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# Overwintering Habitat of American Dipper, *Cinclus mexicanus*, Observed in an Arctic Groundwater Spring Feeding on Dolly Varden, *Salvelinus malma*

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ABSTRACT. Perennial groundwater springs along the Alaska and Yukon North Slope provide overwintering habitat for various organisms, including birds and fishes. We observed an American Dipper, *Cinclus mexicanus*, in the open water of a perennial spring situated in Fish Creek, Yukon, in Ivvavik National Park on 8 March 2018. The observation at Fish Creek was among the most northern documented sightings of an American Dipper during the winter in North America. Moreover, the observation was approximately 650 km farther north than where American Dippers have been documented overwintering in Yukon, making this the most northern Canadian observation documented for this species in any season. Additionally, the American Dipper was photographed feeding on a juvenile Dolly Varden, *Salvelinus malma*. Although American Dippers are known to feed on small fish, our observation was a novel documentation of a trophic interaction between both species during winter. The open-water habitat in Fish Creek, which is important for both species and has not been previously described, was short (~730 m long), shallow (mean = 20 cm deep), narrow (mean = 2.8 m wide), and cold (mean water temperature = 0.34ºC). While there is little information regarding the ecological interactions of American Dipper overwintering in the Arctic, we note that all observations in the North Slope area during winter occurred in river systems also used by Dolly Varden, which indicates that juvenile Dolly Varden could be an important source of food for American Dipper in winter.

Key words: American Dipper; *Cinclus mexicanus*; Dolly Varden; *Salvelinus malma*; predation; winter; spring stream; habitat; Yukon North Slope

RÉSUMÉ. Les sources d'eau souterraine pérennes le long du versant nord de l'Alaska et du Yukon procurent un habitat d'hivernage à divers organismes, y compris les oiseaux et les poissons. Le 8 mars 2018, nous avons observé un cincle d'Amérique (*Cinclus mexicanus*) dans l'eau libre d'une source pérenne située au ruisseau Fish, dans le parc national Ivvavik, au Yukon. L'observation faite au ruisseau Fish figurait parmi les observations hivernales les plus nordiques du cincle d'Amérique à avoir été répertoriées en Amérique du Nord. Cette observation a été faite à environ 650 km plus au nord que l'endroit où l'habitat d'hivernage des cincles d'Amérique a été documenté au Yukon, ce qui représente l'observation la plus nordique au Canada à avoir été consignée pour cette espèce à n'importe quelle saison. Par surcroît, le cincle d'Amérique a été photographié en train de se nourrir d'un omble malma juvénile (*Salvelinus malma*). Bien que l'on sache que les cincles d'Amérique se nourrissent de petits poissons, l'observation que nous avons documentée constituait un nouveau cas d'interaction trophique entre les deux espèces pendant l'hiver. L'habitat en eau libre du ruisseau Fish, qui est important pour les deux espèces et n'a pas encore été décrit, était court (environ 730 m de long), peu profond (moyenne de 20 cm de profondeur), étroit (moyenne de 2,8 m de largeur) et froid (moyenne de la température de l'eau = 0,34 ºC). Bien qu'il existe peu d'information sur les interactions écologiques du cincle d'Amérique hivernant dans l'Arctique, notons qu'en hiver, toutes les observations faites dans la région du versant nord ont eu lieu dans des réseaux hydrographiques où vit également l'omble malma, ce qui laisse croire que l'omble malma juvénile pourrait représenter une source de nourriture importante pour le cincle d'Amérique en hiver.

Mots clés : cincle d'Amérique; *Cinclus mexicanus*; omble malma; *Salvelinus malma*; prédation; hiver; cours d'eau de source; habitat; versant nord du Yukon

