

First Records of Sockeye (*Oncorhynchus nerka*) and Pink Salmon (*O. gorbuscha*) from Banks Island and Other Records of Pacific Salmon in Northwest Territories, Canada

JOHN A. BABALUK,^{1,2} JAMES D. REIST,¹ JAMES D. JOHNSON¹ and LIONEL JOHNSON³

(Received 12 March 1999; accepted in revised form 20 December 1999)

ABSTRACT. Eight sexually mature sockeye (*Oncorhynchus nerka*) and one sexually mature pink salmon (*O. gorbuscha*) were captured in the subsistence fishery in the Sachs River estuary at Sachs Harbour, Banks Island, Northwest Territories (NT) in August 1993. We also report a first record for coho salmon (*O. kisutch*) in Great Bear Lake, NT. These capture locations are well outside the known distributions for the species. A pink salmon captured in the West Channel, Mackenzie River near Aklavik, NT, and a chum salmon (*O. keta*) from Cache Creek, NT, also represent new capture locations within the distribution of the species.

Key words: Beaufort Sea, Cache Creek, first record, Great Bear Lake, Mackenzie River, Northwest Territories, Pacific salmon, Sachs Harbour

RÉSUMÉ. En août 1993, on a capturé huit saumons sockeye (*Oncorhynchus nerka*) adultes et un saumon rose (*O. gorbuscha*) adulte dans la pêcherie de subsistance située dans l'estuaire de la rivière Sachs, à Sachs Harbour, dans l'île Banks (Territoires du Nord-Ouest). On signale également une première observation du saumon coho (*O. kisutch*) dans le Grand lac de l'Ours (T.N.-O.) Ces lieux de capture sont nettement à l'extérieur des aires de distribution connues pour ces espèces. Un saumon rose capturé dans le Chenal occidental du Mackenzie près d'Aklavik (T.N.-O.), et un saumon kéta (*O. keta*) provenant de Cache Creek (T.N.-O.) signalent aussi de nouveaux sites de capture à l'intérieur de l'aire de distribution de ces espèces.

Mots clés: mer de Beaufort, Cache Creek, première observation, Grand lac de l'Ours, fleuve Mackenzie, Territoires du Nord-Ouest, saumon du pacifique, Sachs Harbour

Traduit pour la revue *Arctic* par Nésida Loyer.

INTRODUCTION

While sockeye (*Oncorhynchus nerka*), pink (*O. gorbuscha*), coho (*O. kisutch*), and chum salmon (*O. keta*) are widely distributed over the northern Pacific Ocean and the Bering Sea (Hart, 1973; Groot and Margolis, 1991), these four species are also known to occur to a limited degree in North American Arctic waters (McPhail and Lindsey, 1970; Scott and Crossman, 1973; Craig and Haldorson, 1986) (Fig. 1). Pink and chum salmon are the most commonly reported Pacific salmon caught in Arctic waters, as they are more tolerant of low Arctic water temperatures than the rarer sockeye or rarest coho salmon (Salonius, 1973; Craig and Haldorson, 1986). Small spawning populations of pink and chum salmon and stray sockeye and coho salmon have been recorded in the Bering Strait and the Beaufort Sea areas of Alaska (Craig and Haldorson, 1986). Pink salmon, most likely strays, have been reported sporadically in Canadian Arctic waters, usually in the Mackenzie River Delta area, Northwest Territories (NT), since 1890 (Hunter, 1974; Heard, 1991). At least two isolated spawning migrations of chum salmon are known

to occur in the upper Mackenzie River drainage basin: on the Slave River near Fort Smith, NT (McPhail and Lindsey, 1970), and in the upper Liard River, British Columbia (McLeod and O'Neil, 1983) (Fig. 1). Fish from these runs are also caught irregularly in the subsistence fishery at Aklavik, NT (Fabijan, 1991) and in Great Bear and Great Slave Lakes (Craig and Haldorson, 1986). Sockeye salmon are extremely rare in northern Canada (Burgner, 1991): the only recorded catches are those reported by Hunter (1974). He reported that 11 sockeye salmon were caught in the Bathurst Inlet, NT (now Nunavut) area in 1965 and that as many as 30–40 sockeye salmon were caught in the area around Holman, NT (Fig. 1) during August 1966. Spawning populations of coho salmon are known to occur as far north as Point Hope, Alaska (Scott and Crossman, 1973; Sandercock, 1991) while single specimens have been collected as far east as Prudhoe Bay on the Alaska north slope (Craig and Haldorson, 1986) (Fig. 1). Since the Craig and Haldorson (1986) synopsis of reports of Pacific salmon in Arctic North America, stray salmon have continued to turn up in the catches from domestic and subsistence fisheries in the Arctic.

