COLLARED PIKA (*OCHOTONA COLLARIS*) OCCUPANCY

IN TOMBSTONE TERRITORIAL PARK, YUKON: 2013 SURVEY RESULTS

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Summary

- The Collared Pika (*Ochotona collaris*) is considered an indicator species for climate change, because of their sensitivity to climatic fluctuations and the natural isolation of suitable habitat. Given their susceptibility to climate change, Collared Pika is listed as Special Concern in the federal *Species at Risk Act*.
- During late-summer 2013, we conducted occupancy surveys for Collared Pika in Tombstone Territorial Park. Our aim was to provide occupancy estimates for Collared Pika in the park, and compare the results with the survey done in 2009.
- Collared Pikas were observed on 50.7% of 73 sites surveyed.
- Occupancy of the 46 sites surveyed in both 2009 and 2013 suggested a 15% decline in site occupancy between the 2 surveys. The reason for the apparent decline is unknown.
- Because Collared Pika populations may naturally fluctuate between years, multi-year surveys would be required to assess the annual variability in site occupancy and identify population trends.
- Population trend monitoring by means of occupancy surveys can assist in determining the conservation status of Collared Pikas, and serve as a window into the potential impact of climate change on alpine ecosystems in Yukon.

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Introduction

The Collared Pika (*Ochotona collaris*) is a cold-adapted lagomorph that lives in talus slopes in alpine environments. The species' range is globally limited to mountains in northwestern British Columbia, western Northwest Territories, Yukon, and Alaska (MacDonald and Jones 1987). About 60% of the species' range is in Canada; most of it in Yukon (COSEWIC 2011). The Collared Pika is a close relative of the American Pika (*Ochotona princeps*), and their ecology is considered similar (MacDonald and Jones 1987). The ranges of these 2 species are separated by an approximately 800 km gap.

Pika distribution is naturally fragmented within the species' range, because populations are restricted to talus patches. Pikas tolerate heat poorly, and they escape high daytime temperatures by sheltering under rocks. In experiments, American Pikas in exposed cages died when the ambient temperature rose above 25°C (Smith 1974). Talus patches also provide shelter from predators and pikas rarely venture more than 10 m into meadows to forage (Morrison et al. 2004). Because talus patches are critical safe havens for pikas and generally isolated within a matrix of other habitat types, local pika populations form metapopulations, and have a high risk of local extirpation (Franken 2002).

The recolonization of vacant patches largely depends on the surrounding habitat quality (i.e., type and amount of vegetation) and the proximity to other talus patches (Franken and Hik 2004). Consequently, dispersal between mountain ranges is highly limited. Collared Pikas are limited to high-elevation montane areas, where anthropogenic disturbance has been minimal (COSEWIC 2011). However, the natural isolation of high-elevation habitats may limit the resilience of alpine species to contemporary climate change (Beever et al. 2013, Erb et al. 2011, Sekercioglu et al. 2008), especially in the periphery of the species' range (Rodhouse et al. 2010). Because pikas are a cold-adapted species, climate change is expected to cause reduction or extirpation of populations in lower latitudes and altitudes. Projections of American Pika distribution under simulated future climatic conditions indicate likely extinction of southernmost populations, if climate change continues (Galbreath et al. 2009). These findings are supported by field studies that have indicated significant losses of American Pika populations in the Great Basin region in United States (Beever et al. 2003), where low annual precipitation (Erb et al. 2011), and low snowpack and growing season precipitation (Beever et al. 2013) have been shown to be limiting factors for pika persistence.

Decreases in Collared Pika populations as a result of climatic factors have also been recorded in Yukon, where the survival of pikas has been attributed to changes in winter and spring weather patterns. A long-term study on pikas in southwestern Yukon positively correlated adult survival to the Pacific Decadal Oscillation, which, in turn, was negatively correlated to the timing of spring snowmelt at the study area (Morrison and Hik 2007).

However, the specific drivers of population extirpations at finer scale are disagreed upon, suggesting that unique combinations of local environment, biota, and history conspire against generalizations. For example, topographic position, vegetation cover, and regional climate regimes have an effect on the level of vulnerability of pika populations to large-scale climatic effects (Jeffress et al. 2013). Nevertheless, the evidence for climatic factors driving pika population fluctuations and extirpations is unequivocal. As a result, both American Pika and Collared Pika are identified as important indicator species for the impact of climate change on alpine ecosystems, with monitoring programs springing up in national parks throughout western North America (Andresen-Everatt 2010, Jeffress and Garrett 2011, Mountain Studies Institute 2011, Timmins and Whittington 2011).