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Perennial groundwater springs along the Alaska and Yukon North Slope can produce areas of open water throughout winter that create an aufeis field (a mass of layered ice) downstream as water freezes (Craig and McCart, 1975; Clark and Lauriol, 1997; Kane et al., 2013). Groundwater is known to influence the distribution, reproductive success, productivity, and movement of various organisms, including birds and fishes (Power et al., 1999; Huryn et al., 2005; Parker and Huryn, 2006). Although perennial springs account for a small proportion of stream types and amount of habitat area along the North Slope, these habitats have important consequences for biodiversity and food-web dynamics (Huryn et al., 2005). The springs along the North Slope support distinct macroinvertebrate assemblages and provide critical habitat for cold-tolerant riverine fishes including Arctic grayling (*Thymallus arcticus*) and Dolly Varden (*Salvelinus malma*) (Craig and McCart, 1975; Mochnacz et al., 2010; Kendrick and Huryn, 2014). During winter, the warmer water temperatures of the perennial springs protect Dolly Varden eggs that cannot tolerate freezing, while juveniles and adults (> ~300 mm fork length; anadromous life history) take cover under the ice of the upper aufeis field (Sandstrom et al., 2001). Additionally, these areas of open water can provide overwintering habitat for American Dipper (*Cinclus mexicanus*) (Clough et al., 1987; Kendrick and Huryn, 2014), a semiaquatic songbird 14–20 cm long that nests near streams and walks, dives, and swims underwater to feed (Kingery, 1996).

American Dipper is found in western North America from northern Alaska down to the Pacific coast between British Columbia and California, and south from northwestern Mexico to western Panama (Willson and Kingery, 2011). The eastward distribution includes Yukon and locations mainly between Alberta and New Mexico (Willson and Kingery, 2011). American Dipper inhabits clear, fast-flowing mountain and cold coastal streams that include cascades, riffles, or waterfalls with a stream bank structure (e.g., cliffs, large rocks, or overhanging ledges), and substrates consisting of cobble and coarse gravel (Willson and Kingery, 2011). Migration is characterized as generally short-distance, with many birds remaining on territories year-round and a winter range determined partly by the presence of open water for foraging (Willson and Kingery, 2011). American Dipper feeds on aquatic insects and their larvae, small fish typically 100 mm or less in length (trout and salmon fry, Arctic grayling, sculpin [*Cottus* sp.]), fish eggs, and tadpoles (Brent, 1948; Kingery, 1996; Obermeyer et al., 1999; Morrissey and Olenick, 2004; Morrissey et al., 2004). Little documentation exists on American Dipper overwintering in the Arctic outside its year-round range (see Willson and Kingery, 2011), particularly on their aquatic habitats and trophic interactions.

On 8 March 2018 we observed one American Dipper in the open water of a perennial spring situated in Fish Creek, Yukon, Canada (Figs. 1, 2), presumably overwintering at this location (i.e., having remained in Fish Creek since freeze-up). The two nearest known perennial springs are at a distance of ~22 km (unnamed creek in the Firth River Delta; Craig and McCart, 1974) and ~63 km (Kongakut River, see Kane et al., 2013; or Joe Creek). The observation was made during a day trip in the area in collaboration with the Parks Canada Agency to investigate the distribution of muskox (*Ovibos moschatus*) along the Canadian North Slope and collect data on winter habitat for Dolly Varden in Ivvavik National Park. During the three-hour site visit at Fish Creek, the bird was frequently seen walking in the water and flying among the small pools of open water. The observation at Fish Creek was among the most northern documented sightings of an American Dipper during winter in North America (Table 1). Moreover, the observation was approximately 650 km farther north than where American Dipper has been documented overwintering in the Yukon (approximately < 64° N between December and February; Sinclair et al., 2003; Schonewille, 2010), which makes ours the most northern Canadian observation for this species, not only for winter but for all seasons. Additionally, the American Dipper was photographed feeding on a juvenile northern form Dolly Varden (*S. m. malma*) (approximately < 100 mm and swallowed whole) (Fig. 3). Although American Dippers have been documented feeding on juvenile Dolly Varden in the North Slope during the summer (Ivishak River; Parker and Huryn, 2006), our photograph is the first record of this trophic interaction occurring during winter. On the same day, one American Dipper was observed in the open water of both Firth River and Joe Creek, which are systems also inhabited by Dolly Varden (Table 1). Previous winter sightings for American Dipper have occurred at both locations (Sinclair et al., 2003).