¹ Fisheries and Oceans Canada, 501 University Crescent, Winnipeg, Manitoba R3T 2N6, Canada

² babalukj@dfo-mpo.gc.ca

³ 10201 Wildflower Place, Sidney, British Columbia V8L 3R3, Canada

We report here the first record of sockeye and pink salmon in the Sachs River estuary near Sachs Harbour, Banks Island, NT, and coho salmon caught in Great Bear Lake, NT. We also report new records for pink salmon captured in the West Channel of the Mackenzie River near Aklavik, NT, and chum salmon from Cache Creek, NT.

NEW RECORDS OF PACIFIC SALMON IN THE NORTHWEST TERRITORIES

Sockeye and Pink Salmon from Banks Island

The first of eight reported sockeye salmon was captured on 17 August 1993, during the annual subsistence fishery in the Sachs River estuary, Sachs Harbour, NT (71°59'N, 125°15'W) (Fig. 1). It was tentatively identified as a sockeye salmon (ocean phase) from its external colouration, as described by Scott and Crossman (1973). Between 21 and 25 August 1993, an additional seven sockeye salmon (three maturing females, four maturing males) were caught in the area; all displayed typical ocean-phase colouration. While we observed all eight specimens, we were able to obtain parts of only two specimens for more extensive examination (Table 1). Gill raker and pyloric caecae counts for these two fish were within the ranges for sockeye salmon described by Scott and Crossman (1973). Scales from these two fish were also used to identify them as sockeye salmon: they showed two freshwater annuli followed by three marine annuli (age = 2.3), as described by Bilton et al. (1964) and Mosher (1969).

One pink salmon was also caught on 17 August 1993 in the Sachs River estuary subsistence fishery (Fig. 1). This fish was identified in the field as the oceanic form of pink salmon from its colouration, using the criteria of Scott and Crossman (1973). We obtained limited information from this specimen (Table 1).

There were no reports of either sockeye or pink salmon being caught in the Sachs Harbour subsistence fishery in 1994 (Sachs Harbour Hunters and Trappers Committee, Sachs Harbour, pers. comm. 1994) and since there had been no reports of salmon caught in the fishery before 1993 (Sachs Harbour Hunters and Trappers Committee, Sachs Harbour, pers. comm. 1993), the salmon caught in 1993 were most likely strays into the Banks Island area. As the two sockeye specimens examined had spent two years in freshwater before migrating to the sea, they were probably strays from populations in northwestern Alaska (i.e., north of Bristol Bay and the Aleutian Islands) or from areas in Russia north of the Kamchatka Peninsula (Mosher, 1972). In 1993, coincidentally, several specimens of sockeye salmon were also caught in subsistence fisheries in the lower Mackenzie and Arctic Red Rivers, NT (D. Chipczak, Fisheries and Oceans Canada, Yellowknife, pers. comm. 1997). These occurrences of Pacific salmon may have been the result of unusual environmental conditions in 1993. The annual mean air temperatures for the

Beaufort Sea area in 1993 were the highest recorded up to that time during the last three decades (1960–94) (B. Fehr, Environment Canada, Winnipeg, pers. comm. 1995). Also, Shuntov et al. (1995) reported that, unlike other years, in 1993 most of the Pacific salmon (in particular sockeye and pink salmon) caught in the Bering Sea and adjacent Pacific Ocean were taken from the northern reaches of the area. At the same time, warmer than normal water temperatures were observed in the Canadian basin of the Arctic Ocean (Carmack et al., 1995).

