Western Riverside County

Multiple Species Habitat Conservation Plan

Biological Monitoring Program

2024 Coastal California Gnatcatcher Survey and Nest Monitoring Report

Coastal California Gnatcatcher
Photo by Lynn Miller

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NOTE TO READER:

This report is an account of survey activities conducted by the Biological Monitoring Program (BMP) for the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). The MSHCP was permitted in June 2004. Reserve assembly is ongoing and is expected to take 20 or more years to complete. The Conservation Area includes lands acquired under the terms of the MSHCP and other lands that have conservation value (called Public/Quasi Public Lands in the MSHCP) within the boundary of the MSHCP (Plan Area). In this report, the term "Conservation Area" refers to these lands as understood by the BMP at the time the surveys were conducted.

The BMP monitors the status and distribution of the 146 species covered by the MSHCP within the Conservation Area to provide information to Permittees, land managers, the public, and the Wildlife Agencies [i.e., the California Department of Fish and Wildlife (CDFW, formerly California Department of Fish and Game) and the U.S. Fish and Wildlife Service]. BMP activities are guided by defined conservation objectives for each Covered Species, other information needs identified in MSHCP Section 5.3 or elsewhere in the document (Dudek & Associates 2003), and the information needs of the Permittees. A list of the lands where data collection activities were conducted in 2024 is included in Section 8.0 (Appendix B, Table B-1) of the Western Riverside County Regional Conservation Authority (RCA) Annual Report to the Wildlife Agencies.

The primary author of this report was Field Biologist Masanori Abe, who led this project under the guidance of the 2024 Avian Program Lead, Nicholas Peterson. This report should be cited as Biological Monitoring Program. 2025. Western Riverside County MSHCP Biological Monitoring Program 2024 Coastal California Gnatcatcher Survey and Nest Monitoring Report. Prepared for the Western Riverside County Multiple Species Habitat Conservation Plan. Riverside, CA. Available online: https://www.wrc-rca.org/species-surveys/.

While we have made every effort to accurately represent our data and results, it should be recognized that data management and analysis are ongoing activities. Any reader wishing to make further use of the information or data provided in this report should contact the BMP to ensure that they have access to the best available or most current data.

Please contact the BMP Administrator with questions about the information provided in this report. Questions about the MSHCP should be directed to the Executive Director of the RCA. Further information on the MSHCP and the RCA can be found at www.wrc-rca.org.

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INTRODUCTION

The Coastal California Gnatcatcher (*Polioptila californica californica*) is one of 45 bird species covered by the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) and is designated as species of special concern in California and listed as threatened at the Federal level. Coastal California Gnatcatchers are specialists of coastal sage scrub (CSS) habitat, one of the unique plant communities found in coastal and inland southern California and Baja California. This habitat type is characterized by low-growing, drought-deciduous, and semi-woody shrubs, such as California Buckwheat (*Eriogonum fasciculatum*), Brittlebush (*Encelia farinosa*), California Sagebrush (*Artemisia californica*), Black Sage (*Salvia mellifera*), and White Sage (*S. apiana*; Dudek & Associates 2003). CSS habitat is one of the most endangered habitats in the United States (Braden et al. 1997a; Rubinoff 2001).

Population declines in Coastal California Gnatcatchers in southern California have been observed since the 1940s (Atwood and Bontrager 2020); moreover, by the 1960s, their populations were reported to have declined sharply, which continued into the 1990s (USFWS 2003; Atwood and Bontrager 2020). Coastal California Gnatcatcher populations have remained stable after the 1990s as a result of a variety of conservation efforts (Atwood and Bontrager 2020), and a 19–35% increase in their occupancy in 2020 compared to 2016 has been reported (Kus et al. 2024a) . However, suitable CSS habitat for Coastal California Gnatcatchers in western Riverside County has declined by 48% since the 1980s (Hulton VanTassel et al. 2017). The causes of the decline of Coastal California Gnatcatchers are attributed to multiple factors, including habitat loss, fragmentation, and degradation; and the recent increase of wildfires (Kus et al. 2024b). As a result, intensive monitoring of the rapid decline of this subspecies' breeding habitat is needed.

