MAMMALIAN SPECIES No. 125, pp. 1–4, 5 figs.

Brachylagus idahoensis.

By Jeffrey S. Green and Jerran T. Flinders

Published 15 April 1980 by The American Society of Mammalogists

Brachylagus Miller, 1900

Brachylagus Miller, 1900:157. Type species *Lepus idahoensis* Merriam, by author's designation. Proposed as subgenus, see Remarks for history of taxonomic usage.

CONTEXT AND CONTENT. Order Lagomorpha, Family Leporidae. *Brachylagus* is one of nine living genera in the family.

Brachylagus idahoensis (Merriam, 1891)

Pygmy Rabbit

Lepus idahoensis Merriam, 1891:76. Type locality Pahsimeroi Valley, Idaho (near Goldburg, Custer County, Davis, 1939). *Brachylagus idahoensis* Lyon, 1904:411. First usage of current name combination.

CONTEXT AND CONTENT. Content given above. *Brachylagus* is a monotypic genus (Nelson, 1909:275). There are no apparent subspecies of *B. idahoensis* (Grinnell et al., 1930; Davis, 1939; Orr, 1940).

DIAGNOSIS. Body size is smaller than in any other North American leporid (Fig. 1). Hind legs are very short; hind feet are comparatively broad and heavily haired. Ears are short, rounded and densely haired inside and out and are edged with buff. Vibrissae are black and white. Tail is small and inconspicuous, underside is buff rather than white as in cottontails (*Sylvilagus*). Upper parts are buffy gray, nape and anterior surfaces of legs are cinnamon buff. Rostrum is short and pointed (Fig. 2); supraorbital processes are long compared with those of members of the genus *Sylvilagus*. Postorbital extensions of supraorbitals, instead of tapering to blunt end as in species of *Sylvilagus*, are broadest distally and this end is either truncate or slightly notched and elongate. The skull is small and braincase and auditory bullae are relatively large. Anterior palatine foramina are broad (or rarely constricted) posteriorly; palatal bridge is short, usually with a posteromedian spine. Molariform teeth are relatively small; anterior surface of first upper molariform tooth possesses but a single re-entrant angle; posterior halves of the second to the fourth lower molariform teeth possess lateral diameters equal to about one-half of the lateral diameters of the anterior halves. The ridge of enamel separating individual molariform teeth into anterior and posterior sections lacks any crenulation (modified from Davis, 1939; Orr, 1940).

GENERAL CHARACTERISTICS. General descriptions are given in Merriam (1891), Grinnell et al. (1930), Davis (1939), Orr (1940), Janson (1946), and Hall and Kelson (1959). New pelage in fall is long, almost silky, and gray on upper parts and clear white, often tinged with buff, on the abdomen (Fig. 3). By midwinter, the fur becomes worn and appears silver gray (Davis, 1939). The dental formula is i 2/1, c 0/0, p 3/2, m 3/3, total 28.

Weights of six adult males from California averaged 409 g (375 to 435), and nine adult females averaged 398 g (246 to 458) (Orr, 1940). In Utah six adult males averaged 405 g (373 to 428), and four adult females averaged 436 g (415 to 456) (Janson, 1946); in Idaho adult males averaged 418 g and adult females averaged 462 g (Wilde, 1978). The means and ranges (in parentheses) for external measurements (in mm) of six adult males from California are: total length, 272.0 (252 to 285); length of tail, 17.5 (15 to 20); length of hind foot, 69.7 (67 to 76); and length of ear from crown, 60.8 (59 to 64). Corresponding measurements for nine adult females are: 275.3 (230 to 295); 18.7 (15 to 24); 71.7 (67 to 75) and 59.0 (56 to 61) (Orr, 1940). Measurements of six adult males from Utah are: total length, 278 (261 to 283); length of tail 17 (15 to 19); length of hind foot 70 (66 to 75); and length of ear from notch 51 (48 to 56). Corresponding measurements for eight adult females are: 291 (273 to 305); 17 (15 to 19); 70 (67 to 74); and 50 (48 to 51) (Janson, 1946).

