Western Riverside County
Multiple Species Habitat Conservation Plan (MSHCP)
Biological Monitoring Program

Coastal Sage Scrub Bird Survey Report 2007

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TABLE OF CONTENTS

INTRODUCTION **1**

Survey Goals 1

METHODS **1**

Protocol Development 1

Personnel and Training 1

Study Site Selection 2

Survey Methods 3

Nest Monitoring 3

Data Analysis 3

RESULTS **5**

General Distribution of Target Species 5

Nest Monitoring 8

Density 8

Occupancy 8

DISCUSSION **11**

Protocol Efficacy 11

Density and occupancy estimates 11

Species Objectives 12

Recommendations for Future Surveys 12

REFERENCES **15**

LIST OF TABLES AND FIGURES

Table 1. Core Areas and transect effort for the 3 Covered CSS bird species. **6**

Table 2. Number of observations of Covered Species within Core Areas. **7**

Table 3. Results of distance analysis for California gnatcatcher. **9**

Table 4. Results of distance analysis for rufous-crowned sparrow. **10**

Figure 1. Map of CSS bird transect locations for 2006 and 2007. ..... **14**

LIST OF APPENDICES

Appendix A: Western Riverside County MSHCP Biological Monitoring Program Protocol for Coastal Sage Scrub Bird Surveys **16**

Appendix B: Western Riverside County MSHCP Biological Monitoring Program Protocol for Passerine Nest Searching and Monitoring **19**

NOTE TO READER:

This report is an account of survey activities undertaken by the Biological Monitoring Program for the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). The MSHCP was permitted in June 2004. The Biological Monitoring Program monitors the distribution and status of the 146 Covered Species 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 Game and the U.S. Fish and Wildlife Service). Monitoring Program activities are guided by the MSHCP species objectives for each Covered Species, the information needs identified in MSHCP Section 5.3 or elsewhere in the document, and the information needs of the Permittees.

While we have made every effort to accurately represent our data and results, it should be recognized that our database is still under development. Any reader 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 best available or most current data.

The primary preparer of this report was the 2007 Avian Program Lead, Matt Talluto. If there are any questions about the information provided in this report, please contact the Monitoring Program Administrator. If you have questions about the MSHCP, please contact the Executive Director of the Western Riverside County Regional Conservation Authority (RCA). For further information on the MSHCP and the RCA, go to www.wrc-rca.org.

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INTRODUCTION

Three Covered bird species are found frequently or only in coastal sage scrub vegetation ("CSS"): Bell's sage sparrow (*Amphispiza belli belli*; "SAGS"), coastal California gnatcatcher (*Polioptila californica californica*; "CAGN"), and southern California rufous-crowned sparrow (*Aimophila ruficeps canescens*; "RCSP," together "CSS birds"). The species-specific objectives for CAGN require continued use and successful reproduction to be maintained in 75 percent of specified Core Areas once every 3 years. The species objectives for the other 2 CSS birds are less precise, but General Management Measure 7 specifies:

> *"Unless otherwise specified in the species-specific conservation objectives, species presence and continued use shall be maintained at 75% of the locations identified for each species in the species accounts, as measured at a minimum once every eight years."* (Dudek and Associates 2003)

In 2006, the Monitoring Program began a pilot CSS bird study to test a protocol to determine the distributions of winter resident Covered CSS bird species. A second study, aimed at gaining information about Covered CSS bird species during the breeding season, was conducted using the same protocol in spring 2007. To attempt to demonstrate successful reproduction of CAGN, a nest searching pilot was added for the 2007 survey. The goals of the CSS bird study were therefore as follows:

Survey Goals:

A) Evaluate the protocol developed for this survey with respect to feasibility and ability to accomplish survey goals.

B) Determine whether California gnatcatchers are successfully reproducing within Core Areas.

C) Determine detection probabilities for Covered Species to assist with future survey design.

D) Determine the distribution, density, and occupancy during the winter and breeding seasons of Covered CSS bird species and other co-occurring bird species within CSS habitats.

METHODS

Protocol Development

The survey methods for the pilot year CSS bird monitoring are based on a transect count method described in Buckland et al. (2001) and Rosenstock et al. (2002). This method allows us to perform multiple analyses on the data that are collected, including calculating estimates of bird densities corrected for detection probability (Buckland et al. 2001) and proportion of area occupied (MacKenzie et al. 2002).

Personnel and Training

All field personnel demonstrated proficiency at both visual and aural identification of Covered CSS birds as well as other common co-occurring CSS bird species. All observers practiced visual and aural identification for several weeks prior to the beginning of field surveys.

No observer began surveys before passing an examination by correctly identifying recordings of all Covered CSS species and greater than 80% of a sample of typical co-occurring species. Personnel were also trained in visual distance estimation. All personnel demonstrated proficiency with survey techniques before field surveys commenced. Personnel conducting CSS bird surveys in 2006 and 2007 included:

- Matt Talluto, Avian Program Lead (Regional Conservation Authority)
- Andy Boyce (Regional Conservation Authority)
- Amanda Breon (Regional Conservation Authority)
- Conan Guard (Regional Conservation Authority)
- Angela Hyder (Regional Conservation Authority)
- Iris Koski (Regional Conservation Authority)
- Bill Kronland (Regional Conservation Authority)
- Lynn Miller (Regional Conservation Authority)
- Robert Packard (Regional Conservation Authority)
- Chadette Pfaff (Regional Conservation Authority)
- Lee Ripma (Regional Conservation Authority)
- Kim Skahan (Regional Conservation Authority)
- Carol Thompson (Regional Conservation Authority)
- Joe Veverka (Regional Conservation Authority)
- Laura Weisel (Regional Conservation Authority)
- Dan Williams (Regional Conservation Authority)

Personnel involved in the nest searching project received additional training in the reproductive biology of the nest searching target species. Prior to beginning field surveys, all personnel practiced techniques and protocols to be used in the project on common, non-covered species. All observers demonstrated proficiency in the field with common species before proceeding to work with Covered Species. Personnel performing nest searching and monitoring in 2007 included:

- Conan Guard, Nest Searching Project Lead, (Regional Conservation Authority)
- Robert Packard (Regional Conservation Authority)
- Carol Thompson (Regional Conservation Authority)

Study Site Selection

We selected survey locations within the Conservation Area based on the presence of CSS habitat as shown in the updated GIS vegetation map (CDFG et al. 2005). Potential transect start locations were placed in a 500 m grid within CSS habitat. A small number of Core Areas contained CSS habitat that was highly patchy, but widespread, resulting in few grid points being placed within habitat mapped as CSS. In these areas, points were placed randomly at a minimum distance of 500 m from other points. We then chose random survey locations from the potential start points, stratified by Core Area. We selected 2 cardinal travel headings at random from evenly spaced 45 degree intervals. Headings that placed transects through large amounts of inappropriate habitat (as identified on the GIS layer), or resulted in travel outside the Conservation Area were excluded.

