

Tamias cinereicollis. By Clayton D. Hilton and Troy L. Best

Published 23 April 1993 by The American Society of Mammalogists

Tamias cinereicollis J. A. Allen, 1890

Gray-collared Chipmunk

Tamias cinereicollis J. A. Allen, 1890:94. Type locality "San Francisco Mountain [Coconino Co.—Miller and Rehn, 1901:40], Arizona."

CONTEXT AND CONTENT. Order Rodentia, Suborder Sciuromorpha, Family Sciuridae. The genus *Tamias* contains ca. 24 species (Honacki et al., 1982). *T. cinereicollis* (Fig. 1) is in the subgenus *Neotamias*, and either the *amoenus* (Levenson et al., 1985) or *quadrivittatus* species group (Patterson, 1984a). Two subspecies are recognized (Hall, 1981):

T. c. cinereicollis J. A. Allen, 1890:94, see above.

T. c. cinereus (Bailey, 1913:130). Type locality "Magdalena Mountains [Socorro Co.—Miller, 1924:204], New Mexico (alt. 8200 feet), in Copper Canyon."

DIAGNOSIS. *Tamias cinereicollis* has pale-grayish color on the cheeks, shoulders, and anterior part of the back. Prominent areas of gray in these three regions are unique to the species (Hoffmeister, 1986).

Compared with *T. canipes*, the sides of *T. cinereicollis* are darker, the outer pair of dorsal stripes is less brownish (more blackish), and the sides of the nose and face are more heavily washed with buff. The feet of *T. cinereicollis* are less grayish (more buffy), the tail edgings are darker and less grayish (more buffy), and the hind foot averages longer (color nomenclature follows Ridgway, 1912—Howell, 1929). In fresh postbreeding pelage, *T. canipes* is grayer throughout, with paler and duller ochraceous on the sides, the tips of the long hairs on the rump and dorsal surface of the tail are white instead of yellowish, the feet are clear gray without a tinge of yellowish, and the black dorsal stripe extends forward to between the ears (Bailey, 1902). The skull (Fig. 2) of *T. cinereicollis* averages smaller than that of *T. canipes* (Howell, 1929). *T. canipes* has a length of shaft of the baculum of 3.10–3.49 mm compared with

4.7 mm in *T. cinereicollis* (Fig. 3). The angle formed by the shaft and tip of baculum is 112–120° in *T. canipes* and 138–148° in *T. cinereicollis* (Hall, 1981).

The gray-collared chipmunk is grayer than *T. minimus*, especially on the shoulders and cheeks, whereas *T. minimus* is buffy gray. It also differs from *T. minimus* in having a greater postorbital breadth (*T. minimus*, ≤ 10.8 mm with no overlap) and cranial depth



FIG. 1. *Tamias cinereicollis* in Bear Trap Canyon, San Mateo Mountains, Socorro Co., New Mexico. Photograph by T. L. Best.

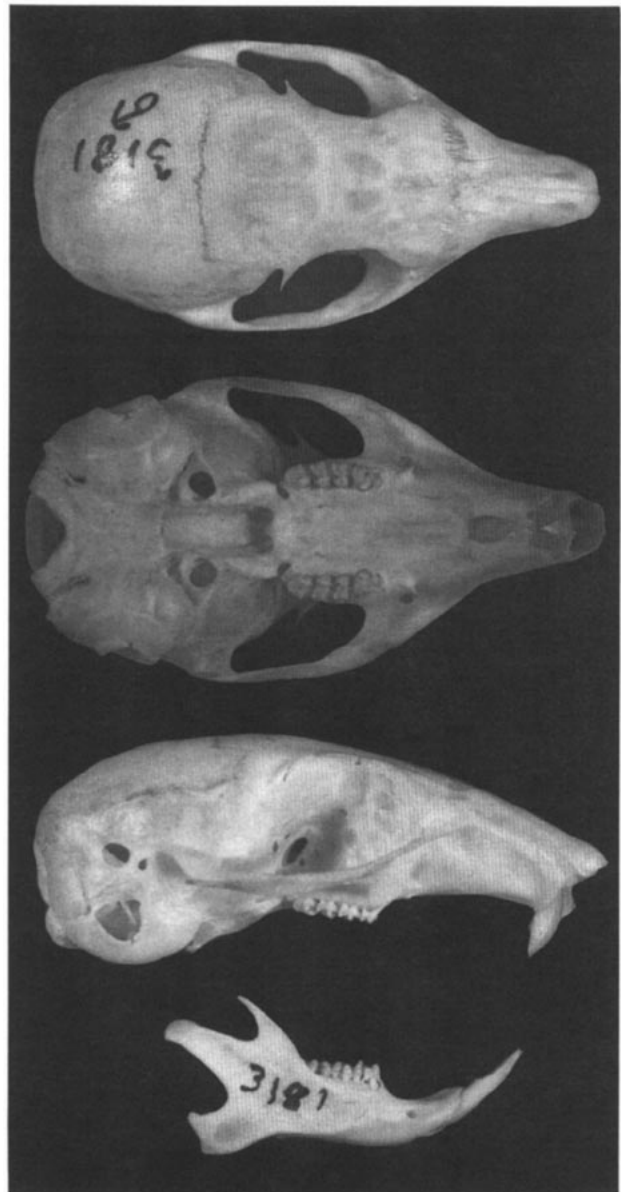


FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Tamias cinereicollis* (male, The University of New Mexico Museum of Southwestern Biology 3181) from Iron Canyon, Black Range, 15 miles E, 6 miles N of Santa Rita, Grant Co., New Mexico. Greatest length of cranium is 35.3 mm. Photographs by T. H. Henry.

