

Birds



California has a rich and diverse avifauna, with over 500 species residing or using parts of the state during the course of a year, some as residents and others as migratory species. California is second only to Texas in North American diversity. The topographic and habitat complexity of the state has fostered geographic and ecological subdivisions, leading to high species diversity, rich avifaunal communities, and endemism at the species and subspecies levels. A now-classic treatment of California's avifauna is Grinnell and Miller's (1944) *The Distribution of the Birds of California*. Miller updated this in 1951, and in this update he divided the state's avifauna into four faunal groups: these were a Boreal avifauna and three Austral faunas, the Great Basin, Sonoran, and Californian. While Miller himself considered these to be "admittedly somewhat arbitrary" (pg. 582), they have served ornithologists fairly well. Quail Ridge lies within the Californian avifauna, and specifically within the Clear Lake Geographical Area on a peninsula jutting into the Berryessa Reservoir. The Californian avifauna is the richest of the four (at least within the state's boundaries) and includes the majority of endemic forms found in the state. Most of the species in the Californian avifauna are year-round residents, although many exhibit seasonal elevational shifts, and the region supports a rich transient diversity.

The Quail Ridge Reserve lies in the heart of the Northern California coastal oak and chaparral zone, and its steep topography and damp canyons afford diverse habitats supporting an equally diverse avifauna. Since surveys began in 2000, 132 species of birds have been recorded from the Reserve. Of that total, 49 species have either been confirmed, or are suspected, to breed on the Reserve. The species diversity is among the highest recorded in the UC Natural Reserve System in similar habitats. Two other nearby Reserves, Stebbins Cold Canyon and McLaughlin, have similar habitats to Quail Ridge but have a more limited avian diversity of 110 and 120 species respectively. Why does Quail Ridge's diversity appear to be higher? The answer lies with the "lake effect" and dense black oak canyon bottoms that are moist and support numerous species in an otherwise dry setting.

Seasonal Nature of Birds of Quail Ridge

California is blessed with a Mediterranean climate characterized by mild winters and hot summers. As a result the region sees several temporal patterns in avifaunal diversity that affect species composition. These patterns and species of birds can be separated into four groups:

Residents – those species that are found on the Reserve year-round;

Winter visitors – those species that migrate to the Reserve in fall to spend their non-breeding (winter) months and then depart to their breeding grounds either in northern latitudes or higher elevations;

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Summer visitors (neotropical migrants) – those species that migrate to the Reserve in spring to breed and then depart to southern latitudes;

Transients – those species that pass through the Reserve in spring and fall en route to and from their breeding grounds and wintering grounds.

Many of the resident species are among the most characteristic and conspicuous species at Quail Ridge. These include species such as Western Scrub-Jay, Oak Titmouse, Anna's Hummingbird, California Towhee, Wrentit, and California Thrasher. The winter visitors generally arrive from mid-September through October and remain on the Reserve through April. Winter visitors are dominated by flocks of sparrows (White-crowned, Golden-crowned, Fox) and insectivores such as kinglets (Ruby-crowned and Golden-crowned), Chestnut-backed Chickadee, and frugivores that concentrate their foraging on toyon berries (Hermit and Varied Thrushes, American Robins, Cedar Waxwings). Summer visitors start their arrival in early March with the first returning birds comprised of swallows (Cliff, Violet-green, and Tree). These are followed in April and May by several neotropical migrants including Black-headed Grosbeak, Cassin's Vireo, Orange-crowned Warbler, and Pacific-slope Flycatcher.

From mid-April through early June these gifted songsters enliven the dawn chorus of the chaparral and oak woodlands. Summer visitors arrive to breed and depart quickly as the canyon water supplies dwindle by mid-summer. Most depart by mid- to late July each year.



Turkey Vulture, *Cathartes aura*

From late March through early June and again from early September through mid-October, the transient species move through Quail Ridge. During these spring months the combination of residents, returning

breeders, and transient species make exciting bird watching as the Reserve's avian diversity reaches its peak. The combination of flycatchers, warblers, vireos, thrushes, and sparrows can be overwhelming to observers. This migration is timed well to take advantage of the numerous insect blooms, particularly geometrid moths associated with blue and live oaks.

