Shrews of the La Sal Mountains, southeastern Utah

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The mountain ranges of western North America support unique local mammal faunas that have been shaped by regional geography and history. These areas have been instrumental in developing and testing ideas on historical biogeography and community structure of mammals (Brown 1971; Patterson and Atmar 1986; Lomolino et al. 1989; Cutler 1991; Grayson 1993; Lawlor 1998; Rickart 2001). Nonetheless, information on many aspects of the distribution of mammals in this region is still surprisingly incomplete, and the faunas of many mountain ranges remain poorly known. These limitations have influenced research efforts. For example, discoveries of previously overlooked taxa on isolated mountain ranges in the Great Basin have greatly altered estimates of colonization and extinction rates of montane mammals in this region (Grayson and Livingston 1993; Grayson et al. 1996; Lawlor 1998).

For small mammals, the quality of available data varies among taxonomic or ecological groups. Shrews (Soricidae) are important components of local small mammal communities throughout western North America. However, information on their distribution and local abundance is particularly incomplete because many species are notoriously difficult to survey using conventional methods (Kirkland 1991; Kirkland and Sheppard 1994).

This paper summarizes information on the elevational distribution, habitat affinities, and relative abundance of shrews occurring in the La Sal Mountains of southeastern Utah. Rising more than 2000 m above surrounding lowlands, the La Sals are a relatively large, isolated range on the Colorado Plateau. Earlier work in the La Sals provided basic information on the mammal fauna and demonstrated faunal affinities with the southern Rocky Mountain region (Kelson 1951; Lee 1960). This report stems from a more detailed survey of the nonvolant mammals along an elevational gradient conducted during 1997 and 1998.

**STUDY AREA**

The La Sal Mountains, centered at 38°30′N latitude, 109°15′W longitude, constitute the largest of several isolated mountain ranges in southeastern Utah that were formed during the mid-Tertiary through laccolithic intrusion (Hunt 1958). The range encompasses more than 800 km² of land area above 2300 m (7500 ft) elevation and includes several peaks that exceed 3650 m (12,000 ft) elevation. Isolated to the west, north, and east by deep canyons of the Colorado and Dolores rivers, the La Sals are separated from mountains to the south by intervening low elevations. The nearest highland areas are the Uncompahgre Plateau, ca

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**ABSTRACT**—We conducted a trapping survey of small mammals along an elevational gradient in the La Sal Mountains and documented 4 species of shrews (Sorex), the largest number inhabiting any mountain range in Utah. *Sorex palustris* was restricted to very moist microhabitats near open water at mid- to high elevations where it was relatively common. Occurring in nearly all habitats across the entire sampling gradient, *S. monticolus* was the numerically dominant small mammal at many sites. *Sorex nanus*, a new record for the La Sals, was found in areas of rockfall at high elevations and in a rocky wash at mid-elevation. *Sorex cinereus*, a new record for southeastern Utah, was recorded at a single high-elevation locality. Most localities had 2 syntopic species of shrews, and at 1 site in and around a rockslide we recorded all 4 species. Despite their current isolation, the La Sal Mountains support a remarkably diverse shrew fauna. Their proximity to the main southern Rocky Mountains as a rich faunal source and the presence of abundant rockfall microhabitat appear to be important causal factors.

**Key words:** shrews, Sorex, new records, La Sal Mountains, elevational gradients, syntopic species, zoogeography.

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50 km to the east in Colorado, and the Abajo Mountains located 60 km further south in Utah. From the standpoint of historical biogeography, the most significant highland association is to the southeast with the San Miguel, San Juan, and Rico Mountains of southwestern Colorado (Lee 1960).

**Methods**

Fieldwork was conducted during August 1997 and 1998. We trapped shrews at sites along an elevational gradient extending from 1775 to 3200 m elevation using a combination of Museum Special snap-traps and pitfall traps constructed by removing the tops from 350-mL aluminum beverage cans. Snap-traps were baited with rolled oats combined with either peanut butter or canned cat food. Pitfall traps were set without drift fences in runways, along the margins of boulders or fallen logs, or near natural openings. We placed a small amount of water in each pitfall to facilitate capture, and although they were not baited, they normally accumulated small invertebrates after several hours. Traps were checked at least twice daily and were set for 2 to 4 nights and occasionally longer periods. Total number of trap nights ranged from 75 to 300 at each locality. Percent trap success (number of individuals captured in 100 trap nights) was used to estimate relative abundance of species. At localities where both pitfalls and snap-traps were used, we based these calculations only on those types of traps that actually captured the species in question. Sex and reproductive condition were determined through necropsy, but these data often were obtainable only for very fresh specimens. Voucher specimens and field notes were deposited at the Utah Museum of Natural History, University of Utah, Salt Lake City (UMNH), and the Field Museum of Natural History, Chicago (FMNH). Earlier records of shrews from the La Sal Mountains were obtained from collections at the Utah Museum of Natural History; the Monte L. Bean Museum, Brigham Young University, Provo, Utah (BYU); and the Carnegie Museum of Natural History, Pittsburgh (CMNH). Specimens were identified on the basis of characters used by Junge and Hoffmann (1981) and through comparison with other specimens at UMNH.

