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**CENTRAL AND COASTAL RESERVE
CALIFORNIA GNATCATCHER STUDY
2011**

LEATHERMAN BIOCONSULTING, INC.

JUNE 2012

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EXECUTIVE SUMMARY

A study to determine the current status of the California gnatcatcher (*Polioptila californica*) was conducted in the Central and Coastal Reserves in 2011. The purpose of this study was to establish a baseline population estimate of habitat occupancy for the California gnatcatcher throughout the reserve system in order to evaluate trends in occupancy over time and in response to management actions.

A plot based transect approach was used to survey for the California gnatcatcher throughout the Central and Coastal Reserves. A total of 149 randomly selected plots were surveyed for occupancy by California gnatcatchers three times each. Data were also collected on the vegetation types in each plot, including the composition and estimated cover of the dominant shrubs in the coastal sage scrub, which will allow the NROC to develop and evaluate habitat suitability models for the California gnatcatcher. Incidental observations of California gnatcatchers (outside the plots), cactus wrens (*Campylorhynchus brunneicapillus*), and other covered species were recorded throughout the study period.

California gnatcatchers were detected at a total of 34 plots during the three rounds of surveys. Twenty-four plots were occupied during the first round of surveys, 22 during the second round, and 22 during the third round. The distribution of gnatcatchers is highly skewed toward the Coastal Reserve where 24 of the 34 occupied plots were located. This appears to be the result of the 2007 fires that burned approximately 75% of the Central Reserve. Early successional shrub species, primarily deerweed (*Lotus scoparius*) and bushmallow (*Malacothamnus fasciculatus*), dominated many of the plots in the burn areas but do not provide quality nesting habitat. These relationships will be investigated more fully by NROC and USFWS when data are analyzed statistically.

A substantial number (136) of incidental observations of 18 other target and covered species were made during study. These incidental observations included 25 locations for California gnatcatchers (mostly pairs and individuals) outside of survey plots.

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1.0 INTRODUCTION

This document presents the methods and results of the 2011 Central and Coastal Reserve California Gnatcatcher Survey (study) for the Nature Reserve of Orange County (NROC). The California gnatcatcher (*Poliophtila californica*) is one of three target species covered by the Orange County Central/Coastal Natural Communities Conservation Plan (NCCP) Reserve, managed by the NROC, and is listed as a threatened species under the federal Endangered Species Act by the U. S. Fish and Wildlife Service (USFWS 1993). As part of its target bird species monitoring program, annual surveys were conducted from 1999 to 2004 in large (20 hectare) plots that resulted in population estimates that did not account for detection probability. A pilot study on smaller plots (5.6 acres) comparing repeated walking transects and point counts on randomly selected plots conducted within the San Diego Multiple Species Conservation Plan reserve system resulted in a higher probability of detection for the walking transects, which was the approach selected for this study.

The NROC is in the process of evaluating the status of the California gnatcatcher on its Central and Coastal Reserves as part of its target bird species monitoring program. The purpose of the current study is to gather baseline data on gnatcatcher habitat occupancy throughout the reserve system that can be used to evaluate occupancy trends over time and in response to management actions. In general, the approach involves conducting three rounds of surveys for the California gnatcatcher on 150 randomly selected plots. Repeat surveys at each plot allow the use of statistical methods that incorporate detection probabilities into an estimate of habitat occupancy: randomly selected plots allow extrapolation across the entire reserve system. Vegetation data collected at each plot using the relevé method will be used to generate habitat suitability indices and investigate how vegetation variables influence habitat occupancy. Locations of other NCCP Target and Covered Species detected incidentally will be recorded opportunistically.

Numerous fires have spread through the Coastal and Central Reserves over the past two decades, resulting in short-term habitat loss and, potentially, long-term habitat type-conversion. The Laguna Fire of 1993 burned much of the Coastal Reserve and is considered a principal factor contributing to the steep population decline of the California gnatcatcher and the cactus wren (Bontrager et al. 1995). More recently, most of the Central Reserve (an estimated 75%) was burned in the Windy Ridge and Santiago Fires in 2007, and likely had a significant negative effect on the population there. NROC is in the process of evaluating the extent to which fires and the recovery of the coastal sage scrub vegetation might be contributing to fluctuations in the California gnatcatcher population on the overall reserve system, which would assist in the development of a long-term management program. To that end, evidence of recent fire damage was evaluated and recorded on each of the randomly selected plots.

The brevity of the report is based on the scope of work identified for the contract, which was to collect and provide data to the NROC. The discussion of the results is particularly brief because valid statements regarding the status of the gnatcatcher or other measured variables cannot be made or supported without data analysis; only general observations about these data can be made. Data collected during this study are reported in tabular form (in the text, the appendices, and as separate electronic files provided to NROC). The randomly selected plots and overall methodology allow for detailed statistical analyses, which will be performed by the NROC and USFWS (and described in subsequent reports) to calculate detection probabilities, estimate occupancy rates, and test models of habitat suitability across the entire reserve system. Covariate analysis using data collected on vegetation structure, composition, and patch size to assess the importance of these key habitat features in explaining species presence or absence and population trends.

2.0 METHODS

A team of seven highly qualified biologists familiar with the Central and Coastal Reserve and experienced with the California gnatcatcher and its habitat conducted the study. Because consistent application of the methodology among all biologists was critical to achieve standardized data sets, thus allowing for the data to be pooled for meaningful comparisons between the Coastal and Central Reserve and the reserve as a whole, a project kick-off meeting that included all the biologists and representatives from the NROC and USFWS was attended to ensure a thorough and consistent understanding of the study and its goals. During the meeting, maps of the entire reserve system were reviewed, the locations of the randomly selected plots were identified, and data sheets developed specifically for the project were reviewed in detail to make sure all biologists understood what data was to be collected and how the data was to be recorded.

2.1 Management Units and Survey Plots

The 37,000-acre reserve is divided into two approximately equal sections known as the Central Reserve and Coastal Reserve. The Central and Coastal Reserves were divided into smaller planning areas to facilitate the implementation of this project. In general, the planning areas were based on the most current Irvine Ranch Wildlands Management Units map prepared by the Irvine Ranch Conservancy and used extensively by the County and NROC. The management units are designed to take advantage of the existing configuration of the reserve, land ownership patterns, park boundaries, and existing landmarks (roads, ridges, ownership etc.). NROC randomly selected 150 sampling plots within the boundaries of the reserve (Figure 1). An overview map showing the distribution of the plots across the reserve system and an aerial photograph of each plot showing the plot boundaries were used as a reference to aid in navigation to a plot on the reserve and conduct the survey. The overview maps and aerial photographs of each randomly selected plot were developed and provided by the County of Orange GIS Department.

The 5.6 acre plots were selected from a pool of potential plots that had been identified as having 50% or more coastal sage scrub as determined by the 1992 vegetation map from the County of Orange GIS Department. Because several hundred potential plots were available in the pool, the randomly selected plots are not numbered sequentially. The minimum distance between the randomly selected plots was 600 m to ensure independence (i.e. that no two plots were within the home range of a single gnatcatcher that might occur on both). Because the vegetation base map is not current and a number of fires have occurred across the reserve in the interim, it was anticipated that a number of plots would no longer support 50% of coastal sage scrub habitat. However, plots were surveyed and vegetation sampling recorded for each selected plot to obtain a measure of the current accuracy of the vegetation map and to evaluate landscape-level changes.

Of the 150 randomly selected plots provided by the NROC, biologists were not able to access or complete surveys on fifteen plots, and new randomly selected plots were assigned. A few plots in more remote sections of the reserve were not accessible because access roads were washed out. Several plots that were located on or beyond cliff faces and steep ridges that were too dangerous to attempt to navigate on foot were replaced for safety considerations. A few plots simply could not be reached by the biologist because of the distance that had to be covered through dense riparian and/or chaparral vegetation, despite attempts from different directions. One plot that could not be accessed was assigned a replacement plot that was not surveyed during the first round of surveys, so a total of 149 plots were surveyed.

Each biologist was assigned a group of plots that were located in the same management unit or adjacent management units to reduce time associated with moving between plots. In general, the same biologist conducted all three surveys in each plot to increase efficiency relative to finding and navigating to individual plots for the first and repeat visits. UTM coordinates of the center and each corner of the plots were downloaded into GPS units used by biologists to aid in navigating to the plots and in determining if California gnatcatcher observations near the boundaries were within the plots themselves. Copies of the overview maps and aerial maps for each plot were provided to the biologists assigned to those plots.

