The Distribution of Pacific Salmon (*Oncorhynchus* spp.) in the Canadian Western Arctic

S.A. Stephenson

Resource Management and Aboriginal Affairs
Central and Arctic Region
Fisheries and Oceans Canada
501 University Crescent
Winnipeg, MB R3T 2N6

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THE DISTRIBUTION OF PACIFIC SALMON (*Oncorhynchus* spp.) IN THE CANADIAN WESTERN ARCTIC

by

S.A. Stephenson

Resource Management and Aboriginal Affairs
Central and Arctic Region
Fisheries and Oceans Canada
501 University Crescent
Winnipeg, MB
R3T 2N6

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ABSTRACT

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To determine if there have been changes in the abundance in Pacific salmon in the Canadian western Arctic I summarize all known captures up to the end of 2003. Chum salmon are the most abundant species both historically and presently and have been harvested in 21 of the last 40 years. In contrast, pink salmon are recorded infrequently and coho salmon have been reported only twice. Except for a pulse noted in the early and mid-1960s, respectively, Chinook and sockeye salmon have been harvested irregularly in small numbers since the 1990s.

Critical analysis of these records was undertaken to classify them into verified and unverified categories. Prior to 2000, information on harvests is often limited because an organized reporting system specifically to track Pacific salmon was not in place. As a result, reliability of identification depended on whether identification was by fisheries experts or fishers. Thus, some early records may be inaccurate.

Local awareness of salmon has undoubtedly increased since 2000 leading to the possibility that recent harvests are biased upwards due to improved reporting. While climate change may eventually enhance the ability of Pacific salmon to colonize the Arctic, there is no evidence of newly established populations and overall not enough information to definitively state that salmon are increasing in frequency in the Canadian western Arctic.

Key words: Pacific salmon, Chinook, chum, coho, pink, sockeye, climate change, harvest, Northwest Territories, western Arctic.

RÉSUMÉ

Stephenson, S.A. 2005. The distribution of Pacific salmon (*Oncorhynchus* spp.) in the Canadian Western Arctic. Can. Manuscr. Rep. Fish. Aquat. Sci. 2737: vi + 29 p.

Afin de déterminer si des changements dans l'abondance du saumon du Pacifique sont survenus dans l'Ouest de l'Arctique canadien, je fais un résumé de toutes les captures connues jusqu'à la fin de 2003. Le saumon kéta est l'espèce la plus abondante, tant au plan historique qu'au plan actuel, et a été pêché dans 21 des 40 dernières années. Par contre, le saumon rose y est rarement observé tandis que seulement deux observations du saumon coho ont été signalées. À l'exception d'une poussée constatée au début et au milieu des années 1960 respectivement, la capture du saumon quinnat et du saumon rouge est irrégulière et peu nombreuse depuis les années 1990.

Une analyse critique de ces observations a été entreprise afin de les classer dans des catégories, confirmées et non confirmées. L'information sur les captures est souvent limitée avant 2000, puisqu'un système organisé de signalement conçu spécialement pour suivre la trace du saumon du Pacifique n'était pas en place. Par conséquent, la fiabilité de l'information reposait soit sur l'identification réalisée par des spécialistes des pêches ou encore celle des pêcheurs. Certaines des premières observations peuvent donc être erronées.

La sensibilisation locale envers le saumon a sans aucun doute augmenté depuis 2000 entraînant donc la possibilité que les récentes captures soient faussées vers le haut en raison de l'amélioration du signalement. Alors que le changement climatique améliorera éventuellement la capacité du saumon du Pacifique à coloniser l'Arctique, il n'existe aucune preuve quant à l'établissement de nouvelles populations et l'information pour affirmer définitivement que la fréquence du saumon augmente dans l'Ouest de l'Arctique canadien soit insuffisante.

Mots clés : Saumon du Pacifique, quinnat, kéta, coho, rose, rouge, changement climatique, capture, Territoires du Nord-Ouest, Ouest de l'Arctique.

Introduction

Climate change in the form of global warming is predicted to bring about changes that will be first observed and especially severe in Arctic and sub-Arctic areas including the near shore Beaufort Sea and Mackenzie River Valley (Dyke and Brooks 2000). Although many of these changes will be most easily or first observed in the terrestrial setting (*e.g.*, the presence of southern bird species), more gradual but similar changes will occur in the aquatic environment. These may not be noticed immediately. Northern fish species may find their historic ranges shrinking as habitat changes and temperatures exceed their tolerances. In some cases, negative interactions with recently arriving southern species may affect their long-term survival as increased predation on young and competition for food and spawning areas occur. The Mackenzie River and its tributaries may act as a corridor for southern freshwater fish invaders to move northward as waters warm. An increase in ocean temperature will weaken the coldwater barrier in the Bering Strait and may assist in the movement of primarily anadromous or entirely marine Pacific fish species into the near shore Beaufort Sea and the Mackenzie River Delta. While the outcome of global warming is yet unclear, what is certain is that the changes associated with this warming will have a profound effect on the fish and fisheries of the Canadian western Arctic.

The current interest in the presence of Pacific salmon in Canadian western Arctic waters is due largely to a belief that a perceived increase in abundance may be further evidence of climate change. However, proof that salmon have increased from former levels of abundance or that individuals captured today represent membership in Arctic stocks established over the past 10-20 years is required before being able to conclusively state that the current distribution of Pacific salmon in the Arctic is a direct result of recent climate change. With a renewed interest (as of 2000) in oil and gas exploration in the Mackenzie River Valley and near-shore Beaufort Sea, established or establishing populations of Pacific salmon and strays in the area could be extremely sensitive to anthropogenic perturbations. Thus, while identifying the Pacific salmon species present, their distribution in the Arctic and determining if and where spawning populations exist, may be of use for monitoring the effects of climate change, a more immediate use may be for screening proposed industrial activities near waterways.

Although the first records of Pacific salmon in the Arctic date back to fish captured in Alaska in the late 1880s (Hunter 1974), some salmon species were undeniably present in the Beaufort Sea and the Mackenzie River Valley prior to that time. Although the frequency of capture will always remain unknown, Pacific salmon were undoubtedly identified as different from the local lake trout (*Salvelinus namaycush*), arctic char (*S. alpinus*) and Dolly Varden (*S. malma*) regularly captured by and well known to Aboriginal people. It was only during the 1930s as more people from the south began inhabiting the Arctic that voucher specimens were sent to museums, records of the capture of Pacific salmon were kept by interested individuals and Aboriginal people began taking specimens to authorities for identification (*e.g.*, Dymond 1940; Hunter 1974).

While Inuit of the western Arctic have names for all large and several of the smaller fish species that they have traditionally harvested, Inuktitut names do not exist for most Pacific salmon in the area (McAllister *et al.* 1987; this study). An Inuktitut name is known only for the most common Pacific salmon in the area: the chum salmon

(*Oncorhynchus keta*) (Coad and Reist 2004). Similarly, a Dene (primarily upper Mackenzie River Valley area) name is known only for the chum salmon (Bayha and Snortland 2002). This suggests that historically, the overall frequency of capture of Pacific salmon in the Arctic was low (*i.e.*, Dymond 1940) as the regular capture of such species would have given rise to Aboriginal names for them. Therefore, as only a single species is named, it is justifiable to state that except for the long known stock(s) of chum salmon that spawn in areas of the upper Mackenzie River drainage (*e.g.*, McPhail and Lindsey 1970), there is no evidence for other established Pacific salmon stocks in the area and that, if at all, the capture of any other Pacific salmon must have been extremely infrequent.

The purpose of this manuscript is to summarize all captures of Pacific salmon from waters of the Canadian western Arctic including the Beaufort Sea, Coronation Gulf, the western-most islands of the Arctic Archipelago, the Mackenzie River Valley and Mackenzie River tributaries up to the end of 2003. By adding to and updating the work of Hunter (1974), this provides the necessary background to determine; 1) if Pacific salmon have increased in abundance since records were first kept, and, 2) if evidence exists to suggest the recent establishment of self sustaining Arctic salmon populations. Years of large salmon migrations are discussed as is the future of Pacific salmon in the Canadian western Arctic. A brief discussion on salmon reporting to harvest studies is made and new distributional records of several species are presented.

METHODS

Records of Pacific salmon in the Canadian western Arctic were gathered by searching published and unpublished literature, regional harvest studies, museum databases (Royal Ontario Museum (ROM) and Canadian Museum of Nature (CMN)) and through discussions with scientists, researchers, regional fisheries biologists and area fishers. This provided information on: salmon captured by area fishers during subsistence or commercial harvesting and reported or unreported in regional harvest studies or commercial fishing information returns, salmon captured by government, university researchers or consultants and, those fish purchased through a program set up by Fisheries and Oceans Canada (DFO) to record the capture of salmon by Aboriginal and non-Aboriginal fishers. Any fish reported only as "salmon" by any of the above mentioned sources were excluded from further consideration.

Due to a sporadic and unpredictable temporal appearance, Pacific salmon in the Canadian western Arctic have not been captured by any directed scientific research program. Rather, the majority of salmon have been captured by Aboriginal subsistence and commercial fishers in isolated locations and as such, reports of captures often come to light only long after the specimen can no longer be examined (*e.g.*, Gwich'in Renewable Resource Board (GRRB), unpubl. data). To better document the frequency of appearance of Pacific salmon and to secure specimens for positive identification and additional study, a salmon collection program was established by DFO for the entire Northwest Territories in 2000. The program offers a monetary reward for the delivery of salmon carcasses and basic information such as the date and location of capture. The collection program has been extensively advertised using posters (Fig. 1), word of mouth during conversation with fishers and promoted through area harvest studies and during radio and newspaper interviews. As the collection program is equally applicable

to subsistence, commercial and recreational fishers, information and specimens can be obtained from a diverse group of participants. Despite three years of promotion, however, some fishers insist they have not heard of the program, prefer not to sell their salmon to DFO or consider involvement in the program too time consuming. Therefore, despite the intention of the collection program, all salmon captured in the Canadian western Arctic are undoubtedly not reported to or seen by DFO.