Coastal California Gnatcatchers are non-migratory insectivores and are distributed from southern Ventura County in California to Baja California Sur in Mexico (Atwood and Bontrager 2020). They primarily occupy CSS, but they may also inhabit desert scrub and Riversidean alluvial fan scrub vegetation habitats for breeding (Dudek & Associates 2003). In Riverside County their breeding season starts in approximately mid-March and ends in July. Coastal California Gnatcatchers defend breeding territories that average 3.4 hectares (ha) in size (Braden et al. 1997a) and build open cup nests in relatively dense stands of CSS shrubs, such as California Buckwheat, Brittlebush, White Sage, Black Sage, and California Sagebrush. Coastal California Gnatcatchers in southern California usually lay a mean of 3.8 eggs (range 2–5) and incubate for a mean of 14 days, and the nestlings fledge approximately 14 days after hatching. Adults continue to care for fledglings up to three weeks post-fledging (Atwood and Bontrager 2020). Coastal California Gnatcatchers are one of the host species of brood parasitism by Brown-headed

Cowbirds (*Molothrus ater*). Brood parasites such as Brown-headed Cowbirds lay their eggs in the nests of host species, including Coastal California Gnatcatchers, oftentimes replacing a host egg with their own. This behavior reduces reproductive productivity by host species (Lowther 2020).

The distribution of the Coastal California Gnatcatchers within the Plan Area is widespread. The Core Areas for the species are primarily in the southwestern region of the Plan Area, and into the Vail Lake/Wilson Valley area (Dudek & Associates 2003; Figure 1). The species also inhabits the northeastern region of the Plan Area.

The MSHCP identifies three species objectives for Coastal California Gnatcatcher. Objective 1 is a conservation objective that requires the conservation of at least 77,070 acres (31,189 ha) of suitable CSS, Riversidean alluvial fan scrub and desert scrub in the Riverside Lowland and San Jacinto Foothills Bioregions (Dudek & Associates 2003) for the species. Objective 2 is also a conservation objective that requires the conservation of at least 13 Core Areas and interconnecting linkages, within nine Core and Linkage areas including El Cerrito/Lake Mathews-Estelle Mountain Reserve, Alberhill area, the proposed North Peak Conservation Bank/Meadowbrook area, Wasson Canyon, Railroad Canyon/Sedco Hills, a portion of the Quail Valley area, Hogbacks/Murrieta Hot Springs, Lake Skinner/Buck Road to Pourroy Road east of Murrieta Hot Springs, and Vail Lake/Wilson Valley including the eastern Temecula Creek area (Dudek & Associates 2003; Figure 1). Objective 3 requires maintaining continued use of and successful reproduction at 75% of the Core Areas once every three years. Successful reproduction is defined as a nest which fledged at least one known young. In the spring and summer of 2024, we conducted pair searching, nest searching and monitoring for Coastal California Gnatcatchers in their nine MSHCP-designated Core Areas.

Survey Goals

1. Determine whether Coastal California Gnatcatchers are maintaining continued use of and successful reproduction at 75% of their designated Core Areas.
    a. Determine use by documenting whether Coastal California Gnatcatchers are foraging, nesting, or otherwise present within MSHCP-designated Core Areas.
    b. Determine whether Coastal California Gnatcatchers are successfully reproducing within MSHCP-designated Core Areas by searching for breeding pairs while documenting use within Core Areas, then searching for and monitoring active nests until fledging or failure occurs.
2. Estimate nest survival of Coastal California Gnatcatchers.
    a. Use the nest survival model included with Program MARK (White and Burnham 1999; Dinsmore et al. 2002) to estimate the daily survival rate (DSR) of Coastal California Gnatcatcher nests.

