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Review and status of north Labrador Arctic charr, *Salvelinus alpinus*

Examen et état de la population d'omble chevalier du nord du Labrador, *Salvelinus alpinus*

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Abstract

Catch, effort, and biological characteristic data from the north Labrador anadromous Arctic charr (*Salvelinus alpinus*) fishery are summarized along with a review of environmental conditions and various attributes associated with the ecology of Arctic charr in the north Labrador region. Catch- and weight-at-age data for each of the Voisey, Nain, and Okak stock complexes are updated to 2003, along with information on trends in age and weight. In addition, a revised summary of all tag return information is provided while a graphical overview of recent food and feeding results is presented for the Voisey and Nain stock complexes. Commercial landings of anadromous Arctic charr over the past 30 years (1974 – 2003) totaled 2748 tonnes, or approximately 6.1 million pounds. Of this total, 77% (2116) was harvested from three primary stock complexes (Voisey, Nain, and Okak) and illustrates the overall capacity of the north coast region to support charr fisheries. Major information gaps currently relate to a lack of specific abundance data on local stocks of charr and incomplete statistics associated with the amount of charr harvested on an annual basis in subsistence or food fisheries.

Résumé

La présente comprend un résumé des données sur les captures, l'effort et les caractéristiques biologiques recueillies dans le cadre de la pêche de l'omble chevalier anadrome du nord du Labrador (*Salvelinus alpinus*) et de l'examen des conditions du milieu et des divers attributs associés à l'écologie de l'omble chevalier dans la région du nord du Labrador. Les données sur les captures et le poids selon l'âge dans chacun des complexes de stocks de Voisey, Nain et Okak sont mises à jour en date de 2003, de même que l'information sur les tendances de l'âge et du poids. De plus, un sommaire révisé de toutes les étiquettes retournées est présenté, et un graphique donne un aperçu des résultats récents en matière d'aliments et d'alimentation pour les complexes de stocks de Voisey et de Nain. Les débarquements commerciaux d'omble chevalier anadrome des 30 dernières années (1974-2003) s'élèvent à 2 748 tonnes, c'est-à-dire environ 6,1 millions de livres. Sur ces débarquements, 77 % (2 116 tonnes) des individus ont été récoltés dans les trois complexes de stocks principaux (Voisey, Nain et Okak), ce qui reflète la capacité globale de la région de la côte nord de soutenir la pêche de l'omble chevalier. À l'heure actuelle, des lacunes importantes dans l'information sont associées à un manque de données précises sur l'abondance des stocks d'omble locaux et à des statistiques incomplètes concernant la quantité d'omble récoltée chaque année dans le cadre de pêches de subsistance ou alimentaires.

Introduction

Arctic charr, *Salvelinus alpinus*, have been of cultural, subsistence, and commercial importance to the Inuit of northern Labrador for generations. Historical and subsistence use were well documented by Brice-Bennett (1977) and a more recent summary was provided by Williamson (1997). Commercial fisheries for north Labrador charr are believed to date from the 1860s (Coady 1974; Coady and Best 1976; MacCrimmon and Gots 1980; LeDrew 1984), with exports in excess of 50 t occurring by the late 1880s. Information on early landings is sporadic, but continuous records of commercial production are available since 1944 (Coady and Best 1976). Detailed information on catch, effort and biological characteristics of stocks from the Nain Fishing Region, which extends northward from the Voisey-Antons area, exist since 1974. Historically, the north Labrador charr fishery was one of the largest, single fisheries for anadromous charr in the world with landings in excess of 200 t in some years (Dempson 1995). Most of the harvest from the Nain Fishing Region occurred along a limited 160 km extent of the north coast, from the Antons-Voisey's Bay area (56°15'N) to Okak Bay (57°28'N) (Figure 1). To place this in perspective, most other commercial anadromous charr fisheries in the Canadian Arctic (e.g. Rankin Inlet, Baffin Region, Cambridge Bay) had, with few exceptions, annual harvests of generally less than 60 t (Yaremchuk et al. 1989).

Biological characteristics of Arctic charr caught in the north Labrador fishery were first obtained in 1953 when charr from Adlatok, Nain, Okak, Hebron and Ramah were sampled (Andrews and Lear 1956). A brief description of the fishery, along with additional samples, were later summarized by Hunter (1964) while Dyke (1967) provided an overview of various aspects associated with how the commercial fishery was prosecuted.

As the north Labrador commercial fishery expanded during the late 1970s and early 1980s, relatively little information was known concerning the life history and ecology of the species in this region. Indeed, as acknowledged by Coady (1974) there was a basic lack of understanding of the resource to be managed. Hence over the ensuing years various investigations were carried out to rectify this situation. Investigations included, but were not limited to:

- morphological variation and stock identification (Dempson 1984a; Dempson and Misra 1984);
- general life history and ecology (Dempson and Green 1985; Dempson 1993; Klemetsen et al. 2003);
- distribution, homing, ocean migration patterns, and sea age at first migration (Black and Dempson 1986; Black et al. 1986; Dempson and Kristofferson 1987; Radtke et al. 1998);
- genetic investigations (Dempson et al. 1988; Bernatchez et al. 1998);
- freezing resistance of Arctic charr and other salmonids (Fletcher et al. 1988);
- parasite infection of freshwater resident and anadromous charr (Bouillon and Dempson 1989);
- natural hybridization among Labrador *Salvelinus* species (Hammar et al. 1989; Hammar et al. 1991);

- population structure, age and growth of lacustrine (lake) populations (Hammar and Filipsson 1985; Hammar 1998).

A series of three additional studies investigated in detail the stock dynamics and long term effects of exploitation (Dempson 1995), climate and environmental influences on regulating the dynamics of populations (Power et al. 2000), and the spatial and temporal variability in food and feeding among local stocks of north Labrador charr (Dempson et al. 2002). All were instrumental in providing insight into understanding the observed changes in some of the characteristic of charr from the north Labrador region.

Despite the wealth of information compiled on the life history and ecology of north Labrador charr, one major deficiency relates to the lack of information on abundance in local rivers that support commercial and subsistence fisheries. Historically, only two studies have focused on changes in abundance in north Labrador rivers that fall with the Nain Fishing Region: Fraser River (Nain Bay) was monitored from 1975-1979 (Dempson and Green 1985), while runs to Ikarut River (Hebron Fiord) were surveyed from 1981-1985 (Table 1). A small project was initiated in 1997 to enumerate Arctic charr migrating into Reid Brook, Voisey's Bay, as part of the environmental impact assessment related to the Voisey's Bay mine-mill development (Jacques Whitford 1997). In addition, there is virtually no information available to quantify harvest in local subsistence or recreational fisheries, particularly on a seasonal or annual basis (DFO 2001). In contrast, since 1999 Arctic charr have been enumerated at English River (54°58'N; 59°51'W), a small system in proximity to the community of Postville in the central coast region of Labrador (Reddin et al. 2000), while an attempt has been made to quantify, in part, some of the subsistence or food fisheries during the open water season in recent years (e.g. Reddin et al. 2002, 2004). Subsistence fisheries are important to the Inuit communities of Labrador just as they are to those in Nunavut (e.g. see Read 2000).

This document provides an overview of some of the general attributes associated with the ecology of Arctic charr in north Labrador, and updates previous information associated with the commercial fishery in a format similar to that presented in previous years and last compiled for the 2000 fishing season (Dempson and Shears 2001). Catch- and weight-at-age data for each of the Voisey, Nain, and Okak stock complexes are updated to 2003, along with information on trends in age and weight. In addition, a revised summary of all tag return information is provided while a graphical overview of recent food and feeding results is presented for the Voisey and Nain stock complexes.

Methods

Environment

Climatic conditions prevailing over the north Labrador region are largely influenced by the geographic position of Labrador, altitude, and the southward flowing cold Labrador current (Lopoukhine et al. 1978). The climate has been classified as 'subarctic' (Nutt and Coachman 1956) with a mean annual temperature of -3 °C and upwards of 900 mm of annual precipitation, 55% of which can occur as snow (Environment Canada Climate Normals 1971-2000). Permafrost is reported to be widespread along coastal margins but continuous in inland areas. Average daily air temperatures are typically below 0 °C from November through April, with summer temperatures averaging 10 to 11 °C during the months of July and August (Environment Canada Climate Normals 1971-2000). Freshwater areas can begin to freeze during the latter part of October and remain frozen until late April or early May. In contrast, sea ice forms in late November or early December with bays or fiords remaining ice covered until the following June. A summary of mean monthly climate data obtained at Nain, Labrador (56°33'N; 61°40'W) is provided in Table 2.

A summary of spatial and temporal oceanographic observations along the Nain Bank was compiled by Colbourne and Foote (1997). Charr, however, are primarily coastal or generally remain within various local bays and fiords. A characterization of the oceanographic features of specific areas frequented by charr during the ocean phase of their migrations (e.g. Nain Bay; Hebron Fiord) can be found in Nutt (1953), Nutt and Coachman (1956) and Nutt (1963). In some areas (e.g. Hebron Fiord), a high Arctic marine environment prevails throughout the year in lower depths of this fiord (Nutt and Coachman 1956). Specifically, water temperatures $\leq$ -1 °C prevail at all depths below 100 m within the fiord even during the summer and fall seasons, while in winter water temperatures of -1.75 °C are found at all levels (Nutt and Coachman 1956).

Since the mid-1980s, sea water temperatures (3 m depth) have been monitored during July and August at two locations in the general vicinity of Nain: an inshore station situated at Tikkoatokak Bay (56°41'N; 62°09'W), and an offshore station at Loon Island (56°35'N; 61°20'W), outside of Nain Bay in Harmony Run. Sea temperatures are slightly warmer in August than July at both Tikkoatokak Bay (July = 4.81 °C; August = 5.34 °C) and Loon Island (July = 3.31 °C; August = 4.60 °C) (Table 3). In general, the offshore Loon Island station is characterized by colder temperatures than that recorded within Tikkoatokak Bay. Particularly cold years at Tikkoatokak Bay were 1985, 1992, and 2002. Average monthly sea temperatures are generally in the range of 3 to 6 °C (Table 3).

Arctic charr commercial fishery

Traditionally, the north Labrador coast was partitioned into two charr fishing regions. The Nain Fishing Region extended north from the Antons-Voisey's Bay area. This region accounted for 80 to 90% of the commercial production of charr in northern Labrador. Hence this area has been the prime focus for research and assessment in north Labrador. The commercial fishery occurs at sea, often in traditional fishing berths, using shore-set multifilament gill nets with stretched mesh sizes of 114 and 127 mm.

Information on commercial landings from the Nain Fishing Region was obtained through purchase slips prepared by the Fishery Statistics Division of the Department of Fisheries and Oceans (DFO) and processed by Salmonids Section staff. Information contained on the purchase slips included: name of the fisherperson, licence number, area where the fish were caught, date, weight of fish landed, and number of fish caught. Landed gutted head-on catches were converted to round weight (in kilograms) using the conversion factor: gutted head-on weight x 1.22 = round weight (Dempson 1984b). Catch per unit effort estimates in this document, expressed in terms of kilograms per person-week fished, follow the traditional values used in past reports and were derived from the method initiated by Coady and Best (1976). Unstandardized values are included for comparative purposes with past reports.

A multiplicative model (Gavaris 1980) was also used to standardize catch rates for each stock complex, as well as separately for the Nain inshore and offshore fishing zones. The model followed that described by Dempson (1995) to account for differences among years and weeks using the following general linear model ($\log_e$ transformed):

$$Y_{ijk} = \mu + \alpha_i + \beta_j + \varepsilon_{ijk}$$

where, Y_{ijk} = the response variable, catch rate, α_i and β_j are class variables year and week, respectively, and ε_{ijk} is the error term. Standardized catch rates are for the period 1977 to 2003.

Commercial catch timing also followed the approach described by Dempson (1995) where timing of the fishery was determined by calculating the day-of-the-year for the 10^{th}, 25^{th}, 50^{th} (median), 75^{th}, and 90^{th} percentiles of the cumulative catch for each stock complex and both inshore and offshore zones of the Nain complex.

Information on length, weight and age (otolith) of Arctic charr caught in the commercial fishery was obtained as fish were processed at the Nain Fish Plant. As in previous years, a two-stage stratified sampling program was carried out, details of which are provided in Dempson (1995). Samples were identified from individual subareas which form component parts of stock complexes (Dempson and Kristofferson 1987). Condition was determined by W/L^3 where W = gutted weight and L = fork length, and where the range in length was restricted to charr 450 to 599 mm in size. A summary of otolith (age) and length samples obtained, by year, for each of the three major stock complexes is provided in Table 4. Information pertaining to recent results of food and feeding studies follow

methods described by Dempson et al. (2002). Simple linear regression was used to examine trends over year in age, weight and condition following Ricker (1981).

North Labrador stock complexes

The Nain Fishing Region is divided on a geographical basis into subareas. Some subareas form component parts of larger stock complexes of which three complexes have traditionally received the greatest amount of commercial fishing effort. The Voisey stock complex is made up of Voisey's Bay and an extended 'offshore' component, the Antons subarea (Figure 1). The Nain stock complex consists of an inner zone made up of Anaktalik Bay, Nain Bay, Tikkoatokak Bay, and Webb Bay, and an offshore zone composed of the Dog Island and Black Island subareas. The Okak complex consists of Okak Bay and the Cutthroat subareas. The primary source of information used in the designation of stock complexes was results from long term fish tagging studies related to distribution and ocean migration patterns (Dempson and Kristofferson 1987), but also complemented by morphometric (Dempson 1984a) and meristic analyses (Dempson and Misra 1984). Genetic analyses have supported the earlier designation of individual stock complexes in the north Labrador region but have further shown that there are microgeographic differences among local populations (Bernatchez et al. 1998).

Results and Discussion

Tag recapture information

Tagging experiments in northern Labrador began in 1974 and have continued, in varying degrees, each year since. To date (2003) almost 16,000 fish have been tagged and released with over 3600 recaptured.

Results of earlier studies (prior to 1986), summarized in Dempson and Kristofferson (1987), indicated little intermixing of populations from widely distributed areas along the 300 km of coastline from Antons to Saglek Fiord. Previously, only 1.3% of the charr tagged in the Voisey or Nain stock complex areas were recaptured north of Black Island and less than 0.2% recaptured south of Antons. Similarly, less than 1% of the charr tagged in the Okak, Hebron, or Saglek subareas were recaptured south of the Kiglapaits. Few have been recaptured more than 100 km from their original release site. Table 5 updates previous information published by Dempson and Kristofferson (1987) and later expanded to include 1999 tag returns (Dempson and Shears 2001). The percentage recovery rates vary among major stock complexes and reflects varying amounts, and distribution of fishing activity from area-to-area over time.

Overall tag recovery rates for all years combined range from 20% to 31% for the three primary stock complexes (Voisey - 20.2%; Nain - 31.0%; Okak - 27.3%). Updated results are consistent with earlier investigations. Of charr tagged and released in the Voisey complex (N_{Tagged} = 3101), 626 have now been recovered through 2003, with 88% of the

recaptures obtained from the same complex area (i.e. Voisey). A limited number of Voisey charr also move into the Nain stock complex area, both inshore and offshore zones (Table 5). While DFO began tagging in the Voisey's Bay area in 1979, the single largest source of information has been obtained from more than 1000 tags applied in 1996 and 1997 as part of the Voisey's Bay environmental impact assessment program (Jacques Whitford 1997) with DFO monitoring tag recoveries since. Most recoveries occurred within the first three years, although some have been caught up to six years post tag release. Charr have also been tagged and released in Kogluktokoluk Brook, Ikadlivik Brook, as well as at Kangeklualuk Bay (Table 5).

