FINAL REPORT

1997 CALIFORNIA GNATCATCHER AND COASTAL CACTUS WREN MONITORING REPORT FOR THE SAN JOAQUIN HILLS BURN AREA

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EXECUTIVE SUMMARY

The study of the California gnatcatcher (*Polioptila californica californica)*, the cactus wren (*Campylorhynchus brunneicapillus*), and their habitat continued in the San Joaquin Hills in 1997, as part of the mitigation measures for the construction of the San Joaquin Hills Transportation Corridor. The study area included those portions of the San Joaquin Hills that burned in the 1993 Laguna Beach fire. The current study has been ongoing since 1996.

All areas of historic coastal sage scrub were observed to be recovering from the effects of the fire by the process of natural revegetation. Shrub species dominated most of the burn area, with California sagebrush and deerweed the most common species. Other dominant shrub species included California buckwheat, California sunflower, black sage, bush monkeyflower and laural sumac. Non-native grasses dominated the ground vegetation. Native plant species provided more cover than non-native species in all burn areas. Total vegetation cover and species richness (number of different species present) increased in all areas between 1996 and 1997.

There are indications that the vegetation is succeeding to a shrub dominated community. Early successional species such as deerweed, bush mallow, phacelia and morning glory had less cover in 1997 compared with 1996. And several of the climax shrub species, buckwheat, black sage, encelia and cactus, had increased their cover since 1996. Although California sagebrush decreased in cover in some areas the combined cover of California sagebrush, California buckwheat, California sunflower and black sage, the four species in which most gnatcatchers nests are located, increased since 1996.

California gnatcatchers were recorded at 37 different locations in the burn area. Of these sightings 27 represented breeding pairs, two sightings were of unpaired adult gnatcatchers and eight were of dispersing juvenile gnatcatchers. The 27 breeding pairs present in the burn area in 1997 represent a substantial increase on the 11 pairs present in 1996 and on the 5 pairs reported in 1995. A total of 11 banded gnatcatchers were located, all of which were banded outside of the study area.

The distribution and abundance of gnatcatcher breeding pairs was positively correlated with the % cover of California sagebrush, California buckwheat, California sunflower and black sage.

Nesting success for the monitored gnatcatcher pairs was high, with 91% of pairs producing fledglings. A total of 55 chicks fledged from the eleven monitored pairs resulting in a mean of 5.55 fledglings/pair. California sagebrush was the most frequently used nest substrate by gnatcatchers, although six other shrubs were also utilized.

One pair of gnatcatchers bred successfully at the TCA's restoration site in Coyote Canyon. No gnatcatchers or cactus wrens nested in the TCA's revegetation areas,

although a gnatcatcher family group was recorded foraging in the revegetation site at Coyote Canyon. Avian species diversity increased in these areas in 1997.

Cactus wrens were recorded at 54 different locations in the burn area in 1997. Of these sightings, 49 represented breeding pairs, the other five sightings were of unpaired adult wrens. This represents an increase in wren numbers from the 39 pairs present in 1996 and from the 31 pairs recorded in 1995. A total of 4 banded cactus wrens were located.

Cactus wren distribution was correlated with the presence of cactus patches, patches less than 1 m in height were used as frequently as those greater than 1 m in height, although all nests were located in substrates at least 1 m tall. *Opuntia littoralis* was the most frequently used nesting substrate.

Nesting success for the monitored cactus wren pairs was high, with 100% of pairs producing fledglings. A total of 43 chicks fledged from the 10 monitored pairs resulting in a mean of 4.30 fledglings/pair.

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1.0 INTRODUCTION

1.1 Introduction

During the 1993 Laguna Beach Fire over 5,260 ha of natural vegetation in the San Joaquin Hills burned, including 2,755 ha of coastal sage scrub (Bontrager *et al.* 1995a). Only 190 ha of coastal sage scrub within the burn area was unburned or lightly burned in the fire (LSA 1994). Prior to the fire an estimated 127 pairs of California gnatcatchers (*Polioptila californica californica*) and 282 pairs of cactus wrens (*Campylorhynchus brunneicapillus*) occupied the burn area of the San Joaquin Hills (Bontrager *et al.* 1995a, LSA 1994, 1995). The fire resulted in the loss or displacement of many of the resident California gnatcatchers and cactus wrens. After the fire (Spring 1994) only 12 pairs of California gnatcatchers and 79 pairs of cactus wrens were present in the burn area (Bontrager *et al.* 1995a; LSA 1995) and these numbers declined to 5 pairs of gnatcatchers and 31 pairs of cactus wrens by the Spring of 1995 (GWB 1996). By 1996 populations had risen to 11 pairs of gnatcatchers and 39 pairs of cactus wrens (Harmsworth Associates 1996).

In an attempt to characterize the natural recovery of the burn areas as sensitive bird habitat, the U.S. Fish and Wildlife Service (USFWS) required the Transportation Corridor Agencies (TCA) to monitor the burn sites to detect the natural restoration of the habitat and the return of the gnatcatcher and the cactus wren. This requirement was part of the mitigation measures for the construction of the San Joaquin Hills Transportation Corridor (Term and Condition #11 of the FWS Biological Opinion (1-6-93-F-98R), Mitigation Measure FWS 17 of the SJHTC Mitigation Monitoring Program, and the Public Resources Code Section 21081.6). The monitoring program was initiated in 1993. Under the current program, which runs until 1998, Harmsworth Associates continues the monitoring efforts on behalf of the TCA, as required in the Biological Opinion. In addition to monitoring the burn areas, the TCA revegetation areas at Coyote Canyon landfill were also surveyed.

The following information summarizes the 1996 findings:

- A total of 292 ha of potential California gnatcatcher and/or cactus wren habitat was found to be present in the burn area in 1996, an increase from the 190 ha present after the 1993 fire. Most of this habitat existed as small discrete patches, typically less than 2 ha in size. All areas of historic coastal sage scrub were observed to be recovering from the effects of the fire by the process of natural revegetation. Shrub species dominated all burn areas, with California sagebrush and deerweed the most common species. Non-native grasses dominated the ground vegetation. Native plant species provided more cover than non-native species in all burn areas. California sagebrush

provided significantly more cover in those grids where gnatcatchers were present than in those grids where gnatcatchers were absent.

- Eleven pairs of California gnatcatchers were recorded in 1996. Nesting success for the monitored gnatcatcher pairs was high, with 78% of pairs producing fledglings. A total of 47 chicks fledged from the nine monitored pairs resulting in a mean of 5.22 fledglings/pair. California sagebrush was the most frequently used nest substrate by gnatcatchers, although six other shrubs were also utilized

- A total of 39 pairs of Cactus wrens were recorded in 1996. At least 43.5% of the cactus wren pairs successfully fledged young.

- The distribution and abundance of gnatcatcher breeding pairs was positively correlated with the % cover of California sagebrush, California buckwheat, California sunflower and black sage, when these shrubs were greater than 0.7 m tall. Cactus wren distribution was correlated with the presence of cactus patches, patches less than 1 m in height were used as frequently as those greater than 1 m in height.

The objectives of this year's surveys were:

- to conduct quantitative vegetation surveys within the burn area,
- to accurately access the distribution and abundance of the California gnatcatcher and cactus wren in the burn area of the San Joaquin Hills and in the TCA revegetation areas at Coyote Canyon landfill, the SJHTC cut and fill slopes, Bonita Creek channel and at Bonita Reservoir,
- to monitor gnatcatcher breeding biology, with the aim of determining nesting success, and;
- to monitor cactus wren breeding biology, with the aim of determining nesting success.

1.2 Target species biology

The California gnatcatcher is an obligate resident of coastal sage scrub in southern California and northwestern Baja California. This small, non-migratory, insectivorous bird nests and forages in moderately dense stands of coastal sage scrub occurring on arid hillsides, mesas, and in washes. It generally occurs below 250 m in elevation (Atwood and Bolsinger 1992). Coastal sage scrub communities dominated by California sagebrush (*Artemisia californica*), California buckwheat (*Eriogonum fasciculatum*), white sage (*Salvia apiana*), and black sage (*Salvia mellifera*) seem to be preferred by this species. The current population of California gnatcatchers throughout their range is estimated to be between 2,000 and 3,000 pairs (Atwood 1990; Atwood 1992). Loss and fragmentation of suitable habitat due to expanding development have been major factors in the declining numbers of this species in southern California. The California gnatcatcher is currently listed as a Threatened Species by the USFWS (USFWS 1991).

The cactus wren is also an obligate resident of coastal sage scrub but, is further restricted in its distribution to large patches of prickly pear cactus (*Opuntia littoralis* and *O. oricola*) and cholla cactus (*O. prolifera*) within the scrub. The coastal population of cactus wrens are believed to be in decline but, this subspecies currently has no standing on the Endangered Species list primarily due to lack of taxonomic separation from other wren subspecies (Rea and Weaver 1990). However, this species was one of the target species around which the Orange County Natural Community Conservation Planning program was designed. Much of its remaining habitat in Orange County has been protected through this program.

1.3 Study area

The San Joaquin Hills are located in southwestern Orange County, east of Newport Beach and north of Laguna Beach and, are traversed by the San Joaquin Hills Transportation Corridor (Figure 1.1). The area encompasses 10,125 ha of mostly undeveloped land, used primarily for cattle ranching, local, regional and state parks. The landscape is dominated by steep-sided canyons and hillsides, with elevations ranging from sea level along the Pacific shoreline to 365 m in the interior. The climate is typically Mediterranean, with warm dry summers and cool wet winters. Early morning coastal fog frequently cloud the hillsides during Spring. Prior to the 1993 Laguna Beach Fire the San Joaquin Hills were covered by a mosaic of plant communities with chaparral, coastal sage scrub and grassland dominating. Oak woodland, riparian woodland and marshes were also present. Due to the fire many of these communities are no longer present in their climax form, but are present in various stages of recovery.

The study area included all the burned portions of the San Joaquin Hills and the TCA revegetation areas at Coyote Canyon landfill, the SJHTC cut and fill slopes, Bonita Creek channel and at Bonita Reservoir.

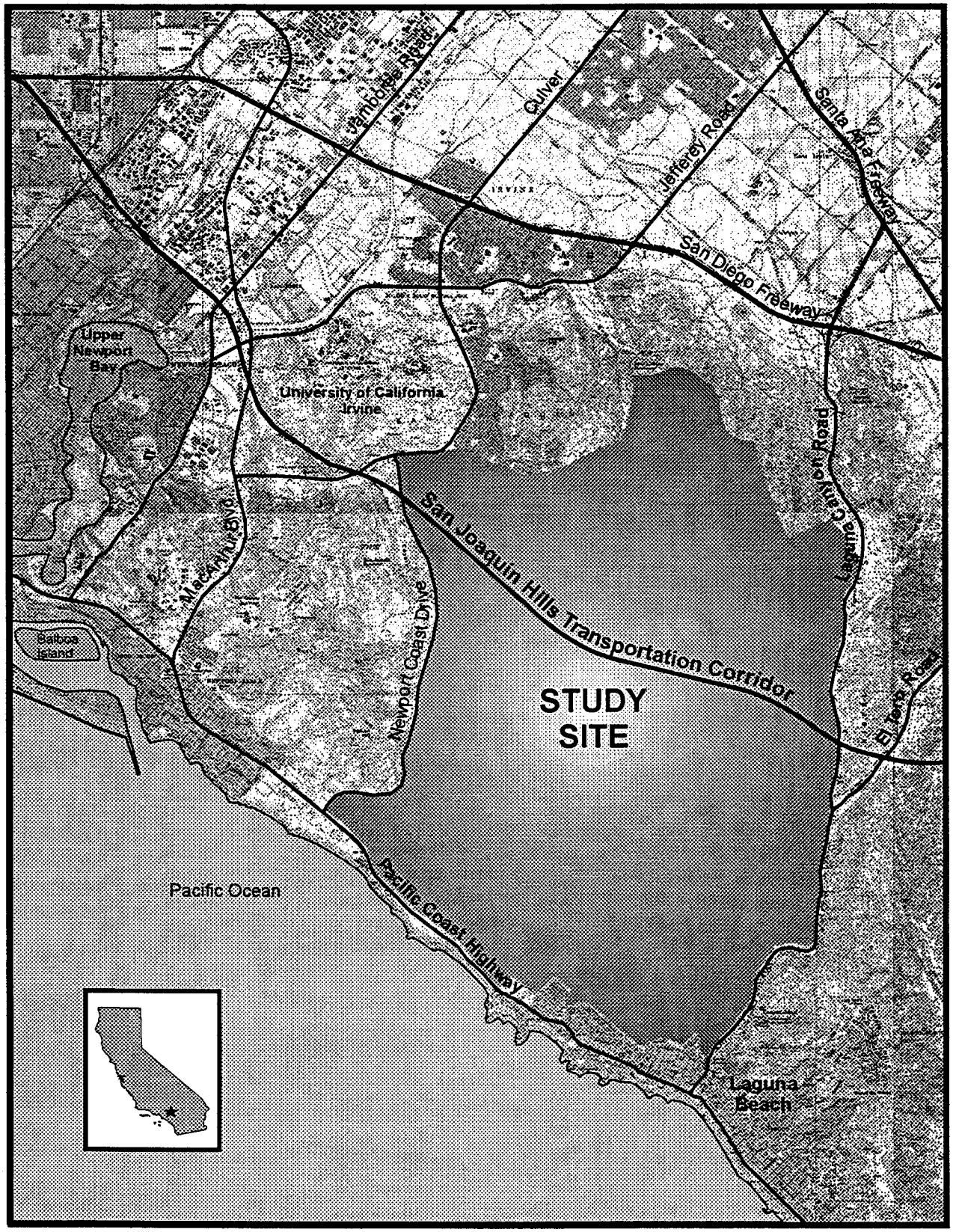

Figure 1.1
Location of study site for the San Joaquin Hills Transportation Corridor Sensitive Bird Surveys, 1997.

2.0 METHODS

2.1 Vegetation analysis

Botanical surveys were performed in those areas historically known to support the coastal sage scrub community prior to the fire of 1993, as documented by the Natural Community Conservation Plan (NCCP) of Orange County. No surveys were conducted in those areas known to support other vegetation types prior to the 1993 fire. The aim of the vegetation surveys were to quantitatively evaluate the cover and diversity of the post-burn coastal sage scrub. All botanical surveys were performed from April 4 to May 5, 1997. Data from a total of eighty four (84) 25-meter transects were collected using the line-intercept methodology. This methodology is the most efficient technique to evaluate shrub-dominated vegetation cover and diversity (Bonham 1989). It is as accurate as traditional quadrats and as statistically robust, but less-time-consuming.

For the purpose of selecting the locations of the transects, the project area was divided into 800 by 800 meter grids. These grids were divided into three categories:

- grids containing good gnatcatcher habitat (as qualitatively identified by the ornithologists) with breeding pairs of gnatcatchers present (labeled as good habitat - gnatcatchers present),
- grids containing good gnatcatcher habitat (as qualitatively identified by the ornithologists) with breeding pairs of gnatcatchers absent (labeled as good habitat - gnatcatchers absent),
- grids containing poor gnatcatcher habitat (as qualitatively identified by the ornithologists) with breeding pairs of gnatcatchers absent (labeled as poor habitat - gnatcatchers absent).

This criteria was implemented in hopes that in subsequent years of monitoring, adequate tracking of post-fire vegetation succession and gnatcatcher utilization of these areas could be evaluated.

Grids to be sampled from each of the three categories were randomly selected (random number generator). The total number of grids selected in all categories was twenty-eight; nine grids from the good habitat - gnatcatchers present category, nine grids from the good habitat - gnatcatchers absent category and ten grids from the poor habitat - gnatcatcher absent category. Within each grid, three 25-meter line-intercept transects were performed. The placement of these transects was randomly selected from one corner of the grid (north, south, east or west). Each transect was approximately 100 m from each other. Figure 2.1 shows the location of each grid, in which the three transects were performed. Representative photographs from each grid type are shown in Figures 2.2, 2.3 and 2.4.

Data was collected on the cover for each plant species encountered along the transect, the height of the vegetation along the transect at 2.5 meter intervals, the height of each plant of four important coastal sage scrub species California sagebrush (*Artemisia californica*), California sunflower (*Encelia californica*), California buckwheat (*Eriogonum fasciculatum*), and black sage (*Salvia mellifera*), and additional species not on the transect but located nearby (for the floral inventory - see Appendix A). Additional data on aspect of the transect, elevation, slope, soil texture, grazing and a general site description were also noted.

The data were analyzed by the three grid types. The data were analyzed by the actual cover and percent absolute cover of each species encountered in the transects. All variation among the grid types are presented as standard error, which incorporates the sample size into the variation assessment. Analyses included:

1. Comparison of the total live cover in each grid type.
2. Determination of the dominant and important species in each grid type. Species/cover types providing at least 25% absolute cover in the grid were classified as **dominant** (Paysen *et al.* 1980). Those species/cover types that provide over 5% cover were classified as **important** in this report to compare with a similar category in "A Manual of California Vegetation" (Sawyer and Keeler-Wolf, 1995).
3. Frequency of cover types by grid type.
4. Cover trends between native vegetation (occurring naturally in an area, not as either a direct or indirect consequence of human activity [Jepson 1993]), non-native vegetation (occurring in an area as a direct or indirect consequence of human activity), bare areas, rocky areas and dead, detrital vegetation, by grid type.
5. Cover trends between herbaceous vegetation and shrubby vegetation. Herbs are defined as plants with little or no wood above ground and above ground parts are of less than one year or growing season duration (Jepson 1993). Herbs can be perennial, but tend to be biennial or annual. Shrubs are defined as woody plants of relatively short maximum height or are much branched from the base (Jepson 1993).
6. Analysis was also performed to assess the cover and height in each grid type for four shrub species: California sagebrush, California sunflower, California buckwheat and black sage. These four species have been identified to serve as the substrate for over 85% of gnatcatcher nesting attempts in most studies in southern California (Atwood *et al.* 1995; Bontrager *et al.* 1995b; Galvin and Andros 1995). These species are also characteristic of coastal sage scrub associations (O'Leary 1989).
7. Average height of the vegetation in each grid type. The standard error of this measurement indicates the heterogeneity of the community with regards to height. Vegetation height may also be an important factor for nesting gnatcatchers and cactus wrens.

