Western Riverside County
Multiple Species Habitat Conservation Plan
Biological Monitoring Program

2015 Cactus Wren
(*Campylorhynchus brunneicapillus*)
Survey Report

Cactus Wren carrying food to nestlings.

26 May 2016

Revised 13 November 2017

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NOTE TO READER:

This report is an account of survey activities conducted by the Biological Monitoring Program for the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). The MSHCP was permitted in June 2004. Reserve assembly is ongoing and 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 in the Plan Area (called public or quasi-public lands in the MSHCP). In this report, the term “Conservation Area” refers to these lands as they were understood by the Monitoring Program at the time the surveys were conducted.

The Monitoring Program 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 and the U.S. Fish and Wildlife Service]. Monitoring Program 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, and the information needs of the Permittees. A list of the lands where data collection activities were conducted in 2015 is included in Section 7.0 of the Western Riverside County Regional Conservation Authority (RCA) Annual Report to the Wildlife Agencies.

The primary author of this report was the 2015 Avian Program Lead, Nicholas Peterson. This report should be cited as:

Biological Monitoring Program. 2015. Western Riverside County MSHCP Biological Monitoring Program 2015 Cactus Wren (*Campylorhynchus brunneicapillus*) Survey Report. Prepared for the Western Riverside County Multiple Species Habitat Conservation Plan. Riverside, CA. Available at http://wrc-rca.org/about-rca/monitoring/monitoring-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. Readers wishing to make further use of the information or data provided in this report should contact the Monitoring Program to ensure that they have access to the most current data.

Please contact the Monitoring Program 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 Cactus Wren (*Campylorhynchus brunneicapillus*) is one of 45 bird species covered by the Western Riverside County MSHCP (Dudek & Associates 2003). Two subspecies, *C. b. anthonyi* and *C. b. sandiegensis*, can occur in western Riverside County, and *C. b. sandiegensis* is designated as a Species of Special Concern in the State of California (Unitt 2008). Because the MSHCP does not specify the conservation of either subspecies in particular, we conducted surveys for the species as a whole.

The MSHCP identifies three species objectives for Cactus Wrens. Objective 1 requires the conservation of at least 77,070 ac (31,189 ha) of suitable coastal sage scrub, desert scrub, and Riversidean alluvial fan sage scrub habitats for the species. Objective 2 requires the conservation of at least 11 Core Areas and interconnecting Linkages, including Aguanga, Alberhill, Badlands, Box Springs Mountain, Chino Hills, Lake Mathews-Estelle Mountain, Lake Perris/Bernasconi Hills, Lake Skinner, Motte-Rimrock, Vail Lake, and Wilson Valley (Fig. 1). Although it is not explicitly stated in the species objective, we assume that we must document that Cactus Wrens are using ≥75% of the aforementioned Core Areas at least once every 8 years (*see* Volume I, Section 5.0, Table 5-8 of the MSHCP; Dudek & Associates 2003). Finally, Objective 3 requires the conservation of microhabitat (i.e., cactus patches) in potential nesting habitat (Dudek & Associates 2003).

Cactus Wrens within the U.S. are found in desert habitats from southern California east to central and southcentral Texas. *C. b. anthonyi*, the most common subspecies in western Riverside County, generally occurs from southern Ventura and Los Angeles counties east through southeastern California, southern Nevada, and western Arizona, with some individuals as far south as northeastern Baja California. *C. b. sandiegensis* generally occurs from southern Orange County south to northwestern Baja California, with some individuals occasionally entering western Riverside County (Hamilton et al. 2011).