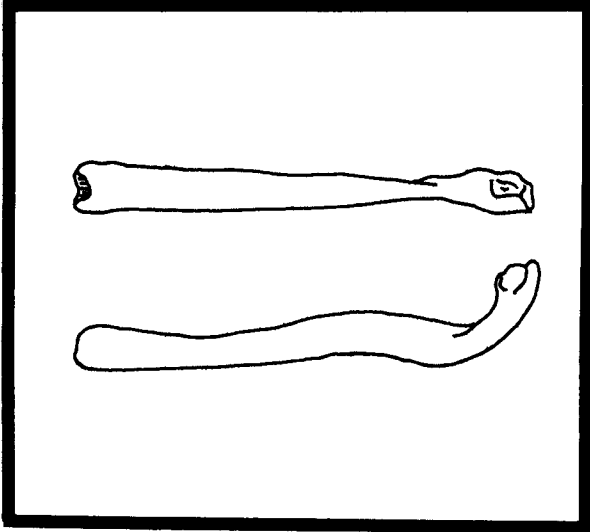


FIG. 3. Baculum of *Tamias c. cinereicollis* from Mount Thomas, White Mountains, Apache Co., Arizona (redrawn from White, 1953).

(*T. minimus*, ≤ 13.7 mm with no overlap). Externally, *T. cinereicollis* and *T. minimus* are difficult to distinguish (Hoffmeister, 1986).

Compared with *T. quadrivittatus*, palatilar length and post-orbital breadth of *T. cinereicollis* are larger on average, and *T. cinereicollis* is gray on the shoulders rather than orange (Hoffmeister, 1986). Karyotypically, *T. quadrivittatus* has a B karyotype of *Tamias*, while *T. cinereicollis* has an A karyotype of *Tamias* (Patterson, 1980b). Compared with *T. umbrinus*, postpalatal length is smaller and total length, palatilar length, zygomatic breadth, and length of maxillary toothrow are larger for *T. cinereicollis* (Hoffmeister, 1986). Five well-defined black dorsal stripes and four pale stripes distinguish *T. cinereicollis* from *T. dorsalis* and *T. merriami*, which have ambiguous or obscure dorsal stripes. The skull of the gray-collared chipmunk is similar to that of *T. dorsalis*, except that the braincase of *T. cinereicollis* is shorter and broader, the rostrum is shorter and more depressed, and the incisors are narrower than in *T. dorsalis* (Mearns, 1907).

The baculum of *T. cinereicollis* (Fig. 3) differs from that of *T. quadrimaculatus* in that the keel is lower, the ridges on either side of the tip are weakly developed, and there is a greater tip-shaft angle in *T. cinereicollis*. The shaft is longer, the base is only slightly widened, and the tip-shaft angle is greater than in *T. bulleri*, *T. palmeri*, *T. panamintinus*, *T. speciosus*, or *T. umbrinus* (White, 1953). When length of baculum is plotted against greatest length of skull, *T. cinereicollis* is separated from *T. canipes*, *T. durangae*, and *T. quadrivittatus* (Patterson and Thaeler, 1982).

GENERAL CHARACTERS. The gray-collared chipmunk has five black or brown dorsal stripes; the lateral-most pair may be difficult to discern. There are two whitish and three brown facial stripes, and the forehead is brown and washed with pale gray. Likewise, the cheeks, neck, shoulders, anterior part of back, and rump are gray (Hoffmeister, 1986).

In summer pelage (August), the top of the head of *T. c. cinereicollis* is sayal brown that is mixed with grayish white and strongly shaded on the top and sides of the nose with clay color or cinnamon buff. The crown is bordered on each side with a stripe of fuscous or warm sepia. The ocular stripe is blackish and shaded with sayal brown. The submalar stripe is sayal brown and shaded with bister. The ears are fuscous or chaetura drab, broadly margined posteriorly with grayish white, and washed on the anterior margin with sayal brown. The inside surface of the ears are washed with sayal brown. The nape and shoulders have a distinct wash of smoke gray, mixed on the sides with pinkish buff or pinkish cinnamon. The dorsal stripes are black, bordered on each side with sayal brown. The median pair of pale stripes are pale smoke-gray. The outer pair is white. The lateral stripes are fuscous black, mixed with sayal brown or russet. The rump and thighs are smoke gray and mixed with cinnamon buff. The sides are sayal brown. The feet are pinkish buff or pale pinkish-cinnamon, shaded with clay color and sometimes

with grayish white. Dorsally, the tail is fuscous black (the bases of the hairs are cinnamon) overlaid with pinkish buff or cinnamon buff. Ventrally, the tail is tawny or ochraceous tawny (fading to clay color) and bordered with fuscous black and edged with pinkish buff or cinnamon buff. The underparts are creamy white and often are tinged with pinkish buff (color nomenclature follows Ridgway 1912—Howell, 1929).

