

Long-Distance Movements of Anadromous Dolly Varden between Alaska and the U.S.S.R.

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ABSTRACT. Two anadromous Dolly Varden, tagged in the Wulik River, Alaska, during September 1988, were recaptured in the Anadyr River, U.S.S.R., one in August 1989 and one in August 1990. Two additional tag recoveries were made south of the Bering Strait, one near Savoonga on St. Lawrence Island, Alaska, and one near Egavik in Norton Sound, Alaska. The greatest distance traveled was 1690 km. This is the first record of fish movement between freshwaters of Alaska and the U.S.S.R. and the longest documented movement of a Dolly Varden or Arctic char.

Key words: Dolly Varden, *Salvelinus malma*, movements, U.S.S.R., Alaska

RÉSUMÉ. Deux Dolly Varden potamotoques étiquetés dans la rivière Wulik en Alaska au cours du mois de septembre 1988 ont été recapturés dans le fleuve Anadyr, en Union soviétique, l'un en août 1989 et l'autre en août 1990. Deux autres captures de poissons étiquetés ont eu lieu au sud du détroit de Béring, l'une près de Savoonga sur l'île Saint Lawrence en Alaska et l'autre près d'Egavik dans Norton Sound en Alaska. La distance maximale parcourue était de 1690 km. Cela représente le premier cas documenté de migration de poissons entre les eaux douces de l'Alaska et de l'Union soviétique, ainsi que la migration documentée la plus longue d'un Dolly Varden ou omble chevalier.

Mots clés: Dolly Varden, *Salvelinus malma*, migration, Union soviétique, Alaska

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Движение По Большому Расстоянию Анадромных Малем (*Salvelinus malma*) Между Аляской и Советским Союзом

Две анадромные мальмы, мечены в реке Улик, Аляска в сентябре 1988 возвращены в реке Анадыре, СССР. Рыбы тоже еще раз пойманы к югу от Берингового пролива близко от Савунги на острове Святого Лаврентия (St. Lawrence Island) и близко от Эгавика в заливе Нортон, Аляска. Самое большое попутешествовавшее расстояние - 1690 км. Эта работа первая запись движения малем между Аляской и Советским Союзом, и самое большое зарегистрированное расстояние или для малем или для обыкновенных гольца.

Важнейшие слова: американский голец, *Salvelinus malma*, движение, Аляска

INTRODUCTION

Movement studies of Dolly Varden, *Salvelinus malma*, and the closely related Arctic char, *Salvelinus alpinus*, have been confined mainly to freshwater and nearshore areas (Armstrong, 1974; Griffiths *et al.*, 1975; Moore, 1975; Craig and McCart, 1976; Armstrong and Morrow, 1980; Craig and Haldorson, 1980; Johnson, 1980; Gyselman, 1984; Dempson and Green, 1985; Dempson and Kristofferson, 1987). Most available literature suggests that while anadromous char are at sea, they do not travel far offshore. Exceptions have been reported from Kodiak Island, Alaska, where a Dolly Varden tagged in the Buskin River was recaptured across Shelikof Strait in Dakavak Bay, a distance of 160 km (Sonnichsen *et al.*, unpubl. data) and from Kamchatka, where Dolly Varden were caught as far as 420 km offshore (Mishima, 1975).

Long-distance movements are less uncommon. Jensen and Berg (1977) reported the longest distance traveled by an Arctic char tagged in the Vardnes River, Norway, as 940 km. The fish was recaptured in the Tuloma River, U.S.S.R. Two other Arctic char were recaptured at distances of 500 and 400 km from the tagging location. Arctic char tagged at the outlet to Nauyuk Lake, Northwest Territories, Canada, have been recaptured at various locations in the Canadian archipelago (Gyselman, 1984) at distances of up to 500 km (Johnson, 1989). An Arctic char tagged in the Ekalluk River, N.W.T., in 1979 was recaptured three years later in Shepherd Bay, 550

km to the east, and the longest distance traveled by an Arctic char in northern Labrador was 250 km (Dempson and Kristofferson, 1987). In northwestern Alaska, a Dolly Varden tagged in a spawning area in the Noatak River system was recaptured at Point Hope one year later, a distance of 485 km (DeCicco, 1989a). On the Beaufort Sea coast of Alaska, Dolly Varden tagged in the Sagavanirktok River were recaptured up to 300 km away in Elson Lagoon, Alaska (Furniss, 1975). Another Dolly Varden tagged in the Lupine River, Alaska, was recaptured in the Firth River, Yukon, Canada, a distance of 350 km (Craig, 1977). The phenomenon of interdrainage exchange by Dolly Varden has also been observed in other Beaufort Sea drainages (Griffiths *et al.*, 1975; Craig and McCart, 1976). Dempson and Kristofferson (1987) reported the movement of Arctic char between river drainages in Cambridge Bay, N.W.T., and northern Labrador, Canada. Sexually mature Dolly Varden in northwestern Alaska commonly overwinter in non-natal rivers during years in which they have been to sea (DeCicco, 1985, 1989a).

