# Arctic Char, *Salvelinus alpinus*, Sport Fishery of Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002 and 2004

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by

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## ABSTRACT

Babaluk, J.A., Ohokannoak, J., Schlosser, K., Wastle, R.J., and Bajno, R. 2010. Arctic char, *Salvelinus alpinus*, sport fishery of Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002 and 2004. Can. Manuscr. Rep. Fish. Aquat. Sci. 2933: ix + 69 p.

During May 2002 and May 2004, creel censuses and biological surveys were conducted on the annual Arctic char, *Salvelinus alpinus*, sport fishing derby held on the Nalusiaq Lake system, Auyuittuq National Park, Nunavut. An estimated 425 fishers took part in the 2002 fishery while an estimated 427 fishers participated in 2004. Fishing pressure decreased from 2002 (1276 angling hours) to 2004 (673 angling hours). However, catch-per-unit-effort increased from 2002 (0.40 fish per hour) to 2004 (0.70 fish per hour). An estimated 510-515 Arctic char weighing a total of 822-830 kg were captured and retained in 2002 while in 2004, 472-474 Arctic char (822-830 kg) were taken. The size range for the 2002 catch was 193-761 mm (fork length) with a mean length of 521 mm. In 2004, sizes ranged from 215-757 mm (mean = 546 mm). The age range for the 2002 catch was 6-21 years (mean = 12.6 years) while in 2004, ages ranged from 5-24 years (mean = 14.3 years). Two growth forms of Arctic char are present in Nalusiaq Lake: a fast-growing large form and slow-growing small form. Micro-chemical analysis of Arctic char otolith strontium distributions indicated an anadromous component to the population. Age-at-first-migration to the sea ranged from 3+ years (fourth year of life) to 6+ years (seventh year of life).

Key words: anadromy; Arctic char; Auyuittuq National Park; biological characteristics; creel census; genetics; otolith microchemistry; sport fishery survey.

## RÉSUMÉ

Babaluk, J.A, Ohokannoak, J., Schlosser, K., Wastle, R.J., and Bajno, R. 2010. Arctic char, *Salvelinus alpinus*, sport fishery of Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002 and 2004. Can. Manuscr. Rep. Fish. Aquat. Sci. 2933: ix + 69 p.

En mai 2002 et à nouveau en mai 2004, nous avons effectué des relevés des prises sportives et des relevés biologiques lors du tournoi de pêche annuel de l'omble chevalier, *Salvelinus alpinus*, tenu dans le réseau du lac Nalusiaq, situé dans le parc national du Canada Auyuittuq, au Nunavut. Quelque 425 pêcheurs ont participé au tournoi de 2002 et 427 à celui de 2004. La pression de la pêche a diminué en 2004 (673 heures de pêche) par rapport à 2002 (1 276 heures de pêche), mais les prises par unité d'effort étaient plus élevées en 2004 (0,70 poisson par heure) qu'elles ne l'étaient en 2002 (0,40 poisson par heure). Selon nos estimations, de 510 à 515 ombles, pesant au total de 822 à 830 kg, ont été capturés et gardés en 2002, et de 472 à 474, pesant de 822 à 830 kg, en 2004. La fourchette des longueurs à la fourche des prises de 2002 allait de 193 à 761 mm (taille moyenne de 521 mm), et celle des prises de 2004, de 215 à 757 mm (taille moyenne de 546 mm). L'intervalle d'âges des prises de 2002 allait de 6 à 21 ans (âge moyen de 12,6 ans), et celui des prises de 2004, de 5 à 24 ans (âge moyen de 14,3 ans). L'omble arctique du lac Nalusiaq présente deux formes de croissance : une forme de grande taille à croissance rapide et une forme de petite taille à croissance lente. Une analyse microchimique de la distribution des concentrations de strontium dans les otolithes d'omble chevalier a révélé la présence d'une composante anadrome dans la population. L'âge à la première descente vers la mer allait de 3+ ans (quatrième année de vie) à 6+ ans (septième année de vie).

Mots-clés : anadromie; omble chevalier; parc national du Canada Auyuittuq; caractéristiques biologiques; relevé des prises sportives; génétique; microchimie des otolithes; enquête sur la pêche sportive.

## INTRODUCTION

Auyuittuq National Park is located in the central, north-eastern portion of Baffin Island, Nunavut (see Fig. 1, upper inset) and with an area of 19,089 $km^2$, is the sixth largest national park in Canada. The area was first established as a “park reserve” in 1976 and became an official national park in 2001. Arctic char, *Salvelinus alpinus*, is the primary fish species inhabiting lakes within the park. Arctic char is an important subsistence and commercial fish to the Inuit of Qikiqtarjuaq (formerly Broughton Island) (see Fig. 1, upper inset) and the char fishery will most likely remain an important factor in maintaining traditional lifestyles for community residents. The residents of Qikiqtarjuaq have traditionally harvested char from lake and river systems both within and outside the boundaries of Auyuittuq National Park (Read 2000). During the late 1980s and throughout the 1990s, the Nudlung Fiord area, just outside the park (see Fig. 1, lower inset), has been harvested commercially (Department of Fisheries and Oceans 1991, 1999). However, fishing within current park boundaries has been limited in the past and was restricted to the areas of Nedlukseak and Narpaign fiords (Drolet 1978) (see Fig. 1, lower inset). Information on other char populations within the park is presented in Stewart and Bernier (1988). One of the lake systems within the park that residents of Qikiqtarjuaq have traditionally fished is composed of the Nalusiaq lakes (Fig. 1). In 1995-1996, a Department of Fisheries and Oceans (DFO)-licensed experimental fishery was conducted on these lakes to determine the feasibility of establishing a commercial fishery (Department of Fisheries and Oceans 1997). In addition to supporting a food and commercial fishery, the char support a local recreational fishery as well. An annual fishing derby, sponsored by the Nattivak (Qikiqtarjuaq) Hunters and Trappers Organization and Papiruq Fisheries and sanctioned by Parks Canada, takes place in late May in the park usually on the second of the five Nalusiaq lakes (Fig. 1). Participants travel from Qikiqtarjuaq to the lake by snowmobile and komatik and camp there during the weekend of the derby.

Recently, derby participants have expressed concerns that catches from the lake appear to be declining. Parks Canada, with the assistance of DFO, monitored the May 2002 fishing derby with the goal of collecting base-line data on the Arctic char of the lake. The purpose of collecting this information was to assess angling pressure and harvest and to describe briefly some of the biological characteristics of the angled catch. Parks Canada, again with the assistance of DFO, monitored the May 2004 fishing derby with the goal of collecting data on the Arctic char of the lake that could be compared with the data collected two years earlier. This report presents and discusses the creel census and biological data collected from the Arctic char fishing derbies conducted between May 25-27, 2002 and May 22-24, 2004. In addition, micro-chemical analysis was conducted to measure and determine the pattern of strontium (Sr) distribution in the otoliths of Arctic char from the lake to determine whether the fish were anadromous. Genetic analysis was conducted with that data to be used in the future to assess differences between populations throughout the range of the species.

## MATERIALS AND METHODS

### STUDY AREA

The study lake is unnamed on Canadian government topographic maps but it has several local names, all most likely derived from nearby Nedlukseak Fiord. When the study was conducted in 2002, the local name provided was Nalusiaq Lake; for the 2004 study, the local name used was Nedlukseak Lake; and on local advertisements for the 2004 fishing derby, the name Nadluqsiaq Lake was used (see Appendix 1). For this report, the name Nalusiaq Lake was used.

The Nalusiaq Lake system (67°51'N, 66°14'W) is made up of a series of five small lakes located between Nedlukseak Fiord and Okoa Bay in Auyuittuq National Park, Baffin Island, Nunavut (Fig. 1). The lakes drain by an unnamed river into the sea at Okoa Bay. The river is ~10 km long with no apparent barriers to fish movement between the lakes and the sea. The area around the lake system is very rugged with steep relief (elevation ranging from sea level to ~1500 m). The lower slopes of the valley around lakes in this area support vegetation but the upper plateau surfaces are barren (Canadian Parks Service 1989). In both 2002 and 2004, the fishing derbies were held on the second of the five lakes in the system (Fig. 1).

### CREEL CENSUS

*2002*

The 2002 Qikiqtarjuaq fishing derby on Nalusiaq Lake was held on May 25-27. Official derby fishing periods were between 0800-2300 h on May 25 and 26 and 0800-1200 h on May 27. Approximately 425 people registered for the derby. All derby fishing was done by jigging with lures through holes in the ice. Some fishing (jigging and gillnetting) continued outside of derby hours but fish caught then were not eligible for derby prizes and no fish caught outside of derby hours were included in the census or biological evaluation. A partial creel census was conducted (i.e., not all participants were interviewed) on all three days of the derby. Over the course of the derby, 100 interviews were conducted: 66 on May 25, 12 on May 26 and 22 on May 27. No participant was interviewed more than once per day but may have been interviewed more than once (up to three times) over the three-day period. The following information was obtained from each angler interviewed: number of hours spent fishing that day and number of char caught during that time.

*2004*

The 2004 Qikiqtarjuaq fishing derby on Nalusiaq Lake was held between May 22-24. This was the 10$^{th}$ annual fishing derby (see Appendix 1). Official derby fishing periods were between 0800-2000 h on May 22 and 0800-1200 h on May 24. No official derby fishing was conducted on May 23 as it was set aside as a “feast” day (see Appendix 1 for details). Four hundred and twenty-seven anglers participated in the derby. All derby fishing was done by jigging through holes in the ice. Some fishing (jigging and gillnetting) continued outside of derby hours but fish caught then were not eligible for derby prizes. Over the course of the derby, 66 interviews were conducted (45 on May 22 and 21 on May 24). Similar to 2002, no participant was interviewed more than once per day but may have been interviewed more than once (up to two times) over the two-day period and the following information was obtained from each angler interviewed: number of hours spent fishing that day and number of char caught during that time.

*Data analysis*

For both years, angler catch per unit effort (CPUE) was calculated as the number of Arctic char caught per angler hour using the following formula:

$$\text{CPUE} = \frac{\text{total number of Arctic char caught by interviewed anglers}}{\text{total number of hours fished by interviewed anglers}}$$

**BIOLOGICAL EVALUATION**

*2002*

During the creel census, as many fish as time and angler permission would allow were sampled for fork length (mm), round weight (g) and sex (n = 100). Due to inclement weather and sampling area conditions, otoliths were not collected in the field. Instead, whole heads of the fish were removed, labelled and frozen. An adipose fin was collected from each specimen and frozen in the field for genetic analysis. Char heads and adipose fins were shipped frozen to DFO in Winnipeg for subsequent processing and analysis. The two sagittal otoliths were extracted from the heads in the laboratory. One of each otolith pair from the sampled char was prepared for age determination by the “break and burn” method described by Chilton and Beamish (1982) and ages were then estimated using the criteria of Kristoffersen and Klemetsen (1991). The second otolith from a select sample of char (n = 10) was prepared for microchemical analysis (see below). Upper and lower arch gill raker counts were also made. In the laboratory, frozen adipose fins were placed in individual vials of 20% DMSO (dimethyl sulfoxide)-NaCl solution and refrozen for genetic analysis (see below). Figure 2 shows where samples were taken on each char examined.

*2004*

A total of 84 char from the fishing derby were sampled for fork length (mm) and weight (g). Due to a reluctance of some of the derby participants to have their catch further sampled, only 47 of these fish were sampled to determine sex and only 34 of these had otoliths removed. To supplement the char sampled from the fishing derby, a gillnet (4” stretched-mesh, ~25 m long) was set thorough the ice for 8 h on May 24, 2004. The 24 char caught were sampled for fork length, round weight and sex. Otoliths were also collected for subsequent age determinations.

*Data analysis*

Length, weight and age data were analysed using Microsoft Excel (2002) and SigmaStat (2.0) personal computer software programs and figures were created using SigmaPlot (2000) and CorelDraw (9). For purposes of plotting length-frequency distributions, char from this study were grouped into 50 mm length groups to allow a better comparison with char from the available literature (e.g., Moshenko 1981; Carder 1992).

Weight-length relationships were described by the equation:

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

where: W = weight in grams
L = fork length in millimetres
a = Y axis intercept
b = slope of the regression line.

Fulton's relative condition factor (K) was determined from the formula:

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

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

**OTOLITH MICROCHEMISTRY**

*Otolith preparation*

One of each of 10 pair of otoliths from the 2002 sample was prepared for wavelength-dispersive electron microprobe analysis. The otoliths were embedded in cold-curing epoxy resin and a transverse cut was made such that a dorso-ventral cross section through the core of the otolith was created, exposing all annuli (yearly growth increments) (Fig. 3a, b). The posterior half of each otolith was then re-embedded with epoxy resin in a standard 25 mm diameter acrylic, geological probe-mount. The exposed otolith surfaces were sequentially ground (30 and 9 μm aluminum oxide lapping film), then polished (5 μm aluminum oxide paste) and finally carbon-coated to prevent charging during microprobe analysis.

*Electron microprobe analysis*

A photograph of each otolith section was prepared and a linear path (transect) for the microprobe beam was plotted across all growth increments (annuli) from the core to the dorsal edge of the otolith or from the core area running parallel to the sulcus to the outer edge of the otolith (Fig. 3b). The photographs were used as reference "maps" by the microprobe operator.

The wavelength-dispersive electron microprobe used in this study was a Cameca SX-100, housed at the Department of Geological Sciences, University of Manitoba in Winnipeg, Manitoba. The electron beam was operated at an accelerating voltage of 15 keV and a current of 20 nA. The transects across the otoliths utilized a beam diameter of 5 μm and a center-to-center distance between sequential points of ~7 μm. Strontium (Sr) X-rays were counted at each point for 25 sec. A small pit was left on the otolith surface at every point. Transects, for retrospective determination of life histories, typically consisted of 75 to 175 points, depending on the size of the otoliths and the transect chosen. Strontium values were recorded as percent weight and were converted to parts per million (ppm) (Potts 1987) for comparison to values from the literature. Strontium distribution graphs were then plotted as Sr (ppm) against the number of sample points from the core to the edge of the otolith (i.e., otolith distance).

Using the otolith Sr concentration range information presented in Table 1 as a guide, Nalusiaq Lake Arctic char otolith Sr concentrations were interpreted as follows: 1) 0 to ~1500 ppm as indicative of residence in a freshwater environment, and 2) >~1500 ppm as indicative of fish entering a marine environment, either estuarine or oceanic.

**GENETICS**

Thirty-four of the 100 Arctic char adipose fin samples collected during the 2002 fishing derby were processed and analyzed to obtain genetic information. Total genomic DNA was extracted from adipose fin tissue using the commercial kit, Genelute™ Mammalian Genomic DNA Miniprep Kit (Sigma-Aldrich Corp., St. Louis, MO, USA).

A total of 941 bases in the control region of the mitochondrial DNA (mtDNA) molecule were sequenced for this study. The control region was amplified by the polymerase chain reaction (PCR) with primers tPro2 (5'-ACCCTTAACTCCCAAAGC-3') (Brunner et al. 2001) and SalpinusCR-R (5'-GGGTCCATCTTAACAGCTTCA-3') (G. Köck, University of Innsbruck, Innsbruck, Austria, personal communication). The target fragment was amplified in a 50 μL reaction containing 10 mM Tris-HCl, 50 mM KCl, 1.75 mM $MgCl_2$, 200 μM of each dNTP, 0.8 μM of each primer, 1 unit *Taq* Polymerase, and approximately 50 ng of DNA. The PCR profile consisted of an initial denaturation at 95° C for 4 minutes followed by 32 cycles of 1 minute at 94° C, 1 minute at 50° C, and 1 minute 30 seconds at 72° C followed by a final extension at 72° C for 10 minutes. An aliquot of the PCR product was visualized under UV light in a 1.5% agarose gel, stained with ethidium bromide. PCR products were purified using the commercial kit QiaQuick® PCR purification kit (Qiagen Inc., Valencia, CA, USA). Due to a long homopolymer stretch found in the central section of the control region, sequencing was done in two separate segments. The left domain was sequenced with primer Char3 (5'-CCCTATGCATATAAGAGAACGC-3') and the right domain sequenced with amplification primer SalpinusCR-R. Direct sequencing of the PCR product was accomplished using the Applied Biosystems Big Dye® Terminator v3.1 Terminator Cycle Sequencing kit (Applied Biosystems, Foster City, CA, USA). The resulting sequence reaction products were run on an Applied Biosystems 3100 genetic analyzer. Sequences were aligned using Seqscape® v2.5 software (Applied Biosystems, Foster City, CA, USA) and individual haplotypes assigned. Sequences from one representative of each haplotype were verified by sequencing the complementary DNA strand with amplification primer tPro2 for the left domain and primer SalInt (5' - CCTTTCAGCTTGCATATACAAG-3') for the right domain.

DNA samples were also assayed for allelic variation at 11 microsatellite loci (Table 2). One primer from each primer pair was 5' end labelled with one of three fluorescent dyes: 6-FAM (for Sco19, Mst85, Sfo8, and Sfo23), VIC (for Sal38, Sal39, Ssa422, Sal5, and Sal81), and NED (for SaZim72 and Ssa85). Microsatellites were amplified in a 20 µL reaction containing 10 mM Tris-HCl, 50 mM KCl, 3 mM $MgCl_2$, 200 µM of each dNTP, 0.5 µM of each primer, 1 unit *Taq* Polymerase, and ~50 ng of DNA template. Two PCR profiles were used to amplify the microsatellite loci (see Table 2). The first profile consisted of 30 cycles with 30 seconds at 95º C, 30 seconds at the annealing temperature, and 45 seconds at 72º C. The second PCR profile was 10 cycles of 1 minute at 94º C, 1 minute at the annealing temperature, and 50 seconds at 72º C followed by a further 25 cycles of 45 seconds at 90º C, 1 minute at 53º C, and 1 minute at 73º C. Both profiles included an initial denaturation at 95º C for 10 minutes and a final extension of 15 minutes at 72º C. Samples were run on an Applied Biosystems 3100 genetic analyzer. Genemapper® software version 3.7 (Applied Biosystems, Foster City, CA, USA) was used to assign microsatellite alleles.

## RESULTS AND DISCUSSION

### CREEL CENSUS

Results from the creel census of the 2002 Qikiqtarjuaq fishing derby are presented in Table 3. A total of 100 angler-interviews representing 300.1 hours of angling showed a mean catch rate of 0.40 char per angler hour. One hundred percent of anglers interviewed were successful (i.e., each caught at least one char). Over the three days of the derby, there was a general decline in fishing effort: on May 25 anglers spent an average of 4.1 hours fishing; on May 26 this declined to 1.0 hour; and on May 27 a further decline to 0.9 hours was noted. The average number of fish caught by each angler who was interviewed was 1.21 (range = 1.00-1.27).

As approximately 425 people were registered for and took part in the 2002 fishing derby, it was estimated, by extrapolation of the creel census data from 100 interviewed anglers (Table 3), that the harvest of Arctic char over the three-day period was approximately 510-515 fish weighing a total of 822-830 kg. These numbers do not include any char caught and retained from outside official fishing derby hours. The 425 registered anglers exerted a total of 1276 angling hours during the 2002 derby.

Results from the creel census of the 2004 Qikiqtarjuaq fishing derby are presented in Table 4. A total of 66 angler-interviews representing 104.1 hours of angling showed a mean catch rate of 0.70 char per angler hour. Fifty-nine of 66 (89.4%) anglers interviewed were successful (i.e., each caught at least one char). Over the period of the derby, there was a general increase in fishing effort: on May 22 anglers spent an average of 1.4 hours fishing while on May 24 an average of 2.0 hours was noted. The average number of fish caught by each angler who was interviewed was 1.11 (range = 1.09-1.14).

An estimated 427 people took part in the 2004 fishing derby. It was estimated, by extrapolation of the creel census data from 66 interviewed anglers (Table 4), that the harvest of Arctic char over the two days of fishing was approximately 472-474 fish (954-958 kg). These numbers do not include any char caught and retained from outside official fishing derby hours. A total of 673 angling hours was expended by the registered anglers during the derby.

The fishing derby was still popular with residents of Qikiqtarjuaq as evidenced by the similar numbers of participants in both years of the survey (2002 = 425; 2004 = 427). Fishing pressure declined from 2002 (1276 angling hours) to 2004 (673 angling hours). However, this may be partly explained by the fact that three days of fishing took place in 2002 while only two days were officially fished in 2004. Angling success was better in 2004 (0.70 char per angler hour) than 2002 (0.40 char per angler hour) although fewer char were removed from the lake in 2004 (472-474) than in 2002 (510-515). However, total weight of char removed in 2004 (954-958 kg) was greater than that in 2002 (822-830 kg) (i.e., the char captured and measured were larger in 2004).

A review of the literature found no references to reports of creel census information collected from Arctic char captured by sport fishing through the ice in over-wintering areas. Therefore, the results from the Qikiqtarjuaq fishing derby could only be compared with results from select creel censuses of open-water sport fisheries for char in Nunavut. Moshenko (1981) reported that 95% of the anglers on the Robertson River, in the Pond Inlet (Mittimatalik) area, were successful in catching at least one char and the catch per unit effort was 1.2 char per angler hour. Kristofferson and Sopuck (1983) reported success rates of 26% for the 1976 and 47% for the 1977 char sport fisheries on the Sylvia Grinnell River (Iqaluit area). Their catch rates were 0.3 and 0.4 char per angler hour, respectively for those years. Carder (1991) reporting on the sport fishery on Freshwater Creek, near Cambridge Bay (Iqaluktuuttiaq), for 1982, 1983 and 1984 calculated catch rates of 0.37, 0.37 and 0.21, respectively. Creel censuses were also conducted on the Diana River, in the Rankin Inlet (Kangiqliniq) area in 1984, 1985 and 1986 (Carder 1992). Catch rates for the Diana River angling fishery were reported in two categories: subsistence (local) anglers and tourist (non-local) anglers. The local anglers were more successful in all three years of the study with 0.95 (1984), 1.71 (1985) and 0.62 (1986) char per angler-hour compared to 0.48, 1.02 and 0.49 char per angler hour for the non-residents. Qikiqtarjuaq fishing derby success rates (100% and 89%, respectively) and catch rates (0.40 and 0.70 char per angler hour, respectively) compare favourably to other char sport fisheries.

## BIOLOGICAL EVALUATION

Similar to the creel census information, a literature review found no references to biological information collected from Arctic char captured by sport fishing through the ice. Thus, the results from the Nalusiaq Lake fishing derby were compared with results from studies of open-water sport fisheries for char in Nunavut. Biological data for individual fish captured and sampled in 2002 and 2004 are presented in Appendices 2 and 3, respectively.

### *Size composition of the catch*

A total of 100 Arctic char from Nalusiaq Lake were measured and weighed during the 2002 fishing derby. Length frequency distributions for these fish (all fish including females, males and fish where sex was not determined and by sex) are shown in Fig. 4 (also see Appendix 4). The all fish sample of char ranged in fork length from 193-761 mm with a mean length of 521 mm (Fig. 4a). Char identified as females had a fork length range of 367-650 mm (mean = 518 mm)

(Fig. 4b) while males ranged in length from 363-761 mm and had a mean of 541 mm (Fig. 4c). The sex of several small fish (<300 mm in length) was unable to be determined (Fig. 4a). The sampled catch of all fish appeared to be slightly bimodal (i.e., two relatively strong length groups) (Fig. 4a). The first group or mode was composed of fish in the 400-450 mm length range. This group contained mainly males (see Fig. 4a, c). The second mode of 500-550 mm fish was made up mainly of females (see Fig. 4a, b). Female char showed a uni- or single-modal length frequency distribution (Fig. 4b) while the males showed a bimodal distribution (Fig. 4c). The all sex catch (total catch) ranged in weight from 60-4320 g (mean = 1661 g). Female char ranged in weight from 490-3780 g (mean = 1549 g) while males ranged from 490-4320 g (mean = 1790 g) (see Appendix 4).

A total of 108 Arctic char from Nalusiaq Lake were measured and weighed during the 2004 fishing derby (including 24 that were gillnetted). Length frequency distributions for these fish (all fish and by sex) are shown in Fig. 5 (also see Appendix 5). The all fish sample of char ranged in fork length from 215 - 757 mm with a mean length of 546 mm (Fig. 5a). Char identified as females had a fork length range of 294 - 673 mm (mean = 541 mm) (Fig. 5b) while males ranged in length from 215 - 757 mm and had a mean of 570 mm (Fig. 5c). The sampled catch of all fish appeared to be slightly bimodal. The first group or mode was composed of fish in the 400-450 mm length range. The second mode of 550-600 mm fish was made up mainly of females (see Fig. 5a, b). Female char showed a unimodal length frequency distribution (Fig. 5b) while the males showed a bimodal distribution (Fig. 5c). Length frequency distributions for angled and gillnetted char are also shown (Appendices 6 and 7, respectively). The all fish catch ranged in weight from 100-4450 g (mean = 1069 g). Female char ranged in weight from 200-3500 g (mean = 1826 g) while males ranged from 100-4450 g (mean = 2371 g) (see Appendix 5).

