Reptiles and Amphibians

The reptile and amphibian fauna found at Quail Ridge Reserve is a relatively rich subset of the California herpetofauna. Of the 141 species that occur in this state (Stebbins, 2003), 20 have been documented at Quail Ridge and at least another four likely are found there. The richest group at Quail Ridge is the snakes, with 10 recorded and four probable species (of a total of 33 species in California), whereas the most poorly represented is the turtles, with only the western pond turtle found here (although only three species are found state-wide). Falling between these extremes are the salamanders (three recorded and one probable), the frogs and toads (three recorded), and the lizards (four recorded and two probable). See the full list in Appendix 7.

Quail Ridge lies at the boundary between two major biogeographic regions, the Pacific Border and Sierra Madrean (Savage 1960). The Pacific Border herpetofauna is centered along the Pacific Coast from the Coast Range of California to southeast Alaska. The climate of this region is mild and very moist, and reaches its southeastern extreme at about the latitude of Quail Ridge. A major component of this faunal group is the amphibians, primarily salamanders. All of the salamanders of Quail Ridge are members of this group.

In contrast to the Pacific Border region, the Sierra Madrean region has its origin in the warm and dry region of central Mexico. The range of this fauna includes Mexico, parts of Arizona, southern California, and California's Central Valley (Savage 1960). Thus, Quail Ridge is found at the northwestern edge of this region. The Sierra Madrean group is dominated by a variety of species of lizards and snakes.

An interesting statewide pattern in the herpetofauna of California is the ring around the Central Valley. Following the prevailing climate and vegetation patterns, many species are found in narrow bands that circle the Valley. Pacific Border species are restricted to cooler and moister climates than are found in the Central Valley and thus have expanded from the north along both the Coast Ranges and the foothills of the Sierra Nevada. A particularly well-studied example of this is the ensatina, *Ensatina eschscholtzii,* a species of lungless salamander (Stebbins 1966).

While some Sierra Madrean species were able to move over the Tehachapi Mountains into the San Joaquin Valley, other species require a more mountainous environment. Some of these entered the lower elevation hills surrounding the Central Valley, either from the south around the Coast Range and Sierra Nevada, or from the northeast, moving south down these mountain ranges (Peabody and Savage 1958). One example of this pattern is the southern alligator lizard (*Elgaria multicarinatus*) (Peabody and Savage 1958). Thus, the ring distribution that characterizes a number of species in California was achieved via radically different routes by different species.

REPTILES AND AMPHIBIANS

Only one species in the Quail Ridge herpetofauna is endemic to California. The California newt (*Taricha torosa*) occurs throughout the Coast Ranges and Sierra Nevada but fails to reach into any other state (Stebbins 1966).

The herpetofauna of the Quail Ridge Reserve represents a largely untapped wealth of research opportunities for studies in evolution, ecology, and behavior. There are many common species easily found and observed over a broad range of habitats.

Salamanders

Four species of salamanders have been observed on the UC Quail Ridge Reserve. It is possible that a fourth species, the Pacific giant salamander (*Dicamptodon ensatus*) may also be found on the Reserve. However, this is unlikely considering the lack of permanent streams on the Reserve.

California newt, *Taricha torosa* (Salamandridae) – These large (7-9 cm SVL, = snout-vent length) salamanders have orange dorsal coloration and a light yellow ventral coloration. Most of the year they have rough, bumpy skins; however males develop smooth skin, keeled tails and enlarged hind limbs when they enter ponds to breed. With the onset of the winter rains, adults and subadults become active at night. Hundreds may be seen on the roads in a single night, with most of the adults apparently moving towards breeding sites on the Reserve. California newts breed in each of the four ponds and in the ephemeral springs on the Reserve. Males court females individually, or form large balls of writhing males with a single female in the center. Fertilization of eggs is internal by females picking up spermataphores. Females lay many spherical egg masses of 10 to 40 eggs on vegetation and debris. The eggs hatch after 10 or more days, and larvae take several months to metamorphose, depending on water temperature, food availability, and other environmental variables. Newts will spend several years on land before reaching the size of sexual maturity. At the UC Hastings Natural Reserve, Pete Trenham (1998) observed that adult newts commonly moved 3 km from their breeding pond, and occasionally over 4 km, in a given year.