2.2 Qualitative Vegetation Sampling

Dominant plant communities and plant species within each plot were recorded by each biologist assigned to the plot using the relevé method. Aerial cover of each major plant community type was estimated with the help of the aerial photograph as the biologist walked the entire survey plot to verify plant species composition. Major plant communities considered included riparian woodland, oak woodland, chaparral, coastal sage scrub, grassland, disturbed, and developed. A list of the five most dominant plant species within the coastal sage scrub habitat was then compiled and the percent cover of each species was estimated. Percent cover for each species was estimated based on its cover within the coastal sage scrub habitat only and not for the plot as a whole. The average height of the coastal sage scrub vegetation was also estimated and recorded. The presence and estimated cover of invasive non-native species was also recorded for each plot for evaluating and planning potential future control efforts. Biologists assessed whether the site recently burned and indicated (to the extent possible given the time since the fire) if the vegetation was severely, moderately, or lightly burned. Sample data sheets on which this data was recorded are provided in Appendix A. No vegetation was mapped.

2.3 Focused California Gnatcatcher Surveys

Three rounds of focused surveys were conducted for California gnatcatchers in each of the 149 plots sampled. Each of the three surveys was conducted within a discrete survey period. The time to conduct the first round of surveys was extended by six days due to inclement weather conditions that inhibited access to certain portions of the reserve because of muddy road conditions, and due to logistical issues associated with obtaining permits to access portions of the reserve under different ownerships. The first round of surveys was conducted between March 15 and April 7. The second and third rounds of surveys were conducted between April 11 and April 28, and May 2 and May 20, respectively. All surveys for each round were completed before the next round of surveys were initiated.

Surveys were conducted throughout the day as long as suitable survey conditions prevailed. Surveys were not conducted if average winds exceeded 20km/h, precipitation exceeded more than a mist/light drizzle, or air temperatures were less than 4.5C more than 32C. The plot number, name of the biologist conducting the survey, date, survey start and end time, cloud cover, wind, and temperature were recorded for each survey.

Focused surveys consisted of walking a meandering transect slowly and methodically at a uniform rate throughout the coastal sage scrub habitat on each plot searching for adult California gnatcatchers. To the extent possible, the same survey route and rate of survey were used for each round of surveys. Use of taped vocalizations of territorial male gnatcatchers was kept to a minimum; at least 10 minutes were spent on each plot before they were used. The number of times vocalizations were used was recorded. Taped vocalizations were not used after California gnatcatchers were detected. Once an adult gnatcatcher was observed on a plot the survey of that plot was discontinued; otherwise plot surveys were generally conducted over a 40 to 60-minute time period.

Site occupancy is based on the presence of at least one adult California gnatcatcher on a plot during the survey period. Therefore, the age (adult, independent juvenile, dependent juvenile, recently fledged juvenile, nestling, unknown), number, and sex of all California gnatcatchers observed were recorded for each plot. California gnatcatchers that were detected outside the plot and remained outside the plot during the survey were recorded as incidental observations. Gnatcatchers that entered the plot at any time during the survey period were recorded as an observation within the plot. Whether observed gnatcatchers were observed outside the plot and whether it entered to the plot in response the taped vocalizations was recorded on the data sheet. Taped vocalizations were not used to draw gnatcatchers beyond the plot boundaries onto the plot. California gnatcatchers observed before or after the survey period or observed while hiking to or from a survey plot were recorded as incidental observations.

2.4 Incidental Observations of Other NCCP Target and Covered Species

Biologists conducting the California gnatcatcher surveys documented incidental observations of other NCCP Target and Covered species throughout the reserve system while conducting the focused California gnatcatcher surveys and recording vegetation data. Incidental observations were recorded while driving between plots, while hiking to and from plots, or while conducting the focused surveys on the plots. Incidental observation data for all species are provided in Appendix B.

3.0 RESULTS AND DISCUSSION

3.1 California Gnatcatcher Occupancy by Plot

The purpose of the study was to collect baseline data at randomly selected plots throughout the reserve system so that the California gnatcatcher population could be estimated, based on detection probabilities and occupancy rates of surveyed plots, as derived from statistical analyses. A total of 149 plots were surveyed three times for the California gnatcatcher. Survey dates, times and biologists for the three rounds of surveys are provided for each plot in Appendix C. The distribution of the survey plots and the locations of California gnatcatcher-occupied plots throughout the reserve system are shown in Figures 2 and 3.

Site occupancy for a given plot is based on the presence of at least one adult California gnatcatcher. A total of 24 plots were occupied during the first round of surveys, 22 were occupied during the second round of surveys, and 22 were occupied during the third round of surveys (Table 1). A cumulative total of 34 plots were found to be occupied at least once: California gnatcatchers were never detected within the remaining 115 plots during the surveys. Of the 34 plots found to be occupied, 10 were found to be occupied during only one of the surveys, 14 during two of the surveys, and 10 during all three surveys.

Incidental observations of California gnatcatchers were documented throughout the reserve system when they were encountered. The locations of 25 incidental observations were recorded. Five of the incidental observations were of California gnatcatchers immediately adjacent to plots that did not enter the plot during the survey. Only 8 of the 25 incidental observations (32%) were in the Central Reserve.

3.2 Plot Distribution by Management Unit

The Irvine Ranch Wildlands Management Units map prepared by the Irvine Ranch Conservancy was used to divide the Central and Coastal Reserves into smaller planning areas. However, portions of the Central and Coastal Reserve occur beyond the boundary of that map. The surveyed reserve areas not included in the Irvine Ranch map were identified as separate management units and named accordingly. Because the 149 plots were randomly selected, and because the size of the management units vary widely, some of the management units did not have any plots within them, and some of the management units had one, a few, or many plots within them. The number of plots within each management unit and the number of occupied plots are provided in Table 2.

The number of occupied plots in the Central and Coastal Reserves is substantially different. Only 10 of 79 plots (12.7%) in the Central Reserve were occupied, whereas 24 of 70 plots (34.3%) in the Coastal Reserve were occupied. The lower occupancy rates in the Central Reserve are also reflected in the number of incidental observations of California gnatcatcher in each area (8 in the Central Reserve and 17 in the Coastal Reserve). This is likely the result of the loss of most of the coastal sage scrub habitat in the Central Reserve resulting from the fires in 2007, discussed further below.

3.3 California Gnatcatcher Occupancy at Unburned and Burned Plots

Table 3 summarizes the relationship between the number of plots in burned and unburned area and the number of those plots that were found to be occupied by California gnatcatcher at least once during the three survey periods. Of the 84 plots located in unburned areas, 27 were occupied by the California gnatcatcher (32.1%). The percentage of occupied plots in burned areas was substantially lower - a combined 10.1% (7 of 65). The data indicate that the apparent severity of the fire effected occupancy by the California gnatcatcher; 23.1% of the lightly burned plots were occupied, 8.9% of the moderately burned plots were occupied, and 0% of the severely burned plots were occupied.

In the Crystal Cove State Park and Laguna Coast Wilderness Park management units, 15 of 36 plots (41.7%) were occupied. This region of the Coastal Reserve has not burned since the 1993 Laguna Beach fire and most of the habitat is recovered. Only one of these plots was judged to be recently burned (and it was not occupied). In contrast, the Limestone and Weir Canyon management units were subjected to the

relatively severe Windy Ridge and Santiago Fires in 2007, and most of the habitat has not recovered. Only 2 of the 24 plots (8.3%) were occupied by the California gnatcatcher. Both of those occupied plots were in areas that did not recently burn in those fires.

All ten of the plots found to be occupied only one time (out of the three rounds of surveys) were within plots that had not recently burned. In contrast, all seven of the plots occupied in the burned areas had gnatcatchers during at least two of the survey periods (4 of the 7 were found to be occupied all three times). These data suggest that gnatcatchers in burned areas might be limited to, and therefore have to remain in, the smaller patches of suitable habitat that are left (i.e. small unburned patches occupied by gnatcatchers are surrounded by unsuitable burned habitat). These types of relationships can be evaluated more fully in the subsequent statistical analyses to be conducted on the data by the NROC and USFWS.

