



Central and Arctic Region

DFO Science
Stock Status Report D5-62 (2002)



Babbage River Dolly Varden

Background

The northern form of Dolly Varden, *Salvelinus malma* (Walbaum), inhabits the Babbage River. The Inuvialuktun name is *iqaluqpiq*, however, most local people call them *char* (Papik et al. 2003). The Babbage River is located within the Inuvialuit Settlement Region (ISR), and also forms the eastern boundary of Ivvavik National Park.

This stock spawns and overwinters in an open-water area called "Fish Hole", which is maintained throughout the winter by freshwater thermal springs (4°C) located in Wood Creek and Fish Hole Creek, near their confluence with the Canoe River (Sandstrom et al. 1997). The open-water area continues for 1.5 km down the Canoe River (Sandstrom et al. 1997).

Prior to the 1970s, Babbage River Dolly Varden were harvested in small coastal fisheries at Herschel Island, Shingle Point, King Point and, possibly, in Alaskan coastal waters. A smaller scale mixed stock fishery still occurs in these areas. Some sport fishing occurs on the river, however, this stock is considered to be relatively unexploited.

The status of this stock is being reviewed to evaluate its characteristics. The Inuvialuit Final Agreement (1984) established a resource co-management arrangement for the ISR. Information will support co-management needs of Fisheries and Oceans Canada (DFO), the Fisheries Joint Management Committee (FJMC), Parks Canada, and the community of Aklavik. The West Side Working Group (WSWG) was established in 2001 to develop an integrated fisheries management plan for this and other stocks of North Slope Dolly Varden.

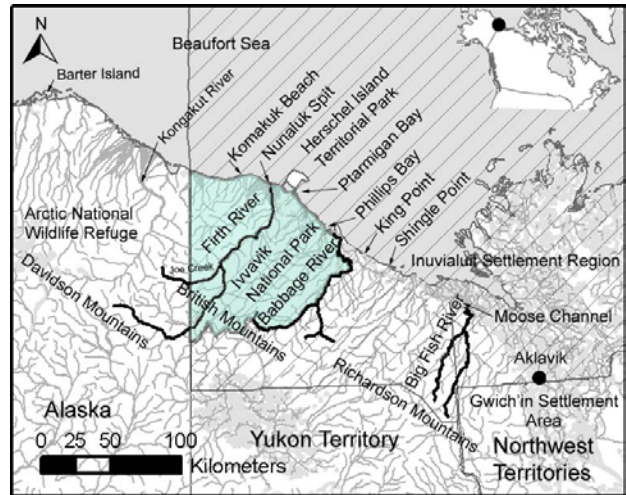


Fig. 1. Map of the North Slope area.

Summary

- Anadromous Dolly Varden spawn and overwinter in an area called the "Babbage Fish Hole" on one of the Babbage River tributaries.
- These Dolly Varden are genetically distinct from other populations in neighbouring systems.
- The Dolly Varden from the Babbage River are fished in mixed stock fisheries along the coast in Canadian and, possibly, Alaskan waters, and in a small sport fishery.
- The contribution of Babbage River Dolly Varden to the mixed stock fisheries is unknown.
- Coastal movements of Babbage River Dolly Varden are unknown and likely variable.

- This stock of Dolly Varden is considered to be relatively unexploited.

Species Biology

Dolly Varden (*Salvelinus malma*) are closely related to Arctic char (*S. alpinus*), lake trout (*S. namaycush*) and brook trout (*S. fontinalis*). Externally, all chars, including Dolly Varden, can be distinguished from salmon and true trouts by possessing light spots (yellow, orange or pink) on a darker background, as opposed to black spots or speckles on a lighter background. Dolly Varden can usually be distinguished from Arctic char by having more numerous and smaller spots with blue halos, more laterally compressed bodies, and, generally, less-forked tail fins. The anadromous form of Dolly Varden, when in non-breeding condition, is silvery with an olive-green to brown colour on the dorsal surface. Colours vary between stocks, fish size, and breeding condition (Armstrong and Morrow 1980).

In the Canadian Arctic, Dolly Varden inhabit North Slope rivers (Fig. 1) to the west of the Mackenzie River, including the Vittrekwa River (Peel River drainage), Big Fish, Babbage, Firth, and Rat rivers. Dolly Varden are recognized as a distinct species (Reist *et al.* 1997), although earlier literature for this area either refers to them as the western Arctic form of Arctic char, or combines the information for the two species.

