Colville River Small Mammal Surveys, June 2015

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ABSTRACT

In northern Alaska, the presence, distribution, and habitat associations of small mammals are not well-documented. In 2015, we conducted small mammal surveys in six habitat types along the Colville River. We captured five species of rodents, including root voles (*Microtus oeconomus*), red-backed voles (*Myodes rutilus*), singing voles (*Microtus miurus*), brown lemmings (*Lemmus trimucronatus*), and collared lemmings (*Dicrostonyx groenlandicus*). Root voles had the highest capture rate and were present at all sites, followed by red-backed voles, which were absent from the westernmost sites. Sampled habitat types included wet sedge meadow tundra, tussock tundra, shrub-tussock tundra, low willow shrub, tall willow shrub, and tall alder-willow shrub. Both root and red-backed voles were captured in a variety of habitats. The highest root vole capture rate occurring in wet sedge meadows. Collared lemmings, brown lemmings, and singing voles were infrequently captured. Collared lemmings were captured in greater abundance in tussock tundra, while brown lemming captures were greater in tussock tundra that had a higher shrub component. No bat species were detected during the study.

INTRODUCTION

The Colville River runs 560 km east from the De Long Mountains, along the foothills of the Brooks Range, before turning northward and flowing into the Beaufort Sea at Nuiqsut. It is considered a Special Area by the Bureau of Land Management (2008). Most of the wildlife studies in the area and on the North Slope more generally have focused on large mammals such as caribou, brown bears, and muskox (ADNR 2011). To our knowledge, there have been no recent surveys on the status or habitat use of small mammals in the northern foothills of the Brooks Range. Understanding the status and habitat associations of small mammal species in remote Arctic tundra is important for the area's management, for documenting changes in range extent and distributions, and for assessing overall ecosystem health. Indeed, small mammals are a critical prey base for a variety of predators such as raptors, mustelids, and canids, and play important roles as herbivores and seed dispersers.

According to range maps (ACCS Wildlife Data Portal; https://aknhp.uaa.alaska.edu/apps/wildlife/) and distribution models (AKGAP 2013, Hope et al. 2013, Baltensperger and Huettmann 2015a), the following small mammal species are predicted to occur: northern collared lemming (*Dicrostonyx groenlandicus*), brown lemming (*Lemmus trimucronatus*), singing vole (*Microtus miurus*), root vole (*Microtus oeconomus*), meadow vole (*Microtus pennsylvanicus*), taiga vole (*Microtus xanthognathus*), northern red-backed vole (*Myodes rutilus*), masked shrew (*Sorex cinereus*), dusky shrew (*Sorex monticola*), tundra shrew (*Sorex ugyunak*) and the Holarctic least shrew (*Sorex minutissimus*, formerly considered the Alaska tiny shrew *S. yukonicus*; Hope et al. 2010). In addition, the northern range limit of little brown myotis (*Myotis lucifugus*) has not been explored and this species may be present in the area. Five of the listed species have been identified by the Alaska Species Ranking System (https://accs.uaa.alaska.edu/wildlife/alaska-species-ranking-system/) as having a moderately high conservation need, with the little brown myotis identified as a species with the highest level of conservation need.

To help fill these data gaps, we conducted a baseline survey for small mammal taxa along the Colville River. Specifically, we sought to determine:

1. What species/subspecies are currently present along the Colville River.
2. What is the distribution of each taxon.
3. What types of habitat are currently being used by each taxon.

From this research, we hoped to better understand the distribution and community composition of small mammal species along the Colville River, particularly the Holarctic least shrew and little brown myotis, and to collect samples for the University of Alaska Fairbanks Museum of the North.

METHODS

Study site

Small mammal surveys were conducted at five sites along a 250 mile section of the Colville River between the confluence of the Kiligwa River and Umiat from 10 June to 26 June 2015 (Figure 1). Sites were selected based on accessibility and adequate representation of microhabitats in the area. We also re-surveyed a small mammal sampling site in Umiat that was originally surveyed in 1952 by Bee and Hall (1956).