In summer pelage (September), the top of the head of *T. c. cinereus* is pale smoke-gray, mixed with cinnamon, and bordered on each side with fuscous black. The sides of the nose are washed with pale pinkish-cinnamon. The ocular stripe is fuscous black and shaded with mikado brown. The submalar stripe is mikado brown and shaded with fuscous. The ears are chaetura drab and broadly margined posteriorly with grayish white and washed anteriorly with mikado brown. The postauricular patches are large and grayish white. The nape and shoulders are extensively washed with smoke gray. The dark dorsal stripe is black and margined with mikado brown; the outer pair sometimes is mainly brownish. The lateral stripes are fuscous black shading to mikado brown. The median pair of pale stripes is grayish white and the outer pair is white. The rump and thighs are smoke gray and mixed with pinkish buff. The sides are between sayal brown and pale-clay color. The feet are pinkish buff or pinkish cinnamon shaded with pale smoke-gray. Dorsally, the tail is fuscous black (the bases of the hairs are pinkish cinnamon) overlaid with pinkish buff. Ventrally, the tail is creamy white and tinged with pale buff (color nomenclature follows Ridgway, 1912—Howell, 1929).

Winter pelage (October) of *T. c. cinereicollis* is similar to summer pelage, but the sides are paler (pale sayal-brown). The edgings of the tail are paler and the upperparts usually are more extensively washed with grayish. Winter pelage of *T. c. cinereus* (October) is similar to summer pelage (color nomenclature follows Ridgway, 1912—Howell, 1929).

Breeding pelage (May–July) is softer and fuller than autumn pelage (most noticeable when comparing May and August animals), but the colors generally are faded. The tints of gray, black, and white are not as pure or clear and the sides are tinged with pale yellowish-brown or pale buff, occasionally blending with the general color of the dorsum (Allen, 1890).

Mean and range of measurements (in mm) of *T. c. cinereicollis* from the Mogollon Rim, Coconino Co., and White Mountains, Apache and Greenlee counties, Arizona, respectively, are: total length, 223 (212–243), 229 (217–243); length of tail, 91 (80–110), 101 (92–113); length of hind foot, 33 (31–36), 34 (32–36); greatest length of cranium, 35.4 (33.8–36.5), 36.0 (35.2–37.1); condylobasal length, 31.4 (29.7–32.6), 31.9 (30.8–32.7); palatilar length, 15.3 (14.8–16.0), 15.4 (14.8–16.0); postpalatal length, 12.4 (11.6–13.0), 12.6 (11.9–12.9); nasal length, 10.8 (10.3–11.5), 11.0 (10.2–11.7); interorbital breadth, 7.9 (7.2–8.3), 8.1 (7.8–8.3); postorbital breadth, 11.5 (10.9–12.0), 11.6 (11.2–12.1); zygomatic breadth, 19.7 (18.7–20.5), 19.7 (19.0–20.2); cranial breadth, 15.9 (15.3–16.4), 16.1 (15.7–16.6); depth of cranium, 14.3 (13.8–14.7), 14.6 (14.3–15.1); length of bulla, 8.0 (7.7–8.2), 8.0 (7.6–8.4); length of maxillary toothrow, 5.8 (5.5–6.1), 5.8 (5.4–6.2—Hoffmeister, 1986).

Zygomatic breadth, cranial breadth (Hoffmeister, 1986), and length of head and body of females are larger than those of males (Levenson, 1990). Average measurements (in mm) of adult males and females, respectively, are: length of body, 128.20, 133.18 (Levenson, 1990); total length, 223, 225; length of tail vertebrae, 95, 99; length of tail to end of hairs, 118, 125; length of hind foot, 34.3, 34.1; length of ear from crown, 15.1, 16.0; length of ear from notch, 20.3, 20.1; length of head, 38.3, 39.5; distance from tip of nose to eye, 16.3, 15.8; distance from tip of nose to ear, 30.0, 30.6 (Mearns, 1907).

Coloration of *T. c. cinereus* is similar to that of *T. c. cinereicollis*, but is paler and grayer, the rufescent areas of the body not only are paler in color, but also are smaller in *T. c. cinereus*. The crown, shoulders, and rump are clear ashy gray. The white of the belly is clearer and more extensive, and the hind feet are pale buffy. The dorsal stripes (three black, two gray, two white) are broad, clear, and sharply defined (Bailey, 1913). Average and range of measurements (in mm) for *T. c. cinereicollis* and *T. c. cinereus*, respectively, are: total length, 225 (212–242), 222 (208–231); length of tail vertebrae, 102 (95–109), 95 (90–101); length of hind foot, 35 (34–36), 35 (33–36); length of ear from notch, 15.3 (14.3–16.0), 14.8 (14.0–15.3); greatest length of cranium, 35.9 (35.1–36.6), 36.1 (35.5–36.7); zygomatic breadth, 19.7 (19.4–20.2), 19.6 (19.4–19.8); breadth of cranium, 14.9 (14.0–15.4), 15.3

