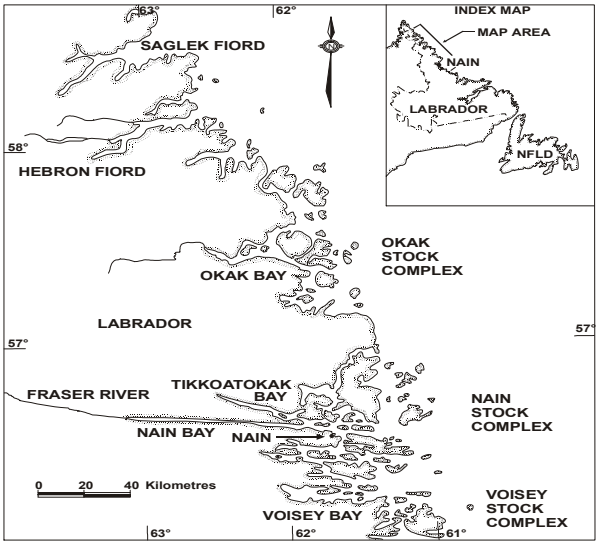
North Labrador Arctic Charr

Background

Arctic charr, Salvelinus alpinus, are distributed throughout the circumpolar regions of the northern hemisphere. They are the most northerly distributed freshwater fish, and one of a few fish species known to occur naturally in single fish species ecosystems. They exist as both anadromous (sea run) and resident freshwater populations. In general, resident freshwater populations predominate in southern areas while the anadromous form is common in more northern regions. In Labrador, the frequency of anadromous populations increases with latitude being replaced by sea-run brook charr and Atlantic salmon in more southern areas.

Anadromous charr spend two to seven years in freshwater before migrating to sea for the first time. Marine migrations are generally of short duration (1 to 4 months), in limited coastal areas where they feed readily prior to returning to freshwater to overwinter. While many spawning charr home to their natal rivers, non-spawning fish may overwinter in other adjacent systems where suitable overwintering habitat occurs. In Labrador, anadromous female charr begin to mature when they are about 6 years of age, with most fish having spawned at least once by age 9.

In addition to its importance for Aboriginal subsistence and domestic use, anadromous Arctic charr populations in north Labrador have also supported commercial fisheries for well over 100 years. The highest landings of over 200 t per year occurred in the late 1970s and early 1980s and since 1974, 2676 t, or 5.9 million pounds of charr, have been caught in the commercial fishery that extends over a coastal area of only about 200 km. The amount of charr harvested in subsistence or food fisheries is unknown, but could be substantive in some years. The north Labrador area is composed of various stock complexes where charr first enter the fishery at age 6 with some living to 20 or more years of age.



Summary

- North Labrador Arctic charr have a long history of commercial exploitation, dating back over 100 years. Historic catch records are incomplete, but since 1974, 2676 t, or 5.9 million pounds of charr, have been caught, most (97%) along a limited 225 km section of coast extending from Voisey's Bay north to the Hebron Fiord. Unknown, but possibly significant quantities of charr are also harvested in subsistence and recreational fisheries.

- Management has focused on three primary stock complexes: Voisey, Nain, and Okak, where approximately 80% of the charr are harvested. Landings from these areas in 2000 were either the highest or second highest recorded during the past 7 to 10 years.

- Trends in commercial catch, catch rates, age and size composition of the catch were updated from information collected in 2000.

- Landings of 47 t in 2000 were 16% higher than in 1999, and were the highest recorded since 1992. Commercial catch rates have been variable over time, with evidence of a longer term decline in some areas. However, catch rates in 2000 were the highest or among the highest recorded in all three stock complexes. In the absence of independent estimates of abundance, interpretation of commercial catch rates as indices of abundance may be questionable and thus the actual status of the resource is largely unknown.

- Mean age and size of charr has declined over time, but increased mean weight, and mean-weight-at-age has characterized all stocks in recent years.

- Early maturity and relatively high fecundity of Labrador charr have sustained an intense fishery for many years, primarily on the strength of four age-classes. There is no evidence of any substantive change in this pattern.

Species Biology

Migration

The seaward migration of anadromous Arctic charr in north Labrador coincides with spring runoff and ice break-up in coastal rivers and consists of both first-time and repeat migrants. First time migrants are usually 2 to 7 years of age (10 – 20 cm) while repeat migrants include both adults (maturing and nonmaturing) and juvenile smolt-sized fish. In contrast with Atlantic salmon, anadromous charr have a shorter and more irregular period of marine residence. Arctic charr are not known to overwinter at sea and juveniles and adults spend only 1 – 4 months in the ocean before returning to freshwater. Ocean migrations are limited in spatial extent with most fish moving less than 100 km from their home rivers although exceptions to this have occurred. Return migrations normally begin in early-to-mid July, with peak migrations during late July and early August. Larger maturing fish usually enter early followed first by nonmaturing adults and then juveniles in late August and September.

