Yukon

SR-20-04

Results of 2020 Field Surveys for Collared Pika (*Ochotona collaris*) in Yukon

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Government of Yukon
Fish and Wildlife Branch
SR-20-04

Authors

Thomas S. Jung, Piia M. Kukka, Michael J. Suitor, Julie P. Thomas, Shannon A. Stotyn, Justine E. Benjamin, Elise Brown-Dussault, Jaylene Groots, Lars Jessup, Martin Kienzler, Meghan Larivee, Carrie McClelland, Jessica Norris, Kyle Russell, Sydney G. Cannings, and Bruce A. Bennett

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Copies available from:

Government of Yukon
Fish and Wildlife Branch, V-5
Box 2703, Whitehorse, Yukon Y1A 2C6
Phone 867-667-5721
Email: environmentyukon@yukon.ca
Online: Yukon.ca and open.yukon.ca

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Abstract

- Collared Pika were assessed by the COSEWIC (Committee on the Status of Endangered Wildlife in Canada) as a species of Special Concern and they are legally listed as such in Canada's *Species at Risk Act*. The main threat to the species is climate change.
- Approximately 60% of the global population of Collared Pika are estimated to live in Canada, with the majority in Yukon (COSEWIC 2011, ECCC 2020). In conjunction with Alaska, Yukon is the primary global steward of Collared Pika.
- Inventory and monitoring of Collared Pika in Yukon has largely been limited to a single area in southwestern Yukon, and more recently Tombstone Territorial Park.
- The purpose of our monitoring in 2020 was to expand the spatial extent of our surveys; we aimed to better determine patch occupancy rates in central and southern Yukon. Specifically, we wanted to establish a baseline of the species occupancy rates along a latitudinal transect to assess climate change impacts over time.
- We used a rapid assessment protocol to survey 185 sites for Collared Pika. Our sites were distributed among three areas in central and southern Yukon, including near SixtyMile and Mount Nansen, and in Kusawa Territorial Park.
- Collared Pika were detected at 149 of 185 sites, producing a naïve occupancy rate of 0.62. However, occupancy rates differed between locations, with those near SixtyMile being considerably lower (0.29) than those at Kusawa (0.75) or Mount Nansen (0.79). Reasons for these differences are yet unknown.
- Moreover, we resurveyed 27 sites in Kusawa that were originally surveyed in 2013. Naïve occupancy rates were slightly higher in 2020 (0.74) than in 2013 (0.67), although refinement of our survey protocols may be responsible for this moderate difference.
- Next steps include detailed modeling to estimate occupancy rates and the influence of site covariates on these estimates.
- Additionally, long-term monitoring of Collared Pika at Kusawa Territorial Park is recommended, similar to that at Tombstone Territorial Park. Kusawa is ideally situated to serve as a southern site to monitor for climate-induced changes to pika occurrence near the southern edge of their distributional range.

Contents

Introduction

Collared Pika (*Ochotona collaris*; Figure 1) are a small, alpine-dwelling lagomorph that survived the Last Glacial Maximum (LGM) amidst the ice sheets in eastern Beringia. This is in contrast to their sibling species, the American Pika (*O. princeps*), that survived the LGM south of the expanse of ice that covered much of northwestern North America. Their evolutionary history has shaped Collared Pika into being cold-adapted and sensitive to climate warming (Morrison and Hik 2007). They are subject to metapopulation dynamics, including periodic extirpation and colonization events of suitable habitat patches (Franken and Hik 2004), and have limited dispersal ability. Collared Pika were assessed by the Committee on the Status of Endangered Wildlife in Canada as a species of Special Concern, with the main threat being climate change (COSEWIC 2011), and they are legally listed as such in Canada's *Species at Risk Act*. Consequently, pika (both species) are among the most ideal indicator species for monitoring climate change impacts to alpine ecosystems in western North America.

Approximately 60% of the global population of Collared Pika is estimated to live in Canada, with the vast majority of those animals in Yukon (COSEWIC 2011, ECCC 2020). Thus, in conjunction with Alaska, Yukon is the primary global steward of Collared Pika. However, inventory and monitoring of Collared Pika in Yukon has largely been limited to a single site in southwestern Yukon ('Pika Camp'; e.g., Franken and Hik 2004, Morrison and Hik 2007), where research concluded approximately a decade ago. Smaller scale monitoring efforts have been occurring in Tombstone Territorial Park since 2009 (e.g., Andersen et al. 2010, Kukka et al. 2014), and reconnaissance surveys have recently occurred in northern Yukon (Cannings et al. 2019, Kukka et al. 2020).

The purpose of our monitoring effort in 2020 was to expand the spatial extent of occupancy-based surveys across the distributional range of Collared Pika in Yukon. We wanted to determine patch occupancy rates in central and southern Yukon. By so doing we established a baseline of occupancy along a latitudinal gradient, with survey locations covering the trailing and leading edges of their range, as well as the centre (*sensu* Gilbert et al. 2020). These data will allow us to assess change in Collared Pika occurrence over time, through repeated surveys and in response to climate change. Repeated monitoring of Collared Pika populations is a key action recommended in the draft national management plan for the species (ECCC 2020).

Methods

Study areas

During summer 2020, we surveyed pika occupancy in three parts of southern and central Yukon (Figure 2). Specifically, we focussed on the SixtyMile area, west of Dawson City (Figure 3), the Mount Nansen area west of Carmacks (Figure 4), and Kusawa Territorial Park (Figure 5). The first two survey locations were chosen because there were records of pika occurring in the area, and the areas were subject to resource development. Moreover, other species at risk or wildlife work was co-occurring these areas so pika surveys capitalized on those efforts.

