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SNOWSHOE HARE (*LEPUS AMERICANUS*) AND MOUNTAIN COTTONTAIL (*SYLVILAGUS NUTTALLII*) BIOGEOGRAPHY AT THEIR SOUTHERN RANGE LIMIT

JENNIFER K. FREY* AND JASON L. MALANEY

Department of Fishery and Wildlife Sciences and The Vertebrate Museum, Department of Biology, New Mexico State University, P.O. Box 30003, MSC 4901, Las Cruces, NM 88003, USA (JKF)
Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM 87131, USA (JLM)

We surveyed snowshoe hare (*Lepus americanus*) and mountain cottontail (*Sylvilagus nuttallii*) in coniferous forests in northern New Mexico. *L. americanus* was restricted to the Sangre de Cristo and San Juan ranges in a narrow band of elevations corresponding to subalpine coniferous forest. In contrast, *S. nuttallii* was widely distributed and virtually cosmopolitan, occupying a wide range of elevations and vegetation zones, including subalpine coniferous forest where it was syntopic with *L. americanus*. Previous reports about the distribution and ecological associations of these species at their southern limits indicated broader ecological associations for *L. americanus* and narrower ecological associations for *S. nuttallii*. Historical reports about the biogeography of these species likely were based on misinterpretation of leporid sign and specimen records. We make recommendations for reducing problems associated with the interpretation of anecdotal natural history information and specimen records.

Key words: biogeography, distribution, elevation, *Lepus americanus*, mountain cottontail, natural history, New Mexico, Rocky Mountains, snowshoe hare, *Sylvilagus nuttallii*

The snowshoe hare (*Lepus americanus*) has the largest geographic range of any North American leporid (Hall 1981; Nelson 1909). Its distribution is broadly associated with boreal and subalpine forests, which span more than 65° of latitude from the northern Canadian Arctic southward through the Appalachian, Rocky, and Sierra Nevada mountains (Hall 1981). The extreme southern extent of its distribution is the Southern Rocky Mountains in northern New Mexico (Hall 1981). Here, available data about distribution and ecology of *L. americanus* are limited and restricted to museum records and scant anecdotal information (e.g., Bailey 1931; Findley et al. 1975; Hill 1942; Ligon 1927; but see Malaney [2003] and Malaney and Frey 2006).

Findley et al. (1975) provided the most recent review of distribution of *L. americanus* in New Mexico. They examined a total of 15 museum specimens from 8 localities, including 5 localities from Taos, Mora, and San Miguel counties in the Sangre de Cristo Range and 3 localities from Rio Arriba County in the San Juan Range. Findley et al. (1975) also reported 3 localities from the literature. One was a report by Hill (1942) of 2 specimens collected from Agua Fria Mountain, which is a part of the Sangre de Cristo Range in Colfax County. We found these in the American Museum of Natural History (AMNH 131874 and AMNH 131875). The remaining 2 localities were based on observations of sign reported by Bailey (1931) in the Gallinas Mountains, Rio Arriba County, and in the Jemez Mountains, Sandoval County. Findley et al. (1975:93) considered the Gallinas and Jemez mountains reports ''probable but unproven'' because specimens did not exist.

The mountain cottontail (*Sylvilagus nuttallii*) is broadly sympatric with *L. americanus* over most of its range throughout the intermountain region of western North America (Hall 1981). *S. nuttallii* also reaches the southern extent of its distribution in the American Southwest. Findley et al. (1975) reported 72 specimens of *S. nuttallii* from New Mexico, which represented most counties in the northern one-third of the state, including all mountain ranges where *L. americanus* has been reported. Although the 2 species are sympatric, they are considered to be ecologically segregated and have not been reported in syntopy (i.e., occurring at the same locality). Usually, *S. nuttallii* is found in habitat zones below subalpine coniferous forest, including desertscrub, grassland, woodland, and montane coniferous forests (Chapman et al. 1982; Findley et al. 1975; Frey and Yates 1996). However, in some southern mountains

* *Correspondent: jfrey@nmsu.edu*

where *L. americanus* is absent (e.g., White Mountains, Arizona, and Pikes Peak Range, Colorado) *S. nuttallii* is known to occur upward into the subalpine coniferous forest zone (Armstrong 1972; Hoffmeister 1986). Further, Findley et al. (1975) reported a specimen each of *L. americanus* and *S. nuttallii* collected in 1956 from Goose Lake, Taos County, in the Sangre de Cristo Range. This locality is at 3,542 m elevation at the upper edge of the subalpine coniferous forest where it meets alpine tundra. These records raise questions about the distribution of *S. nuttallii* in higher-elevation subalpine forests and the extent to which syntopy occurs between *S. nuttallii* and *L. americanus* at their southern range limits. Consequently, we initiated a survey to assess distribution of *L. americanus* and *S. nuttallii* within coniferous forests in northern New Mexico. Further, we compared observed distribution and ecological associations with historical accounts of each species in order to assess any temporal or spatial changes.

Materials and Methods

Leporids were opportunistically surveyed in montane and subalpine coniferous forests in the Sangre de Cristo, San Juan, and Jemez ranges of northern New Mexico using spotlighting and traps during summer 2001 and 2002. Spotlighting was conducted at night by driving roads using handheld spotlights and vehicle headlights to locate leporids. Tomahawk live traps (Tomahawk Live Trap Co., Tomahawk, Wisconsin) were used to assess leporid occurrence in interior forest away from roads following protocols described in Malaney (2003) and Malaney and Frey (2006). Sampling effort included approximately 3,000 km of spotlight surveys and 515 total trap-nights. When possible, specimens were collected and prepared as standard skin and skeleton vouchers, with frozen tissues, and deposited in the Eastern New Mexico University Natural History Museum, Portales, New Mexico. Trapping and euthanasia protocols followed guidelines of the American Society of Mammalogists (Animal Care and Use Committee 1998).

