Status of the Cactus Wren (*Campylorhynchus brunneicapillus*) within the Coastal Subregion of Orange County, California

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Abstract: In 1993 the Laguna Fire burned 75% of the coastal reserve of the Nature Reserve of Orange County (NROC). From 1999 to 2004, annual monitoring efforts showed the cactus wren population in the coastal reserve declined from an estimated 132 (±93) to 55 (±40) territories, a 58% decline during the six years. In the same period, the estimated decline in the central reserve was only 26%, a figure consistent with short-term declines documented for other CSS birds, including the California gnatcatcher, during the same period. In 2006, we completed two rounds of focused cactus wren surveys in the coastal reserve, including existing use, special linkages, and non-NROC open space areas. We mapped and classified all cactus-containing habitats within 20 management areas. These surveys found 65 occupied territories within the coastal reserve. Using site occupancy models we estimate 71.4 (±6) territories were present in the surveyed area. Out of 2,323 acres of cactus scrub mapped in 2006, 1,336 acres, or 58%, mostly within the Laguna Fire perimeter appeared to be insufficiently developed for occupancy by cactus wrens. Only 187 acres were found to be occupied, whereas our estimates based on historic data indicate approximately 1,473 acres were occupied in 1992, an 87% decline. Out of eight management areas that held at least 8 territories in 1992, only two areas, Sand Canyon and Turtle Rock, did not show significant declines between 1992 and 2006. Portions of the coastal reserve experiencing significant losses included the Sycamore Hills and Aliso & Woods management areas, both of which did not burn in 1993. Declines in unburned areas may reflect differences in biological productivity, edge effects, and an inability of wrens to disperse large distances. Given the small size of the cactus wren population in the coastal reserve, slow recovery of burned cactus scrub habitat, and significant population declines in unburned areas, this population warrants further focused study and development of a management program that aims toward stabilizing the population in the short-term.

Introduction

Survival of the coastal cactus wren (*Campylorhynchus brunneicapillus*) is considered one of the great challenges in bird conservation for southern California (Unitt, 2004). A year-round resident of the sunny and dry landscapes of southern California's Pacific-slope, the coastal cactus wren has historically maintained a limited distribution in coastal southern California and extreme northwestern Baja California, with the majority of the coastal population centered in Orange County, California (Harper and Salata, 1991).

The coastal cactus wren, a habitat specialist of southern cactus scrub, builds its nests almost exclusively in mature stands of coastal cholla (*Cylindropuntia prolifera*) and coastal prickly pear (*Opuntia littoralis*) cactus. These well protected nests serve as night roosts for adults and juveniles throughout the year. In the last century, much of the coastal cactus wren habitat in the region has been reduced due to development and agricultural displacement (O'Leary, 1995). Following changes in land use, dramatic declines for the species were reported for Orange and San Diego Counties (Rea and Weaver, 1990).

In 1996, as part of the statewide Natural Community Conservation Planning (NCCP) program, the coastal and central reserves of Orange County, totaling more than 38,000 acres, were formed to protect the increasingly rare plant and animal species associated with the coastal sage scrub plant community of southern California. In response to the dramatic declines of cactus wren habitat and naturally limited distribution of the species, the regional conservation plan identified the cactus wren as one of three target species described as the focus of NCCP planning (NCCP County of Orange Central & Coastal Subregion, 1996).

During development of the conservation plan, the unanticipated Laguna Fire of 1993 burned more than 75% of the total land area in the coastal reserve. Concern about the fire's immediate impact on the coastal cactus wren population prompted post fire surveys that revealed the number of cactus wren pairs in the burn area was less than 28% of pre-fire levels (Bontrager et al., 1995). Annual surveys of the burn area, performed to monitor the recovery of the target species in the nature reserve, indicated that the number of pairs of birds in the burn area had yet to recover as of 2001 (Harmsworth, 2001a).

Recent reports prompted additional concerns over the viability of the coastal population of cactus wrens. Hamilton (2004) warned of further declines throughout the coastal reserve, citing estimates that show the number of cactus wren pairs in the coastal reserve declined by 58% since 1999, with the 2004 population decline uncharacteristically out of sync with trends reported for the central reserve population of cactus wrens and California gnatcatchers. Following completion of six years of field surveys, Hamilton (2004) concluded that the current status of coastal cactus wrens in the coastal reserve warranted further investigation and was of potential significant conservation concern.

The slow recovery of the cactus wrens in the coastal reserve has been attributed in the past to the habitat specialization of the species. The southern cactus scrub plant community is susceptible to high intensity fires, and with the slow growth rates of cactus, recovery times for this habitat following a wildfire are suspected to be on the order of decades. With much of the coastal reserve's cactus scrub habitat destroyed in the 1993 wildfire, wren numbers were initially expected to remain low until the cactus stands once again reached maturity. Thus the lack of recovery to date for this population of cactus wrens, following the 1993 wildfire, is not surprising. However, what is unexpected is the recent indication that the population is undergoing further declines. At present, the reasons behind this recent decline remain unknown.

