Nature Reserve of Orange County: Monitoring Coastal Cactus Wren Reproduction, Dispersal and Survival, 2009-2011

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EXECUTIVE SUMMARY

From 2009 through 2011, the Nature Reserve of Orange County conducted a study of Cactus Wren reproduction, dispersal and survival in Orange County's Central and Coastal Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP). Cactus Wren populations declined by over 80% in the last two decades, initially because of catastrophic wildfires. In our study of wrens in unburned habitats, we found that productivity, or the number of young produced by a pair in a breeding season, was relatively low. Productivity was regulated by nest predation and food availability and varied annually and between sites. Based on this study and other studies in southern California, Cactus Wren productivity is positively associated with January and February precipitation. However, the response is non-linear and very high levels of rainfall also depress productivity. Within the Reserve System, there is insufficient suitable cactus scrub habitat to recover wren populations to 1992 levels. Habitat quality, particularly in relation to invasive annual grasses, may be an important determinant of insect food availability during the breeding season.

Wrens were sedentary in our study; 91% of juveniles establishing territories remained at their natal sites and 25.7% inherited their natal territory. There were several longer distance dispersals, including by adults. Wren behavior makes it difficult to determine adult and juvenile survivorship and more years of data collection are needed. Predation by Cooper's Hawks is suspected to be an important cause of death for fledgling, juvenile, and adult Cactus Wrens. Predation pressure may be particularly high at smaller, reserves surrounded by residential neighborhoods where Cooper's Hawks nest and concentrate foraging in the reserve fragment. High rates of Cooper's Hawk predation on adult wrens, in combination with low productivity, could lead to a rapid decline in Cactus Wren numbers, particularly in smaller, isolated populations.

To facilitate recovery of Cactus Wren populations in Orange County's Central and Coastal NCCP/HCP, the most important management action is to enhance and restore cactus scrub. Cactus scrub restoration is necessary to expedite dispersal by creating linkages between populations and to expand breeding habitat to increase existing populations and establish new populations. To undertake management actions to improve habitat quality and potentially increase productivity, we need to understand the relationship between plant and arthropod communities and evaluate how that translates into Cactus Wren productivity. There is a need to determine whether reducing shrub overgrowth of cactus could encourage wrens to establish territories in areas of the reserve with denser coastal cactus scrub. It is also important to better understand how predation by Cooper's Hawks is affecting Cactus Wren survival and population dynamics.

1.0 INTRODUCTION

Southern California supports both coastal and desert populations of the Cactus Wren (*Campylorhynchus brunneicapillus*). In coastal regions, Cactus Wrens are year round residents of coastal sage scrub plant communities that contain cholla and/or prickly-pear cactus tall enough (>1 m) to support and protect nests. Mature stands of cactus are patchily distributed within coastal sage scrub leading to a naturally patchy distribution of Cactus Wren in coastal southern California. Despite this uneven distribution, Cactus Wrens were historically widespread and abundant. In the last few decades, coastal populations have shown dramatic declines and are of great conservation concern (Sauer et al. 1999; Proudfoot et al. 2000; Solek and Szijj 2004; Mitrovich and Hamilton 2007). This report details the results of a three year study investigating Cactus Wren reproduction, dispersal and survival in Orange County's Central and Coastal Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP).

1.1 Taxonomic Status

The southernmost populations of coastal Cactus Wren in southern Orange County, San Diego County, and northern Baja California are classified as San Diego Cactus Wren (*C. b. sandiegensis*). Populations in Ventura and Los Angeles Counties and in deserts of California, Nevada and eastern Arizona are often classified as *C. b. anthonyi* (Rea and Weaver 1990; Proudfoot et al. 2000). The subspecies status of populations in central and coastal Orange County is uncertain and the two subspecies may interbreed where they come into contact in Orange County. Coastal populations, regardless of subspecies status, share song characteristics, have a similar ecology, and are isolated from desert populations, supporting designation as a distinct subpopulation (Atwood and Lerman 2007).

1.2 Conservation Status

Habitat loss and fragmentation, edge effects associated with development, and catastrophic wildfire have contributed to a loss of Cactus Wren populations in coastal southern California. The San Diego Cactus Wren (*C. b. sandiegensis)* is designated as a Species of Special Concern by the California Department of Fish and Game (Unitt 2008) and coastal populations of Cactus Wrens are target species for the Natural Community Conservation Planning (NCCP) program. NCCP Plans have been completed for western Riverside County, central and coastal Orange County, and northern and southern San Diego County. The Cactus Wren is one of three Target Species conserved under Orange County's Central and Coastal NCCP/HCP (County of Orange 1996).

1.3 Factors Contributing to the Decline of Coastal Populations of Cactus Wrens

Over the past two decades, extensive urban development in coastal southern California has led to habitat loss and fragmentation resulting in small, isolated Cactus Wren populations. Dispersal between populations may be constrained increasing the potential for local extinction and limited recolonization. Remnant patches of cactus scrub are also subject to edge effects that may impact Cactus Wren reproduction and survival and affect population dynamics. Exotic plant species often invade habitat fragments and can alter the structure and composition of native cactus scrub, potentially affecting wren foraging and breeding. Mortality and nest predation may also be high within habitat fragments because of changes to the predator community associated with urban development and human activities.

Recent catastrophic wildfires in southern California have burned large expanses of cactus scrub and have impacted Cactus Wren populations across the region. In addition to wildfire induced mortality, wrens are also affected by the temporary and even permanent loss of cactus scrub habitat. Following a wildfire, it can take many years for cactus to grow back to a size sufficient to support breeding Cactus Wrens (Proudfoot et al. 2000; Solek and Szijj 2004).

1.4 Population Status of Cactus Wrens in the NCCP/HCP

The Nature Reserve of Orange County (NROC) is responsible for implementing Orange County's Central and Coastal Subregion NCCP/HCP. When the NCCP/HCP was established in 1996, 67.5% of 994 Cactus Wren locations that were documented during 1992 surveys were conserved in a multiple owner/manager Reserve System (County of Orange 1996). Another 10.4% of these locations were potentially conserved in special linkages and existing use areas. Since the NCCP/HCP was established, NROC has been monitoring Cactus Wren populations in the Reserve System. Although the original Cactus Wren locations within the Reserve System were conserved, wrens have disappeared from many of these areas over the last two decades. Large wildfires have played a major role in the decline of Cactus Wren populations in Orange County's Central and Coastal NCCP/HCP Reserve System.

In 1993, the Laguna Fire burned 75% of the ~17,000 acre Coastal Reserve. Surveys in the first year following the fire found the number of Cactus Wrens reduced to 28% of their pre-fire levels (Bontrager et al. 1995). A post-fire study of Cactus Wrens in the San Joaquin Hills showed little recovery of wren populations or habitat five years after the Laguna Fire (Harmsworth Associates 1999). Cactus Wren surveys and cactus scrub mapping of the Coastal Reserve in 2006 found 58% of burned cactus scrub remained unoccupied over 13 years after the fire; this was attributed to the small stature of recovering cactus (Mitrovich and Hamilton 2007). An analysis of cactus scrub habitat

and Cactus Wren locations indicated an 87% decline in occupied habitat between 1993 and 2006 (Mitrovich and Hamilton 2007). In fall 2007, the Santiago Fire burned 75% of the Central Reserve, severely burning 1,059 acres (75%) of mapped cactus scrub (Leatherman BioConsulting 2009). Approximately 684 acres were considered potentially suitable for occupancy by Cactus Wrens and were surveyed. It was estimated that 67 territories remained in unburned and lightly burned cactus scrub, representing an 82% decline in Central Reserve territories based on the 2004 estimates.

While the Laguna Fire substantially impacted Cactus Wren populations in the Coastal Reserve, there have also been considerable declines in local wren populations in unburned habitat. Annual surveys conducted from 1999 to 2004 documented larger proportional reductions in Cactus Wren populations in unburned portions of the Coastal Reserve than in the ~20,000 acre Central Reserve (Hamilton 2004). These declines may be due to reduced annual productivity and survivorship and to increased population isolation from urban development, new road construction and wildfire destruction of habitat. To manage Cactus Wren populations and enhance their recovery within the Reserve System will require a better understanding of factors affecting population dynamics.

1.5 Cactus Wren Population Demographics

Cactus Wrens tend to have a fairly long nesting cycle relative to other North American passerines (Clark and Martin 2007). The period from nest building to fledging can extend 42-55 days with another 17-25 days of post-fledging dependence on parents (Proudfoot et al. 2000). Cactus Wren can produce three broods in a breeding season, although most wrens produce only one or two broods with three young per brood.

Food limitation and nest predation have long been considered the most important factors regulating avian productivity (e.g., Lack 1954; Martin 1987; Newton 1998). There has been considerable debate regarding their relative importance in regulating avian fecundity and influencing population dynamics. Although nest predation is the major cause of nest failure in passerines (Ricklefs 1969; Martin 1993), experimental food supplementation studies show an important role of food limitation in influencing avian productivity (e.g., Boutin 1990). In arid and semi-arid ecosystems, such as in southern California, the timing and amount of annual rainfall influences reproductive output in birds (e.g., DeSante and Geupel 1987; Grant et al. 2000; Morrison and Bolger 2002). Rainfall is often positively correlated with food availability for nesting birds.

The role of nest predation in limiting Cactus Wren productivity is not well known. As protection against predation, Cactus Wrens build domed nests in spiny cholla and prickly pear cactus, making the nests inaccessible to many predators (Proudfoot et al.

2000). However, some avian species and snakes can still access and depredate nests. Documented nest predators include several snake species and Greater Roadrunners (*Geococcyx californianus*). Cactus Wren pairs have been observed defending nests against ground squirrels, Loggerhead Shrikes (*Lanius ludovicianus*), Western Scrub-Jays (*Aphelocoma californica*), and Northern Mockingbirds (*Mimus polyglottus*), indicating a wider range of potential nest predators (Anderson and Anderson 1963a; Proudfoot et al. 2000; Solek and Szijj 2004).

Cactus Wrens are sedentary, with juveniles typically dispersing short distances to find an available territory and mate. Studies of adult and juvenile survivorship show that it tends to be relatively low (Anderson and Anderson 1963b, Ricklefs and Hainsworth 1968, Atwood et al. 2002)

1.6 Objectives of this Study

Conservation and management of the coastal Cactus Wren relies upon a better understanding of how individual productivity, dispersal, and survival are related to population dynamics. The Nature Reserve of Orange County is conducting a multi-year study to intensively monitor Cactus Wrens in Orange County's Central and Coastal Subregion NCCP/HCP. The intent of this research is to collect data to guide development of adaptive management actions to enhance recovery of populations within the NCCP/HCP Reserve System.

The objectives of this study include:

1. Measure individual productivity and annual survival in populations of banded wrens.
2. Measure dispersal and establishment of territories/pair bonds of banded individuals.
3. Determine the degree to which individuals are dispersing between populations and whether individuals are recolonizing locations where wrens have disappeared.
4. Identify factors affecting Cactus Wren population dynamics.
5. Collect genetic material to conduct Cactus Wren taxonomic analyses, determine population genetic structure, and assess connectivity between local populations.

This report describes NROC's three years of monitoring Cactus Wrens in Orange County's Central and Coastal NCCP/HCP Reserve System.

2.0 METHODOLOGY

2.1 Monitoring Sites

In 2009 we studied Cactus Wrens at five unburned cactus scrub monitoring sites within NROC's Coastal and Central Reserves (Figure 1). In 2010 and 2011 we expanded our study to include a total of nine sites. We monitored the reproduction of banded individuals, and conducted surveys to document their dispersal and annual survival. The sites represent a range in population abundance and degree of isolation from other populations. Monitoring sites supported from one to twenty wren territories. Coastal Reserve study sites included the University of California Irvine Ecological Preserve (UCI), Upper Newport Bay (UNB), Crystal Cove State Park (CCSP) and within the City of Irvine Open Space Preserve South (COI) there are sites at Bommer Canyon (BMR)/Bommer Ridge Road (BRR), Mule Deer (MD)/Quail Hill (QH), Sand Canyon Reservoir (SCR), and Turtle Ridge (TRD). In the Central Reserve we monitored Cactus Wrens at the Southern California Edison-Viejo Conservation Easement (SCE) and El Modena Open Space Preserve (ELMO).

2.2 Survey Sites

In addition to the nine monitoring sites, we tracked wrens over time at fourteen nearby survey sites to assess Cactus Wren populations and look for dispersing banded birds (Figure 1). In the Coastal Reserve, survey areas included James Dilley Preserve (Sycamore Hills), Muddy Canyon, Aliso Canyon, Wood Canyon, south Bommer and El Moro Ridges, Bonita Creek, Muddy Canyon, Emerald Ridge, Boat Canyon, Los Trancos Canyon, and Newport Back Bay. In the Central Reserve we surveyed Peter's Canyon Regional Park and Limestone Canyon and Whiting Ranch Wilderness Park, along El Toro Road and north of Glen Ranch Road.

2.3 Monitoring Reproductive Behavior

At the nine monitoring sites, we attempted to observe each pair weekly from February through the end of July to gather data on reproductive success and productivity. NROC biologists and volunteers observed wren behavior to identify nesting stages. We supplemented these observations with nest checks conducted by Dana Kamada, Karly Moore, Kristine Preston and Scott Thomas. Each of these biologists possesses the appropriate permits to conduct nest checks. Nest checks were conducted only as necessary to check nesting stage, nest fate and to determine the appropriate time to band nestlings, ideally around 8-9 days of age. During our observations we noted behaviors such as nest building, nest defense, courtship and copulation, female visits to the nest to incubate and brood, male and female trips to the nest with food, removal of fecal sacs, and care of young once they fledge. We confirmed reproductive success by

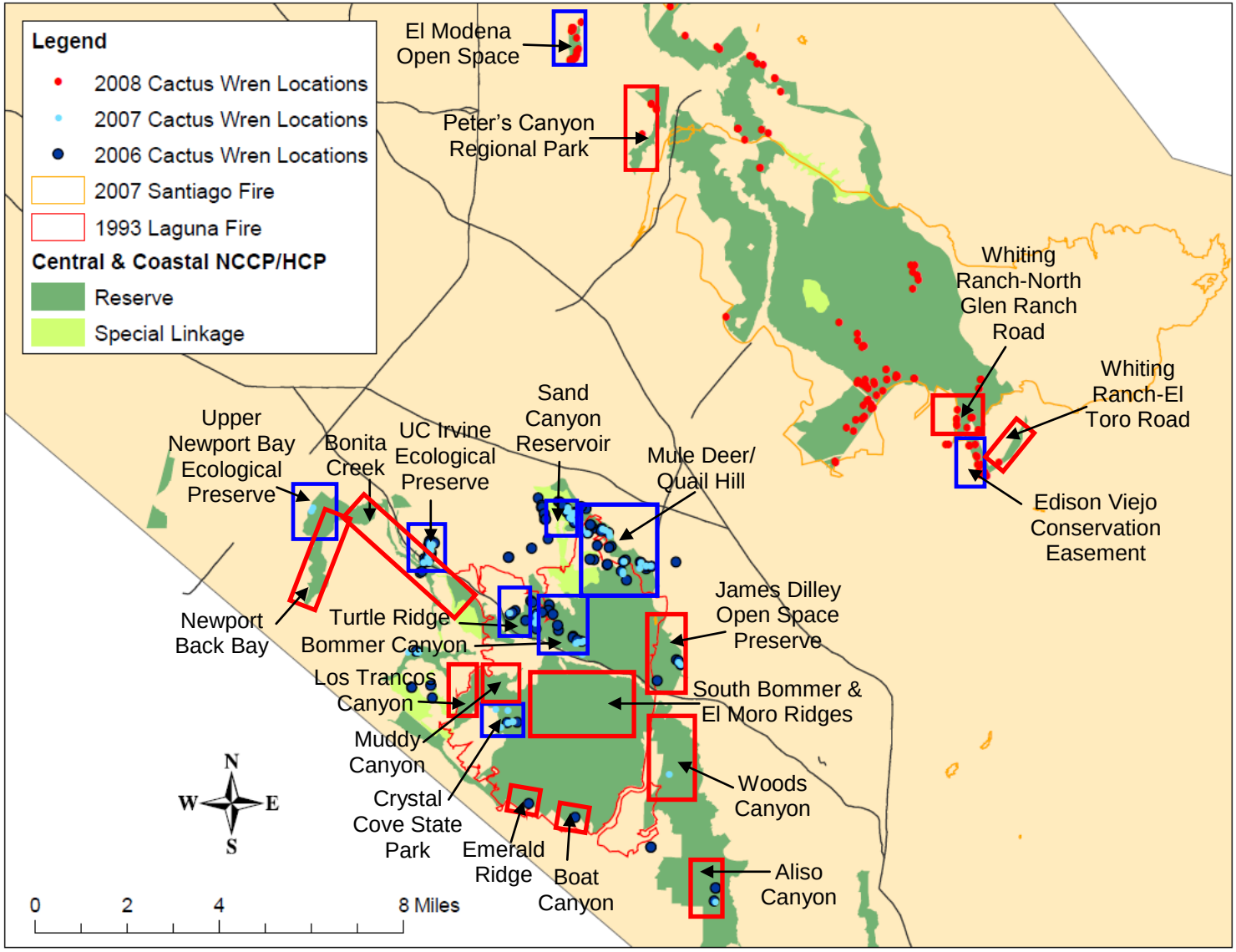

Figure 1. Cactus Wrens locations, monitoring sites (blue boxes), and survey areas (red boxes) on NCCP/HCP Reserve System lands in the Nature Reserve of Orange County's 2011 Cactus Wren Monitoring Study.

searching for and counting the number of fledglings and recording their color band combinations during visits in the post-fledging period. By monitoring reproductive behavior throughout the breeding season, we were able to record nesting phenology, the number of broods, number of young fledged, and number of failed nesting attempts. For unsuccessful pairs, we attempted to identify the stage at which reproduction failed. To assess nestling development, we compared apparent nestling stage of development at banding with the actual age calculated from hatching date.

Nest monitoring data is important in assessing whether productivity is a factor limiting Cactus Wren populations. We hypothesized that Cactus Wren pairs facing food limitation would delay initiating clutches, abandon nests with eggs or young, fail to renest following nest failure, show evidence of delayed nestling development and starvation, and if successful, have small broods. Pairs facing high nest predation risk, but which were not limited by food, would exhibit multiple re-nesting attempts, and when successful, have relatively large broods. It may not be possible to distinguish between pairs affected by both food limitation and nest predation and those pairs whose productivity is limited solely by food availability.

In addition to observing reproductive behavior, we mapped the locations and color band combinations of all detected Cactus Wrens. We recorded intraspecific territorial disputes and potential predators of nests and free-ranging wrens. Potential avian nest predators include Western Scrub-Jay, Greater Roadrunner, Common Raven (*Corvus corax*) and American Crow (*Corvus brachyrhynchos*). We also noted snakes and potential mammal predators such as coyotes (*Canis latrans*), bobcats (*Lynx rufus*) and domestic cats. We recorded responses of Cactus Wren to potential predators, particularly near the nest. We also noted the occurrence of predators of adults and young that had fledged from the nest, such as the Cooper's Hawk.

2.4 Banding and Collection of Genetic Material

Since January 2009 we captured and banded adults at our nine monitoring sites so that most resident birds had unique color band combinations. While banding individuals with US Fish and Wildlife Service metal bands and colored bands, we also collected information on age, sex, plumage, body condition, molts, body fat, and nestling age. During the breeding season, we prioritized banding nestlings. When banding adults and juveniles, we collected feather samples for genetic analysis. We typically plucked secondary feathers from the wings in 2009 and 2010, although, with some of the earliest captured birds we experimented with collecting tail and body feathers. It was determined that secondary feathers were likely to contain more DNA than body feathers and were unlikely to be as important as tail feathers in wren behavioral displays. In 2009 and 2010, we did not collect feathers from nestlings. However,

beginning in 2011, we were trained by Dr. Barbara Kus and her team of field biologists at the United States Geological Service (USGS) to collect growing feathers from nestlings and to obtain toenail clips from fledglings, juveniles and adults. Growing feathers and toenail clips contain relatively abundant levels of DNA that can be used for genetic analysis.

2.5 Monitoring Dispersal and Annual Survival

We visited each territory periodically during the breeding season to determine if color-banded fledglings remained in the natal territory and to see if the pair was attempting another nest. During the non-breeding season we attempted to survey the monitoring sites monthly and the survey sites quarterly to determine where juveniles were dispersing and establishing territories. We also surveyed for adults throughout the year to collect data on annual survival and to detect any changes in territory and/or mate status.

3.0 RESULTS

3.1 Field Effort

In 2009 we monitored 34 Cactus Wren territories at five sites in the Coastal and Central Reserves. We expanded our efforts in 2010 to nine sites and monitored reproduction at 50 territories. In 2011 we monitored 62 territories. Our efforts were reduced at TRD in 2011 relative to 2010 as we added three territories in QH in the COI Open Space Preserve South where we occasionally monitored reproduction. Appendix Tables 1a-c provide details on dates of field work, the names of field personnel, and the types of activities conducted at each site from 2009 through 2011. Generally one person was responsible for monitoring reproduction at each site. When needed, teams of two or three would visit to help with banding or in locating difficult to find birds.

In addition to reproductive monitoring, we conducted periodic Cactus Wren surveys to document dispersal and survival at our nine monitoring sites during the non-breeding season and at adjacent survey sites throughout the year. We started with six survey sites in 2009 and expanded to 14 in 2010 and 2011. We searched the survey sites from one to seven times in 2011, looking for color banded birds (Appendix Tables 2a-c). We also banded birds at a couple of the survey site locations. Locations of territories that were monitored in 2011 for reproduction and surveyed for dispersing birds are shown in Figures 2-13. The number of Cactus Wren territories increased at most sites during the study, particularly ELMO from 12 territories in 2009 to 19 in 2011 and SCE from 11 in 2009 to 16 in 2011.