We chose Kusawa Territorial Park because we intend to establish it as a long-term pika monitoring site similar to that at Tombstone Territorial Park, but near the southern edge of the species' range. Parks are good areas to serve as benchmark sites for monitoring for climate change because they are typically free of other influences such as natural resource extraction activities. Such developments could potentially confound and mask the influence of climate change.

Limited survey effort previously occurred at these locations, with the exception of a portion of Kusawa Territorial Park in 2013, where 28 sites were surveyed using similar protocols for a pilot study. Additional surveys were also conducted in Tombstone Territorial Park during 2020; however, those results will be reported elsewhere. Pika monitoring in Tombstone Territorial Park is a longer-term initiative that began in 2009 (Kukka et al. 2014).

Survey protocols

During the summer of 2020, we used a survey protocol refined from our previous efforts (Andresen et al. 2010, Cannings et al. 2019, Kukka et al. 2014, 2020) to survey for patch occupancy by pika. Specifically, we used a rapid assessment protocol wherein two surveyors simultaneously, but independently, surveyed each talus patch for pika or their sign (haypiles, Figure 1). Surveyors walked around and through each talus patch looking and listening for pika (Figure 1). However, new for 2020, search efforts were limited to 10 minutes per surveyor at each patch, and the time-to-detection was recorded. At each survey site we also recorded aspect, elevation, geographic coordinates, and a habitat quality rank. Our habitat quality rank was based on a 4-point scale that took into account percent of favourable rock size and percent of prefered forage (Kukka et al. 2020). We also recorded old sign of patch use by pikas (e.g., latrines or old haypiles). Other species observed were also noted. At each major survey area a helicopter was used to reposition crews. This gave us adequate spatial coverage of the survey area (Figures 3-5). More details on our protocol

can be found in Kukka et al. (2020) and Appendix 2. Additionally, at each of our study locations, we recorded opportunistic pika observations that fell outside our survey plots, and reported those to the Yukon Conservation Data Centre.

Figure 1. Photographs of a vigilant Collared Pika (*Ochotona collaris*; top panel); biologists searching and listening for pika or their sign (e.g., haypiles) in ideal talus habitat (bottom right panel); and a fresh haypile (bottom left panel).

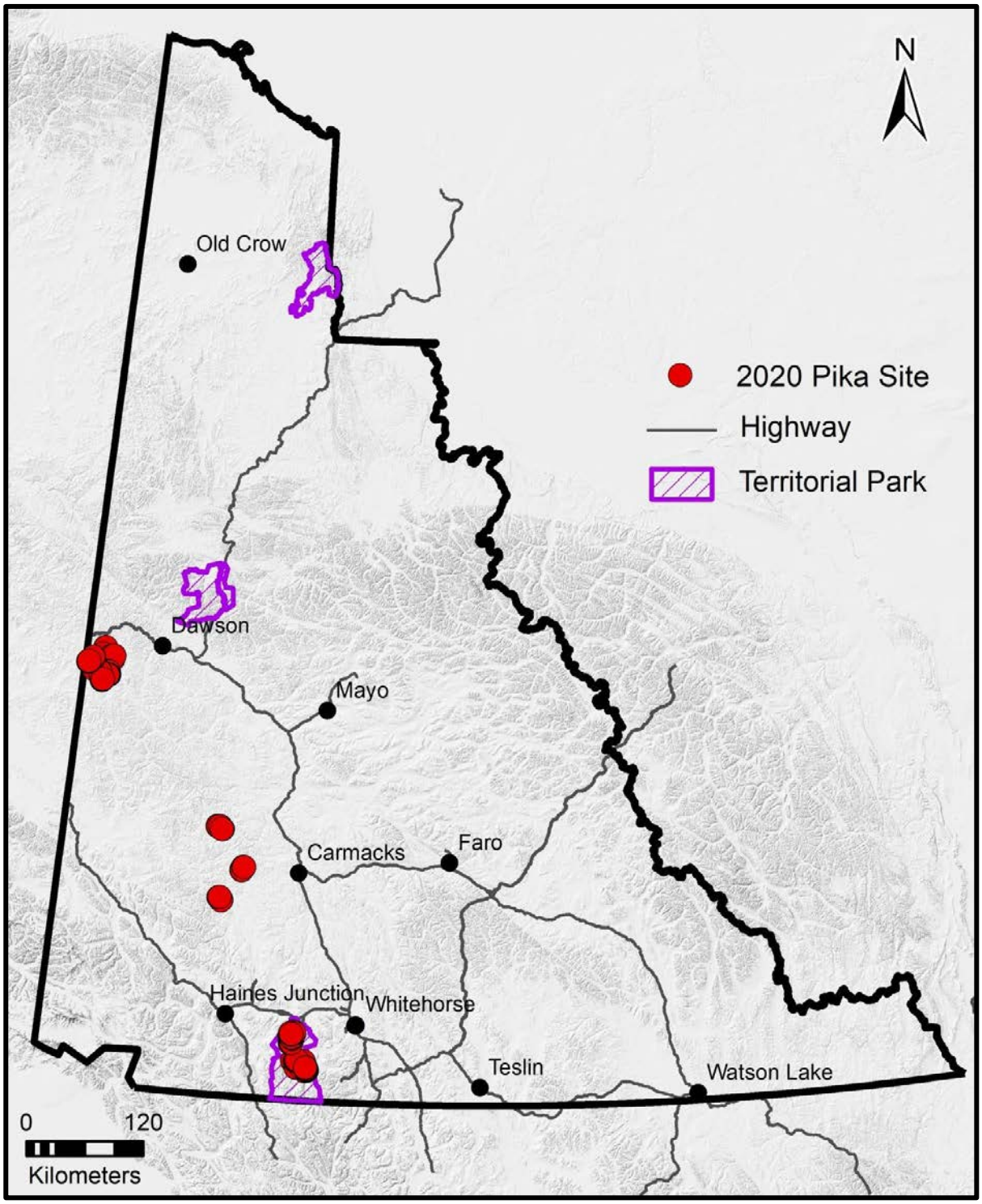

Figure 2. Geographic clusters of the locations of field surveys for Collared Pika (*Ochotona collaris*), summer 2020. Hatched areas are territorial parks were occupancy-based surveys for Collared Pika have occurred in 2019 or 2020 — from north to south these include Dàadzàii Vàn, Tombstone, and Kusawa territorial parks).

