

**CALIFORNIA GNATCATCHERS,
CACTUS WRENS, AND
CONSERVATION OF COASTAL SAGE
SCRUB ON THE PALOS VERDES
PENINSULA**

PROGRESS REPORT NO. 3 (1995)

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INTRODUCTION

A critical aspect of the the State of California's Natural Community Conservation Planning (NCCP) program is the central role that science is intended to play in the formulation of land-use planning decisions and policies. By applying principles of modern conservation biology to data on the distribution, ecology, and population dynamics of selected plant and animal species, the objective of NCCP is to design regional reserves that will ensure the long-term viability of rare and declining habitat types. Such a "proactive" conservation approach, if successful, may potentially halt the decline of sensitive species dependent on the habitat type being considered, and thereby reduce the need to protect biodiversity through the cumbersome regulatory framework afforded by endangered species laws. Conversely, NCCP will also identify areas that are scientifically determined to be less important from a biological standpoint, and where economic development may consequently proceed without fear of triggering further additions to federal or state endangered species lists.

The pilot project of the NCCP program has focused on a plant community known as coastal sage scrub, which in the southern portion of its range is patchily distributed in the coastal lowlands west of the Transverse and Peninsular ranges of southern California. Historically, coastal sage scrub was a dominant feature of the southern California landscape, where it occurred in a natural matrix that also included grassland, chaparral, and oak woodland communities. Today, as a result of urban and agricultural impacts, 70-90% of the historic acreage of coastal sage scrub is estimated to have been lost, and those natural areas that remain in the region generally occur as "islands" surrounded by ever-increasing "seas" of urban development. Habitat loss and fragmentation has caused nearly 100 species and subspecies of plants and animals belonging to the coastal sage scrub community to decline to the point that federal and state wildlife agencies have formally designated them as endangered or threatened, or identified them as potential candidates for such listing (Atwood 1993).

The NCCP coastal sage scrub Scientific Review Panel selected three "target species" to use as the focus of conservation planning efforts for this habitat type: California Gnatcatcher (*Poliptila californica*), Cactus Wren (*Campylorhynchus brunneicapillus*), and orange-throated whiptail (*Cnemidophorus hyperythrus*). Although different or additional species are, in practice, being used as surrogates for coastal sage scrub conservation planning in some areas of southern California, virtually all NCCP efforts that have been initiated to date have included maintenance of biologically viable populations of California gnatcatchers and cactus wrens as a principal objective. Consequently, sound ecological and behavioral information about these species will play a critical role in the preparation of NCCP plans.

To provide some of the biological information needed to develop scientifically credible conservation plans, Manomet Observatory for Conservation Sciences began, in 1992, an intensive, long-term study of California Gnatcatcher and Cactus Wren ecology and population dynamics, especially focusing on populations of these species that occur on the Palos Verdes Peninsula, Los Angeles Co., California. The primary objectives of Manomet's study have been largely defined by the research needs identified in the NCCP coastal sage scrub conservation guidelines prepared by the California Department of Fish and Game. These objectives include: (1) develop GIS data layers delineating the extent of coastal sage scrub vegetation and the distribution of California gnatcatchers and cactus

wrens; (2) determine the extent and causes of annual variation in gnatcatcher and wren reproductive success, survivorship, and territory size; and (3) collect data on factors affecting the dispersal behavior of gnatcatchers and wrens.

This report, pursuant to the requirements of U.S. Navy Contract No. N68711-95-C-7615, summarizes data collected during the 1995 breeding season including, where appropriate, comparison of results with those obtained in 1993 (Atwood et al. 1994) and 1994 (Atwood et al. 1995). Because of the continuing process of data entry and editing, the results presented here supersede those presented in previous progress reports. At the present time, Manomet's Palos Verdes study is anticipated to continue at least through 1997.

METHODS

Vegetation analyses. -- Discrete units of natural vegetation on the Palos Verdes Peninsula were identified on plastic overlays affixed to 1" = 1200' color aerial photographs dated 8 January 1992 and 19 April 1993. The minimum size of delineated polygons was approximately 0.2 ha. Each vegetation unit was inspected in the field, either from nearby vantage points using binoculars or by direct visits to the sites. Polygon boundaries were adjusted as appropriate, and visual estimates of the percent cover of the following plant species or categories were recorded for each unit: (a) *Artemisia californica*, (b) *Eriogonum* spp. (including *E. fasciculatum* and *E. cinereum*), (c) *Salvia* spp. (including *S. leucophylla* and *S. mellifera*), (d) *Opuntia littoralis*, (e) *Rhus integrifolia*, (f) *Opuntia prolifera*, (g) *Encelia californica*, (h) *Elymus condensatus*, (i) *Baccharis pilularis*, (j) *Foeniculum vulgare*, (k) *Salsola Kali*, (l) miscellaneous ornamental shrubs, (m) disturbed grassland, (n) riparian, and (o) bare ground. Vegetation data were digitally entered using ArcInfo GIS software.

Various classification systems have been applied to coastal sage scrub subassociations (Munz 1970, Thorne 1976, Kirkpatrick and Hutchinson 1977, Westman 1981, DeSimone and Burk 1992, Jones and Stokes Associates, Inc. 1993). Here, we used a cluster analysis to identify major vegetation groupings found on the Peninsula, and then prepared a dichotomous key reflecting these results (Atwood et al. in press). Each mapped polygon was then categorized using this key as belonging to one of four scrub subassociations (Lemonadeberry Scrub, Sage-Lemonadeberry Scrub, Sagebrush Scrub, and Cactus Scrub) or two types of disturbed grassland (Grassland - Scrub Ecotone and Grassland). Residential areas, landscaped parks, playing fields, shopping centers, roads, and ruderal areas with $\geq 50\%$ cover by *Eucalyptus*, *Acacia*, or other ornamental species were considered to be developed. Polygons classified as the same subassociation and which shared a common boundary were subsequently merged to form larger units than originally had been mapped. Area estimates for vegetation polygons, uncorrected for slope effects, were obtained using ArcInfo.

Population surveys. -- All major areas of natural habitat on the Palos Verdes Peninsula were surveyed for breeding California Gnatcatchers and Cactus Wrens during February - June of each year of the study (1993 - 1995). The Peninsula's isolation renders it a "closed system" with regard to the movements of these non-migratory species. Furthermore, because of the limited amount of extant natural habitat, it is feasible each year to find and identify most or all surviving individuals. Surveys were generally conducted before 11:00 h and after 16:00 h, under weather conditions deemed acceptable in terms of wind and temperature. Tape recordings of gnatcatcher and wren vocalizations were used to elicit responses. In areas where closely adjacent territories of unbanded birds posed potential confusion over the number of pairs actually present, teams of 2 - 4 biologists would revisit the site in order to obtain simultaneous observations of all birds in question. Funding limitations prevented us from precisely following the gnatcatcher survey protocols recommended by the NCCP scientific review panel or the U.S. Fish and Wildlife Service (USFWS), and some areas were only visited on one or two dates. Nonetheless, because of the limited amount of suitable habitat and the fact that our population estimates were based on observations of uniquely banded birds, the locations of simultaneously active nests, or simultaneous observations of unbanded birds, we feel confident in the accuracy of our results. There was no substantial change in our survey effort or technique among the three years reported here.