Recovery of the California gnatcatcher population in the San Joaquin Hills following the devastating Laguna Fire in 1993 was documented in several studies. Initially, surviving pairs persisted in unburned or lightly burned patches of coastal sage scrub, usually where fire-resistant cacti acted as buffers (Bontrager et al. 1995), similar to what our data suggest. Vegetation and gnatcatcher survey data indicate recovery of the population began when climax shrub species (species typically used for nesting) attained 50-60% cover in recovering patches of coastal sage scrub (Harmsworth 1999). Five years after the fire (in 1998), California gnatcatcher population estimates represented 57% of the pre-fire population (73 pairs versus 127 pairs). Because 2011 is the baseline year for this study, comparable population estimates are not available from prior to the 2007 fires. In the San Joaquin Hills, the California gnatcatcher population recovered to 57% of the pre-fire in five years. This upcoming (2012) spring will mark the five year point from the 2007 fires; however, early successional shrub species not typically used by California gnatcatchers as nesting substrate, especially deerweed (*Lotus scoparius*) and bushmallow (*Malacothamnus fasciculatus*), still dominate many of the plots in the burn areas, indicating that these areas are not fully recovered. The low number of occupied plots and incidental observations suggest that the California gnatcatcher population is not likely to be close to the levels that probably existed prior to the fire, but any comparisons would be made with data collected using different methodologies.

3.4 Other NCCP Target and Covered Species

A total of 136 incidental observations of 18 other target and covered were documented during the California gnatcatcher surveys. These included two species of plants, one amphibian, five reptiles, eight birds, and two mammals. Locations of several temporary ponds/vernal pools were also recorded. These observations included 25 California gnatcatchers (mostly pairs and individuals) and 46 cactus wrens (mostly individuals heard vocalizing). Incidental observation data for all species are provided in Appendix B.

4.0 RECOMMENDATIONS

Management of the resources within the NROC is a complex issue. As it relates to the California gnatcatcher, management activities should be implemented on multiple spacial and temporal scales. At the largest scale, the entire reserve system should be managed based on conservation principles that project well into the future (100 years). The Central and Coastal Reserves should also be managed based on differences in weather patterns along the coast versus the inland areas, differences in edge habitat, access, fire potential, isolation etc. The critically low population sizes of the cactus wren in the Central Reserve (Leatherman BioConsulting, Inc. 2009) and the Coastal Reserve (Mitrovich and Hamilton 2007), in addition to the data provide herein on the California gnatcatcher populations in the reserve system, suggest that management actions should be taken soon rather than later. At the smallest scale, individual management units should be managed based on site specific characteristics as opportunities present themselves over the short term.

The purpose of this study was to collect baseline data to estimate the current population size of the California gnatcatcher based on occupancy rates and detection probabilities derived from statistical analyses. On a reserve-wide scale, this baseline estimate provides the basis for a long-term monitoring program capable of evaluating effectiveness of reserve design and clarifying the responses of California gnatcatchers and coastal sage scrub to fire. Occupancy estimates can be compared to future estimates to evaluate the efficacy of management activities and provide a basis for making decisions in the context of adaptive management.

Current occupancy levels of the California gnatcatcher between the Central and Coastal Reserve appear to be significantly different. Movement of individuals between Central and Coastal Reserves and among subpopulations in the various management units may become more important for long term management and persistence. Genetic sampling of the California gnatcatcher population to evaluate the extent to which individuals can or are moving between (dispersing) different subpopulations in the reserve should be considered. If genetic markers in the California gnatcatcher can be used to identify individuals at the population level, collecting these data may actually be more cost effective than nest monitoring, banding, and following/searching for dispersing birds that were banded.

Habitat restoration can be an effective management strategy. Several restoration projects report California gnatcatcher nesting within four years of planting (Earthworks 1999a, 1999b, Miner et al. 1998). Nesting has been documented in less time (three years) on sites where substantial numbers of container plants resulted in the immediate existence of taller and more diverse scrub layers (LSA and Earthworks 1999). At two restoration site, California gnatcatchers were observed the same year it was planted (Bonterra Consulting 2007, NewFields 2012), and nesting was documented the next spring (BonTerra Consulting 2008). NROC should explore the possibility of expanding current cactus scrub restoration and creation projects to include the broader scope of coastal sage scrub restoration and creation.

NROC is currently involved with translocation studies of the cactus wren, based in part on the results of previous surveys for the wren on the Central and Coastal Reserves and associated management recommendations. Those translocation efforts are currently being monitored. The extent to which similar efforts might be made with the California gnatcatcher may warrant discussion depending on the success of the translocation effort with the wren. Obvious differences in the biology - survivorship, habitat preference, flight capability, home range - and project logistics would have to be examined to assess if this could be a reasonable option in the future.

Relative to the methodology, the random selection of the plots made access to a number of the plots impossible, and the steepness of the slopes and or the vegetation on some plots were not suitable for occupancy by the California gnatcatcher. The biologists understand that randomly selected plots are a critical component of the methodology if the results are to be extrapolated over the reserve as a whole. However, the biologists indicated that: 1) a lot of good habitat was not surveyed, 2) several of the plots were too steep to survey, 3) some of the plots did not have suitable coastal sage scrub, 4) some of the plots were centered on roads, parking lots in parks, or other developed areas, 5) many plots were not in areas that

the NROC is likely to implement management actions to improve conservation value for the gnatcatcher. The team recommends considering a pre-screening of plot areas or a type of stratified random sampling that might reduce the number of selected plots that are problematic in terms of their effects on logistical implementation and quality of survey.

A vegetation map of the coastal sage scrub habitat throughout the reserve should be prepared to update existing maps currently in use by the County of Orange GIS Department. This effort alone would improve the random selection process of plots by eliminating from the pool plots that don't support suitable coastal sage scrub.

Coordination with the various landowners to obtain access permits should be initiated in January for surveys to be conducted that spring. Although project preparation and planning seems to account for all logistical hurdles, unforeseen obstacles consistently delay implementation, especially on a study that is reserve-wide in scale.

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Table 1. California Gnatcatcher Occupied Plots by Survey

Plot No.	Management Unit	Occupied Plots (indicated by x)		
		Survey 1	Survey 2	Survey 3
3	NB-Buck Gully		x	x
4	CA-Crystal Cove State Park	x	x	x
8	CA-Crystal Cove State Park	x	x	x
11	CA-Crystal Cove State Park	x	x	
12	CA-Crystal Cove State Park	x	x	
16	CA-Crystal Cove State Park		x	x
19	COI-South Bommer Canyon	x		x
23	CA-Crystal Cove State Park	x	x	x
27	CA-Crystal Cove State Park			x
36	COI-South Bommer Canyon			x
44	OC Parks-El Modena	x	x	x
47	OC-Laguna Coast Wilderness Park		x	
48	OC Parks-El Modena	x	x	x
52	OC-Laguna Coast Wilderness Park	x	x	
61	OC-Laguna Coast Wilderness Park	x		x
68	OC-Laguna Coast Wilderness Park	x	x	
82	COI-South Shady Canyon	x	x	x
83	OC-Laguna Coast Wilderness Park	x	x	x
92	COI-South Shady Canyon			x
101	OC Parks-Peters Canyon Regional Park	x	x	x
105	OC-Laguna Coast Wilderness Park	x	x	
109	OC-Aliso & Wood Canyons Wilderness Park			x
110	OC-Laguna Coast Wilderness Park			x
111	OC-Laguna Coast Wilderness Park	x	x	
112	OC-Loma Ridge	x		
123	OC-Aliso & Wood Canyons Wilderness Park	x		x
124	OC-Aliso & Wood Canyons Wilderness Park	x	x	
127	OC-Weir Canyon	x		
130	OC-Weir Canyon		x	x
133	OC-Aliso & Wood Canyons Wilderness Park		x	
195	FAA-El Toro	x		
215	FAA-El Toro	x		x
218	TIC-Irvine Open Space Preserve North-Limestone	x	x	x
246	SCE (OC Parks manages)	x	x	x
		24	22	22