Some cranial measurements (in mm) for six adult males from California are: basilar length, 38.9 (36.9 to 40.9); zygomatic breadth, 27.3 (26.4 to 28.2); postorbital constriction, 9.2 (8.5 to 9.5); length of nasals, 19.1 (18.2 to 19.6); width of nasals, 9.2 (8.4 to 10.0); length of molar series, 9.2 (9.0 to 9.4); diameter of external auditory meatus, 5.1 (4.8 to 5.4); breadth of braincase, 20.2 (19.7 to 20.8); and length of palatal bridge, 4.1 (3.3 to 4.6). Corresponding measurements for nine adult females are: 39.3 (37.5 to 41.0); 27.3 (26.4 to 28.3); 9.5 (8.9 to 10.5); 18.8 (17.6 to 20.4); 9.7 (9.1 to 10.4); 9.1 (8.8 to 9.6); 4.9 (4.6 to 5.4); 20.0 (19.4 to 20.6); and 4.0 (3.5 to 4.6) (Orr, 1940). Additional measurements are in Nelson (1909), Durrant (1952), Kenner (1965), and Wilde (1978).

DISTRIBUTION. The geographic range of *Brachylagus idahoensis* includes most of the Great Basin and some of the adjacent intermountain areas of the western United States (Fig. 4). One apparently isolated population occurs in southeastern Washington, west of Lower Coulee (Johnson et al., 1951). The species is not ubiquitous over the outlined range; they are found primarily on big sagebrush (*Artemisia tridentata*) dominated plains, and alluvial fans where plants occur in tall, dense clumps (Orr, 1940). Range of vertical distribution in Nevada is from about 1,370 to over 2,135 m in elevation (Nelson, 1909) and from about 1,520 to 1,615 m in California (Orr, 1940). Jensen (1965) found no evidence of *B. idahoensis* in his survey of the mammals of Rich County, Utah; however, the pygmy rabbit was collected there in 1978, and was also observed in southwestern Wyoming, northeast of Rich County, Utah in 1978 by J. N. Jensen (personal communication). Stephenson (1966) noted an eastern extension of the known range of pygmy rabbits that included the upper Sevier River Valley, near Panguitch, Utah. The communities of big sagebrush that dominate many alluvial fans and riparian sites in areas near the reported range of pygmy rabbits probably support populations of these rabbits. The dense stands of big sagebrush growing adjacent to permanent and intermittent streams, along fence lines, and in borrow ditches next to roadways may be avenues of dispersal for these rabbits.

FOSSIL RECORD. Fossil remains of *B. idahoensis* have been found in Jaguar Cave, Lemhi County, Idaho, dating to late Wisconsin or early Postglacial time (carbon-14 dates 11,580 ± 250 and 10,370 ± 350 B.P.; Kurten and Anderson, 1972). Butler (1972) stated that the total population of *B. idahoensis* was greater prior to 7,000 years ago than at any time since. Changes in the sagebrush-grass-forb component of the habitat likely account for these postulated changes in numbers of pygmy rabbits.

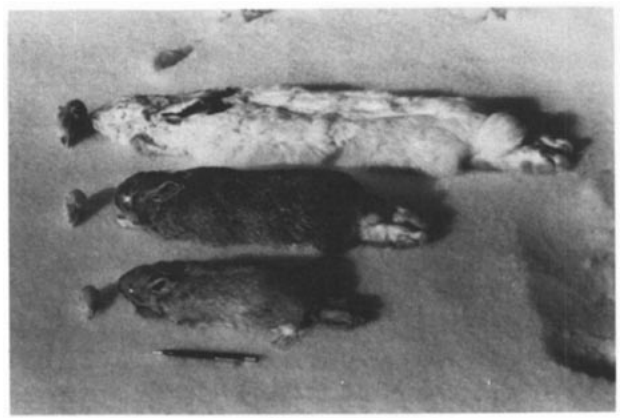

FIGURE 1. Three adult leporids, listed from top to bottom as follows: *Lepus townsendii*, *Sylvilagus nutallii*, and *Brachylagus idahoensis*. Photograph by J. T. Flinders.