Cactus Wrens inhabit areas of native scrub vegetation containing mature cholla (*Cylindropuntia* spp.) or prickly pear (*Opuntia* spp.) cacti that are ≥ 1 m tall and can be used as nest sites (Anderson and Anderson 1957; Ricklefs 1966; Unitt 1984; Rea and Weaver 1990; Solek and Szijj 2004; Mitrovich and Hamilton 2007; Hamilton et al. 2011). Sites may also contain yucca (*Yucca* spp.) and can be located in dry washes or on south-facing slopes (Garrett and Dunn 1981; Rea and Weaver 1990). Finally, Cactus Wren occurrence is negatively correlated with increased mesquite (*Prosopis* spp.) density because this generally results in decreased cholla abundance (Lloyd et al. 1998).

Goals and Objectives

A. Document the distribution of Cactus Wrens in the MSHCP-identified core areas.
    a. Conduct repeat-visit point-count surveys within accessible Cactus Wren habitat in the Plan Area by broadcasting Cactus Wren vocalizations. Record all bird species observed.

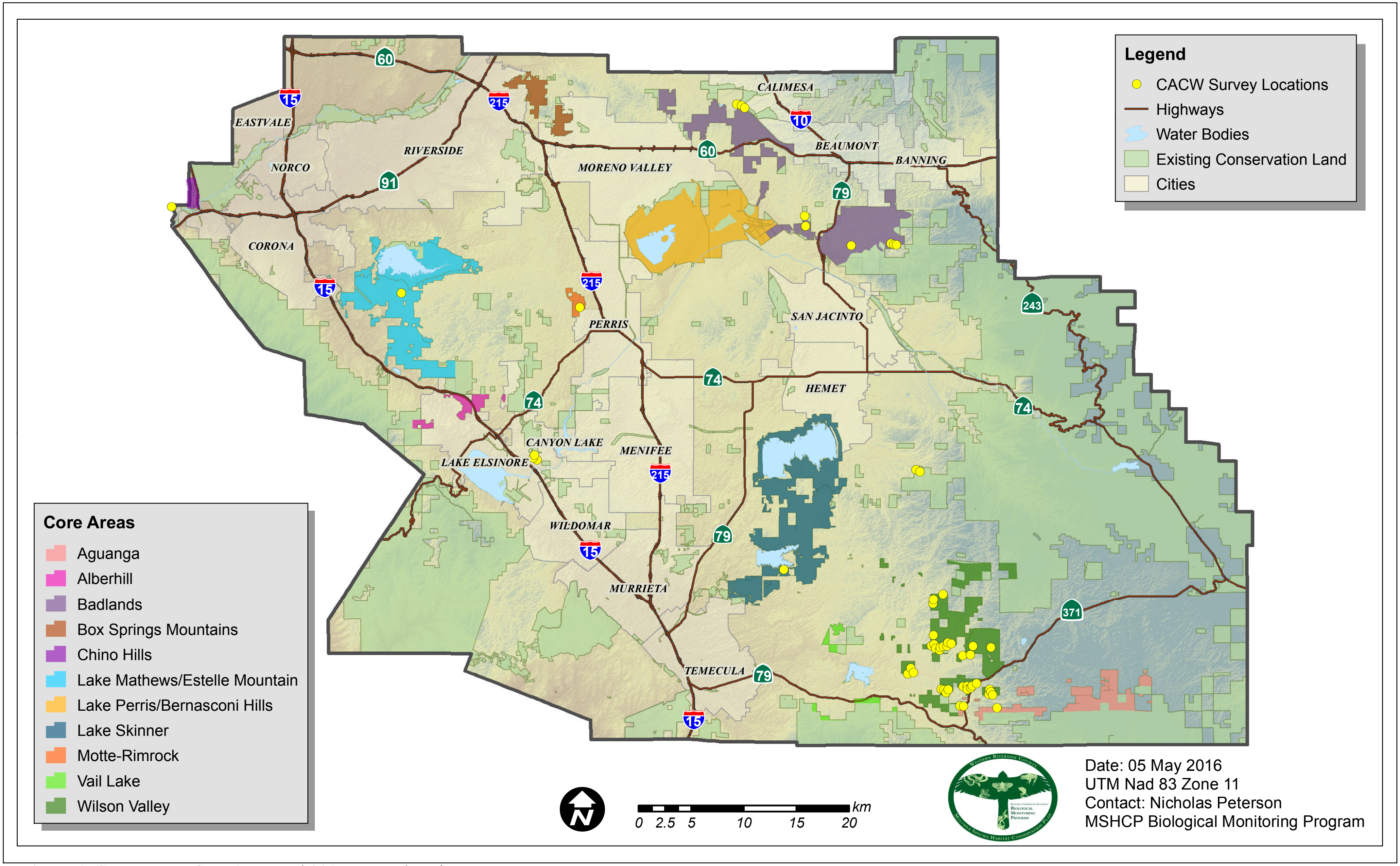

Figure 1. Cactus Wren Core Areas and 2015 survey locations.

METHODS

Survey Design

We documented the presence of Cactus Wrens with repeat-visit point-count surveys using vocalization broadcasts (Mitrovich and Hamilton 2007; Cooper et al. 2012) at points that were at least 250 m apart. I developed survey methods using techniques described in Rosenstock et al. (2002). The design I used allows for the calculation of transect-level detection probability (*p*) and can also be used to evaluate correlations between covariates (MacKenzie et al. 2006).

I began study site selection by selecting habitats within our ArcGIS (ESRI 2006) vegetation layer (CDFG et al. 2005) that were identified by the MSHCP (Dudek & Associates 2003) as suitable for the Cactus Wren, specifically coastal sage scrub, desert scrub, and Riversidean alluvial fan sage scrub. After I identified appropriate habitat in GIS, I clipped that layer to a separate GIS layer consisting of conserved lands within the Cactus Wren Core Areas designated by the MSHCP. Next, I generated 55 randomly-located survey points, separated by at least 250 m, within those Core Areas (Fig. 1). We started our surveys in early March and finished in early June, during which time we had conducted three survey rounds. This time period allowed us to detect Cactus Wrens beginning with the period of peak territory establishment (i.e., March and April; Cooper et al. 2012) and continuing through the end of the peak of the breeding season (i.e., early June; Hamilton et al. 2011).

