ZAPUS HUSICNIUS IN SOUTHERN COLORADO

CHERI A. JONES

Two species of jumping mouse (Zapodidae: Zapus) are known from Wyoming, Colorado, and New Mexico. The western jumping mouse (Z. princeps princeps) is the more common and widely distributed species in the region. It occurs throughout the western two-thirds of Colorado, mainly in riparian vegetation and meadow meadows from 1830 to 3500 m (Armstrong, 1972; Fitzgerald et al., 1994). Fitzgerald et al. (1994) suggested the possible occurrence of Z. p. utahensis in northwestern Colorado. The meadow jumping mouse (Z. hudsonius) is represented by three taxa, all with restricted distributions, in Wyoming, Colorado, New Mexico, and Arizona. The range of Z. hudsonius campestris includes the Black Hills of northeastern Wyoming (Clark and Stromberg, 1987). Preble's meadow jumping mouse, Z. h. preblei, is known only from Colorado's Front Range and from southeastern Wyoming (Clark and Stromberg, 1987; Fitzgerald et al., 1994). A third subspecies, Z. h. luteus, occupies isolated patches in New Mexico and in southeastern Arizona (Hafner et al., 1981). Local distributions of the taxa luteus and preblei are of special interest (e.g., Morrison, 1990, 1992; Meaney et al., 1996, 1997; Ryon, 1996; Hafner, 1997); New Mexico listed luteus as endangered in 1983 and preblei was listed as federally threatened on 12 May 1998. The report by Clarion Associates (1998) includes a bibliography compiled by Chris Pague (cpague@tnc.org), which lists numerous surveys and status reports regarding Z. h. preblei in Colorado.

In 1996, I caught 14 jumping mice during a survey of mammals on the Lake Dorothy State Wildlife Area, southeast of Trinidad in Las Animas County, Colorado. The wildlife area is located in Sugarite Canyon, between Barela Mesa and Fishers Peak Mesa. Sugarite Canyon opens southwards, approximately 16 km NE of the city of Raton, New Mexico. Two creeks (Chicorica and Schwachheim) and two lakes (Dorothy and Maloya) occupy the canyon north of the Colorado border. Vegetation on the floor of the canyon includes meadows of grasses and forbs, in which meadow voles (Microtus pennsylvanicus) were the most frequently captured rodent. Ruderal vegetation lines roads and parking areas; scrub oak (Quercus gambeli), ponderosa pines (Pinus ponderosa), and other conifers occupy the walls of the canyon. Jones (1996; in press) provided more detailed descriptions of the vicinity.
MATERIALS AND METHODS

In June and July 1996, I captured three jumping mice in Sherman live traps as part of a general survey of mammals (Jones, 1996). Consequently, in August 1996, C. Jones, D. Meshko, and I set snap traps to sample small mammals along Chiricahua and Schwachheim Creeks. I determined localities using the Global Positioning System and the U.S.G.S. Barcela Quad topographic map. skins and skulls were deposited in the Denver Museum of Natural History and frozen tissues were deposited at Texas Tech University. I also collected hair and ear-punch samples for use by the Colorado Division of Wildlife.

I recorded external measurements from skin tags and measured ten cranial characteristics, following Krutzsch (1954) and Hafner et al. (1981): greatest condylobasal length, greatest zygomatic breadth, least interorbital breadth, length of maxillary toothrow, palatal length, palatal breadth at P4, length of incisive foramina, breadth of incisive foramina, interbullar width (at basioccipital-basisphenoid suture), and greatest mastoid breadth. Specimens were classified as adult or subadult based on presence or absence of wear on M3 (Krutzsch, 1954; Hafner et al., 1981). Sexes were combined, because neither Krutzsch (1954) nor Hafner et al. (1981) found evidence of sexual dimorphism. Measurements of the Lake Dorothy specimens were compared with those of samples of Z. h. preblei from Colorado, Z. h. luteus from New Mexico, and Z. p. princeps from both Colorado and New Mexico. Specific localities and catalogue numbers of material from the Denver Museum of Natural History (DMNH), the Museum of Southwestern Biology (MSB), the University of Colorado Museum (UCM), and of tissues from Lake Dorothy specimens deposited in the frozen tissue collection of Texas Tech University (TTU), are listed under Specimens Examined. Nomenclature follows that of Saldaña-DeLeon and Jones (1998).