Characteristic of insectivorous birds in winter is the formation of mixed-species foraging flocks. These flocks center on core species that include bushtits and kinglets. Wrens, chickadees, creepers, small woodpeckers, warblers, and vireos key on these aggregations, as they move together in tight groups through the forest canopy. Finding one of these flocks can be an exciting and rewarding activity for bird watchers visiting the Reserve because one never knows what unusual species might be found.

Habitat Use

Part of California's inner coastal region, on the edge of the Central Valley, Quail Ridge offers a unique temperate mix of habitats with a nearby freshwater source in Berryessa Reservoir. The gradations of chaparral, live oak, riparian woodland, and lakeshore constitute a host of microhabitats and ecotones that support Quail Ridge's diverse avifauna. Birds use these habitats for nesting, foraging, and territorial displays. Congeners partition resources based on tree species and/or spatially within the canopy or undergrowth. For example Hutton's and Cassin's Vireos partition resources in the oak woodlands with Cassin's Vireo more abundant in black oak woodlands than in live/blue oak woodlands (4.67 birds/ha vs. less than .5 birds/ha respectively), and Hutton's Vireo more abundant in the live/blue oak habitat but also found in black oak habitats (2.65 vs. 2.02 birds/ha respectively). How the two species partition the black oak woodland is still unknown (Engilis, pers. comm.).



Anna's Hummingbird on *Mimulus* flower.

Each major plant community supports a characteristic assemblage of bird species. Chaparral, which dominates dry, western- and southern-facing slopes of Quail Ridge, often hosts localized, intermittent brush fires and landslides that maintain a mosaic of young and old successional stages dominated by brushy vegetation. A wide variety of small and ground-dwelling birds thrive here, including many California endemics – California Thrasher, California Towhee, and Wrentit. Blue-gray Gnatcatcher, Anna's Hummingbird, Sage Sparrow, Rufous-crowned Sparrow, Common Poorwill, and California and Mountain Quail also use chaparral's dense groundcover.

Black oak woodlands dominate north-facing canyons at Quail Ridge and host birds that favor a denser canopy and relatively moist surroundings. Species such as the Pacific-slope Flycatcher, Red-breasted Sapsucker, Cassin's Vireo, Warbling Vireo, and Pileated Woodpecker reside almost exclusively in these areas of the Reserve. Other inhabitants include the Great-horned Owl, Dark-eyed Junco, Lawrence's Goldfinch, and Winter Wren.

Live and blue oaks are interspersed with black and valley oaks in Decker Canyon, but they also extend further up in elevation to meet the ridges. This transition from covered to more open woodland facilitates use by species that prefer either setting or those that require a variety of habitats. Oak Titmouse, Hutton's Vireo, Western Screech Owl, Lesser Goldfinch, Ash-throated Flycatcher, Blue-gray Gnatcatcher, and California Towhee are some that occur in this more open forest. Open woodland is characterized by larger forest clearings, which are the favored by Western Kingbirds, Wild Turkeys, and Western Bluebirds. Habitat generalists like the Spotted Towhee are widespread from the ridge to Decker Canyon.

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Distinct from these upland communities, the waters and shoreline of Berryessa Reservoir attract a number of aquatic birds. Ospreys, Bald Eagles, Belted Kingfishers, grebes, cormorants, mergansers, and herons rely on the reservoir's supply of fish. Gulls and Spotted Sandpipers occupy the shores, and on the open waters float ducks, geese, and coots. Western and Clark's Grebe, two closely related congeners, appear to partition the lake arms – Clark's Grebes restricted predominately to Wragg Canyon and Western Grebes to other arms and open water around the Quail Ridge peninsula.

