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

Grasshopper Sparrow (*Ammodramus savannarum*) Survey
Report 2005

July 7, 2006
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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

LIST OF APPENDICES

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 of 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 MSHCP information needs identified in Section 5.3 or elsewhere in the document, and the information needs of the Permittees.

The primary preparer of this report was the Field Crew Leader, Andrew Miller. 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

The grasshopper sparrow (*Ammadramus savannarum*; “GRSP”) is widely, but sparsely distributed in the Plan Area. It is associated with grassland communities, is sensitive to edge effects, and requires relatively large blocks of contiguous habitat. This species will not become a Covered Species Adequately Conserved until MSHCP Species Objective 2 is met.

MSHCP Species Objectives for Grasshopper Sparrows

Objective 1

> Include within the MSHCP Conservation Area at least 38,690 acres of suitable habitat for the grasshopper sparrow including grassland habitat within the Riverside Lowland, San Jacinto Foothills, and Santa Ana Mountains Bioregions.

Objective 2

> Within the MSHCP Conservation Area, maintain occupancy within 3 large Core Areas (100 percent) and at least 3 of the 4 smaller Core Areas (75 percent) in at least 1 year out of any 5 consecutive year period. In order for this species to become a Covered Species Adequately Conserved, the following conservation must be demonstrated: Include within the MSHCP Conservation Area at least 8,000 acres in 7 Core Areas. Core areas may include the following: 1) Prado Basin, 2) Lake Skinner/Diamond Valley Lake/Johnson Ranch area, 3) Lake Mathews-Estelle Mountain, 4) Badlands, 5) Box Springs, 6) Santa Rosa Plateau/Tenaja, 7) Kabian Park, 8) Steele Peak, 9) Sycamore Canyon, 10) Potrero, and 11) Mystic Lake/San Jacinto Wildlife Area. Three of the 7 Core Areas will be large, consisting of a minimum of 2,000 acres of grassland habitat or grassland-dominated habitat (<20 percent shrub cover). The other 4 Core Areas may be smaller but will consist of at least 500 acres of contiguous grassland habitat or grassland-dominated habitat (<20 percent shrub cover). Five of the 7 Core Areas will be demonstrated to support at least 20 grasshopper sparrow pairs with evidence of successful reproduction within the first 5 years after permit issuance. Successful reproduction is defined as a nest which fledged at least one known young (Dudek & Associates 2003).

Note that Objective 2 includes a long-term monitoring component to assess GRSP distribution during the life of the MSHCP plan, as well as a near-term component to assess specific conservation requirements that must be met before this species is considered “adequately conserved.”

Survey Goals

The 2005 survey season was the first year the MSHCP Biological Monitoring Program attempted surveys for GRSP. Because of substantial uncertainty concerning the current distribution of GRSPs within the MSHCP Conservation Area, we developed the following objectives for the 2005 breeding season:

1) Train personnel in survey techniques for breeding GRSPs;
2) Determine presence and reproductive status of GRSPs within the 11 proposed Core Areas;
3) Estimate GRSP detection probabilities and densities in potential habitat within the Core Areas; and
4) Model habitat associations between occupied and non-occupied sampling locations.

METHODS

Personnel and Training

Surveyors learned to identify GRSPs by sight and song using field guides (Rising 1996, National Geographic Society 2003, Peterson 2001), digitally recorded vocalizations (Keller 2003), and observing GRSP's in the field. We consulted literature (Vickery 1996, Collier 1994) and local expert Christine Beck (formerly Collier) for information concerning GRSP natural history and behavior. All surveyors demonstrated familiarity with GRSP vocalizations, survey methods, and data collection prior to working independently. The following biologists conducted GRSP surveys:

- Andrew Miller, Field Crew Leader (Regional Conservation Authority)
- Christine Rothenbach (Regional Conservation Authority)
- Josh Koepke (Regional Conservation Authority)
- Annie Bustamante (California Dept of Fish and Game)
- Nicholas Van Deusen (California Dept of Fish and Game)
- Ricardo Escobar III (California Dept of Fish and Game)
- Rosina Gallego (California Dept of Fish and Game)
- Karin Cleary–Rose (U.S. Fish and Wildlife Service)

Distance sampling data were analyzed by Brian Root (Biomonitor, U.S. Fish and Wildlife Service, Carlsbad field office).

Survey Areas

We conducted GRSP surveys in 10 of the 11 MSHCP-identified Core Areas between 28 April and 20 June 2005. Surveys were only conducted within areas where land managers granted access. The Prado Basin was not visited by Monitoring Program staff because of access restrictions, but observations of GRSP were reported by the Orange County Water District (seasonal biologist Dharm Pellegrini).

Protocol Development

Survey protocols for GRSP were developed by the Biological Monitoring Program. Survey protocols consisted of two parts: Qualitative Surveys and Quantitative Sampling Surveys. The major goal of Qualitative Surveys was to address the near-term component of the MSHCP's GRSP species objective 2: assessing the broad distributional and reproductive status requirements that must be met before this species is considered "adequately conserved." The purpose of these surveys was to generate broad characterizations of GRSP distribution, breeding pair status, and presence of fledglings within the Core Areas. The major goal of Quantitative Sampling Surveys was to start addressing the long-term component of the MSHCP's GRSP species objective 2: to monitor long-term occupancy of GRSPs within the MSHCP Conservation Area. Survey protocols and field data sheets are described in the methods section below and in Appendices A, B, and C of this report.

