

USE OF RESTORED COASTAL SAGE SCRUB HABITAT BY CALIFORNIA GNATCATCHERS IN A PARK SETTING

KAREN L. MINER, California Department of Parks and Recreation, Southern Service Center, 8885 Rio San Diego Drive, San Diego, California 92108

ADRIAN WOLF and ROBB HIRSCH, Crystal Cove State Park, 8471 North Coast Highway, Laguna Beach, California 92651

Public lands are increasingly being relied upon to provide the natural open space necessary to conserve California's rich natural heritage. Simple inclusion of land in parks is often assumed to provide the habitat and protective mechanisms required to ensure the long-term viability of natural populations. The conflicts inherent in administering these lands for public use while protecting all resources, however, are often not taken into consideration. Here we examine if one species, the California Gnatcatcher (*Poliophtila californica*), is reproductively successful in a park with restored habitat near public facilities.

The California Department of Parks and Recreation purchased Crystal Cove State Park and began constructing facilities for public access in 1983. This park covers 1595 ha with approximately 5.1 km of coastline and is located in Orange County between the cities of Corona del Mar and Laguna Beach. At the time of acquisition, over 28 ha of the approximately 100-ha coastal terrace south of Pacific Coast Highway were devoid of vegetation and the severe compaction of the soils was accelerating bluff erosion. Remnants of the terrace's original coastal sage scrub occurred only in the canyons dissecting the terrace and along the bluff face. These areas were dominated by California sagebrush (*Artemisia californica*), with lemonadeberry (*Rhus integrifolia*), coyote bush (*Baccharis pilularis*), black sage (*Salvia mellifera*), bladderpod (*Isomeris arborea*), and Mexican elderberry (*Sambucus mexicana*) commonly in association.

As part of a 4-year development plan, 20 ha of abandoned roads, trails, parking areas, and disturbed areas adjacent to new construction were revegetated with a mix of coastal sage scrub species in order to increase cover of the native plant community and reduce bluff erosion on the terrace. Consequently, many of the areas treated were linear in shape and adjacent to the newly built facilities. The revegetation efforts encompassed a variety of restoration techniques, including scarification, importation of topsoil, prescribed burning, hydroseeding (55 to 127 kg/ha), broadcast of seeds by hand (13 to 80 kg/ha), mulch and tackifier application, and container planting (24,175 plants total) (Hillyard and Black 1988). Success of each treatment combination was not uniform over the entire treatment area. Adverse soil conditions and competition from exotic plants appeared to affect the establishment of coastal sage scrub species substantially. Several sites were retreated with various combinations of methods between 1983 and 1987, making it difficult to attribute revegetation success at any one site to a specific set of treatments.

Since 1991, park biologists have surveyed for the California Gnatcatcher on the 100-ha coastal terrace south of Pacific Coast Highway, between

CALIFORNIA GNATCATCHER USE OF RESTORED SAGE SCRUB

Pelican Hills Golf Course on the west and Muddy Creek on the east (Figure 1). Twelve pairs were observed within the study area in 1991, 14 pairs and 1 single male in 1992, 20–22 pairs in 1993 (Miner unpubl. data), and 41–44 pairs in 1994 (Hirsch and Wolf unpubl. data). The population increase from 1991 through 1993 was presumed to be due to the increase in available habitat on site and the lost of adjacent habitat to development. We presume the jump in the population from 1993 to 1994 to be largely a result of the 1993 Laguna Fire, which consumed most of the inland habitat in the San Joaquin Hills but not the coastal terrace (Atwood et al. 1998). Although fledglings were evident on site each year, it is unknown how much of the observed population increase was due to natural recruitment or to immigration from adjacent areas.

Regardless of the source of the increasing number of birds, the population of California Gnatcatchers is concentrated within the most highly visited portion of the park and is using restored habitat adjacent to areas heavily used by the public, such as park roads, trails, parking lots, and restrooms. There are five public parking lots, four of which are connected by a single access road parallel to the coast. A bike trail and five beach-access ramps serve pedestrians, bicyclists, and the park's safety and maintenance vehicles. Vegetation along these roads and trails is kept trimmed off the pavement edge. Two questions then arise: (1) are the gnatcatchers reproducing as