California's Endemic Birds

Richly unique in vegetation, the California floristic province extends from the southwestern edge of Oregon to northwestern Baja California and includes more than 70% of California. A Mediterranean climate of hot, dry summers and cool, wet winters facilitates the persistence of a large diversity of ecosystems: coastal sage scrub, prickly pear shrubland, sagebrush steppe, coastal dunes, salt marshes, chaparral, and multiple types of oak woodland and coniferous forest. The mild climate, variety of habitats and landforms, and sheer size of the region make this province host to one of the richest arrays of endemic species in North America.

With oak and chaparral habitats characteristic of the floristic province (Habitat Use section), Quail Ridge provides both breeding and foraging grounds for four of the eleven bird species endemic to the floristic province: California Thrasher, California Towhee, Nuttall's Woodpecker, and Oak Titmouse. In addition, Lawrence's Goldfinches breed only in the oak woodlands of California. Although this species is also found in Arizona and Mexico outside of Baja – and therefore is not a California province endemic in the strictest sense – it may be termed a “breeding endemic.”



Figure 1. Distribution of Oak (black) and Juniper (gray) Titmouse. Note geographic break along High Sierra and Southern Cascades (adapted from Cicero, 2000).

Incipient speciation events have probably increased the number of endemic subspecies in the California floristic province. Geographical barriers, most notably the Sierra Nevada, have facilitated separation of populations within the same species. If the isolation persists for an evolutionarily significant period of time, two distinct species may result. Populations diverge genetically preventing interbreeding were they rejoined. Newly developed pre-zygotic isolating mechanisms such as behavioral and morphological changes may further impede hybridization in the wild. Although difficult to confirm, such events seem to have occurred with multiple sister species, including the California and Canyon Towhees, Yellow-billed and Black-billed Magpies, and Nuttall's and Ladder-backed Woodpeckers.

The case of the Oak Titmouse and Juniper Titmouse may be reviewed as an example of such speciation. The ranges of the two are clearly separated by the Sierra Nevada-Cascade ranges (Fig. 1), a feature that discourages transit with its high altitudes and freezing temperatures. Formerly known together as the Plain Titmouse, these birds were only recently divided into separate species based on morphology, genetics, and vocal characters.

When geographical separation has taken place for a shorter period of time, the process of speciation may be ongoing and much more difficult to confirm. This phenomenon likely occurs quite frequently at local scales and can be disrupted when animals from either population hybridize and thus remix the gene pool. Researchers currently are working to identify species limits genetically, geographically, and morphologically for birds such as the Sage Sparrow, Rufous-crowned Sparrow, and Western Scrub Jay, all with disjunct populations. Such delineation has important implications for species conservation.

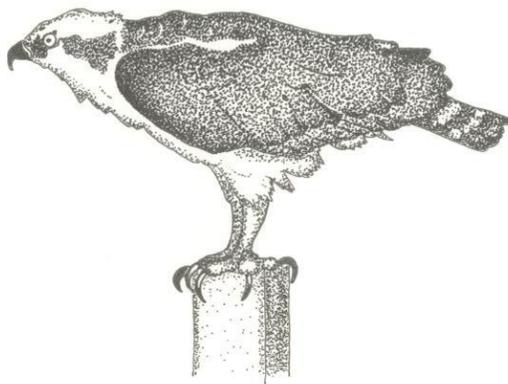
Species and Guild Accounts

Ospreys (Accipitridae)

Always located near large bodies of fresh or saltwater, Ospreys (*Pandion haliaetus*) migrate throughout California, as well as the entire continental United States. In the western U.S., they winter mainly along California's southern coast. However, Ospreys may occupy Quail Ridge year-round, and have been observed in both winter and spring. They nest on the northern tip of Quail Ridge and at other locations around the reservoir.

Osprey numbers declined dramatically in the 1960s due to pesticides, human encroachment on nesting habitats, and shooting. However, the installation of elevated nesting platforms and a ban on the use of DDT have reversed this trend.

Distinct from other hawks, Ospreys have extremely long wings that resemble a "W" in flight. They forage predominantly on fish by plunging into bodies of water feet first. With long legs and highly specialized feet with pads covered in bumpy projections, or tubercles, and sharply curved, elongate talons, they easily grasp and hold on to prey. Bald Eagles (*Haliaeetus leucocephalus*), which cannot catch fish as far below the water's surface, often steal fish from Ospreys.



