

Central and Arctic Region

Stock Status Report D5-04 (1998)



Mackenzie River Inconnu

Background

The inconnu (also called coney or sruh), *Stenodus leucichthys nelma* (Pallas), is a long silvery fish with large scales, a wide mouth extending back to the posterior edge of the pupil and a projecting lower jaw (McPhail and Lindsey 1970). It is a member of the family Salmonidae, subfamily Coregoninae or whitefishes (Nelson 1976). Adult inconnu may grow to lengths in excess of 1 meter.

Inconnu are most abundant in large silty northern rivers and associated lakes. The adults are voracious predators feeding mainly on small fishes (McPhail and Lindsey 1970). Anadromous inconnu are highly migratory, often travelling in excess of 1000 km upstream to spawning areas in the mainstream Mackenzie River and its major tributaries. Spawning occurs just prior to freeze up in early October. After spawning, inconnu migrate to feeding and overwintering areas in the lower reaches of the Mackenzie River, Tuktoyaktuk Harbour, and west along the Beaufort Sea coast to Shingle Point. Some stocks of inconnu in the Mackenzie River are non-anadromous.

Aboriginal fisheries along the Mackenzie River have harvested inconnu for centuries. It is one of several species caught by the mixed-species subsistence fisheries that occur along the Mackenzie River and by the smaller commercial fishery in the Mackenzie Delta. The Mackenzie River flows through four land claims areas: Deh Cho, Sahtu, Gwich'in and Inuvialuit (Figure 1). This report was prepared as input for the Integrated Fisheries Management Plan being developed by the Department of Fisheries and Oceans, Fisheries Joint Management Committee and Gwich'in and Sahtu Renewable Resource Boards.