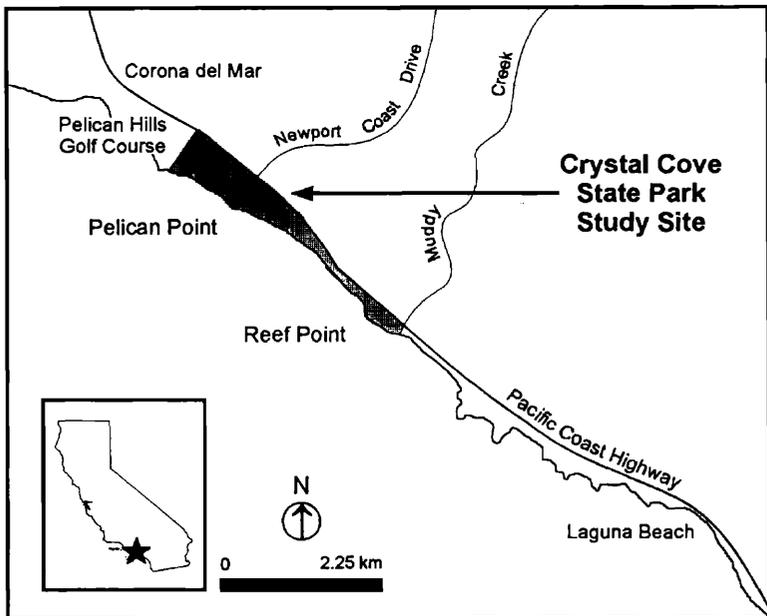


Figure 1. Location of the Crystal Cove State Park study site on the Pacific coast of Orange County, California.

CALIFORNIA GNATCATCHER USE OF RESTORED SAGE SCRUB

successfully in restored habitat as in nonrestored habitat, and (2) does the proximity of intensive public use negatively affect reproductive success?

METHODS

In 1995 surveys to identify individuals, pairs, and territories of California Gnatcatchers on the 100-ha coastal terrace of Crystal Cove State Park began on 25 February. The population density and resulting high level of territorial displays on the bluff tops of the park made locating the birds relatively easy. Researchers remained in areas of suitable habitat until the birds made themselves known either visually or by calling. In an effort to keep disturbance to a minimum, calling or "pishing" were used only on occasion when gnatcatchers were seemingly absent from patches of suitable habitat. Emphasis was placed on nonobtrusive observation throughout the breeding season.

Nest monitoring commenced 3 March and continued through 1 August. During this time, we limited ourselves to three and occasionally four visits per nesting attempt. Nests were located during the building phase from a distant observation point, then approached for the first time during incubation to document the number of eggs and any parasitism by the Brown-headed Cowbird (*Molothrus ater*). We revisited the nests after the adults began bringing insects to the nestlings to estimate the age and number of nestlings. Fifty nestlings were uniquely color-banded at 8 or 9 days of age. Nests were considered successful if the fledglings were seen during the first few days after leaving the nest.

We collected data on the nesting substrate, including host-plant species, after the nest was abandoned and no longer used as material for building the subsequent nest. In addition, we estimated the distance from each nest to the closest paved road or path. Using aerial photographs and acetate overlays, we mapped and compared gnatcatcher territories, nests, and previous restoration sites. For the purposes of this study, "restored" areas (Figure 2a) were defined as areas modified by means such as scarification, seeding, and planting to reestablish vegetative cover and included areas partially landscaped with nonnative species. Remnants of the original coastal sage scrub and scrub that regenerated naturally were considered "nonrestored" habitat (Figure 2b).

RESULTS

During the 1995 breeding season, 22 pairs and 3 single males were observed holding territories on the coastal terrace of Crystal Cove State Park. Eighteen (82%) of the pairs raised at least one young for a total of 73 fledglings and a mean of 3.32 fledglings per pair. Of the 91 nesting attempts observed in the study area during 1995, 22 (24%) were successful. A total of 69 (76%) nests failed. Of the failures, we attribute 43 (62%) to predation; 25 (36%) failed for undetermined reasons. We recorded one case of nest parasitism by a Brown-headed Cowbird, and that nest failed because of abandonment by the adults.

Nest success did not appear to be dependent on whether the nest was placed in restored or non-restored habitat. Nine of 42 nests (21%) placed in

CALIFORNIA GNATCATCHER USE OF RESTORED SAGE SCRUB



Figure 2. Coastal Sage Scrub vegetation at Crystal Cove State Park: (a). "restored" habitat: (b). "nonrestored" habitat. Five-foot pole is shown for comparison of shrub height.

restored areas and 13 of 49 (27%) nests placed in nonrestored areas were successful ($\chi^2 = 0.321$, d. f. = 1, $P > 0.05$).

Most of the territories contained a mix of restored and nonrestored habitat, and because of the complicated distribution of treated areas the actual portion of restored habitat in each territory was difficult to determine. However, of the five pairs whose territories were fully within restored

CALIFORNIA GNATCATCHER USE OF RESTORED SAGE SCRUB

habitat, four were successful in fledging at least one young from 5 of 16 nests, for a nest-success rate of 31%. Three pairs had territories fully within nonrestored habitat, and two of these were successful with 3 of 16 (19%) of the nests fledging at least one young.