Field Methods

We began surveys on 9 March 2015 and completed our third and final round of surveys on 3 June 2015. We surveyed from sunrise until 1000 h and did not survey if the temperature exceeded 29°C; during rain, drizzle, or fog; or if maximum wind speeds exceeded 12.9 km/h (Lloyd et al. 1998; Mitrovich and Hamilton 2007).

Observers conducted surveys by broadcasting Cactus Wren vocalizations, acquired from xeno-canto (www.xeno-canto.org), using an MP3 player and a portable speaker. Surveys were 5 min in duration and consisted of three 40-sec bouts of wren vocalizations, each of which were followed by 1 min of silence. Observers immediately terminated broadcasts if they detected a Cactus Wren, but continued to listen for additional birds for the duration of the 5-min survey period. Observers oriented their speakers during the broadcasts so they were directed toward apparently suitable wren habitat. If there was one patch of suitable habitat, the speakers were not moved during the survey period; however, if several patches existed, observers ensured that speakers were rotated throughout the survey period to adequately broadcast toward all suitable habitat patches (Mitrovich and Hamilton 2007).

Observers recorded on their data sheet (Appendix A) information for all bird species detected while at each point. For non-covered species, observers recorded information for only the first individual of that species detected, which provided species richness data for the site. For such species, observers recorded the four-letter species code, age class information, and sex. For Covered Species, observers recorded the four-letter species code, age class, and sex for every individual detected. If observers were unsure whether they had already recorded data on an individual (i.e., they were double-counting), they erred on the side of caution and recorded information on that individual.

