The Canadian Field-Naturalist

A reconnaissance survey for Collared Pika (*Ochotona collaris*) in northern Yukon

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Cannings, S.G., T.S. Jung, J.H. Skevington, I. Duclos, and S. Dar. 2019. A reconnaissance survey for Collared Pika (*Ochotona collaris*) in northern Yukon. Canadian Field-Naturalist 133(2): 130–135. https://doi.org/10.22621/cfn.v133i2.2109

Abstract

Collared Pika (*Ochotona collaris*) is a cold-adapted Beringian species that occurs on talus slopes and is sensitive to climate warming. Collared Pikas are patchily distributed throughout the sub-Arctic mountains of northwestern Canada and Alaska; however, information on their occurrence in the northern part of their distributional range is limited. In particular, no survey information is known from the southern Richardson Mountains and the Nahoni Mountains. We conducted aerial- and ground-based surveys to document Collared Pika occurrence and general habitat suitability in northern Yukon. We flew 505 km of aerial survey (not including ferrying to targetted survey areas) and performed ground surveys at 22 sites within the Richardson Mountains (including a portion of Dàadzàii Vàn Territorial Park) and the Nahoni Mountains in and adjacent to Ni'iinlii Njik (Fishing Branch) Territorial Park. Overall, suitable habitat for Collared Pikas was patchy in the mountains of northern Yukon—talus was sparse and many patches of talus appeared to be unsuitable. Collared Pikas were detected at eight of 22 (36%) sites visited, representing important new records for the species in the northern portion of their range. Our reconnaissance provides a first approximation of habitat suitability for Collared Pikas of the mountains of northern Yukon, as well as new records for the species in the region. These data are useful in better determining the contemporary distribution of Collared Pika through species distribution modelling, and may serve to identify areas for more detailed survey and monitoring initiatives for this climate-sensitive mammal.

Key words: Collared Pika; Dàadzàii Vàn Territorial Park; distributional range; Ni'iinlii Njik (Fishing Branch) Territorial Park; *Ochotona collaris*

Introduction

Collared Pika (*Ochotona collaris*) is a small, cold-adapted mammal that is Beringian in origin (Lanier and Olson 2013; Lanier *et al*. 2015) and patchily distributed throughout the sub-Arctic mountains of Alaska and northwestern Canada (MacDonald and Jones 1987). Collared Pika are closely associated with talus (i.e., boulder fields) that is interspersed by alpine meadows (MacDonald and Jones 1987; Franken and Hik 2004; Morrison and Hik 2007). Talus provides Collared Pikas with critical protection from predators and inclement weather; as such, they are rarely found far from this habitat. However, not all talus is suitable for Collared Pika. In Tombstone Territorial Park (central Yukon, Canada), for instance, Collared Pika occupancy was positively associated with large patches of talus that had an average rock size of 30–100 cm, and where *Dryas* spp. and *Carex* spp. were available within and adjacent to the patch (L.M. Andresen *et al.* unpubl. data). Given that talus is naturally patchy on the landscape, Collared Pikas have a fragmented distribution. They have limited dispersal ability and are subject to metapopulation dynamics—whereby local populations may periodically become extinct—leaving apparently suitable habitat variably occupied (Franken and Hik 2004; Morrison and Hik 2007).

In Canada, Collard Pika has been assessed as a species of Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), largely because of the threat of climate change (COSEWIC 2011). The region where the Collared Pika occurs is "experiencing climate-driven shifts in habitat, temperature, and precipitation at faster rates than elsewhere in Canada" (COSEWIC 2011). Climate-induced shrubification of alpine tundra (Danby and Hik 2007; Myers-Smith *et al.* 2011) is of chief concern re-

garding the persistence of Collared Pika populations, as is the depth and duration of snowpack (Morrison and Hik 2007). Local populations of Collared Pikas in southwestern Yukon have declined due to variability in snowpack (Morrison and Hik 2007). This demonstrated sensitivity to climate-induced changes to their habitat, coupled with poor dispersal ability and the fragmented nature of their habitats, make Collared Pikas particularly vulnerable to climate change (Morrison and Hik 2007, 2008; COSEWIC 2011). As such, Collared Pika may be a useful bioindicator of climate change impacts to alpine ecosystems (Morrison and Hik 2008).