Within the Babbage River system, three life history forms of Dolly Varden are found, the most common of which is the anadromous (sea-run) form. Along with them are the smaller resident males (known as residuals), which remain in the river system year-round (Kristofferson

and Baker 1988). An isolated, non-anadromous population also occurs above the falls (68°44'N, 139°02'W) on the mainstem Babbage (Kristofferson and Baker 1988), but is not dealt with in this report.

Free-swimming young-of-the-year fish emerge in May or June and feed in the margins of the spawning stream (McCart 1980). For about the first three summers of their lives, small juveniles (parr) remain in the river system. After about three years, parr move downstream during the spring to the estuary, Philips Bay (Bond and Erickson 1989), where they smoltify and feed, before returning to freshwater to overwinter (Sandstrom 1995). The physiological changes that occur during smoltification allow the anadromous fish to migrate into marine waters each summer (Armstrong and Morrow 1980). Upstream migration typically begins during the first and second week of August, and is complete by the first or second week of September. Movements in the ocean are generally not well understood, but char may migrate for significant distances along the coast.

Karasiuk, *et al.* (1993) provides detailed information on aquatic organisms, communities, and habitats, within Ivavik National Park. Both freshwater and marine environments are included. Biological characteristics of the Babbage River stock were studied in 1972-1973 by Bain (1974) and in 1990-1992 by Sandstrom (1995). Eddy *et al.* (2001) provides a summary specifically for the Babbage River Dolly Varden. There is, however, a lack of information about the biology of Canadian Dolly Varden in marine waters during the open-water season.

The age of maturation of anadromous Dolly Varden in the Babbage River is later than that of the Big Fish River (Sandstrom and Harwood 2002). Although females mature as early as 4 years, and males mature as early as 3 years, 50% maturity may not be reached until age 7 (females) and age 6 (males) for Babbage River fish (S. Sandstrom, pers. comm.). Preliminary otolith analysis for strontium corroborated this (Babaluk and Reist, in prep.).

Anadromous males were observed to comprise between 40-48% of the spawners in the Babbage River (1990 - 1992) (Sandstrom *et al.* 1997), which is similar to the 1974 estimate from Bain (1974). The resident males reach sexual maturity earlier than the anadromous males in the population, and “sneak” into the redds to spawn with the anadromous females. Resident males generally mature between 2 and 6 years of age (McCart 1980). Resident males were not as abundant in the Babbage River as they were in the Big Fish River (Sandstrom and Harwood 2002).

The length-at-age relationship for Dolly Varden in the Babbage River (Fig. 2) is similar for both males and females. Non-spawning females comprised between 27% and 44% of the adult (>425 mm) population, suggesting that females likely spawn biannually, as opposed to the annual spawning thought to be occurring in the Big Fish River (Sandstrom 1995).

Description of Habitat

The Babbage River (Fig. 3) originates in the British Mountains and flows north to Phillips Bay on the Beaufort Sea coast. The river is 137 km long and has a

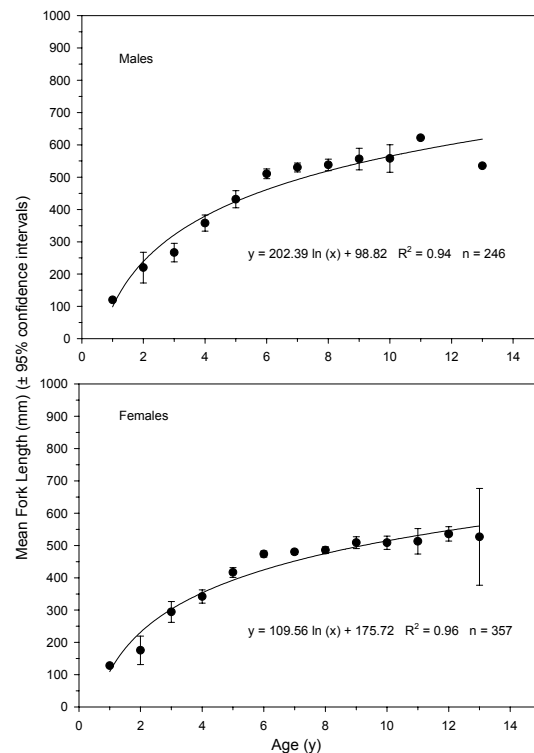


Fig. 2. Length-at-age data from male and female Dolly Varden from the Babbage River. Data are combined for 1986, 1988, and 1990 to 1993 (Sandstrom *et al.* 1997; J. Reist, unpublished data; S. Stephenson, unpublished data).

drainage area of approximately 1510 km² above the water survey gauge (Ayles and Snow 2002). The water gauge was in operation from 1976-1994. Bain (1974) and Sandstrom *et al.* (1997) provide detailed descriptions of the Babbage River System.

