Historical and Current Status of the Greater Roadrunner in the Central Valley and Surrounding Foothills of California

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ABSTRACT

The Greater Roadrunner (*Geococcyx californianus*) is an uncommon and sparsely distributed resident of the Central Valley and the surrounding foothills, with most observations around the edges of the valley and in the lower foothills of the Sierra Nevada and Coast Ranges. The species is most frequently encountered along the perimeter of the San Joaquin Valley. It is patchily distributed around the Sacramento Valley with most observations on the western side of the valley in the lower foothills of the Coast Range. Some researchers have suggested that the roadrunner was previously more common in this region, however, no specific sources were cited to confirm that. We attempted to determine the historical status of this species in this region from pre-European times to the present. We consulted publications about the material culture, myths, and rituals of the indigenous people of the area to gain some understanding of the status prior to and during the early days of European settlement. We reviewed specimen records, published observations of 19th and early 20th century naturalists, reports of 19th century expeditions, and accounts of early explorers and residents of the region. To assess the recent status of this species, we analyzed data from Christmas Bird Counts, Breeding Bird Surveys, Breeding Bird Atlases, and eBird. Due to the small number of detections of this species on these surveys, it was not possible to determine statistically significant trends. However, these data all suggest that the Greater Roadrunner has declined in the past few decades. Our review of historical information suggests that this species was never more than an uncommon to rare resident, patchily distributed within the region.

Any attempt to understand the historical status and distribution of bird species in California's Central Valley is challenging (Engilis 2021). Here, we review available historical and recent information on the status of the Greater Roadrunner (*Geococcyx californianus*, hereafter roadrunner) in the Central Valley and surrounding foothills of California. We also highlight many of the available historical references we consulted as a contribution to future evaluations of the status of other species in this region.

Prior to the middle of the 20th century, the Central Valley and surrounding foothills region was largely ignored by naturalists (Engilis 2021). During the period of Spanish and Mexican colonization from the 18th into the early 19th centuries, settlement and exploration were limited almost entirely to coastal areas. The Central Valley was viewed as an area of little value, a swampy, malarial wasteland through much of the fall and winter, hot and dry in the summer, and inhabited by hostile natives (Faragher 2020). Few naturalists visited California in this early period and almost none entered the Central Valley.

The first naturalist to visit California was likely Spaniard Alejandro Malaspina who stopped at Monterey and San Francisco in 1791 during a coastal voyage but never ventured inland (Fischer 2001). At the end of the 18th century, two able Spanish naturalists, José Longinos Martinez and José Mariano, described and illustrated many plants and animals (Engstrand 1998). However, they spent nearly all their time in southern California from San Luis Obispo County southward, apparently never entering the Central Valley (Engstrand 1998). Archibald Menzies briefly visited coastal areas of California as part of the George Vancouver 1792 Pacific coast expedition (Moring 2002).

During 1826 to 1828, British and French expeditions each visited ports from San Francisco south (Palmer 1917, Alden and Ifft 1943). The British expedition included naturalists Alexander Collie and George Lay, but they also stayed mainly close to the coast (Fischer 2001). The French expedition included Italian physician and naturalist Paola Botta, who explored and collected in coastal California from Bodega Bay to San Diego, but apparently never ventured further inland in northern California than western Solano County (Palmer 1917). He collected the type specimen of the roadrunner somewhere in southern California (Palmer 1917, Fischer 2001). David Douglas spent nearly three years in California from 1829–1832, but his explorations were mainly confined to coastal areas from Monterey to San Diego, with a few excursions into the Coast Range (Mitchell and House 1999, Moring 2002). Likewise, Thomas Nuttall's visits in the 1830s were limited to coastal regions near Monterey, Santa Barbara, San Pedro, and San Diego (Graustein 1967, Moring 2002).

During much of the 1840s, William Gambel explored and collected in the southern California deserts and coastal areas (Fischer 2001). Gambel was also on an 1849 expedition that traversed the Sierra Nevada and into its western foothills (Spencer 1986, Moring 2002), but he contracted typhoid fever and died in Plumas County before reaching the foothills or Central Valley region (Spencer 1986). Apparently, the only naturalist to visit the Central Valley in the first half of the 19th century was Titian Ramsay Peale (Spencer 1986), the son of the well-known artist and naturalist, Charles Peale. His observations are detailed in the section *Roadrunner Status Assessment* below.

Many more naturalists spent time in California in the second half of the 19th century (Fischer 2001), though only a few visited the Central Valley. Prominent ornithologist Lyman Belding lived in Stockton in the northern San Joaquin Valley from the late 1880s until his death in 1917 (Fisher 1920) and published on the region's avifauna (e.g. Belding and Ridgway 1879, Belding 1890, 1891, 1901a, 1901b, 1901c). In the 1850s, an expedition to survey potential railroad routes included limited natural history work, some of which was in the Central Valley (Newberry 1857, Baird 1858). By the early 1900s, naturalists (including Joseph Grinnell) apparently considered the Central Valley too altered by human activity to justify systematic surveys (Trochet and Engilis 2014). Given this limited source of natural history information, any assessment of the historical status of most birds in the Central Valley must rely on scant and largely anecdotal evidence, including observations (or lack of observations) from non-naturalists who visited or lived in the area.

The Roadrunner Problem

Engilis (2021) identified 44 priority bird species whose historical or recent status in the Central Valley is incomplete or may be inaccurate. Among those was the roadrunner, a species widely distributed from northern Mexico throughout the southwestern U.S., reaching its northernmost limits near the northern edge of the Central Valley (Hughes 2011). The roadrunner is currently a rare to uncommon and highly localized resident in this region (Hughes 2011), mostly at the edges of the valley and into the low surrounding foothills. Some 20th century accounts suggest that this species was historically more common in and around the valley (McCaskie et al. 1979, Verner and Boss 1980). Grinnell and Miller (1944) characterized the species as "now greatly reduced in numbers or even gone entirely" in areas where it was formerly common that were "thickly settled or heavily hunted". McCaskie et al. (1979) noted that it "no longer occurs on the floor of the Central Valley" and Verner and Boss (1980) asserted that it was "apparently more common in the past." However, none of these reports provide citations to support a formerly more abundant population. Our intent was to search for any information that might confirm or refute the assertions that the roadrunner was once significantly more common than presently.