Where appropriate, the Tukey's test for significant statistical differences between grid types was performed. Statistical significance was established at the 0.05 level. Additional analyses between the data collected in 1996 (Harmsworth 1996) and this years data was evaluated by the student's T-test (unpaired), where $p = 0.05$.

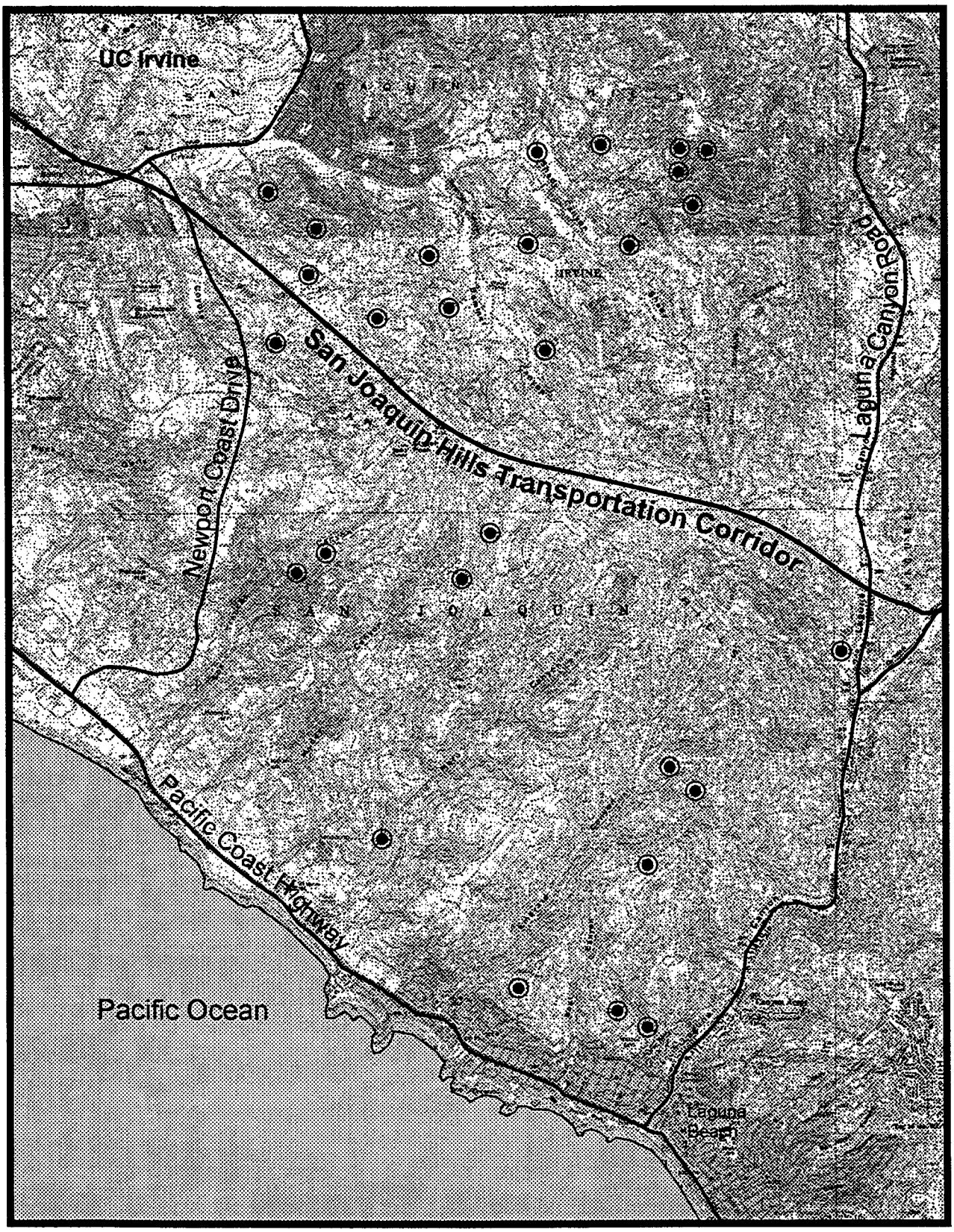

Figure 2.1

Locations of each of the vegetation sampling grids (◉) in the San Joaquin Hills in 1997, 3 transects were run at each grid location.

Figure 2.2: Transects through grids containing good gnatcatcher habitat with breeding pairs of gnatcatchers present.

Figure 2.3: Transects through grids containing good gnatcatcher habitat with breeding pairs of gnatcatchers absent.

Figure 2.4: Transects through grids containing poor gnatcatcher habitat with breeding pairs of gnatcatchers absent.

2.2 Habitat classification

All potential and suitable gnatcatcher and cactus wren habitat was mapped and quantified in 1996. At each patch the percentage cover of each of the dominant shrub species was recorded, as was the percentage tree and herb/grass cover. The average canopy height of each of the dominant shrub species was also recorded at each patch. All habitat patches were classified twice, once in relation to gnatcatcher nesting requirements and once in relation to cactus wren nesting requirements (Tables 2.1 and 2.2; Harmsworth Associates 1996). Habitat was not reclassified in 1997, but will be in 1988. Bi-annual mapping will be sufficient to accurately document habitat changes given the slow rate at which habitat change occurs.

Table 2.1: California gnatcatcher habitat classification categories used for the SJHTC sensitive bird study, 1996 and 1997[1].

Category	Height	% Cover by CSS Shrubs[2]
G1	> 0.7 m	> 66%
G2	< 0.7 m	> 66%
G3	> 0.7 m	33 - 66%
G4	< 0.7 m	33 - 66%
G5	> 0.7 m	< 33%
G6	< 0.7 m	< 33%

[1] data collected 1996, [2] CSS Shrubs used: *Artemisia californica, Eriogonum fasciculatum, Salvia mellifera, Encelia califronica*

Table 2.2: Cactus wren habitat classification categories used for the SJHTC sensitive bird study, 1996 and 1997[1].

Category	Height	% Cover by Cactus[2]
W1	> 1 m	> 66%
W2	< 1 m	> 66%
W3	> 1 m	33 - 66%
W4	< 1 m	33 - 66%
W5	> 1 m	< 33%
W6	< 1 m	< 33%

[1] data collected 1996, [2] Cactus species used: *Opuntia littoralis, O. oricola, O. prolifera*

2.3 Determination of gnatcatcher and cactus wren distribution and abundance

To determine the distribution and abundance of California gnatcatchers and cactus wrens in the study area, presence/absence surveys were conducted at all suitable and potential habitat within the burn area three times between early February and early April. The TCA revegetation areas at Coyote Canyon landfill were also surveyed. The SJHTC cut and fill slopes, Bonita Creek channel and at Bonita Reservoir were not surveyed in 1997, as it was too soon since installation for these areas to support breeding gnatcatchers or cactus wrens. The methodology used in the surveys followed the guidelines set forth by Mock *et al.* (1990), and by the Southern California Coastal Sage Scrub Scientific Review Panel (Brussard *et al.* 1992). In addition a 7-day interval was maintained between visits to the same area. The surveys were conducted during the morning hours (prior to 12:00 a.m.) and when the temperature exceeded 55°F. No more than 100 acres were surveyed by each biologist per day, and no surveys were conducted during windy (>15 miles per hour), rainy, or extremely hot (>95°F) conditions. Taped vocalizations of gnatcatcher and wren calls were used when necessary (i.e., when pairs could not be located after observing the area for at least 10 minutes) to elicit a response from resident birds, if they were present.

Once birds were located their legs were checked for the presence of bands, when present the unique color combination of the bands were recorded. Biologists followed each bird long enough to determine whether the bird was paired or single. This, and other behavioral information, was recorded at each location. Bird locations were mapped on color aerial photographs and later transferred to 7.5 minute USGS topographic maps.

Harmsworth Associates biologists conducting this study hold current California gnatcatcher survey permits (Permit number PRT-810768).

2.4 Monitoring of gnatcatcher and cactus wren breeding success

Gnatcatcher and cactus wren nest monitoring commenced in mid March and continued until all monitored pairs had completed their nesting cycle (late July). During this period each pair was monitored once per week. This monitoring allowed us to collect information on the pairs breeding biology, nesting success, and level of cowbird parasitism. A total of 11 gnatcatcher pairs and 10 cactus wren pairs were monitored, time constraints prevented us from monitoring all located gnatcatcher and cactus wren pairs. Those that were monitored were selected based on their accessibility and location. An attempt was made to monitor pairs from the different parts of the hills (eg. some coastal, some inland) so that the monitored pairs were representative of the entire population.

A passive method of surveying the breeding pairs was used, and every effort was made to avoid disturbing the gnatcatchers. Taped vocalizations of the gnatcatcher were only used when pairs could not be located after observing the area for at least 20 minutes; when

taped vocalizations were used, it was only be for a short time period (<5 seconds). During the nest building phase, biologists were extremely careful not to disturb the pairs because this could cause them to abandon their nest. If either bird appeared agitated, the biologists slowly retreated from the pair and returned at a later date. Nests were only checked for eggs if they were easily accessible or could be seen with the use of a mirror. Nests were checked in the afternoon and only when no predators were present and the gnatcatcher's were not agitated. The biologists followed a roundabout path to the nest and checked several decoy bushes before checking the actual nest. A different path leading to and coming from the nest was used, and the creation of a path or scent trail directly to the nest was avoided. All of this prevented the nest location being revealed to predators.

A series of measurements were recorded at each located nest. These measurements were recorded only after the nest was no longer in use, either after successful fledgling of young or after nest failure. Nest height was taken as the distance from the top lip of the nest to bottom of the nest on the outside; inside height as the distance from the top lip of the nest to the bottom of the inside of the nest; nest height above the ground as the distance from the top lip of the nest to the ground directly below; nest width as the distance of the widest part of the nest; distance from nest to nearest open space as the distance from the nest to the nearest area not covered by shrubs, trees or mustard.

2.5 Non target avifauna and other wildlife

During each field survey biologists kept a record of all avian species observed and heard in the study area, and of all other wildlife species encountered.

3.0 RESULTS

3.1 Vegetation analysis

The following analyses of the vegetation quantitatively evaluate the community components by cover, frequency and height. The cover type was analyzed by the three grid types: good habitat - gnatcatchers present, good habitat - gnatcatchers absent, poor habitat - gnatcatchers absent.

3.1.1 Vegetation cover and frequency

The percent absolute cover of live vegetation was lower (mean of 166.38%) in the good habitat - gnatcatchers present grids than in the other two grid types where gnatcatchers were absent (Table 3.1). Percent cover exceeded 100 because the cover of each vegetation layer was counted and the layers often overlapped. The poor habitat - gnatcatchers absent grids had the greatest cover of live vegetation, however, these differences in cover of live vegetation were not statistically significant. Cover of live vegetation increased in all three grid types since 1996 and, these differences were statistically significant ($p = 0.05$).

Table 3.1: Absolute cover of live vegetation by grid type in the San Joaquin Hills, 1997. Percent absolute cover exceeded 100 because each vegetation layer was counted and layers overlapped.

Grid Type	Mean % Absolute Cover	Standard Error
good habitat - gnatcatchers present	166.38	± 7.10
good habitat - gnatcatchers absent	167.73	± 5.79
poor habitat - gnatcatchers absent	184.78	± 10.04

The good habitat - gnatcatchers present grids had the least mean number of cover types (individual plant species, bare areas, rocky substrate or dead organic material), (mean of 19.78), while the good habitat - gnatcatchers absent grids had the highest mean number of cover types (mean of 24.2; Table 3.2). These differences were not statistically different. The mean number of cover types increased in all grids since 1996, however differences between years were only statistically significant for good habitat - gnatcatchers absent

grids ($p = 0.05$). In those grids mean number of cover types increased from 17.0 in 1996 to 24.20 in 1997.

The total number of plant species documented by this study was 138 different species, an increase from the 112 species recorded in 1996. This number includes the plant species encountered in the transects as well as species that were observed adjacent to the transects in the coastal sage scrub community.

Table 3.2: Mean, standard error and range of cover types (different plant species, bare areas, rocky substrate or dead organic material) by grid type in the San Joaquin Hills, 1997.

Cover Types Per Grid	good habitat - gnatcatchers present	good habitat - gnatcatchers absent	poor habitat - gnatcatchers absent
Mean	19.78	24.20	21.30
± Standard Error	± 1.47	± 0.98	± 1.35
Range	13 - 28	20 - 28	15 - 29

One cover type, a mixture of non-native annual grasses, was dominant in all grid types (Table 3.3, Appendix B). The non-native annual grasses were primarily composed of red brome (*Bromus madritensis* ssp. *rubens*), Zoro fescue (*Vulpia myuros*), ripgut (*Bromus diandrus*), with occasional occurrences of soft chess (*Bromus hordaceus*), barley (*Hordeum murinum*), false purple brome (*Brachypodium distachyon*) and wild oats (*Avena barbata* and *A. fatua*). Although the frequency of these non-native grass species varied from transect to transect, they were lumped together as a single cover type, because they provided the same type of cover: a relatively low (usually < 30 cm), very dense vegetation. Only one other cover type provided enough cover to be classified as a dominant. This was the shrub species deerweed (*Lotus scoparius*) which provided 41.76% cover in the poor habitat - gnatcatchers absent grids (Table 3.3).

A number of other plant species were important in providing cover (important species or cover types provided ≥ 5% cover). In the good habitat - gnatcatchers present grids six shrubby perennials (California sagebrush, California buckwheat, California sunflower, black sage and deerweed), and one cactus species (coastal prickly pear [*Opuntia littoralis*]) were important in providing cover (Table 3.3). Two additional important cover components in these grids were the presence of dead organic material and bare ground.

In the good habitat - gnatcatchers absent grids six shrubby perennial species (bush monkeyflower [*Mimulus aurantiacus*], deerweed, laurel sumac [*Malosma laurina*], black sage, California sagebrush, and California buckwheat) were also important in providing cover. Dead organic matter provided an important amount of cover in these grids.

In the poor habitat - gnatcatchers absent grids six perennial shrubby species and one herbaceous perennial were important in providing cover. These species included California sagebrush, black sage, California buckwheat, lemonadeberry (*Rhus integrifolia*), laurel sumac, bush monkeyflower, and the native bunch grass (*Nassella lepida*). Dead organic material provided an important amount of cover in these grids, too.

All of these species that provided dominant or important amounts of cover, with the exception of non-native grasses, are native species.

Table 3.3: Dominant (provide ≥ 25% absolute cover) and important (provide ≥ 5% absolute cover) cover types by grid type in the San Joaquin Hills, 1997.

Cover Types/ Species	good habitat - gnatcatchers present (% Absolute Cover ± S.E)	good habitat - gnatcatchers absent (% Absolute Cover ± S.E)	poor habitat - gnatcatchers absent (% Absolute Cover ± S.E)
≥ 25% Absolute Cover	Non Native Grasses (46.60 ± 4.16)	Non Native Grasses (62.61 ± 8.68)	Non Native Grasses (46.62 ± 8.60) Lotus scoparius (41.76 ± 5.77)
≥ 5% Absolute Cover	*Artemisia californica* (18.75 ± 4.98) *Eriogonum fasciculatum* (15.61 ± 4.55) *Encelia californica* (13.52 ± 5.90) *Opuntia littoralis* (10.55 ± 3.97) *Salvia mellifera* (9.74 ± 6.90) *Lotus scoparius* (6.1 ± 2.73) Dead Organic Material (9.48 ± 1.79) Bare Ground (5.81 ± 1.87)	*Mimulus aurantiacus* (13.69 ± 5.70) *Lotus scoparius* (11.85 ± 4.46) *Malosma laurina* (8.62 ± 6.01) *Salvia mellifera* (7.67 ± 3.36) *Artemisia californica* (6.94 ± 1.42) *Eriogonum fasciculatum* (6.24 ± 2.59) Dead Organic Material (10.66 ± 3.16)	*Artemisia californica* (14.0 ± 8.00) *Salvia mellifera* (13.8 ± 4.54) *Rhus integrifolia* (5.95 ± 3.47) *Eriogonum fasciculatum* (11.01 ± 3.15) *Malosma laurina* (5.93 ± 2.00) *Mimulus aurantiacus* (5.74 ± 4.71) *Nassella lepida* (5.49 ± 2.75) Dead Organic Material (15.84 ± 5.31)

Comparing with the 1996 data indicates that non-native grasses increased their % absolute cover in all grid types. The cover of two shrub species, California sagebrush and deerweed decreased since 1996. In the good habitat - gnatcatchers present grids California sagebrush was a dominant in 1996 and in the good habitat - gnatcatchers absent grids deerweed (*Lotus scoparius*) was dominant in 1996. In 1997, these species were still present, but at lower cover values.

With regards to the important species (those that provided ≥ 5% cover): in the good habitat - gnatcatchers present grids; California buckwheat, California sunflower, coastal prickly pear cactus and black sage increased their cover since 1996, while the cover of deerweed, bush monkeyflower and phacelia decreased since 1996. In the good habitat - gnatcatchers absent grids bush monkeyflower, laurel sumac, black sage, and California buckwheat increased in cover since 1996, while California sagebrush and California sunflower decreased in cover since 1996. In the poor habitat - gnatcatchers absent grids; California sagebrush, black sage, lemonadeberry, California buckwheat, bush monkeyflower and foothill needlegrass increased in cover since 1996, while morning glory (*Calystegia macrostegia*) and chaparral mallow (*Malacothamnus fasciculatus*) decreased in cover since 1996.

Non-native grasses was the only cover type to be recorded in all transects in each of the grid types (Table 3.4, Appendix A). Other important plant species that were found in all grids types at least 50% of the time include California sagebrush, California buckwheat, deerweed, and foothill needlegrass. Dead organic material and bare ground/rocky substrates were also present in each transect in every grid type.

Comparing with the 1996 data, the same species were recorded in all grid types at least 50% of the time both years, except foothill needlegrass which was more widespread in 1997 and bush monkeyflower which was less widespread in 1997.

Native vegetation provided a majority of the cover in each of the grid types (Table 3.5). The poor habitat - gnatcatchers absent grids had the highest cover of native species (115.50%). The difference in cover of native species between the poor habitat - gnatcatchers absent grids and the good habitat - gnatcatchers absent grids was statistically significant ($p = 0.05$). There was no statistical difference between the amount of cover provided by native vegetation between the other grids types.