In its upper reaches, the Babbage River is shallow with a substrate of gravel and rock. In the lower reaches located in the coastal plain, the river meanders, the channel is deeper, and the substrate is composed of gravel overlain by a deep layer of mud and silt. Snowmelt, precipitation and groundwater upwellings are the source of summer flows, and groundwater is the only source of water in winter. The entire lower portion



Fig. 3. Map of the Babbage River area indicating the overwintering and spawning site (○), weir and water gauge locations. Canoe River is called Fish Hole Creek on current topographic sheets.

of the river is frozen during the winter, and is grounded to the river bed in most places. Water in the Babbage River above the coastal plain is clear throughout most of the year, with the exception of the spring freshet, while water in the lower portion of the river is more turbid (Sandstrom *et al.* 1997).

As with all North Slope populations of Dolly Varden, spawning and overwintering habitat is probably the most significant limiting factor affecting the potential abundance of the Babbage River stock. The Babbage Fish Hole (68°37'N, 138°42'W) (Fig. 3) includes the lower portions of Fish Hole Creek

and Wood Creek, and a 1.5 km section of Canoe River (sometimes identified as a section of Fish Hole Creek in publications and on maps). Open water is maintained year-round by thermal springs (4°C), in both creeks, approximately 40 m above their junction with Canoe River (Sandstrom *et al.* 1997). As water flows downstream from the thermal springs, its temperature decreases until it freezes into large ice fields (*aufeis* fields).

Brackish waters in Philips Bay may also be very important habitat for Babbage River Dolly Varden (Baker 1987). The salinity gradient in this area allows young fish to gradually increase their ability to withstand marine waters until they are able to make more extensive migrations. It is also used as a summer feeding area by both juvenile and adult fish (Baker 1987). Generally warmer temperatures in this area may also promote the growth of young fish. In addition, the use of this area by current-year spawners for feeding may allow them to acquire the necessary energy reserves for spawning, without the need to expend energy associated with adjustments in osmoregulatory abilities that are required for entry into full strength seawater.

The Fishery

Historical harvest

When people lived along the coast (prior to the 1940s and 50s), the Babbage River Dolly Varden were harvested regularly in mixed stock fisheries along the coast and at the Babbage Fish Hole for subsistence purposes (Papik *et al.* 2003).

A small commercial fishery (The Menzies Fish Co. Ltd.), operated by the residents of Herschel Island in the mid-1960s, based at Shingle Point (Papik *et al.* 2003), captured Dolly Varden from multiple stocks. These probably included fish from the Firth, Babbage and Fish rivers (Sandstrom 1995), and may have included Alaskan fish. Approximately 7300 kg of Dolly Varden were harvested in 1965, and 363 kg were harvested in 1966 before the fishery closed (Baker 1987).

Historically, the Babbage River stock was also used by the Gwich'in who camped below the falls. It was fished by people who traveled through the area en route to Aklavik for supplies or from Old Crow visiting camps along the coast.

Current harvest

At present, harvest of Babbage River Dolly Varden is thought to be low. In 1994, 101 fish were harvested from the "Babbage Fish Hole" (Inuvialuit Harvest Study, unpublished data), and in 1999, 350 Dolly Varden were harvested from the Babbage River (S. Stephenson, pers. comm.). The proportion of the total coastal harvest originating from the Babbage River, however, is unknown. Unpublished data, collected during the Inuvialuit harvest studies, indicate that coastal fisheries removed an average of 326 Dolly Varden annually, of which an average of 214 came from the Shingle Point area, and 112 came from the Herschel Island area. At Shingle Point, tagged Babbage and Big Fish Dolly Varden were caught in roughly the same proportion as the number of fish tagged. Fish from the Rat River stock made up a much smaller proportion relative to the number tagged (L. Harwood, pers. comm.). Based on this, the assumption