Feeding

While Arctic charr feed opportunistically during their period of residence at sea, spatial differences in the diet can occur over small geographic areas. Sand lance (*Ammodytes* spp.), capelin (*Mallotus villosus*), and sculpins (Cottidae: *Triglops* spp., *Myoxocephalus* spp.) were the most important components of charr diet in the Voisey stock complex, with capelin, sand lance, and hyperiid amphipods (*Parathemisto* spp.) dominating in the Nain complex. In contrast, hyperiid amphipods and sculpins were the primary prey organisms in the more northern Hebron and Saglek fiords. The relative importance of prey also varies with size of the predator. Diet shifts have occurred over time, in particular with the noticeable decrease in the importance of capelin for charr in the Nain stock complex since 1991.

Reproduction

North Labrador charr mature at smaller sizes (35 – 45 cm) and younger ages (6 – 8 years), and are characterized by having return upstream migrations consisting of higher proportions of spawning individuals, compared to other charr stocks from northern Canada. On average, approximately 70% of the returning adult female charr will spawn in

the same year, and have a relative fecundity of about 290 eggs/100 g. Spawning normally occurs between mid-October and early-November and can occur in either streams or lakes over a variety of substrates.

Age and growth

Growth is generally slow during the freshwater phase of their life cycle, with fish aged 1 and 2 years averaging 6.5 and 9.0 cm, respectively. Adult size-at-age is highly variable and is dependent upon the age at first sea migration and the number of marine migrations a fish has taken. At the Fraser River, Labrador (Nain stock complex), age 7 charr average 40 cm in length (14 – 58 cm) while those age 10 average 50 cm (37 – 64 cm). Corresponding size of charr caught in the commercial fishery are larger owing to the selective nature of the gill-net fishery. While charr over 20 years of age have been found in north Labrador, the majority of charr caught are less than 15 years of age.

The Fishery

Arctic charr are caught by shore-set surface gill nets, 25 fathoms in length, with a minimum mesh size of 114 mm. Quotas have been in place in some areas since 1979. The fishery begins in mid-June and is usually over by the end of August. Since 1974, commercial landings data have been recorded separately from bays and fiords along the north Labrador coast. Various combinations of these areas form component parts of larger stock complexes, identified largely on the basis of extensive tagging studies and later complemented with limited genetic analyses. Approximately 80% of the charr are harvested from three primary stock complexes: Voisey, Nain, and Okak.

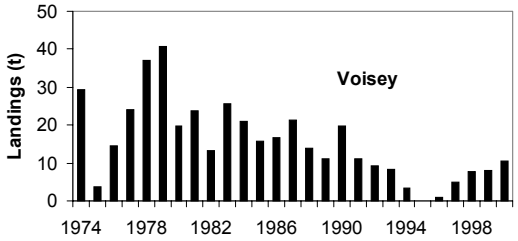
During the 27 year interval, 1974 - 2000, commercial landings of Arctic charr averaged 99 t per year. The highest landings of over 200 t per year occurred in the late 1970s and early 1980s. Following the closure of the commercial salmon fishery in the early 1990s, many fishers sold their licences and landings of charr declined. The lowest landings, 13 t, occurred in 1996. Since then, landings have increased each year totalling 47 t in 2000 (approximately 27,000 charr), 16% greater than landings in 1999. There is a high degree of association between the amount of charr caught and the relative amount of effort directed to the fishery. Commercial effort (person-weeks fished) similarly peaked in the late 1970s and early 1980s, but in recent years has declined by about 80% relative to former years. Thus the low catch in 1996 coincided with the least amount of effort recorded.

Since 1974, 2676 t, or 5.9 million pounds of charr have been caught in the commercial fishery that extends over a coastal area of only about 200 km. While commercial effort has declined over time, there has been a corresponding increase in subsistence effort since the early 1990s. The amount of charr harvested in subsistence or food fisheries is unknown, but could be substantive in some years.

Voisey stock complex

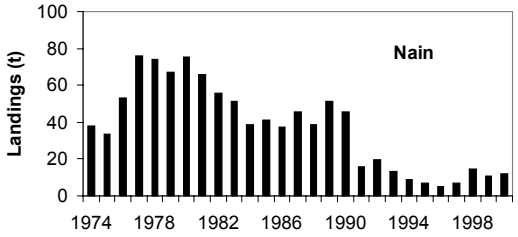
The Voisey stock complex is made up of Voisey's Bay and the Anton's subarea. Since 1974, 415 t of charr, equivalent to 225 thousand fish (in number), have been harvested from the Voisey stock complex. Annual landings ranged from 0 to 41 t from 1974 - 2000 (mean = 15 t; note, there was no fishery in 1995). The highest catches occurred during the late 1970s, but they fell coincident with decreased effort during the 1990s. A total allowable catch (TAC) of 14 t was maintained for 2000. Landings in 2000

increased to 10.5 t, the highest catch from this stock complex since 1991, and contributed 22% of the landings from the north Labrador charr fishing region.