To further complicate cactus wren recovery, the increase in urbanization of the region is expected to lead to a subsequent increase in the ignition rate of wildfires (Keeley and Fotheringham, 2001). This expected increase in fire frequency suggests that fires similar to the Laguna Fire in 1993 will become more frequent in future years and likely threaten the long-term viability of the southern cactus scrub plant community and its animal associates throughout the region.

In order to better understand the repercussions of more frequent wildfires and meet the conservation challenges presented by the coastal cactus wren population, the Nature Reserve of Orange County funded a multifaceted research study to more thoroughly understand the issues surrounding cactus wren viability. Because of current gaps in knowledge concerning the status of cactus wrens in the coastal reserve and potential future need for direct management of this species in the reserve, we conducted field studies in the spring and summer of 2006 designed to: 1) elucidate the present-day status of cactus wrens in the coastal reserve; 2) identify new threats to the population; and 3) guide future restoration efforts.

In this report, we describe methodologies used to survey and census cactus scrub habitat and cactus wren population in the coastal subregion, identify key results, and propose new interpretations for the recently documented wren declines. We conclude the work with recommendations for future research and management of the population.

Methods and Materials

In the spring and summer of 2006 we mapped the extent of cactus scrub habitat and surveyed for the presence of cactus wrens in the coastal reserve including special linkage, existing use, and non-reserve open space. Field surveys were designed to allow for the definition of the extent of southern cactus scrub and distribution of cactus wrens in the coastal subregion. In addition, research was meant to inform biologists of what constitutes suitable habitat for coastal cactus wrens and aid in the streamlining of future cactus wren monitoring efforts.

All fieldwork was conducted in two stages. The first stage involved the mapping of habitat and initial survey for cactus wrens at all mapped sites. Mapping and survey efforts took place concurrently in the field during the first stage. The second stage involved repeat surveys of all sites identified in stage one.

Mapping effort required identifying and recording the location on field maps of all areas of scrub that included cactus patches judged capable of supporting nesting cactus wrens (i.e., stands ≥ 1 m tall that were expansive enough to protect a nest; see Appendix). These areas were mapped as cactus scrub and surveyed for wrens. Large contiguous areas of cactus scrub, which were not able to be surveyed adequately from a single point, were divided into multiple sites. Typically, the absence of cactus cover and/or ridge-lines and drainages, were used to delineate survey site boundaries. Site boundaries were defined as to maximize the independence of each site (i.e. minimize the likelihood of inter-site movement by wrens).

Following site selection and delineation, each site was surveyed from a single, strategically located vantage point. The point location was captured using GPS (NAD 83) and noted clearly on the field map. Cactus wren surveys involved playing tapes of the cactus wren call and listening and watching for responses. Specifically, surveys involved cactus wren vocalizations being played for three 40 seconds intervals with a minute of silence between each interval. Upon detection of a cactus wren vocalizations were discontinued. At a minimum, each site was surveyed for at least five minutes or until a cactus wren was detected. Cactus wren presence was occasionally recorded outside of this 5-minute period.

The second stage of fieldwork involved resurveying all sites present within mapped polygons of cactus scrub for the presence of cactus wrens. Performing repeat surveys was necessary for estimating detection probabilities. Understanding a species' detection probability is critical for effective monitoring as it allows researchers to reliably estimate the annual proportion of sites or area occupied by a species and associated error.

In addition to recording the spatial location of all mature cactus scrub, we identified the location on field maps of all significant individual prickly pear and cholla plants, termed "satellites", and the extent of scrub containing cactus stands not yet mature enough to support cactus wrens, termed "proto-cactus scrub".

During both the first and second stage of the field effort qualitative characteristics of the habitat was also recorded. Each surveyed site was scored on its quality of cactus scrub and cholla development. Sites received a score of 1, 2, 3, or 4 describing type of cactus scrub and a score of 1, 2, or 3 for cholla development (see Appendix). For cactus scrub, scores varied between sites differing in path size, areal cover of mature cactus, and the presence or absence of cholla. For cholla, scores varied between sites differing in development of cholla cluster, cholla height, and branching structure.

To estimate present-day rates of occupancy for the cactus wren, we constructed likelihood-based models of site occupancy using the program PRESENCE (MacKenzie et al. 2002). In these models we included site covariates describing cactus structure and vegetative composition and size of surveyed cactus scrub patches to assess the importance of these key habitat features in explaining species presence and absence. Candidate set of models were ranked according to AIC criteria (Akaike 1973) and parameter estimates (i.e. site occupancy, local extinction, and detection probability) model-averaged using Akaike weights to derive a weighted average. Model fit was assessed using methods developed by MacKenzie and Bailey (2004).