Osprey.

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Osprey nest near water singly or in colonies, from April to June, typically in live or dead standing trees. Both males and females participate in nest building, and the pair reuses the same nest each year if it is left undisturbed. A female will lay two to four eggs (usually three) yearly. After fledging, the young may wander locally before returning to their natal area at about two or three years of age; they reach maturity at three.

Ground-dwelling birds (Odontophoridae and Phasianidae)

Namesake of Quail Ridge, California Quail (*Callipepla californica*) predominantly inhabit the coastal and interior regions of California. Their abundance on the Reserve is likely due in part to their tolerance for dehydration during periods of high temperatures and drought. However, quail do require standing water for survival during these times. Quail Ridge also hosts Mountain Quail (*Oreortyx pictus*), providing the chaparral and brush cover vital for protection and breeding. Both species are short, plump, mostly ground-dwelling birds, distinguished by black, head-borne plumes, comma-shaped on the California Quail and upwardly erect on the Mountain Quail.



California Quail, *Callipepla californica*

In coastal chaparral mountains and the foothills of the Sierra, Mountain and California quail are sympatric. Since Quail Ridge may be too isolated for Mountain Quail to use as a periodic migration destination (they are short-distance fliers), this species is likely resident. Further study is needed to examine their geographic movements and foraging at Quail Ridge.

Both quail are able to digest vegetation as a consequence of intestinal symbionts obtained when pecking at adult feces as chicks. The California Quail feed mainly on legume leaves, other vegetation, and insects in the winter and then expand their diet to include berries and flowers in the summer. The Mountain Quail, on the other hand, primarily eat winter fruits and berries while in the same range.

Highly gregarious, quail form groups, or coveys, of two to 200 birds that forage collectively and move within a range during the non-breeding season. The males

participate in a dominance hierarchy that may function in mate selection, brood movement, and inter-covey social relationships. The birds maintain contact using various calls. At the onset of the breeding season, the members of a covey break up into pairs to independently raise their young. Females typically make a depression in the ground and line it with grass or stems; alternatively they will nest in lower tree regions or brush piles. Egg laying occurs from late April to early June. A female may lay one to 28 eggs and incubate them while the male stands as sentinel. The eggs are vulnerable to a wide variety of predators, including Western Scrub Jays, gopher snakes, northern raccoons, American Crows, coyotes, and gray foxes. Once the precocial chicks have hatched and gained the ability to roost in trees, the pair and chicks will rejoin the covey.

The third ground-dwelling species – and Quail Ridge’s largest avian inhabitant – is the Wild Turkey (*Meleagris gallopavo*). Wild Turkeys were introduced into California and have spread as a result of limited competition and predation. Forming flocks upwards of 40 to 50 individuals, turkeys spend most of their time walking the landscape in search of forage. They feed on berries, acorns and other nuts, seeds, and some insects in deciduous forest clearings and grasslands. In spring, turkeys form harems before females separate to nest. They lay 8 to 14 eggs in a nest hollow in the ground that is often concealed by grass or shrubs. Once hatched, turkey young follow their parents for approximately two weeks before achieving flight. Despite their largely earthbound lifestyle, adult turkeys fly well enough to evade potential predators and to roost together in low trees.



Wild Turkey, *Meleagris gallopavo*

Woodpeckers (Picidae)

Quail Ridge hosts six resident and two wintering species of woodpeckers. Most are characterized by bold dark and white patterns and red head or facial markings (more often on the male). The first indication of their presence is usually the loud, species-specific calls and tapping. Zygodactylous (two toes pointed forward and two behind) feet and stiff tail feathers facilitate climbing of tree trunks. All species use a strong, chisel-like bill to drum mating calls or territory delineations and to bore holes in trees for forage or nest cavities. Eggs are laid on the bare or chip-lined floor of the cavity, and both parents care for their young. The woodpecker diet consists predominantly of wood-associated insects found within tree canopies or caught aerially. Notable exceptions include the Sapsuckers (*Sphyrapicus* sp.), which specialize on tree sap and the ants that it attracts, and the Acorn Woodpecker (*Melanerpes formicivorus*), which not surprisingly consumes acorns as a significant portion of its diet.