METHODS

We attempted to gain a better understanding of the historical status and distribution of the roadrunner in the valley and surrounding foothills by focusing on four historical periods: pre-European, early 19th century, late 19th century into the early 20th century, and late 20th century to the present. We relied on sources that describe the material culture, myths, and rituals of the indigenous people living in the valley to assess pre-European settlement times. For information about the 19th and early 20th century status, we used natural history accounts, specimen records (Table 1), and accounts from both naturalists and non-naturalists. Besides the museums noted in Table 1, we searched available specimen records using the online archives Arctos (https://arctos.database.museum/home.cfm) and VertNet (http://www.vertnet.org/). Sources for data on the more recent period included Christmas Bird Counts (National Audubon Society 2020), Breeding Bird Survey raw data (https://www.pwrc.usgs.gov/bbs/rawdata/), Breeding Bird Atlases, published natural history accounts, and eBird data (eBird Basic Dataset 2024). We used data from 36 Christmas Bird Count circles and ten Breeding Bird Survey routes conducted in the region between 1973 and 2022. We also reviewed regional reports from American Birds and North American Birds (American Birding Association archives). We defined the region of interest (Central Valley/foothills) as the Central Valley floor and the surrounding foothills of the Sierra Nevada and Coast Range below the elevation where dense woodlands occur (which can occur as high as 1000 m in the southern Sierra Nevada foothills).

RESULTS

Pre-European times

Fossils of the roadrunner dating back more than 30,000 years are found from California to Texas, including multiple individuals in McKittrick in Kern County, near the southern end of the Central Valley (Larsen 1930, Howard 1962). Therefore, a bird essentially identical to the modern roadrunner (Larsen 1930) was present in the region during the Pleistocene. Throughout the core of its current range in western Texas, New Mexico, Arizona, and southern California, the roadrunner figures prominently in the myths, rituals, and the art of the native peoples (Dobie 1939, Maxon 2005). Among the Pueblo peoples of New Mexico, the roadrunner was associated with courage, strength, and endurance, and its "X"-shaped tracks (two toes forward and two backward) were thought to convey the power to confuse enemies by disguising which direction it had taken (Maxon 2005). The roadrunner's reputation for bravery among the Zuni people of New Mexico was enhanced by its habit of preying on rattlesnakes. Roadrunner feathers were used for courage in Zuni ceremonies (Parsons 1924, Maxon 2005), and members of the Zuni roadrunner clan were responsible for healing certain kinds of ailments.

We presumed that if the pre-European roadrunner abundance in the Central Valley and foothills was even somewhat similar to that of the core region, this distinctive bird would also be featured in many aspects of the cultures of the indigenous Central Valley tribes.

California's many native tribes speak (or spoke) many languages. Prior to European settlement, the Central Valley and surrounding foothills were mostly occupied by people using four different dialect groups: Wintun, Maidu, Miwok, and Yokuts (Heizer and Whipple 1971, Lightfoot and Parrish 2009). The Wintun mainly occupied the northernmost part of the Sacramento Valley and the Coast Range to the west (Heizer and Whipple 1971). The Maidu occupied the northern Sierra Nevada and the foothills to the east (Dixon 1905, Faye 1923, Heizer and Whipple 1971). The Miwok were widespread from coastal areas north of the San Francisco Bay, the Sacramento/San Joaquin Delta, and across the valley and into the central Sierra (Barrett 1908, Barrett and Gifford 1933, Heizer and Whipple 1971). The Yokuts peoples occupied most of the San Joaquin Valley and the coast range on the west and the Sierra Nevada on the east (Heizer and Whipple 1971).

The Miwok sometimes used roadrunner feathers for fletching arrows, believing that the swiftness of the bird gave these arrows special properties (Barrett and Gifford 1933), but Red-tailed Hawk (*Buteo jamaicensis*) feathers were much more commonly used (Lightfoot and Parrish 2009). Dixon (1905), Faye (1923), and Gifford (1927) all mention the Maidu's uses of many different feather types for dress, decoration, healing, and rituals including geese, ducks, swans, California Quail (*Callipepla californica*), Turkey Vultures (*Cathartes atratus*), hawks, eagles, Northern Flickers (*Colaptes auratus*) and other woodpeckers, jays (either Steller's, *Cyanocitta stelleri*; or California Scrub-Jay, *Aphelocoma californica*), Yellow-billed Magpie (*Pica nuttalli*), and American Crow (*Corvus brachyrhynchos*). However, there is no mention of roadrunner feathers being used by the Maidu. Heizer and Whipple (1971) list many bird species eaten by the Yokuts of the San Joaquin Valley, including many waterbirds (waterfowl, pelicans, shorebirds), but roadrunners were not mentioned as being used for food or any other material purpose. Maxon (2005) compiled a list of names ascribed to the roadrunner by tribes in New Mexico, Arizona, southern Nevada, and southeastern California, but did not list any roadrunner names used by the Central Valley tribes. However, the roadrunner was apparently known as *uiuyu* or *uuyuyu* to the Miwok (Barrett and Gifford 1933 and Broadbent 1964, respectively) and as *oi-oi* to the Yokuts (https://steemit.com/legend/@pinkspectre/how-the-roadrunner-got-his-eye-spots). Merriam (1908) described various totem animals associated with California native tribes including 37 animals used by the southwestern Maidu, but the roadrunner was not among them. Two stories about fire, including how the roadrunner got the red spot behind its eye, are associated with the

Yokuts (Kroeber 1907, https://steemit.com/legend/@pinkspectre/how-the-roadrunner-got-his-eye-spots).

Petroglyphs of California tribes were, except those of some Great Basin tribes, almost exclusively abstract rather than representational (Heizer and Whipple 1971), and no petroglyphs depicting a bird resembling the roadrunner are reported from the Central Valley or foothills (Payen 1959, Heizer and Whipple 1971, Lightfoot and Parrish 2009). Native California place names, which often commemorate animals, do not include any named for the roadrunner (Gudde 1969).

The few mentions of the roadrunner in the sources we consulted on the native peoples of the valley and foothills suggest that it was uncommon in this region in pre-European times, and it almost certainly was not as common as in Texas, New Mexico, Arizona, or southern California.

Early 19th Century (1800–1848)

Although Europeans had been visiting California since the early 1500s, the first significant settlement did not begin until the late 1700s (Faragher 2020) with the establishment of the first Spanish missions in southern California. Therefore, we chose 1800 as the start of the European era. This century can be most logically divided into two halves by the discovery of gold in 1848. As Faragher (2020) noted, the California gold rush was "one of those rare events that fracture the flow of history, opening a chasm between what came before and what came after."