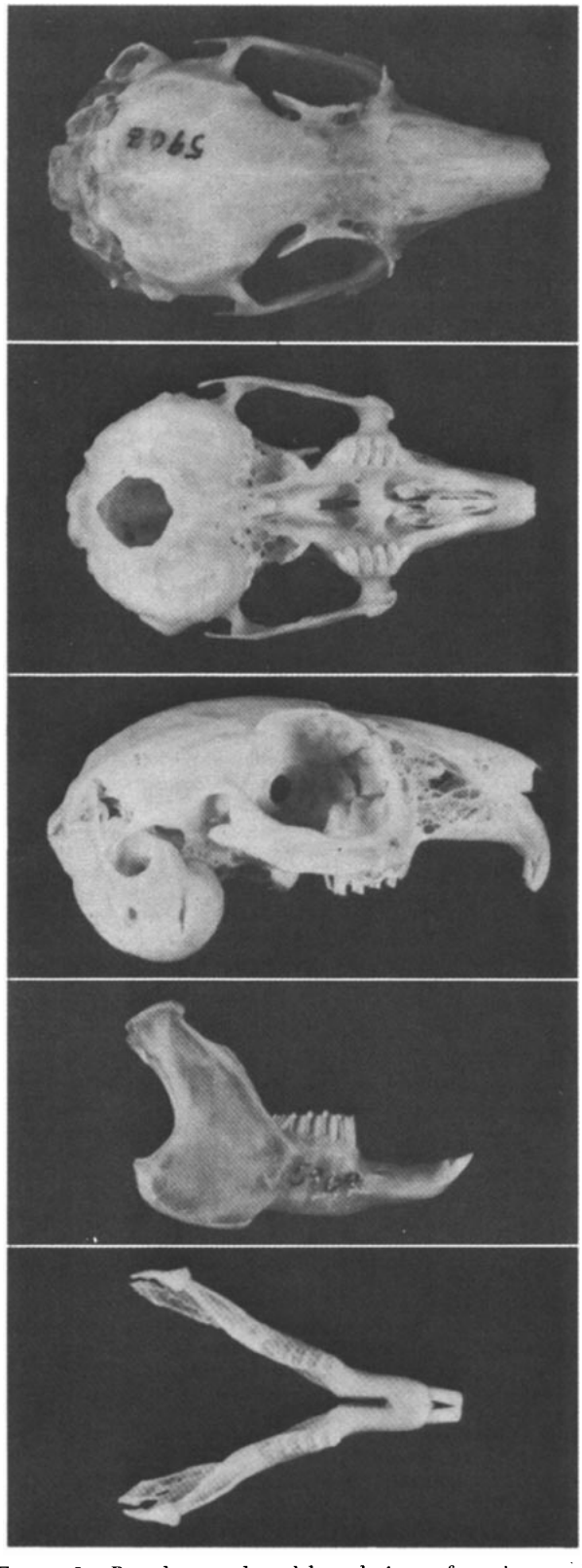

FIGURE 2. Dorsal, ventral, and lateral views of cranium, and lateral and occlusal views of mandible of *Brachylagus idahoensis* (from top: BYU 5908 female, 5906 male, 5905 female, 5909 male, and 5905 female; all from 5 mi. N. Dubois, Clark Co., Idaho; all approx. $\times 1/5$). Photographs by M. Huffman.

FORM AND FUNCTION. This species has one molt per year in mid to late summer. Pelage changes through fall and winter are due to wear and abrasion and were duplicated on study skins by scraping a dull knife over the fur (Grinnell et al., 1930).

There are 10 mammae, five on each side; two pairs are pectoral, two pairs are abdominal, and one pair is inguinal. The prostate gland of the male is usually inconspicuous, but in Utah rabbits measured 27 mm long and 16 mm wide in March and April (Janson, 1946).