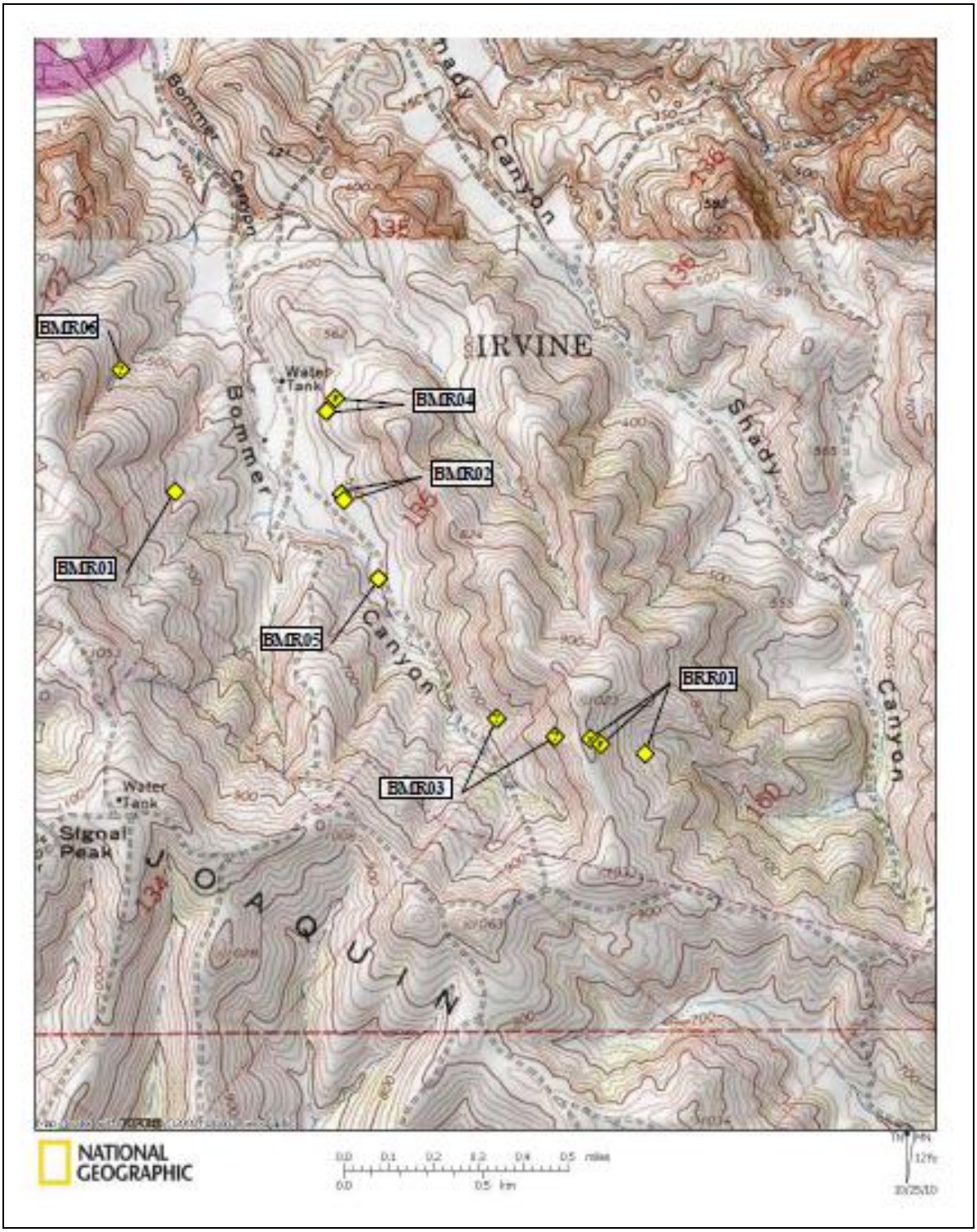

Figure 2. Cactus Wren territories located at the Bommer Canyon/Bommer Ridge monitoring site at the City of Irvine Open Space Preserve South in 2011. Yellow diamonds represent nests monitored for reproduction.

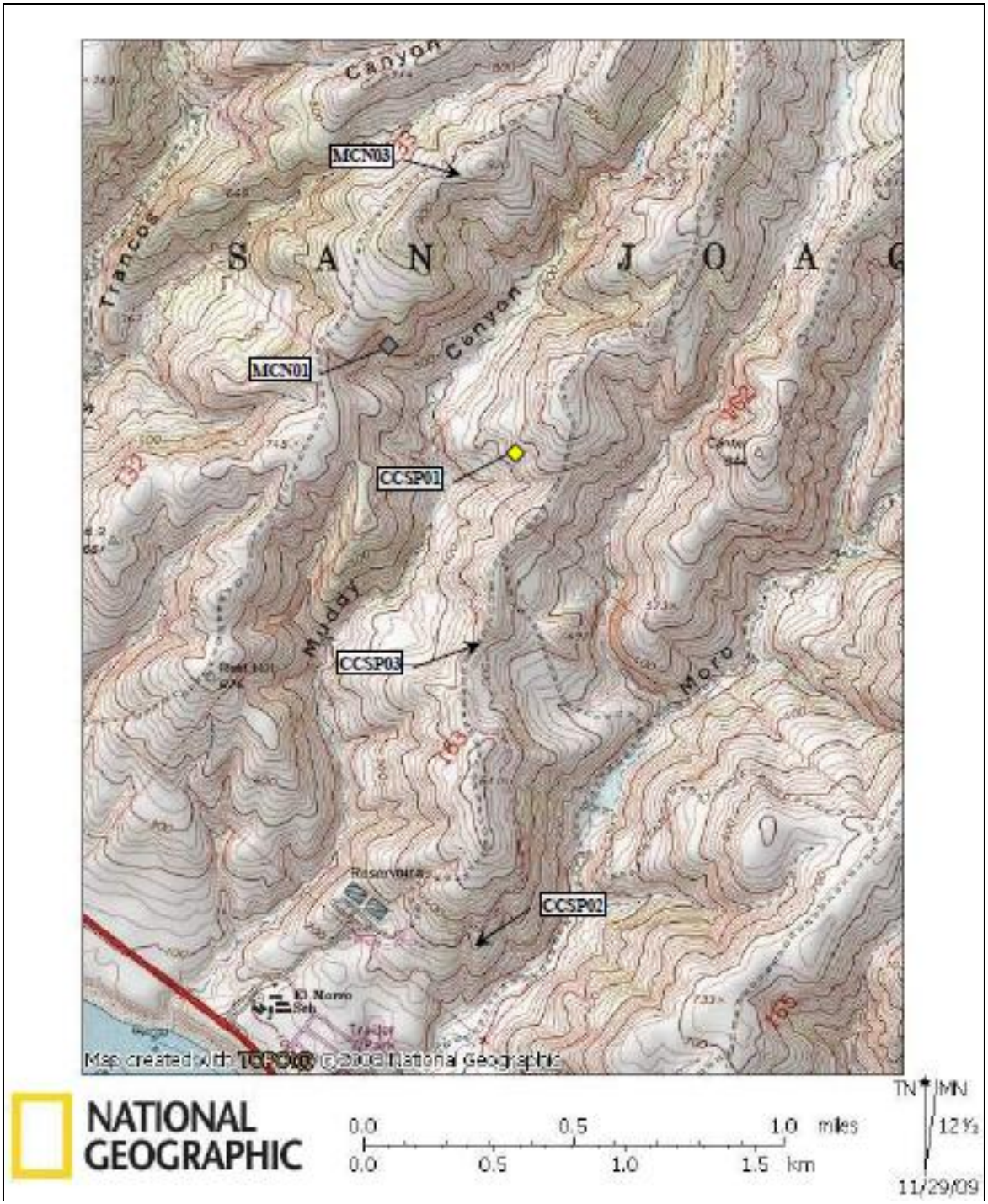

Figure 3. Cactus Wren territories located at the Crystal Cove State Park monitoring site and the Muddy Canyon survey area in 2011. Yellow diamonds represent nests monitored for reproduction, whereas gray diamonds indicate nests of unmonitored pairs. Bird locations without a symbol represent individuals that were not monitored as they appeared at the site after the breeding season or were in a survey area rather than a reproductive monitoring site.

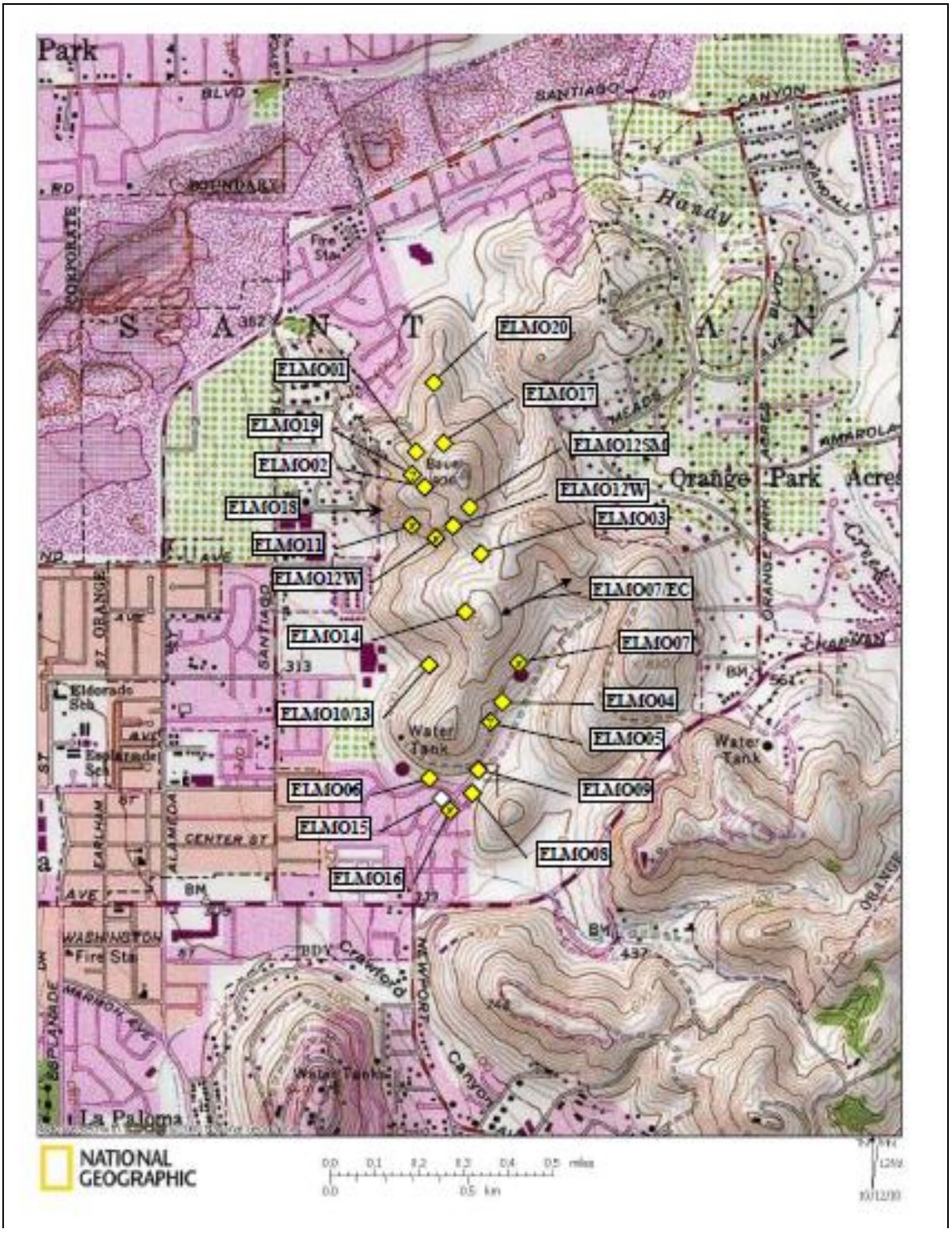

Figure 4. Cactus Wren territories located at the El Modena Open Space Preserve monitoring site in 2011. Yellow diamonds represent nests where eggs were laid and white diamonds indicate nests without eggs.

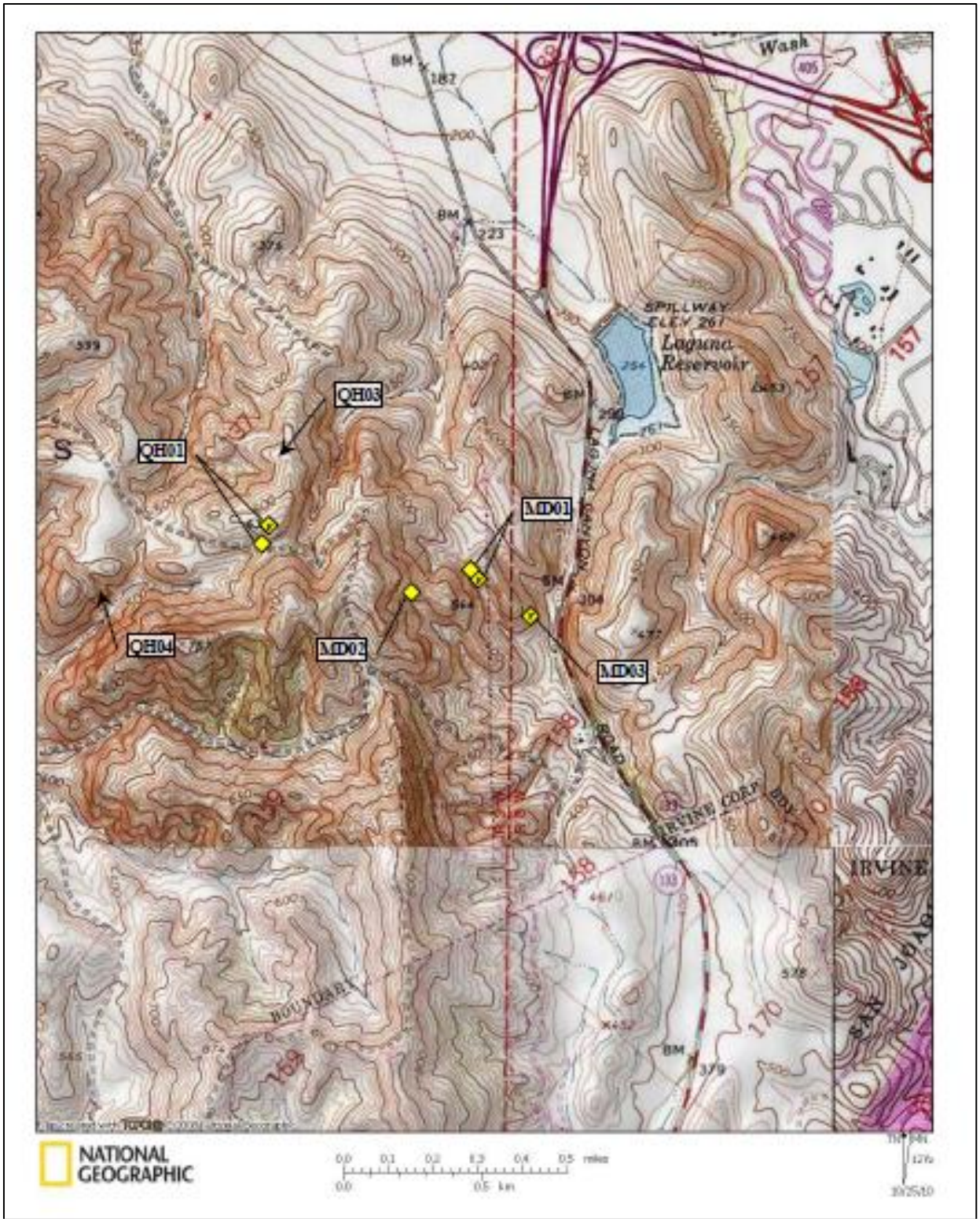

Figure 5. Cactus Wren territories at Mule Deer Canyon/Quail Hill monitoring site in the City of Irvine Open Space Preserve South in 2011. Yellow diamonds represent monitored nests.

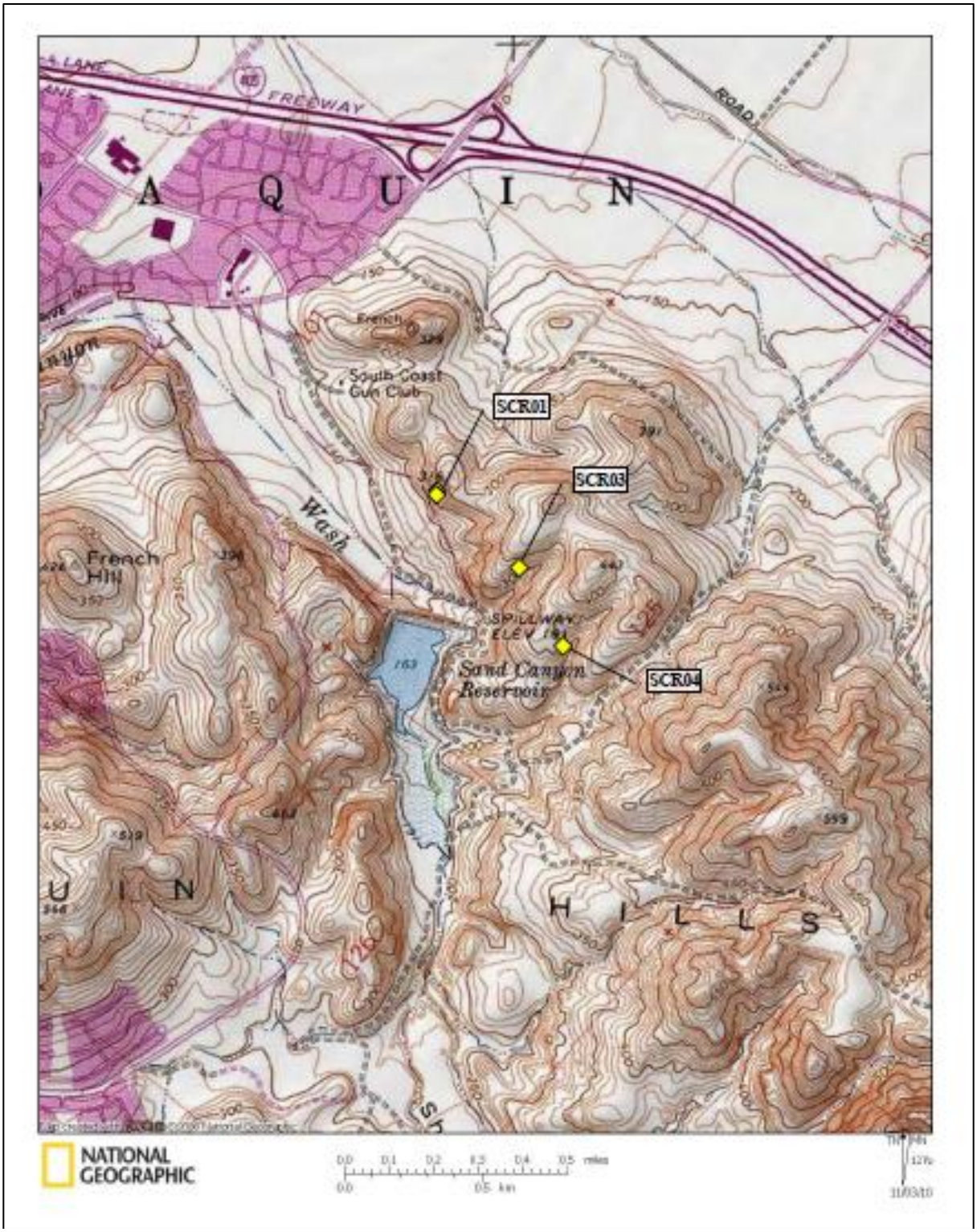

Figure 6. Cactus Wren territories at the Sand Canyon monitoring site in the City of Irvine Open Space Preserve South in 2011. Yellow diamonds represent monitored nests.

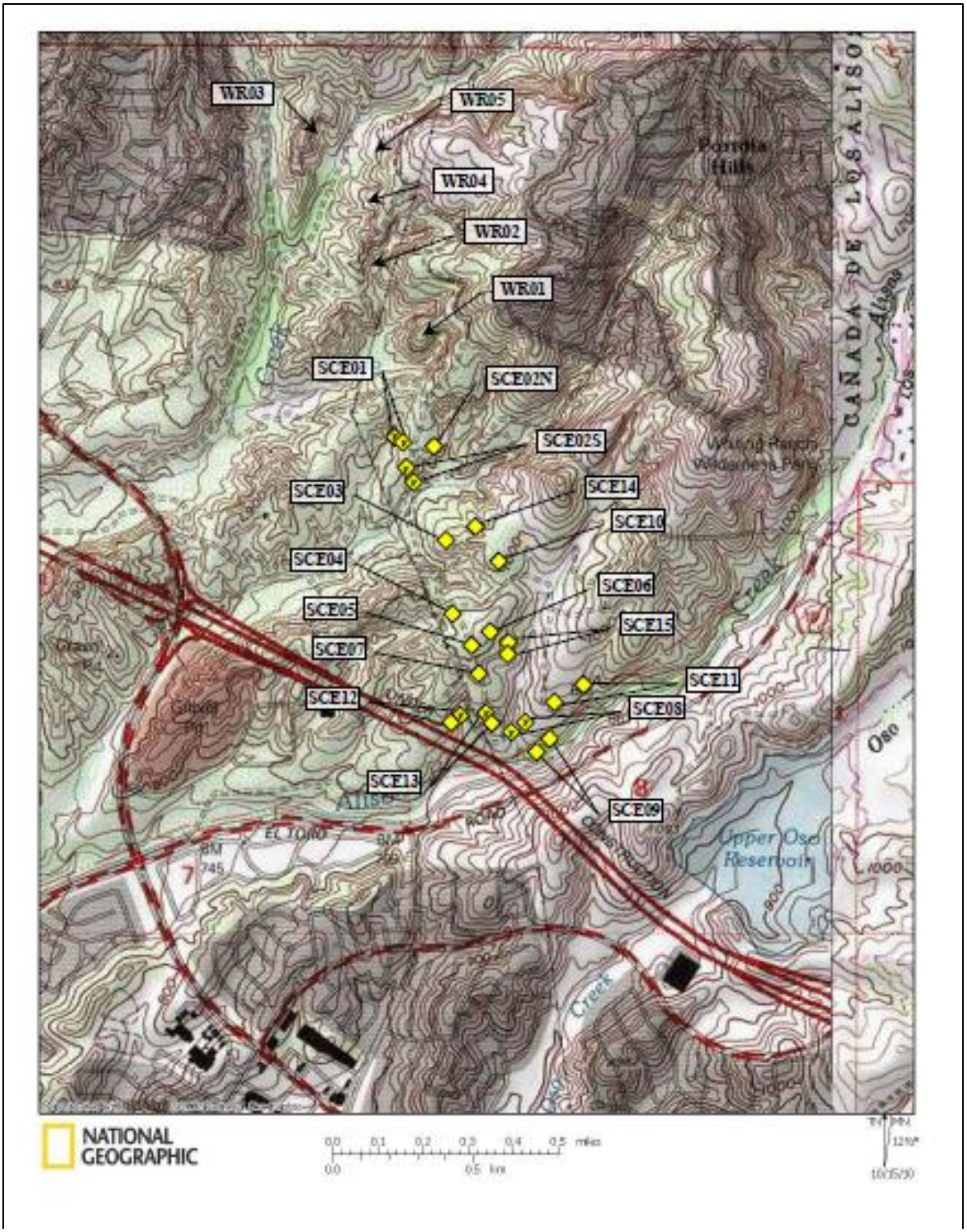

Figure 7. Cactus Wren territories at the Southern California Edison-Viejo Conservation Easement monitoring site and Whiting Ranch-North Glen Ranch Road survey site in 2011. Yellow diamonds indicate nests monitored for reproduction.

