OBSERVATIONS ON THE ECOLOGY OF THE ENDEMIC MEARNS'S SQUIRREL (*TAMIASCIURUS MEARNSI*)

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ABSTRACT—Mearns's squirrel (*Tamiasciurus mearnsi*) is an endemic species of the montane forest of the Sierra de San Pedro Mártir in Baja California. Despite having been described for the first time in 1893 and a listing as threatened by Mexican authorities, no information is available on the ecology of this southernmost *Tamiasciurus*. We observed the ecology of Mearns's squirrels during 2004 and 2005. Mearns's squirrel apparently does not form larderhoards, known as middens, or leaf nests commonly built by other members of this genus. We observed Mearns's squirrels to feed heavily on tree seeds and fungi. We noted males with scrotal testes and a female in estrus in late spring. We did not observe eastern gray squirrels (*Sciurus carolinensis*), introduced to the western Sierra in 1946, within the areas that we searched for *T. mearnsi*. Mearns's squirrels might possess unique adaptations for their persistence in the dry, open forest of the Sierra de San Pedro Mártir.

RESUMEN—La ardilla de San Pedro Mártir (*Tamiasciurus mearnsi)* es una especie endémica del bosque de montaña de la Sierra de San Pedro Mártir en Baja California. A pesar de haber sido descrita por primera vez en 1893 y a que se encuentra catalogada como amenazada por las autoridades mexicanas, no hay información disponible sobre la ecología de esta *Tamiasciurus* más austral. Observamos la ecología de las ardillas de San Pedro Mártir durante 2004 y 2005. La ardilla San Pedro Mártir parece no formar cúmulos de comida conocidos como basurales, o nidos de hoja comúnmente construidos por otros miembros de este género. Observamos a las ardillas de San Pedro Mártir alimentarse principalmente de las semillas de los árboles y de hongos; notamos machos con testículos escrotados y una hembra en celo a finales de la primavera. No observamos a las ardillas *Sciurus carolinensis,* introducidas en la parte oeste de la Sierra en 1946, dentro de las áreas donde buscamos a las *T. mearnsi*. Las ardillas de San Pedro Mártir pueden poseer adaptaciones únicas para su persistencia en el bosque abierto y seco de la Sierra de San Pedro Mártir.

Conservation of endemic organisms presents one of the greatest challenges for ecologists. Northwestern Mexico possesses one of the most diverse floras and faunas in the world, in part due to the montane sky islands that often harbor endemics (Turner et al., 1995; Koprowski, 2005*a*). Fauna of peninsular Baja California is especially distinct given a long evolutionary history in isolation (e.g., Welsh, 1988; Hafner and Riddle, 1997). In many cases, knowledge of peninsular endemics, especially montane species, is extremely poor. The Mearns's squirrel (*Tamiasciurus mearnsi*) in the Sierra de San Pedro Mártir of Baja California, Mexico (Wilson and Cole, 2000) is one such example. Mearns's squirrels are closely related to Douglas's squirrels (*T. douglasii*) in the Sierra Nevada of California, USA, with specific status contentious (Lindsay, 1981; Arbogast et al., 2001). Not a single ecological paper has been published on Mearns's squirrels despite over 100 years since the species was first described (Allen, 1893; Townsend, 1897); it currently is listed as threatened under Mexican law (Ceballos et al., 2002). The basic ecology of Mearns's squirrel such as diet, habitat, and reproduction is poorly known (Yensen and Valdés-Alarcón, 1999) other than that inferred from distributional and comparative anatomical and genetic studies (Lindsay, 1981; Arbogast et al., 2001). In addition, the introduction of eastern gray squirrels (*Sciurus carolinensis*) in 1946 might pose a threat (Huey, 1964) as evidenced in other countries where intentional releases have occurred (Gurnell, 1987). Herein, we present observations on the reproduction, food habits, vocalizations, and interspecific interactions of Mearns's squirrels.

Our study area was the 65,000-ha Parque Nacional Sierra de San Pedro Mártir located about 100 km east of San Telmo, Baja California, Mexico. Open forested parklands (Minnich et al., 2000) at elevations above 2,100 m are dominated by Jeffrey pine (*Pinus jeffreyi*), lodgepole pine (*P. contorta*), ponderosa pine (*P. ponderosa*), sugar pine (*P. lambertiana*), and white fir (*Abies concolor*). We visited forests in the Vallecitos, La Corona de Abajo, Arroyo Los Alamillos, La Grulla, and La Zanja areas of the national park during 4 to 7 November 2004 and 16 to 20 March, 23 to 24 April, and 19 to 24 May 2005. We visually assessed all trees and surrounding ground cover within the open forests of our study sites on foot in search of Mearns's squirrels as well as sign, including leaf nests (Young et al., 2002) and larderhoards of cones known as middens (Finley, 1969) that typically indicate the presence of *Tamiasciurus*. The open forest structure and a paucity of downed trees (Stephens and Gill, 2005) greatly facilitated observations. Once we located an individual, we noted its behavior and attempted to determine sex and reproductive condition from external genitalia.