Survey Methods

Objectives of qualitative surveys

a. Familiarize surveyors with breeding GRSPs and their habitats within the MSHCP Conservation Area.
b. Assess distribution and reproductive status of GRSPs within all of the potential Core Areas.

As our initial assessment of GRSP distribution within the MSHCP Conservation Area, we conducted non-randomized surveys within legally accessible portions of the Core Areas between 22 March and 27 May 2005. We surveyed locations where GRSPs were most likely to occur based on land managers' records of previously observed GRSPs and descriptions of habitat characteristics (Collier 1994). These area searches consisted of surveyors moving slowly through grassland patches and stopping periodically to listen for GRSP vocalizations. Where habitat was extensive, surveyors walked parallel transects spaced approximately 200m apart. We felt confident that many singing birds could be detected at this distance. We started surveying on the Santa Rosa Plateau Ecological Reserve, where GRSPs are relatively common, in order to give observers multiple opportunities to observe GRSPs during a single visit.

When detected, we approached and observed singing GRSPs for indications of breeding status, which included singing males not attempting to exclude another GRSP in close proximity (assumed to be his mate), and adults carrying food and/or attending juveniles (Collier 1994). Based on these observed behavioral characteristics, we categorized each GRSP as paired, singing adult, non-vocal adult, or post-fledge juvenile.

In addition to the above-described method, we also experimented with rope-drag nest surveys (Winter et al. 2003) for finding GRSP nests to document reproductive activity. While rope dragging helped locate nest sites at the Santa Rosa Plateau, we discarded the method because it required several people to survey a relatively small area and the nesting information obtained can be collected through less intensive survey methods.

Objectives of quantitative sampling surveys

a. Estimate GRSP detection probability and density at potential habitats within the Core Areas.
b. Associate habitat characteristics with GRSP presence.

In order to develop an unbiased and efficient monitoring protocol, we first needed to obtain information on GRSP detection probabilities and densities. These data then provide the basis for designing an optimal monitoring protocol. Habitat association data are used as sampling strata or covariates in the distance-sampling analyses, as well as to provide information to land managers to help guide habitat management decisions.

Detection probability and density estimates

General design: We used a distance-based sampling protocol (Buckland et al. 2001) and computer program DISTANCE (Thomas et al. 2005) to estimate GRSP detection probabilities and densities. In distance sampling, linear transects are surveyed, and the perpendicular distances from each individual observed to the transect line are recorded. We chose the length of each of our linear transects to be 250m, which allowed us to establish transects in relatively small habitat patches.

Classification of potential breeding habitat: As the basis for GRSP sampling within the MSHCP Conservation Area, we created a GIS layer that incorporated potential GRSP breeding habitats. We overlaid known site observations from the MSHCP initial 2005 GRSP surveys [*n*=61] and the University of California, Riverside, Center for Conservation Biology 2004 surveys [*n*=9] (U.C. Riverside 2005) that had good geographic precision on the recently produced habitat classification for Western Riverside County (California Native Plant Society 2005). We did not use an additional 74 historic observations from 1889 to 1999 from the MSHCP database assembled by Dudek & Associates, Inc. because we were unable to assess how vegetation may have changed between the time of observation and the 2005 vegetation classification.

The above-identified records occurred in the following seven vegetation classes (California Native Plant Society 2005): We considered the following six of them to be potential GRSP habitat:

- Chamise – coastal sage scrub/disturbance mapping unit
- Annual grassland with native perennials mapping unit
- Santa Rosa Plateau vernal pool mapping unit
- California buckwheat alliance
- California buckwheat disturbance sub alliance
- Weedy disturbance type

Because these habitats generally agreed with previously synthesized GRSP autecological information (Collier 1994, Rising 1996, Vickery 1996), we used them to define the boundaries of potentially suitable GRSP habitat within the MSHCP.

We did not include areas mapped as agriculture because this vegetation class was not expected to be significant in the Conservation Area and we were seeking to avoid areas that were actively cultivated. As discussed in results, this decision resulted in an under-representation of GRSP habitat in the Conservation Area, because areas that were used for grazing prior to coming into conservation were classified as agriculture.

Transect establishment: To geographically distribute distance-sampling transects, we created a map of potentially suitable GRSP habitat types located within MSHCP-identified GRSP Core Areas where the Monitoring Program had access. We overlaid this map with a grid of 250m cells. We buffered Core Area boundaries internally by 250m to keep survey transects from passing outside of accessible areas, resulting in 739 eligible grid cells. Transects were geographically stratified so that at least three transects occurred within each Core Area. Transects were also placed at least 500m apart to increase independence among locations. Because of time and staff limitations during 2005, all surveyed transects were located within one km of a road access point. Finally, we randomly selected 74 locations (10% of the originally eligible possibilities) for transect establishment (Figure 1). Using the SE corner of the grid cell as the starting point, each 250m transect was established along a randomly selected azimuth between 0 and 359 degrees.