With respect to the Nain stock complex, N_{Tagged} = 7381 with 2290 recoveries, 92.8% were recovered from within the same stock complex area (Table 5). A number of the projects targeted charr during their outward spring migration from 1979 to 1987. Dempson and Kristofferson (1987) reported that charr in the Nain Bay and Tikkoatokak Bay subareas appeared to leave the immediate vicinity of the river mouths and distributed themselves throughout the bays, moving farther away with the melting and retreating sea ice. Recapture results indicated there was intermixing of local and adjacent populations at sea, but this was more common among the offshore island subareas than in the inner bays. Ocean movement patterns were also found to vary annually. Charr in some areas were found to interchange from one year to another among rivers within a particular fiord in Labrador (Dempson and Kristofferson 1987). Results of radio telemetry studies carried out at Reid Brook and Ikadlivik Brook, Voisey's Bay (Beddow et al. 1998), showed that interchange among streams can also occur within the same year.

No recent studies have been carried out at Okak. Previously, 505 charr had been tagged and released with 138 recoveries, 87% of which coming from the same complex.

Migration characteristics

Anadromous Arctic charr make periodic migrations to sea that enable them to avail of ample marine food items. Thus, while the rivers and lakes provide spawning and overwintering areas, the sea provides sufficient feeding resources to support the biomass of charr that exists in the northern Labrador region.

Seaward movement coincides with spring runoff and ice breakup in coastal rivers. Over a period of nine years (1979-1987), charr were tagged as they congregated at the mouths of various rivers in Nain Bay, Tikkoatokak Bay, Webb Bay, and Voisey's Bay. Beginning dates of these tagging studies varied from May 22 to June 5, depending upon the year. In all cases, charr were readily available in these locations at these dates.

The outward migration consists of both first-time and repeat migrants. Larger charr also have a tendency to enter the sea first. First-time migrants may have spent up to 7 years in freshwater before migrating to the sea. Analyses of otolith microprobe strontium:calcium ratios from Ikarut River (Hebron Fiord), Labrador, showed that most charr began migrating at ages 2+ or 3+ (Radtke et al. 1997). These results are consistent with inferences on age at

seaward migration determined from analyses of parasites in young charr (Bouillon and Dempson 1989). Specifically, the marine parasites *Bothrimonus sturionis* (Cestoda) and *Brachyphallus crenatus* (Digenea) were found in charr as young as 1+ and 2+ years of age.

Repeat migrant charr can include both adults (maturing and nonmaturing) and juveniles. Both adults and juveniles, then, undergo a number of ocean migrations (Johnson 1980; Dempson and Kristofferson 1987). Some studies indicated that the smallest charr captured at sea were usually about 15 cm in length but that a greater modal size was common (Johnson 1980; Finstad et al. 1989). Delabbio et al. (1988) noted that a fork length of 15-18 cm could represent the threshold body size for Arctic charr seawater tolerance. In contrast, results from studies carried out in north Labrador reported finding small charr (< 12 cm) in the estuary and mouth of Ikarut River, Hebron Fiord, in areas where salinities up to 30 psu were recorded. Later, small charr were also caught at sea in salinities ranging from 21 to 32 psu.

Arctic charr are not known to overwinter at sea (Johnson 1980). Minimum estimates for the average length of time at sea in north Labrador were 8-9 weeks, but some fish were reported to spend as little as 32 days in the ocean in some years (Dempson and Kristofferson 1987). The return to freshwater follows a pattern similar to that of the outward migration: larger maturing fish enter early followed by nonmaturing adults and then juveniles (Dempson and Kristofferson 1987). Peak adult migrations occur during the latter part of July and early August (Dempson and Green 1985) whereas smolt-sized charr (modal size = 18-20 cm) enter in late August and throughout September. Figure 2 illustrates the characteristic pattern of the timing, numbers, and length of upstream migrating Arctic charr to the Ikarut River, Labrador, averaged over the period 1981-1985. The progressive decline in size of charr over the season is particularly relevant when comparing trends in commercial fisheries data owing to variation in the annual timing of commercial fisheries.

Ocean feeding characteristics

Between 1982 and 2003, 4382 stomach samples were examined from Arctic charr from north Labrador. Of these, about 5% pertain to charr < 300 mm in fork length, the results of which are summarized in Dempson et al. 2002. Remaining samples from charr ≥ 300 mm come primarily from the inshore zone of the Nain stock complex (N = 2005; 45.8%), the offshore Nain zone (N = 743; 17.0%), and the Voisey complex (N = 1002; 22.9%). Previous analyses (Dempson et al. 2002) identified substantive differences in diet among limited spatial scales (e.g. Voisey complex compared with Nain; Nain inshore vs. Nain offshore, etc.). Sand lance (*Ammodytes* spp.), capelin (*Mallotus villosus*), and sculpins (Cottidae: *Triglops* spp., *Myoxocephalus* spp.) were the most important components of the diet of charr sampled from the Voisey stock complex, with capelin, sand lance, and hyperiid amphipods (*Parathemisto* spp.) dominating in the Nain inshore region. However, major shifts in diet were evident over time with capelin largely disappearing from the diet of Nain charr. A summary of recent key diet items for the Voisey complex and the inshore zone of the Nain complex is provided in Figure 3, while changes in the contribution of key

items, by weight, of capelin, sand lance, sculpins and amphipods are updated in Figure 4 for the Voisey, Nain inshore and Nain offshore zones.

Commercial fishery

Nain Fishing Region

Table 6 summarizes landings from the Nain (all subareas) and Makkovik Fishing Regions, 1974 to 2003. Commercial fishing for charr in the Makkovik Region has essentially ended being replaced by food or subsistence fisheries. At Nain, fishing has continued under a commercial-communal licence, but subsistence/food and recreational fishing also occurs. Commercial landings at Nain over the past 30 years (1974 to 2003) have totaled 2748 tonnes, equivalent to about 6.1 million pounds. Of this amount, 77% (2116 tonnes) has been harvested from the three primary stock complexes (Voisey, Nain, and Okak), and illustrates the overall productive capacity of this relatively limited area of the north coast to produce fish.

In addition to the reported commercial component of the fishery, attempts have been made in recent years to obtain catch information from food fisheries. Details pertaining to how information is compiled are provided by Reddin et al. (2004). In the latter report, for example, the reported food fishery catch from Salmon Fishing Area 1 (northern Labrador) was 7175 or 13,442 kg. In this report, data are not broken out by individual community, however, estimated food fishery catches for the community of Nain were as follows: 2001 - 1729 charr; 2002 - 2979 charr; 2003 - 2300 charr (D. Reddin, personal communication). These catches pertain to the open water season only. Information provided for April and May 'ice fisheries' at Nain were: 2000 - 2793; 2001 - 1208; 2002 - 3231 (N. Andersen, personal communication). Open water catches are derived from voluntary log-book returns. Ice fishing data were provided by the local fisheries officer and based upon direct observation, interviews, and other anecdotal information. Accuracy and extent of coverage of these data are questionable, but underscore the importance of developing reliable reporting mechanisms to better account for all harvests in this region. This is particularly important given the large reduction in directed commercial effort while food/subsistence or recreational effort has likely expanded substantially over the past 15 years.

Voisey Stock Complex

Annual landings ranged from about 1 t (1996) to 41 t (1979) with an overall mean annual catch of 14.7t, for the interval 1974 to 2003 (Table 7). Over the entire 30 year interval, landings from the Voisey stock complex have contributed 16% of the total commercial catch from the Nain Fishing Region (Table 7). The highest catches occurred during the late 1970s (Figure 5) but fell coincident with decreased effort during the 1990s. In 1995 there was no directed commercial fishery on this stock. The highest landings during the past decade were in 2000 when 10.5 t or approximately 6275 fish, were landed. Directed fishing in this complex has been sporadic in recent years with catches ranging from 1 to

about 6 t (Table 7). Over the past 30 years (1974 - 2003) 425.8 tonnes, equivalent to 938.8 thousand pounds have been harvested from the Voisey stock complex.

The multiplicative analysis of commercial catch rates for the Voisey stock complex explained 33% of the variation ($F = 2.68$, $P = 0.0001$, $df = 32, 174$). Catch rates (CUE) fluctuated over time declining from the late 1970s through the early 1990s (Figure 5), followed by increased rates in 1999, 2000, and 2003. However, given the low directed effort since the mid-1990s, catch rates may not be indicative of actual abundance and no other independent sources of abundance are available.

Over all years, median timing of the fishery (50^{th} percentile) was July 18, with interquartile dates (25^{th} and 75^{th} percentiles) of July 9 and July 28, respectively. Directed fisheries were particularly early in 1987 and again in 2001 (Figure 6) but generally have been rather consistent over time.

Catch- and weight-at-age data are summarized in Tables 8 and 9, respectively. Including the catch in 2003, approximately 206 thousand charr have been harvested from the Voisey stock complex since 1977. Over all years, age 7- to 10-year-old charr contributed 86% of the catch while charr age 12+ and older made up only 4.6% of the fishery (Table 8). There was no consistent trend for a change in overall mean age of charr captured in the fishery (Table 9) ($r^2 = 0.0393$, $P = 0.3316$). However, there was a significant decline in overall mean weight by about 0.040 kg (40 g) per year ($r^2 = 0.7771$, $P < 0.0001$) through to 1997 after which mean weight increased (Figure 7). Mean weights-at-age also declined over time (Table 9, Figure 8) before increasing in recent years. Condition declined over time to 1997 ($r^2 = 0.5669$, $P < 0.001$, slope = -0.0729) but has increased somewhat over the past several years (Figure 7).

Nain Stock Complex

Annual landings ranged from 5 (1996) to 76 t (1977) with an overall mean annual catch of 34.8 t for the interval 1974 to 2003 (Table 10). Over the entire 30 year interval, landings from the Nain stock complex have contributed 40% of the total commercial catch from the Nain Fishing Region (Table 10). The highest catches occurred during the late 1970s and early 1980s (Figure 9), with the catches declining during the 1990s coincident with a reduction in effort. The highest landings during the past decade were in 2001 when 15.6 t, or about 9953 charr, were landed. Over all years, landings from the inshore zone have averaged 24.2 t, or about 63% of the Nain stock complex total although this can vary substantially among individual years (Table 10). Conversely, the offshore zone had an average annual catch of 10.7 t although historically, more than 20 t have been taken in some years. Over the past 30 years (1974 - 2003) 1044.1 tonnes, equivalent to 2.3 million pounds have been harvested from the Nain stock complex.

The multiplicative analysis of commercial catch rates for the inshore zone of the Nain stock complex explained 52% of the variation ($F = 6.47$, $P = 0.0001$, $df = 35, 212$). The highest catch rates occurred in the late 1970s and early 1980s followed by a long term decline

through to the mid-1990s (Figure 9). Catch rates have increased consistently since then. With respect to the offshore zone, the multiplicative analysis explained 55% of the variation in CUE ($F = 6.55$, $P = 0.0001$, $df = 33, 179$). Catch rates increased from the late 1970s through 1990 then declined through to 1996 (Figure 9). Since then catch rates for the offshore zone have fluctuated. As noted for the Voisey stock complex, given the reduction in directed effort since the mid-1990s, catch rates may not be indicative of actual abundance and no other independent sources of abundance are available.

Median catch timing of the Nain stock complex fishery was August 2, with interquartile dates of July 22 and August 11, respectively. Fisheries were typically earlier from 1976 to 1982 after which, median dates were about three weeks later (Figure 6). In large part, this has been driven by the change to much later fisheries for the inshore zone, by about 3 weeks, changing from a median date July 8 (1977 to 1982) to July 31 (1983 to 2003) (Figure 10). In contrast, timing of fisheries in the offshore zone, which were typically about two weeks later than those of the inshore zone, has varied relatively little (Figure 10), and is now more comparable with timing of fisheries in the inshore zone. An exception occurred in 1991 and 1992 when fisheries were anomalously late owing to heavy ice conditions affecting the offshore zone. In the absence of fish counting facilities, variability in migration timing of charr to local rivers is unknown and hence the impact on commercial fisheries is somewhat uncertain. However, since larger charr are generally known to enter the rivers first, run timing can potentially influence or confound the interpretation of changes in size of charr caught in the commercial fishery.

The following table illustrates the mean lengths of charr sampled from each of the primary stock complexes for four in-season time periods:

	Mean length (mm)		
Time Period	Voisey	Nain	Okak
June 15 – July 15	532	532	521
July 16 – July 31	518	513	510
Aug 1 – Aug 15	513	501	505
Aug 16 – end	513	490	500

Catch- and weight-at-age data are summarized in Tables 11 and 12, respectively. Including the fishery in 2003, approximately 546 thousand charr have been harvested from the Nain stock complex since 1977. Over all years, age 7-to 10-year-old charr contributed 84% of the catch while charr age 12+ and older made up only 6.3% of the fishery (Table 11). The fishery is consistently dominated by four age classes. Mean age initially increased from 1977 (8.46 y) to 1982 (9.83 y) after which it declined significantly through to 2000 (8.27 y) ($r^2 = 0.7721$, $P < 0.0001$, slope = -0.0693) hence, over all years it also indicates a trend to reduced age ($r^2 = 0.3372$, $P = 0.0015$, slope = -0.0299). As observed with charr in the

Voisey stock complex, mean weight ($r^2 = 0.8369$, $P < 0.0001$, slope = -0.0305) (Figure 7) and mean weights-at-age have declined over time but have increased lately (Table 12, Figure 8). Condition of charr caught in the Nain stock complex decreased significantly to 1997 ($r^2 = 0.2394$, $P = 0.0244$, slope = -0.0030) but has also increased in recent years (Figure 7).

Recent investigations have shown that fluctuations about some of the trends in mean age and mean weight of charr from the Nain stock complex cannot be explained entirely as a result of exploitation and that variability in environmental factors may be partially responsible (Power et al. 2000). In addition, analyses of the diet show that 66% of the variation in mean weight of charr from the Nain stock complex could be explained by the relative amount of capelin in the diet (Dempson et al. 2002).

Okak Stock Complex

Annual landings ranged from a low of 180 kg in 1992 to a high of 76 t in 1978 with an overall mean annual catch of 22.3 t for the interval 1974 to 2002 (Table 13). Note that there was no fishery in 2003, and extremely small landings in 1992, 1993 and 2002 (< 1 t). Over the entire period of record, landings of charr from the Okak stock complex have contributed 23% of the total commercial catch from the Nain Fishing Region (Table 13). The highest catches occurred during the late 1970s and early 1980s (Figure 11). The highest landings during the past decade were in 2000 when 14.1 t, or about 8975 charr, were landed. Since 1974, 646.2 tonnes of charr, equivalent to 1.4 million pounds have been harvested from the Okak stock complex.

Landings from the Okak stock complex have been inconsistent since the early 1990s. Inconsistency in landings could be due, in part, to effort directed toward other nearby subareas at least in recent years (e.g. Tasiuyak in 1997 - 2001, and Napartok Bay in 1998 - 2001) that do not formally form part of the three primary stock units (Voisey, Nain, Okak). The Tasiuyak and Napartok Bay subareas accounted for 8 tonnes, or 17% of the charr caught within the Nain Fishing Region during 2000, and 8.4 t or 26% of the regional catch in 2001. However, in 2003 there were no fisheries in subareas to the north of Black Island. Commercial fishing in areas to the north of Napartok (Hebron, Saglek, Ramah) last occurred in 1993.

The multiplicative analysis of commercial catch rates for the Okak stock complex explained 65% of the variation ($F = 8.90$, $P = 0.0001$, df = 28, 136). Catch rates from this stock complex, however, are irregular at least in latter years. An apparent decline in values from the late 1970s to 1991 was followed by relatively high catch rates from 1994 to 1996 (Figure 11) with highly variable rates since. The discrepant values for the mid-1990s may be suggestive of a change in recorded effort. Thus, as noted for the Voisey and Nain stock complexes, given the reduction in directed effort since the mid-1990s, catch rates particularly at Okak, are likely not indicative of actual abundance. No other independent sources of abundance are available.

Over all years, median timing of the fishery (50th percentile) was August 10, with interquartile dates (25th and 75th percentiles) of August 4 and August 15, respectively (Figure 6). Fisheries were progressively earlier from 1977 to 1982 after which they have tended to fluctuate somewhat from year to year.

Catch- and weight-at-age data are summarized in Tables 14 and 15, respectively. Including the catch in 2002, approximately 323 thousand charr have been harvested from the Okak stock complex since 1977. Okak is similarly dominated by 7-to 10-year-old charr, contributing 75.2% of the catch while charr age 12+ and older made up 12.3% of the fishery (Table 14). However, the contribution of older fish in recent years has declined such that charr 12+ and older have represented only 2.6% of the catch since 1993. The consequence of this is a significant decline in average age ($r^2 = 0.5906$, $P < 0.0001$, slope = -0.0606) over all years.