The characteristics of Fish Creek's open-water habitat that are important for both American Dipper and Dolly Varden have not been described before. The location of the open water in Fish Creek was 14 km (Euclidian distance) from the Beaufort Sea coast. An approximately 730 m stretch of the creek (upper bound: 69.46140° N, 140.24762° W; lower bound: 69.46483° N, 140.23403° W) had discontinuous patches of open water interrupted by short sections of snow-covered ice (Fig. 2). The tundra vegetation consisted of snow-covered willow shrubs (< 2 m height) growing along the banks of the creek. Measurements of stream depth and width (i.e., distance between snowbanks) and water temperature were collected from 10 pools (one, two, three, four measurements made in five, two, two, one pools, respectively; total of 19 readings). Depth was measured in the centre of the channel and at the left and right snowbanks of the pools. Pools of open water in Fish Creek were shallow, as depths in the middle of the channel averaged (± SD) 20.7 ± 7.8 cm, while those on the banks averaged 14.1 ± 6.8 cm. Stream width averaged 2.8 ± 0.9 m and the mean water temperature was 0.34 ± 0.74°C (range = −0.7°C to 1.3°C). The substrate was composed of gravel and cobble. The height of the snowbanks was between approximately 1 and 2 m and tended to be higher in the lower reach where the aufeis had formed.