ONTOGENY AND REPRODUCTION. In Idaho, testes of males began to descend in mid-December, were fully scrotal by late January, and contained copious sperm by at least March (Wilde, 1978). In Utah, testes size increased progressively from January and peaked in March (Janson, 1946). Testicular development is thought to be regulated by photoperiod and regression of testes begins in June (Wilde, 1978). Time of reproduction is apparently dependent on female readiness, which is influenced by photoperiod and vegetative condition of the habitat (Wilde, 1978). Gravid females were collected in Utah from late February through late March (Janson, 1946), and in Idaho from late March through late May (Wilde et al., 1976). The gestation period is unknown, but is between 27 and 30 days in various species of cottontails (*Sylvilagus*) (Dalke, 1942; Chapman and Harman, 1972).

Wilde et al. (1976) found a mean of 7.7 corpora lutea (range, 7 to 8) for three females examined in Idaho and estimated an average of six young born per female (Wilde, 1978). In Utah, 14 pregnant females had a mean of 5.9 embryos (range, 4 to 8) (Janson, 1946). Davis (1939) reported two females from Idaho with six embryos each; the embryos averaged 72 mm in rump-crown length, were naked, and were apparently close to birth. A maximum of three litters per year have been reported in Idaho (Wilde, 1978). It is unlikely that litters are born in the fall (Orr, 1940). Apparently all pygmy rabbits that survive to the next breeding season are capable of reproduction; juveniles do not breed (Wilde, 1978).

Sex ratios may be variable, but in Idaho they were not significantly different from 1:1. Growth rates of juveniles are dependent on date of birth; earlier cohorts grow larger due to a longer developmental period prior to winter. The order of completion of growth of pygmy rabbits is length of foot, length of body, and weight, respectively. Mortality of adults was highest in late winter and early spring, with a maximum estimated annual mortality of 88%. Juvenile mortality was highest from birth to 5 weeks of age (Wilde, 1978).

Although pygmy rabbits use burrows, the location of nests, whether on the surface or underground, is unknown (Janson, 1946). Bradfield (1975) found no chambers or nesting material in burrows. Several burrows were excavated in areas where lactating females were taken, but no young were found (Janson, 1946).

ECOLOGY. Pygmy rabbits are closely associated with aggregations of sagebrush throughout their range (Merriam, 1891; Grinnell et al., 1930; Borell and Ellis, 1934; Orr, 1940). They also occupy areas in Idaho supporting greasewood (*Sarcobatus* spp.) (Davis, 1939). They apparently prefer tall, dense clumps of big sagebrush (Orr, 1940; Green, 1978), which may account for the fact that they have been "so easily overlooked by collectors" (Severaid, 1950). Often extensive, well-used runways interlace the sage thickets and provide travel and escape routes for the rabbits (Davis, 1939).

Members of this species make extensive use of burrows, largely of their own construction, a fact that may be unique among native North American leporids (Walker et al., 1964). Burrows have several entrances (typically four or five, but up to 10 have been noted) and are usually located at the base of sagebrush plants (Janson, 1946). However, Wilde (1978) found just two entrances to be most common. Burrows are usually found on slopes, and are oriented in a north to east direction (Wilde, 1978). Entrance diameter of burrows is about 10 to 12 cm. Tunnels widen below the surface, forming chambers, and extend to a maximum depth of about 1 m. Holes among volcanic rocks, in stone walls, around abandoned buildings and those made by badgers (*Taxidea taxus*) (Grinnell et al., 1930) and marmots (*Marmota flaviventris*) (personal observation) are also used. Use of burrows is variable, but is greatest for juveniles. Early reproductive activities of adults may be concentrated at burrows (Wilde, 1978). Forms under vegetation are used during the day in a manner similar to that of other lagomorphs (Janson, 1946).

Weasels (*Mustela* spp.) readily enter burrows and traps containing pygmy rabbits (Wilde, 1978), and are the principal predators of *B. idahoensis*. Coyotes (*Canis latrans*), red foxes (*Vulpes vulpes*), owls (*Bubo* spp.) and marsh hawks (*Circus cyaneus*) also readily prey on pygmy rabbits (Janson, 1946; and personal ob-

FIGURE 3. Adult *Brachylagus idahoensis* in winter pelage from Clark Co., Idaho. Photograph by J. S. Green.

servations). Bobcats (*Felis rufus*) (Gashwiler et al., 1960) and badgers, as well as other predators, likely take pygmy rabbits.