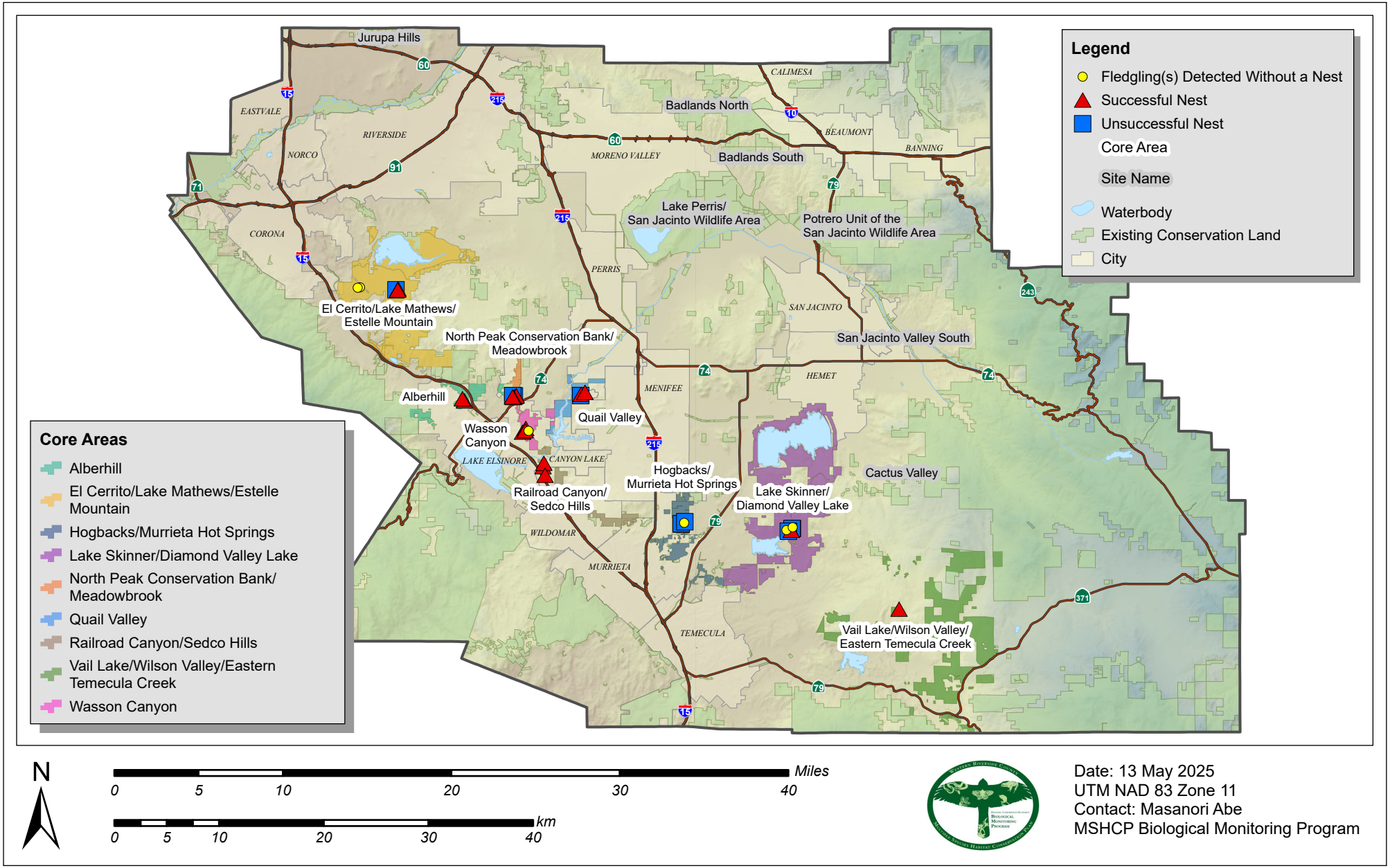

Figure 1. Coastal California Gnatcatcher Core Areas and nests and fledgling locations in 2024.

METHODS

Survey Design

We conducted nest searching and monitoring between 1 April and 20 June 2024 within each Core Area (Figure 1). We performed searches within 250 meters (m) × 250 m (6.25 ha) grid cells that were delineated using ArcGIS Pro (Esri 2023). We then selected grid cells that were in apparently suitable Coastal California Gnatcatcher habitat in which the cover of CSS plants was approximately more than 20% (Atwood and Bontrager 2020) by visual estimation, and common nest substrates were available (Dudek & Associates 2003). To calibrate our plant cover estimates, we used the reference plot cover estimation diagram provided by the United States Forest Service (Manley et al. 2006).

We began this project by visiting the locations within Core Areas where Coastal California Gnatcatchers were previously detected (Biological Monitoring Program 2009, 2012, 2015, 2019, 2022). We then employed Google Earth satellite images or ground-truthing to determine whether the sites were suitable for Coastal California Gnatcatchers (Grishaver et al. 1998; Sockman 2000; Mock 2004) when we investigated a new area without any prior Coastal California Gnatcatcher information.