has been made that the catch of Babbage River fish at Shingle Point and King Point is 50% of the total harvested (L. Harwood, pers. comm.). Without any information on the representation of the stocks in the Herschel Island harvest, we might assume that 50% comes from each of the two nearest stocks, the Babbage and Firth River stocks. An estimate of the coastal harvest originating from the Babbage River would be on average 163 fish, with the estimate ranging from 16 to 682 during the Inuvialuit Harvest Study period. All fish harvested are not always reported (D.C. Gordon, Aklavik, pers. comm.), so that harvest numbers are generally underestimates of the true harvest. Some Babbage River fish might be taken in coastal fisheries in Alaska (Krueger *et al.* 1999). In addition to the coastal and subsistence river fisheries, small numbers of fish are caught by summer sport fishing in the Babbage River by park visitors and staff. In 2001, four Dolly Varden were kept and four were caught and released (McLean, in prep.). No recreational harvest of Dolly Varden was reported along the North Slope coast during spring and summer months of 2001. Sport fishing is regulated by Parks Canada within Ivvavik National Park.

View of Fishers

The Inuvialuit have long depended on the Dolly Varden (*iqaluqqiq*) of the Yukon North Slope for subsistence use. Inuvialuit fishers have changed their fishing locations and practices over the decades because a number of circumstances have changed. People lived at the mouth of the Babbage River when Herschel Island was a thriving community, and they used the Babbage

River to catch their winter supply of fish (Papik *et al.* 2003). People fished mostly in the late summer and early fall when the char started migrating to their spawning areas.

Beginning in the 1930s and continuing into the 1950s, RCMP posts, stores and the school on Herschel Island closed as people moved to the Mackenzie Delta and Aklavik to take advantage of good muskrat trapping opportunities. Since the 1960s, most people have used Aklavik as a base, and only go to the coastline for shorter trips. People do not fish the Babbage River Fish Hole, but they do harvest some Babbage River Dolly Varden along the coast. Elders feel that Phillips Bay, especially at Kay Point, has been getting shallower over the years, making access more difficult, but possibly making gill netting more effective.

Even though Babbage River Dolly Varden are not harvested extensively, the fishers still consider it to be an important system, especially given the present condition of the Big Fish River stock (DFO 2003). Elders and fishers consider that a holistic approach is essential to ensure the future survival of Dolly Varden in the ISR. They have supported the establishment of the WSWG by the FJMC, DFO, the Aklavik HTC and Parks Canada to develop a long-term, objectives-based Fisheries Management Plan for all fish stocks west of the Mackenzie River to the Canada/Alaska border, including the Babbage River Dolly Varden.

Resource Status

Stock Delineation

The anadromous Dolly Varden that spawn and overwinter in the Babbage Fish Hole are a distinct genetic stock. This has been determined by studies of morphological and genetic characteristics (Reist 1989; Everett *et al.* 1997; Krueger *et al.* 1999; Rhydderch 2001; Bajno and Reist, in prep). The residual males belong to the same stock as the anadromous fish (Reist 1989, Rhydderch 2001).

The population of Dolly Varden isolated above the falls in the Babbage River are significantly different from other North Slope populations, including the downstream anadromous population (Bajno and Reist, in prep.).

Discrete stocks appear to be maintained by high fidelity to natal streams by spawning fish. While some wandering into other river systems is evident from tagging studies, these fish are thought to be non-spawners (McCart 1980), and may be overwintering in a non-natal system. Between 1988 and 1996, 39 of almost 4000 fish tagged in the Big Fish, Babbage and Rat rivers combined, have been recaptured (L. Harwood, pers. comm.). Most were caught in coastal fisheries. One, originally tagged in the Big Fish River in 1988, was caught in Husky Channel in 1991, and another, tagged at the Babbage weir in 1992, was recaptured in 1995 at the Firth River spawning site (L. Harwood, pers. comm.). Of the 1522 Babbage River fish marked between 1990 and 1991, 15 recaptures were reported from the Shingle Point fishery, although it is known that not all tagged fish from this fishery were reported (S. Stephenson,

pers. comm.). There were no other tags reported from other sites along the coast.