Until Mexican independence in 1821, Spanish settlements did not expand much beyond the coastal missions, and the eastern part of the state (including the Central Valley and foothills) remained mostly unsettled and unexplored by non-native peoples. After independence, the Mexican government began making land grants further inland and the first large cattle-raising ranchos appeared, a few of which were in and around the valley.

As noted, the only account of birds from a naturalist who visited the Central Valley prior to 1849 was from Titian Peale (Poesch 1961) who was with the Wilkes expedition that visited the area in the fall of 1841 (Wilkes 1958). The expedition entered the valley from the north and followed the Sacramento River south, venturing into the eastern parts of present-day Yuba and Butte counties. After visiting Sutter's settlement at the confluence of the Sacramento and American rivers, the expedition explored the easternmost Sacramento and San Joaquin counties and westernmost Amador and Calaveras counties, then crossed the valley westward and through the Coast Range near Altamont Pass in western San Joaquin and eastern Alameda counties before entering the Santa Clara Valley and proceeding to San Francisco. Thus, the expedition covered extensive parts of the roadrunner's

current range including the eastern edges of the Sacramento and San Joaquin valleys, the area around the Sutter Buttes, and the lower slopes of the Coast Range in San Joaquin County.

Peale's journals (Poesch 1961) from this period suggest that his collecting was limited by a short supply of shot which was needed more for obtaining meat for the expedition than for science. What few specimens he may have collected were either lost during the expedition or in transit back to the east. His notes express astonishment at the "innumerable" numbers of ducks and geese in the valley. He mentioned 27 different bird species, but the roadrunner was not among them. It seems likely that such a distinctive species, and one likely unfamiliar to Peale, would have warranted a mention. The almost complete lack of small passerines among his observations is likely a testament to the lack of useful optics and Peale's reluctance to shoot anything not meaty enough for the pot.

Charles Wilkes, leader of the expedition, published his journals from that time (Wilkes 1958). They are mostly concerned with his observations about the geography, politics, and people of the area. He was astounded by the wildlife of the Central Valley, but the only birds he mentioned were California Quail and "wild-fowl".

Accounts of explorers and settlers who ventured into the area during this time and left written records include Jedediah Smith, Jonas Suter (John Sutter), John Bidwell, John C. Fremont, and Kit Carson. Except for Jedediah Smith, their writings include almost nothing about wildlife, other than animals meant for dinner or the pocketbook. Sutter received a nearly 100,000 ha land grant in the southern Sacramento Valley in 1838 and lived out his life in the area but left no accounts of the birds of this area (Watson 1932). Fremont, an avid botanist, mounted a number of western expeditions and traversed the length of the Central Valley in the 1840s (Fremont 1849a, 1849b). Although he contributed many hundreds of plant specimens to the Smithsonian Museum, he apparently collected no birds, and we could find no mention of the roadrunner in his writings. John Bidwell explored and lived in the Sacramento Valley and western foothills of the Sierra Nevada from the late 1840s until his death but also left no mention of the roadrunner (Quaife 1928, Bidwell 1964). Kit Carson's autobiography includes little about his time in the Central Valley in the 1840s and no mention of the roadrunner (Quaife 1966).

Jedediah Smith showed a strong interest in wildlife natural history. He was the first U.S. citizen to visit California, leading a party from Idaho in 1826, south through Utah and Nevada, into southern California and then north over the Tehachapi range, through the eastern edge of the San Joaquin Valley, and as far north as the American River in Sacramento County (Brooks 1977). He then crossed the Sierra Nevada in 1827, becoming the first non-native to

cross that range. Although his main purpose during these travels was to trap beavers, he noted many bird species and showed himself to be a careful amateur observer. He gave an excellent description of a Gambel's Quail (*Callipepla gambelii*) encountered in southern Nevada, nearly 20 years before the type specimen was described and named by William Gambel (Gambel 1843). While in the Central Valley, he described the Acorn Woodpecker (*Melanerpes formicivorus*) and its acorn caching, apparently the earliest observation of this species' behavior by a non-native. He described Band-tailed Pigeons (*Patagioenas fasciata*), Yellow-billed Magpies, and noted the presence of Mallards (*Anas platyrhynchos)*, "white brant" (presumably Snow Geese), Mourning Doves (*Zenaida macroura*), eagles, and "a large bird which I supposed to be a vulture or condor" (Brooks 1977). Notably, while spending much time in valley and foothill areas where roadrunners are currently resident, he did not describe this distinctive species, which almost certainly would have been new to him prior to his expedition.

Having only the accounts of Peale and Jedediah Smith to go by, it is difficult or impossible to draw any conclusions about the roadrunner's status in this period. The fact that both traveled through areas of good roadrunner habitat and made no mention of the bird, suggests that it was likely uncommon to rare at the time.

Late 19th Century into the early 20th Century (1849–1950)

The second half of the 19th century in California began with the discovery of gold in 1848, just a month before Mexico ceded the state to the U.S. These two events brought huge numbers of people west seeking to exploit, as well as understand, what this new acquisition had to offer. The non-native population of California increased nearly ten-fold in just over two years (Faragher 2020). The native populations began a dramatic decline due to displacement, loss of game food resources, disease, and extermination, resulting an irretrievable loss of knowledge of pre-European conditions. This increase in immigration and interest provided the first documented observations of the roadrunner in the Central Valley and foothill region and the first assessments of its status and distribution.

The first "naturalist" who visited the Central Valley after 1848 was John Woodhouse Audubon, the son of John James Audubon (Audubon 1905). Audubon joined, then led a party to California by way of Texas, northern Mexico, and Arizona to San Diego and then northward into the Central Valley, traveling mostly along the eastern edges of the San Joaquin Valley and western Sierra Nevada foothills between November 1849 and May 1850. He mentioned 23 species encountered in the Central Valley and foothills. However, in spite of spending much of this time in excellent roadrunner habitat in the lower Sierra foothills, roadrunners do not appear in Audubon's journals.