Field sampling: Surveys occurred between 0600 and 1100 hrs from 3 June to 23 June 2005. Surveyors walked slowly (~ 1km/hr) along each transect, and recorded the azimuth and distance (m) to any detected GRSP using a laser rangefinder and compass (Appendix A). Additionally, there were six listening points, spaced 50m apart, on each transect. Surveyors stopped at each listening point for approximately 2 minutes to increase opportunities to detect GRSP's along the transect.

Of the 74 transects, 65 (88%) were visited once and 31 (42%) were visited twice during the breeding survey period. When GRSP detections at sites known to be occupied dropped to zero, we ended the 2005 survey period.

<u>Habitat sampling</u>

As an initial attempt to describe micro-scale habitat characteristics at sites occupied by GRSPs, we measured eight habitat variables at all points (n = 30) where GRSPs were detected, as well as at 31 randomly selected non-detection points. We measured elevation, slope, aspect, numbers of perennial shrubs and annual forbs (taller than grass canopy), average grass height, and distance to the closest tree within a 5m radius of each point. We also estimated the size of the grass patch were the point occurred. See the footnote in Appendix C for field methods used to measure these habitat variables. We chose these variables because they were readily measured in the field (we did not have the time available during 2005 to collect more-detailed measurements), and because we expected them to be either directly or indirectly correlated with GRSP habitat suitability (Collier 1994).

We assessed individual habitat characteristics between occupied and non-occupied sites using Student's t-tests (unequal variances) and chi-square tests, using SPSS and Excel software. In addition, we conducted a multiple logistic regression (SAS 9.1 software) using forward, backward, step-wise, and best-subsets model selection routines to generate the vegetation model that best explained GRSP presence. We used a Hosmer and Lemeshow (2000) goodness-of-fit test to assess how well the models performed across our ranges of habitat metrics. We performed 2-way correlations, as well as regression diagnostics, to assess collinearity (i.e., positive or negative correlations) among our variables.

RESULTS

Dates, locations, times, and environmental conditions for Qualitative and Quantitative surveys are provided in Tables 1 and 2, respectively.

Qualitative Surveys

We visited nine core areas (the Badlands site was surveyed only during quantitative distance sampling) from one to four times between 22 March and 27 May 2005 (Table 3). We observed 126 individual GRSPs, including 35 territorial pairs. We observed fledglings at the Santa Rosa Plateau, Lake Skinner/Johnson Ranch, and Lake Mathews/Estelle Mountain Core Areas. Additionally, results from the Prado Basin suggested that there were 20-30 GRSP territories there (D. Pellegrini, pers. comm. to Andrew Miller).

Quantitative Sampling Surveys

Distance sampling: We recorded 52 GRSP detections during the 96 transect visits (Table 4). A majority of our detections (71%) occurred within the Santa Rosa Plateau.

Our original study design was created to make an inference about detection probabilities and densities across all accessible lands within the MSHCP Conservation Area (see “All transects” in Table 5). However, because of the prevalence of GRSP detections that occurred on the Santa Rosa Plateau, and because the general habitat structure at this site differed from the other Core Areas (esp. the presence of native grasses), we conducted a *post hoc* analysis where we calculated separate distance-based statistics for the Santa Rosa Plateau versus all other sites.

The model for “All transects” produced robust results (i.e. they had sufficient sample sizes to adequately fit detection curves; see Buckland et al. 2001), which is critical to calculating detection probabilities and density estimates. The model for “All sites excluding Santa Rosa Plateau” had too few detections to adequately fit a detection curve, so results should be viewed with caution.

Habitat Characteristics: Several individual habitat characteristics differed between occupied and non-occupied sites (Tables 6 and 7). Grassland patch size and average grass height were greater at occupied GRSP sites, whereas slope, perennial shrub abundance, and elevation were greater at non-occupied sites. Distance to the closest tree tended to be greater at occupied sites, although variance was large. Neither annual forb abundance nor aspect differed between occupied and non-occupied sites.

Model-selection results from the multiple logistic regression analysis all selected the same “best” model – GRSP presence (probability) was best explained by a combination of grassland patch size, average grass canopy height, and slope. The goodness-of-fit test indicated that this model fit the data well ($\chi^2 = 1.39$, df = 8, p = 0.99). There was little evidence of collinearity among the variables, although grassland patch size and slope tended to be negatively correlated (r = -0.21, $p = 0.12$). The regression equation is:

$$\text{GRSP presence} = -2.62 - 0.21\times\ln(\text{slope}[^\circ]) + 0.57\times\ln(\text{avg. grass height [dm]}) + 0.22\times\ln(\text{grassland patch size[ha]})$$

Correlation coefficients indicated that average grass canopy height was negatively correlated with forb and shrub abundance (r's = 0.44 and 0.49, respectively), although grass height seemed to be a better predictor of GRSP presence.

DISCUSSION

Including GRSP detections from our qualitative and quantitative MSHCP surveys, and those from the Prado Basin, GRSPs were observed at 9 of the 11 Core Areas. However, our 2005 surveys documented large populations only at the Santa Rosa Plateau (13 pairs) and Lake Skinner/Johnson Ranch/Diamond Valley Lake (20 pairs) Core Areas. In addition, 20 to 30 GRSP territories were reported in the Prado Basin (D. Pellegrini, pers. comm. to Andrew Miller). We detected fledgling GRSPs (indicating successful reproduction) at the Santa Rosa Plateau, Lake Skinner/Johnson Ranch, and Lake Mathews/Estelle Mountain Core Areas. Though not documented, we expect that breeding pairs in the Prado Flood Control Basin also reproduced successfully. Therefore, based on 2005 surveys, the MSHCP has not yet attained its near-term objective of documenting five local GRSP populations with greater than 20 successfully breeding pairs within the Conservation Area.