Data Analysis

I estimated per-visit cumulative detection probability ($P*$) for Cactus Wrens using closed-capture occupancy models (MacKenzie et al. 2006). I considered locations with Cactus Wren observations *used* rather than *occupied* because the survey design likely did not meet the assumption of population closure (i.e., random movement of animals in and out of sample plots across visits). I used Program MARK (White and Burnham 1999) to construct and compare candidate models that examined the full combination of site and visit effects on transect-level detection probability (p). I then ranked candidate models according to Akaike's Information Criterion for small samples (AIC*c*), calculated Akaike weights (w_i), and derived weighted-average estimates for p across the entire candidate set unless a single model showed clear support (i.e., $w_i > 0.9$) (Burnham and Anderson 2002). I calculated cumulative detection probability ($P*$) across three visits using model-derived estimates of p and the following formula where p_i is the detection probability on a given survey visit:

$$P^{*} = 1 - \left(\prod_{i=1}^{3} 1 - p_i \right)$$

Finally, I calculated variances for $P*$ using the delta method (MacKenzie et al. 2006; Powell 2007).

RESULTS

Cactus Wren Detections

We detected 71 avian species during our 2015 Cactus Wren surveys; 11 of the species are covered under the MSHCP (Appendix B). We have detected Cactus Wrens in 4 (36%) of the 11 designated Core Areas and Linkages during the current reporting period (2008–2015; Table 1).

Table 1. The most recent detection of Cactus Wrens within each of the designated Core Areas and Linkages. Current reporting period is 2008–2015.

Core Area / Linkage	Most recent Cactus Wren detection
Aguanga	2015
Alberhill	Never
Badlands	2015
Box Springs Mountain	Never
Chino Hills	2010
Lake Mathews-Estelle Mountain	Never
Lake Perris/Bernasconi Hills	Never
Lake Skinner	Never
Motte-Rimrock	Never
Vail Lake	Never
Wilson Valley	2015
Overall within current reporting period	**4 (36%) core areas and linkages**

We detected Cactus Wrens at 22 (40%) of 55 survey points during Round 1 of surveys (9 March–1 April), 27 (49%) during Round 2 (1 April–7 May), and 32 (58%) during Round 3 (7 May–3 June). Overall, we detected Cactus Wrens at 33 (60%) of the survey points during the entirety of our survey season.

We have detected Cactus Wrens 213 times within the Plan Area from 2005 to 2015 (Fig. 2). The majority of the detections (157, or 74%) are within the Wilson Valley Core Area, followed by Aguanga (11, or 5%), Badlands (5 or 2%), and Chino Hills (1 or 0.5%). The remaining 41 (19%) detections occurred outside of the designated Core Areas and Linkages. Similarly, most of our 2015 Cactus Wren detections occurred in Wilson Valley (77 of 81 detections, or 95%), followed by Aguanga (3, or 4%) and Cactus Valley (1, or 1%), which is not a designated Core Area.

Detection Probability Analysis

Program MARK identified the p(t) model (AIC_C weight = 0.97) as the best-fit model (Table 2). This model indicated that detection probability (± SE) varied by time (t), or more specifically, during each survey round: 0.67 ± 0.08 in Round 1, 0.82 ± 0.07 in Round 2, and 0.97 ± 0.03 in Round 3. The cumulative detection probability (± SE) was 0.998 ± 0.018. I eliminated the p(g) model, which considers variations in detection probability by group (g) or Core Area, from analysis because we had too few (n = 4) Cactus Wren detections outside of the Wilson Valley Core Area to justify including the model. Finally, Program MARK provided an overall site occupancy (ψ ± SE) of 0.60 ± 0.07.