The Collared Pika is assessed as a species of Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC;(2011) because of its sensitivity to climatic variations, and its global distribution being in an area where climate-driven changes in the environment are occurring at a fast rate. (The species is currently awaiting listing on the federal Species at Risk Act.) Baseline information on Collared Pika population trends is limited to one site in southwestern Yukon (e.g., Franken and Hik 2004, Morrison and Hik 2007). Further population-level studies on Collared Pika could confirm if trends observed in southwestern Yukon are indicative of what is occurring across the species' range.

We conducted surveys for Collared Pika in Tombstone Territorial Park, during 2013. Our aim was to determine site occupancy rates for Collared Pika, and compare the results with a similar survey conducted in 2009. These data should be useful in assessing the conservation status of Collared Pika in Yukon, and provide information on climate-related changes to alpine ecosystems.

Methods

Our survey was based on a pilot study done in 2009 in Tombstone Territorial Park (Andresen-Everatt 2010).

The pilot study involved the development and testing of a potential field survey protocol, description of preferred pika habitat characteristics, and initial pika occupancy rate. The goal of the 2009 pilot study was to assess the feasibility of determining site occupancy by Collared Pika, which can be used as a proxy for a change in abundance. Occupancy is defined as the proportion of sites that are occupied by a species and is estimated from presence only data. Occupancy can be used to estimate changes in population size by assuming that changes in the proportion of sites occupied by a species are correlated to changes in its population status (MacKenzie et al. 2006). Thus, site occupancy data can be used to estimate the rate of change in abundance or distribution for species that are sensitive to habitat or climate change (MacKenzie et al. 2003), and it is particularly suitable for detecting population trends where individuals are highly detectable.

In late-summer 2013, we re-surveyed 46 of 59 sites established in 2009 by Andresen-Everatt (2010). In addition, we established 27 new sites. Our survey sites were located on 7 distinct mountains: Mt Adney, Blackcap/Goldensides Mountains, Fold Mountain, Discovery Ridge, Grizzly Lake Trail, Twin Lakes and Syenite Lake (Figure 1; Appendix). Most areas were accessed by foot during day trips.

However, sites at Twin Lakes, Syenite Lake, and a portion of the Grizzly Lake Trail were more remote and required overnight trips or helicopter access; these sites were surveyed opportunistically in conjunction with other park monitoring activities.

A site was defined as a talus patch that is separated by meadows or other uninhabitable landscape features (i.e., scree, forest, snow, or water). Adjacent survey sites were separated by minimum of 10 m. Only suitable Collared Pika talus habitat, as determined by Andersen-Everatt (2010), and identified in 2012 (Environment Yukon, unpublished data) were chosen as survey sites. These sites were composed of patches of talus with rocks larger than 30 cm, and were between 1200 m and 1700 m in elevation.

We conducted 2 simultaneous, but independent surveys of each talus site. Prior to the surveys, the site boundaries were discussed between surveyors. Each site was simultaneously surveyed by 2 independent surveyors, each walking the perimeter of the patch in opposite directions. Observers were not allowed to communicate any findings during the survey, because observer-independent data was needed for calculating detection probability.