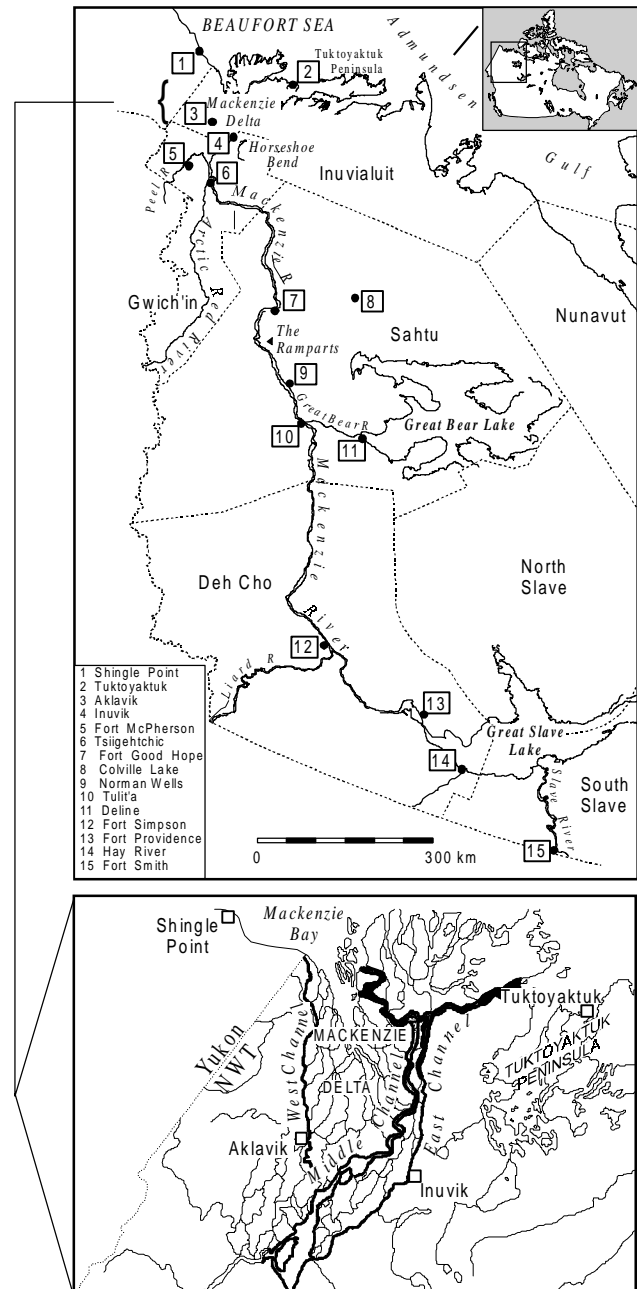


Figure 1. Map of the Mackenzie River, Mackenzie Delta, Great Slave and Great Bear Lakes showing the Inuvialuit, Gwich'in, Sahtu and Deh Cho Land Claim Areas.

The Fishery

The food fisheries along the Mackenzie River and its tributaries are sporadic in nature, therefore the harvest statistics presented in this section do not represent trends in inconnu abundance. Variation in the catch reflects the considerable year-to-year variation in fishing effort which is characteristic of both the food and commercial fisheries.

Between 1988 and 1997, Inuvialuit food fisheries (Figure 2) harvested, on average,

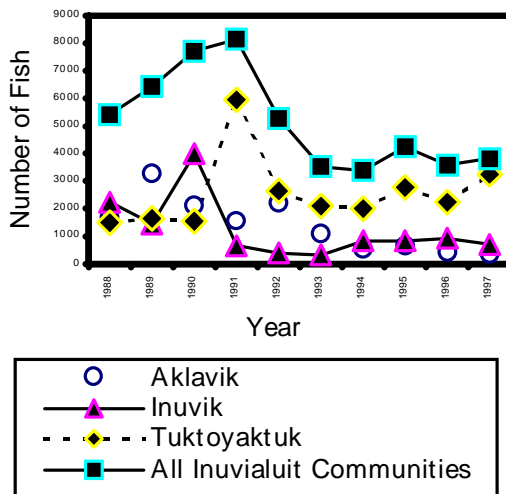


Figure 2. Inconnu harvested by the Inuvialuit food fishery.

approximately 5150 inconnu per year (12,875 kg). Gwich'in food fishery harvests (Figure 3) averaged approximately 4,225 inconnu per year (10,560 kg) between 1995 and 1997. Harvest levels in the Sahtu and Deh Cho Land Claim Areas are largely unknown. Reported catches are underestimates because they do not account for fishers who were not interviewed and inconnu that were enumerated as "fish species" when fishers could not remember what species they had caught.

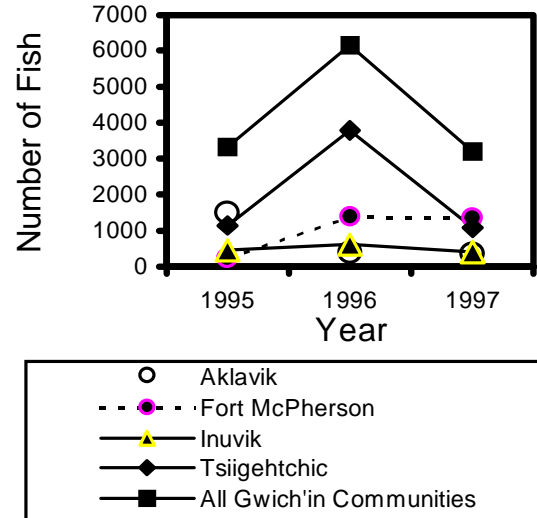


Figure 3. Inconnu harvested by the Gwich'in food fishery.

Estimates of weight harvested are based on the assumption that the average harvested weight of an inconnu is 2.5 kg, calculated from length-weight equations and mean lengths presented by Howland *et al.* (unpublished (b)) for an exploratory fishery conducted in the Horseshoe Bend area with 139 mm mesh gillnets. Calculated weights are probably underestimates because Horseshoe Bend is in the lower reaches of the Mackenzie River and the exploratory fishery was conducted at a time when many of the larger adult spawning inconnu had already passed through as they moved further upstream to spawning areas.