Janson (1946) reported the following parasites on *B. idahoensis*: nematodes (*Dermatoxys veligera* and *Nematodirus* sp.); botfly larvae (*Cuterebra* sp.), fleas (*Cediopsylla inaequalis*); mite larvae; and ticks (*Dermacentor parumapertus*, *Haemaphysalis leporis-palustris* and *Ornithodoros* sp.). Wilde (1978) reported two additional flea species (*Odontopsyllus dentatus* and *Orchopeas sexdentatus*) on pygmy rabbits in Idaho. Davis (1939) often found fleas to be so abundant on pygmy rabbits as to cause a wavy motion in the fur. Bacon et al. (1959) collected an adult *Dermacentor andersoni* from a pygmy rabbit in Washington. Helminths found in western species of *Sylvilagus* may also infect *B. idahoensis* (see Erickson, 1947).

The primary food of *B. idahoensis* is big sagebrush, which may comprise up to 99% of the food taken in winter. Grasses (*Agropyron* spp. and *Poa* spp.) assume a more important role (30 to 40% of the diet) in mid to late summer (Green, 1978; Wilde, 1978). This preference for big sagebrush by pygmy rabbits is not just a function of limited availability of other nutritious woody vegetation. Green (1978) quantified woody vegetation at six sites in eastern Idaho occupied by pygmy rabbits. Antelope brush (*Purshia tridentata*) equaled big sagebrush in percent cover (19%), and yielded 2,125 kg/ha in mean dry biomass, which compared closely with the 2,541 kg/ha mean dry biomass for big sagebrush. In this study, antelope brush never represented more than 2% mean relative frequency of occurrence in the diets of pygmy rabbits during any season of the year.

Deposition rates of fecal pellets have been used to assess relative population densities of pygmy rabbits (Green, 1978). Green compiled deposition rates for nine adult pygmy rabbits (four males and five females) for a nine day period in captivity. Mean rate of defecation was 36.1 (SE = 2) pellets per hour (mean total for 24 hours was 868 pellets). Nine individual defecations of pellet groups had a mean of 67.8 (SE = 5.4) pellets per group. On the average, pygmy rabbits defecated 12.8 pellet groups per day.

There is no indication of population cycles for *B. idahoensis*, although in some years they seem scarcer than in others. Several areas in Utah containing pygmy rabbits in 1941 had none in 1946 (Janson, 1946). Janson (1946) reported densities of 1.75 and 3.5 rabbits per acre (0.7 and 1.4 rabbits/ha, respectively) in two favorable areas in Utah. Green (1978) reported 45 rabbits per hectare in ideal habitat in Idaho. Whether this apparent aggregation is a result of the habitat and/or pygmy rabbit social behavior is not known (Orr, 1940; Green, 1978).

Trapping success for adult pygmy rabbits in Idaho was least in summer and greatest in winter (Wilde, 1978). In addition to trapping, Green (1978) described techniques for capturing pygmy rabbits. A noose at the end of a nylon cord attached to a collapsible fishing rod proved effective in taking rabbits in winter as they emerged from their burrows in the snow. A spotlight used at night during the summer rendered some rabbits incapable of escape and allowed capture by throwing a coat or burlap sack over them.