Coho Salmon from Great Bear Lake

On 25 September 1987, a Pacific salmon was caught in the subsistence fishery at Deline (formerly Fort Franklin), NT (65°10'N, 123°25'W) on Great Bear Lake near the outflow to Great Bear River (Fig. 1). The fish was identified as a coho salmon on the basis of breeding colouration and meristic criteria described by Scott and Crossman (1973) (Table 1). A coho salmon in Great Bear Lake is extremely unusual, as the species has not been previously reported from Arctic Canada. The nearest reported capture was that of a single specimen caught at Prudhoe Bay, Alaska (Craig and Haldorson, 1986), approximately 1500 km from the Great Bear Lake site (Fig. 1). Although our specimen was in spawning condition, the possibility of an isolated spawning population in the lake is remote, as no coho salmon are known to spawn north or east of Point Hope, Alaska (Craig and Haldorson, 1986; see Fig. 1).

Pink Salmon from Aklavik

On 1 September 1992, we caught a pink salmon in the West Channel of the Mackenzie River near Aklavik, NT (68°18'N, 135°10'W) (Fig. 1). The fish was identified using the colouration and meristic criteria described by Scott and Crossman (1973) (Table 1). A scale sample from this specimen also confirmed the identification as pink salmon (Bilton et al., 1964; Mosher, 1969). The scales, characterized as small relative to the size of the fish, had a single marine annulus (age = 0.1) and mixed ladder and globular reticulation. This capture location is outside the known distribution of the species (Fig. 1). Although captures from the general area have been reported (Hunter, 1974), these occurrences are rare.

Chum Salmon from Cache Creek

On 26 September 1986, we caught a chum salmon in Cache Creek, NT (68°17'N, 136°21'W) (Fig. 1). The fish was identified using the criteria outlined by Scott and Crossman (1973) (Table 1). Chum salmon are the Pacific salmon most frequently caught by the fishermen in the lower Mackenzie River area (Hunter, 1974), whose nets are in the water during the upstream spawning migration of the isolated chum salmon populations in the Slave and Liard Rivers of the upper Mackenzie River drainage basin.

