	2916.7	293.0	0.9899	1		2		2.0
Total	105	-							55	-	50	-	0.9
Mean		56.8	6.0	2042.9	662.4	1749.0	535.1	1.0830	-	-	-	-	

Appendix 14. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Keith Bay, 1979.

Length Interval (cm)	No.	Fork Length (cm) Mean	SD	Dressed Weight (g) Mean	SD
45.0 - 49.9	41	48.3	1.2	1065.9	99.6
50.0 - 54.9	52	52.1	1.5	1344.2	175.9
55.0 - 59.9	39	57.1	1.4	1801.3	192.5
60.0 - 64.9	20	62.4	1.6	2302.5	268.3
65.0 - 69.9	9	67.0	1.5	2627.8	295.9
70.0 - 74.9	1	74.1	0.0	3450.0	0.0
75.0 - 79.9	1	79.4	0.0	4400.0	0.0
Total	163				
Mean		54.7	6.1	1603.7	570.0

Appendix 15. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Keith Bay, 1979.

Age (Yr)	No.	Fork Length (cm) Mean	Fork Length (cm) SD	Dressed Weight (g) Mean	Dressed Weight (g) SD
8	5	50.4	3.4	1270.0	332.8
9	20	49.8	4.1	1175.0	310.6
10	49	52.3	4.3	1385.7	348.7
11	31	54.2	3.8	1567.7	395.5
12	21	58.4	5.2	1919.0	480.2
13	10	57.1	5.1	1860.0	632.8
14	7	60.3	3.6	2000.0	391.6
15	1	56.2	0.0	1650.0	0.0
16	3	63.9	3.0	2500.0	458.3
17	1	68.2	0.0	2650.0	0.0
18		-			
19	1	74.1	0.0	3450.0	0.0
Total	149				
Mean	10.9	54.4	5.7	1573.8	517.2

Appendix 16. Mean fork length, mean round weight, mean dressed weight, condition factor (K), maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at Keith Bay, Spring 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	WEIGHT(G) MEAN	WEIGHT(G) SD	DRESSED WEIGHT(G) MEAN	DRESSED WEIGHT(G) SO	CONDITION FACTOR(K)	MALES NO.	MALES % MATURE	FEMALES NO,	FEMALES Y. MATURE	PERCENT FEMALES
45	4	27	48.0	1225	144	1013	103	1.10	3	0	1	0	25
50	4	27	53.9	1750	122	1450	4-i	1*12	2	0	2	0	50
55	5	33	57.3	2090	108	1700	106	1.11	1	0	4	0	80
60	2	13	'63.3	2775	35	2250	0	1*10	2	50	0		0
TOTAL	15								8	13	7	0	47
MEAN			54.7	1860	518	1523	411	1*11					

Appendix 17. **Mean fork length and mean dressed weight by length interval** for plant-sampled Arctic char taken by the test fishery at Keith Bay, Spring 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	DRESSED WEIGHT(G) MEAN	SD
45	9	8	48.1	1050	122
50	34	30	53.0	1429	149
55	47	42	57.2	1733	166
60	19	17	62.1	2082	223
65	2	2	68.0	2750	354
70	2	2	70.6	2625	318
TOTAL	113				
MEAN			56.5	1680	381

Appendix 18. Mean fork length and mean dressed weight by age for **plant-** sampled Arctic char taken by the test fishery at Keith 8ay, Spring 1980.

AGE (YR)	No.	PERCENT	FORK LENGTH(CM) MEAN	SD	DRESSED WEIGHT(G) MEAN	SD
9	4	4	54.0	4.4	1450	414
10	17	17	53.5	3.5	1479	285
11	28	28	55.2	3.3	1613	270
12	27	27	57.5	3.3	1763	272
13	13	13	58.9	5.3	1865	517
14	6	6	58.9	7.8	1908	637
15	2	2	60.4	3.2	1800	71
16	2	2	63.5	0.1	2325	104
TOTAL	99					
MEAN			56.5	4.5	1693	375
MEAN AGE	11.6					

Appendix 19. Mean fork length, mean round weight, mean dressed weight, condition factor(K), maturity and sex ratio by length interval for **on-site-** sampled Arctic char taken by the test fishery at Keith Bay, Fall 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	WEIGHT(G) MEAN	SD	DRESSED WEIGHT(G) MEAN	SD	CONDITION FACTOR(K)	MALES NO.	MALES % MATURE	FEMALES NO.	FEMALES % MATURE	PERCENT FEMALES
40	1	1	42.4	950	-	800	-	1.25	0	-	1	0	100
45	5	3	48.9	1650	71	1370	76	1.41	1	0	4	0	80
50	63	44	53.5	2094	154	1771	130	1.36	33	0	30	0	48
55	65	45	56.8	2456	194	2077	171	1.34	35	0	30	0	46
60	5	3	62.4	3030	228	2580	152	1.25	2	0	3	0	60
65	3	2	66.1	3600	229	2983	104	1.24	1	0	2	0	67
70	1	1	71.8	4050	-	3100	-	1.09	0	-	1	100	100
TOTAL	143								72	0	71	1	50
MEAN			55.5	2313	404	1952	332	1.34					

Appendix 20. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Keith Bay, Fall 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	DRESSED WEIGHT(G) MEAN	SD
45	4	6	48.7	1350	147
50	19	30	53.3	1742	140
55	33	52	56.9	1988	169
60	5	8	62.5	2370	140
65	3	5	68.9	2967	382
TOTAL	54				
MEAN			56.4	1951	356

Appendix 21. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Keith Bay, Fal 1 1980.