J. Goldsborough Bruff, although not a trained naturalist, was a draftsman, artist, and keen observer who recorded his experiences in the Sacramento Valley and foothills of the northern Sierra from spring of 1849 through summer of 1851 (Bruff 1949). Bruff traveled back and forth across the Sacramento Valley, spent time in the valley near the Sutter Buttes and at Peter Lassen's Rancho near the Sacramento River in southeastern Tehama County, and in the lower foothills of eastern Butte and Yuba counties. He mentions 17 bird species (most identified just to family) but not a roadrunner.

An interest in extending railroad access to and along the west coast prompted an ambitious expedition from 1853 to 1854 to survey for potential routes (U.S. War Department 1855). The surveys covered a large swath of the western U.S. from Chicago to Washington, across the plains and Great Basin to northern California, and through the southwest to southern California. Potential routes were also surveyed north from southern California, including the length of the Central Valley from Tejon Pass through Redding. Although focused mainly on information for railroad routes, the expeditions included naturalists who collected plant and animal specimens. Along the southern route and north into California, naturalists collected 23 roadrunner specimens in Texas, New Mexico, Arizona, and California (Newberry 1857, Baird 1858). Of those, only a single specimen, collected by John Newberry in the low foothills in western Calaveras County (Baird 1858), was from the Central Valley or surrounding foothills. This single specimen is the first physical documentation, other than the Pleistocene fossils in Kern County, of the presence of the roadrunner in the Central Valley and surrounding foothills. Newberry's (1857) expedition notes cite a report of a roadrunner seen near Redding at the northern edge of the Central Valley. He described the species as "common in southern California," suggesting that they were less so in the north. He described the roadrunner's distribution in the Central Valley and foothills as "limited to hilly, chaparral districts, more common on east side of the valley, throughout the eastern hills, becoming more common to the south."

Ridgway's (1877) account of the 1867 King Expedition along the 40th parallel from Sacramento to Salt Lake City mentions collecting over 1,500 ornithological skins and eggs, none of which were roadrunners. However, for unexplained reasons, he reported that it was not possible to collect during the journey from Sacramento into the Sierra Nevada, the only portion of the expedition route where roadrunners occur. He reported observing 70 bird species in and around Sacramento, but not the roadrunner (Ridgway 1877, Harris 2017). The Whitney expedition (or California Geological Survey) covered much of the Central Valley and adjacent foothills and collected many plant specimens, but apparently no bird specimens (https://collections.nmnh.si.edu/search/botany/?q=ex+Geological%20Survey%20of%

20California). William Brewer was the primary naturalist with this expedition from 1860 to 1864. His extensive notes from that time (Brewer 1966) include no mention of the roadrunner.

Baird et al. (1874) described the North American status of the roadrunner as "abundant throughout mesquite regions" but makes no mention of its Central Valley status. The only general description of this species' 19th century status in the state is from Belding (1890) who characterized it as common to abundant in southern California, rare in the valleys and foothills, and rare in Central California. Joseph Grinnell's assessment of the roadrunner's California distribution (Grinnell 1907) mentions that it occurs on both sides of the Central Valley, but not in the "often swampy" central portions. He makes no mention of it having been more abundant previously. Hoffmann (1927) described the statewide status as "common (rarer northward) in valleys and brush-covered foothills north to … Shasta County." Grinnell and Miller (1944), mainly referring to the southern California status, considered the species as "Under optimum conditions, common, in the sense that 8 or 10 individuals may be seen along roads in a half day's auto trip. In parts of the state where formerly common, and which have been thickly settled by people, or heavily hunted, now greatly reduced in number or even gone entirely." Townsend (1887) characterized the roadrunner as "rare in northern California", but "not uncommon near Red Bluff".

We also have several qualitative regional status assessments from the late 1800s and early 1900s. Residents of the foothills of western Tehama County in the northeast corner of the Central Valley reported seeing roadrunners in many places "below the 3300 foot level" (Grinnell et al. 1930). Nelson (1875), who collected and observed the bird life around Nevada City from late fall into winter of 1872, with ventures into the open country of the lower foothills where roadrunner habitat exists, did not observe any roadrunners. He mentioned that he "was told of their rare occurrence. Did not hear of any being seen for several years prior to my visit." Lyman Belding spent much of the late 19th and early 20th centuries in the Central Valley. During more than 20 years (1857–1879) he found the roadrunner a "rare resident" of the chaparral regions of the foothills of Calaveras and Yuba counties and on the "Marysville" (presumably Sutter) Buttes, despite careful searching of all these areas (Belding and Ridgway 1879). After retiring to Stockton on the valley floor, he continued to publish his findings, noting the presence of 123 bird species observed in the vicinity of Stockton (Belding 1891, 1901a, 1901b, 1901c), but with no mention of the roadrunner.

H. Ernest Adams, who kept careful records of the birds he observed in Placer County during the late 1800s and early 1900s (Adams 1909), characterized the roadrunner's status in Placer County as, "Occasionally met with in the lower Sonoran Zone (i.e. foothill woodland/chaparral zones) has

been noted both summer and winter just north of Auburn." Bolander (1907) spent May and June travelling in eastern Yuba County and the lower foothills of Placer and Nevada counties, keeping careful records of all the birds he observed, including details of their nesting behaviors. He noted the presence of 28 species, but no roadrunners. In this same area, Richards (1924) found the roadrunner, "Resident in limited numbers in the southern part of the Grass Valley district" of western Nevada and Placer counties. Hutchings (1888) and Bunnell (1892) mentioned that roadrunners were present in the foothills west of Yosemite National Park, but neither described its local abundance. Grinnell and Storer (1924) characterized the roadrunner as a sparse resident of the lower foothills of the Sierra Nevada and note that "only small numbers were found in the Yosemite region". Stebbins and Stebbins (1954) described the roadrunner as a "sparse resident in foothills near western edge of (Yosemite) park", and Gaines (1992) cites a single observation in Yosemite Valley in 1924 as the only record for the park. Accounts from the late 1890s into the early 1900s (Goldman 1908, Linton 1908, Tyler 1913) note the presence of roadrunners in the vicinity of historical Tule Lake in the southern San Joaquin Valley, a region that included extensive areas of alkaline saltbrush (*Atriplex* spp.) habitat at the time.

