PERSISTENCE OF THE MEADOW JUMPING MOUSE, *ZAPUS HUDSONIUS LUTEUS*, IN NEW MEXICO

JOAN L. MORRISON

Los Alamos National Laboratory, Environmental Protection Group, Mailstop K490, Los Alamos, NM 87545
Present address: Department of Wildlife and Range Sciences, University of Florida, 118 Newins-Ziegler Hall, Gainesville, FL 32611

Zapus hudsonius luteus is a subspecies of the meadow jumping mouse (Hafner et al., 1981) that is restricted to New Mexico and Arizona, where it occupies mesic habitats in lowland valleys and along montane streams (Bailey, 1913; Findley et al., 1975; Hafner et al., 1981; Hoffmeister, 1986). The subspecies has been reported from 14 localities in New Mexico (Hafner et al., 1981; R. D. Ohmart and V. C. Hink, in litt.) and 11 localities in Arizona (Hafner et al., 1981; Hall, 1981; Hoffmeister, 1986). In New Mexico, these records are from the San Juan Mountains (El Rito area), Sangre de Cristo Mountains (North Williams Lake), Jemez Mountains (upper Guadalupe River drainage), Sacramento Mountains (Rio Penasco and Silver Springs Creek), and the Rio Grande Valley (Espanola to the Bosque del Apache National Wildlife Refuge; Fig. 1).

Southwestern populations of the genus *Zapus* were initially described by Miller (1911) as a distinct species, *Zapus luteus*, then as a subspecies of the western jumping mouse, *Zapus princeps* (*Z. p. luteus*), by Krutszch (1954). Based on genetic relationships between southwestern *Zapus* and other representatives of the genus, Hafner et al. (1981) concluded that these peripheral isolates were instead conspecific with the meadow jumping mouse, *Z. hudsonius*, and, therefore, considered them to be *Z. h. luteus*.

Because of its restricted range and documented loss of natural riparian habitat, it was believed that *Z. h. luteus* was approaching extinction in New Mexico; no extant populations were found along the Rio Grande Valley between 1930 and 1976 (Hafner et al., 1981). However, the distribution and status of the genus within the Southwest had not been well documented as no extensive searching for the subspecies had been recently undertaken. In addition, little was known about its habitat requirements or sensitivity to habitat loss. Recently, concerns have developed that isolated populations are being threatened not only by agricultural and industrial development along major rivers but also by recreational development and range management activities in montane areas. These concerns resulted in placement of *Z. h. luteus* on the endangered species list of the State of New Mexico in 1983. This subspecies is also listed as Category I by the United States Fish and Wildlife Service and is currently under review for federal listing as endangered.

During the summers of 1985 through 1989, I conducted extensive survey trapping at over 50 sites throughout New Mexico to determine the distribution, relative abundance, and habitat associations of *Z. h. luteus*. Localities where the subspecies was previously documented were resurveyed, with the exception of four localities: El Rito, North Williams Lake, two in the Rio Grande Valley (one NW of Albuquerque and the other at Socorro). Additional localities in the lower Rio Chama Valley, Rio Grande Valley (Casa Colorado and Bernardo-La Joya State Wildlife Areas), Rio Bonito (tributary of the Rio Hondo) watershed, and Capitan Mountains, where habitat appeared to be suitable for the subspecies, were surveyed.

Trapping results verified the persistence of *Z. h. luteus* at all resurveyed localities where the subspecies had been previously documented. In addition, the subspecies was found at other sites in the Jemez and Sacramento mountains, Rio Grande Valley, and lower Rio Chama Valley (Appendix 1; Fig. 1). No records were obtained in the Capitan Mountains, the Rio Bonito watershed, or the Bernardo-La Joya State Wildlife Areas.

All specimens of *Zapus* taken during this study were identified as *Z. h. luteus* (D. Hafner, pers. comm.) using pelage and morphological characteristics as described in Hafner et al. (1981). Specimens were deposited at the University of New Mexico Museum of Southwestern Biology.