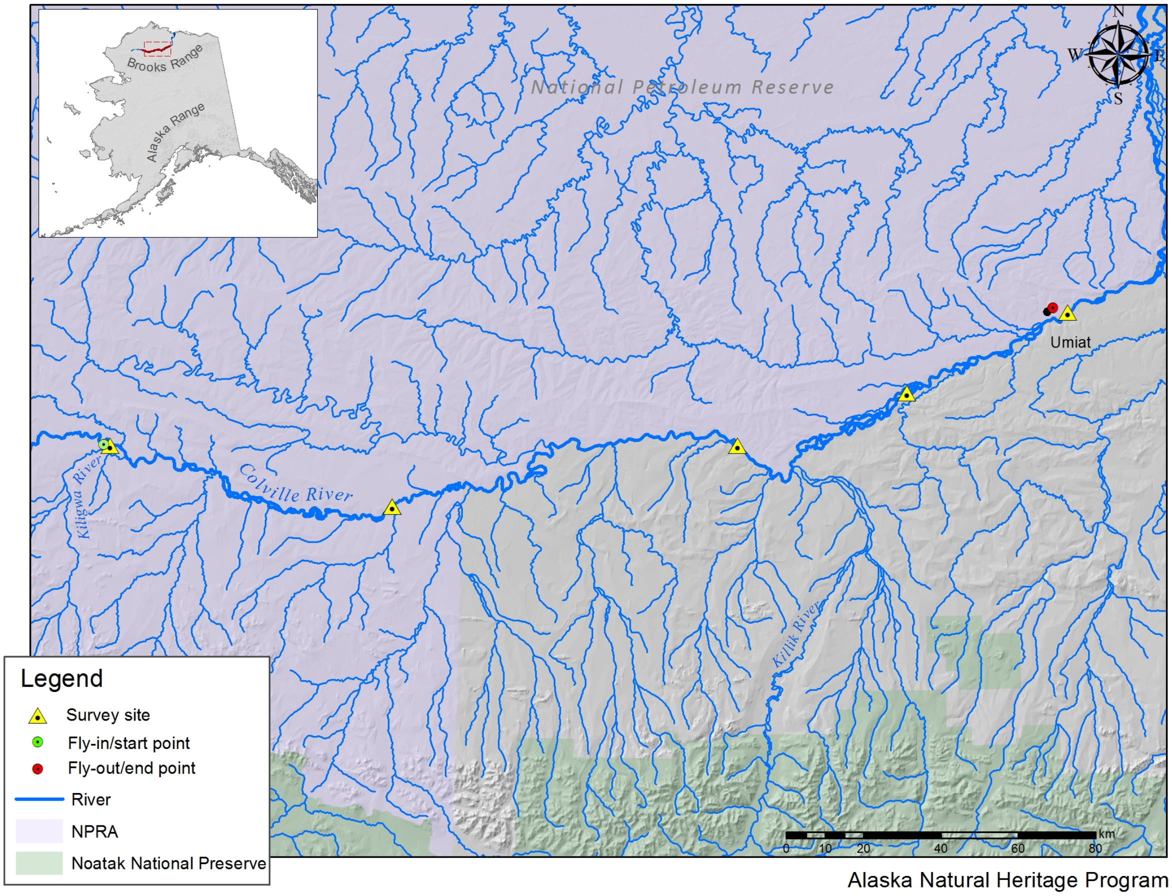

Figure 1: Small mammal survey sites along the Colville River, AK, June 2015.

Survey methods

At each survey site, we set up three trapping loops, each placed in a habitat type distinct from the others. Each loop was approximately 1 kilometer in length and consisted of 100 traps placed approximately 10 meters apart. We used three types of small mammal traps: Sherman, pitfall, and Museum Special. Each loop consisted of 80 Museum Special traps, with a Sherman trap at every 5th trap location, and a pitfall trap at every 10th trap location. Traps were set for two nights and one day, totaling 600 trap-nights per site. At each site, we also set up two trail cameras (Moultrie, A-8 Spy; target: medium-sized mammals) and two echolocation recorders (Wildlife Acoustics, SMZC; target: bats) along obvious wildlife trails and in foraging habitats.