This research was conducted under U.S. Fish and Wildlife Service Endangered Species recovery permit PRT-800922, U.S. Fish and Wildlife Service Master Bird-Banding Permit 09996, State of California Scientific Collecting Permit 1025, and a California Department of Fish and Game Memorandum of Understanding dated 25 August 1992 (as amended).

Breeding biology and reproductive success. -- Study of California Gnatcatcher breeding biology included documentation of total reproductive output of 10 pairs during 1993, 23 pairs during 1994, and 22 pairs during 1995; data from 4, 5, and 10 pairs of Cactus Wrens were similarly obtained in each of these years, respectively. Territories occupied by each pair were visited from 1 - 3 days per week, beginning in early March and continuing through late June or mid-July. Nests were located through direct observation of nest building, nest exchanges, or feeding of nestlings. In all cases, we are confident that we discovered all of the successful nesting attempts of each of these focal pairs. The number of juveniles fledged per successful nest was based on counts obtained 1 - 5 days after fledging.

To minimize impacts that might potentially result from monitoring activities, visits by biologists to California Gnatcatcher nests were generally limited to 3 dates from the beginning of nest building to fledging, especially during 1994 and 1995. Visits were planned to occur once near the beginning of incubation, once during the first week of the nestling stage (in order to estimate age of juveniles and thereby schedule a follow-up banding visit), and once to band nestlings at approximately 8 days of age. We made no effort to expand the presently available data on clutch size, as our primary goal was to determine the total number of fledglings produced annually by each pair. Nests were not visited when Scrub Jays (*Aphelocoma coerulescens*), Loggerhead Shrikes (*Lanius ludovicianus*), or Brown-headed Cowbirds (*Molothrus ater*) were seen nearby. Cactus Wren nests were irregularly inspected due their generally inaccessible locations.

We used Japanese mist nets to capture adult and fledgling gnatcatchers and wrens for banding; birds were usually attracted to the vicinity of the nets by playback of recorded vocalizations. Most nestling gnatcatchers were banded at approximately 8 - 9 days of age; handling before this age was impractical due to the birds' small size. Nestling cactus wrens were generally banded at approximately 10 days of age. Banding efforts as reported to the USFWS Bird-Banding Laboratory are provided in Appendix A.

Physical characteristics of nesting sites, recorded from 1993 - 1995 at 162 California Gnatcatcher nests, included: (a) supporting shrub species, (b) height of nest from ground, (c) height of supporting shrub, (d) estimated slope of ground at nest, (e) slope aspect, and (f) visual estimate of the total percent cover of dominant coastal sage scrub plant species located within a 5-m radius circle centered on the nest.

From 1993 - 1995 we mapped the use areas (here we make no effort to distinguish the terms use area, home range, or territory) of 34 breeding pairs of California Gnatcatchers and 15 breeding pairs of Cactus Wrens. Observations were located on 7.5 minute series USGS topographic maps that were xerox-enlarged to a scale of approximately 1"=500'. Although vocal and visual registrations of both gnatcatcher sexes were used, the majority of our data reflect locations of the more easily observed males. If both pair members were recorded simultaneously, only the male's

position was used in the analysis. When a nest exchange occurred during an observation bout, resulting in assumption of incubation or brooding duties by the pair member previously under observation, the bird that earlier had been attending the nest became the focal individual for the duration of the observation session. Although locations of fledglings were mapped, they were not included in the following analyses.

Playback of tape recorded vocalizations or "spishing" were only rarely used to relocate birds that had temporarily disappeared from view. Observations were generally made from distances of > 50 m to reduce the possibility that normal behavior was being influenced by researcher presence. Twenty-two of the 34 observed pairs of gnatcatchers (65%) included at least one uniquely color-banded bird; 21 of the 29 observed pairs of wrens (72%) included at least one color-banded bird. Behavioral details and information concerning reproductive status were recorded during each visit, as well as during supplemental visits when specific locations were not mapped.

Pairs were visited on varying numbers of dates from late February through early August, with most observations being made during the mid-morning hours. On each date we attempted to obtain at least 10 observations spaced at 5-min intervals; points recorded at shorter time periods were excluded. In reality, gaps between successive observations were often greater than 5-min in length, and on some days it proved impossible to obtain the desired 10 data points given our project's time constraints. Finally, in order to reduce potential sampling bias (Atwood et al. *in press*), we randomly selected one observation point per day after excluding the date's initial observation point from consideration.

We digitized point locations from raw field maps and obtained UTM coordinates for them using ArcInfo GIS software. Analysis was then accomplished using the CALHOME Home Range Analysis Program developed by the U.S. Forest Service and California Department of Fish and Game (Kie et al. 1994). As provided by CALHOME, we applied the adaptive kernel method of Worton (1989), the harmonic mean method of Dixon and Chapman (1980), and the minimum convex polygon method of Mohr (1947). We allowed CALHOME to determine the appropriate grid cell size for each analysis. For both of these nonparametric methods of estimating use area we calculated the 75% and 90% point distribution contours. The minimum convex polygon containing 100% of the observation points was constructed.

Dispersal behavior and survivorship. -- Maximum direct-line distances were used as the basis for evaluating the dispersal behavior of juvenile California Gnatcatchers and Cactus Wrens. To reduce the likelihood of including observations of birds that had not yet begun to disperse from their natal territories, we excluded all resightings obtained < 45 days after the initial banding date. Only observations of juveniles that were banded as nestlings are included here. We also examined the movements of known breeding adults between successive nesting seasons.

Survivorship estimates of breeding adults were calculated, by sex, between the nesting seasons of 1993 - 1994, and from 1994 - 1995. Additionally, juvenile survivorship was examined by comparing the number of birds known to have fledged in 1993 and 1994 with the number known to have survived into the subsequent breeding season (1994 and 1995, respectively).

RESULTS

Habitat distribution. -- Approximately 644 ha of coastal sage scrub were located on the Palos Verdes Peninsula (Fig. 1), of which 170 ha (26%) consisted of relatively small fragments of less than 5 ha each. Only one area of scrub habitat, extending from west of Altamira Canyon to east of Klondike Canyon, exceeded 100 ha in size; this single tract represented approximately 17% of the total coastal sage scrub vegetation remaining on the Peninsula (Fig. 1).

Sagebrush Scrub represented 46% of the total area of coastal sage scrub present on the Palos Verdes Peninsula (Table 1). The least common of the four major subassociations was Cactus Scrub, which comprised only 6% of the total scrub area. Approximately 198 ha of Grassland - Scrub Ecotone, where coastal sage scrub plant species represented 15 - 29% of the vegetation cover, were also located. Approximately 828 ha of Grassland occurred on the Peninsula.

Approximately 59% of coastal sage scrub remaining on the Palos Verdes Peninsula was located within the jurisdiction of the City of Rancho Palos Verdes (Table 1). Even greater percentages of the total remaining amounts of Sagebrush Scrub (69%) and Cactus Scrub (81%) occurred within Rancho Palos Verdes city limits. Scrub habitat located in Palos Verdes Estates and Rolling Hills was predominantly classified as Lemonadeberry Scrub or Sage - Lemonadeberry Scrub (Table 1).