To assess the range-wide impact of climate change on Collared Pika, wildlife managers require better information on the current species distribution. Precise location data also may be used to develop accurate spatial distribution models that can then be used to predict changes in distribution under different climate change scenarios (e.g., Li *et al.* 2015; Struebig *et al.* 2015). Detailed monitoring and systematic surveys of Collared Pika have occurred in southwestern Yukon (Morrison and Hik 2008) and Tombstone Territorial Park (Kukka *et al.* 2014); however, information on their occurrence in the northern part of their distributional range is limited. In particular, no survey information was known from the southern Richardson Mountains and the Nahoni Mountains (i.e., Ni'iinlii Njik [Fishing Branch] Territorial Park).

The purpose of this study was two-fold: 1) to survey for the presence of Collared Pika in the northern portion of their range, and 2) to conduct a rapid assessment of the habitat suitability for this species in the Richardson Mountains (including Dàadzàii Vàn Territorial Park) and in the Nahoni Mountains (including in Ni'iinlii Njik [Fishing Branch] Territorial Park) in northern Yukon. To do so, we undertook a reconnaissance survey for Collared Pika and their habitat, using aerial- and ground-based surveys. Our aim was to provide new information on Collared Pikas in the northern portion of their distributional range so that these data can inform habitat modelling, monitoring, and management planning, initiatives for this species at risk.

Methods

We surveyed for Collared Pikas and their habitat in northern Yukon, Canada, during 3–6 July 2018. Specifically, we searched for suitable habitat in the Richardson Mountains east and north of Eagle Plains, Yukon (including a portion of Dàadzàii Vàn Territorial Park), as well as in the Nahoni Mountains (including Ni'iinlii Njik [Fishing Branch] Territorial Park), south of Old Crow, Yukon (Figure 1). We used an AStar helicopter (AS350B3; Eurocopter, Marignane, France) to provide an aerial overview of the habitat conditions in the survey area, and to locate the apparently most suitable habitat for ground-based surveys. We flew 100–400 m above ground level at slow speeds (i.e., 100–120 km/h) in suitable terrain (i.e., mountains) and searched for areas of extensive talus slopes and investigated these more closely. Based on occupancy models developed for Collared Pika in Tombstone Territorial Park (L.M. Andresen *et al.* unpubl. data) that identified predictive habitat covariates, we created four habitat suitability ranks to apply to observed talus slopes (Table 1). We applied these to broadly characterize the suitability of the talus as Collared Pika habitat.

At select sites (n = 22) we landed and searched talus areas for Collared Pika presence. We attempted to select the most suitable talus sites for ground surveys (i.e., habitat suitability rank 3 or 4; Table 1); however, where no such habitat was apparent we elected to search lower ranked areas of talus to ensure that we covered the possibility that Collared Pikas were selecting these sites based on their availability. At each site 4–5 observers searched separate talus patches for approximately 30–60 minutes to detect the presence of Collared Pikas. We walked along the perimeter of the talus patch, and also traversed portions of the talus to intersect potential Collared Pika territories. Pikas (*Ochotona* spp.) are highly territorial and vocalize when conspecifics or other species (including humans) enter their territory (Conner 1984; Trefry and Hik 2009). As such, we largely relied on acoustically detecting Collared Pika (Moyer-Horner *et al.* 2012). We also used binoculars to periodically scan for Collared Pika within the talus; however, Collared Pika are cryptically-coloured to match talus, and may be difficult to visually observe if they are not moving or vocalizing. Finally, pikas build easily recognizable hay piles and latrines within the talus (MacDonald and Jones 1987), and we also used these signs to detect their presence (Morrison and Hik 2008; Moyer-Horner *et al.* 2012; L.M. Andresen *et al.* unpubl. data). For each site surveyed we assigned a habitat suitability rank of 1–4 (poor to excellent; Table 1).

