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HIGH-ELEVATION RECORDS FOR *NEOTOMA CINEREA* IN THE WHITE MOUNTAINS, CALIFORNIA

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ABSTRACT.—New records for bushy-tailed wood rat (*Neotoma cinerea*) on the White Mountains of eastern California increase the elevation from which this animal is known on the White Mountains, outside of human habitation, from 3,120 to 3,648 m. These records, coupled with archaeological data, suggest that the isolated bouldery outcrops occupied by bushy-tailed wood rats above timberline here are true habitat islands, occasionally colonized by dispersing individuals and characterized by frequent local extinction.

During the summer of 1984, a single bushy-tailed wood rat (*Neotoma cinerea*) was collected from the summit hut on White Mountain Peak (White Mountains, Inyo County, California) at an elevation of 4,342 m (Carey and Wehausen, in press). This record increased the maximum known elevation of *N. cinerea* in the White Mountains by 1,222 m and provided the highest known occurrence of this species in the Great Basin. However, because the animal was occupying a human structure, and because no records existed between 3,120 and 4,342 m, it is possible that the animal was transported to this elevation by people. In this paper we present new information on the distribution of *N. cinerea* in the higher elevations of the White Mountains and attempt to place the White Mountain Peak individual in local biogeographic perspective.

Archaeological Records

Although human use of the alpine tundra zone of the central White Mountains extends back at least 5,000 years, the nature of human occupation here changed dramatically soon after A.D. 600, when a series of small village sites located at elevations between 3,150 and 3,850 m began to be occupied. A variety of dating techniques suggest that at least some of these sites were occupied by A.D. 660, and that at least some continued in use into early historic times (Bettinger and Oglesby 1985).

To date, the vertebrate faunas from 10 of these sites have been identified. The faunas are dominated by yellow-bellied marmots (*Marmota flaviventris*) and mountain sheep (*Ovis canadensis*), but a variety of smaller mammals are also represented. Six of the sites have provided the remains of *Neotoma cinerea* or *N.* cf. *cinerea* (Table 1). Specimens assigned to *N.* cf. *cinerea* cannot be identified to species with certainty, but they are much larger than corresponding elements of the desert wood rat, *N. lepida*, and there can be little doubt that they represent bushy-tailed wood rat. In addition, three of the sites have also provided teeth that can be securely identified as *Neotoma cinerea*.

Modern Records

The sites that provided these remains range from 3,150 to 3,560 m in elevation (see Table 1) and thus fall within the 1,222 m elevational gap in the currently known distribution of *N. cinerea* in the White Mountains. However, because these specimens are archaeological, it is possible that they represent either transport of the animals by people, as was common in the Great Basin ethnographically, or altered prehistoric distribution of wood rats in this area. To determine whether bushy-tailed wood rats exist here now, we sought *N. cinerea* sign adjacent to all 10 sites. We found such sign—cut vegetation, bone collections, rock-edge urine stains, and *Neotoma* scat—in the boulder accumulations adjacent to the following five sites:

1. *Crooked Forks.* The north-facing exposure of the rocky knob (elev. ca 3,158 m) above the Crooked Forks site, on Crooked Creek,

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TABLE 1. Modern and archaeological records for *Neotoma cinerea* in the White Mountains (NISP = number of identified specimens).

Village site	Elevation (m)	NISP	*Neotoma cinerea* present? Archaeological	Modern
Crooked Forks	3,150	950	yes (NISP, 9)	yes
Enfield	3,170	165	yes (NISP, 5)	yes
Corral Camp North	3,350	763	yes (NISP, 2)	no
Corral Camp South	3,350	791	no	yes
Midway	3,440	865	yes (NISP, 1)	no
Pressure Drop	3,460	92	no	yes
Raven Camp	3,460	720	yes (NISP, 1)	no
Rancho Deluxe	3,560	1,433	yes (NISP, 1)	no
Shooting Star	3,620	66	no	yes
12640	3,850	20	no	no

provided an accumulation of cut vegetation, skeletal material, and *Neotoma* scat that appeared fresh. The skeletal material included the remains of hares (*Lepus* sp.), Nuttall's cottontails (*Sylvilagus nuttallii*), *Marmota flaviventris*, meadow voles (*Microtus* sp.), and the proximal end of an *Ovis* second phalanx, the gracile nature of which suggests it is of domestic sheep (*Ovis aries*). In addition, this accumulation included five *Neotoma* mandibles, the measurements of four of which allow secure identification as *N. cinerea* (see Grayson 1983, 1985 for the use of mandibular and dental measurements to identify this animal). The dominant vegetation in this area includes sagebrush (*Artemisia* sp.), wax currant (*Ribes cereum*), occasional small limber pine (*Pinus flexilis*), and scattered to thick grasses.