Animal handling and collections

We identified captured individuals to species using a dichotomous key (MacDonald 2003). We recorded age, sex, and morphometric measurements (body mass, body length, tail length, ear length, hind foot length), and took photos of each individual. Live captures were released immediately after data collection. Lethal captures were placed in DMSO EDTA for preservation after skulls were removed. All specimens were submitted to the Museum of the North. Protocols were approved by the Museum of the North, the University of Alaska Anchorage, the Institutional Animal Care and Use Committee (IACUC), and the Alaska Department of Fish and Game.

Vegetation and habitat

At each transect, we did at least one vegetation plot (10 meter x 10 meter) per habitat type. Vegetation plots were located in homogeneous vegetation using a modified version of the "subjective sampling without preconceived bias" approach (Mueller-Dombois and Ellenberg 1974). We recorded all vascular plant taxa, as well as the dominant nonvascular plant taxa, that occurred within the plot. Dominance was defined as those taxa with >5% foliar cover. Taxa that could not be identified in the field were collected and identified at a later date. Plant nomenclature follows the standardized taxonomy provided by the PLANTS Database (USDA, NRCS 2015). A complete species list is provided as Appendix A.

Percent aerial cover was visually estimated for all taxa, physiognomic groups (e.g. tall shrub, graminoid, forb) and categories of unvegetated groundcover (e.g. gravel, cobble). For this project, aerial cover was considered to be the vertical projection of an individual plant's foliage, or the outline collectively covered by all individuals of a species or physiognomic group on the ground as viewed from above (Brown 1954, Daubenmire 1959). Where multiple strata of vegetation were present (e.g. shrub, herb, moss) total cover often exceeded 100%. Heights were measured for all woody taxa and physiognomic groups.

Abiotic site characteristics

Latitude, longitude, elevation, and positional error were recorded at the approximate center of each plot using a handheld GPS unit (Garmin 76CSx, Garmin Ltd., Olathe, KS, USA). Terrain slope was measured using a clinometer and recorded in degrees from level. Aspect was measured using a hand-held compass and recorded in degrees from true north. Landform and moisture class were described in accordance with Viereck et al. (1992). Abiotic site data is summarized in Appendix B.

RESULTS

We surveyed sixteen transect loops at five survey sites. Transect loops were located in a variety of landform types: active floodplain (3), inactive floodplain (3), hillslope (3), and terrace (7). Sampled habitat types included: wet sedge meadow tundra (2), tussock tundra (1), shrub-tussock tundra (4), low willow shrub (3), tall willow shrub (3), tall alder-willow shrub (3). A description of habitat types can be found in Appendix B.

We captured 176 individuals along 13 of the 16 transect loops. Individuals belonged to one of five species: root voles (*Microtus oeconomus*), red-backed voles (*Myodes rutilus*), singing voles (*Microtus miurus*), brown lemmings (*Lemmus trimucronatus*) and northern collared lemmings (*Dicrostonyx groenlandicus*). Red-backed voles were only present in the three easternmost sites, while root voles were present at all five study sites (Figure 2). Lemmings and singing voles were captured in relatively low numbers across sites (Figure 2). We did not capture or observe meadow voles or taiga voles, nor did we capture any shrews, though one shrew (unknown species) was observed between traps in Umiat. No medium or large mammals were recorded by the camera traps, and no bat echolocation calls were recorded by the SM2 acoustic recorder.