TABLE 1. DISTRIBUTION OF COASTAL SAGE SCRUB AND GRASSLAND HABITATS
ON THE PALOS VERDES PENINSULA, 1993 - 1995.

VEGETATION TYPE	TOTAL					JURISDICTION ^a				
	AREA (ha)	X	S.D.	N	MAX (ha)	RPV	PVE	RH	RHE	SP
Sagebrush Scrub	299	2.79	2.90	107	22.4	205	27	33	15	19
Cactus Scrub	37	1.06	0.76	35	2.9	30	5	2	0	0
Sage-Lemonadeberry Scrub	101	3.05	4.25	33	24.5	46	0	49	6	0
Lemonadeberry Scrub	207	4.91	6.23	42	26.7	97	42	61	7	0
Grassland - Scrub Ecotone	198	2.28	2.42	87	15.9	135	25	24	2	12
Grassland	828	7.68	16.45	124	122.8	579	57	41	57	94

^a RPV = Rancho Palos Verdes; PVE = Palos Verdes Estates; RH = Rolling Hills; RHE = Rolling Hills Estates; SP = San Pedro. Area estimates for each jurisdiction provided in ha.

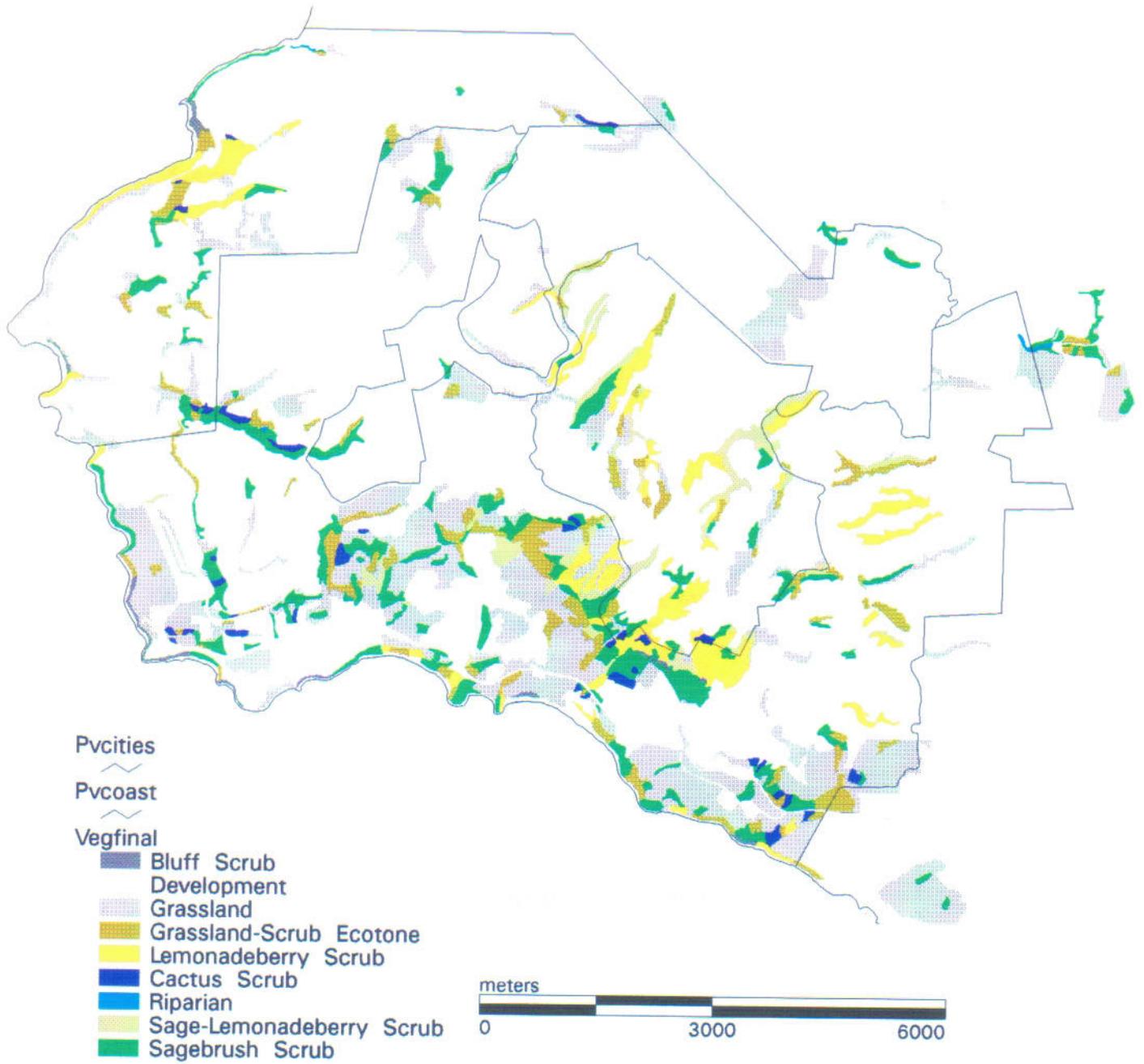


FIGURE 1. DISTRIBUTION OF MAJOR NATURAL VEGETATION TYPES ON THE PALOS VERDES PENINSULA.

Population size and distribution. -- Twenty-six to 56 breeding pairs of California Gnatcatchers were found on the Palos Verdes Peninsula during the 1993 - 1995 nesting seasons. The gnatcatcher population was at its highest level (56 pairs) in 1994, and showed a 54% decrease between 1994 and 1995. The majority of pairs (1993 - 86%; 1994 - 86%; 1995 - 80%) were located in polygons classified as Sagebrush Scrub or Cactus Scrub (Table 2). During 1993 - 1995 most gnatcatchers on the Peninsula occurred within the jurisdictional boundaries of the City of Rancho Palos Verdes (Fig. 2; Table 2).

Fifty, 61, and 63 breeding pairs of Cactus Wrens were found on the Palos Verdes Peninsula during 1993, 1994, and 1995, respectively. Because of difficulties associated with censusing this species, we believe these results to indicate an essentially stable population during these years. The majority of pairs (1993 - 48%; 1994 - 48%; 1995 - 46%) were located in polygons classified as Cactus Scrub (Table 2); as breeding pairs of this species are invariably associated with patches of *Opuntia*, location of pairs in polygons delineated as habitats such as Grassland merely reflects inherent inaccuracies in mapping of vegetation and pair locations, as well as in definition of vegetation subassociations (Atwood et al. 1994). During 1993 - 1995 most Cactus Wrens on the Peninsula occurred within the jurisdictional boundaries of the City of Rancho Palos Verdes (Fig. 3; Table 2).

TABLE 2. DISTRIBUTION OF CALIFORNIA GNATCATCHERS AND CACTUS WRENS ON THE PALOS VERDES PENINSULA BY HABITAT TYPE AND CIVIL JURISDICTION.

