THE ALASKA SMALL MAMMAL GROUP
2022 NEWSLETTER




Contents

Introduction

Small mammals are important members of Alaska’s terrestrial wildlife community – they represent a large proportion of the state’s mammalian diversity and play critical roles as herbivores, insectivores, seed dispersers, disease vectors, and prey species. This newsletter highlights current research and monitoring projects investigating small mammals across the state of Alaska in 2021 and 2022. We have included brief

summaries of ongoing projects and abstracts from published or submitted peer-reviewed articles. We also provide a list of recent publications on small mammals in Alaska, as well as taxonomic updates. For more information or to join the Alaska Small Mammal Group, please contact Katie Christie or Julie Hagelin.
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Photo: *Myotis lucifugus, ADF&G*

Little brown bat hibernation

The Milieu Souterrain Superficiel as hibernation habitat for bats: implications for white-nose syndrome*
Karen Blejwas, Grey Pendleton, Michael Kohan, Laura Beard

Recent studies have revealed that western populations of little brown bats (*Myotis lucifugus*) in North America exhibit different hibernation behavior than their eastern counterparts. Understanding these differences is essential for assessing the risk white-nose syndrome (WNS) poses to western bat populations. We used acoustic monitoring and radiotelemetry to study the overwintering behavior of little brown bats near Juneau, Alaska during 2011–2014. Our objectives were to identify the structures they use for hibernation, measure the microclimates within those structures, and determine the timing of immergence and emergence and the length of the hibernation season. We radiotracked 10 little brown bats to underground hibernacula dispersed along two ridge systems. All hibernacula were ≤ 24.2 km from where the bats were captured. Eight bats hibernated in the "Milieu Souterrain Superficiel" (MSS), a network of air-filled underground voids between the rock fragments found in scree (talus) deposits. Two bats hibernated in holes in the soil beneath the root system of a tree or stump (rootball).

At least two hibernacula in the MSS were reused in subsequent years. Average MSS and rootball temperatures were warmer and more stable than ambient temperature and were well below the optimal growth range of the fungus that causes WNS. Temperatures in the MSS dropped below freezing, but MSS temperatures increased with depth, indicating bats could avoid subfreezing temperatures by moving deeper into the MSS. Relative humidity (RH) approached 100% in the MSS and under rootballs and was more stable than ambient RH, which also was high, but dropped substantially during periods of extreme cold. Acoustic monitoring revealed that bats hibernated by late October and began emerging by the second week of April; estimates of minimum length of the hibernation season ranged from 156 to 190 days. The cold temperatures, dispersed nature of the hibernacula, and close proximity of hibernacula to summering areas may slow the spread and reduce the impacts of WNS on local populations of little brown bats.

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*Details are in publication section below

Little brown myotis activity patterns

Little brown myotis activity patterns in South-central Alaska*

ML Snively, GW Pendleton, KS Christie, KM Blejwas

In this study, we investigated how Little Brown Myotis (*Myotis lucifugus*), North America's northernmost bat species, adjusted to variable spring and autumn conditions and very little darkness during the boreal summer. We recorded bat activity around Anchorage and the lower Matanuska-Susitna Valley, Alaska. Initiation of bat activity in the spring varied among years and was affected by minimum nightly temperatures in late April and, to a lesser extent, precipitation. Cessation of bat activity in the autumn was consistent among years, with a weak association with early-October minimum temperature. During summer, bat activity was highest on warm, clear nights, but was reduced by wind or rain. Bat activity was positively related to open water and forest cover and negatively related to human development. Most bat activity occurred between sunset and sunrise, even during very short nights in mid-summer. Although there was some activity prior to sunset, bat activity after sunrise was very rare. Pre-sunset bat activity was almost exclusively at sites with high forest cover. After sunset, moderately forested sites were also used, but sites with little forest cover were rarely used before or after sunset.

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*Details are in publication section below

Photo: Clethrionomys gapperi, Ranger Robb

JBER Long-Term Ecological Monitoring (LTEM)

Colette Brandt

Small mammal monitoring is part of the broader Long-term Ecological Monitoring (LTEM) management framework conducted on Joint Base Elmendorf-Richardson (JBER). In 2013, 122 permanent plots were established to monitor long-term ecological change. The sites are stratified across all vegetative communities throughout JBER and designed to complete 10 percent of the sites each year on a rotational basis.