California Newt (*Taricha torosa)*

California slender salamander, *Batrachoseps attenuatus* (Plethodontidae) – This is another of the common salamanders of the Reserve. They are relatively small (ca. 3-6 cm SVL) with long, thick tails, tiny limbs, and large, forward-facing eyes. Dorsal coloration is variable, and may include slate-grey, mottled, and thick brick-red dorsal stripes. They are mostly found during the moist months, usually December through May, under rocks, logs, and cover boards on the Reserve, although a few can be observed on the surface on moist nights. Slender salamanders do not have a larval stage; they lay terrestrial eggs that hatch directly into small juveniles.

Arboreal salamanders, *Aneides lugubris* (Plethodontidae) – These large (6-10 cm SVL) salamanders are slate grey, and uncommonly observed on the Reserve. Arboreal salamanders may be observed under cover boards in damp weather. They are active on damp, rainy nights. Adults often will be found on these nights on oak trees next to cracks and holes in the tree. When approached, they retreat into the holes. Several such trees in which arboreal salamanders have been repeatedly observed on rainy nights are along the driveway from the sign-in box to the station. Another tree is the interior live oak (*Quercus wislizenii*) just to the west of the porch. Arboreal salamanders, like slender salamanders, are direct-developers, without a larval period.

Arboreal salamander (*Aneides lugubris*)

Ensatina, *Ensatina eschscholtzii* (Plethodontidae) – These medium salamanders appear similar to California newts, with reddish-brown dorsal coloration and light-yellow belly coloration. They can be differentiated from newts, however, by their smooth skin, relatively slender legs, and relatively longer snout. *Ensatina* appear to be rare here; two have been observed, both on rainy nights above ground in 2003.

Frogs

Three species of frog have been observed at the Reserve; two of these are native, while the third has been introduced to California. Additionally, foothill yellow-legged frogs (*Rana boylii*) are known to occur near Quail Ridge, but the lack of suitable habitat (permanent streams) makes it unlikely that this species will be found on the Reserve.

Western toad, *Bufo boreas* (Bufonidae) – Western toads occasionally are seen around the south end of the Reserve, usually at night or under cover objects. These medium-sized (5-13 cm SVL) brown and tan frogs with bumpy skin are not likely to be confused with the other frogs of the Reserve. Although adult toads have been observed in the drying mud of Decker Pond in May, they have not been observed to breed on the Reserve.

Western toad (*Bufo boreas)*

Pacific treefrog, *Hyla regilla* (Hylidae) – This is the most abundant frog of the Reserve. Males can be heard calling any month of the year, although large breeding aggregations begin in late December or early January, and continue through May. These small frogs (2-5 cm SVL) are readily recognized by the toepads and the dark stripe behind the eye. The dorsal coloration and pattern is highly variable, ranging from bright green to a tan or gray coloration, and can change within a few minutes. Males have multiple types of calls that they use to attract females and communicate with other males. The most common advertisement call is a loud 'kreeck-eckk'. They breed at all four ponds on the Reserve, but they do not appear to breed in the ephemeral streams. Tadpoles metamorphose into little froglets between May and July, and they usually reach maturity in one (males) or one to two (females) years. Some adults will live to breed for several years. Despite their small size, these frogs are very mobile, and can be found far from the breeding ponds. Quail Ridge Reserve was the site of a multi-year study on demography, movement, and local adaptation in Pacific treefrogs.

Bullfrog, *Rana catesbeiana* (Ranidae) – Bullfrogs are nonnative and breed in the reservoir surrounding the Reserve. They can be recognized from their large size (9-20 cm SVL), large tympanum (eardrum), strongly webbed feet, smooth, olive to green dorsal color, and often a mottled brown and white belly. Every year a few subadult bullfrogs move into Decker Pond. In 2004, an adult male was able to make it into Fordyce Pond – a mile away from the reservoir. Diet analysis has found bullfrogs will eat nearly any animal small enough to swallow, from a host of insects, to other frogs, to snakes, small mammals, and birds. They are an important threat to red-legged frogs (*Rana aurora*) in the foothills of the Sierra Nevada. Bullfrogs are potentially so damaging that they should be eliminated on sight!