As noted for the other stock complexes, mean weight of charr declined over time up to 1997 (Table 15, Figure 7) ($r^2 = 0.7326$, $P < 0.0001$, slope = -0.0300). Mean weight, and mean weight-at-age (Figure 8) have increased in recent years. Condition of Okak charr has varied over time, without any significant trend through 1997 ($r^2 = 0.1402$, $P = 0.0944$, slope = -0.0031) as noted at Voisey and Nain stock complexes (Figure 7).

Summary and Conclusions

Over a 30 year interval, from 1974 to 2003, more than 2700 tonnes or about 6 million pounds of anadromous Arctic charr have been caught in the north Labrador commercial fishery. Since 1977, landings from the three primary stock complexes (Voisey, Nain, Okak) exceed over 1 million fish with many others taken in recreational and subsistence fisheries. As stated earlier, the collective harvests illustrate the capacity of this region to produce as well as sustain fisheries.

Effects of the extensive fishery specifically on the Nain stock complex were the subject of an earlier analysis (Dempson 1995). Some of the characteristics observed, such as changes in catch rates, mean age and mean weight, apply equally to charr from the Voisey and Okak stock complexes. The most apparent change was the overall reduction in mean weight from 1980 to 1997. Mean weight of charr from the Voisey stock complex declined at about 40 g per year, while Nain and Okak charr declined by about 30 g per year. Perhaps because of reduced exploitation, mean weight and mean weight-at-age have generally increased in recent years.

As stated in past reports, there are no independent estimates of Arctic charr abundance from any of the stock complexes within the Nain Fishing Region. This is despite having more than 76 thousand charr harvested in commercial fisheries from the Voisey, Nain and Okak stock complexes alone during the past five years (1999 – 2003) and largely unknown quantities removed from recreational and subsistence fisheries. In the past, changes in annual catch rates may have provided a general indication as to how stock abundance was varying over time. However, with reduced commercial effort in recent years, both in terms

of spatial and temporal coverage, interpretation of catch-rates as an index of abundance is more questionable.

Status of anadromous charr stocks in the Cambridge Bay (Victoria Island), Nunavut, fishery is inferred from harvests in the commercial fishery as well as by examining trends in biological characteristics, in particular, with emphasis on changes in age distributions (DFO 2004). Charr harvested in the Cambridge Bay fishery are typically older and larger than north Labrador charr. Thus, as a result of fishing pressure more dramatic changes have been observed over time in the size and age distribution of some individual Cambridge Bay stocks by comparison with north Labrador where relatively little change has been observed in length and age composition despite changes in mean weight (Figure 7) and mean weight-at-age (Figure 8). Indeed, the general age and length composition of charr at Voisey and Nain is rather similar to that reported by Andrews and Lear (1956) based on limited sampling ($N \leq 121$) from about 50 years ago in 1953 for Adlatok (about 130 km south of Voisey) and Nain. In contrast, charr sampled from Okak were reportedly smaller (Figure 12) but slightly older in 1953 than that observed over the past decade or by comparison with samples obtained in 1973 – 1974 by Coady and Best (1976). Length distributions, illustrated in Figure 13 for a group of years in each of the past several decades, at first glance appear somewhat similar over time among the stock complexes. However, a closer look reveals more subtle changes occurring. Modal size has decreased in all three stock complex areas. There has been a reduction in variance for the Voisey and Nain complexes, and a decrease in the maximum size of charr captured. Similarly, the percentage of 'larger' charr, that is fish ≥ 60 cm, has declined but more so in the Voisey and Nain complexes than at Okak. Considering that more than one million charr have been caught since 1977, more apparent changes in length and age structure might have been expected. Consequently, the rather stable age and length distributions of north Labrador charr that have persisted over decades of high exploitation preclude their utility to infer when stocks are being overexploited whereas changes in mean weight (Figure 7) or mean weight-at-age (Figure 8) may yield more useful information.

Recommendations to obtain stock specific abundance information, and data on annual harvests in subsistence or food fisheries apply equally to both the Cambridge Bay (DFO 2004) and north Labrador fisheries. Both aspects remain the single largest sources of uncertainty associated with the north Labrador charr resource.

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Table 1. Counts of upstream migrating Arctic charr at Fraser River (Nain Bay) and Ikarut River (Hebron Fiord). Smolt at Ikarut River refer to charr < 25 cm in length.

	Fraser River		Ikarut River	
Year	Adult	Year	Adult	Smolt
1975	3997	1981	3559	6026
1976	2344	1982	2210	3830
1977	2362	1983	3536	3626
1978	-	1984	2674	6546
1979	6407	1985	2692	6681

Table 2. Summary of mean monthly temperature (°C) and precipitation data at Nain, Labrador. Data were obtained from Environment Canada climate normal information for the period 1971 to 2000. Data at Nain were available from only 21 of the 30 year period.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature													
Daily average °C	-18.5	-18.3	-12.3	-4.9	1.0	6.2	10.1	10.7	7.0	1.1	-5.1	-12.8	-3.0
Standard Deviation	3.2	3.7	2.8	2.5	1.7	1.5	1.3	1.1	1.1	1.9	2.6	3.2	1.4
Daily maximum °C	-14.0	-13.6	-7.3	-0.3	5.1	11.0	15.1	15.6	10.9	4.2	-1.8	-8.8	1.3
Daily minimum °C	-23.1	-22.9	-17.3	-9.5	-3.0	1.4	5.2	5.7	3.0	-2.1	-8.3	-16.8	-7.3
Extreme maximum °C	15.7	7.6	12.1	14.5	25.6	33.3	33.3	32.7	26.1	19.4	11.7	6.7	
Extreme minimum °C	-42.5	-38.3	-37.0	-31.1	-17.5	-6.7	-2.8	-2.8	-6.7	-19.0	-24.4	-41.5	
Precipitation													
Rainfall (mm)	1.3	0.9	4.2	12.7	28.4	63.9	86.8	69.2	74.2	37.9	15.3	5.7	400.4
Snowfall (cm)	77.2	55.3	82.5	58.7	28.8	16.0	0.0	0.0	2.6	26.9	63.8	80.3	492.2
Total precipitation (mm)	78.4	56.2	86.6	71.5	57.3	79.9	86.8	69.2	76.8	64.9	79.0	86.2	892.7

Climate normal data obtained from:

www.climate.weatheroffice.ec.ca/climate_normals/results_e.html

Table 3. Summary of mean monthly sea temperature data (°C) recorded by thermographs set at 3 m depth in Tikkoatokak Bay and at Loon Island (outer Nain Bay), north Labrador. Data were derived from mean daily information for the respective dates thermographs operated.

	Area: Tikkoatokak Bay					Area: Loon Island (Nain Bay)				
	Average temperature		Date of Operation			Average temperature		Date of Operation		
Year	July	August	Start	End	Depth	July	August	Start	End	Depth
1985	3.11	4.08	July 10	Aug 26	1 m	3.05	4.03	July 13	Aug 17	3 m
1986	7.68	7.30	July 14	Aug 31	3 m					
1987	5.86	6.95	July 1	Aug 27	2 m	2.72	3.39	July 22	Aug 27	3 m
1988	6.47	5.05	July 6	Aug 31	3 m	2.08	3.06	July 22	Aug 31	3 m
1989	4.84	5.93	July 3	Aug 27	2 m					
1990	4.62	5.07	July 25	Aug 28	3 m		5.78	Aug 1	Aug 28	3 m
1991	5.51	5.91	July 13	Aug 21	3 m					
1992	3.73	3.60	July 17	Aug 31	3 m		3.62	Aug 2	Aug 28	3 m
1993	5.08	4.76	July 7	Aug 23	3 m	2.01	4.65	July 12	Aug 23	3 m
1994	4.07	5.43	July 9	Aug 20	3 m	4.33	4.48	July 26	Aug 22	3 m
1995	4.87	5.65	July 7	Aug 28	3 m	4.23	6.09	July 10	Aug 28	3 m
1996	4.51	5.14	July 15	Aug 27	3 m					
1997	3.86	4.41	July 18	Aug 25	3 m					
1998	4.97	5.54	July 11	Aug 31	3 m	3.69	5.24	July 19	Aug 31	3 m
1999	4.48	6.24	July 3	Aug 25	3 m	3.74	5.01	July 3	Aug 25	3 m
2000	5.98	6.01	July 11	Aug 17	3 m	4.02	5.48	July 11	Aug 21	3 m
2001	5.59	5.67	July 12	Aug 28	3 m	2.44	4.66	July 12	Aug 28	3 m
2002	2.60	3.65	July 5	Aug 31	3 m	3.01	3.02	July 5	Aug 31	3 m
2003	3.61	5.15	July 2	Aug 31	3 m	4.34	5.82	July 2	Aug 31	3 m
Mean	4.81	5.34				3.31	4.60			

Table 4. Summary of available biological characteristic data for anadromous Arctic charr sampled from the commercial fishery in each of the three main stock complex areas, 1977 - 2003, and other locations sampled opportunistically when fisheries occurred. Length-frequencies pertain to charr 32 to 84 cm in fork length.

Year	Number of Otolith samples							Number of Length samples						
	Primary Stock Complexes			Other subarea locations				Primary Stock Complexes			Other subarea locations			
	Voisey	Nain	Okak	Kiglapaits-Tasiuyak	Napartok	Hebron-Saglek	Ramah-Nachvak	Voisey	Nain	Okak	Kiglapaits-Tasiuyak	Napartok	Hebron-Saglek	Ramah-Nachvak
1977	322	671	162		306	92								
1978	340	746	351		207									
1979	364	308	423		169									
1980	459	640	774	1	22	382		3279	3978	6894		106	1322	
1981	398	737	703			726	21	2050	4962	1641			9774	222
1982	308	1116	648	88	369	942	403	1151	4652	2420	53	1543	6400	1031
1983	606	1723	1162	204				3531	5943	8380	1383			
1984	882	1537	501	256		381	170	6368	7331	2494	1212		3373	797
1985	286	1272	436	156			429	3844	10956	3720	1077			2304
1986	273	1226	528	162			293	4981	8317	4814	816			2057
1987	333	1506	458					3173	10759	4089	750			
1988	328	1635	458					3374	11504	2812	502		182	
1989	371	931	649	241				4852	9326	5970	2682			
1990	478	852	632	153				4415	5862	5403	841			
1991	540	889	231	220	21	282		4541	5247	2123	902	67	5299	
1992	431	966	34	139	159	479		3683	5687	37	767	1257	5899	
1993	479	651	143	123		330	48	3470	5334	330	725		3481	232
1994	223	909	266	83				1377	4609	6538	570		1164	
1995		290	258	72		38			2048	2212	275		489	
1996	45	296	248					169	1130	1429			983	
1997	318	241	198			82		1139	692	1576			771	
1998	297	400	222		154			1194	1659	964		531		
1999	336	348	217	20	60			1579	1954	1058	116	308		
2000	248	341	227					1726	1546	1141	220	467		
2001		301	201						1490	1048	306	741		
2002	237	411	55					1142	1586	147				
2003	191	330						1422	1566					
Total	9093	21273	10185	1918	1467	3734	1364	62460	118138	67240	13197	5020	39137	6643

Table 5. Percentage distribution of tag recoveries, by stock complex and subarea, of anadromous Arctic charr tagged and released from various subareas and rivers of northern Labrador, 1974 - 2003. Rounding of percentages may result in some values exceeding 100%.

Tagging location, stock complex, & subarea	Number Tagged	Number Recaptured	Percent recapture by stock complex or subarea													
			Makkovik - Davis Inlet	Voisey			Nain			Okak			Napartok	Hebron	Saglek	Area Unknown
				Inshore	Offshore	Total	Inshore	Offshore	Total	Inshore	Offshore	Total				
Voisey																
Antons	216	19	15.8	15.8	10.5	26.3	47.3	10.5	57.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Voisey's Bay	875	195	0.5	64.1	17.9	82.0	11.3	5.6	16.9	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Kogluktokoluk Bk	127	7	0.0	42.9	28.6	71.5	0.0	28.6	28.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ikadlivik Bk	411	103	0.0	80.6	9.7	90.3	5.8	2.9	8.7	0.0	1.0	1.0	0.0	0.0	0.0	0.0
Reid Bk	1333	272	0.0	94.9	1.5	96.4	1.8	1.8	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kangeklualuk Bay	139	30	3.3	86.7	3.3	90.0	6.7	0.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	
Sub-Total	3101	626	0.8	79.6	8.6	88.2	7.0	3.7	10.7	0.2	0.0	0.2	0.0	0.0	0.0	0.2
Nain																
Anaktalik Bay	290	79	0.0	0.0	3.8	3.8	69.6	19.0	88.6	0.0	2.5	2.5	0.0	0.0	0.0	5.1
Nain Bay	3085	800	0.3	1.4	3.1	4.5	65.8	27.4	93.1	0.3	0.8	1.0	0.0	0.0	0.0	1.1
Fraser River	807	243	0.0	0.0	0.8	0.8	84.0	10.3	94.2	0.0	0.8	0.8	0.0	0.0	0.0	4.1
Tikkoatokak Bay	2257	909	0.0	1.3	2.8	4.1	63.7	28.8	92.5	0.3	1.7	2.0	0.0	0.0	0.0	1.4
Webb Bay	312	144	0.0	0.0	0.0	0.0	94.4	4.9	99.3	0.0	0.7	0.7	0.0	0.0	0.0	0.0
Offshore	630	115	1.7	1.7	5.2	7.0	33.0	52.2	85.2	0.0	2.6	2.6	0.0	0.0	0.0	3.5
Sub-Total	7381	2290	0.2	1.1	2.7	3.8	67.2	25.7	92.8	0.2	1.3	1.5	0.0	0.0	0.0	1.7
Okak																
Okak Bay	505	138	0.0	0.0	0.0	0.0	1.4	5.1	6.5	44.2	42.8	87.0	0.0	0.0	0.0	6.5
Napartok																
Napartok Bay	228	15	0.0	0.0	0.0	0.0	6.7	0.0	6.7	0.0	20.0	20.0	46.7	26.7	0.0	0.0
Hebron																
Hebron Fiord	411	66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	6.1	9.1	1.5	84.8	1.5	3.0
Ikarut River - adults	1245	289	0.0	0.0	0.0	0.0	0.0	0.3	0.3	1.7	4.2	5.9	1.0	92.0	0.3	
Ikarut River - juveniles	1253	57	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
River H-3	420	38	0.0	0.0	0.0	0.0	5.3	2.6	7.9	0.0	10.5	10.5	0.0	81.6	0.0	0.0
River H-6	106	15	0.0	0.0	0.0	0.0	0.0	6.7	6.7	20.0	13.3	33.3	0.0	53.3	0.0	6.7
Sub-Total	3435	465	0.0	0.0	0.0	0.0	0.4	0.6	1.1	2.2	4.7	6.9	0.9	89.9	0.4	0.9
Saglek																
Saglek Fiord	342	37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	91.9	0.0
Pangertok Inlet Bk	163	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	87.5	0.0	0.0
Southwest Arm Bk	683	50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
North Arm Bk	129	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
Sub-Total	1317	103	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.9	96.1	0.0
Grand Total	15967	3637														

Table 6. Summary of northern Labrador anadromous Arctic charr commercial landings (kg) by fishing region, 1974 - 2003. Effort is recorded by the number of person-weeks fished, while catch per unit effort (CUE) for the Nain Region is in kg per person week fished (unstandardized).

