Surveys

Distribution of Low-Elevation American Pika Populations in the Northern Great Basin

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Abstract

The recent discovery that a portion of the historically described populations of American pikas *Ochotona princeps* in the Great Basin of North America appear to be extinct added emphasis to earlier warnings that these populations may be highly vulnerable, in particular those occurring at low elevations (<2,500 m). Pikas in the Great Basin have received increased scientific interest; however, there is still little known about the distribution or number of populations throughout their range. Here we report on the discovery of several previously undescribed low-elevation pika populations in Southeast Oregon and Northwest Nevada. The average elevation of sites currently occupied by pikas was 1,993 m (range = 1,648–2,357 m). This and other recent discoveries suggest that pikas may be more common at low elevations in portions of the northern Great Basin than previously suspected (i.e., >2,500 m).

Keywords: American pika; Great Basin; low-elevation distribution; Sheldon-Hart Mountain National Wildlife Refuge Complex

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Introduction

The American pika *Ochotona princeps* (hereafter pika) occupies talus and talus-like habitats with cool, moist micro-climates across the intermountain West of North America (Smith and Weston 1990; Verts and Carraway 1998). Pikas are obligate to talus or piles of broken rock fringed by suitable vegetation (Smith and Weston 1990), and across their geographic range they are often found near the talus–meadow interface (see summary by Smith and Weston 1990). American pikas of the Great Basin have received a great deal of scientific attention (Grayson 2005; see also Brown 1971; Smith 1974a, 1974b, 1980; Grayson and Livingston 1993; Skaggs and Boecklen 1996; Smith and Gilpin 1997; Lawlor 1998; Beever et al. 2003, 2008, 2010, 2011; Millar and Westfall 2010). However, the numbers of populations that comprise each of the pika subspecies are not well-known throughout the species' range. Beever et al. (2003) described site-level extirpations across the 25 historical pika sites in the Great Basin, and reported increasing rates of extirpation and upslope retraction after 1999 vs. during the 20th century (Beever et al. 2011). This added emphasis to earlier warnings that Great Basin populations of this species may be highly vulnerable (McDonald and Brown 1992), particularly those occurring at low elevations (<2,500 m).

Climatic conditions have shaped the current distribution of the American pika over time, creating geographically isolated populations on montane refugia (Hafner 1994; Hafner and Sullivan 1995; Grayson 2005). However, the current distribution of pikas in the Great Basin is considered but a subset of their range during the Pleistocene, including the relatively recent restriction of pikas to rocky habitats (Grayson 2005). In the northern

portion of this species' distribution, elevations range from near sea level along the western coast to the highest peaks (>4,000 m) of the western United States and Canada (Hafner and Smith 2010). In the southern extent, temperature appears to limit their distribution (Grinnell 1917; Smith 1974b; Hafner 1994). In the interior mountain ranges of the western United States, pikas have been previously described as typically not found below 2,500 m (Smith and Weston 1990; Beever et al. 2008; Millar and Westfall 2010); most records of historical elevations for the Great Basin fall above that elevation (Millar and Westfall 2010).

An incomplete understanding of the full historical and current distribution of pikas limits biologists' ability to accurately track changes in distribution over time (Beever et al. 2010; Nichols 2010). Here we report on the persistence of American pika populations on Hart Mountain National Antelope Refuge in Southeast Oregon, as described by Beever et al. (2003), and the discovery of previously undescribed low-elevation (<2,500 m) pika populations on Sheldon National Wildlife Refuge in Northwest Nevada.

Study Site

Sheldon National Wildlife Refuge (232,694 ha) and Hart Mountain National Antelope Refuge (111,288 ha), managed jointly by the U.S. Fish and Wildlife Service, occur within the northern portion of the Great Basin, in Northwest Nevada and Southeast Oregon, respectively (Figure 1). Elevations range from 1,307 to 2,442 m. Recent summer temperatures for the refuges have ranged from 0°C (31°F) to 34°C (93°F) and winter temperatures have ranged between −29°C (−20°F) and 14°C (57°F); annual precipitation rarely amounts to >30 cm. The refuges are dominated by sagebrush–steppe and associated habitats. Dominant vegetation consists of shrubs, particularly sagebrush *Artemisia* spp. Open woodlands consisting of western juniper *Juniperus occidentalis* or curl-leaf mountain mahogany *Cercocarpus ledifolius* occupy ridgelines and some slopes. Aspen *Populus* spp. and willows *Salix* spp. can be found in scattered snowpockets and in areas of persistent water. Talus and broken rock habitats are found along the edge of tabletops and escarpments, and along steep side-slopes.