The specimens discussed herein are presented as: 1) those verified to species by knowledgeable personnel (*e.g.*, biologists and other individuals familiar with the species) by examining the fish or, in some rare cases, using only photographs, 2) those reported through harvest studies or, 3) those reported through conversation with fishers or non-fisheries biologists. Some specimens identified through numbers 2 or 3 may be uncertain or suspect due to no opportunity for an expert to examine the specimens. In recent years (1995-2003) all species identifications were made using taxonomic keys of external characteristics (*e.g.*, Scott and Crossman 1973). Whenever possible, the specimen was secured for additional examination including internal/external morphometric and meristic counts and possible genetic analysis. Due to the experience of personnel and the availability of identification keys, salmon examined by resource management staff over the past twenty years were given a higher probability of being properly identified than those not seen by resource managers.

Based on the above methods of identification, the reliability of an identification in the following lists of specimens was accorded a rank of good, fair or poor (Table 1). Good identifications were those where the fish was keyed out using a taxonomic key or identified by a person that had some prior experience with Pacific salmon. A fair ranking was given to those species that have widely known and readily identifiable characteristics or those in which large numbers have been seen on a regular basis (*i.e.*, annual or semi-annual) so that many people had familiarity with them. This ranking holds true for chum salmon identifications as they are common in the Canadian western Arctic, have been seen by many fishers and possess obvious characters (*e.g.*, rosy colour with dark vertical bars) when entering the spawning phase. A rank of poor was given to those specimens where limited information (*e.g.*, no mention of length, weight or colouration) was recorded, the fish was captured in a silver (ocean) phase and had not yet taken on reproductive characteristics which assist identification, other fishers had not confirmed the identification of the fisher who captured the fish or where it was known the fish represented a unique harvest to the fisher. In many cases, conversation with the fisher enabled determining if recent captures were correctly identified. When this was not possible or if the harvests had occurred in the past, the possibility of a correct identification was conservatively ranked.

RESULTS AND DISCUSSION

Chum salmon

Chum salmon are the most common of the Pacific salmon found in the Canadian western Arctic with spawning populations known in the Colville River, Alaska (Fig. 2) and the Mackenzie River drainage (Salo 1991; Scott and Crossman 1973). While spots are completely absent on chum salmon, spawning fish develop distinct purplish-green lateral bars over a reddish background that are especially prominent in males (Salo 1991). Due to their confirmed spawning populations in the Mackenzie drainage, it is believed

that the majority of fishers in the Mackenzie Delta and along the Mackenzie River Valley have had several opportunities to see these fish and are therefore able to easily distinguish chum salmon from other salmon species.

Chum salmon have been harvested from the Mackenzie River in 21 of the last 40 years (Table 1). The wide geographic area (along the entire length of the Mackenzie River and numerous tributaries) and regular frequency with which captures occur suggest that most chum salmon in the western Arctic are not strays from the Pacific or northern Alaska, but are those en route to known spawning areas at the rapids (Rapids of the Drowned) below Fort Smith in the Slave River (McPhail and Lindsey 1970) and possibly in the upper Liard River, British Columbia (McLeod and O'Neil 1983). Johnson (1975) noted the occasional reports of chum salmon from Great Bear Lake, but felt that it was unlikely that an established population existed within the lake as almost continual fishing by residents of Deline near the outlet to the Great Bear River only resulted in infrequent captures.

Excluding the possibility of very strong year classes of salmon returning to spawn in the Mackenzie, chum salmon populations established in northern Alaskan rivers could be the origin of some fish captured in the Mackenzie River, especially in those years during which very large numbers are reported. Should global warming continue, chum salmon are the species most likely to exhibit increases in abundance due to possible greater straying from nearby Alaskan populations, larger returns due to improved spawning success in the Mackenzie drainage and possible colonization of new spawning areas (resulting in a larger and more widespread spawning population).

Chum salmon have been infrequently reported east of the Mackenzie River. Hunter (1974) reported a possible capture in the Anderson River and a single specimen was taken much farther east in the Kugluktuk area in 1981 (CMN, CMNFI 1981-0959.1) (Fig. 3). Fishers in Paulatuk reported chum salmon from the Hornaday River in 1978, 1979 (Corkum and McCart 1981) and 2003 (this study). However, the general paucity of chum salmon captures east of the Mackenzie Delta supports a strong homing sense by these fish to natal areas in the Mackenzie drainage.

Pink salmon

Pink salmon (*O. gorbuscha*) are the smallest of the Pacific salmon and possess elongate, oval shaped spots dorsolaterally and on both lobes of the caudal fin. Males develop a very pronounced kype and hump prior to spawning. Pink salmon do not ascend rivers for any great distance and even in large rivers, such as the Yukon, they seldom move more than 160 km upstream (McPhail and Lindsey 1970) before spawning in smaller tributaries. The smaller gravel substrates required for spawning are often present in greatest abundance in the lower reaches of rivers and thus most pink salmon in the western Arctic spawn near the Beaufort Sea coast.

Although confirmed to spawn between Point Hope and Point Barrow, Alaska, it is uncertain if the pink salmon captured to the east in the Colville River during some years represents a spawning population (Craig and Haldorson 1986). However, the proximity of the Colville River to the Mackenzie River may explain the presence of pink salmon in the Canadian western Arctic in some years.

Pink salmon have been reported infrequently in the Canadian western Arctic and in almost all cases only single

specimens have been captured (Table 2). Although Craig and Haldorson (1986) suggested that that pink salmon in western Alaska were more abundant in even-numbered years than odd-numbered years, from the capture data available for the Canadian western Arctic it is clear that there is no similar trend in this area. To date, all pink salmon captures in the area have taken place either in August or early September. The furthest inland captures have been from the Peel River, approximately 120 km from the coast (Hunter 1974), although most pink salmon have been reported from along the coast or in the lower reaches of rivers (Fig. 4). Except for a single capture on Banks Island (Babaluk *et al.* 2000a), none have been taken further east or north and most have been captured near the Mackenzie Delta.

The use of large mesh gill nets (127 mm+) and a tendency for fall fishing to take place near communities rather than in coastal areas or Yukon North Slope rivers might in part explain the few captures of pink salmon. The infrequent rate of capture with no evidence of strong year classes (*i.e.*, only one or two fish captured in both odd and even years) suggests there are no established populations in the Canadian western Arctic. However, due to the proximity to known and suspected spawning populations in Alaska, pink salmon may become established in the Canadian western Arctic if they encounter suitable conditions. Small and possibly ephemeral spawning populations could already exist in the infrequently fished areas of the Tuktoyaktuk Peninsula and the Yukon North Slope.

Coho salmon

The northernmost known population of spawning coho salmon (*O. kisutch*) is near Point Hope, Alaska (Fig. 2) although they have been occasionally captured in marine waters farther east near Prudhoe Bay (Craig and Haldorson 1986). Coho salmon have spots confined to the upper portion of their body and caudal fin and possess white gums and mouth unlike the Chinook salmon (*O. tshawytscha*) which possess black gums and mouth and spots on the upper and lower lobe of their caudal fin (McPhail and Lindsey 1970). Coho salmon are rather non-distinct when spawning although their body takes on a much darker colour and males may develop a brilliant red stripe on their sides (McPhail and Lindsey 1970). Due to some similarity to other salmon species, if captured in their non-spawning phase, coho salmon might be confused as either chum or sockeye salmon by fishers unfamiliar with the species.

Coho salmon are the rarest of the Pacific salmon in the Canadian western Arctic. Babaluk *et al.* (2000a) reported the capture of a single coho salmon in Great Bear Lake in September of 1987 (Fig. 5). A second capture was made using a hook and line through the ice of the Mackenzie Delta near Inuvik in October of 1998 (this study) (Table 3). While the Inuvialuit Harvest Study reported the harvest of six coho salmon from Sachs Harbour in 1993 (Fabijan 1995a), these fish were misidentified by local people and actually represent the sockeye salmon (*O. nerka*) reported by Babaluk *et al.* (2000a). The rarity of verified captures of this species in the Canadian western Arctic confirms that established populations do not exist in the area and that both known captures represent examples of straying fish.

Sockeye salmon

Similar to several other Pacific salmon species, the northernmost known spawning population of sockeye salmon is south of Point Hope, Alaska in Kotzebue Sound (Burgner 1991). As spawning becomes imminent, sockeye salmon take on their very distinctive red

colour over most their body while the head turns an olive green. Males develop the additional traits of a strong kype and large teeth. Externally, silver fish can be identified primarily by their lack of any spots. However, without some experience with the species or looking at other characters such as gill rakers, sockeye salmon might, based on the lack of spots alone, be identified as chum salmon. Therefore, both the historic and current abundance of sockeye salmon may be much greater than reported here.

Hunter (1974) reported the unverified identification of a sockeye salmon from Fort Providence on the Mackenzie River made in 1908; not so unbelievable a report based on future reported captures (Table 4). Hunter (1974) also reported the first verified Canadian Arctic captures of eleven fish near Bathurst Inlet in 1965 with up to 40 additional fish captured near Holman on Victoria Island in 1966 (Fig. 6). Babaluk *et al.* (2000a) reported the capture of eight sockeye salmon from the Sachs Harbour area of Banks Island in 1993. An additional eight fish, the first verified specimens from the Mackenzie River, were captured at Tsiigehtchic near the Arctic Red River during September and October of 1993 (R.Tallman, DFO, pers. comm. 2004). These captures tend to reaffirm that spawning sockeye are schooling fish (Burgner 1991). Sockeye are the single Pacific salmon species that has most often been captured in large numbers in a single net.

Although Tallman *et al.* (1996a) report that Tallman *et al.* (1996b) captured sockeye salmon in the Slave River in 1995, a review of Tallman *et al.* (1996b) reveals that the species is not among those listed. Tallman (DFO, pers. comm. 2005) stated that the fish reported by Little (1997) was the same one that had inadvertently been left off the list of species captured presented in Tallman *et al.* (1996b). Therefore, there has been but a single capture of sockeye salmon in the Slave River. This is the southernmost capture site for the species.