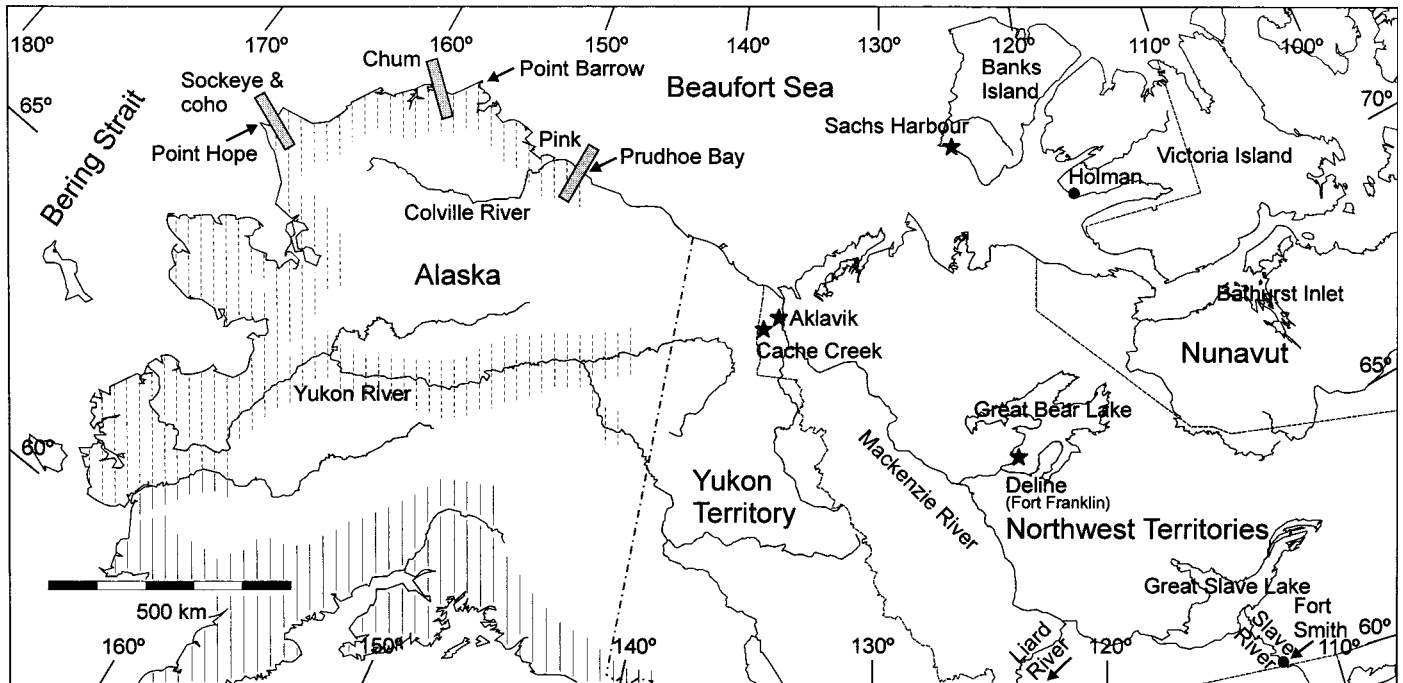


FIG. 1. Generalized coastal and spawning distribution of sockeye, pink, coho, and chum salmon in Arctic North America (solid vertical lines = primary distribution; broken vertical lines = limited occurrence) (from Craig and Haldorson, 1986; Burgner, 1991). Shaded bars represent northern limits of known spawning stocks of salmon (from Craig and Haldorson, 1986). Locations of new records are indicated by solid stars.

TABLE 1. Lengths, weights, sex, age, selected meristic counts, and colouration for six specimens of *Oncorhynchus* spp. captured in northwestern Northwest Territories, Canada, 1986–93.

Species	Capture Location	Fork Length (mm)	Weight (g)	Sex	Age (yr)	Gill Rakers	Pyloric Caecae	Lateral Line Scales	Colouration
<i>O. nerka</i>	Sachs Harbour	692	4025	M	2.3	37	90	–	marine colouration; no black spots
<i>O. nerka</i>	Sachs Harbour	630	3620	F	2.3	34	93	–	marine colouration; no black spots
<i>O. gorbuscha</i>	Sachs Harbour	415	–	M	–	–	–	–	marine colouration; black spots on caudal fin and dorsal surface
<i>O. kisutch</i>	Deline	686	3527	M	–	23	63	144	breeding colouration; small black spots on dorsal surface
<i>O. gorbuscha</i>	Aklavik	453	1051	M	0.1	29	141	ca. 162	marine colouration; black spots on caudal fin and dorsal surface
<i>O. keta</i>	Cache Creek	559	2192	F	–	23	ca. 190	159	marine colouration; faint vertical lateral bars

The specimen from Cache Creek was most likely a stray from one of these two known populations, as the stream is regularly fished and this is the first report of the species from this location.

CONCLUSION

These capture records for Pacific salmon in the western Canadian Arctic represent significant extensions of known, normal distributions. Significant temperature increases in Arctic areas as a result of climate change (e.g., Quadfasel et al., 1991; Watson et al., 1996) may result in greater numbers of Pacific salmon in the area. Welch et al. (1998) have predicted that global warming will greatly reduce the

acceptable summer and winter thermal habitat for Pacific salmon, in particular sockeye salmon, restricting it to the Bering Sea and areas to the north during summer. The present distribution of Pacific salmon in the Arctic is most likely limited by low water temperatures (Craig and Haldorson, 1986), and anadromous fishes in the Arctic in general are limited by availability of overwintering and spawning habitats (Craig, 1989). If more frequent straying of Pacific salmon into Arctic waters occurs, the impact on indigenous salmonids (e.g., arctic charr *Salvelinus alpinus* and Dolly Varden charr *S. malma*) may be significant and should be closely monitored. Furthermore, changes in distributions for salmon may be useful as proxies for monitoring the effects of climate change on the Beaufort Sea.

ACKNOWLEDGEMENTS

This work was supported in part by the Inuvialuit Fisheries Joint Management Committee. We thank Natural Resources Canada (Polar Continental Shelf Project) and the Aurora Research Institute (Inuvik Research Centre) for logistical support of field aspects of the work. The late C. Haogak provided field assistance and access to his catch on Banks Island. We also thank W. Bayla, J. Blondin Jr., A. Carpenter, L. Carpenter, and W. Gully for providing access and information on catches. S. MacLellan (Fisheries and Oceans Canada, Nanaimo) corroborated sockeye and pink salmon ages determined from scale samples. D. Bodaly, A. Kristofferson, D. Welch, and two anonymous reviewers provided constructive comments on earlier versions of the manuscript.