We used a one-sample t-test to check for differences in the proportion of high quality habitat between management areas and chi-square analyses to test for differences in proportion of sites occupied between sites with and without highest ranking habitat types present.

In order to compare the results of our surveys with historic data describing the distribution of cactus wren in the coastal reserve in 1992, we buffered individual wren locations identified in 1992 by 75 m and checked for overlap between buffered areas and the boundaries of sites defined in the present study. If overlap occurred, sites were considered to be occupied in 1992. Similarly, we estimated the total amount of mapped cactus scrub habitat occupied in 1992 by calculating the total acreage of all mapped polygons in full or partial contact with buffered historic wren locations.

Results

We identified and mapped 2,323 acres of cactus scrub habitat in the coastal subregion (Fig. 1). Of the 2,323 acres, 1,473 acres (or 63%) were considered to be occupied in 1992. In our 2006 surveys, we found cactus wrens occupying sites totaling 187 acres in size, indicating an 87% decline in the total amount of acreage occupied over the 14 year period.

Much of this decline in occupied habitat can be attributed to the 1993 Laguna Fire, which burned roughly 13,000 acres in the San Joaquin Hills. Of the 2,323 acres of cactus scrub mapped in 2006, 1,336 acres (or 58%) was mapped as “proto-cactus scrub” and appeared to be insufficiently developed for occupancy by cactus wrens.

Within the 987 acres of cactus scrub habitat judged suitable for occupancy by cactus wrens, 421 sites were delineated and surveyed in our study. Of these 421 sites, we found cactus wrens at a total of 65 sites. Based on the results of our occupancy modeling (Table 1) we estimate 71.4 ± 6 (Mean ± SE) territories were present in the surveyed areas during the double-round surveys. This total represents approximately a 60% decline from estimated 1992 levels, which, using our method of estimating historical occupancy, we show to be at a minimum of 172 occupied sites. The relatively small error around our occupancy estimate indicates a clear decline from 1992 as the ninety-nine percent confidence interval around the estimate ranges from 49.5 to 93.4 sites.

Of the 421 cactus scrub sites, 103 included both Mexican Elderberry (*Sambucus mexicana*) and Class I *Opuntia* and/or *Cylindropuntia* patches. Sites classified as Class I *Opuntia* included at least one contiguous acre with ≥ 20% estimated areal cover of mature cactus (generally ≥ 1 m tall). Sites classified as Class I *Cylindropuntia* had at least one cluster of cholla that was fully developed, standing ≥ 1.3 m tall and in good health with extensive branching.

Sites that contained both *Sambucus* and Class I *Opuntia* and/or *Cylindropuntia* were identified as “Combination” sites. The highest ranking occupancy model included the site covariate “Combination” in its model structure, indicating wren occupancy was better explained by the presence and absence this combination of vegetative characteristics relative to any other singular descriptors (e.g. presence/absence of *Sambucus mexicana* or Class I *Opuntia*; Table 1). According to the highest ranging model, cactus wrens were 8.0 times (± SE = 2.4) more likely to be found at "Combination" sites that at any other sites.

As is expected, other more direct measures of wren occupancy showed the same relationship between habitat type and wren presence. Of the 65 cactus wren territories detected in our surveys, 40 (62%) were in sites with "Combination" type of vegetation present, indicating again, the strong preference by wrens for "Combination" or high quality sites ($\chi^2 = 57.169$, df = 1, $P < 0.0001$).

Interestingly, patch size did not improve model support nearly as much as measures of habitat quality (Table 1). Patch size did, however, influence rates of detection, with wrens more likely to be detected if they were present in larger habitat patches relative to smaller patches.

Overall, measures of model fit indicated the highest ranking occupancy model was an adequate description of the data ($\chi^2 = 1.2139$, $P = 0.33$, c-hat = 1.012; see MacKenzie and Bailey [2004] for a description and interpretation of these measures).

Declines in wren occupancy between 1992 and 2006 were not consistent across sampled areas. Examining eight specified management areas with a minimum of 8 historic occupied sites (Fig. 2), six showed major declines whereas two showed little or no change (Table 2).

Interestingly, the two management areas that showed no change, Sand Canyon and Turtle Rock, supported a higher proportion of habitat categorized as high quality (Mean ± SE = 0.70 ± 0.08, n = 2) than the other management areas (0.254 ± 0.07, n = 6; one-sample t-test: $t_6 = 3.624$, $P < 0.05$). The importance of these two management areas for the coastal population of cactus wrens, becomes apparent when the differences in total proportion of the population found in these areas in 1992 (38% of the total number of occupied sites) versus 2006 (73%) are compared.