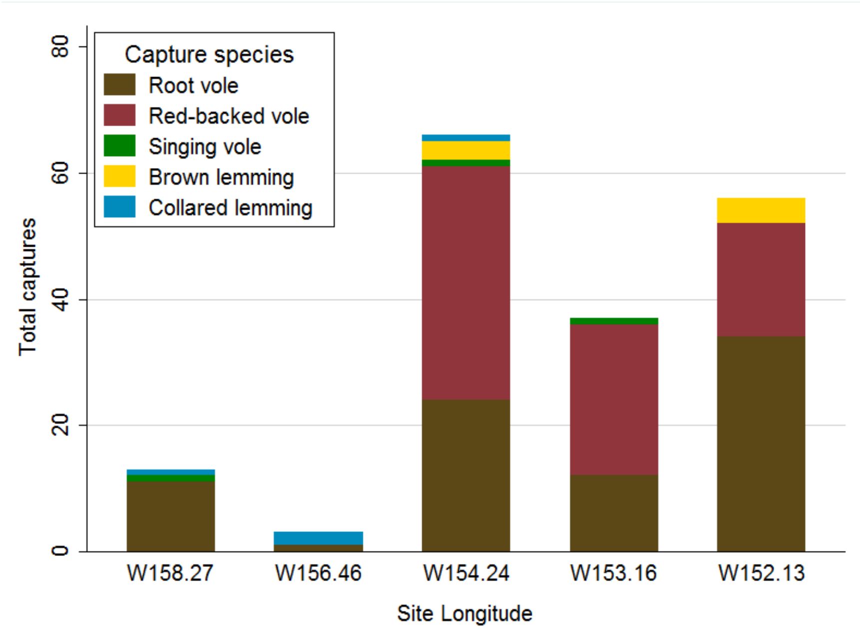

Figure 2: Small mammal captures at sites moving from west to east along the Colville River, AK.

Small mammal species were observed across all sampled habitat types (Figure 3). Collared lemmings were captured in greater abundance in tussock tundra, whereas brown lemming captures increased in moist tussock tundra habitats that had a higher component of shrub. Root voles were captured in greater numbers in wet sedge meadows, but both root and red-backed voles were captured in a variety of habitats (Figure 3).

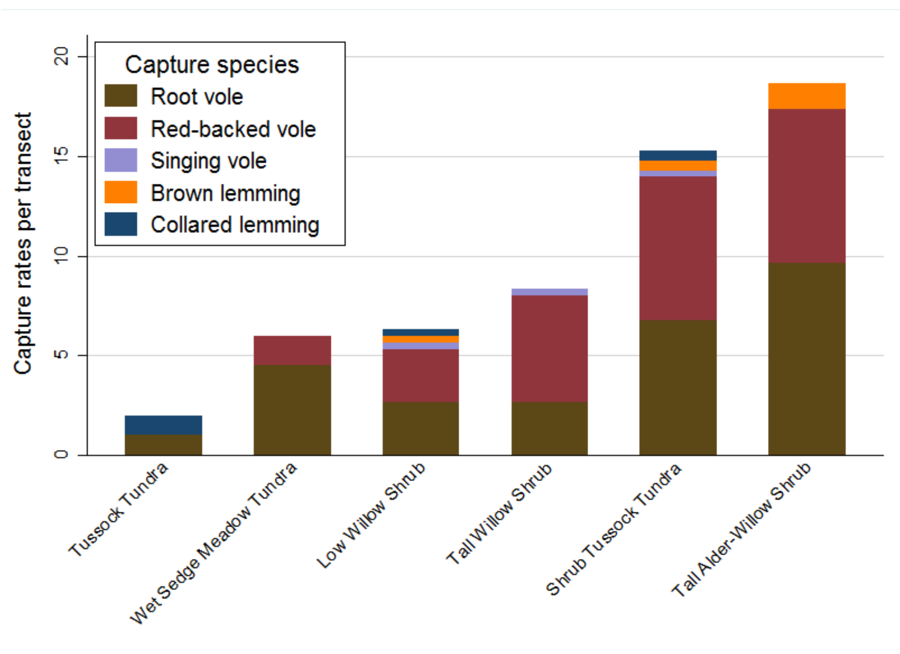

Figure 3: Small mammal captures associated with various habitat types along the Colville River, AK