Harvests in the Gwich'in Settlement Area peak in early July, corresponding to the harvest of current-year spawning adults, captured while swimming upstream. Harvests peak again in October, corresponding to the harvest of adult post-spawning migrants moving downstream (Figure 4). Harvests in the Inuvialuit Settlement Region peak during the same months as observed in the Gwich'in Settlement Area but the trend is not as pronounced. There are considerable

differences in monthly harvest patterns for both of these areas among years and among communities.

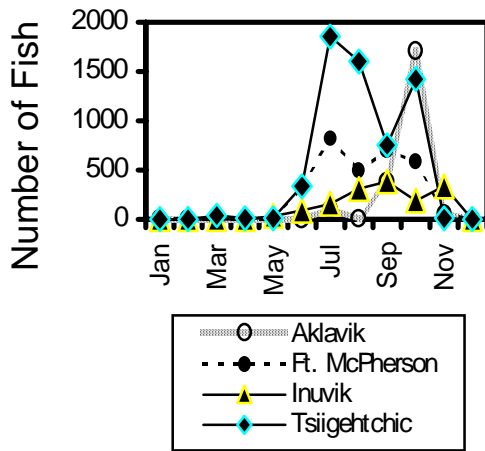


Figure 4. Monthly sums of inconnu harvested by the Gwich'in food fishery for the years 1995 to 1997.

All inconnu harvested by the Gwich'in food fishery are not necessarily harvested within the Gwich'in Settlement Area. The same holds true for Inuvialuit subsistence harvests. For example, the harvests of Gwich'in fishers in the Inuvialuit Settlement Region are reported only in the Gwich'in subsistence harvest monitoring reports. Future harvest monitoring data will be more useful for management purposes if harvest location can also be reported. Location data are available for Gwich'in subsistence harvests and it would be very useful for management purposes to analyze and publish these data.

Commercial and exploratory fishing effort is low and restricted to the management areas of the Mackenzie Delta and Horseshoe Bend. Commercial fisheries have, on average, harvested approximately 2,500 kg annually for the period between 1988 to 1997 (Figure 5). Sport fishers and resident non-aboriginal fishers also harvest

Mackenzie River inconnu but these harvests are extremely low.

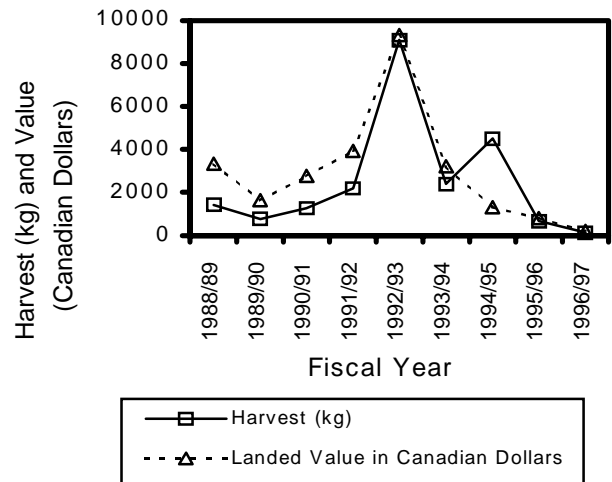


Figure 5. Inconnu harvests of Inuvialuit and Gwich'in commercial and exploratory fisheries.

The vulnerability of Mackenzie River inconnu to food and commercial fishing cannot be characterized by a single age, length or stage of maturity. The food fishery harvests fish from a number of different stocks and life history stages within each stock. Each stock may have unique age and size distributions and rates of maturity. Furthermore, fishing occurs at various locations and uses a variety of mesh sizes.

The Horseshoe Bend exploratory fishery used 139 mm mesh gillnets, the most common size of gillnet used by the food and commercial fisheries. Inconnu, taken by this fishery, become fully vulnerable to the fishery at lengths of approximately 600 to 700 mm and at ages of 9 to 14 years (Howland *et al.* unpublished (b)). These vulnerability statistics may be biased because many of the larger adult spawners had likely passed through Horseshoe Bend prior to the time at which the fishery occurred.