Rollo Beck was an avid and exceedingly prolific collector of bird specimens and spent much of the first half of the 20th century living and collecting in the San Joaquin Valley (Swarth 2024). He contributed approximately 20,000 bird specimens to museums, including more than 9,000 to the California Academy of Sciences (Beck Collection 2008, Swarth 2024, E. Pandolfino unpublished data). The California Academy of Sciences ornithology collection includes more than 2,000 bird specimens he collected in the Central Valley (https://www.calacademy.org/scientists/ornithology-mammalogy-collection). He also kept a sizable number of specimens for his own collection, apparently including the only roadrunner he collected (in western Merced County in 1937; Beck Collection 2008). His field notes include no other mention of encountering roadrunners in the region (Beck Collection 2008) although he spent time in the western edges of Merced County where roadrunner habitat exists and the species has been recorded regularly in recent years.

All our information about the roadrunner's status during this period is anecdotal, but it suggests that this bird was uncommon to rare and patchily distributed at the edges of the valley and in the low foothills (Figure 1; Table 1).

Late 20th Century to the present (1950–2024)

Quantitative data on the status and distribution of the roadrunner in this region did not become available until the late 1900s. Data from Christmas

Bird Counts (National Audubon Society 2020) and Breeding Bird Surveys (https://www.pwrc.usgs.gov/BBS/RawData/) from the early 1970s through early 2020s are consistent with the qualitative descriptions from the late 19th and early 20th centuries (Figure 2).

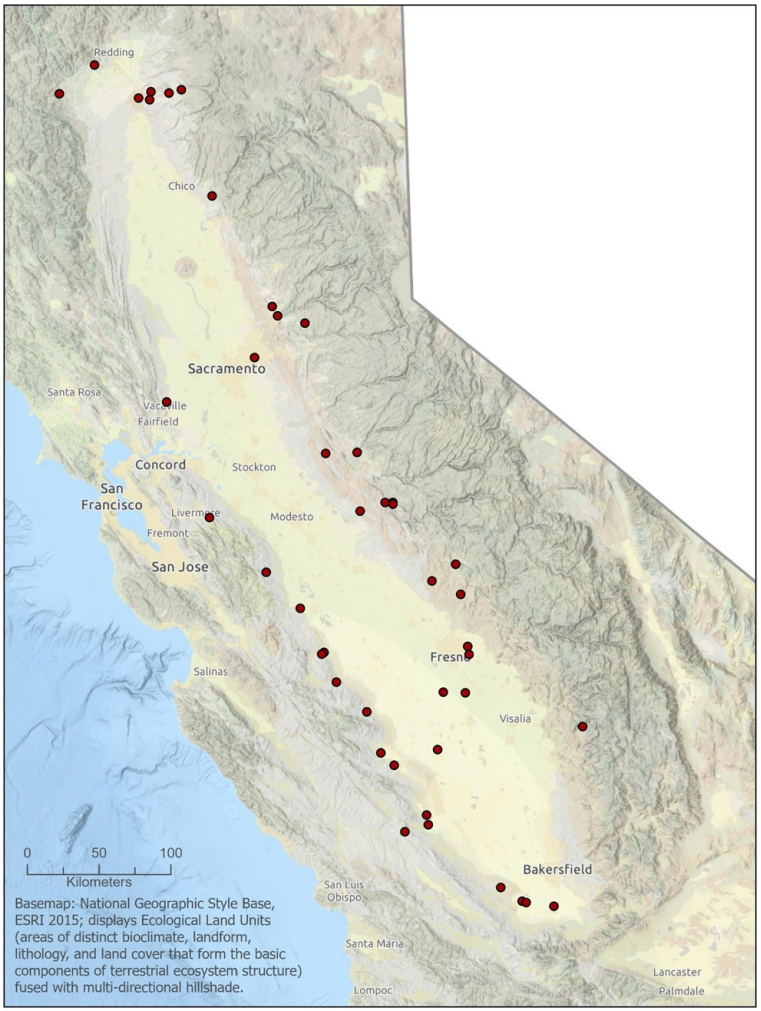

Figure 1. Locations of specimens or well-documented Greater Roadrunner observations prior to 1950 in the Central Valley/foothill region. Some dots represent locations of more than one specimen. Details in Table 1.

Table 1. Specimens, nests, eggs, or well-documented observations in the Central Valley/foothills region before 1950, listed by latitude north to south. Museum abbreviations are: MVZ = Museum of Vertebrate Zoology; WFVZ = Western Foundation of Vertebrate Zoology; HSU = California State Polytechnic University; UCM = University of Colorado Museum of Natural History; UBCBBM = University of British Columbia Beaty Biodiversity Museum; CAS = California Academy of Sciences.

Locale/County	Date	Lat	Long	Source	Type
Igo, Shasta	1880s?	40.50	-122.54	Belding 1891	obs
e. Payne's PO, Tehama	31 Dec 1924	40.34	-121.83	MVZ	skin
n. of Dales, Tehama	25 Jul 1925	40.33	-122.08	Grinnell et al. 1930	obs
se. Beegum, Shasta	15 Jun 1943	40.32	-122.83	MVZ	skin
nr. Payne's PO, Tehama	18 Apr 1929	40.32	-121.93	Grinnell et al. 1930	obs
ne. of Red Bluff, Tehama	1 Jan 1928	40.29	-122.18	Grinnell et al. 1930	obs
Red Bluff, Tehama	4 Dec 1939	40.28	-122.09	CAS	skin
Dry Creek, Butte	6 Apr 1929	39.67	-121.59	MVZ	egg
n. Auburn, Placer	1890s	38.97	-121.12	Adams 1919	obs
Auburn, Placer	late 19th C	38.91	-121.08	Adams 1909	obs
Garden Valley, El Dorado	15 Jan 1917	38.86	-120.86	UBCBBM	skin
Fair Oaks, Sacramento	1 Jan 1894	38.65	-121.27	CAS	skin
Vacaville, Solano	Unknown	38.38	-121.98	Grinnell & Wythe 1927	nest
Murphys, Calaveras	27 Feb 1905	38.04	-120.47	Belding 1890	obs
Calaveras Co.	1856			Baird 1858	skin
Pleasants Valley, Mariposa	10 May 2019	37.72	-120.20	Grinnell & Storer 1924	obs

Table 1. (cont.)