	Fishing Region					
	Nain				Makkovik	Total
Year	Catch (kg)	Effort	CUE	Catch as % of Total	Catch (kg)	Catch
1974	120414	531	227	81.1	28133	148547
1975	44118	309	143	82.2	9542	53660
1976	134898	616	219	89.6	15645	150543
1977	186165	863	216	88.5	24205	210370
1978	213915	966	221	86.2	34387	248302
1979	175263	918	191	82.3	37693	212956
1980	167991	880	191	82.5	35561	203552
1981	231221	914	253	91.8	20733	251954
1982	203012	856	237	83.8	39163	242175
1983	149732	804	186	83.7	29100	178832
1984	123045	729	169	83.2	24792	147837
1985	107120	637	168	75.9	33945	141065
1986	99963	554	180	87.8	13888	113851
1987	97379	533	183	90.7	9965	107344
1988	74010	471	157	83.3	14819	88829
1989	85970	436	197	85.3	14808	100778
1990	86292	394	219	86.5	13509	99801
1991	54614	320	171	78.3	15137	69751
1992	60754	315	193	82.3	13044	73798
1993	33562	226	149	87.9	4622	38184
1994	29345	122	241	94.3	1778	31123
1995	25080	84	299	84.7	4522	29602
1996	13281	70	190	83.2	2691	15972
1997	33977	160	212	89.4	4029	38014
1998	37458	201	186	100.0	0	37458
1999	40271	178	226	99.4	243	40514
2000	46818	163	287	100.0	0	46818
2001	32845	111	296	96.1	1328	34173
2002	20530	90	228	100.0	0	20530
2003	19017	63	302	100.0	0	19017
Avg. 1994-2003	29862	124	247	94.7	1459	31322
Avg. 1974-2003	91602	450	211	88.0	14909	106512
Total 1974 - 2003	2748060				447282	3195350

Table 7. Summary of Arctic charr catch (kg-round), effort (person-weeks), and catch per unit (CUE) effort for the Voisey stock complex in north Labrador, 1974 - 2003. Offshore pertains to the Antons subarea. CUE is unstandardized.

Year	Catch	Effort	CUE	% Offshore	Stock as % of Nain Region Total
1974	29180			31	24
1975	3727			94	8
1976	14652	57	257	21	11
1977	24108	75	321	9	13
1978	36991	102	363	11	17
1979	40590	116	350	47	23
1980	19694	82	240	42	12
1981	23810	90	265	33	10
1982	13309	60	222	45	7
1983	25593	80	320	89	17
1984	20873	101	207	62	17
1985	15648	57	275	91	15
1986	16655	82	203	82	17
1987	21242	101	210	41	22
1988	14037	52	270	60	19
1989	11019	32	344	100	13
1990	19895	69	288	64	23
1991	10971	60	183	26	20
1992	9284	39	238	96	15
1993	8461	48	176	23	25
1994	3335	15	222	5	11
1995			No Fishery		
1996	977	6	163	0	7
1997	4860	30	162	85	14
1998	7722	31	249	44	21
1999	8006	31	258	35	20
2000	10498	28	375	56	22
2001	1019	7	146	67	3
2002	3701	17	218	76	18
2003	5977	18	332	80	31
Avg. 1994-2003	5122	20	236	50	16
Avg. 1974-2003	14684	55	254	52	16
Total 1974 - 2003	425834				

Table 8. Estimated catch- and percent-at-age of Arctic charr from the Voisey stock complex commercial fishery, 1977 - 2003.

CATCH - AT - AGE

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
6	318	619	475	154	68	316	1045	291	1	44	8	140	68	17	9
7	2085	4374	4914	803	915	755	2947	2891	1917	351	1312	1638	911	1110	909
8	4030	5372	7928	3386	2571	1566	3410	3254	3066	3230	2813	2319	1445	2865	1047
9	2086	2330	3382	4140	4803	2346	3449	2238	3242	3888	4420	1465	1520	2945	1625
10	1237	1236	1163	1424	2359	1226	1611	1392	433	1400	2029	1440	1135	1827	1257
11	600	1141	634	500	941	657	1084	753	324	686	966	771	702	1083	691
12	389	380	212	238	406	65	827	414	233	244	280	289	245	588	362
13	212	380	159	159	41	13	147	355	64	149	38	28	107	440	155
14	108	334	55	28	19	27	45	83	55	123	57	43	183	136	89
6+	11065	16166	18922	10832	12123	6971	14565	11671	9335	10115	11923	8133	6316	11011	6144

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
6	364	494	188	No	31	458	288	80	62	6	0	5
7	1198	2088	602	Fishery	208	1233	1338	1262	2074	201	236	363
8	1034	1344	647	-	190	962	1427	1564	1739	169	603	943
9	1511	1025	487	-	53	618	972	1031	1142	111	625	904
10	1099	574	374	-	111	316	569	463	873	85	366	702
11	480	237	99	-	11	113	189	234	214	21	252	297
12	241	98	22	-	52	33	46	108	145	14	60	112
13	30	10	5	-	0	3	9	22	24	2	13	29
14	5	6	5	-	0	12	0	0	2	0	8	0
6+	5962	5876	2429	-	656	3748	4838	4764	6275	609	2163	3355

PERCENT - AT - AGE

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
6	2.9	3.8	2.5	1.4	0.6	4.5	7.2	2.5	0.0	0.4	0.1	1.7	1.1	0.2	0.1
7	18.8	27.1	26.0	7.4	7.5	10.8	20.2	24.8	20.5	3.5	11.0	20.1	14.4	10.1	14.8
8	36.4	33.2	41.9	31.3	21.2	22.5	23.4	27.9	32.8	31.9	23.6	28.5	22.9	26.0	17.0
9	18.9	14.4	17.9	38.2	39.6	33.7	23.7	19.2	34.7	38.4	37.1	18.0	24.1	26.7	26.4
10	11.2	7.6	6.1	13.1	19.5	17.6	11.1	11.9	4.6	13.8	17.0	17.7	18.0	16.6	20.5
11	5.4	7.1	3.4	4.6	7.8	9.4	7.4	6.5	3.5	6.8	8.1	9.5	11.1	9.8	11.2
12	3.5	2.4	1.1	2.2	3.3	0.9	5.7	3.5	2.5	2.4	2.3	3.6	3.9	5.3	5.9
13	1.9	2.4	0.8	1.5	0.3	0.2	1.0	3.0	0.7	1.5	0.3	0.3	1.7	4.0	2.5
14	1.0	2.1	0.3	0.3	0.2	0.4	0.3	0.7	0.6	1.2	0.5	0.5	2.9	1.2	1.4

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
6	6.1	8.4	7.7	-	4.7	12.2	6.0	1.7	1.0	1.0	0.0	0.1
7	20.1	35.5	24.8	-	31.7	32.9	27.7	26.5	33.1	33.0	10.9	10.8
8	17.3	22.9	26.6	-	29.0	25.7	29.5	32.8	27.7	27.8	27.9	28.1
9	25.3	17.4	20.0	-	8.1	16.5	20.1	21.6	18.2	18.2	28.9	26.9
10	18.4	9.8	15.4	-	16.9	8.4	11.8	9.7	13.9	14.0	16.9	20.9
11	8.1	4.0	4.1	-	1.7	3.0	3.9	4.9	3.4	3.4	11.7	8.9
12	4.0	1.7	0.9	-	7.9	0.9	1.0	2.3	2.3	2.3	2.8	3.3
13	0.5	0.2	0.2	-	0.0	0.1	0.2	0.5	0.4	0.3	0.6	0.9
14	0.1	0.1	0.2	-	0.0	0.3	0.0	0.0	0.0	0.0	0.4	0.0

Table 9. Average weight-at-age (kg-round) of Arctic charr from the Voisey stock complex commercial catch, 1977 - 2003.

AVERAGE WEIGHT - AT - AGE

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
6	1.53	1.53	1.53	1.03	0.93	1.20	1.33	1.25	1.05	1.07	1.03	1.23	1.27	1.12	1.11
7	1.77	1.77	1.77	1.24	1.26	1.46	1.54	1.53	1.39	1.21	1.41	1.50	1.43	1.48	1.47
8	2.07	2.07	2.07	1.60	1.77	1.70	1.64	1.71	1.63	1.44	1.73	1.69	1.68	1.70	1.64
9	2.60	2.60	2.60	1.89	2.04	2.02	1.89	1.93	1.77	1.64	1.80	1.78	1.79	1.83	1.79
10	2.78	2.78	2.78	2.19	2.17	2.20	2.04	2.06	1.98	1.72	1.95	1.89	1.95	1.94	1.84
11	2.94	2.94	2.94	2.42	2.30	2.49	2.18	2.14	1.99	1.90	2.02	1.98	2.06	2.01	2.01
12	3.24	3.24	3.24	2.49	2.37	2.33	2.10	2.32	2.18	1.90	1.92	1.88	1.90	1.98	2.01
13	2.60	2.60	2.60	2.70	3.36	2.83	2.20	1.91	2.26	1.97	2.31	2.23	2.04	1.90	2.01
14	2.76	2.76	2.76	3.73	2.76	3.42	2.55	1.82	2.26	1.45	1.58	1.45	1.90	2.29	2.15
Mean	2.280	2.210	2.170	1.830	1.980	1.940	1.780	1.790	1.680	1.580	1.790	1.730	1.780	1.810	1.770

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*	2002	2003
6	1.17	0.98	0.88	-	0.82	0.81	1.03	1.17	1.09	1.09	-	1.17
7	1.32	1.30	1.19	-	1.37	1.14	1.35	1.43	1.45	1.45	1.42	1.37
8	1.44	1.50	1.39	-	1.42	1.44	1.66	1.68	1.67	1.67	1.65	1.61
9	1.62	1.58	1.50	-	1.80	1.59	1.81	1.85	1.85	1.85	1.70	1.84
10	1.70	1.73	1.58	-	1.58	1.66	1.97	1.90	1.97	1.97	1.81	2.01
11	1.90	1.85	1.72	-	1.95	1.63	1.78	2.07	1.90	1.90	1.89	2.00
12	1.97	1.92	2.41	-	1.84	1.71	1.80	1.88	1.89	1.89	2.11	2.20
13	2.51	2.74	2.55	-	-	2.64	0.85	1.80	2.14	2.14	2.32	2.50
14	-	2.59	2.20	-	-	2.19	-	-	3.15	3.15	2.12	-
Mean	1.570	1.320	1.390	-	1.490	1.300	1.600	1.680	1.673	1.673	1.710	1.781

MEAN AGE OF CATCH

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Age	8.62	8.5	8.2	8.86	9.09	8.84	8.63	8.66	8.51	8.97	8.98	8.77	9.18	9.28	9.31

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Age	8.7	8.01	8.29	-	8.38	7.91	8.21	8.37	8.33	8.33	9.03	9.02

* No biological data for 2001. Used 2000 information

Table 10. Summary of Arctic charr catch (kg-round), effort (person-weeks fished), and catch per unit effort (CUE) statistics for the Nain stock complex, 1974 - 2003. CUE is unstadardized.

	Inshore zone			Offshore zone				Nain Stock complex total			
Year	Catch	Effort	CUE	Catch	Effort	CUE	% Offshore	Catch	Effort*	CUE	Stock as % of Nain Region Total
1974	30822			6923			18.1	37745			31
1975	31076			2754			8.1	33830			77
1976	50813	146	348	2500	52	48	4.7	53313	196	272	40
1977	70908	183	387	5347	114	47	7	76255	291	262	41
1978	70465	212	332	3298	106	31	4.5	73763	314	235	34
1979	54967	189	291	11877	152	78	17.8	66844	336	199	38
1980	52328	183	286	22727	215	106	30.3	75055	390	192	45
1981	49956	157	318	15676	131	120	23.9	65632	278	236	28
1982	43108	119	362	12509	117	107	22.2	55617	235	237	27
1983	33603	147	229	17599	149	118	34.4	51202	289	177	34
1984	24558	131	187	14342	128	112	36.9	38900	244	159	32
1985	21527	125	172	19631	130	151	47.7	41158	252	163	38
1986	16347	91	180	20748	101	205	55.9	37095	185	201	37
1987	17840	71	251	28032	135	208	61.1	45872	200	229	47
1988	14535	90	162	23759	149	159	62.1	38295	229	167	52
1989	30449	103	296	21016	87	242	40.8	51465	183	281	61
1990	17069	88	194	28205	108	261	62.3	45275	188	241	52
1991	10162	102	100	5730	50	115	36.1	15892	149	107	29
1992	10504	71	148	9051	60	151	46.3	19555	131	149	32
1993	5591	60	93	7819	59	133	58.3	13410	116	116	40
1994	4592	31	148	4232	38	111	48	8825	69	128	30
1995	844	11	77	5991	33	182	88	6835	41	167	27
1996	2306	11	72	2545	21	121	52	4851	53	92	37
1997	3317	20	166	3707	23	161	53	7024	42	167	21
1998	6244	44	142	8358	34	246	57	14602	77	190	39
1999	5824	22	265	5024	25	201	46	10848	44	247	27
2000	7915	32	247	4259	26	164	35	12175	53	230	26
2001	13518	23	588	2069	9	230	13	15587	31	503	47
2002	11316	42	269	2810	14	201	20	14126	55	257	69
2003	11380	31	367	1660	14	119	13	13040	42	310	69
Avg. 1994-2003	6726	27	234	4066	24	174	43	10791	51	229	39
Avg. 1974-2003	24129	91	238	10673	81	147	37	34803	168	211	40
Total 1974 - 2003	723884			320198				1044086			

* Total effort should be equal to or less than the sum of the inshore and offshore effort.

Table 11. Estimated catch- and percent-at-age of Arctic charr from the Nain stock complex commercial fishery, 1977 - 2003.

CATCH - AT - AGE

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
6	2003	371	430	75	145	83	470	182	103	210	483	204	903	459	203
7	9250	6703	4306	960	2118	977	2791	2612	2463	4129	5462	6288	4750	4726	1365
8	12453	13122	11568	10519	6877	4782	5842	4619	6506	7713	6293	7166	9707	6115	2085
9	7630	7984	9593	16342	15435	7255	6996	5671	4722	5862	7548	4688	8464	8844	2631
10	5052	4406	4208	8345	9787	7987	4177	4374	4111	2857	4498	3607	3785	4681	2175
11	2454	2367	2168	4077	3746	4936	4357	2173	2494	1284	2013	1631	2853	1908	874
12	988	1688	1573	1340	991	2976	2762	1495	1605	625	1375	650	1234	927	444
13	358	312	418	813	304	561	600	738	901	240	898	324	665	378	183
14	180	272	312	522	151	451	557	281	534	199	306	136	277	137	92
15	1	118	34	43	42	59	70	96	322	205	357	52	28	186	48
16	1	97	14	1	13	46	27	57	93	50	180	20	6	1	36
17	1	1	1	66	10	23	95	89	21	42	37	40	1	1	2
6+	40371	37441	34625	43103	39619	30136	28744	22387	23875	23416	29450	24806	32673	28363	10138

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
6	269	83	92	197	30	348	490	216	1030	0	40	168
7	3195	1982	999	1040	474	1267	3274	2347	1762	2257	1210	2433
8	3809	2874	2087	1294	944	795	2552	2023	2201	2295	2634	2412
9	3166	2525	1628	1539	1072	1700	1847	1238	1383	2885	2344	1854
10	2574	1596	859	426	454	747	931	609	806	1575	1304	1008
11	905	469	282	201	241	343	767	460	492	495	727	364
12	422	296	94	25	52	138	195	242	183	379	266	192
13	241	171	39	0	49	64	106	63	51	67	92	88
14	48	49	20	5	0	26	42	0	66	0	0	12
15	32	38	24	0	0	0	0	10	18	0	0	6
16	1	0	3	0	0	0	0	0	0	0	0	0
17	1	2	0	0	0	0	0	0	0	0	0	0
6+	14663	10085	6127	4727	3316	5428	10204	7208	7992	9953	8617	8537