Results and Discussion

We flew 505 km of survey effort for Collared Pika in northern Yukon (not including ferrying to targetted survey areas). This effort included low-level aerial survey of 158 and 178 km of potential Collared Pika habitat (i.e., mountain slopes) in the southern and northern Richardson Mountains, respectively, and 169 km of potential habitat in Ni'iinlii Njik (Fishing Branch) Territorial Park (Figure 1).

While some mountains observed had large patches of talus (e.g., approximately ≥5 ha; Figure 2), in gen-

eral we did not observe extensive boulder fields in the same relative abundance as that found in Tombstone Territorial Park, likely because much of the Richardson and Nahoni mountains were unglaciated during the Last Glacial Maximum (Catto 1996). Quantity of talus, in general, was greatest during our survey in the northern Richardson Mountains, in and adjacent to Dàadzàii Vàn Territorial Park, with much of that observed being ranked as 3–4 (good–excellent) as Collared Pika habitat. In contrast, quantity of talus was low in the southern Richardson Mountains, and its suitability as Collared Pika habitat was ranked only as 1–2 (poor-marginal). Mountain peaks there were low and rounded and most talus observed was small (<30 cm) and unsuitable as Collared Pika habitat. Potential Collared Pika habitat was variable in the Nahoni Mountains, with some local areas having abundant talus of suitable characteristics (rank 2–4; marginal-excellent) and other areas have little talus available. Overall, we would rate the northern Richardson Mountains being most suitable as Collared Pika habitat in the areas we surveyed, although local areas in the Nahoni Mountains were also suitable. We observed little suitable Collared Pika habitat in the southern Richardson Mountains.