The good habitat - gnatcatchers absent grids supported the greatest cover of non-native species (71.28%), while the poor habitat - gnatcatchers absent grids supported the most dead vegetation (15.84%) and the good habitat - gnatcatchers present grids had the most bare/rocky areas (6.48%; Table 3.5). None of these differences between the grid types were statistically significant.

There were no significant differences in the cover of native vegetation between 1996 and 1997 for any of the grid types. In the good habitat - gnatcatchers present grids, there was a significant increase in cover provided by non-native plants between 1996 and 1997 ($p = 0.05$). There were no significant differences in the cover of non-native vegetation between 1996 and 1997 for the other two grid types. In 1997, the good habitat - gnatcatchers absent grids had significantly more bare areas/rocky substrate and more areas with dead material than in 1996 ($p = 0.05$). No significant differences occurred between the cover of bare/rocky substrates or dead organic material between 1996 and 1997 for the other two grid types.

Table 3.4: Cover types that occurred in at least one grid type, in ≥ 50% of the transects in the San Joaquin Hills, 1997.

Cover Types/ Species	good habitat - gnatcatchers present (Frequency In %)	good habitat - gnatcatchers absent (Frequency In %)	poor habitat - gnatcatchers absent (Frequency In %)
Artemisia californica	**88.9**	**100**	**90**
*Brassica nigra**	33.3	**77.8**	20
*Centaurea melitensis**	**55.6**	**55.6**	-
Encelia californica	**55.6**	11.1	20
Eriogonum fasciculatum	**88.9**	**77.8**	**80**
Galium angustifolium	--	22.2	**50**
Galium nuttalianum	22.2	**55.6**	**60**
Gnaphalium californicum	44.4	**55.6**	**50**
Grasses (Non-Native)*	**100**	**100**	**100**
Hemizonia fasciculata	22.2	**22.2**	**50**
*Hirschfeldia incana**	22.2	**66.7**	20
Lotus scoparius	**55.6**	**88.9**	**100**
Malacothamnus fasciculatus	33.3	33.3	**70**
Malosma laurina	22.2	**66.7**	**70**
Mimulus aurantiacus	33.3	**77.8**	**50**
Nassella lepida	**77.8**	**55.6**	**70**
Opuntia littoralis	**66.7**	44.4	**50**
Rhus integrifolia	44.4	44.4	**70**
Salvia mellifera	44.4	**66.7**	**80**
Solanum douglasii	22.2	**55.6**	20
Bare ground/Rock	**100**	**100**	**100**
Dead Organic Material	**100**	**100**	**100**
Total # of species over 50%	10	16	17

* indicates non-native species
Bold face indicates that the species occurred in that grid type in over 50% of the transects
Underline indicates that the species occurred in all grid types and in over 50% of the transects

Shrubs provided more cover than herbs in both the good habitat - gnatcatchers present grids and in the poor habitat - gnatcatchers absent grids, while in the good habitat - gnatcatchers absent grids herbs provided more cover than shrubs (Table 3.6). However, these differences were only statistically significant in the poor habitat - gnatcatchers absent grids ($p = 0.05$). Shrubs had the greatest cover in the poor habitat - gnatcatchers absent grids and the least cover in the good habitat - gnatcatchers absent grids (Table 3.6), differences between the latter two grid types were significant ($p = 0.05$). Herb cover was greatest in the good habitat - gnatcatchers absent grids and least in the poor habitat - gnatcatchers absent grids but none of the differences were statistically significant.

No significant differences occurred between the amount of cover provided by herbs and shrubs in any grid types from 1996 to 1997.

Table 3.5: Absolute cover provided by native plant species, non-native plant species, bare ground and rock, and dead by grid type in the San Joaquin Hills, 1997. Percent cover exceeded 100 since each vegetation layer was counted and layers overlapped.

GRID/COVER TYPE	MEAN % ABSOLUTE COVER	± STANDARD ERROR	RANGE
good habitat - gnatcatchers present			
• Native Vegetation	**92.97**	**± 8.04**	**71.59 - 141.53**
• Non-native Vegetation	**57.45**	**± 4.43**	**32.95 - 72.87**
• Dead Vegetation	**9.48**	**± 1.79**	**3.20 - 22.11**
• Bare Ground / Rock	**6.48**	**± 1.94**	**0.1 - 18.70**
good habitat - gnatcatchers absent			
• Native Vegetation	**80.57**	**± 6.67**	**52.92 - 120.23**
• Non-native Vegetation	**71.28**	**± 7.99**	**28.99 - 110.63**
• Dead Vegetation	**10.66**	**± 3.16**	**1.33 - 26.32**
• Bare Ground / Rock	**5.22**	**± 2.19**	**0.25 - 20.85**
poor habitat - gnatcatchers absent			
• Native Vegetation	**115.50**	**± 9.55**	**83.32 - 176.37**
• Non-native Vegetation	**51.08**	**± 8.73**	**4.32 - 101.59**
• Dead Vegetation	**15.84**	**± 5.31**	**1.07 - 47.76**
• Bare Ground / Rock	**2.31**	**± 0.62**	**0.29 - 6.24**

Table 3.6: Comparison of the absolute cover provided by herb and shrub plant species by grid type, in the San Joaquin Hills, 1997.

Grid/Cover Type	Mean % Absolute Cover	± Standard Error	Range
good habitat - gnatcatchers present			
• Herb	**65.63**	**± 4.88**	**40.71 - 83.32**
• Shrub	**84.64**	**± 8.00**	**60.28 - 133.92**
good habitat - gnatcatchers absent			
• Herb	**78.35**	**± 8.41**	**30.21 - 116.32**
• Shrub	**73.50**	**± 7.35**	**46.32 - 119.00**
poor habitat - gnatcatchers absent			
• Herb	**59.82**	**± 9.10**	**7.32 - 117.03**
• Shrub	**106.76**	**± 9.21**	**78.84 - 172.84**

All four of the plant species typically used by gnatcatchers as a nesting substrate (California sagebrush, California buckwheat, California sunflower and black sage) provided cover in each grid type (Table 3.7). California sagebrush provided most cover in both the good habitat - gnatcatchers present grids and the poor habitat - gnatcatchers absent grids and just slightly less cover than black sage in the good habitat - gnatcatchers absent grids. California buckwheat and black sage provided similar amounts of cover in each grid type, while California sunflower provided little cover in the good habitat - gnatcatchers absent grids or in the poor habitat - gnatcatchers absent grids. None of the differences in cover between plant species and between grid types were statistically significant. Taking the four species together, the good habitat - gnatcatchers present grids provided the greatest amount of cover (Table 3.7).

The cover of California sagebrush in the good habitat - gnatcatchers present grids decreased significantly between 1996 and 1997 ($p = 0.05$), while the cover of California buckwheat in the poor habitat - gnatcatchers absent grids increased significantly between 1996 and 1997 ($p = 0.05$). No other differences in cover values between 1996 and 1997 were statistically significant.

Table 3.7: Absolute cover of four important plant species by grid type in the San Joaquin Hills, 1997.

Grid Type	Mean % Absolute Cover	± Standard Error
good habitat - gnatcatchers present		
California sagebrush	**18.75**	**± 4.98**
California sunflower	**13.52**	**± 5.90**
California buckwheat	**15.61**	**± 4.55**
Black Sage	**9.74**	**± 6.90**
Total for 4 species	**57.62**	-
good habitat - gnatcatchers absent		
California sagebrush	**6.94**	**± 1.42**
California sunflower	**2.38**	**± 2.38**
California buckwheat	**6.24**	**± 2.59**
Black Sage	**7.67**	**± 3.36**
Total for 4 species	**23.23**	-
poor habitat - gnatcatchers absent		
California sagebrush	**14.00**	**± 8.00**
California sunflower	**2.07**	**± 1.38**
California buckwheat	**11.01**	**± 3.15**
Black Sage	**13.08**	**± 4.54**
Total for 4 species	**40.16**	-

Cryptobiotic crusts (cyanobacterial-lichen soil crusts) were present in both the good habitat - gnatcatchers present grids and the poor habitat - gnatcatchers absent grids. Cryptobiotic crusts are good biometers of a community's health and structure (Belknap 1993). These soil crusts play important roles in soil stability and nutrient cycling. They also enhance seedling establishment and survival, which is particularly important to post-burn communities.

3.1.2 Vegetation height

The poor habitat - gnatcatchers absent grids had the tallest mean vegetation height (0.79 m) while the good habitat - gnatcatchers present grids contained the shortest average vegetation height (0.61 m.). Differences between the vegetation height in all the grid types were statistically significant ($p = 0.05$). The low standard error associated with the mean vegetation heights indicates that there was a high level of homogeneity in the vegetation height of each of the grid types.

The mean height of the good habitat - gnatcatchers present grids was significantly lower in 1997 than 1996 ($p = 0.05$). Height differences for the other two grid types between 1996 and 1997 were not statistically different.

Table 3.8: Mean, standard error and range of vegetation heights (in meters) by grid type in the San Joaquin Hills, 1997.

Height In Centimeters	good habitat - gnatcatchers present	good habitat - gnatcatchers absent	poor habitat - gnatcatchers absent
Mean	0.61	0.70	0.79
± Standard Error	± 0.218	± 0.263	± 0.232
Range	0 - 1.80	0 - 2.50	0 - 2.80

Analyses of the height of the four species typically used by gnatcatchers for nesting indicates that black sage was the tallest in all of the grid types, while California sunflower was consistently the second tallest, California sagebrush the next tallest and buckwheat the shortest of the four species (Table 3.9). Difference in the heights of each species between grid types were not statistically significant.

Within grids however, there were statistical significant differences ($p = 0.05$). In the good habitat - gnatcatchers present grids black sage was significantly taller than the other three species, and California sunflower was significantly taller than California sagebrush and buckwheat. In the good habitat - gnatcatchers absent grids black sage was

significantly taller than California sagebrush and buckwheat only. In the poor habitat - gnatcatchers absent grids black sage was significantly taller than the other three species.

Table 3.9: Height of four important plant species by grid type in the San Joaquin Hills, 1997.

Grid Type	Mean Height	± Standard Error
good habitat - gnatcatchers present		
California sagebrush	**63.79**	**± 2.86**
California sunflower	**77.06**	**± 3.87**
California buckwheat	**60.61**	**± 2.75**
Black Sage	**100.82**	**± 4.34**
TOTAL FOR 4 SPECIES		--
good habitat - gnatcatchers absent		
California sagebrush	**66.88**	**± 3.06**
California sunflower	**77.50**	**± 7.19**
California buckwheat	**59.20**	**± 3.43**
Black Sage	**96.61**	**± 4.27**
poor habitat - gnatcatchers absent		
California sagebrush	**68.44**	**± 3.33**
California sunflower	**74.50**	**± 4.62**
California buckwheat	**65.69**	**± 2.42**
Black Sage	**101.58**	**± 3.73**

3.2 Habitat classification

A total of 154 patches of potential or suitable gnatcatcher and/or cactus wren habitat were located within the study area in 1996. These patches had a combined area of 292 ha and ranged in size from 0.06 ha to 16.52 ha. Patches were frequently clumped together, with most of the good gnatcatcher and cactus wren habitat located towards the perimeter of the burn area in Shady Canyon, Bommer Canyon, Church Canyon, Laidlaw, Boat Canyon, Emerald Canyon and Moro Canyon (Harmsworth Associates 1996). Although habitat was not re-mapped in 1997, observation made during the avian surveys indicate that in general patches had increased in size and plant cover since 1996.

The classification of the habitat patches in relation to gnatcatcher and cactus wren nesting requirements revealed that the majority of these patches had less than 33% cover of the most commonly used nesting substrates for these two avian species in 1996 (Tables 3.10 & 3.11). Of all the habitat patches mapped, for only 11 patches (22.2 ha) were the

combined coverage of California sagebrush, California buckwheat, black sage and California sunflower greater than 66% (Table 3.10), while cactus coverage was greater than 66% in only 20 patches (8.9 ha) (Table 3.11). Increase in shrub cover and height since these data were collected might cause some patches to move up in category, had the habitat been re-mapped in 1997.

Table 3.10: Characteristics of habitat patches located in the San Joaquin Hills, 1996, classified in relation to gnatcatcher nesting requirements.

Category*	# of Patches	Total Area (ha)	% Area	Mean ± SD(ha)	Range (ha)
G1	6	8.35	2.9	1.39±1.48	0.18-4.13
G2	5	13.81	4.7	2.76±2.45	1.71-6.67
G3	28	61.37	21.0	2.19±2.15	0.09-10.44
G4	8	16.67	5.7	2.08±2.25	0.21-6.02
G5	52	137.84	47.2	2.65±3.68	0.06-16.52
G6	55	54.12	18.5	0.98±1.33	0.06-6.61

*Habitat Categories explained in Section 2.2

Table 3.11: Characteristics of habitat patches located in the San Joaquin Hills, 1996, classified in relation to cactus wren nesting requirements.

Category*	# of Patches	Total Area (ha)	% Area	Mean ± SD(ha)	Range (ha)
W1	7	5.96	2.0	0.85±0.09	0.05-2.24
W2	13	2.95	1.0	0.23±0.18	0.06-0.65
W3	14	17.19	5.9	1.23±1.80	0.06-6.61
W4	8	17.11	5.9	2.14±2.73	0.12-8.14
W5	21	69.97	23.9	3.33±4.51	0.08-16.52
W6	91	178.93	61.3	1.97±2.27	0.06-11.27

*Habitat Categories explained in Section 2.2

3.3 Distribution and abundance of the California gnatcatcher and the cactus wren

California gnatcatchers were recorded at 37 different locations in the burn area in 1997 (Figure 3.1). Twenty seven (27) of these sightings represented breeding pairs, two sightings were of unpaired adult gnatcatchers and eight were of dispersing juvenile gnatcatchers. Gnatcatcher breeding pairs were located throughout the hills, with the largest numbers in Shady Canyon and at Laidlaw (Table 3.12). Three gnatcatcher pairs were recorded in the Coyote Canyon landfill area. Two of the pairs occupied mature coastal sage scrub and the other pair occupied the 18 acre CSS restoration site. None of the pairs nested in the CSS revegetation area, although adults with young were observed foraging in the revegetation area. An additional gnatcatcher pair occupied the willow/scrub habitat to the north of the revegetation area (not counted in total as they are considered outside the study area).

The 27 gnatcatcher pairs present in the burn area in 1997 represent a substantial increase on the 11 pairs present in 1996 and the 5 pairs reported in 1995. These data suggest that the gnatcatcher population in the San Joaquin Hills is recovering rapidly from the effects of the 1993 fire. The current population is still well below the pre fire population (Figure 3.2) but if the current rate of increase is sustained then the populations may return to pre fire levels by the year 2000. However may factors, particularly habitat recovery from the fire, will effect this outcome.

Table 3.12: Location of California gnatcatchers and cactus wrens in the San Joaquin Hills, 1997.

LOCATION	CAGN-PAIR	CAGN-SINGLE	CAGN-JUV	CCWR-PAIR	CCWR-SINGLE
Coyote Canyon	3	0	2	0	0
Laidlaw	5	0	1	0	0
Church Canyon	3	0	0	9	1
Bommer Canyon	1	1	1	10	2
Shady Canyon	7	0	0	14	1
Laguna Canyon	1	1	2	1	0
Los Trancos Canyon	1	0	0	4	0
Muddy Canyon	1	0	0	4	1
Moro Canyon	2	0	0	2	0
Emerald Canyon	1	0	2	3	0
Boat Canyon	2	0	0	2	0
TOTAL	**27**	**2**	**8**	**49**	**5**

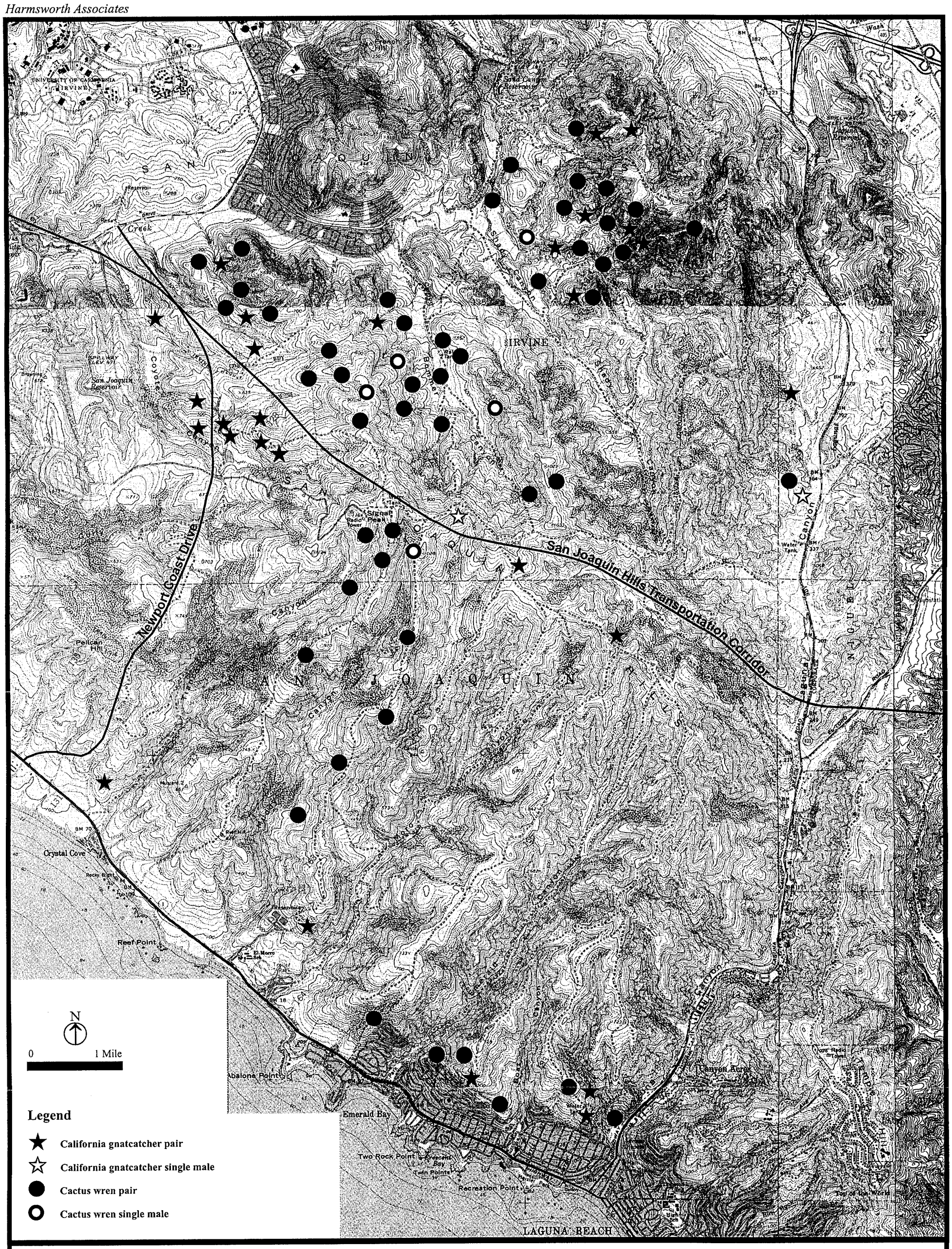

Figure 3.1

Locations of California gnatcatchers and cactus wrens in the San Joaquin Hills study site, 1997.