AGE (YR)	NO.	PERCENT	FORK LENGTH(CM) MEAN	SD	DRESSED WEIGHT(G) MEAN	SD
7	1	2	47.0		1150	
10	16	26	54.3	2.4	1847	217
11	23	38	55.6	2.9	1896	260
12	11	18	55.8	2.8	1882	204
13	2	3	60.5	2.1	2250	212
14	4	7	58.7	6.5	2175	625
19	2	3	64.1	7.3	2575	1025
20	1	2	63.5		2600	.
22	1	2	69.5		2550	
TOTAL	61					
MEAN			56.2	4.3	1943	359
MEAN AGE	11.7					

Appendix 22. Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at the Kingark River, 1979.

Length Interval (cm)	No.	Fork Length (cm) Mean	SD	Round Weight (g) Mean	SD	Dressed Weight (g) Mean	SD	Condition Factor	Males No.	% Mature	Females No.	% Mature	F/M Ratio
50.0 - 54.0	7	52.4	1.5	1378.6	251.4	1221.4	232.5	0.9529	4	N/A	3	N/A	0.8
55.0 - 59.9	10	57.8	1.4	2000.0	221.1	1770.0	201.7	1.0370	6		4		0.7
60.0 - 64.9	21	62.5	1.7	2478.6	282.7	2171.4	256.2	1.0131	6		15		2.5
65.0 - 69.9	17	66.8	1.6	3082.4	435.9	2720.6	373.4	1.0329	6		11		1.8
70.0 - 74.9	9	72.1	1.1	3733.3	406.2	3327.8	360.7	0.9984	7		2		0.3
75.0 - 79.9	5	76.3	1.0	4280.0	313.4	3700.0	215.1	0.9630	5				
80.0 - 84.9	1	81.5	0.0	5500.0	0.0	4750.0	0.0	1.0160	1				
Total	70	-							35	-	35	-	1.0
Mean		64.3	6.9	2780.0	911.2	2447.1	794.5	1.010	-	-	-	-	

Appendix 23. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Kingark River, 1979.

Length Interval (cm)	No.	Fork Length (cm) Mean	Fork Length (cm) SD	Dressed Weight (g) Mean	Dressed Weight (g) SD
45.0 - 49.9	2	46.8	1.9	825.0	35.4
50.0 - 54.9	2	52.0	0.4	1175.0	106.1
55.0 - 59.9	4	58.1	1.8	1950.0	168.3
60.0 - 64.9	26	63.0	1.5	2142.3	215.7
65.0 - 69.9	28	67.6	1.3	2676.8	337.1
70.0 - 74.9	19	72.8	1.1	3239.5	408.8
75.0 - 79.9	17	76.8	1.4	3664.7	471.6
80.0 - 84.9	4	80.6	0.7	4300.0	353.6
Total	102				
Mean		68.4	7.0	2779.4	797.6

Appendix 24. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Kingark River, 1979.

Age (Yr)	No.	Fork Length (cm) Mean	Fork Length (cm) SD	Dressed Weight (g) Mean	Dressed Weight (g) SD
9	1	52.2	0.0	1100.0	0.0
10	1	48.1	0.0	850.0	0.0
11	6	57.5	7.6	1841.7	715.1
12	5	62.9	1.9	2160.0	260.8
13	7	65.2	3.7	2385.7	371.6
14	9	64.6	5.5	2438.9	412.1
15	14	68.3	3.6	2714.3	599.8
16	9	69.3	5.3	2894.4	772.4
17	6	70.7	4.4	2833.3	671.3
18	3	76.8	3.7	4133.3	305.5
19	1	75.5	0.0	3450.0	0.0
20	1	73.0	0.0	3450.0	0.0
21	1	80.0	0.0	3850.0	0.0
22	1	78.7	0.0	3600.0	0.0
23		-	-		
24	1	73.4	0.0	3300.0	0.0
Total	66				
Mean	14.8	66.9	7.1	2629.5	784.2

Appendix 25. Mean fork 1 ength, mean round weight, mean dressed weight, condition factor(K), maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at Kingark River, 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	WEIGHT(G) MEAN	WEIGHT(G) SD	DRESSED WEIGHT(G) MEAN	DRESSED WEIGHT(G) SD	CONDITION FACTOK'(K)	MALES NO.	MALES % MATURE	FEMALES NO,	FEMALES % MATURE	PERCENT FEMALES
45	1	2	46.8	1050	-	900	-	1.02	0	-	1	0	100
50	3	7	53.3	1383	76	1317	58	0.91	2	0	1	0	33
55	6	14	58.1	2017	88	1767	108	1.03	1	0	5	0	83
60	12	27	62.8	2525	273	2254	230	1.01	4	0	8	13	67
65	13	30	67.4	3015	434	2654	389	0.98	7	14	6	33	46
70	6	14	72.1	3592	622	3183	609	0.95	4	0	2	0	33
75	3	7	76.5	5233	388	4650	433	1.17	3	67	0	-	0
TOTAL	44								21	14	23	13	52
MEAN			64.7	2819	978	2501	868	1.00					

Appendix 26. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Kingark River, 1980.