A single sockeye salmon was captured in the Kagloryuak River east of Holman on Victoria Island in 1997 (this study). In 2003, single specimens of sockeye salmon were captured in the Mackenzie River at Norman Wells and Jean Marie. Unverified, but probable, captures were also reported from the Mackenzie River at Fort Good Hope in the fall of 2003. Overall, sockeye salmon have the widest geographic distribution of all Pacific salmon species in the Canadian western Arctic (Fig. 6).

Although unrelated to the anadromous salmon discussed here, Babaluk *et al.* (2000b) reported the capture of a single specimen of the non-anadromous form of the sockeye salmon, Kokanee salmon (*O. nerka*), from Great Slave Lake in the commercial fishery in 1991. The known population of Kokanee salmon in the headwaters of the Peace River (McPhail and Lindsey 1970) was the probable source of this fish. Babaluk *et al.* (2000b) postulated that the sockeye salmon reported by Little (1997) from the Slave River may have been a Kokanee salmon although there was no reason given for this speculation.

Chinook salmon

The northernmost known Chinook salmon spawning population is believed to be in Kotzebue Sound, Alaska (Healey 1991). Craig and Haldorson (1986) have reported strays captured in the Kuk and Colville rivers along the northern coast of Alaska (Fig. 2). Chinook salmon are the largest of the Pacific salmon and can often exceed 18 kg in weight (Scott and Crossman 1973) although the fish reported from the Canadian western Arctic average near 10 kg. Chinook salmon can be identified from other salmon by a caudal fin that possesses spots on both the upper and lower lobes;

a trait that can be used to identify the fish regardless of spawning condition. Chinook salmon also possess black gums and mouth while the smaller coho salmon have white gums and mouth. Size alone may be the most often used character by fishers unfamiliar with the species in identifying Chinook salmon, but it may not always be correct to assume a large salmon is a Chinook.

Verified records of Chinook salmon are rare in the Canadian Arctic. Hunter (1974) reported the species from the Kugluktuk area in 1950 based on one capture and again in 1961 or 1962 based on over a dozen fish averaging 11 kg in weight (Fig. 7). Chinook salmon then went unreported in the Canadian western Arctic until a small specimen (2.9 kg) was captured in the Liard River at Fort Liard near the British Columbia border in 1979 (McLeod and O'Neil 1983). McCart (1986) reported Chinook salmon from the Slave River prior to 1986, but did not provide details on numbers or dates of capture. Two of the references McCart (1986) cited as Slave River references to support the reported captures did not deal with the Slave River. Assuming that the third reference referred to what became RL&L/EMA Slave River Joint Venture (1985) (referred to in McCart (1986) as RL&L Environmental Services Ltd. files), there remains a problem with the reference as RL&L/EMA Slave River Joint Venture (1985) did not report capturing any Chinook salmon during their 1983-1985 studies. Similarly, although Tallman *et al*. (1996a, 2005) report that Tallman *et al*. (1996b) captured Chinook salmon from the Slave River in 1995, examination of Tallman *et al*. (1996b) shows that Chinook salmon are not among the 18 fish species listed as captured. Little (1997) reported the capture of Chinook salmon from the Slave River near Fort Smith in 1995. Tallman (DFO, pers. comm. 2005) stated that the fish reported by Little (1997) was the same one that had inadvertently been left off the list of species captured in Tallman *et al.* (1996b). Therefore, although Chinook salmon were captured from the Slave River in 1995, they are only reported in Little (1997).

Although fishers from Aklavik reported the capture of several Chinook salmon along the Yukon North Slope in August of 1993 (Fabijan 1995a; this study) and one fisher reported the capture of dozens of Chinook in the same area in 1997 (D.A. Gordon, Aklavik Hunters and Trappers, pers. comm. 2001), it is unknown if some of these were simply large chum salmon in their ocean phase. The next verified capture of Chinook salmon was not made until the fall of 2002 when a 7.9 kg female was captured near Aklavik. The fisher who made the 2002 capture also reported that he had captured a similar fish at the same location in 2001 (Table 5).

A report of large salmon, some up to 11 kg in weight, captured near the Arctic Red River and in the Peel River in 1914 (Dymond 1940) are thought to have possibly been Chinook salmon (Hunter 1974). The large salmon seen in this run were apparently not seen again in the ensuing 26 years although some Aboriginals had reportedly seen similar fish in the Yukon River (Dymond 1940) which does have a run of Chinook salmon. Due to their reported large size and rarity to Aboriginals who were at that time at least somewhat familiar with chum salmon, the possibility that these fish were Chinook salmon appears plausible.

Reported vs. Unreported Harvests

Unreported harvests of Pacific salmon hamper our understanding of the true distribution of these fish in the Canadian western Arctic making it difficult to determine if salmon are actually increasing in abundance. Considering the time period from 1990 to the present,

unreported harvests of salmon in the northern portion of the Northwest Territories in the Canadian Arctic fall into three categories; those made by non-Aboriginals, those made by Aboriginals in settled land claim areas and not reported to ongoing harvest studies and those made by Aboriginals prior to land claim settlement and the start of harvest studies or after harvest studies had been completed within their claim area.

Licensed, non-Aboriginal gill net fishers (*i.e.*, commercial and domestic) in the Inuvialuit, Gwich'in and Sahtu land claim areas are few and there are no records of any salmon being captured by these fishers during the period 1990-2003. There is only one record of salmon being angled in these or more southern areas of the Northwest Territories leading to the belief that in general, few salmon have ever been captured by angling. In the southern Northwest Territories, there appears to be greater reporting of salmon captured in gill net fisheries by non-Aboriginal fishers. This is perhaps due to the general low frequency of salmon captures resulting in a willingness to share the information and seek a proper identification. In addition, captures of salmon made during the commercial fishery in areas near or in Great Slave Lake can be rather easily reported or turned into Hay River due to a DFO Area Office and the Freshwater Fish Marketing Corporation fish plant in that community.

The Inuvialuit Harvest Study, which recorded wildlife harvests from Holman, Paulatuk, Sachs Harbour and Tuktoyaktuk (Fig. 2), four communities bordering the Beaufort Sea, as well as Inuvik and Aklavik in the Mackenzie Delta, was discontinued in 2000. Since that time, harvest studies organised by DFO have only taken place in the Beaufort Sea communities (*e.g.*, Stephenson 2004). The Gwich'in Harvest Study, which recorded harvest throughout the southern Mackenzie Delta and the lower Mackenzie River, was discontinued at the end of 2003. Although the Sahtu Harvest Study was completed in 2003, in January 2004 a decision was made to continue the study for an additional two years. The Sahtu study area includes much of the middle Mackenzie River and the Great Bear Lake area.

The Gwich'in, Inuvialuit and Sahtu harvest studies (*e.g.*, McDonald 1998; Fabijan 1991a; Bayha and Snortland 2003) reported the harvest of Pacific salmon in the Canadian western Arctic between 1988 and 2001. However, some known salmon harvests by beneficiaries of these claims were never reported to these studies during those years (this study). Comparing the number and species of salmon that have been reported to harvest studies in the northern Northwest Territories to the number and species that were known harvested by DFO confirms that Aboriginal harvesters have not reported all salmon harvests and that numerous misidentifications have occurred (*i.e.*, the Banks Island sockeye-coho of 1993). While it is difficult to arrive at an accurate estimate of the number of salmon unreported to harvest studies, the number of salmon reported to harvest studies fall short of known salmon harvests by almost 50% in three years in which DFO has additional harvest information for geographically specific fisheries.

Limited harvest studies, generally confined to only a few communities, not organized on a regional basis and seldom lasting more than a single season or year, occur in the southern Northwest Territories in the upper Mackenzie River, the Liard River or Great Slave Lake area and record only the Aboriginal subsistence harvest (G. Low, DFO, pers. comm. 2004). Thus, the capture of salmon in these southern areas may have been and may continue to be

unreported in part due to the irregular nature or termination of harvest studies in relatively isolated communities. There are no means to estimate how many fish might have been unreported in this area. As land claims are settled in the southern Northwest Territories, it is possible that harvest studies will be included as part of the settlement and reports of salmon harvests may increase. To ensure the majority of salmon are documented, the promotion of the salmon collection program is essential in these areas until claims are signed and regular harvest studies begin.

A large unknown remains the question of how often area harvesters seek assistance in properly identifying fish unfamiliar to them? Unless the individual was truly interested in finding out what they had captured, there historically seems to have been little benefit to the fisher in trying to get the fish identified. Transporting fish from isolated fishing locations to DFO or other government offices, especially during warm weather periods, could have discouraged even the most determined individuals. If salmon were caught during extended camping or harvesting trips, there would be few means to preserve such a catch intact until it could be delivered to the appropriate personnel. Furthermore, until the DFO salmon collection program began in 2000, there was no financial incentive in turning over a salmon to DFO for identification. It is therefore not surprising that some portion of the historic salmon harvest went unreported as there was only an extra cost to the fisher in bringing in and turning over a fish for identification which may have resulted in the fisher relinquishing a fish that could have been eaten or fed to dogs. Even with the current financial incentive of the collection program, there are likely still problems with preserving fish for an extended period of time during the warmer months of the year before they can be turned over to DFO.

The above demonstrates the uncertainty as to how many salmon have recently been or are currently being captured in the Canadian western Arctic. Additionally, the single statistic that might provide verification of an increase in abundance, catch-per-unit-effort (CPUE), was, and remains, absent from all harvest studies. Few fishers, save commercial fishers in Great Slave Lake, keep records from which CPUE can be determined. Therefore, the number of salmon recently (*i.e.,* past 15 years) captured in the Canadian western Arctic is likely higher than reported, but by an unknown factor. A conservative estimate would suggest that 25% of all salmon captured are not reported based on the known under reporting of almost 50% in some cases.