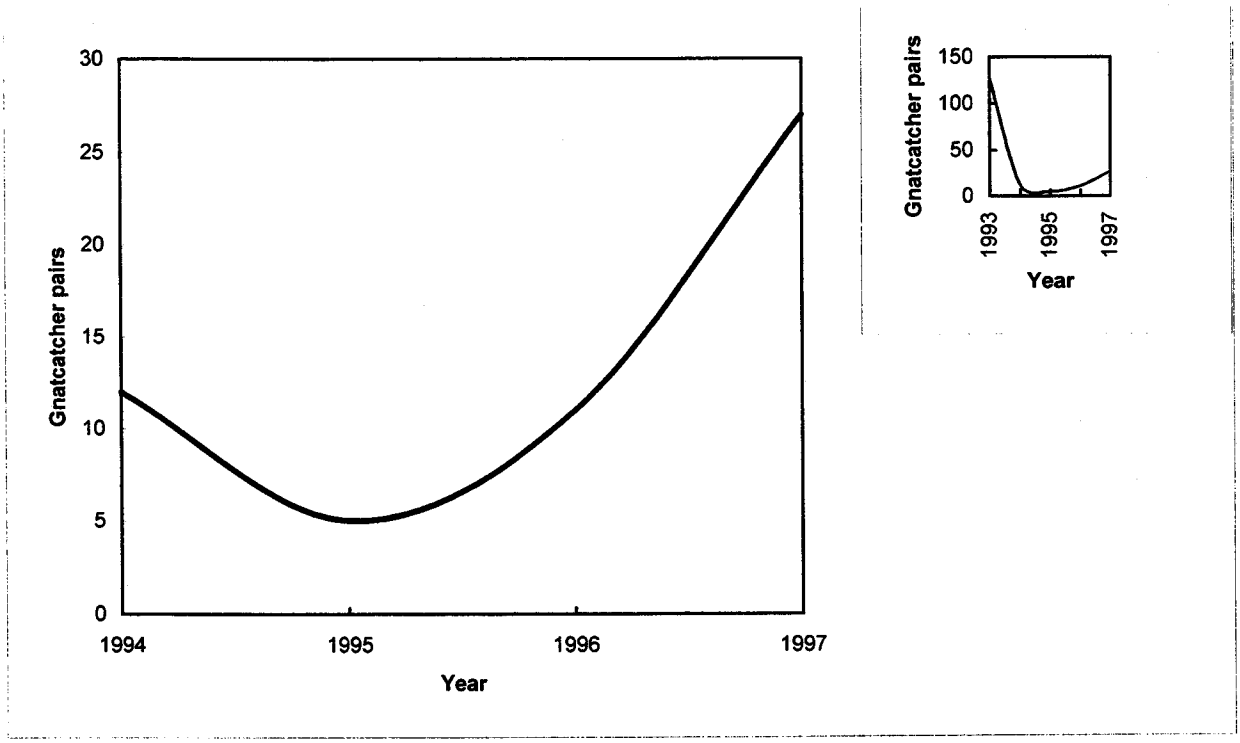

Figure 3.2 California gnatcatcher population (# of pairs present) in the San Joaquin Hills since the 1993 Laguna Beach Fire. Inset: same data including pre-fire population status.

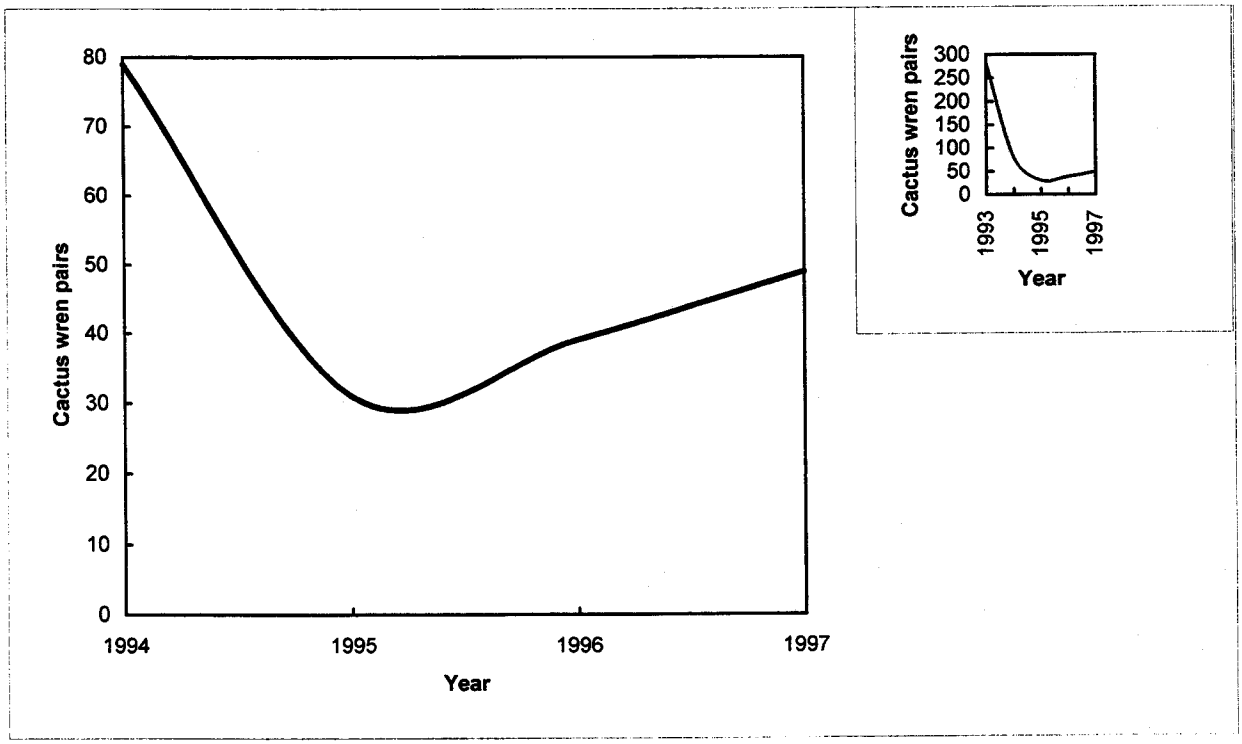

Figure 3.3 Cactus wren population (# of pairs present) in the San Joaquin Hills since the 1993 Laguna Beach Fire. Inset: same data including pre-fire population status.

Cactus wrens were recorded at 54 different locations in the burn area in 1997 (Figure 3.1). Of these sightings, 49 represented breeding pairs, the other five sightings were of unpaired adult wrens. Wrens were located throughout the San Joaquin Hills but were most abundant in Shady Canyon, Bommer Canyon and Church Canyon (Table 3.12).

Cactus wren numbers have also increased since 1996 when 39 pairs were present (Figure 3.3). The cactus wren population appears to be recovering more slowly than the gnatcatcher population, perhaps due to the slower rate of growth of cactus. Although numbers of wrens has increased consistently since 1995, the current population in the burn area is still less than 20% of the pre fire population.

Comparing gnatcatcher distributions with the habitat classification indicates that although gnatcatcher breeding pairs occured in every habitat category they were primarily located in categories G1, G3 and G5, (Figure 3.4). Breeding pairs were most abundant in those patches with greater than 33% combined cover of California sagebrush, California buckwheat, black sage and California sunflower and an average shrub height of at least 0.7 m (categories G1, G3) (Figure 3.4). It is also important to recognize the different acreage's covered by each category, categories G5 and G6 covered a much larger area than the other categories (Table 3.10). Category G1 habitat contained an average of 1 breeding pair every 1.7 ha, category G3 had an average of 1 breeding pair every 6.8 ha while category G5 habitat contained an average of 1 breeding pair every 27.6 ha. In this study, gnatcatchers occupied home range areas which varied greatly in their cover by California sagebrush, California buckwheat, black sage and California sunflower, but there appeared to be a positive correlation between gnatcatcher numbers and percentage cover by these shrub species. Nineteen pairs of gnatcatchers occurred in habitat patches where the shrub height exceeded 0.7 m compared to seven pairs which occurred in habitat patches where the shrub height was below 0.7 m (Figure 3.4), indicating that gnatcatchers had a strong preference for nesting in areas with taller shrub species.

Comparing cactus wren distributions with the habitat classification indicates that the cactus wren breeding pairs were located in all habitat categories (Figure 3.5). Breeding pairs were more abundant in those patches with less than 33% combined cover of all cactus species (categories W5, W6) than in patches with greater than 66% combined cover of cactus (categories W1, W2), (Figure 3.5). It is important to remember that categories W5 and W6 covered a much larger area than categories W1 and W2 (Table 3.11). Categories W1/W2 habitat contained an average of 1 breeding pair every 1.8 ha, while categories W5/W6 habitat contained an average of 1 breeding pair every 8.8 ha. Cactus wrens were only recorded in or adjacent to cactus patches. However, it appears that a study at a finer scale is required to detect the amount of cactus coverage in a given area that is necessary in order for cactus wrens to breed.

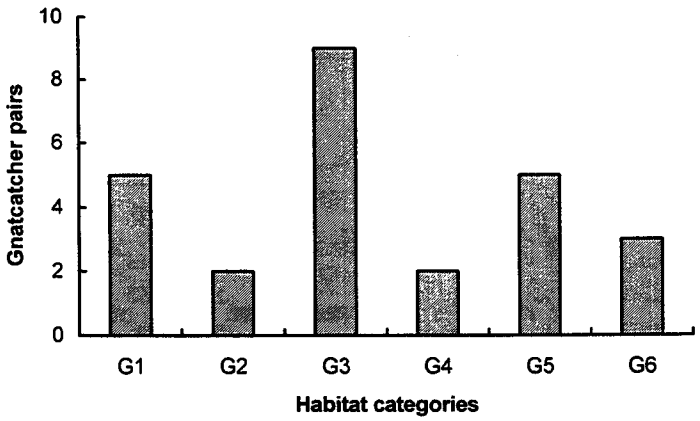

Figure 3.4: Location of California gnatcatcher breeding pairs in relation to habitat categories, in the San Joaquin Hills, 1997. Habitat categories explained in Table 2.1, habitat data collected 1996.

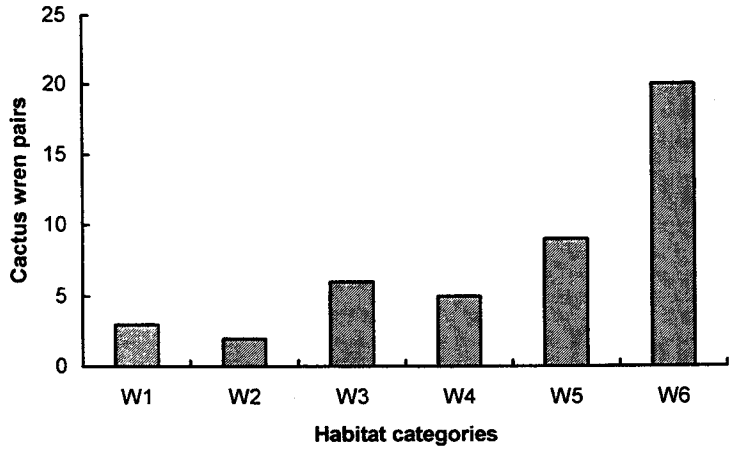

Figure 3.5: Location of cactus wren breeding pairs in relation to habitat categories, in the San Joaquin Hills, 1997. Habitat categories explained in Table 2.2, habitat data collected 1996.

3.4 California gnatcatcher breeding biology

3.4.1 Gnatcatcher breeding chronology

A total of eleven gnatcatcher breeding pairs (pairs # 1-11) were monitored during the breeding season. Nest monitoring commenced in mid March, 1997, at which time all monitored pairs had commenced nest building. The first chicks hatched on March 19, 1997 and the first young fledged on April 1, 1997, compared with April 9 and April 24 respectfully in 1996. All pairs had completed their nesting attempts by the end of June. This breeding chronology was three to four weeks earlier than for the same population in 1996 and for gnatcatchers at other study sites most other years (Atwood 1990, Bontrager *et al.* 1995b, Harmsworth Associates 1996). Other populations monitored in the San Joaquin Hills area were also early this year (Robb Hirsch, Dana Kamada, pers. comm.), perhaps due to the heavy rain early in the season.

3.4.2 Gnatcatcher reproductive success

A total of 29 nests were located for the 11 gnatcatcher pairs which were monitored, giving an average of 2.62 nest attempts per pair (Table 3.13). Of the 29 nests located, 24 nests (83%) reached incubation, 19 (66%) reached the nestling stage and, 17 (59%) fledged at least one young. Thus five nests were abandoned prior to egg laying, five were depredated at the egg stage, two were predated at the nestling stage and 17 were successful in producing at least one fledgling. No incidence of brood parasitism by brown-headed cowbirds on gnatcatchers were observed in the study area.

Overall, ten of the eleven monitored pairs (91%) produced successful broods (at least one young fledged), seven of the pairs (64%) produced 2 successful broods each, 3 pairs (27%) produced 1 successful brood each and 1 pair (9%) produced no successful broods (Table 3.13). Mean clutch size of the 24 nests reaching the incubation stage was 3.76 eggs per clutch, (S.D. = 0.44; range 3-4). In total 83 eggs were located, from which 69 chicks hatched and 61 young fledged (Table 3.13). The overall rate of reproductive success was 5.55 fledglings/pair (S.D. = 2.54; range 0-8). This was similar to 5.22 fledglings/pair recorded in 1996.

The two banded female gnatcatcher present in 1996 were present in 1997 in the same locations (females from pairs # 1 and # 5). As in 1996, they again produced two successful broods each in 1997. Both birds fledged in 1995, the female from pair # 1 has now produced 15 young and the female from pair # 2 has produced 14 young. Two pairs (# 8 and # 11) disappeared during the breeding season and were never relocated.

Table 3.13: Breeding success of individual California gnatcatcher pairs located in the San Joaquin Hills, 1997.

Pair #	Pair location	# of nests attempted	# of eggs laid	# of young hatched	# of young fledged	Comments
1	Laidlaw	3	10	7	7	Successful nests in phacelia and buckwheat, unsuccessful nest in sagebrush
2	Laidlaw	2	8	8	8	Both nests in sagebrush, first brood fledged 4/10/97
3	Laidlaw	2	7	7	7	Nests in phacelia and sagebrush
4	Liadlaw	2	4	4	4	Successful nest in bush monkeyflower, unsuccessful nest in sagebrush
5	Laidlaw	3	8+	6	6	Successful nests in phacelia and sagebrush, unsuccessful nest in phacelia, eggs predated before clutch size determined
6	Coyote Canyon	4	8	8	8	All nests in encelia, territory in CSS restoration area
7	Boat Canyon	3	12	8	8	Successful nests in encelia and bush mallow, unsuccessful nest in black sage, first brood fledged 4/1/97
8	Emerald Canyon	2	4	4	0	Nests in encelia, pair disappeared in early May
9	Shady Canyon	3	11	6	6	Successful nests in sagebrush and encelia, unsuccessful nests in sagebrush
10	Shady Canyon	3	3	3	3	Successful nest in black sage, unsuccessful in bush mallow
11	Coyote Canyon	2	8	8	4	Successful nest in sagebrush, unsuccessful in sagebrush, territory in mature CSS but pair disappeared in June
Total		**29**	**83**	**69**	**61**	

8+ indicates that 8 were known to occur but more were suspected or known but could not be quantified.

3.4.3 Nest site selection

A total of 7 different nesting substrates were used by the monitored gnatcatcher pairs in 1997. California sagebrush was the most frequently used nest substrate, accounting for 37% of all nesting attempts (Table 3.14). California sagebrush was also the most frequently used substrate in 1996. California sunflower and common phacelia were also commonly used nest substrates in 1997. The number of nests located in the four shrub species used in the habitat classification (California sagebrush, California buckwheat, black sage and California sunflower) increase this year to 74% (compared with 63% in 1996). In most cases (76% of located nests) the vegetation within a 5m radius of the nest was dominated by these four shrub species, which had an average cover within a 5m radius of all located nests of 55.4%.

Table 3.14: Nesting substrates used by California gnatcatchers in the San Joaquin Hills, 1997.

Nest substrate	# of successful nests	# of unsuccessful nests	total # of nests	% of nests
California sagebrush	6	4	10	37
California buckwheat	1	0	1	4
California sunflower	4	3	7	26
Black sage	1	1	2	7
Common phacelia	3	1	4	15
Bush mallow	1	1	2	7
Bush monkeyflower	1	0	1	4
Total	**17**	**10**	**27**	**100%**

3.4.4 Nest site characteristics

There was no significant difference in any of the nest site characteristics between 1996 and 1997. The mean height of shrubs used as nest substrates by gnatcatchers was 1.04 m (S.D. = 0.21 m; range 0.39-1.57 m), while the mean height of the located nests above ground was 0.68 m (S.D. = 0.16 m; range 0.23-1.07 m), (1996 and 1997 data pooled; Table 3.15). Means, standard deviation, range, and sample size for a variety of nest characteristics (1996 and 1997 data polled) are presented in Table 3.15.

There was a significant difference in the mean height of the located nests above ground between successful nests (mean height = 0.72 m ±0.14) and unsuccessful nests (mean height = 0.62 m ±0.18) (T-Test, p = 0.05; 1996 and 1997 data polled). Height of supporting shrub was also taller for successful nests (1.06 m ±0.19) compared with

unsuccessful nests (0.99 m ±0.23) but the difference was not significant. No other nest site characteristic showed significant differences between successful and unsuccessful nests.