Table 1 shows the frequency of plant species used for nest placement in restored and non-restored areas. California sagebrush and California encelia (*Encelia californica*) were the first and second most frequently used species for nest placement in both restored and nonrestored areas. A significant number of nests (19%) in the restored areas were placed in Brewer's saltbush (*Atriplex lentiformis* ssp. *breweri*). One territory was centered on a landscaped area, in which several of the large shrubs were nonnative, accounting for the placement of one nest in Australian bottlebrush (*Melaleuca nesophila*). Gnatcatchers built nests in a greater diversity of plants in the restored than in the nonrestored habitat.

Nest success also did not appear to be negatively affected by the proximity of the nest to actively used and maintained roads or trails (Figure 3). Thirteen percent of the nests were placed within 3 meters of a paved road or trail. Thirty-three percent of these were successful. While this success rate is higher than for those placed greater than 3 meters from a road or trail (23%), the difference was not significant ($\chi^2 = 0.632$, d. f. = 1, $P > 0.05$).

DISCUSSION

Population increases observed on the coastal terrace from 1991 to 1993 were likely due to suitable habitat, once restored, being available for California Gnatcatchers either recruited from the local breeding population or displaced by development of surrounding habitat. In the fall of 1993, the

Table 1 Plant Species Used for Nest Placement by California Gnatcatchers at Crystal Cove State Park in 1995^a

Species	Number of nests		Percentage of total
	Restored	Nonrestored	
California sagebrush, <i>Artemisia californica</i>	14	27	45
California encelia, <i>Encelia californica</i>	10	10	22
Brewer's saltbush, <i>Atriplex lentiformis</i> ssp. <i>breweri</i>	8	2	11
California buckwheat, <i>Eriogonum fasciculatum</i>	5	2	8
Coastal goldenbush, <i>Isocoma menziesii</i>	1	3	4
Coyote brush, <i>Baccharis pilularis</i>	0	2	2
Black sage, <i>Salvia mellifera</i>	2	0	2
Lemonadeberry, <i>Rhus integrifolia</i>	1	0	1
Pink melaleuca, <i>Melaleuca nesophila</i>	1	0	1
Prickly sow thistle, <i>Sonchus asper</i>	0	1	1
Total	42	47	

^aSee text for definition of plants considered "restored" and "nonrestored."

CALIFORNIA GNATCATCHER USE OF RESTORED SAGE SCRUB

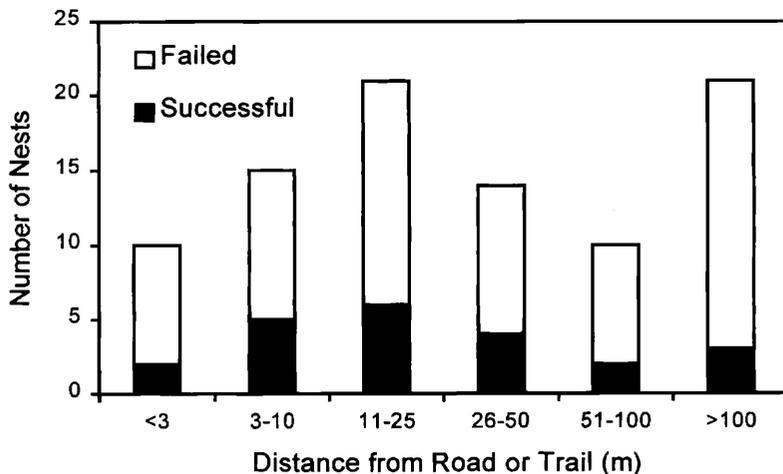


Figure 3. Number of California Gnatcatcher nests observed at increasing distances from paved roads or trails at Crystal Cove State Park in 1995. Differences in success rates were not significant.

Laguna Fire consumed a large area of the San Joaquin Hills, including the inland portion of Crystal Cove State Park and other adjacent parklands. Subsequently, increases in the number of gnatcatchers within unburned refugia on the fire's margins, including the Crystal Cove study site, were observed in 1994, presumably because of immigration of displaced birds (Atwood et al. 1998, Bontrager et al. 1995a). The population at the Crystal Cove study site doubled between 1993 and 1994, resulting in reduced and overlapping territories (Hirsch pers. obs.). In 1995, the number of California Gnatcatchers (22 pairs) were similar to that observed in 1993 (20–22 pairs). A possible explanation for the decline in 1995 is increased mortality due to the harsh, wet winter of 1994–1995. Similar population declines between 1994 and 1995 were observed for other gnatcatcher populations in Orange County (Erickson and Miner 1998, Atwood et al. 1998). Dispersal from the site in response to overcrowding is another possible explanation. Only a few gnatcatchers were observed within the burned area in 1995 and 1996, however (P. Galvin pers. comm., Griffith Wildlife Biology unpubl. data). Therefore, if gnatcatchers dispersed from Crystal Cove, most either relocated to remote unsurveyed sites or perished. Subsequent population estimates for the Crystal Cove terrace (29 pairs in 1996 and 25 pairs in 1997, Hirsch unpubl. data) and the fact that very little suitable habitat there goes unused by gnatcatchers indicate that the site may be near carrying capacity. However, habitat restoration on the terrace is continuing.