Methods

Pikas in and around the Great Basin (Figure 2A) can be highly detectable (Ray and Beever 2007; Beever et al. 2008, 2010; Hersey et al. 2009; Millar and Westfall 2010; Rodhouse et al. 2010). We conducted ground surveys of potential pika habitat between June and September in 2009, 2010, and 2011 by walking line transects approximately 15 m apart. Potential pika habitat was identified as rocky areas with talus or piles of broken rock (Figure 2B), and we surveyed each potential site (n = 35) for the presence of pikas only once during the 3-y period. We searched for sign of pika occupation (e.g., sightings, vocalizations, haypiles, fecal pellets) with no set criteria for weather, time of day, size of area, elevation, slope, aspect, or substrate. At each site, we searched for a minimum of 30 min, after which we characterized the site as a nondetection if pika evidence was not observed. As noted by Millar and Westfall (2010), however, a limitation of any rapid survey is false negative results, wherein a site is scored as nondetection when in fact it is occupied. While these sites could have pikas present, detection would depend on repeat visits or intensive assessments; such sites can be highlighted for revisit with intensive survey methods.

We used both direct (vocal or visual detection) and indirect sign (detection of "fresh" and/or "old" pika fecal pellets and haypiles, see descriptions below) for determining occupancy. Sites containing fresh haypiles, fresh pellets, or where an individual was heard or seen, we characterized as being currently occupied; sites containing old haypiles and/or old pellets we classified as "old" or previously occupied.

We attempted to distinguish between old and fresh pellets and haypiles. According to Nichols (2010), fecal pellets of American pikas can persist in talus for decades or more and can be used to infer recent pika distributions, although observations by Millar and Westfall (2010) did not corroborate this. We characterized fresh fecal pellets as green to reddish in color, moist, and usually located on the top of rocks and stuck together in small piles (Figure 2C); we characterized old pellets as blackish to grey in color, dry, and scattered (Figure 2D). These categories are similar to those used by Nichols (2010), who found that the characteristics of "fresh" to "moderately fresh" pellets could be used to reasonably classify them as being deposited within the past several months and "old" pellets as being several months to several years old.

Pikas forage by feeding and haying (Huntly et al. 1986; Smith and Weston 1990; Dearing 1997). Feeding (the immediate consumption of vegetation) occurs year-round. Haying (the storage of vegetation for later consumption) occurs during the summer months (Smith and Weston 1990), although pikas will augment their haypiles throughout late winter or early spring (Millar 2011). Haypiles may be constructed on the surface of the talus or tucked under rocks, thus leaving little vegetation exposed (Smith and Weston 1990). For our purposes, fresh haypiles were classified as those that contained green vegetation (Figure 2E), whereas old haypiles were dried and contained no green vegetation (Figure 2F).

For both unoccupied talus patches and locations where we detected pika sign, we recorded elevation, aspect, and average slope gradient; we did not attempt to quantify patch size. We recorded as independent those instances of pika sign that were approximately 50 m apart from all other incidences (old or fresh). This was more conservative than the 30-m threshold used by Beever et al. (2003, 2011), but similar to the criterion described by Millar and Westfall (2010). We obtained position and elevation with a handheld GPS unit, which provided accuracy of 0.6–10 m.

Results

We detected evidence of previous or current occupancy by pikas at 54% of sites surveyed during 2009–