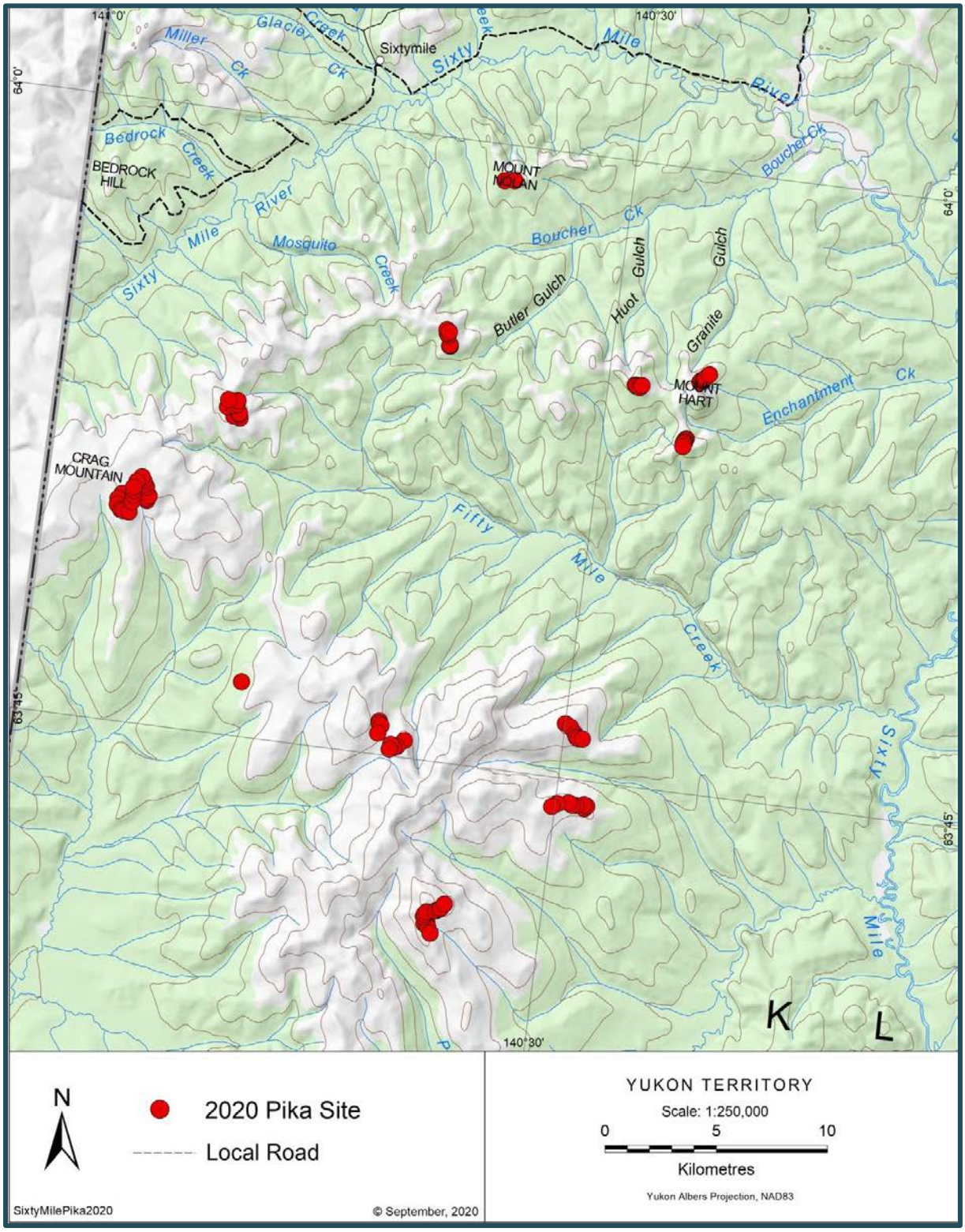

Figure 3. Sample plots surveyed for Collared Pika (*Ochotona collaris*; *n* = 56) in the SixtyMile River region, west of Dawson City, Yukon, summer 2020.