We detected Collared Pika presence at nine of 22

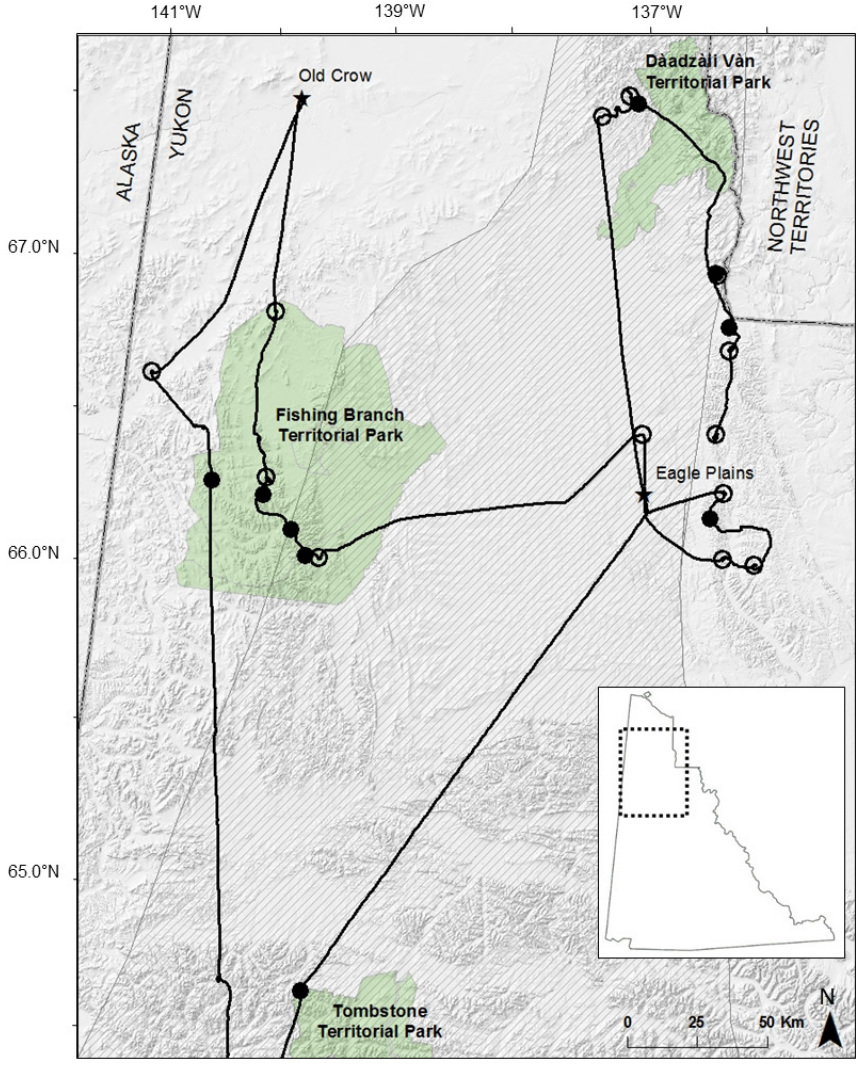

Figure 1. Flight path (black transect) of an aerial survey for Collared Pika (*Ochotona collaris*) and their habitat in northern Yukon. Closed circles are sites surveyed on the ground where Collared Pika was detected, and open circles where they were not detected. The stippled polygon represents the putative distributional range of Collared Pika (Lanier and Hik 2016). Stars indicate human settlements. Site numbers are in Table 2. The insert shows the study area situated within Yukon, Canada.

TABLE 1. Description of habitat suitability ranks given to areas surveyed for Collared Pika (*Ochotona collaris*) in northern Yukon, July 2018.

Habitat suitability rank	General description
1	Poor habitat quality: Average rock size <30 cm or >100 cm with many smaller rocks that fill in the interstitial spaces between the larger rocks.
2	Marginal habitat quality: Average rock size 30–100 cm, but with areas of extensive shrub cover in and around the talus, or with no to small amounts of *Dryas* spp. cover adjacent to talus, or many smaller rocks that fill in the interstitial spaces between the larger rocks.
3	Good habitat quality: Average rock size 30–50 cm; large area covered by talus slopes that are interspersed with non-shrubby patches of vegetation including *Dryas* spp.
4	Excellent habitat quality: Average rock size 50–100 cm; large area covered by talus slopes that are interspersed with non-shrubby patches of vegetation including extensive *Dryas* spp. cover.

FIGURE 2. Photograph of site 8 (see Table 2)—an example of the site characteristics where Collared Pika (*Ochotona collaris*) were observed in northern Yukon, Canada. Photo: J.H. Skevington.

sites surveyed on the ground (Table 2; Figure 1). One of these sites was just outside the northern boundary of Tombstone Territorial Park, where Collared Pika are already known and monitored (Kukka *et al.* 2014; Figure 1). We detected Collared Pika at three of five and one of seven sites surveyed in the northern and southern Richardson Mountains, respectively, and four of eight sites in the Nahoni Mountains (Figure 1). At two sites (sites 4 [Figure 3a] and 11; Table 2) we detected only old sign of Collared Pika, indicating that the population may have been extirpated. This included the single site where we detected Collared Pika in the southern Richardson Mountains (site 4, Table 2). Although our survey was not designed to estimate the density of Collared Pika at our sites, it appeared that they persisted at low densities at all the sites where they were detected. In only one instance did we detect more than a single individual at a site. In suitable habitat in southwestern Yukon, Collared Pika density is estimated at <1 to 4 individuals per ha (Morrison and Hik 2007).

Habitat suitability was variable among the 22 sites we surveyed on the ground, with 36% of them having poor-marginal (1–2 ranks) and 64% having good-excellent (3–4 ranks) habitat suitability ranks (Table 2). Collared Pikas were detected at only one of eight sites that were of poor-marginal habitat suitability, but they were detected at seven of 14 sites we classified as being of good-excellent habitat suitability (Figures 2 and 3). Anecdotally, the most limiting habitat features at the sites we surveyed were likely the average rock size being <50 cm, coupled with many sites having extensive shrubby vegetation in and around the talus (as opposed to *Dryas* spp. and other forage plants; L.M. Andresen *et al.* unpubl. data). The elevation where we detected Collared Pika was variable with a mean of 961.1 ± 175.8 m (SD; range = 685–1329 m; Table 2).