**Results**

Four species of shrews have been recorded from the La Sal Mountains. The following species accounts summarize information on elevational range, habitat associations, and relative abundance. We list the number of specimens from collecting localities in our survey, as well as other known records of occurrence within the mountain range.

*Sorex cinereus*

Specimens of the masked shrew were identified on the basis of relative size of the unicuspid teeth (U3 larger than U4) and relatively small body size (adult mass < 5 g, condylobasal length < 17 mm). The species is distinguished from the closely related *S. preblei* by its larger size (condylobasal length > 15 mm) and inflated as opposed to relatively flat cranium (Junge and Hoffmann 1981). In August 1998 we trapped 3 individuals at 2850 m elevation at a site near Warner Lake. All were taken in pitfall traps in a grove of small aspen (*Populus tremuloides*) along the margin of a talus slope (260 trap nights; 1.2% trap success). At the time of the survey, this locality was relatively dry, with no permanent surface water. *Sorex monticolus* and *S. nanus* also were taken at this site. The specimens include a young male (UMNH 29935), an adult male with scrotal testes but without prominent flank glands (UMNH 29936), and an adult female with prominent mammae (FMNH 162898). These represent the first records for *S. cinereus* from southeastern Utah. The closest known records are from Grand Mesa (ca 120 km NE) and the San Juan Mountains (ca 150 km SE) in western Colorado (Armstrong 1972), and from the Aquarius, Fishlake and Wasatch plateaus (ca 200 km W) in Utah (Durrant and Newey 1953, Lee 1960, unpublished UMNH and FMNH specimen records).

**Survey specimens.**—Total 3. Grand County: 0.7 km N, 0.4 km W Warner Lake, 2850 m elevation (1 FMNH, 2 UMNH).

*Sorex monticolus*

The dusky shrew was recorded over the entire sampling transect from 1775 to 3200 m elevation. At lower elevations it was taken only in riparian habitat. It was relatively uncommon (ca 2% trap success) at 1775 m in
streamside habitat dominated by Frémont cottonwood (*Populus fremontii*) and willow (*Salix* sp.), and with adjacent dry habitat dominated by piñon (*Pinus edulis*), juniper (*Juniperus osteosperma*), and sagebrush (*Artemisia tridentata*). The species was common (9% trap success) at 2350 m elevation in streamside habitat dominated by aspen, Douglas fir (*Pseudotsuga menziesii*), and low shrub cover, with surrounding vegetation including mixed piñon, juniper, scrub oak (*Quercus gambelli*), and mountain mahogany (*Cercocarpus ledifolius*). It also was common in relatively dry scrub oak habitat at 2700 m (8% trap success). *Sorex monticolus* was common or abundant at sites between 2800 and 3200 m elevation, where it was trapped along stream margins, in wet meadows, aspen woodland, mixed stands of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*), and in talus fields. It was the most frequently captured small mammal species in most of these habitats (5–15% trap success). Specimens taken during August included recently weaned young, reproductively active females, and adult males with scrotal testes and prominent flank glands. Nearly half of all individuals were caught during daylight hours. The nearest regional records for this species are from the Abajo Mountains in Utah (Lee 1960) and the Uncompahgre Plateau in Colorado (Armstrong 1972).

**Survey specimens.**—Total 123. Grand County: 0.4 km S, 2.4 km W Warner Lake, 2700 m (8 FMNH); vicinity of Warner Lake, 2800–2865 m (39 FMNH; 30 UMNH). San Juan County: Brumley Creek near confluence with Pack Creek, 1775 m (2 UMNH); Horse Creek, 2350 m (9 UMNH); 0.4 km S, 1.0 km W Geyser Pass, 3125 m (6 FMNH; 6 UMNH); 0.6 km S, 0.5 km E Geyser Pass, 3200 m (11 FMNH); 0.4 km S, 0.4 km W Geyser Pass, 3200 m (7 FMNH); head of Dark Canyon, N of Mt. Peale, 3200 m (5 UMNH).