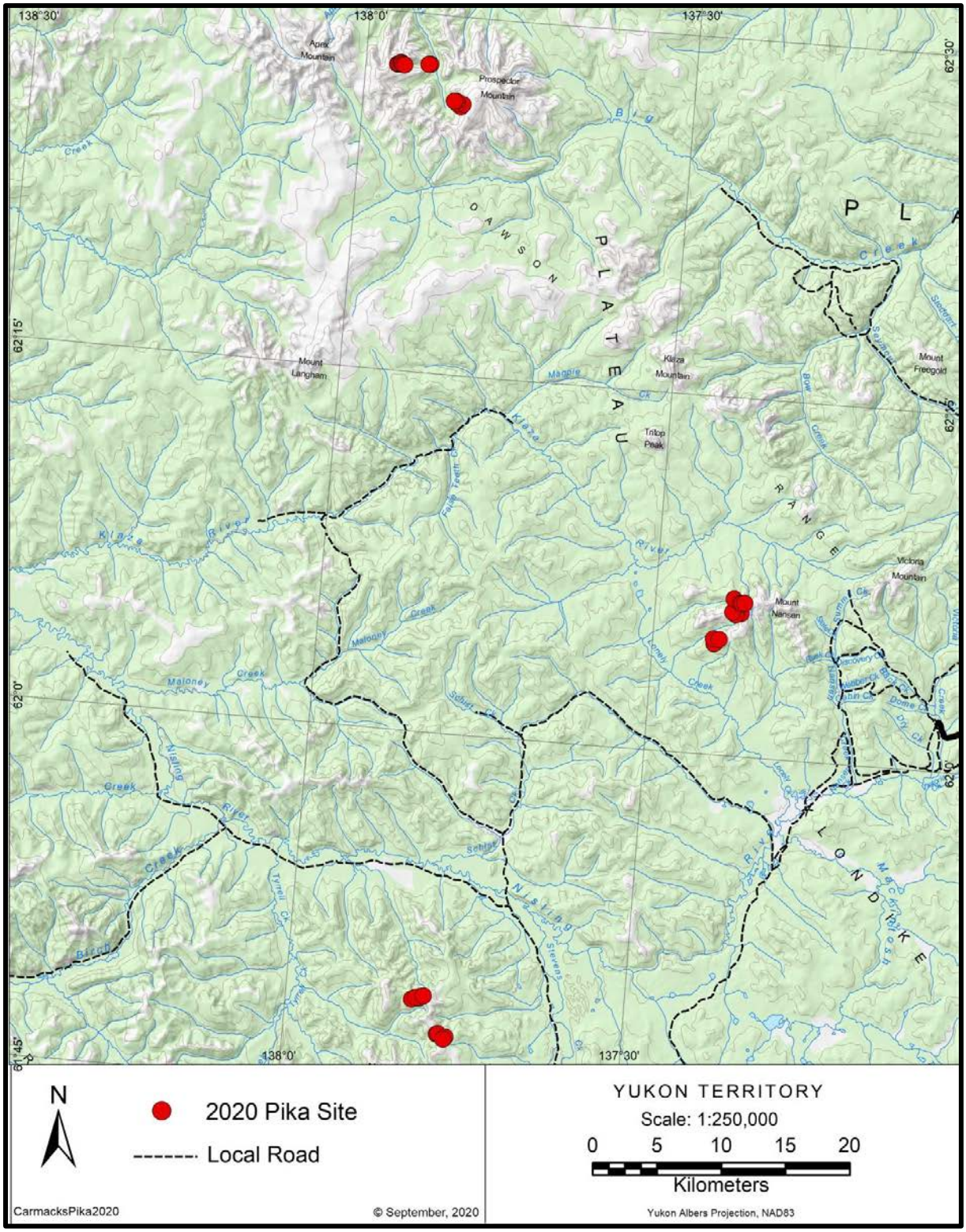

Figure 4. Sample plots surveyed for Collared Pika (*Ochotona collaris*; *n* = 34) in the Mount Nansen area, west of Carmacks, Yukon, summer 2020.

