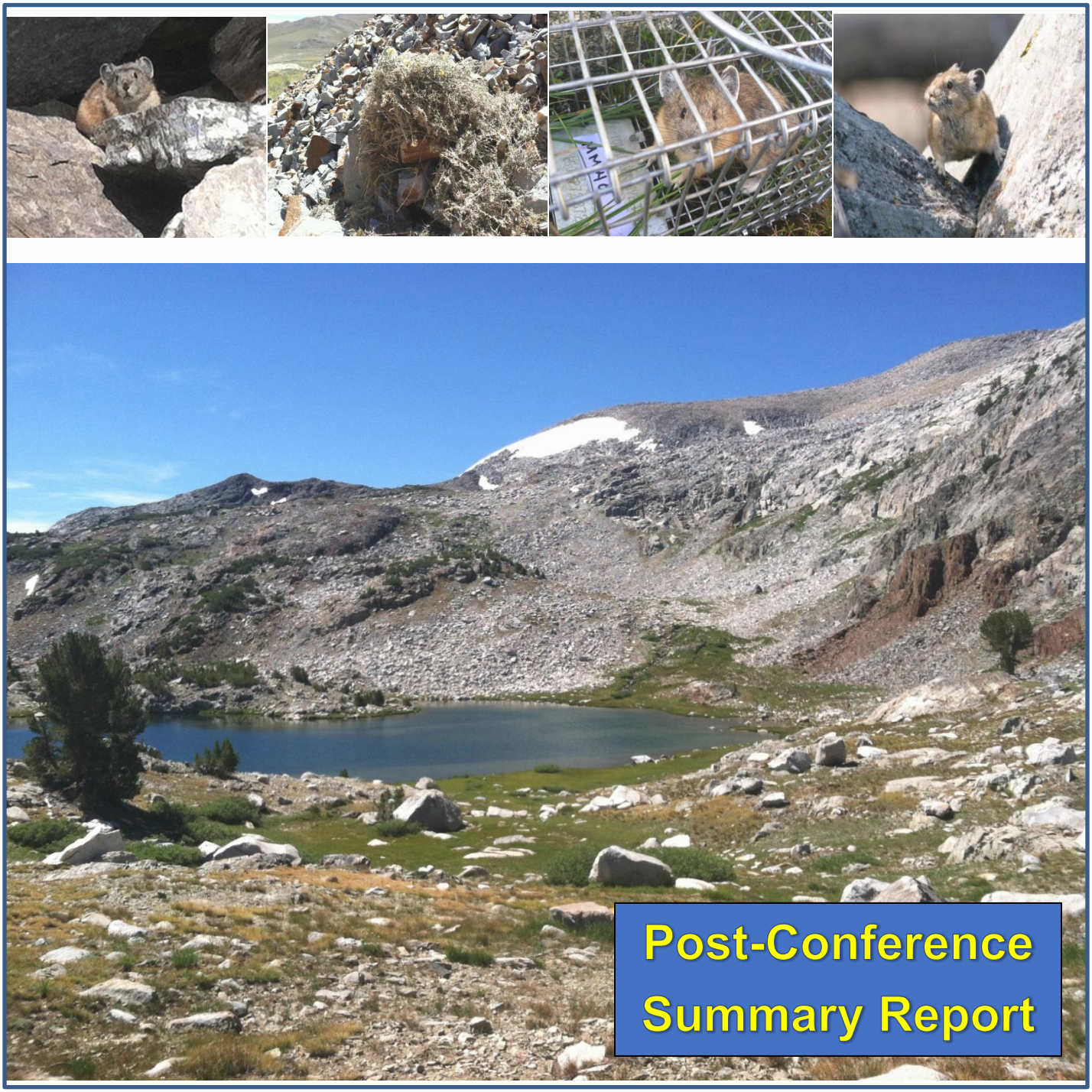
3rd Conference of the North American Pika Consortium

April 17-18th, 2015 • American Mountaineering Center • Golden, Colorado



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3rd North American Pika Conference

Summary Report Overview

APRIL 17-18, 2015 ● AMERICAN MOUNTAINEERING CENTER ● GOLDEN, COLORADO

May 29, 2015

Dear Conference Participant,

Thank you for attending the 3rd Conference of the North American Pika Consortium at the American Mountaineering Center in Golden, Colorado. We had a great turnout of 42 participants and 27 presentations in various formats. Congrats again to Matt Waterhouse for best student talk and to Johanna Varner for best student poster! Furthermore, we want to thank Dr. Preston Somers for his charismatic keynote and our sponsors, Teton Science Schools, Craighead Institute, and Maudes Media, for helping making it all possible.

Enclosed in this summary report, you will find the following:

1. Conference schedule
2. Paper and poster abstracts
3. Participant list
4. Notes from the working group discussions
5. Conference evaluation summary

We hope the conference helped you build relationships and ideas, and we'd like to see that continue. Consequently, Embere Hall got right to work after the conference and created a website for our group. Please check it out at: http://ochotona.wix.com/pikaconsortium. Are you on Facebook? If so, don't forget to "Like" our page at: https://www.facebook.com/americanpikas, and if you'd like to join our "westernpikas" listserv, please email Janet Foley at peroqueen@gmail.com. Once subscribed, you can send emails to all subscribers at westernpikas@ucdavis.edu. Furthermore, Chris Ray has created a pika researcher database that has been posted to Google Sheets. If you are interested in being listed as a pika researcher here, please update the document with your information.

Here are a few more wrap-up items: 1) If you are interested in obtaining one of the snazzy pika shirts, please contact Erik (ebeever@usgs.gov) for order details. 2) Erik also reached out to the California Pika Consortium about the potential for hosting our 4th NAPC Conference in Spring 2017, with positive responses from several folks. We're exploring options for that event; please let us know if you'd like to help with that planning. 3) We know that some participants were interested in having the presentations posted and we are currently looking into options for that. However, with the field season fast approaching, we can't make any promises.

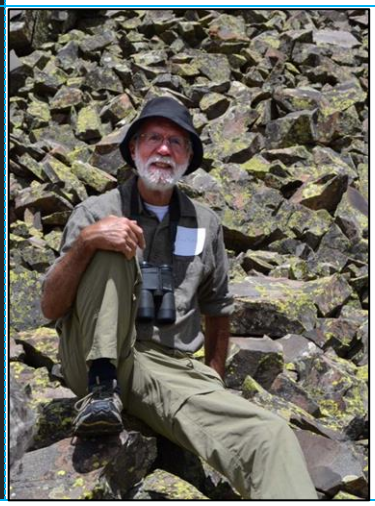
We hope that you enjoyed the conference and we look forward to continued work and collaboration with you.

Sincerely,

-The 2015 NAPC Conference Planning Team (Erik, Chris, Nifer, Liesl, Embere, and Mackenzie)

3rd Conference of the North American Pika Consortium

Friday, April 17, 2015	
8:00 am	**Erik Beever** Welcome & Introduction
8:10 am	**Matthew Waterhouse** University of British Columbia-Okanagan *Genetic evidence for restricted dispersal in American pika across a human-modified landscape*
8:30 am	**Jessica Castillo** Oregon State University *A survey of genetic diversity and structure across space and time for American pikas*
8:50 am	**Hayley C. Lanier** University of Wyoming *Colonization from divergent ancestors: glaciation signatures on contemporary patterns of genomic variation in collared pikas (*Ochotona collaris*)*
9:10 am	**Kelly Klingler** University of Nevada-Reno *A temporal investigation of population genetic structure in the American pika (*Ochotona princeps*) in Bodie, CA*
9:30 am	Break (30 minutes)
10:00 am	**April C. Craighead** Craighead Environmental Research Institute *Developing habitat connectivity models for the American pika (*Ochotona princeps*) using citizen science and field collected data*
10:20 am	**Kristina A. Ernest** Central Washington University *Population connectivity of American pikas across an interstate highway in the Washington Cascades*
10:40 am	**Chris Ray** University of Colorado-Boulder *Pikas in peril? A multi-regional assessment of climate-mediated vulnerability*
11:00 am	Lunch (2 hours)
1:00 pm	**Erik Beever** USGS Northern Rocky Mountain Science Center & Montana State University *Losses of pikas from three regions are linked to temperature and water balance: re-surveys of historic records reflect differences in mainland vs. insular dynamics*
1:20 pm	**Embere Hall** Wyoming Cooperative Fish & Wildlife Research Unit, University of Wyoming *Microrefugia in a warming world: Prime real estate, or just a nice perk?*
1:40 pm	**Sabuj Bhattacharyya** University of Colorado-Boulder *Climate change and foraging efficiency in a territorial herbivore: A decline in winter food-cache quality associated with declining snow cover*
2:00 pm	Break (30 minutes)

	Friday, April 17th, 2015 (continued)
2:30 pm	**James Howe Jr.** University of Colorado-Boulder *Seasonal effects of microhabitat structure on sub-surface microclimates in blocky debris*
2:50 pm	**Erik Beever** USGS Northern Rocky Mountain Science Center & Montana State University *Distribution of a climate-relict species at an interior range margin*
3:10 pm	**Aidan Beers** University of Colorado-Boulder *Fine-scale topographic heterogeneity creates suitable microhabitat for a climate-sensitive habitat specialist, the American pika*
3:30 pm	Break (30 minutes)
4:00 pm	**Meghan Wiebe** University of Colorado-Boulder *Effects of surface and sub-surface temperature on the activity budget of a microhabitat specialist*
4:20 pm	**Katherine Solari** Stanford University *Evidence of variable selection in mitochondrial cytochrome c oxidase genes within the genus* Ochotona
4:40 pm	**Jennifer Wilkening** University of Colorado-Boulder *Determining effects of microclimate on individual survival in the American pika*
5:00 pm	End of Long Presentation Session
7:00 pm	Poster Session **April C. Craighead** *Don't crawl under a rock, look there for pikas! Engaging the public in climate-change science through surveys of a rock rabbit, the American pika* **Johanna Varner** *Too hot to trot? Effects of wildfire disturbance on pika-relevant microclimates* **Marie Louise Westover** *Intra- and interspecific body size patterns of pikas* (Ochotona) *reflect ecology* **Carly Wickhem** *Forage selection by American pikas in relation to highway revegetation plans as a means to improve population connectivity in the Washington Cascades*
7:30 pm	 Keynote Address by **Dr. Preston Somers** Dr. Somers is Professor Emeritus of Biology at Fort Lewis College in Durango, Colorado. From 1968 to the present his research interests have included the ecology and behavior of the American pika with an emphasis on the geographic variations in its vocalizations. Recently he has enjoyed being a volunteer in the PikaNet program.

