PREBLE'S MEADOW JUMPING MOUSE (*Zapus hudsonius preblei*) IN WYOMING: STATUS REPORT, JULY 2001

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MANAGEMENT STATUS

On 13 May 1998, the USDI Fish and Wildlife Service listed the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) as Threatened under the U.S. Endangered Species Act, as amended (U.S. Department of the Interior 1998). On 22 May 2001, the same agency issued a special rule allowing incidental take of *Z. h. preblei* as a consequence of certain types of rodent control, agricultural activity, landscape maintenance, and water management (U.S. Department of the Interior 2001). To date there has been no official recovery plan established for this subspecies.

Because status as Threatened under the U.S. Endangered Species Act takes precedence over other federal agency status, neither the USDI Bureau of Land Management nor the USDA Forest Service confer special status on *Z. h. preblei* at this time. The Wyoming Game and Fish Department also confers no special status on this subspecies.

The Wyoming Natural Diversity Database at the University of Wyoming (WYNDD) uses a three-rank system to denote the biological status of *Z. h. preblei*:

G5 (the full species *Z. hudsonius* is secure across its entire range);

T2 (the subspecies *Z. h. preblei* is imperiled across its entire range);

S1 (the subspecies *Z. h. preblei* is critically imperiled within Wyoming).

Due to the recent increase in the number of documented locations of *Z. h. preblei* in Wyoming, the latter rank will likely be upgraded to S2 within the next few months.

DESCRIPTION

Zapus hudsonius preblei - A small rodent with hind legs much longer than forelegs. The tail is longer than the body, sparsely haired, and darker above than below. Eyes are midway between the nose and the ear. Ears are dark but edged with white. There are 18 teeth, with upper incisors having distinct grooves on their outer faces. Cheek pouches are absent. Fur on the back is yellow olive-brown with scattered, long, black-tipped hairs which create a faint dorsal stripe. The sides are light yellow-brown, and the belly is white to light buff. Young tend to have softer, lighter fur than the adults. Adult measurements: total length 180-220 mm; head and body length less than 89 mm; tail 115-136 mm; hind foot 28-31 mm; ear 11-16 mm; weight 12-22 g (Clark and Stromberg 1987, Compton and Hugie 1993). In addition, incisive foramina shorter than 4.6 mm; palatal breadth at last molariform tooth less than 4.2mm; condylobasal length usually less than 20.3mm; and maxillary toothrow usually 3.7mm or less (Whitaker 1972).

DISTRIBUTION

Genus *Zapus* - North America supports 4 species of jumping mice, 3 of which are included in the genus *Zapus* (Figure 1). Two of these, the western jumping mouse (*Z. princeps*) and the meadow jumping mouse (*Z. hudsonius*), occur in Wyoming and surrounding states (Figure 1; Figure 2). The more common and westerly-distributed *Z. princeps* generally occurs along streams and in mesic upland vegetation in montane and subalpine zones, occasionally ranging into foothills and even prairie zones along stream courses. The more easterly-distributed *Z. hudsonius* is rarer in this region, occurs in prairie and foothills riparian environments, and occasionally ranges into montane areas (Quimby 1951, Krutzsch 1954, Long 1965, Whitaker 1972, Hall 1981, Clark and Stromberg 1987, Cranford 1999, Whitaker 1999).

Species *Zapus hudsonius* - It is generally accepted that 5 subspecies of *Z. hudsonius* occur in vicinity of Wyoming (Figure 2). Three of these (*intermedius*, *campestris*, and *pallidus*) are

thought to be contiguous with one another (i.e., interbreed regularly along the boundaries of their respective distributions), and essentially represent the westernmost extent of the continuous distribution of *Z. hudsonius* in the United States (Figure 1; Figure 2; Hall 1981, Whitaker 1999).

The remaining two subspecies (*luteus* and *preblei*) are regarded as disjunct, satellite populations of *Z. hudsonius* restricted to remnant areas of suitable habitat along the eastern front of the Southern Rocky Mountains. Presumably, suitable habitat was more widespread in this region during the Pleistocene (ca. >10,000 years ago). The subsequent warming and drying of the Great Plains shifted the main center of occurrence of *Z. hudsonius* to the north and east; however, pockets of suitable habitat remained along the Rocky Mountain front, allowing disjunct populations to persist here (Hafner et al. 1981, Jones 1981, Morrison 1992).