Table 3.15: Mean, standard deviation, range, and sample size (N) for a variety of nest characteristics recorded from California gnatcatchers located in the San Joaquin Hills, 1996 and 1997.

Character	N	Mean ± S.D. (m)	Range (m)
% Canopy cover within 5m radius of nest	43	80.5%±15.5%	50%-100%
Height of nest substrate above ground	43	1.04±0.21	0.39-1.57
Height of nest above ground	41	0.68±0.16	0.23-1.07
Nest height	35	0.069±0.012	0.03-0.09
Inside height of nest	34	0.036±0.008	0.01-0.05
Nest width	32	0.064±0.011	0.03-0.095
Distance from nest to edge of bush	38	0.205±0.130	0.05-0.45
Distance from nest to nearest trail	41	1.36±1.23	0.2-5.0
Distance from nest to nearest open space	39	15.37±21.54	0.75-100.0
Distance from nest to nearest CSS edge	40	18.86±22.71	0.5-100.0
Slope of nesting area	43	7.93^0±4.9^0	0^0–15^0

3.5 Cactus wren breeding biology

3.5.1 Cactus wren breeding chronology

A total of ten cactus wren breeding pairs (pairs # 1-10) were monitored during the breeding season. Nest monitoring commenced in mid March, 1997, at which time all monitored pairs had commenced nest building. The first chicks hatched on April 7, 1997 and the first young fledged on April 21, 1997. All pairs had completed their nesting attempts by the end of June.

3.5.2 Cactus wren reproductive success

A total of 20 nests were located for the 10 cactus wren pairs which were monitored, giving an average of 2.0 nest attempts per pair (Table 3.16). Of the 20 nests located, 19 nests (95%) reached incubation, 16 (66%) reached the nestling stage and, 16 (80%) fledged at least one young. Thus one nest was abandoned prior to egg laying, three were depredated at the egg stage and 16 were successful in producing at least one fledgling.

Nesting success for the monitored wren pairs was high, all 10 of the monitored pairs (100%) producing fledglings, six of the pairs (60%) produced 2 successful broods each and four pairs (40%) produced 1 successful brood each (Table 3.16). Average clutch size of the eight nests which were accessible was 2.75±1.28, range 1-4. A total of 43 chicks fledged from the ten monitored pairs resulting in a mean of 4.30 fledglings/pair.

3.5.3 Nest site selection and characteristics

A total of 3 different nesting substrates were used by the monitored cactus wren pairs in 1997. *Opuntia littoralis* was the most frequently used nest substrate, accounting for 80% of all nesting attempts. Three (15%) nests were located in *Opuntia prolifera* and 1 (5%) nest was located in California sagebrush. The mean height of the nest substrate was 1.46 m ±0.28 (range 1.0 - 2 m), while the mean height of the nest above ground was 1.27 m ±0.34 (range 0.7 - 1.7 m), indicating that the wrens generally built their nest near the top of tall cactus. No nest substrate was less than 1 m tall despite the fact that much of the wren habitat was dominated by cactus below this height (Table 3.11), indicating a strong preference for the taller cactus as a nesting area. The direction of the opening of the wren nests was random with respect to direction.

Table 3.16: Breeding success of individual cactus wren pairs located in the San Joaquin Hills, 1997.

Pair #	Pair location	# of nests attempted	# of eggs laid[1]	# of young hatched[1]	# of young fledged	Comments
1	Shady Canyon	2	3+	4	4	Nests in *Opuntia littoralis* and *Opuntia prolifera*
2	Shady Canyon	3	4	1	1	All nests in *Opuntia littoralis*
3	Shady Canyon	1	4	4	4	Nest in *Opuntia littoralis*
4	Shady Canyon	2	3+	5	5	Nests in *Opuntia littoralis*
5	Shady Canyon	1	4	4	4	Nest in *Opuntia littoralis*
6	Bommer Canyon	2	?	8	8	Nests in *Opuntia prolifera*
7	Bommer Canyon	2	4+	3	3	Nests in *Opuntia littoralis*
8	Boat Canyon	2	?	3+	4	Nests in *Opuntia littoralis*
9	Emerald Canyon	2	?	6	6	Nests in *Opuntia littoralis*
10	Boat Canyon	3	?	3+	4	Two nests in *Opuntia littoralis*, one failed nest in California sagebrush
Total		**20**	**22+**	**41+**	**43**	

[1] total # of eggs laid and chicks hatched not always possible to determine due to nest location and shape, 3+ indicates that 3 were known to occur but more were suspected or known but could not be quantified.

3.6 Banded birds located

A total of 15 banded birds including 11 gnatcatchers and 4 cactus wrens were located in the study area in 1997 (Table 3.17). Eight of the banded gnatcatchers were adults which bred in the study area and were present all season. Four of these were among the pairs which were monitored for nesting success (gnatcatcher # 1 was the female from pair # 1; gnatcatcher # 2 was the female from pair # 5; gnatcatcher # 3 was the male from pair # 7; and the female from pair # 8). Gnatcatchers #1 and 2 were also present in 1996. All of these gnatcatchers were banded outside the study area. Complete band combinations were recorded for 7 of these gnatcatchers which had a mean dispersal distance of 3.58 ± 0.63 km. Banding locations and dispersal distance of the remaining four gnatcatchers were not determined due to incomplete band combinations (band missing from birds leg) and possible errors in recording band combinations.

In the past two years a total of 14 gnatcatchers have dispersed into the burn area from surrounding areas indicating that all the gnatcatcher populations in the region are connected. As the population in the burn area increases juvenile gnatcatchers will disperse both within the burn area and to other locations in the region. It is important to attempt to document the extent and location of these dispersal events. In order to achieve this, gnatcatcher nestlings from the monitored breeding pairs in the burn area will be individually color banded in 1998. Birds dispersing within the burn area will be recorded during future monitoring efforts by TCA biologists and those which disperse outside the burn area should be documented by other biologists working in the region.

All four banded cactus wrens were breeding adults, two were located in Bommer Canyon and two in Shady Canyon (Table 3.17). Two of the wrens were also present in 1996. Cactus wren # 8 had a dispersal distance of 1.71 km. Banding locations and dispersal distance of the remaining three wrens were not determined due to incomplete band combinations (band missing from birds leg) and possible errors in recording band combinations.

Table 3.17: Band combinations, locations and origin of banded gnatcatchers and cactus wrens located in the San Joaquin Hills, 1997. All birds banded by The Superpark Project.

Species	Sex	*Band combination	Banding location	Banding date	Observation location	Observation date	Dispersal distance
Gnatcatcher #1	F	LG W/M	Crystal Cove	04/22/95	Laidlaw	All breeding season, 1997	4.27 km
Gnatcatcher #2	F	O/LG M	Turtle Rock	05/24/95	Laidlaw	All breeding season, 1996/1997	4.02 km
Gnatcatcher #3	M	O/DB M	Crystal Cove OR Laguna Laurel	05/03/95 OR 06/02/95	Boat Canyon	All breeding season, 1996/1997	7.32 km or 8.05 km[1]
Gnatcatcher #4	M	M Bl/R-W	Turtle Rock	06/01/96	Shady Canyon	4/21/97	2.93 km
Gnatcatcher #5	F	M DB/Y	Sand Canyon Reservoir	02/15/95	Shady Canyon	4/21/97	2.68 km
Gnatcatcher #6	J	DG/M R-W	Bonita Canyon	04/14/97	Coyote Canyon	June/July, 1997	3.66 km
Gnatcatcher #7	J	M W/Bl	Laguna Laurel	04/08/97	Bommer Canyon	July, 1997	3.90 km
Cactus wren #8	F	LB/M Y/Y	Laguna Laurel	06/06/95	Shady Canyon	Feb/March 1996 & 1997	1.71 km

* right leg first, M = USFWS metal band, O = orange, W = white, Y = yellow, LB = light blue, DB = dark blue, LG = light green, DG = dark green, Bl = black, R-W = red over white split band. [1] same band combination fitted to two different gnatcatchers.

3.7 TCA revegetation areas

Three gnatcatcher pairs were recorded in the Coyote Canyon landfill area. Two of the pairs occupied mature coastal sage scrub and the other pair occupied the 18 acre CSS restoration site. None of the pairs nested in the CSS revegetation area, although adults with young were observed foraging in the revegetation area. A total of 34 wildlife species were detected in Coyote Canyon in 1997, including 1 reptile, 28 birds and 5 mammals, an increase on the 17 avian species recorded in 1996 (Appendix C). A number of sensitive species including black-shouldered kite (*Elanus caeruleus*), northern harrier (*Circus cyaneus*), California horned lark (*Eremophila alpestris*), loggerhead shrike (*Lanius ludovicianus*) and grasshopper sparrow (*Ammodramus savannarum*) were located. Blacktail jackrabbits (*Lepus californicus*) and mule deer (*Odocoileus hemionus*),

were among the mammals located at Coyote Canyon landfill. The latter were observed utilizing the wildlife crossing under the SJHTC at Laidlaw.

No gnatcatcher or cactus wren surveys were conducted at the TCA revegetation areas along the SJHTC cut and fill slopes, Bonita Creek channel or at Bonita Reservoir in 1997, since it was determined that these areas were not sufficiently well vegetated to support the target species (Margot Griswold pers. com.).

3.8 Non target avifauna and other wildlife

A total of 139 wildlife species were detected in the San Joaquin Hills in 1997, including four amphibians, 10 reptiles, 111 birds and 14 mammals (Appendix D). A number of sensitive species including northern red diamond rattlesnake (*Crotalus ruber ruber*), black-shouldered kite, northern harrier, sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus*), California horned lark, loggerhead shrike, yellow warbler (*Dendroica petechia*), yellow-breasted chat (*Icteria virens*) and grasshopper sparrow were located. Unusual species recorded include a sage thrasher (*Oreoscoptes montanus*) in a cactus patch near Laguna Beach in February and 3 cattle egrets (*Bubulcus ibis*) near Bonita Canyon Road in May.

4.0 DISCUSSION

Coastal sage scrub is a very diverse community, forming many associations within the context of the larger community (DeSimone 1995). These subassociations are correlated with slope, aspect and soils. In the San Joaquin Hills this already complex situation is compounded by the disturbance from the 1993 fire, which burned with unequal intensities across the study site. The intrinsic heterogeneity of the community coupled with the variety of post-burn seral stages is reflected in the overall variation in the data recorded (represented by standard error), and the different dominant and important species represented on the site. If the community was defined using the Manual of California Vegetation (Sawyer and Keeler-Wolf 1995), it would fall into a minimum of five vegetation series.

There was a significant increase in the cover of live vegetation between 1996 and 1997, for all grid types (Table 3.1). The increased vegetation in 1997 was probably due to the growth of existing vegetation and a certain amount of re-establishment of additional species. Favorable weather conditions of early rains and warm winter temperatures coupled with a cool dry spring provided an early start to the growing season, enabling greater cover to be produced during the duration of the growing season (winter through spring).

Differences in cover values for number of species between 1996 and 1997 could indicate two trend scenarios. First, with a better growing season in 1997, more species may have been able to germinate and persist for identification, in which case this trend may or may not be continued in subsequent years, depending on climatic conditions. A second scenario may explain the results as a factor of the early seral stages of the community: as it matures, more species have a chance to establish and persist. Future study should confirm or modify these speculations.

This years data indicates that in all the sites, non-native grasses were the dominant cover type (Table 3.3). The abundance of this cover type could be due to the growing season, where early rains had stimulated the early growth of these aggressive annual species. Mooney (1987) recognizes their presence as representing an ecotone between the scrub and grassland, with the transition zone occurring as a bare area, devoid of vegetation, due to the inhibitory effect of volatile terpenes from the sage species. A transition zone was not evident in this year's or last year's study. In fact, the annual grasses often provided an understory to the sage species. This correlates with Paysen *et al.* (1980), who identify the coastal sagebrush series as supporting an understory of grasses and forbs. Although non-native grasses are a component of the coastal sage scrub community (Mooney 1987, DeSimone and Burk 1992), the increase in cover of these species from 1996 levels, and the decrease in cover provided by shrub species in two grid types (good habitat - gnatcatchers present and good habitat - gnatcatchers absent), may be a concerning trend, suggesting type conversion of shrubland to grassland, which has been documented in fire

studies of coastal sage scrub (White 1995, O'Leary 1995). More likely, however, the results are indicative of successional processes. By regarding the data in the context of historical disturbance (1993 fires), different hypotheses for the trend can be defined. In the good habitat - gnatcatchers present grids, despite the reduction of cover provided by California sagebrush in 1997, more shrubby species (especially of the important species for gnatcatchers) provided greater amounts of cover than 1996. The decrease in cover provided by deerweed and the disappearance of *Phacelia distans* as a important cover, both of which are early successional species, would be expected in successional processes. Coupled with the increase in other shrubby species may indicate that the community is maturing. In the good habitat - gnatcatchers absent grids the trend can also be hyothesized as successional processes. Again the amount of cover provided by deerweed decreased, and twice as many shrubby perennials provide cover this year than last. In the poor habitat - gnatcatchers absent grids the deerweed is still a dominant species, but the morning glory and chaparral mallow, both early successional species, no longer provide important amount of cover. California sagebrush, black sage and laurel sumac, all of which were present in 1996, are present this year at higher cover values. Other shrubby perennials also provide important cover this year.

An additional trend that could indicate a maturing community, is the presence of dead organic material, that provides an important amount of cover in the good habitat, no gnatcatchers present and the historic scrub grids. In a mature community, dead material provides the habitat necessary for decomposers to thrive, and nutrient cycles to establish, both of which are in integral part of any natural system (Raven *et al.* 1992)

Fewer species were providing more cover in the good habitat - gnatcatchers present grids than the other two grid types (Table 3.4). These data could be correlated with this same grid type having less diversity than the others (Table 3.2), and may indicate a trend towards a more mature community.

Because all of the grid types this year had more cover provided by native species than non native species and more cover by dead organic material than bare rocky areas (and no statistical difference in the cover types between any of the grids), the similarities between the grid types are apparent. In the good habitat - gnatcatchers present grids, the statistically significant increase in non-native cover is due primarily to the increase in non-native grasses from last year. The dominance of native vegetation in all grid types (Table 3.5) suggests that the study area is resisting the invasion of exotic species and that the community is recovering naturally from the effects of the fire. This trend is imperative if this community is to persist and provide resources to support the native fauna of the area.

In the good habitat - gnatcatchers absent grids the statistically significant increase in dead vegetation potentially indicates that post-burn vegetation is maturing and dying off, a normal process, and the natural process of nutrient cycling is re-establishing. Also in this grid type, in 1997, more bare ground and rocky areas are present, which indicates a greater heterogeneity in the community from last year. Due to the robustness of the

crown-sprouting of some of the woodier species (toyon and lemonadeberry), bare areas associated with "hot burns" last year were not as evident this year. This year, bare areas were generally unvegetated rocky substrates or soil substrates precluding the establishment of vegetation, and did not appear to be transition zones between shrub species and grasslands.

In the good habitat - gnatcatchers absent grids the documentation of greater cover being provided by herbs is primarily due to the amount of non-native grasses that occur in those grid types. Although the higher herb than shrub cover is concerning, the cover was not statistically different from the 1996 values, and may be a seral stage, where the shrubs will eventually regain their dominant cover value. If the trend continues, or additional disturbance happens presently in the general area, these grids would be least likely to rebound back into a scrub community.

The lack of statistically different amounts of cover provided by the four important plant species indicates that the grids are quite similar for those resources. The statistically significant difference between the grid types from this and last year in the good habitat - gnatcatchers present grids indicates that the amount of cover provided by California sagebrush decreased from 1996, which is not a positive trend, although other important species of the community are increasing their cover in those grids. In the poor habitat - gnatcatchers absent grids California buckwheat significantly increased its cover from 1996 to 1997, indicating that this important species in the community is rebounding after the fire.

All grid types were significantly different from each other with regards to mean vegetation height, indicating a heterogeneity between them that is not reflected in the cover values. This year the good habitat - gnatcatchers present grids had the shortest mean vegetation height, which was also statistically shorter than the areas they used last year. However, last years sampling occurred in areas where some of the vegetation used by gnatcatchers was either not burned or lightly burned while this year sampling in the good habitat - gnatcatchers present grids occurred in areas where the vegetation had been burned. This may account for the apparent decrease in vegetation height between 1996 and 1997.

General trends observed from the 1997 vegetation data:

good habitat - gnatcatchers present grids:

- supported the least live plant cover
- supported the least number of different cover types
- contained the least cover of dead organic material
- contained the most cover of bare and rocky areas
- supported the most cover by California sagebrush, California sunflower and California buckwheat combined
- supported the shortest mean vegetation height and California sagebrush height

good habitat - gnatcatchers absent grids:

- supported the most number of different cover types
- supported the most cover of non-native vegetation including non-native grasses
- supported the least cover of native vegetation
- supported more cover of herbs than shrubs
- supported the least cover by California sagebrush, California buckwheat and black sage combined
- supported the tallest California sunflower height and the shortest California buckwheat and black sage height

poor habitat - gnatcatchers absent grids:

- supported the most live plant cover
- supported the most cover of native vegetation and dead material
- supported the least cover of non-native vegetation
- supported the most cover of shrubs
- supported the least cover of herbs
- supported the most cover of black sage and the east amount of cover of California sunflower combined
- supported the tallest mean vegetation height
- supported the tallest California sagebrush, buckwheat and black sage height and the shortest California sunflower height.

The mean percent cover of shrub species and native species in this year's study fell between the data collected by Westman (1980) and the Laguna Laurel (Martha Blane Associates and Sycamore Associates, 1993), except in the poor habitat - gnatcatchers absent grids (Table 4.1). Also this year, herbs and non-native species provided greater cover than in the two comparison studies. In comparing the data from this year and last year, the values this year exceeded the values last year in shrub cover, herb cover and non-native cover. In native cover, the values in the good habitat - gnatcatchers present grids and in the good habitat - gnatcatchers absent grids decreased from last year. The

general increase in cover in most of the grids may be due to edaphic and climatic conditions. Some of this variation is due to the influence of the fire, however, the increasing occurrence of non-native species and herbs is concerning. If this trend continues, it may be indicative of an assault on the re-establishment of native vegetation after the disturbance of the community by fire.