If not collected, species identification was based on visual observation. Snowshoe hares appeared to have uniformly grayish bodies (during summer, but turning white in autumn and winter) with long legs and large splayed hind feet. Mountain cottontails appeared brownish with short legs and obvious white tails. Snowshoe hares ran with long leaps, while mountain cottontails hopped with short strides.

Locality data were collected with a handheld global positioning system unit at each location where a leporid was observed or collected. Museums with major holdings of New Mexico mammals were queried for additional records of *L. americanus*.

Historical information on distribution and ecological associations of each species was obtained from Nelson's (1909) monograph on the rabbits of North America and Bailey's (1931) monograph on the mammals of New Mexico, which is the most thorough account of these species in the state. Historical accounts used the life zone concept of Merriam (1890) to describe mammal distributions and ecological associations. Consequently, we compared New Mexico life zones as described by Bailey (1913) with modern New Mexico forest classifications described by Dick-Peddie (1993). Each leporid locality was assigned to one of these forest types.

Results

Life zones were directly referable to modern forest classifications. The only exception was that life zones had higher reported elevation boundaries than currently recognized forest types, which was not surprising because Bailey (1931) frequently overestimated elevations, probably because of map and altimeter inaccuracies. The Hudsonian Life Zone was equivalent to subalpine coniferous forest, which occurs just below timberline (i.e., 3,000–3,650 m) and is usually dominated by a subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) series, but also may consist of an open bristlecone pine (*Pinus aristata*) woodlands series on dry exposures. The Canadian Life Zone was equivalent to upper montane coniferous forest, which occurs at midelevations (i.e., 2,400–3,100 m) and is dominated by blue spruce (*Picea pungens*), Engelmann spruce, white fir (*Abies concolor*), limber pine (*Pinus flexilis*), and Douglas-fir (*Pseudotsuga menziesii*). The Transition Life Zone was equivalent to lower montane coniferous forest, which is the lowest-elevation coniferous forest (i.e., $<$2,600 m) and is dominated by ponderosa pine (*Pinus ponderosa*).

We obtained 42 new records of *L. americanus* from 40 localities (Fig. 1; Appendix I). Of these, 33 were the result of field surveys and 9 were from museum queries. New locality records included 5 from the San Juan Range and 35 from the Sangre de Cristo Range, including the 1st from Santa Fe County. We did not document any significant range extensions nor did we record *L. americanus* in the Jemez Range. Based on field surveys, the elevational range of *L. americanus* was 3,006–3,338 m, which approximated limits of the subalpine zone (Fig. 2). All localities of *L. americanus* were associated with the Engelmann spruce–subalpine fir series, or rarely, dense, prostrate, postfire stands of aspen (*Populus tremuloides*—Malaney and Frey 2006).

We obtained 63 new records of *S. nuttallii* in the Sangre de Cristo, San Juan, and Jemez ranges (Appendix II). Localities of *S. nuttallii* extended upward to an elevation of 3,341 m, which was higher than our highest record for *L. americanus* (Fig. 2). *S. nuttallii* was found in virtually all habitats, including the Engelmann spruce–subalpine fir series (Malaney and Frey 2006). Further, we documented syntopy between *L. americanus* and *S. nuttallii* at 5 localities in the Sangre de Cristo Range (Appendices I and II). The distribution of syntopic localities was widespread and elevations ranged from 3,015 to 3,310 m, which was nearly the entire vertical range of *L. americanus*.

Discussion

We found *L. americanus* to be relatively uncommon and restricted to subalpine coniferous forest, whereas *S. nuttallii* was widespread and relatively common in upper montane and subalpine coniferous forests. In contrast, historical accounts considered *L. americanus* to occur primarily in upper montane forest and *S. nuttallii* to occur primarily in lower montane forest (Table 1). Thus, historical descriptions of the ecological distribution of *L. americanus* and *S. nuttallii* in New Mexico starkly contradict results of our field study. Consequently, we assessed whether differences resulted from actual changes in distributions and ecological associations over the past century.

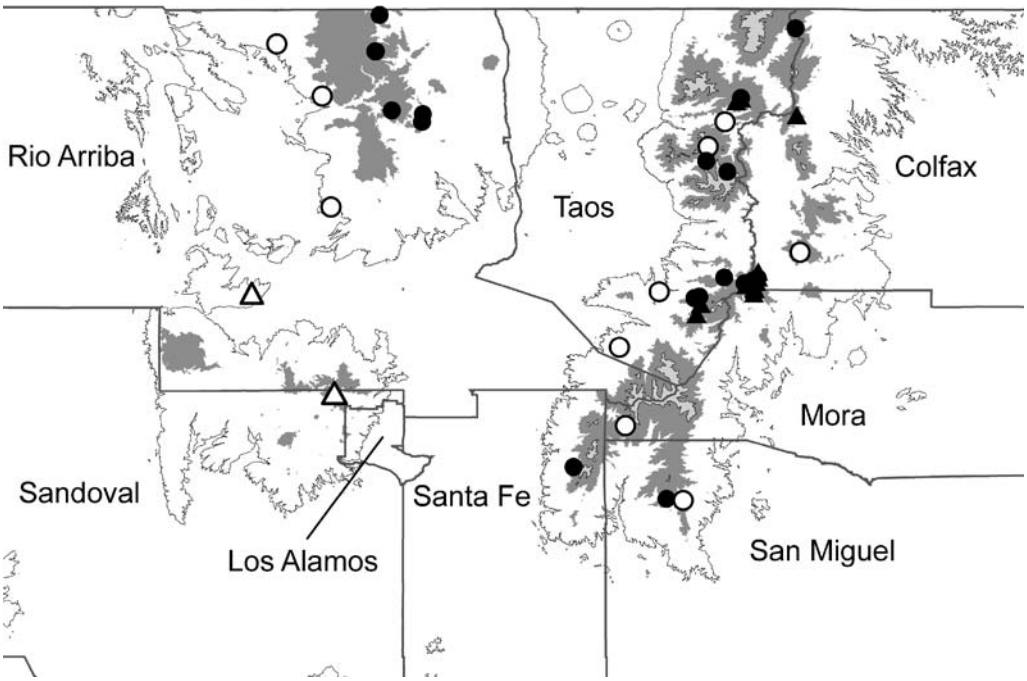

Fig. 1.—Records of snowshoe hare (*Lepus americanus*) in New Mexico. Historic localities reported in Findley et al. (1975) are shown as open symbols, whereas new records since the study by Findley et al. (1975) are shown as closed symbols. Triangles indicate observation records and circles indicate specimen records. Shading represents elevations of 3,000–3,500 m, which approximates the limits of subalpine coniferous forest (Dick-Peddie 1993). The 2,400-m contour interval illustrates the mountains of northern New Mexico. Words are county names.