LTEM sites have served as the basis for wildlife plot sampling that include breeding bird and small mammal surveys, as well as provide accurate assessment of the condition of vegetative systems on JBER necessary to managing the training and natural resource environment. The goal of this project is to provide key insight to the natural resources on JBER to support management decisions to ensure sustainability of these resources for mission support of natural training environments. Objectives of the small mammal monitoring are to: 1. Document small mammal species occurrence; 2. Collect data that will support long-term trend analysis; and 3. Document small mammal distribution within vegetation communities.

Starting in 2017, JBER also began collecting ticks from small mammals during the LTEM surveys. The JBER wildlife biologist works with the State of Alaska, Division of Environmental Health State Veterinarian (the Office of the Alaska State Veterinarian) for this portion of the study. This also contributes to the boarder tick study being conducted with the State of Alaska.

The LTEM is intended to meet installation-wide ecosystem monitoring and assessment goals set identified in the 2016 JBER Integrated Natural Resources Management Plan as mandated by the Sikes Act (16 United States Code 670 et seq.), Department of Defense instruction (DoDI) 4715.03 and Air Force Instruction (AFI) 32-7694.

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Northern bog lemming diet

High dietary and habitat diversity indicate generalist tendencies for northern bog lemmings (*Synaptomys borealis*) in Alaska*

Baltensperger, AP, JL Hagelin, PA Schuette, A Droghini, K Ott

The northern bog lemming (*Synaptomys borealis*) is a rare small mammal in North America that is undergoing a federal Species Status Assessment (SSA) under the U.S. Endangered Species Act (ESA). Despite a wide North American distribution, very little is known about its dietary and habitat needs or its projected responses to climate change. To quantify diet composition of northern bog lemmings (NBL) in Alaska, we used mitochondrial DNA metabarcoding from 59 archived specimens to describe the diversity and relative abundance of foods in recent diets. DNA analyses revealed a broad diet composed of 110 families and 92 genera of bryophytes, graminoids, fungi, forbs, and woody shrubs. Nine bryophyte genera and *Carex* sedges composed the largest portions of NBL diets. To quantify habitat preference, we attributed 467 georeferenced occurrence records of NBL with remotely sensed landcover classes and used a compositional analysis framework that considers relative abundance of landcover types in Alaska. We did not detect significant habitat preference for specific landcover types, although bog lemmings frequently occurred in evergreen forest, woody wetlands, and adjacent to water. This research highlights the importance of bryophytes, among a diversity of dietary components, and describes NBL as boreal habitat generalists. Our results will inform the SSA by quantifying the ecological constraints of NBL in a rapidly changing climate.

*Publication details are in publication section below

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Photo: Urocitellus parryii, ADF&G

Arctic ground squirrel diet

Small mammal diet indicates plant diversity, vegetation structure, and ecological integrity in a remote ecosystem*

Paul Schuette, Steve Ebbert, Amanda Droghini, Timm Nawrocki

We evaluated patterns of herbivory and predation/scavenging by a small mammal, the arctic ground squirrel (*Urocitellus parryii*), as an indicator of biological diversity, vegetation structure, and ecological integrity on two contrasting islands in the vast and remote Alaska Maritime National Wildlife Refuge. Using DNA metabarcoding techniques, we assessed the taxonomic composition of vertebrates, vascular plants, and bryophytes at family and growth form levels in arctic ground squirrel fecal samples collected on the ecologically intact island of Chowiet, which supports diverse seabird and vegetation communities, and the degraded island of Chirikof, which has incurred centuries of disturbance from introduced arctic fox (*Vulpes lagopus*) and cattle (*Bos taurus taurus*). We also evaluated whether fecal samples collected across the growing season (May—August) could act as indicators of herbivore-plant phenology. We did not detect any vertebrate taxa, however, observed herbivory patterns closely matched known differences in island plant diversity based on independent surveys. Diets from the ecologically intact island exhibited higher taxonomic richness, greater evenness, and higher shrub content than the ecologically degraded island, which is a grass- and forb-dominated ecosystem. On Chowiet Island, diets changed seasonally, likely in response to changing availability, nutritional quality, and toxin content associated with primary production. Small mammal diet served as an effective indicator of plant diversity, vegetation structure, and ecological integrity when compared against known composition and status of these remote island ecosystems. Non-invasive fecal sampling and dietary analyses using genetic techniques may provide a useful strategy for monitoring biological diversity, particularly in remote areas where widespread intensive sampling is unfeasible.