LENGTH INTERVAL {CM)	NO,	PERCENT	MEAN FORK LENGTH(CM)	DRESSED WEIGHT(G) MEAN	DRESSED WEIGHT(G) SD
45	1	1	47.2	950	-
50	4	5	53.5	1200	158
55	5	6	5?.7	1680	179
60	25	32	62.3	2148	260
65	22	28	67.5	2595	336
70	9	11	72.3	3100	415
75	10	13	77.4	4345	403
80	3	4	82.6	5333	503
TOTAL	79				
MEAN			66.6	2687	1025

Appendix 27. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Kingark River, 1980.

AGE (YR)	NO.	PERCENT	FORK LENGTH(CM) MEAN	FORK LENGTH(CM) SD	DRESSED WEIGHT(G) MEAN	DRESSED WEIGHT(G) SD
10	3	5	55.1	4.9	1333	454
11	1	2	59.2		1750	
12	7	11	62.8	2.4	2243	303
13	8	13	62.8	3.3	2213	363
14	16	25	64.7	4,7	2469	639
15	6	10	68.0	4.8	2775	787
16	7	11	72.2	6.7	3486	1277
17	4	6	71.0	6.7	3275	1190
18	1	2	77.1		3600	
1'?	4	6	72.9	3.9	3275	641
20	3	5	72.2	4.4	3317	1329
21	3	5	78.1	3.8	4217	884
TOTAL	63					
MEAN			67.0	6.9	2735	970
MEAN AGE	14.9					

Appendix 28. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Tourist River, 1979.

Length Interval (cm)	No.	Fork Length (cm)		Dressed Weight (g)	
		Mean	SD	Mean	SD
45.0 - 49.9	3	49.5	0.4	1133.3	104.1
50.0 - 54.9	17	52.3	1.4	1285.3	163.7
55.0 - 59.9	24	57.4	1.5	1758.3	224.9
60.0 - 64.9	23	62.4	1.2	2197.0	245.0
65.0 - 69.9	21	67.0	1.3	2600.0	349.3
70.0 - 74.9	8	71.4	1.0	3206.3	498.2
75.0 - 79.9	4	76.3	1.4	3550.0	195.8
Total	100				
Mean		61.3	6.9	2124.3	694.3

Appendix 29. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Tourist River, 1979.

Age (Yr)	No.	Fork Length (cm)		Dressed Weight (g)	
		Mean	SD	Mean	SD
8	4	53.8	6.5	1412.5	529.7
9	18	55.4	3.5	1588.9	308.9
10	14	57.6	3.8	1878.6	446.2
11	13	62.1	4.3	2223.1	478.1
12	8	66.5	6.2	2575.0	783.3
13	4	62.3	4.9	2012.5	417.1
14	3	65.3	6.0	2416.7	894.9
15	4	70.8	4.9	2850.0	651.9
16	1	68.7	0.0	2800.0	0.0
17					
18	1	70.5	0.0	2800.0	0.0
19	1	72.8	0.0	3000.0	0.0
Total	71				
Mean	11.0[a]	60.5	6.7	2047.2	643.0

[a]Indicates mean age.

1

Appendix 30. **Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Tourist River, 1980.**

LENGTH INTERVAL (CM)	No.	PERCENT	MEAN FORK LENGTH(CM)	DRESSED WEIGHT(G) MEAN	SD
40	1	2	44.0	750	-
45	12	18	47.9	975	106
50	15	23	53.0	1340	172
55	19	29	57.7	1732	125
60	11	17	62.6	2195	139
65	7	11	67.5	2443	224
TOTAL	65				
MEAN			56.5	1642	513

Appendix 31. **Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Tourist River, 1980.**

AGE (YR)	NO.	PERCENT	FORK LENGTH(CM) MEAN	SD	DRESSED WEIGHT(G) MEAN	SD
7	1	?	47.3		900	
8	10	17	50.2	4.6	1155	331
9	24	40	54.8	5.4	1513	444
10	15	25	59.3	4.6	1373	405
11	8	13	60.8	6.0	1950	450
12	1	2	62.5		2350	
13	1	2	69.5		2500	
TOTAL	60					
MEAN			56.2	6.4	1622	510
MEAN AGE	?*4					

Appendix 32. **Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Mangles Bay, 1979.**

Length Interval (cm)	No.	Fork Length (cm) Mean	SO	Oressed Weight (9) Mean	SO
45.0 - 49.9	2	49.9	0.0	975.0	0.0
50.0 - 54.9	3	53.0	2.5	1316.7	321.5
55.0 - 59.9	14	58.3	1.2	1832.1	143.6
60.0 - 64.9	3 1	62.4	1.5	2175.8	222.4
65.0 - 69.9	21	67.6	1.7	2819.0	333.7
70.0 - 74.9	10	72.2	1.4	3335.0	354.4
75.0 - 79.9	2	75.9	1.3	3500.0	353.6
Total	83				
Mean		63.9	5.8	2392.2	643.4

Appendix 33. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Mangles Bay, 1979.