Historical evidence.—Nelson's (1909) assessment of the distribution and ecological associations of these species in Colorado and New Mexico was apparently based only on specimen records. However, the number of specimen localities was meager, which for *L. americanus* consisted of 5 in New Mexico and 9 in Colorado (Nelson 1909). Bailey (1931) mentioned only 3 specimens of *L. americanus*, each of which had previously been referenced by Nelson (1909). Of the 5 historical localities of *L. americanus* in New Mexico only 2 had reported elevations (i.e., 3,048 and 3,353 m), both within the subalpine zone. Specimens of *L. americanus* recorded from the towns of "Chama" (Rio Arriba County, New Mexico) and "[Hot] Sulphur Springs" (Grand County, Colorado) map to about 2,438 m in elevation, which likely accounts for the lower elevational limit reported by Nelson (1909:112) and later by Bailey (1931). However, these localities may be misleading because locations on specimen tags do not always refer to the exact place where a specimen was collected, but rather to the staging point from which specimen-collecting expeditions occurred or to the location from which specimens were shipped to museums (Frey et al. 1997). This was particularly true historically when there were few named geographic locations and detailed maps were not available. For example, although Chama is in a valley at the lower edge of the lower montane coniferous forest zone, it is less than 7 km from subalpine coniferous forest in the adjacent San Juan Range.

Bailey (1931) noted that *S. nuttallii* and especially *L. americanus* were difficult to visually observe and collect. Consequently, Bailey's observations of sign formed a major basis for his descriptions of the species' distribution, abundance, and ecological associations, especially for *L. americanus*. Specific sign reported by Bailey (1931) included fecal pellets and trails, although in most cases he did not identify the type of sign upon which he was relying for evidence.

Tracks of *L. americanus* in snow are readily distinguishable from those of *S. nuttallii* by their large size and splayed shape. However, Bailey did not work in northern New Mexico during

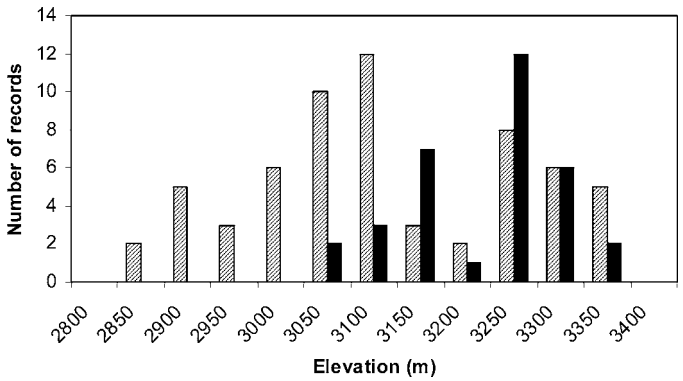

Fig. 2.—Frequency histogram of elevation records of leporids in coniferous forest zones during summer 2001 and 2002 in New Mexico. Black bars represent records of snowshoe hare (*Lepus americanus*) and hatched bars represent records of mountain cottontail (*Sylvilagus nuttallii*). The boundary between the upper montane coniferous forest zone (i.e., Canadian Life Zone) and the subalpine coniferous forest zone (i.e., Hudsonian Life Zone) in New Mexico is about 3,000 m elevation; the lower boundary of alpine tundra is approximately 3,500 m elevation.

Table 1.—Elevational range and coniferous forest associations reported for *Lepus americanus* and *Sylvilagus nuttallii* in New Mexico.

	Nelson (1909)[a]	Bailey (1931)	Current study
Lepus americanus			
Elevation (m)	2,438–3,353[b]	2,438–3,353[b]	3,006–3,338
Forest zone	Upper montane and subalpine	Primarily upper montane, also subalpine	Subalpine
Sylvilagus nuttallii			
Elevation (m)	2,286–>3,048	2,286–3,048	≤3,341
Forest zone	Primarily lower montane, also edges above and below this zone[c]	Primarily lower montane, also edges above and below this zone[c]	All zones

[a] Data pertain to New Mexico and Colorado.
[b] Timberline was considered to be 3,353 m.
[c] Below lower montane in winter.

early spring, late autumn, or winter when snow is present (Bailey 1928). Second, at more northern latitudes *L. americanus* has been reported to make distinctive runways, especially in the snow during peaks in cyclical abundance (e.g., Bailey 1936; Murie 1974). However, *S. nuttallii* also has been reported to make runways, but differences in runways between the 2 species have not been reported (Bailey 1931). We did not observe any obvious leporid runways during our field studies.

The most conspicuous type of leporid sign we found during summer was fecal pellets. However, we did not find a significant difference in size (*L. americanus*: $n = 90$, $\bar{X} = 9.8$ mm $\pm$ 1.48 *SD*; *S. nuttallii*: $n = 90$, $\bar{X} = 9.6$ mm $\pm$ 1.38 *SD*; $t = 1.73$, *d.f.* $= 89$, $P = 0.235$), nor notice any observable differences in shape or composition of fecal pellets produced by trapped *L. americanus* or *S. nuttallii*. The similarity in fecal pellet size reflects the similarity in body size of these species in New Mexico (Smith et al. 1995). Thus, Bailey's identification of pellets was likely influenced by the habitat in which they were found and his perception of the ecological associations of the species. Further, Bailey's identification of fecal pellets may have been influenced by his experience with these species in other regions where they exhibit greater differences in body size. In Oregon, where Bailey did considerable fieldwork before working in New Mexico, *S. nuttallii* is the smallest subspecies (*S. n. nuttallii*), averaging about 40% smaller in mass than *L. americanus* (Bailey 1928; Verts and Carraway 1998). In contrast, *S. nuttallii* in New Mexico is the largest subspecies (*S. n. pinetis*), which is similar in size to *L. americanus* (Bailey 1936; Hoffmeister and Lee 1963). Thus, Bailey (1931) may have mistaken the relatively large fecal pellets of New Mexico *S. nuttallii* for pellets of *L. americanus*.