2. *Enfield.* Located north of County Line Hill, the Enfield site sits below a small rock exposure, on the summit of which was found a small accumulation of *Neotoma* scat (elev. ca 3,190 m). This accumulation consisted of a small number of somewhat eroded pellets; no cut vegetation or other wood rat sign accompanied this material. The dominant vegetation on and immediately beneath this exposure includes rabbitbrush (*Chrysothamnus* sp.), *Artemisia* sp., and grasses.

3. *Corral Camp South.* Corral Camp South is in the upper reaches of the drainage of Cottonwood Creek; the rocky slope above this site provided a collection of *Neotoma* scat and a fragmentary *Neotoma* mandible (elev. ca 3,435 m). The dominant vegetation here includes bristlecone pine (*Pinus longaeva*), *Ribes cereum*, and scattered grasses.

4. *Pressure Drop.* Located west of Lamb Camp, the bouldery exposure (elev. ca 3,461 m) immediately above this site yielded a sparse collection of eroded *Neotoma* scat and a single distal right *Ovis* tibia, whose gracile nature again suggests domestic sheep. This scanty accumulation was on a west-facing slope, the dominant vegetation characterized by *Artemisia* sp., *Ribes cereum*, and scattered grasses.

5. *Shooting Star.* This site is located in the drainage of a small tributary of Cottonwood Creek approximately 1.2 km southeast of Barcroft Laboratory. The *Neotoma* accumulation found above this site consisted of scat, cut vegetation, and bones at an elevation of 3,633 m; typical *Neotoma* urine stains were found 15 m above this location. The bones collected from this midden included a cricetid femur, two pika (*Ochotona princeps*) mandibles, a *Marmota flaviventris* phalanx, a *Neotoma* lumbar vertebra, and the right maxilla of a juvenile domestic sheep. This material was found in a southwest-facing exposure behind a dense patch of *Ribes cereum;* other dominant plants in the vicinity of the midden include *Artemisia* sp. and scattered grasses.

These five records establish the presence of *Neotoma* some 530 m above the elevational limits documented by previous work in the area, though still 994 m beneath the White Mountain Peak summit record. While only the Crooked Forks midden specimens can be securely identified to species, the extreme elevation of the five accumulations leaves little doubt that all reflect the presence of *Neotoma cinerea.*

Because we did not trap, we do not know if any of these middens are still active. The association of the remains of domestic sheep with three of the accumulations, however, is significant. Although the associations may be

accidental, the fact that three middens provided the remains of domestic sheep alongside other bones suggests that the sheep remains were collected by wood rats. If we accept these associations at face value, we can arrive at some indication of the age of the middens. Domestic sheep were introduced into the White Mountains during the 1890s. They began to be removed from the area in the 1930s, but scattered flocks remained as late as the 1950s (Wehausen 1986). Thus, at least three of the middens seem to have been active during the past 100 years, even if they are not active today.

CONCLUSIONS

Neotoma cinerea habitat is patchily distributed above timberline in the White Mountains. The bouldery exposures that provide cover for this animal may be separated from one another by hundreds of meters, the intervening expanses devoid of rocky cover and often nearly devoid of vegetation (Lloyd and Mitchell 1973). Although not all bouldery outcrops above timberline provide acceptable *Neotoma* shelter, some clearly do, and those that we have found with *Neotoma* sign are marked by vegetation that typically includes *Artemisia* sp., *Ribes cereum*, and scattered grasses. However, many outcrops that possess these attributes today show no sign of occupation by *Neotoma*. The archaeological site of Midway, for instance, is only 900 m from (and 120 m lower than) Shooting Star. The bouldery exposures above Midway are characterized by the same plants that characterize the slopes above Shooting Star; yet there is no evidence that *Neotoma cinerea* currently occupies the area. The species is, however, represented in the archaeological deposits of the site. Much the same can be said of Rancho Deluxe and Raven Camp: they are both adjacent to apparently appropriate habitat with no sign of contemporary *Neotoma*, but with *Neotoma* represented in the archaeological collections. We speculate that above-timberline, boulder-strewn exposures on the White Mountains often form true habitat islands for *N. cinerea*. These islands are occasionally colonized by dispersing bushy-tailed wood rats, with local extinction often following such colonization; the archaeological records from Midway and Raven Camp may, but do not necessarily, represent such extinctions. Escherich (1981) has noted the impressive dispersal abilities of *N. cinerea* and has noted as well that local populations of these animals commonly undergo extinction. Our data are fully consistent with his analysis.

Thus, new records for *N. cinerea* in the White Mountains increase the elevation from which this animal is known outside of human habitation from 3,120 to 3,648 m. Although elevations between 3,648 m and 4,342 m remain without records for this animal, we will not be surprised if dispersing individuals have occupied this zone as well. Even if the White Mountains Peak individual were transported by people, it arrived in much the same way as other bushy-tailed wood rats seem to have reached isolated patches of habitat above timberline here: dispersal across inhospitable areas.

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