PERCENT - AT - AGE

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
6	5.0	1.0	1.2	0.2	0.4	0.3	1.6	0.8	0.4	0.9	1.6	0.8	2.8	1.6	2.0
7	22.9	17.9	12.4	2.2	5.3	3.2	9.7	11.7	10.3	17.6	18.5	25.3	14.5	16.7	13.5
8	30.8	35.0	33.4	24.4	17.4	15.9	20.3	20.6	27.3	32.9	21.4	28.9	29.7	21.6	20.6
9	18.9	21.3	27.7	37.9	39.0	24.1	24.3	25.3	19.8	25.0	25.6	18.9	25.9	31.2	26.0
10	12.5	11.8	12.2	19.4	24.7	26.5	14.5	19.5	17.2	12.2	15.3	14.5	11.6	16.5	21.5
11	6.1	6.3	6.3	9.5	9.5	16.4	15.2	9.7	10.4	5.5	6.8	6.6	8.7	6.7	8.6
12	2.4	4.5	4.5	3.1	2.5	9.9	9.6	6.7	6.7	2.7	4.7	2.6	3.8	3.3	4.4
13	0.9	0.8	1.2	1.9	0.8	1.9	2.1	3.3	3.8	1.0	3.0	1.3	2.0	1.3	1.8
14	0.4	0.7	0.9	1.2	0.4	1.5	1.9	1.3	2.2	0.8	1.0	0.5	0.8	0.5	0.9
15	0.0	0.3	0.1	0.1	0.1	0.2	0.2	0.4	1.3	0.9	1.2	0.2	0.1	0.7	0.5
16	0.0	0.3	0.0	0.0	0.0	0.2	0.1	0.3	0.4	0.2	0.6	0.1	0.0	0.0	0.4
17	0.0	0.0	0.0	0.2	0.0	0.1	0.3	0.4	0.1	0.2	0.1	0.2	0.0	0.0	0.0

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
6	1.8	0.8	1.5	4.2	0.9	6.4	4.8	3.0	12.9	0.0	0.5	2.0
7	21.8	19.7	16.3	22.0	14.3	23.3	32.1	32.6	22.0	22.7	14.0	28.5
8	26.0	28.5	34.1	27.4	28.5	14.6	25.0	28.1	27.5	23.1	30.6	28.3
9	21.6	25.0	26.6	32.6	32.3	31.3	18.1	17.2	17.3	29.0	27.2	21.7
10	17.6	15.8	14.0	9.0	13.7	13.8	9.1	8.4	10.1	15.8	15.1	11.8
11	6.2	4.7	4.6	4.3	7.3	6.3	7.5	6.4	6.2	5.0	8.4	4.3
12	2.9	2.9	1.5	0.5	1.6	2.5	1.9	3.4	2.3	3.8	3.1	2.2
13	1.6	1.7	0.6	0.0	1.5	1.2	1.0	0.9	0.6	0.7	1.1	1.0
14	0.3	0.5	0.3	0.1	0.0	0.5	0.4	0.0	0.8	0.0	0.0	0.1
15	0.2	0.4	0.4	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 12. Average weight-at-age (kg-round) of Arctic charr from the Nain stock complex commercial catch, 1977 - 2003.

AVERAGE WEIGHT - AT - AGE

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
6	0.89	1.31	1.37	0.89	0.79	1.13	1.27	1.18	1.10	1.15	1.14	1.13	1.16	1.17	1.29
7	1.28	1.71	1.52	1.20	1.18	1.37	1.56	1.40	1.43	1.37	1.33	1.38	1.38	1.42	1.38
8	1.77	1.86	1.85	1.52	1.51	1.68	1.66	1.63	1.65	1.56	1.53	1.55	1.56	1.50	1.54
9	2.07	2.24	2.02	1.78	1.70	1.84	1.84	1.78	1.78	1.69	1.62	1.63	1.63	1.66	1.59
10	2.59	2.41	2.08	1.93	1.76	1.89	1.88	1.88	1.83	1.69	1.65	1.64	1.71	1.76	1.63
11	2.86	2.35	2.18	1.83	1.78	1.93	1.88	1.87	1.81	1.68	1.68	1.67	1.68	1.68	1.71
12	2.74	2.67	2.41	1.91	1.80	1.96	1.92	1.89	1.83	1.70	1.71	1.71	1.64	1.77	1.70
13	3.16	3.34	2.25	1.93	1.74	2.11	1.96	1.93	1.82	1.95	1.68	1.70	1.69	1.65	1.76
14	3.28	2.88	1.94	1.97	1.72	1.93	1.77	2.07	1.90	1.79	1.74	1.44	1.74	1.75	1.65
15	2.65	2.65	2.65	2.71	2.87	2.26	1.84	1.84	1.89	1.61	1.80	1.68	1.97	1.46	1.66
16	2.15	2.15	2.15	2.15	3.88	2.69	2.05	1.46	1.53	1.71	1.61	1.75	2.56	1.97	1.47
17	2.45	2.45	2.45	4.43	2.45	2.69	2.28	1.91	1.64	1.64	2.03	1.75	1.64	1.81	4.65
Mean	1.880	2.060	1.930	1.750	1.660	1.850	1.790	1.740	1.730	1.590	1.560	1.550	1.580	1.600	1.570
Inshore	-	-	-	1.740	1.660	1.820	1.840	1.840	1.820	1.590	1.580	1.570	1.550	1.580	1.580
Offshore	-	-	-	-	-	1.850	1.600	1.670	1.590	1.530	1.480	1.540	1.540	1.630	1.560

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
6	0.94	0.80	0.96	1.14	0.88	0.78	1.04	1.22	1.18	-	1.13	1.16
7	1.20	1.16	1.25	1.29	1.27	1.16	1.33	1.37	1.43	1.40	1.44	1.37
8	1.33	1.31	1.44	1.46	1.44	1.30	1.43	1.54	1.58	1.53	1.54	1.51
9	1.37	1.39	1.51	1.50	1.53	1.40	1.53	1.62	1.72	1.60	1.67	1.64
10	1.41	1.42	1.58	1.62	1.53	1.49	1.59	1.66	1.67	1.72	1.87	1.63
11	1.54	1.50	1.47	1.68	1.57	1.48	1.67	1.55	1.49	1.70	1.82	1.68
12	1.44	1.52	1.55	1.97	1.75	1.63	1.80	1.66	1.79	1.75	1.72	2.08
13	1.49	1.38	1.86	-	1.46	1.47	1.76	2.11	1.83	1.67	2.00	2.03
14	1.52	1.24	1.75	2.69 -		1.49	1.60	-	1.56	-	-	2.09
15	1.93	1.46	1.52	-	-	-	-	2.05	1.85	-	-	2.55
16	1.87	-	2.20	-	-	-	-	-	-	-	-	-
17	2.38	3.63	-	-	-	-	-	-	-	-	-	-
Mean	1.340	1.330	1.440	1.450	1.460	1.290	1.430	1.507	1.524	1.566	1.640	1.528
Inshore	1.260	1.290	1.380	1.300	1.290	1.610	1.450	1.474	1.487	1.533	1.660	1.518
Offshore	1.340	1.340	1.530	1.430	1.520	1.240	1.420	1.573	1.594	1.676	1.529	1.644

MEAN AGE OF CATCH

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Age	8.46	8.75	8.87	9.34	9.28	9.83	9.52	9.40	9.47	8.77	9.10	8.65	8.86	8.92	9.16

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Age	8.73	8.75	8.64	8.36	8.79	8.61	8.33	8.33	8.27	8.71	8.86	8.41

Table 13. Summary of Arctic charr catch (kg-round), effort (person-weeks), and catch per unit (CUE) effort for the Okak stock complex in north Labrador, 1974 - 2003. Offshore pertains to the Cutthroat subarea. CUE is unstandardized.

Year	Catch	Effort	CUE	% Offshore	Stock as % of Nain Region Total
1974	46891			27	39
1975	5057			53	11
1976	25338	148	171	30	19
1977	42392	243	174	37	23
1978	76024	352	216	54	36
1979	43261	283	153	41	25
1980	49035	253	194	66	29
1981	47541	202	235	78	21
1982	34171	186	184	75	17
1983	48978	286	171	39	33
1984	18146	94	193	25	15
1985	33261	208	160	26	31
1986	28896	172	168	30	29
1987	19649	134	147	20	20
1988	17450	136	128	28	24
1989	16563	163	102	10	20
1990	16125	100	161	22	19
1991	4432	31	143	7	8
1992	180	13	14	100	<1
1993	578	9	64	100	2
1994	10866	23	472	0	37
1995	10635	26	409	2	42
1996	3425	8	428	2	26
1997	13515	69	196	7	40
1998	5997	43	139	0	16
1999	5232	35	149	0	13
2000	14123	38	372	0	30
2001	7805	20	390	0	24
2002	679	3	226	0	3
2003			No fishery		
Avg. 1994-2003	8031	29	309	1	26
Avg. 1974-2003	22284	121	206	30	23
Total 1974 - 2003	646245				

Table 14. Estimated catch- and percent at-age of Arctic charr from the Okak stock complex commercial fishery, 1977 - 2002.

CATCH - AT - AGE

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
6	84	205	1	130	39	93	475	220	17	41	42	150	190	80	22
7	139	2465	1989	638	526	713	1762	1202	2675	2056	1008	1007	1760	1474	577
8	417	8163	7462	5631	2135	2760	4471	2047	4948	6333	1636	1822	1829	2667	778
9	1084	5494	4997	9175	7166	4167	5787	1885	5385	5197	3686	2977	2058	2108	693
10	2667	5594	3299	6487	7615	3848	5601	1621	2740	3291	3247	2241	1718	1267	332
11	3388	3747	1954	2863	4673	3622	5169	1937	2936	1261	1371	1492	1714	1234	164
12	5417	3953	878	1382	1330	1542	4075	1290	987	875	395	772	865	556	122
13	2278	2773	761	407	1044	444	1643	1034	740	562	299	187	296	261	68
14	1694	514	527	350	459	342	658	514	768	148	166	125	139	94	23
15	1472	1027	410	262	359	183	307	192	103	170	85	13	52	92	0
16	832	308	351	90	44	57	107	111	75	8	34	32	56	0	23
17	277	567	399	178	223	114	68	123	123	3	2	1	16	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	23	0
6+	19749	34810	23028	27593	25613	17885	30123	12176	21497	19945	11971	10819	10700	9856	2802

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
6	0	9	113	260	37	494	426	24	116	15	4	No
7	3	99	1059	998	327	1276	1144	771	2052	609	71	Fishery
8	18	120	1972	2123	560	1289	1164	715	1882	838	79	-
9	31	122	1817	2556	661	1337	1042	988	1539	1420	104	-
10	26	62	985	1245	437	1068	344	367	1837	692	71	-
11	11	6	655	459	184	509	217	287	775	499	37	-
12	18	10	174	151	64	60	50	56	516	43	15	-
13	7	0	43	55	13	94	27	15	140	31	5	-
14	0	0	0	2	0	0	5	0	37	0	1	-
15	0	0	7	0	0	0	0	3	81	14	2	-
16	0	0	0	0	0	0	0	0	0	31	1	-
17	0	0	0	0	0	0	0	0	0	0	0	-
18	0	0	0	0	0	0	0	0	0	0	0	-
19	0	0	0	0	0	0	0	0	0	0	0	-
6+	114	428	6825	7849	2283	6127	4419	3226	8975	4192	390	

PERCENT - AT - AGE

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
6	0.4	0.6	0.0	0.5	0.2	0.5	1.6	1.8	0.1	0.2	0.4	1.4	1.8	0.8	0.8
7	0.7	7.1	8.6	2.3	2.1	4.0	5.8	9.9	12.4	10.3	8.4	9.3	16.4	15.0	20.6
8	2.1	23.5	32.4	20.4	8.3	15.4	14.8	16.8	23.0	31.8	13.7	16.8	17.1	27.1	27.8
9	5.5	15.8	21.7	33.3	28.0	23.3	19.2	15.5	25.1	26.1	30.8	27.5	19.2	21.4	24.7
10	13.5	16.1	14.3	23.5	29.7	21.5	18.6	13.3	12.7	16.5	27.1	20.7	16.1	12.9	11.8
11	17.2	10.8	8.5	10.4	18.2	20.3	17.2	15.9	13.7	6.3	11.5	13.8	16.0	12.5	5.9
12	27.4	11.4	3.8	5.0	5.2	8.6	13.5	10.6	4.6	4.4	3.3	7.1	8.1	5.6	4.4
13	11.5	8.0	3.3	1.5	4.1	2.5	5.5	8.5	3.4	2.8	2.5	1.7	2.8	2.6	2.4
14	8.6	1.5	2.3	1.3	1.8	1.9	2.2	4.2	3.6	0.7	1.4	1.2	1.3	1.0	0.8
15	7.5	3.0	1.8	0.9	1.4	1.0	1.0	1.6	0.5	0.9	0.7	0.1	0.5	0.9	0.0
16	4.2	0.9	1.5	0.3	0.2	0.3	0.4	0.9	0.3	0.0	0.3	0.3	0.5	0.0	0.8
17	1.4	1.6	1.7	0.6	0.9	0.6	0.2	1.0	0.6	0.0	0.0	0.0	0.1	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
6	0.0	2.1	1.7	3.3	1.6	8.1	9.6	0.7	1.3	0.4	1.0	-
7	2.6	23.1	15.5	12.7	14.3	20.8	25.9	23.9	22.9	14.5	18.2	-
8	15.8	28.0	28.9	27.0	24.5	21.0	26.3	22.2	21.0	20.0	20.3	-
9	27.2	28.5	26.6	32.6	29.0	21.8	23.6	30.6	17.1	33.9	26.7	-
10	22.8	14.5	14.4	15.9	19.1	17.4	7.8	11.4	20.5	16.5	18.2	-
11	9.6	1.4	9.6	5.8	8.1	8.3	4.9	8.9	8.6	11.9	9.5	-
12	15.8	2.3	2.5	1.9	2.8	1.0	1.1	1.7	5.7	1.0	3.8	-
13	6.1	0.0	0.6	0.7	0.6	1.5	0.6	0.5	1.6	0.7	1.3	-
14	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.4	0.0	0.3	-
15	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.9	0.3	0.5	-
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.3	-
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-

** Owing to limited samples, Okak data for 2002 is based on lth-wt, age-lth key, and lth-frequency averaged from 2000 - 2002, but applied to the 2002 catch

Table 15. Average weight-at-age (kg-round) of Arctic charr from the Okak stock complex commercial catch, 1977 - 2002. Note, no fishery occurred in 2003.