Field Methods

Pair Searching

Once we arrived at the survey grid cells, we conducted an area search to confirm suitable Coastal California Gnatcatcher habitat and then searched for Coastal California Gnatcatchers pairs to determine their use in the Core Areas. We started surveys using a passive method that consisted of walking in a survey area and trying to find a Coastal California Gnatcatcher pair by visual and auditory cues. If we could not find any pairs after 30 minutes of searching, we used Coastal California Gnatcatcher call playbacks. We played a maximum of two 20-second call bouts, then searched again for Coastal California Gnatcatchers. We played broadcasts again after 30 minutes of searching if we had not found any Coastal California Gnatcatchers. If a pair was detected, we conducted nest searches without time-of-day and weather constraints.

Nest Searching

We uploaded assigned survey grid cells on a handheld GPS unit and smartphone. When we found a pair of Coastal California Gnatcatchers during a survey within an assigned survey grid cell, we recorded on the datasheet the birds' behaviors and locations associated with nesting. Behavior such as carrying nest materials, delivering food, producing begging calls, and making alarm calls were usually indicators of an active nest nearby. During observations, we maintained a safe distance (>15 m) from the nesting pairs to minimize stress on them and avoid the likelihood of potential nest predators

being drawn to the nest. If we felt we were standing too close to the nest (e.g., the adults appeared distressed), we retreated and waited until the parents displayed unagitated behavior before observing them again. If it was too difficult to observe adults due to rough terrain or dense vegetation cover, we tried to identify the primary area used by them, then systematically checked each shrub to flush nesting adults or detect a nest visually within this area (Reynolds 1981). We paid particular attention to nesting substrates in which we have detected Coastal California Gnatcatcher nests during past survey efforts (Biological Monitoring Program 2009, 2012, 2015, 2019, 2022), specifically California Buckwheat, Brittlebush, White Sage, California Sagebrush, Yellow Bush-penstemon (*Keckiella antirrhinoides*), and Black Sage.

Upon identifying a potential nest, we approached the site and attempted to determine whether it was active. We marked the location using a handheld GPS unit and recorded the nest information on the datasheet. Initial data collected include the GPS coordinates, the substrate and substrate height, and the nest height. We collected the GPS coordinates above the nest without disturbing the nest. If there was a risk of damaging the nest site when collecting the coordinates, we marked the waypoint from a distance, then reported on the datasheet the bearing and distance between the waypoint and the nest.

Nest Monitoring

We attempted to revisit each nest approximately every seven days. During these follow-up visits we determined whether the nest was active by approaching briefly. During each follow-up visit we documented the nest status; the behavior(s) of both parents; a count of Coastal California Gnatcatcher eggs, nestlings, and fledglings; and a count of Brown-headed Cowbird eggs and nestlings. If we observed avian predators, we waited until they were no longer visible, or we monitored nests by watching the behavior of the adults from a safe distance. Doing this allowed us to determine the nest's stage (e.g., incubation or nestling) while minimizing risk of predation and stress on the adults.

When we needed to approach the nest to check the stage, we minimized time spent around it. We also took different paths during each visit to avoid making a clear path to the nest and conducted mock nest searches in nearby vegetation before and after investigating the actual nest, decreasing the chance of predators detecting the nest (Martin and Geupel 1993). If investigating a nest's content would lead to damaging the nest substrate, or unnecessarily stressing the adults, we forewent assessing the nest contents and instead observed whether it was active by watching the behaviors of the adults from a safe distance (Heath et al. 2008). Additionally, we never touched nests and nest contents before a nest failed or fledged. Even if we observed Brown-headed Cowbird eggs or nestlings in the nest, we left them untouched. We conducted follow-up visits until the nest fledged young or failed. To verify fledging we documented the begging calls of young birds and observed adults delivering food to areas other than the nest (Heath et al.

2008). Our primary focus was to document successful reproduction; secondary to this was gathering information about clutch size, incubation stage duration, nest success, mean number of fledglings per nest, potential causes of nest failure, parasitism rate, and nest substrate and height. We measured all heights from the ground to the top of the nest rim using a meter stick after the nest fledged young or failed. The survey protocol used in 2024 is described more completely at the *Western Riverside County MSHCP Biological Monitoring Program California Gnatcatcher 2024 Nesting Survey Protocol*, available from https://wrc-rca.org/survey_protocols.

Data Analysis

Nest Survival

We estimated the DSR of Coastal California Gnatcatcher nests, and overall nest survival rate in 2024, by using the nest survival model in Program MARK (White and Burnham 1999; Dinsmore et al. 2002). DSR represents the probability (0.0–1.0) that an active nest on day t will survive to day $t + 1$. We pooled all reproductive data from the Core Areas when estimating DSR. For sample sizes that are too small for estimation of an area-dependent DSR, we used a constant model (i.e., no covariates) for estimating the DSR. Finally, we estimated the overall nest survival rate for Coastal California Gnatcatchers by raising the DSR estimates to an exponential power that is equal to the approximate length of a nesting cycle, from first egg laid until the first nestling fledges (31 d; Atwood and Bontrager 2020).