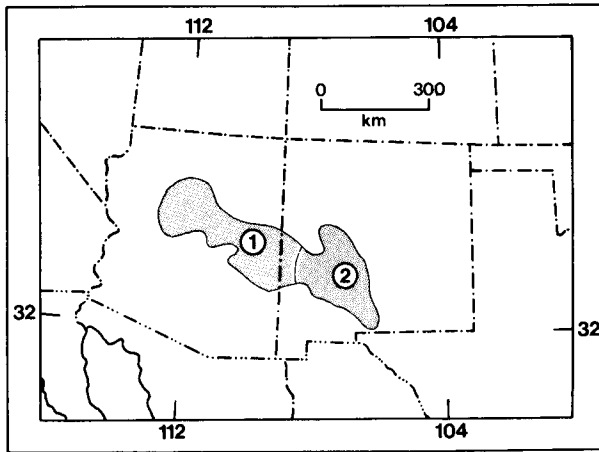


FIG. 4. Distribution of *Tamias cinereicollis* in western North America: 1, *T. c. cinereicollis*; 2, *T. c. cinereus* (modified from Hall, 1981).

(14.8–15.6); interorbital breadth, 8.1 (7.9–8.6), 7.9 (7.8–8.0); length of nasals, 11.2 (10.5–12.3), 11.2 (10.5–11.6—Howell, 1929); average body mass of *T. c. cinereus* is 61.7 g (Patterson, 1980b).

DISTRIBUTION. The gray-collared chipmunk is found only in montane coniferous forest (Hoffmeister, 1986) at altitudes of 1,950–3,440 m (it is most common at 2,100–3,300 m—Mearns, 1907). Its range includes the mountain and plateau region of central Arizona from the Bill Williams and San Francisco mountains southward across the Mogollon Plateau to the White Mountains and Prieto Plateau, and into the Black, Datil, Elk, Magdalena, Mimbres, Mogollon, San Francisco, and San Mateo Mountains of New Mexico (Fig. 4; Bailey, 1931; Elliot, 1905; Hoffmeister, 1986; Howell, 1929; Patterson, 1980a).

FOSSIL RECORD. Fossil remains of *T. cinereicollis* have been found in Baldy Peak Cave, Florida Mountains, Luna Co., New Mexico, an area that is thought to be late Wisconsinan in age (Harris, 1985). A jaw fragment identified as that of *T. cinereicollis* was recovered from late Pleistocene deposits in Fowlkes Cave, Culberson Co., Texas; however, this specimen may be *T. canipes* (Dalquest and Stangl, 1984).

FORM AND FUNCTION. The dental formula of *T. cinereicollis* is $i\ 1/1$, $c\ 0/0$, $p\ 2/1$, $m\ 3/3$, total 22. The palate is elongate, the bullae are small, and the braincase is narrow (Fig. 2; Hoffmeister, 1986). There are four pair of mammae (Mearns, 1907).

The spring molt takes place early in the year. On 15–17 May, three males from Flagstaff, Arizona, were in worn winter pelage that was being replaced by uneven patches on the upperparts (Howell, 1929).

One *T. cinereicollis* from near Silver City, Grant Co., New Mexico, had aberrant coloration. This was a subadult female with a pale grayish-brown mid-dorsal stripe extending from mid-body to between the ears. The other dark stripes were gray posteriorly and became whitish-gray anteriorly, while the dorsal pale stripes were pale gray on the rump becoming white anteriorly. The hind legs and the dorsal sides of the hind feet were gray. The tail was whitish-gray on the ventral surface; the dorsal surface was grayish-brown basally and became gray posteriorly, terminating in a black tip. All hairs on the tail were tipped with white. The ears were grayish black and the dorsal side of the snout was black. The ventral body surface, face, and dorsal side of the head were white. The eyes were pink (Fleharty and Jones, 1960).

There is no relationship between length of baculum and greatest length of cranium (Patterson and Thaler, 1982). The tip of the baculum is 34% of the length of the shaft. The distal 33% of the shaft is slightly compressed laterally and the base is barely widened (White, 1953). Means of bacular measurements (in mm) from the San Mateo, Black, and Mogollon mountains of New Mexico, respectively, are: total length, 6.47, 5.85, 6.10; length of tip, 1.72, 1.69, 1.83; height of keel, 0.50, 0.50, 0.48; bend of shaft, 0.62, 0.62, 0.65; width of base, 0.63, 0.64, 0.72; width of neck, 0.29, 0.29, 0.29; width of tip, 0.44, 0.45, 0.46; angle of tip (in degrees),



FIG. 5. Habitat of *Tamias cinereicollis* in the Magdalena Mountains, Socorro Co., New Mexico. Photograph by T. L. Best.

134.40, 136.50, 137.75 (Patterson, 1980b). Usually, the angle between tip and shaft of the baculum is $>140^\circ$ (Hoffmeister, 1986; White, 1953). Another sample of bacula of *T. cinereicollis* from New Mexico and Arizona had measurements (in mm) as follows: length of shaft, 4.27–5.72; width of base, 0.49–0.87; tip-shaft angle, $136\text{--}148^\circ$ (Fleharty, 1960).