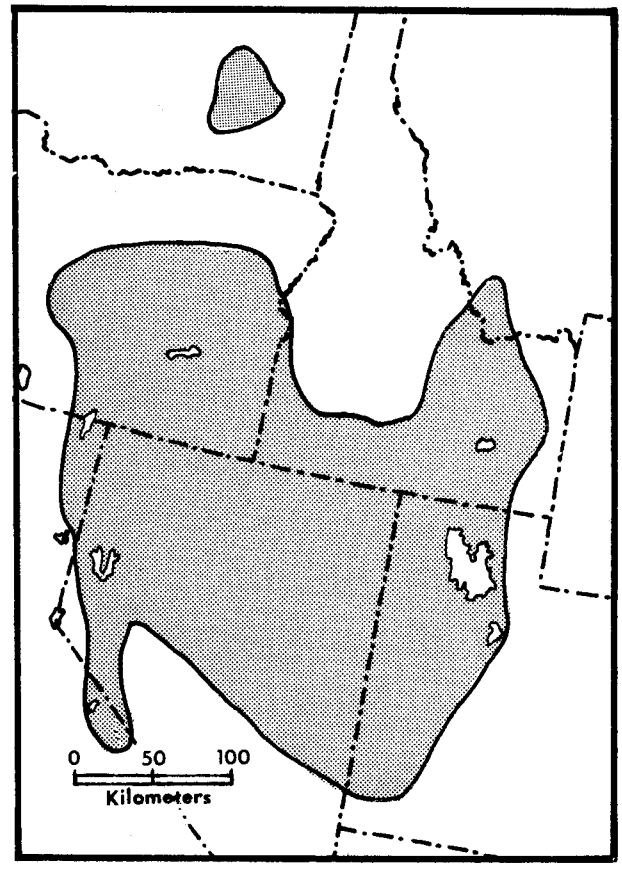

FIGURE 4. Distribution of *Brachylagus idahoensis* (adapted from Hall and Kelson, 1959).

BEHAVIOR. *Brachylagus idahoensis* may be active at any time; however, they are generally crepuscular (Davis, 1939; Janson, 1946). They have been observed feeding at midday, sometimes in the tops of sagebrush plants, but they usually rest near or inside their burrows throughout the day (Janson, 1946).

Pygmy rabbits have a low scampering gait, "not leaping as most rabbits do," and they easily maneuver through the brush when pursued (Merriam, 1891). They may travel approximately 15 miles per hour (24 km/h) (Janson, 1946). Movement is generally confined to a small area (30 m radius) around the burrow in winter, with longer movements in spring and summer (Janson, 1946). Homing from a 2.5 km displacement was reported for one juvenile female (Green and Flinders, 1979). When approached, pygmy rab-

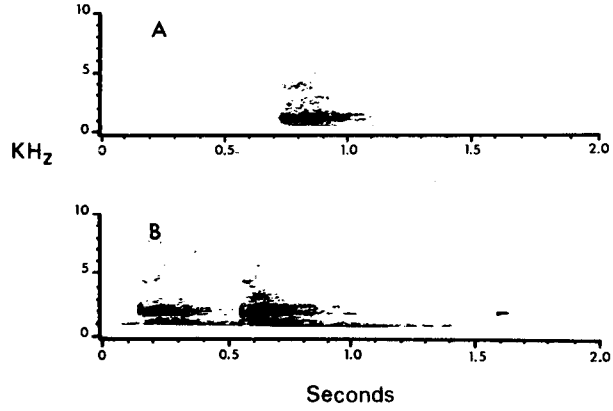

FIGURE 5. Sonagraph of a postulated alarm vocalization from *Brachylagus idahoensis*; A, single syllable, and B, double syllable ending with a squeak.

bits may move leisurely through the brush rather than retreating immediately to a burrow (Davis, 1939).

Pygmy rabbits have several vocalizations. They emit a loud squeal when captured, which is typical of other lagomorphs (Janson, 1946; Green, 1978; Wilde, 1978). A "pika-like" call was noted by Janson (1946) and Wilde (1978), and was described by Green (1978) as an alarm call (Fig. 5). Two additional vocalizations, a squeak and a chuckle, were identified by Green (1978).

Brachylagus idahoensis has been seen in the same areas as young cottontails and black-tailed jackrabbits (Anthony, 1913). In Idaho, they often occur in habitat also occupied by *Sylvilagus nuttallii*, *Lepus townsendii* (personal observation), and *L. californicus* (Wilde, 1978). No interspecific encounters have been described, but *S. nuttallii* and *B. idahoensis* have been observed simultaneously in the same burrow system (personal observation). Several pygmy rabbits may occupy the same burrow, particularly when frightened, but one adult per burrow is usual (Janson, 1946). In the breeding season, male and female adults have been captured from the same burrow (Janson, 1946; Wilde, 1978; and personal observation).