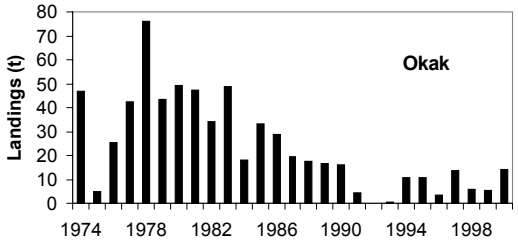
Nain stock complex

The Nain stock complex consists of an inshore zone made up of Anaktalik Bay, Nain Bay, Tikkoatokak Bay, and Webb Bay subareas, and an offshore zone made up of the Dog Island and Black Island subareas. Since 1974, 1001 t of charr, equivalent to 590 thousand fish (in number), have been caught from the Nain stock complex. Annual landings ranged from 5 to 76 t from 1974 - 2000 (mean = 37.1 t). The highest catches occurred during the late 1970s and early 1980s, declining during the 1990s coincident with the reduction in effort resulting from the sale of commercial licences. A TAC of 32 t remained in place for 2000. Landings in 2000 totalled 12.2 t, 12% greater than 1999, and represented 26% of the landings from the north Labrador charr fishing region. Over all years, 62% of the catch has been taken from the inshore fishing zone.



Okak stock complex

The Okak stock complex consists of an inshore zone made up of Okak Bay and an offshore island zone made up of the Cutthroat subarea. Since 1974, 637 t of charr, equivalent to 365 thousand fish (in number), have been harvested from the Okak stock complex. Annual landings ranged from < 1 t to a high of 76 t (mean = 23.6 t) during 1974 – 2000. The highest catches occurred during the late 1970s and early 1980s. During the past decade, landings from this stock complex have been inconsistent, dependent highly upon the amount of directed effort and whether fisheries were occurring in areas north of Okak Bay that are not included within the three primary stock complexes. A TAC of 31 t remained in place for 2000. Landings from the Okak complex in 2000 totalled 14 t, the highest since 1990, and represented 30% of the landings from the north Labrador charr fishery.



Resource Status

In the absence of direct indices of abundance, observations only on trends in catch rates, age and size of composition of the catch were updated from information collected from the 2000 fishery.

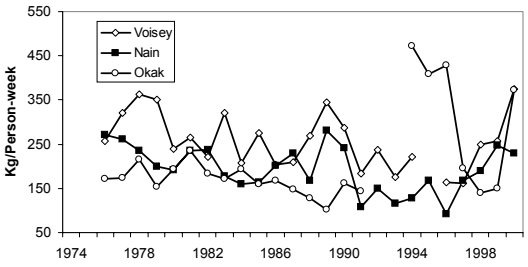
Commercial catch rates

Catch rates within the Voisey stock complex have varied over time with a declining trend through the mid-1990s. There was no fishery in the Voisey area during 1995 as fishers

redirected effort elsewhere. The lowest catch rates occurred in 1996-1997, but they have since increased to the highest value recorded, in 2000. Over all years, catch rates were typically higher than those recorded from the Nain and Okak stock complexes.

Catch rates from the Nain stock complex have also varied over time. The lowest rates occurred in early to mid-1990s. Catch rates have similarly increased with rates in the past two years (1999 – 2000) among the highest recorded.

Okak catch rates were moderately stable until the early 1990s, and generally lower than either of the other two stock complexes. Fisheries were virtually non-existent in 1992 and 1993. Although landings in recent years were considerably less than in the 1970s and 1980s, catch rates since 1994 have fluctuated from the highest to among the lowest values recorded.

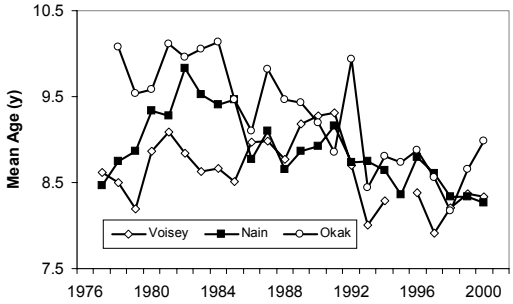


Age composition of the catch

In the Voisey stock complex, 7 - 10 year old charr, from the 1989 to 1992 year classes, represented 93% of the commercial catch in 2000. This dependence on four year classes is consistent with most previous years. Mean age was variable, but has declined by about 0.6 years from 1980 - 1989 to 1996 - 2000. Charr 12 years of age or older usually made up less than 10% of the catch.