Years of Large Salmon Runs

Excluding a few years reported by previous authors such as the "notable runs" of salmon in the Mackenzie in 1914 (Dymond 1940), the Chinook salmon captured in Bathurst Inlet in 1961-1962 and the large number of sockeye salmon captured in Holman in 1966 (Hunter 1974), there are more recent years in which salmon abundance has been high. Several of the last 25 years stand out due either to the number of species recorded or the total number of salmon captured.

The most unusual of these years was 1979 due to the sheer number of chum salmon reported harvested. In a "normal" year, a few to dozens of chum salmon are captured at multiple locations along the Mackenzie River Valley or in Great Slave Lake (Table 1). In 1979, however, thousands of chum salmon were reported during harvest surveys carried out in the late fall of the year in communities along the Mackenzie River and the shores of Great Slave Lake (G. Low, DFO, pers. comm. 2004). Although Table 1 lists most of these fish as having good

identifications, due to the large number of salmon harvested at some locations that year, some misidentification may have occurred especially if other salmon species, such as sockeye, were mixed with returning chum salmon. Most identifications are, however, listed as good because most fishers are familiar with chum salmon and, as the distance from the coast increases, chum exhibit their typical spawning colours which increases the probability of correct identification. While some of the harvest estimates may be overestimates on the part of the harvesters, they nonetheless indicate the very large chum salmon harvests made in 1979 compared to previous and succeeding years. Over 240 chum salmon were recorded from the Liard River in 1979 (McLeod and O'Neil 1983); an area from which the species had not previously been reported. The first verified capture of a Chinook salmon in the Mackenzie drainage was also made in the Liard River in 1979 (McLeod and O'Neil 1983).

In 1993 sockeye salmon were recorded from the Mackenzie River near Tsiigehtchic and at Sachs Harbour on Banks Island. Pink salmon were also recorded from Sachs Harbour and Chinook salmon were reported, but not confirmed, from the Beaufort Sea off the Yukon North Slope near Shingle Point (Fig. 2). Oddly, chum salmon were not recorded as being common that year and only a few were reported from the Yukon North Slope (Table 1). However, the apparent absence of chum salmon may have been the result of poor reporting to area harvest studies rather than an actual absence of the species in the Canadian western Arctic.

The Canadian western Arctic experienced an extremely warm year in 1998. Large numbers of chum salmon were reported from the Peel River near Fort McPherson and in the Mackenzie River at Fort Good Hope (Table 1), the second authenticated capture of a coho salmon in the Canadian western Arctic was made in the Mackenzie Delta, and sockeye salmon were reported captured, although not confirmed, at the community of Tuktoyaktuk.

Finally, 2003 saw a large increase in both the numbers and number of species of salmon recorded, especially within the Mackenzie River. Chum salmon were reported in large numbers in many Mackenzie River Valley communities including several in which they had formerly been rare. The capture of chum salmon into December of 2003 may attest to the large number of chum salmon that entered the Arctic in the fall of 2003, although many may have been the returns from a strong cohort in 1999 or 2000. The capture of sockeye salmon far up the Mackenzie River may suggest that a greater than average number of Pacific salmon strayed north of their usual ranges. As in other years, extreme warmth in the north Pacific and Bering Strait may have assisted the northward movement of some of these fish.

The above demonstrates that exceptional years, judged either by the total number of salmon captured or the number of salmon species present, seem as common now as they were in the past. However, because it is unlikely that all species were properly identified in the past (and some may still be incorrectly identified), it is those years of overall high salmon abundance, rather than the number of species present, that are most useful as a possible indicator of climate change. Assuming that there has been some increased reporting in recent years over those of the past (largely due to increased attempts to document the species, but still acknowledging some non-reporting), there still seems to be little evidence to support a theory that Pacific salmon are more common in the Canadian western Arctic today than they have been over the past 90 years.

Juvenile Salmon

Several studies have sampled areas of the Mackenzie River drainage documenting fish distribution using techniques (*e.g.*, small mesh index nets, drift nets, electro-shockers, beach seines) that specifically target juvenile and young-of-the-year (YOY) fish. However, despite these studies in the Mackenzie River drainage and nearby coastal areas during many seasons of the year, no juvenile or YOY salmon have ever been captured (*e.g.*, Stein *et al.* 1973; Lawrence *et al.* 1984; Chang-Kue and Jessop 1991; Stephenson, unpublished data).

While the young of some salmon species move downstream soon after hatching (*i.e.*, chum and pink) therefore making them unlikely candidates for capture by scientific surveys (*e.g.*, no YOY chum salmon were captured by Tripp *et al.* (1981) during the Slave River studies even though the species is known to spawn in the river), the young of other species spend one or more years in freshwater prior to smolting (*i.e.*, Chinook, coho and sockeye) (Scott and Crossman 1973). If these last three species are spawning within the Mackenzie River drainage or in nearby areas, their young should be susceptible to capture by appropriate gear types.

While there are no fishers that utilise gear which could capture YOY salmon, there are some fishers that use small mesh gill nets to capture cisco (*Coregonus* spp.) that could also capture juvenile salmon. Thus while YOY salmon must be detected through scientific surveys, juvenile salmon could be captured during scientific surveys or by area harvesters. However, scientific surveys using the gear types necessary to capture juvenile and YOY fish do not occur annually in the Canadian western Arctic. If one further considers that these studies are typically of short duration and that few scientific studies have captured adult salmon, the reality is that it is unlikely that any scientific study will result in the capture of juvenile or YOY salmon unless these fish are especially abundant. There is a higher probability that a juvenile salmon will be taken by cisco fishers rather than by a scientific study simply due to a greater number of participants and the longer duration and greater frequency of the cisco fishery (*e.g.*, Stephenson 2004).

Hunter (1974) believed the probability of juvenile or YOY salmon, if they were present, being distinguished from indigenous trout or char to be low. However, most researchers are now better informed about the possibility of encountering Pacific salmon than they were in the 1970s. While it is possible that a single YOY or juvenile salmon might be overlooked in a large sample containing char or trout, the diligent use of a taxonomic key should result in its identification. Although they are becoming more conscious of the presence of salmon, area residents could be reminded through the DFO salmon collection project or local harvest studies that juvenile salmon may be captured in small mesh gill nets.

Notwithstanding the above statements concerning possible impediments to the capture and detection of juvenile or YOY salmon, the lack of capture of young specimens of any Pacific salmon species along with the irregular capture of adults further supports the hypothesis that Pacific salmon have not colonised the Canadian western Arctic (*i.e.*, reproduction is not occurring) beyond the known spawning population of chum salmon in the Slave River.

THE FUTURE OF PACIFIC SALMON IN THE CANADIAN WESTERN ARCTIC

The continued absence of confirmed spawning populations of pink, coho,

sockeye and Chinook salmon east of Point Hope, Alaska suggests that, although the final destination of these individuals remains unknown, the capture of these species in the Beaufort Sea and adjacent inland waters represents straying individuals. As several reports of large numbers of Chinook and sockeye salmon into the Canadian western Arctic exist from at least 40 years ago, the infrequent capture of a few more of these fish since that time represents neither the stable presence (as would be indicated by regular captures) nor the consistent increase in abundance required to characterize established or establishing populations in Canadian waters. Thus, with the exception of chum salmon, the infrequent capture of all other species of Pacific salmon in the Canadian western Arctic supports a hypothesis of continued straying from Alaskan or perhaps even southern Canadian populations.

An end to many harvest studies In the Northwest Territories coupled with a gradually declining subsistence fishery (Stephenson 2004) and a small, widely distributed human population in the Canadian western Arctic suggests that the results above represent only a small percentage of the salmon actually present in the area. As a result, if the abundance of salmon does increase in the future, the chances of having all captures reported are low and accurate estimates of the distribution and abundance of salmon will remain unknown. The DFO salmon collection program is intended to obtain salmon harvest information from a diverse group of resource users. Despite three years of promotion, however, there is some evidence that many fishers are, for a variety of reasons, not participating in the program. Many salmon are therefore not reported and, in some cases when they are, the species identification is suspect as the fish has not been examined. The continued promotion and expansion of the salmon collection program will be a vital, and in many cases the only, way of recording the distribution of salmon in the Canadian western Arctic. Consideration should be given to expanding the program to western Nunavut communities, such as Kugluktuk, where chum and Chinook salmon have been captured. More easterly communities such as Cambridge Bay may see the arrival of Pacific salmon and therefore could also be advised of and included in the program.

For new populations of Pacific salmon to become established in the Canadian western Arctic, they must encounter favourable conditions for a number of years in both the freshwater and marine environments. The large increase in chum salmon seen in 1979 was either a direct result of massive straying or the culmination of three or four very good years which included successful spawning, hatching, out-migration, feeding, growth and finally, a return to the Mackenzie River. Without these successive favourable years, probably all of which are largely dependent on at least moderately above average temperatures, it is improbable that Pacific salmon will successfully sustain populations in the Canadian western Arctic.

Although one species (*i.e.*, coho) has only recently been documented in the Canadian western Arctic and the frequency of capture of at least one formerly rare species (*i.e.*, sockeye) has increased noticeably, albeit sporadically, over the past 20 years, the basic question that remains difficult to answer is: have Pacific salmon been recorded in increasing numbers in recent years because there has been an increased interest and effort to identify and document them, or are they actually increasing in abundance? Only continued efforts to document and verify harvests of these species and recording CPUE data on a wide-scale basis will provide a

definitive answer. However, the results above suggest that, generally, Pacific salmon are no more common in the Canadian western Arctic today than they have been over the past 90 years. Ultimately, the abundance and distribution of Pacific salmon in the Canadian western Arctic will depend on their response to continually changing environmental conditions over a wide area, their interaction with indigenous northern species and their ability to find habitats suitable for long-term colonization.

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Table 1: Number, location and year of capture of chum salmon reported from the Canadian western Arctic. Reliability of identification is based on available information that details or infers knowledge of person making identification (G=good, F=fair, P=poor).