Age (Yr)	No.	Fork Length (cm)		Dressed Weight (g)	
		Mean	SD	Mean	SD
10	3	55.2	5.7	1566.7	500.8
11	5	56.5	4.2	1580.0	383.4
12	10	62.3	4.9	2215.0	523.9
13	9	62.2	5.0	2222.2	585.3
14	5	66.0	2.3	2560.0	232.9
15	14	65.0	4.9	2496.4	641.7
16	4	68.7	1.2	3037.5	311.9
17	2	64.7	6.1	2675.0	954.6
18	1	71.0	0.0	3150.0	0.0
19	1	73.5	0.0	3600.0	0.0
20	1	71.4	0.0	2850.0	0.0

[illegible]ork length, mean round weight, mean dressed weight, condition factor(K), maturity and sex ratio by [illegible]ength interval for on-site-[illegible]d Arctic char taken by the test fishery at Mangles Bay, Spring 1980.

PERCENT	MEAN FORK LENGTH(CM)	WEIGHT(G)		DRESSED WEIGHT(G)		CONDITION FACTOR(K)	MALES		FEMALES		PERCENT FEMALES
		MEAN	SD	MEAN	SD		NO.	% MATURE	NO.	% MATURE	
6	59.6	2220	202	1780	[illegible]	[illegible]	[illegible]	-	-		
31	63.2	2616	266	2350	257	1.[illegible]4	12	17	13	23	52
29	67.0	3052	297	2737	274	1.[illegible]1	12	33	11	9	48
19	72.4	3820	472	3420	448	1.[illegible]0	11	36	4	50	27
13	77.0	4215	655	3730	576	0.[illegible]2	7	43	3	33	30
7	81.1	4900	424	4175	318	0.[illegible]2	2	100	0	-	0
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.01	47	32	33	21	[illegible]

Appendix 35. **Mean fork length and mean dressed weight by length interval** for plant-sampled Arctic char taken by the test fishery at Mangles Bay, Spring 1980.

LENGTH INTERVAL (CM)	No.	PERCENT	MEAN FORK LENGTH(CM)	DRESSED WEIGHT(G) MEAN	SD
60	4	22	62.5	2138	507
65	7	39	67.0	2464	278
70	6	33	72.2	2817	380
75	1	6	78.4	3400	-
TOTAL	18				
MEAN			68.4	2561	475

Appendix 36, Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Mangles Bay, Spring 1980.

AGE (YR)	NO.	PERCENT	FORK LENGTH(CM) MEAN	S[1	DRESSED WEIGHT(C) MEAN	SD
11	1	8	65.7		2300	
12	2	17	60.8	().4	1700	71.
13	5	42	66.8	2.6	2550	302
15	2	17	68.3	1.4	2800	71
17	2	17	72.2	0.8	2650	212
TOTAL	12					
MEAN			66.8	3.9	2446	420
MEAN AGE	13.7					

Appendix 37, Mean fork length, mean round weight, mean dressed weight, condition factor(K), maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at Mangles Bay, Fall 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	WEIGHT(G) MEAN	SD	DRESSED WEIGHT(G) MEAN	SD	CONDITION FACTOK'(K)	MALES NO.	MALES % MATURE	FEMALES NO.	FEMALES % MATURE	PERCENT FEMALES
40	1	1	44.0	1100	-	950	-	1.29	1	0	0	-	0
45	4	3	46.9	1263	193	1113	160	1.21	2	0	2	0	50
50	6	5	52.9	1892	323	1650	277	1.27	4	0	2	0	33
55	35	30	57.3	2380	358	2105	302	1.26	18	0	17	0	49
60	24	21	62.5	3002	304	2625	247	1.23	7	0	17	6	71
65	21	18	66.4	3764	488	3231	426	1.29	7	14	14	14	67
70	13	11	72.5	4762	586	4127	[illegible]	1.25	9	33	4	0	31
75	10	9	76.0	5195	509	4425	464	1.18	8	38	2	50	20
80	2	2	82.2	6550	1344	5325	1732	1.19	2	100	0	-	0
TOTAL	116								58	16	58	7	50
MEAN			63.1	3266	1232	2831	1035	1.25					

Appendix 38. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Mangles 8ay, Fall 1980.

LENGTH INTERVAL (CM)	No.	PERCENT	MEAN FORK LENGTH(CM)	DRESSED WEIGHT(G) MEAN	SD
50	3	4	51.8	1433	321
55	9	13	57.4	2100	306
60	17	25	62.6	2562	378
65	15	22	66.7	3000	402
70	12	17	72.8	3904	663
75	12	17	76.3	4242	592
80	1	1	83.8	4350	-
TOTAL	69				
MEAN			66.8	3099	952

Appendix 39. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Mangles 8ay, Fall 1980.