Stock Size

Sandstrom *et al.* (1997) estimated the 1991 Babbage River anadromous Dolly Varden stock to be about 13600 fish (95% CI 7600-19700), using Bailey's deterministic model, and adjusted for a tag loss frequency of 11.3%.

Stock Trends

There are no abundance estimates from which trends in abundance can be determined. Length-frequency distributions of Dolly Varden captured at the weir between 1990 and 1992 were similar in all three years (Fig. 4), as were age-frequency distributions (Fig. 5).

Sustainable Harvesting Rate

It has been recommended that until sustainable exploitation rates for Dolly Varden stocks located west of the Mackenzie River have been determined, annual exploitation rates should not exceed 5% of the harvestable sized fish (Cosens *et al.* 1998).

Based on the 1991 abundance estimate from Sandstrom *et al.* (1997) of 13600 a harvest at 5% would be 680 fish (95% CI 380 - 985). The average annual harvest from the Babbage River between 1987 and 1999 was 152 (Inuvialuit Harvest Study, unpublished data; S. Stephenson, pers. comm.). The average annual coastal harvest (from Herschel Island to Shingle Point) from 1987 to 1998, of fish originating from the Babbage River stock, is estimated at 163 fish (range 19 – 683),

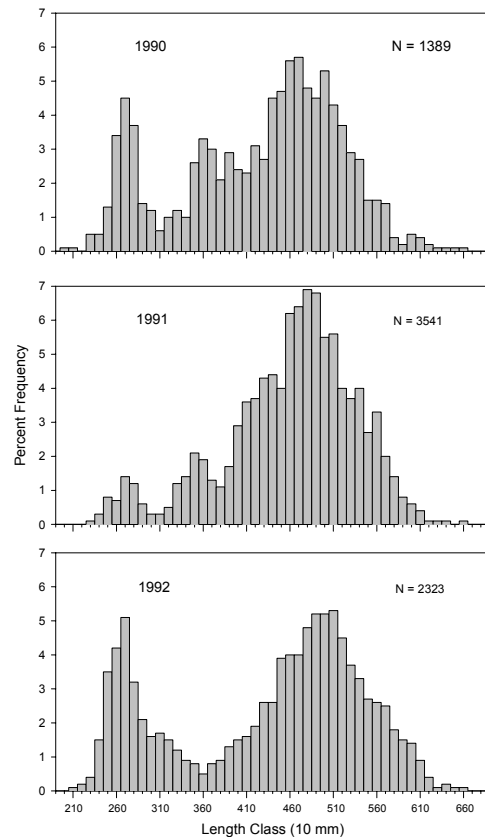


Fig. 4. Length-frequency distributions for the anadromous Dolly Varden caught by the weir in the Babbage River during the upstream migration in 1990, 1991, and 1992 (Sandstrom *et al.* 1997).

based on the assumption that 50% of the average total coastal harvest of 326 fish (range 37 - 1365)(Inuvialuit Harvest Study unpublished data) came from the Babbage River. Therefore, the known harvest of Babbage River Dolly Varden has been either below or within the 95% confidence interval for a 5% exploitation rate. It is also possible that some Dolly Varden from the Babbage River stock are harvested along the Alaskan coast, and some harvests within Canadian waters are not reported. In some years, therefore, the harvest might exceed 5% of the stock.