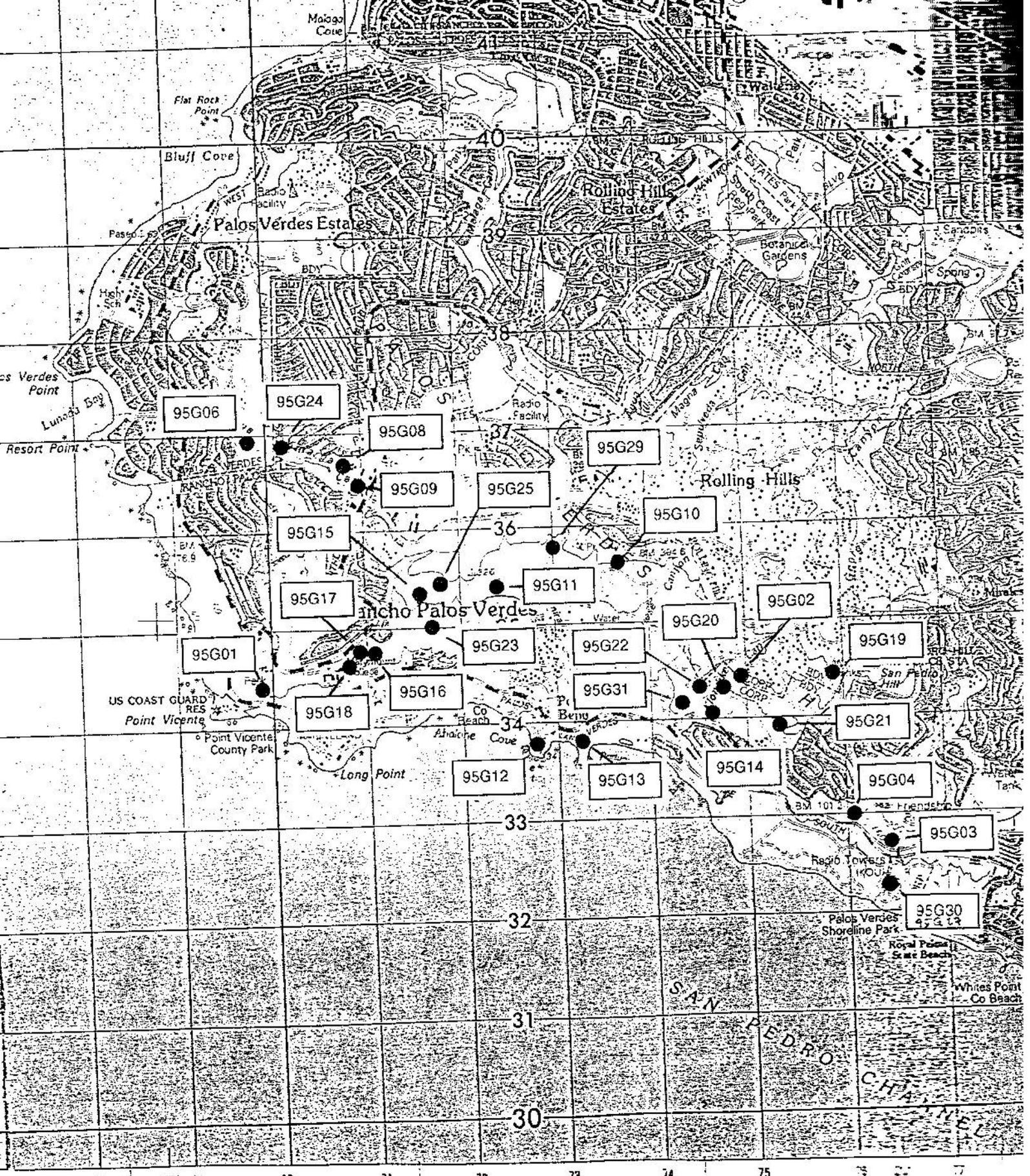
	HABITAT TYPE ^a						JURISDICTION ^b				
	SS	CS	SL	LS	GS	GR	RPV	PVE	RH	RHE	SP
<u>California Gnatcatcher</u>											
1993	35	9	2	2	2	1	42	3	1	0	5
1994	39	9	1	1	5	1	46	3	1	1	5
1995	16	4	2	1	2	1	23	2	1	0	0
<u>Cactus Wren</u>											
1993	18	24	2	2	4	0	46	4	0	0	0
1994	18	29	3	1	8	2	53	6	2	0	0
1995	22	29	1	0	9	2	58	5	0	0	0

^a SS = Sagebrush Scrub; CS = Cactus Scrub; SL = Sage - Lemonadeberry Scrub; LS = Lemonadeberry Scrub; GS = Grassland - Scrub Ecotone; GR = Grassland.

^b RPV = Rancho Palos Verdes; PVE = Palos Verdes Estates; RH = Rolling Hills; RHE = Rolling Hills Estates; SP = San Pedro.

FIGURE 2. DISTRIBUTION OF CALIFORNIA GNATCATCHER PAIRS, 1995.

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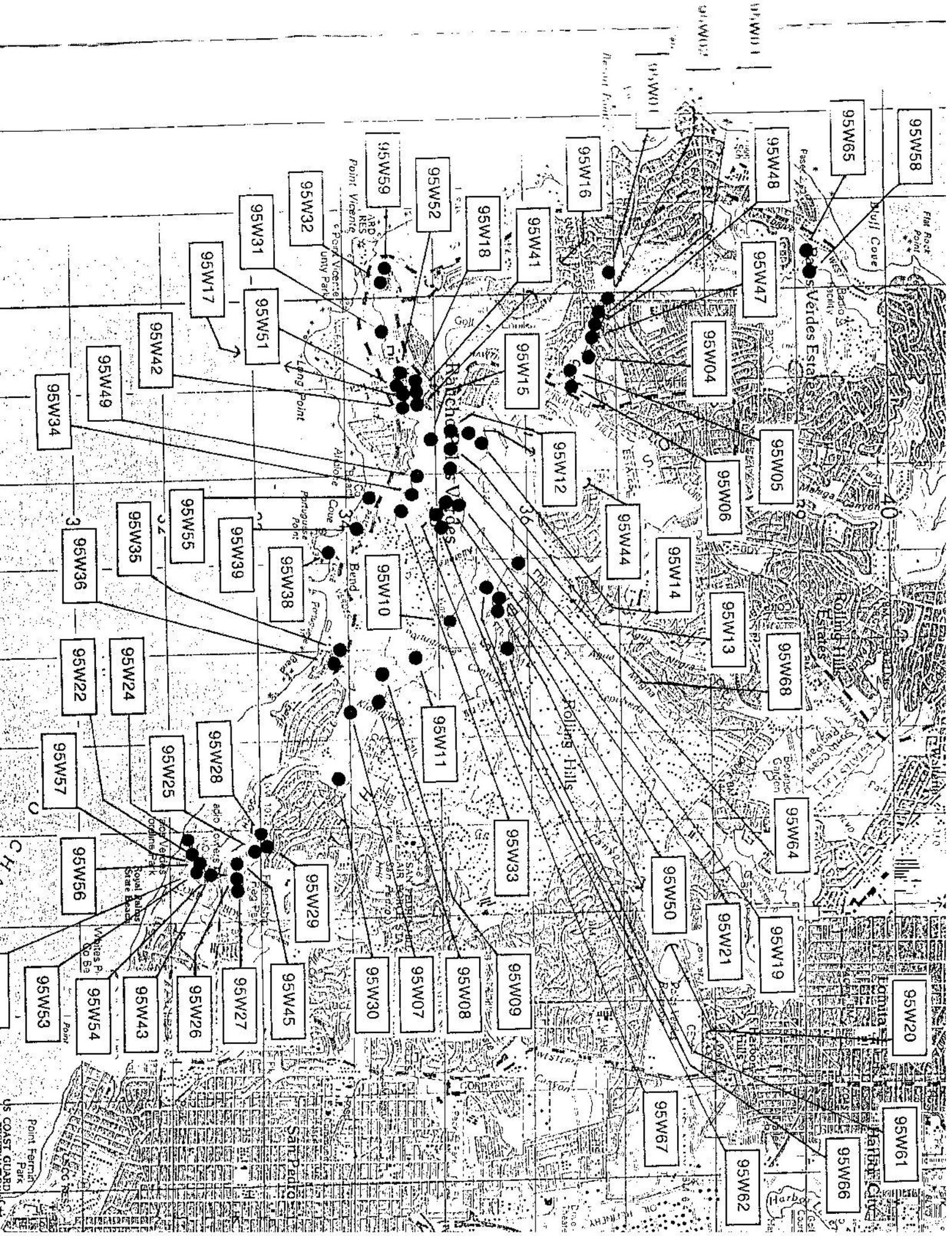