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Contributing to their coexistence at Quail Ridge, each woodpecker species exhibits distinguishing patterns of behavior and habitat use. While most woodpeckers are solitary and monogamous, the highly social Acorn Woodpecker lives communally and participates in cooperative breeding and resource defense. Members of the colony store acorns and other food items in oak woodland “granaries” – trunks or telephone poles bored with holes – that they mutually defend. Although difficult for kleptoparasites to access, many of these nuts are supplementary resources for other species during winter. Another dietary specialist, the Red-breasted Sapsucker (*Sphyrapicus ruber*), provides rows of open sap wells and insects for other species; rows of sapsucker holes can be found in several trees on the bottom of Decker Canyon. A general forest inhabitant, the Northern Flicker (*Colaptes auratus*), is ubiquitous throughout California and the western U.S. The flicker frequents open ground for foraging and will nest in snags or any suitable cavities. Nuttall’s Woodpecker (*Picoides nuttallii*) is another common and endemic resident of California. It is the most prevalent woodpecker at Quail Ridge (density measured at nearly 2 birds/ha) and prefers nesting in dead riparian deciduous trees and foraging in oaks. Nuttall’s occasionally hybridizes with the Downy Woodpecker.

Sharing a similar range and physical appearance with the Hairy Woodpecker (*Picoides villosus*), the Downy Woodpecker (*Picoides pubescens*) frequents riparian and deciduous woodland as well as nearby grassy areas. While the Hairy forages on lower trunks of mature trees, the smaller Downy forages more peripherally on small tree limbs or weed stalks. Thus the Hairy more often resides in mature woods. Both species are uncommon on the Reserve.



Pileated woodpeckers (*Dryocopus pileatus*) in Decker Canyon

Of special mention are the two resident pairs of Pileated Woodpeckers (*Dryocopus pileatus*) at Quail Ridge. Although common to deciduous and mixed-coniferous forests of the eastern United States, the species has declined in the west with the loss of old-growth trees in which they nest. Sizeable nesting cavities and ample forest tracts are necessary to accommodate this large woodpecker. At Quail Ridge, these birds nest in either mature black oak or gray pine, maintaining year-round pair

bonds and territories. This population is among the southernmost found breeding in the state in the Coast range.

Cavity Nesters

Birds from many families – including woodpeckers (Picidae), wrens (Troglodytidae), Ash-throated Flycatchers (Tyrannidae), Oak Titmice (Paridae), Western Bluebirds (Turdidae), Violet-green Swallows (Hirundinidae), and White-breasted Nuthatches (Sittidae) at Quail Ridge – nest in cavities that they find, usurp, or excavate themselves. Cavities afford more shelter from environmental conditions and predators than most open nests, which may explain why cavity-nesters often lay white, unmarked eggs. However, successful breeding is strongly limited by the number of appropriate and available cavities, resulting in high levels of competition for nest sites. Some species favor snags, and others can only excavate old, rotting trees with softened interiors. With such high resource dependence, native cavity-nesting populations are often threatened by more aggressive introduced species including the European Starling and the Brown-headed Cowbird. Starlings steal holes particularly from Western Bluebirds, while cowbirds parasitize a wide variety of species, often ejecting or eating one of the host's eggs.

Tyrant Flycatchers (Tyrannidae)

Quail Ridge provides habitat for six species of tyrant flycatcher, hawking insectivorous birds with a relatively large head, mostly drab plumage, and a rather flattened bill with bristles at its base. Tyrannids are the only North American representatives of a passerine suborder termed the Suboscines, characterized by structural differences in the syrinx – the reason for their throatier, less developed songs. The family is divided into multiple genera, of which *Empidonax* and *Contopus* are worthy of mention.