The length frequency distributions for the overall catches for both years of the fishing derby showed a slight bimodal tendency (Figs. 4a, 5a). This overall bimodality appeared to be the result of the bimodality noted in the males (Figs. 4c, 5c) as the females caught in both years showed unimodal length frequency distributions (Figs. 4b, 5b). There was a slight shift to larger fish being caught in 2004 as indicated by the second mode in Figs. 4a and 5a.

Length ranges from the studies cited below are approximate as they were taken from length frequency figures and/or tables in the resultant reports (length data for individual fish were not available). Moshenko (1981), in a study of the Arctic char sport fishery on the Robertson River, reported a fork length range (all fish) of 400-850 mm (mean = 659 mm). Robertson River females had a length range of 400-800 mm (mean = 621 mm) while males ranged in length from 550-850 mm and had a mean of 720 mm. The Robertson River char had a unimodal length frequency distribution with the single modal group between 600-700 mm in length. In a study on the stressed (i.e., heavily fished) Sylvia Grinnell River char stock, Kristofferson and Sopuck (1983) reported a length range (all fish) of 100-600 mm (mean = 338 mm). Similar to the Robertson River catch, the Sylvia Grinnell catch was unimodal in distribution although its modal group was much smaller (300-350 mm). Sylvia Grinnell River females (range = 100-500 mm, mean = 334 mm) were smaller than males (range = 200-600 mm, mean = 346 mm). In another study, Carder (1992) sampled the char in the 1984 sport fishery on the Diana River. Char from this fishery had a length range (all fish) of 250-800 mm (mean = 470 mm). Diana River females had a fork length range of 350-650 mm (mean = 487 mm) while males ranged in length from 300 to 650 mm and had a mean length of 482 mm. Similar to the Robertson and Sylvia Grinnell rivers, Diana River char had a uni-modal length frequency distribution (modal group = 450-500 mm). Although, unlike for those stocks listed above, there is a bimodal shape to the length frequency distribution for Nalusiaq Lake char, this is not unusual as Johnson (1983) stated that both unimodal and bimodal length frequency distributions are common in Arctic char stocks. For example, Carder (1991), while conducting a creel census at Freshwater Creek, recorded some biological data on the char catch. He reported a length range (all fish) of 250-850 mm (mean = 582 mm). Freshwater Creek females had a fork length range of 250-800 mm (mean = 545 mm) while males ranged in length from 250-850 mm and had a mean length of 612 mm. Similar to the Nalusiaq Lake char, the all fish and males only sample of Freshwater Creek char had bimodal length frequency distributions with a strongly represented group in the 450-500 mm range and another in the 650-750 mm range. Freshwater Creek female char also showed a unimodal length frequency distribution.

*Age composition of the catch*

Age frequency distributions for Arctic char angled from Nalusiaq Lake during the 2002 fishing derby (all fish and by sex) are shown in Fig. 6 (also see Appendix 8). Fish (all sexes) caught and sampled during the derby ranged in age from 6 to 21 years (Fig. 6a). The sampled catch is unimodal with a modal age of 12 years and a mean age of 12.6 years. Females had a narrower age range (9-17 years, Fig. 6b) than males (7-21 years, Fig. 6c). Mean age for females was 12.7 years and 13.0 years for males. The strongest (modal) age group for both sexes was the 12-year-old group although 13 year olds were also quite abundant in the female component.

Age frequency distributions for Arctic char caught (angled and gillnetted combined) from Nalusiaq Lake during the 2004 fishing derby (all fish and by sex) are shown in Fig. 7 (also see Appendix 9). Fish (all sexes) caught and sampled during the derby ranged in age from 5-24 years (Fig. 7a). The sampled all fish catch was bimodal with one mode at 9 years and another at 14 years. Mean age was 14.3 years. Females had a narrower age range (9-20 years, Fig. 7b) than males (5-24 years, Fig. 7c). Mean age for females was 14.7 years while for males, it was 14.1 years. The strongest (modal) age group for both sexes was the 14-year-old group although 13 year olds were equally represented in the female component. Age frequency distributions for angled and gillnetted char are also shown (Appendices 10 and 11, respectively).

There is a tendency for Arctic char age frequency distribution curves to be of similar shape to length frequency distribution curves (Johnson 1983). This appeared to be the case with Nalusiaq Lake char where the unimodal 2002 age frequency distribution (Fig. 6) was similar to the only slightly bimodal length frequency distribution (Fig. 4, one more specimen in the 450-500 mm group or one less in the 400-450 group and it would have been unimodal). The 2004 age frequency distribution showed a bimodality (Fig. 7) which corresponded the bimodality of the length frequency data (Fig. 5).

A very strong year-class is evident in the Nalusiaq Lake char population: the 1990 year-class of fish (i.e., fish born in that year) (12+ years old in 2002, Fig. 6; 14+ years old in 2004, Fig. 7). Another potentially strong year-class has also started having an effect on the population. This is the 1995 year-class (7+ years old in 2002, Fig. 6; 9+ years old in 2004, Fig. 7).

For our study of Nalusiaq Lake char, the “break-and-burn” (section) method of determining ages was used whereas, in the studies referred to below, ages were determined by using the whole otolith method. The whole otolith method has a tendency to underestimate ages of mature char (i.e., older fish) (Barber and McFarlane 1987; Kristoffersen and Klemetsen 1991; J. Babaluk and R. Wastle, unpubl. data).

Arctic char (all sexes) caught and sampled during the 1979 Robertson River sport fishery ranged in age from 11 to 28 years (Moshenko 1981). The sampled catch appeared to be unimodal with a modal age of 18 years and a mean age of 17.9 years. Males ranged in age from 14-28 years while females ranged from 11-24 years. Mean age for males was 19.2 years while for females it was 17.2 years. The strongest (modal) age group for both sexes was the 18-year-old group. Arctic char (all sexes) caught and sampled during the 1977 Sylvia Grinnell River sport fishery ranged in age from 5-16 years (Kristofferson and Sopuck 1983). The sampled catch also appeared to be unimodal with a modal age of 11 years and a mean age of 10.5 years. Males ranged in age from 5-16 years while females ranged from 6-15 years. The strongest (modal) age groups for both sexes were the 10-11 year olds. Arctic char (all sexes) caught and sampled during the 1983 Freshwater Creek sport fishery ranged in age from 6 to 19 years (Carder 1991). The sampled catch also appeared to be unimodal with a modal age of 12 years and a mean age of 11.8 years. Males and females ranged in age from 6-19 years. The strongest (modal) age group for both sexes was the 12-year-old group. Arctic char (all sexes) caught and sampled during the 1984 Diana River sport fishery ranged in age from 6-13 years (Carder 1992). The sampled catch also appeared to be unimodal with a modal age of 8 years and a mean age of 8.4 years. Males and females ranged in age from 6-13 years. The strongest (modal) age group for both sexes was the 8-year-old group.

*Growth*

The relationships between fork length and age (i.e., growth rate) for Nalusiaq Lake Arctic char, based on the sampled catches from this study, are shown in Figs. 8 (2002) and 9 (2004). There appeared to be no differences in overall growth rates between 2002 and 2004 (Figs. 8a and 9a). There also appeared to be no difference in growth rates between females and males (Figs. 8b, c and 9b, c). It appeared that male char in Nalusiaq Lake live slightly longer and reach greater ultimate lengths than females (Figs. 8b, c and 9b, c). Although the 2002 sample indicated that only one growth form (likely anadromous life history) was present in the lake (Fig. 8), the 2004 sample suggested that two growth forms were present (Fig. 9). Two specimens (one 13 years, ~340 mm and the other 24 years, ~220 mm) were likely non-anadromous (slower growing, lake residents) while the remainder were likely faster-growing anadromous fish (see otolith microchemistry section below).

The 10-year-old char (n = 10) that were sampled from the 2002 and 2004 fishing derbies had a mean length of 406 mm (range = 359-497 mm) while the 15-year-old fish (n = 10) sampled from both years had a mean length of 604 mm (range = 511-680 mm). For comparison, 10-15 year-old fish from the Sylvia Grinnell River had mean lengths of 340 mm and 438 mm (Kristofferson and Sopuck 1983), respectively while Freshwater Creek 10 and 15 year old fish had mean lengths of 498 mm and 697 mm (Carder 1991). In the Robertson River catch, no 10-year-old fish were present but 15-year-old fish had a mean length of 557 mm (Moshenko 1981) while in the Diana River creel census sample, 10-year-old char had a mean length of 549 mm and no 15-

year-olds were caught.

The relationship between body weight (W) and fork length (L) for Arctic char (all fish) caught in 2002 from Nalusiaq Lake is graphically presented in Fig. 10a and is described by the equation:

$$\text{Log}_{10} W = -5.298 + 3.115 (\log_{10} L)$$

($r^2$ = 0.972, n = 100).

Mean relative condition factor (K) for the 2002 Nalusiaq Lake Arctic char all fish catch was 1.03 (n = 100, see Appendix 4).

For 2004, the weight-length relationship for Nalusiaq Lake Arctic char (all fish) is graphically presented in Fig. 11a and is described by the equation:

$$\text{Log}_{10} W = -5.708 + 3.271 (\log_{10} L)$$

($r^2$ = 0.986, n = 106).

Mean relative condition factor (K) for the 2004 Nalusiaq Lake Arctic char all fish catch was 1.08 (n = 108, see Appendix 5).

The relationship between fork length (L) and body weight (W) for 2002 Arctic char females from Nalusiaq Lake is graphically presented in Fig. 10b and is described by the equation:

$$\text{Log}_{10} W = -5.280 + 3.112 (\log_{10} L)$$

($r^2$ = 0.931, n = 55).

Mean relative condition factor (K) for 2002 Nalusiaq Lake female Arctic char was 1.06 (n = 55, see Appendix 4).

For 2004, the relationship between fork length (L) and body weight (W) for Arctic char females from Nalusiaq Lake is graphically presented in Fig. 11b and is described by the equation:

$$\log_{10} W = -6.079 + 3.403 (\log_{10} L)$$

$$(r^2 = 0.970, n = 27).$$

Mean relative condition factor (K) for 2004 Nalusiaq Lake female Arctic char was 1.05 (n = 28, see Appendix 5).

The relationship between fork length (L) and body weight (W) for 2002 Arctic char males from Nalusiaq Lake is graphically presented in Fig. 10c and is described by the equation:

$$\log_{10} W = -5.193 + 3.071 (\log_{10} L)$$

$$(r^2 = 0.973, n = 42).$$

Mean relative condition factor (K) for 2002 Nalusiaq Lake male Arctic char was 1.01 (n = 42, see Appendix 4).

For 2004, the relationship between fork length (L) and body weight (W) for Arctic char males from Nalusiaq Lake is graphically presented in Fig. 11c and is described by the equation:

$$\log_{10} W = -5.652 + 3.252 (\log_{10} L)$$

$$(r^2 = 0.991, n = 39).$$

Mean relative condition factor (K) for 2004 Nalusiaq Lake male Arctic char was 1.10 (n = 40, see Appendix 5).

Kristofferson and Sopuck (1983) gave the following weight-length relationship equations for Sylvia Grinnell River Arctic char and Robertson River (all fish), respectively: $\log_{10} W = -5.2101 + 3.0724 (\log_{10} L)$ and $\log_{10} W = -4.9933 + 3.0041 (\log_{10} L)$. Moshenko (1981) calculated condition factors (K) of 1.01 (males), 0.96 (females) and 1.01 (all fish) for Robertson River char returning from the sea in fall 1979 while Carder (1991) gave condition factors of 0.97 (males), 0.96 (females) and 0.96 (all fish) for Diana River char migrating to the sea in spring 1984. Weight-length relationships and condition factors can be variable within and between years (e.g., a char returning from the sea will be “fatter” than one about to migrate to the sea after spending a winter in fresh water).

*Gill rakers*

Gill rakers are the bony, finger-like projections of the gill arch on the opposite side from the red-coloured gill filaments (Fig. 2). The gill rakers point forward and inward and function in retaining prey. They vary in number between species and can vary in number within a species. Fish which eat larger prey usually have fewer gill rakers than fish that feed on small food items (e.g., plankton). Gill rakers can be a useful tool for identifying fish. With counts that encompass the range as described by Scott and Crossman (1973), there appeared to be greater variability in Nalusiaq Lake Arctic char gill raker counts (upper = 8-14, lower = 12-19) than that of other anadromous and non-anadromous populations on Baffin Island (e.g., Nettilling Lake, Sapuladjuk) (Table 5). This suggested that Nalusiaq Lake char feed on a wider range of food items (e.g., plankton, benthos, fish) than other char populations.

**OTOLITH MICROCHEMISTRY**

Otoliths ("ear stones") are small, paired structures found in a fish's inner ear that are used to sense orientation and acceleration (Fig. 2). They are composed mainly of a calcium carbonate (aragonite) and protein matrix but trace elements similar to calcium (Ca), such as strontium (Sr), can be incorporated into or replace Ca in the otolith (Degens et al. 1969). The Ca and trace elements are derived mainly from the waters that the fish inhabits (Ichii and Mugiya 1983). Otoliths do not undergo resorption during the life of the fish (Campana and Neilson 1985) and thus provide an elemental record of the fish's life. Sea water contains, on average, 8.0 $mg{\cdot}L^{-1}$ (ppm) Sr whereas fresh water contains, on average, 0.1 $mg{\cdot}L^{-1}$ Sr (Rosenthal et al. 1970). For example, in Quttinirpaaq National Park lakes (northern Ellesmere Island), Sr concentrations range from 0.033-0.329 $mg{\cdot}L^{-1}$ (Babaluk et al. 1999). Kalish (1989) showed that these differences in Sr levels between sea water and fresh water were evident in fish otolith composition and thus could be used to retrospectively determine life history characteristics (e.g., anadromous behaviour) in fish and Sr concentrations in otoliths closely reflect levels in the waters that the fish live (Babaluk et al. 1998).

*Arctic char of known life histories*

Figure 12a shows a typical Sr distribution profile from an otolith of a known non-anadromous

Arctic char from Kilbourne Lake (no outlet to the sea) in Quttinirpaaq National Park, Nunavut. This pattern shows a relatively constant and low Sr content ("flat" profile) from the core area (0 microns) to the outer edge of the otolith (~1400 microns) indicating that this fish occupied an environment in which the Sr content was relatively low and relatively constant (i.e., the fresh water of Kilbourne Lake) throughout its life.

Figure 12b shows a typical Sr distribution profile from an otolith of a known anadromous Arctic char (the fish was caught while migrating from the sea to fresh water) from Halovik River on Victoria Island, Nunavut. The pattern has a low Sr region corresponding to the core area and the first several years of the fish's life which were passed entirely in fresh water. This is followed by a marked increase in Sr content corresponding to when the fish first migrated to a high Sr environment (i.e., the sea). The elevated Sr content seen in the subsequent oscillatory peaks is easily distinguishable from the lower levels typical of the freshwater stage of its life history. The observed Sr peaks are consistent with annual summer feeding trips to the sea followed by a return to fresh water in the fall to over-winter.

The Sr distribution profiles illustrated in Fig. 12 were determined by scanning proton microprobe analysis. Although we used electron microprobe analysis on the Nalusiaq Lake char otoliths, the Sr profiles derived by this instrument would be similar to ones derived by the proton microprobe (Campana et al. 1997; R. Brown, U.S. Fish and Wildlife Service, Fairbanks, AK, USA, personal communication).

*Nalusiaq Lake Arctic char of unknown life histories*

All 10 Nalusiaq Lake Arctic char otolith Sr distributions showed a pattern of low Sr levels that lasted for several years followed by a pattern of relatively high, usually annually fluctuating Sr levels that continued until the fish were captured (Figs. 13-22). Based on comparison with the Sr distribution profiles for known non-anadromous and anadromous Arctic char (Fig. 12), all of the Nalusiaq Lake char otoliths analyzed were from anadromous individuals (i.e., the Sr profiles resemble that of the known Arctic char).

Figure 13 shows the otolith Sr distribution from a Nalusiaq Lake Arctic char (designated as no. 49013). The life history of this fish as interpreted from the Sr distribution pattern is as follows. The age of this fish at time of capture was 9+ years (i.e., entering its $10^{th}$ year of life). The pattern of Sr distribution for this char has a region of relatively low Sr levels which correspond to the first several annuli. A marked increase in Sr content corresponds to the region of the $4^{th}$ annulus, indicating that in its $5^{th}$ year, this fish moved to an environment with a higher Sr content (i.e., the sea). This fish made five annual migrations to and from the sea before being captured during the fishing derby in May 2002 in fresh water. Although there are some “minor” Sr peaks prior to the fish’s first seaward migration, in particular in the fish’s first year (~1500 ppm), they are of a level that meets the fresh water residence criteria set out above (Materials and Methods section). A possible explanation for these variable levels is that uptake of Sr into the otoliths may be related to body growth rate (i.e., greater growth, thus higher Sr, in summer than in winter (Sadovy and Severin 1994).

Figure 14 shows the Sr distribution from an otolith from Arctic char no. 48964. The age of this fish at time of capture was determined as 8+ years (i.e., entering its $9^{th}$ year of life). The pattern of Sr distribution for this char has a region of relatively low Sr levels which correspond to the first several annuli. A marked increase in Sr content corresponds to the region of the $4^{th}$ annulus, indicating that in its $5^{th}$ year, this fish migrated to the sea. This fish made four annual migrations to and from the sea before being captured in May, 2002 in fresh water ($8^{th}$ annulus).

Figure 15 shows the otolith Sr distribution from Arctic char no. 48966 that was captured in May, 2002 at age 17+ years. This char first migrated to sea during its $7^{th}$ year (6+ years old) and, although there are large variations in the subsequent Sr peaks, it appears to have made 11 consecutive annual excursions into waters with higher Sr levels. Although several of the Sr peaks are at ~1500 ppm, it was assumed that these represented migrations into a marine environment (estuary or ocean).

The Sr distribution for Arctic char no. 48970, depicted in Fig. 16, suggested that it first migrated to sea during its $4^{th}$ year (3+ years old) and appeared to have made four consecutive annual excursions to and from the sea before being captured as a 7+-year-old .

Figure 17 shows the otolith Sr distribution from Arctic char no. 48981 that has been interpreted to have migrated to the sea for the first time in its $6^{th}$ year (5+ years old). This fish made two annual migrations to and from the sea before making what appears to be two migrations within a single year (between the $7^{th}$ and $8^{th}$ annuli). This is highly unlikely as there are no published records of this phenomenon. The low Sr levels between the peaks in that year may be the result of deposition of vaterite in the otolith. Vaterite can replace calcite in otoliths and contains very low levels of Sr (Brown and Severin 1999). The fish continued with annual migrations until it was captured (15+ years).

Figure 18 shows the otolith Sr distribution from a 21+-year-old anadromous Arctic char no. 48982 that migrated to the sea for the first time in its 7th year (6+ years old) and then made 10 consecutive, annual excursions into marine waters. However, in its 17th year (16+ years old), it appears to have remained in fresh water. It migrated again to the sea in its 18th year but then spent two years (19th and 20th) exclusively in fresh water. This behaviour is similar to that of anadromous Arctic char from Nauyuk Lake (Kent Peninsula), Nunavut and has been associated with spawning events (Johnson 1989). In its last year, this fish again migrated to and from the sea before being captured.

Figure 19 shows the otolith Sr distribution from Arctic char no. 48989 that was interpreted as having migrated to the sea for the first time in its 5th year (4+ years old). Similar to the chars depicted in Figs. 13, 16 and 17, there were some “minor” Sr peaks prior to this that have been attributed to variations in annual growth rate. This fish made five annual migrations to and from the sea. Unfortunately, due to an instrument malfunction, the electron beam did not traverse all of the annuli and as a result Sr data for the last three years of the fish’s life (annuli 10-12) was not collected.

The previous otoliths (Figs. 13-19) were analyzed along the long axis from the core to the dorsal surface (see Fig. 3b) but because all annuli were not evident along this axis for the remaining three individuals (Figs. 20-22), their otoliths were analyzed along the shorter axis that runs parallel to the sulcus from the core to the edge (see Fig. 3b). Although the annuli along this axis are generally thinner, all are present. As this transect is shorter, fewer sample points are made with a resultant “coarser” (less precise) Sr distribution profile.

Figure 20 shows the otolith Sr distribution from Arctic char no. 48979 that could be interpreted as having migrated to the sea for the first time in its 6th year (5+ years old) although a case could be made for it having migrated to sea for the first time in its 4th year (3+ years old). If it did migrate to sea in its 4th year, it appeared to have remained in fresh water for its 5th year. If it migrated for the first time in its 6th year, this fish made three consecutive annual excursions into waters of higher Sr levels (estuary or ocean); then it remained in fresh water for its 9th year (8+ years); and finally resumed a pattern of three annual sea migrations before it was captured in fresh water during the 2002 fishing derby.

Figure 21 shows the otolith Sr distribution from a 21+-year-old Arctic char no. 48996 that migrated to the sea for the first time in its 5$^{th}$ year (4+ years old) and then made eight consecutive annual excursions into waters of higher strontium levels. It remained in fresh water for its 13$^{th}$ year (12+ years) and then resumed a pattern of five annual sea migrations. In its 18$^{th}$ year, it again remained in fresh water followed by another year with a migration (19$^{th}$ year) and then no migration in its 20$^{th}$ year. It migrated one more time (21$^{st}$ year) before it was captured in fresh water during the 2002 fishing derby. The high levels of Sr at the otolith core are greater than subsequent levels in the fish's freshwater phase. These levels may be the result of the waters of the fish's natal (spawning) area having a much higher level of Sr than other parts of the Nalusiaq Lake system or, more likely, they could be the result of this specimen being the progeny of a female char that returned from the sea the same year that it spawned (i.e., eggs would be developing while the fish was at sea). The composition of the developing egg would reflect the chemical composition of the seawater environment (i.e., higher Sr). Since the progeny's otolith begins formation in the embryonic stage, a higher level of strontium would be evident in the otolith (Kalish 1990).

Figure 22 shows the otolith Sr distribution from a 15+-year-old Arctic char no. 49036 that migrated to the sea for the first time in its 7$^{th}$ year (6+ years old) and then made eight consecutive annual excursions into waters of higher strontium levels. In the year prior to capture, it appears to have remained in fresh water.

Otolith Sr distributions can be a very useful tool to retrospectively determine life history characteristics of fish populations although the interpretation of the data can in some cases by subjective and very speculative (e.g., Fig. 20). The Arctic char of Nalusiaq Lake have a varied and complex set of life history traits. From our limited otolith Sr distribution data, it appeared that age-at-first migration to the sea can range from 3+ years old (4$^{th}$ year of life) to 6+ (7$^{th}$ year). Once seaward migrations begin, they can continue uninterrupted on an annual basis (e.g., Fig. 13) or they can be interrupted by periods of a year or more spent in fresh water, perhaps for spawning events. Relatively low Sr levels in the otolith core (i.e., 0-20 sample points) for the majority of Nalusiaq Lake char analyzed suggested that these char (females) spend the year leading up to spawning in fresh water. However, the relatively high level of Sr in the core of one specimen (Fig. 21) suggested that some females may spawn in years that they also migrated to and from the sea.

## GENETICS

A summary of the genetic data for Nalusiaq Lake Arctic char is presented in Table 6. Mitochondrial DNA sequencing can be used to indicate whether Nalusiaq char are closely related to previously described groups of char (e.g., Greenland Arctic char, central Canadian Arctic char) while microsatellite analysis can assess differences within the Nalusiaq Lake stock and between it and geographically, closely related stocks (e.g., other stocks on Baffin Island). Further analysis of these data will be conducted in the future.