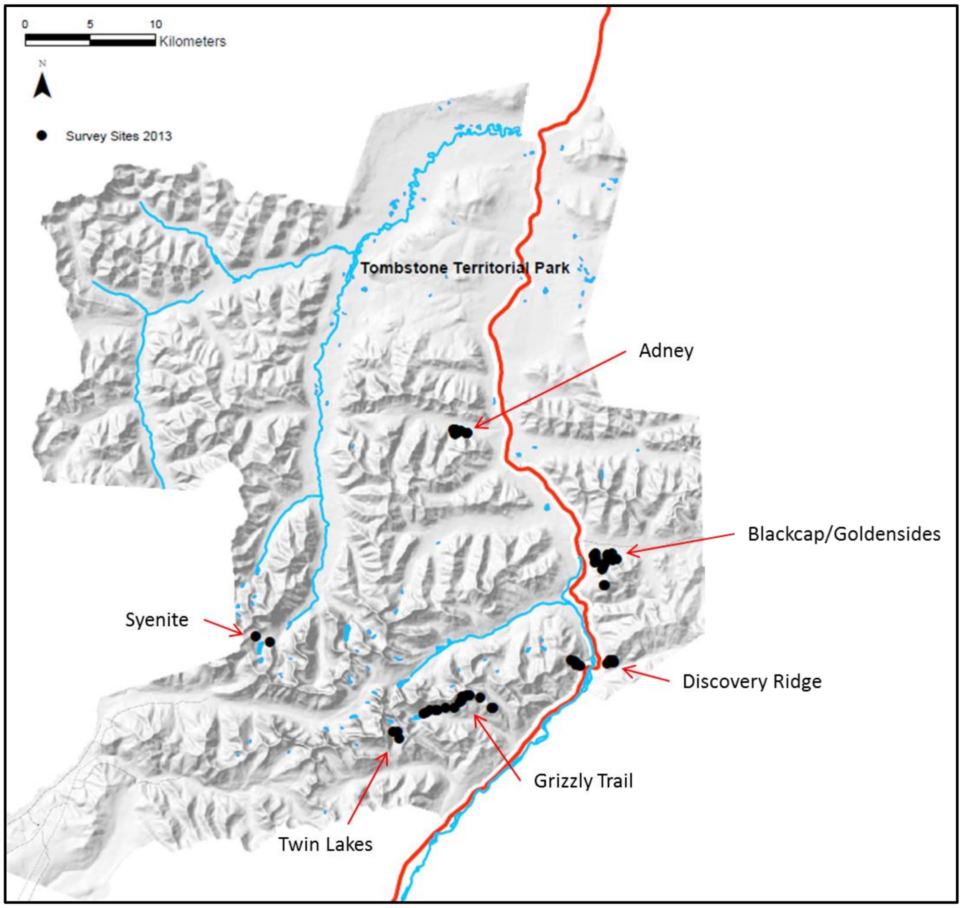

Figure 1. Sites surveyed for Collared Pika (black dots, n = 73) in Tombstone Territorial Park, Yukon, in summer 2013.

The surveyors walked slowly and stopped approximately every 10 m to look and listen. Detection could be either direct or indirect, and consist of either seeing or hearing pikas, or finding fresh haypiles. Approximately 10 to 25 minutes (depending on talus patch size and complexity) were spent assessing each site for occupancy by Collared Pikas. Each observer recorded the length of the survey and the type of Collared Pika observation (e.g. visual, call, haypile), if applicable.

Surveys occurred between 30 July and 16 September 2013.

This time period is ideal because pikas are more detectable in later summer and fall (Bruggeman 2010), when they are highly territorial (active alarm calling) and actively caching food into conspicuous hay piles (MacDonald and Jones 1987, Dearing 1997).

The high detectability of individuals and their isolation of distribution within talus patches make Collared Pikas an ideal subject for occupancy surveys.

Results

We surveyed 73 sites (talus patches) for Collared Pika occupancy in summer 2013 (Table 1), including 46 of 59 (78%) of the sites surveyed in 2009 by Andersen-Everatt (2010). We established 27 new sites on talus patches that we considered suitable Collared Pika habitat, based on elevation and rock size (Andersen-Everatt 2010).

Eleven of these sites were established at three previously unsurveyed areas (Fold Mountain, Twin Lakes and Syenite Lake.

Collared Pikas were observed in 50.7% of 73 sites surveyed in 2013. In comparison, pikas were observed in 55.9% of 59 sites surveyed in 2009.

The difference in occupancy between the 2009 and 2013 surveys was not significant (two-tailed N-1 two proportion test, $P = 0.55$). In contrast, there is some evidence suggesting that Collared Pika occupancy decreased for the sites that were surveyed both in 2009 and 2013. Collared Pika observations decreased from 54% in 2009 to 39% in 2013 ($n = 46$, two-tailed N-1 two proportion test, $P = 0.09$). Pikas were observed in 70% of new sites ($n = 27$).

In 2013, the overall detection probability was 92%, which is comparable to 91% obtained in 2009.

Table 1. Summary results from the 2013 Collared Pika occupancy survey in Tombstone Territorial Park, Yukon.

Total number of sites surveyed in 2013	73	July 30 - September 16
Number of 2009 sites revisited (total=59)	46	78%
Number of new sites established	27	17 sites in existing study areas, 11 sites in three new study areas
Person-days	20	10 survey days by 2 people
Percentage of all sites with pikas in 2013	50.7%	*n* = 73
Percentage of all sites with pikas in 2009	55.9%	*n* = 59
Change in pika observations in re-surveyed sites	↓15%	2009, 54% had pikas 2013, 39% had pikas
Percentage of new sites with pikas	70%	*n* = 27

Discussion

The detection probability was similar in both the 2009 and 2013 surveys, suggesting that pika were readily, and equally detectable in both surveys. Pikas were found in a slightly lower percentage of sites between the 2009 and 2013 surveys. The difference, however, is more notable if only the re-surveyed sites are compared between the years; detections were down 15% in 2013, compared to those sites surveyed in 2009. The reason for decline in Collared Pika occupancy is unknown. Pika populations may fluctuate among years (Franken 2002; Morrison and Hik 2008) and the natural variability in pika occupancy is currently unknown.