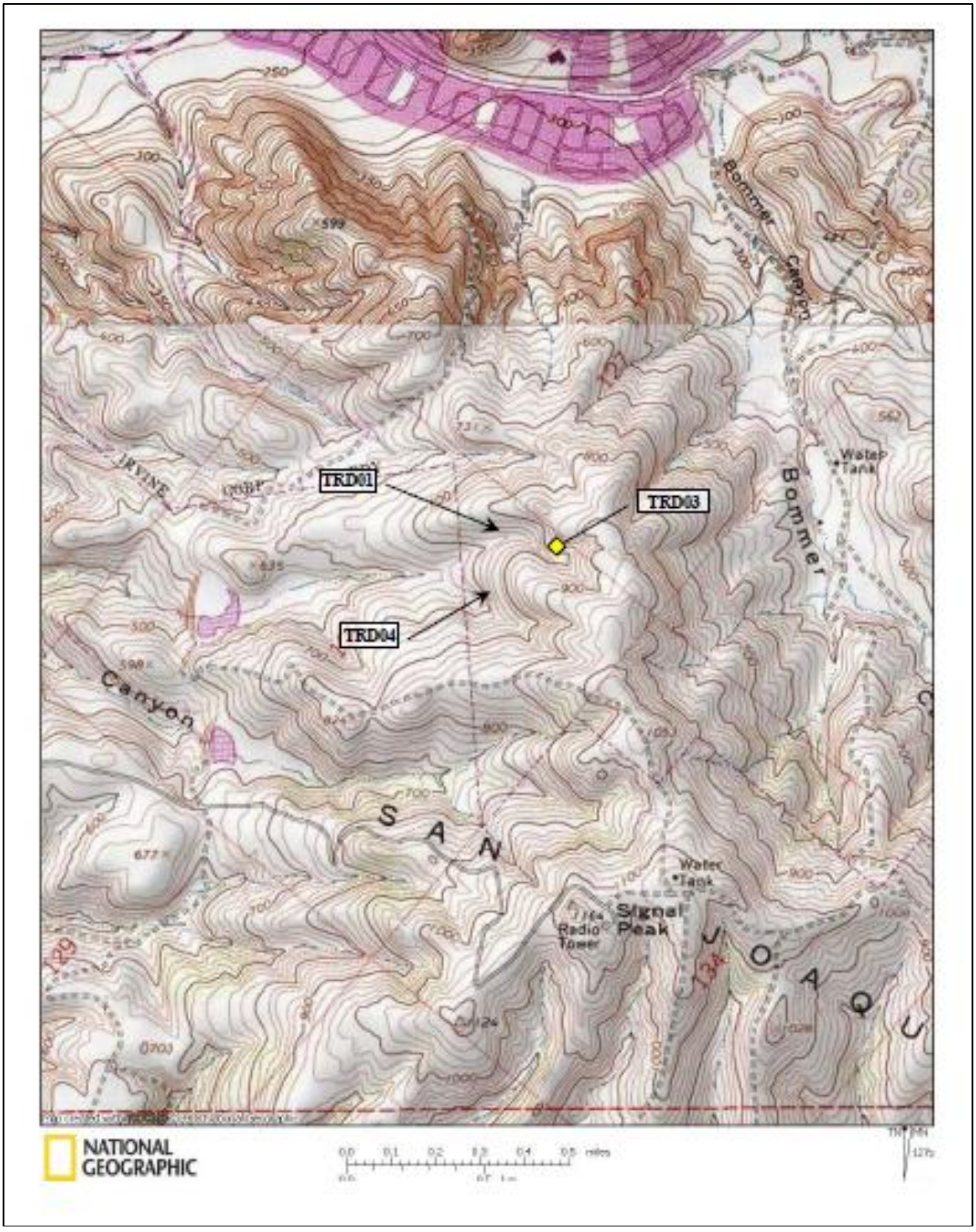

Figure 8. Cactus Wren territories at the Turtle Ridge monitoring site in the City of Irvine Open Space Preserve South in 2011. Yellow diamonds indicate nests monitored for reproduction.

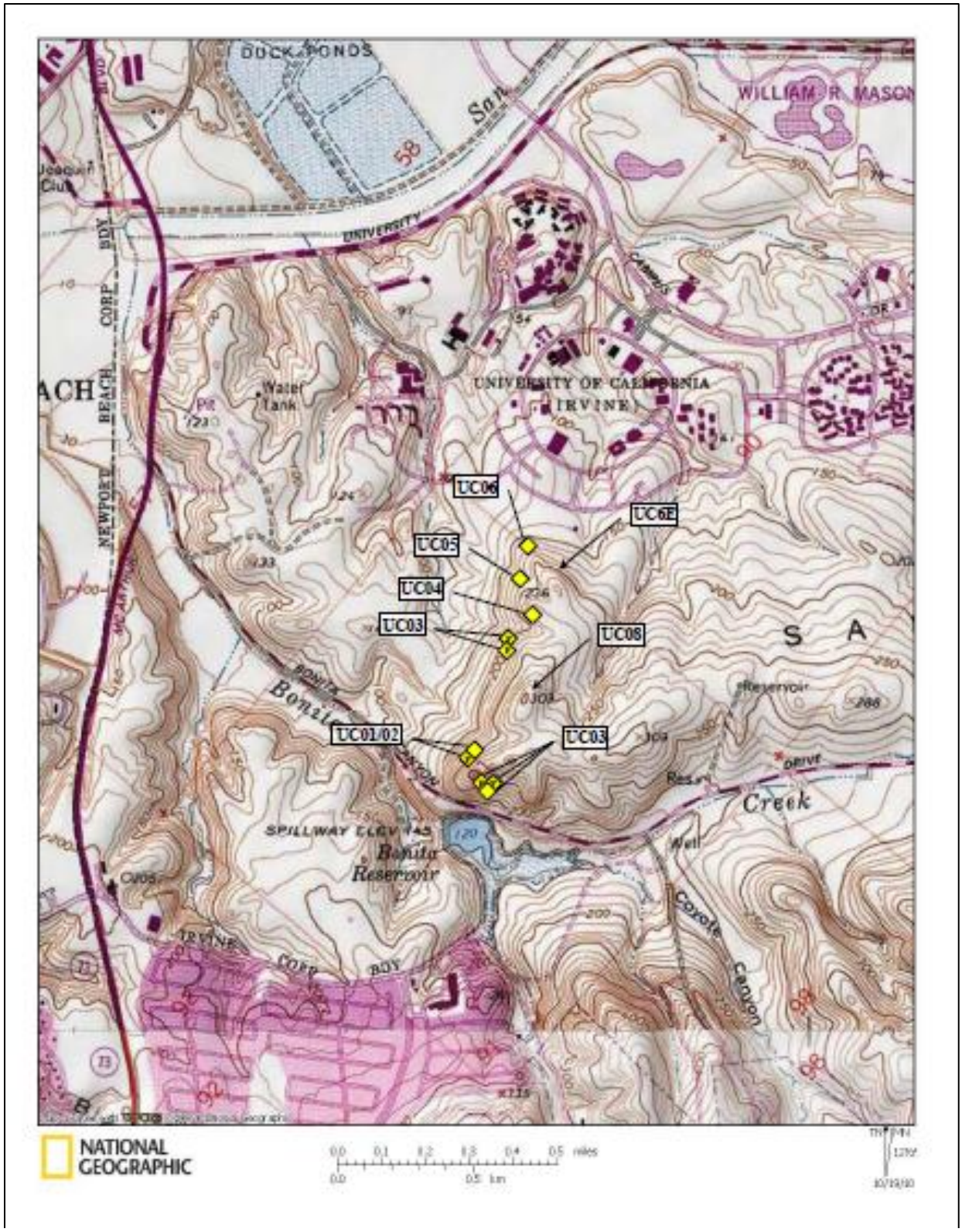

Figure 9. Cactus Wren territories at the UC Irvine Ecological Preserve monitoring site in 2011. Yellow diamonds represent nests monitored for reproduction.

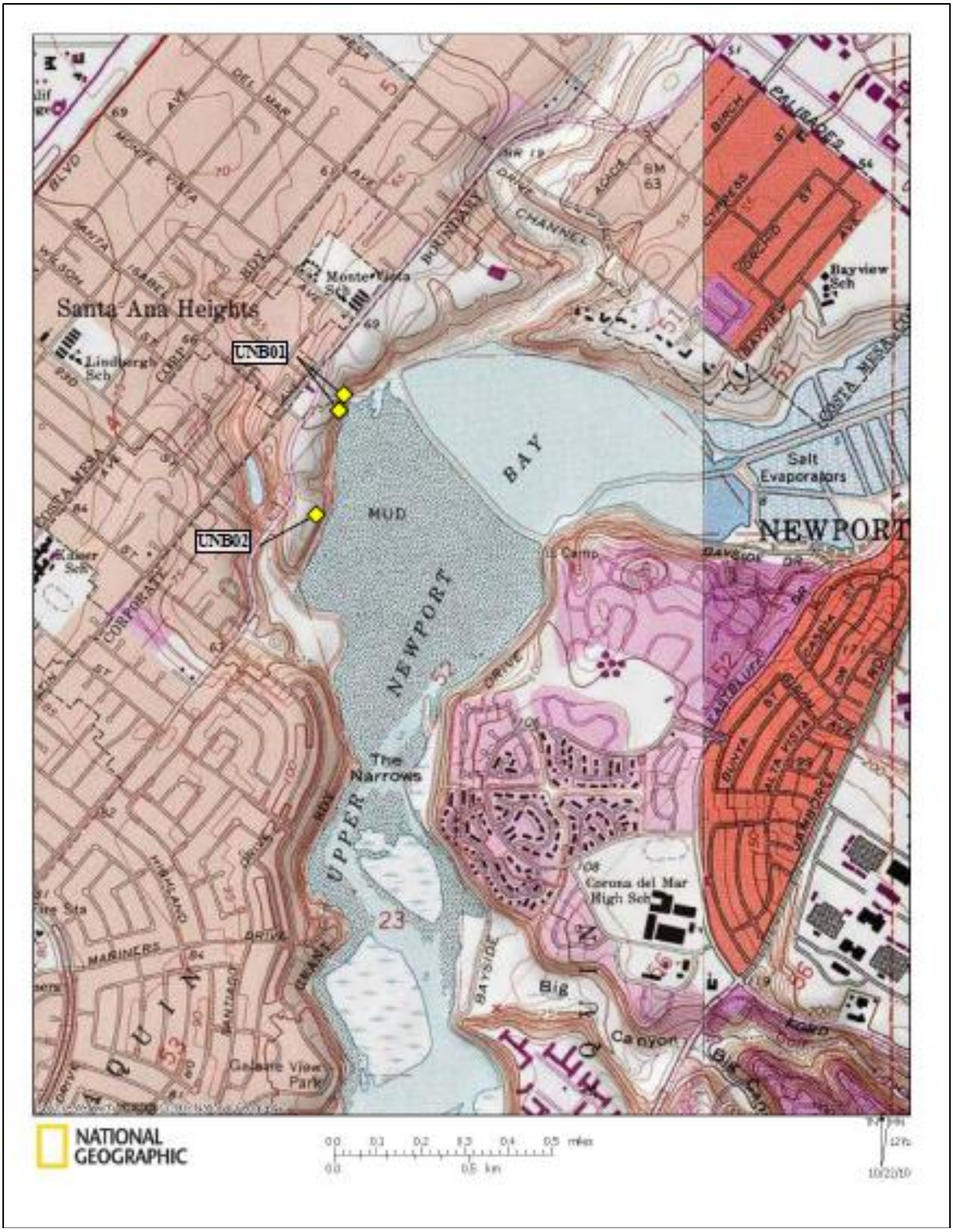

Figure 10. Cactus Wren territories at the Upper Newport Bay monitoring site in 2011. Yellow diamonds represent nests monitored for reproduction.

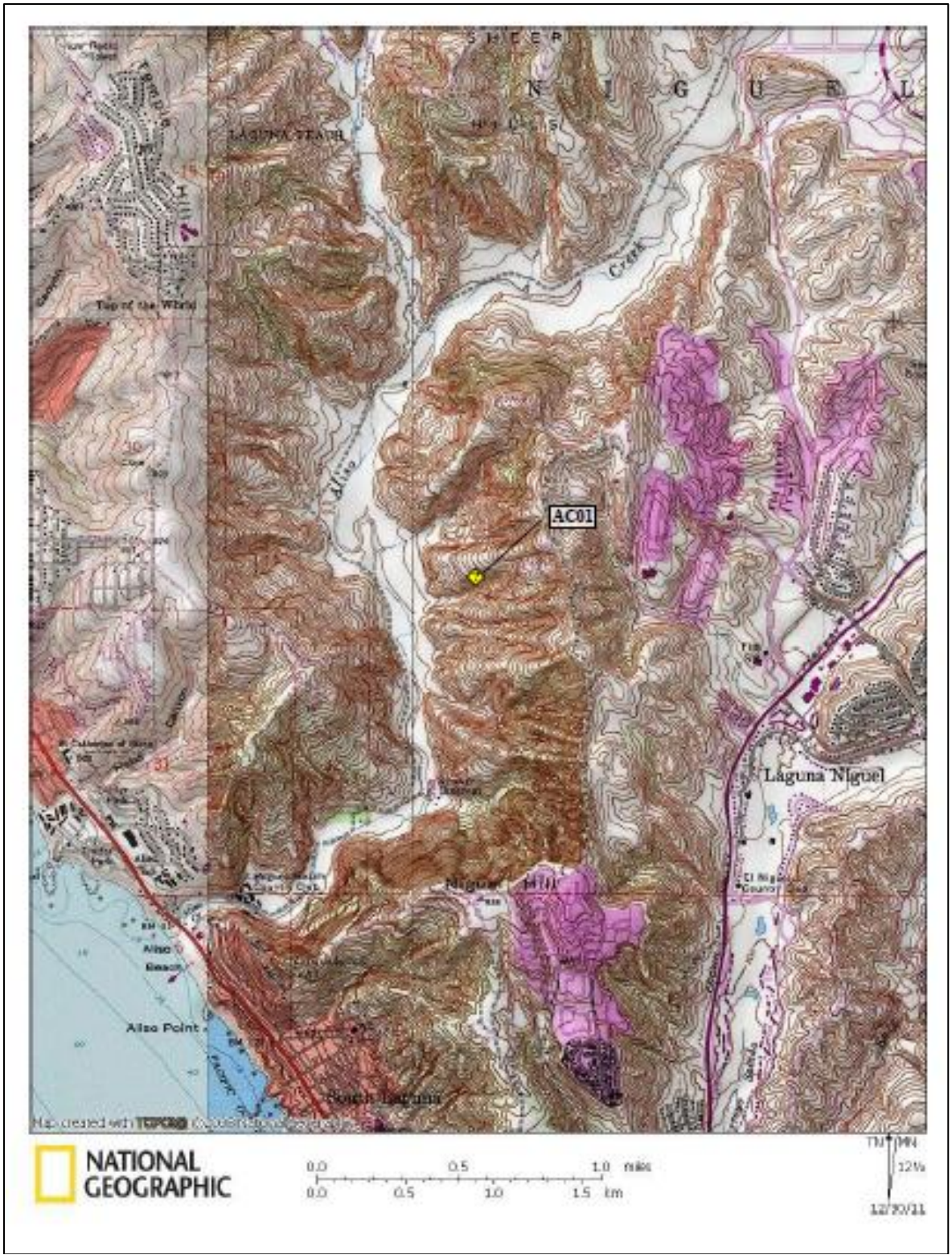

Figure 11. Cactus Wren territories at the Aliso Canyon survey site in 2011. The yellow diamond indicates an active nest whose fate was not determined.

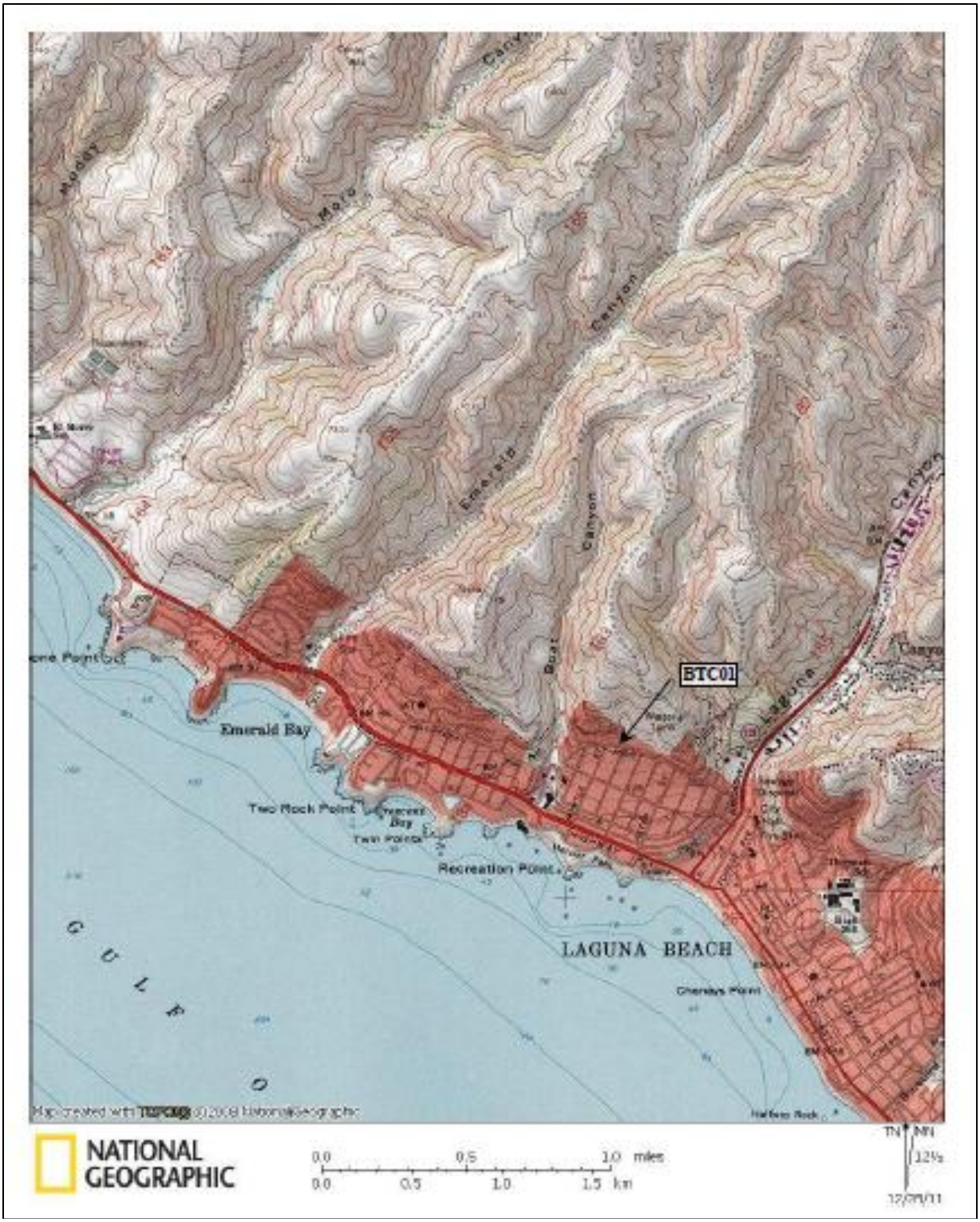

Figure 12. Cactus Wren territories at the Boat Canyon survey site in 2011.