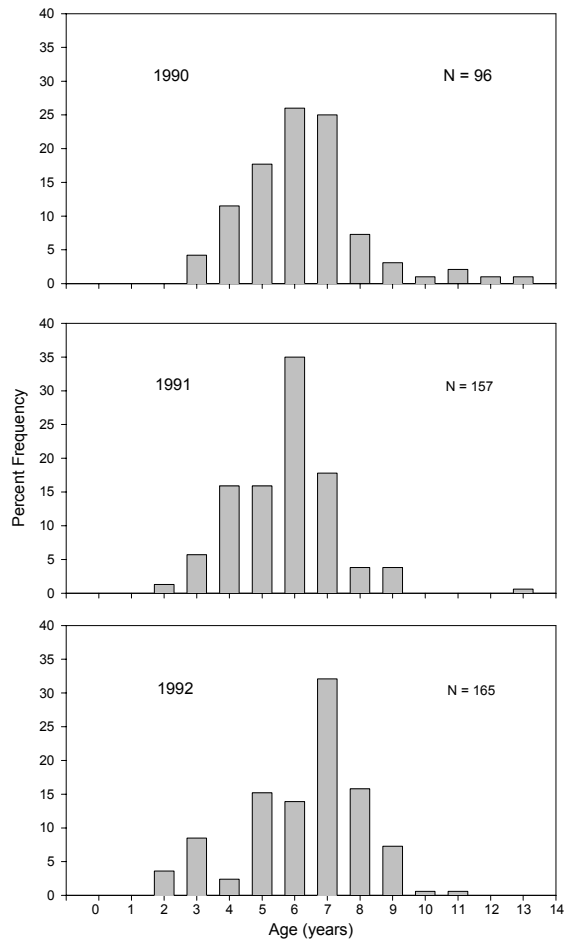


Fig. 5. Age-frequency distributions for the anadromous Dolly Varden caught by the weir in the Babbage River during the upstream migration in 1990, 1991, and 1992 (Sandstrom *et al.* 1997).

Sources of Uncertainty

There is no current estimate of stock size, and little information on the size of the coastal harvest since 2000. Incomplete reporting of harvest information may have occurred. The present day contribution of the Babbage River stock to any of the coastal harvests is unknown. Habitat changes may be occurring in the Babbage River (Papik *et al.* 2003), but the extent of any change is unknown. Very few trend

data are available, and there are no catch-effort data available for this system.

Outlook

Based on the most recent available data, already ten years old, the stock does not appear to be in danger of overexploitation. The mixed stock coastal fishery may increase pressure on the stock in some years. If additional recreation, subsistence or commercial fishing of the Babbage River stock were to take place, it should be carefully assessed.

Management Considerations

The Babbage River Dolly Varden fisheries are co-managed by DFO, FJMC and Parks Canada as established under the Inuvialuit Final Agreement (IFA 1984).

The Ivvavik National Park of Canada Management Plan describes the management and protection of the ecological resources of Ivvavik National Park, including Dolly Varden and their habitat. The plan was developed by Parks Canada in partnership with Inuvialuit resource management organizations and co-management boards established through the Inuvialuit Final Agreement.

The FJMC, DFO, Aklavik HTC and Parks Canada established the WSWG to develop a long-term, objectives-based Fisheries Management Plan for the Babbage River and other rivers between the Mackenzie River and the Canada/Alaska border. The WSWG is currently made up of fishers from Aklavik, community elders, biologists and managers.

The WSWG has initiated a process to:

- assemble scientific and traditional knowledge and information on fish stocks and habitats, implemented through the DFO Science Regional Advisory Process (RAP),
- establish conservation limits for the stock,
- set fisheries management objectives and strategies for the stock, and
- develop the fisheries management operational plan.

The Aklavik Inuvialuit Community Conservation Plan (Community of Aklavik *et al.* 2000) was prepared by the community of Aklavik, the Wildlife Management Advisory Council (NWT) and the Joint Secretariat. This plan has designated the Babbage River watershed in Ivvavik National Park and a 1 km buffer east of Babbage River, outside the park, as Management Category D, which indicates lands and waters where renewable resources are of particular significance and sensitivity throughout the year. Management should eliminate, where possible, potential damage and disruption.

Management of fish from this stock is complicated by the fact that they are caught in a mixed stock fishery along the Beaufort Coast, likely on both sides of the Canada/U.S. border.

Fishing pressure may increase on the Babbage River because of the decline of the Big Fish River stock, as fishers look for alternate sources of Dolly Varden. In the event of increased harvest, there would be an opportunity to study the transition from a relatively unexploited to a harvested stock.

Timing of Harvests

Fish that are concentrated in over-wintering sites are highly vulnerable to capture, and large numbers can often be harvested in a short period of time. Harvest in these areas following spawning also has the potential to increase egg mortality. This can occur if seining activities disturb or destroy redds (Stephenson 1999).

Other considerations

Habitat alteration and/or degradation of the spawning and over-wintering sites on the Babbage River system are the major threats faced by this stock of Dolly Varden. Any development activity (e.g., roads, right-of-way) that would diminish the integrity or physical characteristics (water level, oxygen level, silt loads, temperature, pH) of the spawning and over-wintering area, could pose a threat to developing embryos, rearing juveniles, and spawning and over-wintering adults found there. The integrity of the watershed must be maintained. More pervasive threats, such as climate change and/or increased incident ultraviolet radiation resulting from ozone depletion, may affect the fish and their habitat, but the details of this are not understood at the present time.