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*Details are in publication section below

Photo: Dr. Nick Kerhoulas from Humboldt State University scans for marmots in the Chilkat Mountains of SE Alaska (L.E. Olson)

Marmots, pikas, and woodrats in SE Alaska

Marmots, pikas, and woodrats feature in UA Museum-led inventory of alpine small mammals SE Alaska

Link Olson

In summer 2021, a collaborative effort to document the occurrence and range of melanistic (dark-colored) hoary marmots (*Marmota caligata*) and other small mammals in Southeast Alaska was undertaken by researchers from the University of Alaska Museum of the North (UAMN) at the University of Alaska Fairbanks (UAF), Humboldt State University, the Sam Noble Museum at the University of Oklahoma, and the University of California-Berkeley. By helicopter, sea kayak, and foot, the team explored both alpine and sea-level habitats known or suspected to support marmot populations. Despite the broadest distribution of any North American alpine mammal, hoary marmots are remarkably uniform in external appearance throughout their range, with the striking exception of visually conspicuous melanistic individuals in and around Glacier Bay and the nearby Chilkat Mountains. Hypothesized reasons for the persistence of such a seemingly maladaptive trait--and there are many!--are the subject of UAMN/UAF Ph.D.

candidate Kendall Mills's dissertation research, with potential implications for the closely related, critically endangered, and similarly dark-colored Vancouver Island marmot (*M. vancouverensis*). In addition to expanding the known range of melanistic hoary marmots north of the Endicott River (a hypothesized biogeographic barrier), the crew also extended the range of collared pikas (*Ochotona collaris*) south of their previously documented limit near Skagway by locating these alpine hoarders' signature haypiles, and in the process of collecting pika scat for DNA analysis, discovered the scat of bushy-tailed woodrats (*Neotoma cinerea*), thereby extending the Alaskan range of *that* species northward (DNA confirmation and locality details are being submitted for publication). A second field season is planned for 2022.

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Photo*:* Chris Barger capturing an Alaska Hare (ADF&G).

Alaska Hare Study

Chris Barger, Travis Booms, Richard Merizon

Alaska hare (*Lepus othus*) have long been a widely used recreational and subsistence food source for many residents of rural western Alaska. However, vital rates, geographic distribution, and current population trends remain very poorly understood. Current abundance of this species is believed to be well below average in most areas of its current range throughout western and southwestern Alaska. This study will attempt to document general movement and mortality of a small sample of individuals using GPS necklace collars. To date, 8 hares have been captured and collared throughout the species range in western Alaska. Individuals have been captured using bow nets and pen traps. Secondly, this study will evaluate a long-term population monitoring technique by genotyping individuals through pellet collections at discrete locations throughout the species range in western Alaska. Due to the reclusive nature of this species, pellet related population monitoring has proven to be the most efficient and cost-effective method for the ADF&G to institute a long-term population trend monitoring program. To date, over 2,000 pellets have been analyzed resulting in few than 130 individual hares. As a result of this study and what has been learned about this species, regulatory action has been taken both on state and federal hunting regulations to adopt a much more conservative management strategy. A final report is expected in 2023.

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Photo: Court Brown, surveying for pikas near Paxson, Alaska (Shelby McCahon).

Collared pika abundance surveys

Jeff Wagner, Katie Christie, Paul Schuette

An analysis examining potential ecological drivers of collared pika abundance is underway. Scientists at the Alaska Center for Conservation Science collected data at 47 sites throughout the state in the summers of 2018 and 2019 with the goals of producing the first-ever density estimates for pika in Alaska and examining current occupation status at historically occupied sites. Preliminary results suggest that mean annual summer temperature may be an important driver of pika densities, with lower densities at sites with higher summer temperatures. This may be indicative of heat-stress related mortality, a well-documented issue for the collared pika's southern congener, the American pika (*Ochotona princeps)*, that is being exacerbated by climate change. Other hypothesized drivers of density include site-level primary productivity and shrub encroachment.

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Collared Pika Survival and Diet

Katie Christie

The ecology and behavior of collared pikas is currently not well understood, but this species may be vulnerable to shrub expansion and a warming climate in Alaska. In light of these concerns, there is an urgent need for information on how abundance, survival, and reproduction are influenced by environmental change across their range. Working with researchers from the University of Alaska Anchorage, Joint Base Elmendorf-Richardson, the University of Idaho, Washington State University, Colorado Mesa University, and the University of Oklahoma, we are a) conducting a mark-recapture study of pikas to estimate adult and juvenile survival, b) assessing stress levels of pikas across an elevational gradient, and c) quantifying dietary selectivity and nutritional quality of different forage types. So far, we have captured and tagged 171 pikas and sorted 143 winter food cache samples. We found that collared pikas cache a broad diversity (133 species) of shrubs, forbs, ferns, grasses, mosses, and lichens for the winter. We conducted 25 cafeteria trials with individual pikas to understand selection of different alpine shrubs, grasses, and forbs. We are currently analyzing the data and look forward to another productive field season in 2022.