This paper presents data on movements of anadromous Dolly Varden that are of much greater distance than previously known, are not coastal in nature and indicate the first documented movement of Dolly Varden between freshwaters of Alaska and the Soviet Union. These data suggest that mixing of Dolly Varden stocks may occur over a wide geographic area throughout the northern Bering and southern Chukchi seas.

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METHODS

During September 1988, 4075 anadromous Dolly Varden (northern form, Behnke, 1980) were tagged in an overwintering area of the Wulik River in northwestern Alaska (Fig. 1). The purpose of the tagging was to estimate abundance of the overwintering population. Results of the abundance estimate are reported elsewhere (DeCicco, 1989b). Fish were captured with beach seines, measured for fork length and tagged with individually numbered Floy FD-67 internal anchor tags. Tagged fish ranged in fork length from 230 to 800 mm. Dolly Varden that overwintered in the Wulik River began moving seaward on 13 June 1989 and continued to enter the sea through 3 July 1989. As of November 1991, 118 tags had been recovered: 93 from the Wulik River, 19 from Kotzebue Sound, 2 from the Noatak River, 1 from Norton Sound, 1 from St. Lawrence Island and 2 from the U.S.S.R.

RESULTS AND DISCUSSION

During August 1989, a Dolly Varden tagged in the Wulik River was recaptured in the Anadyr River, near Markovo in the U.S.S.R., 540 km from the mouth (Fig. 1). The fish traveled a distance of 1560 km during approximately 60 days, averaging 26 km·day⁻¹. The tag was forwarded by Dr. N.P. Novikov

of the Pacific Research Institute of Fisheries and Oceanography in Vladivostok, U.S.S.R.

A second fish tagged in the Wulik River in 1988 was recovered from the Anadyr River in 1990. The fish was recaptured 670 km upstream from the mouth, having traveled a total distance of 1690 km in 14 months. The information was provided by Dr. Igor A. Chereshevnev of the Institute of Biological Problems of the North in Magadan, U.S.S.R. (pers. comm.), although the tag has not yet been returned.

During August 1989, two tag recoveries were made indicating long-distance movements of Dolly Varden within Alaskan waters. Both fish moved south of the Bering Strait (Fig. 1). One was recaptured near Egavik in Norton Sound, 750 km along the Alaskan Coast, and the other near Savoonga on St. Lawrence Island, 180 km offshore from the Alaskan Coast and 530 km from the mouth of the Wulik River.

Dolly Varden tagged and released in the Kotzebue Sound and Chukchi Sea drainages of northwestern Alaska have shown complex movement patterns. Dolly Varden home to spawn, but stocks are mixed at sea and in overwintering areas. Interdrainage movement is common, with some fish tagged in all known spawning areas of the Noatak, Wulik and Kivalina rivers having been recaptured in the Wulik River overwintering area during years subsequent to spawning. Some