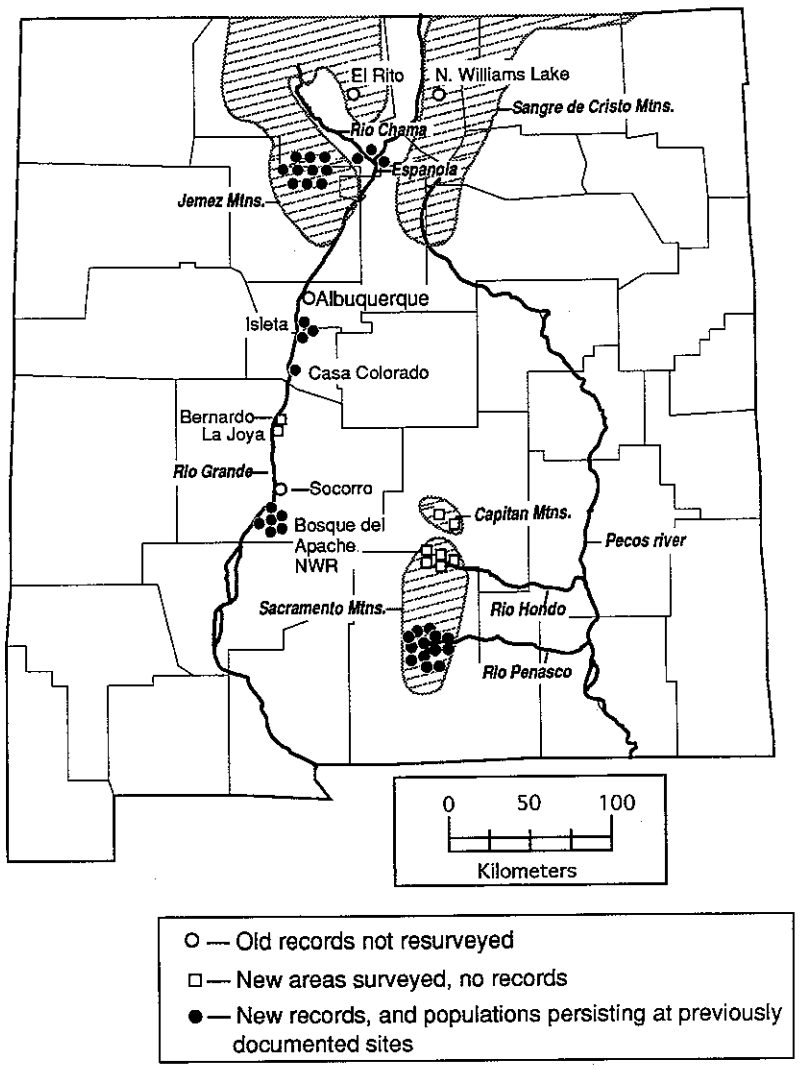

FIG. 1—The known distribution of *Zapus hudsonius luteus* in New Mexico. Hatched areas represent three mountain ranges. Each symbol represents one population or one location, surveyed or unsurveyed.

Zapus hudsonius luteus was found at eight new sites in the Jemez Mountains. All were in the upper Guadalupe River drainage, suggesting that meadow jumping mice may have once existed all along this river system. The habitat at these sites may be characterized as the narrow grass-forb-willow streamside riparian zone along permanent waterways and is described in Morrison (1990).

Two new sites were identified in the Rio Grande Valley in the vicinities of Isleta and Espanola, and a new record was obtained at the Casa Colorado State Wildlife Area south of Belen. Although a new record of the subspecies was also documented along the Rio Chama, *Z. h. luteus* has been reported along the El Rito (Hall, 1981), a tributary of the Rio Chama. Populations along these rivers occurred in large, wet meadow areas within the river floodplain. Vegetation in these lower-elevation meadows was similar to the higher-elevation streamside riparian zones, but the meadows were larger and were not always adjacent to the river (Morrison, 1990).

Within the Bosque del Apache National Wildlife Refuge, the subspecies was found to persist at many sites, inhabiting narrow riparian zones along irrigation ditches. This habitat had many

of the same plant species found at the wet meadow sites along the Rio Grande Valley (Morrison, 1990).

In the Sacramento Mountains, meadow jumping mice were located at 13 different sites along tributaries of the Rio Penasco. As in the Jemez Mountains, the Sacramento Mountain populations were found in grass-forb riparian habitat along the permanent waterways. Habitat characteristics at these sites in the Sacramento Mountains were similar to those in streamside riparian habitat where jumping mice were found in the Jemez Mountains (Morrison, 1990).

According to Hafner et al. (1981), *Z. h. luteus* was formerly widespread over larger areas of the Southwest, when more mesic conditions prevailed, probably as recently as the Wisconsonian glaciation (10,000 YBP). As moist conditions retreated northward, to higher elevations and along river courses, jumping mice persisted in isolated pockets of suitable habitat along permanent waterways.

Although pre-1930 records of jumping mice existed from numerous sites along the Rio Grande and associated tributaries (Findley et al., 1975; Hafner et al., 1981), by 1976, only one population (at the Bosque del Apache National Wildlife Refuge) was known from the Rio Grande valley. The observation by Hafner et al. (1981:501) that ". . . modern agricultural development of the Rio Grande Valley (initiated in the 1930's) has eliminated much of the natural riparian habitat . . ." summarized the general concern that remaining peripheral populations of jumping mice were in danger of disappearing because of continuing destruction of habitat.