RESULTS AND DISCUSSION

The first jumping mice caught near Lake Dorothy were two nonscrotal males captured 11 June 1996 in Sherman live traps along the south bank of Schwachheim Creek, one on either side of the footbridge between lakes Dorothy and Maloya. Both mice were captured in riparian vegetation consisting of grasses, forbs, and coyote willow (Salix exigua); one was prepared as a voucher (DMNH 8630). On 16 July a gravid female (DMNH 8631) carrying six embryos (measuring 6x4 mm) was captured in ruderal vegetation, including wild rose (Rosa sp.), legumes, and grasses,along the road through Sugarite Canyon. Microtus pennsylvanicus, Reithrodontomys megalotis, and Thomomys talpoides also were captured in this trapeine. Eleven additional individuals (DMNH 8632-8642), including two lactating females, were caught in August 1996 in snap traps deployed at water’s edge along Chiricahua Creek and along the West Fork of Schwachheim Creek above Lake Dorothy. Vegetation at Chiricahua Creek consisted primarily of willow; other species of mammals caught there were Sorex palustris and M. pennsylvanicus. Along the West Fork of Schwachheim Creek, willows were less abundant and the heavy groundcover consisted primarily of grasses and forbs; jumping mice were captured in the same trapeine as S. monticolus, S. palustris, M. longicaudus, and Peromyscus maniculatus. Thus, jumping mice were known from four different localities (all below an elevation of 7800’) on the Lake Dorothy State Wildlife Area in 1996. An additional male (DMNH 9065) was captured near Chiricahua Creek 24 August 1997 on the Lake Dorothy State Wildlife Area by staff of the Colorado Natural Heritage Program; this animal was collected 2-3 m from the water’s edge underneath willow (M. B. Wunder, pers. comm., 1998). Except for this male and the female (DMNH 8631) collected on the roadside, all specimens from Lake Dorothy were captured no more than 1 m from the water, although others (Whitaker, 1972; Choate et al., 1991; Tester et al., 1993; Zwank et al. 1997; also see discussion by Morrison 1990:141) have reported captures of Z. hudsonius at more variable distances from water. Captures at greater distances from water might represent dispersal and/or movement to nests and hibernacula (e.g., Zwank et al., 1997).

Only measurements of adults were used in analyses. Average (and extreme) measurements of the nine adults from Lake Dorothy and of comparative material are shown on Tables 1 and 2. I did not in-
clude length of ear, which was not recorded by most early collectors of Zapus. Initial assignment of the Lake Dorothey material to the species Z. hudsonius was indicated by the presence of the anteromedian fold on the anterior edge of the m1 (Klingener, 1963; Hafner, 1993) and by characters in the key developed by Armstrong (1972:248) to separate Colorado Zapus; i.e., Z. h. preblei is distinguished from Z. p. princeps by a zygomatic breadth usually less than 11.5 mm and incisive foramina usually 4.5 or shorter. The Lake Dorothey specimens also lack the whitish ear fringe of the Z. princeps to which they were compared.

Hafner et al. (1981:509) described Z. h. luteus as "ochraceous-buff in color, with a but weakly defined middorsal band; ear either lacking pale fringe or possessing narrow ochrous fringe; never with a white ear fringe." Only one specimen from Lake Dorothey (DMNH 8631) has a dark, well-defined dorsal stripe and all have an ochraceous-buff color similar to the New Mexican specimens examined. This ochre is brighter than the coloration of the 13 skins of Z. h. preblei to which they were compared, resembling the color of the few skins of Z. h. americanus and Z. h. intermedius housed in the DMNH collection. Generally, skulls of Z. h. luteus from New Mexico and from Lake Dorothey are broader and longer than those of Z. h. preblei (Table 2). Zygomatic breadth was greater in the specimens of Z. h. luteus from New Mexico than those from Colorado.

Ear and hair samples from 10 Lake Dorothey specimens (DMNH 8632-8637, 8639-8642) were included in mitochondrial-DNA analyses conducted by Biosphere Genetics Inc; non-coding region sequence data also suggested that jumping mice from Lake Dorothey belong to the subspecies Z. h. luteus (Riggs et al., 1997; pers. comm., 1998).

The population of Zapus on the Lake Dorothey State Wildlife Area represents the first reported in extreme southern Colorado. Neither species of Zapus was previously known near Sugarite Canyon (Armstrong, 1972). Six specimens collected by C. A. Meaney in San Isabel National Forest (in July 1991) extended the known range of Z. princeps into Las Animas County, approximately 64 km (40 air miles) northwest of Lake Dorothey. The southernmost record of Z. h. preblei is in El Paso County, approximately 224 km (140 miles) north of Las Animas County (C. A. Meaney and C. Pague, in litt., 1999). The closest historic record of Z. h. luteus in northern New Mexico is North Williams Lake in the Sangre de Cristo Mountains (Morrison, 1992), about 144 km (90 air miles) southwest of Lake Dorothey. The possible occurrence of isolated populations of Zapus along the Colorado-New Mexico border needs to be investigated further to elucidate the historical biogeography and present ecological requirements of members of this genus.