Surveyors navigated to transect start locations using handheld GPS units, then traveled in the first of the 2 randomly selected headings for 500 m. Flagging was installed along the route, and GPS waypoints were recorded approximately every 100 to 150 m. If the terrain became impassable less than 250 m from the start point, the transect was abandoned, all flagging was removed, and the observer returned to the start point to attempt the second randomly selected heading. If both headings were impassable, observers randomly chose headings until a transect could be installed. If the terrain became impassable more than 250 m from the start point but less than the full 500 m, the transect was installed with the shorter length. Transects were placed a minimum of 500 m apart to minimize the chance of surveyors observing an individual bird at multiple survey locations.

Survey Methods

Survey methods are detailed in the *2007 Western Riverside County MSHCP CSS Bird Survey Protocol* (hereafter "Protocol"; Appendix A). During the survey, observers walked 250 to 500 m transects and recorded every individual bird observed visually or aurally. Upon observing a bird, observers recorded the species, distance from the observation point to the bird (visually estimated or measured with a laser rangefinder, estimated for acoustic only observations), the angle between the transect line and the bird, age class and sex of the bird (if identifiable), the location of the bird (inside CSS vegetation, inside grassland vegetation, other vegetation, or flying over CSS or grassland vegetation), and the cues used to identify the bird (visual, aural, or both). Observers also recorded temperature, wind speed, and weather conditions at the end of each transect. Observers walked transects at an average of 0.71 km/hr. To account for variability in completion time, observers recorded the start and end time of each transect.

All transects were visited 3 times in the fall and 3 times in spring. The survey periods for fall were 13 October 2006 to 3 November 2006, 3 November 2006 to 6 December 2006, and 6 December 2006 to 9 January 2007. Spring survey periods were 5 March 2007 to 30 March 2007, 2 April 2007 to 4 May 2004, and 14 May to 8 June 2007.

Nest Monitoring

We performed a pilot nest searching and monitoring project during the spring 2007 survey to address the reproductive species objective for CAGN. When personnel were available for nest searching, they returned to the location of CAGN observed previously on transect counts to observe birds for breeding behavior and, if possible, locate nests. These nests were then revisited to determine nest success. A nest was considered successful if it produced at least 1 chick that survived until fledging. If a fledgling was observed within a Core Area, this observation was assumed to represent a successful nest, even if no actual nest was found. Nest searching methods are detailed in the *2007 Western Riverside County MSHCP Nest Searching Protocol* ("Nest Searching Protocol," Appendix B).

Data Analysis

We estimated target species densities and population sizes using program DISTANCE (Thomas et al 2006). This method estimates detection probability based on distance sampling data and uses this information to provide a corrected density estimate. We estimated density of Covered Species stratified by Core Area. Because distance sampling requires relatively large sample sizes (40-60 detections per stratum for a simple model with no covariates), we could not

calculate individual detection probabilities for specific Core Areas. Species with too few detections to fit a reliable global detection function were not analyzed using this method.

We evaluated multiple detection functions for each species analyzed using both half-normal and hazard-rate key functions with either cosine or polynomial adjustment terms. The model that minimized Akaike's Information Criterion (AIC) was selected and used for all further analysis. When model fit was poor (determined visually and using χ^2 goodness of fit tests), models were truncated and pooled by hand.

Much of the CSS habitat we encountered in the field was fragmented and had a patchy distribution. As a result of the random placement of transects, many sampled areas contained high proportions of grassland. To determine whether the landscape-scale proportions of CSS and grassland affected the density of Covered Species, we calculated the proportion of CSS within 100 m of each transect using a GIS layer of vegetation type. We then stratified our sample *post-hoc* into 4 categories containing approximately equal transect effort (measured as total distance walked). For species with adequate sample sizes, we calculated detection probability and density individually for each stratum; for other species we calculated a global detection probability and estimated density individually for each stratum.

We used program PRESENCE (Hines 2006) to calculate the Proportion of Area Occupied (PAO) for both the fall and spring surveys. This analysis determines transect-level detection probabilities based on multiple visits to the same locations and then estimates the proportion of the survey area occupied by the target species. This method cannot determine population size nor can it detect trends in population size, but it can provide information about whether the overall range of a species is expanding or contracting when observations from multiple years are compared. An advantage of PAO analysis is that it is more robust than distance sampling at lower sample sizes (Mackenzie et al. 2006).

When sample sizes were large enough to support more complex analyses, we tested the effects of environmental variables on occupancy, density, and detection probability. For 2006 and 2007 data, these included site-specific variables only, including elevation and the proportion of area within 100 m of a transect dominated by CSS vegetation (calculated using GIS vegetation layers from CDFG et al. 2005). Sample-specific covariates (e.g., temperature) were not included due to small sample size and numerous missing values. In order to determine if our sampling method affected detection probability, we also tested the effects of transect length and walking speed on detection probability in both distance and occupancy models. All models were compared to models containing no stratification or covariates. The best fitting model was chosen using AIC, and we have reported the results of these models here.

Both distance and PAO methods rely heavily on the assumption that populations remain closed (no immigration, emigration, mortality, or birth) during the survey period. Violations of this assumption can lead to large errors in parameter estimates. For this reason, we have not performed combined analyses of fall and spring data. While it is reasonable to assume that bird populations remain relatively stable during a given season, the highly mobile nature of migratory birds as well as the changes in distributions associated with territory establishment in early spring make it very unlikely that closure assumptions are met between seasons. When sample sizes were large enough, we compared density and PAO estimates between seasons to determine the magnitude of these changes between the winter and the breeding season.

RESULTS

The MSHCP identifies 17 total Core Areas for the 3 CSS bird species we targeted. We performed surveys in 10 of these areas in 2006 and in 14 Core Areas in 2007 (Table 1). The Railroad Canyon/Sedco Hills Core Area was not surveyed because it had no contiguous conserved habitat patches that were large enough to support a 500 m transect. Tule Valley and the area West of Lake Elsinore were not surveyed due to a lack of available survey personnel. Because CAGN has a reporting frequency of 3 years, we gave higher priority to CAGN Core Areas when deciding which areas to survey. We performed surveys on a total of 83 transects for a total of 104.0 transect-km in 2006, and 96 transects for 127.7 transect-km in 2007 (Figure 1).