Saturday, April 18, 2015	
9:00 am	**Narayan Prasad Koju** Tribhuvan University, Nepal *Comparing behaviors of the large-eared pika (*Ochotona macrotis*) in the Himalaya of Nepal with those of the American pika (*Ochotona princeps*)*
9:07 am	**Liesl Peterson Erb** Colorado College *The interactive effects of climate and vegetation on multi-year occupancy of the American pika in the Southern Rocky Mountains*
9:14 am	**Amy Masching** Denver Zoological Foundation *What the Front Range Pika Project can do for you*
9:21 am	**Aaron Johnston** U.S. Geological Survey, Bozeman, MT *Modeling microhabitat of American Pikas with LiDAR*
9:28 am	**Cheryl Blair** Thompson Rivers University *Survival in a low elevation, human-modified landscape: the American pika (*Ochotona princeps*)*
9:35 am	**Mackenzie R. Jeffress** Nevada Department of Wildlife *The Nevada "Pika Blitz": 2014 results and future plans*
10:00 am	Working group meetings: 1) Health and Physiology, 2) Genetics, 3) Field Methods, and 4) Climate
11:30 am	Lunch (1 hour)
12:30 pm	Working group meetings: 1) Research and Review, 2) Education, Citizen Science, and Outreach, and 3) Distribution and Habitat
2:00 pm	Steering committee meeting
3:00 or 3:30 pm	Adjourn

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Paper & Poster Abstracts

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Papers (in order of presentation)

*Denotes presenting author

Genetic evidence for restricted dispersal in American pika across a human-modified landscape

Matthew Waterhouse, Cheryl Blair, Karl Larsen, and Michael Russello, University of British Columbia-Okanagan*

The negative impacts of habitat modifications have been documented in nearly every taxonomic group. However, the ecological outcomes of disturbance and fragmentation are difficult to predict since the effects are often context- and species-specific. Here we investigated the genetic consequences of severe landscape modifications in the form of road construction and mining operations on the American pika. The Highland Valley Copper mine in British Columbia, Canada, is one of the largest open pit copper mines in the world. We sampled 112 pikas across 22 sites in and adjacent to the Highland Valley Copper mine both north and south of a major highway bisecting the region. Based on genotypic data at 11 polymorphic microsatellites, we found evidence for three discrete genetic units, one north and two south of the highway, suggesting this landscape feature acts as a significant barrier to gene flow. Preliminary results found that the extent of site-level genetic variation does not significantly vary within or adjacent to the mine. On-going analyses are being conducted to investigate the extent and direction of gene flow across this human-modified landscape, as well as to assess potential impacts on mating behavior and levels of inbreeding.

***Matthew Waterhouse**, Ph.D. student, University of British Columbia-Okanagan, Kelowna, BC, Canada, matthew.waterhouse@ubc.ca*

A survey of genetic diversity and structure across space and time for American pikas

Jessica A. Castillo and Clinton W. Epps, Oregon State University*

Rapid, contemporary climate change over the past century has already resulted in local extinctions and detectable changes in patterns of occupancy for a number of species. In addition to shaping future habitat suitability, climate change is expected to impact dispersal ability and therefore population connectivity, further complicating predictions of range shifts and species viability. This is particularly true for species with low dispersal ability inhabiting naturally fragmented landscapes, such as the American pika (*Ochotona princeps*). In this study we characterized genetic diversity and population structure in 12 contemporary pika populations throughout the majority of the range of American pikas, as well as two historic populations in California: Lassen Volcanic National Park where the northern Sierra Nevada and southern Cascade Range meet (1923-1926, and 2010-2011), and Yosemite National Park in the central Sierra Nevada range (1915 and 2012-2014). We found no significant changes in genetic diversity in either study area from historic to contemporary, suggesting stability in population size over the last century. However, genetic diversity varied widely across contemporary study sites, as did population structure. We detected changes in population structure in Yosemite National Park, suggesting increased isolation of particular regions within the study area. Our results provide an important benchmark for long-term genetic monitoring of these populations. Our results also emphasize that maintaining functional connectivity, particularly for populations that are characterized by a metapopulation structure, should be a management priority in the face of rapid climate change.

***Jessica Castillo,** Ph.D. candidate, Oregon State University, jessica.castillo@oregonstate.edu*

Colonization from divergent ancestors: glaciation signatures on contemporary patterns of genomic variation in Collared Pikas (*Ochotona collaris*)

Hayley C. Lanier, Rob Massatti, Qixin He, Link E. Olson and, L. Lacey Knowles, University of Wyoming*

Determining the underlying genetic structure of a species and the factors that drive it is an important first step in population management because populations evolving from separate ancestral sources may show potentially different characteristics. In particular, analyses of population connectivity should jointly consider evolutionary history and contemporary environmental variables. This is particularly true for climate-sensitive species of conservation concern, such as pikas. Here, we combine a restriction-associated DNA sequencing (RADSeq) dataset containing 4,156 single nucleotide polymorphisms (SNPs) with ecological niche models of present and past habitat suitability to characterize population structure and evaluate the effects of historical range shifts, contemporary climates, and landscape factors on gene flow in Collared Pikas. Results strongly suggest that current Collared Pika populations originated from a minimum of three divergent source populations, beginning around 148 kya. Despite general correspondence between regional environmental differences and population relatedness, contemporary environmental factors appear to have contributed less to population structure than ancestral source population. In general, populations are quite comparable with respect to generally low genetic diversity within a population and little to no admixture among populations. The predominance of divergent histories structuring populations implies that if we are to understand and manage pika populations we must specifically assess and accurately account for the forces shaping variation and allele sharing among populations.

***Hayley C. Lanier**, Assistant Professor at the University of Wyoming, WY, hlanier@uwyo.edu*

A temporal investigation of population genetic structure in the American pika (*Ochotona princeps*) in Bodie, CA

Kelly Klingler and Mary M. Peacock, University of Nevada, Reno*

Global climate change is likely to be a significant extinction threat for the American pika (*Ochotona princeps*). Large fluctuations in population size due to environmental variability may lead to erosion of genetic variation and therefore evolutionary potential. Long-term monitoring of natural populations provides a powerful tool for understanding species' response to ecological stressors. Here we compare genetic data collected from the Bodie population of *O. princeps* found in the Sierra Nevada (Mono County, CA) during 1988-1991 and 2012-2014. Occupied territories within this highly anthropogenically fragmented site were re-visited for non-invasive collection of fecal DNA within and across field seasons. A Bayesian genotyping clustering approach for grouping individuals based upon multilocus genotype data shows that patterns of movement among habitat patches have not changed over the last 30 years contrary to predicted climate impacts. Microsatellite data suggest a highly fluid movement dynamic among habitat patches among years with the highest statistical support for two genotype clusters (k=2) across years for both datasets. However, in addition to k=2 we did observe statistical support for k=6 in 2013, which supports earlier observations in 1990 and 1991 of local subpopulation clustering. High turnover may contribute to yearly variation in specific genotype cluster membership within local subpopulations. Genetic monitoring of pika populations over time is an important approach towards predicting future impacts of climate change in this thermally-sensitive species.

***Kelly Klingler,** Ph.D. student, University of Nevada, Reno, kbrieklingler@gmail.com*

Developing habitat connectivity models for the American pika (*Ochotona princeps*) using citizen science and field collected data

April Craighead, Craighead Environmental Institute, Brent Brock, Holocene Wildlife Services LLC*

Habitat connectivity models provide researchers a tool to understand movement and dispersal of species over heterogeneous landscapes. This is important in the face of climate change as species move upslope or change latitude to find suitable habitat. Habitat models were developed at two scales to predict areas of connectivity for the climate sensitive American pika within southwestern Montana. We developed habitat models using logistic regression and GIS to predict pika connectivity at a watershed and regional scale. The watershed scale model used data collected in the field and the broad scale model utilized citizen science data for pika locations and readily available GIS layers. Current research indicates that pikas select suitable habitat at fine scales (temperature, talus matrices and plant selection) however their ability to disperse to habitats and refugia is unknown at either watershed or broad scales. The broad-scale model for pika habitat performed well but we found the resolution of readily available GIS layers (≥ 30 meter pixels) makes it difficult to predict pika habitat selection within watersheds. Fine scale modeling of pika habitat could likely be achieved if LiDAR data were readily available for mountainous areas however the current cost proves to be prohibitive. Utilizing multiple analyses (habitat connectivity models and genetic connectivity analysis) might provide the best predictor of pika habitat now and into the future.

***April C. Craighead**, Wildlife Biologist, Craighead Environmental Institute, Bozeman, MT, april@craigheadinstitute.org*

Population connectivity of American pikas across an interstate highway in the Washington Cascades

Kristina A. Ernest, Stanford University*

Habitat for American pikas (*Ochotona princeps*) in the Cascade Range of Washington is bisected by an interstate highway (I90). Construction is in progress to expand the number of lanes in a 15-mile section of the highway east of Snoqualmie Pass, while also enhancing population and ecosystem connectivity by perforating this presumed wildlife barrier with wildlife crossing structures. Pikas in this region occupy both natural rocky patches on mountain slopes and human-made rocky patches along roadways. Since 2008, before any wildlife crossing structures were built, we have investigated pika occupancy patterns and habitat use to eventually assess the effectiveness of crossing structures in improving connectivity. We conducted occupancy surveys at over 100 sites, quantified pika habitat, monitored newly created rock patches for colonization by pikas, tracked movements by radio-collared individuals, and collected genetic samples. Patch occupancy has been relatively high, varying between 75 and 95% most years. Approximately 10-15% of sites show dynamics in occupancy, with apparent local extinction or re-colonization between years. Many of the anthropogenic sites are relatively small, with few resident pikas, but are within typical dispersal distances (for pikas) from other occupied patches. These conditions may contribute to both the relatively high rate of occupancy by pikas, and the quick colonization of new rocky patches that have formed as a result of construction activities along the highway. While long-term effects of the highway construction will take years to decipher, early signs indicate that pikas might be more resilient than we had predicted.