A female genital bone (baubellum or os clitoris) is present. Average and range of measurements (in mm) of the os clitoris are: length of base, 0.95 (0.85–1.00); length of shaft, 0.99 (0.85–1.00); depth of shaft, 0.52 (0.42–0.59); length of tip, 0.94 (0.85–1.10); length of keel, 0.36 (0.26–0.39); angle of the tip-shaft, 144.8° ($136\text{--}156^\circ$). The os clitoris has a thin, untapered base that forms an acute angle with the shaft. The shaft is thick, with a slight break and no heel at the tip-shaft angle. The large tip has a 33° bend to the right and is rotated ca. 6° counterclockwise. The keel is large with conspicuous flanges extending onto the sides of the shaft. The os clitoris of 267 females representing 16 species of *Tamias* is longest for *T. cinereicollis* (Sutton, 1982).

ONTOGENY AND REPRODUCTION. One litter is produced each year (Bailey, 1931; Clothier, 1969; Hoffmeister, 1986) with conception occurring from early April to mid-May (Dunford, 1974). Rearing takes place during June, July (Mearns, 1907), and August (Merriam, 1890). Young are above ground by late July (Clothier, 1969; Hoffmeister, 1986), but lactating females may occur as late as 3 August (Merriam, 1890).

In southeastern Coconino Co., Arizona, pregnant females occurred from 29 April to 7 June. The gestation period was at least 30 days. Young were born during the first 2 weeks of June, with the peak of the breeding season possibly occurring in late April. Fourteen young that were born in captivity on 2, 4, and 8 June began eating solid foods at 36–40 days and stopped nursing at 41–45 days. Litter size ranged from four to six, with an average of 4.9 young/litter (Clothier, 1969).

The half-grown young of August and September are of similar coloration to the adults, but the pelage is thinner and more silky (Allen, 1890). By September and October the young are almost fully grown (Bailey, 1931).

Juveniles with a deciduous Pm4 fully erupted can be distinguished from adults by the presence of a small hole in the bone lingual to this tooth. This is not found in adults. Also, the anterior root of Pm4 is more slanted in juveniles than adults (Hoffmeister, 1986).

ECOLOGY. The gray-collared chipmunk occupies Ponderosa pine (*Pinus ponderosa*) forest (Fig. 5), extending into the spruce-fir (*Picea-Pseudotsuga*) forest. It is common up to the timberline in the San Francisco Mountains, and frequently is seen running along fallen logs or perched on stumps. *T. cinereicollis* often is seen in more open parts of the forest, but this may be because it is more conspicuous there and not because it selects this habitat more often than dense forest (Hoffmeister, 1986). It is most common where Douglas fir (*Pseudotsuga menziesii*) and pine overlap. *T. cinereicollis* is a good climber and often is found hidden in dense foliage (Merriam, 1890).

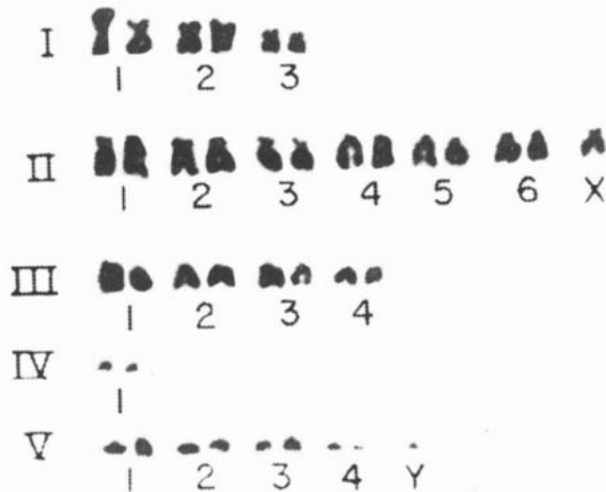


FIG. 6. Karyotype of a male *Tamias cinereicollis cinereus* from near Kingston, Grant Co., New Mexico. Roman numerals indicate the type of chromosome: I, large metacentric; II, submetacentric; III, large acrocentric; IV, small metacentric; V, small acrocentric. The number of chromosomes of each type is noted (modified from Sutton and Nadler, 1969).

Of all the forest chipmunks in New Mexico, *T. cinereicollis* is least likely to occur below the Ponderosa pine forest and tends to occupy only the most mesic of the high forests (Findley et al., 1975). However, *T. cinereicollis* also occurs in association with oak (*Quercus*) trees (Allen, 1895), and it may be common in oak and juniper (*Juniperus*) habitat (Findley and Caire, 1977). In a second-growth pine forest, densities ranged from ca. 5/ha in May to 12.5/ha in August, when young-of-the-year were present (Clothier, 1969).

Nests are placed under logs, stumps, and roots, or in hollows in trees. In the San Francisco Mountains, a nest made of grass and weed fibers was located in a crevice on the underside of a downed log (Hoffmeister, 1986). In the White Mountains, a mother and six young used a woodpecker hole in a large Ponderosa pine as the entrance to a nest. The hole was in a large limb 18 m above the ground and faced the ground. Elsewhere, *T. cinereicollis* has used woodpecker holes 6–23 m above the ground in conifers (Broadbooks, 1974).