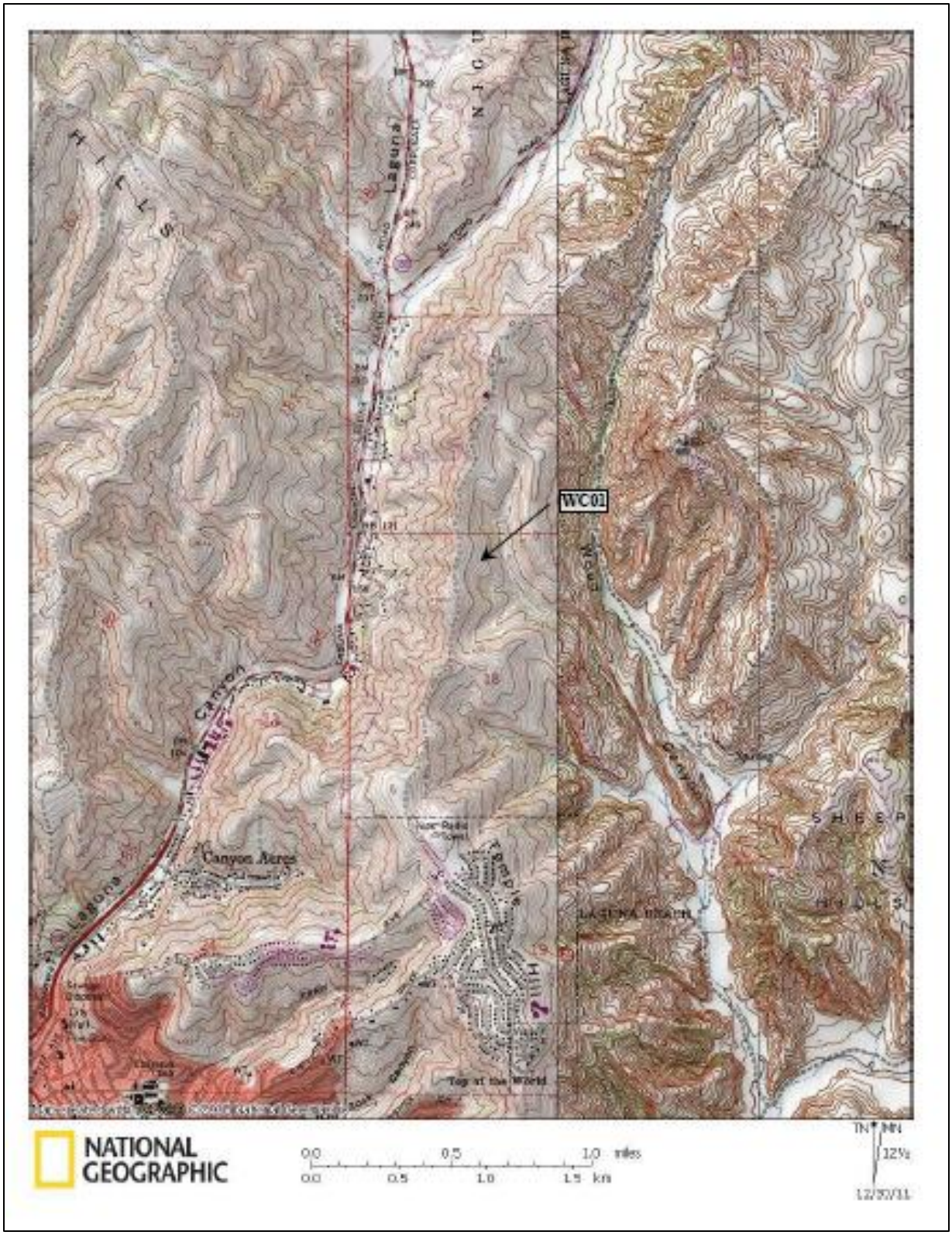

Figure 13. Cactus Wren territories at the Wood Canyon survey site in 2011.

Of the 62 established territories monitored for reproduction in 2011, 59 supported pairs that initiated breeding and laid eggs. Three pairs at ELMO actively engaged in nest building but were not observed progressing to egg laying. This site appeared to be at maximum carrying capacity, and those pairs that did not lay eggs were at the margins of habitat and edges of previously established territories. There were also two transitory territories at UCI supporting single birds; however, these were not classified as established territories as the birds were only observed for a short portion of the breeding season.

3.2 Color Banding and Collection of Genetic Material

A total of 501 Cactus Wrens (87 adults and 414 nestlings/fledglings/juveniles) have been banded with unique color bands since the study began in 2009 (Appendix Tables 3a-c). We banded 143 birds in 2009, 93 (65%) of which were nestlings, fledglings or juveniles (Preston and Kamada 2009). In 2010, we banded 185 birds, 170 (92%) of which were born in 2010 (Preston and Kamada 2011). In 2011 we banded 168 Cactus Wren, 147 (87.5%) of which were nestlings and fledglings. We focused on banding nestlings at the nine monitoring sites in 2011, since most adults were already banded. The only unbanded birds were those that were difficult to capture or newly arrived immigrants. Prioritizing banding of nestlings allowed us to maximize our sample of potentially dispersing juveniles. In addition to banding birds at the nine monitoring sites, we also banded birds at selected survey sites as time allowed. We banded birds in Boat Canyon and Whiting Ranch Wilderness Park north of the Glen Ranch staging area. We also banded birds captured at Glass Creek in Lake Forest that were translocated to another site prior to grading of their habitat for development of a sports complex. These birds were released at James Dilley Open Space Preserve, which has a large area of cactus scrub habitat unoccupied by wrens since 2007.

Since 2009 we have collected genetic material from 238 banded birds with 162 of these samples obtained in 2011. We collected secondary, tail, and/or body feathers from 83 birds (7 samples in 2011). Growing feathers were collected from 132 nestlings and one molting juvenile in 2011. Toe-nail clips were obtained from 22 adults and juveniles. All genetic samples collected from 2009-2011 were given to the USGS to develop microsatellite markers and to sample for genetic composition. These samples are currently being analyzed along with samples from Cactus Wrens in San Diego County to determine regional connectivity. Further analyses will be conducted of the birds in Orange County's Central and Coastal Subregion NCCP/HCP Reserve System to determine genetic population structure and relatedness among individuals.

Table 1. Reproductive statistics (mean ± standard deviation (sample size)) for Cactus Wren pairs monitored from 2009 to 2011 at nine sites in the Coastal and Central Reserves. Means ± standard deviations for the overall study period are highlighted in light gray for each monitoring site and for the combined sites.

	City of Irvine Open Space Preserve South				Crystal Cove State Park			
Reproductive Parameter	2009	2010	2011	This Study	2009	2010	2011	This Study
1st Egg Lay Date (Julian)	-	99.6±5.6 (5)	95.7±22.4 (7)	97.7±11.9	-	87.0 (1)	112.0 (1)	99.5±17.7
Fledging Date (Julian)	-	172.5±27.5 (16)	161.2±29.0 (11)	166.8±8.0	203 (1)	158 (1)	152 (1)	171.0±27.9
Site Breeding Season Length (1st egg to last fledgling)	-	117	127	122.0±7.1	91	71	40	67.3±25.7
Breeding Season Length/Pair	-	69.9±23.4 (10)	75.0±31.9 (7)	72.5±3.6	91 (1)	71 (1)	40 (1)	67.3±25.7
Number of Nest Attempts	-	1.6±0.5 (14)	1.7±0.7 (10)	1.7±0.1	2.0 (1)	2.0 (1)	1.0 (1)	1.7±0.6
Percent of Successful Pairs		100% (13)	93.3% (15)	96.7±4.7%	100% (1)	100% (1)	100% (1)	100.0±0.0%
Nest Fate (number of nests)		(20)	(22)	(42)	(2)	(2)	(2)	(6)
Successful	-	70.0%	72.7%	71.4%	100.0%	50.0%	100.0%	83.3%
Depredated	-	30.0%	27.3%	28.7%	0.0%	50.0%	0.0%	16.7%
Abandoned	-	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Depredated/Abandoned	-	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Infertile Eggs	-	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Clutch Size	-	3.5±0.7 (21)	3.4±0.5 (16)	3.5±0.1	3.0±1.4 (2)	3.0±1.4 (2)	-	3.0±0.0
Number of Nestlings at Banding	-	3.2±1.1 (13)	2.5±1.0 (13)	2.9±0.5	4.0 (1)	2.0 (1)	-	3.0±1.4
Number of Fledglings/Pair	-	3.4±1.1 (13)	2.4±1.7 (15)	2.9±0.7	4.0 (1)	2.0 (1)	1.0 (1)	2.3±1.5
Number of Fledglings/ Successful Pair	-	3.4±1.1(13)	2.6±1.6 (14)	3.0±0.6	4.0 (1)	2.0 (1)	1.0 (1)	2.3±1.5
Number of Broods/Pair	-	1.1±0.3 (13)	1.1±0.5 (15)	1.1±0.0	2.0 (1)	1.0 (1)	1.0 (1)	1.3±0.6

Table 1 *continued*. Reproductive statistics (mean ± standard deviation (sample size)) for Cactus Wren pairs monitored from 2009 to 2011 at nine sites in the Coastal and Central Reserves. Means ± standard deviations for the overall study period are highlighted in light gray for each monitoring site and for the combined sites.

	UC Irvine Ecological Preserve				Upper Newport Bay			
Reproductive Parameter	2009	2010	2011	This Study	2009	2010	2011	This Study
1st Egg Lay (Julian Date)	88.8±17.9 (4)	89.8±8.1 (5)	85.5±15.5 (6)	88.0±5.1	79.0 (1)	65.5±17.7 (2)	105.0±24.4 (2)	83.2±4.7
Fledging Date	144.7±26.0 (6)	147.4±21.9 (5)	142.8±21.9 (5)	145.0±2.3	129.0±35.4 (2)	151.0±63.4 (3)	161.5±2.1 (2)	147.2±16.6
Site Breeding Season Length (1st egg to last fledgling)	124	95	121	113.3±15.9	75	165	75	105.0±52.0
Breeding Season Length/Pair	71.7±25.8 (3)	60.2±23.7 (5)	55.3±28.1 (6)	62.4±2.2	75 (1)	165 (1)	56.5±21.9 (2)	98.8±58.0
Number of Nest Attempts	1.6±0.6 (5)	1.8±0.5 (5)	1.7±0.8 (6)	1.7±0.1	1.5±0.7 (2)	2.5±2.1 (2)	1.5±0.7 (2)	1.8±0.6
Percent of Successful Pairs	80% (5)	80% (5)	83.3% (6)	81.1±1.9%	50% (2)	50% (2)	100% (2)	66.7±28.9
Nest Fate (number of nests)	(8)	(8)	(10)	(26)	(3)	(4)	(3)	(10)
Successful	75.0%	55.6%	50.0%	60.2%	66.7%	50.0%	66.7%	61.1%
Depredated	25.0%	22.2%	20.0%	22.4%	33.3%	50.0%	33.3%	38.9%
Abandoned	0.0%	0.0%	10.0%	3.3%	0.0%	0.0%	0.0%	0.0%
Depredated/Abandoned	0.0%	0.0%	20.0%	6.7%	0.0%	0.0%	0.0%	0.0%
Infertile Eggs	0.0%	22.2%	0.0%	7.4%	0.0%	0.0%	0.0%	0.0%
Clutch Size	3.4±0.8 (7)	3.6±0.5 (9)	3.7±0.9 (9)	3.6±0.2	4.0 (1)	3.8±0.5 (4)	3.7±0.6 (3)	3.8±0.2
Number of Nestlings at Banding	3.0±0.6 (6)	2.2±1.3 (5)	2.8±1.0 (6)	2.7±0.4	4.0 (1)		2.5±0.7 (2)	3.3±1.1
Number of Fledglings/Pair	2.8±1.9 (5)	2.2±1.6 (5)	1.5±0.8 (6)	2.2±0.7	2.5±0.7 (2)	4.5±6.4 (2)	2.0±0.0 (2)	3.0±1.3
Number of Fledglings/ Successful Pair	3.5±1.3 (4)	2.8±1.3 (4)	1.8±0.5 (5)	2.7±0.9	5.0 (1)	9.0 (1)	2.0±0.0 (2)	5.3±3.5
Number of Broods/Pair	1.2±0.8 (5)	1.0±0.7 (5)	0.8±0.4 (6)	1.0±0.2	1.0±1.4 (2)	1.5±2.1 (2)	1.0±0.0 (2)	1.2±0.3

Table 1 *continued*. Reproductive statistics (mean ± standard deviation (sample size)) for Cactus Wren pairs monitored from 2009 to 2011 at nine sites in the Coastal and Central Reserves. Means ± standard deviations for the overall study period are highlighted in light gray for each monitoring site and for the combined sites.

	El Modena				So CA Edison			
Reproductive Parameter	2009	2010	2011	This Study	2009	2010	2011	This Study
1st Egg Lay (Julian Date)	90.0±11.9 (9)	85.6±12.9 (11)	112.4±7.6 (14)	96.0±14.4	102.4±7.4 (8)	97.8±9.8 (11)	103.0±9.7 (16)	101.1±2.8
Fledging Date	129.1±26.9 (8)	141.5±29.5 (15)	153.0±11.1 (11)	141.2±12.0	156.3±26.3 (8)	151.6±20.6 (14)	153.3±22.7 (16)	153.7±2.4
Site Breeding Season Length (1st egg to last fledgling)	114	129	79	107.3±25.7	110	110	110	110.0±0.0
Breeding Season Length/Pair	50.0±22.3 (9)	65.8±30.5 (12)	39.8±0.75 (11)	51.9±13.1	47.8±17.7 (9)	53.8±21.1 (12)	57.1±22.1	52.9±4.7
Number of Nest Attempts	1.4±0.7 (11)	1.5±0.7 (13)	1.0±0.0 (17)	1.3±0.3	1.2±0.4 (11)	1.3±0.5 (12)	1.5±0.5 (16)	1.3±0.2
Percent of Successful Pairs	58.3% (12)	92.3% (13)	68.4% (19)	73.0±17.5%	100% (11)	100% (12)	81.3% (16)	93.8±10.8%
Nest Fate (number of nests)	(16)	(20)	(16)	(52)	(13)	(16)	(24)	(53)
Successful	56.3%	75.0%	81.3%	70.9%	92.3%	81.3%	66.7%	80.1%
Depredated	37.5%	20.0%	6.3%	21.3%	7.7%	18.7%	25.0%	17.1%
Abandoned	6.3%	5.0%	0.0%	3.8%	0.0%	0.0%	4.2%	1.4%
Depredated/Abandoned	0.0%	0.0%	12.5%	4.2%	0.0%	0.0%	4.2%	1.4%
Infertile Eggs	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Clutch Size	3.1±0.6 (13)	3.7±0.5 (19)	3.4±0.5 (14)	3.4±0.3	3.6±0.8 (11)	3.7±0.8 (16)	3.6±0.6 (24)	3.6±0.1
Number of Nestlings at Banding	3.1±1.1 (7)	3.0±1.0 (3)	2.8±1.0 (11)	3.0±0.2	3.4±1.1 (11)	3.4±1.0 (14)	3.1±0.9 (18)	3.3±0.2
Number of Fledglings/Pair	2.0±1.7 (12)	3.3±1.6 (13)	1.8±1.3 (19)	2.4±0.8	3.0±0.9 (11)	3.3±1.4 (12)	3.1±2.3 (16)	3.1±0.2
Number of Fledglings/Successful Pair	3.0±0.9 (8)	3.6±1.3 (12)	2.6±0.5 (13)	3.1±0.5	3.0±0.9 (11)	3.3±1.4 (12)	3.8±2.0 (13)	3.4±0.4
Number of Broods/Pair	0.8±0.6 (12)	1.2±0.6 (13)	0.8±0.4 (17)	0.9±0.2	1.1±0.3 (11)	1.1±0.3 12)	1.0±0.0 (16)	1.1±0.1

Table 1 *continued*. Reproductive statistics (mean ± standard deviation (sample size)) for Cactus Wren pairs monitored from 2009 to 2011 at nine sites in the Coastal and Central Reserves. Means ± standard deviations for the overall study period are highlighted in light gray for each monitoring site and for the combined sites.

	Combined Sites			
Reproductive Parameter	2009	2010	2011	This Study
1st Egg Lay (Julian Date)	93.8±12.9 (22)	91.6±13.6 (36)	102.7±15.3 (46)	96.0±5.9
Fledging Date	144.5±29.9 (25)	154.7±29.8 (54)	154.3±21.4 (46)	151.2±5.8
Site Breeding Season Length (1st egg to last fledgling)	102.8±19.6 (46)	114.5±31.8 (46)	92.0±33.3 (46)	103.1±11.3
Breeding Season Length/Pair	54.8±22.4 (23)	65.2±29.2 (41)	54.3±23.9 (43)	58.1±6.2
Number of Nest Attempts	1.4±0.6 (30)	1.6±2.9 (47)	1.4±0.6 (52)	1.5±0.1
Percent of Successful Pairs	78.1% (32)	93.5% (46)	81.3% (59)	84.3±8.1%
Nest Fate (number of nests)	(42)	(70)	(77)	(189)
Successful	73.8%	70.4%	69.7%	71.3%
Depredated	23.8%	23.9%	21.1%	22.9%
Abandoned	2.4%	1.4%	2.6%	2.1%
Depredated/Abandoned	0.0%	1.4%	6.6%	2.7%
Infertile Eggs	0.0%	2.8%	0.0%	0.9%
Clutch Size	3.4±0.8 34)	3.6±0.6 (71)	3.5±0.6 (66)	3.5±0.1
Number of Nestlings at Banding	3.3±1.0 (26)	3.2±1.0 (54)	2.8±1.0 (50)	3.1±0.3
Number of Fledglings/Pair	2.6±1.6 (25)	3.2±1.7 (46)	2.3±1.7 (52)	2.7±0.5
Number of Fledglings/ Successful Pair	3.2±1.0 (25)	3.4±1.5 (43)	2.8±1.5 (48)	3.1±0.3
Number of Broods/Pair	1.0±0.6 (30)	1.1±0.5 (47)	0.9±0.5 (57)	1.0±0.1

3.3 Reproduction

3.3.1 Reproductive Success and Productivity. Cactus Wren reproductive success and productivity were highly variable between sites and years during our study. Approximately 84% of pairs produced offspring during the study (Table 1), with highest success in 2010 (93.5%) and lowest in 2009 (78%). Averaging across years, over 94% of pairs produced fledglings at SCE, CCSP and the COI, which included sites at BMR/BRR, MD/QH, SCR and TRD. In contrast, UCI, UNB, and ELMO averaged 67-81% of pairs producing young during the three year study. Within sites, reproductive success varied annually at some sites while remaining constant at others. For example, the percentage of pairs successfully producing young varied from 58% in 2009 to 92% at ELMO, whereas the single pair at CCSP produced young all three years.

Productivity, or the number of young produced by a pair in a breeding season, averaged 2.7 across sites and years, varying from 3.2 in 2010 to 2.3 in 2011 (Table 1). During the three year study, the most productive sites averaging around 3.0 fledglings per pair were SCE, UNB, and COI sites. In contrast, UCI, CCSP, and ELMO averaged only 2.2 to 2.4 fledglings/pair.

During 2011, productivity was especially low, ranging from 1 fledgling for the single pair at CCSP to a high of 3.1 at SCE. CCSP, UCI, and ELMO pairs produced less than 2.0 fledglings in 2011. SCE was the only site that remained stable in the number of young produced. Productivity was highest in 2010, with the two UNB pairs producing an average of 4.5 young and all sites producing at least 2 fledglings/pair.

Independent of complete nest failure from predation or abandonment, there was also an incremental loss in productivity between nesting stages. Some eggs did not hatch or disappeared due to partial nest predation and some nestlings died of predation or suspected starvation. On average, there was a reduction of 0.4 between the number of eggs in a nest and the number of nestlings that hatched (Table 1). There was a further reduction of 0.4 nestlings prior to fledging. It is important to note that the number of fledglings reflects a minimum estimate, as it includes only those young seen after departing the nest. It is possible that some young may have successfully fledged and gone undetected. Cactus wren in the Coastal and Central Reserves between 2007 and 2011 showed lower overall productivity than in the reserve or the Palos Verdes Peninsula during the 1990s (Table 2; Harmsworth Associates 1999, Atwood et al. 2002). Based upon this data set, Cactus Wren productivity was positively associated with the amount of precipitation in January and February, although the response is nonlinear and best explained by a cubic model (Adjusted R^2=0.72, F Value=9.55, $p = 0.007$, $n = 11$).

Table 2. Cactus wren productivity for studies conducted in coastal southern California.

	NROC This Study			NROC Telemetry	Harmsworth OC	Atwood et al PV Peninsula
Reproductive Parameter	2009	2010	2011	2007	1997 & 1998	1993-1997
# Pairs Monitored	34	50	62	12	10 prs/yr (20 total)	3-9 prs/yr (28 total)
% Pairs Successful	78%	94%	81%	50%	100%	
Average # Fledglings/Pair	2.6	3.2	2.3	0.9	4.3	3.0-3.6
Average # Fledgings/ Successful Pair	3.2	3.4	2.8	1.6	4.3	?

3.3.2 Nest Success.

Cactus Wrens build multiple nests including potential breeding nests and roost nests for individuals to use during the night. We did not include roost nests in our analysis, focusing on brood nests where eggs were laid. These nests typically have a deep, lined chamber, are jointly constructed by both the male and female, and defended by the adult pair. Overall, 71.3% of 189 nests successfully produced fledglings, 22.9% were depredated at the egg or nestling stages, and 2.1% were abandoned with eggs (Table 1). For another 2.7% of nests, it could not be determined if the eggs were abandoned or potentially depredated and 0.9% failed because eggs did not hatch and were likely to be infertile. Over the three year study, average nest success was lowest at UCI (60%) and UNB (61%). Highest nest success was at CCSP (83%) and SCE (80%).

Based on observations of Cactus Wren nest defense and the presence and behavior of suspected nest predators, potential nest predators included Western Scrub-Jay, Greater Roadrunner, Common Raven (*Corvus corax*), American Crow (*Corvus brachyrhynchos*), and snakes. There were a few depredated nests with large holes in the top, indicating predation from above, likely from Common Ravens and American Crows. Cactus Wrens vigorously scolded Western Scrub-Jays and Greater Roadrunners when near nests or even within the wren's territory. Jays were observed perched near wren nests and visiting nests and inspecting contents. Roadrunners were also observed very close to nests that were later depredated.

3.3.3 Nesting Phenology and Breeding Effort.

Cactus wrens tended to initiate nests at the beginning of April, although this was highly variable between years, sites, and individual pairs (Table 1). In 2011, egg laying in the first nests of the season was delayed by about 10 days compared with previous years. One pair in BMR delaying egg laying until May 17, 2011. Cold, rainy weather may have

delayed nesting and reduced the availability of insects for females during the period of egg formation and laying. In 2010, an experienced pair at UNB initiated egg laying February 22, 39 days earlier than the average date for initial egg laying in that year. Average fledging dates, including first and later broods were late May and early June. Extremes in fledging dates during the three year study were April 2, 2010 for the first brood of the UNB pair and August 6, 2010 for the third brood of that pair.