***Kristina A. Ernest,** Biology Professor, Central Washington University, Ellensburg, WA ernestk@cwu.edu*

Pikas in peril? A multi-regional assessment of climate-mediated vulnerability

Donelle Schwalm, Clinton W. Epps, Thomas J. Rodhouse, William B. Monahan, Jessica A. Castillo, Chris Ray, and Mackenzie Jeffress*

Many species will lose ground to climate change if climate is the dominant driver of species-range dynamics. However, climate-mediated losses can be countered by other factors, including habitat quality and connectivity. We evaluated the dominance of climatic controls in a multi-regional study of the American pika (*Ochotona princeps*), a species often identified as climate-sensitive. Our objectives were to sample and model current patterns of pika occurrence and gene flow in eight National Park landscapes, rank climatic and other predictors of occurrence, and project pika dynamics in each landscape. In 2010-2012, we determined pika occurrence patterns in each park, and collected fecal samples for genetic analysis of dispersal. We modeled current and future pika occurrence using indices of heat stress, cold stress, growing season and habitat connectivity. Connectivity was based on our park-specific dispersal estimates. To generate a sample of future predictor values, we used eight climate projections combined with moderate to high carbon-forcing scenarios. We found that topographic position and vegetation influenced contemporary pika occurrence in all parks, but climatic drivers varied from heat stress in the driest parks to cold stress in the wetter parks. Dispersal was impeded by south-facing aspects and steep terrain, but increased wherever rocky habitats were sufficiently contiguous. Local habitat availability and dispersal influenced the pika's vulnerability to climate change in each park. Our projections ranged from complete extirpation in some parks to stable occupancy in others. Notably, habitat composition and connectivity frequently outranked climate in predicting occupancy for this climate-sensitive species.

Chris Ray, *Quantitative Ecologist***,** *University of Colorado-Boulder, cray@colorado.edu*

Losses of pikas from three regions are linked to temperature and water balance: re-survey of historic records, mainland vs. insular dynamics

Erik A. Beever, U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, MT, John D. Perrine, California Polytechnic State University, San Luis Obispo, CA, Tom Rickman, U.S. Forest Service, Lassen National Forest, Susanville, CA, Mary Flores, U.S. Forest Service, Modoc National Forest, Alturas, CA, John P. Clark, U.S. Forest Service, Modoc National Forest, Alturas, CA, Cassie Waters, National Park Service, Zion National Park, Springdale, UT, Shana Weber, Princeton University, Princeton, NJ, Braden Yardley, National Park Service, Cedar Breaks National Monument, Cedar City, UT, David Thoma, National Park Service, Colorado Plateau Inventory & Monitoring Network, Bozeman, MT, Tara Chesley-Preston, Institute on Ecosystems, Montana State University, Bozeman, MT, Michael Magnuson, National Park Service, Lassen Volcanic National Park, Mineral, CA, Nancy Nordensten, National Park Service, Lava Beds National Monument, Tulelake, CA, and Melissa Nelson, Bureau of Land Management, Eagle Lake Field Office, Susanville, CA*

The juxtaposition of apparent trend of pika distribution in the mainland Sierra Nevada and Rocky Mountains versus in the hydrographic Great Basin illustrates the nuance with which contemporary climate changes and other factors may act on wildlife species, and begs for a unifying framework. To begin to compare the relative importance of climatic and other factors in mainland versus insular populations, we performed pika surveys at >650 locations (nested within 34 sites) in three geographic regions of western North America, primarily during June-November 2014. In each region, we found widespread evidence of range contraction (i.e., local extirpations, upslope retractions, and encounter of only old sign). Locally comprehensive surveys suggest extirpation of *O. princeps* from four of six

sites previously unreported from the hydrographic Great Basin, and from 8 of 23 sites in northeastern California. Despite records from as recent as 2011 and 2012 in Zion and Cedar Breaks NPS units in Utah, *O. princeps* appears extirpated from all reported localities, there. Logistic regressions suggested that the ability of temperature-related variables to predict pika persistence was nearly rivaled by that of water-balance-related metrics estimated from DAYMET, and these strongly predicted persistence in the Great Basin and in Utah but not in northeastern California. Whereas local talus extent has driven patterns of persistence in the Sierras, our data do not support this effect in Utah or the Basin. These trends must be viewed in concert with new reports of previously undocumented pika occurrences in the northern Great Basin and western edge of the Sierra Nevada massif.

Erik Beever, *Research Ecologist U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, MT, EBeever10@gmail.com*

Microrefugia in a warming world: Prime real estate, or just a nice perk?

Embere Hall, Wyoming Cooperative Fish and Wildlife Research Unit, Department of Zoology and Physiology, University of Wyoming, Anna Chalfoun, U.S. Geological Survey, Wyoming Cooperative Fish and Wildlife Research Unit, Department of Zoology and Physiology, University of Wyoming, Erik Beever, U.S. Geological Survey, Northern Rocky Mountain Science Center, Annie Loosen, Unaffiliated, and Kerry Murphy, U.S. Forest Service, Bridger-Teton National Forest*

Rapid climate change affects nearly all biomes, causing notable shifts in phenology, community ecology and extinction dynamics. Favorable microclimates may buffer organisms against rapid change, thereby allowing time for populations to adapt. The degree to which microclimates facilitate the persistence of climate-sensitive species, however, is largely an open question. We addressed whether the importance of favorable microclimates was context-dependent in mammalian thermal specialists, using the American pika (*Ochotona princeps*) as a model organism. We tested four hypotheses about the relationship between microclimates and pika occurrence: 1) Local habitat hypothesis; 2) Subsurface microrefugia hypothesis; 3) Surface temperature hypothesis; and 4) Context-dependent hypothesis. We examined pika occurrence at 146 sites arranged along a gradient of elevation. Site characteristics such as slope, aspect and forage availability were measured at each site. We deployed 40 pairs of temperature loggers at a subset of points to quantify how much the subterranean environment moderated surface temperatures. Relative support for competing hypotheses was quantified using logistic-regression models in an AICc framework. We found unequivocal support for the subsurface microrefugia hypothesis. Pikas were more likely to occur at sites where the subsurface environment substantially moderated surface temperatures. Microrefugium (surface temperature – subsurface temperature) was the single strongest predictor of pika occurrence, independent of other biotic characteristics. By buffering ambient temperatures, microrefugia likely influence where temperature-limited animals can persist in rapidly warming environments. As climate change continues to manifest, efforts to understand the changing dynamics of animal-habitat relationships will be enhanced by considering both the availability and quality of microrefugia.

Embere Hall *Ph.D. candidate, Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming, emberehall@gmail.com*

Climate change and foraging efficiency in a territorial herbivore: A decline in winter food-cache quality associated with declining snow cover

Sabuj Bhattacharyya and Chris Ray*

For a sub-surface habitat specialist like the American pika (*Ochotona princeps*), the most immediate effects of climate change might be related to surface activities and surface resources. We hypothesized that climate change might impact this territorial herbivore by 1) reducing the quality of available forage and 2) limiting surface activities like food-cache construction. To test these hypotheses, pika food caches and available forage were sampled in two locations in the south-central Rocky Mountains for a comparative study spanning two decades. To facilitate temporal comparisons, our contemporary quantification of forage characteristics followed methods used previously at each site. Contemporary pikas at each site were found to prefer plant species high in moisture and nitrogen, and low in fiber and secondary metabolites. However, plant species low in moisture and nitrogen, and high in fiber, have become more abundant in the environment and in pika food caches at the lower latitude study site. Earlier snow melt at this lower latitude site might have reduced soil moisture, reducing the abundance of moist meadow species like *Geum rossii*, which is relatively high in nutrients, and increasing the abundance of some graminoids and *Minuartia obtusiloba*, which are relatively low in nutrients. Changes in forage and foraging behavior were not significant at the higher latitude site, and the duration of snow cover did not change at that site. Pikas at the lower latitude site may face nutritional deficiencies, especially if the observed changes in climate and available forage continue.

Sabuj Bhattacharyya, Ph.D. *Centre for Ecological Sciences, Indian Institute of Science, Bangalore, India, bhattacharyyasabuj@gmail.com*

Seasonal effects of microhabitat structure on sub-surface microclimates in blocky debris

James Howe Jr., Christian Prince and Chris Ray*

The current distribution of the American pika is distinctively constrained to habitats consisting of blocky debris (such as talus), often underlain by ice. This microhabitat offers relatively cool refuge during the summer and is commonly insulated by snow cover during the winter. Pikas are known to use these microhabitats to shed heat during the summer and to escape extreme temperatures year-round. However, little is known about how these sub-surface microclimates vary with surface features and microhabitat structure. We used a comparative approach to characterize sub-surface temperatures in blocky debris relative to aspect, elevation, debris depth, canopy cover, sub-surface water flow, and cavity size (indexed by rock size). Data loggers were placed in "shallow" (<10 cm) and "deep" (>50 cm) sub-surface positions to record temperatures during 2013-2014 at sites on and adjacent to Niwot Ridge in Boulder County, Colorado, USA. In shallow positions during winter, average temperatures in a talus patch were significantly warmer toward patch edges, and significantly colder at higher elevations and on north-facing slopes. During summer, average temperatures in deep cavities showed no significant effect of aspect, but declined significantly with increasing elevation at a sub-surface lapse rate of nearly 1°C per 100 vertical meters. Excluding shallow placements, average temperatures declined significantly with cavity depth, at almost 6°C per meter. Canopy cover had a moderating effect on temperature in shallow cavities, and sub-surface water flow moderated temperature in deep cavities. Finally, the difference and lag in temperature between shallow and deep cavities declined significantly with cavity size.

James Howe, Jr*. Recent graduate, University of Colorado-Boulder, James.HoweJr@colorado.edu*

Distribution of a climate-relict species at an interior range margin

Chris Ray, Institute for Arctic and Alpine Research, University of Colorado-Boulder, 450 UCB, Boulder, CO 80309-0450, and Erik Beever, U.S. Geological Survey, Northern Rocky Mountain Science Center, 2327 University Way, Ste. 2, Bozeman, MT 59715 , PrefT.J. Rodhouse, National Park Service, Upper Columbia Basin Network, Bend, OR 97701*

Pikas in Lava Beds National Monument, northeastern California, occur at elevations much lower than predicted by the Monument's latitude and longitude, suggesting the presence of microhabitat important for pikas. We hypothesized that pika occurrence within Lava Beds would: a) be associated primarily with structurally complex, thick lava features such as "ice caves" in which sub-surface ice persists outside the winter months, b) reflect reserve-style management, or c) reflect local forage resources. Temperature-logger data confirmed that sub-surface (shaded) temperatures were cooler and more stable at cave entrances than at non-cave sites. We also recorded habitat characteristics and evidence of pika occupancy at randomly selected cave and non-cave sites over two years. Overall occupancy varied from 27% in summer 2005 to 69% in summer 2006. Contrary to our hypothesis, occupancy was not higher at cave sites. In 2005, occupancy of cave and non-cave sites was similar; but in 2006, occupancy was significantly lower at cave sites. Vegetation metrics were the best predictors of site use by pikas, followed by distance to the nearest edge (lava-soil interface) of the flow containing the site, and elevation. The importance of vegetation as a predictor of pika distribution at this interior range margin is congruent with recent studies from other portions of the species' range. However, we caution that vegetation composition and chemistry depend on microclimate, which may be the proximal driver of pika distribution. Although pikas have been lost from structurally simpler talus, they persist throughout the Monument, even far from ice-cave and lava-tube-collapse refugia.