Overall, GRSP detection probabilities (approx. 0.4) were similar to many other bird species. Our best data came from the Santa Rosa Plateau, because the larger sample sizes there allowed for robust estimations of both detection probabilities and densities. GRSP densities were substantially greater within the Santa Rosa Plateau relative to the other Core Areas

Some research has suggested that GRSPs depend on native perennial grasslands, such as those found at the Santa Rosa Plateau (Collier 1994). Our observations of relatively high GRSP densities in stands of near-monotypic oat grass (*Avena* spp.), both at the Santa Rosa Plateau and in other Core Areas, do not support this suggestion. The highest density of GRSPs found in 2005 occurred in a patch of non-native grasses in the Mesa de Burro on the Santa Rosa Plateau, in an area that was burned in 2004 as part of restoration efforts. Three successful breeding pairs (i.e. with fledglings) were detected in this 4 ha area. This and other observations suggest that, while the Santa Rosa Plateau has greater GRSP density than other Core Areas, GRSP occupancy may be more associated with habitat structure of grasses than the presence of native grass species.

The distance-based models estimated an "effective strip width" of approximately 60m on each side of the transect. To obtain thorough, predictable coverage of a given site, these results suggest that GRSP surveyors should be spaced no more than 120m apart during breeding season surveys.

Local-scale habitat characteristics seemed to be important in explaining whether GRSPs were detected. Occupied sites occurred in larger grassland patches which had less topographic relief, a taller grass canopy, and lesser numbers of perennial shrubs. The larger grassland patches that occurred on the Santa Rosa Plateau may have at least partially accounted for the greater GRSP densities there, relative to other Core Areas.

Precipitation amounts and frequency during winter 2004-2005 were substantially greater than the long-term average across southern California, which resulted in highly productive grass and herbaceous growth within the study area. While it is unknown how this unusually wet year may have affected habitat and food availability for GRSPs within all of the MSHCP Planning Area, some populations may have occurred at higher than normal densities and experienced greater productivity than usual.

Problems/Issues

1) *Distance sampling:* Birds frequently sang from out of sight below the tops of the grass, or were not visible because of the distance from the observer. In these cases, we were unable to precisely measure the distance to the detected bird. These detections were lumped into a "> 150m" category. This led to analysis difficulties, because one of the assumptions in distance sampling is that observers obtain an accurate measurement of distance from the observer. This was particularly true for the non-Santa Rosa Plateau analyses, because > 150m detections were common. We assessed the effects of these "lumped" data by performing analyses with and without these data. Overall results were similar, except for the non-Santa Rosa Plateau analyses, where too few detections remained after excluding detection in the > 150m category.

2) *Some sites were not adequately surveyed:* Johnson Ranch, San Jacinto Wildlife Area (SJWA), and Potrero were under-represented in our quantitative distance-sampling survey design, although all three of these sites were visited during the qualitative survey period. Johnson Ranch went unvisited because the area was subjected to a controlled burn prior to our arrival on June 20, 2005. Transects were not established at SJWA and Potrero because potential GRSP habitats at those locations were classified as "agricultural" in our aerial-photography-based GIS layers. During our site visits, we observed that potentially suitable GRSP habitats occurred in at least portions of these "agricultural" classified areas.

Recommendations for Future Surveys

1) *Begin Surveys in March:* 2005 GRSP surveys began late relative to when GRSP begin to vocalize in early March (Collier 1994). Because song rates begin decreasing earlier in the day as the season progresses, we recommend having GRSP surveyors ready to begin surveying by the 1st of March. The earlier survey period should provide for greater detection probabilities along survey transects, and therefore a more-efficient survey design. Density estimates should also be more precise, and should allow for comparisons among the core areas. An early March start date will also provide for a longer survey period, which will allow us to make repeated transect visits. This will provide on-going information on temporal changes in GRSP singing rates, which will allow us to better plan future surveys.

2) *Revise distance-sampling study design*: Because we did not include "agricultural" areas as potential GRSP habitat in our 2005 distance-sampling design, we underestimated

the total amount of potential GRSP habitat that needs to be surveyed. "Agricultural" classified areas should be added (after field verification for the presence of suitable GRSP habitat), and distance-sampling transects should either be re-selected, or additional transects should be chosen within "Agricultural" habitats. This change should provide more thorough coverage, especially within the Diamond Valley Lake portion of Lake Skinner/Johnson Ranch/Diamond complex, Potrero, and the Mystic Lake/San Jacinto Wildlife Area.

3) *Surveys of controlled burn detection sites*: Johnson Ranch and Mesa de Burro of the Santa Rosa Plateau were treated with controlled burns after 2005 GRSP qualitative surveys were completed. The response of native and non-native grasslands following controlled fires has important management implications for GRSP habitat management within the MSHCP. Numerous authors report a positive response of GRSP populations immediately following controlled burns (see Collier 1994). These sites should be revisited in 2006 to assess the reoccupation of GRSP following prescribed fire.