Subspecies *Zapus hudsonius preblei* - The subspecies *Z. h. preblei* occurs in the North Platte, South Platte, and Arkansas river basins. It inhabits primarily riparian areas in the foothills and adjacent prairies; the dry shortgrass prairie immediately to the east may be a barrier to eastward expansion (Figure 2; Figure 3). However, as discussed later, the northern and eastern extents of *Z. h. preblei* range have not yet been firmly established.

In Wyoming, presumed *Z. h. preblei* have been documented in both the North Platte and South Platte basins, with collection sites as far north as the town of Douglas, west to the town of Boxelder, and east to the vicinity of Slater (Figure 3). The Laramie Mountains are generally regarded as the western boundary of *Z. h. preblei* in Wyoming. However, the USDA Forest Service and other field workers have captured several suspected *Z. h. preblei* between 7500 - 8500 ft elevation in the Laramie Range (WYNDD, unpublished data). Because much of the crest of the range is lower than this, and because suitable habitat exists at lower elevations to the west in the Laramie Valley and Shirley Basin, this suggests that occurrence farther west is possible.

Two capture sites not shown in Figure 3 bear mentioning in this context. In summer 2000, WYNDD staff captured several *Zapus* on the floor of the Laramie Valley (central Albany County). These individuals were taken from a cottonwood-willow riparian corridor bordered by mixed grassland, several miles from the nearest montane forest. Such habitat suggests *Z. hudsonius* rather than *Z. princeps.* The specific identity of these specimens is currently being investigated. Also, a *Zapus* specimen captured in the Snowy Range (southwest Albany County) in the 1970's was originally identified as *Z. hudsonius*, but then was subsequently relabeled *Z.*

princeps based on the relatively high elevation of the capture location. However, preliminary results from an on-going study of skull morphology suggest that this specimen may in fact be *Z. hudsonius* (C. Jones, Denver Museum of Nature and Science, personal communication). If further analyses confirm these specimens as *Z. hudsonius*, the suspected range of *Z. h. preblei* in Wyoming may need to be extended to include the drainage basins of Rock Creek, Little Laramie River, Upper Laramie River, and possibly Medicine Bow River.

The 13 May 1998 listing of *Z. h. preblei* as Threatened under the U.S. Endangered Species Act has dramatically increased field surveys for this taxon (Figure 3). In 1998 WYNDD was aware of only 13 stream segments in southeast Wyoming where suspected *Z. h. preblei* had been captured. Furthermore, the most recent captures on 11 of these segments had occurred prior to 1980. In contrast, WYNDD is currently aware of 46 stream segments in southeast Wyoming where suspected *Z. h. preblei* have been captured, and the most recent captures on 36 of these segments have occurred since 1998. Note that this discussion does not include the 2 sites discussed above in central and southwestern Albany County.

SYSTEMATICS AND CLASSIFICATION

Zapus hudsonius* and *Zapus princeps - Both molecular (i.e., genetic) and morphological analyses show these 2 species to be distinct and identifiable evolutionary units, especially when specimens from distant sites are compared (e.g., Hall 1981, Jones 1981, Hafner et al. 1981, Wunder and Harrington 1996 as cited in Schorr 2001, Riggs et al. 1997, Pague and Grunau 2000, Schorr 2001). Confusion arises, however, when attempting to distinguish the 2 species in areas of co-occupation, as is the case in southeast Wyoming. Although *Z. princeps* is on average larger than *Z. hudsonius* (Long 1965, Clark and Stromberg 1987), no external character can positively establish the species identity of live individuals from this area (e.g., Compton and Hugie 1993; C. Jones, Denver Museum of Nature and Science, personal communication). The presence of an anterior fold on the first lower molar appears to be a reliable indicator of species identity; however, this requires dead specimens without excessive tooth wear. Mammalogists are currently determining if various skull measurements can be used to classify live specimens to species (C. Jones, Denver Museum of Nature and Science, personal communication).

Because of the uncertainty in determining species identity of live individuals, researchers and managers have generally relied on capture location to assign specimens to species. Specimens from montane and subalpine environments have been assumed *Z. princeps*, while those from foothills and prairie life zones have been assumed *Z. hudsonius*. However, this is an unreliable technique in southeastern Wyoming where the 2 species coexist across a rather broad area (e.g., Long 1965, Clark and Stromberg 1987). In contrast to the rather abrupt eastern front of the Front Range in Colorado, the eastern front of the Laramie Range in Wyoming is gradual and supports more interdigitation of prairie, foothills, and montane environments, leading to a broader mixing of faunas associated with these environments.

