


Mammals

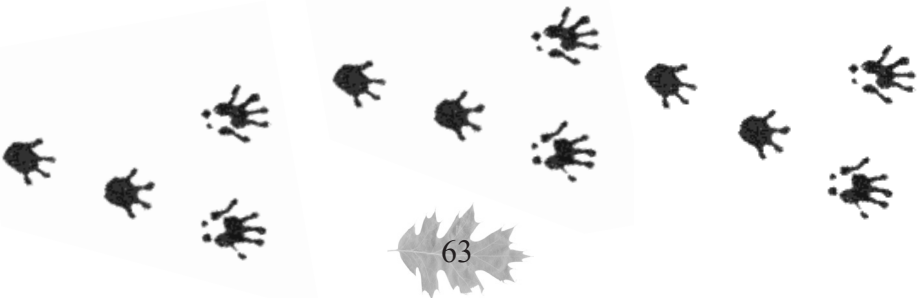


Approximately 220 species of wild mammals occur in California and the surrounding waters (including introduced species, but not domestic species such as house cats). Amazingly, the state of California has about half of the total number of species that occur on the North American continent (about 440). In part, this diversity reflects the sheer number of different habitats available throughout the state, including alpine, desert, coniferous forest, grassland, oak woodland, and chaparral habitat types, among others (Bakker 1984, Schoenherr 1992, Alden et al. 1998). About 17 mammal species are endemic to California; most of these are kangaroo rats, chipmunks, and squirrels.

Nearly 25% of California's mammal species are either known or suspected to occur at Quail Ridge (Appendix 9). Species found at Quail Ridge are typical of both the Northwestern California and Great Central Valley mammalian faunas. Two California endemics, the Sonoma chipmunk (see Species Accounts for scientific names) and the San Joaquin pocket mouse, are known to occur at Quail Ridge. None of the mammals at Quail Ridge are listed as threatened or endangered by either the state or federal governments, although Townsend's big-eared bat, which is suspected to occur at Quail Ridge, is a state-listed species of special concern.

Many mammal species are nocturnal, fossorial, fly, or are otherwise difficult to observe. However, it is still possible to detect the presence of mammals at Quail Ridge, both visually and by observation of their tracks, scat, and other sign. The mammals most often seen during the day are mule deer and western gray squirrels. Mice and rats are nocturnal and thus not often seen, although the large stick-houses of dusky-footed wood rats are apparent in oak woodland and riparian habitats. Carnivores such as mountain lions, foxes, and bobcats may be detected by the presence of scat and tracks left in mud or dust on the dirt roads. Black bear sign has even been observed, most obviously the claw marks on an abandoned truck on the west side of the peninsula.

Different species of mammals are found in the various plant communities at Quail Ridge. In chaparral, rodents such as brush mice, wood rats, and harvest mice are common. Ground squirrels, pocket gophers, harvest mice, and voles inhabit grassland habitats. Wood rats, gray squirrels, skunks, raccoons, brush mice, and deer mice may be found in woodland habitats. Larger mammals such as mule deer, coyotes, bobcats, and mountain lions may be spotted across Quail Ridge. Some small mammals, such as deer mice and brush mice, can be found in more than one habitat type.



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Shrews and Moles (Soricomorpha¹)

Shrews (Soricidae)

Because no sampling at Quail Ridge has focused on insectivores, only one species of shrew has been documented. Three species may occur on the peninsula, and all are small (ca. 100 mm head plus body length (HBL)). The one confirmed species, Trowbridge's shrew (*Sorex trowbridgii*), is a dull gray shrew, with the belly not significantly paler than the dorsum, and a relatively long (ca. 50-60 mm) and markedly bicolored tail. In contrast, both the Vagrant and Ornate shrews (*S. vagrans* and *S. ornatus*, respectively) are brownish or grayish-brown, lighter ventrally than dorsally, and have shorter tails (ca. 30-50 mm) that are not markedly bicolored. These latter two are very difficult to distinguish in the field, because it is necessary to look at dental characteristics; the pigment on the anterior surface of the upper incisor extends above the median tine in *S. ornatus*, but not in *S. vagrans*. Generally, however, Vagrant shrews are found in hills and montane regions of northern California, whereas Ornate shrews are the typical shrew of the Central Valley and southern coastal ranges (although they do extend north-westward to the area of Napa Valley and Pt. Reyes).