Discussion

Our work shows a major change in the distribution of cactus wren population in the coastal subregion between 1992 and 2006. Estimates show an 87% reduction in the total area of cactus scrub occupied since 1992, and in areas still supporting wren habitat the estimated reduction, as measured in the number of occupied cactus scrub sites, is close to 60%.

We assume that the observed changes in distribution of the wrens represent loss from the population. For the most part, cactus wren populations are stable in the absence of major disturbance (Hamilton, 2004). Thus, declines reported in the present-study likely represent sustained loss and are largely not the byproduct of regular inter-annual fluctuations in population size.

When interpreting these patterns of loss it is important to look at fire history. The absence of wrens from many sites could be explained by the slow recovery rate of cactus following wildfire. Even though the surveyed areas are 13 years post-fire, approximately 60% of cactus scrub mapped in 2006 had yet to recover and was considered unsuitable for use by cactus wrens. The present-day sparseness of the cactus cover and its generally diminutive stature in these areas present unsuitable nesting sites for use by the cactus wrens. It is generally known that cactus wrens prefer taller (>1m) cactus for nesting (Rea and Weaver, 1990; Flaagan, 1999; and Harmsworth, 2001b) and clearly, based on our work, the quality of cactus habitat present at a site influences occupancy of the site by cactus wrens.

The presence of *Cylindropuntia prolifera* (coastal cholla) at survey sites was shown in earlier surveys to be an important component of suitable cactus wren habitat in the coastal reserve (Harmsworth, 2001b). Coastal cholla is also known to be the typical choice for nest sites in southern San Diego County where large prickly pear cactus (*Opuntia littoralis*) are scarce (Rea and Weaver, 1990). Our results largely agree with these findings and also stress the importance of well developed stands of *Opuntia littoralis* in explaining local patterns of occupancy.

We show the presence of lemonade berry (*Rhus integrifolia*) is of little value when attempting to predict the presence or absence of wrens, but the presence of Mexican elderberry (*Sambucus mexicana*), when in the combination with mature cholla or prickly pear cactus stands, is an important component of suitable wren habitat. The diet of the cactus wren is known to consist partly of elderberry fruit (Bent, 1948). Elderberry is thought to offer cactus wrens important high perches and foraging habitat (Hamilton, 2004) and is likely an indicator of high quality foraging habitat as it favors moister environments.

Cactus wren losses were not consistent throughout the study region. Two of the management areas (Sand Canyon and Turtle Rock) outside of 1993 Laguna Fire perimeter showed no change between the years, while all other major management areas showed declines. What explains this differential loss? Clearly it is not solely fire history. Although major declines were documented within the 1993 Laguna Fire perimeter, losses also occurred in the unburned Sycamore Hills and Aliso and Woods Management Areas. In these areas, habitat structure did not change during the 14 year interval between surveys, thus in theses two cases alternative explanations are necessary to explain the wren declines.

There are several reasons why wrens might decline in areas outside of the burn perimeter. (1) Areas support a smaller prey base; (2) Cactus wren populations in the management areas became isolated following the fire; and (3) Rates of predation are higher in the two management areas relative to other sampled areas.

Differences in prey availability between management areas could explain the observed differences in wren population stability. Cactus wren locations in the two stable management areas, Turtle Rock and Sand Canyon, were clustered in cactus scrub habitat adjacent to low elevation grasslands. Grassland-scrub matrix is typically biologically more productive than scrub and chaparral dominated habitats, and thus in these areas a more consistently rich prey base might be available to the local wren population providing greater long-term population stability.

Isolated sites are more likely to lose dispersing juveniles and receive minimal recruitment from distant populations. Nearest-neighbor distance is much greater for cactus wrens in the isolated populations. If cactus wrens tend to settle in cactus patches near other cactus wrens, birds in higher-density populations would tend to disperse shorter distances, thereby bolstering those local populations, while birds in sparsely populated areas might need to travel farther distances in search of new population centers. Unoccupied and isolated sites in the Sycamore Hills and Aliso and Woods Management areas are less likely to be colonized if the wrens suffer from limited dispersal abilities. The dispersal ability of juvenile cactus wrens has been estimated to average 2 km with dispersal events up to 10 km considered very rare (Atwood, 1998). In general, cactus wrens are considered to be poor colonizers of suitable habitat isolated by urbanization (Soule, 1988; Ogden Environmental and Energy Services, 1992), thus in the highly urbanized coastal subregion movement between isolated sites might be minimal.