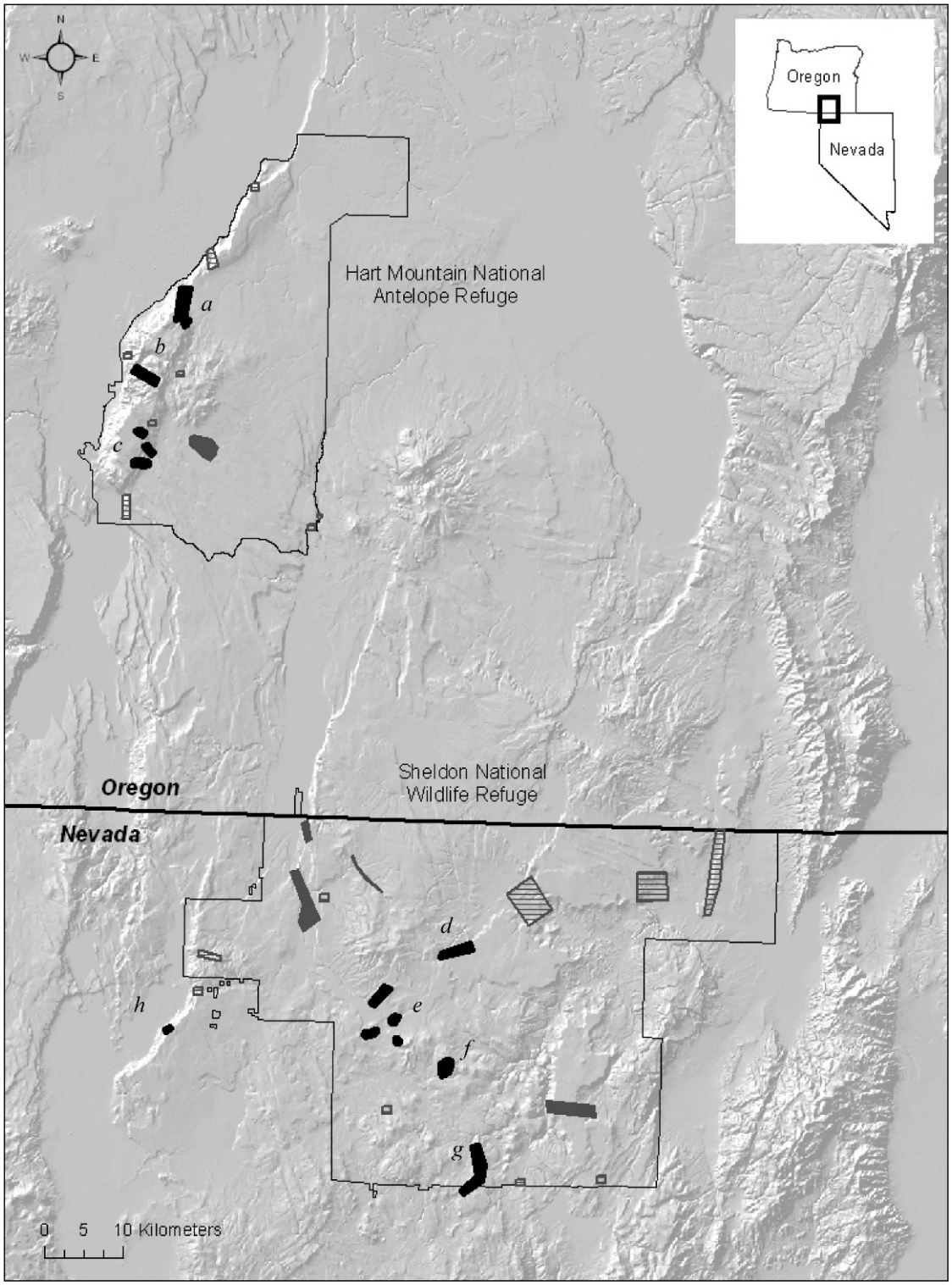

Figure 1. Map showing distribution of sites surveyed for American pika sign *Ochotona princeps*, 2009–2011, in Oregon and Nevada, USA. Currently occupied sites (in black) include: Hart Mountain–Willow Creek (***a***); DeGarmo Canyon (***b***); Goat–Warner–Calderwood (***c***); Echo Canyon (***d***); Fish Creek–Horse Canyon (***e***); Blowout Mountain (***f***); Mahogany Mountain (***g***); and Massacre Rim (***h***). Previously occupied sites are represented in grey and unoccupied sites are represented by hashed-areas.

(A)

(B)

(C)

(D)

(E)

(F)

Figure 2. Photos of representative examples of old vs. fresh pellets and haypiles, pika talus habitat, and a pika itself. **(A)** American pika *Ochotona princeps*, Sheldon National Wildlife Refuge, Nevada. Photo credit: Nevada Department of Wildlife. **(B)** Talus habitat of the American pika on Sheldon National Wildlife Refuge. Photo credit: A. Wellborn, USFWS. **(C)** "Fresh" fecal pellets of an American pika (center), Sheldon National Wildlife Refuge, June 2009. Photo credit: G. Collins, USFWS. **(D)** "Old" fecal pellets of an American pika (center, left), Sheldon National Wildlife Refuge, June 2009. Photo credit: G. Collins, USFWS. **(E)** "Fresh" haypile of an American pika, Sheldon National Wildlife Refuge, June 2009. Photo credit: G. Collins, USFWS. **(F)** "Old" haypile of an American pika, Sheldon National Wildlife Refuge, June 2009. Photo credit: G. Collins, USFWS.