Scale 1:50,000



FIGURE 3. APPROXIMATE DISTRIBUTION OF CACTUS WREN PAIRS, 1995.
NOTE THAT DUE TO MAP SCALE AND THE CLOSE PROXIMITY OF SOME TERRITORIES, SOME SOLID
CIRCLES REPRESENT MULTIPLE PAIRS.

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During each year of the study period, a substantial portion of the Peninsula's gnatcatcher population was concentrated in three patches, located in the vicinities of Agua Amarga Canyon, Edward's Canyon (McCarrell's Canyon), and Klondike Canyon (Fig. 4). These three areas, which encompassed only approximately 25% of the total area of coastal sage scrub (all subassociations) present on the Peninsula, supported from 57% - 73% of the total breeding population of gnatcatchers found from 1993 - 1995.

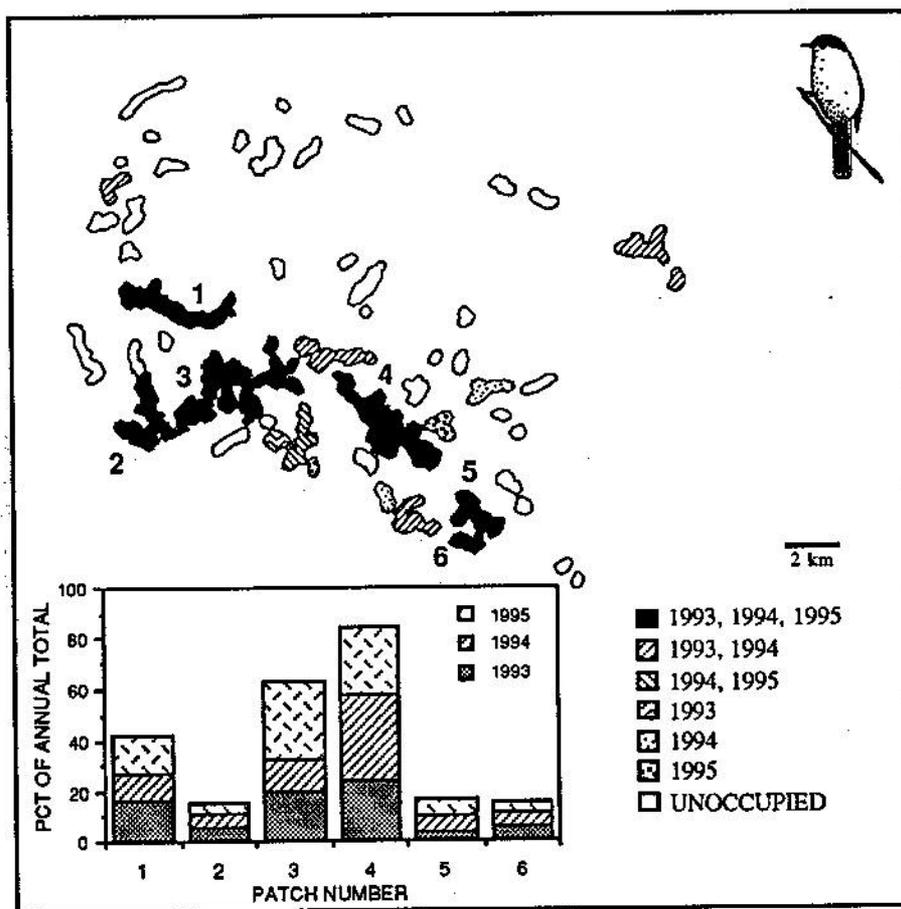


FIGURE 4. CALIFORNIA GNATCATCHER OCCUPANCY OF MAJOR TRACTS OF COASTAL SAGE SCRUB, 1993 - 1995. EACH PATCH DEFINED BY 75 M BUFFER SURROUNDING POLYGONS DESIGNATED AS SAGEBRUSH SCRUB OR CACTUS SCRUB. GRAPH (INSET) SHOWS PERCENT OF TOTAL BREEDING PAIRS FOUND IN EACH OF 6 CONSISTENTLY OCCUPIED PATCHES (NUMBERED ON MAP).

Of special interest was the disappearance of breeding gnatcatchers from the U.S. Navy Fuel Depot located in San Pedro. This isolated site supported 5 pairs of gnatcatchers during the 1993 and 1994 breeding seasons, but only two unpaired females were present at the beginning of the 1995 study. By 20 April 1995 these birds began to regularly associate with each other, and on 04 May began to build a nest. Both females contributed to nest building, both apparently laid eggs in the completed nest (8 eggs total), and both incubated the combined clutch which was completed on 15 May. All eggs present in the nest were taken by an unknown predator on 17 May. Such female-female pairing has not been previously observed in California gnatcatchers. Both females remained on the site throughout the remainder of 1995, but no subsequent "nesting" behavior was observed.

Reproductive success. -- We documented 248 nesting attempts by California Gnatcatchers on the Palos Verdes Peninsula during the three years of our study. Sixty-seven (27%) of these attempts were abandoned before egg-laying, 56 (23%) failed during the egg-laying or incubation period, 49 (20%) failed during the nestling stage, 71 (29%) were successful in producing fledged young, and 5 (2%) were of unknown outcome. We observed no instances of brood parasitism by Brown-headed Cowbirds. Because our protocol emphasized determining the number of fledglings produced annually by each pair, and because the frequency of monitoring visits to each pair influences the likelihood of detecting all nest failures and re-nesting efforts, these values probably underestimate rates of nest failure.