The gray-collared chipmunk eats seeds of small plants (Merriam, 1890), fir cones, acorns of Gambel's oak (*Quercus gambeli*), currants and gooseberries (*Ribes*), shadblow berries (*Amelanchier*), tubers, starchy roots (Bailey, 1931), and feeds heavily upon legumes in the summer (Mearns, 1907). *T. cinereicollis* also consumes mushrooms (Bailey, 1931) and other fungi (Fogel and Trappe, 1978), *Pseudotsuga menziesii*, *Pinus edulis* (Van Dersal, 1938), and the seed of *P. ponderosa* (Smith, 1943; Taylor and Gorsuch, 1932). Stomach contents reveal a mixture of masticated seeds, green vegetation, and traces of insects (Bailey, 1931).

Tamias cinereicollis may occur in the same geographic area as *T. dorsalis* and *T. minimus* (Allen, 1895; Hoffmeister, 1986; Patterson, 1981). In Arizona, *T. cinereicollis* only occurs with *T. dorsalis* in a few places on the Mogollon Plateau and White Mountains. Usually, *T. cinereicollis* occurs higher in the forest and in less rocky situations (Hoffmeister, 1986). In New Mexico, *T. cinereicollis* occupies only the most mesic higher forests, with *T. dorsalis* occupying the lower zones. Competition with *T. dorsalis* may help maintain this relationship (Findley et al., 1975). In the White Mountains of Arizona, *T. cinereicollis* occurs more often in spruce-fir and mixed-conifer forest than does *T. minimus*, which uses pine and mixed-conifer forest (Sullivan, 1985). Other mammals associated with gray-collared chipmunks include *Sorex merriami*, *S. monticolus*, *S. nanus*, *S. palustris*, *Sylvilagus nuttalli*, *Spermophilus lateralis*, *Sciurus aberti*, *Tamiasciurus hudsonicus*, *Thomomys talpoides*, *Clethrionomys gapperi*, *Microtus longicaudus*, *M. mexicanus*, *M. montanus*, *Zapus hudsonicus*, and *Neotoma mexicana* (Lomolino et al., 1989).

BEHAVIOR. Contrary to Allen's (1895) report that *T. cinereicollis* primarily is arboreal and rarely occurs on the ground or on rocks, it often is terrestrial (Broadbooks, 1974; Hoffmeister,

1986). Throughout the Mogollon Mountains *T. cinereicollis* frequently climbs conifers in search of food (Broadbooks, 1974; Hoffmeister, 1986). Favorite haunts are log piles near clearings, or the edges of burned forests, but it also is commonly found in the dense pine, spruce, or fir forests (Bailey, 1931). *T. cinereicollis* is a good climber, often taking to the trees for protection and escaping by hiding among the dense, evergreen foliage. Generally, *T. cinereicollis* is shy and when alarmed it commonly disappears among the logs or trees (Bailey, 1931).

The gray-collared chipmunk is an active species, and has a loud, sharp call (Allen, 1895; Merriam, 1890). When not alarmed, gray-collared chipmunks may sit on stumps or logs and slowly wave their tails from side to side as they make a low "chuck-chuck-chuck" or sharp "chipper." The alarm call is a shrill, rapid "chipper" (Bailey, 1931; Mearns, 1907).

Tamias cinereicollis makes nests on the ground beneath stones, logs, and tree roots and burrows in fallen logs, the ends of which have dry grass and similar material for the birth and rearing of young. It will climb even the tallest trees to gather food and stores acorns in large quantities in the ground or in hollow logs (Mearns, 1907). *T. cinereicollis* often uses woodpecker holes as nest sites (Broadbooks, 1974).

Tamias cinereicollis may hibernate late in the year, or not at all (Merriam, 1890). In autumn, it may be active until 30 November and reappear from hibernation by 18 March (Clothier, 1969). This species does not become noticeably fat in autumn; however, it does gather food for winter. *T. cinereicollis* is active in the Mogollon Mountains at 2,400–3,000 m altitude, up to the end of October, even with 5 cm of snow on the ground. Its tracks may be abundant on snow in the mountains, but it is probable that during the cold of winter it remains in dens under the deep snow, either sleeping or feeding on stored food (Bailey, 1931). In Arizona, *T. cinereicollis* commonly emerges from beneath the deep snow in winter, and runs about during the warm part of the day. However, during stormy or severely cold periods it does not venture forth (Mearns, 1907).

GENETICS. This species has karyotype A of *Tamias* (Fig. 6; Nadler et al., 1977). The diploid karyotype contains 38 chromosomes including three pair of large metacentric, six pair of large submetacentric, four pair of large acrocentric, one pair of small metacentric, and four pair of small acrocentric chromosomes. The X and Y chromosomes are submetacentric and acrocentric, respectively (Hoffmeister, 1986; Sutton and Nadler, 1969). Based upon 20 allozymes, *T. cinereicollis* had an average heterozygosity of 0.0242 and one polymorphic locus (red cell phosphoglucosmutase—Levenson et al., 1985).

REMARKS. Primarily on the basis of the five dark stripes, presence of a third premolar, certain features of the hyoid and the baculum, microcomplement fixation, and some features of the chromosomes, many scientists regard the gray-collared chipmunk and other western chipmunks to be in the genus *Eutamias* (Hoffmeister, 1986).