General Distribution of Target Species

In 2006, we observed SAGS in 6 of 7 surveyed Core Areas and in 2 additional areas. A total of 33 SAGS were observed on transects during 2006. SAGS were also observed incidentally in 1 non-Core Area. In 2007, we observed SAGS in 8 of 11 surveyed Core Areas and in 1 additional area. SAGS were observed incidentally in 2 non-Core Areas in 2007. A total of 47 SAGS were observed on transects in 2007 (Table 2).

Combining 2006 and 2007 survey data with incidental observations, SAGS have been observed in a total of 8 of 13 Core Areas (62%) thus far. SAGS have also been observed in 4 areas that are Core Areas for other CSS bird species but not for SAGS.

In 2006, we observed CAGN during surveys in 6 of 7 surveyed Core Areas and in 1 additional area. CAGN were observed incidentally in 1 Core Area and 2 non-Core Areas. A total of 84 CAGN were observed on transects during 2006. CAGN were observed incidentally in 1 Core and 2 non-Core Areas. In 2007, we observed CAGN in 6 of 8 surveyed Core Areas and in 1 additional area. CAGN were observed incidentally in 1 Core and 1 non-Core Area. A total of 42 CAGN were observed on transects in 2007 (Table 2). The Railroad Canyon/Sedco Hills Core was not surveyed in either year and had no incidental CAGN observations.

Combining 2006 and 2007 surveys with incidental observations, CAGN have been observed in a total of 8 of 9 Core Areas (89%). CAGN have also been observed in 3 areas that are Core Areas for other CSS bird species but not for CAGN.

In 2006, we observed RCSP in 7 of 7 surveyed Core Areas and in 3 additional areas. RCSP were also observed incidentally in 1 Core Area. A total of 218 RCSP were observed on transects during 2006. In 2007, we observed RCSP in 8 of 8 surveyed Core Areas and in 5 additional areas. RCSP were observed incidentally in an additional Core Area. A total of 563 RCSP were observed on transects in 2007 (Table 2). One Core Area, the portion of the Cleveland National Forest that lies west of Lake Elsinore, was not surveyed in either year, although RCSP were observed incidentally there. An additional 4 RCSP were observed in 2007 on transects that did not fall into any Core Areas.

Combining 2006 and 2007 surveys with incidental observations, RCSP have been observed in all 9 Core Areas (100%). RCSP have also been observed in 6 areas that are Core Areas for other CSS bird species but not for RCSP.

Table 1. Core Areas and transect effort for the 3 Covered CSS bird species.

Core Area	Species[1]	# transects		Total Transect Effort (m)	
		2006	2007	2006	2007
Aguanga	SAGS	0	2	0	2817
Alberhill	CAGN	4	4	5622	5622
Badlands	RCSP, SAGS	5	7	3874	10176
Box Springs Mountain	RCSP, SAGS	5	4	5820	5046
Jurupa Mountains[2]	SAGS	0	1	0	1572
Lake Mathews & Estelle Mountain	CAGN, RCSP, SAGS	11	11	14328	14328
Lake Perris & San Jacinto Wildlife Area	RCSP, SAGS	18	18	21170	23007
Lake Skinner & Diamond Valley Lake	CAGN, RCSP, SAGS	23	20	30618	27531
Lakeview Mountains	SAGS	0	1	0	1440
Murrieta Hot Springs & Hogbacks	CAGN, RCSP, SAGS	0	4	0	5787
North Peak Conservation Bank	CAGN	4	5	6501	6501
Quail Valley, Kabian Park	CAGN	4	4	4314	5220
Railroad Canyon & Sedco Hills[3]	CAGN, SAGS	0	0	0	0
Tule Valley	SAGS	0	0	0	0
Wilson Valley	CAGN, RCSP, SAGS	4	6	5121	6739
Wasson Canyon	CAGN, RCSP, SAGS	4	4	5313	5313
West of Lake Elsinore (Cleveland NF)	RCSP	0	0	0	0
Other	NONE	1	5	1293	6552
Total		83	96	103974	127651

[1]Species for which each area is a core. CAGN = California gnatcatcher, RCSP = rufous-crowned sparrow, SAGS = sage sparrow
[2]The Biological Monitoring Program did not have access to the area around Lake Mathews, so only Estelle Mountain was surveyed
[3]At the time surveys were initiated, this Core Area did not have enough conservation to allow for placement of transects.

Table 2. Number of observations of Covered Species within Core Areas during 2006 and 2007 surveys. A value of n/a indicates an area that was not surveyed, and a value of P indicates a species that was observed incidentally in that area, but not during a survey.

	SAGS		CAGN		RCSP	
Core Areas Surveyed	2006	2007	2006	2007	2006	2007
Aguanga	n/a	0	P	0	n/a	3
Alberhill	0	P	7	7	10	23
Badlands	1	3	0	0	7	34
Box Springs Mountain	0	3	0	0	8	34
Jurupa Mountains	n/a	0	P	P	n/a	0
Lake Mathews/Estelle Mountain	1	1	8	1	22	70
Lake Perris/San Jacinto Wildlife Area	11	12	2	2	33	80
Lake Skinner/Diamond Valley Lake	8	11	54	16	97	180
Lakeview Mountains	n/a	0	n/a	0	n/a	5
Murrieta Hot Springs/Hogbacks	n/a	3	n/a	6	n/a	17
North Peak Conservation Bank	2	P	2	P	23	56
Quail Valley, Kabian Park	4	8	6	5	9	19
Railroad Canyon/Sedco Hills	n/a	n/a	n/a	n/a	n/a	n/a
Tule Valley	n/a	n/a	n/a	n/a	n/a	n/a
Wilson Valley	3	4	P	0	4	23
Wasson Canyon	3	2	5	5	5	19
West of Lake Elsinore (Cleveland NF)	P	n/a	n/a	n/a	P	P

Nest Monitoring

A total of 3 CAGN nests were located during 2007 nest monitoring surveys. One of these nests, located in the Lake Skinner/Diamond Valley Lake Core Area successfully produced at least 1 fledgling. One of the remaining nests failed and the other was not followed to completion due to lack of available personnel. A CAGN fledgling was also observed by monitoring program biologists in the North Peak Conservation Bank Core Area in 2005.

Density

Models that allowed individual detection probability to vary between Fall 2006 and Spring 2007 were more strongly supported than models that assumed detection probability was equal between the 2 seasons. Therefore, we analyzed the 2 seasons individually for each species with respect to both detection probability and density. Models including no covariates for detection probability were more strongly supported for all species than any models including covariates. Results reported here are based on detection probability estimates from models without covariates. Too few SAGS were detected in either 2006 or 2007 to allow distance analysis, therefore no density estimates were obtained for this species.