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Photo: Collared pika “resting” behavior (Lily Harrison).

Collared pika occupancy and behavior

Lily Harrison

Collared pikas may be vulnerable to many direct and indirect effects of climate change, especially related to temperature fluctuations within their dens during winter, and changes in forage availability during the spring and summer. In collaboration with the Alaska Department of Fish and Game and the Department of Defense at Joint Base Elmendorf Richardson, researchers from the University of Idaho are examining how collared pikas respond to different environmental conditions by studying their occupancy patterns and behavior across three study areas of contrasting climate gradients in Arctic Valley, Hatcher’s Pass, and along the Denali and Steese Highways. These study areas are historically occupied sites that were re-visited and monitored since 2018 by ADF&G and differ primarily in their vegetation communities and weather conditions. At 13 sites, we monitored at total of 165 individual pika dens to determine whether they continued to be occupied from 2019 - 2021. We took measurements of the microhabitat within each pika territory and the microclimate with temperature loggers set within their dens. With these explanatory variables, we are analyzing changes in pika den occupancy by estimating annual colonization and extinction rates through a dynamic occupancy model. In addition to pika den monitoring, we also observed behavioral activity through on- the-ground behavior surveys in the summer and through motion-sensor cameras set inside tagged pika dens to determine what the optimal foraging temperature range and weather conditions are for collared pikas. Through these behavior surveys and camera detections, we will compare their level of activity to temperature records from ambient temperature sensors at each site and local weather stations through the summer foraging season. These cameras also pick up on the activity of other animals that visit pika dens and occasionally steal from their haypiles, providing a unique view into the interspecific interactions between pikas and their competitors in a wide variety of habitat types. This study will help us understand the range of environmental conditions under which pikas thrive and how they are responding to changes in conditions over time.

Collared pika genetics

How far is too far? Genetic diversity and connectivity of collared pika (*Ochotona collaris*) populations*

Marcos da Cruz and Kimberly Jones

Abstract

Predicting how species will respond to climate change represents a key conservation challenge of our time. With rapidly changing environmental conditions, gene flow and standing genetic variation are two important factors that can influence the probability of persistence or extinction of a population and can often be important aspects of conservation planning. Understanding these factors may be particularly important for climate-sensitive species, such as pikas. Here, we used a reduced-representation genomics approach (3RAD) to generate data for 5 collared pika (*Ochotona collaris*) populations in Alaska to better understand connectivity, isolation, and genetic diversity. Populations show considerable gene flow at 5-10 km, but connectivity diminishes significantly around 20-30 km. Estimates of genetic diversity are correlated with habitable area, with those regions that have greater talus (broken rock) exposure maintaining greater standing diversity. Genetic diversity (measured by pi and Watterson's theta) was generally lower than that in American pikas. These results may suggest that some populations of collared pikas might be at higher risk of extinction in comparison to America pika populations because of their lower genetic diversity. Additionally, the results provide a baseline for understanding the potential for extirpated localities or for habitat that becomes suitable due to climate change at range margins to be colonized by natural dispersal processes.

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*Abstract submitted to "The American Society of Mammalogists" conference

Photo: Sorex cinereus, Phil Meyers

Endemic shrew genetics

Genetic drift drives rapid speciation of an Arctic insular endemic shrew (*Sorex pribilofensis*)*

Wiens, BJ, FJ Combe, B Dickerson, LM Divine, VM Padula, GK Sage, SL Talbot, AG Hope

Episodes of Quaternary environmental change shaped the genomes of extant species, and these legacy changes have continuing consequences for a species' ability to respond to contemporary environments. Island endemics are among the most vulnerable to rapid environmental change, accounting for a disproportionate number of recent extinctions. It is vital for conservation of island biodiversity to combine current population ecology with knowledge of evolutionary history, to account for potential genomic constraints that have accrued through time. The Bering Sea has a history of cyclic island isolation and reconnection, coupled with modern rates of climate change that far exceed global averages. The endangered Pribilof Island shrew (*Sorex pribilofensis*) is endemic to St. Paul Island, Alaska, which was isolated from mainland Beringia ~14,000 years ago by rising sea levels. Using ~11,000 SNPs, 17 microsatellites, and mitochondrial sequence data, we test predictions about the evolutionary processes driving shrew speciation across Beringia. Our data show considerable differentiation of *S. pribilofensis* from mainland sibling species, relative to levels of divergence between mainland shrews. We also find a genome-wide loss of diversity and extremely low effective population size for *S. pribilofensis.* We then show that intraspecific genetic diversity and interspecific divergence are statistically associated, and differentiation between *S. pribilofensis* and other Beringian shrews is highest across loci that are fixed in *S. pribilofensis*, meaning strong genetic drift has driven differentiation of this island species. Our findings show that drift as a consequence of island isolation and Arctic climate cycling can rapidly reshape insular biodiversity. Island species through the Arctic that lack genomic diversity and have evolved in response to past climate may have limited ability to respond to modern environmental changes.