DISCUSSION

Species presence and distribution

We confirmed the presence of five small mammal species along the Colville River: brown lemmings (*Lemmus trimucronatus*), northern collared lemmings (*Dicrostonyx groenlandicus*), root vole (*Microtus oeconomus*), singing voles (*Microtus miurus*) and northern red-backed voles (*Myodes rutilus*). Root voles and red-backed voles were the most abundant species captured (Figure 2). High capture rates of red-backed voles are typical throughout Alaska (Baltensperger and Huettmann 2015; Douglass 1984), but such prevalence has not previously been documented in the region. Lemmings and singing voles were captured with lower frequency, which is consistent with other studies in northern Alaska (Baltensperger and Huettmann 2015; Douglass 1984). The lack of shrew captures in pitfall traps is unusual, but may have been the result of difficulties in placing pitfall traps in frozen or flooded soils. Dr. Andrew Hope (personal communication) also reported similarly low capture success for shrews in the Arctic National Wildlife Refuge during this same year.

We observed a difference in the distribution of the two most commonly caught species. Root voles were captured at all survey sites, but red-backed voles were absent from the western-most sites and increased in abundance as we moved eastward down the Colville River. Although this trend could be correlated with warming temperatures associated with eastern sites being surveyed at a later date, the abundance of root voles captured at each site remained relatively constant and laboratory studies suggest that red-backed vole activity is only suppressed at temperatures well below freezing (-8 to -18° C; Getz 1968), which is much cooler than experienced during our study. We propose that increasing prevalence of woody shrubs at the eastern survey sites led to a higher prevalence of red-backed voles. Other small mammal surveys in northern Alaska have shown that near the northern extent of their range, red-backed voles are captured less frequently, while other microtine species are captured in greater relative abundance (Baltensperger and Huettmann 2015).

The absence of bat echolocation calls detected during this study may be the result of limited sampling effort, however, we suggest that it is likely due to the lack of canopy cover and therefore lack of tree-associated roost sites (Fenton and Barclay 1980). All habitat types surveyed were devoid of trees, though some downriver sites had stands of alders and willows over 2 m high, which simulated early-successional deciduous forest habitats. In addition, the absence of true solar darkness may increase the risk of predation (Speakman 1991), particularly in the absence of a canopy cover to provide some measure of risk mitigation (Rydell et al. 1996). While bats have been observed inhabiting regions with 24-hour daylight in Europe, the reported study areas were below treeline, providing bats with some measure of darkness to avoid predators (Rydell 1992, Rydell et al. 1994, Rydell et al. 1996). While a more thorough and targeted study assessing bat activity along the Colville River may provide more robust results, based on our habitat observations and the lack of bat acoustics, we suggest that the combination of 24-hour daylight and lack of canopy cover or roost sites likely limits the presence of bats in this region.

Species habitat use

The five rodent species captured during this study used habitats typical throughout the rest of the species' ranges. The relatively high capture rate of collared lemmings in habitats dominated by the tussock-forming sedge, *Eriophorum vaginatum*, and its dwarf shrub associates *Vaccinium vitis-idaea* and *Cassiope tetragona* is consistent with the idea that tussocks provide cover and important permafrost-free nesting habitat for collared lemmings (Bee and Hall 1952). The higher capture rate of both brown lemmings and root voles in habitats dominated by the sedge *Carex aquatilis* suggests that wet sedge meadows provide preferred forage (Batzli and Lesieutre 1991, Baltensperger et al. 2015). The preferential occupation of this habitat by these species is supported by previous observations (Bee and Hall 1956, Gough 2007, Baltensperger et al. 2015). Of the species of rodents considered here, red-backed voles were the least dependent on riparian plant communities (wet sedge or tussock habitats; Figure 3). Red-backed voles were detected in a wide variety of habitats and these findings are consistent with descriptions of red-backed voles as habitat generalists (Martell and Fuller 1979, MacDonald and Cook 2009). Similarly, root voles were captured across a variety of habitats, suggesting a broad niche for this species as previously shown (Zimmerman 1965, MacDonald and Cook 2009, Baltensperger et al. 2015).

Conclusion

This project served to fill a data gap for small mammal occurrences north of the Brooks Range. In addition, the absence of *Myotis lucifugus* echolocation detections provides initial data for assessing the northern range limits of this chiropteran species. Future research may include a comparable survey transect parallel to the Colville River at a higher latitude to investigate the northern limits of these rodent species.

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