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Table 1. Grasshopper sparrow qualitative survey dates, locations, times, and environmental conditions.

Dates	Core Area	Surveyors	Time	Air Temp. (F)	Wind (mph)	% Cloud Cover
4/28/05	Santa Rosa Plateau	Andrew Miller	Start: 0830 End: 1030	Start: 60 End: 70	Start: 2 End: 5	Start: 0 End: 30
4/29/05	Potrero	Andrew Miller	Start: 0730 End: 1000	Start: 60 End: 75	Start: 2 End: 5	Start: 10 End: 30
5/2/05	Santa Rosa Plateau	Andrew Miller, Chris Rothenbach, Ricky Escobar III	Start: 0715 End: 1045	Start: 50 End: 75	Start: 2 End: 6	Start: 10 End: 30
5/4/05	Kabian Park	Andrew Miller, Chris Rothenbach, Ricky Escobar III	Start: 0815 End: 1030	Start: NR End: NR	Start: 0 End: 0	Start: 100 End: 20
5/6/05	Box Springs	Andrew Miller, Chris Rothenbach, Ricky Escobar III	Start: 0800 End: 1040	Start: NR End: NR	Start: 5 End: 0	Start: 75 End: 0
5/10/05	San Jacinto Wildlife Area	Andrew Miller, Chris Rothenbach	Start: 0650 End: 0945	Start: 56 End: 75	Start: 5 End: 5	Start: 20 End: 0
5/12/05	Steele Peak	Andrew Miller, Chris Rothenbach	Start: 0710 End: 1030	Start: 70 End: 80	Start: NR End: NR	Start: 0 End: 0
5/13/05	Johnson Ranch	Andrew Miller, Chris Rothenbach, Ricky Escobar III, Annie Bustamante	Start: 0750 End: 1040	Start: 74 End: 85	Start: 4 End: 6	Start: 0 End: 0
5/18/05	Johnson Ranch	Andrew Miller, Chris Rothenbach	Start: 0700 End: 1123	Start: 72 End: NR	Start: 0 End: 4	Start: 0 End: 0
5/19/05	Lake Skinner	Andrew Miller, Chris Rothenbach	Start: 0639 End: 1000	Start: 73 End: 85	Start: 0 End: 4	Start: 0 End: 0
5/20/05	Santa Rosa Plateau	Andrew Miller, Chris Rothenbach	Start: 0625 End: NR	Start: NR End: NR	Start: NR End: NR	Start: NR End: NR
5/25/05	Lake Skinner	Andrew Miller, Chris Rothenbach	Start: 0600 End: 0945	Start: NR End: NR	Start: NR End: NR	Start: NR End: NR
5/26/05	Lake Mathews	Andrew Miller, Chris Rothenbach, Karin Cleary - Rose	Start: 0700 End: 1130	Start: 72 End: 88	Start: 0 End: 2	Start: 0 End: 0
5/27/05	Lake Mathews	Andrew Miller, Chris Rothenbach	Start: 0630 End: 1000	Start: 54 End: NR	Start: 1 End: 4	Start: NR End: NR
5/31/05	San Jacinto Wildlife Area	San Jacinto Wildlife Area	Start: 0645 End: 0900	Start: 69 End: 80	Start: 1 End: 5	Start: 20 End: 0

NR = not recorded

Table 2.Grasshopper sparrow distance sampling dates, locations, times, and environmental conditions.

Dates	Core Area	Surveyors	Time	Air Temp. (F)	Wind (mph)	% Cloud Cover
6/3/2005	Lake Matherws/Estelle Mountain	Andrew Miller, Chris Rothenbach	Start: 0717 End: 1146	Start: 60 End: 65	Start: 2 End: 2	Start: 75 End: 0
6/6/2005	Box Springs	Andrew Miller	Start: 0635 End: 1135	Start: 60 End: 68	Start: 2 End: 6	Start: 80 End: 60
6/6/2005	Sycamore Canyon	Chris Rothenbach	Start: 0617 End: 1037	Start: 55 End: 65	Start: 8 End: 10	Start: 100 End: 50
6/7/2005	Lake Skinner	Andrew Miller, Chris Rothenbach	Start: 0745 End: 1150	Start: 64 End: 77	Start: 0 End: 0	Start: 10 End: 10
6/9/2005	Santa Rosa Plateau	Andrew Miller, Chris Rothenbach, Josh Koepke	Start: 0647 End: 1135	Start: 55 End: 64	Start: End:	Start: 100 End: 100
6/13/2005	Lake Matherws/Estelle Mountain	Andrew Miller, Chris Rothenbach	Start: 0915 End: 1010	Start: 75 End: 80	Start: 0 End: 4	Start: 0 End: 0
6/14/2005	Sycamore Canyon	Chris Rothenbach, Nicholas VanDeusen	Start: 0621 End: 0650	Start: 71 End: 71	Start: 3 End: 3	Start: 0 End: 0
6/14/2005	Steel Peak	Chris Rothenbach, Nicholas VanDeusen	Start: 0923 End: 1145	Start: 83 End: 88	Start: 0 End: 0	Start: 0 End: 0
6/15/2005	Steel Peak	Nicholas VanDeusen, Josh Koepke	Start: 0704 End: 0759	Start: 68 End: 74	Start: 0 End: 0	Start: 100 End: 100
6/15/2005	Kabian Park	Nicholas VanDeusen, Josh Koepke	Start: 1011 End: 1130	Start: 75 End: 81	Start: 0 End: 0	Start: 0 End: 0
6/15/2005	Potrero	Chris Rothenbach, Annie Bustamante	Start: 0648 End: 1002	Start: 65 End: 85	Start: 0 End: 0	Start: 100 End: 0
6/16/2005	Potrero	Chris Rothenbach, Nicholas VanDeusen	Start: 0630 End: 1002	Start: 66 End: 69	Start: 2 End: 1	Start: 100 End: 100
6/17/2005	Santa Rosa Plateau	Andrew Miller, Chris Rothenbach, Nicholas VanDeusen	Start: 0628 End: 1109	Start: 56 End: 72	Start: 2 End: 6	Start: 10 End: 10
6/20/2005	Lake Skinner	Andrew Miller, Chris Rothenbach	Start: 0700 End: 1057	Start: 70 End: 80	Start: 0 End: 2	Start: 0 End: 0
6/21/2005	Sycamore Canyon	Nicholas VanDeusen	Start: 0628 End: 1012	Start: 69 End: 83	Start: 1 End: 5	Start: 0 End: 0
6/22/2005	Estelle Mountain	Andrew Miller, Chris Rothenbach, Nicholas VanDeusen	Start: 0627 End: 0848	Start: 72 End: 89	Start: 0 End: 0	Start: 0 End: 0
6/23/2005	Lake Skinner	Andrew Miller, Chris Rothenbach, Nicholas VanDeusen	Start: 0614 End: 0808	Start: 60 End: 80	Start: 0 End: 0	Start: 0 End: 0