Other mammals or their sign (e.g., burrows, diggings, dens, scat, antlers) detected at our survey sites for Collared Pika included Grizzly Bear (*Ursus arctos*), Wolverine (*Gulo gulo*), Dall's Sheep (*Ovis dalli*), Caribou (*Rangifer tarandus*), Muskox (*Ovibos moschatus*), Moose (*Alces americanus*), Arctic Ground Squirrel (*Urocitellus parryii*), and small rodents (likely Singing Vole [*Microtus miurus*], Tundra Vole [*Microtus oeconomus*], Northern Red-backed Vole [*Myodes rutilus*], or Brown Lemming [*Lemmus trimucronatus*]; Table 2). Notably, we did not observe any sign of Hoary Marmot (*Marmota caligata*) during our survey. Moreover, Arctic Ground Squirrels were surprisingly not abundant at any of the sites we surveyed north of the Ogilvie Mountains, where there they are often on mountains associated with Collared Pika (T.S.J. pers. obs.). We detected Arctic Ground Squirrels at only six of 21 (29%) sites that were surveyed north of the Ogilvie Mountains.

Our reconnaissance of the mountains of northern Yukon provides a first approximation of habitat suitability for Collared Pikas, as well as important new records for the species, in the northern portion of their distributional range. These data are useful in determining the contemporary distribution of Collared Pika through species distribution modelling and may serve to identify areas for more detailed survey and monitoring initiatives for this

TABLE 2. Description of sites surveyed for Collared Pika (*Ochotona collaris*) in northern Yukon, 3–6 July 2018.

Site	Habitat rank*	Collared Pika detected	Detection type†	Location	Elevation (m)	Other mammals observed‡
1	3	Yes	1, 2	64.77657°N, 139.08717°W	1329	1, 2, 3, 6, 7
2	1	No	—	66.24000°N, 136.09439°W	1092	1, 2, 7
3	3	No	—	66.22826°N, 135.84087°W	771	1, 5, 7
4	2	Yes	3	66.36445°N, 136.21266°W	944	3, 5, 7
5	1	No	—	66.44556°N, 136.11227°W	851	1, 2, 7
6	1	No	—	66.62994°N, 136.20248°W	1205	1, 2, 7
7	2	No	—	66.89725°N, 136.13144°W	565	1, 3, 5, 7
8	3	Yes	2	66.96921°N, 136.14555°W	927	1, 2, 3, 7
9	4	No	—	67.13135°N, 136.26424°W	1011	1, 2, 3, 4, 7
10	3	Yes	2	67.13584°N, 136.27515°W	862	5, 6
11	4	Yes	3	67.65533°N, 137.01370°W	1047	1, 2, 3, 5, 6, 7
12	3	No	—	67.67641°N, 137.08986°W	941	2, 3, 7
13	4	No	—	67.60668°N, 137.31078°W	957	1, 2, 3, 7
14	2	No	—	66.61674°N, 136.79306°W	873	3
15	3	No	—	66.13930°N, 139.29184°W	994	1, 6, 7
16	3	Yes	2	66.14023°N, 139.39793°W	817	1, 5, 6, 7, 8
17	3	Yes	2	66.21690°N, 139.53180°W	685	5, 6, 7
18	4	Yes	1, 2, 3	66.31663°N, 139.78535°W	1120	1, 2, 3, 6, 7
19	1	No	—	66.37148°N, 139.77873°W	871	1, 5
20	2	No	—	66.89491°N, 139.85330°W	984	1, 2, 5, 6, 7
21	1	No	—	66.65713°N, 140.79265°W	680	5, 7
22	3	Yes	2	66.34312°N, 140.20544°W	919	5, 7