AVERAGE WEIGHT - AT - AGE

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
6	1.21	1.21	1.21	1.02	1.29	1.13	1.15	1.16	1.12	1.06	1.14	1.16	1.26	1.13	1.32
7	1.48	1.48	1.48	1.20	1.24	1.38	1.25	1.26	1.27	1.32	1.30	1.33	1.32	1.40	1.48
8	1.66	1.66	1.66	1.59	1.51	1.58	1.43	1.41	1.45	1.50	1.43	1.37	1.47	1.55	1.51
9	1.85	1.85	1.85	1.77	1.73	1.66	1.56	1.46	1.52	1.64	1.58	1.53	1.51	1.69	1.57
10	1.98	1.98	1.98	1.81	1.93	1.75	1.66	1.58	1.67	1.73	1.64	1.60	1.65	1.79	1.80
11	2.02	2.02	2.02	1.89	1.89	1.76	1.69	1.52	1.61	1.85	1.64	1.63	1.66	1.76	1.83
12	2.36	2.36	2.36	2.05	1.93	1.94	1.76	1.62	1.90	1.85	1.75	1.76	1.77	1.88	1.66
13	2.30	2.30	2.30	2.47	2.10	2.01	1.73	1.64	1.77	1.77	1.87	1.85	1.86	1.74	1.72
14	2.38	2.38	2.38	2.10	1.87	2.02	1.52	1.68	1.66	1.72	1.97	1.74	1.99	1.84	1.63
15	2.48	2.48	2.48	1.83	1.93	2.18	1.81	1.76	2.04	1.60	2.04	2.31	1.89	1.63	-
16	2.30	2.30	2.30	2.82	1.54	1.65	1.70	1.66	1.89	2.72	2.48	1.91	1.76	-	1.63
17	2.30	2.30	2.30	2.37	2.39	2.56	2.73	2.10	2.07	-	-	-	2.17	-	-
18	2.30	2.30	2.30	2.58	3.17	1.84	2.07	-	3.16	1.68	-	-	2.30	-	-
19	2.30	2.30	2.30	2.69	-	-	2.07	1.43	1.37	-	-	-	-	1.84	-
Mean	2.200	1.950	1.860	1.770	1.830	1.720	1.600	1.510	1.540	1.600	1.580	1.530	1.560	1.640	1.580

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
6	-	0.88	1.02	1.03	0.88	0.73	0.77	1.14	1.06	1.08	1.04	-
7	1.15	1.03	1.27	1.10	1.24	0.98	1.25	1.42	1.37	1.49	1.42	-
8	1.57	1.29	1.47	1.31	1.37	1.18	1.40	1.54	1.47	1.84	1.66	-
9	1.41	1.51	1.73	1.36	1.59	1.47	1.53	1.67	1.68	1.90	1.83	-
10	1.64	1.62	1.90	1.60	1.72	1.53	1.69	1.83	1.69	2.03	1.90	-
11	1.84	2.32	1.77	1.59	1.69	1.59	1.66	1.97	1.79	1.96	1.90	-
12	1.63	2.30	1.95	1.68	1.61	2.12	1.67	2.01	1.78	3.10	1.96	-
13	1.84	-	1.21	1.67	2.09	1.55	2.26	1.88	2.09	1.98	2.16	-
14	-	-	-	3.93	-	-	2.77	-	2.21	-	2.61	-
15	-	-	3.21	-	-	-	-	-	1.50	2.44	1.76	-
16	-	-	-	-	-	-	-	-	-	1.98	1.94	-
17	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-
Mean	1.580	1.370	1.590	1.360	1.500	1.210	1.360	1.621	1.574	1.857	1.739	-

MEAN AGE OF CATCH

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Age	12.00	10.08	9.53	9.58	10.11	9.96	10.05	10.14	9.47	9.1	9.82	9.46	9.43	9.19	8.85

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Age	9.93	8.44	8.8	8.74	8.88	8.56	8.17	8.65	8.98	9.03	8.98	-

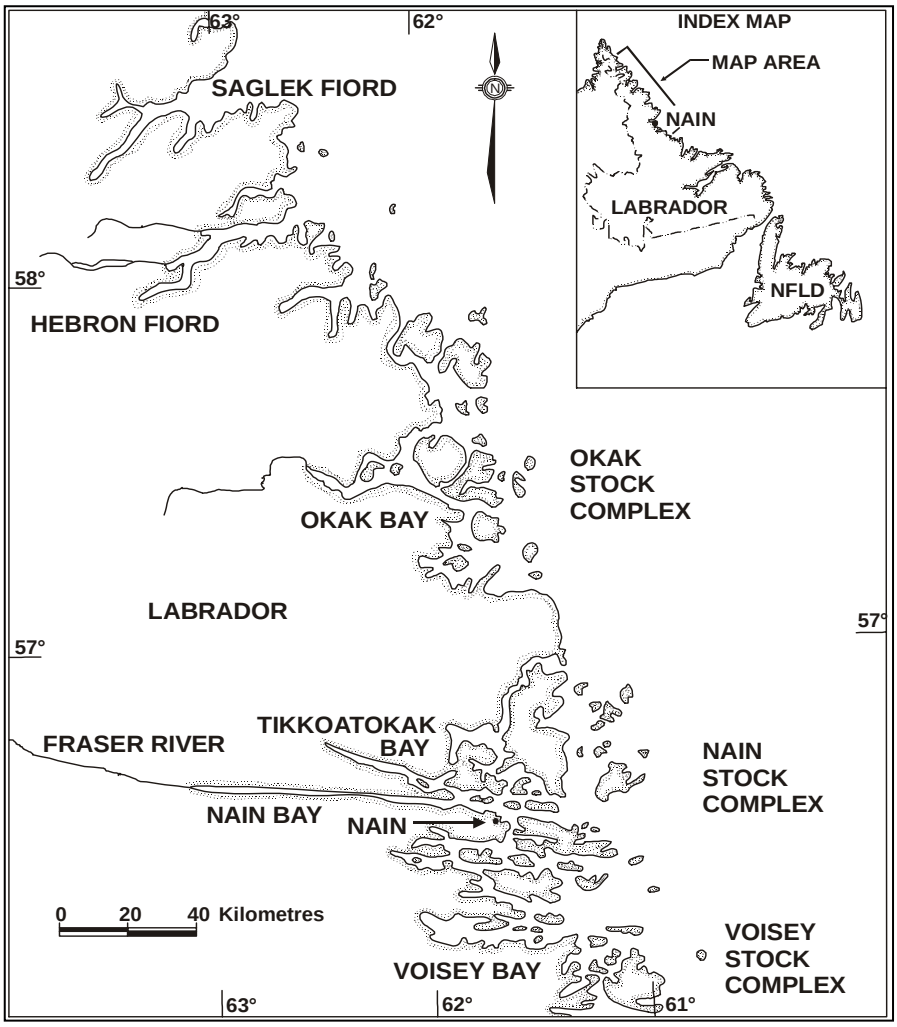

Figure 1. Map of north Labrador illustrating the general location of the various anadromous Arctic charr stock complex areas.

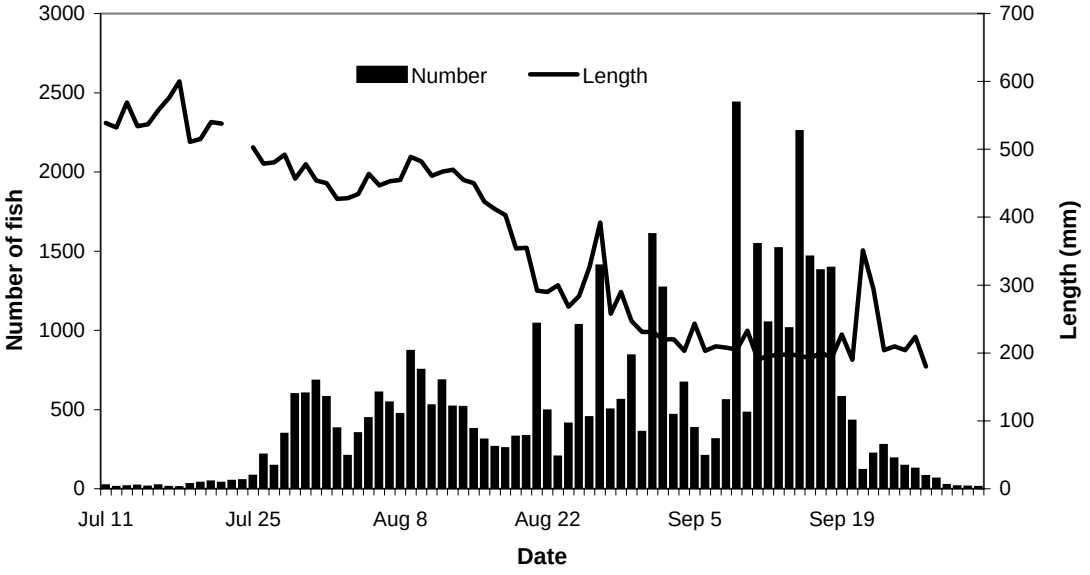

Figure 2. Total numbers of upstream migrating anadromous Arctic charr at Ikarut River, Hebron Fiord, along with change in mean length by day throughout the run. Data are combined for years 1981 to 1985.

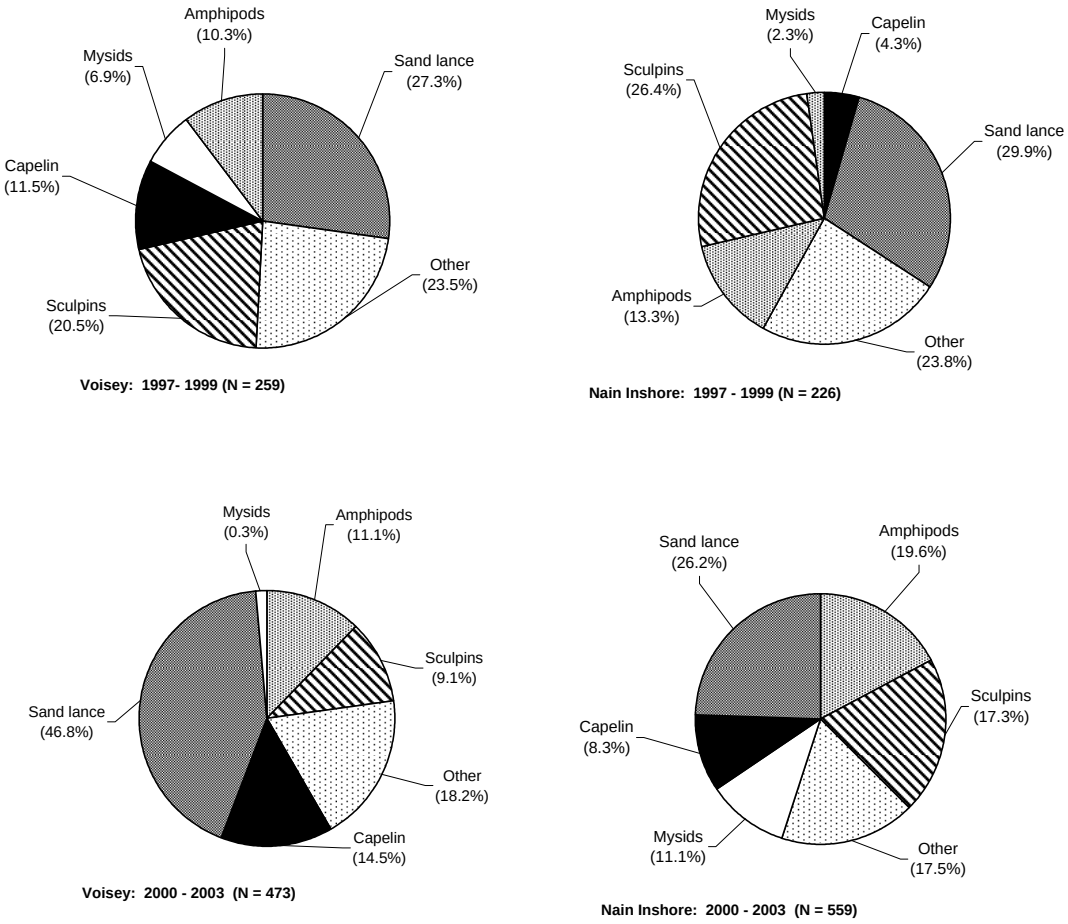

Figure 3. Relative importance (% wet weight) of prey items in the diet of anadromous Arctic charr≥ 30 cm in for length from various stock complex areas or zones in north Labrador, illustrating data from two specific time intervals: 1997 - 1999 and 2000 - 2003.

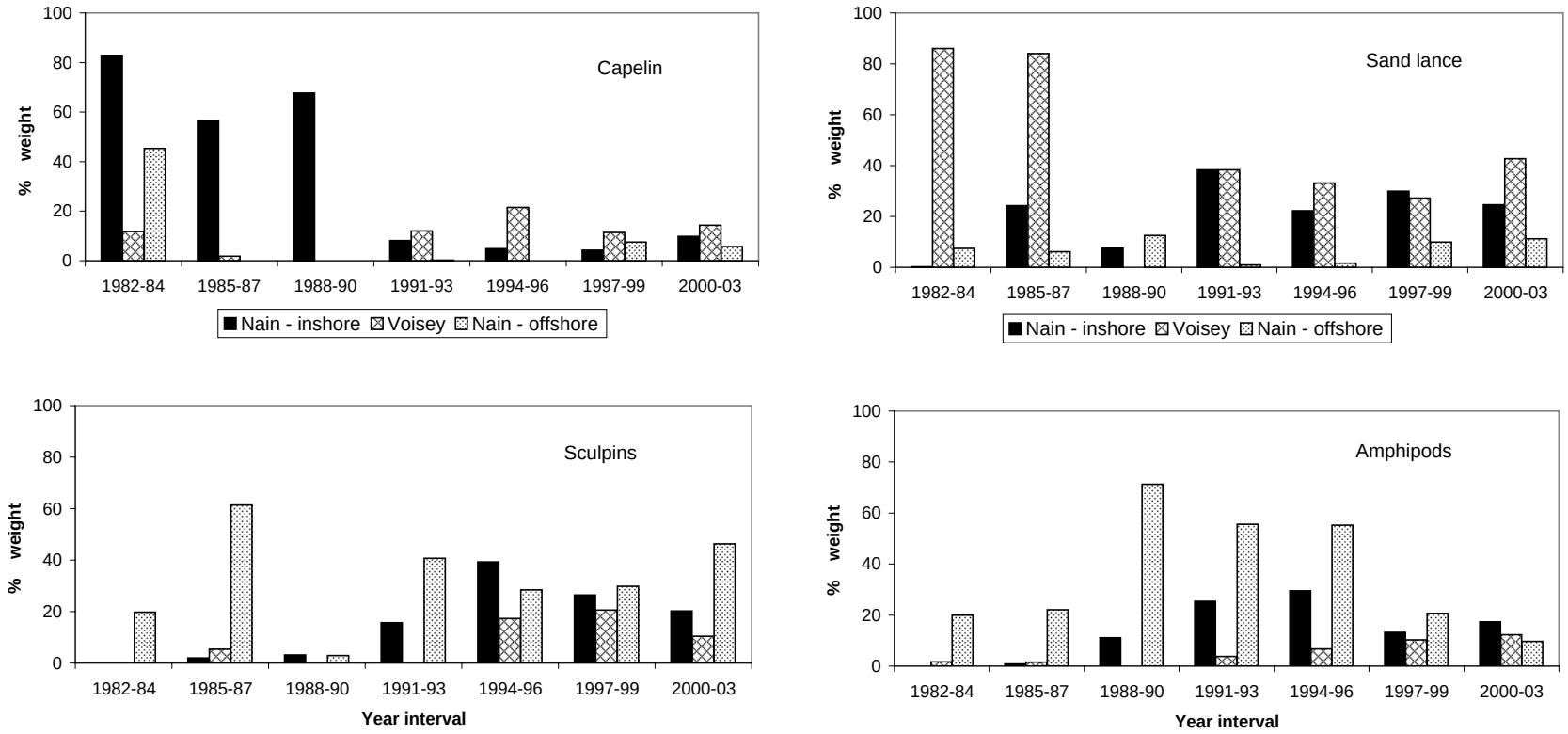

Figure 4. Temporal variation in the mean percentage wet weight of capelin, sand lance, sculpins, and amphipods in the diet of anadromous Arctic charr from the Voisey, and inshore and offshore zones of the Nain stock complex. Data are for charr >= 300 mm in fork length.

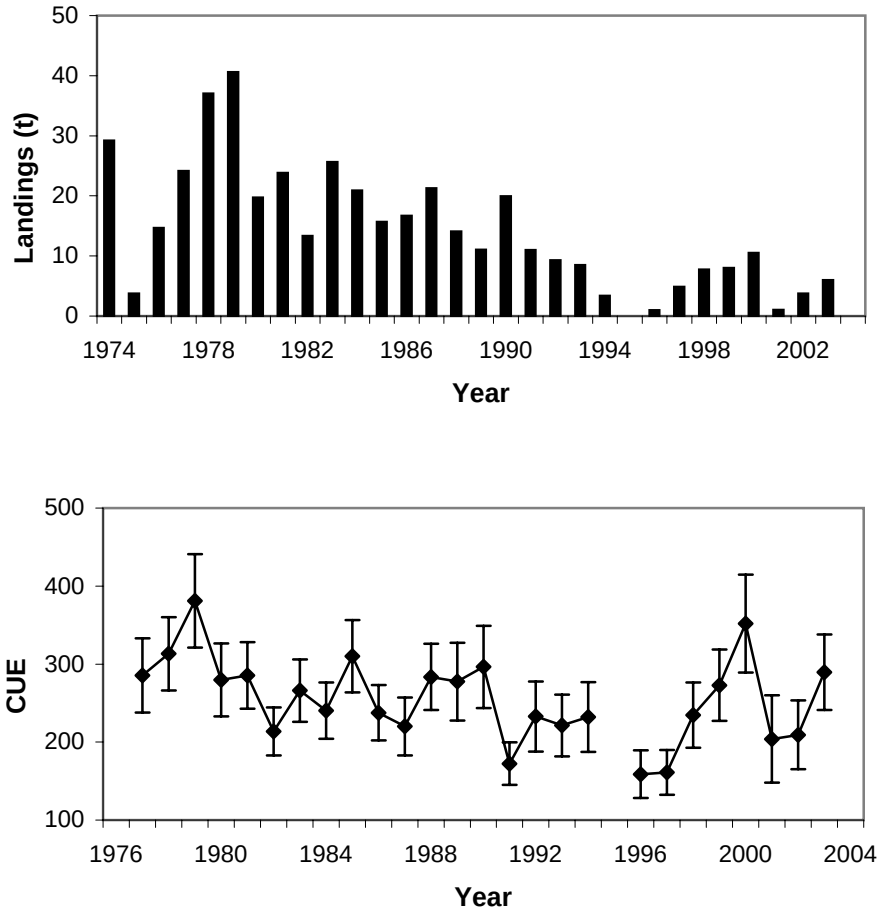

Figure 5. Commercial landings of anadromous Arctic charr from the Voisey stock complex, 1974 - 2003. Lower panel illustrates standardized commercial catch rates (kg/person-week fished). Vertical lines represent ± one standard error about the mean catch rate value.