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Table 1. Ranges of otolith Sr concentrations for select anadromous, freshwater and marine fish species.

| Species | Location | Otolith Sr range (ppm) | | Source |
|---|---|---|---|---|
| | | Freshwater | Marine (includes estuary) | |
| Arctic char (*Salvelinus alpinus*) | Selected Canadian central and western Arctic | <600 | 1500-3000 | J. Babaluk (unpubl. data) |
| Dolly Varden (*Salvelinus malma*) | North Slope (Alaska) | 400-1000 | 1500-3000 | J. Babaluk (unpubl. data) |
| Arctic char/Dolly Varden | Kodiak Island (Alaska) | 700-1500 | 1500-2200 | J. Babaluk (unpubl. data) |
| Inconnu (*Stenodus leucichthys*) | Mackenzie River | ~ 1000 | 1500-3700 | Howland et al. (2001) |
| Sockeye salmon (*Oncorhynchus nerka*) | Beaufort Sea | 400-600 | 1800-3300 | Babaluk et al. (2000) |
| Kokanee (*Oncorhynchus nerka*) | Great Slave Lake | 400-750 | na | Babaluk et al. (2000) |
| Striped bass (*Morone saxatilis*) | Hudson River/Long Island Sound (New York) | 600-800 | 2000-2400 | Secor et al. (2001) |
| Striped bass | Roanoke River/Albemarle Sound (North Carolina) | 0-2000 | 2000-8000 | Morris et al. (2005) |
| Greenland halibut (*Reinhardtius hippoglossoides*) | Davis Strait | na | 1500-3000 | J. Babaluk (unpubl. data) |

Table 2. Microsatellite primers used in this study. Primer sequences, annealing temperatures and references are shown. Primers that were fluorescently labelled have been denoted with an *. The number in brackets under the microsatellite locus name indicates the PCR program profile that was used.

| Locus | Primer sequence (5' → 3')<br>F- forward, R-reverse | Annealing temp (ºC) | Reference |
|---|---|---|---|
| Mst85 (1) | F: GGAAGGAAGGGAGAAAGGT*<br>R: GGAAAATCAATACTAACAA | 50 | Presa and Guyomard (1996) |
| Sal5 (2) | F: TTTGCATTGAGCCTCTGTTG*<br>R: TGTTTCAGCTGCTATTAGGAAAT | 48/53 | R.G. Danzmann (University of Guelph, Guelph, ON, personal communication) |
| Sal38 (1) | F: CGCCTTGTCATACATTACACC*<br>R: ACGCTACAGAAACAGGAGAAAG | 50 | McGowan et al. (2004) |
| Sal39 (2) | F: GGGGAGTCTGTGTTAAGTTGG*<br>R: TGAATGGACGTTCCTCTGAC | 48/53 | McGowan et al. (2004) |
| Sal81 (2) | F: CAGCATAATCACTCCCGC*<br>R: GAAAGCTACCTTGCGTGC | 48/53 | McGowan et al. (2004) |
| Sa72Zim (2) | F: AACTTCAAGATATATGATGT*<br>R: ATTCGTTTAGTCTGAGAA | 45/53 | Englbrecht et al. (2000) |
| Sco19 (1) | F: CTTGAAATTAGTTAAACAGC*<br>R: CCAAACTACCCAATAATC | 50 | Taylor et al. (2001) |
| Sfo8 (1) | F: CAACGAGCACAGAACAGG*<br>R: CTTCCCCTGGAGAGGAAA | 55 | Angers et al. (1995) |
| Sfo23 (1) | F: GTGTTCTTTTCTCAGCCC<br>R: AATGAGCGTTACGAGAGG* | 55 | Angers et al. (1995) |
| Ssa85 (2) | F: AGGTGGGTCCTCCAAGCTAC<br>R: GTTTCTTACCCGCTCCTCACTTAATC* | 48/53 | O'Reilley et al. (1996) |
| Ssa422 (1) | F: TTATGGGCGTCCACCTCT<br>R: CACCCCAGCCTCCTCAACCTTC* | 55 | Cairney et al. (2000) |

Table 3. Summary of creel census information from the Qikiqtarjuaq fishing derby at Nalusiaq Lake, May 2002.

| Date | Number of angler interviews | Number of Arctic char caught | Hours fished | Number of Arctic char per angler interview | Number of Arctic char per angler hour |
|---|---|---|---|---|---|
| May 25 | 66 | 84 | 267.69 | 1.27 | 0.31 |
| May 26 | 12 | 15 | 11.57 | 1.25 | 1.30 |
| May 27 | 22 | 22 | 20.87 | 1.00 | 1.05 |
| Total[a] or mean[b] | 100[a] | 121[a] | 300.13[a] | 1.21[b] | 0.40[b] |

Table 4. Summary of creel census information from the Qikiqtarjuaq fishing derby at Nalusiaq Lake, May 2004.

| Date | Number of angler interviews | Number of Arctic char caught | Hours fished | Number of Arctic char per angler interview | Number of Arctic char per angler hour |
|---|---|---|---|---|---|
| May 22 | 45 | 49 | 61.87 | 1.09 | 0.79 |
| May 24 | 21 | 24 | 42.22 | 1.14 | 0.57 |
| Total[a] or mean[b] | 66[a] | 73[a] | 104.09[a] | 1.11[b] | 0.70[b] |

Table 5. Comparison of gill raker counts from several Arctic char populations in the Canadian Arctic.

| Location | Form or life history type | Upper arch | | Lower arch | | Source |
|---|---|---|---|---|---|---|
| | | Range | Mean | Range | Mean | |
| Nalusiaq Lake (Auyuittuq National Park) | Unknown | 8-14 | 10.6 | 12-19 | 15.5 | This study |
| Nettilling Lake (Baffin Island) | Anadromous | - | - | 14-17 | 16 | McPhail (1961) |
| Sapuladjuk (Cape Dorset area, Baffin Island) | Non-anadromous | - | - | 14-17 | 16 | McPhail (1961) |
| Cambridge Bay area (Victoria Island) | Anadromous | - | 10.9 | - | 15.5 | Reist et al. (1997) |
| Lakes 103/104 (Ivvavik National Park) | Non-anadromous | - | 10.3 | - | 17.0 | Reist et al. (1997) |
| Lake Hazen (Quttinirpaaq National Park) | Non-anadromous, large | - | 10.2 | - | 15.5 | Reist et al. (1997) |
| Lake Hazen (Quttinirpaaq National Park) | Non-anadromous, small | - | 10.3 | - | 15.2 | Reist et al. (1997) |
| Canadian Arctic (in general) | All | 7-13 | - | 12-19 | - | Scott and Crossman (1973) |

Table 6. Genetic data at 11 microsatellite loci and the sequence haplotypes for the mitochondrial DNA (mtDNA) control region's left and right domains. Identification of the alleles for the microsatellite data is given in base pairs. "xxx" indicates no data. Mitochondrial haplotypes have been assigned based on the variation seen in the sequence alignments of all samples analyzed.

| Sample ID | Microsatellite | | | | | | | | | | | | | | | | | | | | | | mtDNA haplotype | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sal81 | | Mst85 | | Sal5 | | Sal38 | | Sal39 | | Sa72Zim | | Sco19 | | Sfo8 | | Sfo23 | | Ssa85 | | Ssa422 | | left domain | right domain |
| 48964 | 144 | 146 | 212 | 212 | 202 | 242 | 153 | 193 | xxx | xxx | 148 | 158 | 201 | 245 | 281 | 283 | 185 | 217 | 206 | 238 | 249 | 249 | e1A | Sal01 |
| 48965 | 144 | 144 | 206 | 214 | 202 | 246 | 151 | 175 | xxx | xxx | 148 | 152 | 201 | 245 | 257 | 277 | 217 | 219 | 206 | 214 | 249 | 253 | e1A | Sal03 |
| 48966 | 144 | 144 | 212 | 214 | 232 | 232 | 151 | 151 | xxx | xxx | 148 | 148 | 199 | 249 | 259 | 291 | 207 | 215 | 218 | 238 | 219 | 225 | e1A | Sal01 |
| 48967 | 144 | 144 | 214 | 214 | 202 | 242 | 117 | 153 | 228 | 240 | 148 | 152 | 199 | 249 | 277 | 279 | 205 | 219 | 206 | 214 | 215 | 249 | e1A | Sal01 |
| 48968 | 144 | 144 | 212 | 214 | 210 | 252 | 149 | 151 | 240 | 260 | 148 | 148 | 249 | 253 | xxx | xxx | 207 | 211 | 214 | 238 | 249 | 253 | e1A | Sal04 |
| 48969 | 144 | 146 | 212 | 212 | 202 | 242 | 153 | 225 | 228 | 248 | 148 | 198 | 199 | 199 | 281 | 281 | 185 | 195 | 206 | 238 | 249 | 249 | e1A | Sal01 |
| 48970 | 144 | 144 | 212 | 224 | 202 | 252 | 143 | 153 | 240 | 264 | 148 | 152 | 235 | 237 | 281 | 285 | 335 | 355 | 232 | 240 | 225 | 253 | e1A | Sal01 |
| 48971 | 144 | 148 | 212 | 214 | 214 | 252 | 151 | 239 | 262 | 262 | 148 | 148 | 249 | 251 | 257 | 263 | 207 | 209 | 214 | 242 | 249 | 249 | e1D | Sal01 |
| 48972 | 144 | 144 | 212 | 214 | xxx | xxx | 151 | 153 | 240 | 260 | 148 | 148 | 249 | 251 | 263 | 281 | 205 | 207 | 214 | 214 | 219 | 249 | e1A | Sal01 |
| 48973 | 144 | 144 | 212 | 212 | 242 | 242 | 153 | 221 | xxx | xxx | 148 | 148 | 247 | 251 | 281 | 291 | 205 | 207 | 214 | 240 | 249 | 249 | e1A | Sal04 |
| 48974 | 144 | 144 | 214 | 224 | 252 | 254 | 147 | 153 | 240 | 260 | 148 | 198 | 199 | 201 | 261 | 287 | 209 | 217 | 206 | 206 | 249 | 249 | e1A | Sal01 |
| 48975 | 144 | 144 | 214 | 214 | 200 | 250 | 149 | 243 | xxx | xxx | 148 | 148 | 249 | 251 | 261 | 291 | 185 | 195 | 214 | 238 | 225 | 249 | e1A | Sal01 |
| 48976 | 144 | 144 | xxx | xxx | 202 | 214 | 149 | 153 | 228 | 260 | 148 | 152 | 199 | 249 | 279 | 291 | 209 | 291 | 216 | 230 | 249 | 253 | e1A | Sal01 |
| 48977 | 144 | 144 | 212 | 212 | 202 | 252 | 117 | 149 | 240 | 248 | 152 | 152 | 203 | 203 | 261 | 291 | 197 | 217 | 206 | 212 | xxx | xxx | e1A | Sal03 |
| 48978 | xxx | xxx | xxx | xxx | 236 | 236 | 161 | 197 | 260 | 260 | 152 | 152 | 259 | 259 | 279 | 311 | xxx | xxx | xxx | xxx | 215 | 253 | e1A | Sal02 |
| 48979 | 144 | 144 | 212 | 214 | 202 | 214 | 151 | 153 | 248 | 260 | 198 | 198 | 249 | 249 | 263 | 295 | 209 | 209 | 214 | 238 | 249 | 249 | e1A | Sal01 |
| 48980 | 144 | 144 | 212 | 214 | 202 | 232 | 155 | 221 | 260 | 262 | xxx | xxx | 249 | 253 | 261 | 291 | 203 | 207 | 208 | 214 | 249 | 249 | e1A | Sal01 |
| 48981 | 144 | 144 | 212 | 224 | 200 | 202 | 135 | 143 | 240 | 260 | 148 | 158 | 249 | 269 | 263 | 291 | 195 | 209 | 214 | 242 | 249 | 249 | e1A | Sal01 |
| 48982 | 144 | 144 | xxx | xxx | 232 | 252 | 119 | 153 | 240 | 270 | 152 | 152 | 199 | 255 | 257 | 263 | 209 | 211 | 206 | 206 | 225 | 225 | e1A | Sal01 |
| 48983 | 144 | 144 | 212 | 214 | 252 | 252 | 151 | 237 | 260 | 262 | 152 | 184 | 201 | 201 | 257 | 257 | 205 | 219 | 206 | 244 | 225 | 249 | e1A | Sal01 |
| 48984 | 144 | 144 | 212 | 212 | 230 | 252 | 149 | 197 | 262 | 264 | 148 | 148 | 245 | 251 | 283 | 293 | 335 | 355 | 206 | 238 | 249 | 249 | e1A | |
| 48985 | 144 | 146 | 210 | 214 | 242 | 242 | 153 | 153 | xxx | xxx | 148 | 158 | 203 | 249 | 277 | 291 | 209 | 219 | 218 | 238 | 225 | 249 | e1A | |
| 48986 | 144 | 144 | 212 | 214 | 202 | 252 | 121 | 199 | 240 | 260 | xxx | xxx | 249 | 251 | 291 | 291 | xxx | xxx | 238 | 238 | xxx | xxx | e1A | |
| 48987 | 144 | 144 | 212 | 214 | 230 | 242 | 151 | 155 | xxx | xxx | 148 | 152 | 235 | 253 | 281 | 295 | 185 | 219 | 216 | 234 | 249 | 249 | e1A | |
| 48988 | xxx | xxx | 212 | 212 | 188 | 254 | 147 | 151 | 240 | 248 | 148 | 148 | 201 | 249 | xxx | xxx | 205 | 283 | xxx | xxx | xxx | xxx | e1A | |
| 48989 | 144 | 144 | 214 | 214 | 202 | 242 | 153 | 155 | 260 | 260 | 148 | 158 | 251 | 253 | 279 | 279 | 189 | 209 | 206 | 240 | 249 | 249 | | |
| 48995 | xxx | xxx | 214 | 214 | 202 | 232 | 153 | 155 | 262 | 262 | 148 | 148 | 199 | 249 | 257 | 291 | 207 | 207 | xxx | xxx | 249 | 249 | | |
| 48996 | 144 | 144 | 214 | 214 | 202 | 232 | 153 | 225 | 260 | 260 | 148 | 152 | 249 | 261 | 261 | 281 | xxx | xxx | 210 | 238 | 249 | 249 | | |
| 48997 | 144 | 144 | xxx | xxx | 202 | 252 | 151 | 151 | 260 | 262 | 148 | 152 | 255 | 255 | 277 | 291 | 205 | 211 | 206 | 206 | 253 | 253 | | |
| 49012 | 144 | 144 | 214 | 224 | xxx | xxx | 151 | 153 | 240 | 266 | 148 | 152 | 203 | 249 | 261 | 291 | 207 | 219 | 214 | 240 | 249 | 253 | | |
| 49013 | 144 | 144 | 212 | 212 | 202 | 254 | 117 | 135 | xxx | xxx | 158 | 158 | 199 | 199 | 277 | 285 | 221 | 221 | 206 | 236 | 249 | 251 | | |
| 49014 | 144 | 144 | 214 | 216 | 188 | 242 | 149 | 157 | 240 | 264 | 148 | 152 | 241 | 257 | 261 | 281 | 213 | 219 | 240 | 240 | 249 | 249 | | |
| 49015 | 126 | 144 | xxx | xxx | 188 | 252 | 155 | 177 | 240 | 240 | 152 | 158 | 205 | 205 | 277 | 277 | 207 | 217 | xxx | xxx | 219 | 249 | | |
| 49035 | 144 | 144 | 214 | 224 | 200 | 210 | 151 | 153 | xxx | xxx | 152 | 250 | xxx | xxx | 277 | 291 | 193 | 215 | xxx | xxx | 249 | 249 | | |

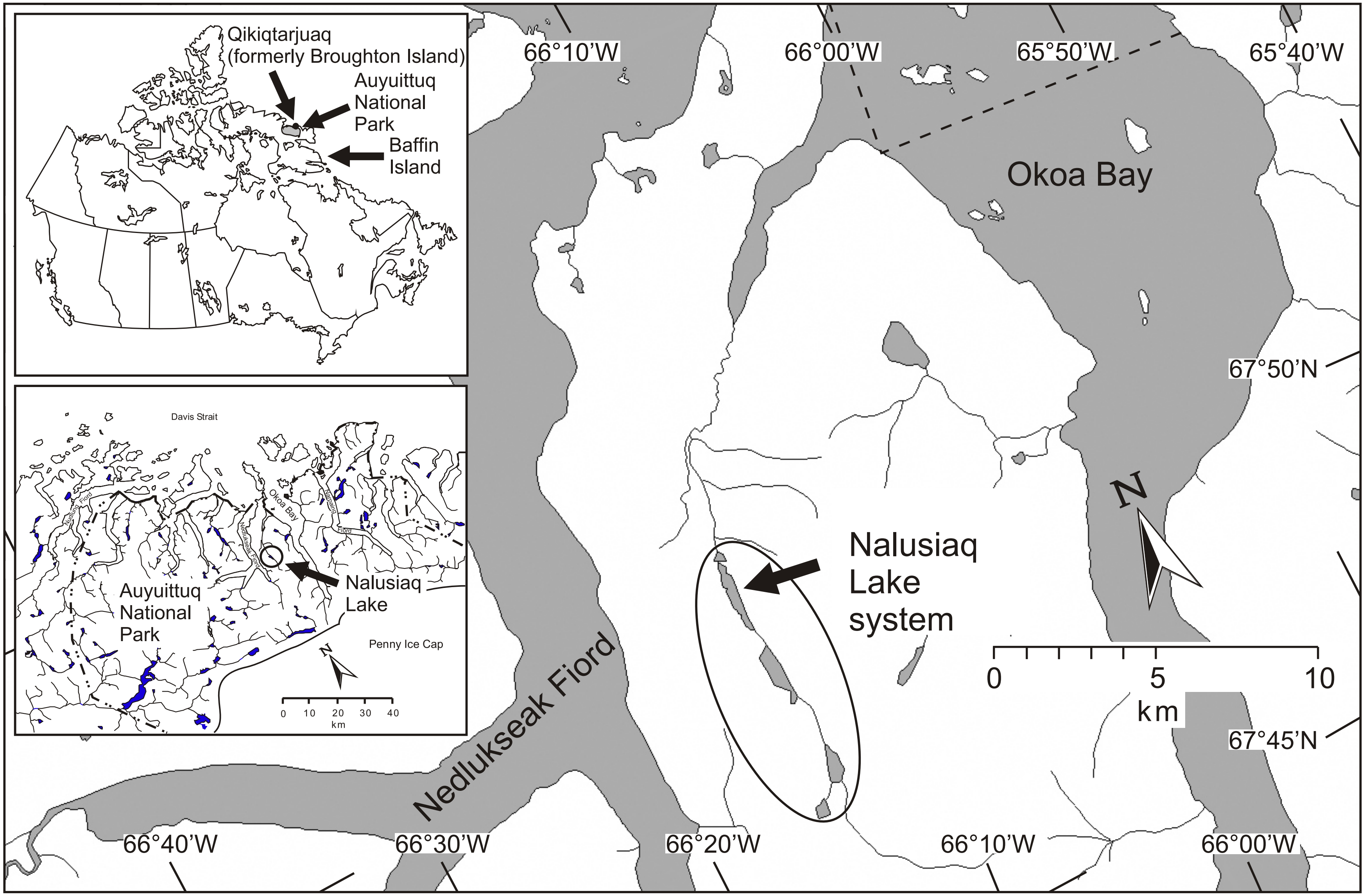



Figure 1. Map of the Nalusiaq Lake area, Auyuittuq National Park, Baffin Island, Nunavut showing the lake where the fishing derby was held (indicated by arrow).

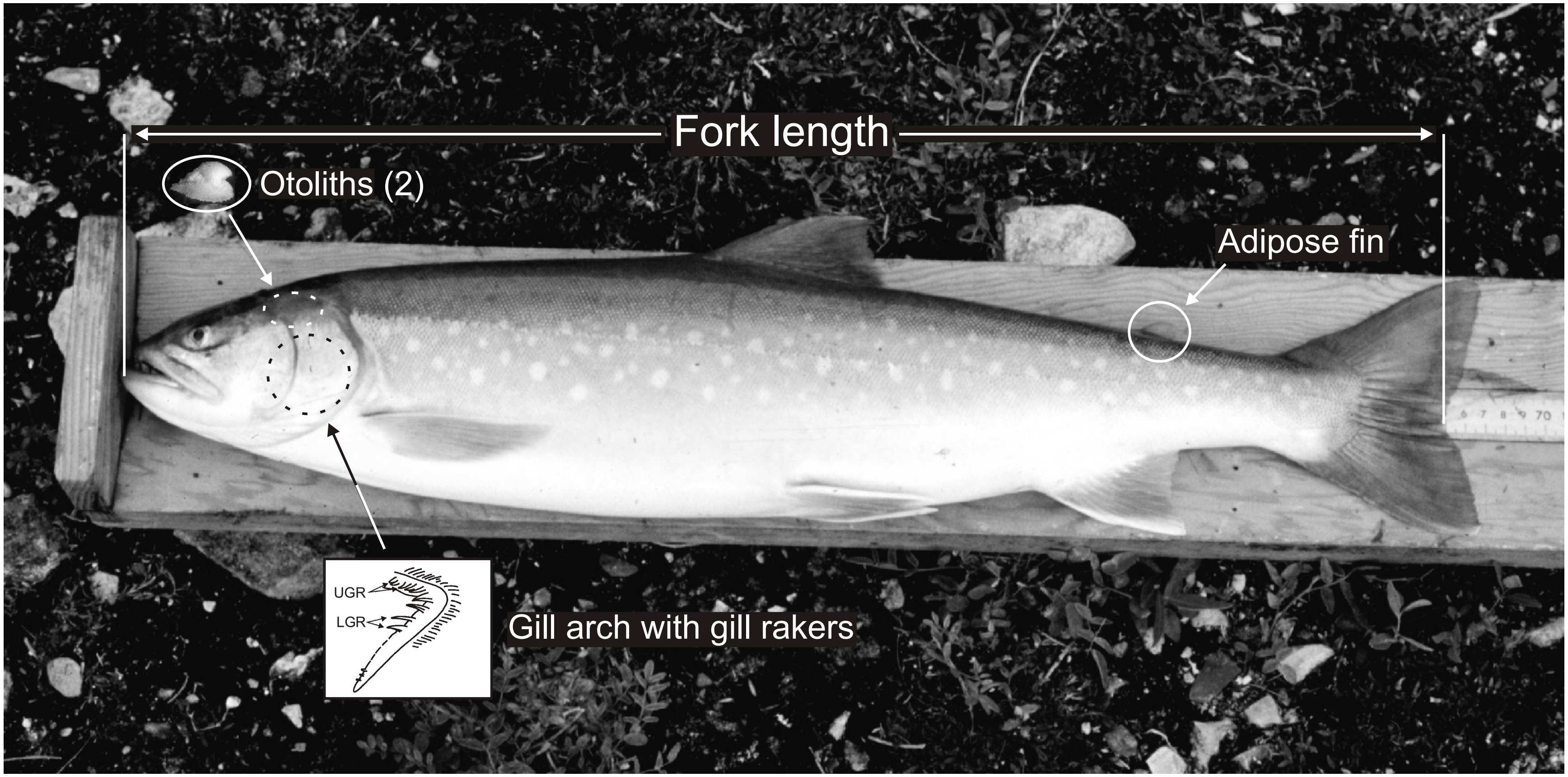



Figure 2. Photograph of an Arctic char showing areas where samples were collected (otoliths, adipose fin, gill arch) and measurement (fork length) was made (UGR = upper gill rakers, LGR = lower gill rakers).

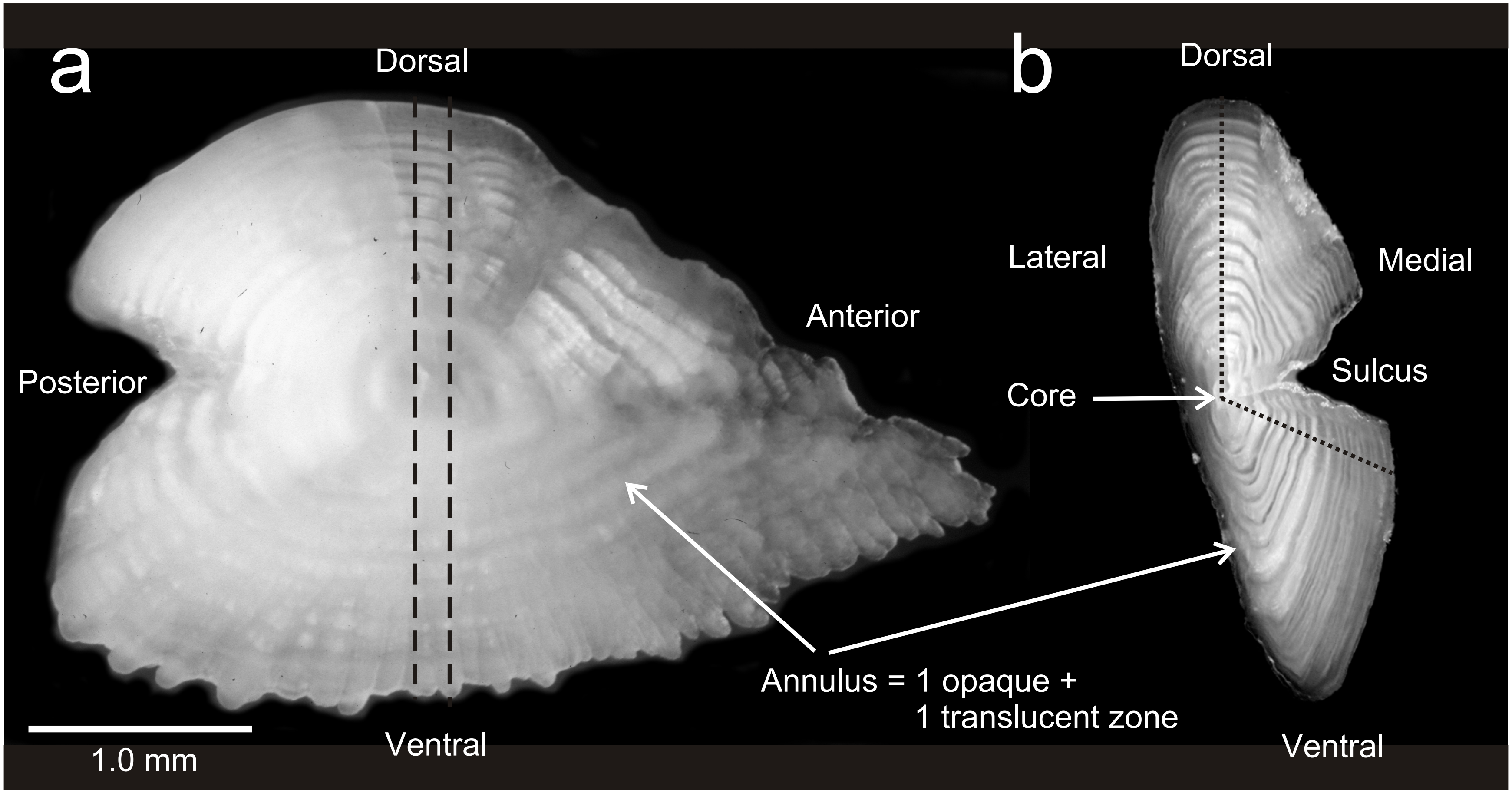



Figure 3. Typical Arctic char otolith showing the a) lateral side of its external surface; dashed lines indicate the transverse section taken to expose the internal surface for electron microprobe analysis and b) exposed surface of the otolith section showing typical transects (dotted lines) along which the analyses were conducted.