Additional annual surveys are recommended to establish baseline conditions and interannual variability in occupancy.

Pikas were observed in 70% of newly established sites, which is high compared to the overall pika observation rate of 51%. This is likely the result of choosing high quality sites. Some sites established in 2009 were in poor pika habitat, whereas in 2013 we were confident in selecting sites with good pika habitat. The 2009 pilot study showed that elevation and rock size were the best predictors of Collared Pika occupancy in Tombstone Territorial Park (Andersen-Everatt 2010).

Pikas were found most often at elevations of 1200-1400 m, followed by elevations of 1400-1600 m, and considerably less at elevations higher than this.

Pikas were most likely to occur in sites composed of medium-sized rocks (30-100 cm) than in sites with small (<30 cm) or boulder-sized (>100 cm) rocks; however, boulders over 100 cm were under-represented in the data set (7%) and it was not possible to infer that pikas would not occupy large boulders if they were available (Andresen-Everatt 2010). However, the results from this study suggested that there is a minimum rock size that pikas prefer. In 2013, we chose sites according to site selection observed by Andresen-Everatt (2010).

We surveyed 73 sites in 10 days of effort, which we consider efficient in the rugged landscape where access is often limited. Because the protocol is easy to use, we were able to engage surveyors with a minimum amount of training. Identification of Collared Pikas and their calls is easy to learn, and they are readily distinguished from other animals in alpine ecosystems.

Recommendations

- In order to better understand the natural variability in pika occupancy, we recommend annual surveys for a 3–5 year period to establish interannual variability and determine appropriate survey intervals required to observe trends in occupancy rates (Bruggeman 2010).
- This report provides the basic summary of survey findings; more detailed analyses of the data through occupancy modeling should be completed to provide naïve occupancy rates that can be compared to those obtained in 2009.
- Ensuring that repeat visits to survey sites are consistent, new sites should be established in areas that can be accessed as day trips. Currently, backcountry sites are surveyed opportunistically by park rangers on patrol, and this opportunity may not always exist.
- Establishment of new sites should be completed by experienced surveyors so that sites are selected in good Collared Pika habitat in a consistent fashion.
- Our survey protocol and pika identification are easy to learn, and monitoring can be accomplished with a minimal training; thus Collared Pika monitoring may be an ideal program for engaging citizen science groups. Occupancy surveys, specifically, are considered a reliable method of data collection in programs that engage non-professional volunteers (Moyer-Horner *et al.* 2012; van Strien *et al.* 2013). Future engagement of local organizations may aid in program sustainability.

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Appendix

Site Number	Mountain Block	Latitude	Longitude	Elevation (mASL)	Surveyed in 2009	Surveyed in 2013
TS040	Blackcap Mountain	64.5286	-138.19408	1686	√	√
TS041	Blackcap Mountain	64.529018	-138.19241	1725	√	√
TS129	Blackcap Mountain	64.539192	-138.19899	1636		√
TS130	Blackcap Mountain	64.541318	-138.19762	1529		√
TS049	Blackcap Mountain	64.542989	-138.19816	1458	√	√
TS051	Blackcap Mountain	64.54328	-138.19582	1445	√	√
TS050	Blackcap Mountain	64.543652	-138.19654	1419	√	√
TS048	Blackcap Mountain	64.5439	-138.21199	1382	√	√
TS001	Blackcap Mountain	64.544874	-138.21146	1407	√	√
TS002	Blackcap Mountain	64.545562	-138.21123	1423	√	√
TS003	Blackcap Mountain	64.546164	-138.21190	1410	√	√
TS131	Blackcap Mountain	64.547253	-138.21059	1453		√
TS132	Fold Mountain	64.471381	-138.21982	1196		√
TS133	Fold Mountain	64.472758	-138.22569	1365		√
TS134	Fold Mountain	64.472178	-138.22699	1361		√
TS135	Fold Mountain	64.474897	-138.23522	1526		√
TS136	Fold Mountain	64.474074	-138.22945	1415		√
TS045	Blackcap Mountain	64.549612	-138.21235	1398	√	√