Moles (Talpidae)

Broad-footed mole (*Scapanus latimanus*). This mole may be found in meadows where the soil is soft and porous. Highly specialized fossorial (subterranean) mammals, moles are distinguished by having forelimbs broader than long, a slightly haired tail, and a blackish brown coat that appears silvery when smoothed. As adaptations to their subterranean habitat, they have no external ears, small eyes, and fur that lies readily in any direction. They feed on insects and earthworms. Molehills can be distinguished from those of pocket gophers; the former often is "cloddy" and lacks clear evidence of a plugged hole, whereas the latter consists of fine soil with a plugged hole near one side of the mound.

Bats (Chiroptera)

Vesper bats (Vespertilionidae)

Several bats in the genus *Myotis* may occur at Quail Ridge, and some may be difficult to distinguish except by experienced biologists. In the absence of any surveys, it is somewhat unclear which species occur here. Little brown myotis (*Myotis lucifugus*) have yellowish glossy brown hair with the tips a bit darker on the backside and a lighter underside. The fur is shiny or burnished, and somewhat yellowish brown in coloration. These bats can be found foraging above streams and around the edges of forests. They emerge from their day roosts at dusk and forage on insects, capturing them on the wing. Yuma myotis (*Myotis yumanensis*) is one of the most common of the western *Myotis*. Yuma myotis have a characteristic dull brownish color with

¹ Previously included within Insectivora.

hairs that are darker at the base. The undersides of these bats are whitish in color. Yuma bats are late-night fliers that stick close to the ground when foraging and are typically found in oak savannas. These generally have duller fur than little brown myotis, and they are slightly larger (e.g., forearm length 35-40 mm as opposed to 32-37 mm). Other species which may occur at Quail Ridge include fringed myotis (*M. thysanodes*), long-legged myotis (*M. volans*), long-eared myotis (*M. evotis*), California myotis (*M. californicus*), and the western small-footed myotis (*M. ciliolabrum*).

The big brown bat (*Eptesicus fuscus*) is one of the most common bat species in the United States. The coats of these bats are long with a brown to black color and a glossy hue. Another distinctive characteristic is the dark black coloring of their patagia (wing membranes). Big brown bats tend to roost alone in caves, crevices, buildings, or trees, but have also been known to roost in small groups. They feed mainly on beetles and are known to hibernate for months during the winter.

The western pipistrelle (*Pipistrellus hesperus*), or “Pips”, are small bats, and have a distinctive yellow-gray smoke-like coloration on their backs, and a whitish belly. They are found near water sources in more arid areas, and they roost in caves, cliffs, under loose rocks, and in buildings. These bats can be found foraging on insects in the early evening, sometimes even before sundown.



Townsend's big-eared bat, *Corynorhinus townsendii*

An unusual, and aptly named bat, Townsend's big-eared bat (*Corynorhinus* (previously *Plecotus*) *townsendii*) has remarkably long ears – roughly one third of forearm length – that meet basally at the top of the forehead. They have a brown coat with a grayish tint and have distinctive lumps between the nostrils and eyes. Big-eared bats forage at the edge between forest and grassland habitats. These bats are of conservation concern because they appear to be extraordinarily sensitive to human disturbance – a single human visit may cause abandonment of a roost site – and their numbers are declining in California.

Three species of related bats, the Lasiurine bats, are notable for having furry tail membranes. The western red bat (*Lasiurus blossevillii*) is readily distinguished by its rusty, brick-red coloration, with white-tipped hairs. Red bats roost among the foliage of trees and are solitary. However, they forage in pairs, and forage over the same area repeatedly. Red bats migrate south in the fall. Because of their apparent dependence on riparian vegetation, these bats may be faring poorly in California, where riparian habitats have been largely degraded or destroyed. Hoary bats (*Lasiurus cinereus*) have a yellowish brown coat with white-tipped hairs over most of their

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body and patches of white fur on their elbows and wrists. These bats are also solitary and can be found foraging late at night or roosting in trees during the day. Silver-haired bats (*Lasionycteris noctivagans*) have a dark brown coat with hairs tipped with white/silver. Only the proximal half of the interfemoral membrane is well furred. Silver-haired bats roost among foliage in forested areas and forage among the trees.