Table 2. Number of Plots and Occupied Plots in each Management Unit

Irvine Ranch Wildlands Management Units	No. of Plots in MU	No. of Plots Occupied
OC-Gypsum	1	0
OC-Weir Canyon	11	2
OC-Fremont Canyon	1	0
OC Parks-Irvine Regional Park	0	-
OC-Fremont East Orange	3	0
OC-Black Star	0	-
OC Parks-Peters Canyon	3	1
OC-Loma Ridge	3	1
COI-Loma Ridge	8	0
IRWD-Loma Ridge West	0	-
OC-Limestone Canyon	13	0
OC Waste-Bowerman County Landfill	3	0
OC-Round Canyon	5	0
OC-Aqua Chinon	8	0
TIC-Irvine Open Space Preserve North-Limestone	2	1
FAA-El Toro	5	2
CA-Upper Newport Bay Nature Reserve	0	-
IRWD-San Joaquin Wildlife Sanctuary	0	-
NB-Buck Gully	1	1
COI-Bonita Canyon	0	-
COI-Open Space Preserve South-Bommer Canyon	5	2
COI-Open Space Preserve South-Shady Canyon	8	2
COI-Open Space Preserve South-Quail Hill	0	-
OC-Laguna Laurel	0	-
OC-Laguna Coast Wilderness Park	0	-
CA-Crystal Cove State Park	17	7
BSA-Outdoor Education Center	0	-
CA-Laguna Coast Wilderness Park	28	8
OC Waste-Coyote Canyon Landfill	0	-
Other Management Units in NROC		
OC Parks-Limestone Canyon & Whiting Ranch Wilderness Park	8	0
OC Parks-El Modena	2	2
TCA-Bonita Creek	1	0
SCE (OC Parks manages)	1	1
OC Parks-Santiago Oaks Regional Park	2	0
OC-Aliso & Wood Canyons Wilderness Park	10	4
Total	149	34

Table 3. Survey Results in Burned and Unburned Plots

Burn Severity	No. of Plots Surveyed	No. of Occupied Plots	% of Occupied Plots
Unburned Area	84	27	32.1
Low	13	3	23.1
Moderate	45	4	8.9
High	7	0	0
Total	149	34	

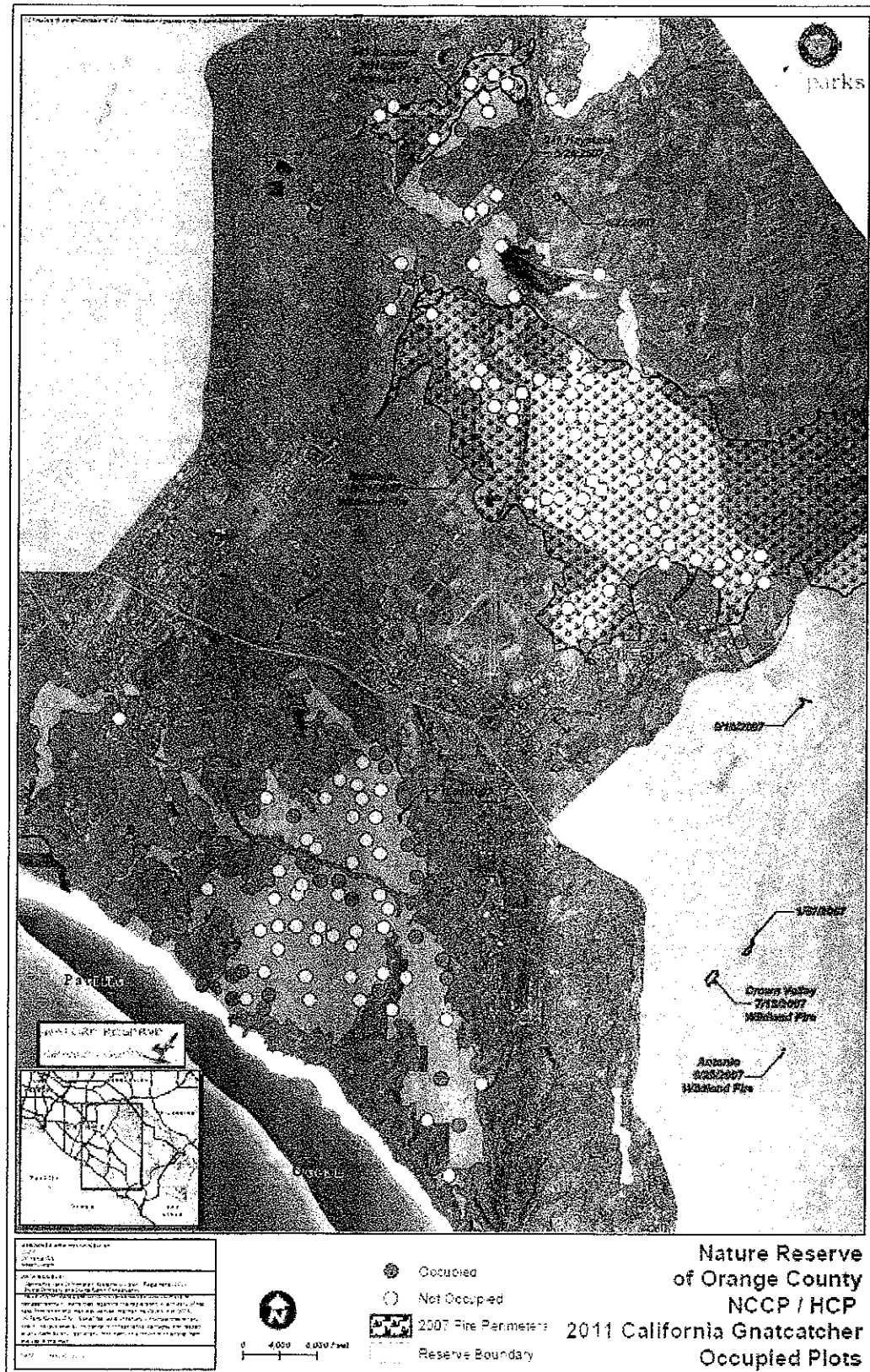


Figure 1. Nature Reserve of Orange County 2011 California Gnatcatcher Survey Plots Relative to 2007 Wildfire Perimeters



Figure 2. Central Reserve Survey Plots Occupied by California Gnatcatchers during 2011 Surveys

