

nests of other arboreal mammals. Occasionally other mammals (e.g. Western Gray Squirrels, *Sciurus griseus*) inhabit a single nest at the same time or sequentially.

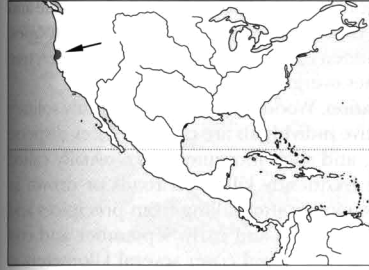
Status and Conservation. Classified as Near Threatened on *The IUCN Red List*. Relatively low reproductive potential of Red Tree Voles and limited dispersal capabilities make them vulnerable to loss and fragmentation of preferred old growth forests by clearcut logging. Early seral stages or young forests can be dispersal barriers. Because Red Tree Voles have a relatively narrow environmental niche tied to large trees in old growth forests, industrial scale deforestation in Oregon and northern California (USA) is hypothesized as potentially problematic for their long-term persistence.

Bibliography. Bellinger *et al.* (2005), Corn & Bury (1988), Hafner *et al.* (1998), Hall (1981), Hayes (1996), Johnson & George (1991), Linzey & NatureServe (Scheuering & Hammerson) (2008), Manning & Maguire (1999), Meiselman & Doyle (1996), Musser & Carleton (2005), Thomas (1993), Verts & Carraway (1988).

26. Sonoma Tree Vole *Arborimus pomo*

French: Phénacomys de Sonoma / **German:** Sonoma-Baumwühlmaus / **Spanish:** Topillo arboreo de Sonoma

Other common names: California Red Tree Mouse, California Red Tree Vole, Pomo Tree Vole



Taxonomy. *Arborimus pomo* M. L. Johnson & George, 1991, "Jenner Ridge, 0-8 km (0.5 mi) north of Jenner, Sonoma County, California."

This species is monotypic.

Distribution. Coastal forests of N California from the Klamath Mts of Del Norte County S to Sonoma County. The N border of this species and the S boundary of the Red Tree Vole (*A. longicaudus*) are poorly defined and this region near Humboldt County, California, warrants further study.

Descriptive notes. Head-body 95-98 mm (males) and 101-103 mm (females), tail 64-68 mm (males) and 66-73 mm (females), ear 10-12 mm, hindfoot 19-20 mm; weight 20-45 g. Females are usually larger than males. The Sonoma Tree Vole is a small vole that differs from other voles (except for the Red Tree Vole, *A. longicaudus*) by its reddish brown back and light gray belly, sometimes tinged reddish orange. Tail is hairy and relatively long (more than 50% of head-body length). Lower molars distinguish it from other sympatric vole species. On labial side, reentrant angles of lower molars extend two-thirds the way to lingual side, while reentrant angles on lingual side extend only one-third the way to labial side. Skull has distinct longitudinal depression between orbits, bordered by pronounced ridge, highly recurved incisors, and relatively wide incisive foramina. Molars are unrooted in juveniles and become rooted in adults. The Sonoma Tree Vole differs from the Red Tree Vole by being smaller, with nasals not extending posteriorly beyond maxillaries, and differences in karyotype: 2n = 40 or 42 vs. 48 or 54 in the Red Tree Vole.

Habitat. Wet conifer forests of Douglas fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), Sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), all Pinaceae, and coastal redwood (*Sequoia sempervirens*, Cupressaceae). Sonoma Tree Voles prefer old growth forest, where densities are highest, but they can also be found in older second growth forests.

Food and Feeding. Sonoma Tree Voles, like the Red Tree Vole, primarily eat needles of Douglas fir and also consume needles and occasionally inner bark of twigs of other conifer trees. They obtain water from dew and fog that accumulates on vegetation.

Breeding. Sonoma Tree Voles breed year-round, but most litters are born in February-September. Females can breed within 24 hours of giving birth. Gestation varies from 27 to 48 days, possibly due to delayed implantation, and averages 31 days. Litters usually have two young (1-5). Young are weaned at 25-48 days old.