We also analyzed parameters using pooled data from all Coastal California Gnatcatcher surveys in 2008, 2011, 2014, 2018, and 2021. The result from the pooled data made analysis more robust and avoided biases from low sample sizes. We used pooled data to evaluate the effect of Core Areas and year on the DSR in Program MARK (White and Burnham 1999; Dinsmore et al. 2002). When analyzing the pooled data for DSR, we ranked candidate models using Akaike's Information Criterion for small samples (AIC_C), and Akaike weights.

RESULTS

Detections and Reproductive Data

In 2024 we monitored 28 Coastal California Gnatcatcher nests and 37 breeding pairs in the nine designated Core Areas, and we documented that they were using and successfully reproducing in all (100%) of them (Figure 1). The mean number of nests monitored in each Core Area was 3.1 (range = 1–6) and the mean number of breeding pairs was 4.1 (range = 2–6; Table 1). Additionally, we found fledglings within the El Cerrito/Lake Mathews/Estelle Mountain, Hogbacks/Murrieta Hot Springs, Lake Skinner/Diamond Valley Lake, and Wasson Canyon Core Areas without finding their nest.

Table 1. Distribution, abundance, and outcome of Coastal California Gnatcatcher pairs, nests, and family groups detected within designated Core Areas in 2024.

			No. nests per outcome (% of known nests in Core Area)		
Core Area / Site Name	No. pairs	No. nests	Successful	Failed	No. family groups[1]
Alberhill	3	2	2 (100)	0 (0)	0
El Cerrito/Lake Mathews/Estelle Mountain	5	3	2 (67)	1 (33)	2
Hogbacks/Murrieta Hot Springs	4	3	0 (0)	3 (100)	1
Lake Skinner/Diamond Valley Lake	6	4	1 (25)	3 (75)	2
North Peak Conservation Bank/Meadowbrook	4	6	4 (67)	2 (33)	0
Quail Valley	4	3	2 (67)	1 (33)	0
Railroad Canyon/Sedco Hills	3	3	3 (100)	0 (0)	0
Vail Lake/Wilson Valley/eastern Temecula Creek	2	1	1 (100)	0 (0)	0
Wasson Canyon	6	3	3 (100)	0 (0)	1
Total	37	28	18 (64)	10 (36)	6

[1] Fledglings detected without finding their nest location.

During the current monitoring period (2022–2024), we detected Coastal California Gnatcatchers 112 times outside of the Core Areas. Lake Perris/San Jacinto Wildlife Area had the highest number of detections (n = 69), followed by Badlands South (n = 22), Jurupa Hills (n = 9), San Jacinto Valley South (n = 4), Cactus Valley (n = 4), Badlands North (n = 3), and the Potrero Unit of the San Jacinto Wildlife Area (n = 1). Additionally, we consistently noticed that Coastal California Gnatcatchers were successfully reproducing in the Jurupa Hills (Figure 1). These detections occurred incidentally while we were conducting surveys for other MSHCP-covered species (i.e., we were not surveying for nesting Coastal California Gnatcatchers outside of their MSHCP-designated Core Areas).

Of 28 monitored nests in 2024, 18 (64%) succeeded and 10 (36%) failed (Table 1). Of the 10 failed nesting attempts, eight (80%) were predated and two failed for unknown reasons. Of the eight predated nests, two were parasitized by Brown-headed Cowbirds prior to predation. Further, three of the predated nests were intact, suggesting avian or snake predation. Five of the predated nests were torn out of the nesting substrate. Finally, we documented at least one case of Coastal California Gnatcatchers reusing old nest materials following nest failure, with the adults making frequent trips between the new and old nest sites to gather material. We also observed that one nest in the Wasson Canyon Core Area (Figure 2) had two layers of nesting material, in which the pair built a complete second nest, rim, and bottom, over the original nest. Ultimately, the second nest

fledged offspring. We dissected the nest after the young fledged and found one Coastal California Gnatcatcher egg buried in the nest (M. Abe, personal observation, 2024). This was the second case we observed in our last six survey seasons.