Table 4.1: Comparison of mean percent cover in the San Joaquin Hills, 1997 with other published studies.

Study	Shrubs	Herbs	Native	Non-Native
Westman (1983)	85	24	105	12
Laguna Laurel (1993)	68	24	76	16
Present Study				
1996 good habitat - gnatcatchers present	81.1	49.8	96.8	38.6
good habitat - gnatcatchers absent	73	68.7	83.9	57.5
poor habitat - gnatcatchers absent	84	57.7	94.4	48.1
1997 good habitat - gnatcatchers present	84.64	65.63	92.97	57.45
good habitat - gnatcatchers absent	73.5	78.35	80.57	71.28
poor habitat - gnatcatchers absent	106.76	59.82	115.50	51.08

The range of percent cover for California sagebrush, bush monkeyflower, lemonadeberry, laurel sumac and deerweed was greater in this year's study than in previous studies DeSimone (1992) and Laguna Laurel (1993), (Table 4.2). This substantially higher cover for deerweed in undoubtedly due successional processes occurring in the post-burn community. The ranges of California buckwheat, black sage, bedstraw (*Galium angustifolium*), white sage (*Salvia apiana*) and elderberry were comparable between studies. At this point in the monitoring, all data on cover and height are really only comparable to other disturbed coastal scrub communities. Subsequent year's data will allow trend analyses that indicates if this maturing community is becoming quantitatively more comparable to mature coastal sage scrub.

Table 4.2: Comparison of ranges of cover in the San Joaquin Hills, 1997 with other published studies.

	1992	1993	1996			1997		
Species	**DeSimone**	**Laguna Laurel**	**good habitat - gnatcatchers present**	**good habitat - gnatcatchers absent**	**poor habitat - gnatcatchers absent**	**good habitat - gnatcatchers present**	**good habitat - gnatcatchers absent**	**poor habitat - gnatcatchers absent**
Artemisia californica	9.0-52.0	9.8-35.9	5.7-72.7	2.8-31.7	0.1-29.1	0.0 - 39.08	1.33 - 13.07	0.0 - 84.00
Eriogonum fasciculatum	0.0-48.7	1.5-17.0	0.0-24.3	0.0-16.1	0.0-7.7	0.0 - 45.87	0.0 - 22.68	0.0 - 28.21
Salvia mellifera	0.0-55.2	0.2-68.5	0.0-7.5	0.0-12.3	0.0-18.8	0.0 - 62.43	0.0 - 26.64	0.0 - 34.71
Mimulus aurantiacus	0.0-17.5	0.0-4.5	0.0-20.0	0.0-14.1	0.0-11.9	0.0 - 7.64	0.0 - 44.80	0.0 - 47.67
Rhus integrifolia	--	0.0-18.0	0.0-17.3	0.0-4.7	0.0-16.1	0.0 - 29.11	0.0 - 22.96	0.0 - 29.92
Galium angustifolium	0.0-1.8	0.2-2.9	--	0.0-4.0	0.0-2.1	--	0.0 - 1.71	0.0 - 1.85
Salvia apiana	--	0.0-6.0	--	0.0-5.1	--	--	0.0 - 1.76	--
Malosma laurina	0.0-13.8	0.1-4.5	0.0-16.1	0.0-23.2	0.0-23.6	0.0 - 13.87	0.0 - 54.27	0.0 - 15.51
Sambucus mexicana	--	0.0-10.0	0.0-1.6	0.0-0.1	0.0-3.6	0.0 - 0.83	0.0 - 2.93	--
Lotus scoparius	0.0-11.0	1.2-26.9	0.0-21.1	0.0-92.1	0.3-87.2	0.0 - 18.81	0.0 - 37.23	0.03 - 67.08

A total of 27 California gnatcatchers breeding pairs were recorded the burn area of the San Joaquin Hills in 1997. This represents a substantial increase on the number recorded in the past few years (11 pairs in 1996, 5 pairs in 1995, 12 pairs in 1994), but still well below the pre-fire estimate of 127 pairs (Bontrager *et al.* 1995b). The population is growing rapidly, in fact it has more than doubled in each of the last two years (Figure 3.2). The new birds appear to be a combination of offspring from resident breeding pairs and immigration from surrounding populations (banding returns indicate birds have come from the Bonita Reservoir, Turtle Rock, Laguna Laurel, Sand Canyon Reservoir, Sycamore Hills and Crystal Cove). The high fledgling rate of the resident birds is probably contributing significantly to the population growth. This increase is excepted as new habitat becomes available in the burn area as a result of shrub recovery from the fire. The high fledgling rate in 1997 suggest that the population will increase again by 1998. Population growth could be checked by saturation of existing habitat and/or poor weather conditions over the winter.

The gnatcatcher distributions can be correlated with the results from both the quantitative vegetation sampling and the habitat classification conducted for this study. Note however, that the actual % cover of shrub species determined by each method is not directly comparable. In the habitat classification system, % cover was estimated visually for the shrub species only and heights were estimated only for California sagebrush, California buckwheat, California sunflower and black sage. In the quantitative vegetation analysis, % cover was recorded for all vegetation layers and layers could overlap. Height was measured for all species present. Some species, eg. California sagebrush, occur as shrubs and as smaller plants not yet old enough to reach the shrub level. These species will have higher % cover in the quantitative vegetation analysis than in the habitat classification system. Both systems should highlight similar trends in vegetation composition and bird distribution.

The quantitative vegetation analysis indicated that gnatcatcher breeding pairs were more abundant in areas with higher % cover of California sagebrush, California buckwheat, California sunflower and black sage. The habitat classification system found a similar pattern. Those habitat patches with greater than 33% combined cover of California sagebrush, California buckwheat, black sage and California sunflower accounted for approximately 70% of all occurrences of gnatcatcher breeding pairs (Figure 3.4). Those areas with the highest % cover of these four scrub species had the highest density of gnatcatchers. Habitat category G1 had 0.59 pairs/ha compared to 0.15 pairs/ha for habitat category G3 and 0.04 pairs/ha for category G5.

The habitat classification system found a positive correlation between gnatcatcher distribution and shrub height, 70% of gnatcatchers occurred in habitat patches where the shrub height exceeded 0.7 m. However, the quantitative vegetation analysis indicated no such trend, as that grids where gnatcatchers were present had lower overall plant height than in those without gnatcatchers (Table 3.8) and there was no statistical difference in the average shrub height of the four species typically used by gnatcatchers as nesting

substrates between the areas where gnatcatcher were present and areas where they were absent, all grid typs had average heights in excess of 0.7 m (Table 3.9).

Nesting success for the monitored gnatcatcher pairs was very high. Ten of the eleven monitored pairs (91%) produced fledglings (Table 3.13). This is significantly higher than nesting success reported at other locations, 42% of gnatcatchers nested successfully in Rancho Mission Viejo (Bontrager 1991), 65% at Rancho San Diego (Mock, Bolger, and Jones 1991), 71%, 63% and 60% at the Superpark Project (Bontrager *et al.* 1995b, 1996 and D. Kamada pers. comm.) and 73.9% at Siphon Reservoir (Galvin and Andros 1995) and 78% for the burn area in 1996. Over half of the monitored pairs (64%) produced two successful broods, which was significantly more than reported for other studies, 16% produced two broods at the Superpark Project (Bontrager *et al.* 1995b), 17% produced two broods at Siphon Reservoir (Galvin and Andros 1995), 22% produced two broods at Palos Verdes (Atwood *et al.* 1995) and 56% produced two broods in the burn area in 1996.

A total of 61 chicks fledged from the 11 monitored pairs (Table 3.13), resulting in a mean of 5.55 fledglings per pair, slightly more than the 5.22 fledglings per pair in 1996. This is significantly higher than that reported from other studies, 1.93 fledglings/pair at Riverside (Braden *et al.* 1995), 2.99 fledglings/pair at Palos Verdes (Atwood *et al.* 1995), 2.7, 2.3 and 2.0 fledglings/pair at the Superpark Project (Bontrager *et al.* 1995b, 1996 and D. Kamada pers. comm.), 3.2 fledglings/pair at Siphon Reservoir (Galvin and Andros 1995) and 4.65 fledglings/pair at UCI Reserve (Woehler *et al.* 1995). The following factors may be contributing to the high reproductive success in the burn area:

- the relatively low number of gnatcatchers present in the burn probably select only the highest quality habitat in the area, therefore increasing their likelihood of successful nesting. This does however assume that the habitat in the burn, just 4 years after the fire, is of high quality. Consider two gnatcatcher pairs in the burn area which were not atypical of the monitored pairs, pair # 5 which fledged 6 young at Laidlaw (the pair in the same territory in 1996 fledged 8 young) and pair # 9 which fledged 6 young at Shady Canyon (the pair in the same territory in 1996 fledged 8 young). The combined coverage of California sagebrush, California buckwheat, California sunflower, black sage and cactus was 26% in the home range of pair # 5 and 55% in the home range of pair # 9. Other dominant plants in these areas included deerweed, bush mallow and laurel sumac. These areas would not be considered high quality habitat by many biologists.
- populations of both intra- and inter-specific competitors are presumably below pre-fire levels, thus the gnatcatchers which are present may be faced with lower than normal levels of competition for important resources. We have no quantitative data on population levels of other species, so we cannot evaluate levels of inter-specific competition. Intra-specific competition can be evaluated be analyzing the number of gnatcatchers which live adjacent to a given pair. In the burn area the mean number of gnatcatcher home ranges adjacent to any of the monitored pairs was 1.27 (seven of the monitored pairs had 1 or less gnatcatchers pairs adjacent to their home range area).

At the only area where the gnatcatchers were clumped, Laidlaw, the mean number of gnatcatcher home ranges adjacent to any of the monitored pairs was 2.0 (these pairs had a slightly higher fledgling/pair the rest of the monitored pairs). If low levels of competition is playing a role in the high reproductive success in the burn area, reproductive success should fall in the future as populations recover and competition increases.

- predator populations are presumably lower in the burn area than prior to the fire and if so, they may be having less of an impact on gnatcatcher nesting success than in "normal" situations. There is some evidence to suggest that this is indeed the case. In the burn area (1996 and 1997 data combined) 14% of nests failed at the nest building stage, 16% during egg laying/incubation, 9% during the nestling stage and 61% were successful. This compares with 28% during the nest building stage, 31% during egg laying/incubation, 15% during the nestling stage and 20% successful at the Superpark Project (1995 and 1996) and 27% at the nest building stage, 23% during egg laying/incubation, 20% during the nestling stage and 29% successful at the Palos Verdes project (Atwood *et al.* 1995, Bontrager *et al.* 1996). Thus rates of nest failure are approximately twice as high at every stage at these other sites compared with the burn area. This may be attributable directly to lower predator populations in the burn area. However, we have no quantitative data on predator populations in either the burn area or the other two study sites to support this theory.

A total of seven different nesting substrates were used by gnatcatchers in this study. The most commonly used substrate this year and in 1996 was California sagebrush. The number of the nests located in the four shrub species used in the habitat classification (California sagebrush, California buckwheat, black sage and California sunflower) increased this year from 63% to 74%. This is still lower than in most other studies, where these four species form the substrate in over 85% of gnatcatcher nesting attempts (Atwood 1990; Simonsen *et al.* 1995; Atwood *et al.* 1995; Bontrager *et al.* 1995b; Galvin and Andros 1995). However, most nests were located in an area dominated by these species. The mean nest height above the ground for this study was 0.69 m, while the mean height of the nest substrate was 1.04 m (Table 3.15). Both these figures are within the range recorded in other studies (Bontrager 1991, Atwood *et al.* 1995; Bontrager *et al.* 1995b; Galvin and Andros 1995; Woehler *et al.* 1995).

There was a significant difference in the mean height of the located nests above ground between successful nests and unsuccessful nests and, although the height of supporting shrub was also taller for successful nests compared with unsuccessful nests, the difference was not significant. Perhaps nests placed lower in the nest substrate are more prone to predation than those placed higher in the substrate.

A total of 49 pairs of cactus wrens were recorded in the burn area of the San Joaquin Hills in 1997. This represents an increase in wren numbers in the burn area since 1996 when 39 pairs were recorded. However, this is less than the pre-fire number of 282 pairs and the post-fire number of 79 pairs (Bontrager *et al.* 1995a; LSA 1994; 1995). Cactus wrens

appear to be recovering more slowly than gnatcatchers, however, the important thing is that the population is increasing.

Cactus wren distribution was correlated with the presence of cactus patches. Cactus patches with an average height less than 1 m were used as frequently as those with an average height greater than 1 m by breeding cactus wrens (Figure 3.5). However, wrens only nested in cactus taller than 1 m (Section 3.5.3). Apparently cactus wrens can use areas dominated by with low growing cactus, if some tall cactus is present for nest location.

Nesting success for the monitored wren pairs was high, all 10 of the monitored pairs (100%) producing fledglings, and the mean fledglings/pair was 4.30. This was higher than the only study we have for comparison, at the Palos Verdes where fledgling success/pair was 3.42 (Atwood *et al.* 1995). *Opuntia littoralis* was the most frequently used nest substrate, accounting for 80% of all nesting attempts, perhaps reflecting the fact that this was by far the most abundant cactus species in the burn area. No nest substrate was less than 1 m tall despite the fact that much of the wren habitat was dominated by cactus below this height, indicating a strong preference for the taller cactus as a nesting area.

All the objectives of this year's surveys outlined in the introduction were successfully completed:

- quantitative vegetation surveys were conducted within the burn area,
- the distribution and abundance of the California gnatcatcher and the cactus wren in the burn area of the San Joaquin Hills and in the TCA revegetation areas at Coyote Canyon landfill, the SJHTC cut and fill slopes, Bonita Creek channel and at Bonita Reservoir were determined,
- gnatcatcher breeding biology was monitored and nesting success was determined, and;
- cactus wren breeding biology was monitored and nesting success was determined.

Summary

- Shrub species dominated all burn areas, except the good habitat - gnatcatchers absent grids where herbs dominated, with California sagebrush and deerweed the most common species. Non-native grasses dominated the ground vegetation. Native plant species provided more cover than non-native species in all burn areas.
- Total vegetation cover and species richness (number of different species present) increased in all areas between 1996 and 1997.
- There are indications that the vegetation is succeeding to a shrub dominated community. Early successional species such as deerweed, bush mallow, phacelia and morning glory had less cover in 1997 compared with 1996. And several of the climax shrub species, buckwheat, black sage, encelia and cactus, had increased their cover

since 1996. California sagebrush decreased in cover in some areas but increased in others.

- 27 breeding pairs of California gnatcatchers were located, an increase of 16 pairs from the 11 pairs present in 1996.
- The distribution and abundance of gnatcatcher breeding pairs was positively correlated with the % cover of California sagebrush, California buckwheat, California sunflower and black sage.
- Nesting success for the monitored gnatcatcher pairs was high, with 91% of pairs producing fledglings. A total of 61 chicks fledged from the 11 monitored pairs resulting in a mean of 5.55 fledglings/pair.
- California sagebrush was the most frequent nest substrate used by gnatcatchers.
- One pair of gnatcatchers bred successfully at the TCA's restoration site in Coyote Canyon. No gnatcatchers or cactus wrens nested in the TCA's revegetation areas, although a gnatcatcher family group was recorded foraging in the restoration site at Coyote Canyon. Avian species diversity increased in these areas in 1997.
- 49 breeding pairs of cactus wrens were located, an increase of 10 pairs from the 39 pairs present in 1996.
- Cactus wren distribution was correlated the presence of cactus patches, patches less than 1 m in height were used as frequently as those greater than 1 m in height, although all cactus wren nests were located in cactus greater than 1 m in height.
- Nesting success for the monitored cactus wren pairs was high, with 100% of pairs producing fledglings. A total of 43 chicks fledged from the 10 monitored pairs resulting in a mean of 4.30 fledglings/pair.

5.0 RECOMMENDATIONS

The 1998 monitoring program will follow the same general format that was conducted successfully in the 1996 and 1997 seasons. The following recommendations will be implemented in 1998:

- A quantitative vegetation survey will be conducted in the burn area, similar in nature and scope to the one conducted in 1997.

- All suitable/potential California gnatcatcher and cactus wren habitat in the burn area will be mapped and quantified.

- The distribution and abundance of California gnatcatchers and cactus wrens in the burn area of the San Joaquin Hills and in the TCA restoration and revegetation areas at Coyote Canyon landfill, will be mapped. In order to conduct this mapping, all suitable and potential habitat for the two target species in the burn area will be surveyed 3 times, beginning in early February, 1998.

- Similar mapping surveys will be conducted in the TCA revegetation areas at the SJHTC cut and fill slopes, Bonita channel and at Bonita Reservoir, if the vegetation in these areas is sufficiently well established that it could potentially support one or both of the target species. The TCA's revegetation Project Biologist, Margot Griswold, will be consulted in February to determine the need for the surveys in these areas.

- The nests of 10 pairs of California gnatcatchers and 10 pairs of cactus wrens (in the burn area) will be monitored during the breeding season, to assess the nesting success for these species in the burn area. Nest monitoring will commence in mid March and continue until all monitored pairs have completed their nesting cycle (usually by the end of July).

- California gnatcatcher nestlings from the monitored pairs will be individually color banded, so their dispersal patterns can be documented.

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8.0 APPENDICES

8.1 Appendix A: Floral inventory of plant species located in or adjacent to the transects performed in the San Joaquin Hills, May, 1997.