There was no significant difference in the total number of fledglings produced annually by each pair of gnatcatchers (Table 3), although the mean of the small sample obtained in 1993 was higher than those from 1994 or 1995 and the probability value was marginal ($P = 0.07$, Kruskal-Wallis test). Among the 55 gnatcatcher pairs for which we were able to confidently determine all successful nesting attempts, 2 (4%) fledged 3 broods in a single year, 12 (22%) fledged 2 broods, 25 (45%) fledged 1 brood, and 16 (29%) produced no fledglings. The number of successful nesting attempts by each pair of gnatcatchers varied among years ($P = 0.049$; Monte Carlo contingency table analysis, 25000 trials). In 1993, 50% of the monitored pairs ($n = 10$) successfully fledged two broods, and only 1 pair (10%) failed to produce any fledglings (Fig. 5). By contrast, in 1995 10 (45%) of the 22 monitored pairs failed to have any successful nesting attempts, but 2 pairs (9%) produced 3 successful broods. In 1995, 31 of the 59 fledglings (53%) documented were produced by only 4 (18%) of the 22 focal pairs.

Mean reproductive success of Cactus Wrens on the Palos Verdes Peninsula (1993 - 1995 data combined due to small sample sizes) was 3.42 (s.d. = 3.01, $n = 19$, range = 0 - 9).

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TABLE 3. REPRODUCTIVE SUCCESS (NUMBER OF FLEDGLINGS PRODUCED PER PAIR PER YEAR) OF CALIFORNIA GNATCATCHERS ON THE PALOS VERDES PENINSULA, 1993 - 1995.

YEAR	X	s.d.	n	min	max
<u>California Gnatcatcher</u>					
1993	4.10 3.889	1.75 1.691	10 9	0	6
1994	2.61 2.700	2.27 2.342	23 20	0	8
1995	2.27 2.619	2.57 3.090	22 21	0	7 10

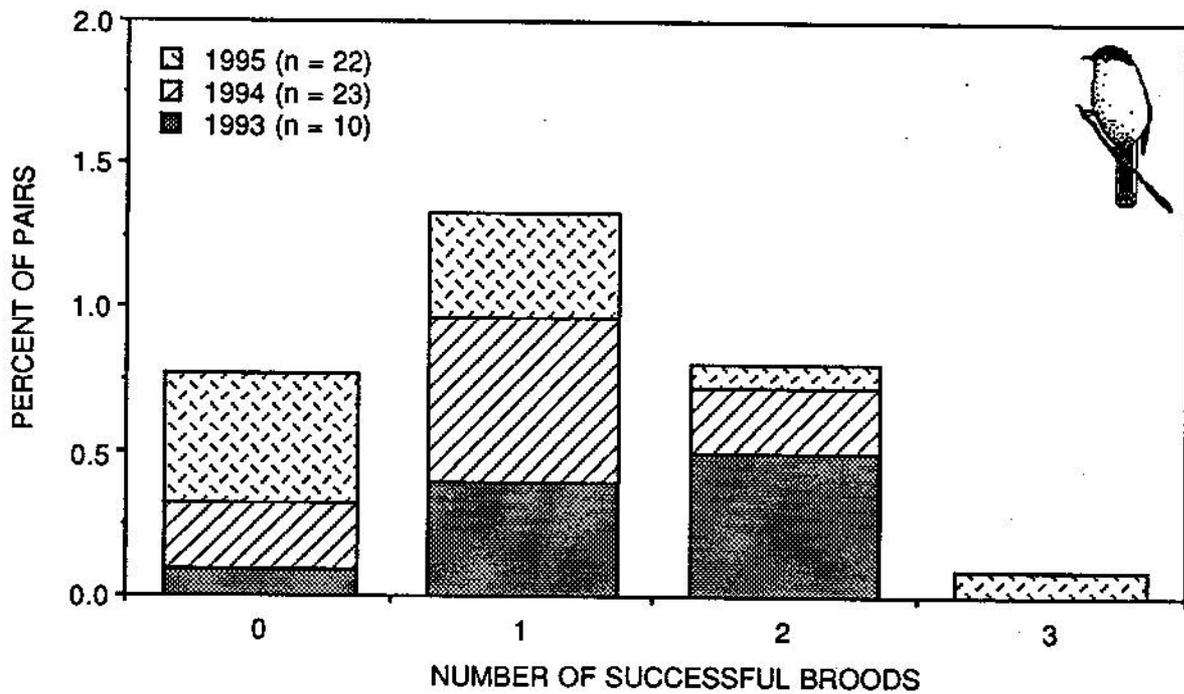


FIGURE 5. NUMBER OF SUCCESSFUL BROODS PRODUCED BY CALIFORNIA GNATCATCHER PAIRS ON THE PALOS VERDES PENINSULA DURING 1993 - 1995.

Table 4 presents descriptive statistics regarding the physical characteristics of nest sites used by California Gnatcatchers from 1993 - 1995. Most gnatcatcher nests were placed in *Artemisia californica* (Fig. 6). The majority of gnatcatcher nests were located on south or west-facing slopes (Fig. 7).

TABLE 4. PHYSICAL CHARACTERISTICS OF CALIFORNIA GNATCATCHER NEST SITES ON THE PALOS VERDES PENINSULA, 1993 - 1995.

	Mean (cm)	s.d.	Min - Max (cm)	n
Slope	18.4	13.9	0 - 64	162
Height of Supporting Bush	128.0	30.9	65 - 254	154
Nest Height	85.9	22.3	41 - 165	139

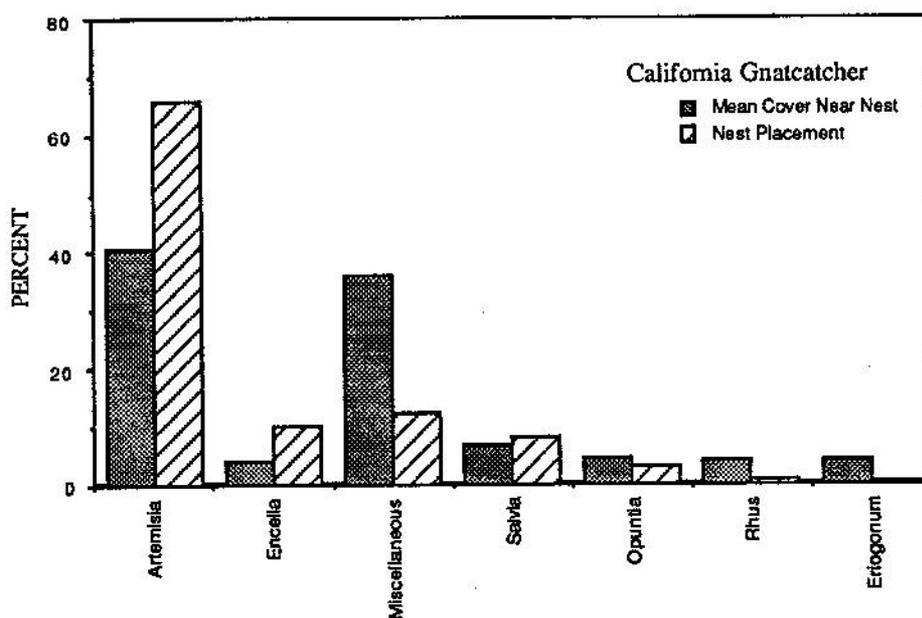


FIGURE 6. CALIFORNIA GNATCATCHER NEST PLACEMENT ON THE PALOS VERDES PENINSULA DURING 1993 - 1995 (N = 159). DOMINANT SPECIES ESTIMATES BASED ON VISUAL ESTIMATES OF PERCENT COVER WITHIN A 5-M RADIUS CIRCLE CENTERED ON THE NEST SITE.