Jemez and Gallinas mountains.—We did not find *L. americanus* in the Jemez Range despite 5 consecutive nights of survey in the vicinity of Chicoma Mountain (=Santa Clara Peak), Rio Arriba County. This is the highest peak (elevation 3,524 m) in the range and is within the most extensive area of contiguous high-elevation habitat above 3,200 m. It usually required only 1 and never >2 nights of survey to document *L. americanus* in other ranges. In contrast, *S. nuttallii* was very common at Chicoma Mountain including the highest elevations accessible by road (e.g., 3,329 m) near timberline. Structure and composition of Engelmann spruce–subalpine fir forest at localities of *S. nuttallii* were indistinguishable from those at localities of *L. americanus* in the San Juan and Sangre de Cristo ranges (Malaney and Frey 2006).

There are at least 2 alternative explanations for the apparent current absence of *L. americanus* in the Jemez Range. First, it is possible it was recently extirpated or reduced to undetectable numbers, at least in the area surveyed. In New Mexico *L. americanus* uses closed-canopy Engelmann spruce–subalpine fir forests with high horizontal foliage cover, whereas *S. nuttallii* uses more open habitat with more herbaceous ground cover (Malaney and Frey 2006). Consequently, events that open the canopy and reduce horizontal cover are likely detrimental to *L. americanus* and beneficial to *S. nuttallii* (Malaney and Frey 2006). The area around Chicoma Peak had been clear-cut logged resulting in windthrow, regeneration problems, and spruce beetle (*Dendroctonus rufipennis*) infestations (Allen 1989). Such factors could have negatively impacted *L. americanus* and potentially resulted in local extirpation.

Alternatively, the record of *L. americanus* in the Jemez Mountains may be erroneous. Evidence for its occurrence in the Jemez Mountains was based on Bailey's (1931:46) statement: "in the Jemez Mountains their characteristic pellets were found scattered through the deep forests of spruce and fir at 10,000 to 11,000 feet [3,048 to 3,353 m] altitude where no other species of rabbit ever penetrates." Given that we found the pellets produced by the 2 species to be indistinguishable, it seems likely that Bailey was influenced by the idea that only *L. americanus* occurred at elevations above 3,048 m. That this record is likely erroneous is corroborated by the lack of any subsequent physical evidence of the species' occurrence in this range. Consequently, we tentatively conclude that *L. americanus* did not recently occur in the Jemez Range, although surveys of other high-elevation areas (i.e., San Pedro Mountains and Redondo Peak) may be warranted to confirm this conclusion. Regardless, as in other mountain ranges in the American Southwest where *L. americanus* is absent, *S. nuttallii* seems to be filling the ecological niche of *L. americanus* in the subalpine zone in the Jemez Range.

In the Gallinas Mountains Bailey (1931:46) reported *L. americanus* "signs were abundant up to 10,000 feet [3,048 m]." It is likely that this sign was actually referable to *S. nuttallii*. The Gallinas Mountains (=Mesa Prieta) are located in Rio Arriba County between the Rio Chama to the northeast and Salitral Creek to the south (V. Bailey 1913; F. M. Bailey 1928). The region has a maximum elevation of 2,806 m and is montane coniferous forest (Dick-Peddie 1993), which is unsuited to *L. americanus*. Further, *S. nuttallii* has been collected from the highest elevation in the range (Bailey 1931). Thus, we conclude that *L. americanus* has not recently occurred in the Gallinas Mountains.

Conclusions.—In New Mexico, *L. americanus* is limited to the San Juan and Sangre de Cristo ranges of the Southern

Rocky Mountains. We found no conclusive evidence that it currently or historically occurred in the Jemez or Gallinas mountains and, consequently, find no compelling evidence that its range has contracted. However, in the San Juan and Sangre de Cristo ranges, its distribution was restricted to high elevations within a narrow vegetation zone. We conclude that early reports of *L. americanus* in montane coniferous forest in New Mexico were erroneous and regard the species to be restricted to subalpine coniferous forest, at least during summer. Thus, its local distribution within each mountain range may be discontinuous as a result of topographic and corresponding habitat variation (Fig. 1). Given the species' uncommon occurrence and highly restricted distribution and habitat associations, we recommend that conservation and management efforts be directed at *L. americanus* in New Mexico.

In comparison with *L. americanus* in northern New Mexico, *S. nuttallii* had a larger geographic range, was relatively more abundant, and had a nearly ubiquitous distribution within coniferous forests, including the subalpine zone. Our cosmopolitan depiction is different from its portrayal in historical accounts. Given the species' secretive habits, inadequate sampling, and inaccurate identification of leporid sign, it is conceivable that *S. nuttallii* always occurred in the subalpine zone, perhaps restricted to open habitats on warm aspects or in burned areas, which are habitats that it is known to use (Malaney and Frey 2006). Alternatively, human land use practices leading to more open forests may have influenced the species' distribution in New Mexico. This hypothesis is supported by its previously unrecognized widespread occurrence and high relative abundance in subalpine coniferous forests, its previously unrecognized widespread syntopy with *L. americanus*, and that it is often associated with human-caused openings in subalpine forests, especially along roads and in heavily logged areas (Malaney and Frey 2006). Consequently, we recommend additional studies to assess the extent to which habitat changes have facilitated the occurrence of *S. nuttallii* in this system, including potential for competition with *L. americanus*.