Edge effects and increased predation by edge-adapted predators such as the Cooper's Hawk could also explain loss. Although this is possible, cactus wrens can nest close to roads and human habitations as long as requisite vegetation for nesting and foraging is present (Eggert, 1996; Wheeler, 1997). In addition, surveys conducted in the coastal reserve show south of the transportation corridor the majority of cactus wren locations were found along the urban-scrub interface (Harmsworth, 2001b).

Conclusion

The temporary but prolonged loss of habitat due to Laguna Fire in 1993 has had large consequences for the cactus wren population in the coastal reserve. With the recovery time of the young cactus stands estimated to be several decades away, it is likely management of the wren will require modification of natural areas (e.g. the creation and distribution of artificial cactus structures) as to enhance nesting sites for wrens in the interim period. In addition, further research is needed concerning the dispersal behavior of juvenile and adults wrens. If movement is limited in urbanized regions of the county, and isolated but otherwise productive areas go uncolonized following local extinction events, then the cactus wren population in the coastal subregion as a whole will continue to exist well below the true carrying capacity of the Nature Reserve and eventually be threatened with regional extinction.

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Table 1. Summary of model selection procedure and parameter estimates for the cactus wren (*Campylorhynchus brunneicapillus*). Difference in AIC values between each model and the low-AIC model (ΔAIC); AIC model weights (w), number of parameters in the model (K); overall estimate of the fraction of sites occupied (ψ), probability of detection (P), and associated standard error (in parentheses).

Model	ΔAIC	w_i	K	Ψ	P
ψ(Combination)*p*(Size)	0.00	0.86	4	0.18 (0.02)	0.64 (0.05)
ψ(Combination)*p*(·)	3.63	0.14	3	0.17 (0.02)	0.70 (0.05)
ψ(*Opuntia*)*p*(·)	33.20	0.00	3	0.17 (0.03)	0.70 (0.05)
ψ(*Sambucus*)*p*(·)	36.48	0.00	3	0.17 (0.03)	0.70 (0.05)
ψ(*Cylindropuntia*)*p*(·)	41.43	0.00	3	0.17 (0.05)	0.70 (0.05)
ψ(Size)*p*(·)	50.59	0.00	3	0.17 (0.04)	0.70 (0.05)
ψ(·)*p*(·)	52.15	0.00	2	0.17 (0.02)	0.70 (0.05)
ψ(*Rhus*)*p*(·)	54.07	0.00	3	0.17 (0.03)	0.70 (0.05)
Model-averaged estimates:				0.18 (0.02)	0.65 (0.05)

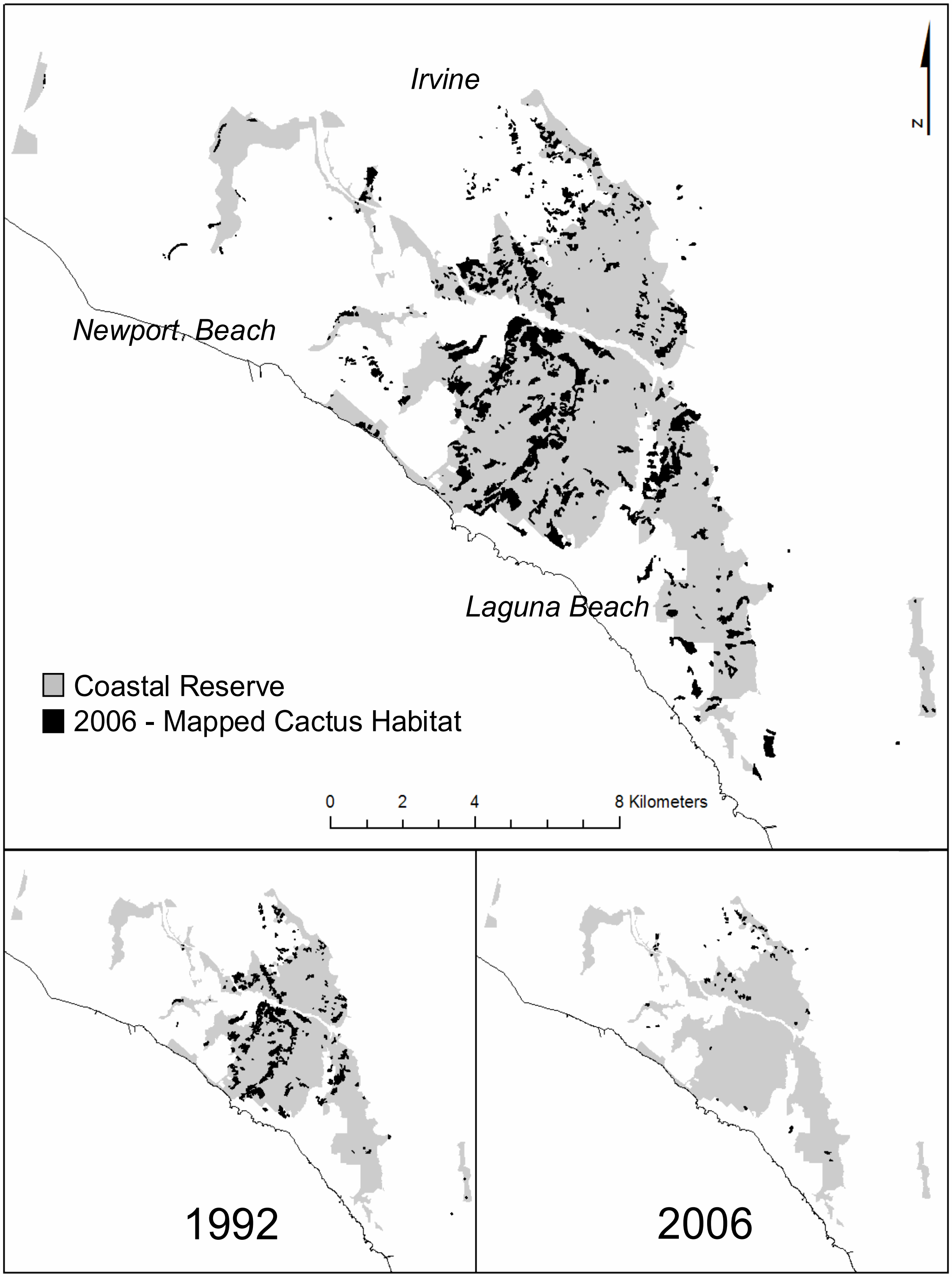
Table 2. Number of survey sites, number of occupied sites in 1992 and 2006, and proportion of surveyed habitat categorized as "high quality" by Management Area. "High quality" habitat defined by presence of both *Sambucus* and Class I *Opuntia* or *Cylindropuntia*. Estimates of the number of sites occupied in 1992 are based on historic survey data and 75m distance rule. An asterisk in the "# sites occupied in 2006" column indicates a significant decline ($\alpha = 0.00625$) in the proportion of occupied sites between 1992 and 2006.