In spring 2007, we observed a global mean density of 0.031 individual CAGN/ha (95% CI: 0.018 – 0.053 individuals/ha) for a total population estimate of 517 CAGN within the Conservation Area (95% CI: 303 – 882 birds). Detection probability for spring was 0.31 (95% CI: 0.24 – 0.41). CAGN density varied by an order of magnitude between occupied Core Areas, although the precision of estimates within individual Core Areas was low (Table 3). Mean density in fall 2006 was 0.033 individuals/ha (95% CI: 0.021 – 0.053 individuals/ha) for a total population estimate of 1110 CAGN within the Conservation Area (95% CI: 692 – 1782 birds). Detection probability for fall was 0.41 (95% CI: 0.30 – 0.58). There was no significant difference in CAGN density between the 2 seasons, and the proportion of CSS in the landscape surrounding the transects had no effect on density or detection probability estimates.

Rufous-crowned sparrow density was 0.37 individuals/ha in spring 2007 (95% CI: 0.30 – 0.44 individuals/ha) for a total population estimate of 11,505 RCSP in the Conservation Area (95% CI: 9523 – 13,899 RCSP). Density was 0.18 individuals/ha in fall 2006 (95% CI: 0.11 – 0.29 individuals/ha) for a total population estimate of 4937 RCSP in the Conservation Area (95% CI: 3071 – 7938 RCSP). We calculated a detection probability of 0.34 in 2007 (95% CI: 0.32 – 0.37) and 0.34 in 2006 (95% CI: 0.28 – 0.40). Between Core Areas, density varied considerably, although the precision of these estimates was low (Table 4). The proportion of CSS in the landscape surrounding the transects had no effect on density or detection probability estimates.

Occupancy

We observed CAGN on 21% of transects, with an estimated occupancy of 29% of sampled habitat (95% CI 17-44%) during spring 2007. Detection probability for spring 2007 was 0.35 (95% CI 0.21-0.53). During fall 2006 surveys, we observed CAGN on 36% of transects, and estimated that 42% of sampled habitat was occupied (95% CI 30-56%). Detection probability in fall was 0.48 (95% CI 0.35-0.60).

We observed RCSP on 92.7% of transects, with an estimated occupancy of 93.3% of sampled habitat (95% CI 85.7-97.0%) during spring 2007. Detection probability for spring 2007 was 0.82 (95% CI 0.76-0.86). During fall surveys, we observed RCSP on 77.1% of transects, and

Table 3. Results of distance analysis for California Gnatcatcher. Parenthetical values are 95% confidence intervals.

	Estimated Population Density (individuals/ha)				Estimated Population Size			
Core Area	Winter 2006		Spring 2007		Winter 2006		Spring 2007	
Alberhill	0.10	(0.023-0.44)	0.093	(0.016-0.57)	36	(8-158)	34	(6-206)
Lake Mathews/Estelle Mountain	0.039	(0.015-0.099)	0.0074	(0.0013-0.043)	177	(70-443)	33	(6-191)
Lake Perris/San Jacinto Wildlife Area	0.0076	(0.0015-0.038)	0.0092	(0.0021-0.040)	35	(7-177)	42	(10-187)
Lake Skinner/Diamond Valley Lake	0.13	(0.077-0.23)	0.050	(0.023-0.11)	761	(444-1304)	289	(135-619)
Murrieta Hot Springs/Hogbacks	n/a		0.11	(0.022-0.54)	n/a		41	(8-201)
North Peak Conservation Bank	0.012	(0.0013-0.12)	0		5	(1-49)	0	
Quail Valley/Kabian Park	0.11	(0.0081-1.54)	0.081	(0.13-0.52)	70	(5-960)	50	(9-328)
Wasson Canyon	0.076	(0.017-0.33)	0.079	(0.013-0.48)	26	(6-115)	27	(5-166)
Total	0.033	(0.021-0.053)	0.031	(0.018-0.053)	1110	(692-1782)	517	(303-882)
Detection Probability	0.41	(0.30-0.58)	0.31	(0.24-0.41)				

Table 4. Results of distance analysis for rufous-crowned sparrow. Parenthetical values are 95% confidence intervals.

	Estimated Population Density (individuals/ha)				Estimated Population Size			
Core Area	Winter 2006		Spring 2007		Winter 2006		Spring 2007	
Aguanga	n/a		0.10	(0-7118)	n/a		328	(0-2.0e7)
Alberhill	0.16	(0.010-0.25)	0.36	(0.16-0.83)	57	(36-91)	131	(58-299)
Badlands	0.18	(0.31-1.04)	0.28	(0.12-0.62)	1215	(208-7086)	1888	(839-4246)
Box Springs Mountain	0.14	(0.025-0.74)	0.64	(0.37-1.08)	136	(25-743)	637	(374-1084)
Jurupa Mountains	n/a		1.05	(0.99-1.11)	n/a		189	(178-201)
Lake Mathews/Estelle Mountain	0.14	(0.073-0.29)	0.45	(0.28-0.71)	649	(328-1285)	2009	(1266-3187)
Lake Perris/San Jacinto Wildlife Area	0.15	(0.089-0.27)	0.31	(0.22-0.45)	711	(411-1230)	1445	(1002-2085)
Lake Skinner/Diamond Valley Lake	0.29	(0.22-0.38)	0.57	(0.46-0.72)	1678	(1285-2191)	3329	(2668-4152)
Lakeview Mountains	n/a		0.34	(0.32-0.36)	n/a		29	(27-30)
Motte-Rimrock Reserve	n/a		0.14	(0.0002-77.1)	n/a		37	(0-20782)
Murrieta Hot Springs/Hogbacks	n/a		0.25	(0.091-0.70)	n/a		94	(34-261)
North Peak Conservation Bank	0.33	(0.18-0.60)	0.81	(0.51-1.28)	137	(75-248)	330	(207-527)
Quail Valley/Kabian Park	0.18	(0.025-1.34)	0.58	(0.35-0.95)	114	(16-836)	360	(218-593)
Wasson Canyon	0.093	(0.013-0.65)	0.31	(0.18-0.55)	32	(5-223)	107	(61-188)
Wilson Valley	0.077	(0.021-0.23)	0.22	(0.073-0.66)	209	(56-779)	593	(198-1777)
Total	0.18	(0.11-0.29)	0.37	(0.30-0.44)	4937	(3071-7938)	11505	(9523-13899)
Detection Probability	0.34	(0.28-0.40)	0.34	(0.32-0.37)				

estimated that 82.1% of sampled habitat was occupied (95% CI 69.7-90.2%). Detection probability in fall was 0.61 (95% CI 0.52-0.68).