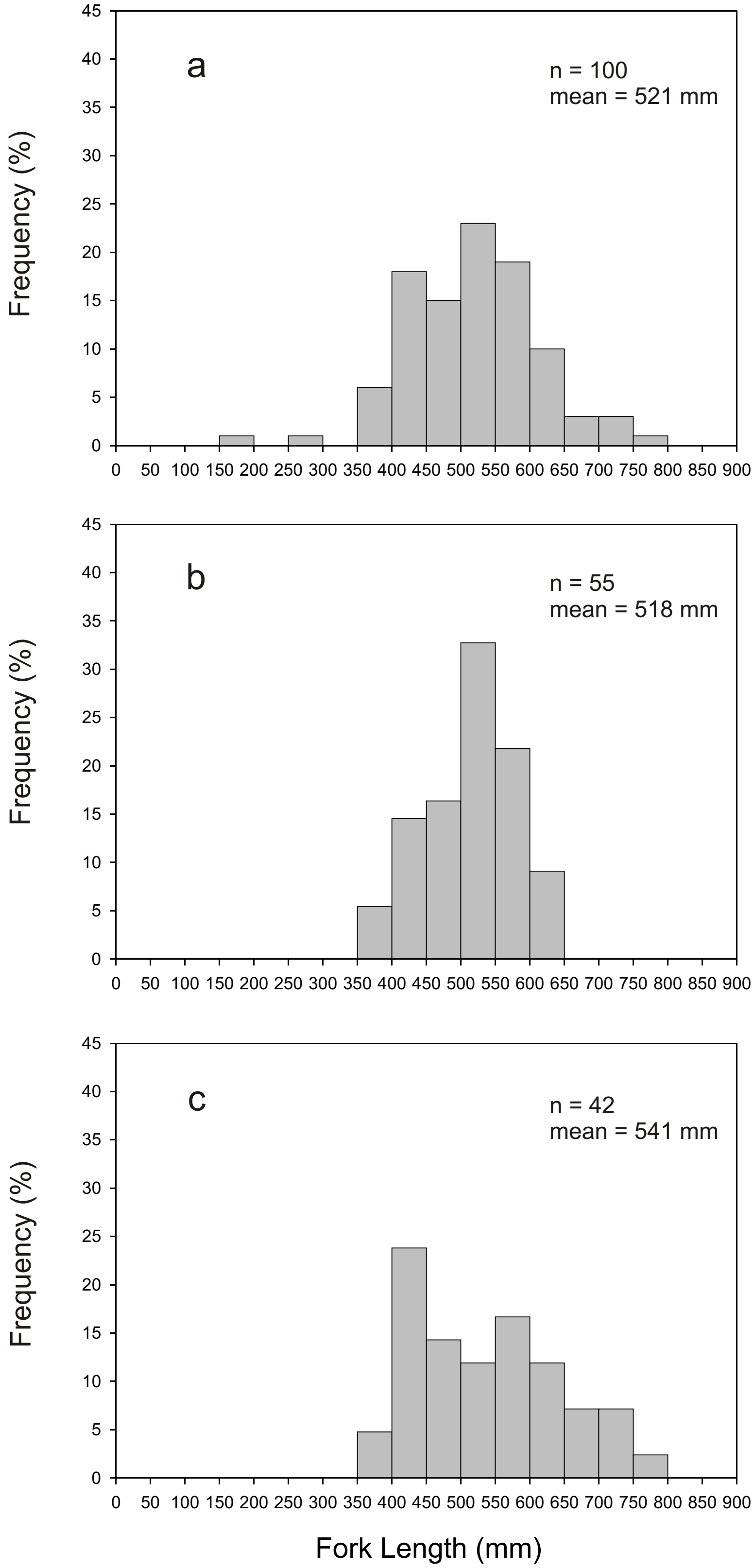



Figure 4. Length-frequency distributions for Arctic char (a) all fish, (b) females and (c) males from Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002.

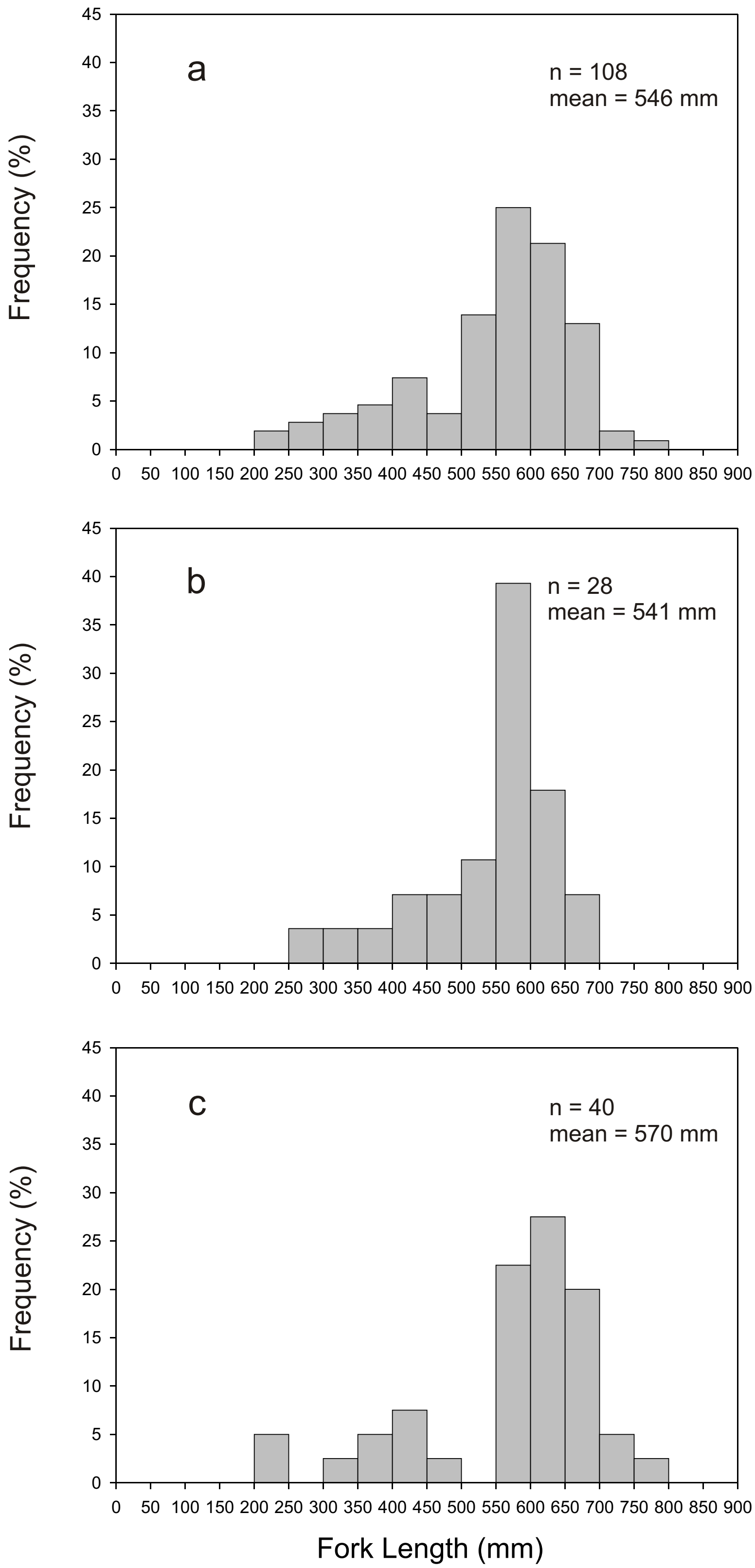



Figure 5. Length-frequency distributions for Arctic char (a) all fish, (b) females and (c) males from Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2004.

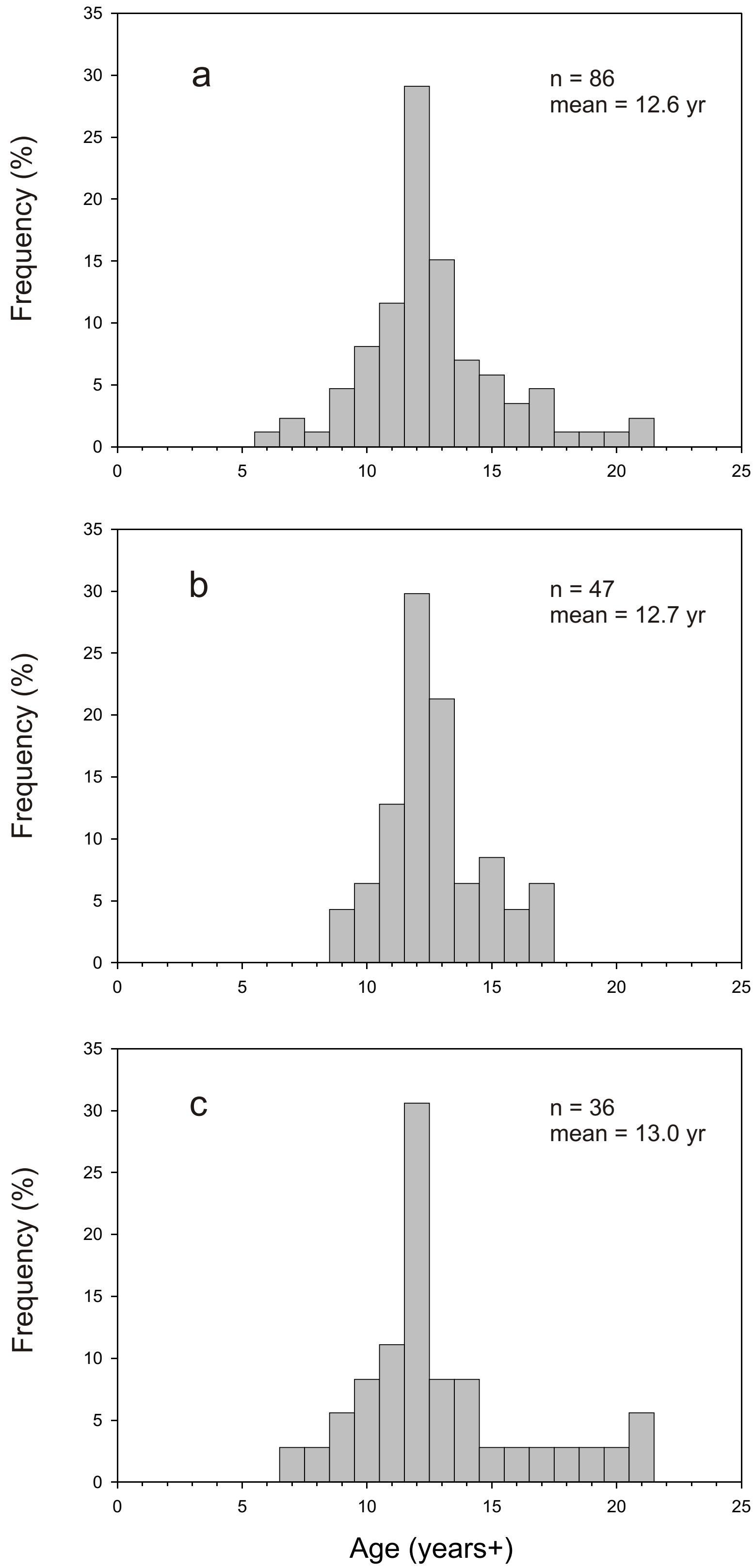



Figure 6. Age-frequency distributions for Arctic char (a) all fish, (b) females and (c) males from Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002.

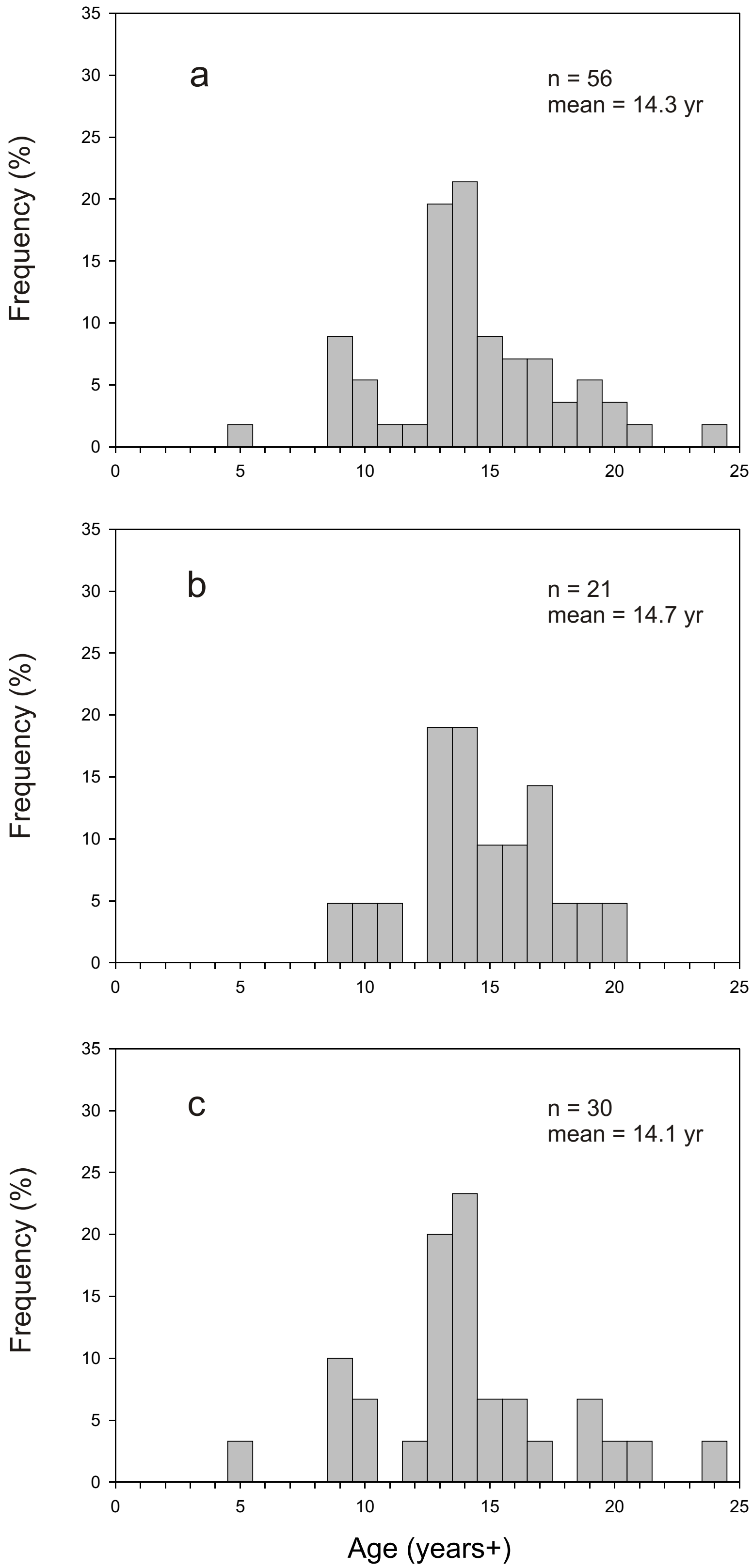



Figure 7. Age-frequency distributions for Arctic char (a) all fish, (b) females and (c) males from Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2004.

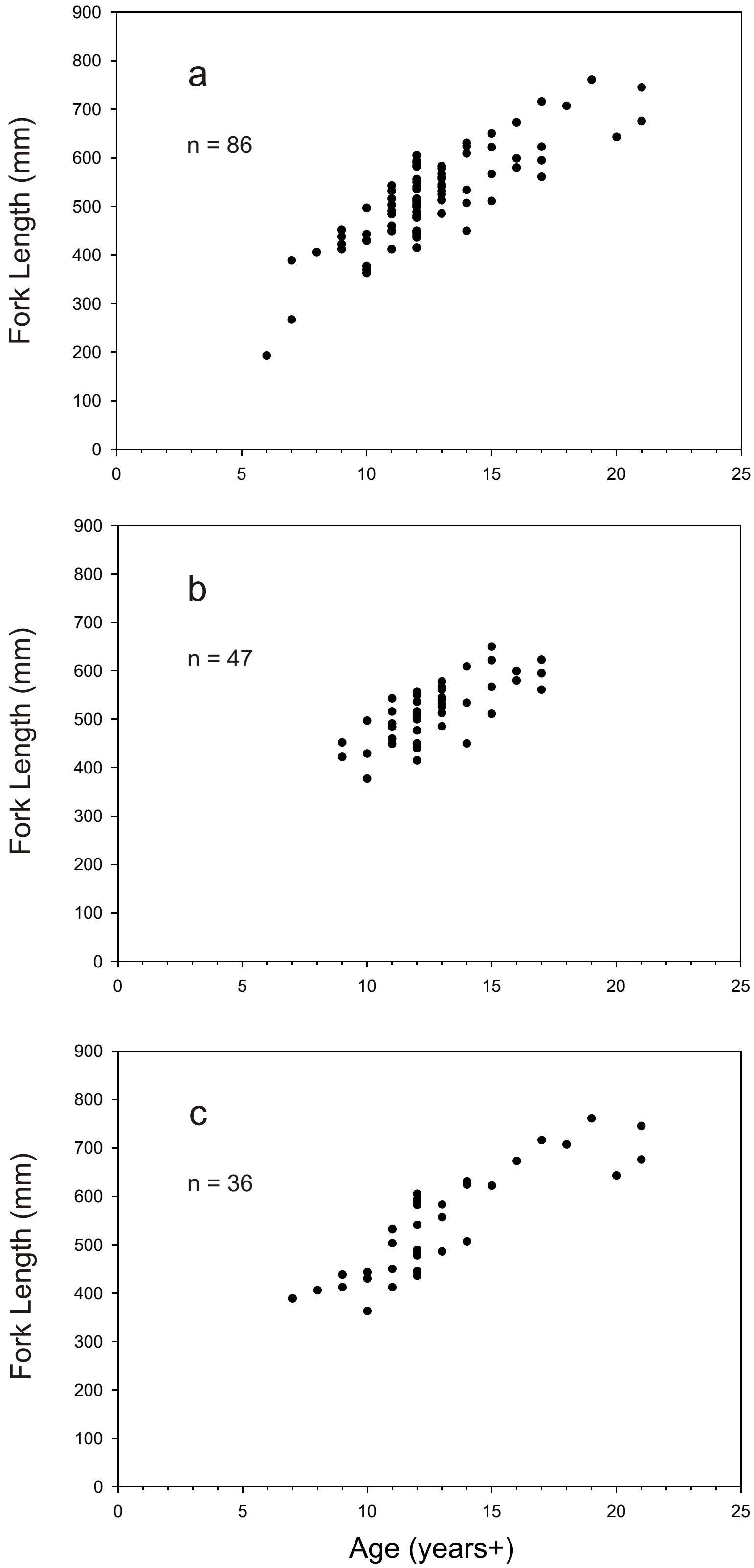



Figure 8. Relationship between fork length and age for Arctic char (a) all fish, (b) females and (c) males from Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002.

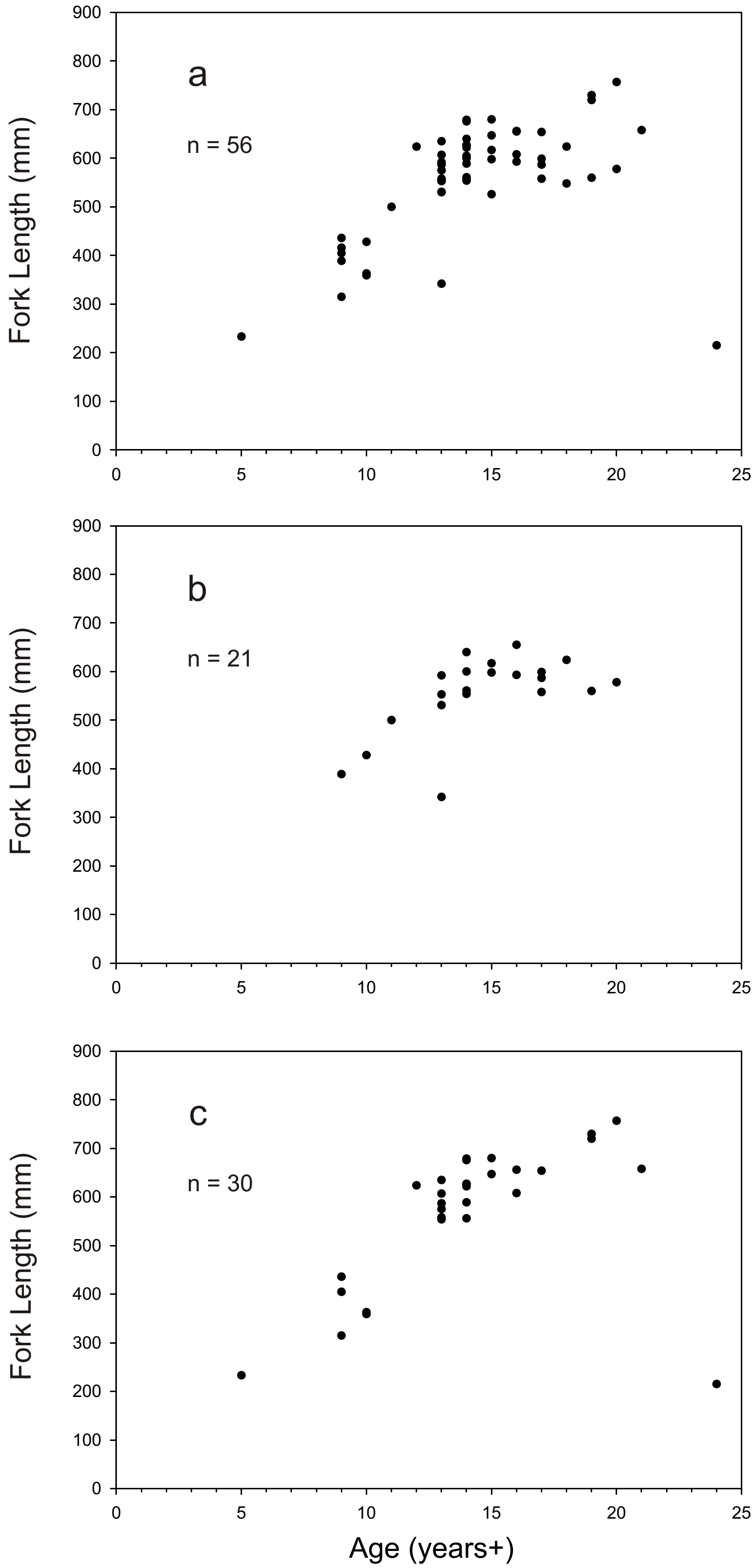



Figure 9. Relationship between fork length and age for Arctic char (a) all fish, (b) females and (c) males from Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2004.