SCIENTIFIC NAME	**COMMON NAME**
FERNS AND FERN ALLIES	
SELAGINELLACEAE	**SPIKE-MOSS FAMILY**
Selaginella bigelovii	Spike-moss
ANGIOSPERMS - DICOTS	
ANACARDIACEAE	**SUMAC OR CASHEW FAMILY**
Malosma laurina	Laurel Sumac
Rhus integrifolia	Lemonadeberry
Toxicodendron diversilobum	Poison Oak
APIACEAE	**CARROT FAMILY**
Apiastrum angustifolium	Wild Celery
Daucus pusillus	American Carrot
*Foeniculum vulgare**	Sweet Fennel
Sanicula crassicaulis	Pacific sanicle
ASTERACEAE	**SUNFLOWER FAMILY**
Ambrosia psilostachya	Western Ragweed
Artemisia californica	Coastal Sagebrush
Asteraceae sp.	Unidentified Sunflower
Baccharis pilularis	Chaparral Broom/Coyote Brush
Baccharis salisifolia	Mulefat
Brickellia californica	California Bricklebush
*Centaurea melitensis**	Tocalote
Cirsium occidentale	Cobwebby Thistle
Cirsium sp.*	Thistle
*Conyza canadensis**	Horseweed/Mare's Tail
*Cynara cardunculus**	Artichoke Thistle
Encelia californica	California Encelia
Ericameria pinifolius	Pine bush
Eriophyllum confertiflorum	Golden Yarrow
Filago californica	California Fluffweed
Gnaphalium californicum	California Everlasting
Gnaphalium canescens ssp. benevolens	Everlasting

SCIENTIFIC NAME	**COMMON NAME**
Gnaphalium palustre	Lowland cudweed
Hazardia squarrosa	Common Hazardia
Hemizonia fasciculata	Fascicled Tarweed
*Hypochoeris glabra**	Smooth cat's ear
*Hypochoeris radicata**	Hairy cat's ear
Isocoma veneta	Coast Goldenbush
*Lactuca serriola**	Prickly lettuce
Lessingia filaginifolia	California Aster
Malacothrix saxatilis	Cliff Malacothrix
Rafinesquia californica	California Chicory
*Silybum marianum**	Milk Thistle
*Sonchus asper**	Prickly Sow Thistle
*Sonchus oleraceus**	Common Sow-thistle
Stephanomeria virgata	Stephanomeria
BORAGINACEAE	**BORAGE FAMILY**
Amsinckia menziesii ssp. intermedia	Fiddleneck
Cryptantha intermedia	Common cryptatha
Cryptantha sp.	Unidentified Popcornflower
Plagiobothrys nothofulvus	Rusty Popcornflower
BRASSICACEAE	**MUSTARD FAMILY**
*Brassica nigra**	Black Mustard
*Brassica sp.**	Unidentified Mustard
*Hirschfeldia incana**	Shortpod Mustard
CACTACEAE	**CACTUS FAMILY**
*Opuntia ficus-indica**	Indian-fig
Opuntia littoralis var. littoralis	Coast Prickly Pear
Opuntia prolifera	Coast Cholla
CAPPARACEAE	**CAPER FAMILY**
Isomeris arborea	Bladderpod
CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**
Sambucus mexicana	Blue Elderberry
CARYOPHYLLACEAE	**PINK FAMILY**
Cardionema ramosissimum	Sand Mat
*Silene gallica**	Windmill Pink
*Spergula arvensis**	Stickwort/ Starwort
CHENOPODIACEAE	**GOOSEFOOT FAMILY**
*Salsola tragus**	Russian Thistle
CONVOLVUACEAE	**MORNING-GLORY FAMILY**
Calystegia macrostegia	Morning-glory

SCIENTIFIC NAME	**COMMON NAME**
CRASSULACEAE	**STONECROP FAMILY**
Crassula connata	Pygmy-weed
Dudleya lanceolata	Lance-leaved Dudleya
Dudleya pulverulenta	Chalk Dudleya
CUCURBITACEAE	**GOURD FAMILY**
Marah macrocarpus	Wild Cucumber
CUSCUTACEAE	**DODDER FAMILY**
Cuscuta californica	California Dodder
EUPHORBIACEAE	**SPURGE FAMILY**
Chamaesyce albomarginata	Rattlesnake Spurge
Eremocarpus setigerus	Dove Weed
FABACEAE	**LEGUME FAMILY**
Lotus scoparius	Deerweed
Lotus strigosus	Lotus
Lupinus bicolor	Miniature Lupine
Lupinus hirsutissimus	Stinging Lupine
Lupinus succulentus	Succulent Lupine
Lupinus truncatus	Lupine
*Melilotus alba**	White Sweetclover
*Melilotus indica**	Sour-clover/ Yellow Sweet Clover
FAGACEAE	**BEECH FAMILY**
Quercus agrifolia	Coast Live Oak
GERANIACEAE	**GERANIUM FAMILY**
*Erodium botrys**	Long-beaked Filaree
*Erodium cicutarium**	Red-stemmed Filaree/ Storksbill/ Heron Bill
GROSSULARIACEAE	**GOOSEBERRY FAMILY**
Ribes speciosum	Fuchsia-flowered Gooseberry
HYDROPHYLLACEAE	**WATERLEAF FAMILY**
Eucrypta chrysanthemifolia	Common Eucrypta
Phacelia cicutaria	Caterpillar Phacelia
Phacelia distans	Common Phacelia/ Blue Phacelia
Phacelia ramosissima	Branching Phacelia
LAMIACEAE	**MINT FAMILY**
*Lamium amplexicaule**	Dead Nettle
*Marrubium vulgare**	Horehound
Monardella lanceolata	Horse Mint
Salvia apiana	White Sage
Salvia mellifera	Black Sage
MALVACEAE	**MALLOW FAMILY**

SCIENTIFIC NAME	**COMMON NAME**
Malacothamnus fasciculatus	Mesa Bushmallow/ Chaparral Mallow
Malva parvifolium	Cheeseweed
NYCTAGINACEAE	**FOUR O'CLOCK FAMILY**
Mirabilis californica	California Wishbone Bush/ Wishbone Bush
ONAGRACEAE	**EVENING PRIMROSE FAMILY**
Camissonia bistorta	Southern Sun Cup
Zauchneria canum	California fuchsia
PAPAVERACEAE	**POPPY FAMILY**
Eschscholzia californica	California Poppy
PLATANACEAE	**SYCAMORE FAMILY**
Platanus racemosa	Western Sycamore
PLUMBAGINACEAE	**LEADWORT FAMILY**
*Limonium perezii**	Sea Lavender
POLYGONACEAE	**BUCKWHEAT FAMILY**
Chorizanthe staticoides ssp. *chrysacantha*	Orange County Turkish Rugging
Eriogonum elongatum	Long-stemmed Buckwheat
Eriogonum fasciculatum	California Buckwheat
Pterostegia drymarioides	Pterostegia
*Rumex crispus**	Curly dock
PRIMULACEAE	**PRIMROSE FAMILY**
*Anagallis arvensis**	Scarlet pimpernel
RHAMNACEAE	**BUCKTHORN FAMILY**
Rhamnus ilicifolia	Holly-leafed coffeeberry
ROSACEAE	**ROSE FAMILY**
Heteromeles arbutifolia	Toyon
RUBIACEAE	**MADDER FAMILY**
Galium angustifolium	Bedstraw
Galium aparine	Goose Grass
Galium nuttalii	Nuttall's Bedstraw
Rubiaceae sp.	Unidentified Madder
SCROPHULARIACEAE	**FIGWORT FAMILY**
Antirrhinum coulterianum	White Snapdragon
Antirrhinum nuttalianum	Snapdragon
Castilleja exserta	Purple Owl's Clover
Cordylanthus filifolius	Bird's beak
Mimulus aurantiacus	Monkey Flower
Scrophularia californica	California Bee Plant/ California Figwort
SOLANACEAE	**NIGHTSHADE FAMILY**
*Nicotiana glauca**	Tree Tobacco

SCIENTIFIC NAME	**COMMON NAME**
Nicotiana quadrivalvis	Indian Tobacco
Solanum douglasii	Douglas' Nightshade
VERBENACEAE	**VERVAIN FAMILY**
Verbena lasiostachys	Blue vervain
ANGIOSPERMS - MONOCOTS	
IRIDACEAE	**IRIS FAMILY**
Sisyrinchium bellum	Blue-eyed Grass
JUNCACEAE	**RUSH FAMILY**
Juncus balticus	Wire Rush
LILIACEAE	**LILY FAMILY**
Bloomeria crocea	Golden Stars
Calochortus splendens	Splendid Mariposa Lily
Chlorogalum pomeridianum	Amole
Dichelostemma pulchellum	Blue Dicks
POACEAE	**GRASS FAMILY**
*Avena barbata**	Slender Wild Oat
*Avena fatua**	Wild Oat
Brachypodium distachyon	False Purple Brome
Bromus carinatus	California Brome
*Bromus diandrus**	Ripgut Grass
*Bromus hordeaceus**	Soft Chess
*Bromus madritensis ssp. rubens**	Red Brome/ Foxtail Chess
Gastridium ventricosum	Nitgrass
Hordeum murinum ssp. leporinum	Hare Barley
*Lamarckia aurea**	Goldentop
Leymus condensatus	Giant Wild Rye
*Lolium perenne**	Perennial Ryegrass/ English Ryegrass
Melica imperfecta	Coast Range Melic
Muhlenbergia microsperma	Small-flowered Melic
Nassella lepida	Foothill Needlegrass
Nassella pulchra	Purple Needlegrass
Nassella sp.	Unidentified Nassella
Poa secunda	One-sided Bluegrass/ Pine Bluegrass
Poaceae sp.	Unidentified Grass
*Polypogon monspeliensis**	Annual Beard Grass/Rabbitfoot Grass
*Schismus barbatus**	Mediterranean Grass
*Vulpia myuros var. hirsuta**	Foxtail Fescue/ Vulpia
* indicates a non-native species	

8.2 Appendix B: Total Cover and % Absolute Cover for Each Plant Species Encountered in Each Plot, in the San Joaquin Hills, 1997.

Live vegetation	**good habitat - gnatcatchers present**			**good habitat - gnatcatchers absent**			**poor habitat - gnatcatchers absent**		
Scientific name	**total cover ± S.E.**	**% absolute cover ± S.E.**	**frequency in grids (%)**	**total cover ± S.E.**	**% absolute cover ± S.E.**	**frequency in grids (%)**	**total cover ± S.E.**	**% absolute cover ± S.E.**	**frequency in grids (%)**
Anagallis arvensis	0.01 ± 0.01	0.02 ± 0.01	22.2	**	0.01 ± 0.01		0.09 ± 0.07	0.12 ± 0.10	
Antirrhinum nuttallianum	--	--	--	0.01 ± 0.01	0.01 ± 0.01		**	0.01 ± 0.01	
Apiastrum angustifolium	--	--	--	--	--		**	**	
Artemisia californica	14.10 ± 3.74	18.75 ± 4.98	88.9	5.20 ± 1.07	6.94 ± 1.42		10.50 ± 5.99	14.00 ± 8.00	
Asteraceae sp.	--	--	--	0.01 ± 0.01	0.01 ± 0.01		0.02 ± 0.02	0.03 ± 0.02	
Baccharis pilularis	--	--	--	0.47 ± 0.31	0.63 ± 0.42		0.03 ± 0.02	0.04 ± 0.03	
Baccharis salisifolia	--	--	--	0.02 ± 0.02	0.03 ± 0.03		--	--	
Bloomeria crocea	--	--	--	0.06 ± 0.06	0.08 ± 0.08		--	--	
Brassica nigra	0.85 ± 0.44	1.13 ± 0.58	33.3	1.70 ± 0.77	2.26 ± 1.02		0.11 ± 0.09	0.15 ± 0.12	
Brassica sp.	0.14 ± 0.09	0.19 ± 0.13	22.2	0.04 ± 0.04	0.05 ± 0.05		--	--	
Brickellia californica	--	--	--	1.03 ± 0.83	1.38 ± 1.10		--	--	
Bromus carinatus	--	--	--	0.04 ± 0.03	0.06 ± 0.04		--	--	
Calochortus splendens	--	--	--	--	--		**	0.01 ± 0.01	
Calystegia macrostegia	0.07 ± 0.07	0.10 ± 0.10	22.2	0.16 ± 0.08	0.21 ± 0.11		--	--	
Castilleja exserta	**	0.01 ± 0.01	11.1	--	--		--	--	
Centaurea melitensis	0.41 ± 0.24	0.54 ± 0.32	55.6	0.42 ± 0.27	0.56 ± 0.36		0.07 ± 0.05	0.10 ± 0.06	
Chaemasyce albomarginata.	0.04 ± 0.02	0.05 ± 0.02	33.3	--	--		**	**	
Chorizanthe staticoides ssp. *chrysacantha*	**	**	11.1	--	--		--	--	
Cirsium occidentalis	--	--	--	0.03 ± 0.03	0.04 ± 0.04		--	--	
Conyza canadensis	0.01 ± 0.01	0.01 ± 0.01	11.1	--	--		--	--	
Crassula connata	**	0.01 ± 0.004	22.2	**	**		**	0.03 ± 0.03	
Cryptantha intermedia	--	--	--	0.02 ± 0.02	0.03 ± 0.03		0.16 ± 0.11	0.21 ± 0.15	
Cryptantha sp.	0.29 ± 0.29	0.39 ± 0.39	11.1	**	**		0.01 ± 0.01	0.02 ± 0.02	
Cuscuta californica	0.07 ± 0.07	0.09 ± 0.09	11.1	--	--		--	--	
Cynara cardunculus	0.23 ± 0.13	0.30 ± 0.17	33.3	1.01 ± 0.84	1.34 ± 1.12		0.02 ± 0.02	0.03 ± 0.02	
Daucus pusillus	0.02 ± 0.02	0.02 ± 0.02	11.1	0.03 ± 0.03	0.05 ± 0.04		0.07 ± 0.05	0.09 ± 0.06	

Dichelostemma pulchellum	--	--	--	**	0.01 ± 0.004	0.06 ± 0.05	0.08 ± 0.07
Encelia californica	10.14 ± 4.43	13.52 ± 5.90	55.6	1.79 ± 1.79	2.38 ± 2.38	1.55 ± 1.04	2.07 ± 1.38
Eremocarpus setigerus	**	**	11.1	--	--	--	--
Ericameria pinifolius	0.28 ± 0.24	0.37 ± 0.32	22.2	--	--	0.62 ± 0.42	0.83 ± 0.56
Eriogonum elongatum	--	--	--	0.23 ± 0.23	0.30 ± 0.30	--	--
Eriogonum fasciculatum	11.71 ± 3.42	15.61 ± 4.55	88.9	4.68 ± 1.94	6.24 ± 2.59	8.26 ± 2.36	11.01 ± 3.15
Eriophyllum confertiflorum	--	--	--	--	--	0.30 ± 0.22	0.40 ± 0.30
Erodium botrys	0.71 ± 0.71	0.95 ± 0.95	11.1	0.14 ± 0.14	0.19 ± 0.19	--	--
Erodium cicutarium	0.05 ± 0.04	0.07 ± 0.05	22.2	0.04 ± 0.02	0.06 ± 0.03	0.10 ± 0.05	0.13 ± 0.07
Eucrypta chrysanthemfolia	--	--	--	0.03 ± 0.03	0.04 ± 0.04	0.11 ± 0.11	0.15 ± 0.15
Filago californica	0.01 ± 0.01	0.01 ± 0.01	11.1	0.01 ± 0.01	0.01 ± 0.01	--	--
Galium angustifolium	--	--	--	0.16 ± 0.14	0.21 ± 0.19	0.25 ± 0.14	0.33 ± 0.18
Galium nuttalii	0.02 ± 0.02	0.03 ± 0.02	22.2	0.38 ± 0.17	0.50 ± 0.23	0.89 ± 0.44	1.18 ± 0.59
Gnaphalium canescens ssp. *benevolens*	--	--	--	**	**	--	--
Gnaphalium californicum	0.74 ± 0.56	1.00 ± 0.75	44.4	0.40 ± 0.30	0.54 ± 0.40	0.21 ± 0.11	0.28 ± 0.15
Gnaphalium palustre	--	--	--	--	--	**	**
Grasses (Exotic)	36.45 ± 3.12	48.60 ± 4.16	100	47.00 ± 6.51	62.61 ± 8.68	34.96 ± 6.45	46.62 ± 8.60
Grasses (Exotic)/*Centaurea melitensis*	2.95 ± 1.96	3.93 ± 2.61	22.2	--	--	0.18 ± 0.18	0.24 ± 0.24
Grasses (Exotic)/*Erodium botrys*	0.83 ± 0.83	1.10 ± 1.10	11.1	--	--	--	--
Grasses (Exotic)/*Erodium cicutarium*	--	--	--	0.49 ± 0.49	0.65 ± 0.65	1.36 ± 1.25	1.81 ± 1.66
Grasses (Exotic)/*Hypochoeris* sp.	--	--	--	--	--	0.23 ± 0.23	0.30 ± 0.30
Grasses (Exotic)/*Nassella pulchra*	--	--	--	0.61 ± 0.61	0.81 ± 0.81	--	--
Hazardia squarrosa	0.18 ± 0.15	0.24 ± 0.21	22.2	1.00 ± 1.00	1.34 ± 1.34	0.09 ± 0.09	0.12 ± 0.12
Hemizonia fasciculata	0.77 ± 0.77	1.03 ± 1.02	22.2	0.03 ± 0.03	0.04 ± 0.04	0.14 ± 0.09	0.18 ± 0.12
Hirschfeldia incana	0.09 ± 0.06	0.11 ± 0.09	22.2	1.20 ± 0.56	1.60 ± 0.75	0.16 ± 0.11	0.21 ± 0.15
Hypochoeris glabra	**	**	11.1	--	--	**	**
Hypochoeris radicata	0.03 ± 0.03	0.04 ± 0.04	11.1	0.01 ± 0.01	0.01 ± 0.01	0.16 ± 0.16	0.22 ± 0.22
Hypochoeris sp.	--	--	--	--	--	**	**
Isocoma veneta	0.17 ± 0.16	0.22 ± 0.22	22.2	--	--	--	**
Isomeris arborea	0.16 ± 0.16	0.21 ± 0.21	11.1	--	--	--	--
Lamium amplexicaule	--	--	--	--	--	0.07 ± 0.07	0.10 ± 0.10
Lessingia filaginifolia	0.19 ± 0.16	0.26 ± 0.21	22.2	0.08 ± 0.06	0.11 ± 0.08	0.17 ± 0.16	0.22 ± 0.21
Leymus condensatus	--	--	--	0.72 ± 0.37	0.97 ± 0.49	--	--
Lotus scoparius	4.51 ± 2.05	6.01 ± 2.73	55.6	8.89 ± 3.34	11.85 ± 4.46	31.32 ± 4.33	41.76 ± 5.77
Lotus strigosus	0.02 ± 0.02	0.03 ± 0.03	11.1	0.03 ± 0.03	0.04 ± 0.04	0.02 ± 0.02	0.02 ± 0.02
Lupinus bicolor	0.02 ± 0.02	0.02 ± 0.02	11.1	0.02 ± 0.01	0.02 ± 0.02	--	--