In spring 2007, we calculated that 56% of the sampled habitat was occupied by SAGS (95% CI: 18-88%). Transect-level detection probability was 0.24 for both of the first 2 survey periods, but decreased to 0.04 for the third survey period, for a cumulative detection probability of 0.45. The cumulative detection probability for the fall 2006 survey for SAGS was 0.42. Occupancy for the fall survey was 19% (95% CI: 10% to 32%). Because detection probability did not vary between survey periods for the fall survey, we did not estimate detection probability for the individual survey periods.

DISCUSSION

Protocol Efficacy

The goal of the pilot CSS bird study during Fall 2006 was to test a protocol for determining the distributions of wintering CSS birds in the Conservation Area for possible use in spring 2007. The protocol was determined to be sufficient at detecting 3 of 4 CSS birds. For coastal California gnatcatcher, Rufous-crowned sparrow, and Bell's sage sparrow, individuals were detected regularly in most survey areas, indicating that the protocol is likely effective in determining seasonal occupancy for these species. This protocol was implemented during spring of 2007 with few modifications, and was effective at detecting CAGN, RCSP, and SAGS.

Although cactus wren occurs in CSS habitats, it was not included as a target species in this study because random transect placement did not intersect sufficient cactus wren habitat. The very low encounter rate observed in the field is likely due to little overlap with proper habitat for this species. Stratification to include cactus wren habitat was not possible due to low-resolution vegetation data and the infeasibility of a preliminary survey to identify appropriate habitat throughout the Conservation Area. A focused effort aimed at first identifying cactus wren habitat and then surveying for cactus wrens will be required to effectively detect this species.

Density and occupancy estimates

California gnatcatcher densities and detection probabilities did not vary between the fall 2006 and spring 2007 surveys. Low precision of estimates did not allow for any meaningful comparisons of CAGN density between individual Core Areas. We found CAGN population sizes to be similar in all Core Areas with the exception of Lake Skinner/Diamond Valley Lake, which, due to its large size rather than any difference in density, supports a considerably larger population of California gnatcatchers than any other Core Area.

The greater number of rufous-crowned sparrow detections allowed for much more precise estimates of density and population size within individual Core Areas. Both the Jurupa Mountains and the North Peak Conservation Bank supported breeding densities of RCSP that were significantly higher than most other cores. The greatest population sizes, however, were found at reserves with moderate densities but much larger areas, including the San Jacinto Wildlife Area and Lake Perris, Lake Skinner/Diamond Valley Lake, Estelle Mountain, and the Badlands.

Although occupancy estimates for Bell's sage sparrow during the breeding season were high, the total number of observations was low. This is reflected in the wide confidence intervals

for the estimate and may be a function of the very low detection probability during the third survey period. The third spring survey period coincided with the time period when many birds were raising chicks, so singing rates were likely much lower and this may have resulted in the decreased detection probability. Occupancy estimates for spring should be viewed with caution because of this lack of precision. Estimates for the fall survey were considerably more precise and may more closely represent the true distribution of SAGS within the Conservation Area.

Species Objectives

The coastal California gnatcatcher is the only CSS bird with species-specific objectives, including both occupancy and reproductive components. California gnatcatchers were detected in 89% of Core Areas, satisfying the occupancy component of the species objective. However, we only observed CAGN in 67% of their Core Areas during the breeding season. Although we collected only limited information on CAGN reproduction, successful CAGN reproduction has been observed in only 2 of 9 (22%) CAGN Core Areas. Increased effort will be required to locate enough CAGN nests to adequately address the reproductive objective for this species.

One Core Area (Railroad Canyon/Sedco Hills) was not surveyed because the conserved areas were too small to support 500 m transects. Monitoring Program biologists made several visits to this area during the breeding season to look for CAGN and determine the suitability of the conserved habitat for CAGN nesting. No CAGN were observed during any of these visits. The conserved portion of the Sedco Hills is very small and consists of mostly chaparral-like vegetation; it is therefore unlikely to support any breeding CAGN. Given the number of unoccupied Core Areas in 2006 and 2007 surveys, and the poor quality of the conserved habitat in the only Core Area not surveyed, it is unlikely that the reproductive species objective is being met. Further surveys will be required to determine this conclusively.

Rufous-crowned sparrows have been observed within 100% of Core Areas either incidentally or during 2006 and 2007 surveys. Furthermore, population size estimates for the species were high relative to other CSS Covered birds. We conclude that the occupancy species objective for RCSP is currently being met, and no management action or further surveys are required until the next 8 year period.

The occupancy species objective for SAGS was not demonstrated by the 2006 and 2007 CSS bird surveys. Because detection probability for this species was low and confidence limits on occupancy estimates were relatively broad, we cannot draw any conclusions about the status of the Species Objectives for SAGS at this point.

Recommendations for Future Surveys

The transect count method we employed was successful at detecting CAGN, RCSP, and SAGS. However, the long transect length restricted the area containing enough suitable habitat to support a transect. A greater number of smaller transects are recommended for future surveys. Once consequence of shorter transects is an increased ratio of travel time to transect time (due to less time spent on a given transect in one area). Future sampling design efforts should focus on balancing these parameters to most effectively use available funds.

Three Core Areas, Railroad Canyon/Sedco Hills (CAGN, SAGS), Tule Valley (SAGS), and the Cleveland National Forest (RCSP) were not surveyed during either 2006 or 2007. Future

surveys should expand to include these areas to provide for stronger conclusions about species objectives.