Pallid bats (*Antrozous pallidus*) are colonial, roosting in caves, buildings, trees, and mine tunnels. They are a gray to dull yellow color and have long ears that extend beyond the snout when bent forward, but do not touch basally. Pallid bats feed near the ground on Jerusalem crickets, beetles, and other invertebrates.

Free-tailed bats (Molossidae)

The Brazilian free-tailed bat (*Tadarida brasiliensis*) is readily distinguishable by its tail, which extends beyond the interfemoral membrane, and the reddish brown coat. The ears generally do not touch basally, and are distinguished by having a series of little bumps on their edges. Brazilian free-tailed bats are colonial, roosting in caves and buildings, emerging at dusk to forage on moths. The largest colonies of mammals known are this species; at Bracken Cave in Texas some 20 million bats emerge to forage every evening in the summer.

Rabbits and Hares (Lagomorpha)

Hares and rabbits (Leporidae)

As many as three species of leporids may occur at Quail Ridge. Most visible is the black-tailed jackrabbit (*Lepus californicus*), the common jackrabbit of much of temperate California. Jackrabbits have a grayish brown pelage and a black stripe on the top of the tail; the long ears are also tipped with black. Jackrabbits occur in open habitats, such as grasslands, and can frequently be seen running down the roads at Quail Ridge at night. Two species of cottontails also may occur at Quail Ridge. Cottontails are readily distinguished from jackrabbits by their smaller size and relatively shorter hindlimbs; additionally, young cottontails are born blind and helpless (altricial), whereas hares and jackrabbits are born in a more advanced (precocial) state. The Desert cottontail (*Sylvilagus audubonii*) – also called Audubon’s cottontail – is a relatively large cottontail with a mixed black and brown dorsum. The ears are large, sparsely furred, and dark at the tip, and the tail is black above and white (entirely) below (when moving it often is the underside of the tail that is most visible). Desert cottontails occur in woodlands and brushy areas, but likely are uncommon at Quail Ridge. Likely more common here are brush rabbits (*Sylvilagus bachmani*), which are readily distinguished by being smaller (600-800 g vs. 900-1200 g), having ears not dark at the tips, and the hairs on the underside of the tail are white with gray bases. Brush rabbits prefer dense vegetation and seldom stray far from cover.

Rodents (Rodentia)

Squirrels (Sciuridae)

Two species of arboreal squirrels are found at Quail Ridge: the Sonoma chipmunk (*Tamias sonomae*) and the western gray squirrel (*Sciurus griseus*). Sonoma chipmunks are diurnal, have a reddish dorsum, and can be recognized by a series of dark and light stripes that extend from their nose to their rump. California appears to be a hotbed of chipmunk speciation, and species here are notoriously difficult to distinguish; however, as no other chipmunks occur in the area, chipmunk identification is easy at Quail Ridge. These chipmunks occur in chaparral and grassland habitats and are rarely seen. Western gray squirrels have a smoky gray coat with a white underside and a long bushy tail. They may be distinguished from California ground squirrels by their white belly and bushier tail. These squirrels can be seen foraging among oak or pine trees and on the ground in oak woodlands. Evidence of their presence in an area is nests made out of leaves, sticks, and bark high up in trees, and chewed pine cones.



Western gray squirrel, *Sciurus griseus*

One species of ground squirrel, the California ground squirrel (*Spermophilus beecheyi*), may occur at Quail Ridge. Ground squirrels are found in open areas such as meadows, and are a significant agricultural pest in California. It is possible that California ground squirrels occur at Quail Ridge, but these diurnal mammals have never been seen or heard on the Reserve. It is likely that the habitat at Quail Ridge is too thick and brushy for these squirrels, which prefer open, grassy habitats.