**Other records.**—Grand County: Beaver Creek, 2 mi NE Mt. Waas, 2660 m (4 UMNH); Beaver Creek, 1.5 mi E La Sal Peak, 2740 m (14 UMNH); Beaver Creek, 0.5 mi E Beaver Basin, 2900 m (2 UMNH); Beaver Basin, NW of Manns Peak, 3170 m (7 UMNH); 2.5 mi NE La Sal Peak, 2590 m (8 UMNH); Warner Ranger Station, 2960 m (2 UMNH). San Juan County: Geyser Pass (1 BYU; 5 CMNH); T27S, R24E, sec 5NE, 2720 m (2 BYU); Horse Creek, 2715 m elevation (2 BYU); T27S, R25E, sec 3NE, 2700 m (3 BYU).

**Sorex nanus**

The dwarf shrew is identified on the basis of its small body size (adult mass <4 g, condylobasal length <15 mm), relative size of the unicuspoid teeth (U3 smaller than U4), and dorsoventrally flattened cranium (Junge and Hoffmann 1981). On 31 July and 1 August 1997, we trapped a subadult female (UMNH 162958) and an old adult male (UMNH 162959) at 3200 m elevation at the head of Dark Canyon on the north flank of Mount Peale. Both specimens were taken in pitfall traps (36 trap nights; 5.6% trap success) placed in deep, moist soil at the lower margin of an actively moving talus field or “rock glacier” (Nicholas 1991). Surrounding vegetation included open meadow with grasses and forbs, and mixed stands of Engelmann spruce and subalpine fir. Snap-traps at this locality failed to capture *S. nanus*. *Sorex monticolus* and *S. palustris* also were taken at this site. In August 1998 we caught 2 adult-sized *S. nanus* of undetermined sex (FMNH 162958, 162959) in pitfall traps in an aspen grove along the lateral margin of a talus slope near Warner Lake at 2850 m elevation (260 trap nights; 0.8% trap success). *Sorex cinereus*, *S. monticolus*, and *S. palustris* also were taken at or near this site. Another specimen of *S. nanus* (an adult of undetermined sex, FMNH 162960) was snap-trapped in a deep crevice within a rock outcrop in the bottom of a steep, dry wash located north of Brumley Creek at 2165 m elevation in an area dominated by piñon and juniper. This was the only shrew recorded at this locality (225 trap nights; 0.4% trap success). These represent the first records for this species in the La Sal Mountains. Previous records for this species in Utah are from Elk Ridge on the west flank of the Abajo Mountains, ca 75 km SW of the La Sals (Durrant and Lee 1955), and the western Uinta Mountains, ca 250 km N (Kirkland 1981). The nearest records in Colorado are from Mesa Verde, ca 150 km SE of the La Sals (Hoffmeister 1967, Spencer 1975).

**Survey specimens.**—Total 5. Grand County: 0.7 km N, 0.4 km W Warner Lake, 2850 m (2 FMNH). San Juan County: tributary N of Brumley Creek, 2165 m (1 FMNH); head of Dark Canyon, N of Mt. Peale, 3200 m (2 UMNH).
**Sorex palustris**

The water shrew has been recorded over a broad range of elevations in the La Sal Mountains. We encountered it only in very wet areas, almost always in close proximity to flowing water. At 2350 m, the lowest elevation where the species has been documented in the La Sals, it was common in streamside habitat dominated by aspen and Douglas fir (ca 7% trap success). It probably occurs at somewhat lower elevations in the mountain range, although it was not recorded at our lowest riparian site at 1775 m. The species was most common at sites in the vicinity of Warner Lake (2800–2865 m elevation) where it was trapped around ponds, along streams, near springs, and in wet meadows (8–10% trap success in these habitats). It was less common in streamside habitat at 3200 m elevation near stream headwaters (ca 3% trap success). The nearest regional records for *S. palustris* are from the Abajo Mountains in Utah (Lee 1960) and the Uncompahgre Plateau in Colorado (Armstrong 1972).

**Survey specimens**—Total 32. Grand County: vicinity of Warner Lake, 2800–2865 m (13 FMNH; 9 UMNH). San Juan County: head of Dark Canyon, N of Mt. Peale, 3200 m (1 UMNH); 0.4 km S, 0.4 km W Geyser Pass, 3200 m elevation (2 FMNH); Horse Creek, 3235 m elevation (7 UMNH).