Erik Beever, *Research Ecologist, U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, M, EBeever10@gmail.com*

Fine-scale topographic heterogeneity creates suitable microhabitat for a climate-sensitive habitat specialist, the American pika

Aidan Beers, Rob Guralnick, and Chris Ray*

Climate change is likely to affect mountainous areas unevenly due to the complex interactions between topography, vegetation, and the accumulation of snow and ice. This heterogeneity might complicate relationships between species presence and large-scale spatial drivers such as precipitation, especially in species that require different resources in different seasons. We studied the potential for fine-scale variation in climate and habitat use in the American pika, a species known for strong microhabitat associations but virtually unstudied during the winter season. In this study we used radio telemetry to track pika position and movements through winter and into summer in order to pinpoint the habitat that pikas need to survive the extreme conditions at nearly 3400 m in the southern Rocky Mountains, USA. We tracked conditions with light and temperature sensitive data loggers in the talus to detect fine variation in subsurface temperature and snow cover. We used metrics of fine-scale topography from a Lidar-derived DEM to model the effects of the terrain on snow cover and pika presence against pseudo-absence points in logistic regressions. We found that pikas are more likely to spend time in both winter and summer in areas of greater terrain heterogeneity, but not necessarily all measures of sheltered habitat. This suggests that not all areas of talus habitat are equally suitable as shelter from extreme conditions. Future occupancy modeling

might therefore benefit from accounting for fine-scale variation in the climate and terrain factors that drive pika occupancy.

Aidan Beers *Graduate Student, University of Colorado- Boulder, aidan.beers@colorado.edu*

Effects of surface and sub-surface temperature on the activity budget of a microhabitat specialist

**Meghan Wiebe, Maxwell Plichta, Heather Batts, Sara McLaughlin, Jessica Johnson and Chris Ray*

Small mammals that make use of sub-surface microclimates might be able to adapt quickly to a warming climate by altering the amount and timing of certain surface activities. For example, energy-intensive territorial defense or foraging activities might be shifted to cooler times of day. We explored this hypothesis using data on the American pika (*Ochotona princeps*), a small, diurnal lagomorph that uses talus and other rocky microhabitats for shedding heat between bouts of surface activity. Over three consecutive summers (mid-June to mid-August, 2012-2014), we conducted 128 observations (45 minutes each) involving N = 69 unique pikas, using a standardized protocol to record behaviors during continuous focal-animal sampling. During each observation, data loggers were used to record shade temperatures in surface and sub-surface microhabitats available to the focal pika. Most observations were conducted at the Niwot Ridge Long Term Ecological Research site in Boulder County, Colorado (USA), with the goal of comparing historical data from this site with contemporary and future data. Here, we report a contemporary, temperature-indexed activity budget for pikas in this area. Surface temperatures averaged 5-10°C higher than sub-surface temperatures during our diurnal observations, and pikas spent 40-70% of their time below the surface. Surface activity was inversely related to surface temperature but directly related to the potential for behavioral thermoregulation (PBT), indexed as surface minus sub-surface temperature. Foraging and other energy-intensive activities declined significantly with surface temperature or with PBT, while the frequency of vocalizations increased, suggesting a shift in strategy for vigilance and/or territorial defense.

Meghan Wiebe *Undergraduate Student, University of Colorado-Boulder, Meghan.Wiebe@colorado.edu*

Evidence of variable selection in mitochondrial cytochrome c oxidase genes within the genus *Ochotona*

Katherine Solari and Elizabeth Hadly*

Although pikas are associated with cold environments, not all species evolved at high elevations. The *Ochotona* genus spans from sea level to 6400 m, with individual species occupying unique elevational ranges. In response to climate change, pikas are shifting to cooler environments, which are generally poleward or upslope. However, the physiological mechanisms that will influence their survival in oxygen-limited high elevation refuges are poorly understood. Cytochrome c oxidase (COX) is an enzyme crucial to mitochondrial respiration, having the potential to directly compensate for demands presented by a limited oxygen supply. The three COX subunits (COX1, COX2, and COX3) that are encoded in the mitochondrial genome create the catalytic core of COX and are well conserved across eukaryotes. Thus, mitochondrial COX genes make strong candidate genes for investigating adaptations to hypoxia in the genus *Ochotona*. We have sequenced COX1, COX2 and COX3 for 11 pika species across the *Ochotona* phylogeny and have identified many variable amino acid sites in each subunit. This molecular data was analyzed using the software TreeSAAP to investigate evidence of positive selection. This analysis revealed radical destabilizing selection acting on two amino acid properties in COX1, one in COX2 and four in COX3. Upon categorizing mutations as either

increasing or decreasing the efficiency of the protein, we see a significant positive relationship between the number of mutations increasing the efficiency of the protein and the elevation occupied by that pika species, consistent with the hypothesis that COX is playing a role in hypoxia tolerance in pikas.

Katherine Solari *Ph.D. student, Stanford University, ksolari@stanford.edu*

Determining effects of microclimate on individual survival in the American pika

**Jennifer Wilkening and Chris Ray*

With the rise of environmental niche modeling, it has become popular to project how climate change will alter the distribution of a species. Such models extrapolate future dynamics based on contemporary correlations between species occurrence and climate. Lacking a mechanistic basis, these models are useful mainly to prompt further research. For example, the American pika (*Ochotona princeps*) has been predicted to lose a majority of currently suitable habitat during this century under some climate projections. We have investigated a mechanistic basis for this prediction, relating individual survival and physiological stress to the microclimates that pikas experience. Pikas were marked, sampled and released at several study sites in the Rocky Mountains during 2008-2013. Blood and fresh fecal samples were collected for enzyme-immunoassay analyses to measure acute and chronic stress in each pika, indexed by glucocorticoid stress hormones and their metabolites. Survival of marked pikas was estimated via program MARK using an annual re-sight protocol. Microclimatic data were collected using temperature data loggers positioned in each marked pika's territory. Individual survival was well predicted by our metric of chronic stress: pikas that survived one year after sampling (N = 33) had initial stress hormone levels almost 60% lower than pikas that did not survive (N = 49). We further characterized relationships between microclimate, stress metrics and individual survival using structural equation models. Results suggest mechanistic effects of microclimate on physiological stress and survival. We present our methods as a feasible approach for characterizing mechanistic relationships that drive population and range dynamics.

Jennifer (Nifer) Wilkening *Ph.D.***,** *University of Colorado-Boulder, Jennifer.Wilkening@colorado.edu*

Comparing behaviors of the large-eared pika (*Ochotona macrotis*) in the Himalaya of Nepal with those of the American pika (*Ochotona princeps*)

Narayan Prasad Koju, Mukesh Kumar Chalise, and Jiang Xuelong*

Differences in the behavior of closely related species may indicate differences in ecology and species-habitat interactions. This phenomenon is important for understanding and conserving species of special concern. The behavior of *Ochotona macrotis* was studied in Langtang National Park (LNP), Nepal, using focal scan sampling. Data from 684 hours of sampling (representing 129 days and all four seasons) were compared with published data on *O. princeps*, to evaluate differences in food hoarding, calling, parental care, geophagy and fur coloration. In LNP, *O. macrotis* spent only 0.025% (0.075trips/hr) of its annual time budget in activities related to food hoarding, much less than reported for *O. princeps* (13 trips/hr) at similar elevations (3600-3900 masl). Although *O. princeps* makes strong and frequent calls, *O. macrotis* was observed calling only 0.92% of the time in summer and not at all in winter. Several behaviors observed in *O. macrotis* appear much less common in *O. princeps*. For example, adult *O. macrotis* were observed carrying young 2-3 times every 3-4 days in June, by biting the nape. Also, *O. macrotis* was observed licking rocks and soil frequently (12% of

foraging and 1.3% of total behavior) during winter. But licking self-body parts, yawning and snow eating behavior reported in *O. princeps* were not observed in *O. macrotis*. Finally, seasonal changes in pelage coloration were more noticeable in *O. macrotis* than reported for *O. princeps*. Reduced hoarding and calling behaviors, and extended parental care, may be evolutionary adaptations to avoid predators.

Narayan Prasad Koju *Ph.D. student, Tribhuvan University, Bhaktapur, Nepal, npkoju.2003@gmail.com*

The interactive effects of climate and vegetation on multi-year occupancy of the American pika in the Southern Rocky Mountains

**Liesl P. Erb, Chris Ray, and Robert Guralnick*

Documenting the pace and drivers of species declines is particularly challenging for taxa exhibiting source-sink dynamics, where absences may reflect either short term response to environmental stochasticity or the beginnings of long-term decline. To distinguish normal population fluctuations from a conservation crisis, species must be monitored for multiple years. Here we determine multi-year occupancy related to climatic and habitat factors in *Ochotona princeps*, a taxon known for source-sink dynamics. This research was conducted at 19 sites in the Southern Rocky Mountains of New Mexico, Colorado, and Wyoming, USA (35° 20′ N to 41° 30′ and -104° 54′ to -108° 17′ W). Climate, vegetation, and other habitat features were investigated as potential drivers of average pika occupancy, which was determined via field surveys. We evaluated the relative support for persistent drivers of pika occupancy in this region by comparing models of multi-year occupancy using an information-theoretic approach. While the majority of pika populations (74%) in this study were maintained from 2008-2011, two of 19 sites lacked pikas in all four years and four sites lacked pikas in at least one of four survey years. Logistic regression modeling indicates high summer average temperatures and low vegetation quality, in the form of high graminoid to forb ratios, explain pika population extirpations in this region. These same factors have explained patterns of pika occupancy in other regions, and our multi-year study indicates that these trends are likely occurring over broad spatial and temporal scales.