AGE (YR)	NO.	PERCENT	FORK LENGTH(CM) MEAN	SD	DRESSED WEIGHT(C) MEAN	SD
8	1	2	58.3		?100	
10	3	6	55.3	0.9	1817	29
11	7	13	59.8	3.3	2293	432
12	7	13	60.0	5.0	2329	572
13	6	12	64.1	3.1	2792	512
14	8	15	59.3	5.9	3500	907
15	12	23	66.5	6*7	3058	984
16	1	2	56.2		3150	·
17	2	4	76.0	1.0	4275	247
18	1	2	69.7		3500	
19	3	6	75.8	0,7	3800	508
22	1	2	76.1		4100	
TOTAL	52					
MEAN			65.2	7.2	2924	907'-'
MEAN AGE	13,8					

Appendix 40. Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at the Kellett River, 1979.

Length Interval (cm)	No.	Fork Length (cm) Mean	SD	Round Weight (g) Mean	SD	Dressed Weight (g) Mean	SD	Condition Factor	Males No.	% Mature	Females No.	% Mature	F/M Ratio
40.0 - 44.9	3	44.1	0.3	900.0	132.3	766.7	76.4	1.0498	2	N/A	1	N/A	0.5
45.0 - 49.9	9	48.1	1.5	1277.8	187.3	1061.1	134.1	1.1412	3		6		2.0
50.0 - 54.9	13	52.5	1.5	1661.5	182.7	1384.6	161.2	1.1513	9		4		0.4
55.0 - 59.9	11	57.3	1.4	2195.5	173.9	1827.3	158.7	1.1718	10		1		0.1
60.0 - 64.9	6	61.9	1.3	2741.7	220.0	2241.7	196.0	1.1563	4		2		0.5
65.0 - 69.9	-	-											
70.0 - 74.9	-								-		-		
75.0 - 79.9	2	77.9	1.9	5850.0	70.0	4600.0	141.4	1.2416	2		-		
Total	44	-		-	-				30	-	14	-	0.5
Mean		54.6	7.4	2002.3	1016.7	1650.0	794.8	1.1522	-	-	-	-	-

Appendix 41. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Kellett River, 1979.

Length Interval (cm)	No.	Fork Length (cm)		Dressed Weight (g)	
		Mean	SD	Mean	SD
40.0 - 44.9	1	44.7	0.0	750.0	0.0
45.0 - 49.9	23	48.5	1.2	1045.7	101.0
50.0 - 54.9	41	52.7	1.3	1341.5	198.1
55.0 - 59.9	29	57.2	1.6	1810.5	161.9
60.0 - 64.9	14	62.2	1.7	2250.9	292.9
65.0 - 69.9	3	66.2	1.3	2533.3	275.4
70.0 - 74.9	1	71.3	0.0	3250.0	0.0
75.0 - 79.9	2	76.1	0.1	3950.0	707.1
Total	114				
Mean		55.0	5.9	1601.4	583.0

Appendix 42. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Kellett River, 1979.

Age (Yr)	No.	Fork Length (cm)		Dressed Weight (g)	
		Mean	SD	Mean	SD
8	13	50.6	4.2	1188.5	333.0
9	42	53.2	4.1	1428.6	383.8
10	32	56.2	4.2	1701.7	453.7
11	10	54.0	6.1	1515.0	573.5
12	8	60.5	7.4	2281.3	931.9
13	1	66.0	0.0	2250.0	0.0
14					-
15	1	71.3	0.0	3250.0	0.0
Total	101 -				
Mean	9.7[a]	54.6	5.5	1571.3	564.9

[a]Indicates mean age.

Appendix 43. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Becher River, 1979.

Length Interval (cm)	No.	Fork Length (cm)		Dressed Weight (g)	
		Mean	SD	Mean	SD
40.0 - 44.9	2	43.6	1.1	775.0	35.4
45.0 - 49.9	10	47.1	1.8	925.0	137.9
50.0 - 54.9	34	52.4	1.4	1370.6	186.7
55.0 - 59.9	33	57.5	1.4	1734.8	172.5
60.0 - 64.9	12	62.0	1.5	2212.5	228.8
65.0 - 69.9	5	67.7	1.9	2530.0	345.7
70.0 - 74.9	1	73.1	0.0	3200.0	0.0
75.0 - 79.9	2	75.2	0.1	3575.0	176.8
80.0 - 84.9	1	84.8	0.0	4900.0	0.0
Total	100				
Mean		56.3	6.9	1691.0	642.9

Appendix 44. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Becher River, 1979.

Age (Yr)	No.	Fork Length (cm)		Dressed Weigth (g)	
		Mean	SD	Mean	SD
8	7	47.8	2.9	1000.0	335.4
9	36	53.6	3.3	1465.3	293.7
10	19	56.4	4.1	1644.7	343.9
11	8	58.3	4.7	1850.0	529.8
12	2	64.0	8.3	2175.0	106.1
13	4	66.1	2.9	2437.5	460.8
14	3	72.1	11.0	3266.7	1422.4
Total	79				
Mean	9.8[a]	55.8	6.5	1641.8	597.6

[a]Indicates mean age.