We observed Mearns's squirrels (Fig. 1) on 17 occasions (5 female, 6 male, 6 unknown sex) in the Vallecitos and Arroyo Los Alamillos areas as we surveyed approximately 4,000 ha of forest. Notably, we did not detect any middens or leaf nests during our surveys. *Tamiasciurus hudsonicus* can nest in cavities or burrows (Yahner, 1980; Young et al., 2002), and the large number of overmature trees and snags (Stephens and Gill, 2005) might permit reliance on such nest types. Furthermore, *T. mearnsi* seems not to rely on larderhoards of cones. Other *Tamiasciurus* are known to scatterhoard and larderhoard food items in logs or snags (reviewed in Gurnell, 1987; Steele, 1998, 1999). *Tamiasciurus hudsonicus* scatterhoard where food types or environmental conditions are not conducive to midden formation and maintenance (Hurly and Robertson, 1986). Lack of larderhoards could reflect the xeric conditions inhabited by this southernmost member of *Tamiasciurus* (Lindsay, 1981), where cool moist conditions that retard cone opening (Smith, 1968) might not occur.

All male squirrels that we observed possessed scrotal testes (1 male on 20 May, 1 male on 21 May, 4 males on 22 May 2005). One female Mearns's squirrel possessed an enlarged pink vulva and was pursued by 2 or possibly 3 males on 22 May 2005 in a mating chase. Our scant observations on reproductive males and female in late spring suggest similarity with other *Tamiasciurus* (Steele, 1998, 1999). In particular, the similarly isolated and endangered Mount Graham red squirrel (*T. hudsonicus grahamensis*) of southern Arizona can breed in the spring and summer (Koprowski, 2005*b*).

Mearns's squirrels were observed feeding on cones of the current year of Jeffrey pine (2 females, 2 males) and white fir (1 male), branch tips of white fir (1 female), and basidiomycete fungi, veiled polypores (*Cryptoporus volvatus*), found on the upper trunk of white fir (2 females, 3 males). Feeding sign on Jeffrey pine was found commonly in areas that we visited, with the exception of La Zanja. Other *Tamiasciurus* also feed heavily on fungi, conifer seed, and conifer branch tips during spring and early summer (Steele, 1998, 1999).

At least 6 distinct vocalizations are known from *Tamiasciurus* (Gurnell, 1987). We discerned 3 calls based on our observations. On 3 occasions (1 male, 2 unknown sex), we heard a call similar to the territorial ''rattle'' of *T. hudsonicus* and *T. douglasii* (Smith, 1978) but of seemingly higher pitch. Mearns's squirrels also gave a ''chirp'' call (Smith, 1978) on 3 occasions (2 females, 1 male) when aggravated and a woofing bark or ''buzz'' call (Smith, 1978) when startled or mildly aggravated (1 female, 1 male).

We observed 4 interspecific interactions. On 7 November 2004, a red-tailed hawk (*Buteo jamaicensis*) chased a *T. mearnsi* through the canopy of sugar and lodgepole pines for <10 s before disappearing from sight. Western bluebirds (*Sialia mexicana*) mobbed a solitary adult female Mearns's squirrel on 2 occasions (20 and 22 May 2005). Lastly, we observed a coyote (*Canis latrans*) passing under a tree where a Mearns's squirrel rested 8 m aboveground on 22 May 2005. This elicited only a raised head from the adult male squirrel.

Mearns's squirrels seem to be uncommon and reclusive in the Sierra de San Pedro Mártir. Most biologists have referred to the species as occurring in low densities (Leopold, 1959; Huey, 1964; Yensen and Valdés-Alarcón, 1999). Our brief observations on the ecology of *T. mearnsi* suggest that some aspects of their bi-

ology, such as food habits, reproduction, and vocalizations, are similar to those of other members of *Tamiasciurus* (Steele, 1998, 1999). However, absence of obvious larderhoards and leaf nests indicates that Mearns's squirrels might have unique adaptations to dry and open forests of this southernmost extension of the genus *Tamiasciurus*.

Eastern gray squirrels were introduced at La Zanja and Arroyo San Rafael on the western slopes of the Sierra de San Pedro Mártir in 1946 (Yensen and Valdéz-Alarcón, 1999). However, we did not observe any individuals or sign during our visit to La Zanja. The last report of eastern gray squirrels at La Zanja is from 1956 (Huey, 1964). We were not able to assess the status of eastern gray squirrels in Arroyo San Rafael.

Our observations suggest the need for research into several aspects of the ecology of *T. mearnsi*. The significance of the lack of middens and leaf nests must be assessed to elucidate important selective pressures faced by Mearns's squirrels. Because these conspicuous signs of squirrel presence are not available, census techniques must be developed to effectively monitor population status of *T. mearnsi*. Furthermore, investigation of the status of introduced eastern gray squirrels is necessary to formulate conservation strategies for the endemic Mearns's squirrel.

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Fig. 1—An adult female Mearns's squirrel (*Tamiasciurus mearnsi*) descending a white fir (*Abies concolor*) on 22 May 2005, Parque Nacional Sierra de San Pedro Mártir, Baja California, Mexico. Photograph by B. S. Pasch.

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RECENT RECORDS OF DESERT BIGHORN SHEEP (*OVIS CANADENSIS MEXICANA*) IN EASTERN SONORA AND NORTHWESTERN CHIHUAHUA, MEXICO

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ABSTRACT—The desert bighorn sheep (*Ovis canadensis mexicana*) was extirpated from most of its range in northern Mexico and the southwestern United States by the 1980s. Several populations have been established through reintroductions in both countries, but none in the Chihuahua–Sonora border region, where we report here 3 recent records. These records suggest the possibility