The nature of the riparian habitat has indeed been significantly altered (Hubbard, 1977; R. D. Ohmart and V. C. Hink, in litt.), and valley populations of *Z. h. luteus* appear to have been isolated as a result of fragmentation of suitable habitat. However, the results of this study indicate that the meadow jumping mouse may not necessarily be limited to natural riparian habitats and may utilize man-made mesic habitats (i.e., irrigation waterways adjacent to agricultural fields such as that found at the Casa Colorado State Wildlife Area and Bosque del Apache) in the absence of the former. At sites within the Rio Grande valley where *Z. h. luteus* was found, Morrison (1990) reported similarities in vegetative composition, canopy coverage, and soil moisture between riparian habitat along man-made waterways and natural riparian habitat in wet meadows. This implies that food and cover requirements of meadow jumping mice may be met in both habitats. Such findings suggest that *Z. h. luteus* may not be as sensitive to habitat disturbance as originally believed; additional populations may persist along major drainages throughout New Mexico, where suitable habitat remains.

I thank D. Leon, B. Edeskuty, L. Stephenson, D. Landrum, G. Tietjen, M. Morrison, and G. Graham for technical assistance and support. The comments of D. Hafner, J. Hubbard, P. Kennedy, E. Zimmerman, and two anonymous reviewers improved earlier drafts of this manuscript. Reference to R. D. Ohmart and V. C. Hink refers to their Final report on the middle Rio Grande biological survey submitted in 1984 to the Center for Environmental Studies, Arizona State University. Funding for this study was provided by the New Mexico Department of Game and Fish Share With Wildlife Program, and the U.S. Forest Service, Santa Fe and Lincoln National Forests.

Literature Cited

Bailey, V. 1913. Ten new mammals from New Mexico. Proc. Biol. Soc. Washington, 26:129–134.

Findley, J. S., A. H. Harris, D. E. Wilson, and C. Jones. 1975. Mammals of New Mexico. Univ. New Mexico Press, Albuquerque.

Hafner, D. J., K. E. Petersen, and T. L. Yates. 1981. Evolutionary relationships of jumping mice (genus *Zapus*) of the southwestern United States. J. Mamm., 62:501–512.

Hall, E. R. 1981. The mammals of North America. Second ed. John Wiley and Sons, New York, 2: 774–775.

Hoffmeister, D. F. 1986. Mammals of Arizona. Univ. Arizona Press and Arizona Dept. Game Fish, Tucson.

Hubbard, J. P. 1977. Importance of riparian ecosystems: biotic considerations. Pp. 14–18, *in* Importance, preservation and management of riparian habitat: a symposium (R. R. Johnson and D. A. Jones, eds.). General Tech. Rept., USDA Forest Serv., RM-43:1–217.

Krutzsch, P. H. 1954. North American jumping mice (genus *Zapus*). Univ. Kansas Publ., Mus. Nat. Hist., 7:349–472.

Miller, G. S., Jr. 1911. A new jumping mouse from New Mexico. Proc. Biol. Soc. Washington, 24:253–254.

Morrison, J. L. 1990. The meadow jumping mouse in New Mexico: habitat preferences and management recommendations. Pp. 136–141, *in* Proceed-

ings of the symposium on managing wildlife in the Southwest (P. R. Krausman and N. S. Smith, eds.). Arizona Chapter, The Wildl. Soc., Phoenix.

Appendix 1

Record locations for *Zapus hudsonius luteus* in New Mexico. Voucher specimens of *Z. h. luteus* are housed at the following institutions: Museum of Southwestern Biology, University of New Mexico (MSB); Mammal collection at New Mexico State University (NMSU); New Mexico Environmental Improvement Division (NMEID); The Museum, Texas Tech University (TTU); Museum of Natural History, University of Kansas (KU); National Museum of Natural History (USNM). If no institution is listed, specimens were taken live and subsequently released.