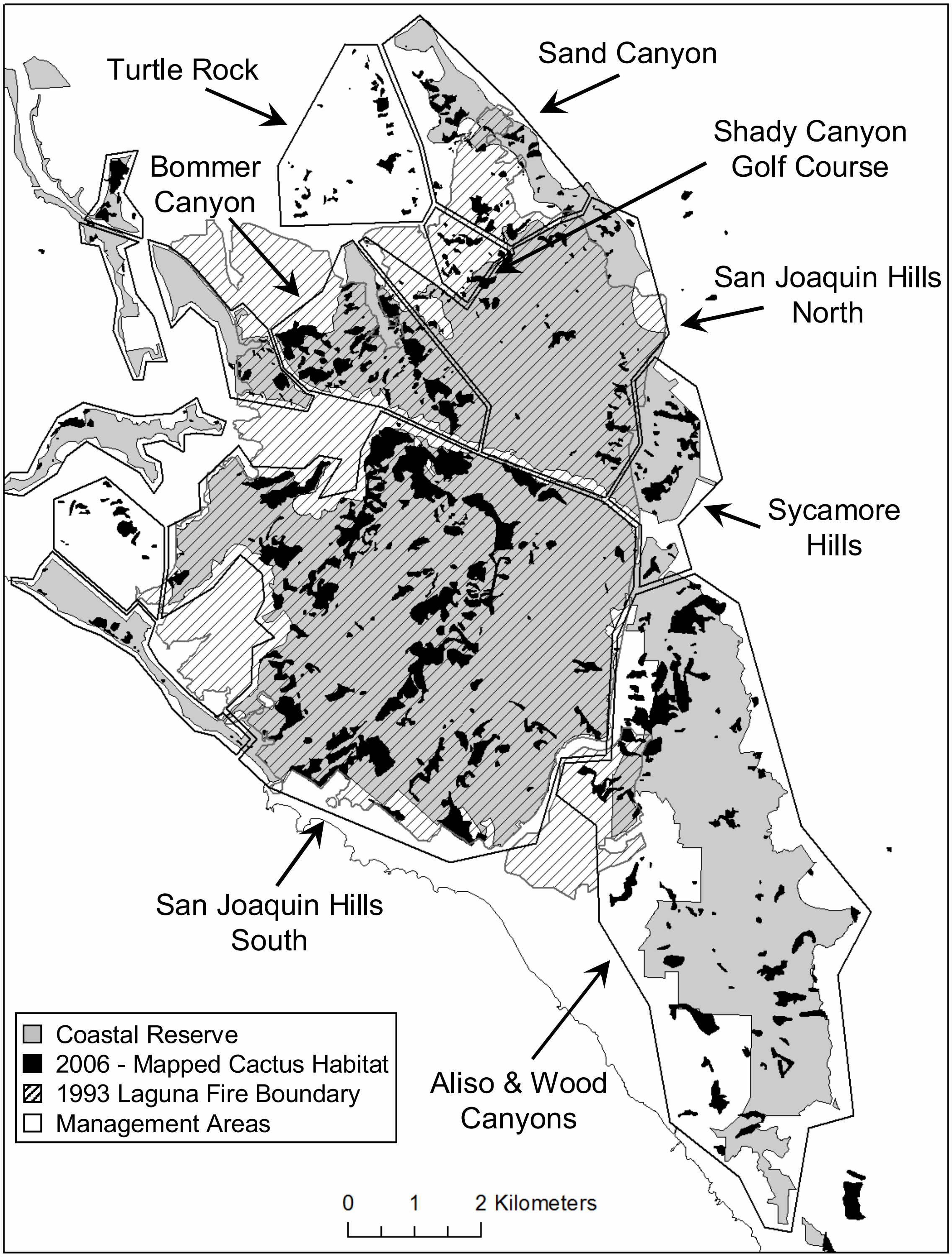
Management Area	# survey sites	# sites occupied 1992	# sites occupied 2006	Proportion of surveyed habitat categorized as "high quality"
Sand Canyon	62	22	21	0.78
Turtle Rock	29	8	8	0.63
Bommer Canyon	51	30	12*	0.40
Shady Canyon Golf Course	16	11	0*	0.19
San Joaquin Hills North	38	21	5*	0.34
San Joaquin Hills South	40	22	3*	0.00
Sycamore Hills	37	22	3*	0.42
Aliso & Wood Canyons	78	21	3*	0.19