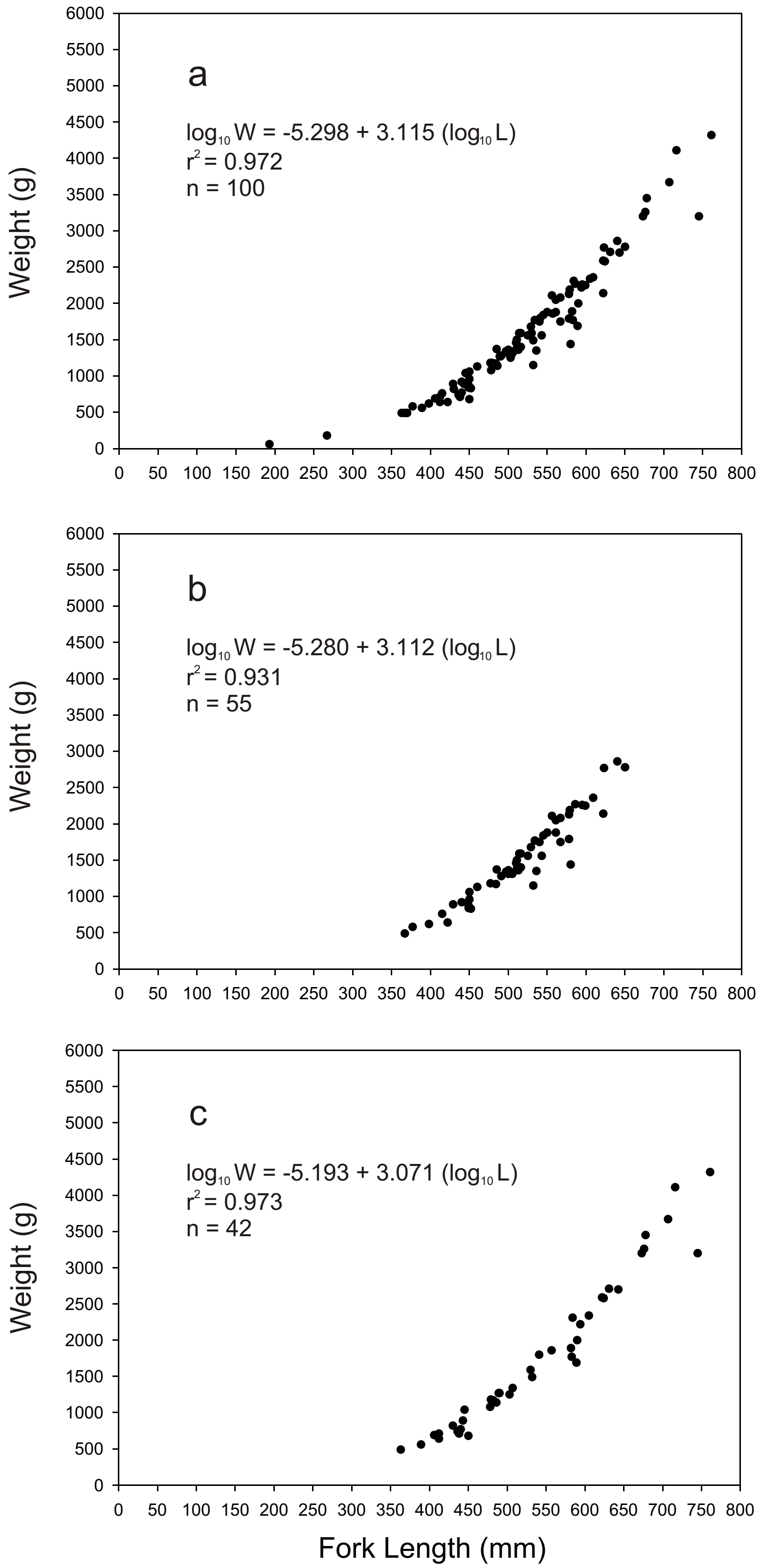



Figure 10. Relationship between weight and fork length for Arctic char (a) all fish, (b) females and (c) males from Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002.

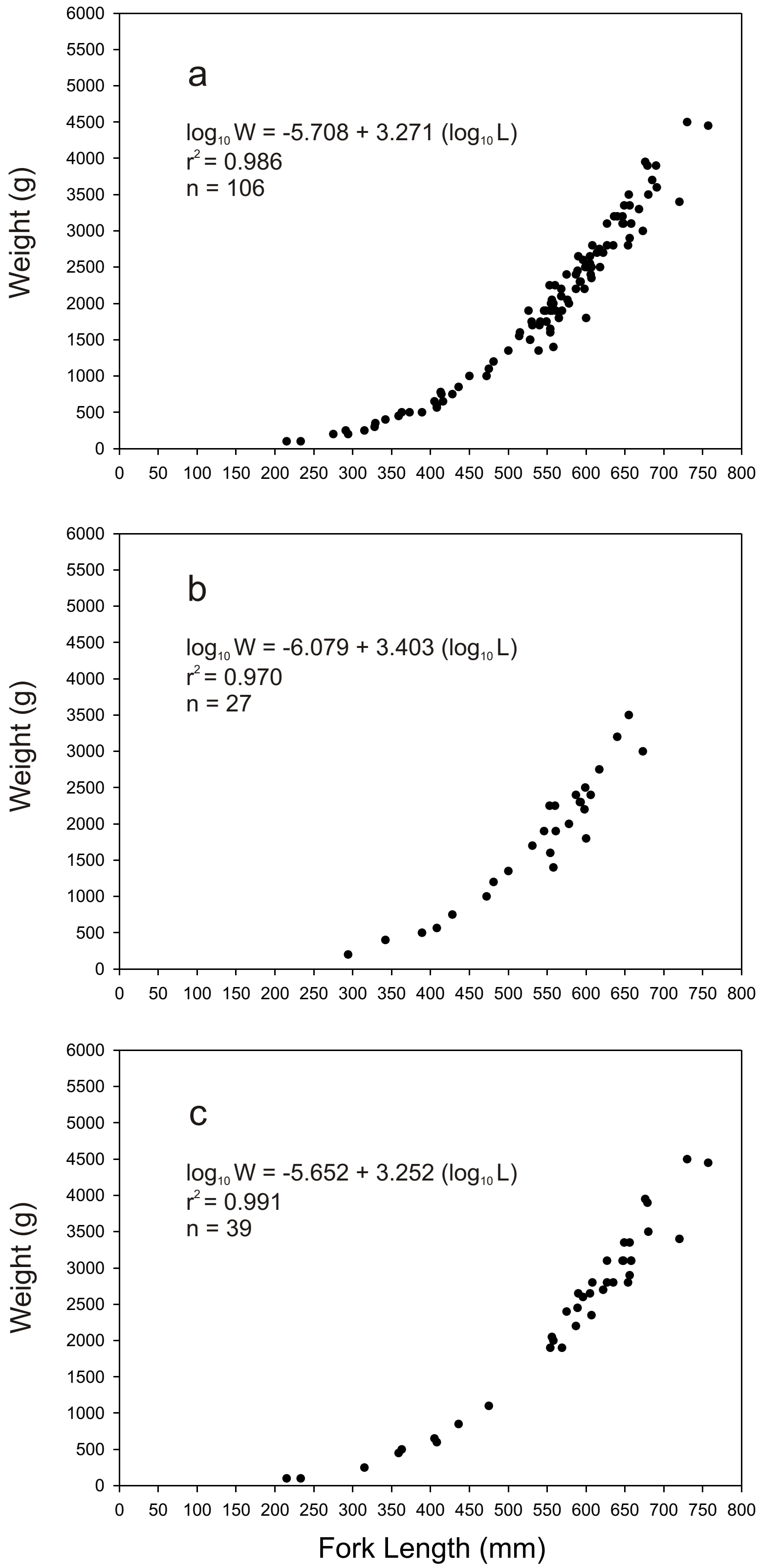



Figure 11. Relationship between weight and fork length for Arctic char (a) all fish, (b) females and (c) males from Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2004.

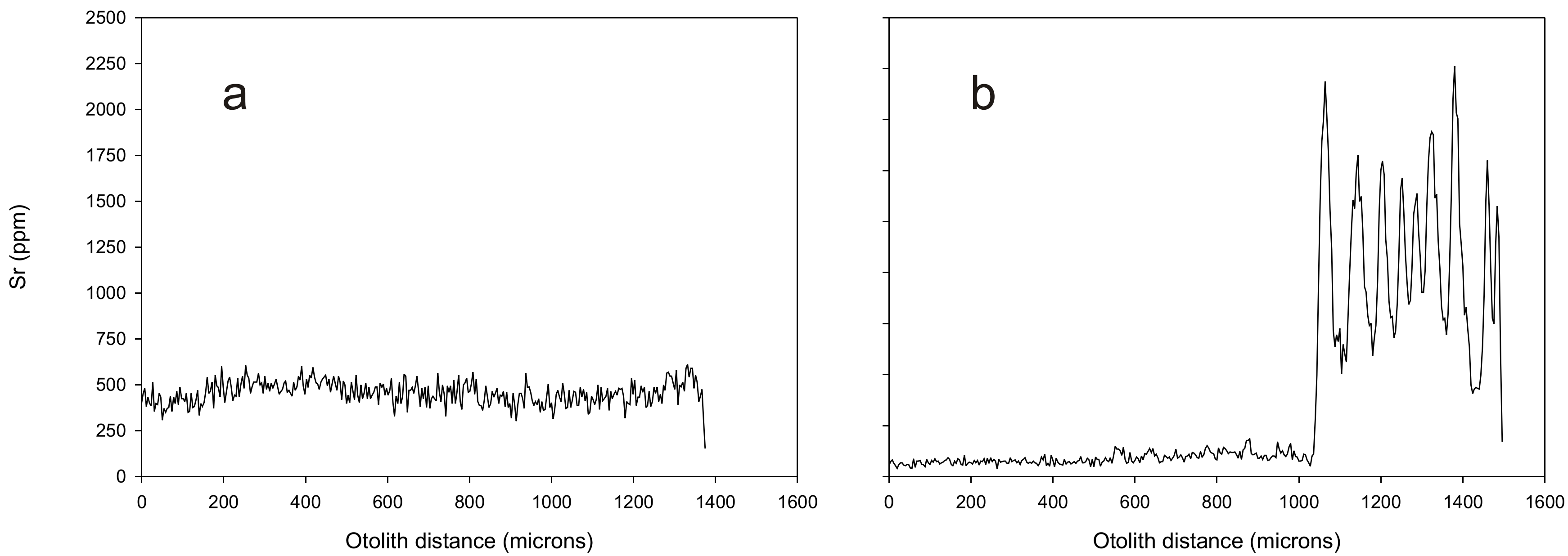



Figure 12. Typical strontium distribution profiles from scanning proton microprobe line-scans of an otolith collected from (a) a known non-anadromous Arctic char from Kilbourne Lake (Quttinirpaaq National Park, Ellesmere Island, Nunavut) and (b) a known anadromous Arctic char from Halovik River (Victoria Island, Nunavut).

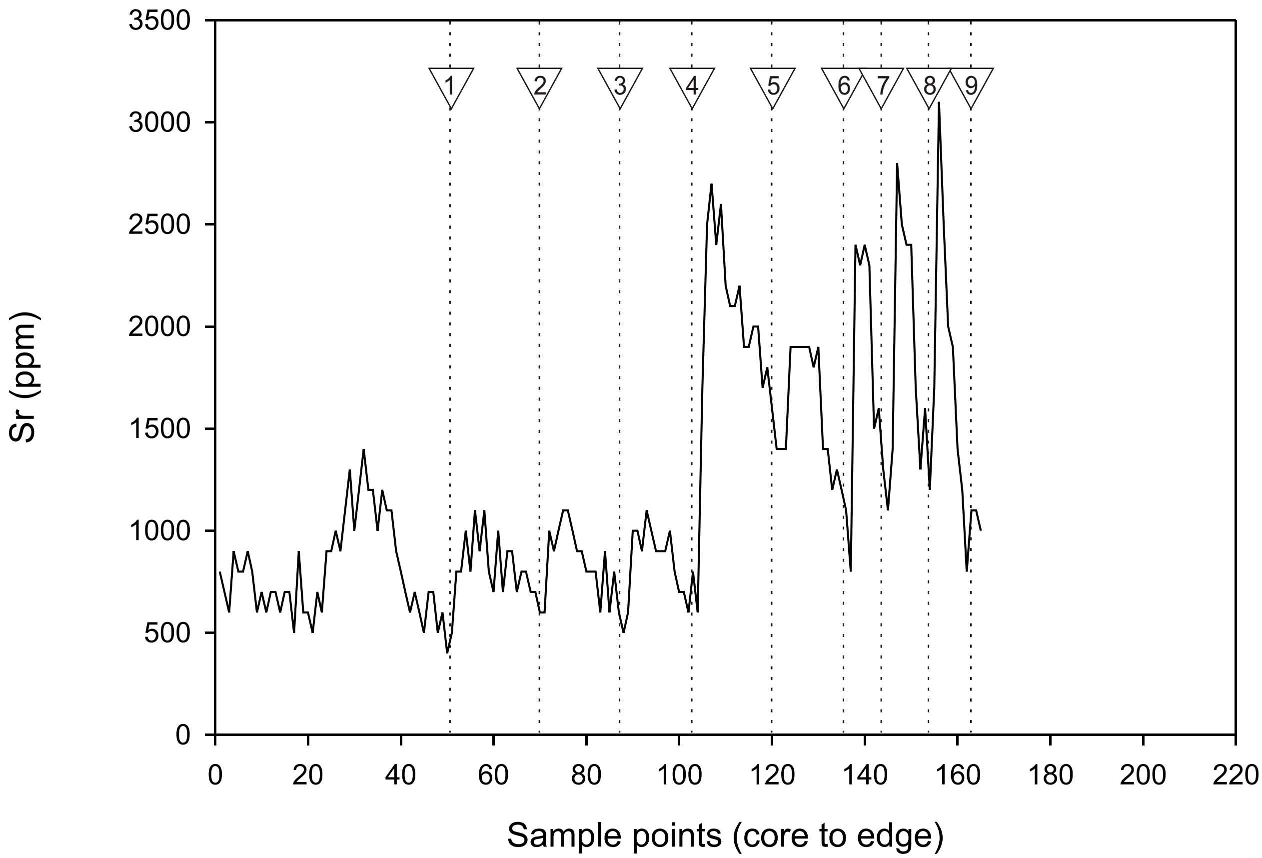



Figure 13. Strontium distribution profile from a wavelength-dispersive electron microprobe line-scan of an otolith from an Arctic char (#49013, 452 mm, 830 g, female, 9+ yr) caught in Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002. Numbered triangles and dashed lines indicate approximate location of annuli.

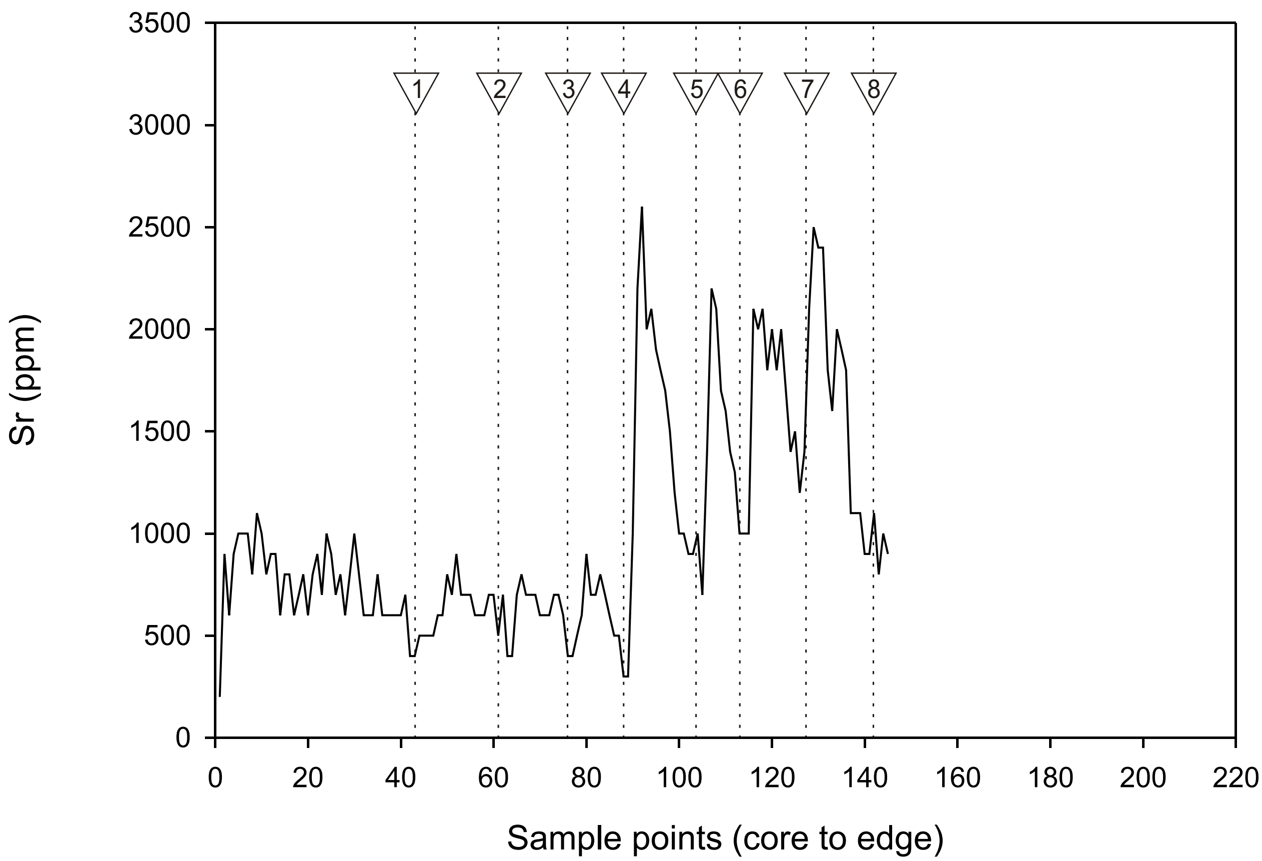



Figure 14. Strontium distribution profile from a wavelength-dispersive electron microprobe line-scan of an otolith from an Arctic char (#48964, 406 mm, 690 g, male, 8+ yr) caught in Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002. Numbered triangles and dashed lines indicate approximate location of annuli.

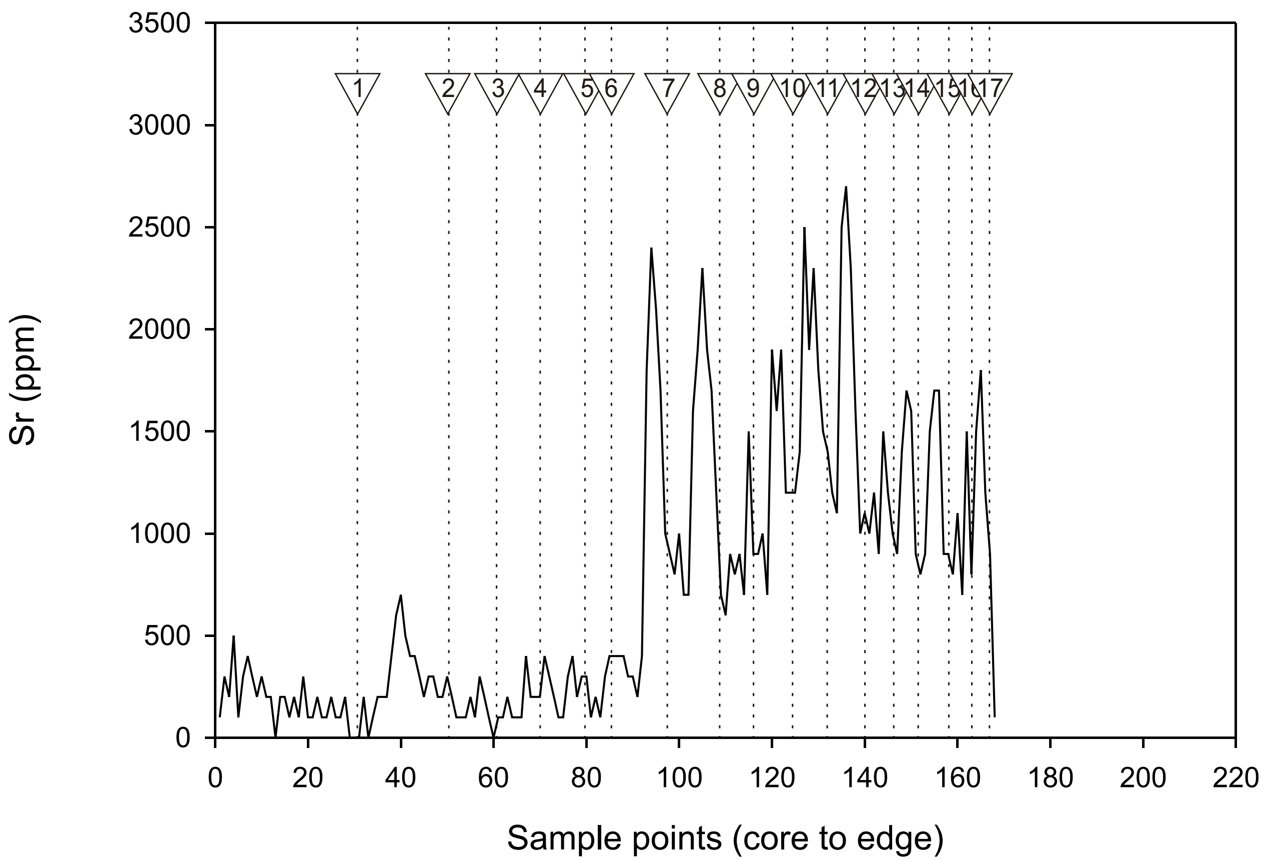



Figure 15. Strontium distribution profile from a wavelength-dispersive electron microprobe line-scan of an otolith from an Arctic char (#48966, 595 mm, 2260 g, female, 17+ yr) caught in Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002. Numbered triangles and dashed lines indicate approximate location of annuli.

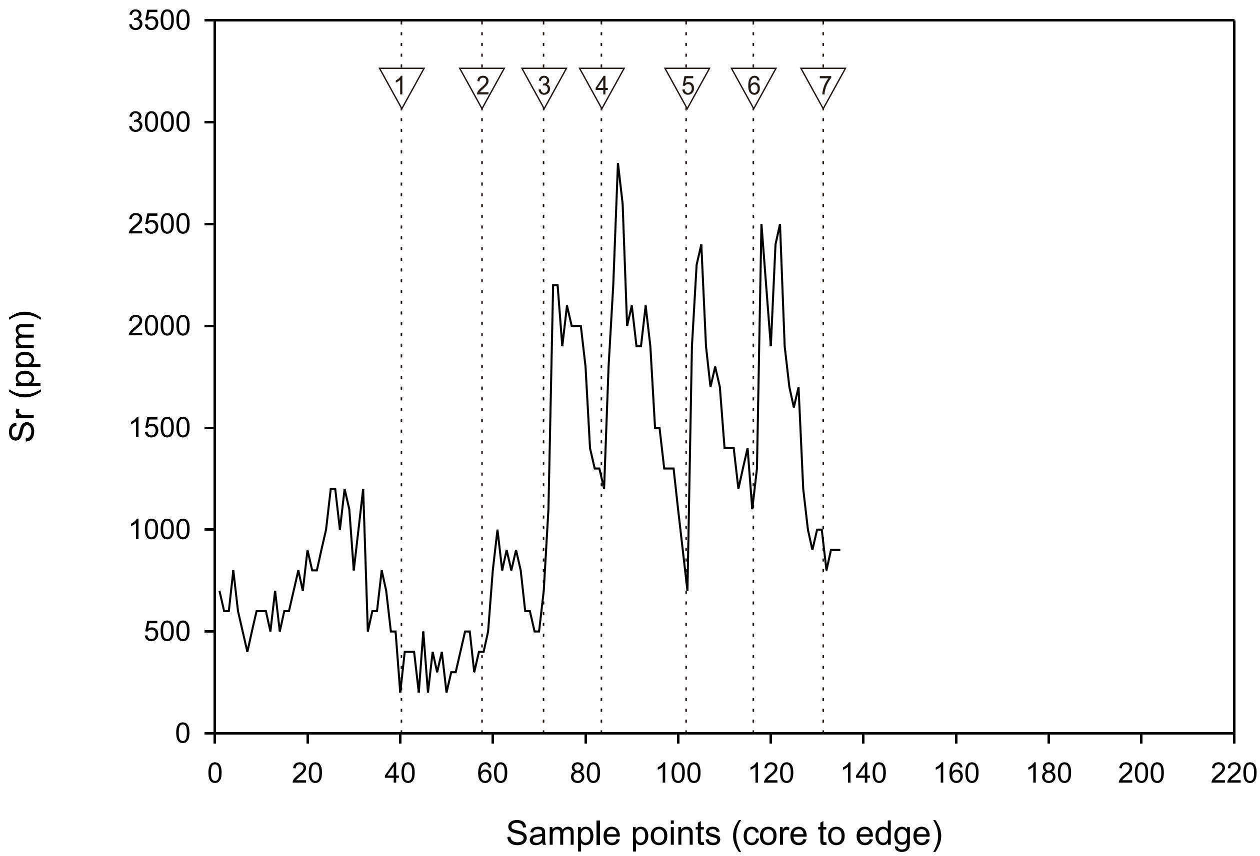



Figure 16. Strontium distribution profile from a wavelength-dispersive electron microprobe line-scan of an otolith from an Arctic char (#48970, 389 mm, 560 g, male, 7+ yr) caught in Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002. Numbered triangles and dashed lines indicate approximate location of annuli.