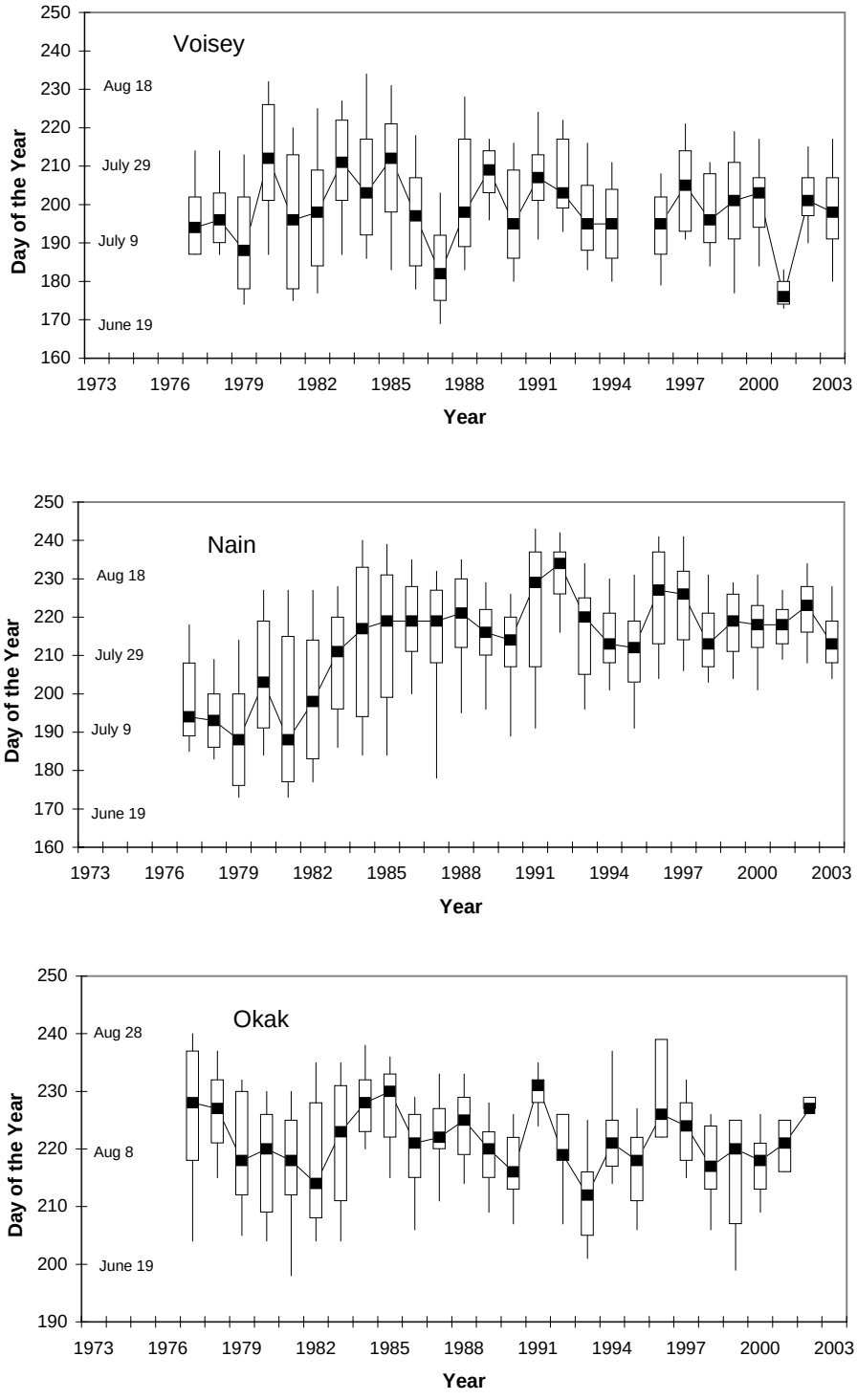

Figure 6. Commercial catch timing of the Voisey, Nain, and Okak stock complex Arctic charr fisheries, 1976 - 2003. Vertical lines represent the 10th and 90th percentiles f the day of the year of catch timing, the rectangle is the 25th and 75th percentiles, while the solid marker within the rectangle is the median (50th) date of run timing.

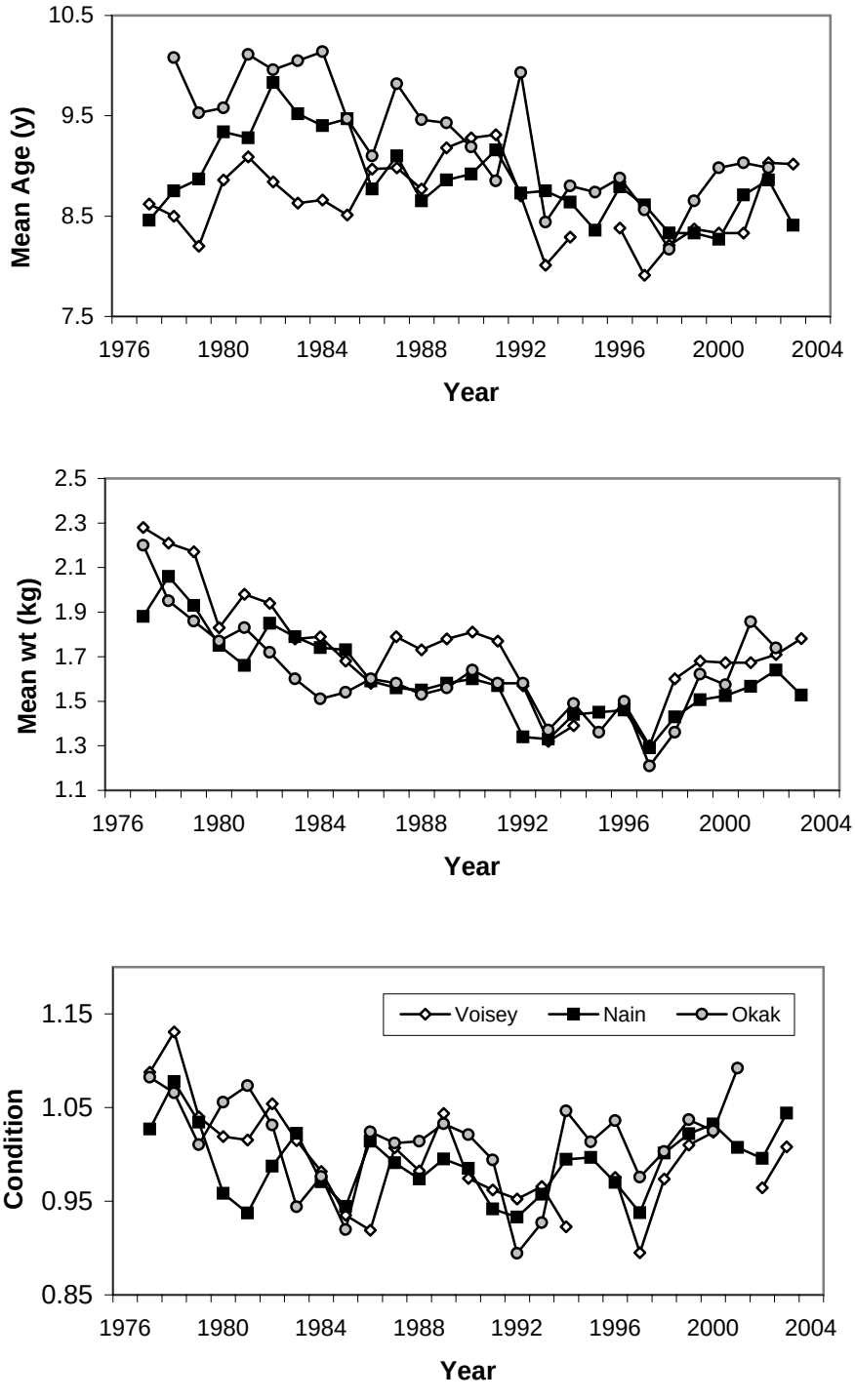

Figure 7. Trends in mean age, weight and condition, as derived from biologcial sampling of anadromous Arctic charr caught in commercial fisheries from the Voisey, Nain, and Okak stock complexes in north Labrador.

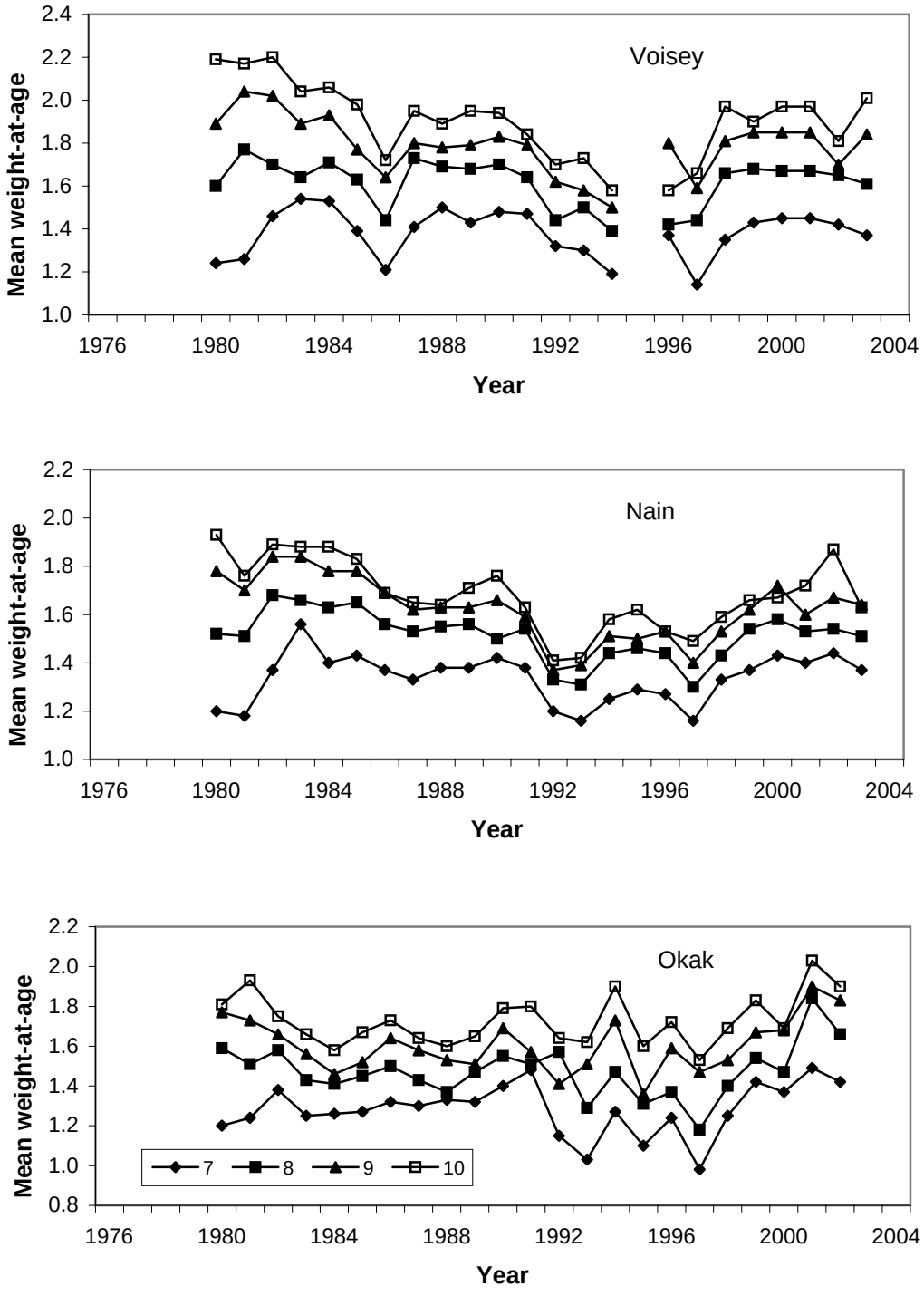

Figure 8. Trends in mean weight-at-age of 7, 8, 9, and 10 year old anadromous Arctic charr from the Voisey, Nain and Okak stock complexes, 1980 - 2003.

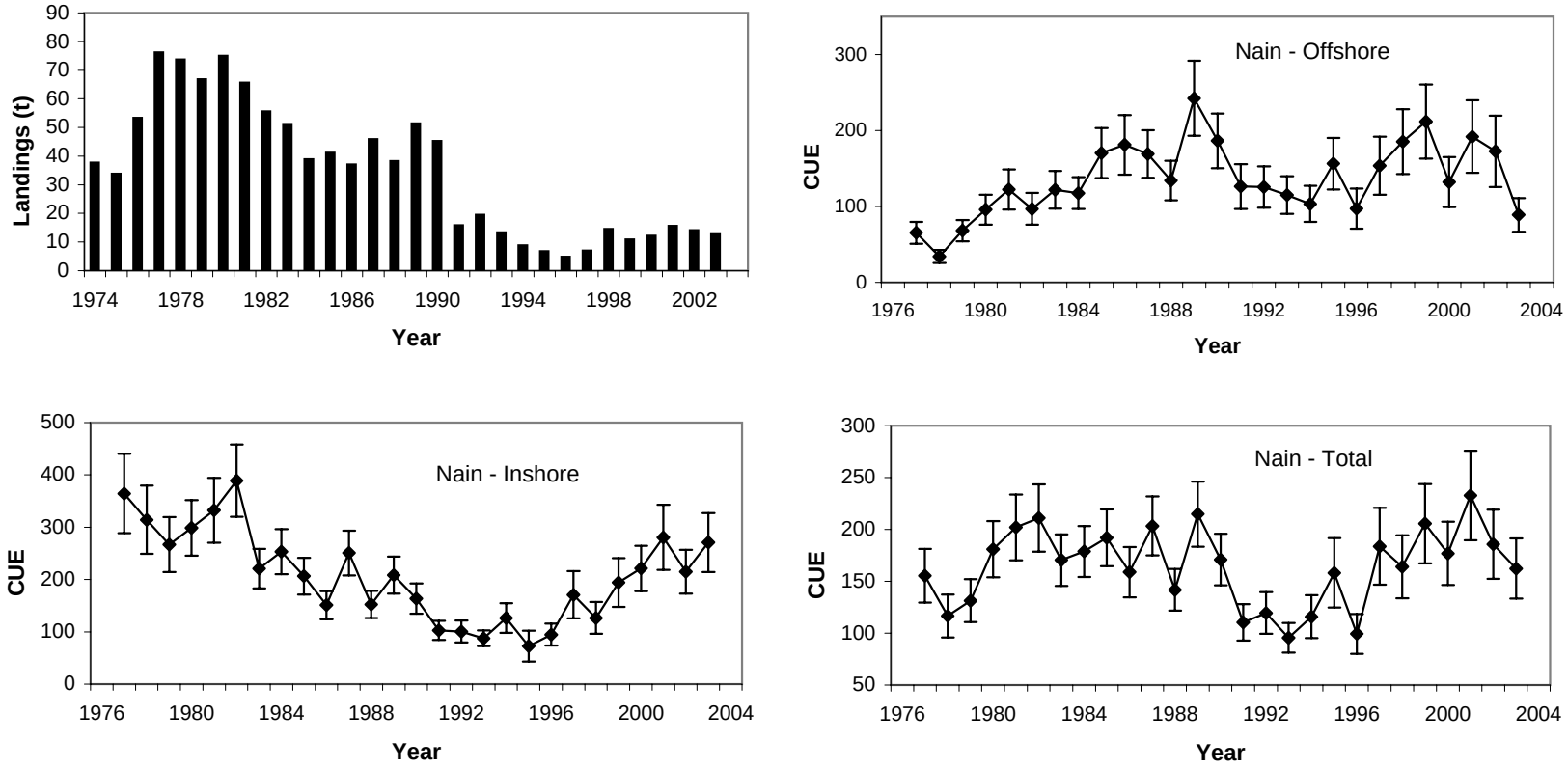

Figure 9. Commercial landings of anadromous Arctic charr from the Nain stock complex, 1974 - 2003. Lower left and top right panels illustrate standardized commercial catch rates (kg/person-week fished) for the inshore and offshore zones, while the bottom left right panel shows a composite index for the inshore and offshore zones combined. Vertical lines represent ± one standard error about the mean catch rate value.