Year	Location	Number	Reference	Reliability
1914	Mackenzie River	a "notable" run	Dymond 1940	G
1931	Slave River	1	Dymond 1940	G
1931	Mackenzie Delta	10+	Dymond 1940	F
1937	Peel River	1	Dymond 1940	G
1938	Yukon coast	30	Dymond 1940	G
1938	near Kigtluit (probably Kidluit Bay)	6	Dymond 1940	G
1938	Whitefish Station (Mackenzie River)	3	E. Holm, ROM, pers. comm. 2004	G
1947	Peel River	1	Hunter 1974	G
?	Anderson River	1+	Hunter 1974	F
1956	Hay River	1+	Hunter 1974	G
1957	Peel River	2	Hunter 1974	G
1957	Big Buffalo River	1	Hunter 1974	G
1957	Hay River	2	Hunter 1974	G
1958	Great Slave Lake	6	Hunter 1974	G
1957-59	Slave River	3	Hunter 1974	G-F
1958	Talston Bay, Great Slave Lake	1	Hunter 1974	G-F
1966	Great Slave Lake	1	Hunter 1974	G
1968	Great Bear Lake	1	Hunter 1974	G
1971	Mackenzie Delta	1	Stein *et al.* 1973	G
1972	Tsiigehtchic	8	Stein *et al.* 1973	G
1972	Peel River	1	Stein *et al.* 1973	G
1972	Norman Wells	1	Stein *et al.* 1973	G
1974?	Great Bear Lake	1+	Johnson 1975	G
1978	Mackenzie Delta area	7*	Corkum and McCart 1981	G-F
1978	Tsiigehtchic	3*	Stewart 1996	G-F
1978	Paulatuk	7*	Corkum and McCart 1981	G-F
1978	Fort McPherson	2*	Stewart 1996	G-F
1978	Fort Good Hope	100-200	G. Low, DFO, pers. comm. 2004	G
1978	Hay River	10-15	G. Low, DFO, pers. comm. 2004	G
1978	Fort Smith	10-15	G. Low, DFO, pers. comm. 2004	G
1979	Paulatuk	12*	Corkum and McCart 1981	G-F

1979	Aklavik	2000-3000	G. Low, DFO, pers. comm. 2004	G
1979	Inuvik	2*	Stewart 1996	G-F
1979	Tsiigehtchic	500	G. Low, DFO, pers. comm. 2004	G
1979	Fort McPherson	1500-2000	G. Low, DFO, pers. comm. 2004	G
1979	Fort Good Hope	5000	G. Low, DFO, pers. comm. 2004	G
1979	Fort Simpson	100-200	G. Low, DFO, pers. comm. 2004	G
1979	Fort Providence	80-120	G. Low, DFO, pers. comm. 2004	G
1979	Hay River	50-100	G. Low, DFO, pers. comm. 2004	G
1979	Fort Resolution	100-150	G. Low, DFO, pers. comm. 2004	G
1979	Little Buffalo River	3	G. Low, DFO, pers. comm. 2004	G
1979	Lutsel K'e	2	G. Low, DFO, pers. comm. 2004	G
1979	Fort Smith	50-100	G. Low, DFO, pers. comm. 2004	G
1979	Slave River (Fort Smith)	3+	Tripp *et al.* 1981	G
1979-80	Liard River	246	McLeod and O'Neil 1983	G
1980	Aklavik	5-10	G. Low, DFO, pers. comm. 2004	G-F
1980	Mackenzie Delta	87*	Corkum and McCart 1981	G-F
1980	Fort McPherson	10-20	G. Low, DFO, pers. comm. 2004	G-F
1980	Tsiigehtchic	67	G. Low, DFO, pers. comm. 2004	G
1980	Tsiigehtchic	10*	Corkum and McCart 1981	G-F
1980	80 km below Fort Good Hope	1	RL&L 1980	G
1980	Fort Good Hope	1000	G. Low, DFO, pers. comm. 2004	G
1980	Fort Simpson	10-20	G. Low, DFO, pers. comm. 2004	G
1980	Fort Providence	10-20	G. Low, DFO, pers. comm. 2004	G
1980	Hay River	5-10	G. Low, DFO, pers. comm. 2004	G
1980	Fort Smith	10-15	G. Low, DFO, pers. comm. 2004	G

1981	Hay River	2	G. Low, DFO, pers. comm. 2004	G
1981	Fort Liard	1-5	G. Low, DFO, pers. comm. 2004	G
1981	Kugluktuk	1	CMN, CMNFI 1981-0950.1	G
1984	Fort Smith	2	RL&L/EMA Slave River Joint Venture 1985	G
1986	Cache Creek (Aklavik)	1	Babaluk *et al.* 2000a	G
1987	Aklavik	103	Fabijan 1991a	G
1988	Aklavik	2	Fabijan 1991a	G-F
1988	Inuvik	6	DFO 1991	G-F
1989	Aklavik	7	Fabijan 1991b	G-F
1993	Shingle Point	9	this study	F
1993	Tsiigehtchic area	2	K. Howland, DFO, pers. comm. 2005	G
1997	Peel River	2	McDonald 1998	F
1998	Peel River	40	R. Tallman, DFO, pers. comm. 2004	G
1998	Norman Wells	1	Bayha and Snortland 2002	F
1998	Fort Good Hope	219	Bayha and Snortland 2002	G
1998	Paulatuk	1	Fabijan 2000	G-F
1999	Fort Good Hope	51	Bayha and Snortland 2002	G
1999	Tsiigehtchic	2	this study	G
1999	Inuvik	4	this study	G
1999	Fort McPherson	4	this study	G
2000	Peel River	2	GRRB unpubl. data	F
2000	Aklavik	1	this study	G
2000	Tsiigehtchic	1	GRRB unpubl. data	F
2000	Tsiigehtchic	2	this study	G
2000	Fort Good Hope	14	Bayha and Snortland 2003	G-F
2001	Deline (Great Bear Lake)	1	this study	P
2001	Peel River	4	GRRB unpubl. data	G-F
2001	Fort Good Hope	12	Bayha and Snortland 2003	G-F
2002	Tsiigehtchic	10	GRRB unpubl. data	G-F
2002	Fort McPherson	1	this study	G
2002	Fort Good Hope	1	this study	F

2002	Liard River	1	this study	G
2003	Hornaday River (Paulatuk)	1	this study	G-F
2003	Great Bear Lake	1	this study	G
2003	Aklavik	12	this study	G
2003	Norman Wells	5+	this study	G-F
2003	Great Slave Lake	3	G. Low, DFO, pers. comm. 2003	G
2003	Fort Good Hope	15+	this study	G-F
2003	Fort Providence	1	G. Low, DFO, pers. comm. 2004	G
2003	Aklavik	40	GRRB upubl. data	G-F
2003	Peel River	65	GRRB unpubl. data	G-F
2003	Tsiigehtchic	8	GRRB unpubl. data	G-F
2003	Tree River (Mackenzie River)	34	GRRB unpubl. data	G-F

* Numbers calculated from reported fish weights of 3 kg per fish

Table 2: Number, location and year of capture of pink salmon reported from the Canadian western Arctic. Reliability of identification is based on available information that details or infers knowledge of person(s) making identification (G=good, F=fair, P=poor).

Year	Location	Number	Reference	Reliability
1936	Kigtluit (probably Kidluit Bay)	1	Dymond 1940	G
1938	Kittigasuit Bay	1	Dymond 1940	G
1945 or 1947	Kidluit Bay	1 or 2	Hunter 1974	G
1945 or 1947	Peel River	1	Hunter 1974	G
?	Peel River	?	Hunter 1974	F
1956	Rat River	> 1	Hunter 1974	F
1957	Peel River	1	Hunter 1974	G
1958	Tuktoyaktuk Harbour	?	Riske 1960	G
1959	Aklavik	1	Hunter 1974	G-F
1992	Mackenzie River (Aklavik)	1	Babaluk *et al.* 2000a	G
1993	Sachs Harbour	1	Babaluk *et al.* 2000a	G
1997?	Mackenzie Delta	1	this study	G

Table 3: Number, location and year of capture of coho salmon reported from the Canadian western Arctic. Reliability of identification is based on available information that details or infers knowledge of person(s) making identification (G=good, F=fair, P=poor).

Year	Location	Number	Reference	Reliability
1987	Great Bear Lake	1	Babaluk *et al.* 2000a	G
1998	Mackenzie Delta	1	this study	G

Table 4: Number, location and year of capture of sockeye salmon reported from the Canadian western Arctic. Reliability of identification is based on available information that details or infers knowledge of person(s) making identification (G=good, F=fair, P=poor).