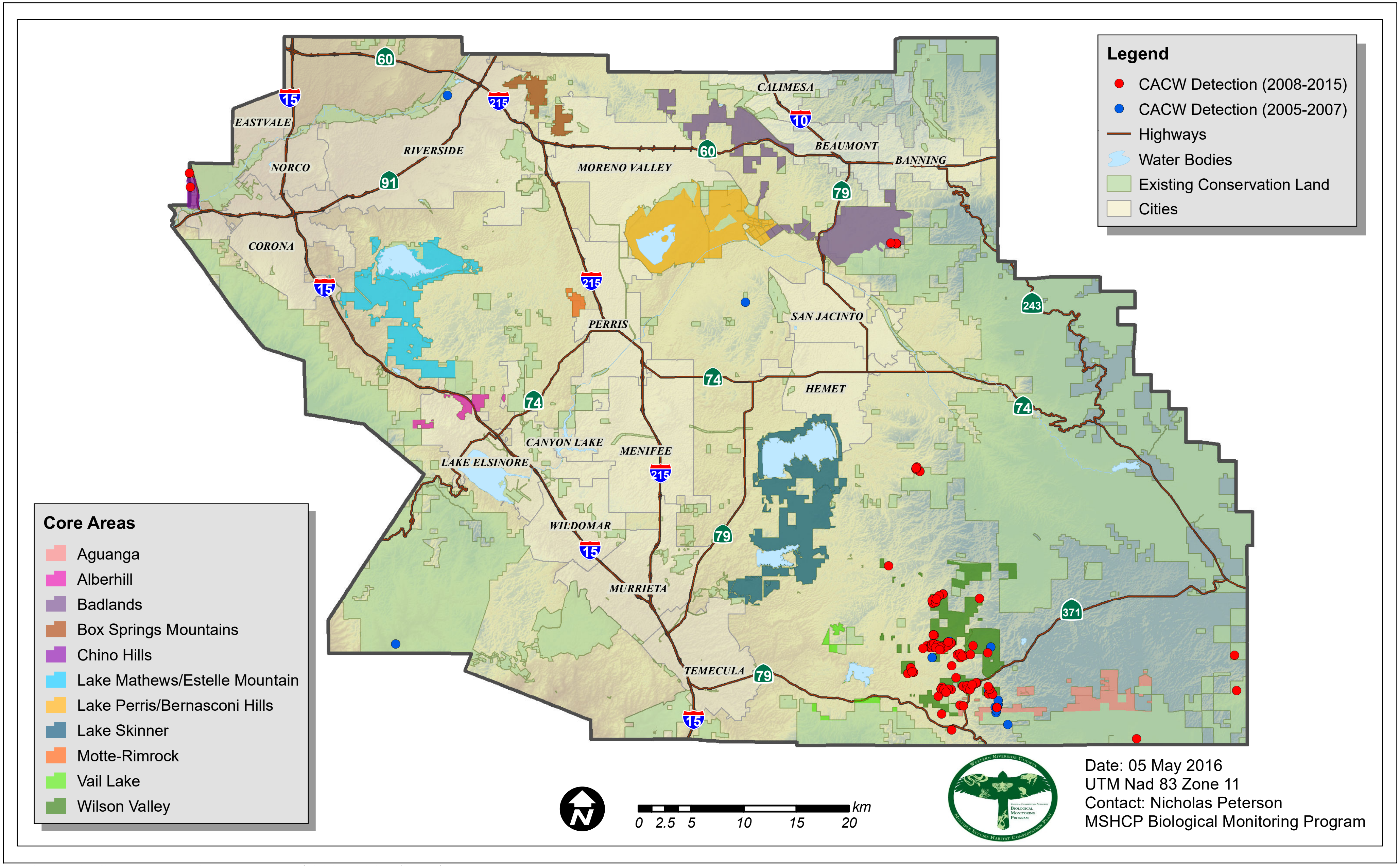

Figure 2. Cactus Wren Core Areas and 2005-2015 detections.

Table 2. Model rankings for Cactus Wren surveys in 2015. Variables for detection probabilities (*p*) were modeled to remain constant (.) and vary by time (*t*). Occupancy (ψ) was modeled to remain constant. For model selection, I used Akaike's Information Criterion corrected for small sample size (AIC_C). w_i = AIC_C weight and *k* = number of parameters.