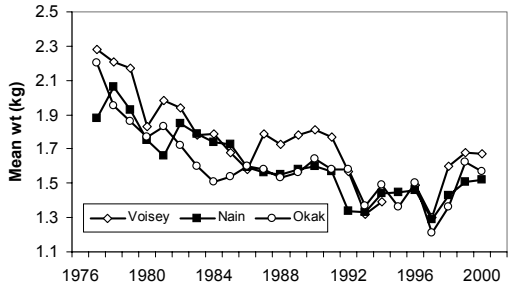
Seven to ten year old charr were also the most prominent in the Nain stock complex representing 77% of the catch in 2000, again with charr greater than 12 years uncommon. Charr caught from 1996 to 2000 were about 0.8 years younger than those caught during the 1980s.

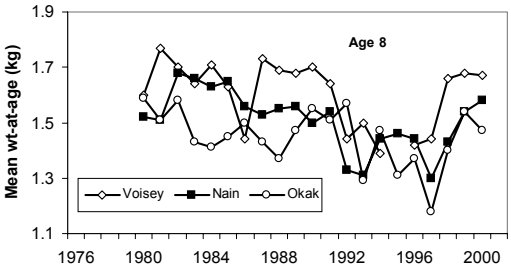
At Okak, the same four age classes (7 – 10 years) dominated the catch during most of the past decade and contributed 82% of the catch in 2000, with charr older than age 12 uncommon in recent years. This contrasts with the 1980s when more older charr were captured. Mean age has varied considerably, with charr caught from 1996 to 2000 about 1.1 years younger than those caught from 1980 to 1989.



Size composition

Mean weight has declined in all stock complexes, with lowest values recorded in 1997. Overall, mean weight fell by 31.8, 27.1, and 21.9 g annually in the Voisey, Nain, and Okak stock complexes, respectively, over the interval 1980 to 1997. Since then, weights have generally increased. For the most part, similar patterns have occurred in mean-weight-at-age data, with long term declines over time generally followed by increases in recent years.





Sources of Uncertainty

In the absence of fish counting facilities, similar to those used for Atlantic salmon assessments, or other independent estimates of Arctic charr abundance, the status of the resource is largely unknown. This is despite there having been approximately 80 thousand charr harvested in commercial fisheries from the three primary stock complexes during the past five years (1996 – 2000), with 27 thousand caught during 2000, and unknown quantities harvested in recreational and subsistence fisheries. With minimal commercial effort in recent years, both in terms of spatial and temporal coverage, interpretation of catch rates as indices of abundance is questionable, and there is need to quantify subsistence catches.

Catches and catch rates are influenced by the annual variation in run timing of charr to adjacent rivers, and the timing of the fishery itself. This is because there is a general decline in the size of charr throughout their upstream migration with run timing possibly varying by several weeks from one year to the next. Thus, interpreting a decline in catch rates or evidence of smaller fish in the catch of a particular year could be confounded simply by variation in timing of runs or timing of the fisheries.

Arctic charr stocks in north Labrador have been heavily exploited for many years and changes in some stock characteristics are likely related to the effects of long term exploitation suggestive of growth overfishing. However, recent studies have shown that climate variables are also important and could have influenced some of the annual variation observed in age, length, and weight. In addition, changes in the diet have also been linked with a significant decline in the mean weight of charr from one stock complex.

Outlook

Commercial landings in recent years, while increasing, are still a fraction of those in the late 1970s and early 1980s and are expected to remain at relatively low levels in the foreseeable future. Removals in subsistence and recreational fisheries, however, could increase. It is unknown whether recent increases in size of charr caught following long term declines, will continue. Continued monitoring of commercial fisheries is required. In the absence of independent estimates of abundance, the overall status remains uncertain.

Management Considerations

Total allowable catches for respective stock complexes were derived in past years when analytical assessments were carried out and may not be appropriate at the current time. Independent estimates of abundance are required as interpretation of commercial catch rates as indices of abundance may be questionable. Commercial landings have

been increasing since 1996, and unknown, but possibly substantive amounts of charr are being harvested in subsistence and recreational fisheries especially from the Nain stock complex. As stated, there is a need to quantify harvests in these fisheries. Concerns have been raised by fishers regarding the status of the resource at Okak Bay, Nain Bay (Fraser River), and Anaktalik Bay and a precautionary approach respecting any changes in harvest allocations is advised.

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