The relatively large zone of co-occurrence in southeast Wyoming raises the issue of potential hybridization between the 2 species. Hybridization between related species in areas of co-occurrence is known to occur in several other free-ranging vertebrates (see examples in Pague and Grunau 2000). Hybridization between *Z. hudsonius* and *Z. princeps* in Wyoming is suggested by recent analyses of variation in mitochondrial DNA. Although these analyses can distinguish the 2 species in other parts of their ranges (e.g., the South Platte basin in Colorado), they are unable to reliably assign species identity to *Zapus* specimens from southeast Wyoming. The general consensus among regional mammalogists is that *Z. hudsonius X Z. princeps* hybridization is the most parsimonious explanation for such results (Riggs et al. 1997, Pague and Grunau 2000, Schorr 2001).

Zapus hudsonius preblei - Historically, records of *Z. hudsonius* from southeast Wyoming and northern Colorado were referred to as *Z. h. campestris* (e.g., Warren 1910, Cary 1911). This trinomial is currently reserved for the Bear Lodge jumping mouse, a separate subspecies that occurs in the Black Hills region (Figure 2). Krutzsch (1954) first established the subspecies *Z. h. preblei* in southeast Wyoming and northern Colorado based on morphological differences. Jones (1981) subsequently concluded that although *Z. hudsonius* in this area were geographically isolated, there was insufficient morphological evidence to support their subspecific status, or indeed the subspecific status of any *Z. hudsonius* population. More recently, Hafner et al. (1981) and Riggs et al. (1997) used genetic analyses to demonstrate the legitimate subspecific status of *Z. h. preblei*. However, as outlined above, these tests were unable to conclusively assign subspecies, or even species, identity to specimens from southeast Wyoming.

The confusion regarding the separation of the full species *Z. hudsonius* and *Z. princeps* in Wyoming has parallels at the subspecies level. It is generally accepted that *Zapus* in southeast Wyoming are geographically isolated from populations to the north (*Z. h. campestris*) and east (*Z. h. pallidus*) because the intervening shortgrass prairie is too dry, even on the borders of streams, to provide suitable habitat (Figure 2). However, there have been very few surveys for *Zapus* in these intervening areas. Also, habitat suitability for *Zapus* has been increasing in these areas over the past century, largely due to the westward progression of gallery forests (Choate and Reed 1986, Knopf 1986, Knopf and Samson 1996), and both Choate et al. (1991) and Frey (1992) have demonstrated recent westward expansions in the ranges of *Z. h. intermedius* and *Z. h. pallidus*. These trends suggest increasing likelihood of connectivity between *Zapus* in southeast Wyoming and populations to the north and east. Connectivity between these populations could have 2 major management implications: (1) increased effective population size and genetic diversity, possibly reducing the risk of local extinction, and (2) erosion of any unique genetic and morphological characters currently maintained in the populations.

In summer 2000, *Zapus* surveys were performed on the USDA Forest Service Thunder Basin National Grassland on streams in the headwaters of the Cheyenne River. No *Zapus* were found (T. Byer, USDA Forest Service, personal communication), lending direct support to the geographic separation of *Z. h. campestris* and *Zapus* in southeast Wyoming. More such surveys are needed in this area to corroborate these initial findings. In addition, surveys along the North Platte River extending from Goshen County, Wyoming into the Nebraska panhandle are needed to establish the degree of overlap between *Zapus* in southeast Wyoming and *Z. h. pallidus* to the east.