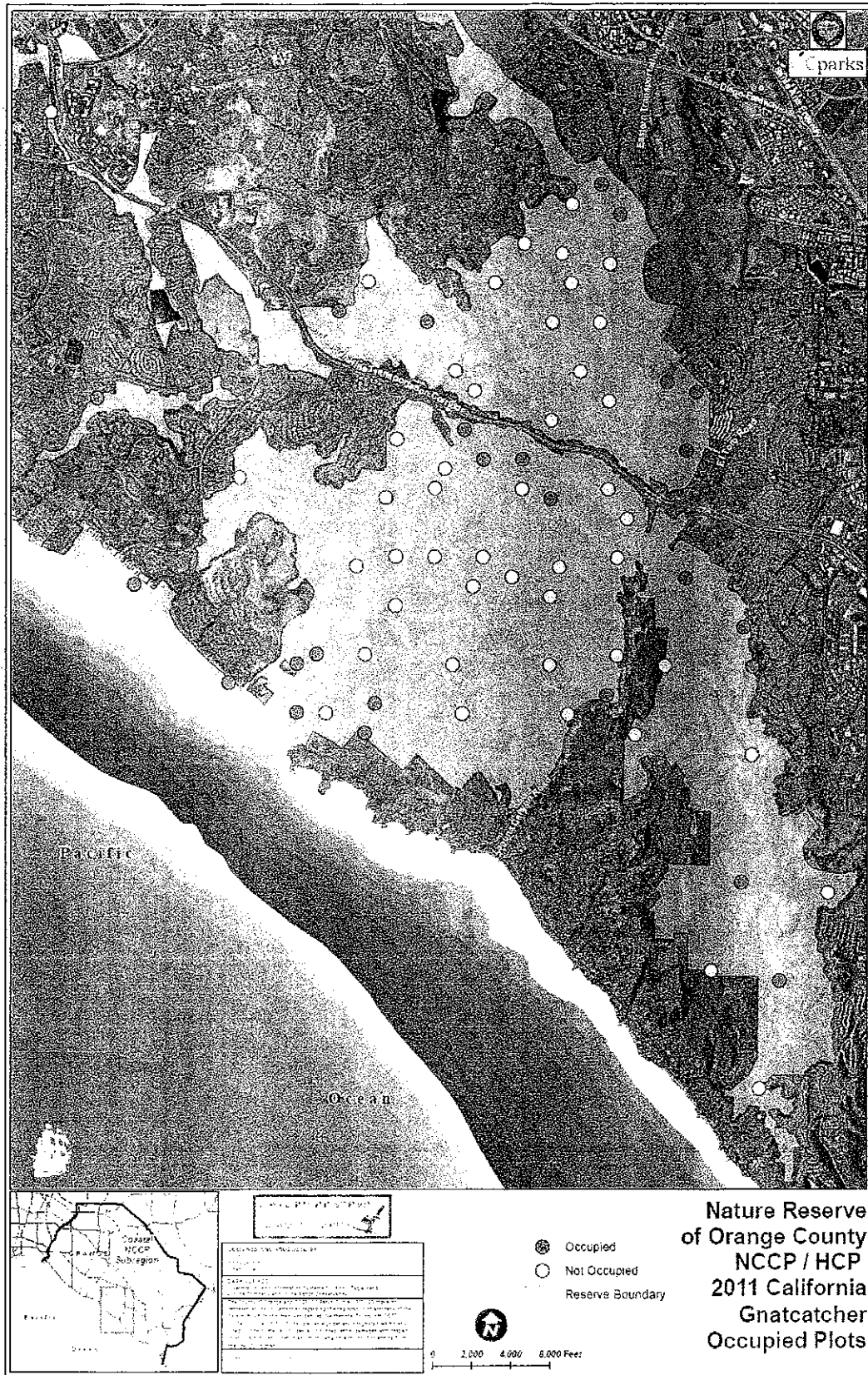


Figure 3. Coastal Reserve Survey Plots Occupied by California Gnatcatchers during 2011 Surveys

6.0 APPENDICES

Appendix A. Sample Field Data Sheets

2011 NROC Central/Coastal Reserve CAGN Study		California Gnatcatcher Survey Form	
Planning Area: _____ Plot No. _____			
Survey Number 1 Investigator(s): _____ Date (mmddyy): _____ Start Time: _____ End Time: _____			
		Temp (C) _____	
		Wind (km/h) _____	
		% Cloud Cover _____	
Adult California Gnatcatcher Detected		Yes	No
Specify No. of the Following:		Males _____	Females _____
		No. Unknown Sex _____	No. Unknown Age _____
CAGN Location Coordinates (NAD 83):		mE _____	mN _____
CAGN Tape Played		Yes	No
No. of Times Tape Played (use hash marks)			
Initial CAGN Observation/Detection		Inside Plot	Outside Plot
Did CAGN enter plot in response to tape?		Yes	No
Type of Detection		Visual	Aural
Comments for Survey #1 _____			
Survey Number 2 Investigator(s): _____ Date (mmddyy): _____ Start Time: _____ End Time: _____			
		Temp (C) _____	
		Wind (km/h) _____	
		% Cloud Cover _____	
Adult California Gnatcatcher Detected		Yes	No
Specify No. of the Following:		Males _____	Females _____
		No. Unknown Sex _____	No. Unknown Age _____
CAGN Location Coordinates (NAD 83):		mE _____	mN _____
CAGN Tape Played		Yes	No
No. of Times Tape Played (use hash marks)			
Initial CAGN Observation/Detection		Inside Plot	Outside Plot
Did CAGN enter plot in response to tape?		Yes	No
Type of Detection		Visual	Aural
Comments for Survey #2 _____			
Survey Number 3 Investigator(s): _____ Date (mmddyy): _____ Start Time: _____ End Time: _____			
		Temp (C) _____	
		Wind (km/h) _____	
		% Cloud Cover _____	
Adult California Gnatcatcher Detected		Yes	No
Specify No. of the Following:		Males _____	Females _____
		No. Unknown Sex _____	No. Unknown Age _____
CAGN Location Coordinates (NAD 83):		mE _____	mN _____
CAGN Tape Played		Yes	No
No. of Times Tape Played (use hash marks)			
Initial CAGN Observation/Detection		Inside Plot	Outside Plot
Did CAGN enter plot in response to tape?		Yes	No
Type of Detection		Visual	Aural
Comments for Survey #3 _____			

2011 NROC Central/Coastal Reserve CAGN Study

Vegetation Data Form

Investigator(s): _____
 Management Unit: _____
 Plot Number: _____

Date (mmddyy): _____

Site Recently Burned Yes No Unsure
 Fire Severity Low Moderate High

Estimate % Cover of Each Major Plant Community

Riparian Woodland _____
 Oak Woodland _____
 Chaparral _____
 Coastal Sage Scrub _____
 Grassland _____
 Disturbed _____
 Developed _____

Estimate % Cover of the Five Most Dominant Shrubs in Coastal Sage Scrub

Plant Species	Cover Category*	Notes
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Average Height of CSS _____

Invasive Non-native Species Present Yes No

Estimate % Cover for Each Species %

_____	_____
_____	_____
_____	_____
_____	_____

Focal Species: Artichoke thistle, fennel, garland chrysanthemum, castor bean, tree tobacco,
 hemlock, mustard, bromes, oats

Notes Regarding Use as Long-term Monitoring Plot

* Cover categories: <1%, 2-5%, 5-10%, 10-20%, 20-30%, 30-40% etc.

KM	5/6/2011	Cactus wren	0428328	3722001	1	nest building
DK	3/16/2011	Cactus wren	0429741	3714593	1	unbanded
DK	3/16/2011	Cactus wren	0429917	3714602	1	
DK	3/18/2011	Cactus wren	0431580	3710036	2	1 unknown sex
DK	4/13/2011	Cactus wren	NR	NR	1	in Wood Canyon
DK	4/14/2011	Cactus wren	0431580	3710036	1	north of plot 133
DK	5/6/2011	Cactus wren	NR	NR	1	in Wood Canyon
JH	3/17/2011	Cactus wren	0437048	3727773	2	2 heard
JH	3/17/2011	Cactus wren	0438130	3728229	NR	
JH	3/17/2011	Cactus wren	0440893	3727637	NR	
JH	3/18/2011	Cactus wren	0440974	3728535	NR	
JH	3/25/2011	Cactus wren	0436391	3727253	NR	
JH	4/4/2011	Cactus wren	0435570	3729439	NR	
JH	4/5/2011	Cactus wren	0432953	3736896	NR	
JH	4/11/2011	Cactus wren	0441088	3727847	1	1 heard
JH	4/11/2011	Cactus wren	0438142	3728244	1	nest in plot
JH	4/21/2011	Cactus wren	0433708	3738453	2	
JH	4/26/2011	Cactus wren	0435965	3729845	1	1 heard
JH	4/27/2011	Cactus wren	0437060	3728212	1	2 heard
JH	5/2/2011	Cactus wren	0439899	3727390	NR	
JH	5/4/2011	Cactus wren	0438344	3729118	NR	
JH	5/5/2011	Cactus wren	0436608	3728246	NR	
JH	5/11/2011	Cactus wren	0439809	3728430	NR	
BL	4/4/2011	Cactus wren	0435944	3729833	1	
BL	4/4/2011	Cactus wren	0435359	3730478	1	
BL	4/4/2011	Cactus wren	0436693	3727438	2	
RR	3/18/2011	California gnatcatcher	0426372	3718132	1	
RR	3/30/2011	California gnatcatcher	0423086	3714300	2	
RR	5/6/2011	California gnatcatcher	0425261	3713934	1	
RR	5/6/2011	California gnatcatcher	0424136	3713861	1	
RR	5/10/2011	California gnatcatcher	0427023	3717655	2	
RR	5/10/2011	California gnatcatcher	0423071	3714228	1	
RR	5/11/2011	California gnatcatcher	0427962	3716986	1	
RR	5/12/2011	California gnatcatcher	0429014	3714148	1	
NK	4/20/2011	California gnatcatcher	0430633	3740747	2	
KM	3/16/2011	California gnatcatcher	0430037	37188021	1	
KM	3/12/2011	California gnatcatcher	0420177	3722698	1	
KM	4/1/2011	California gnatcatcher	0421395	3718811	2	
KM	4/1/2011	California gnatcatcher	0421592	3718860	1	
KM	4/18/2011	California gnatcatcher	0430047	3718107	2	
KM	4/14/2011	California gnatcatcher	0426490	3739628	2	nest building
KM	4/21/2011	California gnatcatcher	0428690	3721470	1	
KM	5/13/2011	California gnatcatcher	0421199	3718783	1	
KM	5/16/2011	California gnatcatcher	0425052	3720023	1	
DK	3/21/2011	California gnatcatcher	0440749	3725731	1	