Snakes

Ten species of snake have been observed on the Reserve. An additional four species may be found on the Reserve. The California mountain kingsnake (*Lampropeltis zonata*) is strikingly colored, with alternating rings of red, white, and black down the length of their body. The rubber boa (*Charina bottae*) is a small- to medium-sized snake that has a blunt tail and head, and dark-brown to olive dorsal coloration. The western terrestrial garter snake (*Thamnophis elegans*) is similar in appearance to the common garter snake, but it generally has 8 upper labial scales instead of 7 in the common garter snake. Additionally, the common garter snake has relatively large eyes compared to the western terrestrial garter snake. Finally, the long-nosed snake (*Rhinocheilus lecontei*) potentially occurs at Quail Ridge, although this is on the very fringe of the species' range and the habitat is not ideal.

Common garter snake, *Thamnophis sirtalis* (Colubridae) – Beginning in late May, common garter snakes are commonly found hunting Pacific treefrog larvae and metamorphs at Far Pond, Fordyce Pond, and the ephemeral creeks near these ponds. They are inexplicably absent from the Decker Canyon Pond and Dan's Pond. These snakes are livebearing, and neonates first appear around the ponds in late June and early July. Palping some of these juveniles has revealed some of them to have eaten large Pacific treefrog metamorphs that weigh over 20% of the snake's mass. When captured these snakes flatten their heads, hiss, strike, sometimes bite, and often will smear captors with feces and anal gland secretions. In 2002, a large common kingsnake was observed eating a common garter snake in Fordyce Pond, and in 2003 a recently killed garter snake was found in Fordyce Pond with bite marks indicative of a coyote or bobcat. These snakes can be easily distinguished from the other garter snake on the Reserve by the presence of bright red scales on the body between the three bright yellow longitudinal stripes. They are medium-sized snakes (46-130 cm; 18-52 inches).

Western aquatic garter snake, *Thamnophis atratus* (Colubridae) – Only one aquatic garter snake has been observed at the Quail Ridge Reserve. This snake can be differentiated from other garter snakes of the area by the lack of red on its body.

Ring-necked snake, *Diadophis punctatus* (Colubridae) – These small (20-75 cm; 8-30 inches), attractive snakes are gray-green dorsally, with a bright orange or deep red ventral coloration and a bright orange/red ring around their neck. When disturbed they often coil up, hide their head in their coils, and expose their brightly colored tail in several coils. Ringneck snakes are observed commonly on the Reserve under rocks and cover boards from February through May, although they may be seen any month of the year. They have been observed under cover objects near Far Pond, where one was found to have eaten a Pacific treefrog metamorph. They have also been reported to feed on sharp-tailed snakes.

Ring-necked Snake (*Diadophis punctatus)*

Night snake, *Hypsiglena torquata* (Colubridae) – These small (30-65 cm; 12-26 inches), nocturnal snakes superficially resemble western rattlesnakes, with vertical pupils, a blotched brown and tan color pattern, dark stripe on the side of the head, and a somewhat triangular head. They feed primarily on sceloporine (spiny) lizards and squamate (scaled reptiles) eggs, and occasionally eat frogs, other squamates, and insects. Only one has been observed on the Quail Ridge Reserve, under a log near Far Pond. Night snakes have small rear fangs on their jaws, but their bites have not been reported to be dangerous to humans.

REPTILES AND AMPHIBIANS

California whipsnake, *Masticophis lateralis* (Colubridae) – These are fast, hard to catch snakes that are most commonly encountered in warm weather. They can reach large sizes (75 to 152 cm; 30 to 60 inches) and have relatively large eyes. They are diurnal, active foragers often found climbing bushes and trees, and eat a broad range of prey, but lizards make up a large portion of their diet. They can be recognized by their dark grey to black dorsal coloration broken by a single white longitudinal stripe on each side. Unlike garter snakes, there is no dorsal stripe.