Therefore, inconnu likely become fully vulnerable to many of the other fisheries

along the Mackenzie River at fork lengths greater than 600 to 700 mm and ages greater than 9 to 14 years.

Female inconnu appear to be more vulnerable to harvest than are males. The ratio of female to male inconnu harvested by the Horseshoe Bend fishery was 3 to 1 (Howland *et al.* unpublished (b)). Adult inconnu harvested by the fisheries are not necessarily current-year spawners because inconnu may not spawn every year after they reach maturity.

Views of the fishers. Fishers from the Sahtu (Taptuna and Low 1995) and the Gwich'in (Gwich'in Renewable Resource Board 1997, Simon 1998) Settlement Areas generally indicated that inconnu abundance has changed little during their lifetimes as fishers. They report no signs that inconnu are smaller in size or have been depleted by the fisheries along the Mackenzie River or have changed in flavour. Survey respondents stressed the importance of inconnu for human and dog food. Inconnu caught in spring and summer are used primarily for human consumption and fish caught in the fall are used primarily for dog food. Fishers stated that the act of fishing for inconnu was important for maintaining a traditional lifestyle (Simon 1998, Gwich'in Renewable Resource Board 1997). Views of fishers from the Inuvialuit and Deh Cho Settlement Regions are unknown.

Resource Status

The Mackenzie River flows northward from Great Slave Lake to the Beaufort Sea. Inconnu spawn in the largest tributaries: the Peel River, Arctic Red River and Liard River. Spawning may also occur in the mainstream Mackenzie River. Before reaching the Beaufort Sea, the river branches into the Mackenzie Delta, a 12,170 square

km complex of channels, islands, lakes and muskeg (Stein *et al.* 1973).

With the limited scientific and traditional knowledge on Mackenzie River inconnu stock structure and migration, general conclusions can be drawn with caution. It is interesting to note that Gwich'in traditional knowledge on migration, stock structure and general inconnu biology (Gwich'in Renewable Resource Board 1997) is consistent with the scientific knowledge available on this species.

Stock delineation

Inconnu inhabiting the lower Mackenzie River appear to be made up of four stocks. Inconnu that spawn in the Peel River (designated as D5-01) are anadromous and appear to overwinter in the western portion of the Mackenzie Delta and further west along the Beaufort Sea Coast to Shingle Point (Chiperzak 1998a, Chiperzak 1998b, Howland 199a, Howland *et al.* unpublished (a)). This stock appears to migrate through the West Channel of the Mackenzie Delta between spawning and overwintering areas. It is probably exploited by the Inuvialuit and Gwich'in food fisheries and, to a much lesser degree, by the commercial fishery in the Mackenzie Delta. It should probably be managed as a single stock.

Inconnu that spawn in the Arctic Red River, (designated as D5-02) and near the Ramparts in the mainstream Mackenzie River (designated as D5-03) are anadromous. They probably migrate through the East and Middle channels of the Delta towards spawning areas in the spring and early summer. They then return to overwintering areas in the east side and middle of the Mackenzie Delta towards Tuktoyaktuk (Chiperzak 1998a, Chiperzak 1998b, Howland 1997a, Howland *et al.* unpublished

(a)). Radio tagging data (Chiperzak 1998a, Howland 1997a and Howland *et al.* unpublished (a)) indicates that these fish are almost certainly a mixture of at least two discrete stocks of inconnu, an Arctic Red River stock (D5-02) and a Ramparts stock (D5-03), and should be managed with this in mind. The Ramparts stock may be composed of fish with different life history strategies with some fish being non-anadromous (riverine) and some being anadromous. These inconnu are probably harvested in a mixed-stock fishery by the Inuvialuit, Gwich'in, perhaps the Sahtu at Fort Good Hope and to a much lesser degree, the commercial fishery in the Mackenzie Delta.