Site Number	Mountain Block	Latitude	Longitude	Elevation (mASL)	Surveyed in 2009	Surveyed in 2013
TS046	Blackcap Mountain	64.549342	-138.21263	1397	√	√
TS047	Blackcap Mountain	64.548608	-138.21468	1360	√	√
TS044	Blackcap Mountain	64.550333	-138.21217	1399	√	√
TS010	Blackcap Mountain	64.55037	-138.19204	1357	√	√
TS013	Blackcap Mountain	64.54957	-138.19319	1353	√	√
TS011	Blackcap Mountain	64.54983	-138.19183	1371	√	√
TS012	Blackcap Mountain	64.55049	-138.18954	1385	√	√
TS014	Blackcap Mountain	64.54975	-138.18734	1441	√	√
TS020	Blackcap Mountain	64.55106	-138.18558	1403	√	√
TS015	Blackcap Mountain	64.54665	-138.18328	1530	√	√
TS016	Blackcap Mountain	64.54779	-138.18239	1484	√	√
TS017	Blackcap Mountain	64.54766	-138.17870	1525	√	√
TS019	Blackcap Mountain	64.54778	-138.17768	1523	√	√
TS059	Mt. Adney	64.62488	-138.43367	1295	√	√
TS058	Mt. Adney	64.62521	-138.43552	1283	√	√
TS057	Mt. Adney	64.62521	-138.43552	1283	√	√
TS004	Mt. Adney	64.62617	-138.44494	1258	√	√
TS005	Mt. Adney	64.62566	-138.44792	1275	√	√
TS006	Mt. Adney	64.62599	-138.45100	1276	√	√

Site Number	Mountain Block	Latitude	Longitude	Elevation (mASL)	Surveyed in 2009	Surveyed in 2013
TS007	Mt. Adney	64.62637	-138.45342	1257	√	√
TS008	Mt. Adney	64.62621	-138.45451	1276	√	√
TS009	Mt. Adney	64.62643	-138.45734	1269	√	√
TS094	Grizzly Trail	64.44295	-138.37395	1671		√
TS102	Grizzly Trail	64.43473	-138.41320	1548		√
TS103	Grizzly Trail	64.43427	-138.42766	1521		√
TS104	Grizzly Trail	64.43203	-138.43977	1412		√
TS105	Grizzly Trail	64.43170	-138.44262	1388		√
TS106	Grizzly Trail	64.43135	-138.45211	1404		√
TS107	Grizzly Trail	64.42943	-138.45705	1386		√
TS108	Grizzly Trail	64.42837	-138.46132	1375		√
TS101	Grizzly Trail	64.43891	-138.40586	1570		√
TS100	Grizzly Trail	64.43993	-138.40388	1524		√
TS099	Grizzly Trail	64.44313	-138.40304	1709		√
TS098	Grizzly Trail	64.44336	-138.39798	1705		√
TS097	Grizzly Trail	64.44410	-138.39547	1710		√
TS095	Grizzly Trail	64.44386	-138.39066	1717		√
TS035	Grizzly Trail	64.43656	-138.35422	1647	√	√
TS034	Grizzly Trail	64.43658	-138.35202	1633	√	√

Site Number	Mountain Block	Latitude	Longitude	Elevation (mASL)	Surveyed in 2009	Surveyed in 2013
TS114	Twin Lakes	64.40970	-138.49605	1499		√
TS112	Twin Lakes	64.41438	-138.49940	1540		√
TS113	Twin Lakes	64.41372	-138.50698	1494		√
TS021	Discovery Ridge	64.47461	-138.17778	-	√	√
TS022	Discovery Ridge	64.47716	-138.17418	-	√	√
TS023	Discovery Ridge	64.47765	-138.16990	-	√	√
TS024	Discovery Ridge	64.47721	-138.16797	-	√	√
TS025	Discovery Ridge	64.47607	-138.16703	-	√	√
TS027	Discovery Ridge	64.47617	-138.16841	-	√	√
TS029	Discovery Ridge	64.47691	-138.17236	-	√	√
TS052	Mt. Adney	64.62466	-138.45196	-	√	√
TS053	Mt. Adney	64.62441	-138.45256	-	√	√
TS054	Mt. Adney	64.62454	-138.45308	-	√	√
TS055	Mt. Adney	64.62454	-138.45488	-	√	√
TS056	Mt. Adney	64.62344	-138.45341	-	√	√
TS137	Syenite	64.47109	-138.73946	-		√
TS138	Syenite	64.46801	-138.71631	-		√