Sharp-tailed snake, *Contia tenuis* (Colubridae) – Sharp-tailed snakes become active on the Reserve from December through April, and are commonly encountered under cover boards on the ridge that descends north of the station. They are small (20 to 45 cm; 8-18 inches), brown to gray in color, with a longitudinal red stripe on each side that fades as they grow older. They often coil into a ball when disturbed. Little is known about the ecology of these snakes.

Common kingsnake, *Lampropeltis getula* (Colubridae) – These striking snakes stand out from all other snakes on the Reserve by their black-and-white ringed bodies. They can reach large sizes (75-208 cm; 30-82 inches), and are active both diurnally and nocturnally beginning around May throughout the Reserve. They are well known for their ability to eat venomous rattlesnakes and many other snakes, but a large portion of their diet comprises lizards, eggs, and small mammals. A large kingsnake was observed eating a common garter snake in May 2002 at the Fordyce Pond.

Common King Snake (*Lampropeltis getula*)

Gopher snake, *Pituophis catenifer* (Colubridae) – This is another large (90-275 cm; 36-110 inches) snake commonly observed in the day and night throughout the Reserve beginning around May. They have a tan and brown dorsal coloration that comes in two forms. The most common is a blotched color pattern, but about 10% of the gopher snakes encountered on the Reserve have a pattern of longitudinal tan stripes. When threatened, these snakes often rapidly vibrate their tail tip, which sounds similar to a rattlesnake rattle in dry leaves or grass. Gopher snakes feed primarily on small mammals, but also include birds, eggs, and occasionally lizards in their diet.

Yellow-bellied racer, *Coluber constrictor* (Colubridae) – These active diurnal snakes have a yellow-green dorsal coloration as adults, and mottled tan-brown coloration as juveniles. They have been observed throughout the Reserve, and appear most commonly from May through the summer months. They are frequently found around Fordyce Pond in the afternoon. Adults reach up to 90 cm (35 inches) in total length.

Western rattlesnake, *Crotalus viridis* (Viperidae) – These large (37-162 cm; 15-64 inches) snakes are the only dangerously venomous snakes on the Reserve (night snakes also have venom, but this is not readily transmitted to humans and is not very dangerous). They may be found throughout the Reserve. They begin to emerge from dens (which may be just a large rock with a hollow underneath) in April. For several weeks they remain close to the dens. As temperatures increase, they eventually leave the dens for most of the summer. They can be recognized by their large, triangular heads. The top of the head is dark, and the cheeks (labial scales) are cream/white in color, bisected by a diagonal dark stripe running roughly from the back corner of the eye to the edge of the mouth. The back of the snake generally has dark diamond patterns that give way to alternating dark and tan rings toward the tail. Most obvious is the rattle on the tail, which grows as the snake sheds skins (but the number of rattles is not a consistent measure of age in years). Rattlesnakes are live-bearing, and have an interesting range of social behaviors, including male-male ritual combat and, in at least several species, parental care until the first shed of the young.

Western rattlesnake (*Crotalus viridis*)

Lizards

Four lizards have been identified at Quail Ridge Reserve. Another three lizard species may also be present on the Reserve: the coast horned lizard (*Phrynosoma coronatum*), the sagebrush lizard (*Sceloporus graciosus*), and the northern alligator lizard (*Elgaria coeruleus*).

Southern alligator lizard, *Elgaria multicarinaus* (Anguidae) – These large (7-18 cm, 3-7 inches) lizards have broad heads, tan or brown coloration with small black-brown rings around the body, and white/grey venters. They are found throughout the Reserve, and frequently may be seen sunning themselves in the road as it begins to warm up in April and May. When captured they frequently will give powerful bites, roll, and expel feces.

California whiptail lizards, *Cnemidophorus tigris* (Teiidae) – Whiptails are large (6-11 cm, 2-4.5 inches) lizards that become active on the Reserve around early June. They are frequently seen in areas of chaparral, particularly the stretch of road just north of Fordyce Pond. They are fast, active lizards that rarely sit still. They have pointed snouts, and have eight tan, often indistinct, stripes on their back. Hatchlings have bright blue tails.