Appendix 45. Mean fork length, mean round weight, mean dressed weight, condition factor(K), maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at Becher River, 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	WEIGHT(G)		DRESSED WEIGHT(G)		CONDITION FACTOR(K)	MALES		FEMALES		PERCENT FEMALES
				MEAN	SD	MEAN	SD		NO.	% MATURE	NO.	% MATURE	
40	2	1	43.0	1600	424	1375	318	2.08	1	0	0	-	0
45	11	8	47.6	1445	181	1223	117	1.33	5	0	1	0	9
50	53	38	53.1	2041	206	1671	188	1.36	12	0	24	0	45
55	54	38	57.3	2537	288	2074	233	1.35	13	0	26	0	48
60	15	11	62.3	3303	308	2727	267	1.36	6	0	5	0	33
65	2	1	67.8	4100	141	3325	177	1.32	0	-	2	0	100
70	3	2	70.8	4850	444	3983	407	1.37	1	0	2	50	67
75	1	1	75.6	5600	-	4450	-	1.30	1	100	0	-	0
TOTAL	141								39	3	60	2	43
MEAN			55.8	2427	728	1991	592	1.36					

Appendix 46. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Becher River, 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	DRESSED WEIGHT(G)	
				MEAN	SD
40	2	1	44.1	875	35
45	17	11	47.8	1156	163
50	55	35	52.6	1595	138
55	62	39	57.0	2055	231
60	15	9	62.2	2597	317
65	4	3	66.2	3125	323
70	3	2	71.8	3550	397
TOTAL	158				
MEAN			55.3	1890	543

Appendix 47. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Becher River, 1980.

AGE (YR)	NO.	PERCENT	FORK LENGTH(CM)		DRESSED WEIGHT(G)	
			MEAN	SD	MEAN	SD
7	2	1	54.7	0.1	1725	106
8	22	16	51.9	5.5	1591	585
9	55	40	54.2	3.7	1799	431
10	43	32	56.3	3.7	1994	448
11	10	7	59.3	6.8	2245	776
12	2	1	58.6	3.5	2300	495
13	1	1	71.9		3400	
14	1	1	68.4		3500	.
TOTAL	136					
MEAN			55.2	5.0	1890	549
HEAN AGE	9.4					

Appendix 48. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Tern Lake, 1979.

Length Interval (cm)	No.	Fork Length (cm)		Dressed Weight (g)	
		Mean	SD	Mean	SD
50.0 - 54.9	2	54.0	1.0	1550.0	282.3
55.0 - 59.9	2	57.1	0.1	1750.0	141.4
60.0 - 64.9	17	62.2	1.5	2123.5	265.2
65.0 - 69.9	9	66.8	1.5	2522.2	276.3
70.0- 74.9	2	70.9	0.9	2800.0	141.4
Tota 1	32				
Mean		63.2	4.2	2218.8	395.5

Appendix 49, Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Tern Lake, 1979.

Age (Yr)	No.	Fork Length (cm)		Oressed Weight (g)	
		Mean	so	Mean	SD
9	1	54.6	0.0	1750.0	0.0
10	4	62.2	4.1	2150.0	612.4
11	9	60.0	3.0	1972.2	311.4
12	9	64.2	2.7	2272.2	281.9
13	2	63.7	0.6	2225.0	318.2
14	2	68.0	0.8	2475.0	35.4
15	-			-	
16	2	67.1	4.4	2700.0	282.8
17					
18					
19				-	-
20	1	71.5	0.0	2700.0	0.0
Total	30				
Mean	12. la	63.0	4.3	2201.7	387.2

[a]Indicates mean age.

Appendix 50. Mean fork length, mean round weight, mean dressed weight, condition factor(K), maturity and sex ratio by length interval for **on-site-** sampled Arctic char taken by the test fishery at Tern Lake, 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	WEIGHT(C) MEAN	SD	DRESSED WEIGHT(G) MEAN	SD	CONDITION FACTOR(K)	MALES No.	% MATURE	FEMALES No*	% MATURE	PERCENT FEMALES
45	3	2	47.7	1383	236	1183	231	1.27	0	-	3	0	100
50	33	24	53.1	1980	182	1698	164	1.32	17	0	16	0	48
55	32	23	57.4	2408	243	2069	200	1.27	14	0	18	0	56
60	41	29	62.6	3145	336	2699	289	1.28	21	0	20	0	49
65	24	17	66.9	3727	248	3190	206	1.25	12	17	12	0	50
70	5	4	71.9	4470	424	3780	297	1.20	4	25	1	0	20
75	1	1	76.5	5150	-	4506	-	1.15	1	100	0		0
80	1	1	30.0	5200		4400	-	1.02	1	100	0		0
TOTAL	140								70	7	70	0	50
MEAN			60.1	2840	819	2434	697	1.28					

Appendix 51. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Tern Lake, 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	DRESSED WEIGHT(G) MEAN	SD
45	1	1	47.2	1050	-
50	22	22	53.6	1700	122
55	22	22	57.1	1995	211
60	35	35	62.4	2583	278
65	14	14	67.0	3014	.154
70	7	7	72.0	3521	305
TOTAL	101				
MEAN			60.5	2372	601

Appendix 52. Mean fork length and mean dressed weight by age for **plant-** sampled Arctic char taken by the test fishery at Tern Lake, 1980.