Liesl P. Erb *Visiting Lecturer, Colorado College, Colorado Springs, CO, peterson.liesl@gmail.com*

What the Front Range Pika Project Can Do for You

*Megan Mueller, Amy Masching**

The Front Range Pika Project is a citizen science program that engages the public in conservation research on the American pika in Colorado. Pika Patrol volunteers follow monitoring protocols to collect data about pikas and their habitat at high altitude field sites, thereby informing efforts to assess whether pikas are impacted by climate change. Created in tandem with other pika citizen science programs, the Front Range Pika Project provides long-term data to aid the conservation of this little-understood alpine species and its associated habitats.Thanks to significant assistance from our science advisers and partners, the data collected through the Front Range Pika Project is not only rigorous, it is accessible to any researcher who wishes to utilize it. The data is available via the project website at www.pikapartners.org. This presentation will briefly demonstrate the data collected by Pika Patrol volunteers and how scientists may access it for their research.

Amy Masching, *Conservation Outreach Coordinator,* *Denver Zoological Foundation, Denver, CO, amasching@denverzoo.org*

Modeling Microhabitat of American Pikas with LiDAR

Aaron Johnston and Erik Beever, U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, MT*

Habitat suitability maps are useful for conservation planning and testing hypotheses about species distributions, yet development of high-resolution maps for American pikas (*Ochotona princeps*) has been limited because of difficulty in mapping important features such as talus and microclimate. Talus can be apparent in some aerial photographs, but widely available photos often have inadequate resolution to discern rock sizes important to pikas (0.2-1 m diameter) and cannot describe microtopography beneath canopy. Airborne LiDAR (light detection and ranging) has good potential to characterize talus at resolutions biologically meaningful to pikas because it models 3-dimensional structure with high accuracy and can be effective for subcanopy modeling. Similarly, existing climate data is too coarse for modeling microrefugia important to pikas, but new methods allow precise predictions of microclimate based on physiography, weather station data, and networks of microclimate sensors. The objectives of this study are to 1) develop high-resolution maps of talus through fusion of LiDAR and aerial imagery, 2) develop microclimate maps, and 3) test hypotheses about the distribution of pikas based on talus distribution and microclimate. We will map habitat suitability and connectivity for pikas at high-resolution (~20 m) across broad study areas (>20,000 ha) that encompass a range of climatic and physiographic conditions. We expect pikas to occupy cool microhabitats where habitat connectivity is high. This study will increase understanding of pika responses to climate change, inform conservation strategies, and provide map products applicable to many research areas including ecology, geomorphology, hazard assessment, and hydrology.

***Aaron Johnston**, Postdoctoral Scholar, U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, MT, gotrhythm@gmail.com*

Survival in a low elevation, human-modified landscape: the American pika (*Ochotona princeps*)

Cheryl Blair, Dr. Karl Larsen, Thompson Rivers University*

The American pika (Order Lagomorpha: *Ochotona princeps*) has long been considered an obligate inhabitant of alpine talus, with relatively low dispersal capability as well as high sensitivity to temperatures above 25.5C and below -5C. Current research and climate forecast suggests that 80% of the species' range will disappear by 2080. However, recent work by ourselves and others reveal this animal to have broader habitat associations than previously reported. In British Columbia, Canada, a population of pikas occupies in a hot, arid, low-elevation (approx. 1300-1500 m asl) "anthropogenic" landscape created through mining reclamation. To understand better how these animals are functioning outside of their expected "bioclimatic" envelope, we conducted comparative research from 2012-2014 on this population and conspecifics inhabiting natural, neighboring habitat. A total of 89 pikas were trapped in natural areas and 95 were trapped in disturbed areas. A subset of both adults and juveniles were collared to attain further insight into habitat use, dispersal and mortality. Analysis revealed no significance between the two habitats in adult over-summer survival (Ps=0.62 and 0.52). Differences in overwinter survival were only borderline significant over the second winter of the study (P=0.064). Our other habitat comparisons included temperature profiles of 70 den sites that were monitored using dataloggers. These data suggest that the ability of anthropogenic rock structures to insulate against high surface temperatures over summer was comparable to that of natural talus (all Ps>0.05) although there was more variance in the anthropogenic den sites. Our results indicate that animal survival in anthropogenic sites is comparable to those in natural sites,

although further population enumeration would be beneficial in determining long-term pika population viability in this region. This work contributes to improving reclamation efforts of human-disturbed habitat for the purposes of wildlife conservation.

Cheryl Blair *Master's student, Thompson Rivers University Kamloops, British Columbia, CA, squrrl@hotmail.com*

The Nevada "Pika Blitz": 2014 results and future plans

**Mackenzie R. Jeffress, Nevada Department of Wildlife*

While much of the latest research implicating climate change in contemporary pika range retractions and local population losses has focused on the Great Basin, there remain many knowledge gaps for the species in this area, particularly in Nevada. The Nevada Department of Wildlife (NDOW) has identified the American pika as a "Species of Conservation Priority" in the state's Wildlife Action Plan, and one of the goals for the NDOW is to conduct a statewide pika inventory. The distribution of pikas in Nevada is mostly known from historical records and opportunistic sightings but several mountain ranges with potential habitat remain unexplored. Furthermore, the distribution in many of the known ranges is unclear. The NDOW initiated discovery surveys in the form of a "Pika Blitz" in 2014. The overall goal of the blitz was to survey potential pika habitat for evidence of current or recent pika occupancy, including explorations of unexplored ranges as well as expanding on and resurveying previously occupied areas. The 2014 surveys resulted in pikas being found in previously undocumented areas, including new portions of the Hays Canyon Range in northwest Nevada. Genetic samples were also opportunistically collected and past survey data and reports from other researchers were compiled into a master database for the NDOW. The NDOW hopes to continue pika surveys in the coming years and results will be used to develop a more refined potential habitat model and distribution map for Nevada, to support focused research questions, and to develop a long-term monitoring program.

Mackenzie Jeffress, *Wildlife Diversity Biologist, Nevada Department of Wildlife, Elko, NV, mrjeffress@ndow.org*

Posters (alphabetical by first author)

Don't crawl under a rock, look there for pikas! Engaging the public in climate-change science through surveys of a rock rabbit, the American pika

Johanna Varner (University of Utah), Liesl Erb (Colorado College), April Craighead (Craighead Institute), Amy Masching (Denver Zoological Association), Lucas Moyer-Horner (University of Utah), Megan Mueller (Rocky Mountain Wild), Emily Olson (Mountain Studies Institute), Chris Ray (University of Colorado, Boulder), William Simpson (US Fish and Wildlife Service), Shankar Shivappa (Cascades Pika Watch), Mike Weddle (Jane Goodall Environmental Middle School)*

Engaging humanity in the issue of climate change is one of today's grand challenges. One promising avenue for increasing engagement is public participation in research projects that document local environmental changes. The American pika (*Ochotona princeps*) is an ideal focus for citizen science with respect to climate change. Pikas are small mountain mammals that are charismatic, easy to identify, and accessible in popular recreation areas. These traits, paired with concerns about recent pika population declines, have made pikas popular with citizen science efforts throughout the western United States. More than ten formal projects across seven states are training citizen scientists to monitor the status of pikas. These include several programs specifically for K-12 students. Here, we summarize the scientific insights and educational impacts of public participation in pika research. A comparison of pika detections between volunteers and professional field crews suggests that citizen-collected data are reliable and can be used to identify changes in pika distribution and density. Public observations have since led to high-impact discoveries about the biology of the species, and surveys suggest that participation also helps volunteers appreciate the causes and consequences of climate change. However, data synthesis across projects has proven challenging, particularly with respect to reconciling disparate survey protocols. Overall, our analysis suggests that pika research can be a powerful platform for public engagement in climate change, but future attention is needed to balance educational, scientific and management objectives in project design.

***April C. Craighead**, Wildlife Biologist, Craighead Environmental Institute, Bozeman, MT, april@craigheadinstitute.org*

Too hot to trot? Effects of wildfire disturbance on pika-relevant microclimates

Johanna Varner, Mallory Lambert, Joshua J. Horns, Laurie Dizney, Erik A. Beever, M. Denise Dearing, University of Utah*

Wildfires have increased in frequency and severity across western North America, but little is known about the potential threat of altered fire regimes to pikas and other wildlife. Pikas may be particularly vulnerable to altered fire regimes because their current distribution overlaps extensively with areas predicted to experience more wildfires as a result of climate change. Here, we leverage an unexpected opportunity to investigate the impact of a severe wildfire on the American pika (*Ochotona princeps*). In August 2011, we surveyed for pikas at several sites in the Mt. Hood National Forest. Shortly thereafter, a large forest fire burned many of these sites, including 2 sites where our dataloggers were recording temperatures in the talus interstices. In the post-fire years (2012-2014), we returned to measure vegetation availability, talus microclimates, and pika abundance at 24 sites on Mt. Hood. During the fire, temperatures remained cool in the talus habitat, suggesting that pikas could have survived *in situ*. Pikas quickly recolonized all sites, even those with very little food resources. This widespread distribution may be due to a quick recovery of vegetation and the fact that the fire did not alter the talus microclimates in the following years. Taken together, these results highlight the

value of talus as a thermal refuge for small animals during and after fire. Large-scale studies of wildfires are impossible to plan and conduct; thus, capitalizing on information provided by such unpredicted events is important for understanding their impacts.

Johanna Varner *Ph.D. candidate, University of Utah, Salt Lake City, UT 84112, johanna.varner@utah.edu*

Intra- and interspecific body size patterns of pikas *(Ochotona)* reflect ecology

Marie L. Westover and Felisa A. Smith*, University of New Mexico

Body size is a universal character among organisms that strongly influences life history, behavior and physiology, including climatic tolerance. Bergmann's rule describes the pattern that species within a genus generally have larger body sizes at higher latitudes, supposedly as a proxy for temperature variation. The underlying mechanism for Bergmann's rule, and how well it holds between biological levels is not well understood. Here, I test the extent to which pikas (*Ochotona*) conform to Bergmann's rule and which climate variables correlate with body mass for: a) species within the genus, and b) populations within a widely distributed species, *O. princeps*. I compared the body mass of georeferenced *O. princeps* specimens and *Ochotona* species ranges with numerous bioclimatic variables in a GIS. I found that burrow dwelling and rock dwelling species exhibit different patterns in response to climate. Burrow dwelling pikas are smaller in areas of increased annual precipitation, while rock dwelling pikas respond most strongly to precipitation in the warmest quarter. *O. princeps*, like other rock dwelling pikas, also tends to be larger in areas with increased precipitation in the warmest quarter. No group significantly conforms to Bergmann's rule in response to temperature. Burrow dwelling pikas are more responsive to climate variables than rock dwelling pikas, suggesting that they are more influenced by the physical environment. While NPP does not significantly influence pika body size, it appears that the timing of precipitation and thus available forage may influence body size trends.