For More Information

Contact: Sam Stephenson
Fisheries and Oceans Canada
501 University Cres.
Winnipeg, MB
R3T 2N6
Telephone: (204) 984-0577
Facsimile: (204) 983-3073
E-Mail: stephensons@dfo-mpo.gc.ca

References

- Armstrong, R.H., and J.E. Morrow. 1980. The dolly varden charr, *Salvelinus malma*. pp. 99-139. *In*: Balon, E.K. (ed). Charrs, Salmonid fishes of the genus *Salvelinus*. Dr. W. Junk bv publishers, The Hague.
- Ayles, G.B., and N.B. Snow. 2002. Canadian Beaufort Sea 2000: The environmental and social setting. *Arctic* 55 (Supp. 1): 4-17.
- Babaluk, J., and J.D. Reist. (in prep.). Micro-PIXE analysis of strontium and zinc distributions in Dolly Varden, *Salvelinus malma*, otoliths from Northwestern Canada and Alaska: retrospective determination of life history traits. Fisheries and Oceans Canada, North Slope Dolly Varden RAP working paper. xi + 69 p.
- Bain, L.H. 1974. Life histories and systematics of Arctic char (*Salvelinus alpinus*, L.) in the Babbage River system, Yukon Territory. Chapter 1. *In*: McCart, P.J. (ed). Life histories of three species of freshwater fishes in Beaufort Sea drainages, Yukon Territory. *Arctic Gas Biological Report Series*. 18: 132 p.
- Bajno, R., and J.D. Reist. (in prep.). Evidence for genetic stock structure of the Dolly Varden of the Alaskan and Canadian North Slope. Fisheries and Oceans Canada, North Slope Dolly Varden RAP working paper. 36 p.
- Baker, R.F. 1987. Status report for Arctic Charr stocks of the Rat, Big Fish, Babbage and Firth rivers of the Northwest Territories and Yukon North Slope. Unpublished reported for Department of Fisheries and Oceans, Winnipeg, Manitoba. 62 p.
- Bond, W.A., and R.N. Erickson. 1989. Summer studies of the nearshore fish community at Phillips Bay, Beaufort Sea coast, Yukon. Canadian Technical Report of Fisheries and Aquatic Sciences. 1676: vi + 102 p.
- Community of Aklavik, the Wildlife Management Advisory Council (NWT) and the Joint Secretariat. 2000. Aklavik Inuvialuit Community Conservation Plan, A plan for the conservation and management of renewable resources and lands within the Inuvialuit Settlement Region in the vicinity of Aklavik, Northwest Territories. Inuvik, NT. 155 p.
- Cosens, S.E., B.G.E. de March, S. Innes, J. Mathias, and T.A. Shortt. 1998. Report of the Arctic Fisheries Scientific Advisory Committee for 1993/94, 1994/95 and 1995/96. Canadian Manuscript Report of Fisheries and Aquatic Sciences. 2473: v + 87
- DFO. 2003. Big Fish River Dolly Varden. DFO Sci. Stock Status Report D5-60 (2002).
- Eddy, J.B., J.D. Reist, and C.L. Evans. 2001. Status and trends of the Babbage River Dolly Varden stock. North Slope Dolly Varden RAP working paper. 36 p.
- Everett, R.J., R.L. Wilmot, and C.C. Krueger. 1997. Population genetic structure of Dolly Varden from Beaufort Sea drainages of Northern Alaska and Canada. American