JH	3/25/2011	California gnatcatcher	0435708	3725926	1	
JH	4/21/2011	California gnatcatcher	0433295	3738644	1	heard from vehicle
JH	4/21/2011	California gnatcatcher	0433585	3738246	2	
JH	4/21/2011	California gnatcatcher	0433543	3738544	1	
BL	5/3/2011	California gnatcatcher	0435737	3725768	2	
BL	5/3/2011	California gnatcatcher	0435588	3725878	2	family group
RR	3/15/2011	Catalina mariposa lily	0425079	3713561	1	
RR	4/13/2011	Catalina mariposa lily	0424387	3713733	7	
RR	4/14/2011	Catalina mariposa lily	0422808	3717279	62	
JH	5/4/2011	Coastal western whiptail	0439201	3730134	1	
JH	5/11/2011	Coastal western whiptail	0436022	3734250	1	
KM	5/16/2011	Cooper's hawk	0429617	3718879	2	
KM	5/16/2011	Cooper's hawk	0430017	3717923	1	nest building
RR	3/15/2011	Coyote	0424056	3714522	1	
RR	5/10/2011	Coyote	0425794	3718693	1	
RR	5/9/2011	Foothill mariposa lily	0426130	3717643	4	
RR	5/11/2011	Foothill mariposa lily	0428049	3715846	2	
JB	5/12/2011	Least Bell's Vireo	0435744	3737417	1	
JB	5/12/2011	Least Bell's Vireo	0432496	3733951	1	
NK	4/14/2011	Least Bell's Vireo	0429250	3737894	1	
NK	4/14/2011	Least Bell's Vireo	0429130	3738266	1	
NK	4/14/2011	Least Bell's Vireo	0429034	3738436	1	
NK	4/14/2011	Least Bell's Vireo	0429473	3738437	1	
NK	5/12/2011	Least Bell's Vireo	0429559	3737691	1	
NK	5/12/2011	Least Bell's Vireo	0429521	3737802	2	
KM	4/18/2011	Least Bell's Vireo	0429560	3719067	1	
NK	5/12/2011	Many-stemmed dudleya	0432050	3739738	~25	
JH	3/18/2011	Mountain lion	0437815	3730066		tracks
RR	3/17/2011	Northern harrier	0426379	3718347	1	
RR	5/9/2011	Northern harrier	0425399	3717107	1	
RR	5/11/2011	Northern harrier	0427087	3715488	1	
JH	3/25/2011	Northern harrier	0435583	3725833	1	
JH	3/29/2011	Northern harrier	0439086	3728973	1	
JB	5/12/2011	Orange-throated whiptail	0433286	3733872	1	
RR	5/12/2011	Orange-throated whiptail	0429253	3715902	1	
JH	4/14/2011	Patch-nosed snake	0439842	3728977	1	
DK	3/30/2011	Red-diamond rattlesnake	0430927	3714147	1	
KM	5/16/2011	Red-shouldered hawk	0429700	3719019	2	
JB	3/29/2011	Rufous-crowned sparrow	0432490	3734044	8	
JB	3/30/2011	Rufous-crowned sparrow	0435101	3735020	5	
JB	5/12/2011	Rufous-crowned sparrow	0431889	3734038	7	
RR	3/16/2011	Rufous-crowned sparrow	0422868	3717258	1	
RR	3/31/2011	Rufous-crowned sparrow	0427163	3715518	1	
DK	3/21/2011	Rufous-crowned sparrow	0440749	3725739	1	
JH	3/17/2011	Rufous-crowned sparrow	0440769	3727812	NR	

JH	3/17/2011	Rufous-crowned sparrow	0438020	3728252	NR	
JH	3/18/2011	Rufous-crowned sparrow	0440927	3728616	NR	
JH	4/4/2011	Rufous-crowned sparrow	0437253	3731794	2	
JH	4/11/2011	Rufous-crowned sparrow	0441258	3728538	NR	
JH	4/19/2011	Rufous-crowned sparrow	0433612	3730208	1	
JH	4/21/2011	Rufous-crowned sparrow	0438421	3731595	NR	
JH	4/21/2011	Rufous-crowned sparrow	0433776	3738471	1	
JH	5/4/2011	Rufous-crowned sparrow	0437889	3731879	NR	
JH	5/10/2011	Rufous-crowned sparrow	0437845	3729367	NR	
JH	5/11/2011	Rufous-crowned sparrow	0439196	3728221	1	
BL	4/4/2011	Rufous-crowned sparrow	0435359	3730478	1	
BL	4/4/2011	Rufous-crowned sparrow	0434930	3726868	1	
RR	5/11/2011	San Diego horned lizard	0427642	3715052	1	
JH	4/12/2011	San Diego horned lizard	0435801	3734121	6	trail east of UTM
JH	5/2/2011	Vernal pool	0441263	3728575		
JH	3/25/2011	Vernal pool	0435544	3726274		
JH	3/25/2011	Vernal pool	0435974	3726675		
JH	3/29/2011	Vernal pool	0438944	3730781		
JH	3/29/2011	Vernal pool	0438816	3730868		
JH	4/12/2011	Vernal pool	0436279	3734171		
RR	4/13/2011	Western spadefoot	0425291	3714177	~150	larvae
RR	4/13/2011	Western spadefoot	0425745	3714699	~25	larvae
BL	4/19/2011	Western spadefoot	0435539	3726280	100+	larvae
NK	5/12/2011	White-tailed kite	0431512	3739886	5	
KM	3/16/2011	White-tailed kite	0429629	3718886	1	
KM	3/17/2011	White-tailed kite	0428981	3721463	1	
KM	3/17/2011	White-tailed kite	0428538	3721689	2	nest building
KM	5/13/2011	Willow flycatcher	0427043	3720291	1	

Biologists: BL = Brian Leatherman, DK = Dana Kamada, JB = Jason Berkley, JH = James Huelsman, KM = Karly Moore,
 NK = Nina Kidd, RR = Rick Riefner
 NR = not recorded

APPENDIX C: Survey Dates, Times and Biologists for each Plot

Survey Number 1					Survey Number 2				Survey Number 3			
Plot No.	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time
1	KM	3/22/2011	1407	1445	KM	4/25/2011	1400	1445	KM	5/13/2011	1538	1615
3	KM	4/1/2011	730	825	KM	4/25/2011	1205	1255	KM	5/13/2011	1405	1443
4	BL	3/25/2011	1230	1244	BL	4/13/2011	1240	1300	BL	5/2/2011	1230	1310
8	RR	3/30/2011	642	709	RR	4/21/2011	1356	1422	RR	5/10/2011	1318	1335
9	RR	3/16/2011	1015	1102	RR	4/14/2011	1142	1218	RR	5/9/2011	608	629
11	RR	3/16/2011	708	719	RR	4/14/2011	1028	1112	RR	5/6/2011	1312	1359
12	RR	3/15/2011	650	733	RR	4/14/2011	932	1010	RR	5/6/2011	1221	1302
16	RR	3/15/2011	801	847	RR	4/14/2011	626	712	RR	5/6/2011	1155	1213
18	RR	3/15/2011	1341	1418	RR	4/13/2011	621	707	RR	5/6/2011	719	801
19	KM	3/30/2011	1325	1335	KM	4/28/2011	1345	1445	KM	5/16/2011	1242	1252
21	RR	3/17/2011	701	742	RR	4/15/2011	1207	1252	RR	5/9/2011	1246	1331
23	RR	3/15/2011	1023	1104	RR	4/13/2011	838	912	RR	5/6/2011	554	620
24	RR	3/16/2011	809	851	RR	4/14/2011	808	849	RR	5/9/2011	1137	1222
26	KM	3/30/2011	1357	1445	KM	4/28/2011	1118	1209	KM	5/16/2011	1045	1125
27	RR	3/15/2011	938	1014	RR	4/13/2011	737	820	RR	5/6/2011	635	706
28	RR	3/16/2011	1308	1347	RR	4/15/2011	1049	1130	RR	5/9/2011	818	859
30	RR	3/15/2011	1238	1316	RR	4/13/2011	1033	1118	RR	5/6/2011	852	941
31	RR	3/17/2011	820	848	RR	4/13/2011	1242	1311	RR	5/6/2011	1056	1117
32	RR	3/16/2011	1146	1231	RR	4/14/2011	1250	1331	RR	5/9/2011	648	735
36	KM	3/30/2011	735	830	KM	4/28/2011	945	1035	KM	5/16/2011	917	939
38	RR	3/15/2011	1135	1217	RR	4/13/2011	1140	1211	RR	5/6/2011	952	1041