Major sources of natural history information for many (if not most) species are based on historical anecdotal reports and museum specimen records and such information is often reiterated in subsequent treatments. To reduce error in interpretation, we recommend that natural history information be validated by investigating the ultimate source of the information. This should include both the citation as well as the basis for the original report. Further, we recommend exercising caution in the use and interpretation of locality data from museum specimens, especially from historical specimens that lack specific localities beyond a geographic place name. Also, given that natural history traits can vary geographically and seasonally, we recommend avoiding extrapolating such information (regardless of the source) to different geographic regions and seasons. Finally, given the inherent problems that can be associated with anecdotal information, we urge that more fundamental, descriptive, and analytical research on natural history be undertaken. Given the growing conservation crisis, a priority may be placed on those studies that provide data on natural history features that may most directly pertain to a species' conservation status, such as its distribution, habitat associations, and critical ecological interactions.

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APPENDIX I

Records ($n = 42$) of snowshoe hares (*Lepus americanus*) from New Mexico since the study by Findley et al. (1975). Numbers preceding parentheses indicate number of specimens, and numbers in parentheses are catalog numbers. Museum acronyms: Eastern New Mexico University Natural History Museum, Portales (ENMU); Museum of Southwestern Biology, University of New Mexico, Albuquerque (MSB; NK for tissue sample only); The Museum, Texas Tech University, Lubbock (TTU); Centennial Museum, University of Texas at El Paso, El Paso (UTEP). Observation records of snowshoe hare were obtained during field surveys in northern New Mexico during 2001 and 2002. Superscripts designate syntopic localities with mountain cottontail (*Sylvilagus nuttallii*; Appendix II).

Specimen records (n = 28).—COLFAX COUNTY: Sangre de Cristo Mountains, Carson National Forest, 1.7 mile SE of Osha Mountain junction of FS (Forest Service) Road 76 and 153, 36°17.016′N, 105°19.406′W, 3,137 m, 1 (ENMU 11191); Sangre de Cristo Mountains, Carson National Forest, 0.25 mile W on FS Road 153 from junction with FS Road 76, near junction 153 and trail 121, 36°16.996′N, 105°19.665′W, 3,228 m, 2 (ENMU 11288, 11289); [1]Sangre de Cristo Mountains, Vermejo Park Ranch, 1.0 mile S, 0.5 mile W of Underwood Lakes, 36°56.723′N, 105°13.240′W, 3,098 m, 1 (ENMU 11290); Sangre de Cristo Mountains, Carson National Forest, junction of FS Roads 76 and 153, T24N, R15E, NE 1/4, SW 1/4 Sec. 26, 36°17.037′N, 105°19.367′W, 3,142 m, 1 (ENMU 11291); Sangre de Cristo Mountains, Carson National Forest, ¾ mile N of junction 76 and 153 on FS Road 76, ¾ mile E of Osha Mountain, T24N, R15E, SE 1/4, SW 1/4 Sec. 23, 36°17.622′N, 105°19.173′W, 3,085 m, 1 (ENMU 11494). RIO ARRIBA COUNTY: Carson National Forest, Upper Lagunitas Campground, 36°53.115′N, 106°19.237′W, 3,226 m, 3 (ENMU 11075, 11080, 11089); 1 mile N, 2 mile E Hopewell Lake, T29N, R7E, Sec. 28, 1 (MSB 60684); T29N, R7E, Sec. 33, 1 (MSB 60682); 15 mile E, 2 mile N Tierra Amarilla, T29N, R5E, Sec. 23, 1 (ENMU 9672); Cruces Basin Wilderness, 6.2 mile from upper Lagunitas Campground, 1 (ENMU 10530). SAN MIGUEL COUNTY: [5]Santa Fe National Forest, 5 mile S of Elk Mountain, 35°43.084′N, 105°33.543′W, 3,310 m, 1 (ENMU 11062); 2 mile S Anton Chico, 1 (MSB 32509). SANTA FE COUNTY: Santa Fe Ski Basin, 1.75 mile W Lake Peak, 1 (UTEP 6911). TAOS COUNTY: Carson National Forest, Greenie Mountain, 0.75 mile along FS Road 54 from junction with FS Road 134, 36°45.779′N, 105°21.862′W, 3,281 m, 1 (ENMU 11063); Sangre de Cristo Mountains, Carson National Forest, Maestas Ridge, T23N, R14E, NW 1/4 Sec. 8, 36°14.486′N, 105°29.182′W, 3,130 m, 1 (ENMU 11065); Carson National Forest, Maestas Ridge, 36°14.688′N, 105°28.355′W, 3,150 m, 1 (ENMU 11074); Sangre de Cristo Mountains, Carson National Forest, 0.4 mile S on FS Road 76 from junction 76 and 153, 36°17.383′N, 105°19.302′W, 3,113 m, 1 (ENMU 11287); Sangre de Cristo Mountains, Carson National Forest, Osha Mountain, Jaracita Park, SSH Grid C2, 36°17.089′N, 105°19.913′W, 3,205 m, 1 (ENMU 11294); Sangre de Cristo Mountains, Carson National Forest, 1.0 mile S on FS Road 441 from FS Roads junction 441 and 478, 36°17.679′N, 105°24.509′W, 3,134 m, 1 (ENMU 11295); Sangre de Cristo Mountains, Carson National Forest, Osha Mountain, Jaracita Park, SSH Grid D4, 36°17.198′N, 105°19.960′W, 3,228 m, 1 (ENMU 11300); Sangre de Cristo Mountains, Carson National Forest, Osha Mountain, Jaracita Park, SSH Grid C3, 36°17.135′N, 105°19.899′W, 3,220 m, 1 (ENMU 11301); Sangre de Cristo Mountains, Carson National Forest, Osha Mountain, Jaracita Park, SSH Grid D5, 36°17.246′N, 105°19.943′W, 3,234 m, 1 (ENMU 11378); Twining, 500 yards NW St. Bernard Hotel, 1 (TTU 2357); Wheeler Peak, Krummholtz, elev. 11,775 feet, 1 (MSB 64379); 7.8 mile S, 1.7 mile E Valle Escondido along Rito de la Olla, T24N, R15E, SE 1/4 Sec. 28, 36°16′49″N, 105°21′16″W, 1 (NK 35515).