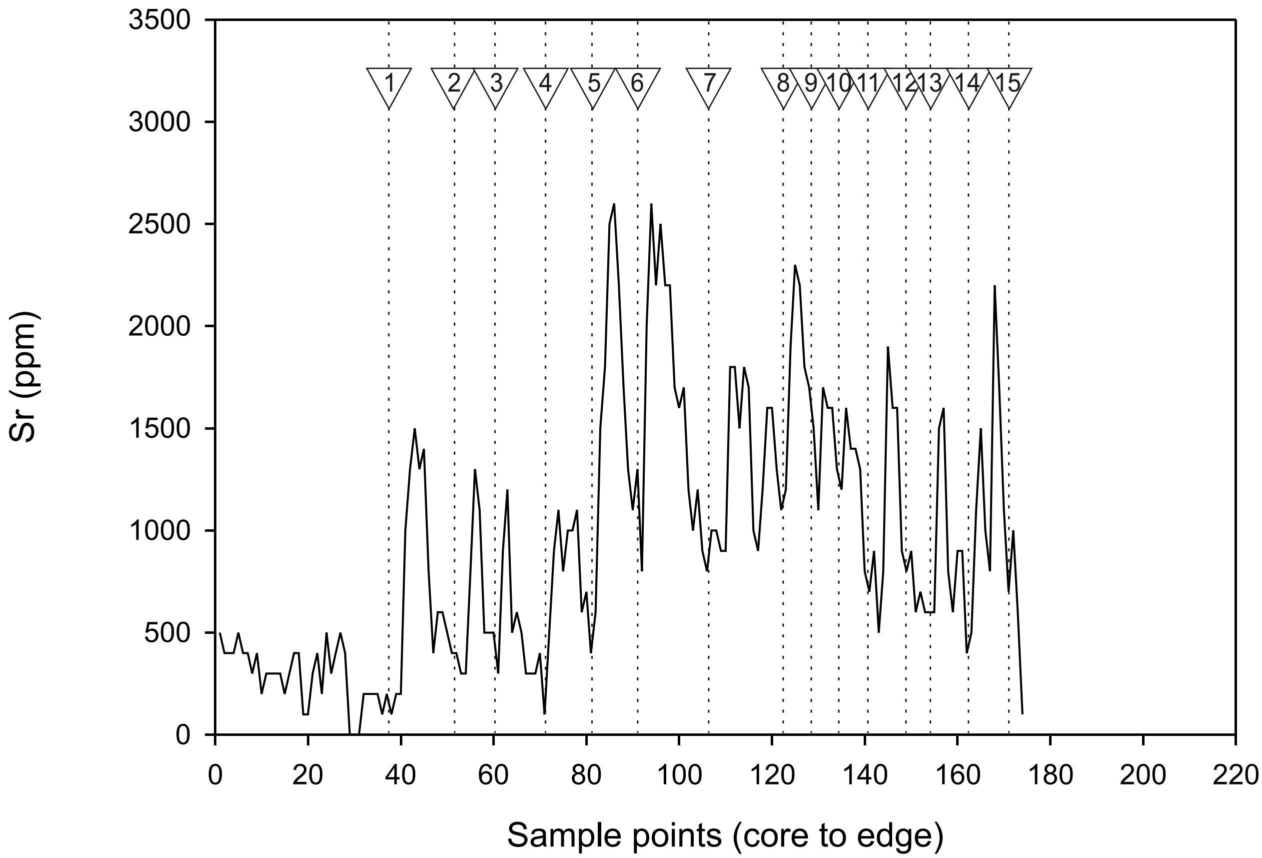



Figure 17. Strontium distribution profile from a wavelength-dispersive electron microprobe line-scan of an otolith from an Arctic char (#48981, 595 mm, 2260 g, female, 15+ yr) caught in Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002. Numbered triangles and dashed lines indicate approximate location of annuli.

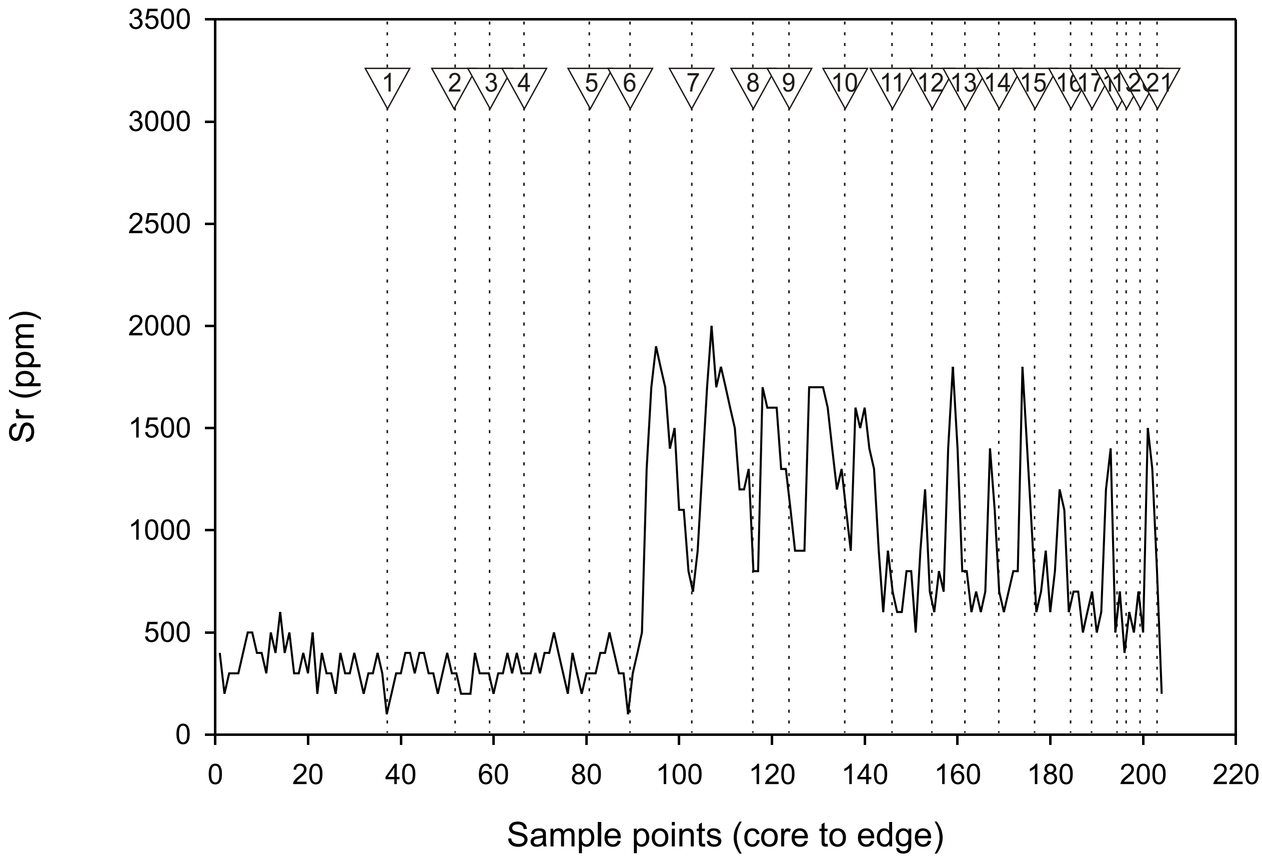



Figure 18. Strontium distribution profile from a wavelength-dispersive electron microprobe line-scan of an otolith from an Arctic char (#48982, 676 mm, 3260 g, male, 21+ yr) caught in Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002. Numbered triangles and dashed lines indicate approximate location of annuli.

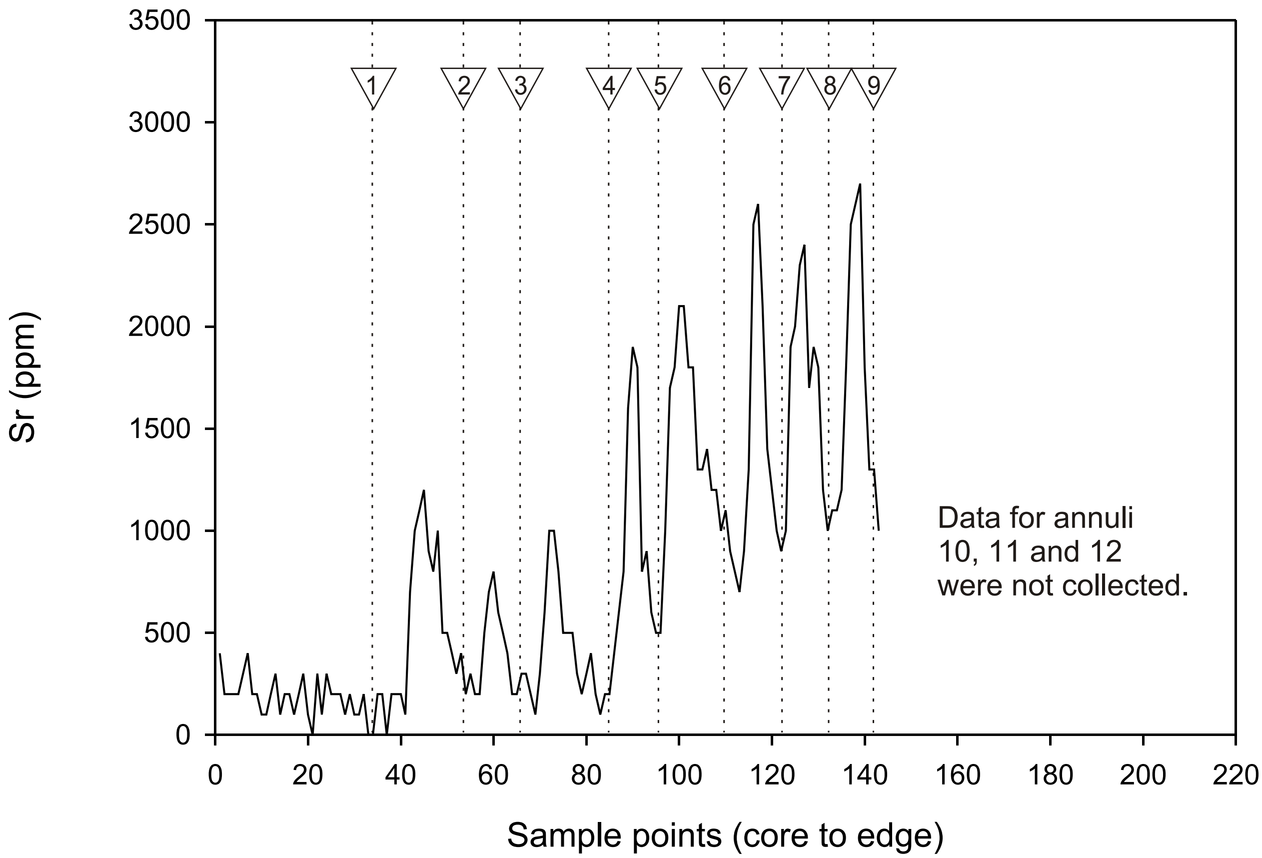



Figure 19. Strontium distribution profile from a wavelength-dispersive electron microprobe line-scan of an otolith from an Arctic char (#48989, 516 mm, 1590 g, female, 12+ yr) caught in Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002. Numbered triangles and dashed lines indicate approximate location of annuli.

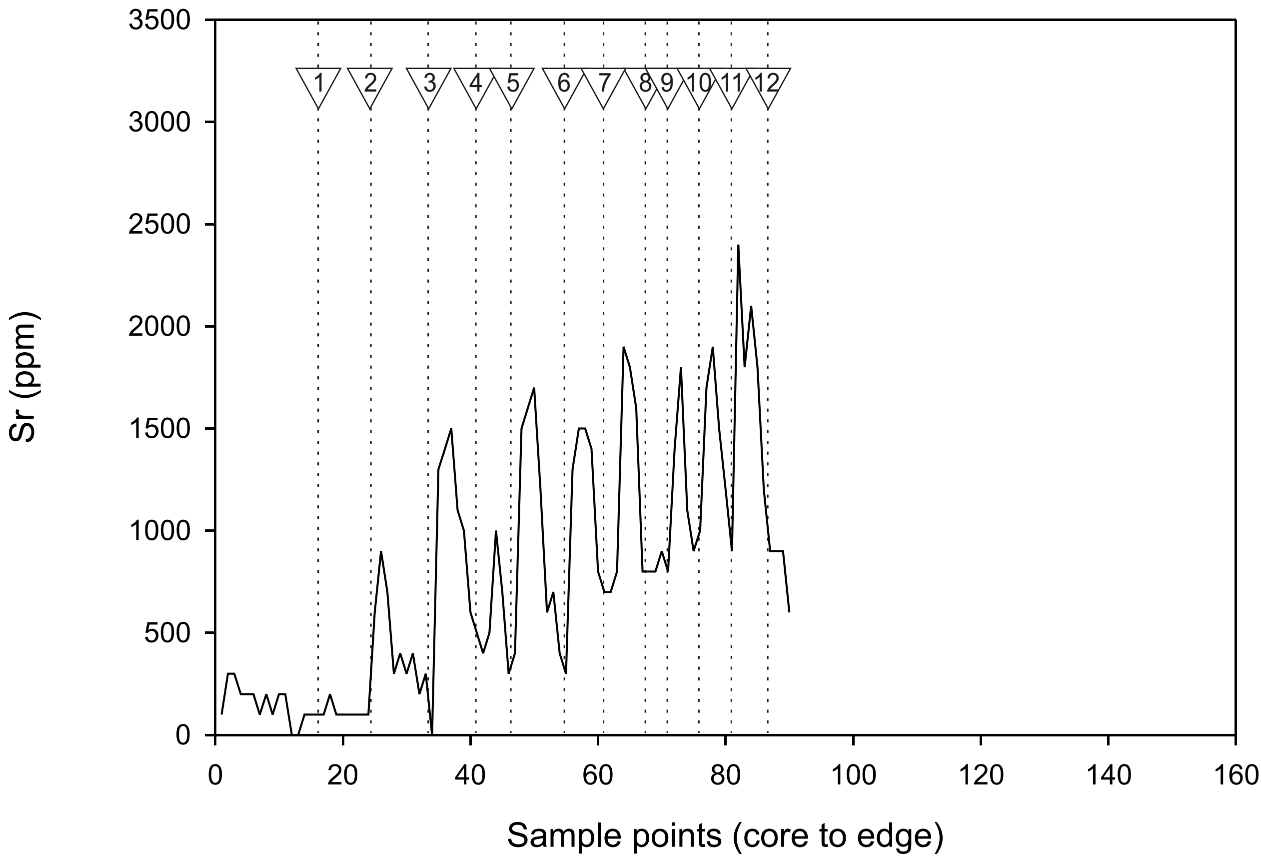



Figure 20. Strontium distribution profile from a wavelength-dispersive electron microprobe line-scan of an otolith from an Arctic char (#48979, 415 mm, 760 g, female, 12+ yr) caught in Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002. Numbered triangles and dashed lines indicate approximate location of annuli.

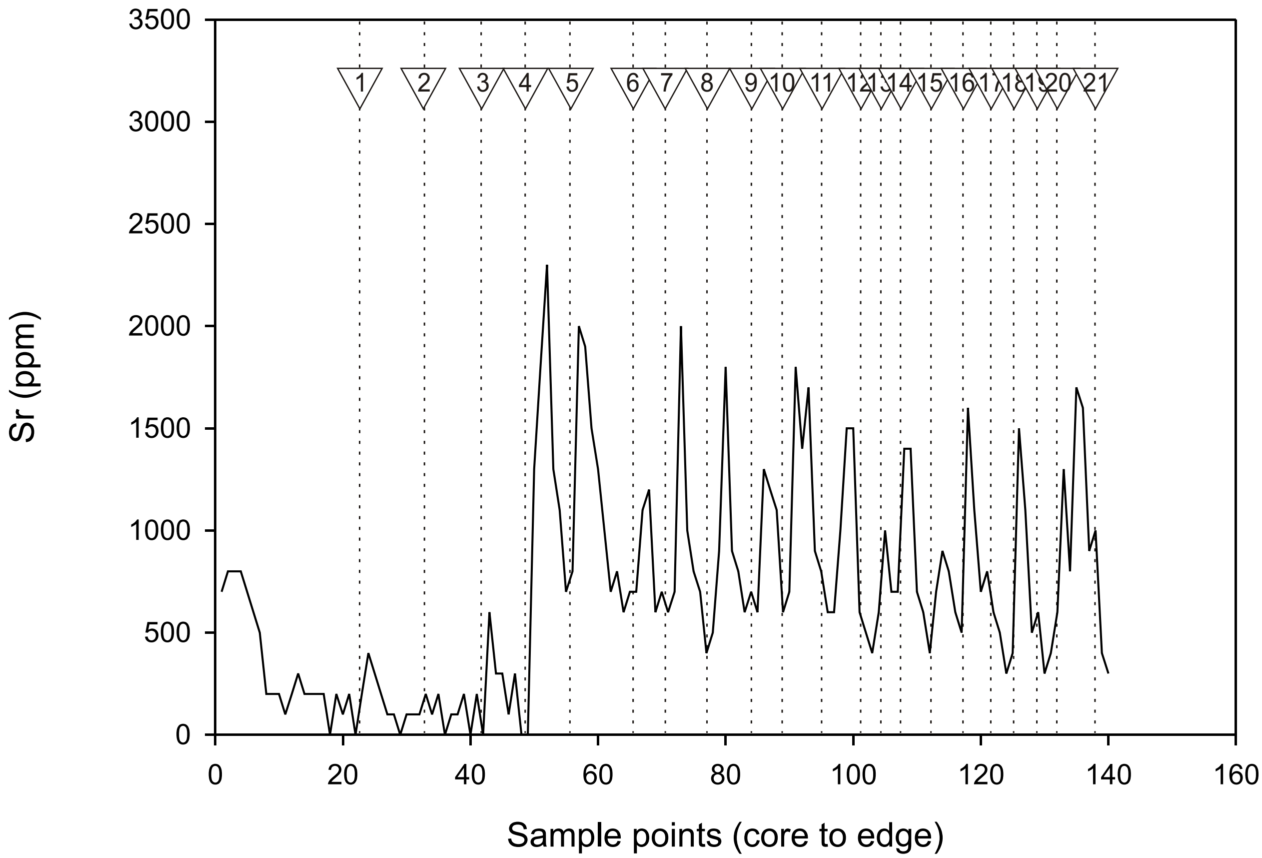



Figure 21. Strontium distribution profile from a wavelength-dispersive electron microprobe line-scan of an otolith from an Arctic char (#48996, 745 mm, 3200 g, male, 21+ yr) caught in Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002. Numbered triangles and dashed lines indicate approximate location of annuli.

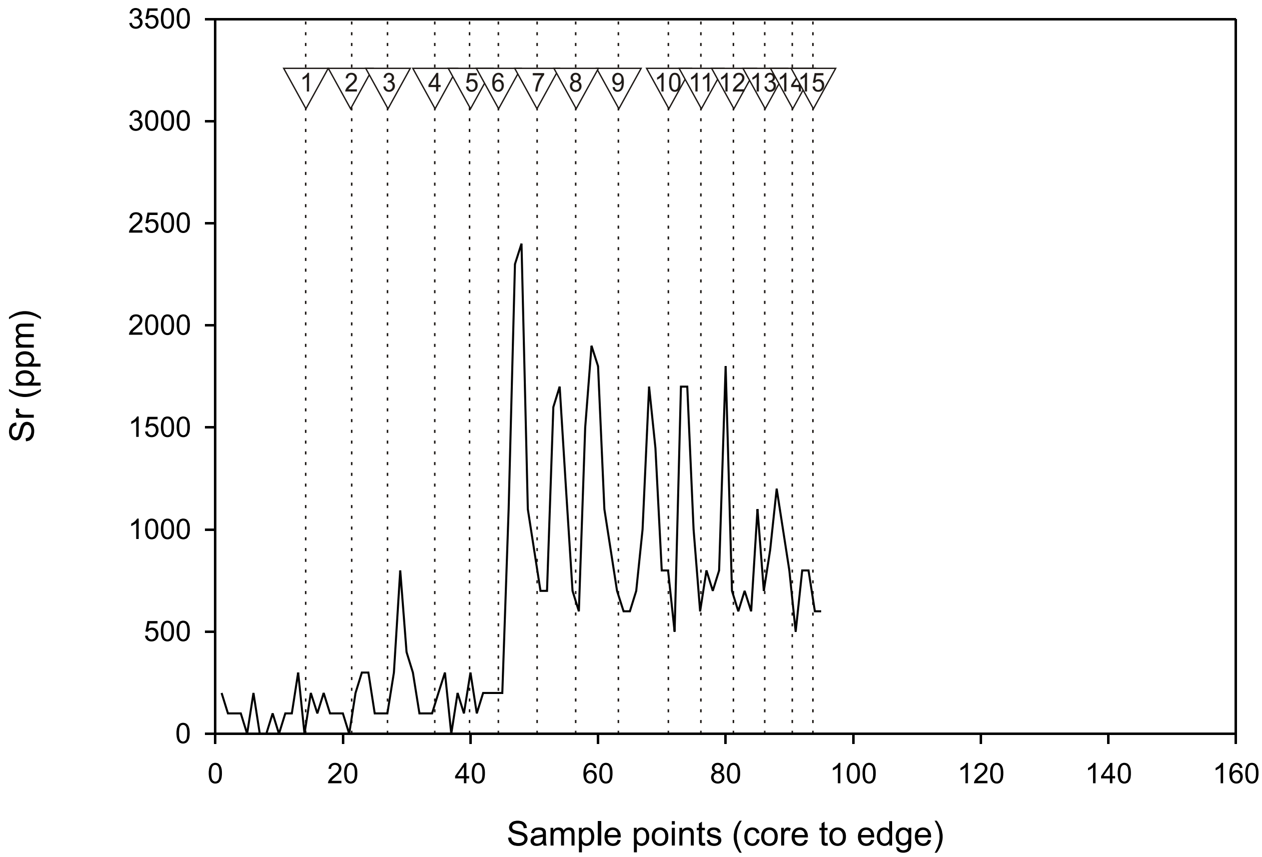



Figure 22. Strontium distribution profile from a wavelength-dispersive electron microprobe line-scan of an otolith from an Arctic char (#49036, 622 mm, 2590 g, male, 15+ yr) caught in Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2002. Numbered triangles and dashed lines indicate approximate location of annuli.