The genus *Empidonax* includes eleven small, nearly identical flycatchers in North America. All have a slightly lighter front than back, a light eye ring, and two white wing bars. They are so physically similar that often only male song reveals their species, perhaps even among themselves. The Pacific-slope Flycatcher (*Empidonax difficilis*) is the only *Empidonax* species at Quail Ridge, which simplifies its identification. It is common in shaded deciduous woodland, often associated with streams, so it reaches high densities in Decker Canyon. Its call is characteristic of the black oak woodland in spring. Females build nests of grasses, bark, fur, and feathers in a variety of locations: stream banks, cliff ledges, or tree cavities or crevices.

Local birds of the genus *Contopus* – the Olive-sided Flycatcher (*Contopus cooperi*) and Western Wood-Pewee (*Contopus sordidulus*) – are present at Quail Ridge, but only in spring. Both species perch in the upper canopy, the larger Olive-sided Flycatcher situating itself more conspicuously. Quail Ridge is within the breeding range for the pewee, but it has not yet been found except during migration.

Three additional flycatchers are locally common on the Reserve. The Ash-throated Flycatcher (*Myiarchus cinerascens*) strictly nests in pre-formed cavities, which it lines with fur, hair, and feathers. It favors somewhat open habitat within chaparral and oak

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and riparian woodland, and densities are relatively constant from Decker Canyon to the ridge (1.5 vs 1.7 birds/ha). The Western Kingbird (*Tyrannus verticalis*) is partial to dry, open areas that facilitate foraging from a high perch. The kingbird nests in riparian woodland or near grassland and builds a stick nest beside the trunk of a tree. In contrast, the Black Phoebe (*Sayornis nigricans*) chooses a low, conspicuous perch in open areas, always near water, where it bobs its tail incessantly. A tenacious carnivore, the Phoebe hawks insects from near the water's surface, commonly eating bees and wasps. Shaded mud nests are built on or under ledges, often directly above a stream. It is common in Decker Canyon and along the lakeshore. Birds will range into the open chaparral to forage.

Vireos (Vireonidae)

Quail Ridge is inhabited by three sympatric species of vireos – the resident Hutton's and the summer visiting Cassin's and Warbling. All are similarly small, olive-colored birds with rounded heads and short bills. They all build cup nests near the ends of live tree branches or chaparral, and both sexes incubate the eggs. In addition, they all will join mixed-species flocks and expand their diets to include fruits in the winter.

The only non-migratory vireo in the western U.S., Hutton's Vireo (*Vireo huttonii*) is typically a woodland resident but may disperse locally. This sedentary tendency has facilitated local divergence of the species – there are up to twelve subspecies – and is the result of an affinity for evergreen trees. The Pacific Hutton's Vireo occupies the western half of California year-round. These birds forage in the middle to upper tree regions, actively gleaning insects and some arthropods from leaf surfaces.

Cassin's Vireo (*Vireo cassinii*) formerly was considered one of nine subspecies of the Solitary Vireo (*Vireo solitarius*), until cytochromic (Murray et. al. 1994) and allozymic (Johnson 1995) testing substantiated its designation as a separate species in 1998 (Cicero and Johnson 1998). Cassin's Vireos breed throughout most of California, with the exception of the Mojave Desert and Central Valley, and they are confirmed breeders at Quail Ridge. Although both females and males strongly defend their clutch of 3-5 (usually four) eggs, their nests are moderately susceptible to parasitism by Brown-headed Cowbirds (one nest at Quail was found to be parasitized). Cassin's Vireo is a deliberate foliage gleaner.