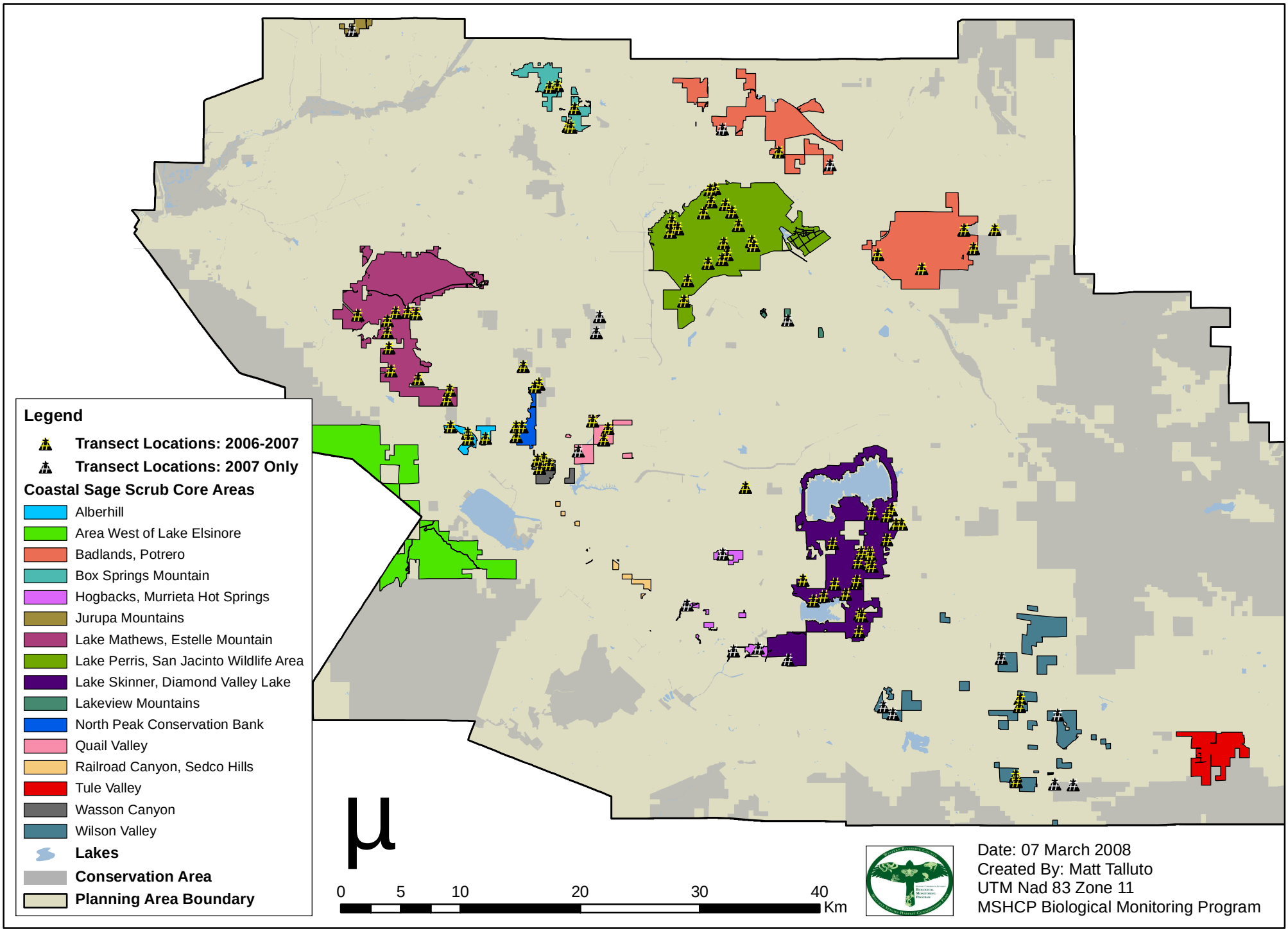
Future surveys for CAGN should focus on determining if the occupancy portion of the species objectives is being met. This should be done through a combination of increased survey activity in CAGN Core Areas, particularly in Core Areas where CAGN density is low, collection of appropriate habitat covariates to more accurately model CAGN occupancy, and inclusion of all Core Areas in future surveys. Greater nest searching effort will also be required to fully address the reproductive objective for this species.

If useful density estimates are to be obtained for CAGN, more detections are needed to improve the precision of these estimates and allow for comparisons of CAGN density among Core Areas and among years. Although the MSHCP species objectives do not require the estimation of density, the data required can be collected concurrently with occupancy-based data for no additional cost. Increasing survey effort to improve density estimates will also improve the precision of other parameters, allowing the Monitoring Program to form stronger conclusions about the status of CAGN within the Core Areas. Furthermore, density estimates can provide information to land managers about population status and habitat suitability, and potentially inform management decisions.

This should be accomplished by increasing survey effort in areas likely to support breeding gnatcatcher populations. Without improved density estimates, downward population trends requiring management action will be difficult to detect.

Because data collected from surveys targeting several Covered CSS species were insufficient to determine that the sage sparrow species objectives were met, more survey effort should be specifically dedicated to SAGS Core Areas in future surveys. If funds are available, additional visits to improve cumulative detection probability for PAO estimates are needed to demonstrate whether this species occupies 75% of its Core Areas. Collecting habitat data may also improve occupancy estimates. Finally, SAGS is not a CSS obligate, and could potentially occupy shrublands not included in the sampling area for this study, which focused only on CSS. Expansion of the survey effort to include chaparral and desert scrub types may increase the number of areas in which SAGS is detected.

Figure 1. Coastal Sage Scrub Bird Transect locations for 2006 and 2007.



REFERENCES

Buckland, S. T., Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L., and Thomas, L. 2001. Introduction to distance sampling: Estimating abundance of biological populations. Oxford University Press, New York.

California Department of Fish and Game (CDFG), Aerial Information Systems (AIS), and California Native Plant Society (CNPS). 2005. Vegetation - Western Riverside Co. [ds170]. Publication Date: 2005-07-31. Online: http://bios.dfg.ca.gov/

Dudek & Associates. 2003. *Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). Final MSHCP, Volumes I and II. Prepared for County of Riverside Transportation and Lands Management Agency*. Prepared by Dudek & Associates, Inc. Approved June 17, 2003.

Hines, J. E. 2006. PRESENCE2 – Software to estimate patch occupancy and related parameters. USGS-PWRC. http://www.mbr-pwrc.usgs.gov/software/presence.html.

MacKenzie, D. I., J. D. Nichols, G. B. Lachman, S. Droege, J. A. Royle, and C. A. Langtimm. 2002. Estimating site occupancy rates when detection probabilities are less than one. Ecology 83:2248-2255.

MacKenzie, D. I., Nichols, J. D., Royle, J. A., Pollock, K. H., Bailey, L, L., Hines, J. E. 2006. Occupancy estimation and modeling: Inferring patterns and dynamics of species occurrence. Elsevier, London.

Rosenstock, S. S., Anderson, D. R., Giesen, K. M., Leukering, T., and Carter, M. F. 2002. Landbird counting techniques: Current practices and an alternative. The Auk 119(1): 46-53.

Thomas, L., Laake, J.L., Strindberg, S., Marques, F.F.C., Buckland, S.T., Borchers, D.L., Anderson, D.R., Burnham, K.P., Hedley, S.L., Pollard, J.H., Bishop, J.R.B. Marques, T.A. 2006. Distance 5.0. Release 2. Research Unit for Wildlife Population Assessment, University of St. Andrews, UK. http://www.ruwpa.st-and.ac.uk/distance/.