*See Table 1 for habitat suitability rank descriptions.
†Detection types as follows: 1 = visual, 2 = acoustic, 3 = sign (haypiles or latrines).
‡Codes for other mammals as follows: 1 = Grizzly Bear (*Ursus arctos*), 2 = Dall's Sheep (*Ovis dalli*), 3 = Caribou (*Rangifer tarandus*), 4 = Muskox (*Ovibos moschatus*), 5 = Moose (*Alces americanus*), 6 = Arctic Ground Squirrel (*Spermophilius parryii*), 7 = voles or lemmings, 8 = Wolverine (*Gulo gulo*).

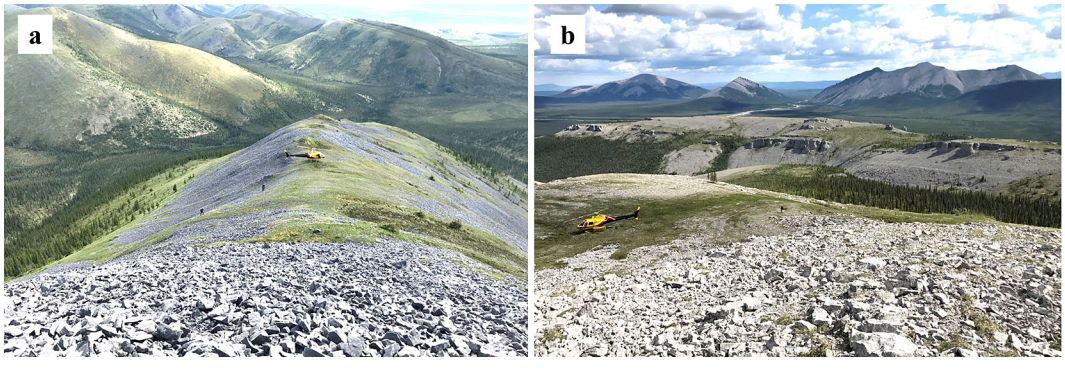

FIGURE 3. Photographs of the general habitat conditions at select survey sites for Collared Pika (*Ochotona collaris*) in the southern Richardson Mountains (a is site 4) and Nahoni Mountains (b is site 15) in northern Yukon, Canada. Photos: J.H. Skevington.

climate-sensitive mammal. We suggest that Collared Pika presence and habitat suitability was good in the northern Richardson Mountains, moderate-to-good in the Nahoni Mountains, and poor in the southern Richardson Mountains. We emphasize, however, that our work is preliminary in nature and our ability to thoroughly survey our target areas was limited; thus, this region would benefit from further survey effort. Preliminary habitat suitability mapping in northern Yukon, using imagery from remote sensing to map large patches of talus, would likely be helpful in determining other sites with a high probability of Collared Pika occurrence. We suggest that the northern Richardson Mountains (in and adjacent to Dàadzàii Vàn Territorial Park) would be an important area to focus future survey efforts, perhaps in conjunction with similar surveys for other small mammals of conservation interest in the region (e.g., collared lemmings [*Discrostonyx* spp.]; Jung *et al.* 2014).

Acknowledgements

We thank Vince Edmonds (TransNorth Helicopters) for safe piloting and effectively contributing to the survey effort. Darius Elias (Vuntut Gwich'in First Nation) kindly assisted in the field during a portion of our surveys and provided logistical support. Piia Kukka (Government of Yukon) made the maps. Shannon Stotyn (Environment and Climate Change Canada), Bruce McLean, Kirby Meister, and Carrie Mierau (Government of Yukon) are also thanked for providing logistical support. We thank Environment and Climate Change Canada, Polar Continental Shelf Project, and Environment Yukon, for supporting this work. Bruce Bennett, Dwayne Lepitzki, Graham Forbes, and two anonymous reviewers kindly provided comments on an earlier draft of this manuscript that improved its quality.

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Received 23 July 2018
Accepted 8 August 2019