Figures

1. Upper frame: Cactus scrub mapped in 2006. Lower frames: Cactus scrub considered occupied in 1992 and cactus scrub known to be occupied in 2006.

2. Management Areas in the coastal reserve with at least eight historically occupied sites. Solid dark polygons indicate boundaries of cactus scrub mapped in 2006. Dashed area shows 1993 Laguna Fire boundary.


Irvine
N
Newport Beach
Laguna Beach
Coastal Reserve
2006 - Mapped Cactus Habitat
0
2
4
8 Kilometers
1992
2006


Turtle Rock
Sand Canyon
Shady Canyon Golf Course
Bommer Canyon
San Joaquin Hills North
Sycamore Hills
San Joaquin Hills South
Aliso & Wood Canyons
Coastal Reserve
2006 - Mapped Cactus Habitat
1993 Laguna Fire Boundary
Management Areas
0
1
2 Kilometers

Appendix - 2006 NROC Cactus Wren Study Field Data Form A

Date: __ __ / __ __ / 2006
month day

Investigator: ________________ Planning Area/Uppercase Alpha Code: ____________ Polygon Numeric ID: ______

Site Lowercase Alpha ID: ____ Survey Pt. GPS (NAD 83) 11S ________________; ________________

Prickly-Pear ≥ 1 m Tall at Site: Yes No *Rhus integrifolia* at Site: Yes No

Cholla ≥ 1 m Tall at Site: Yes No *Sambucus mexicana* at Site: Yes No

Cactus Scrub Type (choose one, see below): Type 1 Type 2 Type 3 Type 4

Cactus Wren Detected in Polygon (Specify How Many Ad's &/or Juv's): Adults ____ Juv's ____

Brown-headed Cowbird Detected On Site (How Many): On Site ____ Fly-overs ____ Juv's ____

California Gnatcatcher Detected On Site: Yes No

List up to Four Dominant Overstory Plant Species in Descending Order of Abundance

(1) ______________________________ (2) ______________________________

(3) ______________________________ (4) ______________________________

Field work may be conducted in fair weather (no rain or drizzle) at any time of day. Temperatures should not exceed 85˚F and estimated wind should not exceed 8 mph.

All cactus detected, including isolated plants, shall be mapped in one way or another (see below).

Each Planning Area shall be given an uppercase alpha ID (A, B, C, etc.).

Scrub that includes cactus patches judged capable of supporting nesting Cactus Wrens (i.e., stands ≥ 1 m tall that are expansive enough to protect a nest) shall (a) be considered a "polygon," (b) given a numeric ID (1, 2, 3, etc.), and (c) surveyed for wrens. Numbering of polygons restarts at "1" in each Planning Area.

Each polygon shall include at least one "site," which shall be given a lowercase alpha ID (a, b, c, etc.). Thus, a given site will have a unique ID, such as "D03d." Large polygons, which cannot be surveyed adequately from a single point, shall be divided into multiple sites. Each site shall receive a unique "Alpha-numeric-alpha" ID.