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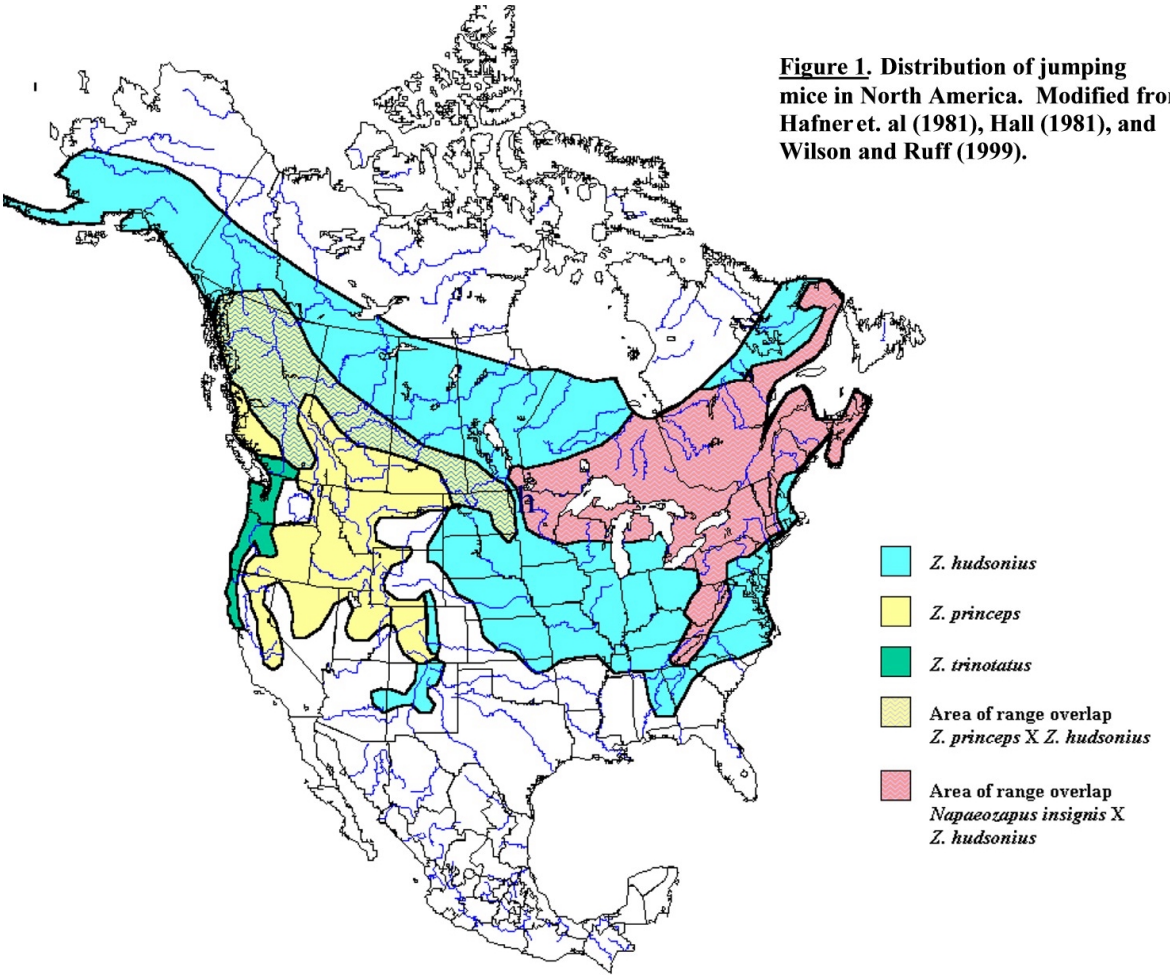

Figure 1. Distribution of jumping mice in North America. Modified from Hafner et. al (1981), Hall (1981), and Wilson and Ruff (1999).