Previously documented locations—Findley, 1975; Hafner et al., 1981; R. D. Ohmart and V. C. Hink, 1984: Bernalillo Co.: 3 mi. NW Albuquerque, 1 (USNM); Isleta Marsh 18 mi. S Albuquerque, 6 (NMSU). Otero Co.: 10 mi. NE Cloudcroft 8,500 ft., 1 (USNM); Silver Springs Creek, 8 mi. NE Cloudcroft, 1 (MSB); 3.2 mi. (by road) E Cloudcroft, 13 (MSB); 12 mi. E. Cloudcroft, 7,500 ft., 2 (USNM). Rio Arriba Co.: 4 mi. N El Rito, 7,000 ft., 4 (KU); Espanola, 5,000 ft., 4 (USNM). Sandoval Co.: 1 mi. S Seven Springs Fish Hatchery, Jemez Mtns, 1 (NMEID); Fenton Lake, Jemez Mtns, 12.5 mi. N Jemez Springs, 1 (MSB). Socorro Co.: Socorro, 1 (USNM); 8 mi. S San Antonio, Bosque del Apache National Wildlife Refuge, 4,500 ft., 13 (MSB); 11 mi. S San Antonio, Bosque del Apache National Wildlife Refuge, 4,500 ft., 15 (MSB). Taos Co.: 2.5 mi. N Williams Lake, 1 (TTU).

Current Locations—Bernalillo Co.: 3 mi. N Isleta Pueblo, 4,890 ft., 1 (MSB); Isleta Marsh, 18 mi. S Albuquerque, 4,880 ft., 3. Otero Co.: Silver Springs Creek, 8 mi. NE Cloudcroft, 8,400 ft., 5 (MSB); 3.2 mi. (by road) E Cloudcroft, Pumphouse Creek, 8,300 ft., 1 (MSB); Dark Canyon 8,000 ft., 1; Rio Penasco, 16 mi. SE Cloudcroft, 7,200 ft., 1 (MSB); Rio Penasco, 14 mi. S Cloudcroft, 8,000 ft., 1 (MSB); Rio Penasco, 12 mi. S Cloudcroft, 8,600 ft., 4 (MSB); Water Creek, 12 mi. S Cloudcroft, 8,600 ft., 1 (MSB); Hay Creek, Masterson Springs, 8,000 ft., 1 (MSB); Potato Creek, 8,200 ft., 2 (MSB); Spring Creek, 8,400 ft., 1 (MSB); Agua Chiquita, 8,000 ft., 2 (MSB). Rio Arriba Co.: 6 mi. NW Espanola, Rio Chama, 5,725 ft., 1 (MSB); 4 mi. N Espanola, San Juan Pueblo, 5,720 ft., 1 (MSB); 1 mi. N Espanola, 5,625 ft., 1 (MSB). Sandoval Co.: Rio de las Vacas, Jemez Mtns, 7,880 ft., 1 (MSB); Rito Penas Negras, Jemez Mtns, 8,360 ft., 6 (MSB); Rio Cebolla, 5 mi. N Fenton Lake, 7,880 ft., 1 (MSB); Seven Springs Fish Hatchery, Jemez Mtns, 7,800 ft., 2 (MSB); Fenton Lake, Jemez Mtns, 7,600 ft., 10 (MSB); San Antonio Creek, Jemez Mtns, 8,250 ft., 2 (MSB); Rio Cebolla, 4 mi. S Fenton Lake, 7,480 ft., 1 (MSB); Rio Cebolla, 8 mi. S Fenton Lake, 7,200 ft., 2 (MSB); Virgin Canyon, Jemez Mountains, 7,460 ft., 1 (MSB). Socorro Co.: 11 mi. S San Antonio, Bosque del Apache National Wildlife Refuge, 4,500 ft., 20. Valencia Co.: 6 mi. S Belen, Casa Colorado State Wildlife Area, 4,800 ft., 1 (MSB).

FEEDING AND FORAGING OF *CALLISAURUS DRACONOIDES* (SAURIA: PHRYNOSOMATIDAE) IN THE INTERTIDAL ZONE OF COASTAL SONORA

Adrián Quijada-Mascareñas

Centro de Ecología, Universidad Nacional Autónoma de México, Apartado Postal, 1354, Hermosillo 83000, Sonora, México

The distribution of *Callisaurus draconoides* comprises much of the inland arid southwestern United States and the Mexican states of Baja California Norte, Baja California Sur, Sonora and Sinaloa (Stebbins, 1985). The feeding ecology in different parts of its geographic range has been well documented (Kay et al., 1970; Pianka and Parker, 1972; Tanner and Krogh, 1975; Vitt and Ohmart, 1977; Smith et al., 1987). Little is known about the feeding and foraging habits of *C. draconoides* in the intertidal zone (Neill, 1958). On the beach of Bahía de los Angeles, Baja California Norte, Tevis (1944) reported feeding activity of *C. draconoides* on small littoral insects and crustaceans. Quijada (1988) provided data on the contents of the stomach from one lizard captured in the intertidal zone, but quantitative data on prey ingested have not been published.

This report presents the results of field observations and stomach analyses of lizards collected in the intertidal zone of coastal Sonora, México. The study area was located 135 km W of Her-