Lupinus hirsutissimus	--	--	--	0.06 ± 0.06	0.08 ± 0.08	--	--
Lupinus truncatus	--	--	--	0.08 ± 0.08	0.10 ± 0.10	--	--
Malacothamnus fasciculatus	0.31 ± 0.16	0.41 ± 0.22	33.3	0.57 ± 0.30	0.76 ± 0.40	1.49 ± 0.69	1.98 ± 0.92
Malosma laurina	1.28 ± 1.15	1.71 ± 1.53	22.2	6.46 ± 4.50	8.62 ± 6.01	4.45 ± 1.49	5.93 ± 2.00
Marah macrocarpus	0.02 ± 0.02	0.03 ± 0.03	11.1	0.05 ± 0.05	0.07 ± 0.07	0.10 ± 0.07	0.13 ± 0.09
Melica imperfecta	0.02 ± 0.02	0.03 ± 0.03	11.1	0.04 ± 0.04	0.05 ± 0.05	0.30 ± 0.27	0.04 ± 0.36
Melilotus officinalis	0.16 ± 0.15	0.21 ± 0.20	22.2	--	--	**	**
Mimulus aurantiacus	1.40 ± 0.77	1.86 ± 1.03	33.3	10.27 ± 4.27	13.69 ± 5.70	4.31 ± 3.53	5.74 ± 4.71
Mirabilis californicus	0.36 ± 0.22	0.48 ± 0.29	33.3	0.48 ± 0.26	0.64 ± 0.35	--	--
Muhlenbergia microsperma	0.02 ± 0.02	0.03 ± 0.03	11.1	--	--	--	--
Nassella lepida	2.63 ± 1.21	3.51 ± 1.62	77.8	0.56 ± 0.25	0.75 ± 0.33	4.12 ± 2.06	5.49 ± 2.75
Nassella pulchra	0.06 ± 0.04	0.09 ± 0.05	44.4	0.20 ± 0.10	0.27 ± 0.14	0.30 ± 0.16	0.40 ± 0.21
Nassella spp.	--	--	--	0.12 ± 0.12	0.16 ± 0.16	--	--
Nicotiana glauca	0.07 ± 0.06	0.09 ± 0.07	33.3	0.72 ± 0.70	0.96 ± 0.94	--	--
Opuntia littoralis	7.91 ± 2.98	10.55 ± 3.97	66.7	1.32 ± 0..68	1.76 ± 0.90	1.58 ± 0.88	2.11 ± 1.18
Opuntia prolifera	0.25 ± 0.24	0.33 ± 0.32	22.2	--	--	--	--
Phacelia cicutaria	--	--	--	0.21 ± 0.21	0.28 ± 0.28	--	--
Phacelia distans	--	--	--	0.29 ± 0.29	0.39 ± 0.39	0.05 ± 0.05	0.07 ± 0.07
Phacelia ramosissima	--	--	--	0.92 ± 0.92	1.22 ± 1.22	0.20 ± 0.20	0.26 ± 0.26
Phacelia sp.	1.30 ± 1.30	1.74 ± 1.73	22.2	1.67 ± 1.66	2.23 ± 2.21	--	--
Poa secunda	--	--	--	0.62 ± 0.62	0.83 ± 0.83	0.82 ± 0.75	1.10 ± 1.00
Poaceae sp.	--	--	--	--	--	--	--
Pterostegia drymarioides	--	--	--	0.05 ± 0.05	0.07 ± 0.07	--	--
Rafinesquia californica	--	--	--	0.03 ± 0.03	0.04 ± 0.04	--	--
Rhamnus ilicifolia	0.05 ± 0.05	0.07 ± 0.07	11.1	--	--	0.03 ± 0.03	0.04 ± 0.04
Rhus integrifolia	2.86 ± 2.38	3.82 ± 0.3.18	44.4	2.96 ± 1.89	3.94 ± 2.52	4.47 ± 2.60	5.95 ± 3.47
Ribes speciosum	--	--	--	0.28 ± 0.28	0.37 ± 0.37	--	--
Rubiaceae sp.	--	--	--	--	--	0.03 ± 0.03	0.04 ± 0.04
Rumex crispus	**	**	11.1	--	--	--	--
Salvia apiana	--	--	--	0.15 ± 0.15	0.20 ± 0.20	--	--
Salvia mellifera	7.31 ± 5.18	9.74 ± 6.90	44.4	5.75 ± 2.52	7.67 ± 3.36	9.81 ± 3.40	13.08 ± 4.54
Sambucus mexicanus	0.07 ± 0.07	0.09 ± 0.09	11.1	0.24 ± 0.24	0.33 ± 0.33	--	--
Sanicula crassicaulis	--	--	--	0.11 ± 0.11	0.14 ± 0.14	--	--
Scrophularia californica	--	--	--	0.51 ± 0.38	0.68 ± 0.50	--	--
Selaginella sp.	0.04 ± 0.04	0.06 ± 0.06	11.1	**	**	--	--
Silene gallica	0.01 ± 0.01	0.01 ± 0.01	11.1	--	--	--	--
Solanum douglasii	0.09 ± 0.08	0.12 ± 0.11	22.2	0.71 ± 0.56	0.95 ± 0.75	0.06 ± 0.04	0.08 ± 0.05
Sonchus asper	--	--	--	0.03 ± 0.03	0.04 ± 0.04	0.03 ± 0.02	0.04 ± 0.03

Sonchus oleraceus	--	--	--	--	--	0.38 ± 0.26	0.50 ± 0.35
Stephanomeria virgata	0.02 ± 0.01	0.03 ± 0.02	22.2	--	--	0.10 ± 0.05	0.13 ± 0.07
Sisyrinchium bellum	0.02 ± 0.02	0.03 ± 0.03	11.1	0.04 ± 0.02	0.05 ± 0.03	--	--
Verbena lasiostachys	--	--	--	0.22 ± 0.22	0.30 ± 0.30	--	--
Zauchneria canum	--	--	--	**	**	--	--
Other							
Bare ground	4.36 ± 1.40	5.81 ± 1.87	100	2.64 ± 0.94	3.52 ± 1.26	1.35 ± 0.34	1.80 ± 0.45
Cryptogamic crusts	0.19 ± 0.19	0.25 ± 0.25	11.1	--	--	0.04 ± 0.04	0.05 ± 0.05
Dead organic material	7.11 ± 1.34	9.48 ± 1.79	100	8.00 ± 2.37	10.66 ± 3.16	11.88 ±3.98	15.84 ± 5.31
Rock substrate	0.50 ± 0.28	0.67 ± 0.37	44.4	1.27 ± 0.77	1.70 ±1.02	0.38 ± 0.38	0.51 ± 0.51
TOTAL	124.79 ± 5.32	166.38 ± 7.10	n/a	125.80 ± 4.35	167.73 ± 5.79	138.58 ± 7.53	184.78 ± 10.04

8.3 Appendix C: Fauna recorded at Coyote Canyon, 1997.

FAMILY/SPECIES NAME	**COMMON NAME**
IGUANIDAE	**IGUANIDS**
Sceloporus occidentalis	western fence lizard
BIRDS	
FAMILY/SPECIES NAME	**COMMON NAME**
CATHARTIDAE	**AMERICAN VULTURES**
Cathartes aura	turkey vulture
ACCIPITRIDAE	**KITES, HAWKS, EAGLES & VULTURES**
Elanus caeruleus	black-shouldered kite
Circus cyaneus	northern harrier
Buteo jamaicensis	red-tailed hawk
PHASIANIDAE	**PHEASANTS, PARTRIDGES & QUAIL**
Callipepla californica	California quail
CHARADRIIDAE	**PLOVERS**
Charadrius vociferus	killdeer
COLUMBIDAE	**PIGEONS & DOVES**
Zenaida macroura	mourning dove
CUCULIDAE	**CUCKOOS & ROADRUNNERS**
Geococcyx californianus	greater roadrunner
APODIDAE	**SWIFTS**
Aeronautes saxatalis	white-throated swift
TYRANNIDAE	**TYRANT FLYCATCHERS**
Sayornis nigricans	black phoebe
Sayornis saya	Say's Phoebe
ALAUDIDAE	**LARKS**
Eremophila alpestris	horned lark
HIRUNDINIDAE	**SWALLOWS**
Hirundo pyrrhonota	cliff swallow
CORVIDAE	**CROWS, JAYS**
Corvus corax	raven
Aphelocoma coerulescens	scrub jay
MUSCICAPIDAE	**THRUSHES, OLD WORLD WARBLERS**
Polioptila californica	California gnatcatcher
MIMIDAE	**MOCKINGBIRDS & THRASHERS**

Mimus poolyglottos	northern mockingbird
LANIIDAE	**SHRIKES**
Lanius ludovicianus	loggerhead shrike
STURNIDAE	**STARLINGS**
Sturnus vulgaris	European starling
EMBERIZIDAE	**WOOD WARBLERS, SPARROWS, NEW WORLD FINCHES & BLACKBIRDS**
Guiraca caerulea	blue grosbeak
Chondestes grammacus	lark sparrow
Ammodramus savannarum	grasshopper sparrow
Passerculus sandwichensis	savannah sparrow
Pipilo crissalis	California towhee
Agelaius phoeniceus	red-winged blackbird
Sturnella neglecta	western meadowlark
FRINGILLIDAE	**OLD WORLD FINCHES**
Carpodacus mexicanus	house finch
Carduelis psaltria	lesser goldfinch
Mammals	
CANIDAE	**DOGS, WOLVES, FOXES**
Canis latrans	coyote
LEPORIDAE	**HARES, RABBITS**
Lepus californicus	blacktailed jackrabbit
Sylvilagus auduboni	desert cottontail
Sylvilagus bachmani	brush rabbit
CERVIDAE	**DEER**
Odocoileus hemionus	mule deer

8.4 Appendix D: Fauna recorded in the San Joaquin Hills, 1997.

FAMILY/SPECIES NAME	**COMMON NAME**
BUFONIDAE	**TRUE TOADS**
Bufo boreas	western toad
HYLIDAE	**TREEFROGS**
Hyla cadaverina	California treefrog
Hyla regilla	Pacific treefrog
RANIDAE	**TRUE FROGS**
Rana catesbeiana	bullfrog
IGUANIDAE	**IGUANIDS**
Sceloporus occidentalis	western fence lizard
Uta stansburiana	side-blotched lizard
Phrynosoma coronatum blainvillei	San Diego horned lizard
TEIIDAE	**WHIPTAILS**
Cnemidophorus tigris multiscutatus	coastal western whiptail
ANGUIDAE	**ALLIGATOR LIZARDS**
Gerrhonotus multicarinatus	southern alligator lizard
COLUBRIDAE	**COLUBRIDS**
Pituophis melanoleucus	gopher snake
Lampropeltis getulus	common kingsnake
VIPERIDAE	**VIPERS**
Crotalus atrox	western diamondback rattlesnake
Crotalus ruber ruber	northern red diamond rattlesnake
Crotalus viridis helleri	southern pacific rattlesnake
BIRDS	
FAMILY/SPECIES NAME	**COMMON NAME**
ARDEIDAE	**HERONS & BITTERNS**
Ardea herodias	great blue heron
Casmerodius albus	great egret
Bubulcus ibis	cattle egret
Egretta thula	snowy egret
ANATIDAE	**SWANS, GEESE & DUCKS**
Anas platyrhynchos	mallard
Anas americana	American wigeon
Anas crecca	green-winged teal
Anas discors	blue-winged teal
Anas cyanoptera	cinnamon teal
CATHARTIDAE	**AMERICAN VULTURES**

Cathartes aura	turkey vulture
ACCIPITRIDAE	**KITES, HAWKS, EAGLES & VULTURES**
Elanus caeruleus	black-shouldered kite
Circus cyaneus	northern harrier
Accipiter striatus	sharp-shinned hawk
Accipiter cooperii	Cooper's hawk
Buteo jamaicensis	red-tailed hawk
Buteo lineatus	red-shouldered hawk
Aquila chrysaetos	golden eagle
FALCONIDAE	**FALCONS**
Falco sparverius	American kestrel
Falco peregrinus	peregrine falcon
PHASIANIDAE	**PHEASANTS, PARTRIDGES & QUAIL**
Callipepla californica	California quail
RALLIDAE	**RAILS & COOTS**
Fulica americana	American coot
Gallinula chloropus	common moorhen
CHARADRIIDAE	**PLOVERS**
Charadrius vociferus	killdeer
LARIDAE	**SKUAS, GULLS & TERNS**
Sterna hirundo	common tern
COLUMBIDAE	**PIGEONS & DOVES**
Zenaida macroura	mourning dove
Columba livia	rock dove
CUCULIDAE	**CUCKOOS & ROADRUNNERS**
Geococcyx californianus	greater roadrunner
TYTONIDAE	**BARN OWLS**
Tyto alba	barn owl
STRIGIDAE	**TYPICAL OWLS**
Bubo virginianus	great horned owl
APODIDAE	**SWIFTS**
Aeronautes saxatalis	white-throated swift
TROCHILIDAE	**HUMMINGBIRDS**
Calypte anna	Anna's hummingbird
Selasphorus sasin	Allen's hummingbird
Calypte costae	Costa's hummingbird
Archilochus alexandri	black-chinned hummingbird
PICIDAE	**WOODPECKERS**
Melanerpes formicivorus	acorn woodpecker
Colaptes auratus	northern flicker
Picoides nuttallii	Nuttall's woodpecker

TYRANNIDAE	**TYRANT FLYCATCHERS**
Tyrannus verticalis	western kingbird
Tyrannus vociferans	Cassin's kingbird
Myiarchus cinerascens	ash-throated flycatcher
Contopus sordidulus	western wood-pewee
Sayornis nigricans	black phoebe
Sayornis saya	Say's Phoebe
Empidonax difficilis	pacific-slope flycatcher
ALAUDIDAE	**LARKS**
Eremophila alpestris	horned lark
HIRUNDINIDAE	**SWALLOWS**
Tachycineta thalassina	violet-green swallow
Hirundo rustica	barn swallow
Hirundo pyrrhonota	cliff swallow
Stelgidopteryx serripennis	northern rough-winged swallow
CORVIDAE	**CROWS, JAYS**
Corvus brachyrhynchos	American crow
Corvus corax	raven
Aphelocoma coerulescens	scrub jay
PARIDAE	**TITMICE**
Parus inornatus	plain titmouse
AEGITHALIDAE	**BUSHTIT**
Psaltriparus minimus	common bushtit
TROGLODYTIDAE	**WRENS**
Troglodytes aedon	house wren
Thryomanes bewickii	Bewick's wren
Cistothorus palustris	marsh wren
Catherpes mexicanus	canyon wren
Campylorhynchus brunneicapillus	cactus wren
Salpinctes obsoletus	rock wren
MUSCICAPIDAE	**THRUSHES, OLD WORLD WARBLERS**
Turdus migratorius	American robin
Catharus guttatus	hermit thrush
Sialia mexicana	western bluebird
Sialia currucoides	mountain bluebird
Regulus calendula	ruby-crowned kinglet
Polioptila caerulea	blue-gray gnatcatcher
Polioptila californica	California gnatcatcher
Chamaea fasciata	wrentit
MIMIDAE	**MOCKINGBIRDS & THRASHERS**
Mimus poolyglottos	northern mockingbird
Toxostoma crissale	California thrasher

Oreoscoptes montanus	sage thrasher
Anthus rubescens	American pipit
BOMBYCILLIDAE	**WAXWINGS**
Bombycilla cedrorum	ceder waxwing
PTILOGONATIDAE	**SILKY-FLYCATCHERS**
Phainopepla nitens	phainopepla
LANIIDAE	**SHRIKES**
Lanius ludovicianus	loggerhead shrike
STURNIDAE	**STARLINGS**
Sturnus vulgaris	European starling
VIREONIDAE	**VIREOS**
Vireo huttoni	Hutton's vireo
Vireo gilvus	warbling vireo
EMBERIZIDAE	**WOOD WARBLERS, SPARROWS, NEW WORLD FINCHES & BLACKBIRDS**
Dendroica coronata	yellow-rumped warbler
Dendroica townsendi	Townsend's warbler
Vermivora ruficapilla	nashville warbler
Oporornis tolmiei	Macgillivray's warbler
Dendroica petechia	yellow warbler
Vermivora celata	orange-crowned warbler
Icteria virens	yellow-breasted chat
Geothlypis trichas	common yellowthroat
Wilsonia pusilla	Wilson's warbler
Pheucticus melanocephalus	black-headed grosbeak
Guiraca caerulea	blue grosebeak
Passerina ciris	lazuli bunting
Zonotricha leucophrys	white-crowned sparrow
Zonotrichia atricapilla	golden-crowned sparrow
Chondestes grammacus	lark sparrow
Spizella passerina	chipping sparrow
Aimophila ruficeps	rufous-crowned sparrow
Ammodramus savannarum	grasshopper sparrow
Melospiza melodia	song sparrow
Passerella iliaca	fox sparrow
Passerculus sandwichensis	savannah sparrow
Pipilo erythrophthalmus	spotted towhee
Pipilo crissalis	California towhee
Euphagus cyanocephalus	Brewer's blackbird
Agelaius phoeniceus	red-winged blackbird
Sturnella neglecta	western meadowlark
Molothrus ater	brown headed cowbird

Icterus galbula bullocki	northern/Bullock's oriole
Icterus cucullatus	hooded oriole
FRINGILLIDAE	**OLD WORLD FINCHES**
Carpodacus mexicanus	house finch
Carduelis psaltria	lesser goldfinch
Carduelis tristis	American goldfinch
Mammals	
PROCYONIDAE	**RACOONS & COATIS**
Procyon lotor	raccoon
CANIDAE	**DOGS, WOLVES, FOXES**
Canis latrans	coyote
Urocyon cinereoargenteus	gray fox
FELIDAE	**CATS**
Lynx rufus	bobcat
SCIURIDAE	**SQUIRRELS**
Citellus beecheyi	California ground squirrel
CRICETIDAE	**MICE, RATS, LEMMINGS, VOLES**
Peromyscus californicus	California mouse
Peromyscus maniculatus	deer mouse
Peromyscus boylei	brush mouse
Neotoma lepida	desert woodrat
Microtus californicus	California vole
LEPORIDAE	**HARES, RABBITS**
Lepus californicus	blacktailed jackrabbit
Sylvilagus auduboni	desert cottontail
Sylvilagus bachmani	brush rabbit
CERVIDAE	**DEER**
Odocoileus hemionus	mule deer