Figure 2. Coastal California Gnatcatcher (*Polioptila californica californica*) nest within the Wasson Canyon Core Area that consists of two layers of nesting material. The upper nest ultimately fledged young.

The first nest we found in 2024 was 1 April, within the Railroad Canyon/Sedco Hills Core Area, and the nest was in the nestling stage. We estimated the nest initiation day was 17 March. The earliest fledging date in our study in 2024 was 15 April, also in the Railroad Canyon/Sedco Hills Core Area. The mean clutch size for all nests in this study was 3.5 eggs (SE ± 0.1; n = 21 nests with complete clutches, defined as a nest

proceeding from the laying stage to the incubation stage), and the mean number of fledglings per nest, including all successful and failed nests, was 2.12 (SE ± 0.3, n = 25 nests that contained eggs or nestlings).

Nest Survival

We included in the analyses 25 of the 28 nesting attempts because three nests failed prior to egg-laying. The estimated DSR of Coastal California Gnatcatcher nests (n = 25) in 2024 was 0.99, or 99% (95% CI = 0.980–0.995, or 98.0–99.5%). Assuming, an average of 31 days from the initiation of egg-laying to fledging (Grishaver et al. 1998; Atwood and Bontrager 2020); this implies an overall estimated nest survival rate of 0.732, or 73.2% (95% CI = 0.535–0.856, or 53.5–85.6%). We did not have enough data to calculate variations in DSR based upon Core Areas or nest stages in 2024.

We pooled the 2024 data with all previous surveys, which included data from 2008, 2011, 2014, 2018, and 2021 (Biological Monitoring Program 2009, 2012, 2015, 2019, 2022), to evaluate the effects of Year and Core Area on DSR (Table 2). The model including covariate "Year" received stronger support (AIC weight (w_i) = 0.933, Table 3) than the models with covariate "Core Area," or without covariates (constant model; Table 3). The nest survival rate in 2024 (0.732, or 73.2%) was the highest of our six surveys conducted since 2008. Nest survival rates from our Biological Monitoring Program data ranged from 0.152, or 15.2% in 2008 (Biological Monitoring Program 2009) to 0.732, or 73.2% in 2024 (Table 2).

Brood Parasitism

We found evidence of brood parasitism by Brown-headed Cowbirds in two (8.0%) out of 25 nests in which we confirmed completed clutches, and each of these two nests contained one cowbird egg. One of the parasitized nests was in Black Sage in the Hogbacks/Murrieta Hot Springs Core Area and the other one was in California Sage in the Lake Skinner/Diamond Valley Lake Core Area. Both nests were predated before we confirmed the eggs hatched.

Nest Substrates

We observed Coastal California Gnatcatchers using six species of shrubs as nesting substrates during the 2024 breeding season. The most commonly used were Brittlebush (n = 16, or 57.1% of nest substrates), and California Buckwheat (n = 4, or 14.3%; Table 4). We observed for the first time that one pair of Coastal California Gnatcatchers used California Cholla (*Cylindropuntia californica*) as their nest substrate, and the nest ultimately fledged young. Overall, Coastal California Gnatcatchers used 14 plant species as nest substrates during the 2008, 2011, 2014, 2018, 2021, and 2024 breeding seasons, collectively. The most used nest substrates across years were Brittlebush (n = 57 nests, or 27.8% of nests overall), followed by California Buckwheat (n = 56, or 27.3%), White Sage (n = 29, or 14.1%), and Yellow Bush-penstemon (n = 18, or 8.8%). Across all

survey years and common nest substrates that were used more than 10 times, the percentage of nests that fledged young ranged from 22.2% in White Sage to 48.2% in Brittlebush (Table 4). Finally, the mean nest height in 2024 was 0.66 m (SE ± 0.04, range = 0.4–1.2 m; *n* = 28 nests).

Table 2. Nest daily survival rates (DSR) and nest survival rates of Coastal California Gnatcatcher using Program MARK nest survival analysis for each covariate, with standard error (SE) and upper and lower confidence intervals (CI) included.