Table 3. Grasshopper sparrow qualitative survey results.

Core Area	Survey Dates	Singing	Pairs (observed or inferred)	Juvenile	Silent**	Total Individuals
Box Springs	5/6/05					0
Kabian Park	3/22/05* , 5/4/05		1			2
Lake Mathews – Estelle Mountain Reserve	5/26/05,5/27/05,		1	1		3
Lake Skinner / Diamond Valley Lake / Johnson Ranch	5/13/05, 5/18/05, 5/19/05, 5/25/05*	23	20	3	9	75
Mystic Lake / San Jacinto Wildlife Area	5/10/05, 5/31/05*	3				3
Potrero	4/29/05, 6/15/05*	1				1
Santa Rosa Plateau	4/28/05, 5/2/05, 5/20/05, 5/24/05	8	13	7	2	43
Steele Peak	5/12/05					0
Sycamore Canyon	4/22/05					0
TOTAL		**34**	**35**	**11**	**11**	**126**

Singing: territorial singing birds; **inferred pairs**: adult carrying food, attending juvenile; **juveniles**: juvenile plumage, food begging, or clumsy flight; **silent**: non-singing bird flushed or flying; **Total Individuals:** all observed birds (counting inferred pairs).
* Observations were incidental to detections on distance-sampling transects.
** Detected birds were not singing – presumed to be either female or juvenile.

Table 4. GRSPs detected on randomly located distance-sampling transects

Core Area	# of Transects	Dates visited	Total transects walked	GRSP detections
Badlands	4	6/15/05, 6/16/05	7	0
Box Springs	5	06/06/05	5	0
Kabian Park	2	06/15/05	2	0
Lake Mathews – Estelle Mountain Reserve	10	6/3/05, 6/13/05, 6/21/05, 6/22/05	17	6
Lake Skinner / Diamond Valley Lake / Johnson Ranch	15	6/7/05, 6/20/05, 6/23/05	24	7
Mystic Lake / San Jacinto Wildlife Area	-	-	-	-
Potrero	1	6/7/05, 6/19/05	2	0
Santa Rosa Plateau / Tenaja	20	6/9/05, 6/17/05	27	37
Steele Peak	3	6/14/05, 6/15/05	3	0
Sycamore Canyon	5	6/6/05, 6/14/05, 6/21/05	9	2
TOTAL	65		96	52

Table 5. GRSP detection probabilities and densities.

	Conditional detection probability(p)	Density / ha	Effective Strip Half-width (m)	Density / transect
All transects	0.42	0.20	63	0.63
Santa Rosa Plateau	0.39	0.46	58	1.33
All sites excluding Santa Rosa Plateau	0.52	0.07	77	0.28

NOTE: All DISTANCE models used negative exponential detection functions and were not right-truncated (see Thomas 2005)