Table 1. Selected external measurements (means and extremes) of four samples of Zapus. Sample sizes were N=9 (Z. h. luteus from New Mexico), N=9 (Zapus from Lake Dorothey), N=12 (Z. h. preblei), and N=30 (Z. p. princeps).

<table>
<thead>
<tr>
<th></th>
<th>Total length</th>
<th>Length of Tail</th>
<th>Hindfoot</th>
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<tbody>
<tr>
<td>Z. h. luteus</td>
<td>213.4(205-221)</td>
<td>126.2(118-130)</td>
<td>29.6(28-31)</td>
</tr>
<tr>
<td>Lake Dorothey</td>
<td>211.8(204-216)</td>
<td>123.6(119-131)</td>
<td>29.4(29-31)</td>
</tr>
<tr>
<td>Z. h. preblei</td>
<td>208.5(195-231)</td>
<td>124.6(116-137)</td>
<td>29.7(27-32)</td>
</tr>
<tr>
<td>Z. p. princeps</td>
<td>231.0(200-247)</td>
<td>139.0(125-156)</td>
<td>31.6(29.5-34)</td>
</tr>
</tbody>
</table>
Table 2. Means and extremes for condylobasal length, zygomatic breadth, interorbital breadth, maxillary tooththrow length, palatal length, palatal breadth, incisive foramina length, incisive foramina breadth, infraorbital width, and mastoidal breadth of four samples of Zapus. Sample sizes were N=10 (Z. h. lateus from New Mexico), N=9 (Zapus from Lake Dorothea), N=13 (Z. h. preblei), and N=30 (Z. p. princeps); smaller samples due to missing measurements are indicated.

<table>
<thead>
<tr>
<th></th>
<th>CB length</th>
<th>Zygomatic</th>
<th>Interorbital</th>
<th>Max tooth</th>
<th>Pal length</th>
<th>Pal breadth</th>
<th>IF length</th>
<th>IF width</th>
<th>IB width</th>
<th>Mastoid</th>
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<tr>
<td>Z. h. lateus</td>
<td>21.2 (20.7-21.6)</td>
<td>11.7 (11.2-12.3)</td>
<td>4.5 (4.2-4.6)</td>
<td>3.9 (3.7-4.0)</td>
<td>11.1 (10.7-11.5)</td>
<td>3.4 (3.0-3.6)</td>
<td>4.3 (4.1-4.5)</td>
<td>2.4 (2.2-2.5)</td>
<td>1.9 (1.6-2.1)</td>
<td>10.7 (10.0-11.0)</td>
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<td></td>
<td>N=9</td>
<td>N=8</td>
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<td>N=9</td>
<td>N=9</td>
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<tr>
<td>Lake Dorothea</td>
<td>20.8 (20.2-22.0)</td>
<td>11.4 (11.3-12.0)</td>
<td>4.5 (4.3-4.7)</td>
<td>3.8 (3.6-4.0)</td>
<td>11.0 (10.7-11.5)</td>
<td>3.5 (3.3-3.6)</td>
<td>4.0 (3.8-4.4)</td>
<td>2.1 (2.1-2.3)</td>
<td>1.97 (1.8-2.2)</td>
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<tr>
<td>Z. h. preblei</td>
<td>20.8 (19.9-21.8)</td>
<td>10.9 (10.7-11.8)</td>
<td>4.2 (4.0-4.5)</td>
<td>3.8 (3.6-4.1)</td>
<td>10.5 (9.7-10.8)</td>
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<td>N=12</td>
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</tr>
<tr>
<td>Z. p. princeps</td>
<td>22.1 (19.5-23.5)</td>
<td>12.5 (11.7-13.2)</td>
<td>4.4 (4.1-4.7)</td>
<td>4.2 (3.8-4.4)</td>
<td>11.5 (10.1-12.3)</td>
<td>3.7 (3.3-4.0)</td>
<td>4.6 (4.0-5.2)</td>
<td>2.3 (2.0-2.5)</td>
<td>2.4 (2.1-2.9)</td>
<td>11.1 (10.6-11.4)</td>
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Rio Cebolla, T19N, R1E, no section, 1 mi upstream from intersection with Rio Las Vacas, 1 (MSB 62097); T19N, R2E, NE Sec 30, Rio Cebolla at intersect. of Rte 376 & Lake Fork Creek, 1 (MSB 56985); Socorro Co: 8 mi S San Antonio, Bosque del Apache National Wildlife Refuge, 6 (MSB 41223, 41225, 41226, 41228, 41229, 41234), 11 mi S San Antonio, Bosque del Apache Game Refuge, 2 (MSB 36119, 36143).