**Other records**—Grand County: Warner Ranger Station, 2960 m (5 UMNH); Oowah Lake, 2680 m (2 UMNH); Beaver Creek, 1.5 mi E La Sal Peak, 2740 m (4 UMNH). San Juan County: Geyser Pass (1 CMNH).

**Discussion**

As an outlying mountain range on the Colorado Plateau, the La Sal Mountains support only a portion of the extensive montane mammal fauna found in the “continental” Rocky Mountains (Lee 1960, Lomolino et al. 1989, Rickart 2001). Although a few montane species may yet remain undetected in the La Sals, most if not all of the missing taxa either failed to colonize in the first place or became locally extinct since the end of the Pleistocene. In light of this general pattern, the shrew fauna of the La Sal Mountains is surprisingly rich. Rather than being depauperate, it includes all 4 species known to occur at high elevations in the mountains of southwestern Colorado (Armstrong 1972). Within Utah, the Uintas are the only other mountain range known to support these 4 species (Rickart 2001). This situation is in stark contrast to that seen in the Henry Mountains, another laccolithic range located ca 150 km further west on the Colorado Plateau. The Henry Mountains are more isolated and also more arid than the La Sals, and they support an extremely depauperate mammal fauna that does not include any shrews (Rickart 2001).

The 4 species of *Sorex* inhabiting the La Sal Mountains differ with respect to habitat affinities and relative abundance. *Sorex monticolus* occupies a wide spectrum of habitats across a broad elevational range. In our survey this species was nearly ubiquitous. Recorded in all but the driest localities, it was the numerically dominant small mammal at nearly all sites where it occurred. *S. palustris* has narrow habitat requirements, occurring only in areas adjacent to water. We found it to be abundant in appropriate habitat at mid-elevations, but less common at high-elevation sites near stream headwaters and probably absent from low elevations. *S. cinereus* was taken at only one locality in our survey, but based on what is known of the habits of this species in the region (Zeveloff 1988, Fitzgerald et al. 1994), it probably occurs at relatively low abundance in a variety of high-elevation habitats throughout the La Sals. We recorded *S. nanus* within (or immediately adjacent to) talus or rock outcrops at mid- to high elevations in the La Sals. This corroborates other studies that have documented broad elevational range and a preference for talus and other rocky microhabitats (Hoffmann and Owen 1980).

We found 2 or more species of shrews at most localities we surveyed in the La Sal Mountains. At a site near Warner Lake, we found 3 species (*S. cinereus, S. monticolus,* and *S. nanus*) occurring together in talus habitat, and a 4th species (*S. palustris*) in streamside habitat immediately adjacent to the talus. High levels of species richness and local syntopy are not at all uncommon for North American shrew communities (Spencer and Pettus 1966, Brown 1967, Williams 1984, Bury and Corn 1987, Kirkland et al. 1997). However, the basis for coexistence of species that have such similar trophic requirements is not entirely clear.
Syntopic species of shrews generally differ in body size and relative abundance, which may promote trophic separation and different patterns of habitat utilization (Kirkland 1991, Hanski 1994). With a more than threefold difference in mean body mass between S. nanus (<4 g) and S. palustris (>12 g), the La Sal assemblage exhibits the broadest size range possible among North American Sorex. Species-rich shrew assemblages typically involve a mix of habitat generalists and specialists occurring in structurally complex habitats, with actual syntopy confined to specific microhabitats (Kirkland 1991). These features characterize the situation in the La Sal Mountains.

The fact that this small outlying mountain range on the Colorado Plateau supports such a remarkably rich shrew fauna is less surprising in light of local geography and geology. Although the La Sal Mountains are currently isolated, they are in close proximity to the main southern Rocky Mountain faunal region. Undoubtedly, this has allowed intermittent colonization of shrews, along with other montane taxa such as pikas (Ochotona princeps) and red squirrels (Tamiasciurus hudsonicus), during more mesic periods (Lee 1960). Furthermore, the very extensive rockfall zones that characterize this laccolithic range (Nicholas 1991) have created abundant areas of microhabitat particularly suitable for shrews. Further studies on other isolated mountain ranges in this region are needed to determine if the La Sal Mountains are truly unique in this respect, or merely appear to be due to inadequate knowledge elsewhere.

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Literature Cited