Contact: Ben Wiens, Biodiversity Institute, bjwiens@ku.edu

*Submitted for publication

Small mammal publications

Blejwas, KM, GW Pendleton, ML Kohan, LO Beard. 2021. The Milieu Souterrain Superficiel as hibernation habitat for bats: implications for white-nose syndrome . Journal of Mammalogy 102: 1110–1127.

Colella, JP, LM Frederick, SL Talbot, JA Cook. 2021. Extrinsically reinforced hybrid speciation within Holarctic ermine (*Mustela* spp.) produces an insular endemic. Biodiversity Research 27: 747-762. https://onlinelibrary.wiley.com/doi/10.1111/ddi.13234

Droghini, A, KS Christie, RR Kelty, PA Schuette, T Gotthardt. 2022. Conservation status, threats, and information needs of small mammals in Alaska. Conservation Science and Practice e12671. https://doi.org/10.1111/csp2.12671

Linden, E, L Gough, J Olofsson. 2021. Large and small herbivores have strong effects on tundra vegetation in Scandinavia and Alaska. Ecology and Evolution 11: 12141-12152. https://doi.org/10.1002/ece3.7977

Mullet, TC, P Burger, K Griffin. 2021. Bats transit and forage over nearshore environments in the northern Gulf of Alaska. Northwestern Naturalist 102: 150-156. https://doi.org/10.1898/NWN20-09

Robold, RB, F Huettmann. 2021. High-resolution prediction of American red squirrel in Interior Alaska: a role model for conservation using open access data, machine learning, GIS and LIDAR. PeerJ. https://peerj.com/articles/11830/

Schuette, P, S Ebbeert, A Droghini, T Nawrocki. 2022. Small mammal diet indicates plant diversity, vegetation structure, and ecological integrity in a remote ecosystem. Biodiversity and Conservation. https://doi.org/10.1007/s10531-022-02370-4

Snively, ML, GW Pendleton, KS Christie, KM Blejwas. 2021. Little brown myotis activity patterns in Southcentral Alaska. Northwestern Naturalist 102: 216-231. https://doi.org/10.1898/1051-1733-102.3.216

Witmer, FDW, TW Nawrocki, M Hahn. 2022. Modeling Geographic Uncertainty in Current and Future Habitat for Potential Populations of *Ixodes pacificus* (Acari: Ixodidae) in Alaska. Journal of Medical Entomology. https://doi.org/10.1093/jme/tjac001

Taxonomic updates

Amanda Droghini

1. **American ermine**: Colella et al. (2021) suggest that the *Mustela erminea* complex may include three species rather than a single species:

Mustela richardsonii (American ermine) – New World species, widespread across North America.

Mustela erminea (Beringian ermine) – Old World species; occurs throughout Eurasia and in Alaska.

Mustela haidarum (Haida ermine) – insular endemic; occurs only in southeast Alaska and British Columbia.

Colella, J. P., L. M. Frederick, S. L. Talbot, and J. A. Cook. 2021. Extrinsically reinforced hybrid speciation within Holarctic ermine (*Mustela* spp.) produces an insular endemic. Diversity and Distributions 27(4):747–762. https://doi.org/10.1111/ddi.13234

2. **North American pygmy shrews**: Hope et al. (2020) found distinct eastern and western species of North American pygmy shrews. They recommend referring to the western species (including Alaska) as *Sorex eximius* and the eastern species as *S. hoyi*. The latter was previously used to refer to what we thought of as a single species.

Hope, A. G., R. B. Stephens, S. D. Mueller, V. V. Tkach, and J. R. Demboski. 2020. Speciation of North American pygmy shrews (Eulipotyphla: Soricidae) supports spatial but not temporal congruence of diversification among boreal species. Biological Journal of the Linnean Society 129(1):41–60. https://doi.org/10.1093/biolinnean/blz139