Model	Δ AIC_C	w_i	Model likelihood	*k*
$p(t)\ \psi(.)^a$	0.00	0.97	1.00	4
$p(.)\ \psi(.)$	6.76	0.03	0.03	2
$^a AIC_C$ = 164.97				

DISCUSSION

Cactus Wren Detections

More than 90% of our Cactus Wren detections from 2008 to 2015 occurred in the southeastern part of the Plan Area (Fig. 2). Birds in this area were identified by Barr et al. (2015) as the Aguanga population of wrens, with an effective population size of 104.1 (95% CI: 31.0–∞). Birds from this population are known to extend as far north as Cactus Valley, where we have also detected the species. This is also the closest known population of Cactus Wrens to Potrero, at the southern end of the Badlands Core Area (Fig. 1), which may have produced the birds we detected there in 2014 and 2015.

A second population identified by Barr et al. (2015) is the Chino Hills population, which likely included the Cactus Wrens we have detected in and near the Chino Hills Core Area (Fig. 1). This is also the population that is closest to the City of Riverside, in which we have detected a Cactus Wren on one occasion (Fig. 2). The Chino Hills population has an effective population size of 10.1 (95% CI: 7.0–15.6) and is restricted to the Chino Hills portion of Riverside and San Bernardino counties (Barr et al. 2015).

The third population of Cactus Wrens that may account for wrens we have detected is the Southern Pendleton population, with an effective population size of 56.5 (95% CI: 11.0–∞) (Barr et al. 2015). This population generally occurs along the boundary between San Diego and Orange counties but an individual has been documented in the hills east of Lake Elsinore, near one of our 2015 survey points (Fig. 1). This population may have produced the Cactus Wren we detected along San Mateo Canyon (Fig. 2).

We have one Cactus Wren detection from 2007 that is centrally located within the Plan Area, specifically in the Lakeview Mountains (Fig. 2). This location is closest to the Aguanga population of Cactus Wrens (~39 km to the center of the population cluster) but is not substantially farther from the Chino Hills or Southern Pendleton population clusters (~54 km to both). This may represent a significant dispersal event for a species that is considered relatively sedentary. For example, Preston and Kamada (2012) reported a maximum dispersal distance of just 3.19 mi (5.13 km) for Coastal Cactus Wrens (*C. b. sandiegensis*) in Orange County, where most wrens either moved short distances from their natal sites as adults or simply inherited natal sites from their parents.

We have never detected Cactus Wrens in 7 of the 11 Core Areas and Linkages (Fig. 2), generally because they do not contain suitable habitat for the species.

Specifically, none of these areas have conserved land that contains stands of mature cholla or prickly pear cacti that are ≥ 1 m tall and can be used as nest sites (Anderson and Anderson 1957; Ricklefs 1966; Unitt 1984; Rea and Weaver 1990; Solek and Szijj 2004; Mitrovich and Hamilton 2007; Hamilton et al. 2011). Two Core Areas, Lake Mathews-Estelle Mountain and Lake Perris/Bernasconi Hills, have relatively large patches of cacti but the plants are < 1 m tall and thus not suitable nest sites for Cactus Wrens. Conversely, Motte-Rimrock has cacti that are ≥ 1 m tall, but the plants are isolated and do not form the dense stands preferred by wrens. Managing habitat for Cactus Wrens in these sites should focus on establishing dense stands of suitably tall cacti that can be used by dispersing wrens, such as the habitat that was used by the wren we detected in Potrero (Fig. 3).

Figure 3. Cholla patch in Potrero in which we detected a Cactus Wren in 2014. Photo by Tara Graham (RCA).