The number of days between the time egg laying commenced at a site and fledging of the last young varied substantially between sites and years, with an overall average of 103 days (Table 1). The breeding season average across sites was shortest in 2011 and longest by 22 additional days in 2010. The shortest breeding season at a site was at CCSP in 2011 where the single pair successfully fledged young in 40 days and did not attempt any further nesting. The longest breeding season was at UNB in 2010 where an experienced, adult pair successfully produced three broods over 165 days. In general, COI sites had longer breeding seasons over the two years of monitoring at that site and the shortest breeding seasons were at CCSP, which had only one pair. SCE had the most consistent breeding seasons between years, equaling 110 days each year.

The length of the breeding cycle for individual pairs during the study averaged 58 days from the first egg laid to the last fledgling leaving the nest (Table 1). Pairs invested an average of 54 days in nesting in 2009 and 2011 and 65 days in 2011. It takes approximately 40 days for a successful nest attempt, thus pairs typically engaged in more than one nest cycle. This depended on whether a nest was depredated and they attempted a replacement nest or whether they successfully produced more than one brood of young. Individual pairs tended to invest longer in nesting in the Coastal Reserve at 62-99 days depending on site, compared with the Central Reserve with an average of about 52 days for both sites. At ELMO in 2011, pairs spent an average of only 40 days in nesting activities, which was 25 fewer days than in 2010 and 19 fewer days than in 2009.

The length of time that a pair spends nesting is largely a function of the number of nesting attempts. At sites with higher predation, pairs may continue to re-nest until they are successful, if there are sufficient food resources. Longer breeding seasons are also a function of pairs producing multiple broods of young. Pairs in the study averaged 1.5 nest attempts per breeding season (Table 1). Wrens at Coastal Reserve sites averaged more nesting attempts, both because of re-nesting following depredation and because of multiple brooding. In 2011, 16 pairs at ELMO made only one attempt to nest; there was no re-nesting following failure or attempts to raise more than one brood.

In 2011, only a few pairs produced more than one brood of fledglings. These pairs were at COI and SCE. At all other sites, pairs produced single broods or were unsuccessful in fledging young. In contrast, in 2009 and 2010, at least one pair at every site produced two broods, with the exception of CCSP where the single pair produced only one brood in 2010. Only one pair produced three broods during the study, the older, experienced pair at UNB that had nested together three previous seasons.

Nestling development was delayed at several sites in 2011 (Table 3). There were 92 nestlings with information on both hatching date and observed stage of development at banding. Based on the difference between actual age calculated from hatching date and the apparent age at banding, nestlings were an average of 0.8 days delayed in development across the study area. COI and ELMO sites were 1.7 and 1.3 days behind in development, respectively. The average age at banding was 7.8 days and a 1.7 day delay is equivalent to a nestling at day 6 or a 26.6% delay in development. There were two nests with development accelerated by 1.5 days. One case was a single nestling surviving from an original brood of two at SCE. The other case was a brood of two nestlings at UCI.

3.4 Survival

A total of 19 of 49 (38.8%) banded adult birds with established territories disappeared between March 2009 and June 2010 and are presumed to have died. Most individuals disappeared between the 2009 and 2010 breeding seasons. Cooper's Hawks were observed hunting for adult, fledgling, and juvenile cactus wrens and were implicated in the deaths of juveniles whose remains were collected. At several sites, Cooper's Hawks nested nearby and were regularly observed foraging in the cactus scrub. Cooper's Hawks appeared to focus their hunting attempts on Mourning Doves (*Zenaida macroura*) and Cactus Wrens, two of the larger passerine species at these sites. We observed hawks hunt for wrens by flying low over the cactus scrub in an attempt to flush and capture individuals, particularly fledglings in family groups. At each of these sites, we lost adults during the breeding season and hypothesized this could be due to predation by Cooper's Hawks.

The remains of five nestlings from depredated/abandoned nests and three juveniles whose feathers were found in 2009 and 2010 were submitted to the United States Geological Service (USGS) office in San Diego for genetic analysis.

Table 3. Mean ± standard deviation (STD) number of days Cactus Wren nestlings were delayed in development at NROC 2011 monitoring sites. Days delayed in development are based on nestling age calculated from hatch date minus the age a nestling appeared at banding. Percent delayed is the number of days old the nestling appeared at banding divided by the actual age calculated from hatching date. A positive number indicates delayed development, while a negative number indicates accelerated development.

Site	Number Days Delayed Mean ± STD (Minimum, Maximum)	% Delayed Mean ± STD (Minimum, Maximum)	n
City of Irvine Open Space	1.7 ± 0.7 (0.5, 3.0)	26.6% ± 14.2 (5.9%, 60.0%)	14
El Modena	1.3 ± 1.0 (-0.8, 3.3)	21.3% ± 19.7 (-8.6%, 68.4%)	24
Southern California Edison	0.5 ± 0.8 (-1.5, 2.5)	8.3% ± 13.1 (15.8%, 45.5%)	37
UC Irvine Ecological Preserve	-0.0 ± 0.9 (-1.5, 1.0)	-0.1% ± 12.4 (-17,6, 14.3)	12
Upper Newport Bay	0.6 ± 1.0 (-0.5, 1.5)	10.5% ± 14.6 (-5.3%, 32.1%)	5
Average for all Sites	0.8 ± 1.0 (-1.5, 3.3)	13.7% ± 17.3 (-8.6%, 68.4%)	92

3.5 *Dispersal*

Between March 2009 and June 2010 we documented dispersal of 16 juvenile birds in the study area (Table 4). We measured the distances that juveniles moved from the nest in the territory where they were born in 2009 to where they established a territory and attempted to breed in 2010. These dispersals do not include juveniles that did not establish a territory and pair bond in 2010. Juveniles moved on average of 0.40 mile as calculated by straight line distance and 0.60 mile as calculated by shortest distance through predominantly natural habitats. The range was 0 miles for individuals inheriting natal territories to 2.09 miles traveled as a straight line or 3.72 miles through natural habitat for a pair of juveniles that traveled from UCI to Buck Gully. This pair likely traveled together and had to traverse non-cactus scrub habitat and travel through a narrow corridor with little native vegetation in order to reach Buck Gully. This pair of wrens as well as others crossed over SR-73, which is eight lanes wide at the UCI site.

Of the 35 young born between 2009 and 2010 that were able to establish territories, 32 (91%) established territories at the site where they were born. Thus, dispersal out of a monitoring site was infrequently detected. Nine of these individuals (25.7%) inherited their natal territory with the death or disappearance of one or both parents. We started to see juveniles wander and some made movements out of their natal territories in early June. Commonly, juveniles remained in or near their natal territories until the following breeding season, with some even remaining as floaters throughout the next breeding season. There were several instances of individuals remaining as floaters on a site and not being detected for a year or two years, when they would suddenly appear to fill a territory vacancy. There were also areas at sites where juveniles tended to congregate in more marginal habitat adjacent to occupied territories. These juveniles would interact, sometimes form temporary pair bonds, and build roost nests. They appeared to be waiting for an opportunity to acquire a territory and mate.

We also documented dispersal of ten adults from 2009 locations (known breeding territories in all but one case) to new breeding territories in 2010 (Tables 3 and 4). Adults moved an average of 0.60 mile in a straight line or 0.66 mile through primarily native habitats. The distances varied from 0.04 mile for both straight line and through natural habitat to 2.52 miles in a straight line or 3.19 miles through natural habitat. The longest dispersal was by an adult female that bred at UCI in 2009 and was displaced by a second year female in 2010. She found another mate prior to leaving and traveled with him across SR-73 and east to TRD where the pair established a territory and successfully bred in 2010. Another female was banded as an adult at CCSP in early 2010 and moved 2.21 miles straight line distance through natural habitats and across the SR-73 to nest in BMR in the COI Open Space Preserve South.

Table 4. Dispersal, territory status, and pairing status of Cactus Wrens in 2010 that were banded prior to territory establishment at nine sites monitored by the Nature Reserve of Orange County.

Band Code	Age at Banding	Sex	Natal/ Original Site	Natal/ Original Territory	Date Last Observed at Original Site	New Site	New Territory	Date First Observed at New Territory	Age at Dispersal/ Territory Change	Straight Line Dispersal Distance (miles)	Shortest Dispersal Distance in Natural Habitats (miles)	Type of Move/ New Territory Status	Breeding Status at New Territory
Second Year Dispersal, Territory Establishment & Pair Bond Formation													
YDG-M	N	F	UCI	UC01	4/3/09	UCI	UC03	3/31/10	SY	0.21	0.21	Displaced Resident Female & Paired with Male	Fledglings
LBP-M	N	F	UNB	UNB01	7/6/09	UNB	UNB02	2/1/10	SY	0.26	0.26	Established 1st Territory/Pair Bond Before Breeding Season	Unsuccessful
M-DBDB	N	F	SCE	SCE03	7/14/09	SCE	SCE06	3/19/10	SY	0.21	0.21		Fledglings
M-WR	N	F	SCE	SCE09	7/15/09	SCE	SCE07	3/29/10	SY	0.21	0.21		Fledglings
PW-M	N	M	UCI	UC04	7/20/09	BG	BG01	3/18/10	SY	2.09	3.72		Unknown
WO-M	N	M	UCI	UC06	7/20/09	UCI	UC03	3/26/10	SY	0.19	0.19		Fledgling
OM-DB	N	M?	SCE	SCE08	7/23/09	ETR	ETR01	10/17/09	HY	0.44	0.46		Unknown
DB-OM	N	M	SCE	SCE09	7/23/09	SCE	SCE11	2/2/10	SY	0.09	0.09		Fledglings
M-ODB	N	F	UCI	UC01	1/25/10	BG	BG01	3/18/10	SY	1.88	3.44		Unknown
MO-R	N	M	SCE	SCE07	3/19/10	SCE	SCE12	3/25/10	SY	0.06	0.06		Fledglings
YM-P	N	M	SCE	SCE05	12/30/10	SCE	SCE10	3/19/10	SY	0.13	0.13		Fledglings
WM-O	HY	M	SCE	SCE11	7/17/10	SCE	SCE06	5/28/10	SY	0.24	0.24	Dispersed & Established 1st Territory/Pair Bond Mid Breeding Season	Paired
MP-Y	SY	F	ELMO	ELMO05/ 09	2/26/10	ELMO	ELMO03	5/17/10	SY	0.43	0.43		Unsuccessful
MLB-P	N	F	ELMO	ELMO02	4/27/10	ELMO	ELMO02	4/27/09	SY	0.00	0.00	Inherit Natal Territory	Fledglings
M-LBP	N	M	SCE	SCE07	6/30/10	SCE	SCE07	5/6/09	SY	0.00	0.00		Fledglings
O-MLB	HY	M	SCE	SCE06	5/13/10	SCE	SCE06	10/23/09	SY	0.00	0.00		Fledglings
Average										0.40	0.60		
Standard Deviation										0.63	1.17		
n										16	16		

Table 3 *continued*. Dispersal, territory status, and pairing status of Cactus Wrens in 2010 that were banded prior to territory establishment at nine sites monitored by the Nature Reserve of Orange County.

Band Code	Age at Banding	Sex	Natal/ Original Site	Natal/ Original Territory	Date Last Observed at Original Site	New Site	New Territory	Date First Observed at New Territory	Age at Dispersal/ Territory Change	Straight Line Dispersal Distance (miles)	Shortest Dispersal Distance in Natural Habitats (miles)	Type of Move/ New Territory Status	Breeding Status at New Territory
After Hatch Year Dispersal, Territory Establishment & Pair Bond Formation													
MDB-R	ASY	F	CCSP	CCSP01	3/15/10	BMR	BMR03	5/14/10	ASY	2.21	2.21	Dispersed as AHY & Established Territory/Mate at Another Site	Fledglings
M-LBDG	AHY	F	UCI	UC01	3/11/10	TRD	TRD02	5/3/10	ASY	2.52	3.19	Displaced by SY Female, Found New Mate & Established Territory at Different Site	Fledglings
PO-M	SY	F	ELMO	ELMO09	3/11/10	ELMO	ELMO04	3/18/10	TY	0.14	0.14	Left Territory (with Unbanded Male?) & Moved to Another Territory	Fledglings
RM-P	AHY	M	SCE	SCE10	5/18/09	SCE	SCE04	3/19/10	ASY	0.10	0.10	Left Territory/Mate & Became Floater, Still Alive Early 2010	Floater
MY-P	AHY	F	SCE	SCE10	6/3/09	SCE	SCE01/ 02	3/19/10	ASY	0.29	0.29	Left Territory/Mate & Became Floater, Still Alive Fall 2010	Floater
MR-LB	AHY	F	SCE	SCE06	3/19/10	SCE	SCE10	3/19/10	ASY	0.11	0.11	Left Territory/Mate & Moved to Another Territory/Mate	Fledglings
DGP-M	AHY	M	SCE	SCE06	12/30/10	SCE	SCE04	3/19/10	ASY	0.08	0.08		Fledglings
R-MP	AHY	F	SCE	SCE05	5/12/09	SCE	SCE04	5/25/09	AHY	0.04	0.04		Fledglings
YM-GN	AHY	F	SCE	SCE11	7/172009	SCE	SCE05	2/2/10	ASY	0.23	0.23	Lost Mate & Moved to Another Territory/Mate	Fledglings
DBM-Y	AHY	F	ELMO	ELMO07	6/29/10	ELMO	ELMO09	3/18/10	ASY	0.23	0.23		Fledglings
Average										0.60	0.66		
Standard Deviation										0.94	1.10		
n										10	10		

Code Definitions:

Band Codes (Right Leg-Left Leg): DB = Dark Blue, DG = Dark Green, K = Black, LB = Light Blue, LG = Light Green, M = Metal USFWS Band, O = Orange, P = Purple, R = Red, W = White, X = Missing Color Band, Y = Yellow

Age Codes: AHY = After Hatch Year, ASY = After Second Year, HY = Hatch Year, N = Nestling, SY = Second Year, TY = Third Year

Sex Codes: F = Female, M = Male

Natal/Original Site & New Site Codes: BG = Buck Gully, City of Newport Beach; BMR = Bommer Canyon, City of Irvine Open Space South (COI); BRR = Bommer Ridge Road, COI; CCSP = Crystal Cove State Park; ELMO = El Modena Open Space Preserve, Orange County Parks; MD = Mule Deer, COI; SCE = Southern California Edison-Viejo Conservation Easement; SCR = Sand Canyon Reservoir, COI; TRD = Turtle Ridge, COI; UC = University of California Irvine Open Space Ecological Preserve; UNB = Upper Newport Bay, Orange County Parks

4.0 DISCUSSION

4.1 The Role of Nest Predation and Food Limitation in Regulating Cactus Wren Productivity

Cactus wren productivity (average of 2.7 fledglings) was relatively low during our three year study in Orange County's Central and Coastal Subregion NCCP/HCP Reserve System. Nest predation was responsible for the failure of approximately one-quarter of the nests found during the study. This level of predation is relatively low compared to the 50-75% predation rate documented in other studies of coastal sage scrub nesting birds, such as the California Gnatcatcher (*Polioptila californica*; e.g., Sockman 1997, Grishaver et al. 1998, Braden 1999, Misenhelter and Rotenberry 2000). However, this rate of nest failure is not trivial, as some pairs with depredated nests may not attempt to re-nest and thus may not produce any young in a breeding season. Nest predation risk is also unequal across the study area, with some sites and pairs facing substantially higher risks of nest failure than others.

The amount and timing of precipitation appears to be an important regulator of productivity in Cactus Wrens by influencing food availability during nesting. While Cactus Wren productivity in southern California is positively correlated with annual rainfall, too much cold winter rain may also reduce the number of young produced. Over the last decade, there have been multiple years of lower than average rainfall in southern California. Extreme drought in 2002 was associated with severe food limitation and led to reproductive failure of birds inhabiting coastal sage scrub and chaparral habitats in San Diego County (Bolger et al. 2005; Preston and Rotenberry 2006a). Cactus wren surveys conducted by NROC in Orange County reported an estimated 30% decrease in abundance from 2002 to 2003, presumably due to the drought and a lack of reproduction (Hamilton 2003). A second exceptional drought year in 2007 was also associated with low cactus wren productivity in the NCCP/HCP Reserve System (Table 2; Kamada 2008). In contrast, higher than normal rainfall and cold temperatures coinciding with nesting, may reduce insect food availability, wren foraging opportunities, and place greater energetic demands on both adults and young. In 2011, there were a series of late season, cold, winter storms, and we observed delayed nesting, a shorter breeding season, lower nestling survival, retarded nestling development, and few pairs producing multiple broods. These are all indicators of limited insect availability during nesting. An abundant growth of invasive grasses may have affected the ability of wrens to effectively forage on the ground. Invasive grasses may also support arthropod communities that do not provide the insect prey used by nesting wrens.

An experimental study of a desert population of cactus wrens demonstrated that annual productivity was influenced by food availability during the nestling stage (Simons and

Martin 1990). Food-supplemented pairs had a greater number of second broods over the two year study and higher nestling survival in one year. There are also reports of nestling starvation in another desert population (Marr and Raitt 1983). This study found that cactus wrens initiated nests when temperatures were high and predicted favorable temperatures and food conditions during the nestling stage. In one year, unusually cold temperatures at night resulted in most pairs abandoning nests with eggs and reduced hatching success and starvation of broods in the remaining nests.

Both food limitation and nest predation influenced Cactus Wren productivity during our three year study. These two factors may act simultaneously to significantly reduce reproductive success and the number of fledglings produced, particularly under poor environmental conditions. For example, during the extreme 2002 southern California drought it was expected that food limitation was the primary factor limiting reproduction in several shrubland bird species (Bolger et al. 2005). However, an experimental study manipulating food and nest predation during the same drought found that both factors had equal and independent effects on annual fecundity of a shrubland songbird in the region (Preston and Rotenberry 2006a,b). Nest predation may preclude a pair from successfully reproducing when there are insufficient food resources for re-nesting. Combined, food limitation and nest predation could lead to a rapid decline in Cactus Wren population size, particularly if associated with poor adult survival.

4.2 Dispersal

Cactus Wrens in our study were highly sedentary, with juveniles typically dispersing short distances to find an available territory and mate. Our preliminary results show that the average juvenile dispersal distance of 0.66 km in this study is 50% or less than that documented for other Cactus Wren studies (Bontrager and Gorospe 1995, Atwood et al. 2002). A study of banded cactus wrens from 1992 to 1994 in NROC's Coastal Reserve (Bontrager and Gorospe 1995) documented juveniles dispersing an average of 1.3 km (std ± 2.0, n = 23, range: 0.0 to 5.6 km). Similar results were documented for the Palos Verdes Peninsula in Los Angeles County where juveniles dispersed an average of 1.6 km (std ± 2.28, n = 71; Atwood et al. 2002). During our three year study, we observed that 91% of juveniles establishing territories did so at their natal study site. Nine of these juveniles (25.7%) inherited their natal territory from their parents, which is similar to the 30% of juveniles inheriting natal territories in the San Joaquin Hills during the early 1990's (Bontrager and Gorospe 1995). A study of desert wrens found juvenile males stayed near their natal territory while females moved farther to find mates (Anderson and Anderson 1973). In our study, we found similar results with 88.9% of those juveniles inheriting their natal territory being males.

Since the early 1990s natural habitats in the NCCP/HCP Reserve System have become more fragmented due to urban development and road construction. As habitat patches become smaller and more isolated, it may be increasingly difficult for juveniles to successfully disperse and establish into a breeding population (Solek and Szijj 2004; Mitrovich and Hamilton 2007; Kamada 2008). Smaller, isolated habitat fragments may also support smaller populations with greater chance of local extinction. The distance that must be traveled between neighboring Cactus Wren populations in the Coastal Reserve and parts of the Central Reserve have increased. We may now face a situation where there are infrequent long distance dispersals between isolated populations, while most juveniles remain at their natal site rather than risk the uncertainty of traveling long distances through unsuitable habitat.

4.3 Annual Survival

We do not yet have good survivorship estimates, as this will take several more years of surveying wrens to document. On the Palos Verdes Peninsula of Los Angeles County, annual survival rates for cactus wren averaged 0.65 (std ± 0.06, n = 5 years) for adults and 0.32 (std ± 0.26, n = 5 years) for juveniles (Atwood et al. 2002). A study of a banded population in the desert found males living an average of 2 years and females 1.4 years (Anderson and Anderson 1963b). This may have been rather low survivorship, as the wrens were of unknown age when banded and were in an urban edge environment with high mortality from domestic cat predation. Based on Bird Banding Lab records, the oldest known banded individual was 6 years and 4 months (Gustafson and Hildenbrand 1998). Another desert study showed survival of fledglings 3-40 days out of the nest was equivalent to less than 50% survival over a year, with survivorship increasing with age (Ricklefs and Hainsworth 1968). Causes of mortality include predation of juveniles and adults by Cooper's hawk (*Accipiter cooperii*) and domestic cats (*Felis domesticus*).

4.4 Threats to Cactus Wren populations

The single largest threat to Cactus Wren populations in Orange County's Central and Coastal Subregion NCCP/HCP Reserve System has been large wildfires. Cactus Wren populations and cactus scrub habitat in the Coastal Reserve were significantly impacted by the 1993 Laguna Fire (Bontrager et al. 1995). The majority of populations remained small and relatively isolated as a result of the loss of extensive areas of suitable habitat, both to fire and urban development (Mitrovich and Hamilton 2007). Following the 2007 Santiago Fire, there was significant loss of Cactus Wrens and suitable habitat in the Central Reserve, with populations smaller, more isolated and vulnerable to local extinction.