Phenetic analysis of electrophoretic data places *T. cinereicollis* closest to *T. amoenus* and *T. umbrinus*. Phenetic analysis of morphologic data places *T. cinereicollis* closest to *T. bulleri*, *T. canipes*, *T. dorsalis*, *T. durangae*, and *T. obscurus* (Levenson et al., 1985). In southern New Mexico, *T. canipes*, *T. cinereicollis*, and *T. quadrivittatus* were considered conspecific until bacular and karyotypic differences were demonstrated (Flehart, 1960; Patterson, 1980b, 1984b). Further study may reveal that *T. durangae* and *T. cinereicollis* are conspecific (Baker, 1956).

Although once considered as conspecifics (Bailey, 1902), there is no basis for the derivation of *T. canipes* from *T. cinereicollis*. Instead, both species appear to have been derived independently from a northern stock currently represented by *T. quadrivittatus*. The early synonymy of *T. canipes* and *T. cinereicollis* thus reflects convergent evolution of these southern populations of the *quadrivittatus* species group (Patterson, 1982).

Tamias is from the Greek *tamias* meaning a storer or distributor. The specific epithet *cinereicollis* is derived from the Latin *cinereus* meaning ash-colored and *collum* meaning neck (Jaeger, 1955). Another common name is ash-colored chipmunk (Elliot, 1905).

We thank L. L. Thornton, A. M. Coffman, and other personnel in the Interlibrary Loan Department at Auburn University R. B. Draughon Library for assistance in obtaining articles from other institutions, J. L. Bartig for preparing Fig. 3, and B. Owen for preparing Fig. 4. F. S. Dobson, W. L. Gannon, and D. A. Sutton

critically evaluated an early draft of the manuscript. This is journal article no. 15-923214 of the Alabama Agricultural Experiment Station.