Pocket Gophers (Geomyidae)

Botta pocket gophers (*Thomomys bottae*) are primarily subterranean, and they have many adaptations to their fossorial lifestyle, such as extremely small eyes and ears, a short tail, and long claws for digging. These animals are brownish to light gray above and gray to white underneath. Their burrows are much more visible than the actual animals; burrows are indicated by piles of fine soil with an opening plugged diurnally with dirt. Botta pocket gophers live in open habitats, such as grassland.

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Pocket mice (Heteromyidae)

The San Joaquin pocket mouse (*Perognathus inornatus*) has been captured only once at Quail Ridge. This species weighs 7-12 g and has an orange buffy pelage and short ears. It can be distinguished from other small mammal species at Quail Ridge by having external fur-lined cheek pouches that can be stuffed with food, which is transported to the burrow for later use. The pocket mouse generally is found in grasslands.

Old World Rats and Mice (Muridae)

Considered vermin by most, house mice (*Mus musculus*), black rats (*Rattus rattus*), and Norway rats (*R. norvegicus*) were introduced to North America early in the exploration of the continent and have been very successful in a variety of habitats. House mice will occupy any human structure with shelter and food, and they are very effective at colonizing many native habitats as well, such as riparian corridors in the Central Valley. They are not prevalent at Quail Ridge, but if found they can be distinguished from other rodents by their small size, naked (hairless) and scaly tail, and a pungent smell. Additionally, the upper incisors are notched in side view, unlike other small rodents in California. These species are remarkably rapid breeders, and they do compete with native small mammals, so should be euthanized if encountered.

The two rat species are in the size range of the woodrat (e.g., 100-350 and 200-500 g for the black and Norway rats, respectively), however, unlike the woodrat, these two species do not have hairy tails; they are naked and scaly. Black rats are smaller than Norway rats, and the tail in the former is longer than the head and body length, whereas it is generally somewhat shorter in the latter species. To date neither of these species has been documented at Quail Ridge, but it seems inevitable that one of them (most likely the black rat) will arrive; they should be eradicated on sight, as they are prolific breeders, voracious nest predators, and strong competitors to native rats and mice.

New World Rats and Mice (Cricetidae²)

Deer Mice, Woodrats, and Allies (Neotominae)

The smallest sigmodontine rodent at Quail Ridge is the western harvest mouse (*Reithrodontomys megalotis*). These animals are tiny (typically 9-12 g at Quail Ridge) and have pale gray to brownish dorsal pelage with a grayish ventrum. Hairs in the ears, on the feet, and around the rostrum often are tinged with orange coloration. These mice can be distinguished from all other species at Quail Ridge by their grooved upper incisors. Harvest mice are particularly common in grasslands and chaparral.

² The taxonomy of these animals has been unstable, but the taxonomy presented here reflects the latest global treatment (Wilson & Reeder. 2008. Mammal Species of the World, 3rd ed.; available online at <http://www.bucknell.edu/msw3/>).

Three species of deer mice (genus *Peromyscus*) may occur at Quail Ridge, although only two have been documented to date. The deer mouse (*Peromyscus maniculatus*)



Brush mouse, *Peromyscus boylii*

is brownish dorsally (although color may range from yellowish brown to gray; juveniles typically have gray pelage) and white ventrally. The tail is bicolored and generally shorter than the combined head and body length (about 90%). Adult deer mice (excluding pregnant females) typically weigh 14-20 g (0.49-0.71 ounces) at Quail Ridge. This is one of the most widely ranging mammal species in North America; it is found in almost all habitat types throughout the continent.