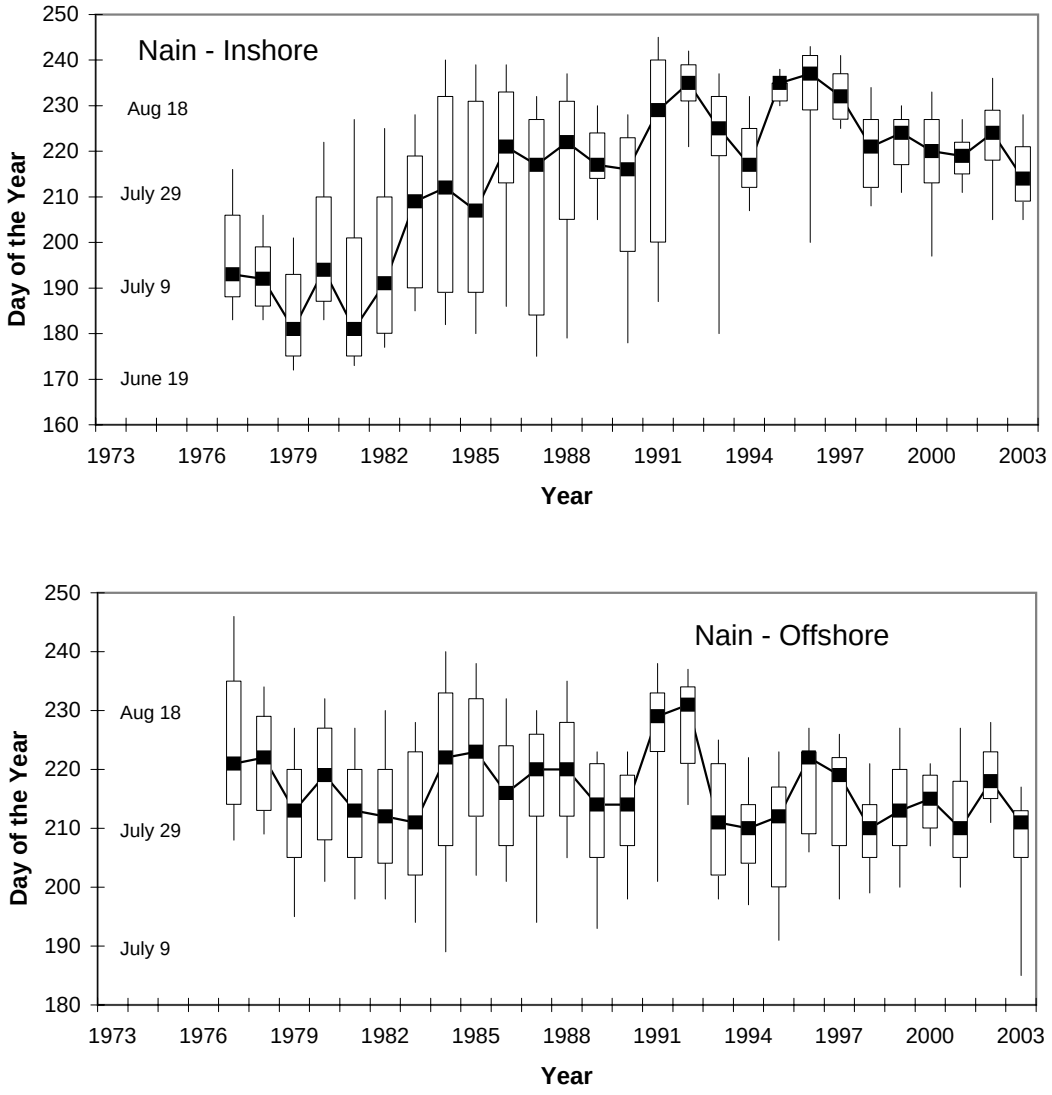

Figure 10. Commercial catch timing for the inshore and offshore zones of the Nain stock complex Arctic charr fishery, 1976 - 2003. Vertical lines represent the 10th and 90th percentiles of the day of the year of catch timing, the rectangle is the 25th and 75th percentiles, while the soild marker within the rectangle is the median (50th) catch timing value.

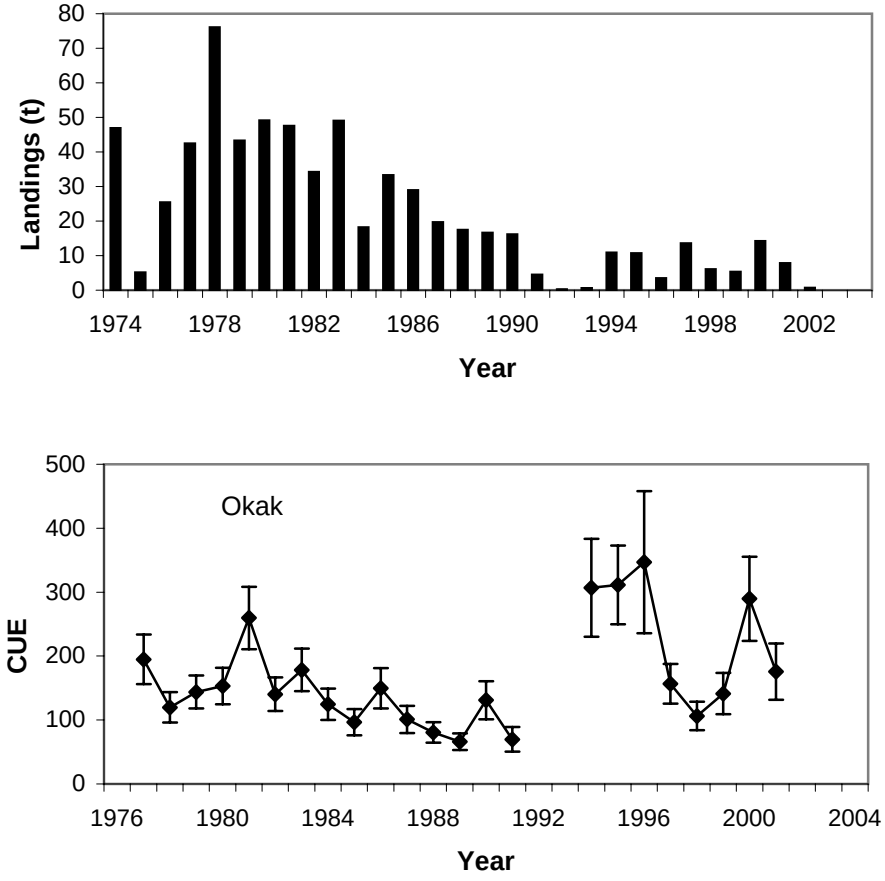

Figure 11. Commercial landings of anadromous Arctic charr from the Okak stock complex, 1974 - 2002. Lower panel illustrates standardized commercial catch rates (kg/person-week fished). Vertical lines represent ± one standard error about the mean catch rate value. No fishery occurred in 2003.

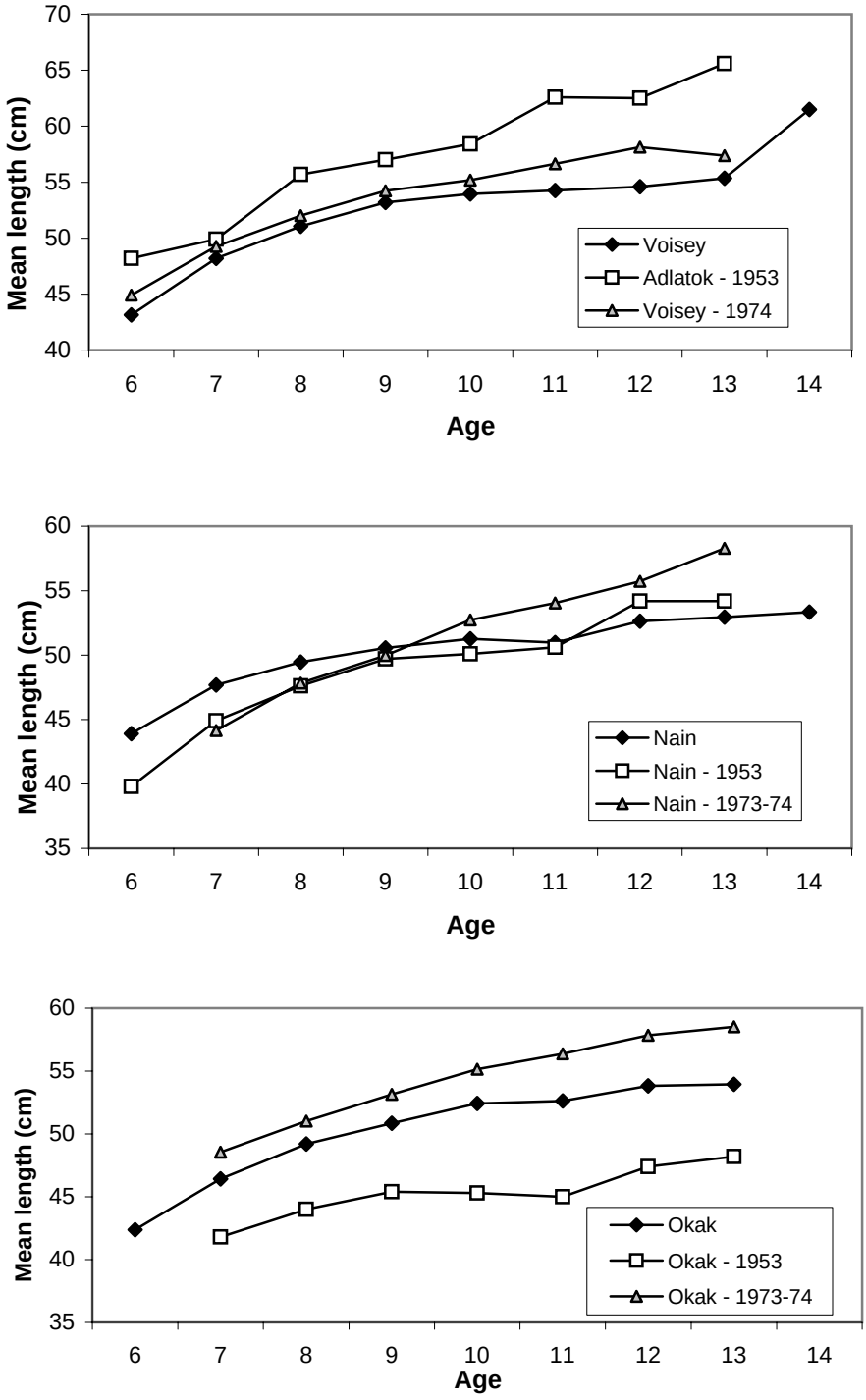

Figure 12. Mean length-at-age of anadromous Arctic charr sampled from north Labrador commercial fisheries. Data from 1953 were obtained from Andrews and Lear (1956), 1973 and 1974 data were from Coady and Best (1976) while other samples pertain to the average over the period 1994 to 2003.

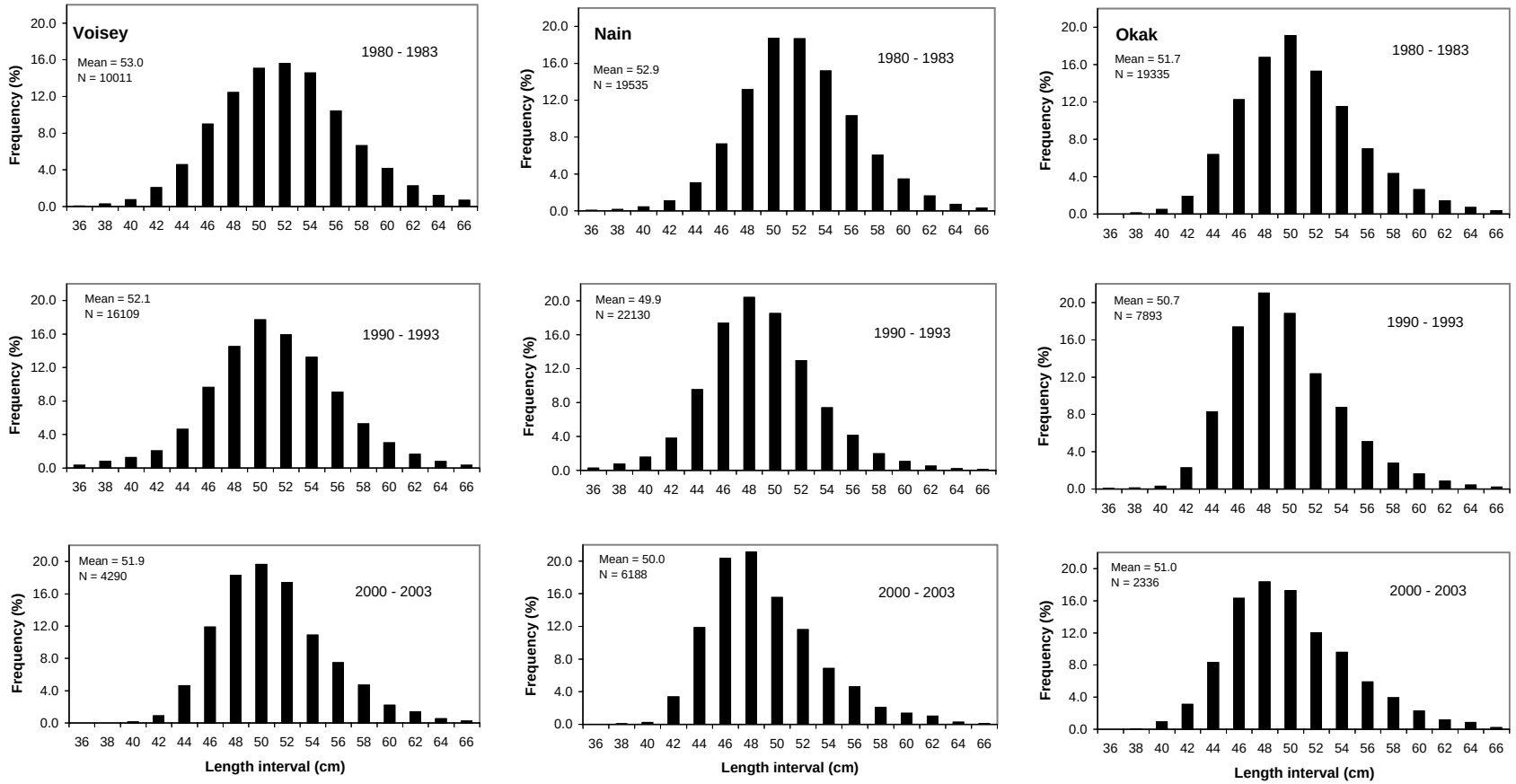

Figure 13. Length frequency distributions of the commercial catch of anadromous Arctic charr by various year groupings for the Voisey, Nain, and Okak stock complexes.