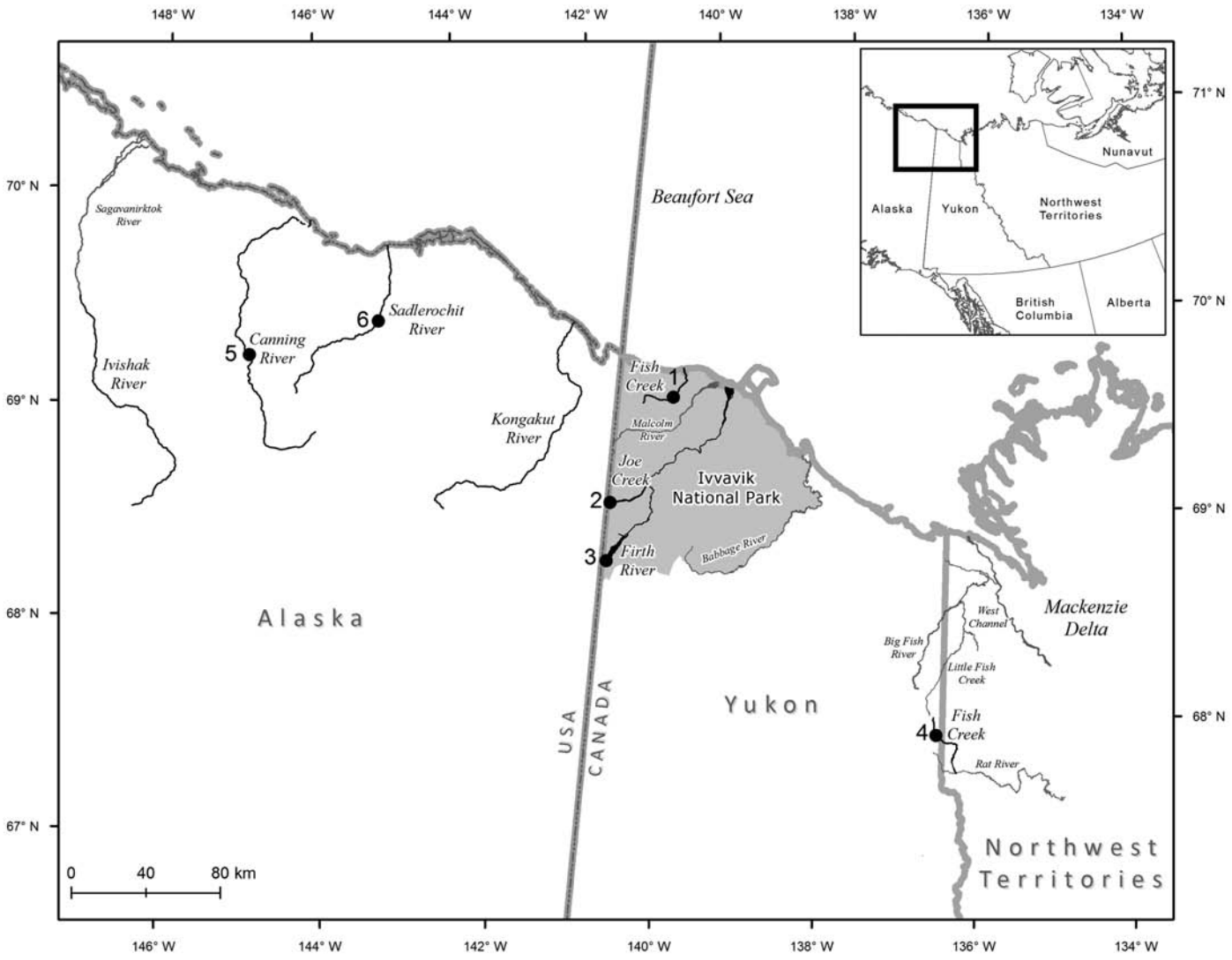


FIG. 1. Locations in northern Yukon, Canada (sites 1–4) and North Slope of Alaska, USA (sites 5 and 6) where American Dipper have been observed during winter in open-water habitats of perennial groundwater springs that are also used by Dolly Varden for overwintering.

Prior fisheries investigations conducted by Craig and McCart (1974) in October 1972 and by the authors in mid-September 2016 and 2017 (unpubl. data) in Fish Creek at the location of the spring have only documented the presence of a relatively high concentration of Dolly Varden, although two vagrant adult sockeye salmon (*Oncorhynchus nerka*) (see Dunmall et al., 2013) were captured in the same habitat occupied by Dolly Varden in 2017. Both the stream resident and anadromous types of Dolly Varden, which have distinct phenotypes (for detailed descriptions see Armstrong and Morrow, 1980; COSEWIC, 2010), inhabit Fish Creek. In addition to these two types of Dolly Varden, we have captured numerous small juveniles (pre-smolt fish that have yet to exhibit the resident or anadromous phenotype) that also have a distinct appearance characterized by brown colouration, parr marks, and a white belly matching that of the fish observed in the bird's beak (Fig. 3).

The observations of American Dipper overwintering among several perennial springs underscore the importance of these habitats for this species to persist in Arctic environments at the northern extent of its known range. Similar to polynyas in the marine environment (Stirling, 1980), albeit on a vastly different geographic and ecological scale, perennial groundwater springs in the Arctic are small oases of open water used by multiple species that are important for maintaining biodiversity during winter. While there is little information regarding the ecological interactions of American Dipper overwintering in the Arctic, we note that all observations in the North Slope area during winter have occurred in river systems also used by Dolly Varden for rearing, spawning, and overwintering (Table 1, Fig. 1). Individual birds that remain year-round in a perennial groundwater spring may possibly rely heavily on lipid-rich juvenile Dolly Varden as a source of food, not only in winter but potentially throughout the year (see Parker and Huryn, 2006). Research on the seasonal diet of American Dippers utilizing perennial springs in the Arctic year-round, specifically on prey preference and availability,

FIG. 2. A perennial groundwater spring in Fish Creek, Yukon, in Ivvavik National Park on 8 March 2018 taken from a helicopter approximately 50 m above the ground. Vertical arrows indicate the upper (solid line) and lower (dashed line) extent of open water sections (stretch of river between arrows was ~730 m in length). The width of open water at the open triangle is 4.25 m. Image is facing northeast with Mount Conybeare (highest peak) in the background. Photo: C. Gallagher.

FIG. 3. American Dipper in Fish Creek, Yukon, in Ivvavik National Park with a juvenile Dolly Varden in its beak (8 March 2018). Photo: E. Lea.

could increase our understanding of how diet influences energetic thresholds and affects the decision to overwinter or migrate to more southern overwintering areas. Future surveys to document additional locations where American Dipper overwinter in river systems draining the North Slope region should use the maps provided by Craig and McCart (1974) and Kane et al. (2013) to assist with site selection. Many of the specific locations mentioned by Craig and McCart (1974) are also inhabited by Dolly Varden.

In addition to documenting the northernmost observation of American Dipper in Canada, we characterized open-water habitat of a previously undescribed river system in Ivvavik National Park and provided novel photographic evidence demonstrating that American Dippers prey on juvenile Dolly Varden during winter. Documenting this small yet important habitat feature is relevant for conservation planning in Ivvavik National Park, as Dolly Varden in the western Canadian Arctic was listed as a species of "Special Concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2010 and received the same designation under Canada's Species at Risk Act in 2017. Therefore, describing habitat and identifying specific sources of natural mortality for Dolly Varden are important for an ecosystem-based approach towards conservation. Our observation is an interesting example of an aquatic-terrestrial food-web linkage in an Arctic stream during winter, particularly given that little is known about the ecological relationship between American Dipper and Dolly Varden.