Marie Louise Westover *Graduate Student, University of New Mexico, mariewestover@gmail.com*

Forage selection by American pikas in relation to highway revegetation plans as a means to improve population connectivity in the Washington Cascades

**Carly Wickhem, Kristina Ernest and Lisa Shipley, Central Washington University*

One of the aims of the Snoqualmie Pass East Project (SPEP) in the Cascades of central Washington is to construct nearly 30 wildlife crossing structures along a 15-mile stretch of Interstate-90. This I-90 corridor has been recognized as a zone of critical connectivity for wildlife populations of the Pacific Northwest, so crossing structures in this area could make major strides in rejoining fish and wildlife populations that have been disconnected for more than 50 years. American pikas (*Ochotona princeps*) are monitored as part of the SPEP because pikas have very specific habitat requirements and are poor dispersers. To encourage pika movement across the highway, the proposed structures need to be as 'pika-friendly' as possible. An important step would be planting suitable forage within these crossings. Pikas living along roadways in this area have been observed haying both native and invasive plant species. During the summer of 2015, I plan to conduct cafeteria-style trials in the field to test the hypothesis that pikas collect invasive species because they are abundant and available, not because they are preferred. Pikas will be presented with an array of potential forage species, including both native and invasive plants. These species will also be analyzed for nutritional content and the presence of secondary compounds. I predict pikas will select native species over invasives

for consumption and haying, and will also select the most nutritious species. Native species found to be preferred and highly nutritious will be recommended for planting in the upcoming crossing structures.

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3rd North American Pika Conference

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APRIL 17-18, 2015 ● AMERICAN MOUNTAINEERING CENTER ● GOLDEN, COLORADO

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3rd North American Pika Conference

Notes from the Working Group Discussions

APRIL 17-18, 2015 ● AMERICAN MOUNTAINEERING CENTER ● GOLDEN, COLORADO

Following are the notes from the various working group sessions. Please contact the working group lead if you would like to be added to a particular working group(s). Also note that both the Population Genetics and the Citizen Science groups have formed their own "Google Groups" that you can join. Information for joining is provided with the groups' discussion notes.

POPULATION GENETICS AND POPULATION GENOMICS WORKING GROUP

(N. American pikas—*O. princeps & O. collaris*)

Lead: Mike Russello, michael.russello@ubc.ca

*Join the Pika Genetics Working Group Forum: https://groups.google.com/forum/#!forum/pika-genetics
(*You must request permission to join the group and once you are a member of the group you can approve others' requests to join.)*

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Knowledge Gaps:

Individual-level

- Inbreeding –
  - What specific genomic regions might be more or less tolerant to inbreeding?
  - Adaptation to climatic factors
  - Inbreeding avoidance
  - Different levels of scale and inbreeding avoidance
  - Mostly we've got a fairly specialized study (Bodie case study), but little idea about rest of range
    - Duplicate study design and mix in NGS
  - Isolation is increasing
  - Quantification of inbreeding
    - Chris Ray's student – looking at the genomics
- Do we know what we think we know about American pika breeding systems? How does this relate to inbreeding
  - Facultatitively monogamous?
  - Mothers and fetuses?
  - Programs like Cervus – Taking advantage of existing resources
- Individual fitness

- Survival and reproductive success
- Stress hormones, genomics, and physiology (link between CORT variability and genomic variability)
- Integrating genetics and physiological considerations for assessing individual fitness

Site Level

- Movement of individuals
  - Are these representative of pikas across their range?
    - We don't know.
    - Considerations on pattern
      - Connectivity patterns among different parts of range?
      - Mary's had a few students
      - IBD across the whole range – Jessica Castillo has some data
        - Some parks with 50 samples
        - Most opportunistically collected
        - Some detailed site-level studies for looking at connectivity
          - Bodie
          - Lisel, Matt, North Cascades
          - BC
          - Not representative of entire distribution
          - Crater Lake and Yosemite (Castillo)
- Different levels of resolution
- What are our population boundaries?

Among Site

- Connectivity at different spatial scales (huge focus)
  - Pattern? And Process? Do existing studies reflect habitat connectivity for Pikas
  - What can we infer about underlying mechanisms?
    - Aspect comes out most frequently (Castillo) – always N facing
      - Further priority – bring out mechanistic explanations for connectivity

Need & Objectives:

Phylogeography

- Galbreath work framing major lineages
- Some of range-wide discussion – points outside of major lineages – priority?
- Do we need to refine our phylogeography knowledge with intermediate and novel sites
  - Conservation
- Marginal populations – not a priority for phylogeography, but
- Mind the gap – what's going on in the gap between American Pikas and Collared Pikas
- Ability to detect and use adaptive variation vs. traditional methods
  - Hybridization factor

Responses to Climate Change

- ability for species to adapt in place?
- which regions of the genome are under selection in a warming world?
- how can we study local adaptation using genetic/genomic approaches?
- integrate adaptive genetic variation in to conservation genetic approaches
- Matt: 3 tiers
  - Potential for behavioral modifications and phenotypic plasticity
  - Changes in gene expression
  - Potential for genomic/genetic change

Targeted genes and GWAS (genome-wide association studies) -> standardization

- Genomic assays for comparative purposes
- Standing variation and putatively adaptive -? How to define and is it helpful?

Methodologically – what we know about different loci and/or gene regions
    - Model for how sharing and building a network
    - Assay samples from different points of range
    - Serve as a model for species-specific researchers

Short-term Goals/Tasks:

Comprehensive review – discuss knowledge-wide about what we know. Each study, case-study wise, but in terms of what we know across the range. Review effort to summarize everything together. State of the knowledge and a path forward.
    - genetics one stand-alone
    - e.g., target *Mammal Review* (?) – how population shrinks or expands over recent years, etc.

Sample Collection protocols (scat, hair, tissue, and blood)

Transplants to improve local diversity and reduce inbreeding (needs?)
    - Come up with a statement about how we feel about translocation
    - Can we repopulate?
    - Great Basin vs. Sierra
    - Hybrid fitness?
    - Why?
    - Levels of isolation, w/in site variation, standing variation, what does identifying putatively adaptive variation at any one site get us? What are we measuring? How can we validate it? How can we use it?
        - Need a clear path forward
    - GAP – ability to detect and use adaptive variation to understand population responses

Targeted study on GB subspp. -> assess genetic distinctiveness
- Connectivity patterns in the Great Basin vs. Sierra, etc. (isolation by distance)
    - Site-level vs. representative

Long-term Goals/Tasks:

Where genetics can help? Climate change world? Leading edge, lagging edge? Priorities in the core?
- fill in gaps in leading/lagging edge
- most interesting adaptations at edge
- representative or a relict
- how limited their dispersal is, if there is validity pikas would be ideal to address it?
- Is it worth prioritizing work on one sub-species over another?
    - Great Basin and Sierra Nevada are same sub-species
    - Genetically they're not dissimilar
        - Example for the other sub-species, and how it gives foresight to the ones that are experiencing climate change down the road?
        - Targeted studies for lineage-specific questions
    - ESA decision – great basin not distinct enough? Is this really true?
        - Assess whether GB pikas represent a Distinct Population Segment

Have patterns-do existing studies reflect connectivity (vs. case studies) and mechanisms?
    - Uncovering mechanisms of connectivity (landscape-level)

Quantifying the role of drift and selection – drift should greatly outweigh selection

- Look at this in RMNP – where two subspecies come together
  - Different genetic history, same environmental conditions
    - Behavior
    - Physiology
    - Otherwise
      - Challenge – one SSP at N. Boundary and one at S. Boundary
        - Potential different constraints – both at their limits but maybe at different ends of the spectrum.
  - Sample along elevational gradients
    - Factor out phylogeny
    - Determine whether local adaptation is happening
- Net effect of changes in gene expression and multiple mutations across the genome
- Patterns of LD across the genome

Genomics

Important Gaps

- Lack of a reference genome
- Lagomics consortium
  - Big push to get at least one *Ochotona* genome assembled
- Identifying adaptation
- Studying local adaptation
- Full annotated genome
- Gene flow – finer spatial resolution
- New options for analytical approaches
- New approach for inferring N_e from genetic data
  - Thousands of SNPs highly effective estimates
    - Estimate drift across regions
- Temporal component
  - aDNA - valuable contribution. Historical (antique) DNA from populations
  - ancient DNA vs. historic DNA (museum specimen resources)

Phylogenetics

- species delimitation
- loci across and within species (adaptive)

HEALTH AND PHYSIOLOGY WORKING GROUP

Lead: Jennifer Wilkening, jennifer.wilkening@colorado.edu

Participants: Johann Varner, April Craighead, Sara McLaughlin, Carly Wickhem, Chris Ray

Gaps in knowledge

Disease, Stress measurement, Genetic issues related to health and physiology, Winter physiology

Needs and Objectives

- SOP for disposition of dead pikas – necropsy
- Identify labs interested in analyzing the samples already available (Shipley – diet analysis)
- Characterize effect of fiber on GCM for comparison among pops
- Suggest topics and locations where winter physiology could be studied

Short-term goals/tasks

- SOP for disposition of dead pikas – necropsy
- Draft trapping protocol
- Draft sampling protocol – include various genetic and physiological sample handling/prep/storage issues
- GCM sampling and analysis protocol
- GC sampling and analysis protocol
- Send protocols/approvals to Mackenzie for curation

Long-term goals/tasks

- Synthesis paper on physiological study methods and frontiers
- Paper on issues surrounding assisted migration
- Identify labs interested in analyzing samples
- Ensure that physiological data align with available data on covariates

Notes on gaps

Disease: So little is known that It might be most informative to initiate broad studies based on samples collected opportunistically, so our notes focus on ease of acquiring samples and notes on samples already available