Weather, particularly the amount and timing of rainfall is important in influencing Cactus Wren productivity and periods of extended and extreme drought may cause noticeable population declines. The extended drought from the late 1990's through 2007 affected the production of young and contributed to the reduction of Cactus Wren populations over the last decade (Hamilton 2003, 2004; Kamada 2008, NROC unpub. data). Cactus Wrens disappeared from a number of sites after the extreme drought year in 2007 (NROC unpub. data). We do not know whether a reduction in individual survivorship also led to the decline of wrens in the Coastal Reserve. If survival was low, perhaps due to predation or disease, this could interact with low productivity to cause a rapid decline in the number of wrens, particularly in smaller, more isolated populations. Drought did not appear to have as severe an effect on cactus wren populations in the Central Reserve (Hamilton 2004). Cactus Wrens in the Coastal and Central Reserves experienced moderate reproductive success and productivity in 2009 and 2010. Both of these years had average to above average rainfall. With this small boost in productivity, we documented recolonization of some areas where wrens had disappeared in 2007 and there was an increase in population size at core sites where wrens have remained extant. However, in 2011 cactus wrens had low productivity and sites appeared to be exceeding carrying capacity, as indicated by failure to nest, behavioral interactions and encroachment on territories and nests by intruding wrens.

It appears that a major threat to the persistence of wrens in the NCCP/HCP Reserve System is the lack of suitable habitat, which reduces the ability of individuals to disperse to isolated populations and to establish territories and obtain a mate. There has been insufficient recovery of cactus scrub in the Coastal Reserve since the 1993 Laguna Fire and wren populations have not returned to their pre-fire levels. Suitable habitat appeared to be limiting at all of our monitoring sites in 2011. With the growth of local populations in 2009 and 2010, competition became intense for territories and mates. There were increased incidences of "floater" individuals remaining at the margin of occupied territories, and unable to establish territories or recruit into the breeding population.

Poor habitat quality is another potentially important threat that needs to be evaluated and potentially addressed to achieve recovery of Cactus Wren populations. Invasive annual plants may also cover bare ground and reduce foraging habitat. In particular, exotic annual grasses may reduce Cactus Wren foraging success and alter the composition of native arthropod communities required by breeding wrens. In some areas of the NCCP/HCP Reserve System there is overgrowth of cactus by native shrubs, which could reduce the availability of cactus wren nesting and foraging habitat.

Another potential threat faced by Cactus Wren is high rates of predation, particularly by Cooper's hawks. With increasing expansion of Cooper's hawks into urban areas, wren populations on small fragmented natural lands may experience higher predation rates, particularly in the nesting season. Young, inexperienced cactus wren appear to be especially vulnerable to predation. It is not clear the effect of Cooper's hawks on population dynamics, but it appears they may act to remove excess individuals from local populations, since we are seeing population numbers increasing at most of our sites. However, in years with low Cactus Wren productivity, Cooper's hawk predation could have a much larger effect and increase the probability of extinction of smaller populations.

4.5 Management Recommendations

The most important management action that can be undertaken to recover Cactus Wren populations is to enhance and restore cactus scrub habitat. Currently, there is insufficient habitat to sustain wren populations over the long-term, particularly in the Coastal Reserve. Enhancing linkages and expanding breeding habitat will facilitate dispersal, territorial establishment and the growth of local populations. As more juvenile and adult dispersal data become available, an analysis should be conducted to see which sites in the Coastal and Central Reserves are most isolated and that may not be connected to other sites. Using this information, cactus scrub restoration projects should be identified and prioritized to improve connectivity between sites supporting Cactus Wrens and to identify opportunities for expanding breeding habitat at existing populations and creating new habitat between populations.

Most cactus scrub restorations involve planting of cactus pads which can take many years to grow to a size suitable for Cactus Wren nesting. More recently the Nature Reserve of Orange County has salvaged large cacti when available and planted it. This has provided immediate foraging and nesting habitat for wrens (Preston, unpub data). Thus, land managers should plant large cacti in their cactus scrub restorations when there is the opportunity to harvest cactus slated for development.

Studies are needed to determine whether poor habitat quality is inhibiting recovery of Cactus Wren populations. There are two aspects of habitat quality that should be addressed. The first is whether invasive annual grasses are reducing productivity and survival of wrens in established territories. Invasive plants may alter arthropod communities and reduce food availability for wrens or could impede wren foraging because of the thick thatch and cover obscuring bare ground where wrens often forage. The second issue related to habitat quality is whether shrub overgrowth of cacti and reduction in open habitat inhibits wren occupancy in some areas, particularly in the Coastal Reserve.

4.6 Future Work

In 2012 NROC will discontinue monitoring reproduction at all nine sites. We plan to continue surveying for banded birds in 2012 and beyond in order to document dispersal, territorial status and survival of birds banded from 2009 through 2011. These surveys are critical for determining whether survival and dispersal are limiting recovery of Cactus Wren populations.

NROC is collaborating with Dr. Kailen Mooney at the Center for Environmental Biology (CEB) at the University of California Irvine and Dr. Jutta Burger from the Irvine Ranch Conservancy (IRC) to study Cactus Wren foraging relative to arthropod richness and abundance on different plant species and substrates in coastal cactus scrub habitats. A goal of this study is to evaluate whether invasive plants are affecting the composition and abundance of arthropods and affecting Cactus Wren foraging. The CEB and IRC will be responsible for sampling plants and arthropods, whereas NROC will record Cactus Wren foraging behavior and monitor reproduction at eight territories at the UC Irvine Ecological Preserve and Bommer Canyon/Bommer Ridge sites.

In 2012 NROC will also be collaborating with USGS to gather blood samples from adults and nestlings in burned areas of the Central Reserve. These are areas we have not been monitoring in our study and we will band all birds that we capture. These additional samples will mean that all populations within the NCCP/HCP Reserve System have been adequately sampled. In 2012 Dr. Barbara Kus and her team of biologists from USGS will collect genetic samples from Cactus Wrens throughout other areas of coastal southern California. This will allow Dr. Vandergast and her staff to evaluate connectivity and compare differences between Cactus Wren population structure for Orange County, Ventura, Los Angeles, Riverside, San Bernardino and San Diego counties. These analyses may also provide some insight into the subspecific status of wrens in coastal southern California.

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7.0 APPENDICES

Appendix Table 1a. Dates of field work, names of field personnel, type of field work conducted, and breeding status of Cactus Wrens at Nature Reserve of Orange County 2009 Monitoring Sites.

Date	Personnel	Crystal Cove State Park (CCSP)	El Modena (ELMO)	SCE- Viejo Conservation Easement (SCE)	UC Irvine Ecological Reserve (UC)	Upper Newport Bay (UNB)
2/19/2009	DK				SV, NA, NB	
2/20/2009	DK, KM				SV, BU, NA,	
2/21/2009	DK				BA	
2/25/2009	KP, DP, MC, DH, SM, EB	O, NA				
2/28/2009	DK				BA	
3/2/2009	KP, EB, SM				O, NA, NB	
3/3/2009	KP		S, O, NA, E?			
3/5/2009	KP, KY					S, O, NA, NB
3/9/2009	KP		S, O, NB			
3/10/2009	DK		BA			
3/10/2009	KP, DP, MC, DH, STM	O, NA				
3/11/2009	EB, SM				O, NA	
3/12/2009	DK, KM, KP		BA, E?			
3/16/2009	DK		BA, E?			
3/17/2009	DK, KM, KP		BA, O, NB, E?			
3/20/2009	DK					SV, O, NA, E?
3/23/2009	DK					BA, NA, E?
3/24/2009	KP, TS		S, NA			
3/26/2009	KP		S, O, NB, E			
3/27/2009	DK	BA, NA				
3/31/2009	DK, KP		O, NB, E			
4/1/2009	DH	O, C?				
4/1/2009	SM, DC				O, E?	
4/2/2009	DK, KP		BA, O, E			
4/3/2009	DK, KM				BN, NA, NB, E, N	
4/3/2009	DK					S, E
4/6/2009	KP, SM				O, N	
4/7/2009	KM		SV, NA, NB			
4/8/2009	DH, MC	O, NA				
4/8/2009	KP		O, E?, N			

Appendix Table 1a *continued*. Dates of field work, names of field personnel, type of field work conducted, and breeding status of Cactus Wrens at Nature Reserve of Orange County 2009 Monitoring Sites.

Date	Personnel	Crystal Cove State Park (CCSP)	El Modena (ELMO)	SCE- Viejo Conservation Easement (SCE)	UC Irvine Ecological Reserve (UC)	Upper Newport Bay (UNB)
4/9/2009	DK, KM, KP		O, E, N			
4/9/2009	DK					O, N
4/10/2009	DK				BN, E, N	
4/13/2009	KP				O, NB, E?, N, NP	
4/14/2009	KP		O, NB, E?, N			
4/15/2009	DK		BN, E, N			
4/16/2009	DH, MC	O, NBF				
4/16/2009	KM		BN, NB, N, NP			
4/20/2009	MC	O, NA				
4/21/2009	DK, KM, KP, TS		BN, O, E, N, F			
4/21/2009	DK				S, E, NP	O, NB, F, NP
4/22/2009	KP, MC, STM	O, E?				
4/22/2009	KP, KY					O, NB, F, MA
4/22/2009	SM, DC				O, N	
4/24/2009	DK	S, E				
4/26/2009	DK					S, NB, F
4/26/2009	KM		S, NB, E, F, NAN, MA			
4/27/2009	DK		BA, BFJ, F, NP			BFJ, F
4/28/2009	DK, KM, KP, TS		BN, BU, O, E, N, F			
4/28/2009	DK				S, N	S, NA
4/29/2009	DK, MC	O, E				
4/29/2009	DK, KM		BJF, F			
4/29/2009	SM, EB				O, E, N	
4/30/2009	KM		S, N, F, NP			
5/4/2009	KP			O, E?, N		
5/5/2009	DK			S, N	BN, N, F	S, NB, NA
5/5/2009	KP, TS		O, E?, N, F			
5/6/2009	DK			BN, NB, E, N		
5/6/2009	SM, EB				O, N	
5/9/2009	DK				S, E, N, F	

Appendix Table 1a *continued*. Dates of field work, names of field personnel, type of field work conducted, and breeding status of Cactus Wrens at Nature Reserve of Orange County 2009 Monitoring Sites.

Date	Personnel	Crystal Cove State Park (CCSP)	El Modena (ELMO)	SCE- Viejo Conservation Easement (SCE)	UC Irvine Ecological Reserve (UC)	Upper Newport Bay (UNB)
5/11/2009	DK, KM		S, NB, N, NP	BA, BN, N		S, E, F
5/12/2009	MC	O, E				
5/12/2009	DK, KM			BA, BN, N		
5/12/2009	KP		O, NB, N, F			
5/13/2009	DK			BN, N		
5/14/2009	KM		S, NB, N?, F			
5/14/2009	SM				O, NB, N	
5/16/2009	DK				BN, N	
5/18/2009	MC	O, N				
5/18/2009	DK, KP, ST			BN, N, F, NP		
5/19/2009	DK, ST			BA, BN, N		
5/19/2009	KP		O, F			
5/20/2009	DK	S, N			S, N, F	
5/20/2009	DK, KM					S, N, NA
5/21/2009	DK				BN, N	BN, N
5/21/2009	KM		S, NB, N, F			
5/21/2009	KP				O, N, F	
5/22/2009	EB				O, E?	
5/25/2009	DK, KM			BA, BN, NB, N		
5/26/2009	DK, KM		S, F, NP			
5/27/2009	DK, KM		S, F		S, E	
5/27/2009	DK	NP, MA?				
5/27/2009	KP		O, N?, F			
5/28/2009	KM		S, N?, F			
5/28/2009	KP			O, NB, F		
5/29/2009	EB				O, NB	
6/1/2009	DK		S, NP		S, NB, N, F, NP	SV, NBF
6/2/2009	DK, KP		S, O, F, J, JD			
6/3/2009	MC	O, ?				
6/3/2009	DK	S, NB			S, E, F, NP	
6/3/2009	KP, TS			O, F		
6/3/2009	KY					O, N
6/4/2009	DK		BA, NB			
6/4/2009	MC	O, NB				

Appendix Table 1a *continued*. Dates of field work, names of field personnel, type of field work conducted, and breeding status of Cactus Wrens at Nature Reserve of Orange County 2009 Monitoring Sites.

Date	Personnel	Crystal Cove State Park (CCSP)	El Modena (ELMO)	SCE- Viejo Conservation Easement (SCE)	UC Irvine Ecological Reserve (UC)	Upper Newport Bay (UNB)
6/4/2009	KY					O, F, NA
6/5/2009	SM, EB				O, NB, F	
6/8/2009	DK, KM, KP				BFJ, E, N, F	
6/8/2009	DK			S, NBF		
6/9/2009	DK		S, NB, E, J, JD			
6/9/2009	KP			O, F, J, JD		
6/9/2009	KM		S, F			
6/10/2009	DK, KM, KP				O, S, E, F	
6/10/2009	DK	S, E				
6/11/2009	SM, EB				O, N, F	
6/12/2009	STM	O, E				
6/15/2009	DK		S, E, F, J, JD			
6/15/2009	KP			S, N, F		
6/16/2009	MC, MG	O, E				
6/16/2009	DK			S, NB, E, F		
6/16/2009	KP		S, NB, F, J, JD			
6/17/2009	DK	S, E				S, F
6/17/2009	DK, KM				S, N, F	
6/19/2009	SM, EB				O, F	
6/22/2009	DK		BN, NB, N, F, J, JD			
6/22/2009	KM		N, NB, F, J, JD, NP			
6/23/2009	DK, KP, DL			O, E, F		
6/23/2009	KM		S, NB, F			
6/24/2009	DK	S, E		S, NB, N, F		S, F, NA
6/24/2009	KM				S, NB, F	
6/25/2009	MC	O, E				
6/25/2009	SM, DC				O, N	
6/25/2009	DK, KM		BA, N, F, J, JD			
6/25/2009	DK			BN, N, F		
6/27/2009	DK		S, NB, J	S, N, F		
6/29/2009	DK		S, NB, N, F, J, JD			
6/29/2009	KP, DL				O, NB, N, F	

Appendix Table 1a *continued*. Dates of field work, names of field personnel, type of field work conducted, and breeding status of Cactus Wrens at Nature Reserve of Orange County 2009 Monitoring Sites.

Date	Personnel	Crystal Cove State Park (CCSP)	El Modena (ELMO)	SCE- Viejo Conservation Easement (SCE)	UC Irvine Ecological Reserve (UC)	Upper Newport Bay (UNB)
6/30/2009	KM		S, F			
6/30/2009	KP, DL			O, E, N, F, J		
7/1/2009	DK		BA, BJ, N, J	S, E, F		
7/2/2009	DK	S, N, J				
7/2/2009	SM, DC				O, F, J, JD	
7/6/2009	DK	S, FN			S, F, J	
7/6/2009	KP, DL, GG					S, F, NA
7/7/2009	DK			S, N, F		
7/8/2009	DK	BN, N	BU			
7/9/2009	DK		BJ, J	BN, N, F, J, JD		
7/9/2009	MG	O, N, F?				
7/9/2009	SM				O, F, J	
7/10/2009	KM		S, F, J			
7/13/2009	KP, DL				S, NB, F, J	
7/14/2009	KP, DL			S, F, J, JD		
7/15/2009	MG	O, N				
7/15/2009	DK			BA, BF, F		
7/16/2009	DK, KM	BA, N				
7/16/2009	KP, TS				S, J, JD	
7/17/2009	DK, KM			BA, BJ, J		
7/20/2009	MG	O, N				
7/20/2009	EB				O, F, J, JD	
7/20/2009	DK		S, F, J, JD			
7/21/2009	KP, TS				MV, S, F, J, JD	
7/22/2009	DK	S, F				
7/23/2009	DK, MG	S, F				
7/23/2009	KP			S, NB, F		
7/24/2009	DK			S, F		
7/30/2009	KP, TS, DL				MV, S, F, J, JD	
7/31/2009	DK			BF, F		
7/31/2009	MG	O, F?				
8/17/2009	KP, TS, DL			MV, NA		
10/17/2009	KP, TS			MV, NB, J, NA		

Appendix Table 1a *continued*. Dates of field work, names of field personnel, type of field work conducted, and breeding status of Cactus Wrens at Nature Reserve of Orange County 2009 Monitoring Sites.

Date	Personnel	Crystal Cove State Park (CCSP)	El Modena (ELMO)	SCE- Viejo Conservation Easement (SCE)	UC Irvine Ecological Reserve (UC)	Upper Newport Bay (UNB)
10/17/2009	DK, ST			SV, J, JD, NA		
10/18/2009	DK, KM		SV, NB, J, JD, NA			
10/23/2009	DK, KM			BA, J, NA		
10/24/2009	DK, KM			BA, J, NA		
10/27/2009	DK, KM			SV, NB, J, JD, NA		
10/28/2009	DK		SV, J, JD,NA			
11/14/2009	DK, KM			SV, NB, J, JD, NA		
11/15/2009	DK, KM, ST, WR		SV, J, JD, NA			
12/5/2009	DK		SV, J, JD			

Personnel Codes	Personnel Activity & Nesting Status Codes
BN = Barbara Norton	*Personnel Activity Codes*
DC = Deana Collins	BA = Band adult
DH = Dominic Herrera	BFJ = Band fledgling or juvenile
DK = Dana Kamada	BN = Band nestling
DL = Dana Lee	BU = Mist netting and banding attempt unsuccessful
DP = David Pryor	MV = Measure vegetation
EB = Elizabeth Brown	O = Observe & collect behavioral data
GG= Gail Gutierrez	S = Look for wrens and check breeding status
JV = Jacky Velasquez	SV = Focused surveys using taped vocalizations
KM = Karly Moore	*Nesting Status Codes*
KP = Kristine Preston	C = Copulation
KY = Kathy Young	E = At least one nest at site observed or checked with eggs (egg laying/incubation)
LC = Laura Cohen	F = At least one pair at site observed with fledglings
MC = Maria Carrillo	J = At least one juvenile independent of adults observed during visit
MG = Mayra Garcia	JD = Juvenile movements outside natal territory/dispersal to new site
PA = Portia Arutunian	N = At least one nest at site observed or checked with nestlings
MC = Maria Carrillo	NA = Nonbreeding single adult or pair detected
MG = Mayra Garcia	NAE = Nest with eggs found abandoned at site during visit
SM = Sally Menzel	NAN = Nest with nestlings found abandoned at site during visit
SR = Shirley Reynolds	NAE = Nest with eggs found abandoned at site during visit

ST = Scott Taylor	NB = Nest build (roost and breeding)
STM = Steve Manee	NBF = No birds found
TS = Trish Smith	NP - At least one nest found depredated at site during visit
WR = William Rodriguez	MA = At least one adult missing & not detected again, presumed mortality

Appendix Table 1b. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2010 Cactus Wren Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Reserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
1/7/2010	KM, ST				B,S	B,S				
1/12/2010	KP		S							
1/14/2010	KM, ST		B,S							
1/15/2010	KM, ST	B,S	B,S		B,S	B,S				
1/25/2010	KM				B,S	B,S				
1/26/2010	KM		B,S							
1/29/2010	RH					I				
2/1/2010	KM					M				
2/2/2010	KM, ST, WR			M	M					
2/3/2010	ST				M					
2/8/2010	KM					M				
2/9/2010	KM, ST		M							
2/11/2010	DK, KM		M		M					
2/12/2010	DK, KM, WR		B							
2/15/2010	KM, ST		M			M				
2/16/2010	DK			M						
2/17/2010	DK	M			M					
2/22/2010	KM					M				
2/23/2010	DK, KM		M	M						
2/24/2010	DK, KM	M	M		M					
2/25/2010	DK, KM, WR				B					
2/26/2010	DK, KM, ST		B							
3/1/2010	DK, KM, KY					M				
3/2/2010	DK, KM, KP		B	M		M				
3/4/2010	DK, KM		M		M					
3/5/2010	DK, KM	M	M							
3/9/2010	KP			M	M					
3/11/2010	DK,EB, KM, KP, SM	M	M		M					

Appendix Table 1b *continued*. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2010 Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Reserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
3/12/2010	DK			M						
3/15/2010	DK, KM, KP	B	M		B					
3/16/2010	KP				M					
3/18/2010	DK, KM		M, B							
3/19/2010	EB, DK, KM, SM		M	M						
3/22/2010	DK, KM, KP		M, B	M	M					
3/23/2010	KM		M							
3/25/2010	DK, KM, KP		M	M	M					
3/26/2010	DK	M			M					
3/28/2010	DK, KP				M					
3/29/2010	DK, KM		M	M						
3/30/2010	DK			M						
3/31/2010	DK, KM	M	M		M					
4/1/2010	KP, SM				M					
4/2/2010	DK, KM		M, B	M						
4/5/2010	DK, KM		M			M				
4/6/2010	DK, KM		M	M		M, B				
4/7/2010	DK			M						
4/8/2010	DK, JH, KM, KP	M	M, B		M					
4/9/2010	DK, KM		M, B		M					
4/11/2010	KM		M, B							
4/12/2010	DK, KM, ST		B	M			S			
4/13/2010	DK, KM		M	M						
4/14/2010	DK, KD, KM,	M	M	M	M, B					
4/15/2010	DK, KM		M, B			M				
4/16/2010	DK, JA			M						

Appendix Table 1b *continued*. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2010 Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Reserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
4/18/2010	DK, KM		M	M						
4/19/2010	DK, KM, KP, ST			M			S, M			
4/20/2010	DK, KM, KP, ST	M	M, B		M	M		S		
4/21/2010	JH	M								
4/22/2010	KM		M, B							
4/23/2010	DK, JA, KM		M	M						
4/24/2010	DK, EB, KM		M, B	M, B	M					
4/25/2010	EB				M					
4/26/2010	DK, KD , KM, KP, ST	M			M, B	M	M	S		M
4/27/2010	DK, KM	M	M	M						
4/28/2010	KM		M			M				
4/29/2010	DK			M, B	M, B					
4/30/2010	DK, EB, JA, SM		M, B	M	M					
5/3/2010	DK, KD, KM, ST	M	M		M	M				S, M
5/4/2010	DK, JA, KM, KP, ST		M, B	M, B					S, B	
5/5/2010	DK, KP			M				B		
5/6/2010	DK	M								
5/7/2010	DK, EB, KM, SM		M, B	B	M				B	
5/10/2010	DK, KM		M	M, B		M, B				
5/11/2010	DK, KM, KP		M		M					M
5/12/2010	DK, KD	M							M	
5/13/2010	DK, JA	M		M						