Dusting areas have been found in pygmy rabbit habitat, although no rabbits have been observed using them (Green, 1978). Some pygmy rabbit habitats in Idaho are completely covered with several feet of snow for up to two or more months during winter. Pygmy rabbits apparently make networks of subnivean trails, which are at the bases of big sagebrush shrubs, and which provide larger feeding areas. Burrows extending to the surface of the snow may or may not be constructed in these areas (personal observation).

REMARKS. There has been some controversy concerning the classification of the pygmy rabbit. Merriam (1891) assigned it to the genus *Lepus*, based on the assumption that the pygmy rabbit had two molts per year, as do hares. Miller (1900) made the pygmy rabbit the type of a new subgenus, *Brachylagus*. On the basis of its unique cranial characters, Lyon (1904) established *Brachylagus* as a monotypic genus. Nelson (1909) concurred with Lyon. Anthony (1913) and, later, Grinnell et al. (1930) confirmed that only one annual molt occurred in pygmy rabbits. Grinnell et al. (1930) felt that the unique cranial characters of the pygmy rabbit merely indicated a "well marked species" within the genus *Sylvilagus*. *Sylvilagus* was the genus in which the pygmy rabbit was placed by Orr (1940) and Hall and Kelson (1959).

Based upon his analysis of dental patterns among the Leporinae, Hibbard (1963) regarded the pygmy rabbit as being closely related only to *Nesolagus*, and stated that "it is incorrect and most misleading to consider *Brachylagus* as a subgenus of *Sylvilagus*." Following a detailed statistical analysis of cranial and dental characters, Kenner (1965) also placed the pygmy rabbit in the monotypic genus *Brachylagus*. Johnson and Wicks (1964) and Johnson (1968) determined that electrophoretic serum and hemoglobin patterns of the pygmy rabbit were quite different from the otherwise similar species of *Sylvilagus* (*S. auduboni*, *S. bachmani*, *S. floridanus*, and *S. nuttallii*). Based on these findings, as well as our own unpublished research which shows that the pygmy rabbit is divergent from cottontails in ecology and behavior, we feel there is little basis for classifying the pygmy rabbit as a *Sylvilagus*.

LITERATURE CITED

Anthony, H. E. 1913. Mammals of northern Malheur County, Oregon. Bull. Amer. Mus. Nat. Hist., 32:1–27.

Bacon, M., C. H. Drake, and N. G. Miller. 1959. Ticks (Acarina: Ixodoidea) on rabbits and rodents of eastern and central Washington. J. Parasit., 45:281–286.

Borell, A. E., and R. Ellis. 1934. Mammals of the Ruby Mountain Region of northeastern Nevada. J. Mamm., 15:12–44.

Bradfield, T. 1975. On the behavior and ecology of the pygmy rabbit *Sylvilagus idahoensis*. M.S. Thesis, Idaho State Univ., Pocatello, 43 pp.

Butler, B. R. 1972. The Holocene and Postglacial ecological crisis on the eastern Snake River plain. Tebiwa, 15:49–63.

Chapman, J. A., and A. L. Harman. 1972. The breeding biology of a brush rabbit population. J. Wildlife Mgt., 36:816–823.

Dalke, P. D. 1942. The cottontail rabbits in Connecticut. Bull. Connecticut Geol. Nat. Hist. Surv., 65:1–97.

Davis, W. B. 1939. The recent mammals of Idaho. Caxton Printers, Ltd., Caldwell, Idaho, 400 pp.

Durrant, S. D. 1952. Mammals of Utah. Univ. Kansas Publ., Mus. Nat. Hist., 6:1–549.

Erickson, A. B. 1947. Helminth parasites of rabbits of the genus *Sylvilagus*. J. Wildlife Mgt., 11:255–263.

Gashwiler, J. S., W. L. Robinette, and O. W. Morris. 1960. Foods of bobcats in Utah and eastern Nevada. J. Wildlife Mgt., 24:226–229.

Green, J. S. 1978. Pygmy rabbit and coyote investigations in southeastern Idaho. Ph.D. Dissertation, Brigham Young Univ., Provo, Utah, 88 pp.