At Quail Ridge, it is more plentiful in riparian areas (such as Decker Canyon) than in drier habitats. A larger species is the brush mouse (*Peromyscus boylii*), which is one of the most abundant small mammal species at Quail Ridge. Brown dorsally and white ventrally, brush mice can be distinguished from deer mice by the larger body size – adults (excluding pregnant females) weigh 23-30 g (0.81-1.06 ounces) – a tail that is longer than the combined head and body length, a tuft of hair at the end of the tail, and an orangish stripe on either side of the body. Their hind foot typically is shorter than the ear. Brush mice typically are found in chaparral and oak woodland areas. The third species is the pinyon mouse (*Peromyscus truei*). Pinyon mice have not been documented at Quail Ridge, although they occur at the nearby Cold Canyon and McLaughlin Reserves. Pinyon mice can be difficult to distinguish from brush mice. The most reliable character is ear length; pinyon mice have very long ears (as long or longer than the hind foot), while brush mice have ears that are approximately 70-80% of hind foot length. Pinyon mice tend to be found in woodland habitats.

The largest member of this group is the dusky-footed wood rat (*Neotoma fuscipes*); these animals, part of a group often referred to as pack rats, construct large stick houses, which may be either on the ground or more than 2 m high in trees. Grayish brown dorsally and grayish to whitish below, woodrats are clearly distinguished by the presence of dusky patches of fur on the feet. Dusky-footed wood rats are found in riparian, oak woodland, and chaparral habitats, and seem to be particularly abundant at Quail Ridge.



Dusky-footed woodrat, *Neotoma fuscipes*

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Meadow mice, Voles (Subfamily Arvicolinae)

The California vole (*Microtus californicus*) is a coarse brownish above and gray-brown to whitish below. The tail is less than 1/3 the length of the head and body, and the ears are barely visible. California voles inhabit grassy meadows at Quail Ridge and construct runways through tall grass. They are largely herbivorous, switching to seeds in summer when green vegetation dies. Voles are important prey for some raptors, especially white-tailed kites, which are virtually vole specialists.

Dogs, Cats, and Bears (Carnivora)

Dog-like Carnivores (Canidae)

Two species of wild canids have been documented at Quail Ridge. Coyote (*Canis latrans*) are about the size of a medium-sized dog, with grayish fur. They are opportunistic feeders who feed primarily on small rodents, but will eat seeds and berries, which can be seen in their scat. Coyotes often are nocturnal but may also be active during the day. Coyotes are rather secretive and their presence is best detected by their tracks and scat, which they often leave in roadways, and the chorus of howls and high pitched yaps that is heard some evenings. Coyotes have been called defiant song-dogs, and are among the most adaptable mammals in North America, found in almost all habitat types. The smaller gray fox (*Urocyon cinereoargenteus*) has gray dorsal pelage, with a black stripe running down the tail to the black tip. The fur is rusty colored on the legs, feet, and neck. Tracks resemble those of a small dog, but are narrower. Gray foxes tend to occur in chaparral and open woodland habitats. They are one of the most arboreal of the canids, and are highly omnivorous, feeding on small mammals, birds, insects, eggs, fruits, etc.



Coyote, *Canis latrans*

Raccoons and allies (Procyonidae)

Raccoons (*Procyon lotor*) have alternating black and gray strips on the tail, which is shorter than the body length, and a black “mask” that covers the face. Raccoons live along streams in wooded areas and are highly omnivorous. Raccoons are known to raid pet food dishes that are left outside, and are strong and dangerous opponents. Raccoons are primarily nocturnal and not often seen, but their tracks are easily identified – they look like the prints of tiny human hands, reflecting the high dexterity they have with their digits. Their smaller relative, the ringtail (*Bassariscus astutus*), has a long slender body with a black and white banded tail, which is longer than the body. Ringtails are nocturnal and highly arboreal animals that feed on small mammals, birds, and sometimes fruits from manzanita, cascara, and madrone.