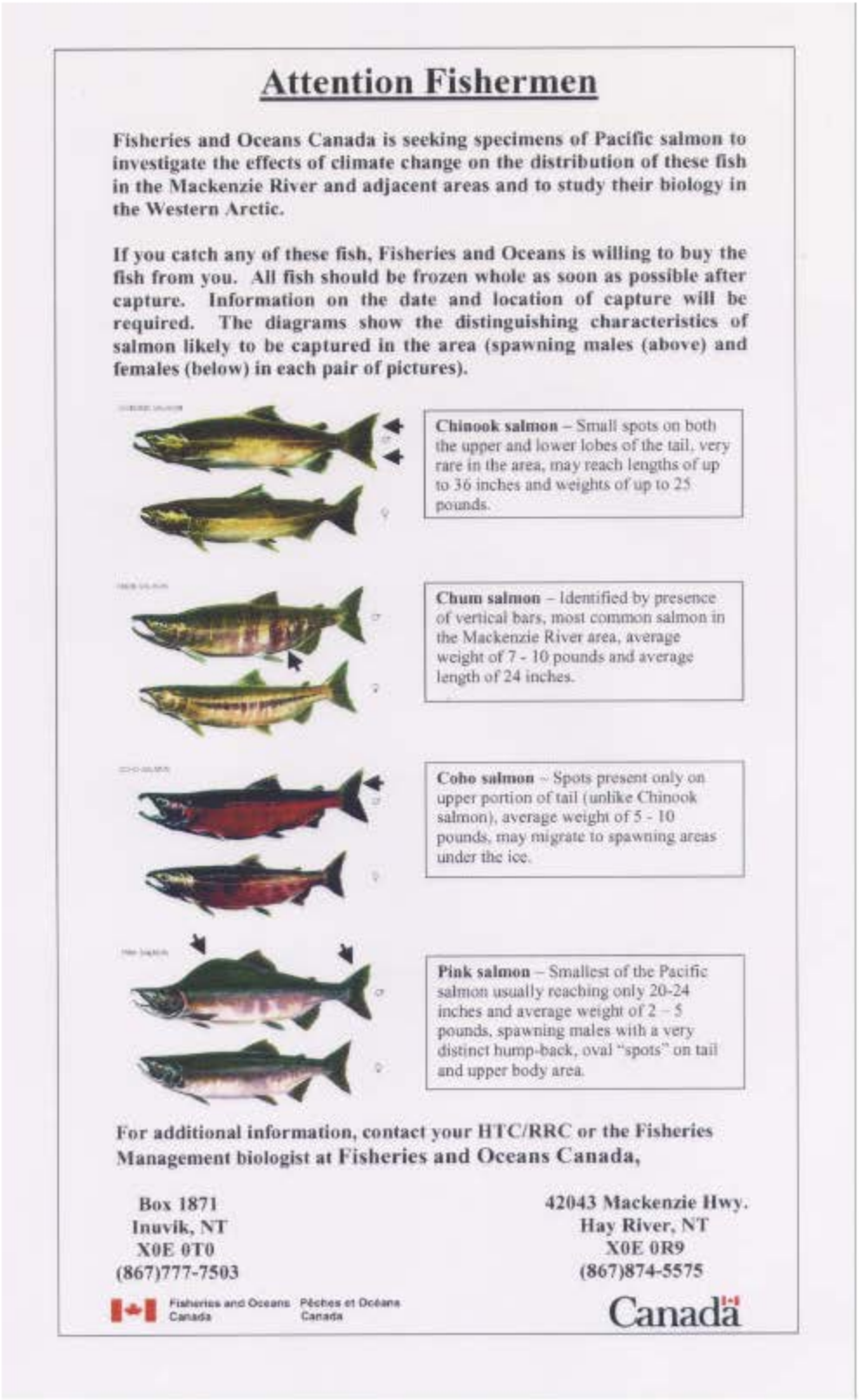
Year	Location	Number	Reference	Reliability
1908	Fort Providence	1	Hunter 1974	P?
1965	Bathurst Inlet	11	Hunter 1974	G
1966	Holman	30-40	Hunter 1974	G
1993	Sachs Harbour	8	Babaluk *et al.* 2000a	G
1993	Tsiigehtchic area	8	R. Tallman, DFO, pers. comm. 2004	G
1994	Tuktoyaktuk	1	Fabijan 1995b	F-P
1994	Horton River*	1	Fabijan 1995b	F-P
1995	Slave River (Fort Smith)	1	Little 1997; (A. Smith, Golder Assoc. Ltd., pers. comm. 2005)	G
1997	Kagloryuak River	1	this study	G
1998	Tuktoyaktuk	3	Fabijan 2000	F-P
2000	Holman	1	this study	F-P
2003	Norman Wells	1	this study	G
2003	Fort Good Hope	1+	this study	F
2003	Jean Marie River	1	this study	G

* Location given as “Tuktoyaktuk” in Fabijan 1995b

Table 5: Number, location and year of capture of Chinook salmon reported from the Canadian western Arctic. Reliability of identification is based on available information that details or infers knowledge of person(s) making identification (G=good, F=fair, P=poor).

Year	Location	Number	Reference	Reliability
1914	Peel River and Tsiigehtchic area	?	Dymond 1940	F
1950	Kugluktuk	1	Hunter 1974	G
1961 or 1962	Kugluktuk	13	Hunter 1974	G
1979	Fort Liard	1	McLeod and O'Neil 1983	G
1993	Shingle Point	1	this study	F-P
1993	Shingle Point*	2	Fabijan 1995a	F-P
1995	Fort Smith (Slave River)	1	Little 1997; (A. Smith, Golder Assoc. Ltd., pers. comm. 2005)	G
1997	Shingle Point	20+	D.A. Gordon (pers. comm.. 2001)	F
2001	Norman Wells	1	this study	P
2001	Aklavik	1	this study	G-F
2002	Aklavik	1	this study	G

* Location given as "Aklavik" in Fabijan 1995b



Attention Fishermen

Fisheries and Oceans Canada is seeking specimens of Pacific salmon to investigate the effects of climate change on the distribution of these fish in the Mackenzie River and adjacent areas and to study their biology in the Western Arctic.

If you catch any of these fish, Fisheries and Oceans is willing to buy the fish from you. All fish should be frozen whole as soon as possible after capture. Information on the date and location of capture will be required. The diagrams show the distinguishing characteristics of salmon likely to be captured in the area (spawning males (above) and females (below) in each pair of pictures).

Chinook salmon – Small spots on both the upper and lower lobes of the tail, very rare in the area, may reach lengths of up to 36 inches and weights of up to 25 pounds.

Chum salmon – Identified by presence of vertical bars, most common salmon in the Mackenzie River area, average weight of 7 - 10 pounds and average length of 24 inches.

Coho salmon – Spots present only on upper portion of tail (unlike Chinook salmon), average weight of 5 - 10 pounds, may migrate to spawning areas under the ice.

Pink salmon – Smallest of the Pacific salmon usually reaching only 20-24 inches and average weight of 2 – 5 pounds, spawning males with a very distinct hump-back, oval "spots" on tail and upper body area.

For additional information, contact your HTC/RRC or the Fisheries Management biologist at Fisheries and Oceans Canada,

Box 1871
Inuvik, NT
X0E 0T0
(867)777-7503

42043 Mackenzie Hwy.
Hay River, NT
X0E 0R9
(867)874-5575

Fisheries and Oceans Canada / Pêches et Océans Canada

Canada

Figure 1: Reproduction of poster used to promote the Fisheries and Oceans salmon collection program.

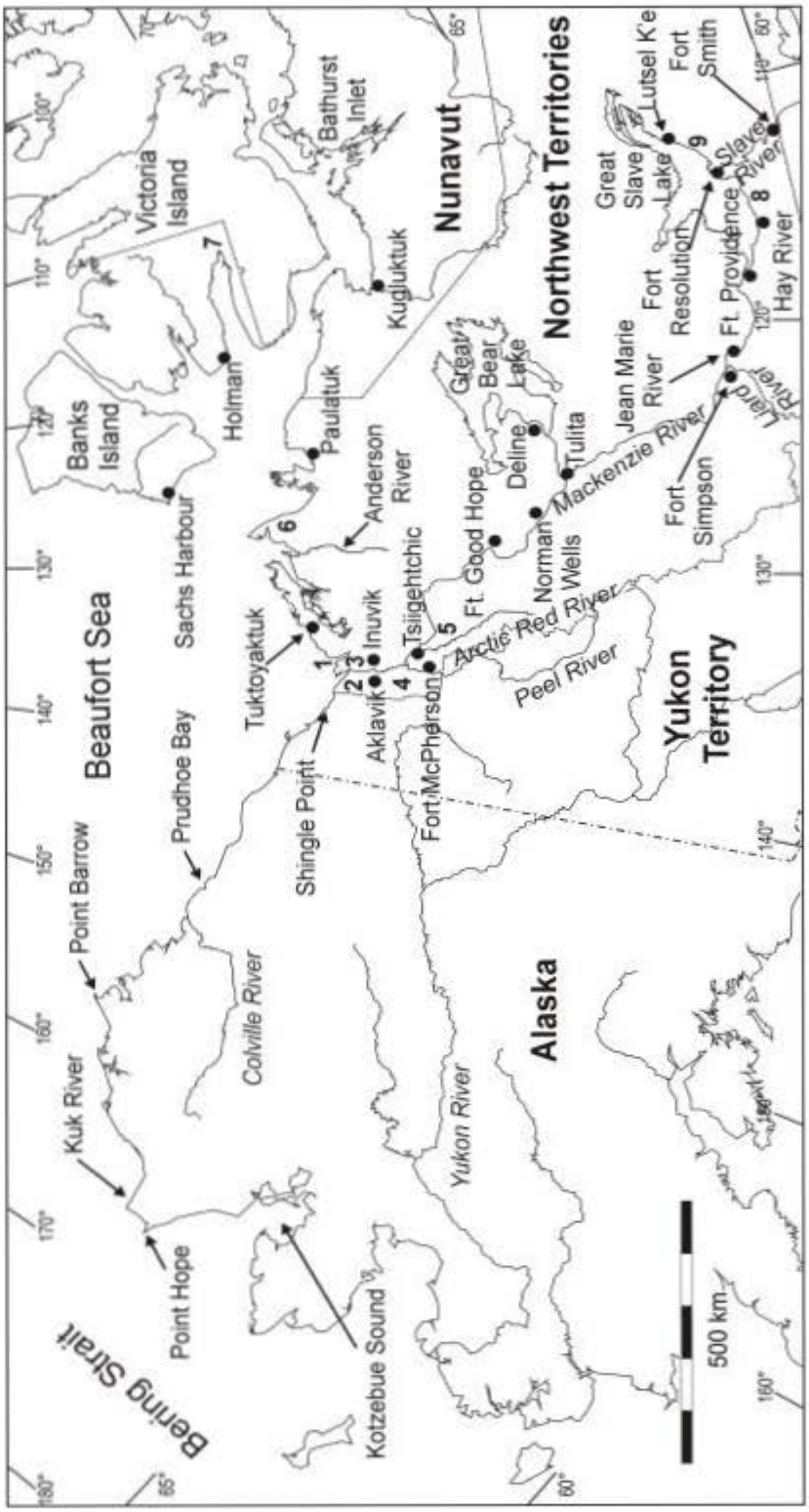


Figure 2: Location of areas discussed in text. Numbered areas are: 1-Kidluit and Kittigasuit bays, 2-Cache Creek (Big Fish River), 3-Whitefish Station, 4-Rat River, 5-Tree River, 6-Horton River, 7-Kagloryuak River, 8-Big and Little Buffalo rivers, and, 9-Talston Bay.