Observation records (n = 14).—COLFAX COUNTY: Sangre de Cristo Mountains, Carson National Forest, 1.5 mile S, 0.25 mile E of Osha Mountain near the junction of FS Road 153 and trail 121, T24N, R15E, NE 1/4, SE 1/4 Sec. 27, 36°16.972′N, 105°19.690′W, 3,215 m; Sangre de Cristo Mountains, Carson National Forest, 0.75 mile N on 76 from junction with FS Road 153, T24N, R15E, S 1/2 Sec. 27, 0.75 mile S, 1 mile E of Osha Mountain, 36°17.685′N, 105°19.116′W, 3,062 m; Sangre de Cristo Mountains, Carson National Forest, 3.0 mile on 153 from 153 and 76 junction, ¼ mile N, ¼ mile E of Cuchillo de Fernando, 36°16.589′N, 105°20.976′W, 3,279 m; Sangre de Cristo Mountains, Carson National Forest, 0.1 mile W of 76 and 153 junction on FS Road 153, 1.5 mile S, 0.5 mile E of Osha Mountain, T24N, R15E, SW 1/4, NE 1/4 Sec. 26, 36°17.080′N, 105°19.458′W, 3,015 m; [3]Sangre de Cristo Mountains, Carson National Forest, ~2.5 mile N of 76 and 153 junction on FS Road 76, 0.25 mile N, 1 mile E of Osha Mountain, T24N, R15E, NE 1/4, SW 1/4 Sec. 14, 36°18.635′N, 105°19.153′W, 3,006 m; Sangre de Cristo Mountains, Carson National Forest, 2.0 mile S of junction 153 and 76 on FS Road 76, 0.25 mile S, 1.5 mile E of Cuchillo de Fernando, 36°15.891′N, 105°19.705′W, 3,248 m; Sangre de Cristo Mountains, Carson National Forest, 2.0 mile S of junction 153 and 76 on FS Road 76, 0.25 mile S, 1.5 mile E of Cuchillo de Fernando, 36°15.907′N, 105°19.708′W, 3,252 m; Sangre de Cristo Mountains, Carson National Forest, FS Road 76, 1.5 mile E of Cuchillo de Fernando, 36°16.092′N, 105°19.729′W, 3,277 m; [2]Sangre de Cristo Mountains, Carson National Forest, Valle Vidal Unit of Carson National Forest, 4.0 mile S, 0.25 mile E of Shurre Ponds, 36°43.126′N, 105°13.054′W, 3,165 m. MORA COUNTY: [4]Sangre de Cristo Mountains, Carson National Forest, FS Road 76 near a spring, 1.0 mile S, 1.25 mile E of Cuchillo de Fernando, 36°15.226′N, 105°19.827′W, 3,242 m. TAOS COUNTY: Sangre de Cristo Mountains, Carson National Forest, 0.1 mile E from FS Road 54 and 54D junction, 0.5 mile S Greenie Mountain, 36°45.308′N,

105°22.570′W, 3,338 m; Sangre de Cristo Mountains, Carson National Forest, 0.75 mile from FS Road 54 and 54D junction, 0.5 mile E Greenie Mountain, 36°45.786′N, 105°21.796′W, 3,268 m; Sangre de Cristo Mountains, Carson National Forest, 1.4 mile S on FS Road 442 from 442 and 439 junction, 0.5 mile S, 3.33 mile W of Cerro Vista, 36°13.632′N, 105°28.156′W, 3,140 m; Sangre de Cristo Mountains, Carson National Forest, 4.25 mile on FS Road 442 from 442 and 439 junction, head of Fowler Canyon, 36°11.996′N, 105°28.810′W, 3,257 m.

Appendix II

Records ($n = 63$) of mountain cottontail (*Sylvilagus nuttallii*) obtained during field surveys in northern New Mexico during 2001 and 2002. Numbers preceding parentheses indicate number of specimens, and numbers in parentheses are catalog numbers. Specimens are in the Eastern New Mexico University Natural History Museum (ENMU; ET for tissue sample only). Superscripts designate syntopic localities with snowshoe hare (*Lepus americanus*; Appendix I).