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TABLE 1. Locations in northern Yukon, Canada and North Slope of Alaska, USA, where American Dippers have been observed during winter in open-water habitats of perennial groundwater springs during winter that are also used by Dolly Varden for overwintering.

| Location | Date | Latitude | Longitude | Source |
|---|---|---|---|---|
| Fish Creek, Yukon, Canada[1] | 8 March 2018 | 69.46258° N | 140.23861° W | Colin Gallagher and Ellen Lea, pers. obs. |
| Joe Creek, Yukon, Canada[2] | 8 March 2018 | 68.93141° N | 140.95937° W | Christopher Lennie, pers. obs. |
| Firth River, Yukon, Canada[2] | 8 March 2018 | 68.64983° N | 140.93526° W | Sasha Olekshy, pers. obs. |
| Fish Creek, Yukon, Canada[3] | 8 March 2017 | 67.90601° N | 136.52104° W | Lord, 2017 |
| Canning River, Alaska, USA | 10 April 2014 | 69.39433° N | 146.06323° W | Helmericks, 2014 |
| Saddlerochit River, Alaska, USA | Not specified | 69.65638° N | 144.39361° W | Clough et al., 1987 |

[1] Ivvavik National Park.

[2] Previous sightings in Sinclair et al. (2003).

[3] A tributary of the Rat River in the Richardson Mountains also named Fish Creek and situated 230 km east of the Fish Creek in Ivvavik National Park.

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## REFERENCES

Armstrong, R.H., and Morrow, J.E. 1980. The Dolly Varden charr, *Salvelinus malma*. In: Balon, E.K., ed. Charrs: Salmonid fishes of the genus *Salvelinus*. The Hague: Dr. W. Junk Publishers. 99–140.

Brent, A.C. 1948. Life histories of North American nuthatches, wrens, thrashers and their allies: Order Passeriformes. United States National Museum Bulletin 195. https://doi.org/10.5479/si.03629236.195.1

Clark, I.D., and Lauriol, B. 1997. Aufeis of the Firth River Basin, northern Yukon, Canada: Insights into permafrost hydrogeology and karst. Arctic and Alpine Research 29(2):240–252. https://www.tandfonline.com/doi/abs/10.1080/00040851.1997.12003239

Clough, N.K., Patton, P.C., and Christiansen, A.C., eds. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resource assessment: Report and recommendation to the Congress of the United States and final legislative environmental impact statement, Vol. 1 (Report). Washington, D.C.: U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Land Management.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010. COSEWIC assessment and status report on the Dolly Varden *Salvelinus malma malma* (Western Arctic populations) in Canada. Ottawa: COSEWIC. http://www.registrelep.gc.ca/document/default_e.cfm?documentID=2267

Craig, P.C., and McCart, P.J. 1974. Fall spawning and overwintering areas of fish populations along routes of proposed pipeline between Prudhoe Bay and the Mackenzie Delta, 1972–1973. In: McCart, P.J., ed. Fisheries research associated with proposed gas pipeline routes in Alaska, Yukon and Northwest Territories. Biological Report Series, Vol. 15. Calgary, Alberta: Canadian Arctic Gas Study. 1–37.

———. 1975. Classification of stream types in Beaufort Sea drainages between Prudhoe Bay, Alaska, and the Mackenzie Delta, N.W.T., Canada. Arctic and Alpine Research 7(2):183–198. https://www.tandfonline.com/doi/abs/10.1080/00040851.1975.12003821

Dunmall, K.M., Reist, J.D., Carmack, E.C., Babaluk, J.A., Heide-Jøgensen, M.P., and Docker, M.F. 2013. Pacific salmon in the Arctic: Harbingers of recent great changes. In: Mueter, F.J., Dickson, D.M.S., Huntington, H.P., Irvine, J.R., Logerwell, E.A., MacLean, S.A., Quakenbush, L.T., and Rosa, C., eds. Responses of Arctic marine ecosystems to climate change. Fairbanks: University of Fairbanks: Alaska Sea Grant. 141–163 https://doi.org/10.4027/ramecc.2013.07

Helmericks, I. 2014. eBird Checklist S18494908 In: eBird: An online database of bird distribution and abundance. Ithaca, New York: eBird. https://ebird.org/ak/view/checklist/S18494908