Locale/County	Date	Lat	Long	Source	Type
nr. Coulterville, Mariposa	17 Mar 1928	37.71	-120.20	UBCBBM	skin
Coulterville, Mariposa	17 Mar 1928	37.71	-120.20	UBCBBM	skin
nr. La Grange, Stanislaus	18 Dec 2015	37.67	-120.46	Grinnell & Storer 1924	obs
Tesla, Alameda	25 Apr 1943	37.65	-121.65	MVZ	egg
w. of Oakhurst, Madera	16 Jan 1913	37.32	-119.72	UCM	skin
Orestimba Pk, Stanislaus	25 Dec 1943	37.30	-121.21	MVZ	skin
Raymond, Madera	17 Apr 1911	37.22	-119.91	MVZ	skin
nr. O'Neal's, Fresno	13 Aug 1951	37.13	-119.69	MVZ	skin
Los Banos, Merced	30 Mar 1937	37.07	-120.95	Beck 2008	skin
Fresno, Fresno	1 Jun 1941	36.80	-119.65	CAS	skin
Little Panoche Crk., Fresno	5 Apr 1922	36.79	-120.77	WFVZ	egg
Big Panoche Cyn., Fresno	20 Mar 1926	36.78	-120.79	HSU	skin
e. of Fresno, Fresno	20 May 1925	36.75	-119.64	WFVZ	2 eggs
Panoche Crk., Fresno	3 Jul 1936	36.60	-120.68	MVZ	skin
Conejo, Fresno	27 Feb 1915	36.52	-119.85	WFVZ	skin
Wildflower Ranch, Fresno	18 Apr 1914	36.51	-119.68	CAS	egg
Cantua Ck, Fresno	5 Apr 1922	36.41	-120.45	WFVZ	egg

Table 1. (cont.)

Locale/County	Date	Lat	Long	Source	Type
Cantua Ck, Fresno	3 Apr 1924	36.41	-120.45	WFVZ	2 skins
Cantua Ck, Fresno	22 Apr 1924	36.41	-120.45	WFVZ	2 skins
Cantua Ck, Fresno	20 Mar 1926	36.41	-120.45	WFVZ	skin
Cantua Ck, Fresno	24 Mar 1926	36.41	-120.45	WFVZ	skin
Cantua Ck, Fresno	24 Mar 1933	36.41	-120.45	WFVZ	skin
Cantua Ck, Fresno	24 Mar 1933	36.41	-120.45	WFVZ	skin
Cantua Ck, Fresno	25 Mar 1934	36.41	-120.45	WFVZ	2 skins
Cantua Ck, Fresno	27 Apr 1934	36.41	-120.45	WFVZ	skin
White River, Tulare	31 May 1894	36.27	-118.78	CAS	skin
nr. Cottonwood, Kings	7 Apr 1939	36.16	-119.91	WFVZ	skin
Coalinga, Fresno	28 Mar 1936	36.15	-120.35	WFVZ	skin
Coalinga, Fresno	24 Mar 1932	36.07	-120.25	WFVZ	skin
Coalinga, Fresno	25 Mar 1933	36.07	-120.25	WFVZ	skin
Nr. Devil's Den, Kern	11 Apr 1939	35.75	-120.01	WFVZ	skin
Point of Rocks, Kern	22 Mar 1923	35.69	-120.00	WFVZ	egg
Point of Rocks, Kern	8 Apr 1939	35.69	-120.00	WFVZ	egg
Annette, Kern	6 Apr 1921	35.65	-120.18	WFVZ	skin
Annette, Kern	12 Apr 1921	35.65	-120.18	WFVZ	skin
Elk Hills, Kern	16 Apr 1924	35.28	-119.46	WFVZ	egg
Buena Vista Lk., Kern	15 Jun 1924	35.19	-119.30	MVZ	egg
Buena Vista Lk., Kern	2 Apr 1917	35.19	-119.30	WFVZ	skin
Buena Vista Lk., Kern	22 Apr 1929	35.19	-119.30	WFVZ	skin
Buena Vista Lk., Kern	11 May 1914	35.18	-119.27	CAS	skin
Kern Lake, Kern	29 Dec 1925	35.15	-119.06	MVZ	skin

The small number of roadrunners recorded on Christmas Bird Counts (CBC) and Breeding Bird Surveys (BBS) limit statistical evaluation. Using data from 36 CBCs within the region conducted from 1973 through 2022, we found that between 1973 and 2002, nine CBC circles averaged more than one roadrunner per count. From 2003 to 2022 only four of those counts averaged more than one roadrunner. Similarly, of the seven BBS routes that have been run consistently during 1973–2022, six recorded roadrunners between 1973 and 1992, only three of them found them between 1993 and 2002, and none were reported from those seven routes between 2003 and 2022. These data suggest that their abundance may have declined over this period within the areas covered by these surveys.

Four Breeding Bird Atlases covering parts of this region have been published for Contra Costa (Glover 2009; atlas period 1998–2002), Solano (Berner 2015; 2005–2010), Nevada (Rose and Rose 2019; 2014–2018), and Sacramento (Pandolfino et al. 2021; 1988–1993 and 2016–2020) counties. None of these atlases reported any roadrunner observations. Beedy and Pandolfino (2013) characterized the status of the roadrunner in the western Sierra foothills and as "possibly extirpated from the mid-Sierra foothills (e.g., Placer and Nevada counties)."

Although eBird data may someday yield more robust quantitative information over many more locations than BBS or CBC data they are not yet useful for detecting trends as its usage only became common in the early 2000s. The eBird data, however, provide the most complete depiction of the current distribution of the roadrunner in this region (Figure 3). The current distribution is generally consistent with that derived from the 1800s and early 1900s descriptions and specimens, as well as from CBC and BBS data. One difference is the presence of roadrunners in the Coast Range foothills on the west side of the Sacramento Valley. This is almost certainly due to the lack of collection in that historically sparsely settled area, and the lack of any BBS routes or CBC circles on the western edge of the Sacramento Valley north of Putah Creek in Yolo County. Most likely, roadrunners have always been present in this area. Another difference is the apparent decline in the abundance of the roadrunner in the central Sierra foothills.

CONCLUSIONS

In drawing any conclusions about the historical status of the roadrunner in the Central Valley and surrounding foothills one must keep in mind the well-worn scientific adage, "absence of evidence is not evidence of absence." Attempts to assess the distribution and abundance of this bird prior to the 1850s are thwarted by a nearly complete absence of evidence. For pre-European times we have a few fossils from the Pleistocene, one mention of the use of roadrunner feathers by indigenous peoples of the region, names used by some tribes, and some Yokuts legends. In the early 1800s, we have

accounts from explorers, early settlers, and a single naturalist (Peale), none of whom mention observing the species. From the gold rush into the early 20th century, we have qualitative assessments of status and distribution and a few dozen specimens, but no quantitative data.