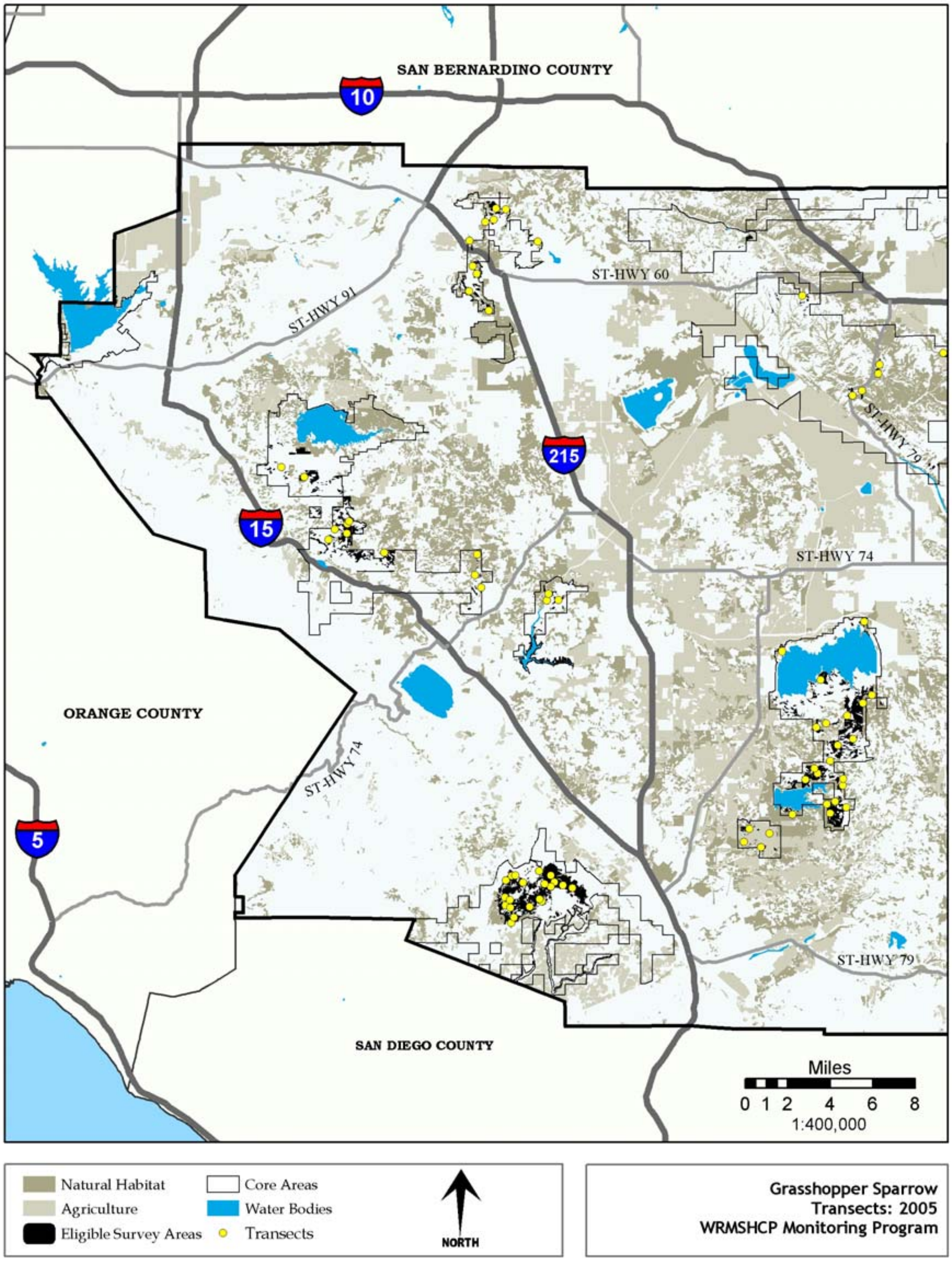
Table 6. Habitat characteristics between occupied and non-occupied GRSP habitats.

	Occupied sites (SE)	Non-occupied sites (SE)	t	p
Grassland patch size (ha)	9.05 (1.52)	4.27 (0.72)	2.85	0.007
Slope(º)	5.4 (0.83)	13.6 (1.6)	-4.58	<0.0001
Perennial shrub abundance (#)	5.4 (2.37)	25.45 (6.28)	-2.94	0.0056
Annual forb abundance (#)	50.6 (9.7)	64.3 (9.9)	-0.99	0.327
Average grass height (m)	0.66 (0.05)	0.39 (0.04)	4.31	<0.0001
Elevation (m)	556.7 (12.7)	585.0 (22.1)	-1.1	0.076
Distance to closest tree (m)	68.9 (16.2)	112.0 (21.8)	-1.59	0.118

Table 7. Observed and expected aspects between occupied and non-occupied GRSP habitats.

	North (316-45º)	**East** (46-135º)	**South** (136-225º)	**West** (226-315º)
Observed				
No GRSP	7	8	7	9
GRSP	5	7	6	12
Expected				
No GRSP	6.1	7.6	6.6	10.7
GRSP	5.9	7.4	6.4	10.3
$\chi^2 = 0.89$, $p = 0.828$, df = 3				

Figure 1. Core Areas and transect locations for 2005 GRSP surveys.



APPENDIX A: Grasshopper Sparrow Distance Survey Protocol 2005.

Transect establishment:
Suitable areas are defined by the overlap of Core Areas, areas where MSHCP has been granted access by land manager, and suitable vegetation. 250-m transects are established in randomly selected cells of suitable habitat.

Restrictions:

Road access – transect must be within 1 km of a road access.
Nearest neighbor - 500 m minimum distance between transects.

The 2005 survey represented 10% of the 739 points, for a total of 74 survey transects. Beginning points for transects were randomly distributed among the Core Areas with a minimum of 3 per Core Area.