Investigators recommend managing Cactus Wren populations and their habitat in one of two ways, depending upon how isolated a population is. If habitat gaps between populations are not too extensive, Barr et al. (2015) recommend planting cacti and other native, preferred scrub species in open spaces to enhance gene flow. In situations where habitat gaps are too extensive (e.g., between our Aguanga, Chino Hills, and Southern Pendleton populations), efforts should focus on improving local population genetics by increasing available habitat within and adjacent to the population cluster (Barr et al. 2015). Finally, translocation (Kamada and Preston 2013) and egg-switching have been used to improve genetic diversity of Cactus Wren populations (Barr et al. 2015).

Detection Probability Analysis

Our survey methods in 2015 resulted in a high cumulative detection probability (0.998) over the course of three survey rounds. This suggests that we nearly always detected the species during at least one of the three visits to a given point, provided the species was indeed present near the point. Additionally, detection probability increased with each survey round, with the highest occurring during the final survey round (7 May to 3 June). This time period coincides with the peak in fledgling presence (May and June; Hamilton et al. 2011) and we noticed in 2015 that family groups (i.e., fledglings and adults) of Cactus Wrens were typically very vocal, thereby potentially making the species more detectable by our biologists than the adults were earlier in the breeding season.

Site occupancy in our study was 0.60 and the lowest detection probability (0.67) occurred during Round 1. Using these data and Table 6.1 in MacKenzie et al. (2006), we can conclude that three is the optimal number of visits to survey sites in future Cactus Wren surveys, assuming we use the same methodology as in 2015. We can also conclude that future surveys should consist of 27–108 survey points, assuming we want to accept a 5–10% coefficient of variation for the occupancy estimate (Equation 6.3 in MacKenzie et al. 2006).

Recommendations for Future Surveys

Future Cactus Wren surveys should consist of three survey rounds, as in 2015, and should consist of 27–108 survey points. We may be able to increase our survey efficiency, specifically being able to survey a higher number of points, if we incorporate a removal design in future surveys. Such a design would mean no additional surveys would be conducted at a site after Cactus Wrens are detected, which would allow us time to survey at additional sites (MacKenzie et al. 2006).

We may also want to incorporate into future survey efforts a habitat data collection component that could be useful to local land managers who are creating or conserving habitat for the species. Investigators have assessed habitat needs for Cactus Wrens outside of western Riverside County (e.g., Lloyd et al. 1998; Mitrovich and Hamilton 2007; Cooper et al. 2012; Conlisk et al. 2014; Conlisk et al. 2015), but few have studied habitat needs within our Plan Area (e.g., Westman 1981).

ACKNOWLEDGEMENTS

Funding for the Biological Monitoring Program is provided by the Western Riverside Regional Conservation Authority (RCA) and the California Department of Fish and Wildlife (DFW). Program employees who conducted surveys were Nicholas Peterson (Avian Program Lead, DFW), Tara Graham (RCA), Lynn Miller (RCA), Robert Packard (RCA), and David Tafoya (RCA). We thank the land managers in the MSHCP Plan Area, who in the interest of conservation and stewardship facilitate Monitoring Program activities on the lands for which they are responsible.

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Appendix A. 2015 Cactus Wren survey data sheet.

MSHCP Cactus Wren Survey Data Sheet, 2015

Point ID: ________ Visit #: ________

Date: ________________

Observer: ________

Start time: ________________

End time: ________________

Site conditions

Max wind: ____________ km h^{-1}

Avg. wind: ____________ km h^{-1}

Sky code: ____________

Ambient noise: ____________

Start temp.: ____________ End temp.: ____________

Species code	Sex (M, F, U)	Age (Ad, Ju, Fl, U)	Notes

Notes, species observed in transit, etc.

Sky Condition Codes: 0 = clear or few clouds; 1 = partly cloudy; 2 = overcast; 3 = fog or smoke; 4 = light drizzle; 5 = constant snow; 6 = constant rain.

Noise Codes: 0 = no noise; 1 = noise, but not affecting bird detection; 2 = moderate noise, may be affecting detection; 3 = loud noise, reducing ability to detect birds; 4 = very loud noise, difficult to hear anything at all.