AGE (YR)	NO.	PERCENT	FORK LENGTH(CM) MEAN	SD	DRESSED WEIGHT(G) MEAN	SD
8	1	1	55.1		1800	
9	6	7	56.7	3.5	2083	534
10	22	24	57.7	4.2	2100	445
11	31	34	50.3	4.4	2358	492
12	21	23	61.7	6.8	2469	724
13	6	7	64.6	5.1	2758	596
14	3	3	66.1	7,8	2933	575
16	1	1	62.5		2350	
"TOTAL	91.					
MEAN			60.2	5.5	2342	579
MEAN AGE	11.1					

Appendix 53. Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at the Arrowsmith River, 1979.

Length Interval (cm)	No.	Fork Length (cm) Mean	SD	Round Weight (g) Mean	SD	Dressed Weight (g) Mean	SD	Condition Factor	Males No.	% Mature	Females No.	% Mature	F/M Ratio
40.0 - 44.9	6	44.5	0.5	983.3	81.6	833.3	68.3	1.1192	3	N/A	3	N/A	1.0
45.0 - 49.9	21	47'.8	1.3	1171.4	132.8	995.2	108.3	1.0682	10		11		1.1
50.0 - 54.9	36	52.7	1.5	1709.7	213.1	1433.3	181.3	1.1620	24		12		0.5
55.0 - 59.9	27	57.2	1.5	2231.5	241.8	1872.2	198.2	1.1904	21		6		0.3
60.0 - 64.9	7	61.2	1.6	2585.7	247.8	2221.4	175.3	1.1322	6		1		0.2
65.0 - 69.9	4	66.3	1.5	3087.5	295.5	2600.0	147.2	1.0560	2		2		1.0
70.0 - 75.9	2	71.9	1.6	3550.0	353.6	2975.0	388.9	0.9595	2				
Total	103	-							68	-	35	-	0.5
Mean		53.9	5.9	1843.2	616.4	1552.9	517.3	1.1378	-	-	-	-	-

Appendix 54. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Arrowsmith River, 1979.

Length Interval (cm)	No.	Fork Length (cm) Mean	SD	Dressed Weight (g) Mean	SD
45.0 - 49.9	16	48.4	1.1	1000.0	104.9
50.0 - 54.9	37	52.3	1.2	1282.4	135.5
55.0 - 59.9	32	57.2	1.4	1707.8	217.8
60.0 - 64.9	13	61.9	1.4	2065.4	217.4
65.0 - 69.9	4	67.4	0.9	2637.5	201.6
70.0 - 74.9	1	74.0	0.0	3600.0	0.0
Total	103				
Mean		55.2	5.3	1544.7	481.6

Appendix 55. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Arrowsmith River, 1979.

Age (Yr)	No.	Fork Length (cm)		Dressed Weight (9)	
		Mean	SD	Mean	SD
7	3	48.4	2.3	1016,7	160.7
8	9	53.4	4.7	1388.9	431.4
9	37	53.9	3.8	1402.7	318.6
10	26	55.3	3.9	1580.8	385.5
11	7	57.2	7.2	1714.3	718.6
12	4	58.0	5.9	1575.0	284.3
13	2	66.2	2.8	2375.0	35.4
14	1	68.2	0.0	2750.0	0.0
Tota 1	89				
Mean	9.6[a]	54.9	5.0	1509.6	439.7

[a]Indicates mean age.

Appendix 56, Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Arrowsmith River, 1980.

LENGTH INTERVAL (CM)	NO.	PERCENT	MEAN FORK LENGTH(CM)	DRESSED WEIGHT(G)	
				MEAN	SD
45	1	13	46.7	1100	-
50	2	25	54.1	1800	141
55	2	25	57.0	2050	71
60	1	13	61.3	2600	-
65	2	25	66.8	3325	35
TOTAL	8				
MEAN			58.0	2256	781

Appendix 57. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Arrowsmith River, 1980.

AGE (YR)	NO.	PERCENT	FORK LENGTH(CM)		DRESSED WEIGHT(G)	
			MEAN	SD	MEAN	SD
8	1	13	46.7		1100	..
9	2	25	56,8	3.1	2000	141
10	3	38	58.0	6.5	2333	850
11	2	25	64.6	4.7	2975	530
TOTAL	8					
MEAN			58,0	6.9	2256	781
MEAN AGE	9.8					

Appendix 58. Mean fork length, mean round weight, mean dressed weight, condition factor, maturity and sex ratio by length interval for on-site-sampled Arctic char taken by the test fishery at Elliot Bay, 1979.