Specimen records ($n = 24$).—COLFAX COUNTY: Carson National Forest, 3.5 mile S, 1.2 mile E of Angostura along Forest Road 61, 36°03.422′N, 105°28.050′W, 2,935 m, 1 (ENMU 11190); Sangre de Cristo Mountains, Cimarron Range, Philmont Scout Ranch, Bubien Camp, 36°25.721′N, 105°06.07′W, 2,898 m, 1 (ENMU 11309); Sangre de Cristo Mountains, Cimarron Range, Philmont Scout Ranch, ~0.3 miles NE of Phillips junction, 36°25.344′N, 105°06.958′W, 2,807 m, 1 (ENMU 11310); Sangre de Cristo Mountains, Vermejo Park Ranch, 0.5 miles N of Underwood Lake, 36°57.942′N, 105°12.748′W, 3,131 m, 1 (ENMU 11313); 0.5 mile N, 1.5 mile E Osha Mountain, T24N, R15E, SW 1/4, NW 1/4 Sec. 13, 36°18.875′N, 105°18.353′W, 2,851 m, 1 (ENMU 11323). MORA COUNTY: Carson National Forest, FS Road 161, 36°03.184′N, 105°28.381′W, 2,977 m, 1 (ENMU 11324). RIO ARRIBA COUNTY: Jemez Mountains, Santa Fe National Forest, Chihuahuenos, 36°00.411′N, 106°30.561′W, 3,072 m, 1 (ENMU 11325); Jemez Mountains, Santa Fe National Forest, Chicoma Mountain, 36°01.294′N, 106°23.464′W, 3,256 m, 1 (ENMU 11326); Jemez Mountains, Santa Fe National Forest, Chihuahuenos, MPS boundary, 36°00.420′N, 106°29.757′W, 3,065 m, 1 (ENMU 11327); Jemez Mountains, Santa Fe National Forest, FS Road 144, 36°01.402′N, 105°21.770′W, 3,009 m, 1 (ENMU 11328); Jemez Mountains, Santa Fe National Forest, 1.25 mile N, 2.0 mile E Chicoma Mountain, Mesa de la Gallina, 36°01.654′N, 106°20.857′W, 2,856 m, 1 (ENMU 11526); Jemez Mountains, Santa Fe National Forest, 0.5 miles S of Cerro Pelon, T21N, R8E, SW 1/4, SW 1/4 Sec. 26, 36°01.032′N, 106°35.686′W, 2,863 m, 1 (ENMU 11329). SAN MIGUEL COUNTY: [5]Sangre de Cristo Mountains, Santa Fe National Forest, ~5 mile S of Elk Mountain, 35°42.658′N, 105°33.690′W, 3,244 m, 1 (ET 1058). TAOS COUNTY: Sangre de Cristo Mountains, Vermejo Park Ranch, 7 Lakes, 36°54.713′N, 105°16.134′W, 2,975 m, 1 (ENMU 11311); Sangre de Cristo Mountains, Vermejo Park Ranch, 7 Lakes, 36°54.796′N, 105°16.402′W, 3,046 m, 1 (ENMU 11312); Sangre de Cristo Mountains, Vermejo Park Ranch, ~0.5 mile W of Costilla Reservoir, 36°52.816′N, 105°16.847′W, 2,965 m, 1 (ENMU 11314); Sangre de Cristo Mountains, Vermejo Park Ranch, Guide Camp, 36°56.136′N, 105°15.630′W, 3,021 m, 1 (ENMU 11315); Vermejo Park Ranch, Costilla Canyon, 36°56.836′N, 105°15.212′W, 3,099 m, 1 (ENMU 11317); Sangre de Cristo Mountains, Vermejo Park Ranch, 0.5 mile down #1 Road, 36°56.806′N, 105°14.216′W, 3,049 m, 1 (ENMU 11318); Sangre de Cristo Mountains, Vermejo Park Ranch, 1.25 mile S, 1.75 mile W of Underwood Lakes, 36°56.449′N, 105°14.707′W, 3,024 m, 1 (ET 1084); Sangre de Cristo Mountains, Valle Vidal Unit, 1.5 mile S, 1.5 mile E of Comanche Point, 36°48.681′N, 105°17.335′W, 2,935 m, 1 (ET 1085); Sangre de Cristo Mountains, Vermejo Park Ranch, 0.25 mile N of 7 Lakes, 36°55.019′N, 105°16.204′W, 3,028 m, 1 (ENMU 11319); Sangre de Cristo Mountains, Vermejo Park Ranch, 0.75 miles S, 1.5 miles W of Underwood Lakes, 36°56.716′N, 105°14.355′W, 3,053 m (ENMU 11316); Sangre de Cristo Mountains, Carson National Forest, 6.4 mile N on FS Road 76 from 76 and 153 junction, 0.75 mile E, 0.25 mile N of Osha Mountain, 36°18.688′N, 105°19.153′W, 3,017 m, 1 (ENMU 11346).

Observation records ($n = 39$).—COLFAX COUNTY: [1]Sangre de Cristo Mountains, Vermejo Park Ranch, 1.0 mile S, 0.5 mile W of Underwood Lakes, 36°56.723′N, 105°13.240′W, 3,098 m; Sangre de Cristo Mountains, Carson National Forest, Valle Vidal Unit, 2.0 mile S, 1.25 mile W of Shuree Ponds, 36°44.640′N, 105°12.891′W, 2,973 m; [2]Sangre de Cristo Mountains, Carson National Forest, Valle Vidal Unit, 4.0 mile S, 0.25 mile E of Shurre Ponds, 36°43.126′N, 105°13.054′W, 3,165 m; Sangre de Cristo Mountains, Carson National Forest, Valle Vidal Unit, 1.25 mile S, 0.25 mile W of Shuree Ponds at FS Road junction 1910 and 1913, 36°45.369′N, 105°12.042′W, 2,821 m; Sangre de Cristo Mountains, Carson National Forest, 2.25 mile S, 0.5 mile E of Osha Mountain, 36°16.332′N, 105°19.482′W, 3,223 m; [3]Sangre de Cristo Mountains, Carson National Forest, Osha Mountain, 7.9 miles along FS Road 76 from New Mexico Highway 434 and FS Road 76 junction, 2.1 miles from junction 153 and 76, 36°18.688′N, 105°19.153′W, 3,017 m. MORA COUNTY: [4]Sangre de Cristo Mountains, Carson National Forest, 1.25 mile S, 1.25 mile E of Cuchillo de Fernando, Rincon Mountains, 36°15.226′N, 105°19.827′W, 3,242 m; Sangre de Cristo Mountains, Carson National Forest, 1.25 mile S, 1.25 mile E of Cuchillo de Fernando, Rincon Mountains, 36°15.160′N, 105°19.780′W, 3,256 m; Sangre de Cristo Mountains, Carson National Forest, 1.0 mile S, 0.5 mile E of Cuchillo de Fernando, 36°15.333′N, 105°20.661′W, 3,263 m; Sangre de Cristo Mountains, Carson National Forest, 0.75 mile along FS Road 161 from New Mexico Highway 518 and FS Road 161 junction, 36°03.654′N, 105°27.571′W, 2,909 m; Sangre de Cristo Mountains, Carson National Forest, 2.0 mile along FS Road 161 from New Mexico Highway 518 and FS Road 161 junction, 36°03.184′N, 105°28.381′W, 2,977 m; Sangre de Cristo Mountains, Carson National Forest, Rincon Mountains, 1.0 mile S, 0.75 mile E of Cuchillo de Fernando, 36°15.417′N, 105°20.634′W, 3,258 m; Sangre de Cristo Mountains, Carson National Forest, Head of Morias Canyon, 1.5 mile S, 1.25 mile E of Cuchillo de Fernando, 36°14.848′N, 105°20.025′W, 3,248 m; Sangre de Cristo Mountains, Carson National Forest, Head of Morias Canyon, 1.5 mile S, 1.25 mile E of Cuchillo de Fernando, 36°14.848′N, 105°20.025′W, 3,248 m; Sangre de Cristo Mountains, Carson National Forest, Head of Morias Canyon, 1.5 mile S, 1.0 mile E of Cuchillo de Fernando, 36°14.875′N, 105°20.155′W, 3,299 m; Sangre de Cristo Mountains, Carson National Forest, Rincon Mountains, 1.25 mile S, 0.75 mile E of Cuchillo de Fernando, 36°15.078′N, 105°20.454′W, 3,341 m. RIO ARRIBA COUNTY: Jemez Mountains, Santa Fe National Forest, 1.25 mile S, 5.75 mile E of Cerro Pelon, T21N, R4E, SE 1/4 Sec. 34, 36°00.391′N, 106°29.490′W, 3,058 m; Jemez Mountains, Santa Fe National Forest, 0.25 mile N, 5.75 mile W of Chicoma Mountain, T21N, R4E, NE 1/4 Sec. 35, 36°00.787′N, 106°29.183′W, 3,053 m; Jemez Mountains, Santa Fe National Forest, 0.75 mile N, 6.0 mile W of Chicoma Mountain, T21N, R4E, SE 1/4 Sec. 27, 36°01.130′N, 106°29.346′W, 3,061 m; Jemez Mountains, Santa Fe National Forest, 0.5 mile N, 5.75 mile W of