LITERATURE CITED

- ALLEN, J. A. 1890. A review of some of the North American ground squirrels of the genus *Tamias*. *Bulletin of the American Museum of Natural History*, 3:45-116.
- . 1895. On a collection of mammals from Arizona and Mexico, made by Mr. W. W. Price, with field notes by the collector. *Bulletin of the American Museum of Natural History*, 7:193-258.
- BAILEY, V. 1902. Seven new mammals from western Texas. *Proceedings of the Biological Society of Washington*, 15:117-120.
- . 1913. Ten new mammals from New Mexico. *Proceedings of the Biological Society of Washington*, 26:129-134.
- . 1931. Mammals of New Mexico. *North American Fauna*, 53:1-412.
- BAKER, R. H. 1956. Mammals of Coahuila, México. University of Kansas Publications, Museum of Natural History, 9:125-335.
- BROADBOOKS, H. E. 1974. Tree nests of chipmunks with comments on associated behavior and ecology. *Journal of Mammalogy*, 55:630-639.
- CLOTHIER, R. R. 1969. Reproduction in the gray-necked chipmunk, *Eutamias cinereicollis*. *Journal of Mammalogy*, 50:642.
- DALQUEST, W. W., AND F. B. STANGL, JR. 1984. The Pleistocene and early Recent mammals from Fowlkes Cave, southern Culberson County, Texas. Pp. 432-455, in *Contributions in Quaternary vertebrate paleontology: a volume in memorial to John E. Guilday* (H. H. Genoways and M. R. Dawson, eds.). Special Publication of Carnegie Museum of Natural History, 8:1-538.
- DUNFORD, C. 1974. Annual cycle of cliff chipmunks in the Santa Catalina Mountains, Arizona. *Journal of Mammalogy*, 55:401-416.
- ELLIOT, D. G. 1905. A check list of mammals of the North American continent the West Indies and the neighboring seas. *Field Columbian Museum Publication 105, Zoölogical Series*, 6:1-701.
- FINDLEY, J. S., AND W. CAIRE. 1977. The status of mammals in the northern region of the Chihuahuan Desert. Pp. 127-139, in *Transactions of the symposium on the biological resources of the Chihuahuan Desert region United States and Mexico* (R. H. Wauer and D. H. Riskind, eds.). United States Department of the Interior, National Park Service Transactions and Proceedings Series, 3:1-658.
- FINDLEY, J. S., A. H. HARRIS, D. E. WILSON, AND C. JONES. 1975. Mammals of New Mexico. The University of New Mexico Press, Albuquerque, 360 pp.
- FLEHARTY, E. D. 1960. The status of the gray-necked chipmunk in New Mexico. *Journal of Mammalogy*, 41:235-242.
- FLEHARTY, E. D., AND C. J. JONES. 1960. Possible Himalayan color pattern in *Eutamias*. *Journal of Mammalogy*, 41:125.
- FOGEL, R., AND J. M. TRAPPE. 1978. Fungus consumption (mycophagy) by small animals. *Northwest Science*, 52:1-31.
- HALL, E. R. 1981. The mammals of North America. Second ed. John Wiley & Sons, New York, 1:1-600 + 90.
- HARRIS, A. H. 1985. Late Pleistocene vertebrate paleoecology of the West. University of Texas Press, Austin, 293 pp.
- HOFFMEISTER, D. F. 1986. Mammals of Arizona. The University of Arizona Press and The Arizona Game and Fish Department Tucson, 602 pp.
- HONACKI, J. H., K. E. KINMAN, AND J. W. KOEPL (EDS.). 1982. Mammal species of the world: a taxonomic and geographic reference. Allen Press, Inc. and The Association of Systematics Collections, Lawrence, Kansas, 694 pp.
- HOWELL, A. H. 1929. Revision of the American chipmunks (genera *Tamias* and *Eutamias*). *North American Fauna*, 52:1-157.
- JAEGER, E. C. 1955. A source-book of biological names and terms. Third ed. Charles C. Thomas, Springfield, Illinois, 323 pp.
- LEVENSON, H. 1990. Sexual size dimorphism in chipmunks. *Journal of Mammalogy*, 71:161-170.
- LEVENSON, H., R. S. HOFFMAN, C. F. NADLER, L. DEUTSCH, AND S. D. FREEMAN. 1985. Systematics of the Holarctic chipmunks (*Tamias*). *Journal of Mammalogy*, 66:219-242.
- LOMOLINO, M. V., J. H. BROWN, AND R. DAVIS. 1989. Island biogeography of montane forest mammals in the American Southwest. *Ecology*, 70:180-194.
- MEARNS, E. A. 1907. Mammals of the Mexican boundary of the United States: a descriptive catalogue of the species of mammals occurring in that region; with a general summary of the natural history, and a list of trees. *Bulletin of the United States National Museum*, 56:1-530.
- MERRIAM, C. H. 1890. Annotated list of mammals of the San Francisco Mountain plateau and desert of the Little Colorado in Arizona, with notes on their vertical distribution, and descriptions of new species. *North American Fauna*, 3:43-86.
- MILLER, G. S., JR. 1924. List of North American Recent mammals 1923. *Bulletin of the United States National Museum*, 128:1-673.
- MILLER, G. S., JR., AND J. A. G. REHN. 1901. Systematic results of the study of North American land mammals to the close of the year 1900. *Proceedings of the Boston Society of Natural History*, 30:1-45.
- NADLER, C. F., R. S. HOFFMANN, J. H. HONACKI, AND D. POZIN. 1977. Chromosomal evolution in chipmunks, with special emphasis on A and B karyotypes of the subgenus *Neotamias*. *The American Midland Naturalist*, 98:343-353.
- PATTERSON, B. D. 1980a. Montane mammalian biogeography in New Mexico. *The Southwestern Naturalist*, 25:33-40.
- . 1980b. A new subspecies of *Eutamias quadri vittatus* (Rodentia: Sciuridae) from the Organ Mountains, New Mexico. *Journal of Mammalogy*, 61:455-464.
- . 1981. Morphological shifts of some isolated populations of *Eutamias* (Rodentia: Sciuridae) in different congeneric assemblages. *Evolution*, 35:53-66.
- . 1982. Pleistocene vicariance, montane islands, and the evolutionary divergence of some chipmunks (genus *Eutamias*). *Journal of Mammalogy*, 63:387-398.
- . 1984a. Mammalian extinction and biogeography in the southern Rocky Mountains. Pp. 247-293, in *Extinctions* (M. H. Nitecki, ed.). The University of Chicago Press, Chicago, 354 pp.
- . 1984b. Geographic variation and taxonomy of Colorado and Hopi chipmunks (genus *Eutamias*). *Journal of Mammalogy*, 65:442-456.
- PATTERSON, B. D., AND C. S. THAELER, JR. 1982. The mammalian baculum: hypotheses on the nature of bacular variability. *Journal of Mammalogy*, 63:1-15.
- RIDGWAY, R. 1912. Color standards and color nomenclature. R. Ridgway, Washington, D.C., 340 pp.
- SMITH, C. F. 1943. Relationship of forest wild life to pine reproduction. *The Journal of Wildlife Management*, 7:124-125.
- SULLIVAN, R. M. 1985. Phyletic, biogeographic, and ecologic relationships among montane populations of least chipmunks (*Eutamias minimus*) in the Southwest. *Systematic Zoology*, 34:419-448.
- SUTTON, D. A. 1982. The female genital bone of chipmunks, genus *Eutamias*. *The Southwestern Naturalist*, 27:393-402.
- SUTTON, D. A., AND C. F. NADLER. 1969. Chromosomes of the North American chipmunk genus *Eutamias*. *Journal of Mammalogy*, 50:524-535.
- TAYLOR, W. P., AND D. M. GORSUCH. 1932. A test of some rodent and bird influences on western yellow pine reproduction at Fort Valley, Flagstaff, Arizona. *Journal of Mammalogy*, 13:218-223.
- VAN DERSAL, W. R. 1938. Native woody plants of the United States: their erosion-control and wildlife values. United States Department of Agriculture, Miscellaneous Publication, 303:1-362.
- WHITE, J. A. 1953. The baculum in the chipmunks of western North America. University of Kansas Publications, Museum of Natural History, 5:611-631.

Editors of this account were GUY N. CAMERON and KARL F. KOOPMAN. Managing editor was CRAIG S. HOOD.

C. D. HILTON AND T. L. BEST, DEPARTMENT OF ZOOLOGY AND WILDLIFE SCIENCE AND ALABAMA AGRICULTURAL EXPERIMENT STATION, 331 FUNCHESS HALL, AUBURN UNIVERSITY, ALABAMA 36849-5414.