Appendix Table 1b *continued*. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2010 Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Reserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
5/14/2010	DK, EB, KM, SM			M	M		S			
5/15/2010	KM		M							
5/17/2010	DK, KM		M	M, B						
5/18/2010	DK, KM,	M	M		M, B	M			M	
5/19/2010	DK			M			M			M
5/20/2010	EB, KM, KP, SM	M			M		S			
5/21/2010	DK, KM		M, B	M	M		M, B	M		
5/24/2010	DK, KM		M	M, B						
5/25/2010	DK, KM	B	M		M	M				
5/26/2010	DK								M	M
5/27/2010	DK, KM, KP, KY					M	M		M	
5/28/2010	DK, EB, SM			M	M					
5/30/2010	DK				B		B			
5/31/2010	DK			M					B	
6/1/2010	DK, KM	M	M		M					
6/2/2010	DK, KP		M		M		M		M, B	
6/4/2010	DK, EB, KD, SM,	M	M	M	M	M				
6/6/2010	DK, KM		M							
6/7/2010	DK, KM, KP			M		M	M		M	
6/8/2010	DK, KM		M		M, B					
6/9/2010	DK, JA, KM		M, B							
6/10/2010	DK, KM, KP	M	M	M			M			
6/11/2010	DK, KM			M, B						
6/13/2010	KM		M							

Appendix Table 1b *continued*. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2010 Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Reserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
6/14/2010	DK, EB, KM, SM			M	M	M	M			
6/15/2010	DK, KM	M	M		M					
6/16/2010	DK								M	
6/17/2010	DK, EB, SM			M, B	M					
6/18/2010	DK				M				M	
6/20/2010	DK, KM		M	M, B						
6/21/2010	DK, KM, KP			M		M	M	M		
6/22/2010	DK, KM, KP	M	M, B		M		M			M
6/23/2010	DK			M						
6/24/2010	DK, KP, ST			M			S, M			
6/25/2010	DK		B						M, B	
6/27/2010	KM, ST						M, B			S
6/28/2010	DK, KM		M	M		M				
6/29/2010	DK, KM, KP		M		M			M	M	M, B
6/30/2010	DK	M								
7/1/2010	DK			M						
7/2/2010	DK			M, B			M, B			B
7/3/2010	DK							B		
7/4/2010	DK, KM		M, B							
7/5/2010	DK, KM		M		M		M, B			
7/6/2010	DK, KM				B				M	
7/7/2010	DK			M						
7/8/2010	DK	M							M	
7/9/2010	KM		M							
7/10/2010	DK, KM		M		M, B		M			
7/11/2010	DK, KM						M, B			
7/13/2010	DK							M		M

Appendix Table 1b *continued*. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2010 Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Reserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
7/15/2010	DK					M	M			M
7/16/2010	DK, KM		M				M, B			
7/19/2010	DK, KM		M	M			M			
7/22/2010	DK, KM, KY					B	M, B			
7/23/2010	DK			M						
7/27/2010	DK, KP				S		M		M	
8/1/2010	DK, KM						S			
8/3/2010	DK					S				
8/9/2010	KM, KY					S				
8/10/2010	DK						S			
8/13/2010	DK, KM						S			
8/19/2010	KP			S						
8/23/2010	KP			S						
8/30/2010	KP				S					
8/31/2010	KP		S							
9/9/2010	KP					S				
9/16/2010	DK	S								
9/20/2010	KP						S			
9/21/2010	KP		S							
9/23/2010	EB, SM				S					
9/28/2010	KP			S						
10/1/2010	EB, SM				S					
10/5/2010	KP				S					
10/8/2010	EB, SM				S					
10/15/2010	EB, SM				S					
10/27/2010	KM					S				
10/28/2010	DK, KM	S	S							
10/29/2010	KM			S						

Appendix Table 1b *continued*. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2010 Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Reserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
11/2/2010	EB, KM, KP, SM				S		S			
11/8/2010	KM					S				
11/9/2010	KP				S					
11/18/2010	DK, KM	S		S						
11/29/2010	KM						S			
11/30/2010	DK, KM		S							

Personnel Codes

DK = Dana Kamada

EB = Elizabeth Brown

JA = Jeff Ahrens

JH = Janette Havens

KD = Kumar Dilip

KM = Karly Moore

KP = Kristine Preston

KY = Kathy Young

SM = Sally Menzel

RH = Robb Hamilton

ST = Scott Thomas

WR = William Rodriguez

Personnel Activity Codes

B = Capture & band birds

I = Incidental observation

M = Survey for Cactus Wren in the breeding season in order to observe & record behavior, monitor breeding status & check nests

S = Survey for Cactus Wrens to document banded birds & locate nesting birds for further monitoring , use taped vocalizations as needed

Appendix Table 1c. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2011 Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Preserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer/ Quail Hill	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
1/4/2011	KP				S					
1/14/2011	SM, EB				S					
1/18/2011	DK, KM			S						S
1/19/2011	KM						S			
1/20/2011	DK, KP				S				S	
1/21/2011	SM, EB, KM		S		S					
1/24/2011	DK	S								
1/29/2011	KM		S			S				
2/1/2011	DK, KP			S	S					
2/2/2011	DK			S						
2/3/2011	DK				S					
2/4/2011	SM, EB				S					
2/8/2011	KP, CA, KM				S	S				
2/9/2011	KP						S			
2/10/2011	KP						S			
2/11/2011	KM, SM, EB		S		S					
2/15/2011	DK				S					
2/18/2011	KM		S							
2/22/2011	DK			S						
2/24/2011	DK					S				
2/25/2011	KM		S							
2/27/2011	KM		S							
2/28/2011	DK			S						
3/1/2011	KM, KP, CA		S				S			S
3/2/2011	DK, KM		B, S		S					
3/3/2011	DK, KM, ST	S			S	S				S
3/4/2011	DK, KM		B, S							
3/8/2011	DK			S						
3/9/2011	DK, KP			S			S			
3/10/2011	DK	S			S					
3/12/2011	DK, KM		S		S					
3/13/2011	KM		S							
3/14/2011	DK, KP			S			S			
3/15/2011	DK, KP			S	S					
3/16/2011	KM, DK	S				S				
3/17/2011	DK				S					

Appendix Table 1c *continued*. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2011 Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Preserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer/ Quail Hill	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
3/19/2011	KM		S							
3/22/2011	DK, KM		S	S						
3/23/2011	DK			S						
3/24/2011	DK, KP, KM				S		S			
3/28/2011	DK, KM		S	S						
3/29/2011	DK, KM, KP		S	S	S					
3/30/2011	DK	B, S								
3/30/2011	KM						S			
3/31/2011	DK, KP						B, S		S	
4/2/2011	DK				S					
4/4/2011	DK, KM		S	S						
4/5/2011	DK, KM		S	S						
4/6/2011	DK	S								
4/6/2011	DK, KM, ST				S	S			S	
4/7/2011	KP						S			
4/10/2011	DK				B, S	S				
4/11/2011	DK			S					B	
4/12/2011	DK, KP			S			S			
4/13/2011	DK, KM	S	S			S				
4/14/2011	KM, KP		S		S		B			
4/15/2011	DK				S	S				
4/17/2011	DK			S						
4/18/2011	DK, KY, KM, KP			S		S		S		
4/19/2011	DK, KM, KP		S	S			S			
4/20/2011	DK, KM		S							
4/21/2011	DK	S			S			S	S	
4/22/2011	DK, KM				S	S		S		
4/23/2011	DK, KM, LA			B, S	B	S				
4/25/2011	DK, KP			S	S	S	S			
4/26/2011	DK, KM		S	S						
4/27/2011	DK, KM	S	S							
4/28/2011	DK, KM			S			S	S	S	S
4/29/2011	DK, KM				B, S	S				
4/30/2011	DK			B, S						

Appendix Table 1c *continued*. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2011 Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Preserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer/ Quail Hill	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
5/1/2011	DK				B, S					
5/2/2011	DK, KM		S	S		S				
5/3/2011	DK, KM		S	B, S						
5/4/2011	DK, KM	S	B, S				S			
5/5/2011	DK, KM, KP			B			B, S			
5/6/2011	DK, KM				B			S		
5/7/2011	DK				B, S					
5/8/2011	DK, KM		B, S					S		
5/10/2011	DK, KM, KP		S	S		S	B			
5/11/2011	DK, KM		B, S	B, S						
5/12/2011	DK	S								
5/13/2011	DK, KM		B, S		S	S		S		
5/14/2011	DK, KM		S							
5/16/2011	DK, KM		B, S	B, S			S			
5/18/2011	DK			B, S						
5/19.2011	DK, KM	S	B, S			S				
5/20/2011	DK, KM		S		S					
5/21/2011	DK			S						
5/22/2011	DK, KM		B, S		S					
5/23/2011	DK, KM		S	S						
5/24/2011	KM		S			S				
5/25/2011	DK, KM, KP		B		S	S	S	S	S	
5/26/2011	DK			S						
5/27/2011	KM				B					
5/28/2011	DK				S					
5/30/2011	DK, KM		B, S	S		B				
5/31/2011	DK, KP			B, S			S			
6/1/2011	KM	S	S						S	
6/2/2011	DK, KM				S		S	B, S		
6/4/2011	KM		S							
6/6/2011	DK, KM			S				S		
6/7/2011	DK, KM, KP			S		S	S	S		
6/8/2011	DK, KM		S		S					
6/9/2011	DK, KM		S	B, S						

Appendix Table 1c *continued*. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2011 Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Preserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer/ Quail Hill	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
6/10/2011	DK, KM, KP							B, S		
6/11/2011	DK, KM		S							
6/13/2011	DK, KM		S	S						
6/14/2011	DK, KM		S	S			B			
6/15/2011	DK, ST, KM		S					S	S	B, S
6/16/2011	DK, KM		B		S	S				
6/17/2011	DK	S								
6/20/2011	DK, KM, KP		B	S			S			
6/21/2011	DK			S			B			
6/22/2011	DK			B						
6/23/2011	DK, KM		S			S		B	B	
6/24/2011	DK, KM							B		
6/25/2011	DK				S					
6/27/2011	DK			S				S		
6/28/2011	KM		S							
6/29/2011	DK, KM		S	B, S						
6/30/2011	DK, KM, KP	S			S		S	S		
7/1/2011	DK, KM				S			S		
7/4/2011	DK			S						
7/5/2011	DK			S						
7/6/2011	DK, KM	B								
7/7/2011	DK								S	
7/8/2011	DK						B			
7/11/2011	DK, KM		S	S						
7/12/2011	DK, KP			S			S			
7/13/2011	DK				S				S	
7/15/2011	DK, KP						S	B, S		
7/20/2011	DK, KM				S					
7/21/2011	DK, KM, ST						S			
7/28/2011	KM, ST					S				
8/9/2011	DK			S						
8/11/2011	DK			S						
8/23/2011	DK	S								
8/25/2011	KM					S				
8/26/2011	KM						S			
8/29/2011	KP				S					

Appendix Table 1c *continued*. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2011 Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Preserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer/ Quail Hill	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
8/30/2011	KP, KM		S		S					
8/31/2011	KM						S			
9/1/2011	DK, KM			S						
9/2/2011	DK			S						
9/9/2011	KM	S				S				
9/12/2011	DK			S						
9/20/2011	DK									S
9/22/2011	KP				S					
9/25/2011	KM		S							
9/30/2011	KM						S			
10/5/2011	KP				S					
10/8/2011	DK			S						
10/9/2011	DK, KM		S	S						
10/10/2011	KP				S					
10/11/2011	DK	S								
10/13/2011	DL			S						
10/19/2011	KP				S					
10/20/2011	KM					S				
10/21/2011	KM		S							
10/24/2011	KM						S			
11/2/2011	DK	S								
11/3/2011	DK			S						
11/5/2011	DK			S						
11/14/2011	KM					S				
11/16/2011	KM		S							
11/17/2011	KM						S			
11/21/2011	KP				S					

Appendix Table 1c *continued*. Dates of field work, names of field personnel, and type of field work conducted at Nature Reserve of Orange County 2011 Monitoring Sites.

Date	Personnel	Crystal Cove State Park	El Modena	SCE- Viejo Conservation Easement	UC Irvine Ecological Preserve	Upper Newport Bay	City of Irvine: Bommer Canyon & Ridge	City of Irvine: Mule Deer/ Quail Hill	City of Irvine: Sand Canyon Reservoir	City of Irvine: Turtle Ridge
12/7/2011	DK	S								
12/8/2011	DK			S						
12/9/2011	DK			S						
12/14/2011	DK		S							
12/19/2011	DK								S	
12/20/2011	KM							S		
12/21/2011	KM						S			
12/27/2011	KM		S			S				

Personnel Codes

CA = Cara Allen

DK = Dana Kamada

EB = Elizabeth Brown

KM = Karly Moore

JA = Jeff Arhens

KP = Kristine Preston

KY = Kathy Young

LA = Lisa Allen

SM = Sally Menzel

ST = Scott Thomas

Personnel Activity Codes

B = Capture & band birds

I = Incidental observation

M = Survey for Cactus Wren in the breeding season in order to observe & record behavior, monitor breeding status & check nests

S = Survey for Cactus Wrens to document banded birds & locate nesting birds for further monitoring , use taped vocalizations as needed

Appendix Table 2a. Dates of surveys, names of field personnel, and status of Cactus Wrens at Nature Reserve of Orange County 2009 survey areas.

Date	Personnel	Aliso-Wood Canyons Wilderness Park (AWC)	James Dilley Preserve (JDP)	Muddy Canyon/ Emerald Ridge	Whiting Ranch/El Toro Road	Newport Back Bay	Caspers Regional Park
3/7/2009	KP, ST, PA, SR	S, NBF					
3/10/2009	KP, DP, MC, DH, STM			S, NBF			
3/16/2009	KP		S, NBF				
3/23/2009	KP, PA	S, NBF					
3/27/2009	KP, BN, LC, JV		S, NBF				
3/27/2009	DK						BA
6/16/2009	DK				SV, J, NA		
7/1/2009	DK	SV, NBF					
7/13/2009	DK		SV, NBF				
7/14/2009	DK		SV, NBF				
7/21/2009	DK			SV, NBF			
7/23/2009	DK			SV, NBF			
7/23/2009	KP				SV, J, NA		
7/28/2009	DK, SR	SV, NBF					
7/29/2009	DK, ST	SV, J					
7/30/2009	DK, ST	SV, NA					
10/17/2009	DK, ST				SV, J, JD		
10/27/2009	DK, KM				SV, NB, NA		
11/14/2009	DK, KM				SV, J, JD, NA		
11/16/2009	KM					SV, NBF	
12/4/2009	DK, WR				SV, NA		

Personnel Codes

BN = Barbara Norton
DH = Dominic Herrera
DK = Dana Kamada
DP = David Pryor
JV = Jacky Velasquez
KM = Karly Moore
KP = Kristine Preston
LC = Laura Cohen
MC = Maria Carrillo
PA = Portia Arutunian
SR = Shirley Reynolds
ST = Scott Taylor
STM = Steve Manee
WR = William Rodriguez

Personnel Activity Codes and/or Nesting Status at Site

Personnel Activity Codes

BA = Band adult
S = Look for wrens and check breeding status
SV = Focused surveys using taped vocalizations

Cactus Wren Status Codes

J = At least one juvenile independent of adults observed during visit
JD = Juvenile movements outside natal territory/dispersal to new site
NA = Nonbreeding single adult or pair detected
NBF = No birds found

Appendix Table 2b. Dates of surveys and names of field personnel at Nature Reserve of Orange County 2010 survey areas. Cactus Wrens were not banded or monitored for reproduction at these sites and the surveys were to document any dispersal of banded birds from Monitoring Sites (Appendix Table 1b).

Date	Personnel	Aliso Canyon	South Bommer & El Moro Ridges	Bonita Creek & Coyote Cyn Landfill	Buck Gully	Emerald & Boat Canyons	James Dilley	Los Trancos Canyon	Muddy Canyon	Newport Back Bay	Peter's Canyon Regional Park	Quail Hill	Whiting Ranch - El Toro Road	Whiting Ranch - Glen Ranch	Wood Canyon
3/18/2010	KP. SA				S										
3/27/2010	KM									S					
4/9/2010	DK, KM				S										
4/10/2010	KP										S				
4/20/2010	KP, ST											S			
4/26/2010	ST														
4/29/2010	KP													S	
5/6/2010	DK								S						
5/10/2010	KP, ST											S			
5/12/2010	DK					S									
5/13/2010	DK, KP			S					S						
5/18/2010	KP						S								
5/27/2010	DK					S									
6/1/2010	DK								S						
6/9/2010	ST	S													
6/10/2010	KP, ST							S							
6/14/2010	ST														S
6/15/2010	KP. ST		S												
6/29/2010	KP			S											
6/30/2010	DK, ST								S		S				
7/1/2010	KP									S					
7/16/2010	ST										S				
7/23/2010	DK														
7/28/2010	ST												S		
7/29/2010	KP			S											
7/30/2010	ST										S				
8/3/2010	ST														S
8/24/2010	KP												S		

Appendix Table 2b *continued*. Dates of surveys and names of field personnel at Nature Reserve of Orange County 2010 Survey Areas. Cactus Wrens were not banded or monitored for reproduction at these sites and the surveys were to document any dispersal of banded birds from Monitoring Sites (Appendix Table 1b).

Date	Personnel	Aliso Canyon	South Bommer & El Moro Ridges	Bonita Creek & Coyote Cyn Landfill	Buck Gully	Emerald & Boat Canyons	James Dilley	Los Trancos Canyon	Muddy Canyon	Newport Back Bay	Peter's Canyon Regional Park	Quail Hill	Whiting Ranch - El Toro Road	Whiting Ranch - Glen Ranch	Wood Canyon
10/26/2010	DK					S									
10/28/2010	DK								S						
11/2/2010	KP			S											
11/8/2010	KM									S					
11/9/2010	DK						S								
11/23/2010	KP												S		
11/28/2010	KP														S

Personnel Codes	Personnel Activity Codes
DK = Dana Kamada	B = Band
KM = Karly Moore	I = Incidental observation
KP = Kristine Preston	M = Survey for Cactus Wren in the breeding season in order to observe & record behavior, monitor breeding status & check nests
ST = Scott Thomas	S = Survey for Cactus Wrens to document banded birds & locate nesting birds for further monitoring , use taped vocalizations as needed

Appendix Table 2c. Dates of surveys and names of field personnel at Nature Reserve of Orange County 2011 Survey Areas. Cactus Wrens were not banded or monitored for reproduction at these sites and the surveys were to document any dispersal of banded birds from Monitoring Sites (Appendix Table 1c).

Date	Personnel	Aliso Canyon	Bonita Creek & Coyote Cyn Landfill	Buck Gully	El Moro & South Bommer Ridges	Emerald & Boat Canyons	James Dilley	Laguna Laurel	Los Trancos Canyon	Muddy Canyon	Newport Back Bay	Peter's Canyon Regional Park	Whiting Ranch - El Toro Road	Whiting Ranch - Glen Ranch	Wood Canyon
1/13/2011	DK					S									
1/24/2011	DK									S					
1/27/2011	KP												S	S	
2/3/2011	KP								S						
2/8/2011	KM										S				
2/10/2011	ST						S								
2/11/2011	ST											S			
2/22/2011	KP		S												
3/1/2011	ST						S								
3/2/2011	ST														S
3/3/2011	DK									S					
3/9/2011	DK													S	
3/16/2011	DK														S
3/18/2011	DK	S													
4/5/2011	KP												S		
4/6/2011	DK					S									
4/25/2011	KM			S											
4/27/2011	DK								S						
4/29/2011	KM										S				
5/4/2011	DK					S									
5/16/2011	KP													S	
5/18/2011	ST	S													
6/6/2011	DK, KP		S											S	
6/21/11	KP		S		S										
7/11/2011	KP				S										
7/14/2011	DK					S									
7/20/2011	DK, KM							S						S	
7/21/2011	DK, KM														
7/22/2011	DK, KM					B, S									
7/28/2011	KM. ST								S						
8/9/2011	DK													S	
8/23/2011	DK									S					
8/25/2011	KM										S				

Appendix Table 2c *continued*. Dates of surveys and names of field personnel at Nature Reserve of Orange County 2011 Survey Areas. Cactus Wrens were not banded or monitored for reproduction at these sites and the surveys were to document any dispersal of banded birds from Monitoring Sites (Appendix Table 1).

Date	Personnel	Aliso Canyon	South Bommer & El Moro Ridges	Bonita Creek & Coyote Cyn Landfill	Buck Gully	Emerald & Boat Canyons	James Dilley	Laguna Laurel	Los Trancos Canyon	Muddy Canyon	Newport Back Bay	Peter's Canyon Regional Park	Whiting Ranch - El Toro Road	Whiting Ranch - Glen Ranch	Wood Canyon
9/1/2011	DK													B	
9/9/2011	DK													S	
9/12/2011	DK													B	
9/14/2011	DK						S								
9/15/2011	DK	S													
10/10/2011	DK					S									
10/11/2011	DK									S					
10/12/2011	DK														S
10/13/2011	DK												S		
10/20/2011	KM								S						
11/14/2011	KM										S				
11/15/2011	DK, MM						S								
11/27/2011	ST											S			
12/5/2011	ST											S			

Personnel Codes	Personnel Activity Codes
DK = Dana Kamada	B = Band
KM = Karly Moore	I = Incidental observation
KP = Kristine Preston	M = Survey for Cactus Wren in the breeding season in order to observe & record behavior, monitor breeding status & check nests
MM = Milan Mitrovich	S = Survey for Cactus Wrens to document banded birds & locate nesting birds for further monitoring , use taped vocalizations as needed
ST = Scott Thomas	

Appendix Table 3a. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2009.