Survey Number 1					Survey Number 2					Survey Number 3				
Plot No.	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time		
39	RR	3/17/2011	1301	1346	RR	4/15/2011	908	939	RR	5/9/2011	916	959		
41	RR	3/17/2011	1126	1211	RR	4/15/2011	738	819	RR	5/9/2011	1011	1059		
42	RR	3/31/2011	1142	1216	RR	4/22/2011	1118	1155	RR	5/11/2011	852	929		
43	KM	3/30/2011	859	1000	KM	4/28/2011	850	925	KM	5/16/2011	830	910		
44	KM	3/22/2011	1120	1141	KM	4/14/2011	1103	1143	KM	5/20/2011	1000	1040		
45	RR	3/31/2011	1252	1340	RR	4/22/2011	1301	1340	RR	5/11/2011	1218	1252		
47	RR	3/17/2011	952	1043	RR	4/15/2011	615	639	RR	5/10/2011	549	632		
48	KM	3/19/2011	1325	1415	KM	4/19/2011	1408	1444	KM	5/19/2011	1305	1338		
49	RR	3/31/2011	842	923	RR	4/22/2011	756	849	RR	5/10/2011	1201	1242		
50	KM	3/30/2011	1005	1050	KM	4/28/2011	745	830	KM	5/16/2011	722	810		
51	RR	3/31/2011	744	831	RR	4/22/2011	638	731	RR	5/10/2011	1113	1151		
52	RR	3/17/2011	1411	1415	RR	4/15/2011	1005	1019	RR	5/10/2011	740	801		
55	KM	3/31/2011	1218	1310	KM	4/25/2011	730	815	KM	5/13/2011	758	840		
58	RR	3/31/2011	1021	1110	RR	4/22/2011	945	1029	RR	5/11/2011	750	829		
60	RR	3/18/2011	815	931	RR	4/19/2011	1412	1445	RR	5/10/2011	648	733		
61	RR	3/18/2011	841	920	RR	4/19/2011	1302	1354	RR	5/10/2011	917	1033		
63	KM	3/18/2011	859	945	KM	4/21/2011	755	840	KM	5/12/2011	820	850		
66	RR	3/18/2011	1301	1350	RR	4/19/2011	925	1031	RR	5/11/2011	1316	1350		
67	RR	3/18/2011	1106	1150	RR	4/19/2011	728	810	RR	5/11/2011	1014	1052		
68	RR	3/18/2011	711	802	RR	4/19/2011	1120	1207	RR	5/11/2011	604	646		
69	KM	3/18/2011	1445	1540	KM	4/21/2011	1315	1400	KM	5/13/2011	905	945		
71	KM	3/18/2011	1215	1315	KM	4/21/2011	1119	1200	KM	5/12/2011	1140	1210		
72	RR	3/18/2011	1011	1042	RR	4/19/2011	616	658	RR	5/11/2011	1110	1151		

	Survey Number 1				Survey Number 2				Survey Number 3			
Plot No.	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time
74	RR	3/30/2011	922	1018	RR	4/21/2011	606	704	RR	5/12/2011	1153	1246
77	KM	3/18/2011	1050	1130	KM	4/21/2011	1004	1056	KM	5/12/2011	1050	1120
78	KM	3/17/2011	1045	1125	KM	4/18/2011	1340	1415	KM	5/6/2011	1300	1340
79	KM	3/18/2011	1340	1420	KM	4/21/2011	1220	1300	KM	5/13/2011	1000	1045
80	NK	3/31/2011	1055	1147	NK	4/20/2011	1235	1310	NK	5/12/2011	1110	1200
81	KM	3/17/2011	1310	1415	KM	4/25/2011	910	1010	KM	5/12/2011	930	1020
82	KM	3/17/2011	1140	1205	KM	4/18/2011	1310	1314	KM	5/6/2011	1210	1229
83	RR	3/30/2011	729	801	RR	4/21/2011	1308	1321	RR	5/12/2011	646	704
85	RR	3/30/2011	1122	1211	RR	4/21/2011	849	936	RR	5/12/2011	1043	1112
86	KM	3/16/2011	740	850	KM	4/18/2011	654	742	KM	5/6/2011	650	730
87	KM	3/16/2011	1326	1427	KM	4/18/2011	1130	1210	KM	5/6/2011	1110	1155
88	RR	3/30/2011	823	918	RR	4/21/2011	1146	1232	RR	5/12/2011	546	631
90	RR	3/30/2011	637	715	RR	4/22/2011	1411	1453	RR	5/12/2011	718	843
92	KM	3/17/2011	730	900	KM	4/18/2011	1208	1252	KM	5/12/2011	645	657
93	NK	3/31/2011	947	1045	NK	4/14/2011	850	935	NK	5/9/2011	625	700
94	JB	4/4/2011	1240	1320	JB	4/20/2011	1105	1135	JB	5/9/2011	1315	1400
95	RR	3/30/2011	1229	1313	RR	4/21/2011	1005	1041	RR	5/12/2011	945	1031
98	DK	3/16/2011	1050	1036	DK	4/13/2011	1705	1750	DK	5/6/2011	920	1006
99	NK	3/31/2011	650	730	NK	4/14/2011	705	745	NK	5/12/2011	910	1005
101	NK	3/31/2011	800	900	NK	4/14/2011	805	840	NK	5/12/2011	1015	1105
102	DK	3/16/2011	1200	1255	DK	4/13/2011	1605	1650	DK	5/6/2011	1020	1120
105	KM	3/16/2011	912	935	KM	4/18/2011	809	840	KM	5/6/2011	755	830
109	DK	3/30/2011	1120	1210	DK	4/13/2011	1515	1555	DK	5/6/2011	1130	1206

Plot No.	Survey Number 1				Survey Number 2				Survey Number 3			
	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time
110	KM	3/16/2011	1112	1223	KM	4/18/2011	954	1045	KM	5/5/2011	955	1015
111	KM	3/16/2011	1005	1026	KM	4/18/2011	847	925	KM	5/6/2011	836	925
112	JB	4/1/2011	1045	1130	NK	4/14/2011	1005	1050	NK	5/9/2011	718	800
115	JB	4/5/2011	1230	1315	JB	4/27/2011	730	830	JB	5/12/2011	1330	1400
117	JB	4/4/2011	905	950	JB	4/20/2011	745	825	JB	5/9/2011	1015	1100
118	DK	3/17/2011	1530	1620	DK	4/14/2011	1000	1045	DK	5/4/2011	1405	1450
123	DK	3/16/2011	1630	1730	DK	4/14/2011	1450	1535	DK	5/19/2011	1005	1035
124	DK	3/16/2011	1355	1425	DK	4/13/2011	1420	1439	DK	5/6/2011	1230	1315
126	DK	3/16/2011	1520	1615	DK	4/13/2011	1245	1355	DK	5/12/2011	1005	1650
127	DK	3/30/2011	1530	1618	DK	4/13/2011	1105	1150	DK	5/12/2011	1450	1535
129	DK	3/18/2011	1100	1153	DK	4/14/2011	1130	1220	DK	5/4/2011	1525	1610
130	NK	4/4/2011	855	945	NK	4/20/2011	720	815	NK	5/9/2011	1005	1105
133	DK	3/18/2011	1600	1650	DK	4/14/2011	1555	1640	DK	5/19/2011	1055	1150
134	NK	3/31/2011	1215	1300	NK	4/14/2011	1100	1130	NK	5/12/2011	605	645
135	NK	4/4/2011	1247	1320	NK	4/20/2011	1100	1140	NK	5/9/2011	1315	1355
139	JB	4/6/2011	825	910	JB	4/26/2011	1240	1330	JB	5/5/2011	1115	1150
141	JB	3/29/2011	1140	1220	JB	4/27/2011	905	940	JB	5/12/2011	1230	1310
142	JB	3/29/2011	1230	1330	JB	4/27/2011	950	1020	JB	5/12/2011	1150	1220
144	NK	3/31/2011	1305	1335	NK	4/14/2011	1135	1215	NK	5/12/2011	650	715
145	NK	4/4/2011	1100	1140	NK	4/20/2011	920	1010	NK	5/9/2011	1132	1215
150	JB	4/4/2011	1025	1110	JB	4/20/2011	900	945	JB	5/9/2011	1115	1200
151	DK	3/18/2011	1325	1427	DK	4/14/2011	1320	1410	DK	5/12/2011	1300	1345
154	NK	4/4/2011	1150	1225	NK	4/20/2011	1015	1045	NK	5/9/2011	1230	1300