Activity patterns. Sonoma Tree Voles are nocturnal and arboreal, but activity is not well documented because they are secretive and hard to catch and study.

Movements, Home range and Social organization. Sonoma Tree Voles are thought to have limited dispersal abilities and early seral stage forests and clearcuts likely present significant barriers to their movement.

Status and Conservation. Classified as Near Threatened on *The IUCN Red List*. Like their sister species, the Red Tree Vole, combination of low reproductive potential, strong ties to old-growth forests, and limited dispersal capabilities make the Sonoma Tree Vole vulnerable to disturbances such as industrial scale deforestation.

Bibliography. Adam & Hayes (1998), Bellinger *et al.* (2005), Benson & Borell (1931), Bradley, Ammerman *et al.* (2014), Brylski, J.H. (1990), Corn & Bury (1988), Hamilton (1962), Johnson & George (1991), Musser & Carleton (2005).

Tribe LEMMINI

Genus SYNAPTOMYS

Baird, 1858

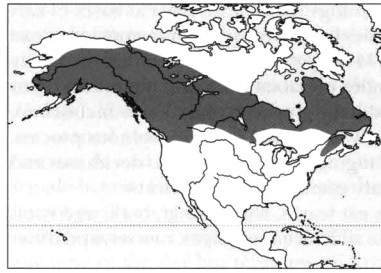
27. Northern Bog Lemming *Synaptomys borealis*

French: Lemming boréal / **German:** Nördlicher Moorlemming / **Spanish:** Lemming de pantano septentrional

Other common names: Okanagan Bog Lemming

Taxonomy. *Arvicola borealis* J. Richardson, 1828, "Great Bear Lake," District of Mackenzie, Canada.

Nine subspecies are recognized.



Subspecies and Distribution.

S. b. borealis J. Richardson, 1828 – Northwest Territories, extreme SW Nunavut, NE British Columbia, N & C Alberta, W Saskatchewan, and N Manitoba, Canada.

S. b. artemisiae R. M. Anderson, 1932 – extreme SC British Columbia, Canada.

S. b. chapmani J. A. Allen, 1903 – SE British Columbia and SW Alberta, Canada, and NE Washington, N Idaho, and NW Montana, USA.

S. b. dalli Merriam, 1896 – C, SC, & SW Alaska, USA, and Yukon and N & C British Columbia, Canada.

S. b. innuitus True, 1894 – N Quebec, Canada.

S. b. medioximus Bangs, 1900 – NE Quebec and Labrador, Canada.

S. b. smithi R. M. Anderson & Rand, 1943 – N & EC Saskatchewan, most of Manitoba, and N Ontario, Canada, and NE North Dakota and NW Minnesota, USA.

S. b. sphagnicola Preble, 1899 – SE Quebec and New Brunswick, Canada, and Maine and New Hampshire, USA.

S. b. truei Merriam, 1896 – SE Alaska, coastal British Columbia, and NW Washington.

Descriptive notes. Head-body 93-113 mm, tail 17-27 mm; weight 27-35 g. Northern Bog Lemmings vary substantially in morphology across their distribution. They are small- to medium-sized, and tail is bicolored and short. Dorsum is grizzled gray to brown, with some black hair interspersed, and venter is plumbeous. Feet are gray to near black. There are a few hairs at bases of ears that are distinctly brighter than rest of pelage. Females have four pairs of nipples. Lower molars do not have closed triangles on labial sides and almost no outer reentrant angles. Lower incisors are relatively slender and sharply pointed. Posterior edge of palate has a noticeable spinous process.

Habitat. Wet habitats with sedges and grasses in riparian zones, meadows and bogs in pine, spruce-fir, or spruce-cedar forests. Northern Bog Lemmings also can be found in wet tundra and successional grasslands after forest fires. In contrast, subspecies *artemisiae* lives in arid sagebrush habitat of the Okanagan Valley of south-central British Columbia.