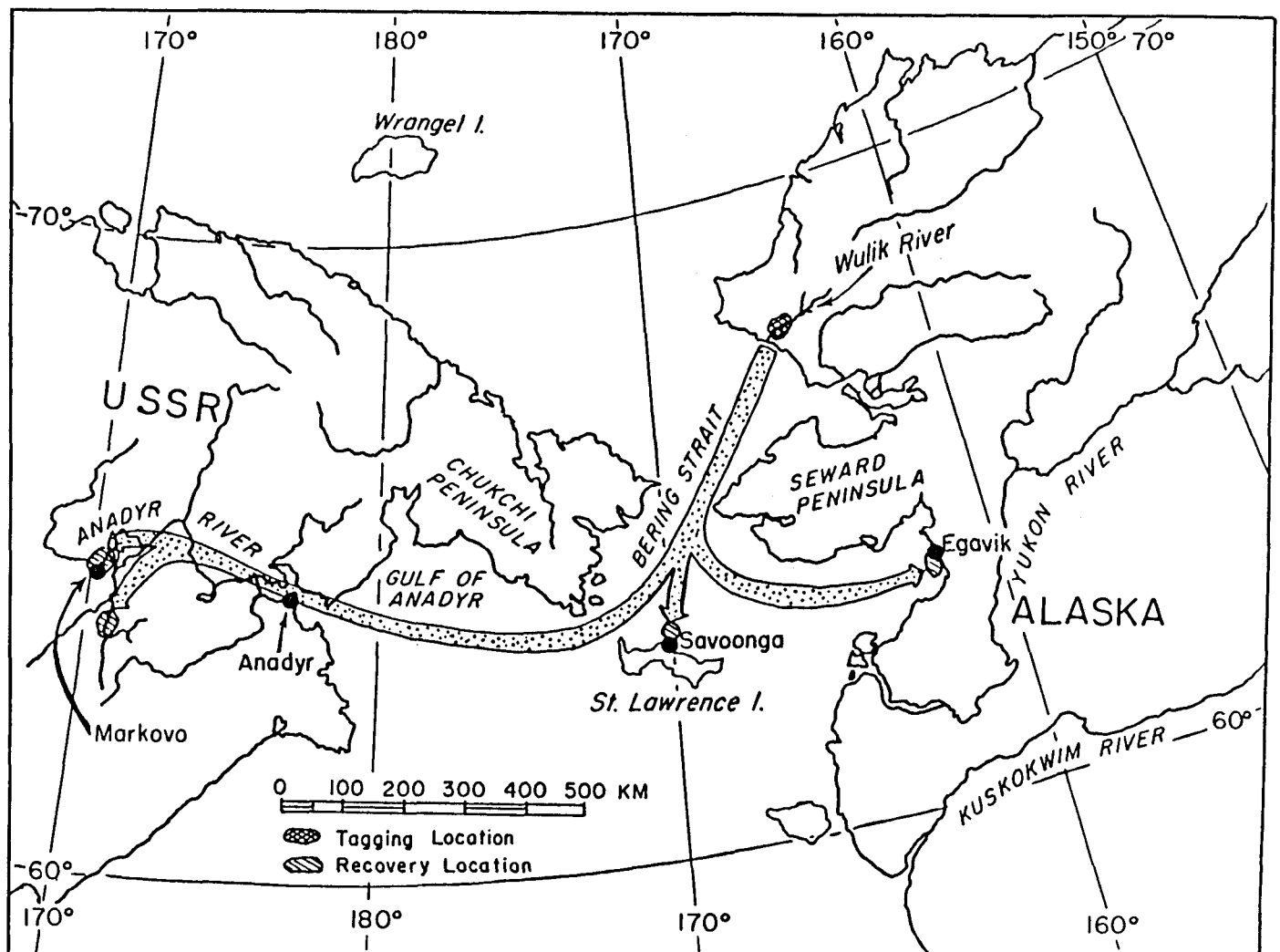


FIG. 1. Map showing long-distance movements of anadromous Dolly Varden with tagging and recapture locations.

interdrainage movement has also been evident in immature anadromous Dolly Varden (DeCicco, 1985, 1989a).

The fish recovered in the Anadyr River in August 1989 was most likely of Anadyr stock that had spent the previous winter in the Wulik River and had subsequently migrated to the Anadyr River to spawn during fall 1989. Anadromous Dolly Varden are uncommon in the Markovo area but some migrate past to spawn in Anadyr River tributaries 100-150 km farther upstream (I.A. Chereshev, pers. comm. 1990). There was no information provided on the sexual condition or size of this fish at capture; however, it was a female, 522 mm in fork length when tagged, a size at which some Dolly Varden in northwestern Alaska first reach sexual maturity. It was taken 540 km upstream from the river mouth, probably upstream of overwintering areas. This movement would be consistent with what has been observed in northwestern Alaska, where late-summer spawning occurs well upstream from areas used by nonspawners for overwintering. Based on the location of capture, 670 km upstream from the river mouth, the second recovery in the Anadyr River was also most likely a fish of Anadyr stock that was to spawn in 1990. The whereabouts and movements of this fish during the 14 months between tagging and recapture are unknown. The stock identity of the two fish recovered in Alaskan waters south of the Bering Strait in 1989 is also unknown. They could be Wulik River fish that had traveled into Norton Sound on a feeding migration, or they could be fish of Norton Sound origin that had spent the previous summer feeding in the Chukchi Sea and overwintered there.

Marine current flow through the Bering Strait during the open water period is in a northerly direction. Current speed just north of the Bering Strait between 16 July and 28 August 1987 ranged from 25 cm·s⁻¹ to 85 cm·s⁻¹. Wind-driven current reversals have been documented but typically occur after 1 September (Richard Tripp, unpubl. data). In northwestern Alaska, Dolly Varden usually undertake three to five ocean migrations before reaching sexual maturity. Since fish do not demonstrate fidelity to overwintering areas, it is during this period of their life history that stocks may become distributed over a wide geographic area. If fish tend to follow food sources that may be carried by marine currents in the northern Bering and southern Chukchi seas, the result could be mixed northerly distribution of stocks after several ocean migrations. Upon reaching sexual maturity, a homeward migration would result in movements indicated by these tag recoveries. Straying has been considered as an alternative explanation for the observed movements; however, it seems unlikely that directed movements of the magnitude and speed observed would result from reproductive straying.

Because of the close proximity of northwestern Alaska and the Chukotsk Peninsula, movements between these two areas might seem more likely than the movements indicated by the two Soviet tag recoveries. However, the Chukotsk Peninsula is sparsely populated and the chances of a tag being found and returned to appropriate authorities are probably small.

Gyselman (1984) suggested that 250 km was the limit to which an Arctic char could migrate in one summer. Rounsefell (1958) ranked Dolly Varden slightly higher than Arctic char in relative degree of anadromy among salmonids. Movement data presented here support the notion that northern form Dolly Varden are well adapted to the marine environment and may change existing concepts of the extent to which anadromous Dolly Varden may move while at sea. Dolly Varden are

capable and may routinely undertake long-distance ocean movements that are not necessarily coastal in nature. Although the amount of stock mixing is unknown, these movements suggest that extensive mixing of stocks from wide geographic areas both at sea and in overwintering areas is possible.

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