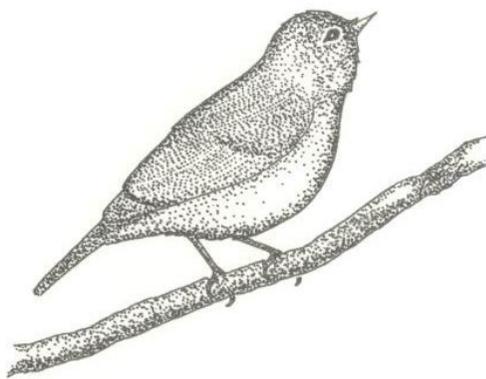
Two of five subspecies of warbling vireos occupy the United States: a western form (*Vireo gilvus swainsonii*) and an eastern form (*V. gilvus gilvus*) that occasionally enters California. The western form breeds along the middle and northern California coast and in parts of the Sierra, and winters in southern California and Mexico. It has not been confirmed as a breeder at Quail Ridge. To catch insects, warbling vireos will frequently employ hawking, stalking, and hovering in addition to gleaning. Although they prefer upper and middle strata, they will forage from just above the ground to near the top of the canopy. Warbling Vireos are frequently parasitized by Brown-headed Cowbirds; *V. g. swainsonii* is particularly susceptible because it has not developed the defense of puncturing and ejecting cowbird eggs like its eastern counterparts.

Bushtit (Aegithalidae)

Year-round residents of Quail Ridge, Bushtits (*Psaltriparus minimus*) are prevalent in live oak and chaparral habitats both on the ridges and in Decker Canyon. In California they inhabit all biomes except the High Sierra and the southeastern desert region. Bushtits are small, unmarked, gray-brown birds with a short bill and a relatively long tail. Adult females have cream-colored eyes, whereas those of juveniles and adult males are darker. Commonly found in loose flocks, Bushtits emit a high-pitched twittering from trees or shrubby thickets. They also are highly gregarious with other species, forming mixed flocks with kinglets, wrens, and chickadees in the winter. Bushtits forage by gleaning insects and spiders from foliage. They breed from April to July and have a clutch size of five to 13 eggs. Bushtits construct gourd-shaped nests of twigs, moss, leaves, and lichen that are bound with spider silk and suspended from trees or bushes.

Transient Warblers (Parulidae)

In addition to the resident Orange-crowned Warbler (*Vermivora celata*), five warbler species migrate through Quail Ridge in the spring and fall, and one species visits in the winter. The Orange-crowned is the only warbler confirmed to breed at Quail Ridge, and although a few Orange-crowned's stay throughout the year, the majority withdraw and/or migrate south in the fall and winter. They frequent brush and the outer regions



Orange-crowned Warbler, *Vermivora celata*

of low trees in chaparral, deciduous woodland, and riparian woodland. In addition to insects, Orange-crowned's may eat fruit, nectar, and tree sap from sapsucker wells. Those that breed at Quail Ridge construct cup nests of fine materials, concealed on or near the ground. In contrast, the uncommon Yellow-rumped Warbler (*Dendroica coronata*) comes to Quail Ridge exclusively in the winter. Found in brushy habitat and open woods, these opportunistic birds often join in mixed-species flocks.

The remaining warbler species use the Reserve as a stopping point on their way to and from breeding grounds in the northern U.S. and Canada, and wintering grounds in Mexico, Central America, and South America. The peak diversity and numbers are found in the last week of April and first two weeks of May. These migrants critically rely on locations like Quail Ridge for food and rest in the spring and fall. All are strongly insectivorous, typically surface gleaning and hawking, though many also eat berries. The Nashville Warbler (*Vermivora ruficapilla*) favors brushy areas and lower regions of oak trees. The Yellow Warbler (*Dendroica petechia*) similarly is found in low trees but also at woodland edges, particularly in riparian areas. Hermit (*D. occidentalis*), Townsend's (*D. townsendi*), and Black-throated Gray (*D. nigrescens*) Warblers are

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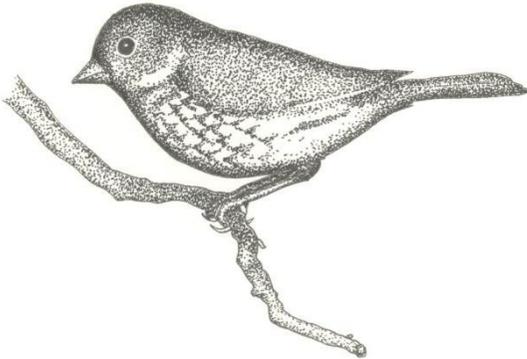
birds of the canopy, actively foraging on small insects. Lastly, Wilson's Warblers (*Wilsonia pusilla*) prefer dense brush near water. For many of these species, males commonly forage higher than females to gain prominence to advertise themselves, while females reduce their visibility.