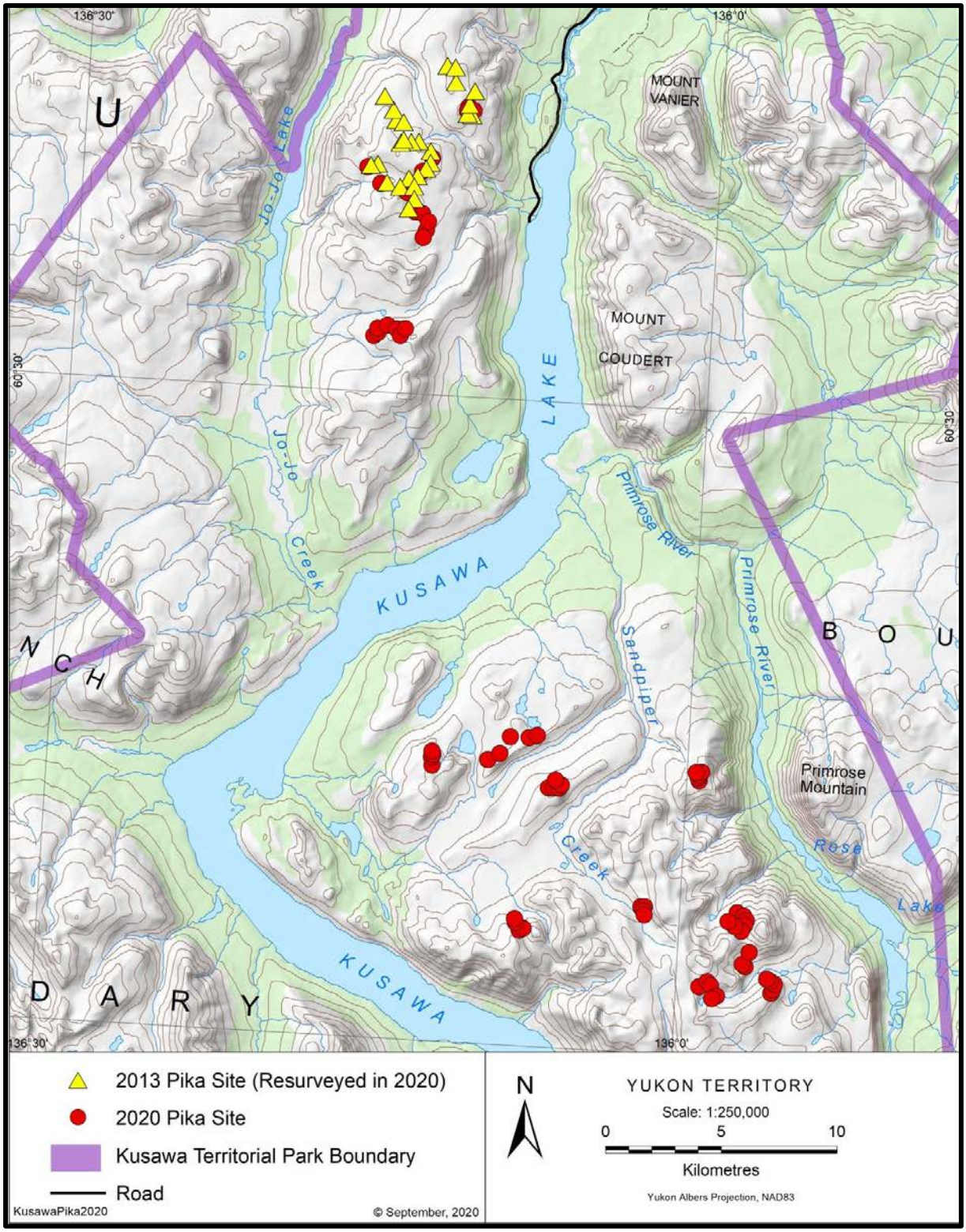

Figure 5. Sample plots surveyed for Collared Pika (*Ochotona collaris*; *n* = 95) in Kusawa Territorial Park, summer 2020.

Results and discussion

We surveyed 185 sites for pika occupancy (Table 1, Figures 3-5, Appendix 1). Naïve occupancy rates varied widely among the three locations, with sites at SixtyMile being the lowest (29%), and those near Mount Nansen the highest (79%).

Table 1. Summary of results from three areas surveyed for Collared Pika (*Ochotona collaris*) in Yukon, summer 2020.

Location	Number of Sites Surveyed	Pika Detection			Naïve Occupancy Rate
		No	Yes		
SixtyMile Region	56	40 (71%)	16 (29%)		0.29
Mount Nansen Area	34	7 (21%)	27 (79%)		0.79
Kusawa Territorial Park	95	24 (25%)	71 (75%)		0.75
All	185	71 (38%)	114 (62%)		0.62

In 2013, Collared Pika were detected at 18 of 27 sites surveyed in the mountain block between Kusawa and Jo-Jo lakes (Figure 4), resulting in a naïve occupancy rate of 0.67. In 2020, Collared Pika were detected at 20 of 27 sites resurveyed, producing a naïve occupancy rate of 0.74. We do not know why occupancy was slightly greater in 2020 than 2013, however our survey protocols were refined in 2020, which may account for the difference. Alternatively, occupancy may have increased slightly between the two surveys for reasons yet unknown . Future surveys are needed to assess trends.

Our naïve occupancy rates from the three locations surveyed in 2020 were all higher than at the extreme northern edge of the species range, which was 0.24 (13 of 55 sites; Kukka et al. 2020). In 2009, the naïve patch occupancy of Collared Pikas at Tombstone Territorial Park was 0.56 (33 of 59 sites; Andresen et al. 2010), which is higher than at the northern edge of their range, but much lower than at our more southerly sites near Mount Nansen or in Kusawa Territorial Park.

Taken together, data from our 2020 surveys and those in 2009 and 2019 suggest a pattern of high occupancy rates in the south of the species range, low to intermediate

occupancy near the middle, and low in the north. This is counter intuitive to what we would expect from a species that is currently experiencing range shifts due to climate warming. Rather, we would expect low occupancy rates at the trailing (southern) and leading (northern) edges of their range, and higher occupancy in the middle (or core) of their range (Gilbert et al. 2019). This is because it may be predicted that climate warming will make sites at the southern edge of the distributional range less suitable for pika over time, while those at the northern edge become increasingly suitable, resulting in a shift in occupancy rates across a latitudinal gradient. However, habitat quality and site location (e.g., elevation and aspect) may mask or mediate latitudinal differences associated with climate change. Further exploration of the data, modeling the influence of site-specific covariates on patch occupancy, are required. For instance, southern sites may be higher quality habitat for Collared Pika. Regardless, long-term monitoring throughout the Collared Pika's range is required if we are to assess changes in their occupancy in relation to climate warming (Kukka et al. 2020, ECCC 2020).

Next steps

Several next steps stem from this work. The most immediate of these, to undertake a more fulsome occupancy modeling of these data. This could be done in combination with 2019 data from Dàadzàii Vàn Territorial Park and the 2020 data from Tombstone Territorial Park, to assess range-wide occupancy in Yukon. These additional analyses would require the use of a small suite of detection and site-specific habitat covariates to explain Collared Pika patch occupancy rates among and within survey locations. Such analyses were conducted for Pika in Tombstone Territorial Park (Andresen et al. 2010) and for Pika in Dàadzàii Vàn Territorial Park (Kukka et al. 2020); however, the reported findings were for Pika specific to these locations and a range-wide occupancy modeling effort for Yukon is still lacking.

Another key next step would be to establish Kusawa Territorial Park as a long-term monitoring site for Collared Pika. Long-term monitoring has been recognized as a key conservation measure for Collared Pika (Jung et al. in prep., ECCC 2020). We recommend 2–4 more years of survey effort in the park to assess annual variability and long-term trends in patch occupancy rates. Thereafter, an assessment should be made to assess the need for annual monitoring. Importantly, Kusawa could serve as the key location for monitoring Collared Pika at the trailing edge of their range (*sensu* Gilbert et al. 2019, Kukka et al. 2020). Ideally, a citizen science and/or wildlife viewing component would be added to surveys in Kusawa to help increase public appreciation for the species and, in doing so, meet the goals and recommended actions in the national management plan for Collared Pika (ECCC 2020). Citizen science efforts have been useful for monitoring pikas (Moyer-Horner et al. 2012), including in Tombstone Territorial Park.