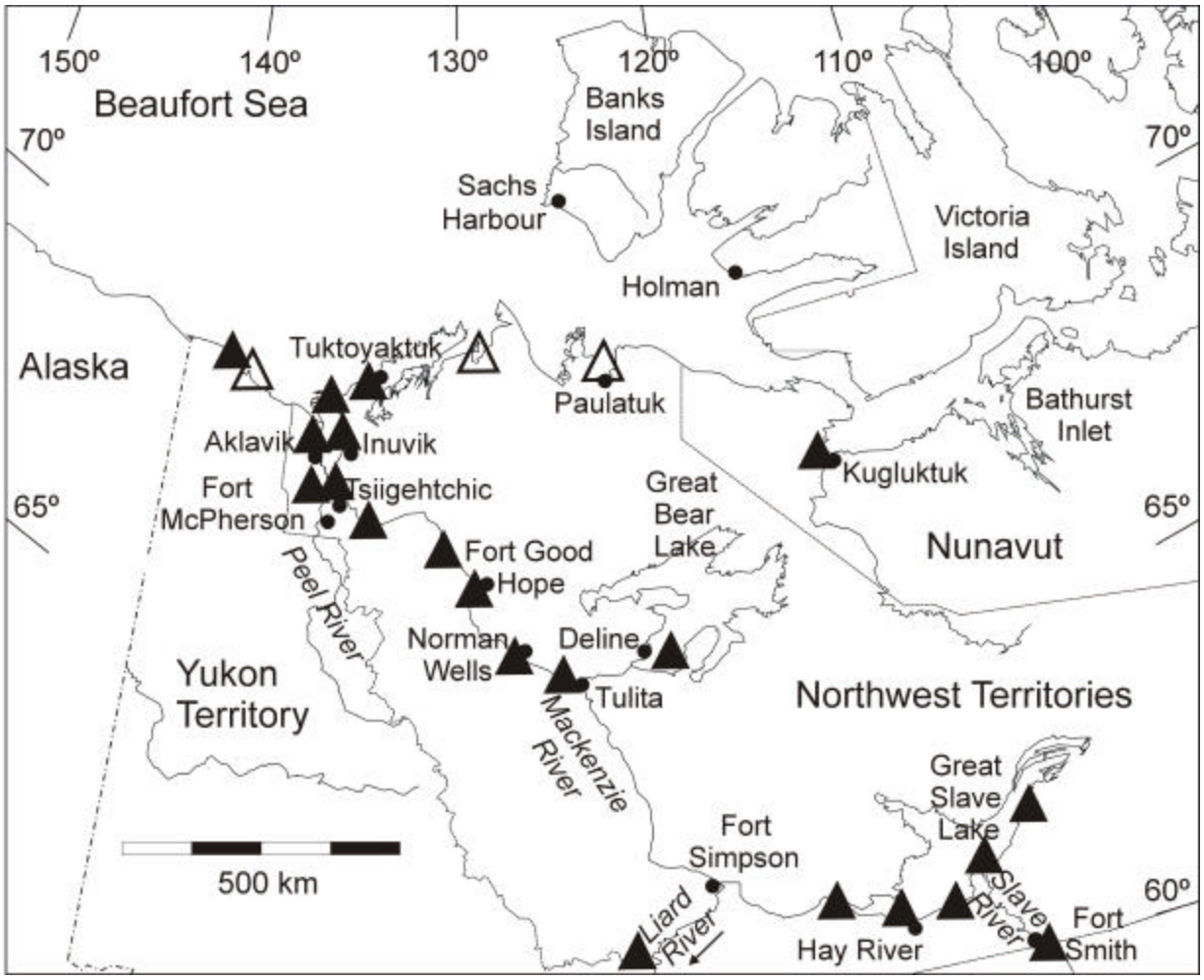


Figure 3: Distribution of verified (closed triangles) and suspected (open triangles) chum salmon captures in the Canadian western Arctic. Each symbol may represent the capture of more than one fish over several years.

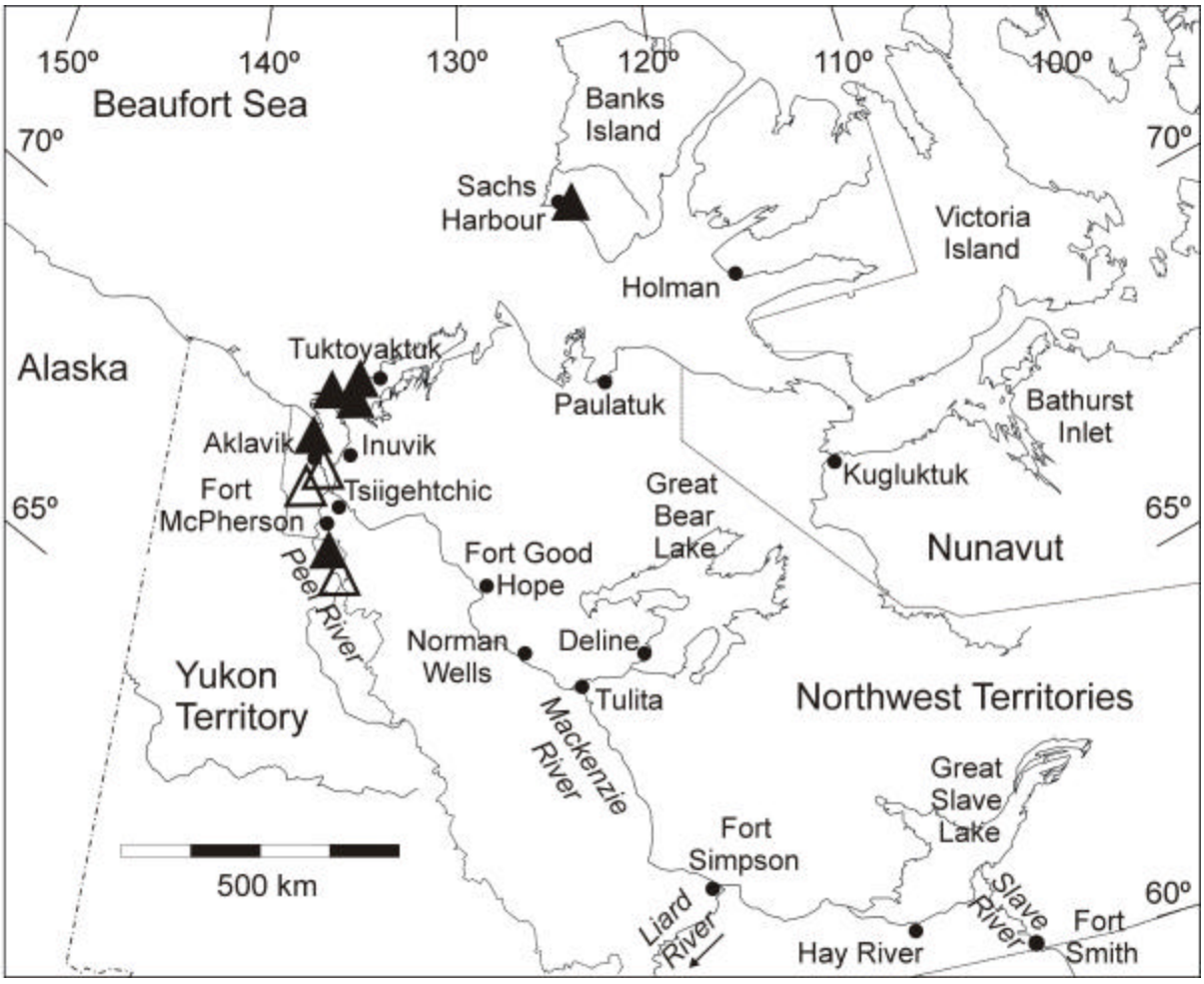


Figure 4: Distribution of verified (closed triangles) and suspected (open triangles) pink salmon captures in the Canadian western Arctic. Each symbol may represent the capture of more than one fish over several years.