REPTILES AND AMPHIBIANS

Western skinks, *Eumeces skiltonianus* (Scincidae) – These lizards have a broad brown stripe down their back, and two very distinct light yellow stripes running from their snout over their eyes and down their back. Juveniles have bright blue tail tips. As the skinks age the tail tip color fades. Adults also develop some reddish coloration on their heads and venter during the breeding season.

Western skink, ***Eumeces skiltonianus***

Western fence lizard, *Sceloporus occidentalis* (Iguanidae) – Western fence lizards are the most commonly encountered lizard on the Reserve. For their body size, these lizards appear more robust than the other lizards on the Reserve. They have variable dorsal patterns that may range from marked chevron type patterns on the back to pale striping, to nearly entirely black individuals with only a faint dorsal pattern. The most distinguishing feature on these lizards is their blue bellies. The blue belly and throat pattern is most vibrant in adult males, although females have this coloration as well. Males defend territories. They have a varied communication system, consisting of a series of head bobs, pushups, shaking movements, and dorsoventral flattening of the body and exposing their blue color pattern. These behaviors are used in establishing and maintaining territory and courtship; they may also be used to signal to predators. Hatchlings begin to appear on the Reserve in late July-early August.

Western pond turtle (*Clemmys marmorata*)

Turtles

There is only one native turtle on the Reserve, the western pond turtle (*Clemmys marmorata*). These turtles are found around the edges of the Berryessa Reservoir most of the year. However, they probably lay eggs on the Reserve. A female was observed in Decker Canyon about 800 m from the edge of the reservoir.

Potential Research Topics

The herpetofauna of Quail Ridge is well documented, and much productive herpetological research has been conducted to date, but many questions remain. Coreigh Greene (formerly of the UCD Graduate Group in Ecology) investigated the influence of social interactions and density dependence on habitat preference in western fence lizards, using animals from Quail Ridge, among other sites. Mike Benard (formerly a UCD Population Biology Graduate Group student, now faculty at Case Western Reserve University) has studied local adaptation of Pacific treefrogs (*Hyla regilla*) to different larval environments, as well as the ability of adults to use and move between temporary ponds at Quail Ridge, and the resulting population genetic structure in this species; similar work on other pond-breeding amphibians, such as the California newt (*Taricha torosa*), would be a useful addition to understanding the herpetofauna of

the region. We have already alluded to the potential role of Quail Ridge in tracking responses to climate change and exotic species.

Western rattlesnakes are important predators in many ecosystems. They have been studied at a number of localities, but none in the Coast Range. Quail Ridge offers a large area for radiotelemetry and other studies on this predator, providing important ecological parallels to studies on other subspecies and in other habitats.

Plethodontid (lungless) salamanders are much more diverse in the eastern United States than in the west (Petranka 1998); with over 250 species (Frost 1985; Duellman 1993) they are the largest family of salamanders, and have been central to much ecological research on salamanders (e.g., Hairston 1987). Most ecological work, however, has been pursued in the eastern half of the country, where they have been documented to play important roles in forest ecosystems. Is that role similar for western taxa? Although the California salamander fauna is not highly diverse (ca. 25 species; Petranka 1998), some species comprise ideal taxa for comparative work to research conducted in the more diverse fauna of the eastern states. An exception to this general dearth of research is Stebbins' (1949) classic work on *Ensatina*. Quail Ridge hosts populations of the California slender salamander (*Batrachoseps attenuatus*). In spite of their potential role in this and other ecosystems, we remain woefully ignorant of the basic ecology of this entire genus.

Other common taxa at Quail Ridge that are in need both of basic research as well as broader studies on local adaptation, predator-prey relations, and the influence of local and regional features on demographic and genetic structure include western skink (*Eumeces skiltonianus*) and the southern alligator lizard (*Elgaria multicarinatus*).

Chaparral currant (*Ribes malvaceum*)