Inconnu from the Fort Simpson area of the mainstream Mackenzie River, designated as F5-01, appear to be mainly riverine. They may migrate to and from spawning grounds in the Liard River although a small proportion of the population may occasionally make seaward migrations (Chiperzak 1998a, Chiperzak 1998b, Howland 1997a, Howland *et al.* unpublished (a)). This riverine form is relatively sedentary in comparison to lower Mackenzie River stocks and is probably harvested primarily by the Deh Cho and, perhaps to a lesser degree, by the Sahtu. It could probably be managed as a single stock.

Stock Trends

In the Mackenzie River, where fishing mortality is low, inconnu are long lived and frequently reach ages in the mid-twenties. According to Gwich'in traditional knowledge, inconnu or *Sruh* (Gwich'in language) can reach 1.2 m in length, weigh 18 kg and take 2 people to carry (Gwich'in Renewable Resource Board 1997). Growth is rapid and linear at all Mackenzie River locations where inconnu have been sampled. These fish attain lengths of 800 mm or more

by their late teens (Bond 1982, Hatfield *et al.* 1972, Howland *et al.* unpublished (b), Jessop *et al.* 1973, Stein *et al.* 1973 and Stewart *et al.* 1997). Females grow slightly faster than do males and they live longer, therefore females attain a larger size (Hatfield *et al.* 1972, Stein *et al.* 1973, Howland *et al.* unpublished (b) and Stewart *et al.* 1997).

Anadromous Mackenzie River inconnu first start to mature at 6 years of age (Stein *et al.* 1973 and Percy 1975). Howland *et al.* (unpublished (b)) and Howland (1997a) reported that male inconnu in the Arctic Red River began to mature at age 7 years and females at age 11 years. Male inconnu in Alaska mature at a younger age (5 to 9 years) than do female inconnu (7 to 12 years) (Alt 1973). In contrast to Mackenzie River inconnu, the heavily exploited Buffalo River inconnu in Great Slave Lake mature relatively early, with most males and females starting to mature at age 5 years but as early as age 4 years. All Buffalo River male inconnu were mature by ages 6 to 7 years and all females by ages 7 to 8 years (Day and Low 1993).

Almost all recorded age and length frequency distributions of migratory Mackenzie River inconnu have strong representation of many age and length classes, especially of larger and older fish. There is no indication of pronounced between-year variation in recruitment or of recruitment failure. This observation applies to data collected in the early 1970's through to the present and indicates low fishing mortality and a high degree of stability in the fishery and recruitment.

Inconnu from Aklavik (Stein *et al.* 1973), Arctic Red River (Hatfield *et al.* 1972, Stein *et al.* 1973), the Ramparts and Little Chicago areas of the Mackenzie River (Stewart *et al.* 1997) exhibit modal lengths ranging from 700 to 750 mm and modal ages

ranging from 14 to 22 years. Relatively young and small fish have been observed in Tuktoyaktuk harbour (Bond 1982), the Fort Simpson area (Stein *et al.* 1973, Jessop *et al.* 1973) and a fall sample taken in the Ramparts area (Stewart *et al.* 1997).

However, these inconnu samples were taken at times when the larger spawners are usually absent and are not the result of depletion by overfishing. It may also be possible that some of the inconnu stocks found in the upper Mackenzie attain smaller maximum sizes.

Total annual mortalities of inconnu, derived from catch curves for the 1989 to 1993 Horseshoe Bend fishery, ranged between 0.22 and 0.30 and total instantaneous rates of mortality ranged between 0.25 and 0.35 (Howland *et al.* unpublished (b)). The Great Slave Lake historical natural mortality rate of pristine inconnu populations is 0.18 (Day and Low 1993) therefore, the total annual fishing mortality of populations harvested at Horseshoe Bend is assumed to be low and in the range of 0.04 to 0.12. Total annual fishing mortalities experienced by other inconnu populations along the Mackenzie, although not yet calculated, are probably also very low, as indicated by the healthy representation of older and larger fish found in samples from these populations.

Although the food fisheries and, to a lesser degree, the commercial fisheries exploit a critical productive component of Mackenzie River inconnu stocks, current- year spawners and post-spawners moving to and from the spawning grounds, fishing mortality is extremely low resulting in healthy stocks.