Skunks (Mephitidae)

Two species of skunk may occur at Quail Ridge; both are known for their smell and often are detected by odor before sight. Both of these species are principally nocturnal. The larger and more common of these is the striped skunk (*Mephitis mephitis*), with twin white stripes over a black body. They are omnivorous, feeding on a variety of prey including small rodents, insects, eggs, berries, and much more. They remain active throughout winter and generally are solitary, although females sometimes congregate in dens, which are under rocks, wood, or buildings. Western spotted skunk (*Spilogale gracilis*) have been documented on the Reserve by tracks, although they have yet to be seen. These animals are easily distinguished from the striped skunk by their much smaller size and by the broken stripes, or spots, covering the back. They are primarily carnivorous but will feed on some vegetable matter. They are nocturnal and solitary, sticking to the ground to forage, but they will retreat to the trees from danger. They will spray a deterring odor at danger. Skunks can be important vectors for rabies and are the principal reservoir in California, so animals that appear unhealthy or that are moving about during the day should be avoided.



Striped skunk, *Mephitis mephitis*

Bears (Ursidae)

The Black bear (*Ursus americanus*) is the largest predator in California and can be recognized by its brownish to black coat and large size (although they are small compared to other North American bears). As with most bears, these are opportunistic omnivores, feeding primarily on roots, fruits, nuts and grasses, but they will feed on small rodents, fish, grubs, and other edible material. They are primarily solitary unless with cubs, and are principally nocturnal.



Cats and allies (Felidae)

Mountain lions (*Puma concolor*) are one of the largest mammals at Quail Ridge and cannot be mistaken for any other species. They are large (1.2-2.5 m in length) cats with a tawny pelage and a long, black-

Scratches are evidence of a black bear's attempt to get behind the wheel of the black truck.

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tipped tail. Kittens have black spots. Mountain lions have very large home ranges and primarily hunt mule deer, although other medium-sized mammals may be taken as well. Mountain lions have been observed at least five times in the past several years at Quail Ridge, and it is likely that they are residents here.

Bobcats (*Lynx rufus*) have very short tails, which are tipped with black on the top, and gray to reddish fur spotted with brown or black. Ears have black tufts at the tip. Bobcats are nocturnal, occur in most habitat types, and hunt in rocky and brushy areas. They are relatively generalist predators, eating small mammals, birds, reptiles, or amphibians.



Bobcat, *Lynx rufus*

Even-toed Ungulates (Artiodactyla)

Deer and allies (Cervidae)

Mule deer (*Odocoileus hemionus*) are abundant at Quail Ridge, and are frequently observed feeding along the roads, primarily around dusk and dawn. They are browsers, foraging on tender leaves of shrubs. Fawns are white-spotted for about 3 months after birth.

Pigs (Suidae)

To date feral hogs (*Sus scrofa*) have not been identified at Quail Ridge. This is good, as feral hogs can be extremely damaging ecologically. Their sign is likely to be the first indication of their presence: when rooting for food they tear up the understory and soil of a site, much as if a small rototiller had been operated on a patch of habitat. Hogs are highly prolific, often having 6-12 young in a litter. Adults are variable but readily distinguished as pigs.



Mountain lions, *Puma concolor*

Potential Research Topics

Over the past decade, researchers from the UC Davis and elsewhere have live-trapped small mammals in riparian areas of Decker Canyon and in chaparral near the research station. Karen Mabry, a former UC Davis animal behavior graduate student and current faculty member at New Mexico State University, is studying the dispersal and habitat selection behavior of brush mice from oak woodland and chaparral habitat types.

Many questions about the mammals of Quail Ridge remain unanswered. As only 18 of the 58 species that may occur at Quail Ridge have actually been confirmed, a general survey of mammalian diversity would be helpful. The bats are particularly understudied, in part because of the difficulty of observing flying, nocturnal animals. Ultrasonic recording equipment is available at the reserve for monitoring of bat calls; recordings of foraging calls are often sufficient for species-level identification of bats. Quail Ridge is well suited for studies of predator/prey dynamics; small mammals such as mice, rats, and voles are abundant and form a prey base for a large number of mammalian and avian predators. At least two, and possibly three, species of *Peromyscus* mice coexist at Quail Ridge – what ecological factors allow such similar and closely related species to coexist? From trail cameras and direct sightings, we know that larger carnivores such as mountain lions, coyotes, and bobcats are abundant at Quail Ridge; studies of their movements, feeding habits and other behaviors are easy to envision.



Deer mouse, *Peromyscus maniculatus*