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Appendices

Appendix 1. Summary of sites surveyed

Site ID	Survey Date	Latitude	Longitude	Elevation	Pika Detected?	Old Sign Observed?
SixtyMile Region						
SM01	29-Jul-20	63.986181	-140.617711	1268	No	No
SM02	29-Jul-20	63.986714	-140.608554	1351	No	No
SM03	29-Jul-20	63.917379	-140.647964	1429	No	No
SM04	29-Jul-20	63.917448	-140.648689	1426	No	Yes
SM05	29-Jul-20	63.917809	-140.648410	1446	No	Yes
SM06	29-Jul-20	63.921652	-140.651244	1477	Yes	Yes
SM07	29-Jul-20	63.922334	-140.652205	1455	Yes	Yes
SM08	29-Jul-20	63.923799	-140.652936	1462	No	Yes
SM09	29-Jul-20	63.923054	-140.650440	1469	No	No
SM10	29-Jul-20	63.911426	-140.475302	1488	No	No
SM11	29-Jul-20	63.911291	-140.473841	1490	No	Yes
SM12	29-Jul-20	63.910950	-140.473927	1500	Yes	Yes
SM13	29-Jul-20	63.910532	-140.470934	1480	No	No
SM14	29-Jul-20	63.911489	-140.469185	1483	Yes	No
SM15	29-Jul-20	63.892439	-140.423053	1400	No	Yes
SM16	29-Jul-20	63.892050	-140.423788	1400	Yes	Yes
SM28	30-Jul-20	63.772770	-140.499790	1658	Yes	No
SM29	30-Jul-20	63.772690	-140.797490	1665	No	No
SM30	30-Jul-20	63.771550	-140.494840	1636	No	Yes
SM31	30-Jul-20	63.769090	-140.489900	1582	Yes	No
SM32	30-Jul-20	63.767950	-140.488530	1545	Yes	No
SM33	30-Jul-20	63.767290	-140.486360	1493	Yes	No
SM34	30-Jul-20	63.767410	-140.482700	1441	No	Yes
SM35	30-Jul-20	63.739780	-140.472960	1517	No	No
SM36	30-Jul-20	63.740780	-140.471040	1461	No	No
SM37	30-Jul-20	63.741200	-140.473980	1486	Yes	Yes
SM38	30-Jul-20	63.740640	-140.480870	1490	No	No
SM39	30-Jul-20	63.740460	-140.484340	1486	No	Yes
SM40	30-Jul-20	63.741250	-140.487870	1496	Yes	No
SM41	30-Jul-20	63.740300	-140.498140	1528	No	No
SM49	30-Jul-20	63.685683	-140.604568	1630	No	No
SM50	30-Jul-20	63.686472	-140.602087	1593	No	Yes
SM51	30-Jul-20	63.685331	-140.601930	1579	Yes	No
SM52	30-Jul-20	63.684474	-140.600605	1560	No	No
SM53	30-Jul-20	63.682222	-140.597887	1557	Yes	Yes

Site ID	Survey Date	Latitude	Longitude	Elevation	Pika Detected?	Old Sign Observed?
SM54	30-Jul-20	63.738889	-140.502778	1550	No	No
SM55	30-Jul-20	63.765130	-140.668580	1470	No	Yes
SM57	30-Jul-20	63.764230	-140.668380	1473	No	Yes
SM59	30-Jul-20	63.763240	-140.668210	1466	No	Yes
SM61	30-Jul-20	63.762450	-140.666340	1411	No	.
SM63	30-Jul-20	63.759240	-140.668410	1440	No	Yes
SM80	31-Jul-20	63.881610	-140.843250	1442	No	.
SM81	31-Jul-20	63.882400	-140.837940	1393	No	Yes
SM82	31-Jul-20	63.883080	-140.834750	1352	Yes	.
SM83	31-Jul-20	63.884560	-140.834440	1282	No	.
SM84	31-Jul-20	63.884560	-140.842860	1438	No	Yes
SM85	31-Jul-20	63.841490	-140.928050	1470	No	.
SM86	31-Jul-20	63.839230	-140.931400	1422	No	Yes
SM87	31-Jul-20	63.836970	-140.931270	1434	Yes	.
SM88	31-Jul-20	63.834870	-140.927380	1459	No	.
SM89	31-Jul-20	63.834630	-140.925130	1459	No	.
SM90	31-Jul-20	63.834480	-140.919860	1388	Yes	Yes
SM91	31-Jul-20	63.838710	-140.918440	1352	No	Yes
SM92	31-Jul-20	63.841490	-140.917800	1356	No	Yes
SM93	31-Jul-20	63.843280	-140.918260	1379	No	Yes
SM94	31-Jul-20	63.844640	-140.918610	1404	No	Yes
Mount Nansen Area						
CAR01	6-Aug-20	62.100370	-137.371280	1695	Yes	Yes
CAR02	6-Aug-20	62.100420	-137.378680	1704	Yes	Yes
CAR03	6-Aug-20	62.099220	-137.378970	1714	Yes	Yes
CAR04	6-Aug-20	62.100870	-137.383730	1647	No	No
CAR05	6-Aug-20	62.077760	-137.408190	1467	Yes	Yes
CAR06	6-Aug-20	62.081260	-137.409260	1489	Yes	No
CAR07	6-Aug-20	62.082190	137.405240	1481	Yes	Yes
CAR08	6-Aug-20	62.081210	-137.401230	1541	Yes	Yes
CAR09	6-Aug-20	62.110110	-137.382980	1590	Yes	Yes
CAR10	6-Aug-20	62.107560	-137.373550	1594	No	No
CAR11	6-Aug-20	62.107260	-137.371120	1605	Yes	Yes
CAR12	6-Aug-20	62.107880	-137.367170	1644	Yes	No
CAR13	7-Aug-20	62.463340	-137.952010	1507	Yes	Yes
CAR14	7-Aug-20	62.463650	-137.949920	1489	Yes	Yes
CAR15	7-Aug-20	62.464780	-137.947020	1498	Yes	Yes
CAR16	7-Aug-20	62.464040	-137.946040	1466	No	No
CAR17	7-Aug-20	62.463310	-137.944050	1444	Yes	Yes
CAR18	7-Aug-20	62.463070	-137.941240	1439	Yes	Yes
CAR19	7-Aug-20	62.465090	-137.902330	1151	No	Yes
CAR20	7-Aug-20	62.465020	-137.904880	1157	Yes	No
CAR21	7-Aug-20	62.437390	-137.851440	1497	Yes	Yes
CAR22	7-Aug-20	62.439050	-137.848530	1478	Yes	Yes