Other Considerations

Fishers have expressed concerns that habitat degradation, pollution and climate change, should they occur, would harm inconnu populations and result in reduced fishing success and or health risks associated with

their consumption. There is no indication that any of these sources of perturbation have occurred or had any impact on Mackenzie River inconnu populations. However, they warrant mention because they have been raised as potential concerns.

Logging near spawning grounds could reduce egg survival by producing stream bank erosion, siltation and warmer water temperatures. Water pollution, resulting from mining operations, and blocked access to migratory corridors, resulting from road development, could also reduce spawning success. Climate change could raise water temperatures in spawning areas. Information on the impact of climate change on the Mackenzie River Basin can be found in Cohen (1997). Howland's (1997b) research is especially relevant to the impact of climate change since this work has demonstrated that temperatures required for successful incubation of inconnu eggs vary amongst stocks.

Management Considerations

The characteristically long migrations of anadromous inconnu from the Mackenzie Delta and Beaufort Sea coast to spawning sites in the mainstream Mackenzie River and its tributaries means that these stocks are likely harvested by beneficiaries of several land claim areas. Of these stocks, the Peel River inconnu should be managed as a single stock whereas the Arctic Red and Ramparts inconnu should be managed as a mixed-stock fishery. The riverine Ft. Simpson stock should be treated as a single stock.

At present levels of harvest, fishing mortality is extremely low. Populations contain many age and length classes of mature inconnu that are the important recruit producing component of Mackenzie River inconnu stocks. Mackenzie River inconnu can probably sustain rates of harvest that are higher than present rates but caution should

be exercised. The rate of sustainable harvest has not been estimated and its calculation is confounded by the complexity of stock structure and migration patterns and by the highly variable spatial and temporal regimes of the fishery.

Howland *et al.* (unpublished (a)) stress the importance of conserving critical inconnu spawning areas for the continued production and health of Mackenzie River inconnu. Location and protection of these habitats should be the first priority for the conservation of this valuable resource.

The Sahtu and Gwich'in have expressed concern about potential detrimental effects that pollution, climate change and habitat destruction would have on their ability to harvest inconnu as a traditional source of food.

Outlook

The outlook for Mackenzie River inconnu and inconnu fisheries is excellent at present levels of harvest. Stocks should remain healthy and productive if critical spawning areas in the mainstream Mackenzie River and its tributaries and critical nursery, feeding and over-wintering areas in the Mackenzie Delta are protected from habitat degradation.

More information on the biology of Mackenzie River inconnu is needed to effectively manage and conserve this valuable and sustainable resource. In co-operation with the Department of Fisheries and Oceans, several research projects are planned or being conducted. Ms. K.L. Howland is conducting research on salinity tolerance, egg development, genetics and life history variation of anadromous and non-anadromous (freshwater) inconnu stocks at the University of Alberta. A Campbell Lake study is being developed by the Gwich'in

Renewable Resource Board and will examine spawning areas, habitat use and inconnu stock structure. The Gwich'in Renewable Resource Board is also planning a tagging study to determine migration patterns, spawning areas and to monitor harvest in the Peel River. The study of key index stocks should prove to be a useful tool for future assessment of Mackenzie River inconnu stocks.

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References

Alt, K.T. 1973. Age and growth of inconnu (*Stenodus leucichthys*) in Alaska. *Journal of the Fisheries Research Board of Canada* 30: 457-459.

Bond, W.A. 1982. A study of the fish resources of Tuktoyaktuk Harbour, southern Beaufort Sea coast, with special references to life histories of anadromous coregonids. *Canadian Technical Report of Fisheries and Aquatic Sciences* 1119: vii + 90 p.

Chiperzak, D. 1998a. Radio tagging study summary of inconnu migration in the Beaufort Sea, outer Mackenzie Delta, the Peel River and Arctic Red River, 1996. Unpublished Report, Canada Department of Fisheries and Oceans. Inuvik, NT., 36 p.