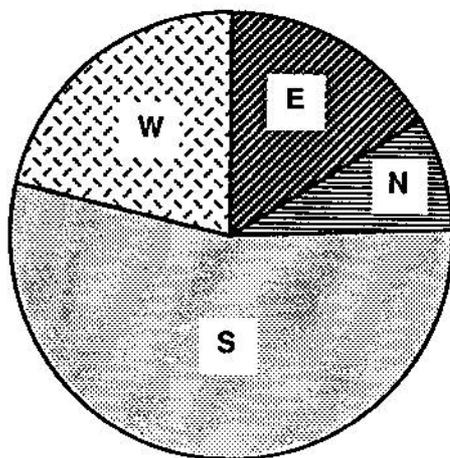


FIGURE 7. APPROXIMATE SLOPE ASPECT OF CALIFORNIA GNATCATCHER NEST SITES LOCATED DURING 1993 - 1995 (N = 162). N = 315° - 45°; S = 135° - 215°; E = 45° - 135°; W = 215° - 315°.

Territory size. -- Mean territory size of 33 pairs of California Gnatcatchers studied from 1993 - 1995 was 1.73 ha (s.d. = 0.87) based on a 90% adaptive kernel model (Fig. 8; Table 5). Additional analysis of these results, including comparable data from Cactus Wrens, is currently underway.

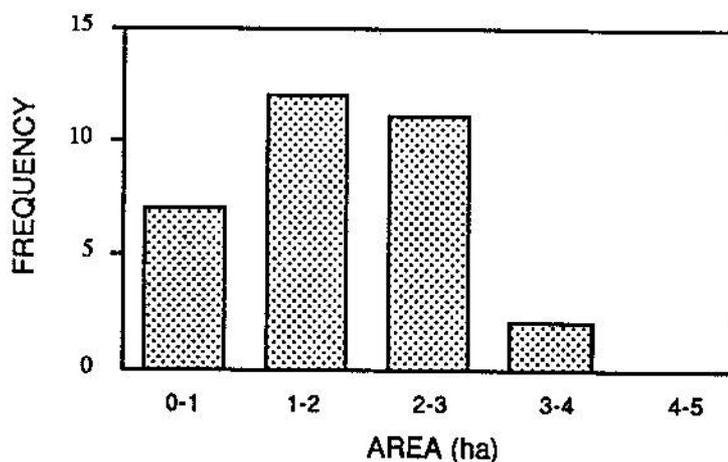


FIGURE 8. FREQUENCY DISTRIBUTION OF CALIFORNIA GNATCATCHER BREEDING TERRITORY SIZE ESTIMATES (90% ADAPTIVE KERNEL MODEL, 1993 - 1995).

TABLE 5. ESTIMATES OF BREEDING TERRITORY SIZE IN CALIFORNIA GNATCATCHERS
ON THE PALOS VERDES PENINSULA, 1993 - 1995.

PAIR_ID	n (days)	AREA (ha) ^a					GRID (m)
		ADK90	ADK75	HMN90	HMN75	MCP100	
93G01	16	2.25	0.58	0.67	0.14	2.17	11
93G02	33	2.49	1.08	1.16	0.60	2.47	11
93G03	24	1.83	1.15	0.41	0.27	1.72	9
93G05	29	0.77	0.51	0.46	0.32	0.99	8
93G07	31	1.68	0.73	0.43	0.27	1.45	10
93G09	14	1.37	0.90	0.51	0.26	1.77	10
93G10	18	2.04	1.26	0.46	0.31	1.49	11
93G11	12	1.04	0.48	0.13	0.09	0.73	7
93G13	15	3.23	2.43	0.64	0.24	1.92	12
93G15	14	1.43	0.99	0.45	0.13	1.07	10
93G17	11	1.51	1.19	0.08	0.05	1.83	8
93G18	18	2.58	1.89	0.70	0.52	2.04	11
93G19	24	3.15	1.32	1.03	0.69	2.36	16
93G42	40	1.49	1.05	0.84	0.49	2.17	10
94G01	35	2.60	1.25	1.29	0.79	2.46	14
94G02	20	2.44	1.27	0.70	0.35	2.18	17
94G03	10	0.86	0.58	0.13	0.08	0.46	6
94G07	21	0.83	0.44	0.30	0.19	0.76	6
94G08	29	2.14	0.63	0.87	0.34	1.71	12
94G09	28	2.52	1.15	1.25	0.59	2.28	10
94G11	31	2.30	0.89	1.43	0.76	1.93	14
94G12	32	2.60	1.32	1.03	0.44	2.15	11
93G13	21	2.79	1.06	0.81	0.38	2.12	12
94G14	11	2.00	1.19	0.06	0.02	1.18	8
95G01	31	1.09	0.56	0.65	0.03	0.90	8
95G03	9	0.34	0.16	0.04	0.03	0.20	4
95G04	9	0.00	0.81	0.04	0.02	0.89	7
95G09	30	1.56	0.74	1.24	0.42	1.27	12
95G14	26	1.42	0.98	0.37	0.26	0.92	9
95G17	32	0.20	0.48	0.97	0.35	1.67	12
95G21	21	2.40	1.81	1.13	0.77	2.28	13
95G22	10	0.50	0.23	0.03	0.02	0.24	4
Mean		1.73	0.97	0.64	0.32	1.55	
Standard Deviation		0.87	0.48	0.42	0.24	0.67	

^a ADK90 = adaptive kernel model, 90% contour; ADK75 = adaptive kernel model, 75% contour; HMN90 = harmonic mean model, 90% contour; HMN75 = harmonic mean model, 75% contour; MCP100 = minimum convex polygon, 100% contour.

Survivorship. -- Of 9 banded female gnatcatchers that bred during 1993, 6 (67%) survived into the 1994 nesting season; only 9 of 32 breeding female gnatcatchers (28%) survived from 1994 - 1995. Survivorship of male gnatcatcher breeders ($n = 8$) between 1993 - 1994 was 38%; six (23%) of 26 banded male breeders survived from 1994 - 1995. Of 46 banded adult Cactus Wrens (both sexes combined) alive during 1993, 25 (54%) survived into the 1994 nesting season; survivorship of 52 adult wrens between 1994 - 1995 was 50%. Of 7 California Gnatcatchers banded prior to the 1994 breeding season and known to have survived into 1995, 1 (14%) had been overlooked during surveys conducted during spring and summer 1994. Of 13 adult Cactus Wrens banded prior to 1994 and known to have survived into 1995, 1 (8%) had been overlooked during 1994 surveys.