Site ID	Survey Date	Latitude	Longitude	Elevation	Pika Detected?	Old Sign Observed?
CAR23	7-Aug-20	62.439430	-137.857250	1461	Yes	Yes
CAR24	7-Aug-20	62.441150	-137.859150	1436	Yes	Yes
CAR25	7-Aug-20	62.441100	-137.862010	1408	No	Yes
CAR26	8-Aug-20	61.790580	-137.772400	1492	Yes	Yes
CAR27	8-Aug-20	61.790930	-137.770130	.	Yes	Yes
CAR28	8-Aug-20	61.788970	-137.759190	1517	Yes	Yes
CAR29	8-Aug-20	61.787250	-137.761930	1489	Yes	Yes
CAR30	8-Aug-20	61.815450	-137.801010	1603	No	Yes
CAR31	8-Aug-20	61.814140	-137.803880	1567	Yes	Yes
CAR32	8-Aug-20	61.813300	-137.813300	1570	Yes	Yes
CAR33	8-Aug-20	61.814950	-137.807170	1562	No	Yes
CAR34	8-Aug-20	61.816360	-137.796390	1599	Yes	Yes
Kusawa Territorial Park						
KUS049	2-Sep-20	60.286000	-135.946560	1620	No	No
KUS050	2-Sep-20	60.286990	135.948870	1647	No	.
KUS051	2-Sep-20	60.291590	-135.944000	1682	Yes	Yes
KUS052	2-Sep-20	60.357070	-135.990480	1916	No	Yes
KUS053	2-Sep-20	60.358200	-135.991170	1888	No	No
KUS054	2-Sep-20	60.359170	-135.990040	1856	Yes	No
KUS055	2-Sep-20	60.360420	-135.988750	1794	Yes	Yes
KUS056	2-Sep-20	60.360200	-135.992890	1751	Yes	No
KUS057	2-Sep-20	60.357340	-136.199220	1658	Yes	Yes
KUS058	2-Sep-20	60.360470	-136.200000	1633	Yes	Yes
KUS059	2-Sep-20	60.361390	-136.199100	1584	Yes	No
KUS060	2-Sep-20	60.362740	-136.199750	1538	Yes	Yes
KUS061	2-Sep-20	60.277340	-135.981660	1818	No	No
KUS062	2-Sep-20	60.279380	-135.975480	1815	Yes	Yes
KUS063	2-Sep-20	60.278050	-135.972690	1786	No	Yes
KUS064	2-Sep-20	60.274020	-135.967730	1753	Yes	Yes
KUS065	2-Sep-20	60.272890	-135.971240	1775	No	No
KUS066	2-Sep-20	60.295390	-136.123860	1619	Yes	Yes
KUS067	2-Sep-20	60.296150	-136.121020	1620	Yes	No
KUS068	2-Sep-20	60.298240	-136.127140	1586	Yes	Yes
KUS069	2-Sep-20	60.299750	-136.128130	1571	Yes	Yes
KUS070	2-Sep-20	60.351020	-136.107500	1707	No	Yes
KUS071	2-Sep-20	60.351210	-136.103270	1728	No	Yes
KUS072	2-Sep-20	60.351190	-136.099120	1736	Yes	No
KUS073	2-Sep-20	60.352500	-136.097530	1637	Yes	Yes
KUS074	2-Sep-20	60.354260	-136.102230	1563	Yes	Yes
KUS075	2-Sep-20	60.276390	-135.925550	1827	Yes	No
KUS076	2-Sep-20	60.277740	-135.924210	1842	Yes	No
KUS077	2-Sep-20	60.279850	-135.923080	1805	Yes	No
KUS078	2-Sep-20	60.280970	-135.926760	1745	No	No
KUS079	2-Sep-20	60.281720	-135.929400	1650	Yes	No