Survey transects are to be walked by a single surveyor familiar with identification of GRSPs by sight and sound between ~ 0600 and 1200 PST/PDT within the survey period (March 15 – June 30). Surveys should not be conducted when temperatures exceed 90º F. Transects are divided into 6 listening points spaced 50 m along the transect beginning at 0 m. They are to be walked at a slow but steady pace (approx. 1km/hr). The surveyors will stop at each listening point, starting with the first one at 0 meters, for a 2-minute listening period, during which time they will listen and scan possible perches in the vicinity of the transect for GRSPs. If detected, the surveyor is to record the distance to detection using a laser rangefinder. Where GRSP position below the tops of grass make distance measurement impossible, the surveyor should estimate the distance and make a note of the estimation.

Required equipment:
GPS with pre-entered transect waypoints. GPS should be set to give locations as UTM coordinates, Map Datum WGS 84, and distances in meters.
Extra AA batteries
TOPO map of transect
Clip board
Data sheets

- GRSP survey
- Vegetation
- Incidental data sheet

Compass
Pen/pencil
Laser rangefinder
Sun block
Hat
Hand held radio

APPENDIX B:
GRSP Distance Survey 2005

Grasshopper Sparrow Survey 2005
Observer: ________________________ **Date: ____________**
Location: ___________________________ **Visit no.: ________**
Transect #: ____
Azimuth of transect: ______

Start Time: ________
End Time: ________

Weather: CC: ______ Wind: ______ Temp (F°): ______
Weather: CC: ______ Wind: ______ Temp (F°): ______

Total birds : _______ Singing: _______ Juvenile: _______ Silent: ______
Total pairs: _______ Pairs observed: ______ Inferred pairs: _______

Point	Time	Detection	How?	Waypoint	UTM E	UTM N	Distance	Azimuth
1								
Perch species:				Notes:				
Point	Time	Detection	How?	Waypoint	UTM E	UTM N	Distance	Azimuth
2								
Perch species:				Notes:				
Point	Time	Detection	How?	Waypoint	UTM E	UTM N	Distance	Azimuth
3								
Perch species:				Notes:				
Point	Time	Detection	How?	Waypoint	UTM E	UTM N	Distance	Azimuth
4								
Perch species:				Notes:				
Point	Time	Detection	How?	Waypoint	UTM E	UTM N	Distance	Azimuth
5								
Perch species:				Notes:				
Point	Time	Detection	How?	Waypoint	UTM E	UTM N	Distance	Azimuth
6								
Perch species:				Notes:				

Total birds: all observed birds (not counting inferred pairs); **Singing**: territorial singing birds; **juveniles**: juv. plumage food begging or clumsily flighted birds; **silent**: non singing bird flushed or flying; **total pairs**: all pairs; **inferred pairs**: adult carrying food, attending juvenile **Point:** #1-6, use n/a if detected while walking between points **Time:** 12h clock; **Detection:** S = singing bird, P = pair, J = juvenile, Q = quiet bird; **How**: A = audible, V = visual, A/V = both; **Waypoint:** 6 character identifier in GPS unit; **Distance:** m from observer; **Azimuth:** in degrees to bird; **Perch species**: describe if not plant material, take and label sample if unknown species **Notes:** behavior, interactions w/ conspecifics that allows determination of breeding status (i.e. food carrying).

APPENDIX C:
GRSP Vegetation Data Sheet

Grasshopper Sparrow Vegetation Survey 2005 – Western Riverside County MSHCP

Point #:_____________ GRSP UTM: ________________________

Observer: 1_______________________2________________________ Date: __________/ 2005

Elevation (m): Slope (degrees): Aspect of slope (degrees):

5 meter radius site-survey:

	none present	1-25 present	26 - 75 present	76 - 150 present	> 151 present
shrubs					
Annual forbs					

Height of dominant grass layer (cm): N ________ E ________ S ________ W _______

Distance to nearest 4 trees (m):

closest tree		next closest		Next closest		next closest	

Patch width in cardinal directions (m): N ________ E ________ S ________ W _______

Point #:_____________ GRSP UTM: ________________________

Observer: 1_______________________2________________________ Date: __________/ 2005

Elevation (m): Slope (degrees): Aspect of slope (degrees):

5 meter radius site-survey:

	none present	1-25 present	26 - 75 present	76 - 150 present	> 151 present
shrubs					
Annual forbs					

Height of dominant grass layer (cm): N ________ E ________ S ________ W _______

Distance to nearest 4 trees (m):

closest tree		next closest		Next closest		next closest	

Patch width in cardinal directions (m): N ________ E ________ S ________ W _______

Elevation: taken from GPS unit. Slope and aspect of slope: taken from compass. 5 m site-survey: indicate category of shrubs and forbs that **stand above the dominant grass layer** by actually counting all that fall within 5 meters of the survey point. Height of dominant grass layer: grass is measured in 30 cm increments against a stick and recorded in sections. 1-30 cm =1, 31-60 cm =2,61-90 cm = 3, etc. Distance to nearest tree: use a range-finder to find the distance in meters to the four closest trees. Patch width: in each cardinal direction, use laser range-finder to find the distance to the nearest habitat edge in meters. ie: If you are standing in grass, locate the distance to the nearest tree-bearing drainage or to the nearest chaparral, ridgeline, lake edge, etc. up to 250 m away.