- Fisheries Society Symposium 19:240-249.
- IFA (Inuvialuit Final Agreement). 1984. The Western Arctic Claim: The Inuvialuit final Agreement, Indian and Northern Affairs Canada, Ottawa, Ontario.
- Karasiuk, D.J., G.J. Birch, T.L. Slaney, and J.D. McPhail. 1993. Aquatic resources of Northern Yukon National Park. Chapter 7. *In*: Canadian Parks Service. Northern Yukon National Park resource description and analysis. Natural Resource Conservation Section, Canadian Parks Service, Prairie and Northern Region, Winnipeg. (RM REPORT 93-01/INP).
- Kristofferson, A.H., and R.F. Baker. 1988. Stock status of Arctic charr in the Babbage River, Yukon Territory. Unpublished report presented to the Arctic Fisheries Scientific Advisory Committee, DFO. 11 p.
- Krueger, C.C., R.L. Wilmot, and R.J. Everett. 1999. Stock origins of Dolly Varden collected from Beaufort Sea coastal sites of Arctic Alaska and Canada. *Transactions of the American Fisheries Society*. 128: 49-57.
- McCart, P.J. 1980. A review of the systematics and ecology of Arctic char, *Salvelinus alpinus*, in the western Arctic. Canadian Technical Report of Fisheries and Aquatic Sciences. 935: vii + 89 p.
- McLean, E.B. (in prep.). Inuvialuit Settlement Region (ISR) 2001 spring-summer sport angler survey. Canada/Inuvialuit Fisheries Joint Management Committee Technical Report, Inuvik, NT.
- Papik, R., M. Marschke, and G.B. Ayles. 2003. Inuvialuit Traditional Ecological Knowledge of Fisheries in rivers west of the Mackenzie River in the Canadian Arctic. Canada/ Inuvialuit Fisheries Joint Management Committee Report, 2003-3: v+ 20 p. (in press)
- Reist, J.D. 1989. Genetic structuring of allopathic populations and sympatric life history types of charr, *Salvelinus alpinus/malma*, in the western Arctic, Canada. *Physiology and Ecology Japan. Special Volume 1*: 405-420.
- Reist, J.D., J.D. Johnson, and T.J. Carmichael. 1997. Variation and specific identity of char from Northwestern Arctic Canada and Alaska. *American Fisheries Society Symposium*. 19:250-261.
- Rhydderch, J.G. 2001. Population structure and microphylogeographic patterns of Dolly Varden (*Salvelinus malma*) along the Yukon North Slope. M.Sc. Thesis, University of Guelph, Guelph, Ontario. v + 128 p.
- Sandstrom, S. 1995. The effect of overwintering site temperature on energy allocation and life history characteristics of anadromous female Dolly Varden char (*Salvelinus malma*), from the Yukon and Northwest Territory North Slope, Canada. M.Sc. Thesis, University of Manitoba, Winnipeg, Manitoba. xii + 161 p.
- Sandstrom, S.J., and L.A. Harwood. 2002. Studies of anadromous Dolly Varden (*Salvelinus malma*) (W.), of the Big Fish River, NT, Canada

1972-1994. Canadian Manuscript Report of Fisheries and Aquatic Sciences. 2603: vi + 31 p.

Sandstrom, S.J., P.J. Lemieux, and J.D. Reist. 1997. Enumeration and biological data from the upstream migration of Dolly Varden charr (*Salvelinus malma*) (W.), from the Babbage River, Yukon North Slope, 1990 to 1992. Canadian Data Report of Fisheries and Aquatic Sciences. 1018: iv + 132 p.

Stephenson, S.A. 1999. Big Fish River: Cache Creek enumeration project – 1998. Unpublished report, Department of Fisheries and Oceans, Central and Arctic Region. 16 p.

Personal Communications

Gordon, D.C., Hunters and Trappers Committee, Aklavik, NT

Harwood, L., Fisheries & Oceans Canada, Yellowknife, NT

Sandstrom, S., Ontario Ministry of Natural Resources, Bracebridge, ON

Stephenson, S., Fisheries & Oceans Canada, Winnipeg, MB

Unpublished Data

Reist, J. Fisheries & Oceans Canada, Freshwater Institute, Winnipeg, MB

Stephenson, S., Fisheries & Oceans Canada, Winnipeg, MB

Inuvialuit Harvest Study, The Joint Secretariat – Inuvialuit Renewable Resource Committees, Inuvik, NT

This report is available from the:

Freshwater Institute
c/o Kathleen Martin
Central and Arctic Region
Fisheries and Oceans Canada
501 University Crescent
Winnipeg, Manitoba R3T 2N6
Telephone: (204) 983-5131
Facsimile: (204) 984-2403
e-mail: martink@dfo-mpo.gc.ca
www.dfo-mpo.gc.ca/csas

ISSN 1480-4913
© Her Majesty the Queen in Right of Canada, 2002

La version française est disponible à l'adresse ci-dessus.



Correct citation for this publication

DFO. 2003. Babbage River Dolly Varden. DFO Sci. Stock Status Report D5-62 (2002).