The very scant evidence we discovered all suggests that the roadrunner was never more than a rare-to-uncommon and sparsely distributed species in this region. We found nothing to support the suggestions of some authors (McCaskie et al. 1979, Verner and Boss 1980) that this species was historically more abundant in and around the Central Valley than in the early 20th century. It is certainly possible, however, that roadrunner numbers declined due to a combination loss of habitat as the human population increased after the Gold Rush, hunting, and direct persecution (Bryant 1916, Dawson 1923, Grinnell et al. 1930, Grinnell and Miller 1944).

The CBC and BBS data we reviewed suggest that this bird may have declined or been extirpated from some parts of its former range since the 1980s (Figure 2). Current eBird data (Figure 3) shows that the species is now extremely rare along the western edge of the Central Sierra Nevada from Merced County north through Butte County, an area that produced a sizable number of specimens and observations in the late 1800s and early 1900s. (Figure 1). As the eBird database continues to grow, it may be possible to determine more definitively if the roadrunner's status in this area is in decline. However, the locations covered by eBird data are selected by the participating birders who tend to avoid vineyards, orchards and residential development. Therefore, it may be difficult to use eBird data to detect trends driven by conversion of habitat into these uses.

Recent Impacts to Roadrunner Habitat in the Region

We speculate that land use changes may be responsible for the species' apparent general decline in the foothills and near extirpation from the Central Sierra foothills as suggested by recent BBS and CBC data. In this region the roadrunner uses a variety of open and semi-open landscapes, often with a mix of grassland, chaparral, and oak savanna (Hughes 2011, Beedy and Pandolfino 2013). These habitats around the edge of the Central Valley had changed relatively little until the mid-20th century. Prior to that they were mainly used to graze cattle. Gold Rush era mining had drastic impacts on stream beds and foothill riparian areas (Rohrbough 1997), but the footprint of those impacts was minor compared to the land use conversions that occurred since the mid-1900s. In recent decades much of this area has been converted into more intense agricultural uses such as vineyards and orchards, and, to a lesser extent, residential development (Cameron et al. 2014), as well as water development for irrigation and flood control. All these changes eliminate and fragment roadrunner habitat.

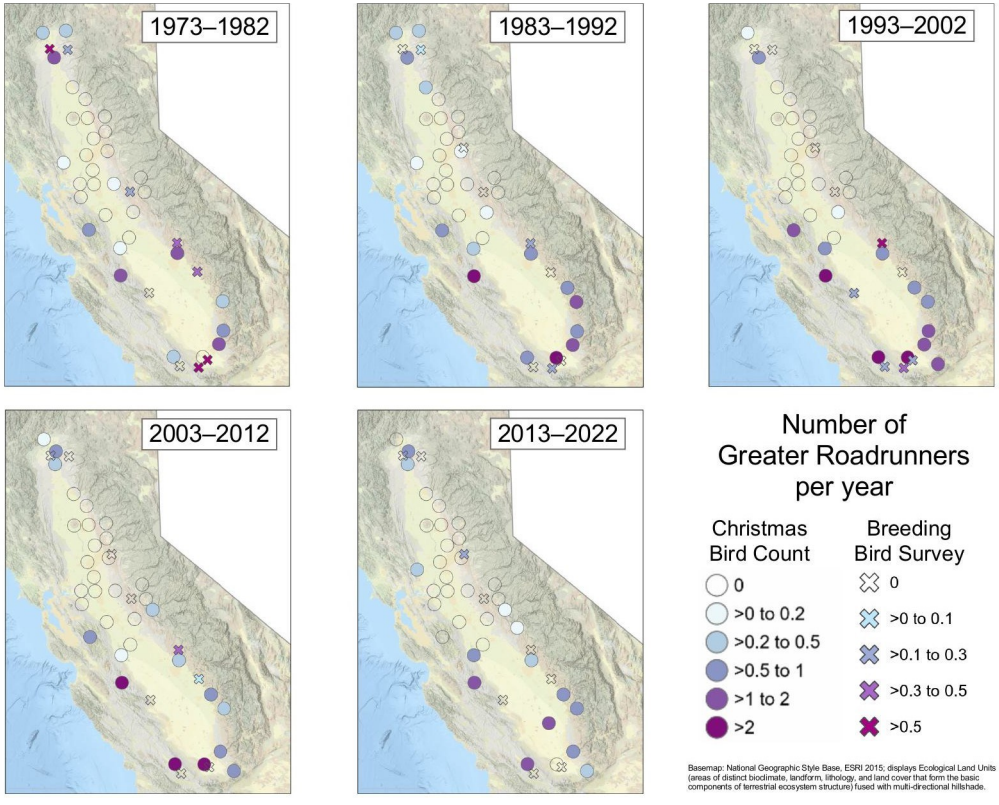

Figure 2. Abundance during the last five decades from CBCs and BBSs within the Central Valley. The unfilled circles and X's indicate a count or survey that was conducted during the time period, but did not record any roadrunners.

Over the period 1965–2000, grape vineyards in California more than doubled from 160,000 ha to nearly 400,000 ha (USDA 2023). In 2021, nearly 60% of the 360,000 ha of vineyards in the state was in the Central Valley and adjacent foothills (USDA 2023). As the expansion of vineyards slowed in the early 2000s, orchard development (particularly almonds) increased dramatically, more than doubling between 2006 and 2021 (CDFA 2016, CDFA 2022). Almonds comprise most of the 700,000 ha of orchard acreage in California, and by 2021 more than 80% of that acreage was in the Central Valley (CDFA 2022). Although most of the area grown to orchards is on the valley floor, conversion of grasslands and open woodland to almond, olive, and other fruits and nuts has recently expanded into the lower foothills (Cameron et al. 2014, E. Pandolfino pers. obs.). This expansion of more intense agriculture into the foothills surrounding the Central Valley is largely limited to the wetter east side (Sierra foothills) rather than the west side which sits in the "rain shadow" of the Coast Range (Dewitz and USGS 2021).