First, map the entire polygon perimeter, erring on the side of making larger polygons rather than dividing them into multiple smaller polygons. Divide the polygon into as many sites as are needed to effectively survey the entire polygon. In some cases, the break between sites in a single polygon will have to be somewhat arbitrary. Within a given polygon, ridges, other topographic features, and/or breaks in cactus scrub habitat should be used to delineate one survey site from another. Each survey site should be independent (wrens should not be able to readily move between sites). Map the location of any cholla plants within the polygon.

Each site shall be surveyed from a single, strategically located vantage point. GPS the point (using NAD 83) and note it clearly on the field map.

Cactus Scrub Type 1: Highest quality. Site includes at least 1.0 *contiguous* acre with ≥ 20% estimated areal cover of mature cactus (generally ≥ 1 m tall). Site may also include habitat with sparser cactus cover.

Cactus Scrub Type 2: Site covers ≥ 1.0 acre. Well-developed cactus patches may be present, but site does not include 1.0 *contiguous* acre with ≥ 20% estimated areal cover of mature cactus (generally ≥ 1 m tall).

Cactus Scrub Type 3: Polygon (a) covers less than 1.0 acre, *and* (b) includes at least one cholla plant ≥ 1 m tall. Density of cactus within the polygon is irrelevant.

Cactus Scrub Type 4: Small, isolated stands of mature cactus without cholla. Polygon (a) covers less than an acre, *and* (b) does *not* include at least one cholla plant ≥ 1 m tall. Density of cactus within the polygon is irrelevant.

Isolated cactus plants ("satellites") and expanses of scrub that do not include any cactus stands capable of supporting a nest ("proto cactus scrub") shall be mapped, but no data shall be taken down and no survey shall be completed. Such areas will be regarded as having essentially no potential for occupancy by Cactus Wrens. Note that even very limited cholla patches ≥ 1.0 m tall may be occupied by nesting Cactus Wrens.

Cactus Wren survey protocol: Surveyor shall play 40 seconds of Cactus Wren vocalizations three times with at least one minute of silence in between them. Do not play vocalizations once a Cactus Wren has been detected. Surveyor must remain at the site for at least five minutes *or* until a Cactus Wren is detected. Cactus Wren presence may be recorded outside of this 5-minute period. Note: surveyor must watch and listen for California Gnatcatchers and Brown-headed Cowbirds at each site; these species shall be counted even if the birds are adjacent to (rather than on) the cactus scrub polygon.

Appendix - 2006 NROC Cactus Wren Study Field Data Form B

Date: __ __ / __ __ / 2006
month day

Investigator: ________________ Planning Area/Uppercase Alpha Code: __________ Polygon Numeric ID: ______

Site Lowercase Alpha ID: ____ Survey Point GPS Correct? Yes No Grid Number(s) of Site: __________

- -

Cholla Type, If Present (choose one, see below): Type 1 Type 2 Type 3

- -

Cactus Wren Detected in Polygon (Specify How Many Ad's &/or Juv's): Adults ____ Juv's ____

Cactus Wren Detected in Polygon (Specify How Many Ad's &/or Juv's): Adults ____ Juv's ____

Brown-headed Cowbird Detected On/Near Site (How Many): On/Near Site ____ Fly-overs ____ Juv's ____

California Gnatcatcher Detected On/Near Site: Yes No

- -

Corrections to Round 1 Data, If Any: ____

____

____

____

____

- -

Field work may be conducted in fair weather (no rain or drizzle) at any time of day. Temperatures should not exceed 85˚F and estimated wind should not exceed 8 mph.

During each survey, surveyor shall review a print-out of the Round 1 data and note any corrections in the appropriate space above.

Cholla Type 1: Highest quality. At least one cluster is fully developed, standing ≥ 1.3 m tall and in good health with extensive branching.

Cholla Type 2: Medium quality. At least one plant/cluster is ≥ 1.0 m tall, in good health, with branching extensive enough to readily hold nest(s).

Cholla Type 3: Poor quality. No plants/clusters appear to have branching extensive enough to readily hold nest(s).

Cactus Wren survey protocol: Surveyor shall play at least three minutes of Cactus Wren vocalizations, and shall listen in silence for responses for at least three minutes after completing playback of wren vocalizations. Do not play vocalizations once a Cactus Wren has been detected. Cactus Wren presence may be recorded outside of this 6-minute period (on the same day of the survey; any birds detected on non-survey dates shall not be counted). Note: surveyor must watch and listen for California Gnatcatchers and Brown-headed Cowbirds at each site; these species shall be counted even if the birds are either on or adjacent to the cactus scrub polygon.