Covariates	DSR	SE	CI Lower	CI Upper	Nest Survival
Constant	0.972[2]	0.003	0.965	0.977	0.415
2008	0.941	0.013	0.909	0.962	0.152
2011	0.970	0.011	0.939	0.986	0.389
2014	0.980	0.007	0.959	0.990	0.535
2018	0.966	0.007	0.950	0.977	0.342
2021	0.966	0.007	0.950	0.978	0.342
2024	0.990	0.003	0.980	0.995	0.732
AL[3]	0.964	0.010	0.939	0.979	0.321
EM	0.987	0.006	0.970	0.995	0.667
MSR	0.959	0.010	0.935	0.974	0.273
MH	0.945	0.015	0.908	0.968	0.173
NP	0.974	0.007	0.956	0.985	0.442
QV	0.973	0.010	0.944	0.987	0.428
SH	0.997	0.003	0.977	1	0.911
WC	0.976	0.008	0.955	0.987	0.471
WV	0.963	0.012	0.930	0.981	0.311

[2] Values range from 0 to 1, corresponding to 0% to 100%, respectively.

[3] Site covariates are abbreviated as follows: *AL* (Alberhill); *EM* (El Cerrito/Lake Mathews/Estelle Mountain); *MSR* (Lake Skinner/Diamond Valley Lake); *MH* (Hogbacks/Murrieta Hot Springs); *NP* (North Peak Conservation Bank/Meadowbrook); *QV* (Quail Valley); *SH* (Railroad Canyon/Sedco Hills); *WC* (Wasson Canyon); and *WV* (Vail Lake/Wilson Valley/eastern Temecula Creek).

Table 3. Model selection results for Coastal California Gnatcatcher nest survival models from Program MARK. Models are ranked based on Akaike's Information Criterion for small samples (AIC_C).

Model	*K*[4]	Deviance	AIC_C	ΔAIC_C	w_i[5]
Year	6	433.192	445.222	0.000	0.933
Core Area	9	433.236	451.3	6.078	0.067
Constant	1	457.236	459.237	14.016	0.000

[4] Number of parameters

[5] AIC_C weight

Table 4. Frequency of all nesting substrates used by Coastal California Gnatcatchers in 2024 and common nesting substrates during previous survey years (2008, 2011, 2014, 2018, 2021), and frequency of successful nests built within each substrate.

Substrate	Number of nests in 2024	Number of nests in 2008, 2011, 2014, 2018, 2021	Percentage of nests within substrate that were successful across all years
Big Sagebrush (*Artemisia tridentata*)	0	1	0
Black Sage (*Salvia mellifera*)	3	11	35.7
Brittlebush (*Encelia farinosa*)	16	41	48.2
California Broomsage (*Lepidospartum squamatum*)	0	1	0
California Buckwheat (*Eriogonum fasciculatum*)	4	52	41.8
California Cholla (*Cylindropuntia californica*)	1	0	100
California Sagebrush (*Artemisia californica*)	3	16	26.3
Fragrant Sumac (*Rhus aromatica*)	0	1	0
San Diego County Viguiera (*Bahiopsis laciniata*)	0	1	0
Tamarisk (*Tamarix ramosissima*)	0	1	0
Thick-leaved Yerba Santa (*Eriodictyon crassifolium*)	0	5	0
White Flowering Currant (*Ribes indecorum*)	0	1	100
White Sage (*Salvia apiana*)	0	29	22.2
Yellow Bush-penstemon (*Keckiella antirrhinoides*)	1	17	38.9
Total	28	177	

DISCUSSION

Detections and Reproductive Data

We documented Coastal California Gnatcatchers using and successfully reproducing within all (100%) Core Areas in 2024, thereby meeting the use and reproductive objectives within the current monitoring period (2022–2024). Similarly, we have documented use in all Core Areas (100%) during survey efforts in 2008, 2011, 2014, 2018, and 2021. We have documented successful reproduction in all Core Areas (100%) in 2011, 2014, and 2018, and eight (89%) Core Areas in 2008 and 2021 (Biological Monitoring Program 2009, 2012, 2015, 2019, 2022).

Nest Survival and Reproduction

The estimated nest survival rate in 2024 was the highest of all the Coastal California Gnatcatcher surveys performed by the BMP (Biological Monitoring Program 2009, 2012, 2015, 2019, 2022), and it is almost five times higher than the nest survival rate of the lowest year, 2008 (Biological Monitoring Program 2009; Table 2). The reason is not entirely clear, but one potential explanation could be increased winter/spring precipitation, or the timing during which the precipitation occurred, which ultimately affects the nest microhabitat, predator abundance, and predator strategies (Morrison and Bolger 2002).