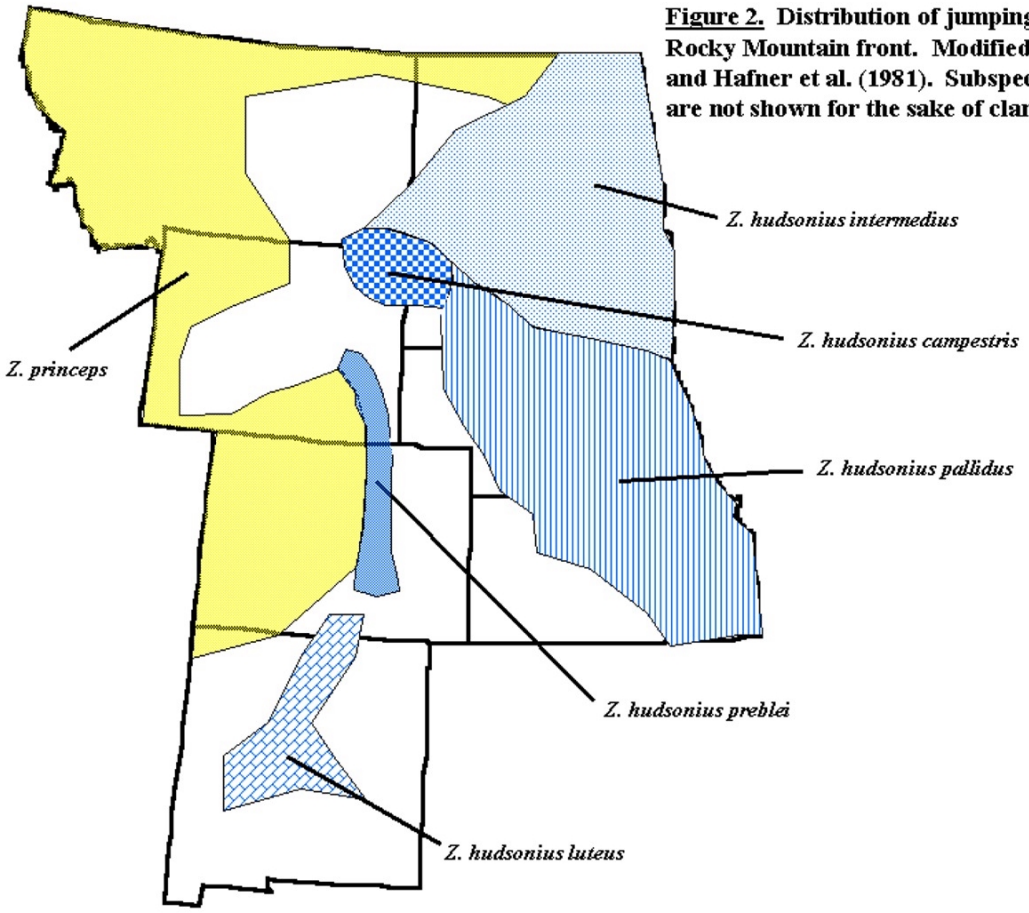

Figure 2. Distribution of jumping mice along the Rocky Mountain front. Modified from Hall (1981) and Hafner et al. (1981). Subspecies of *Z. princeps* are not shown for the sake of clarity.

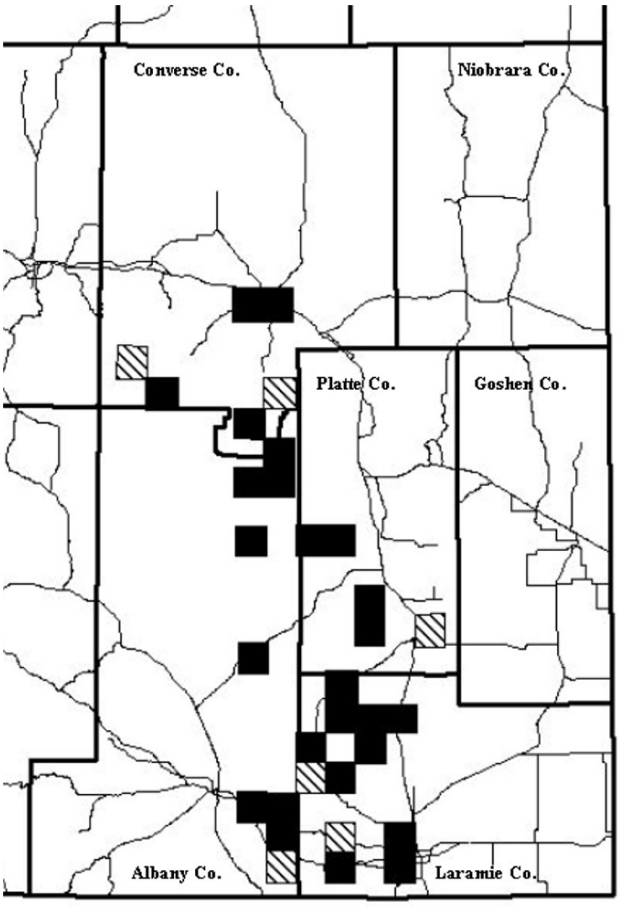

Figure 3. **Distribution of suspected Preble's meadow jumping mice (PMJM) in Townships in southeastern Wyoming. Heavy lines indicate county boundaries; light lines indicate major roads.**

Presence of suspected PMJM has been documented at least once in each highlighted Township. Solid-colored Townships are those in which presence has been documented since 1998.

The 32 highlighted Townships encompass 46 separate stream segments where suspected PMJM have been located. Prior to 1998, suspected PMJM had been located on only 13 of these stream segments.

This map does not show 2 Townships where possible PMJM were captured in southwest Albany Co. Further analyses are needed to confirm the identity of these specimens.

All occurrence data is on file at the Wyoming Natural Diversity Database, University of Wyoming.