Green, J. S., and J. T. Flinders. 1979. Homing by a pygmy rabbit. Great Basin Nat., 39:88.

Grinnell, J., J. Dixon, and J. M. Linsdale. 1930. Vertebrate natural history of a section of northern California through the Lassen Peak Region. Univ. California Publ. Zool., 35:1–594.

Hall, E. R., and K. R. Kelson. 1959. The mammals of North America. Ronald Press, New York, 1:xxx + 1–546 + 79.

Hibbard, C. W. 1963. The origin of the P_3 pattern of *Sylvilagus*, *Caprolagus*, *Oryctolagus*, and *Lepus*. J. Mamm., 44:1–15.

Janson, R. G. 1946. A survey of the native rabbits of Utah with reference to their classification, distribution, life histories and ecology. M.S. Thesis, Utah State Univ., Logan, 103 pp.

Jensen, J. N. 1965. The mammals of Rich County, Utah. M.S. Thesis, Univ. of Utah, Salt Lake City, 131 pp.

Johnson, M. L. 1968. Application of blood protein electrophoretic studies to problems in mammalian taxonomy. Syst. Zool., 17:23–30.

Johnson, M. L., P. W. Cheney, and T. H. Scheffer. 1951. Mammals of Grand Coulee, Washington. Murrelet, 31:39–42.

Johnson, M. L., and M. J. Wicks. 1964. Serum-protein electrophoresis in mammals: Significance in higher taxonomic categories. Pp. 681–694, *in* Taxonomic biochemistry and serology, C. A. Leone (ed.), The Ronald Press Co., New York, 728 pp.

Kenner, G. H. 1965. Comparative osteology of rabbits of the genera *Brachylagus* Miller and *Sylvilagus* Gray. M.S. Thesis, Univ. of Utah, Salt Lake City, 125 pp.

Kurten, B., and E. Anderson. 1972. The sediments and fauna of Jaguar Cave: II—the fauna. Tebiwa, 15:21–45.

Lyon, M. W., Jr. 1904. Classification of the hares and their allies. Smithsonian Misc. Coll., 45:321–447.

Merriam, C. H. 1891. Results of a biological reconnaissance of south-central Idaho. N. Amer. Fauna, 5:1–416.

Miller, G. S., Jr. 1900. A new subgenus for *Lepus idahoensis* Proc. Biol. Soc. Washington, 13:157.

Nelson, E. W. 1909. The rabbits of North America. North Amer. Fauna, 29:1–314.

Orr, R. T. 1940. The rabbits of California. Occas. Papers California Acad. Sci., 19:1–227.

Severaid, J. H. 1950. The pygmy rabbit (*Sylvilagus idahoensis*) in Mono County, California. J. Mamm., 31:1–4.

Stephenson, S. N. 1966. Mammals of the Paunsagunt Plateau Region, Utah. Great Basin Nat., 26:43–44.

Walker, E. P., et al. 1964. The mammals of the world. Johns Hopkins Press, Baltimore, 2:647–1500.

Wilde, D. B. 1978. A population analysis of the pygmy rabbit (*Sylvilagus idahoensis*) on the INEL site. Ph.D. Dissertation, Idaho State Univ., Pocatello, 172 pp.

Wilde, D. B., J. S. Fisher, and B. L. Keller. 1976. A demographic analysis of the pygmy rabbit *Sylvilagus idahoensis*. Pp. 88–105, *in* 1975 Progress Report Idaho National Engineering Laboratory Site Radioecology-Ecology Programs (O. D. Markham, ed.), U.S. Energy Res. Devel. Admin., Idaho Falls, 205 pp.

Editors for this account were DANIEL F. WILLIAMS and SYDNEY ANDERSON.

JEFFREY S. GREEN AND JERRAN T. FLINDERS, BRIGHAM YOUNG UNIVERSITY, PROVO, UTAH 84602. CURRENT ADDRESS OF GREEN, U.S. SHEEP EXPERIMENT STATION, DUBOIS, IDAHO 83423.