A total of 74 banded juvenile California Gnatcatchers were known to have successfully fledged in 1993. Of these, 19 (26%) were known to have survived into the 1994 breeding season, and 13 (18%) were known to have become active breeders. In 1994, 77 banded juvenile gnatcatchers were known to have successfully fledged. Of these, 11 (14%) were known to have survived into the 1995 breeding season, and 8 (10%) were known to have become active breeders. In Cactus Wrens, of 32 fledglings (or nestlings known to have fledged) that were banded in 1993, 9 (28%) were observed during 1994 breeding season. In 1994, 62 banded fledgling wrens were banded; 11 (18%) of these birds were known to have survived into 1995.

At one-year of age, the surviving 1993 cohort of juvenile California Gnatcatchers consisted of 13 females and 6 males; 4 females and 2 males appeared to be unpaired non-breeders. In 1995, the surviving 1994 cohort consisted of 8 females and 3 males; 3 females appeared to be unpaired nonbreeders.

Dispersal behavior and inter-year movements. -- The dispersal movements of 59 California Gnatcatchers banded as nestlings in 1993 and 1994 were evaluated according to the criteria and data restrictions defined in Methods. We found no significant difference ($P = 0.493$, Mann-Whitney U -test) between the mean dispersal distances of birds hatched in 1993 ($X = 1.97$ km, s.d. = 1.92, $n = 35$, range 0.0 - 6.6 km) and 1994 ($X = 2.90$, s.d. = 2.68, $n = 24$, range 0.0 - 9.3 km). There was no significant difference ($P = 0.464$, Mann-Whitney U -test) in mean dispersal distance of juvenile males ($X = 1.78$ km, s.d. = 1.72, $n = 9$, range 0.4 - 5.0 km) and females ($X = 2.88$, s.d. = 1.91, $n = 18$, range = 0.3 - 6.3) that survived into the breeding season following their year of hatching. Mean dispersal distance of juvenile California Gnatcatchers (both sexes) was 2.4 km (s.d. = 2.29, $n = 59$, range 0.0 - 9.3 km) (Fig. 8).

The dispersal movements of 50 Cactus Wrens banded as nestlings or fledglings in 1993 and 1994 were similarly evaluated (although note that for this species, analysis included observations of birds banded as fledglings that may have moved some distance from their natal territories prior to capture). Mean dispersal distance of juvenile Cactus Wrens was 1.1 km (s.d. = 2.01, $n = 49$, range 0.0 - 7.0 km) (Fig. 8).

We noted 5 instances (8% of the total observed dispersal events) where juvenile California Gnatcatchers must have moved at least 0.5 km through non-scrub or non-grassland habitats in order to arrive at their ultimate destination. All of these cases involved birds dispersing from (4 individuals) or to (1 individual) the U.S. Navy's Defense Fuel Support Point property in San Pedro.

Among 21 breeding adult gnatcatchers that were observed in successive years, the mean distance moved between years was 0.1 km (s.d. = 0.13, n = 13, range = 0.0 - 0.3 km) for females and 0.0 km (n = 8, no inter-year movement observed) for males. Adult Cactus Wrens were similarly sedentary; among 48 individuals that were observed in successive years, the mean distance moved between years was 0.3 km (s.d. = 0.52, range = 0.0 - 3.1 km).

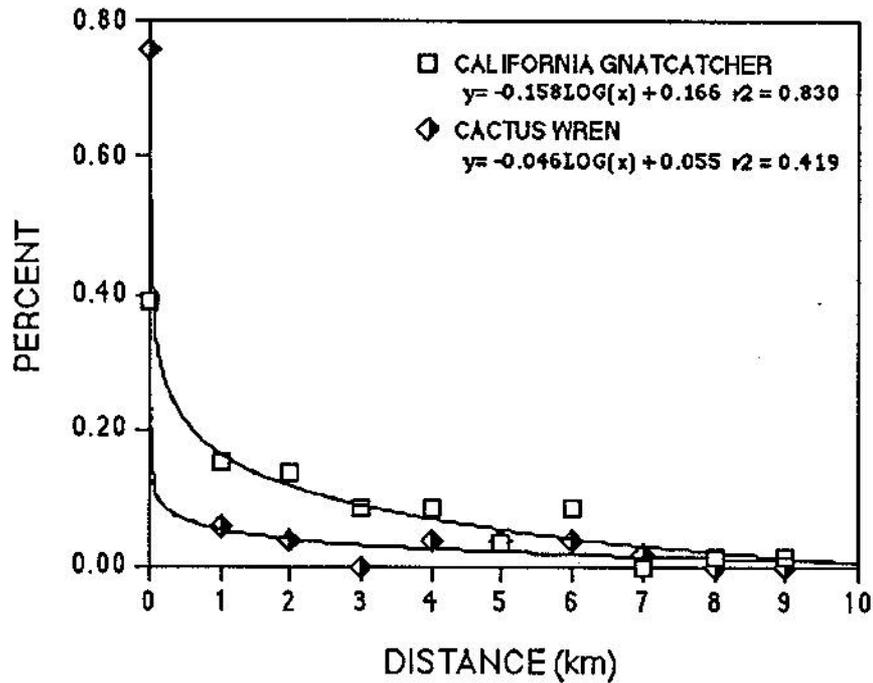


FIGURE 9. DISPERSAL CURVES (LOGARITHMIC MODEL) OF JUVENILE CACTUS WRENS AND CALIFORNIA GNATCATCHERS BANDED ON THE PALOS VERDES PENINSULA IN 1993 AND 1994.

IMPLICATIONS FOR CONSERVATION PLANNING

Population levels of California Gnatcatchers and Cactus Wrens on the Palos Verdes Peninsula are at critically low levels. As a result of poor survivorship of both adults and juveniles during the winter of 1994 - 1995, only approximately 26 pairs of gnatcatchers persisted on the Peninsula at the end of the 1995 breeding season; approximately 63 pairs of wrens were found in 1995. Both species are disproportionately concentrated in three main tracts of coastal sage scrub, located in the vicinities of Agua Amarga Canyon, Edward's Canyon (McCarrell's Canyon), and Klondike Canyon. Complete protection of coastal sage scrub in these areas, coupled with extensive habitat restoration on sites presently not supporting coastal sage scrub, will likely be necessary to conserve these species on the Palos Verdes Peninsula.

RECOMMENDATIONS FOR FURTHER STUDY

Manomet's Palos Verdes project is expected to continue at least through 1997. Acquisition of further data on California Gnatcatcher and Cactus Wren distribution, reproductive success, survivorship, and dispersal will follow the basic procedures used during 1993 - 1995. Given the substantial population decline in gnatcatchers observed during 1995, census results from 1996 (including distribution of remaining pairs) will be of particular interest. Also of special interest will be the status of gnatcatchers at the U.S. Navy Defense Fuel Support Depot in San Pedro; although natural emigration of birds into this area from other portions of the Peninsula has been documented, it is unknown whether such events occur frequently enough to guarantee successful recolonization of this area by the species.

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APPENDIX A

Banding schedules submitted to USFWS Bird-Banding Laboratory, October 1995.

BTGN = California Gnatcatcher, CACW = Cactus Wren.

Appendix A not scanned since
none of the banded birds would be expected
to still be alive in 2009.