Appendix A: Western Riverside County MSHCP Biological Monitoring Program Protocol for Coastal Sage Scrub Bird Surveys

January 2007

Goals: Document the distribution of Coastal Sage Scrub (CSS) birds in the Conservation Area, including the following Covered Species: California Gnatcatcher (CAGN), Coastal Cactus Wren (CACW), Southern California Rufous-crowned Sparrow (RCSP), and Bell's Sage Sparrow (SAGS). Examine potential habitat covariates for the occurrence of these Covered Species. Determine detection probabilities for CSS birds.

Objectives:

To achieve the above goals, surveys will be conducted along randomized transects in CSS habitat within the Conservation Area. Surveys will generally follow the variable width line transect method described in Buckland et al. (2001) and Rosenstock et al. (2002).

Timing:

CSS bird surveys will be conducted during the breeding season for the Covered Species listed above, from February through June. This will be divided into three five-week survey periods, with one week separating the periods.

Survey Locations:

Surveys will be conducted on accessible lands in CSS habitat within the Conservation Area. All accessible MSHCP Core Areas for CAGN will be selected for survey. Additionally, areas with significant stands of CAGN habitat and onsite or nearby historical observations of California gnatcatchers will be selected. Selected Core Areas for RCSP, CACW, and SAGS will also be included.

Methods:

Transect Description:

Survey areas will be selected using a GIS layer of potential California gnatcatcher habitat. Potential transect starting locations will be overlaid on this layer with a minimum distance of 500 m between all locations. Approximately 110 of these points will be randomly selected for survey. This sampling will be stratified by Core Area size to ensure that all major core habitat areas are included and properly covered in the survey. A random compass heading will be assigned to each starting point to give the observer a direction when establishing the transect line.

In the field, observers will navigate to transect starting points within 50 m using a handheld GPS unit, and will mark the location with flagging tape or a durable stake. The location of this stake will be recorded on the GPS unit and used as the basis for measuring line length and for all future navigation to the starting location. In some areas with extremely difficult terrain (e.g., the Badlands), transect start points will be located within 500 m of the original point.

After the start location is marked, the observer will walk 500 m in the direction randomly selected for the line and mark the transect end point in a similar fashion. If the transect is interrupted (e.g., topographic features, private property boundary, edge of coastal sage scrub vegetation) and the distance from the starting point is 250 meters or more, the ending location will be marked and the total transect length recorded from the distance measurement provided by the GPS unit. If the transect is interrupted within the first 250 meters, no end location will be marked. Instead, a new random direction originating from the same starting point will be selected. In areas where the terrain prevents random selection of transect direction, observers will locate transects along passable terrain such as ridgelines or valley floors.

Survey Techniques:

All observers must demonstrate the ability to visually and acoustically identify CSS birds before beginning surveys. Observers must pass an exam by correctly identifying all Covered Species and at least 85% of other species taken from a list of common coastal sage scrub birds.

All sites will be surveyed between sunrise and noon, but surveys will be terminated if the temperature exceeds 35 degrees C, if wind speed exceeds a 4 on the Beaufort Wind Scale (> 18 mph), or if precipitation exceeds more than a light drizzle. Each transect line will be surveyed a total of three times in order to build a detection history for each species at each transect location.

Waypoints and routes for each transect should be entered into a GPS unit prior to beginning a survey. Data will be recorded in the NAD83 datum; all survey areas are in Zone 11S. At the beginning of each transect, observers will record the transect start time, temperature, wind speed (estimated on the Beaufort scale if no wind gauge is available), ambient noise level, and weather conditions.

Observers will walk the length of the transect line at an average speed of 750 m/hour. This can include brief pauses for observation. All birds observed while walking will be recorded, along with the shortest distance to the transect line when an individual is first encountered. To calculate the shortest distance to the line, observers will record the distance from the observer to the bird (obtained using a rangefinder), and use a compass to determine the bearing of the bird relative to the transect line. These values will be estimated in the case of acoustically identified birds. Observers will also record all cues used in detection and identification (song, call, visual, drum) and, if known, the sex and age of the bird. Birds that are observed within the survey area between transect counts will be recorded with all applicable data, but no distance or bearing measurements will be taken. On the datasheet, “IT” will be written in the distance field to indicate that the bird was observed while in transit between transects.

Equipment:

Handheld GPS Unit
Thermometer
Binoculars
Data Sheets
Anemometer
Rangefinder
Compass

Data Analysis:

Occupancy and detection probability for all species will be determined using occupancy models in Program MARK. Detection probability and density will also be calculated using distance models.

Literature Cited:

Buckland, S. T., Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L., and Thomas, L. 2001. Introduction to distance sampling: Estimating abundance of biological populations. Oxford University Press, New York.

Rosenstock, S. S., Anderson, D. R., Giesen, K. M., Leukering, T., and Carter, M. F. 2002. Landbird counting techniques: Current practices and an alternative. The Auk 119(1): 46-53.

Appendix B: Western Riverside County MSHCP Biological Monitoring Program Protocol for Passerine Nest Searching and Monitoring

January 2007

Goal: Document the reproductive status of selected Covered Species within their Core Areas. Species to be surveyed include Yellow Warbler (YWAR), Southwestern Willow Flycatcher (WIFL), Yellow-breasted Chat (YBCH), Lincoln's Sparrow (LISP), California Gnatcatcher (CAGN), Coastal Cactus Wren (CACW), and Least Bell's Vireo (LBVI).

Objectives:

To achieve the above goal(s), nest monitoring of target species will be conducted. Monitored nests will be found during nest searching surveys or observed on point and transect counts.

Timing:

Nest searching and monitoring will occur during the reproductive period for each species, beginning in February for CAGN, April for most other species, and ending in June-August, depending on weather conditions.

Survey Locations:

Surveys will be conducted on accessible lands in riparian and coastal sage scrub (CSS) habitat within the Conservation Area. Only Core Areas for the above target species will be included in the survey.

Methods:

Nest Searching:

All observers must demonstrate the ability to visually and acoustically identify the above species before beginning surveys. Observers must pass an exam by correctly identifying all of the above species and distinguishing them from similar, potentially co-occurring species.

Survey locations will be selected based on data collected during riparian point counts (Spring 2006-2007) and CSS transects (Fall 2006, Spring 2007). When one of the target species is detected during a survey, a nest search will be initiated within one week. If recently recorded observations of the above species are not available early in the season, initial nest searches may also begin at locations recorded in 2006. Any incidental observations of the above species within Core Areas will also be investigated.