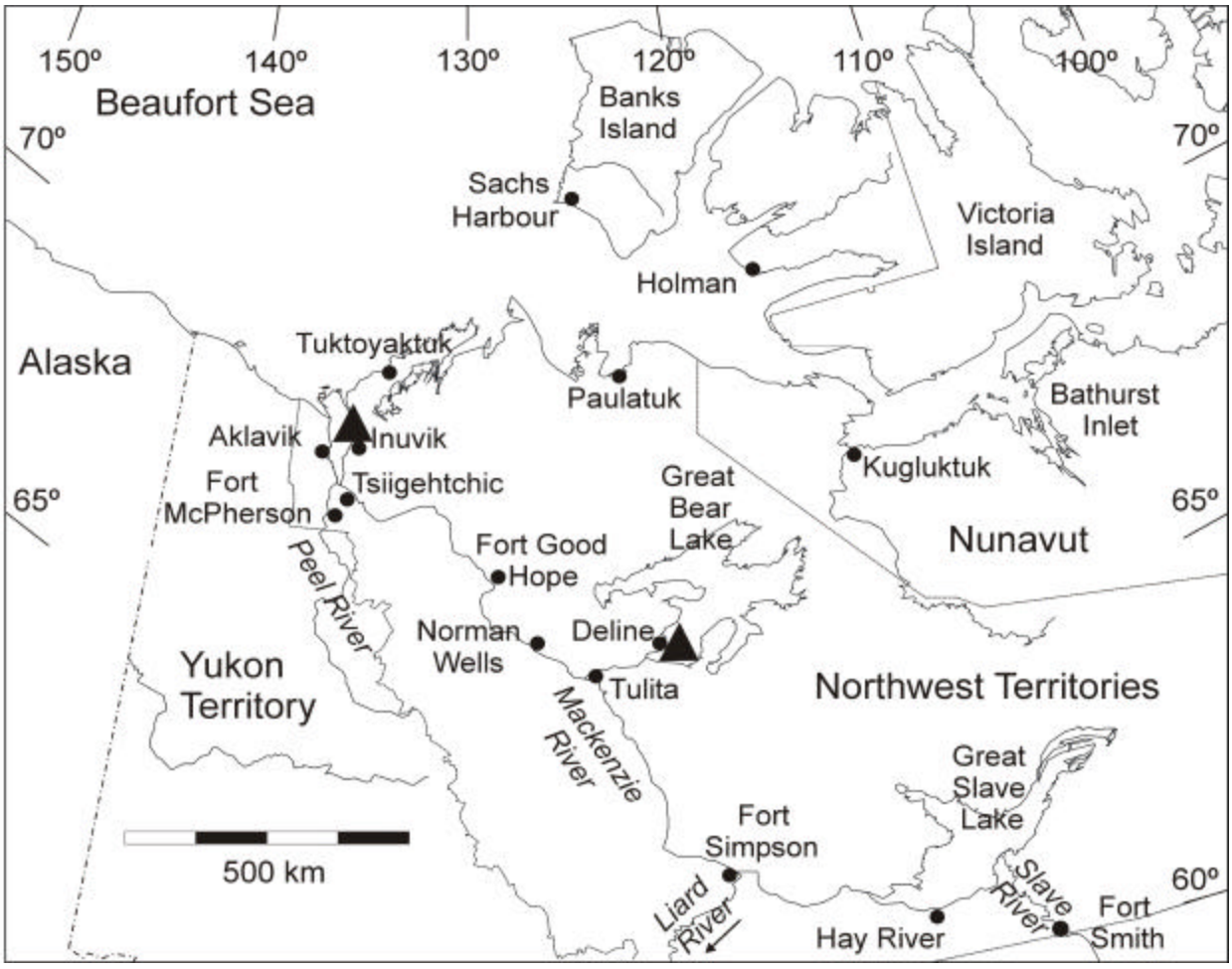


Figure 5: Distribution of verified (closed triangle) coho salmon captures in the Canadian western Arctic. Each symbol represents the capture of a single fish.

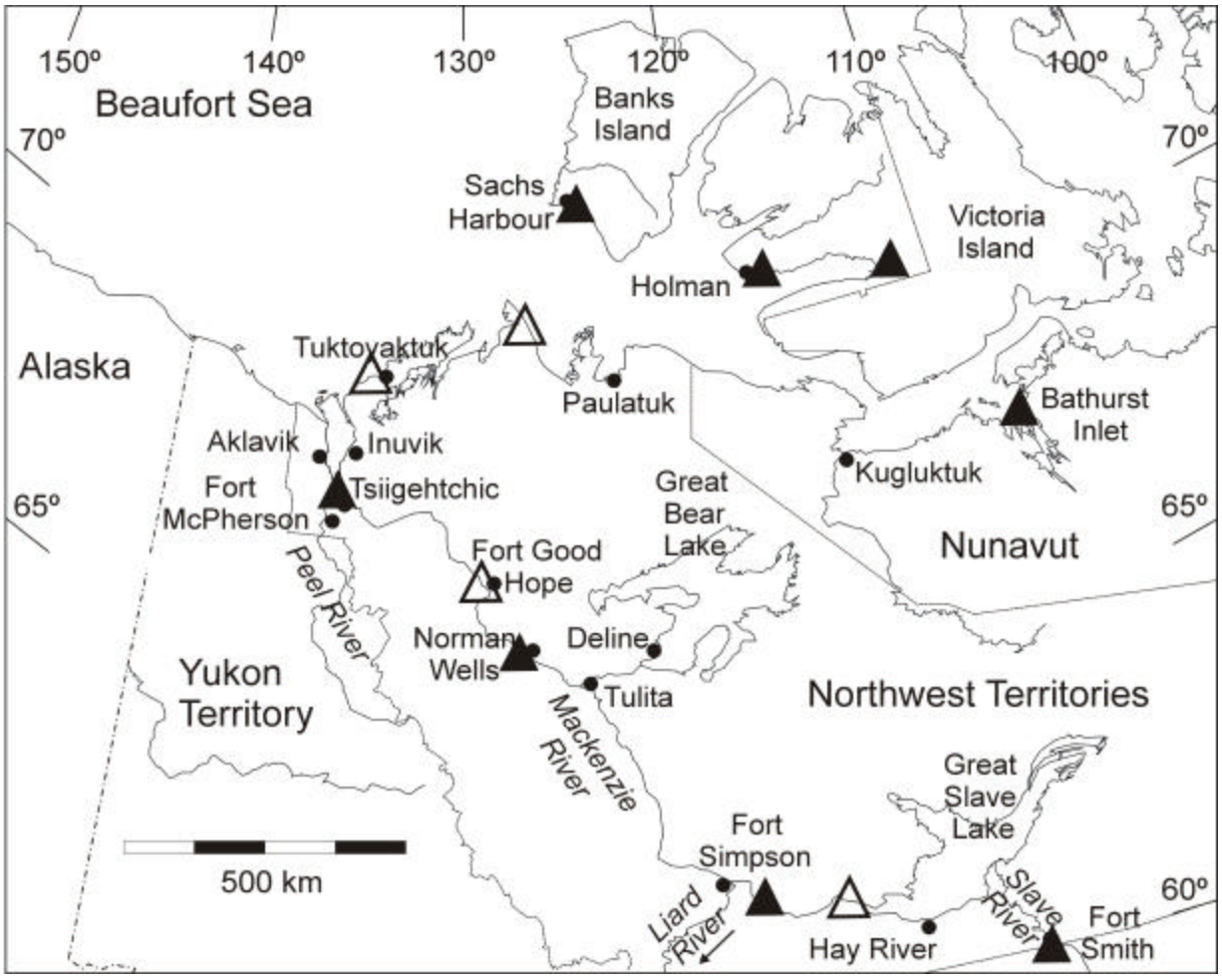


Figure 6: Distribution of verified (closed triangle) and suspected (open triangle) sockeye salmon captures in the Canadian western Arctic. Each symbol may represent the capture of more than one fish over several years.

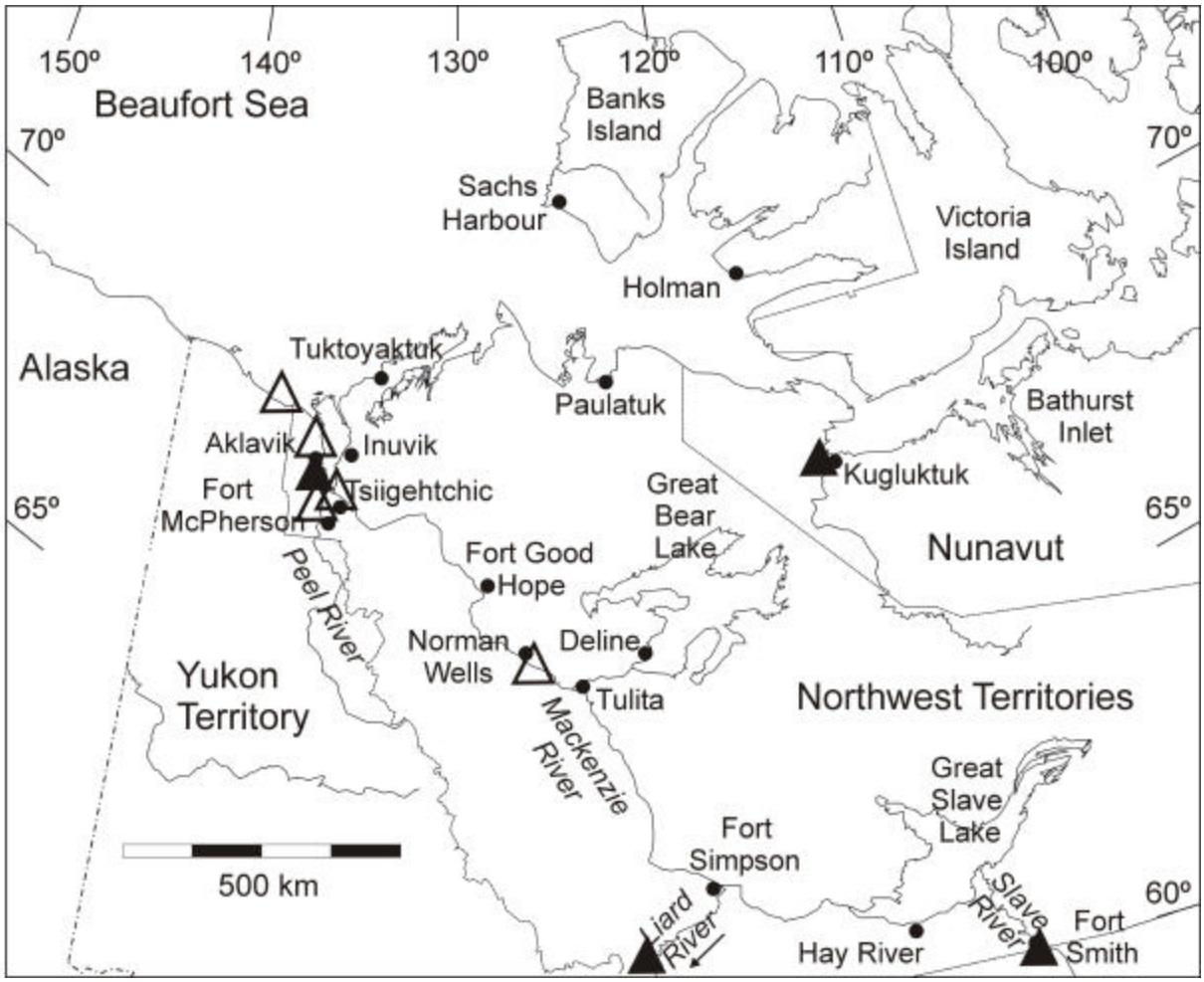


Figure 7: Distribution of verified (closed triangle) and suspected (open triangle) Chinook salmon captures in the Canadian western Arctic. Each symbol may represent the capture of more than one fish over several years.