Yet another potential significant impact on foothill roadrunner habitat has been the intense dam building in California from 1955 to 1979. Of the 27 large (greater than 300 ha surface area) reservoirs around the Central Valley, 17 were built during that period (CDWR 2024). Also, the reservoirs are concentrated in the Sierra Nevada foothills (i.e., 21 reservoirs accounting for 80% of the total reservoir surface area) and in the Central Valley (CDWR 2024). These more recent reservoirs account for 84% of the 49,000 ha total reservoir surface area (CNRA 2013). Although the direct habitat loss from water development is small compared to agricultural conversions, these reservoirs likely have significant indirect impacts on roadrunners by creating many long, flooded canyon areas that fragment the remaining habitat. Thus, reservoirs create patchwork of "island-like" areas of habitat that may have isolated the previously sparsely distributed and largely sedentary roadrunner population. These isolated populations may be susceptible to extirpation by localized events such as fires and by inbreeding. No major dam projects had been approved in California since the 1970s until the recent approval of the Sites Dam in the Coast Range foothills of Colusa County (Sites Project Authority 2023). Potential impacts to the roadrunner were not mentioned in the Final Environmental Impact Report (Sites Project Authority 2023), however, when completed in 2032 it will become the 8th largest reservoir in the region and will flood more than 5,300 ha of roadrunner habitat.

All the impacts noted above, as well as increases in residential development (Cameron et al. 2014), have been concentrated along the eastern edge of this region. Therefore, it is reasonable to speculate that the declines in numbers of roadrunners seen on CBCs and BBS transects, as well as the apparent near disappearance of the roadrunner from the foothills of the Central Sierra, are a result of these combined and cumulative impacts.

The fact that current eBird data shows good numbers of roadrunners in the western foothills of the northern Coast Range is consistent with this as all the impact sources noted have been much less of a factor in that area.

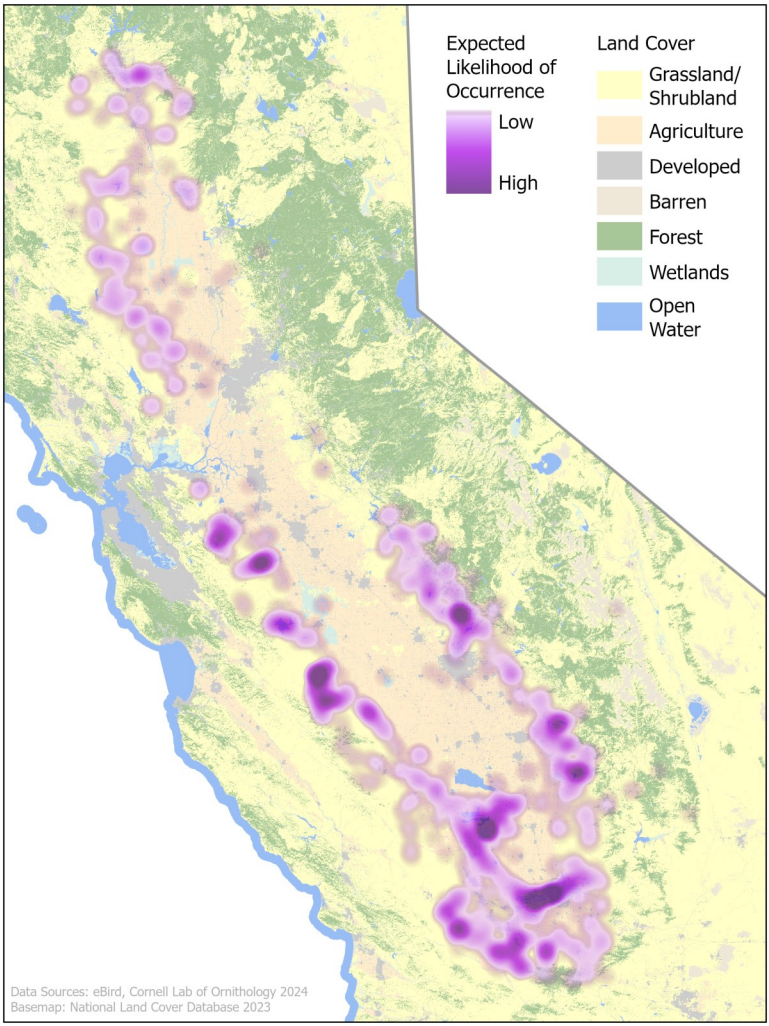

Figure 3. Likelihood of occurrence determined by the number of years Greater Roadrunners were reported at an individual locations from January 2010 through June 2024.

Future Research

Because it is present in low numbers and sparsely distributed in isolated patches, the Greater Roadrunner is highly susceptible to local extirpation, as may have happened in recent decades in parts of the Central Sierra Nevada foothills. The detrimental land use changes including conversion to orchards, vineyards, residential development, and reservoir construction are continuing. If those changes are responsible for the apparent declines in the roadrunner, they appear likely to continue and the species could disappear from much of the region. To address this problem, we recommend the following actions:

1. Assess the characteristics of the habitats used by roadrunners in this region. To date, the only research on habitat associations for the roadrunner has been conducted in west Texas (Hughes 2011).
2. Identify areas of suitable habitat large enough to accommodate substantial numbers of roadrunners.
3. Consider protection for large habitat areas as well as retaining or restoring habitat connectivity between existing patches of suitable habitat.
4. Consider managing such areas to retain key habitat characteristics once they are better known, through grazing, prescribed fire, etc.
5. Evaluate the potential effects of climate change and resulting habitat changes on habitat suitability and availability for the species.
6. Analyze the genetics of this population and compare them to other roadrunner populations to determine if the Central Valley/foothill population is genetically distinct.

Finally, although the sources we examined in our attempt to reconstruct the historical status of the roadrunner revealed relatively little about this species, these sources may prove useful to others interested in exploring the history of other bird species whose local historical status remains largely unknown. For example, our review of the papers of Rollo Beck (Beck Collection 2008) uncovered detailed information about species such as the Fulvous Whistling-Duck (*Dendrocygna bicolor*), Black Tern (*Chlidonias niger*), Least Bittern (*Ixobrychus exilis*), Say's Phoebe (*Sayornis saya*), and Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*), all species which Engilis (2021) cited as lacking historical Central Valley status information. Other sources we found that contain information about some of these species include the 1850s railroad route surveys (Baird 1874), the journals of Titian Peale (Poesch 1961), observations of Lyman Belding during his time in the Central Valley (Belding 1890, 1891, 1901a, b, and c) and various regional accounts (e.g., Nelson 1875, Bolander 1907, Adams 1909).

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