- Fleas – need to trap pikas to obtain, because pika "nests" are not accessible; so, not easy for broad studies; however, C Ray has collected a long time-series of fleas in CO and MT, and a ms is in prep (Patrick Foley et al.)
- Ticks – rare on pikas; see Fleas on ease of study; C Ray has collected a few and sent them to Janet Foley's lab for analysis
- Gut microbes – Kevin Kohl is studying DNA extracts from pika caecal feces (contact Jo Varner); other gut gut parasites could be studied using ceacal or fecal pellets which can both be sampled non-invasively; C Ray has many fresh-frozen samples available; if samples cannot be frozen fresh, they can be stored in a vial of "RNA Later" which preserves nucleic acids for about 1 month
- Hanta virus – requires blood sampling; serum/plasma is commonly used for detection of HV; C Ray says contact Rebecca Eisen at Centers for Disease Control in Ft Collins, because it may be possible to detect HV from blotting paper (Nobuto strips) which could be drenched w/blood from a pika's ear where it would bleed after scraping off earmites; still, requires trapping
- Earmites – may carry severl blood pathogens and may also be informative in genetic studies of pika movement; no one has studied these; C Ray has attempted to find someone interested in analyzing her many samples (stored in alcohol and frozen); requires trapping because earmites are sedentary on pikas and cannot be collected from haypiles, etc.
- Blood - Tara Roth, a PhD student in Janet Foley's lab, is analyzing about 2 dozen plasma and whole-blood samples from C Ray's CO and MT collections, to look for several pathogens
- Carcasses – as more groups begin to trap pikas, there will be more mortalities and opportunities for necropsy and other studies; we should suggest a standard operating procedure for submission of carcasses for necropsy and additional analyses, plus eventual distribution to a curated collection
- Captivity – much could be learned from captive individuals; it would be interesting to have a student collate what has been published (including gray lit.) on the varied success of the various pika studies that have involved captivity: someone affiliated w/the Denver Zoo published 2 notes on the poor success of their pika enclosure, the PhD theses of H. Robert Krear (1965) and Denise Dearing (1995) which are both available electronically, publications by MacArthur and Wang (1973, 1974), and someone should interview Preston Somers (C Ray has notes from an interview circa 2010, but more could be learned)

Stress metrics:

- GCM (glucocorticoid metabolites in fecal samples measure "chronic" stress or stress over the last 12-48 hours) – varies w/diet and especially w/fiber in diet; to characterize this might require a feeding trial (cost-benefit not good?); so, GCM is best for longitudinal studies or comparative studies within a region of relatively low variation in available forage
- GC (glucocorticoids like cortisol and corticosterone in blood samples measure "acute" stressors acting 3 minutes to x hours prior to sampling) – can be measured via blood sampling; for other methods, contact Matt Waterson
- Hair – hair samples and be used to isolate stable isotopes of C (identifies whether C3 or C4 plants are dominant in the diet), N (trophic position) and O (water source); later we learned that Matt Waterson is planning a study of corticosterone isolated from hair samples along 2 elevational gradients (C Ray will provide paired hair and fecal samples for validation)
- Scat – GCM should be analyzed more broadly and tracked over time, so we need an SOP for scat collection/storage/analysis; plant DNA could also be isolated from scat, but J Varner tried this with limited success (couldn't amplify moss, but could detect spinach)
- Cytochrome C – variation in this highly conserved protein allows pika populations endemic to higher elevations to tolerate hypoxia, so genetic info on cytochrome C could aid in planning for assisted migration; requires trapping or perhaps hair-snaring if snares can be adapted to pull growing (instead of shed) hairs from the pika (could follicles be obtained from cheek-rub snares?); earlier, Liesl Erb mentioned that carbon monoxide inhibits e-transport chain and may affect ability for pikas to tolerate hypoxia, which might be a problem for pikas even at lower elevations, and S McLaughlin mentioned that NEON has carbon monoxide data;

Winter physiology:
Most selection appears to occur during winter and winter physiology was identified as the biggest gap in our understanding of pika health; not sure to what extent the research of Ed West filled this gap (his dissertation does not appear to address this, but he at one pika symposium or conference he presented a talk on pika physiology that seemed distinct from the work described in his dissertation abstract and quite relevant to pika physiology)
Requires captive studies or (better yet) internal or collar-based data-loggers and perhaps camera or acoustic traps

FIELD METHODS WORKING GROUP

Lead: Mackenzie Jeffress, mrjeffress@ndow.org

Working Group Members in Attendance	Affiliation	Email
Kris Ernest	Central Washington University	ernestk@cwu.edu
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Mackenzie Jeffress	Nevada Department of	mrjeffress@ndow.org

	Wildlife	

Thanks, Kris, for taking great notes!

Knowledge Gaps:

- Need a website – this will hopefully be addressed by NAPC Steering Team (Embere Hall)
- Standardized protocols (should be on website)
    - Trapping – how to increase success (e.g., pre-baiting, trap placement)
    - Handling – anesthesia (when to use/not use), measurements, samples to take, notes on parasites and disease, how to handle injured animals that need to be euthanized
        - Could work with the Health and Physiology Working Group on many of these aspects
    - Marking – Types of marks used (ear tags, PIT tags?)
    - How to get permits
    - Protocols for describing and quantifying behaviors
    - Additional protocols identified in previous working group meetings include:
        - Temperature sensor deployment and placement
            - Chris Ray has one
        - Anesthesia and handling protocols (cross-listed with pika health working group).
        - Biological sampling collection and storage
            - Fecal sample collection (for genetic analysis) protocol from Jessica Castillo
        - Personnel safety for pika work, a checklist including (where needed) kneepads, rainwear, safety stuff like flashlight/2-way radio/compass, whatever people use in their systems plus things like working with a buddy and safe work on talus
            - NPS has this as an SOP in the Jeffress et al. (2011) Pika Monitoring Protocol
        - Site occupancy surveys using direct and indirect evidence of species presence
            - occupancy surveys at different geographic scales (i.e., one mountain range vs. statewide surveys).
            - Quite a few versions of these out there to grab
        - Mapping talus? Or collecting habitat variables?
            - standardized habitat description protocol – Are we calling the similar habitat types the same thing?
        - Could use a protocol for aging and interpreting sign.
        - How to sex a pika?

Needs and Objectives:

- Occupancy survey protocols – what is out there, which aspects are important to keep constant, vs
- Trapping/handling protocols
- Protocols for camera trapping, audio recording
- Protocols for placement of iButtons – depts., etc.

Short-term Goals/Tasks:

1. Trapping, handling, marking protocol document with literature cited
    a. **Cheryl** will start draft – outline, then see who can help with various sections. **Kris** and **Max** have previous pika trapping experience and others in the larger consortium could be asked to contribute
    b. Include tips, pitfalls/problems to avoid
    c. Will initiate with email and if need be, follow-up conference call
    d. **Mackenzie** will put together example trapping and handling protocols from other species
    e. Document could be reviewed and endorsed by the NAPC team
    f. Eventually try to publish – museum or technical report?
2. **All** – keep track of any pika data forms and protocols and send to **Mackenzie** for compiling
        i. This can include videos/YouTube links (sexing video, etc.)

ii. Also, if possible, include a brief description of the source of the protocol, data form, etc. and who might be the contact for the project
iii. We should also make sure that the author(s) is/are okay with sharing the document(s) before making available on the web
iv. Mackenzie will send link for sharing all of this information via Dropbox

3. Identify additional working group members to add. Will plan to start with email but could consider using Google Groups?

Long-term Goals/Tasks:

1. Wish-list: Behavioral observations protocol – **Max** will work on in the meantime
2. Publish the trapping/handling/marking document
3. Maintain these protocols on the website
4. Connect with Health and Physiology on issues like samples to take, parasites, disease
5. How to identify potential habitat via remote sensing

Suggestion made by the larger group at the reporting out: Ask other researchers for their permit and IACUC information.

CLIMATE WORKING GROUP

Lead: Erik Beever, EBeever@usgs.gov

In attendance:

Embere Hall, U. WY, EmbereHall@gmail.com
Aidan Beers, CU Boulder, Aidan.Beers@colorado.edu
Marie Westover, UNM, MWestover@unm.edu
Will Thompson, MT S.U., WWThompson91@gmail.com
Alice Henderson, unattached GIS & Remote-sensing expertise, GIS_Wildlife@yahoo.com
Anna Chalfoun, U. WY & USGS, AChalfou@uwo.edu
Erik Beever (led the meeting), USGS & MT S.U., EBeever@usgs.gov

Knowledge Gaps:

- To what degree is the rate of change in interstitial refugia decoupled from rate of change in ambient temps, meso-climate, and macroclimate, in different contexts (e.g., shallow talus, deep talus, rock-ice features, moss-covered talus, lava flows, etc.)?
- What's the role of RH in pika distribution, survival, fecundity, etc.?
- Given IACUC realities and restrictions, what designs and experimental approaches can we use to better understand climate-animal relationships, and increase confidence in our conclusions?
- How do we tease apart the contributing roles of all the factors that covary with elevation? I.e., we know that it isn't elevation per se that affects pika distribution and abundance, but to what degree to changes in temperature, RH, precipitation, O_2 concentration, etc. affect those?
- Does the relative importance of certain climatic variables change as elevation increases? I.e., might distribution be locally determined on the lower-elevation boundary of pika occupancy by heat stress, but by cold stress or lack of vegetation at the upper end? If so, does this vary across the species' geographic range?
- What are the fitness implications (e.g., survival, fecundity) of varying climates, and foraging strategies, behavioral plasticity, and other responses to climate variability and change? Unless we understand the fitness implications of these responses, it is difficult to build mechanistic models of climate-wildlife relationships.
- At the tails of temperature histograms at a site over 1 or many years, what is the relative role of reaching the 95th percentile temp vs. the 97th vs. the 99.5th percentile temperature, interstitially? This will obviously change with the magnitude of temperature refugium (i.e., difference between ambient and subsurface temps), but how acute does temperature or drought have to be, to cause pika extirpations … or even declines in abundance?
- Which metrics of climate *variability* are most important for pikas, and within what temporal windows should these be envisioned? This is a real frontier…

Needs and Objectives:

Needs

- LiDAR connections with microclimate data
- More places t correlate gridded datasets with sensor-level data
- In which topographic and climatic contexts can downscaling be most useful?
- In progress (EAB): high-resolution radiant skin temperature matched with sensor data collected every 30 sec

Objectives:

None identified …

Short-term Goals and Tasks:

- Concatenate a general list of where microclimate sensors are located, across the range of *O. princeps*. {*post-hoc Q from Erik B.: does this only include sensors down in the talus?*}
  - Purpose would be to fill information gaps, understand biases in the spatial distribution of sensors, help with linking sensors to gridded climate data, etc.
  - Alice Henderson volunteered to create an Excel-based list of sensor networks, perhaps with a GUI interface

Long-term Goals and Tasks:

- Coordinate pika-relevant temperatures with coarser gridded datasets such as PRISM

EDUCATION, OUTREACH & CITIZEN SCIENCE WORKING GROUP

Lead: Johanna Varner, JohannaVarner@gmail.com

*Join the Pika Citizen Science Group Forum: https://groups.google.com/forum/#!forum/pika-cit-sci
(*You must request permission to join the group and once you are a member of the group you can approve others' requests to join.)*

Members present

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April Craighead	Craighead Institute	april@craigheadinstitute.org
Johanna Varner	University of Utah / Colorado Mesa University	johannavarner@gmail.com

Other members who may still be interested in this subcommittee:

Nifer Wilkening, Lucas Moyer-Horner, Embere Hall, Megan Mueller, Leslie Rodman

Knowledge Gaps (or Challenges) that we identified:

- Areas with high density of citizen science programs are located in places with lots of willing volunteers (e.g., Bozeman, Denver, Portland) and not necessarily in areas with highest conservation priority (e.g., southern Utah, New Mexico, or Great Basin)
- K-12 engagement is often limited by issues of liability and timing of the school year. This also requires a teacher to be a "champion" to help address logistics and maintain enthusiasm in the classroom.

- It can be challenging to connect to audiences that don't already engage with science and nature – how do we reach out to underserved audiences in science? Is this feasible given the geographical and technical realities of pika research?
- There are challenges inherent in engaging volunteers in pika research: e.g., study sites can be difficult to access, need to set realistic expectations for volunteers.

Needs and Objectives of this subcommittee

- FUNDING is a big need – most researchers think of citizen science as "free data", but resources are required to orchestrate and maintain these programs.
    - Coordination capacity is often limited.
- Volunteer dropout rates can be high. How can we maintain volunteer commitment to collecting data, following a training event?
    - We need to create a sense of community among volunteers (via Facebook, blog sites, or sharing of stories).
    - We need to improve and maintain connections between staff and volunteers via follow-up messages and planned events.
- Citizen-generated data can be difficult to analyze:
    - Absence observations are often of lower confidence with citizens.
    - Collection protocols vary across projects, giving rise to data compatibility issues.

Short-term Goals/Tasks

1. Broader impacts examples & templates: Provide other pika researchers with information to include citizen science coordination staff and resources as budget line-items in future grant proposals.
2. Establish a communication option or group for pika citizen science coordinators to share stories and lessons learned, or to pose questions.

Long-term Goals/Tasks

1. Develop an IRB protocol for evaluating the effects of citizen science participation on volunteers themselves
2. Interface with environmental educators to develop assessment tools/instruments that can be used to compare across projects.

DISTRIBUTION AND HABITAT WORKING GROUP

Lead: Kris Ernest

Knowledge Gaps

- How do the different factors co-vary? Even correlates may vary across scales or the range
- Anthropogenic vs natural habitat: are they equal in utility and in longevity?
- How should species interactions play into distribution models and habitat use?
    - Does predation play a significant role in distribution?
- Effects of habitat on colonization and extinction rates

Needs and Objectives

- identify appropriate climate metrics at different scales
    - across environmental gradients in their range
    - quantify variably important features
- better quantify how pikas use the landscape
    - Esp. those climate and landscape features that drive connectivity
    - need to reframe the "bioclimatic envelope"?
        - what sort of areas can be suitable, even as short-term refuge?
        - may be useful to compare the habitats that we have been calling "unusual"

- Improve/standardize modeling
    - How to use presence vs absence (and/or pseudo-absences)?
        - How can they be used in different types of models?
    - Which predictor variables are best suited to different types of models?
    - which potential suites of models are suited to eg. maxent, max like, SEMs
    - Potential gap in differences for occupancy detection
- develop a method for quantifying interactions with predators, competitors (e.g., woodrats, marmots)
    - must also consider detection probabilities for those species

Short-term goals/Tasks:

- better standardize method for detecting occupancy, new or existing protocols
    - Make note of methods' limitations and under what circumstances each is acceptable
- Share more data on occupancy, maybe fine-scale climate factors
    - Potential issues, obviously
- Encourage interspecific considerations:
    - make a list of species that researchers are making note of in their studies
    - Define key species that are likely to affect pikas or are common across the range

Long-term goals/Tasks:

- Map talus extent over a very large scale (range-wide)
    - Also map alternative (non-talus) habitats and connectivity
- How to model forb:gram ratios across broader scales
- Identify climate metrics at different scales and different places
    - Redefine bioclimatic envelope
    - Prioritize studies

Note-taker:
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Edited by:
Kris Ernest

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RESEARCH AND REVIEW WORKING GROUP

Lead: Hayley Lanier (hlanier@uwyo.edu)

Knowledge Gaps

- Identifying the role of this committee
    - Biggest problem is the overlap – could it be reviewing the protocols of other committees? Reviewing? Standardizing?
    - list of desired protocols (last time)
    - Mapping research efforts?
    - Reviewing protocols
    - Status of research
    - Field method protocol implementation
    - Preparing for other petitions?
- Review – when people come to NAPC and ask about the American Pika, have a committee that knows about what is known
    - Review that request
    - Be the point committee on that

Needs and Objectives

Suggestion:

- goals or suggestions for data collection for future research
- database? collection? Weebly website?
    - Might be useful for looking for volunteers
- General view of the fact that this group wasn't organized, and could be better prepared for the next listing petition.
    - Nifer – FWS has lost the push to consider pika listing
    - If the change in taxonomy, what happens to the listing
    - Point – not a lot of studies?
- Since the listing decision, more is known from the Rockies and across the range
    - more mechanistic understanding of vulnerability over short and medium time scales
    - Genetics – is this a DPS?
    - Remain vigilant and prepare for the potential re-listing of pikas

Short-term Goal/Task

- revised outline from 2010 (update) – 3 month by August 1st
    - update objectives and subheadings
- get a database of different pika studies or projects online
    - in EndNote Online
- revisit whether we can do anything with the sensor data and similar opportunities. How could we combine the knowledge and results from multiple studies without having folks feel concerned about data integrity?

Long-term Goal & Task

- state of the knowledge research paper, or an 'opportunities' paper
    - Nifer is heading up a review paper on what the state of the knowledge is for pikas
    - Key piece is that it's already happening, and a MS is already around, what can be done of added value?
    - Opportunities paper instead of an updated 'what is known'
        - Sections could be identified and written by each committee
        - Capitalize on what's been done in last few years?
        - Enough new information that we can review

- What does this teach us about this broader phenomena? Not the story of the pika.
- Is the pika a good model species for particular types of questions?

Two relevant documents (Chris Ray)
NA Pika Research DB
Synthesis Sensor Survey and Call

3rd North American Pika Conference

Evaluation Summary

APRIL 17-18, 2015 ● AMERICAN MOUNTAINEERING CENTER ● GOLDEN, COLORADO

		Average
ORGANIZATION AND COORDINATION		**4.42**
	Information on the conference	3.75
	Registration/Correspondence	4.42
	Organization	4.58
	Time (month/days)	4.50
	Length of Conference	4.58
	Length of Sessions	4.67
TOPICS AND SPEAKERS		**4.47**
	Presentation topics	4.83
	Speakers	4.58
	Keynote	4.75
	Poster session	4.00
	Working groups	4.17
PERSONAL VALUE		**4.66**
	Informal conversations	4.83
	Relevance to current work	4.67
	Registration cost	4.45
FACILITIES/SNACKS		**4.50**
	Meeting rooms	4.55
	Refreshment breaks	4.45

All values on a 1-5 point scale; 5=Excellent

Number of completed surveys: 12

Number of surveys with comments: 10

COMMENTS:

Organization and Coordination

- Nice balance of topics and clustering.
- Email invitations (listerv) could be more accessible.
- Maybe make sessions longer to allow presenters more time.
- Poster session was too short! Not enough time to chat with those interested.
- Getting the program up earlier would have been helpful for planning.

Topics and Speakers

- Working groups: Still has room for improvement, but very valuable and lots accomplished.
- Probably not an organizational issue, but egos slowed progress in working groups.
- Working group sessions were way more organized than 2012. Excellent framework.
- Loved the working groups.

Personal Value

- Excellent opportunity to connect with so many folks.
- Breaks were of appropriate length to allow conversations.
- I love this conference!
- Conference registration and location were budget friendly for me.

Facilities and Snacks

- Just wish I would have been able to dedicate more time to checking out the place…such an outstanding venue!
- Great venue. Maybe a bigger coffee capacity? ☺
- Great venue!

Most Valuable Portions of Conference

- Distilled updates from so many folks working on pikas, all in a row! Great to have everyone together and work on collaborations and new projects.
- The working groups were especially useful for me to connect and interact with researchers I hadn't been in contact with before.
- Short talks.
- Keynote speech.
- Super valuable to put names to faces – this is a big advantage of the smaller, more intimate conference format!
- Interaction
- Working group meeting

Least Valuable

- I was a little disappointed with the working groups, but they could have easily been very good.
- None!

Suggestions for Improvement

- If we intend to work together more, that has to be clearer and easier, maybe with explicitly dedicated to establishing collaboration between similar projects and on future work.
- Longer poster session.
- There may be some working groups that could be disbanded and/or combined!
- None.
- Have moderators not be speakers in their own sessions.

- Info on programs about working groups and steering committee – basically what they do, and open to all conference participants, list conference organizers so we can thank them.
- Maybe have an organized social event at a brewery in the evening.

Post-Conference Materials

- Contact info for everyone and their interests (x3)
- Summary notes of the conference presentations.
- Working group summaries.
- Website! (x3)
- Emails are good, even if just for directing to the website.
- I would like to see a database of research and researchers.
- Listserv (x2)
- Dropbox for protocol concatenation
- Comments on talk
- Proposal for further working group communication
- I didn't know there was a listserv, sounds great!

Other Comments

- Great job – appreciate everything!
- THANKS FOR AN AWESOME TIME!
- Thank you!
- Thank you for organizing!