Chicoma Mountain, T21N, R4E, SW 1/4, SW 1/4 Sec. 26, 36°00.955′N, 106°29.142′W, 3,091 m; Jemez Mountains, Santa Fe National Forest, 1.0 mile N, 1.25 mile E of Chicoma Mountain, 36°01.361′N, 106°21.666′W, 2,990 m; Jemez Mountains, Santa Fe National Forest, 1.25 mile N, 2.0 mile E of Chicoma Mountain, 36°01.654′N, 106°20.853′W, 2,863 m; Jemez Mountains, Santa Fe National Forest, 1.0 mile N of Chicoma Mountain, 36°01.358′N, 106°22.864′W, 3,211 m; Jemez Mountains, Santa Fe National Forest, 1.0 mile N, 1.25 mile E of Chicoma Mountain, 36°01.393′N, 106°22.055′W, 3,048 m; Jemez Mountains, Santa Fe National Forest, 0.5 mile N, 4.75 mile E Chicoma Mountain, T21N, R4E, NE 1/4, NE 1/4 Sec. 35, 36°00.930′N, 106°28.283′W, 3,124 m; Jemez Mountains, Santa Fe National Forest, 0.25 mile N, 5.25 mile E of Chicoma Mountain, T21N, R4E, SW 1/4, NE 1/4 Sec. 35, 36°00.621′N, 106°28.766′W, 3,079 m; Jemez Mountains, Santa Fe National Forest, 1.0 mile S, 5.25 mile E of Cerro Pelon, T21N, R4E, SW 1/4 Sec. 34, 36°00.458′N, 106°29.918′W, 3,075 m; Jemez Mountains, Santa Fe National Forest, 0.25 mile N, 5.0 mile E of Chicoma Mountain, T21N, R4E, SE 1/4, NE 1/4 Sec. 35, 36°00.640′N, 106°28.415′W, 3,093 m; Jemez Mountains, Santa Fe National Forest, 1.0 mile N, 0.75 mile W of Chicoma Mountain, T21N, R5E, NW 1.4, SW 1/4 Sec. 27, 36°01.352′N, 106°23.944′W, 3,329 m; Jemez Mountains, Santa Fe National Forest, 1.0 mile N, 0.25 mile W of Chicoma Mountain, 36°01.218′N, 106°23.543′W, 3,259 m; Jemez Mountains, Santa Fe National Forest, 1.0 mile N of Chicoma Mountain, 36°01.322′N, 106°22.834′W, 3,172 m; Jemez Mountains, Santa Fe National Forest, 1.0 mile N, 0.75 mile E of Chicoma Mountain, 36°01.477′N, 106°22.388′W, 3,124 m; Jemez Mountains, Santa Fe National Forest, 1.0 mile N, 1.25 mile E of Chicoma Mountain, 36°01.406′N, 106°21.765′W, 3,019 m; Jemez Mountains, Santa Fe National Forest, 0.75 mile N, 0.75 mile W of Chicoma Mountain, T21N, R5E, SW 1/4, SW 1/4 Sec. 27, 36°01.059′N, 106°23.801′W, 3,329 m. TAOS COUNTY: Sangre de Cristo Mountains, Vermejo Park Ranch, 0.25 mile S, 1.25 mile W of Seven Lakes, 36°54.566′N, 105°17.373′W, 3,219 m; Sangre de Cristo Mountains, Vermejo Park Ranch, 1.0 mile S, 0.75 mile E of Big Costilla Peak, 36°54.410′N, 105°18.792′W, 3,331 m; Sangre de Cristo Mountains, Vermejo Park Ranch, 2.0 mile N, 1.0 mile W of Underwood Lakes, 36°59.163′N, 105°13.926′W, 3,321 m; Sangre de Cristo Mountains, Carson National Forest, Valle Vidal Unit, 0.75 mile N, 2.25 mile E of Comanche Point, 36°50.576′N, 105°16.463′W, 3,239 m; Sangre de Cristo Mountains, Carson National Forest, Valle Vidal Unit, 1.75 mile E of Comanche Point, 36°49.965′N, 105°16.856′W, 3,190 m.