The effect of survey year on nest survival was strongly supported based upon AIC_C ($w_i = 0.93$; Table 3), suggesting that a variation of nest survival rates by survey years is an important factor to describe the variation in survival rates of Coastal California Gnatcatchers in our study area. The AIC_C weight of this model reached the value $w_i = 0.9$ that Burnham and Anderson (2002) recommend if selecting just one model from *a priori* models as a best model. Similarly, yearly variation of the nest survival for passerine species in semi-arid and grassland regions such as western Riverside County has been reported by several investigators (Morrison and Bolger 2002; Chase et al. 2005; Zuckerberg et al. 2018). Since predation is the main cause of nest failure, the predator abundance strongly affects the rate of nest survival and reproductive strategies (Martin 1993; Martin 1988; Fontaine and Martin 2006).

The nest survival rate within the Railroad Canyon/Sedco Hills Core Area has continuously shown the highest rate across survey years; we detected three successful nests out of three nests monitored in 2024. The overall nest survival rate across all survey years was 0.911, or 91.1%, which is markedly high compared to the second highest, 0.667, or 66.7%, in the El Cerrito/Lake Mathews/Estelle Mountain Core Area, and other Core Areas which showed even lower nest survival rates (Table 2). We monitored 11 nests total during our six survey efforts (2008, 2011, 2014, 2018, 2021, and 2024) in this Core Area; ten nests successfully fledged young and only one nest failed, due to predation. The reason for this high rate of success is unknown, although the small sample size should not be overlooked. One possible explanation could be that predator abundance is lower in this Core Area, but this is difficult to investigate with our survey protocol and efforts.

As stated previously, the El Cerrito/Lake Mathews/Estelle Mountain Core Area has the second highest nest survival rate across years, at 0.667, or 66.7%. This is within the range of nest survival rates in Coastal California Gnatcatcher literature, although it is toward the high end (Atwood and Bontrager 2020). Surveyed areas in our study contained relatively steep hillsides with denser than normal Brittlebush stand covering much of the Coastal California Gnatcatcher territories, which likely provided suitable

cover from avian predators. This dense cover may be advantageous to Coastal California Gnatcatchers by hiding nests and flight paths from predators. The nest survival rate of passerines can be influenced by terrain, vegetation composition, and vegetation density that conceals nests from predators (Braden 1999; Reidy et al. 2017), so the higher nest survival rates in this Core Area may suggest that this microhabitat provides ideal breeding conditions for Coastal California Gnatcatchers.

Brood Parasitism

We documented Brown-headed Cowbird brood parasitism at the Alberhill Core Area in 2021, Hogbacks/Murrieta Hot Springs Core Area in 2021 and 2024, and Lake Skinner/Diamond Valley Lake Core Area in 2018 and 2024. Brood parasitism in Coastal California Gnatcatcher nests, however, was not documented in the Core Areas prior to 2018 by MSHCP. In total, we observed 11 parasitized nests during the aforementioned years, but only one cowbird fledgling was detected. The highest brood parasitism rate was recorded in 2021, which was 20.6% (seven parasitized nests of 34 monitored nests in all Core Areas; Biological Monitoring Program 2022), but those of other years were 8% or lower. According to a previous study, the rates of parasitism in our surveys were lower than in a study that occurred in the 1990s in Riverside County (32%; Braden et al. 1997b).

Nest Substrates

Nest substrate selection by Coastal California Gnatcatchers in 2024 likely reflected the availability of plants within the sites, which is consistent with Grishaver et al. (1998). In most of the areas in western Riverside County, California Buckwheat is the most dominant CSS species and is frequently used by nesting Coastal California Gnatcatchers (Braden et al. 1997a; Braden 1999). Further, Brittlebush is generally dominant on the south-facing slope (Minnich and Dezzani 1998), which is where we oftentimes detected Coastal California Gnatcatchers. Ultimately, these two species of nesting substrate were the most commonly used by Coastal California Gnatcatchers at our survey locations in 2024.

RECOMMENDATIONS

Core Area Definitions

We recommend including Lake Perris (Existing Core H), Badlands/Potrero (Proposed Core 3), and Tule Valley (Proposed Core 6) as additional Core Areas for Coastal California Coastal California Gnatcatchers. We have frequently detected the species in these locations for at least the last 18 years, and we incidentally documented successful reproduction in the Badlands/Potrero Core Area in 2024. We have little information on the reproductive status of Coastal California Gnatcatchers in the northeast half of the Plan Area; therefore, including these as Core Areas would help us to better understand their status in western Riverside County.

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