Table 1. Location, age, and elevation of observed American pika *Ochotona princeps* sign (old and current), and approximate distance to nearest known currently pika-occupied site, Sheldon National Wildlife Refuge, Nevada, and Hart Mountain National Antelope Refuge, Oregon, 2009–2011.

	Number of independent sign	Sign age (%)		Distance to next nearest currently occupied site (km)	Elevation at sign locations (m)		
		Current	Old		Average	Minimum	Maximum
Pika detected sites—current							
Blowout Mountain	107	64	36	7.1	2,033	1,924	2,167
Calderwood Ranch	46	77	23	1.4	2,000	1,810	2,199
DeGarmo Canyon	11	73	27	6.9	2,175	2,037	2,357
Echo Canyon	21	67	33	7.7	1,896	1,842	1,914
Fish Creek	33	88	12	2.9	1,897	1,816	1,998
Fish Creek Mountain	22	95	5	2.4	2,204	1,998	2,045
Fish Creek Spring	31	58	42	2.4	1,942	1,914	1,953
Goat Creek[a]	10	50	50	1.4	2,203	2,137	2,272
Hart Mountain	59	63	37	0.7	1,973	1,648	2,174
Horse Canyon	63	71	29	2.4	1,856	1,847	1,877
Mahogany Mountain	63	83	17	9.9	1,985	1,903	2,090
Massacre Rim[b]	22	68	32	25.5	1,868	1,830	1,926
Warner Creek[a]	4	50	50	1.4	1,919	1,866	2,048
Willow Creek	68	90	10	0.7	1,946	1,894	2,037
Summary elevations of all current sites					1,993	1,648	2,357
Pika detected sites—old							
Catnip Canyon	19		100	11.0	1,841	1,806	1,899
Guano Rim	3		100	20.5	1,873	1,858	1,888
Rock Springs Table	3		100	10.8	1,972	1,930	1,994
Spanish Flat[a]	5		100	6.1	1,829	1,813	1,850
Swan Canyon	7		100	11.9	1,728	1,625	1,799
Summary elevations of all old sites					1,849	1,625	1,994
Pika nondetection sites							
Alger Lake				22.5	1,663	1,662	1,666
Arsenic Canyon[c]				2.8	1,619	1,524	1,693
Badger Mountain[c]				8.2	1,915	1,890	1,920
Bald Mountain				10.3	2,151	2,016	2,191
Big Springs				12.4	1,553	1,423	1,738
Calcutta Lake				5.8	1,963	1,946	1,981
Catnip Creek				14.1	1,839	1,834	1,849
Guano Slough				22.4	1,599	1,552	1,679
Onion Lake				15.1	1,946	1,945	1,948
Poker Jim Ridge				16.7	1,764	1,709	1,897
Railroad Point				35.9	1,359	1,312	1,381
Riffle Canyon				5.4	1,559	1,408	1,670
Rock Creek Canyon				4.3	1,974	1,955	1,995
Sand Creek[c]				4.9	1,803	1,792	1,806
Stockade Creek[a]				1.6	2,074	2,073	2,255
Stone Corral				6.5	1,691	1,378	1,877
Summary elevations of all nondetection sites					1,780	1,312	2,255

[a] Historical monitoring site (Beever et al. 2003).
[b] Located to the west of Sheldon National Wildlife Refuge.
[c] Minimum and maximum elevations searched are approximate.

Table 2. Minimum and maximum elevations of observed old and recent American pika *Ochotona princeps* sign, Sheldon National Wildlife Refuge, Nevada, and Hart Mountain National Antelope Refuge, Oregon, 2009–2011.

	Min. elevation observed (m)		Max. elevation observed (m)	
Refuge	Old sign	Current sign	Old sign	Current sign
Hart Mountain	1,648	1,810	2,276	2,357
Sheldon	1,625	1,816	2,167	2,166

2011 (Table 1; Figure 1; Table S1, *Supplemental Material*). Evidence of pika occupation included old haypiles (n = 141), fresh haypiles (n = 114), old pellet piles (n = 158), fresh pellet piles (n = 297), vocalizations (n = 86), and visual sightings of individuals (n = 24). We did not attempt to estimate the number of individuals present at occupied sites. Pika sign was distributed on all slope aspects, with higher proportions toward north, northwest, and southeast orientations.