- Chiperzak, D. 1998b. Preliminary results of scanning proton microscope analysis of strontium in inconnu otoliths from the Mackenzie River system. Unpublished Rep., Can. Dept. Fish. and Oceans. Inuvik, NT., 3 p.
- Cohen, S. (ed.) 1997. Mackenzie Basin impact study: Final report. Atmospheric Environmental Service, Environment Canada. Downsview, Ontario, Canada. 372 p.
- Day, A.C. and G. Low. 1993. The Great Slave Lake commercial inconnu, *Stenodus leucichthys*, fishery. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2224: 24-25.
- Gwich'in Renewable Resource Board. 1997. *Nanh'Kak Geenjit Gwich'in Ginjik*. Gwich'in Words About the Land. Gwich'in Graphics, Inuvik, NT. 212 p.
- Hatfield, C.T., Stein, J.N., Falk, M.R., Jessop, C.S. and D.N. Shepherd. 1972. Fish resources of the Mackenzie River Valley: Interim report I, Vol. II. Prepared by Department of the Environment, Fisheries Service, Winnipeg, MB. 289 p.
- Howland, K.L. 1997a. Migratory patterns of freshwater and anadromous inconnu, *Stenodus leucichthys*, within the Mackenzie River system. MSc. Thesis, University of Alberta, Edmonton, Alberta. 96 p.
- Howland, K.L. 1997b. Life history variation of inconnu, *Stenodus leucichthys*, in the Mackenzie River system: Genetic or environmental basis? PhD Proposal/Progress Report. University of Alberta, Edmonton, Alberta. 13 p.
- Howland, K.L., Tallman, R.F. and W.M. Tonn. Unpublished (a). Migratory patterns of freshwater and anadromous inconnu, *Stenodus leucichthys*, within the Mackenzie River system. Submitted to Canadian Journal of Fisheries and Aquatic Sciences.
- Howland, K.L., Treble, M.A. and R.F. Tallman. Unpublished (b). A biological analysis and population assessment of northern pike, inconnu and lake whitefish from the Mackenzie River Delta Exploratory Fishery, 1989-1993. Submitted to Canadian Technical Report of Fisheries and Aquatic Sciences.
- Jessop, C.S., Porter, T.R., Blouw, M. and R. Sopuck. 1973. Fish resources of the Mackenzie River Valley: An intensive study of the fish resources of two mainstream tributaries. Environmental-Social Committee, Northern Pipelines, Task Force on Northern Oil Development. Special Report. 148 p.
- McPhail, J.D., and C.C. Lindsey. 1970. Freshwater fishes of Northwestern Canada and Alaska. Bulletin of the Fisheries Research Board of Canada 173, x + 381 p.
- Nelson, J.S. 1976. Fishes of the world. John Wiley and Sons, Inc., United States of America. 416 p.
- Percy, R. 1975. Fishes of the outer Mackenzie Delta. Beaufort Sea Project, Technical Report No. 8. Beaufort Sea Project Office, Victoria, BC. 114 p.
- Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184. 966 p.
- Simon, P. 1998. Questionnaire results: Community concerns on coney (inconnu) in the Gwich'in Settlement Area. Unpublished Report, Gwich'in Renewable Resource Board, Inuvik, NT. 16 p.

Stein, J.N., Jessop, C.S., Porter, T.R. and K.T. J. Chang-Kue. 1973. Fish resources of the Mackenzie River Valley. Interim Report II. Prepared by Department of the Environment, Fisheries Service for the Environmental Social Program, Northern Pipelines. 260 p.

Stewart, D.B., Low, G., Taptuna, W.E.F., and A.C. Day. 1997. Biological data from exploratory fisheries at Special Harvesting areas in the Sahtu Dene and Metis Settlement Area, NWT.: Volume 1. The Upper Ramparts and Little Chicago areas of the Mackenzie River. Canadian Data Report of Fisheries and Aquatic Sciences 1020: vi + 61 p.

Taptuna, F., and G. Low. 1995. A fishery survey of the Sahtu communities. Unpublished Report, Canada Department of Fisheries and Oceans, Hay River, NT. 52 p.

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