**Papiruq Fisheries Enterpize.**
**10th annual fishing derby.**

**May 21st 2004.**
Travel to Lake #1Nadluqsiaq

**May 22 2004.**
First fish brought to papiruq tent. $300.00 any size.

**Most fish** ***8:00am to9:00am***
All participants one prize qamutik with usivik from Housing
***at 9:00am to 9:30Half hour break.***

**Longest fish** ***9:30am to 10:30am***
1st $500.00 grocery gift (CO-OP) from Hazco.
2nd 45 gallon gas with oils from CO-OP
3rd Sewing machine from CO-OP

**Half hour break** ***10:30to11:00am***

**Heaviest fish children** ***11:00to12:00pm***
1. For boy/girl 2 bicycles plus $50.00 each winner (youth committee)
   Ages up to 14 year old from Leelie Enterprise (bikes)

**Lunch 1 hour.** ***12:00pmto1:00pm***

**smallest fish** ***1:00pmto2:00pm***
1st Ottawa return ticket with $1,000.00
2nd $500.00 with 10 gallon gas
3rd $200.00

**Heaviest fish starts**
***2:00to8:00pm & restarts Monday***

**May 23 2004**
***1:00pm feast Sunday.***

**May 24 2004**
***8:00am*** First fish brought to papirus tent $200.00 any size

**Heaviest continue** ***8:00am to 12:00pm***
**1st** $8,000.00 plus 45 gallon gas with one case naptha
2nd. $4,000.0
3rd. $2,000.00

**May 25, 04** **7:00pm**derby prizes at gym 3 draws

**ᐸᐱᕈᖅ 10ᔭᖓ ᐃᖃᓪᓕᐊᕕᔪᐊᓂ**

**ᒪᐃ 21 2004**
ᕿᑭᖅᑕᕐᔪᐊᒥ ᐊᐅᓪᓚᓗᑎᒃ ᓇᓪᓗᖅᓯᐊᒧᑦ ᒥᓯᑎ

**ᒪᐃ 22, 2004**
ᑐᐱᒻᒧᐊᕆᔭᖃᕐᑐᖅ ᐃᖃᓪᓗᒥ ᐸᐱᕈᑯᓄᑦ $300.00ᖃᓄᐃᑦᑐᑐᐃᓇᖅᒥ

***ᐊᒥᓱᓯᖅᓚᕐᓯᓐᓂᖅ 8:00ᒥ 9:00ᒧᑦ ᐃᖃᓗᓕᓯᑦᑐᓕᒪᓄᑦ***
ᐊᑕᐅᓯᖅᒧᑦ ᖃᒧᑎ ᐅᓯᕕᖃᑕᐅᑎᓯᔪᖅ ᐃᓪᓗᓕᕆᔨᓐᓂᑦ.

***9:00ᒥ 9:30ᒧ ᓄᖅᑲᖓᕙᐃᓐᓇᓪᓗᑎᒃ.***

***ᑕᑭᓛᒥᑦ ᐃᖃᓗᓕᐅᑎᓂᖅ 9:30ᒥ 10:30ᒧ.***
1st $500.00 ᓂᕿᑕᕐᑎ (ᑯᐊᐸᑯᓂ) ᕼᐊᑯᓐᓂᑦ ᑐᓂᔭᖅ
2nd ᖃᑦᑕᐅᔭᖅ ᐃᓚᖓᖃᑦᑕᐅᑎᓯᔪᖅ
3rd ᒥᕐᓯᑎ ᑯᐊᐸᒃᑯᓐᓂ

***10:30ᒥ 11:00 ᓄᖅᑲᖓᕙᐃᓐᓇᕐᑐ***

***ᐅᖁᒪᐃᓪᓚᕐᓯᑦᑐ ᓱᕈᓯᑦ 11ᒥ 12ᒧ.***
ᐊᖑᑎᒧᑦ/ᐊᕐᓇᒧᑐ ᒪᕐᕉᒃ ᑐᒃᑲᓇᐊᓕᒃ ᐊᒻᒪ$50.00ᐊᑐᓂ (ᐃᓅᓱᑐᑯᓂᑦ)
14ᒥ ᐊᑖᓄ ᐅᑭᐅᓕᓐᓄᑦ ᓕᓕᐅᑉ ᓂᐅᕕᕕᖓᓂᑦ(ᑐᒃᑲᓇᐊᓕᒃ)

***ᐃᒃᓯᕙᐅᑕᖅᒥ ᐊᑕᐅᓯᖅᒥ ᓂᕆᓐᓇ 12:00-ᒥ 1:00ᐅᓐᓄᓴᒃᑯᑦ***

***ᒥᑭᓛᒥ ᐃᖃᓗᓕᓐᓂᖅ 1:00ᒥ 2:00ᒧ***
1st ᐊᑐᕚᒧᑦ ᖃᐃᖓᑕᐅᑎ ᐅᑎᕐᑎᑦ ᐊᒻᒪ $1,000.00
2nd $500.00 ᐊᒻᒪ 10ᒐᓚ ᐅᓯ
3rd $200.00

**ᐅᖁᒪᐃᓪᓚᕐᓯᓐᓂᖅ ᐱᒋᐊᕐᑐᖅ**
2ᒥ 8ᒧ ᑲᔪᓯᑲᓂᕐᓗᓂ ᓇᒡᒐᔭᐅᒥ

***ᒪᐃ 23, 2004***
1:00ᒥᑦ ᓂᕆᖃᑎᒌᖕᓂ ᓈᑎᐅᖑᔭᒥ.

***ᒪᐃ 24, 2004.***
8:00ᒥ ᑐᐱᒻᒧᐊᕆᔭᖃᕐᑐᖅ ᐃᖃᓗᒻᒥᑦ ᐸᐱᕈᑯᓄ $200.00

***ᐅᖁᒪᐃᓪᓚᕐᓯᓐᓂᖅ ᑲᔪᓯᔪᖅ 8:00ᒥ 12:00ᒧ***
1st $8,000.00 ᐊᒻᒪ 45 ᖃᑦᑕᐅᔭ ᐅᓯ ᐊᒻᒪ ᖁᑦᑎᓯᐅᑎᑦ ᐃᓗᐃᑦᑐᖅ
2nd $4,000.00
3rd $2,000.00

**ᒪᐃ 25,04** 7:00ᒥ ᓴᓚᕝᕕᓯᐊᓂᖅ 3ᓂ ᐊᒧᓯᖃᑕᓗᑎᑦ

Appendix 1. Information pamphlet provided to 2004 Qikiqtarjuaq fishing derby participants by derby organizers.

Appendix 2. Field sample and laboratory processing numbers, fork lengths, weights, sex, otolith ages, and condition factors for Arctic char captured in Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 25-27, 2002.

| Field Sample No. | Laboratory Processing No. | Fork Length (mm) | Weight (g) | Sex | Age (yr+) | Condition Factor (K) | Comments |
|---|---|---|---|---|---|---|---|
| 1 | 49002 | 440 | 920 | F | 12 | 1.080 | |
| 2 | 48990 | 678 | 3450 | M | - | 1.107 | No otoliths collected |
| 3 | 49023 | 536 | 1350 | F | 12 | 0.877 | |
| 4 | 49008 | 513 | 1380 | F | 13 | 1.022 | |
| 5 | 48972 | 482 | 1170 | M | 12 | 1.045 | |
| 6 | 49005 | 550 | 1880 | F | 12 | 1.130 | |
| 7 | 48979 | 415 | 760 | F | 12 | 1.063 | |
| 8 | 48998 | 449 | 870 | F | 11 | 0.961 | |
| 9 | 49037 | 490 | 1270 | M | - | 1.079 | No otoliths collected |
| 10 | 48992 | 500 | 1360 | F | 12 | 1.088 | |
| 11 | 49038 | 640 | 2860 | F | - | 1.091 | No otoliths collected |
| 12 | 49003 | 450 | 1060 | F | 14 | 1.163 | |
| 13 | 49001 | 489 | 1270 | M | 12 | 1.086 | |
| 14 | 48993 | 510 | 1460 | F | 12 | 1.101 | |
| 15 | 49031 | 561 | 1880 | F | 17 | 1.065 | |
| 16 | 49030 | 511 | 1500 | F | - | 1.124 | Otoliths unreadable |
| 17 | 48999 | 430 | 820 | M | 10 | 1.031 | |
| 18 | 48988 | 484 | 1170 | F | 11 | 1.032 | |
| 19 | 48986 | 580 | 1440 | F | 16 | 0.738 | |
| 20 | 48953 | 567 | 1750 | F | 13 | 0.960 | |
| 21 | 49028 | 590 | 2000 | M | 12 | 0.974 | |
| 22 | 49039 | 398 | 620 | F | - | 0.983 | No otoliths collected |
| 23 | 49014 | 363 | 490 | M | 10 | 1.024 | |
| 24 | 49013 | 452 | 830 | F | 9 | 0.899 | |
| 25 | 49040 | 586 | 2270 | F | - | 1.128 | No otoliths collected |
| 26 | 48995 | 578 | 2130 | F | 13 | 1.103 | |
| 27 | 49019 | 500 | 1310 | F | 12 | 1.048 | |
| 28 | 49021 | 540 | 1750 | F | 13 | 1.111 | |
| 29 | 49041 | 578 | 1790 | F | - | 0.927 | No otoliths collected |
| 30 | 49007 | 436 | 740 | M | 12 | 0.893 | |
| 31 | 49034 | 543 | 1560 | F | 11 | 0.974 | |
| 32 | 49004 | 514 | 1590 | F | 12 | 1.171 | |
| 33 | 49000 | 443 | 890 | M | 10 | 1.024 | |
| 34 | 49016 | 438 | 710 | M | 9 | 0.845 | |
| 35 | 48987 | 497 | 1340 | F | 10 | 1.092 | |
| 36 | 48975 | 567 | 2080 | F | 15 | 1.141 | |
| 37 | 48950 | 557 | 1860 | M | 13 | 1.076 | |
| 38 | 49029 | 513 | 1360 | F | 13 | 1.007 | |
| 39 | 48980 | 609 | 2360 | F | 14 | 1.045 | |
| 40 | 49033 | 532 | 1150 | F | 13 | 0.764 | |
| 41 | 48989 | 516 | 1590 | F | 12 | 1.157 | |
| 42 | 48952 | 583 | 1770 | M | 13 | 0.893 | |
| 43 | 49015 | 599 | 2250 | F | 16 | 1.047 | |
| 44 | 49020 | 460 | 1130 | F | 11 | 1.161 | |
| 45 | 48991 | 716 | 4110 | M | 17 | 1.120 | |

Appendix 2. Continued.

| Field Sample No. | Laboratory Processing No. | Fork Length (mm) | Weight (g) | Sex | Age (yr+) | Condition Factor (K) | Comments |
|---|---|---|---|---|---|---|---|
| 46 | 48996 | 745 | 3200 | M | 21 | 0.774 | |
| 47 | 49018 | 193 | 60 | U | 6 | 0.835 | |
| 48 | 49036 | 622 | 2590 | M | 15 | 1.076 | |
| 49 | 49006 | 534 | 1770 | F | 14 | 1.162 | |
| 50 | 48948 | 541 | 1800 | M | 12 | 1.137 | |
| 51 | 49022 | 505 | 1310 | F | 12 | 1.017 | |
| 52 | 49042 | 529 | 1680 | F | - | 1.135 | No otoliths collected |
| 53 | 49032 | 507 | 1340 | M | 14 | 1.028 | |
| 54 | 49025 | 643 | 2700 | M | 20 | 1.016 | |
| 55 | 48994 | 491 | 1280 | F | 11 | 1.081 | |
| 56 | 49027 | 556 | 2110 | F | 12 | 1.228 | |
| 57 | 49024 | 545 | 1840 | F | 13 | 1.137 | |
| 58 | 49011 | 673 | 3200 | M | 16 | 1.050 | |
| 59 | 48983 | 367 | 490 | F | - | 0.991 | Otoliths unreadable |
| 60 | 48984 | 429 | 890 | F | 10 | 1.127 | |
| 61 | 49043 | 530 | 1590 | M | - | 1.068 | No otoliths collected |
| 62 | 49012 | 707 | 3670 | M | 18 | 1.039 | |
| 63 | 49010 | 623 | 2770 | F | 17 | 1.146 | |
| 64 | 49009 | 485 | 1370 | F | 13 | 1.201 | |
| 65 | 49035 | 594 | 2220 | M | 12 | 1.059 | |
| 66 | 49017 | 267 | 180 | U | 7 | 0.946 | |
| 67 | 48968 | 450 | 960 | F | 12 | 1.053 | |
| 68 | 49026 | 449 | 840 | F | 12 | 0.928 | |
| 69 | 48960 | 605 | 2340 | M | 12 | 1.057 | |
| 70 | 48976 | 377 | 580 | F | 10 | 1.082 | |
| 71 | 48955 | 761 | 4320 | M | 19 | 0.980 | |
| 72 | 48997 | 370 | 490 | U | 10 | 0.967 | |
| 73 | 48964 | 406 | 690 | M | 8 | 1.031 | |
| 74 | 49044 | 589 | 1690 | M | - | 0.827 | No otoliths collected |
| 75 | 48961 | 440 | 770 | M | - | 0.904 | Otoliths unreadable |
| 76 | 48967 | 412 | 710 | M | 11 | 1.015 | |
| 77 | 48966 | 595 | 2260 | F | 17 | 1.073 | |
| 78 | 48954 | 622 | 2140 | F | 15 | 0.889 | |
| 79 | 48974 | 477 | 1180 | F | 12 | 1.087 | |
| 80 | 48957 | 582 | 1890 | M | 12 | 0.959 | |
| 81 | 48985 | 532 | 1490 | M | 11 | 0.990 | |
| 82 | 48977 | 422 | 640 | F | 9 | 0.852 | |
| 83 | 48973 | 503 | 1250 | M | 11 | 0.982 | |
| 84 | 48963 | 511 | 1380 | F | 15 | 1.034 | |
| 85 | 48978 | 478 | 1080 | M | 12 | 0.989 | |
| 86 | 48971 | 525 | 1560 | F | 13 | 1.078 | |
| 87 | 48949 | 584 | 2310 | M | 12 | 1.160 | |
| 88 | 48959 | 450 | 680 | M | 11 | 0.746 | |
| 89 | 48951 | 631 | 2710 | M | 14 | 1.079 | |
| 90 | 49045 | 579 | 2190 | F | - | 1.128 | No otoliths collected |
| 91 | 48962 | 412 | 640 | M | 9 | 0.915 | |
| 92 | 48958 | 516 | 1400 | F | 11 | 1.019 | |
| 93 | 48956 | 624 | 2580 | M | 14 | 1.062 | |

Appendix 2. Continued.

| Field Sample No. | Laboratory Processing No. | Fork Length (mm) | Weight (g) | Sex | Age (yr+) | Condition Factor (K) | Comments |
|---|---|---|---|---|---|---|---|
| 94 | 48947 | 561 | 2050 | F | 13 | 1.161 | |
| 95 | 48982 | 676 | 3260 | M | 21 | 1.055 | |
| 96 | 48970 | 389 | 560 | M | 7 | 0.951 | |
| 97 | 48965 | 486 | 1140 | M | 13 | 0.993 | |
| 98 | 48969 | 445 | 1040 | M | 12 | 1.180 | |
| 99 | 48981 | 650 | 3780 | F | 15 | 1.012 | |
| 100 | 49046 | 479 | 1180 | M | - | 1.074 | No otoliths collected |

Appendix 3. Field sample and laboratory processing numbers, fork lengths, weights, sex, otolith ages, and condition factors for Arctic char captured in Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 22-24, 2004.

| Field Sample No. | Fork Length (mm) | Weight (g) | Sex | Age (yr+) | Condition Factor (K) | Comments |
|---|---|---|---|---|---|---|
| 1 | 640 | 3200 | F | 14 | 1.221 | |
| 2 | 408 | 600 | M | - | 0.883 | No otoliths collected |
| 3 | 590 | 2650 | M | - | 1.290 | No otoliths collected |
| 4 | 569 | 1900 | M | - | 1.031 | No otoliths collected |
| 5 | 598 | 2200 | F | 15 | 1.029 | |
| 6 | 568 | 2200 | - | - | 1.201 | No otoliths collected |
| 7 | 673 | 3000 | F | - | 0.984 | No otoliths collected |
| 8 | 528 | 1500 | - | - | 1.019 | No otoliths collected |
| 9 | 472 | 1000 | F | - | 0.951 | No otoliths collected |
| 10 | 601 | 2500 | - | - | 1.152 | No otoliths collected |
| 11 | 528 | 1500 | - | - | 1.019 | No otoliths collected |
| 12 | 549 | 1750 | - | - | 1.058 | No otoliths collected |
| 13 | 618 | 2500 | - | - | 1.059 | No otoliths collected |
| 14 | 408 | 565 | F | - | 0.832 | No otoliths collected |
| 15 | 416 | 650 | - | 9 | 0.903 | |
| 16 | 636 | 3200 | - | - | 1.244 | No otoliths collected |
| 17 | 450 | 1000 | - | - | 1.097 | No otoliths collected |
| 18 | 275 | 200 | - | - | 0.962 | No otoliths collected |
| 19 | 328 | 300 | - | - | 0.850 | No otoliths collected |
| 20 | 329 | 350 | - | - | 0.983 | No otoliths collected |
| 21 | 481 | 1200 | F | - | 1.078 | No otoliths collected |
| 22 | 363 | 500 | M | 10 | 1.045 | |
| 23 | 549 | 1750 | - | - | 1.058 | No otoliths collected |
| 24 | 414 | 750 | - | - | 1.057 | No otoliths collected |
| 25 | 359 | 450 | - | - | 0.973 | No otoliths collected |
| 26 | 500 | 1350 | F | 11 | 1.080 | |
| 27 | 373 | 500 | - | - | 0.963 | No otoliths collected |
| 28 | 233 | 100 | M | 5 | 0.791 | |
| 29 | 554 | 1600 | F | 14 | 0.941 | |
| 30 | 556 | 1900 | - | - | 1.105 | No otoliths collected |
| 31 | 291 | 250 | - | - | 1.015 | No otoliths collected |
| 32 | 389 | 500 | F | 9 | 0.849 | |
| 33 | 413 | 780 | - | - | 1.107 | No otoliths collected |
| 34 | 359 | 450 | M | 10 | 0.973 | |
| 35 | 514 | 1550 | - | - | 1.141 | No otoliths collected |
| 36 | 541 | 1750 | - | - | 1.105 | No otoliths collected |
| 37 | 515 | 1600 | - | - | 1.171 | No otoliths collected |
| 38 | 605 | 2650 | M | - | 1.197 | No otoliths collected |
| 39 | 656 | 3350 | M | - | 1.187 | No otoliths collected |
| 40 | 649 | 3350 | M | - | 1.225 | No otoliths collected |
| 41 | 648 | 3100 | M | - | 1.139 | No otoliths collected |
| 42 | 593 | 2300 | F | 16 | 1.103 | |
| 43 | 546 | 1900 | F | - | 1.167 | No otoliths collected |
| 44 | 599 | 2500 | F | 17 | 1.163 | |
| 45 | 676 | 3950 | M | 14 | 1.279 | |

Appendix 3. Continued.

| Field Sample No. | Fork Length (mm) | Weight (g) | Sex | Age (yr+) | Condition Factor (K) | Comments |
|---|---|---|---|---|---|---|
| 46 | 600 | 1800 | F | 14 | 0.833 | |
| 47 | 624 | - | M | 12 | - | |
| 48 | 680 | 3500 | M | 15 | 1.113 | |
| 49 | 558 | 1400 | F | 17 | 0.806 | |
| 50 | 655 | 3500 | F | 16 | 1.246 | |
| 51 | 635 | 2800 | M | 13 | 1.094 | |
| 52 | 605 | 2550 | - | 14 | 1.152 | |
| 53 | 606 | 2400 | F | - | 1.078 | No otoliths collected |
| 54 | 558 | 2000 | M | 13 | 1.151 | |
| 55 | 757 | 4450 | M | 20 | 1.026 | |
| 56 | 658 | 3100 | M | 21 | 1.088 | |
| 57 | 720 | 3400 | M | 19 | 0.911 | |
| 58 | 654 | 2800 | M | 17 | 1.001 | |
| 59 | 554 | 1900 | M | 13 | 1.117 | |
| 60 | 428 | 750 | F | 10 | 0.957 | |
| 61 | 315 | 250 | M | 9 | 0.800 | |
| 62 | 560 | 2250 | F | 19 | 1.281 | |
| 63 | 690 | 3900 | - | - | 1.187 | No otoliths collected |
| 64 | 691 | 3600 | - | - | 1.091 | No otoliths collected |
| 65 | 436 | 850 | M | 9 | 1.026 | |
| 66 | 685 | 3700 | - | - | 1.151 | No otoliths collected |
| 67 | 576 | 2050 | - | - | 1.073 | No otoliths collected |
| 68 | 575 | 2400 | M | 13 | 1.262 | |
| 69 | 679 | 3900 | M | 14 | 1.246 | |
| 70 | 539 | 1350 | - | - | 0.862 | No otoliths collected |
| 71 | 568 | 2100 | - | - | 1.146 | No otoliths collected |
| 72 | 565 | 1800 | - | - | 0.998 | No otoliths collected |
| 73 | 342 | 400 | F | 13 | 1.000 | |
| 74 | 475 | 1100 | M | - | 1.026 | No otoliths collected |
| 75 | 589 | 2450 | M | 14 | 1.199 | Otoliths unreadable |
| 76 | 647 | 3100 | M | 15 | 1.145 | |
| 77 | 647 | 3200 | - | - | 1.182 | No otoliths collected |
| 78 | 540 | 1700 | - | - | 1.080 | No otoliths collected |
| 79 | 555 | 2000 | - | - | 1.170 | No otoliths collected |
| 80 | 668 | 3300 | - | - | 1.107 | No otoliths collected |
| 81 | 607 | 2500 | - | - | 1.118 | No otoliths collected |
| 82 | 554 | 1650 | - | - | 0.970 | No otoliths collected |
| 83 | 614 | 2700 | - | - | 1.166 | No otoliths collected |
| 84 | 294 | 200 | F | - | 0.787 | No otoliths collected |
| N1 | 578 | 2000 | F | 20 | 1.036 | |
| N2 | 596 | 2600 | M | - | 1.228 | No otoliths collected |
| N3 | 592 | 2300 | F | 13 | 1.109 | |
| N4 | 531 | 1700 | F | 13 | 1.135 | |
| N5 | 587 | 2200 | M | 13 | 1.088 | |
| N6 | 587 | 2400 | F | 17 | 1.187 | |
| N7 | 627 | 2800 | M | 14 | 1.136 | |
| N8 | 561 | 1900 | F | 14 | 1.076 | |
| N9 | 730 | 4500 | M | 19 | 1.157 | |

Appendix 3. Continued.

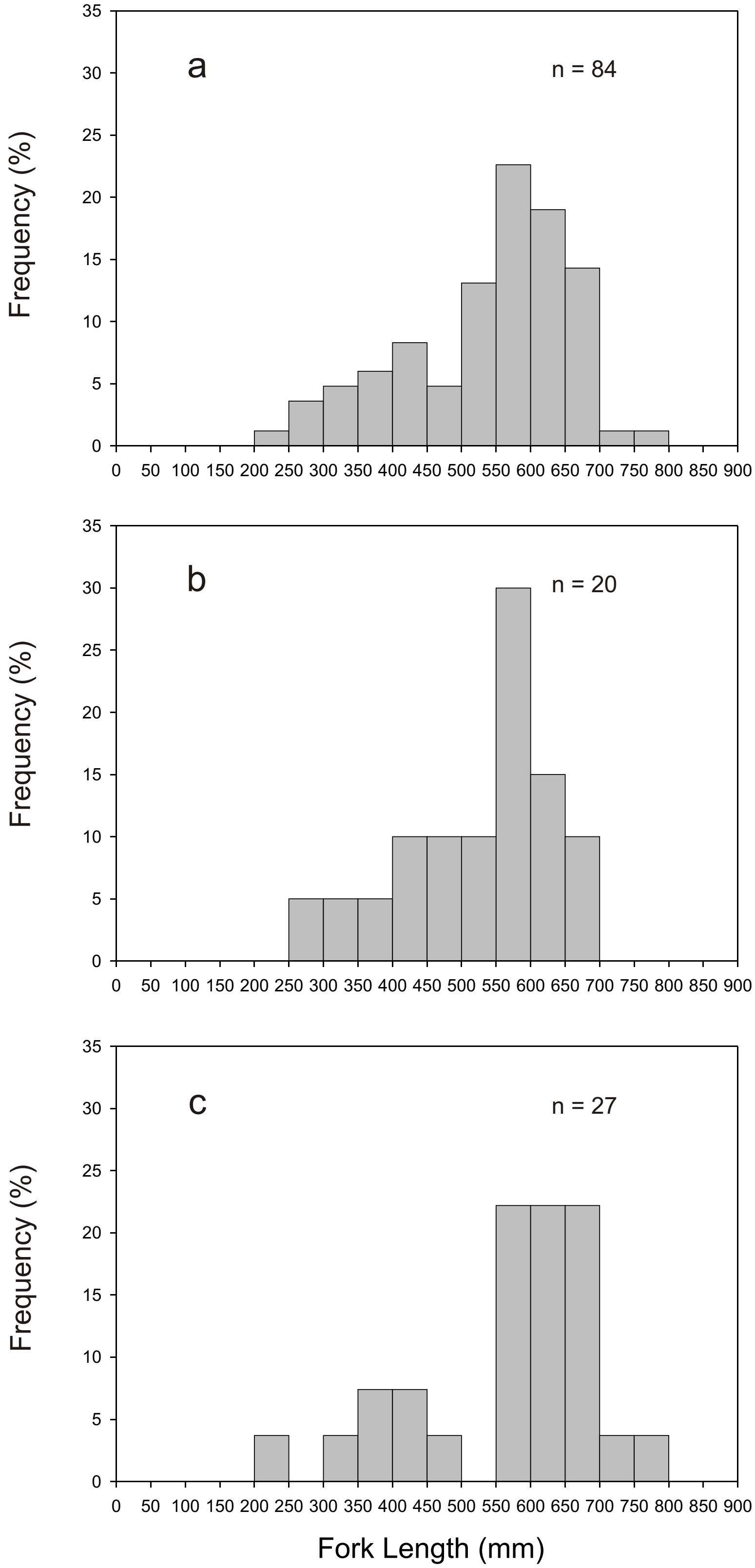
| Field Sample No. | Fork Length (mm) | Weight (g) | Sex | Age (yr+) | Condition Factor (K) | Comments |
|---|---|---|---|---|---|---|
| N10 | 608 | 2800 | M | 16 | 1.246 | |
| N11 | 553 | 2250 | F | 13 | 1.330 | |
| N12 | 530 | 1750 | - | 13 | 1.175 | |
| N13 | 556 | 2050 | M | 14 | 1.193 | |
| N14 | 526 | 1900 | - | 15 | 1.306 | |
| N15 | 627 | 3100 | M | 14 | 1.258 | |
| N16 | 405 | 650 | M | 9 | 0.978 | |
| N17 | 607 | 2350 | M | 13 | 1.051 | |
| N18 | 215 | 100 | M | 24 | 1.006 | |
| N19 | 658 | 3100 | M | - | 1.088 | Otoliths unreadable |
| N20 | 656 | 2900 | M | 16 | 1.027 | |
| N21 | 622 | 2700 | M | 14 | 1.122 | |
| N22 | 548 | 1900 | - | 18 | 1.155 | |
| N23 | 617 | 2750 | F | 15 | 1.171 | |
| N24 | 624 | - | F | 18 | - | |

Appendix 4. Biological data by length interval for Arctic char angled at Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 25-27, 2002.