Zapus h. preblei (21): Colorado: Adams Co: Croak's Lake, 1 (DMNH 2822); Boulder Co: South Boulder Creek, irrigation ditch, 1 (DMNH 9314), ¼ mi S St. Vrain Road on U.S. hwy 36 on unnamed drainage, UTM 13 0477420E, 4446330N, elevation 1689 m, 2 (DMNH 9204, 9205), south of Boulder, 1 (UCM 1225), 3 mi E Boulder, 1 (UCM 551), 5 mi E Boulder, 1 (UCM 503), 8.5 mi N, 3 ¼ mi E Boulder, 1 (UCM 5210), 0.5 mi SSE Eldorado Springs, T1S R70W NE ¼ NW ¼ Sec 31, 6000', 1 (UCM 17001), Niwot, 1 (DMNH 2394); 3 mi NW Niwot, 1 (DMNH 2971); Douglas Co: West Plume Creek, 8 mi N county line, T9S R68W, SW ¼ SW ¼ Sec 24, 2 (UCM 17003, 17004); El Paso Co: U.S. Air Force Academy, 1 (DMNH 9315), U.S. Air Force Academy, Monument Creek, 0.25 mi S Sewage Treatment Plant, T12S R67W SW ¼ NW ¼ NW ¼ Sec 30, 6440', 1 (UCM 17002), Monument, Dirty Woman Creek, T11S R67W NE ¼ SW ¼ Sec 14, UTM 13 0512100E, 4326700N, 1 (DMNH 9206), near Monument on Dirty Woman Creek, T11S R67W, NE ¼ SW ¼ Sec 14, UTM 13 0512100E, 4326700N, 1 (DMNH 9313); Gilpin Co: along Ralston Creek, T2S R70W NE ¼ SW ¼ Sec 31, 6400', 1 (DMNH 9312); Jefferson Co: ¼ mi W Semper, 2 (DMNH 6633, 6634), Rocky Flats, Walnut Creek Drainage, 5809', 1 (DMNH 9203).

Zapus princeps princeps (38): Colorado: Archuleta Co: Devil's Creek, near Dyke, 2 (DMNH 5575, 5576); Upper Navajo River, 5 (DMNH 1227, 1229-1231, 1233); headwaters of Navajo River, 9 (DMNH 1483-1489, 1498, 1499); Boulder Co: 7,000 ft, 2 (DMNH 3258, 3354); 3 mi E Pine Cliff, 3 (DMNH 3378-3380); Clear Creek Co: Camp Lemon, 2 (DMNH 4395, 4396); Gunnison Co: Taylor Park, 1 (DMNH 3903); Jackson Co: 4 mi NW Northgate, 2 (DMNH 1052, 1053); Las Animas Co: San Isabel National Forest, Purgatoire Campground, 2625 m, 6 (DMNH 7914-7919); Routt Co: Dome Peak, Middle Stillwater Creek, 1 (DMNH 4938); Stillwater Reservoir, 10,300 ft, 3 (DMNH 4970-4972). New Mexico: Taos Co: 4 mi N, 11 mi E Arroyo Hondo, 2 (MSB 41346, 41347).

LITERATURE CITED


Author's address:

CHERI A. JONES

Denver Museum of Natural History
2001 Colorado Blvd.
Denver CO 80205-5798
email: cjones@dmnh.org
PUBLICATIONS OF THE MUSEUM OF TEXAS TECH UNIVERSITY

It was through the efforts of Horn Professor J Knox Jones, as director of Academic Publications, that Texas Tech University initiated several publications series including the Occasional Papers of the Museum. This and future editions in the series are a memorial to his dedication to excellence in academic publications. Professor Jones enjoyed editing scientific publications and served the scientific community as an editor for the Journal of Mammalogy, Evolution, The Texas Journal of Science, Occasional Papers of the Museum, and Special Publications of the Museum. It is with special fondness that we remember Dr. J Knox Jones.

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