Towhees (Emberizidae)

Spotted (*Pipilo maculatus*) and California Towhees (*P. crissalis*) reside year-round in the riparian, oak woodland, and chaparral understories of Quail Ridge. While the Spotted is widespread throughout the western U.S. and all but the southern interior of California, the California Towhee is restricted to western California and Baja. At Quail Ridge, similar numbers of each have been found on the ridge, but the Spotted is more abundant in Decker Canyon.

Towhees are distinguished by their foraging behavior: using both feet in unison, a bird will scratch loose ground debris behind itself to reveal underlying food items. Both species are omnivorous, changing their diet from insects and arthropods in the breeding season to seeds and fruits in the non-breeding season. However, the Spotted is more insectivorous, and the California more granivorous. Both towhees also can be

found foraging in mixed-species flocks with smaller sparrows during the winter.



Fox Sparrow, *Passerella iliaca*

Breeding occurs mid-April to late May for these monogamous, highly territorial birds. The female Spotted Towhee builds a cup nest into the ground litter or upon elevated vegetation, typically at the edges of thickets. The California Towhee constructs a bulky stick nest in a shrub or low tree, typically

never on the ground. Both females will lay 3-5 eggs. Spotted Towhees are commonly brood parasitized by Brown-headed Cowbirds and California Quail, while California Towhees are uncommon cowbird hosts. Western Scrub Jays, common king snakes, and California ground squirrels may also eat eggs.

Winter Sparrows (Emberizidae)

Quail Ridge serves as wintering grounds for three species of sparrow: Golden-crowned (*Zonotrichia atricapilla*), White-crowned (*Z. leucophrys*), and Fox (*Passerella iliaca*). Common throughout California, each inhabits riparian, chaparral, and deciduous undergrowth, ground foraging for insects, seeds, and berries. They breed in the northwestern U.S. or Canada, and each forms a cup nest on the ground or on low woody plants.

Throughout the winter, crowned sparrows congregate in stable mixed flocks of 10 to 50 birds that may or may not include other passerines. These sparrows show strong fidelity to their wintering grounds, often returning to the same site every year. Impetus for flocking likely includes predator defense and increased foraging efficiency.

The White-crowned Sparrow has the widest North American distribution, while the Golden-crowned is restricted to the western-most U.S. and Canada. The White-crowned uniquely favors brushy, less forested areas and uses the most diverse array of hunting strategies: hawking, gleaning insects from surfaces, and ground foraging further from cover. It is less common at Quail Ridge than the Golden-crowned Sparrow.

Also widespread throughout the U.S. and Canada, the Fox Sparrow hosts multiple physically and behaviorally distinct populations. Two of these potentially overwinter at Quail Ridge the Sooty (common) and, Slate-colored (rare) races. These variants respectively breed in northern California north to Alaska along the coast and in the Interior Rocky Mountains. As with towhees, this large sparrow uses both feet to kick leaves aside to forage.

Potential Research Topics

Quail Ridge provides prime opportunities to study birds of the California Floristic Province. With healthy populations of endemic and congeneric species, Quail Ridge is one of few locations that could provide information on the life history, ecology, and biogeography questions regarding such species. Fields of research are varied and outlined below:

ecology (niche separation of congeneric vireos, goldfinches, and towhees; parasitism, resource partitioning, species interactions);

behavior (mixed species foraging flock dynamics, foraging behavior of several species, guild structure);

genetics and phylogeny (lend locality for allospecies research);

energetics and phenology (arid-adapted endemics);

patterns of geographic movement and migration (banding studies on migrants, site fidelity, etc);

population variations within species (e.g. vocalizations, plumage, behavior).