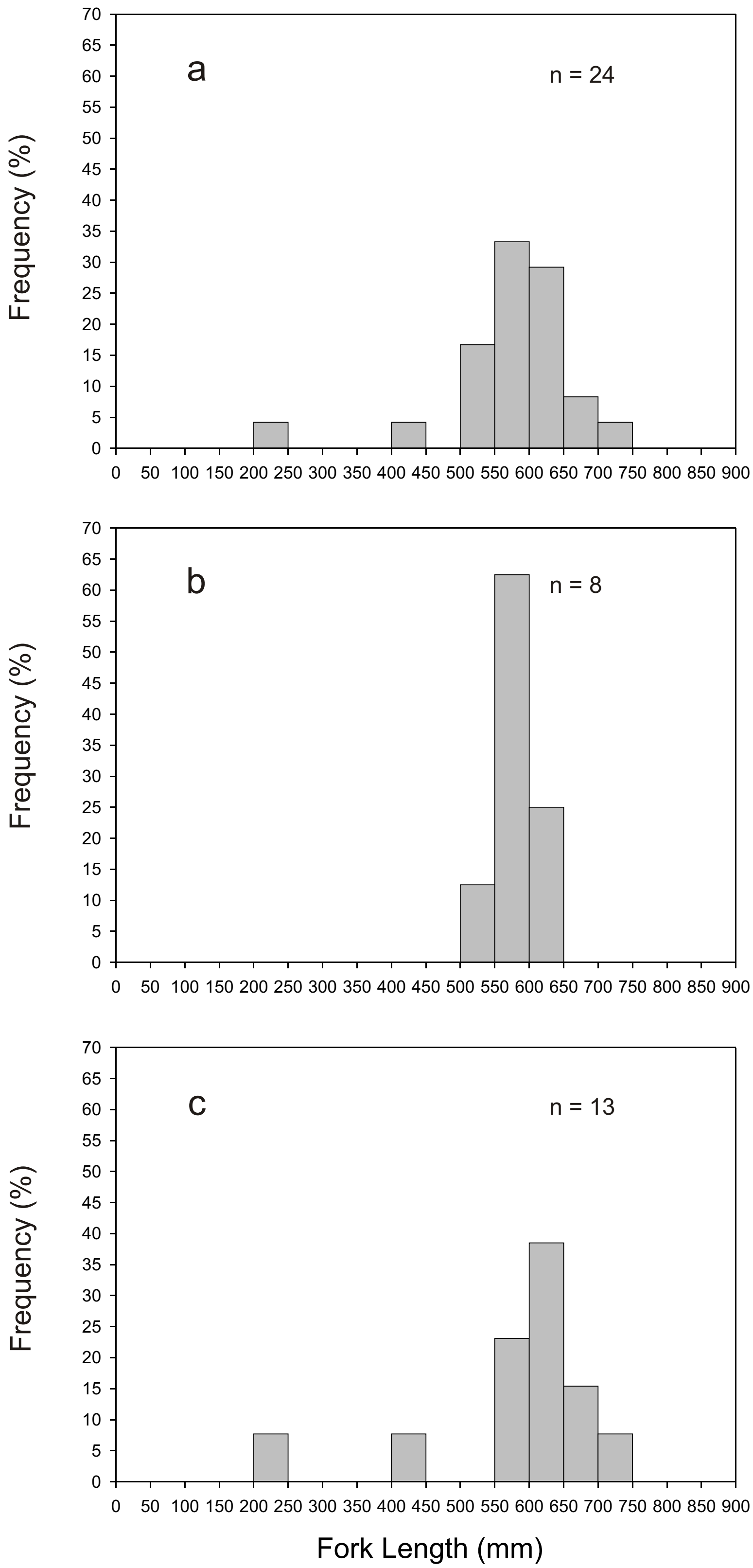
| Length Interval (mm) | Males | | | | | | Females | | | | | | All Fish | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length (mm) | | Weight (g) | | | | Length (mm) | | Weight (g) | | | | Length (mm) | | Weight (g) | | |
| | N | Mean | SD | Mean | SD | K | N | Mean | SD | Mean | SD | K | N | Mean | SD | Mean | SD | K |
| 150 | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 193 | - | 60 | - | 0.83 |
| 200 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 250 | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 267 | - | 180 | - | 0.95 |
| 300 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 350 | 2 | 376 | 18 | 525 | 49 | 0.99 | 3 | 381 | 16 | 563 | 67 | 1.02 | 6 | 377 | 14 | 538 | 56 | 1.00 |
| 400 | 9 | 429 | 15 | 779 | 123 | 0.99 | 6 | 434 | 14 | 820 | 104 | 1.00 | 15 | 431 | 14 | 795 | 114 | 0.99 |
| 450 | 7 | 479 | 14 | 1113 | 203 | 1.01 | 9 | 472 | 19 | 1147 | 177 | 1.09 | 16 | 475 | 17 | 1132 | 183 | 1.06 |
| 500 | 5 | 523 | 17 | 1494 | 216 | 1.04 | 19 | 521 | 14 | 1489 | 183 | 1.05 | 24 | 521 | 14 | 1490 | 185 | 1.05 |
| 550 | 7 | 583 | 12 | 1963 | 229 | 0.99 | 13 | 574 | 15 | 2006 | 246 | 1.06 | 20 | 577 | 14 | 1991 | 235 | 1.04 |
| 600 | 5 | 625 | 14 | 2584 | 149 | 1.06 | 4 | 624 | 13 | 2533 | 340 | 1.04 | 9 | 624 | 13 | 2561 | 235 | 1.05 |
| 650 | 3 | 676 | 3 | 3303 | 131 | 1.07 | 1 | 650 | - | 3780 | - | 1.38 | 4 | 669 | 13 | 3423 | 261 | 1.14 |
| 700 | 3 | 723 | 20 | 3660 | 455 | 0.97 | - | - | - | - | - | - | 3 | 723 | 20 | 3660 | 455 | 0.97 |
| 750 | 1 | 761 | - | 4320 | - | 0.98 | - | - | - | - | - | - | 1 | 761 | - | 4320 | - | 0.98 |
| Total | 42 | | | | | | 55 | | | | | | 100 | | | | | |
| Mean | | 541 | 105 | 1790 | 1043 | 1.01 | | 518 | 65 | 1549 | 626 | 1.06 | | 521 | 95 | 1611 | 859 | 1.03 |

Appendix 5. Biological data by length interval for Arctic char captured at Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 22-24, 2004.

| Length Interval | Males | | | | | | Females | | | | | | All Fish | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length (mm) | | Weight (g) | | | | Length (mm) | | Weight (g) | | | | Length (mm) | | Weight (g) | | |
| (mm) | N | Mean | SD | Mean | SD | K | N | Mean | SD | Mean | SD | K | N | Mean | SD | Mean | SD | K |
| 200 | 2 | 224 | 13 | 100 | 0 | 0.90 | - | - | - | - | - | - | 2 | 224 | 13 | 100 | 0 | 0.90 |
| 250 | - | - | - | - | - | - | 1 | 294 | - | 200 | - | 0.79 | 3 | 287 | 10 | 217 | 29 | 0.92 |
| 300 | 1 | 315 | - | 250 | - | 0.80 | 1 | 342 | - | 400 | - | 1.00 | 4 | 329 | 11 | 325 | 65 | 0.91 |
| 350 | 2 | 361 | 3 | 475 | 35 | 1.01 | 1 | 389 | - | 500 | - | 0.85 | 5 | 369 | 13 | 480 | 27 | 0.96 |
| 400 | 3 | 416 | 17 | 700 | 132 | 0.96 | 2 | 418 | 14 | 658 | 131 | 0.89 | 8 | 416 | 11 | 699 | 98 | 0.97 |
| 450 | 1 | 475 | - | 1100 | - | 1.03 | 2 | 477 | 6 | 1100 | 141 | 1.01 | 4 | 470 | 14 | 1075 | 96 | 1.04 |
| 500 | - | - | - | - | - | - | 3 | 526 | 23 | 1650 | 278 | 1.13 | 15 | 532 | 14 | 1663 | 183 | 1.10 |
| 550 | 9 | 575 | 16 | 2239 | 295 | 1.17 | 11 | 576 | 19 | 2100 | 343 | 1.10 | 27 | 572 | 16 | 2109 | 304 | 1.12 |
| 600 | 11 | 627 | 16 | 2875 | 289 | 1.16 | 5 | 617 | 16 | 2538 | 591 | 1.08 | 23 | 622 | 16 | 2764 | 372 | 1.14 |
| 650 | 8 | 665 | 11 | 3325 | 433 | 1.13 | 2 | 664 | 13 | 3250 | 354 | 1.11 | 14 | 670 | 14 | 3400 | 384 | 1.13 |
| 700 | 2 | 725 | 7 | 3950 | 778 | 1.03 | - | - | - | - | - | - | 2 | 725 | 7 | 3850 | 778 | 1.03 |
| 750 | 1 | 757 | - | 4450 | - | 1.03 | - | - | - | - | - | - | 1 | 757 | - | 4450 | - | 1.03 |
| Total | 40 | | | | | | 28 | | | | | | 108 | | | | | |
| Mean | | 570 | 131 | 2371 | 1200 | 1.10 | | 541 | 95 | 1826 | 872 | 1.05 | | 546 | 115 | 2022 | 1069 | 1.08 |




Appendix 6. Length-frequency distributions for Arctic char (a) all fish, (b) females and (c) males angled from Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2004.



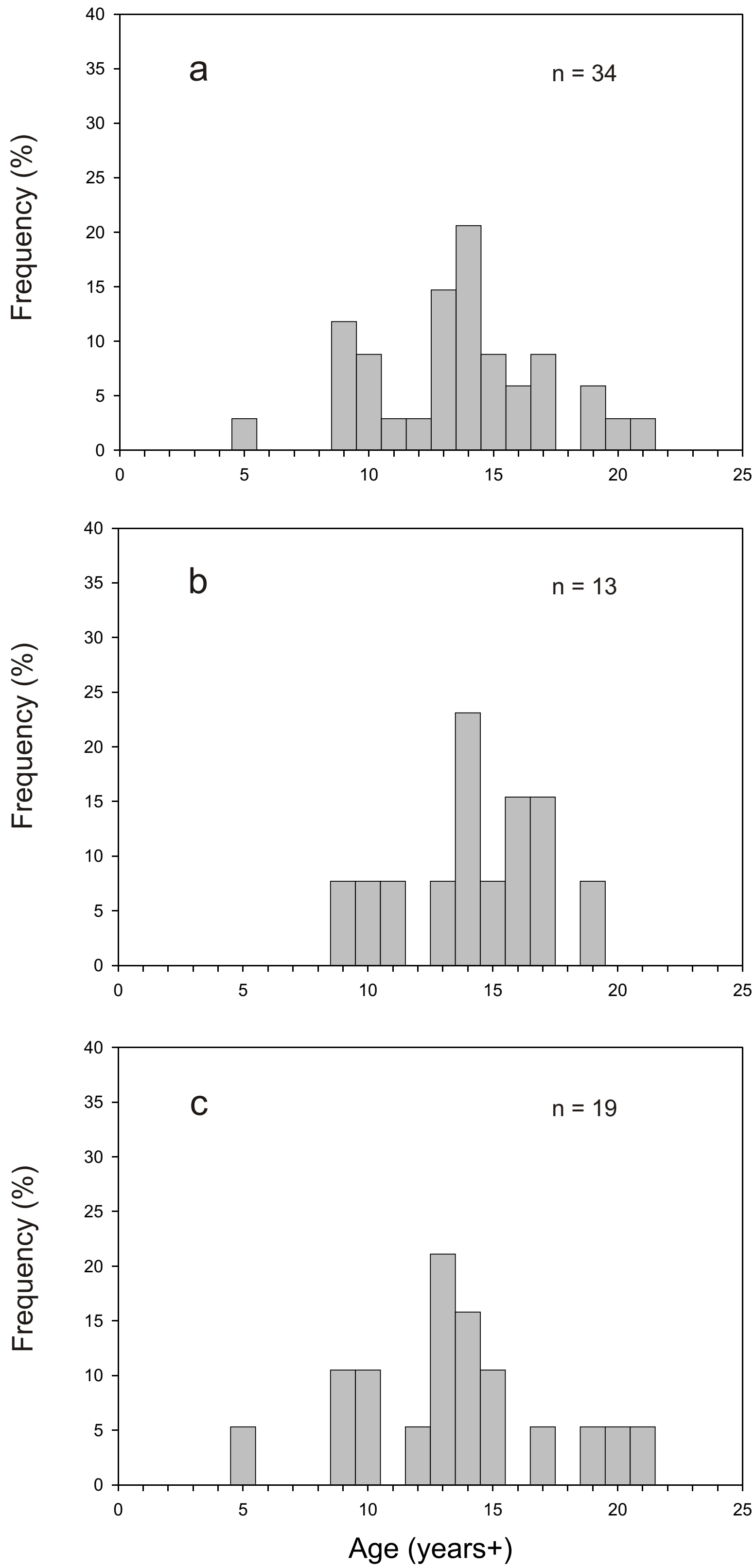

Appendix 7. Length-frequency distributions for Arctic char (a) all fish, (b) females and (c) males gillnetted from Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2004.

Appendix 8. Biological data by age group for Arctic char angled at Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 25-27, 2002.

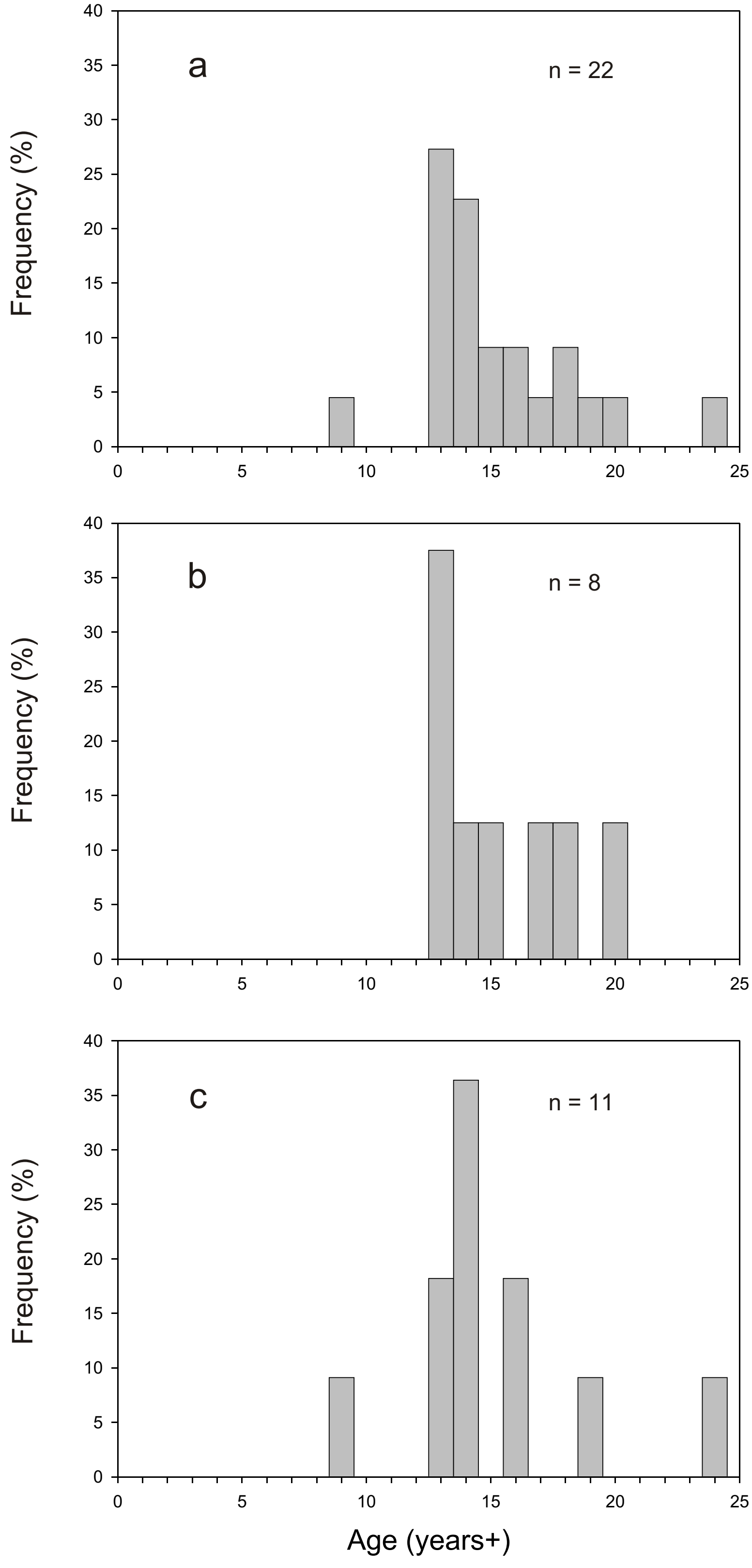
| Age | Males | | | | | | Females | | | | | | All Fish | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length (mm) | | Weight (g) | | | | Length (mm) | | Weight (g) | | | | Length (mm) | | Weight (g) | | |
| (yr+) | N | Mean | SD | Mean | SD | K | N | Mean | SD | Mean | SD | K | N | Mean | SD | Mean | SD | K |
| 6 | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 193 | - | 60 | - | 0.83 |
| 7 | 1 | 389 | - | 560 | - | 0.95 | - | - | - | - | - | - | 2 | 328 | 86 | 370 | 269 | 1.05 |
| 8 | 1 | 406 | - | 690 | - | 1.03 | - | - | - | - | - | - | 1 | 406 | - | 690 | - | 1.03 |
| 9 | 2 | 425 | 18 | 675 | 49 | 0.88 | 2 | 437 | 21 | 735 | 134 | 0.88 | 4 | 431 | 18 | 705 | 90 | 0.88 |
| 10 | 3 | 412 | 43 | 733 | 214 | 1.05 | 3 | 434 | 60 | 937 | 382 | 1.15 | 7 | 416 | 48 | 786 | 302 | 1.09 |
| 11 | 4 | 474 | 54 | 1033 | 402 | 0.97 | 6 | 491 | 35 | 1235 | 238 | 1.04 | 10 | 484 | 41 | 1154 | 310 | 1.02 |
| 12 | 11 | 530 | 65 | 1624 | 555 | 1.09 | 14 | 494 | 43 | 1330 | 388 | 1.10 | 25 | 510 | 55 | 1459 | 492 | 1.10 |
| 13 | 3 | 542 | 50 | 1590 | 392 | 1.00 | 10 | 536 | 28 | 1634 | 323 | 1.06 | 13 | 537 | 32 | 1624 | 323 | 1.05 |
| 14 | 3 | 587 | 70 | 2210 | 756 | 1.09 | 3 | 531 | 80 | 1730 | 651 | 1.16 | 6 | 549 | 74 | 1970 | 684 | 1.19 |
| 15 | 1 | 622 | - | 2590 | - | 1.08 | 4 | 588 | 62 | 2345 | 1017 | 1.15 | 5 | 594 | 56 | 2394 | 888 | 1.14 |
| 16 | 1 | 673 | - | 3200 | - | 1.05 | 2 | 590 | 13 | 1845 | 573 | 0.90 | 3 | 617 | 49 | 2297 | 881 | 0.98 |
| 17 | 1 | 716 | - | 4110 | - | 1.12 | 3 | 593 | 31 | 2303 | 447 | 1.10 | 4 | 624 | 67 | 2755 | 974 | 1.13 |
| 18 | 1 | 707 | - | 3670 | - | 1.04 | - | - | - | - | - | - | 1 | 707 | - | 3670 | - | 1.04 |
| 19 | 1 | 761 | - | 4320 | - | 0.98 | - | - | - | - | - | - | 1 | 761 | - | 4320 | - | 0.98 |
| 20 | 1 | 643 | - | 2700 | - | 1.02 | - | - | - | - | - | - | 1 | 643 | - | 2700 | - | 1.02 |
| 21 | 2 | 711 | 49 | 3230 | 42 | 0.90 | - | - | - | - | - | - | 2 | 711 | 49 | 3230 | 42 | 0.90 |
| Total | 36 | | | | | | 47 | | | | | | 86 | | | | | |
| Mean | | 543 | 109 | 1812 | 1070 | 1.13 | | 517 | 60 | 1528 | 598 | 1.11 | | 519 | 97 | 1602 | 868 | 1.15 |
| Mean Age | | | | 13.0 | | | | | | 12.7 | | | | | | 12.6 | | |

Appendix 9. Biological data by age group for Arctic char captured at Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 22-24, 2004.

| Age | Males | | | | | | Females | | | | | | All Fish | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length (mm) | | Weight (g) | | | | Length (mm) | | Weight (g) | | | | Length (mm) | | Weight (g) | | |
| (yr+) | N | Mean | SD | Mean | SD | K | N | Mean | SD | Mean | SD | K | N | Mean | SD | Mean | SD | K |
| 5 | 1 | 233 | - | 100 | - | 0.79 | - | - | - | - | - | - | 1 | 233 | - | 100 | - | 0.79 |
| 6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 8 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 9 | 3 | 385 | 63 | 583 | 306 | 0.93 | 1 | 389 | | 500 | | 0.85 | 5 | 392 | 46 | 580 | 222 | 0.91 |
| 10 | 2 | 361 | 3 | 475 | 35 | 1.01 | 1 | 428 | | 750 | | 0.96 | 3 | 383 | 39 | 567 | 161 | 0.99 |
| 11 | - | - | - | - | - | - | 1 | 500 | | 1350 | | 1.08 | 1 | 500 | - | 1350 | - | 1.08 |
| 12 | 1 | 624 | - | - | - | - | - | - | - | - | - | - | 1 | 624 | - | - | - | - |
| 13 | 6 | 586 | 31 | 2275 | 322 | 1.13 | 4 | 505 | 111 | 1663 | 884 | 1.14 | 11 | 551 | 76 | 2005 | 619 | 1.14 |
| 14 | 7 | 625 | 44 | 2993 | 714 | 1.20 | 4 | 589 | 40 | 2125 | 727 | 1.02 | 12 | 611 | 42 | 2667 | 773 | 1.14 |
| 15 | 2 | 664 | 23 | 3300 | 283 | 1.13 | 2 | 608 | 13 | 2475 | 389 | 1.10 | 5 | 614 | 58 | 2690 | 650 | 1.15 |
| 16 | 2 | 632 | 34 | 2850 | 71 | 1.14 | 2 | 624 | 44 | 2900 | 849 | 1.17 | 4 | 628 | 32 | 2875 | 492 | 1.16 |
| 17 | 1 | 654 | - | 2800 | - | 1.00 | 3 | 581 | 21 | 2100 | 608 | 1.05 | 4 | 600 | 40 | 2275 | 608 | 1.04 |
| 18 | - | - | - | - | - | - | 1 | 624 | - | - | - | - | 2 | 586 | 54 | 1900 | - | 1.15 |
| 19 | 2 | 725 | 7 | 3950 | 778 | 1.03 | 1 | 560 | - | 2250 | - | 1.28 | 3 | 670 | 95 | 3383 | 1125 | 1.12 |
| 20 | 1 | 757 | - | 4450 | - | 1.03 | 1 | 578 | - | 2000 | - | 1.04 | 2 | 668 | 127 | 3225 | 1732 | 1.03 |
| 21 | 1 | 658 | - | 3100 | - | 1.09 | - | - | - | - | - | - | 1 | 658 | - | 3100 | - | 1.09 |
| 22 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 23 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 24 | 1 | 215 | - | 100 | - | 1.01 | - | - | - | - | - | - | 1 | 215 | - | 100 | - | 1.01 |
| Total | 30 | | | | | | 21 | | | | | | 56 | | | | | |
| Mean | | 565 | 144 | 2347 | 1289 | 1.09 | | 555 | 80 | 1953 | 808 | 1.08 | | 558 | 117 | 2145 | 1095 | 1.09 |
| Mean Age | | | | 14.1 | | | | | | 14.7 | | | | | | 14.3 | | |




Appendix 10. Age-frequency distributions for Arctic char (a) all fish, (b) females and (c) males angled from Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2004.




Appendix 11. Age-frequency distributions for Arctic char (a) all fish, (b) females and (c) males gillnetted from Nalusiaq Lake, Auyuittuq National Park, Nunavut, May 2004.