Huryn, A.D., Slavik, K.A., Lowe, R.L., Parker, S.M., Anderson, D.S., and Peterson, B.J. 2005. Landscape heterogeneity and the biodiversity of Arctic stream communities: A habitat template analysis. Canadian Journal of Fisheries and Aquatic Sciences 62(8):1905–1919. https://doi.org/10.1139/f05-100

Kane, D.L., Yoshikawa, K., and McNamara, J.P. 2013. Regional groundwater flow in an area mapped as continuous permafrost, NE Alaska (USA). Hydrogeology Journal 21(1):41–52. https://doi.org/10.1007/s10040-012-0937-0

Kendrick, M.R., and Huryn, A.D. 2014. The Plecoptera and Trichoptera of the Arctic North Slope of Alaska. Western North American Naturalist 74(3):275–285. https://doi.org/10.3398/064.074.0303

Kingery, H.E. 1996. American Dipper (*Cinclus mexicanus*). In: Poole, A., and Gill, F., eds. The birds of North America, No. 229. Philadelphia: The Academy of Natural Sciences and Washington, D.C.: The American Ornithologists' Union. https://birdsna.org

Lord, S. 2017. eBird Checklist S35330898. In: eBird: An online database of bird distribution and abundance. Ithaca, New York: eBird. https://ebird.org/ak/view/checklist/S35330898

Mochnacz, N.J., Schroeder, B.S., Sawatzky, C.D., and Reist, J.D. 2010. Assessment of northern Dolly Varden, *Salvelinus malma malma* (Walbaum, 1792), habitat in Canada. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2926. Winnipeg, Manitoba: Fisheries and Oceans Canada, Central and Arctic Region. http://science-catalogue.canada.ca/record=b4031631

Morrissey, C.A., and Olenick, R.J. 2004. American Dipper, *Cinclus mexicanus*, preys upon larval tailed frogs, *Ascaphus truei*. Canadian Field-Naturalist 118(3):446–448. https://doi.org/10.22621/cfn.v118i3.22

Morrissey, C.A., Bendell-Young, L.I., and Elliott, J.E. 2004. Linking contaminant profiles to the diet and breeding location of American Dippers using stable isotopes. Journal of Applied Ecology 41(3):502–512. www.jstor.org/stable/3505825

Obermeyer, K.E., Hodgson, A., and Willson, M.F. 1999. American Dipper, *Cinclus mexicanus*, foraging on Pacific salmon, *Oncorhynchus* sp., eggs. Canadian Field-Naturalist 113(2):288–290. https://biodiversitylibrary.org/page/34235150

Parker, S.M., and Huryn, A.D. 2006. Food web structure and function in two Arctic streams with contrasting disturbance regimes. Freshwater Biology 51(7):1249–1263. https://doi.org/10.1111/j.1365-2427.2006.01567.x

Power, G., Brown, R.S., and Imhof, J.G. 1999. Groundwater and fish—insights from northern North America. Hydrological Processes 13(3):401–422. https://doi.org/10.1002/(SICI)1099-1085(19990228)13:3<401::AID-HYP746>3.0.CO;2-A

Sandstrom, S.J., Chetkiewicz, C.B., and Harwood, L.A. 2001. Overwintering habitat of juvenile Dolly Varden (*Salvelinus malma*)(W.) in the Rat River, NT, as determined by radio telemetry. Canadian Science Advisory Secretariat Research Document 2001/092. Ottawa: Canadian Science Advisory Secretariat. http://science-catalogue.canada.ca/record=b4001727

Schonewille, B. 2010. eBird Checklist S7303461. In: eBird: An online database of bird distribution and abundance. Ithaca, New York: eBird. https://ebird.org/canada/view/checklist/S7303461

Sinclair, P.H., Nixon, W.A., Eckert, C.D., and Hughes, N.L., eds. 2003. Birds of the Yukon Territory. Vancouver, British Columbia: UBC Press.

Stirling, I. 1980. The biological importance of polynyas in the Canadian Arctic. Arctic 33(2):303–315. https://doi.org/10.14430/arctic2563

Willson, M.F., and Kingery, H.E. 2011. American Dipper (*Cinclus mexicanus*), version 2.0. In Poole, A.F., ed. The birds of North America. Ithaca, New York: Cornell Lab of Ornithology. https://doi.org/10.2173/bna.229