Site ID	Survey Date	Latitude	Longitude	Elevation	Pika Detected?	Old Sign Observed?
KUS080	2-Sep-20	60.307100	-136.030210	1545	Yes	No
KUS081	2-Sep-20	60.307230	-136.027560	1608	Yes	No
KUS082	2-Sep-20	60.305480	-136.028170	1554	Yes	No
KUS083	2-Sep-20	60.304060	-136.027450	1541	Yes	No
KUS084	2-Sep-20	60.360640	-136.155960	1290	Yes	No
KUS085	2-Sep-20	60.363340	-136.146770	1332	Yes	No
KUS086	2-Sep-20	60.370080	-136.139370	1372	No	No
KUS087	2-Sep-20	60.370130	-136.124660	1453	Yes	Yes
KUS088	2-Sep-20	60.371060	-136.118330	1407	Yes	Yes
KUS089	2-Sep-20	60.306740	-135.955000	1671	No	No
KUS090	2-Sep-20	60.305660	-135.949890	1702	Yes	Yes
KUS091	2-Sep-20	60.403920	-135.947600	1716	Yes	No
KUS092	2-Sep-20	60.301940	-135.948910	1683	Yes	No
KUS093	2-Sep-20	60.299760	-135.951670	1612	Yes	No
KUS094	2-Sep-20	60.301400	-135.956470	1669	Yes	No
KUS095	2-Sep-20	60.303210	-135.961790	1655	Yes	.
KUS001	4-Sep-20	60.524730	-136.261990	1541	No	No
KUS002	4-Sep-20	60.522190	-136.264510	1595	No	No
KUS003	4-Sep-20	60.523270	-136.261410	1616	No	Yes
KUS004	4-Sep-20	60.525130	-136.261510	1510	No	No
KUS005	4-Sep-20	60.526410	-136.254210	1507	Yes	No
KUS006	4-Sep-20	60.525230	-136.246750	1580	Yes	No
KUS007	4-Sep-20	60.522820	-136.243580	1659	Yes	No
KUS008	4-Sep-20	60.525490	-136.240020	1593	Yes	No
KUS009	4-Sep-20	60.542200	-136.242830	.	Yes	Yes
KUS010	4-Sep-20	60.576020	-136.239040	1684	Yes	Yes
KUS011	4-Sep-20	60.570750	-136.237370	1664	Yes	Yes
KUS012	4-Sep-20	60.569940	-136.230610	1586	Yes	Yes
KUS013	4-Sep-20	60.567410	-136.226910	1578	Yes	No
KUS014	4-Sep-20	60.562970	-136.228740	1562	Yes	Yes
KUS015	4-Sep-20	60.561280	-136.230190	1542	Yes	No
KUS016	4-Sep-20	60.592100	-136.226670	1666	Yes	No
KUS017	4-Sep-20	60.594740	-136.227970	1655	Yes	No
KUS018	4-Sep-20	60.598210	-136.237530	1673	No	Yes
KUS019	4-Sep-20	60.598050	-136.244030	1727	Yes	No
KUS020	4-Sep-20	60.597470	-136.251890	1785	No	No
KUS021	4-Sep-20	60.598560	-136.249880	1760	No	No
KUS022	4-Sep-20	60.605320	-136.250980	1648	Yes	No
KUS023	4-Sep-20	60.605980	-136.256180	1659	Yes	Yes
KUS024	4-Sep-20	60.609860	-136.259060	1640	No	No
KUS025	4-Sep-20	60.615090	-125.266710	1608	No	Yes
KUS026	4-Sep-20	60.627826	-136.212465	1736	Yes	Yes
KUS027	4-Sep-20	60.628236	-136.218892	1797	Yes	No
KUS028	4-Sep-20	60.622134	-136.211443	1753	No	Yes

Site ID	Survey Date	Latitude	Longitude	Elevation	Pika Detected?	Old Sign Observed?
KUS029	4-Sep-20	60.619029	-136.196070	1613	Yes	No
KUS030	4-Sep-20	60.613679	-136.199569	1690	Yes	Yes
KUS031	4-Sep-20	60.612730	-136.200490	1676	Yes	Yes
KUS032	4-Sep-20	60.611210	-136.201430	1672	Yes	Yes
KUS033	4-Sep-20	60.610141	-136.200777	1658	Yes	Yes
KUS034	4-Sep-20	60.609710	-136.197097	1603	Yes	Yes
KUS035	4-Sep-20	60.611390	-136.196060	1585	Yes	Yes
KUS036	4-Sep-20	60.590340	-136.227744	1738	Yes	No
KUS037	4-Sep-20	60.587934	-136.230924	1796	Yes	No
KUS038	4-Sep-20	60.586820	-136.233800	1800	Yes	No
KUS039	4-Sep-20	60.584842	-136.237156	1741	No	No
KUS040	4-Sep-20	60.583740	-136.244051	1718	Yes	No
KUS041	4-Sep-20	60.580900	-136.239460	1688	Yes	No
KUS042	4-Sep-20	60.578300	-136.244920	1675	No	No
KUS043	4-Sep-20	60.580387	-136.250618	1694	Yes	No
KUS044	4-Sep-20	60.587280	-136.276900	1688	Yes	No
KUS045	4-Sep-20	60.581696	-136.261013	1677	Yes	No
KUS046	4-Sep-20	60.581140	-136.265990	1638	Yes	No
KUS047	4-Sep-20	60.588740	-136.268942	1739	Yes	.
KUS048	4-Sep-20	60.588103	-136.274501	1725	Yes	No

Appendix 2. 2020 pika survey datasheet

Tombstone Pika Observation Data Sheet Page: of Date (dd/mm):____/____/20 Observer 1 Name: Observer 2 Name: Weather: Temp(C): Precip: nil / light / drizzle / rain / hail / snow Wind: Area:	
Area Notes:	
Site ID: Time Start: Time End: Lat: Long: Elevation: Aspect: N / NW / W / SW / S / SE / E / NE / FLAT Wpt # : Patch Perimeter Track: Y / N Rock Size (cm): <30 / 30-50 / 50-100 / >100 Patch Size (m): small (≤50) / medium (50-100) / large (≥100) Habitat Quality Rank:	
Observer 1: Pika: Y / N Obs Type: Visual / Sign / Heard Time till detected:	Observer 2: Pika: Y / N Obs Type: Visual / Sign / Heard Time till detected:
Photos: Y / N Cam ID:	Photo #'s:
Old Sign? Y / N Old Sign Type:	
Notes/Sketch:	