Food and Feeding. Northern Bog Lemmings eat grasses, sedges, and other vegetation.

Breeding. Northern Bog Lemmings breed in May-August. Gestation is probably about c.3 weeks. Litters have 2-8 young; a female can produce multiple litters each year, and young females usually have 1-2 litters in their first year.

Activity patterns. Northern Bog Lemmings are reported nocturnal and diurnal throughout the year. Northern Bog Lemmings use surface runways but are also fossorial, living in burrow systems up to 30 cm deep and sometimes in small colonies.

Movements, Home range and Social organization. Home ranges vary with habitat but are likely less than 0.5 ha. Young are born in concealed nests above- or underground.

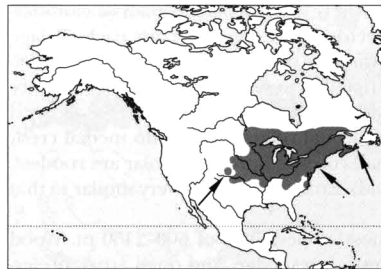
Status and Conservation. Classified as Least Concern on *The IUCN Red List*.

Bibliography. Clough & Albright (1987), Hafner *et al.* (1998), Hall (1981), Linzey & NatureServe (Reichel & Hammerson) (2008), MacDonald & Cook (2009), Musser & Carleton (2005), Wilson & Ruff (1999).

28. Southern Bog Lemming *Synaptomys cooperi*

French: Lemming de Cooper / **German:** Südlicher Moorlemming / **Spanish:** Lemming de pantano meridional

Other common names: Kansas Bog Lemming, Southern Lemming Mouse



Taxonomy. *Synaptomys cooperi* Baird, 1858, type locality not given. Fixed by B. P. Bole, Jr. and P. N. Moulthrop in 1942 as Jackson, Carroll County, New Hampshire, USA.

Subspecies *paludis* and *relictus* are known only from their type localities. Seven subspecies recognized.

Subspecies and Distribution.

S. c. cooperi Baird, 1858 – SE Manitoba, S Ontario, S Quebec, New Brunswick, and Nova Scotia, Canada, and N & C Minnesota, most of Wisconsin, Michigan, Indiana, Ohio, New York, most of Pennsylvania, extreme NW New Jersey, Vermont, New Hampshire, Maine, W Massachusetts, and NW Connecticut, USA.

S. c. gossii Coues, 1877 – extreme SE South Dakota, S Minnesota, SW Wisconsin, Nebraska, Kansas, Iowa, Missouri, Illinois, extreme W & S Indiana, NE Arkansas, W Kentucky, and NW Tennessee, USA.

S. c. helaletes Merriam, 1896 – SE Virginia and NE North Carolina, USA.

S. c. kentucki Barbour, 1956 – CN Kentucky, USA.

S. c. paludis Hibbard & Rinker, 1942 – Meade County State Park in SW Kansas, USA.

S. c. relictus J. K. Jones, 1958 – Rock Creek State Fish Hatchery in Dundy County, SW Nebraska, USA.

S. c. stonei Rhoads, 1893 – E Massachusetts, most of Connecticut, Rhode Island, extreme SE Pennsylvania, most of New Jersey, E Kentucky, West Virginia, Maryland, Delaware, N & W Virginia, E Tennessee, W North Carolina, and extreme NE Georgia, USA.

Descriptive notes. Head-body 105-131 mm, tail 13-24 mm, ear 8-14 mm, hindfoot 16-24 mm; weight 21.4-50 g. The Southern Bog Lemming has substantial morphological variation across its distribution. It is relatively small and has small eyes, short ears, and short tail. Dorsum varies from cinnamon or bright chestnut to brown and is heavily interspersed with black hair. Venter is lighter, ranging from silver to gray. Juve-



PLATE 10

inches 4
cm 10

summer

winter

27

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