Vegetation restoration at Crystal Cove State Park has provided additional suitable habitat for California Gnatcatchers, as evidenced by the large proportion of pairs raising offspring from nests in restored areas. While we

CALIFORNIA GNATCATCHER USE OF RESTORED SAGE SCRUB

did not quantify the structure and diversity of restored vs. nonrestored habitat, it appears that the wider variety of plant species used for nest placement in the restored habitat generally reflects the availability in that habitat. Nevertheless, California sagebrush and California encelia were the primary nesting substrates used by the California Gnatcatcher in both the restored and nonrestored habitat.

It also appears that breeding success of California Gnatcatchers on the coastal terrace of Crystal Cove State Park is not being negatively affected by current management practices and levels of public use. Nest success in 1995 was independent of the distance of nests from human activity. In addition, the reproductive success at the Crystal Cove terrace (3.32 fledglings/pair, $n = 22$) was higher than that reported for the San Joaquin Hills area of Orange County in general in 1995 (2.7 fledglings/pair, $n = 38$, including 8 pairs from the Crystal Cove study site; Bontrager et al. 1995b).

As open space diminishes, public lands are being sought to provide additional recreational opportunities, as well as other land uses, in addition to preserving natural communities. Many of these lands are becoming isolated and are increasingly subjected to urban pressures, so that active management is necessary to assist or artificially continue natural processes. Meeting the challenge of managing park lands for the significant resources for which these lands were set aside requires empirical assessment of the effects of land use and management decisions on these resources. This study was an attempt to provide such an assessment of the effects of habitat restoration and recreation on the California Gnatcatcher population on the coastal terrace of Crystal Cove State Park.

SUMMARY

The California Department of Parks and Recreation initiated restoration of the native vegetation on the coastal terrace of Crystal Cove State Park as part of park development in 1983. As of 1995, 20 ha had been revegetated with coastal sage scrub. California Gnatcatchers increased from 12 pairs in 1991 to at least 41 in 1994, declining to 22 in 1995. Increase in available habitat on site and reduction of adjacent available habitat from development and fire presumably both contributed to the observed population increase. The decline in 1995 was likely due to an increase in winter mortality. Intensive monitoring in 1995 revealed that restored habitat was included in 19 of 22 territories and nests in restored areas were as likely to produce at least one young as nests in naturally generated scrub. Thirteen percent of the nests were placed within 3 meters of actively used roads or trails, and their success rate was similar to that of nests placed further from these high-use areas. Breeding success of California Gnatcatchers on the coastal terrace of Crystal Cove State Park appears not to be negatively affected by current management practices and levels of public use.

ACKNOWLEDGMENTS

We thank Dana Kamada, Amy Gorospe, David Bontrager, and Edward Almanza for sharing their data from the portion of the population they monitored under a

CALIFORNIA GNATCATCHER USE OF RESTORED SAGE SCRUB

separate study, and for their efforts in providing banding expertise. Funding was provided, in part, by the California Department of Parks and Recreation, Orange Coast District, and Prudential Securities.

LITERATURE CITED

- Atwood, J. L., Bontrager, D. R., and Gorospe, A. L. 1998. Use of refugia by California Gnatcatchers displaced by habitat loss. *W. Birds* 29:406-412.
- Bontrager, D. R., Erickson, R. A., and Hamilton, R. A. 1995a. Impacts of the 1993 Laguna Canyon fire on California Gnatcatchers and Cactus Wrens, in *Brushfires in California Wildlands: Ecology and Resource Management* (J. E. Keeley and T. Scott, eds.), pp. 69-76. Int. Assoc. Wildland Fire, Fairfield, WA.
- Bontrager, D. R., Gorospe, A. L., and Kamada, D. K. 1995b. Breeding biology of the California Gnatcatcher in the San Joaquin Hills, Orange County, California. Report prepared for and available from U. S. Fish & Wildlife Service, Carlsbad Field Office, 2730 Loker Ave. West, Carlsbad, CA 92008.
- Erickson, R. A., and Miner, K. L. 1998. Four years of synchronous California gnatcatcher population fluctuations at two locations in coastal Orange County, California. *W. Birds* 29:333-339.
- Hillyard, D., and Black, M. 1988. Coastal sage scrub revegetation at Crystal Cove State Park, Orange County, California: 1987 update, in *Proceedings of the Second Native Plant Revegetation Symposium*, 15-18 April 1987, San Diego (J. P. Rieger and B. K. Williams, eds.), pp. 143-152. Soc. Ecol. Restoration & Mgmt., Madison, WI.

Accepted 9 July 1998