For each species and within each Core Area, we will monitor enough nests to ensure a 95% probability of observing at least one successful nest, determined using nest success rates published in previous studies (Table 1). Once a successful nest is observed within a particular Core Area, no further monitoring for that species is necessary, and all markers from actively monitored nests will be removed.

Table 1: Approximate number of nests needed to provide a 95% probability of observing at least one successful nest per Core Area

Species	Nest Success	Nests required per Core Area	Number of Core Areas	Total Nests Required	Source
California Gnatcatcher	0.21	11	12	132	Braden 1999
Yellow Warbler	0.52	5	7	35	Cain et al. 2003
Yellow-breasted Chat	0.45	6	4	24	Rickets & Ritchison 2000
Least Bell's Vireo	0.53	4	7	28	Brown 1993
Willow Flycatcher	0.37	7	5	35	Cain et al. 2003
Lincoln's Sparrow	Information Not Available				
Cactus Wren	Information Not Available				
				273 nests minimum	

Nest searching techniques will be species-specific rather than habitat-specific. As a result, searchers should be familiar with the breeding phenologies of each species studied (See Appendix A for more information). Nest searching will involve a combination of walking areas where target species have been recently observed, and patient behavioral observation of birds encountered. The methods for finding nests outlined by Martin and Geupel (1993) will provide the focus of the efforts of the Monitoring Program. As most nest searchers will employ a combination of different techniques to find nests, and every searcher has their own strengths, there is no standardized method. See Appendix B for a distilled list of nest searching tips from Martin and Geupel.

Nest searching can be labor intensive; however the learning curve rises sharply in a short amount of time with careful training and practice. Paying special attention to being alert, familiarity with the habitat(s) being searched, and species-specific breeding phenologies will also help observers to quickly become efficient at finding nests (Martin and Geupel 1993). Appropriate training and opportunity for practice will be provided before the breeding season begins.

Observers will spend approximately one hour at the starting location searching for the target species. If the species is located, observers will use the techniques outlined in Appendix B and methods learned in training to identify nest locations. If several points to be searched lay along the same riparian area or CSS transect, searchers should walk directly between them (if possible) as a way to saturate the site to be searched. This is because a bird detected on a count or transect may be at the edge of their territory, outside the territory, or simply flying overhead to land outside the count or transect area. Nests of target species do not have to be located within point count radii or transect area; points and transects are only to focus search efforts.

Nests can be found at any stage of the nesting cycle. However the earlier a nest can be found, the more accurate any extrapolations for fledging dates will be. Also, for many species of Passerines, nesting success decreases with each nesting attempt as the breeding season progresses (Sockman 1997). Therefore, it is important for searchers to be in the field when mated pairs are establishing territories and before nest construction begins.

Nest Monitoring:

Once a nest has been located, it will be marked using a handheld GPS unit. The marked location will be a minimum of 10 m from the nest. This point will be mapped by hand on the datasheet along with the actual nest location and nearby landmarks. The location of the GPS point will also be marked with biodegradable flagging tape. No markers of any kind will be placed within 10 m of the nest.

On the initial visit to a nest, observers will record behavioral observations of the adults from a distance. Observers will then approach the nest and record the number of eggs and hatchlings, approximate age of the hatchlings, approximate distance of the nest from the ground, and the species of any supporting vegetation. During all nest checks, care must be taken to minimize physical disturbance to the nest itself and to the structure of the vegetation surrounding the nest. **The nest and nest contents should not be touched by any observers.** To monitor nests that are above eye level, poles with small mirrors attached will be used to observe nest contents. For nests that are out of range of the poles, verification of nest status can only be determined by patient observation.

Nests will be approached on subsequent visits only if there is clear evidence that the nest has been depredated or abandoned, or if an approximate fledging date could not be determined on the first visit. Observers will attempt to monitor located nests from at least 10 m away and will only come closer than 10 m of the nest when absolutely necessary to determine the current status of the nest. Time spent this close to the nest will be kept to a minimum to avoid stressing the birds and attracting predators. On subsequent visits, observers will repeat behavioral observations from a distance, and also record the presence of any fledglings visible outside the nest.

After a fledging date is estimated, final visits will be made within one day of the approximate fledging date to determine if a nest has successfully fledged young. Any nest being checked, if not being looked into directly, must be observed long enough to verify nest status. Status during construction is obvious because the birds will be gathering and carrying nesting material. The best indicator that the nest is still in the incubation stage is that the female will remain on the nest except to periodically forage and stretch, and will be significantly less detectable within the territory.

Nest searching and monitoring is rather invasive to the host birds. Studies have shown that nests that have higher frequencies of investigator disturbance have the highest rates of predation (Sockman 1997). We will attempt to recheck nests as little as possible, which requires that the fledging date be accurately forecasted. Estimating the date a nest will fledge is the easiest if the nest is found during the construction or nestling stages. Intervals between nest checks will most likely decrease as nests near their forecasted fledge dates. Data gathered during nest checks can vary widely according to the questions being examined. For this project, nest contents will only be checked upon the initial locating of the nest (and possibly a second check).

All other subsequent nest checks will be done at a distance with binoculars or spotting scope. Great care needs to be taken in approaching the nest from different directions to avoid creating visible trails and focusing human scent for predators to pick up on.

Equipment:

Binoculars	Spotting Scope
Pole with mirror attached	Flagging Tape
Handheld GPS Unit	Data Sheets

Literature Cited:

Braden, G.T. 1999. Does nest placement affect the fate or productivity of California gnatcatcher nests? The Auk 116(4):984-993.

Brown, B. T. 1993. Bell's Vireo. *In* The Birds of North America, No. 35 (A. Poole, P. Stettenheim and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington DC: The American Ornithologists' Union.

Cain III, J. W., M. L. Morrison and H. L. Bombay. 2003. Predator activity and nest success of Willow flycatchers and Yellow warblers. J. of Wildlife Management 67(3):600-610.

Martin T.E., and G. R. Geupel. 1993. Nest-monitoring plots: methods for locating nests and monitoring success. Journal of Field Ornithology 64: 507-514.

Ricketts, M.S. and G. Ritchison. 2000. Nesting success of Yellow-breasted chats: Effects of nest site and territory vegetation structure. Wilson Bulletin 112(4):510-516.

Sockman, K. W. 1997. Variations in life-history traits and nest-site selection affects risk of nest predation in the California Gnatcatcher. The Auk 144(3): 324-332.