Length Interval (cm)	No.	Fork Length (cm) Mean	SD	Round Weight (g) Mean	SD	Dressed Weight (g) Mean	SD	Condition Factor	Males No.	Males % Mature	Females No.	Females % Mature	F/M Ratio
50.0 . 54.9	1	52.2	0.0	1400.0	0.0	1200.0	0.0	0.9843	1	-	-		
55.0 - 59.9	7	57.8	2.0	2000.0	304.1	1785.7	241.0	1.0360	3	-	4		1.3
60.0 - 64.9	18	62.6	1.6	2466.7	280.8	2177.8	241.5	1.0028	9	-	9	-	1.0
65.0 - 69.9-	12	67.1	1.3	2975.0	379.3	2633.3	328.4	0.9810	9	-	3	33	0.3
70.0 - 74.9	5	72.3	1.0	3900.0	282.8	3450.0	239.8	1.9329	4	-	1	100	0.3
75.0 - 79.9	2	77.3	0.3	4650.0	0.0	4000.0	141.4	1.0068	1	100	1	100	1.0
Total	45								27	4	18	17	0.6
Mean		64.5	5.5	2762.2	760.3	2438.9	656.5	1.0053					

Appendix 59. Mean fork length and mean dressed weight by length interval for plant-sampled Arctic char taken by the test fishery at Elliot 8ay, 1979.

Length Interval (cm)	No.	Fork Length (cm) Mean	SD	Dressed Weight (g) Mean	SD
45.0- 49.9	1	49.5	0.0	1000.0	0.0
50.0 - 54.9	2	52.8	2.0	1375.0	247.5
55.0 - 59.9	13	57.7	1.7	1753.8	259.4
60.0 - 64.9	19	63.0	1.4	2242.1	227.5
65.0- 69.9	13	67.3	1.3	2680.8	366.0
70.0 - 74.9	3	72.6	2.1	3600.0	624.5
75.0 - 79.9	2	75.4	0.4	3775.0	388.9
Total	53				
Mean		63.1	5.7	2308.5	664.8

Appendix 60. Mean fork length and mean dressed weight by age for plant-sampled Arctic char taken by the test fishery at Elliot Bay, 1979,

Age (Yr)	No.	Fork Length (cm)		Dressed Weight (g)	
		Mean	SO	Mean	SD
9	2	54.3	4.0	1425.0	318.2
10	3	59.2	3.7	1866.7	175.6
11	7	56.5	3.9	1621.4	395.7
12	11	63.3	2.6	2222.7	314.1
13	6	64.2	5.5	2500.0	658.8
14	4	71.7	3.8	3412.5	651.1
15	3	65.0	2.5	2250.0	327.9
16	1	63.3	0.0	2500.0	0.0
17	3	70.8	5.9	3183.3	828.2
Total	40				
Mean	**12.6**[a]	**63.0**	**6.1**	**2292.5**	717.5

[a]Indicates mean age.

ption of the relat ve stages of maturity based on examination of the char gonads.

Code	Female	Code	Male
	-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
2	-Current year spawner -ovary fills body cavity -eggs near full size but not oose -not expelled by pressure	7	-Current year spawner -testes large and lobate -white to purplish color -milt not expelled by pressure
3	-Ovaries greatly extended and fill body cavity -eggs ful size and transparent -expelled by sl ght pressure	8	-Testes full size -white and lobate -milt expelled by s ight pressure
4	-Spawning complete -ovaries ruptured and flaccid -some atretic eggs in body cavity	9	-Spawning complete -testes flaccid with some milt -blood vessels obvious -testes violet-pink in color
5	-Ovary 40-50% of body cavity -membrane thin, loose, and semi·transparent -healed from spawning -developing eggs apparent with few atretic eggs	0	-Testes tubular, less lobate -healed from spawning -no fluid in centre -usually full length -mottled and purplish in color
0	-cannot be sexed -gonads long or short and th n -transparent or translucent		
11	-resting fish -has spawned but gonads rzgenerated -sexing not possible		

Appendix 62. Determination of estimated yield of Arctic char using the Baranov catch equation.

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

where: Z = instantaneous rate of total mortality
A = annual mortality rate
F = instantaneous rate of fishing mortality
C = catch in numbers
N = initial number of fish in the population

Using Jayco River 1980 data (Carder 1981):

Z = 0.39
A = 0.32
F = 0.22

C = 4990 fish

$$N = \frac{CZ}{FA} = \frac{(4990)(0.39)}{(0.22)(0.32)} = 27\ 640 \text{ fish}$$

Assuming population at Murchison and Back rivers is at least half that at Jayco, 27,640/2 = 13,820 was used in the calculation.

Using an exploitation rate of 0.32 (F = 0.40) for Murchison and Back rivers:

F = 0.40
Z = 0.57
A = 0.43
N = 13 820

$$C = \frac{FAN}{Z} = \frac{(0.40)(0.43)(13\ 820)}{0.57} = 4170 \text{ fish}$$

Mean round weight per char = 2.9 kg (Table 2.)

Estimated yield = 4170 x 2.9 = 12 093 kg (26 660 pounds).