Plot No.	Survey Number 1				Survey Number 2				Survey Number 3			
	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time
155	JB	3/29/2011	815	850	JB	4/27/2011	1235	1300	JB	5/12/2011	915	945
156	JB	3/29/2011	1030	1130	JB	4/27/2011	1035	1105	JB	5/12/2011	1110	1140
157	NK	4/4/2011	710	805	NK	4/14/2011	1240	1315	NK	5/12/2011	720	820
159	JB	4/6/2011	735	815	JB	4/26/2011	1205	1235	JB	5/5/2011	1200	1230
160	JB	4/4/2011	1140	1210	JB	4/20/2011	1015	1045	JB	5/9/2011	1215	1345
161	JB	3/29/2011	715	800	JB	4/27/2011	615	700	JB	5/12/2011	830	900
162	JB	3/29/2011	900	945	JB	4/27/2011	1200	1230	JB	5/12/2011	950	1020
163	JB	4/1/2011	905	1000	JB	4/22/2011	900	945	JB	5/6/2011	1145	1230
164	JB	3/29/2011	950	1020	JB	4/27/2011	1110	1150	JB	5/12/2011	1030	1100
167	JH	3/30/2011	945	1015	JH	4/19/2011	930	1010	JH	5/3/2011	805	845
171	JB	3/30/2011	1110	1155	JB	4/26/2011	730	810	JB	5/6/2011	1010	1040
173	JH	3/30/2011	850	920	JH	4/19/2011	825	910	JH	5/3/2011	900	935
177	JB	4/5/2011	825	915	JB	4/22/2011	1105	1150	JB	5/12/2011	545	630
180	JB	3/30/2011	1200	1230	JB	4/26/2011	815	850	JB	5/6/2011	925	1000
182	JH	3/30/2011	1045	1110	JH	4/19/2011	740	815	JH	5/3/2011	940	1005
183	BL	4/4/2011	1315	1400	BL	4/19/2011	730	830	BL	5/2/2011	730	815
184	JB	3/30/2011	700	830	JB	4/26/2011	1120	1150	JB	5/6/2011	840	915
185	JB	3/30/2011	840	910	JB	4/26/2011	855	940	JB	5/6/2011	750	830
188	JB	3/30/2011	955	1030	JB	4/26/2011	1030	1110	JB	5/6/2011	600	645
189	JB	3/30/2011	1240	1330	JB	4/26/2011	630	705	JB	5/6/2011	1050	1130
191	JH	3/30/2011	1120	1200	JH	4/19/2011	1015	1055	JH	5/3/2011	1015	1050
192	BL	4/4/2011	1005	1050	JH	4/19/2011	1115	1150	JH	5/3/2011	1105	1145
193	JB	3/30/2011	1040	1100	JB	4/26/2011	950	1020	JB	5/6/2011	700	740

Plot No.	Survey Number 1				Survey Number 2				Survey Number 3			
	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time
195	JH	3/25/2011	1000	1010	BL	4/19/2011	1235	1325	BL	5/3/2011	755	845
196	BL	4/4/2011	740	825	JH	4/26/2011	1215	1245	JH	5/5/2011	950	1025
197	JH	4/7/2011	825	910	JH	4/27/2011	1005	1040	JH	5/11/2011	1140	1220
198	JH	3/25/2011	1100	1150	BL	4/19/2011	850	940	BL	5/2/2011	1050	1135
199	JH	3/30/2011	1210	1245	JH	4/19/2011	1205	1240	JH	5/3/2011	1150	1225
201	BL	4/4/2011	850	915	JH	4/26/2011	1230	1325	JH	5/5/2011	1030	1115
202	JB	4/5/2011	1050	1140	JB	4/22/2011	650	725	JB	5/12/2011	730	810
204	JH	3/30/2011	1300	1345	JH	4/19/2011	1245	1320	JH	5/3/2011	1240	1325
206	JH	3/31/2011	900	930	JH	4/15/2011	1110	1140	JH	5/12/2011	950	1025
209	JH	3/25/2011	1215	1240	BL	4/19/2011	1000	1040	BL	5/2/2011	900	955
215	BL	4/4/2011	1205	1240	BL	4/19/2011	1055	1145	BL	5/2/2011	1015	1020
217	JH	3/31/2011	1045	1130	JH	4/15/2011	1210	1240	JH	5/12/2011	820	905
218	JH	3/17/2011	820	830	JH	4/14/2011	1130	1150	JH	5/5/2011	910	930
219	BL	4/4/2011	1500	1540	JH	4/27/2011	815	840	JH	5/5/2011	830	850
220	JH	3/18/2011	1220	1245	JH	4/21/2011	755	805	JH	5/10/2011	1220	1230
222	JB	4/1/2011	645	730	JB	4/22/2011	800	845	JB	5/6/2011	1240	1315
223	JH	4/4/2011	830	900	JH	4/21/2011	830	910	JH	5/10/2011	1250	1325
224	JH	3/18/2011	1320	1400	JH	4/26/2011	855	925	JH	5/10/2011	925	1000
225	JH	3/31/2011	1340	1415	JH	4/21/2011	1130	1210	JH	5/4/2011	1240	1310
227	JH	4/4/2011	1145	1220	JH	4/26/2011	810	830	JH	5/10/2011	830	905
228	JH	3/31/2011	1300	1330	JH	4/21/2011	1045	1125	JH	5/4/2011	1205	1235
229	JH	4/4/2011	1000	1020	JH	4/26/2011	1045	1115	JH	5/10/2011	1105	1140
230	JH	3/17/2011	905	950	JH	4/11/2011	1230	1300	JH	5/2/2011	1140	1220

Plot No.	Survey Number 1				Survey Number 2				Survey Number 3			
	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time	Biologist	Date	Start Time	End Time
231	JH	3/18/2011	1410	1440	JH	4/26/2011	940	1005	JH	5/10/2011	1010	1040
232	JH	3/29/2011	930	1000	JH	4/14/2011	920	940	JH	5/4/2011	955	1030
234	JH	3/29/2011	1500	1530	JH	4/21/2011	950	1030	JH	5/4/2011	1120	1155
238	JH	3/29/2011	1330	1400	JH	4/15/2011	845	915	JH	5/4/2011	900	930
239	JH	3/29/2011	1100	1115	JH	4/14/2011	820	840	JH	5/11/2011	830	850
241	JH	3/17/2011	1015	1045	JH	4/11/2011	1150	1215	JH	5/2/2011	1100	1130
242	JH	4/4/2011	1320	1345	JH	4/11/2011	1100	1130	JH	5/11/2011	950	1020
245	JH	3/18/2011	800	845	JH	4/11/2011	1010	1050	JH	5/2/2011	1000	1040
246	DK	3/22/2011	1250	1310	DK	4/12/2011	1535	1550	DK	5/3/2011	910	945
247	JH	3/17/2011	1230	1310	JH	4/11/2011	920	950	JH	5/2/2011	905	932
249	JH	3/18/2011	925	1010	JH	4/11/2011	730	830	JH	5/2/2011	730	810
250	JH	3/17/2011	1130	1210	JH	4/11/2011	840	910	JH	5/2/2011	825	855

Biologists: BL = Brian Leatherman, DK = Dana Kamada, JB = Jason Berkley, JH = James Huelsman, KM = Karly Moore, NK = Nina Kidd, RR = Rick Riefner