Appendix B. Avian species detected during 2015 Cactus Wren surveys. Species in bold are covered under the MSHCP.

COMMON NAME	SCIENTIFIC NAME
American Coot	*Fulica americana*
American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Spinus tristis*
American Kestrel	*Falco sparverius*
Anna's Hummingbird	*Calypte anna*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Bell's Sparrow	***Artemisiospiza belli***
Bewick's Wren	*Thryomanes bewickii*
Black-chinned Sparrow	*Spizella atrogularis*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Black-throated Sparrow	*Amphispiza bilineata*
Blue Grosbeak	*Passerina caerulea*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Brewer's Sparrow	*Spizella breweri*
Bullock's Oriole	*Icterus bullockii*
Bushtit	*Psaltriparus minimus*
Cactus Wren	***Campylorhynchus brunneicapillus***
California Gull	*Larus californicus*
California Quail	*Callipepla californica*
California Thrasher	*Toxostoma redivivum*
California Towhee	*Melozone crissalis*
Cassin's Kingbird	*Tyrannus vociferans*
Cliff Swallow	*Petrochelidon pyrrhonota*
Coastal California Gnatcatcher	***Polioptila californica californica***
Common Ground-Dove	*Columbina passerina*
Common Raven	*Corvus corax*
Common Yellowthroat	*Geothlypis trichas*
Costa's Hummingbird	*Calypte costae*
Eurasian Collared-Dove	*Streptopelia decaocto*
European Starling	*Sturnus vulgaris*
Forster's Tern	*Sterna forsteri*
Great Blue Heron	***Ardea herodias***
Great Egret	*Ardea alba*
Greater Roadrunner	*Geococcyx californianus*
Hooded Oriole	*Icterus cucullatus*
Horned Lark	***Eremophila alpestris***
House Finch	*Haemorhous mexicanus*
House Wren	*Troglodytes aedon*
Ladder-backed Woodpecker	*Picoides scalaris*
Lawrence's Goldfinch	*Spinus lawrencei*
Lesser Goldfinch	*Spinus psaltria*
Loggerhead Shrike	***Lanius ludovicianus***
Mallard	*Anas platyrhynchos*
Mountain Quail	***Oreortyx pictus***
Mourning Dove	*Zenaida macroura*
Northern Flicker	*Colaptes auratus*
Northern Mockingbird	*Mimus polyglottos*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Nuttall's Woodpecker	*Picoides nuttallii*

Appendix B. Continued.

COMMON NAME	SCIENTIFIC NAME
Phainopepla	*Phainopepla nitens*
Red-shouldered Hawk	*Buteo lineatus*
Red-tailed Hawk	*Buteo jamaicensis*
Red-winged Blackbird	*Agelaius phoeniceus*
Rock Wren	*Salpinctes obsoletus*
Rufous Hummingbird	*Selasphorus rufus*
Savannah Sparrow	*Passerculus sandwichensis*
Say's Phoebe	*Sayornis saya*
Scott's Oriole	*Icterus parisorum*
Song Sparrow	*Melospiza melodia*
Southern California Rufous-crowned Sparrow	***Aimophila ruficeps canescens***
Spotted Towhee	*Pipilo maculatus*
Turkey Vulture	***Cathartes aura***
Unidentified hummingbird	Family Trochilidae
Unidentified sparrow	Family Emberizidae
Unidentified swallow	Family Hirundinidae
Unidentified woodpecker	Family Picidae
Violet-green Swallow	*Tachycineta thalassina*
Western Kingbird	*Tyrannus verticalis*
Western Meadowlark	*Sturnella neglecta*
Western Scrub-Jay	*Aphelocoma californica*
White-crowned Sparrow	*Zonotrichia leucophrys*
White-tailed Kite	***Elanus leucurus***
Wrentit	*Chamaea fasciata*
Yellow Warbler	***Setophaga petechia***
Yellow-rumped Warbler	*Setophaga coronata*