REFERENCES

- BILTON, H.T., JENKINSON, D.W., and SHEPARD, M.P. 1964. A key to five species of Pacific salmon (Genus *Oncorhynchus*) based on scale characters. *Journal of the Fisheries Research Board of Canada* 21:1267–1288.
- BURIGNER, R.L. 1991. Life history of sockeye salmon (*Oncorhynchus nerka*). In: Groot, C., and Margolis, L., eds. *Pacific salmon life histories*. Vancouver: UBC Press. 1–117.
- CARMACK, E.C., MACDONALD, R.W., PERKIN, R.G., McLAUGHLIN, F.A., and PEARSON, R.J. 1995. Evidence for warming of Atlantic water in the Southern Canadian Basin of the Arctic Ocean: Results from Larsen-93 Expedition. *Geophysical Research Letters* 22:1061–1064.
- CRAIG, P.C. 1989. An introduction to anadromous fishes in the Alaskan Arctic. *Biological Papers of the University of Alaska* 24:27–54.
- CRAIG, P., and HALDORSON, L. 1986. Pacific salmon in the North American Arctic. *Arctic* 39:2–7.
- FABIJAN, M. 1991. Inuvialuit harvest study (January 1989 – December 1989). Report prepared for Fisheries Joint Management Committee. Available from Inuvialuit Harvest Study, Box 2120, Inuvik, NT X0E 0T0, Canada.
- GROOT, C., and MARGOLIS, L. 1991. *Pacific salmon life histories*. Vancouver: UBC Press. 564 p.
- HART, J. 1973. Pacific fishes of Canada. *Fisheries Research Board of Canada Bulletin* 180. 740 p.
- HEARD, W.R. 1991. Life history of pink salmon (*Oncorhynchus gorbuscha*). In: Groot, C., and Margolis, L., eds. *Pacific salmon life histories*. Vancouver: UBC Press. 119–230.
- HUNTER, J.G. 1974. Pacific salmon in Arctic Canada. *Fisheries Research Board of Canada, Manuscript Report Series* 1319. 11 p.
- McLEOD, C.L., and O'NEIL, J.P. 1983. Major range extensions of anadromous salmonids and first record of chinook salmon in the Mackenzie River drainage. *Canadian Journal of Zoology* 61:2183–2184.
- McPHAIL, J.D., and LINDSEY, C.C. 1970. Freshwater fishes of northwestern Canada and Alaska. *Fisheries Research Board of Canada Bulletin* 173. 381 p.
- MOSHER, K.H. 1969. Identification of Pacific salmon and steelhead trout by scale characteristics. *U.S. Fish and Wildlife Service Circular* 317. 17 p.
- . 1972. Scale features of sockeye salmon from Asian and North American coastal regions. *U.S. National Marine Fisheries Service Fishery Bulletin* 70:141–183.
- QUADFASEL, D., ALEXANDER, S., and WELLS, D. 1991. Warming in the Arctic. *Nature* 350:385.
- SALONIUS, P.O. 1973. Barriers to range extensions of Atlantic and Pacific salmon in Arctic North America. *Arctic* 26:112–122.
- SANDERCOCK, F.K. 1991. Life history of coho salmon (*Oncorhynchus kisutch*). In: Groot, C., and Margolis, L., eds. *Pacific salmon life histories*. Vancouver: UBC Press. 395–445.
- SCOTT, W.B., and CROSSMAN, E.J. 1973. *Freshwater fishes of Canada*. *Fisheries Research Board of Canada Bulletin* 184. 966 p.
- SHUNTOV, V.P., LAPKO, V.V., BALANOV, A.A., and STARTSEV, A.V. 1995. Interannual changes in anadromous migrations of salmon in the western Bering Sea and adjacent Pacific waters. *Russian Journal of Marine Biology* 21:32–40.
- WATSON, R.T., ZINYOWERA, M.C., and MOSS, R.H., eds. 1996. *Climate change 1995. Impacts, adaptations and mitigation of climate change: Scientific-technical analyses*. Cambridge: Cambridge University Press. 889 p.
- WELCH, D.W., ISHIDA, Y., and NAGASAWA, K. 1998. Thermal limits and ocean migrations of sockeye salmon (*Oncorhynchus nerka*): Long-term consequences of global warming. *Canadian Journal of Fisheries and Aquatic Sciences* 55:937–948.