We documented fresh haypiles during all survey months (June to September). Pikas at low elevations (<2,500 m) begin to collect vegetation for winter consumption around mid- to late May (Smith 1974b). Several authors have reported low-elevation pika populations in the Great Basin and adjacent ecosystems with small or undetectable amounts of above-talus haypile material (see summary by Beever et al. 2008). However, on both refuges we documented large, above-talus haypiles that also included the presence of cheatgrass *Bromus tectorum*, as reported by Beever et al. (2008).

Distances between sites (current or old) to the next nearest currently occupied site within Sheldon National Wildlife Refuge and Hart Mountain National Antelope Refuge ranged from 0.7 to 9.9 km (excluding Massacre Rim; Table 1). Distances between nondetection sites and currently occupied sites ranged from 1.6 to 22.5 km. Elevations of current pika occupation were similar between the two refuges. On Hart Mountain National Antelope Refuge, elevations ranged from 1,810 to 2,357 m ($\bar{x}$ = 1,986 ± 116 m); on Sheldon National Wildlife Refuge elevations were between 1,816 and 2,166 m ($\bar{x}$ = 1,958 ± 91 m). Minimum and maximum elevations documented for old vs. current sign were also similar for both refuges (Table 2).

Discussion

Observations of pikas have been recorded in the Great Basin since at least the early 20th century (Grinnell 1917). Hall (1946:590) provided extensive descriptions of pika geographic range in northwestern Nevada, but stated that the animals "are much more widely distributed in northwestern Nevada than our records indicate." However, when surveys failed to detect pikas at all historical locations within Nevada, this suggested a possible extirpation from the state (Beever et al. 2003). Recent discoveries of previously undescribed pika populations at low elevations of the northern and southwestern portions of the Great Basin (Beever et al. 2008; Millar and Westfall 2010; this study), highlight the need for systematic, extensive surveys in poorly studied regions.

Of particular interest is the apparent persistence of pikas at low-elevation sites in the Southeast Oregon and Northwest Nevada portion of the northern Great Basin (this study). All pika-occupied sites were found below 2,500 m; neither refuge has available talus habitat above 2,400 m. Our lowest currently occupied site, at 1,810 m, is comparable to the lower extension of elevational range (1,827 m) reported by Millar and Westfall (2010), although these sites were found in the southwestern Great Basin. Rodhouse et al. (2010) also recently reported on pika occurrence at even lower elevations (1,631 m) within lava flows of the Craters of the Moon National Monument and Preserve to the north of our study site. This elevation closely corresponds to the lower elevational range documented for our old or previously occupied sites on Sheldon National Wildlife Refuge and Hart Mountain National Antelope Refuge (1,625–1,648 m); however, the complexity of the lava flow habitat likely creates a unique microclimate not found on the Sheldon and Hart Mountain National Wildlife Refuges.

On both refuges, the minimum elevations at which old vs. current occupancy of pika were detected were similar. Elevational range contractions of American pikas appear to be pronounced in at least some locations in the Great Basin (Beever et al. 2003; Grayson 2005; Millar and Westfall 2010); it is possible we observed a similar effect at our location. However, pikas have been reported to exhibit island-biogeographic, metapopulation, and source–sink dynamics (Brown 1971; Smith and Gilpin 1997; Lawlor 1998; Moilanen et al. 1998). Metapopulations persist through a balance between extinction and recolonization of habitat patches, and results of decades of census data show that some subpopulations of pikas can frequently go extinct and then be recolonized (Smith and Gilpin 1997). There are reasons to assume that many long-term changes in the distribution and abundance of the species reflect long-term environmental changes; however, dramatic changes may also occur in the absence of long-term environmental trends (Moilanen et al. 1998). Low-elevation distribution data such as ours are important to add to the baseline knowledge of the species and can be used to monitor changes in pika population status over time.

Supplemental Material

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Table S1. Locations of observed American pika *Ochotona princeps* evidences (old and current) at observed minimum and maximum elevations, and

general location of non-detection sites, Sheldon National Wildlife Refuge and Hart Mountain National Antelope Refuge, 2009–2011.

Found at DOI: http://dx.doi.org/10.3996/042012-JFWM-032.S1 (18 KB DOCX).

Reference S1. Ray C, Beever EA. 2007. Distribution and abundance of the American pika (*Ochotona princeps*) within Lava Beds National Monument. Unpublished report. National Park Service.

Found at DOI: http://dx.doi.org/10.3996/042012-JFWM-032.S2; also available at http://www.fws.gov/filedownloads/ftp_region6_upload/FOIA%20READING%20ROOM/FOIA%202010/American%20Pika%2012%20Month/12%20month%20status%20review%20citations/Ray%20and%20Beever%202007.pdf (3681 KB PDF).

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