Bander Initials	USFWS Band Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 3 UTM Easting	NAD83 UTM Northing	Feather Pull
DK	168187730	2/20/2009	UC05	M-DGP	AHY	M	8:50	421556	3722543	N
DK	168187731	2/20/2009	UC03	DGDB-M	AHY	M	12:00	421525	3722316	Y
KM	168187732	2/21/2009	UC01	DG-MDB	AHY	M	8:10	421417	3721958	Y
DK	168187733	2/21/2009	UC01	M-LBDG	AHY	F	8:10	421417	3721958	Y
DK	168187734	2/28/2009	UC04	M-YP	AHY	M	7:40	421537	3722451	N
DK	168187735	2/28/2009	UC04	R-MW	AHY	F	8:10	421537	3722451	Y
DK	168187736	2/28/2009	UC06	RM-O	AHY	M	9:50	421556	3722543	Y
DK	168187737	3/10/2009	ELMO05	M-DGLB	AHY	M	9:40	426511	3739679	Y
DK	168187738	3/10/2009	ELMO04	DG-MP	AHY	F	12:30	426592	3739854	Y
DK	168187739	3/12/2009	ELMO02	MDG-DB	AHY	F	8:40	426334	3740526	Y
DK	168187740	3/12/2009	ELMO02	RM-W	AHY	M	8:50	426334	3740526	Y
DK	168187741	3/12/2009	ELMO01	M-YDG	AHY	M	11:40	426416	3740686	N
KM	168187742	3/12/2009	ELMO01	LB-DGM	AHY	F	12:10	426416	3740686	Y
DK	168187743	3/16/2009	ELMO03	DG-LBM	AHY	F	11:10	426560	3740225	Y
KM	168187744	3/17/2009	ELMO08	PDG-M	AHY	F	13:10	426409	3739403	Y
DK	168187745	3/17/2009	ELMO08	M-RR	AHY	M	13:10	426409	3739403	Y
DK	168187746	3/23/2009	UNB03	MLB-O	SY	M	11:00	417353	3723480	Y
DK	168187747	3/23/2009	UNB02	P-MDG	AHY	M	8:40	417355	3723260	Y
DK	168187748	3/27/2009	CCSP01	M-PDG	ASY	M	7:40	424464	3716265	Ys
DK	168187749	3/27/2009	CCSP01	OM-W	ASY	F	7:40	424464	3716265	Ys
DK	168187750	3/27/2009	CAPK230-1	M-DGDG	ASY	M	11:00	448405	3710883	Ys
DK	168187751	3/27/2009	CAPK230-1	MDG-O	SY	F	11:00	448405	3710883	Ys
DK	168187752	3/27/2009	CAPK203-1	MDG-LB	ASY	U	12:50	442882	3711805	Ys
DK	168187753	4/2/2009	ELMO06	MP-LB	SY	F	8:20	426313	3739532	Ys
KM	168187754	4/2/2009	ELMO09	PO-M	SY	F	9:30	426558	3739658	Ys
DK	168187755	4/3/2009	UC01	MW-W	N	U	13:20	421418	3721925	N
DK	168187756	4/3/2009	UC01	YDG-M	N	U	13:20	421418	3721925	N
DK	168187757	4/3/2009	UC01	MY-R	N	U	13:20	421418	3721925	N
DK	168187758	4/10/2009	UC05	MP-DG	N	U	11:50	421551	3722555	N
DK	168187759	4/10/2009	UC05	WDG-M	N	U	11:50	421551	3722555	N
DK	168187760	4/10/2009	UC05	MW-R	N	U	11:50	421551	3722555	N
DK	168187761	4/15/2009	ELMO03	M-PP	N	U	12:10	426517	3740263	N
DK	168187762	4/15/2009	ELMO03	M-RY	N	U	12:10	426517	3740263	N

Appendix Table 3a *continued*. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2009.

Bander Initials	USFWS Band Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 3 UTM Easting	NAD83 UTM Northing	Feather Pull
DK	168187763	4/15/2009	ELMO03	PDB-M	N	U	12:10	426517	3740263	N
DK	168187764	4/15/2009	ELMO03	M-WY	N	U	12:10	426517	3740263	N
DK	168187765	4/21/2009	ELMO10	DB-PM	N	U	9:40	426319	3739877	N
KM	168187766	4/27/2009	UNB01	DBM-DB	F	U	6:50	417413	3723713	Ys
DK	168187767	4/27/2009	UNB01	LBP-M	F	U	7:30	417413	3723713	Ys
DK	168187768	4/27/2009	ELMO02	MLB-P	F	U	12:00	426334	3740526	Ys
DK	168187769	4/28/2009	ELMO01	MLB-DB	N	U	11:30	426419	3740674	N
DK	168187770	4/28/2009	ELMO01	R-DBM	N	U	11:30	426419	3740674	N
DK	168187771	4/28/2009	ELMO01	MW-O	N	U	11:30	426419	3740674	N
KM	168187772	4/28/2009	ELMO05	DB-WM	N	U	12:40	426506	3739648	N
KM	168187773	4/28/2009	ELMO05	PM-Y	N	U	12:40	426506	3739648	N
KM	168187774	4/28/2009	ELMO05	DB-LBM	N	U	12:40	426506	3739648	N
KM	168187775	4/28/2009	ELMO05	OY-M	N	U	12:40	426506	3739648	N
KM	168187776	4/29/2009	ELMO11	M-WDB	F	U	8:40	426347	3740352	N
KM	168187777	4/29/2009	ELMO11	W-WM	F	U	11:50	426347	3740352	N
DK	168187778	5/5/2009	UC06	P-LBM	N	U	11:00	421741	3722542	N
DK	168187779	5/5/2009	UC06	LB-MDB	N	U	11:00	421741	3722542	N
DK	168187780	5/5/2009	UC06	O-MP	N	U	11:00	421741	3722542	N
DK	168187781	5/5/2009	UC06	WO-M	N	U	11:00	421741	3722542	N
DK	168187782	5/6/2009	SCE07	M-LBP	N	U	13:20	440712	3725240	N
DK	168187783	5/6/2009	SCE07	MO-R	N	U	13:20	440712	3725240	N
DK	168187784	5/6/2009	SCE07	M-DBO	N	U	13:20	440712	3725240	N
DK	168187785	5/6/2009	SCE09	M-WR	N	U	14:10	440969	3725035	N
DK	168187786	5/6/2009	SCE03	MR-Y	N	U	15:00	440600	3725761	N
DK	168187787	5/6/2009	SCE03	DBY-M	N	U	15:00	440600	3725761	N
DK	168187788	5/6/2009	SCE03	M-WP	N	U	15:00	440600	3725761	N
DK	168187789	5/6/2009	SCE03	WW-M	N	U	15:00	440600	3725761	N
DK	168187790	5/6/2009	SCE03	M-DBDB	N	U	15:00	440600	3725761	N
DK	168187791	5/11/2009	SCE01	Y-MP	N	U	13:30	440477	3726104	N
DK	168187792	5/11/2009	SCE01	MY-DB	N	U	13:30	440477	3726104	N
DK	168187793	5/11/2009	SCE01	W-DBM	N	U	13:30	440477	3726104	N
DK	168187794	5/11/2009	SCE01	YO-M	N	U	13:30	440477	3726104	N

Appendix Table 3a *continued*. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2009.

Bander Initials	USFWS Band Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 3 UTM Easting	NAD83 UTM Northing	Feather Pull
DK	168187795	5/11/2009	SCE01	W-RM	AHY	M	13:30	440477	3726104	Y
DK	168187796	5/11/2009	SCE01	YR-M	AHY	F	13:50	440477	3726104	Y
KM	168187797	5/12/2009	SCE03	P-RM	AHY	F	9:20	440600	3725761	Y
KM	168187798	5/12/2009	SCE03	R-MDB	AHY	M	9:30	440600	3725761	Y
DK	168187799	5/12/2009	SCE05	YM-P	N	U	11:00	440659	3725399	N
KM	168187800	5/12/2009	SCE05	RM-DB	N	U	11:00	440659	3725399	N
KM	178175601	5/12/2009	SCE05	M-PO	N	U	11:00	440659	3725399	N
DK	178175602	5/12/2009	SCE05	W-MR	N	U	11:00	440659	3725399	N
DK	178175603	5/12/2009	SCE05	WM-Y	AHY	M	11:00	440659	3725399	Y
KM	178175604	5/12/2009	SCE05	R-MP	AHY	F	11:00	440659	3725399	Y
KM	178175605	5/12/2009	SCE07	O-RM	AHY	M	13:00	440713	3725240	Y
DK	178175606	5/12/2009	SCE09	M-PDB	AHY	M	15:40	440969	3725035	N
DK	178175607	5/13/2009	SCE10	R-MO	N	U	11:10	440707	3725643	N
DK	178175608	5/13/2009	SCE10	PY-M	N	U	11:10	440707	3725643	N
DK	178175609	5/13/2009	SCE10	DB-MR	N	U	11:10	440707	3725643	N
DK	178175610	5/13/2009	SCE10	O-MO	N	U	11:10	440707	3725643	N
DK	178175611	5/16/2009	UC04	MP-P	N	U	13:00	421449	3722407	N
DK	178175612	5/16/2009	UC04	PW-M	N	U	13:00	421449	3722407	N
DK	178175613	5/16/2009	UC04	MDB-DB	N	U	13:00	421449	3722407	N
DK	178175614	5/18/2009	SCE10	MY-P	AHY	F	8:10	440707	3725643	Y
DK	178175615	5/18/2009	SCE10	RM-P	AHY	M	8:10	440707	3725643	Y
DK	178175616	5/19/2009	SCE02	PR-M	AHY	M	7:30	440546	3726134	Y
DK	178175617	5/19/2009	SCE08	MY-O	N	U	12:30	440835	3725075	N
DK	178175618	5/19/2009	SCE08	OM-DB	N	U	12:30	440835	3725075	N
DK	178175619	5/19/2009	SCE08	O-MR	N	U	12:30	440835	3725075	N
DK	178175620	5/19/2009	SCE08	WDB-M	N	U	12:30	440835	3725075	N
DK	178175621	5/19/2009	SCE02	M-OR	N	U	13:30	440596	3726115	N
DK	178175622	5/19/2009	SCE02	M-PW	N	U	13:30	440596	3726115	N
DK	178175623	5/19/2009	SCE02	M-GNW	N	U	13:30	440596	3726115	N
DK	178175624	5/19/2009	SCE02	P-GNM	N	U	13:30	440596	3726115	N
DK	178175625	5/21/2009	UC01	M-ODB	N	U	11:30	421418	3721925	N
DK	178175626	5/21/2009	UC01	WR-M	N	U	11:30	421418	3721925	N
DK	178175627	5/21/2009	UNB01	RW-M	N	U	15:40	417413	3723713	N

Appendix Table 3a *continued*. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2009.

Bander Initials	USFWS Band Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 UTM Easting	NAD83 UTM Northing	Feather Pull
DK	178175628	5/21/2009	UNB01	Y-RM	N	U	15:40	417413	3723713	N
DK	178175629	5/21/2009	UNB01	M-OW	N	U	15:40	417413	3723713	N
DK	178175630	5/21/2009	UNB01	O-MDB	N	U	15:40	417413	3723713	N
DK	178175631	5/25/2009	SCE04	R-WM	AHY	M	7:30	440659	3725458	Y
KM	178175632	5/25/2009	SCE08	MP-W	AHY	M	10:50	440835	3725075	Y
DK	178175633	6/4/2009	ELMO13	YM-O	AHY	F	8:30	426505	3739844	Y
DK	178175634	6/8/2009	UC03	ODB-M	AHY	F	7:30	421525	3722316	Y
DK	178175635	6/8/2009	UC03	R-MR	F	U	7:30	421525	3722316	Y
DK	178175636	6/17/2009	UC05	YW-M	N	U	14:10	421518	3722527	N
DK	178175637	6/17/2009	UC05	P-MR	N	U	14:10	421518	3722527	N
DK	178175638	6/22/2009	ELMO10	YM-DB	N	U	14:00	426325	3739883	N
DK	178175639	6/22/2009	ELMO10	P-WM	N	U	14:00	426325	3739883	N
DK	178175640	6/22/2009	ELMO10	P-MP	N	U	14:00	426325	3739883	N
DK	178175641	6/25/2009	ELMO07	DBM-Y	AHY	F	8:00	426583	3739897	Y
DK	178175642	6/25/2009	ELMO07	Y-MW	HY	U	11:00	426615	3739850	Y
DK	178175643	6/25/2009	SCE09	DB-OM	N	U	14:50	440996	3725047	N
KM	178175644	7/1/2009	ELMO10	R-MY	AHY	F	7:50	426325	3739883	Y
DK	178175645	7/8/2009	CCSP01	YY-M	N	U	12:50	424469	3716270	N
DK	178175646	7/8/2009	CCSP01	WM-P	N	U	12:50	424469	3716270	N
DK	178175647	7/8/2009	CCSP01	M-PY	N	U	12:50	424469	3716270	N
DK	178175648	7/8/2009	CCSP01	DBM-O	N	U	12:50	424469	3716270	N
DK	178175649	7/9/2009	SCE04	WY-M	N	U	12:50	440636	3725454	Y
DK	178175650	7/9/2009	SCE04	MW-DB	N	U	12:50	440636	3725454	Y
DK	178175651	7/15/2009	SCE09	LBM-DB	AHY	F	8:20	440927	3725019	Y
DK	178175652	7/15/2009	SCE09	Y-PM	F	U	8:20	440927	3725019	Y
DK	178175653	7/16/2009	CCSP01	Y-DBM	AHY	F	6:30	424469	3716270	Ys
DK	178175654	7/17/2009	SCE11	WM-O	HY	U	7:50	441004	3725178	Ys
DK	178175655	7/17/2009	SCE11	MR-W	AHY	M	7:50	441004	3725178	Ys
DK	178175656	7/17/2009	SCE11	RDB-M	HY	U	7:50	441004	3725178	Ys
DK	178175657	7/17/2009	SCE11	YM-GN	AHY	F	8:40	441004	3725178	Ys
DK	178175658	7/31/2009	SCE06	OP-M	F	U	5:30	440750	3725420	Ys
DK	178175659	7/31/2009	SCE06	M-YY	F	U	5:30	440750	3725420	Ys
DK	178175660	7/31/2009	SCE06	DB-DBM	F	U	5:30	440750	3725420	Ys
DK	178175661	10/23/2009	SCE06	O-MLB	HY	U	10:00	440750	3725420	Ys

Appendix Table 3a *continued*. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2009.

Bander Initials	USFWS Band Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 3 UTM Easting	NAD83 UTM Northing	Feather Pull
DK	178175662	10/23/2009	SCE06	DGP-M	AHY	U	10:00	440750	3725420	Ys
DK	178175663	10/23/2009	SCE06	MR-LB	AHY	U	10:00	440750	3725420	Ys
DK	178175664	10/24/2009	SCE02	MDB-DG	AHY	F	9:00	440546	3726134	Ys
DK	178175665	10/24/2009	SCE08	M-DBLB	AHY	F	11:10	440885	3725115	Ys
KM	168187801	4/16/2009	ELMO04	LBM-W	N	U	13:50	426622	3739863	N
KM	168187802	4/16/2009	ELMO04	M-DGY	N	U	13:50	426622	3739863	N
KM	168187803	4/16/2009	ELMO04	M-LBY	N	U	13:50	426622	3739863	N
KM	168187804	5/30/2009	CAPK	M-WW	N	U	16:00	447853	3711960	N
KM	168187805	4/16/2009	ELMO08	LB-DBM	N	U	14:30	426419	3739396	N
KM	168187806	4/16/2009	ELMO08	DGO-M	N	U	14:30	426419	3739396	N
KM	168187807	4/16/2009	ELMO08	LBM-P	N	U	14:30	426419	3739396	N

Bander Initials
DK = Dana Kamada
KM = Karly Moore
Location Codes
CAP = Casper's Regional Park
CCSP = Crystal Cove State Park
ELMO = El Modena Open Space Preserve
SCE = Southern California Edison Viejo Conservation Easement
UC = University of California, Irvine Ecological Reserve
UNB = Upper Newport Bay
Color Band Codes (Right Leg-Left Leg)
DB = Dark blue
DG = Dark green
LB = Light blue
LG = Light green
M = Metal USFWS band
O = Orange
P = Purple
R = Red
W = White
Y = Yellow

Age Codes
AHY = After hatch year (adult)
ASY = After second year (adult)
F = Fledgling
HY = Hatch year (juvenile)
N = Nestling
SY = Second year
Sex Codes
F = Female
M = Male
U = Unknown
Feather Pull Codes
N = No feather collected
Y = Contour feathers collected only
Ys = Secondary feather collected

Appendix Table 3b. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2010.

Bander Initials	USFWS Band Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 UTM Easting	NAD83 UTM Northing	Feather Pull
DK	178175666	2/12/2010	ELMO02	R-LGM	6	U	9:00	426324	3740535	Ys
DK	178175667	2/26/2010	ELMO05/09	RLG-M	5	U	8:20	426506	3739648	Ys
DK	178175668	2/26/2010	ELMO05/09	MP-Y	5	U	8:20	426506	3739648	Ys
DK	178175669	2/26/2010	ELMO05/09	YM-LB	6	M	8:20	426506	3739648	Ys
DK	178175670	3/15/2010	CCSP01	MDB-R	6	F	7:20	424469	3716270	Yr
DK	178175671	3/18/2010	UNB01	LG-MLB	4	U	15:40	417416	3723705	N
DK	178175672	3/18/2010	UNB01	YM-W	4	U	15:40	417416	3723705	N
DK	178175673	4/2/2010	ELMO01	LBR-M	4	U	12:00	426351	3740636	N
DK	178175674	4/2/2010	ELMO01	MDB-LG	4	U	12:00	426351	3740636	N
DK	178175675	4/2/2010	ELMO01	PM-O	4	U	12:00	426351	3740636	N
DK	178175676	4/2/2010	ELMO01	LBY-M	4	U	12:00	426351	3740636	N
DK	178175677	4/14/2010	UC01	RLB-M	4	U	14:30	421376	3721863	N
DK	178175678	4/14/2010	UC01	OW-M	4	U	14:30	421376	3721863	N
DK	178175679	4/24/2010	SCE04	P-MW	4	U	11:30	440663	3725470	N
DK	178175680	4/24/2010	SCE04	O-PM	4	U	11:30	440663	3725470	N
DK	178175681	4/24/2010	SCE04	M-RLB	4	U	11:30	440663	3725470	N
DK	178175682	4/24/2010	SCE04	M-PLG	4	U	11:30	440663	3725470	N
DK	178175683	4/24/2010	SCE05	LG-PM	4	U	12:10	440694	3725396	N
DK	178175684	4/24/2010	SCE05	O-OM	4	U	12:10	440694	3725396	N
DK	178175685	4/24/2010	SCE05	LB-YM	4	U	12:10	440694	3725396	N
DK	178175686	4/24/2010	SCE05	M-LBLG	4	U	12:10	440694	3725396	N
DK	178175687	4/24/2010	SCE05	R-YM	4	U	12:10	440694	3725396	N
DK	178175688	4/26/2010	UC01	WLG-M	5	F	6:30	421376	3721863	Ys
DK	178175689	4/29/2010	SCE09	M-OO	4	U	9:40	440974	3725043	N
DK	178175690	4/29/2010	SCE09	MLB-R	4	U	9:40	440974	3725043	N
DK	178175691	4/29/2010	UC04	M-RDB	4	U	15:20	421504	3722441	N
DK	178175692	4/29/2010	UC04	M-LGP	4	U	15:20	421504	3722441	N
DK	178175693	4/29/2010	UC04	LB-LBM	4	U	15:20	421504	3722441	N
DK	178175694	5/4/2010	SCE06	LGP-M	4	U	10:30	440754	3725473	N
DK	178175695	5/4/2010	SCE06	PP-M	4	U	10:30	440754	3725473	N
DK	178175696	5/4/2010	SCE06	M-DBR	4	U	10:30	440754	3725473	N
DK	178175697	5/4/2010	SCE10	MR-P	4	U	11:30	440813	3725563	N
DK	178175698	5/4/2010	SCE10	YDB-M	4	U	11:30	440813	3725563	N
DK	178175699	5/4/2010	SCR03	M-YLG	4	U	13:30	426539	3723583	N
DK	178175700	5/4/2010	SCR03	LB-LGM	4	U	13:30	426539	3723583	N
DK	178175701	5/4/2010	SCR03	DBM-P	4	U	13:30	426539	3723583	N
DK	178175702	5/4/2010	SCR03	M-OY	4	U	13:30	426539	3723583	N
DK	178175703	5/4/2010	SCR03	M-DBLG	4	U	13:30	426539	3723583	N
DK	178175704	5/4/2010	SCR01	W-YM	4	U	14:30	426239	3723861	N
DK	178175705	5/4/2010	SCR01	YLG-M	4	U	14:30	426239	3723861	N

Appendix Table 3b *continued*. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2010.

Bander Initials	USFWS Band Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 UTM Easting	NAD83 UTM Northing	Feather Pull
DK	178175706	5/4/2010	SCR01	LB-RM	4	U	14:30	426239	3723861	N
DK	178175707	5/4/2010	SCR01	P-LGM	4	U	14:30	426239	3723861	N
DK	178175708	5/5/2010	MD01	Y-MLB	4	U	12:00	429095	3721811	N
DK	178175709	5/5/2010	MD01	LBLG-M	4	U	12:00	429095	3721811	N
DK	178175710	5/5/2010	MD01	LG-MO	4	U	12:00	429095	3721811	N
DK	178175711	5/5/2010	MD01	M-DBP	4	U	12:00	429095	3721811	N
DK	178175712	5/7/2010	SCR02	P-MO	4	U	13:10	426505	3723427	N
DK	178175713	5/7/2010	SCR02	MLB-Y	4	U	13:10	426505	3723427	N
DK	178175714	5/7/2010	SCE12	M-LBY	4	U	14:50	440643	3725181	N
DK	178175715	5/7/2010	SCE12	LB-MLG	4	U	14:50	440643	3725181	N
DK	178175716	5/7/2010	SCE12	LG-MW	4	U	14:50	440643	3725181	N
DK	178175717	5/10/2010	SCE11	M-LGY	4	U	12:10	441003	3725179	N
DK	178175718	5/10/2010	SCE11	LG-LGM	4	U	12:10	441003	3725179	N
DK	178175719	5/17/2010	SCE07	M-YR	4	U	15:00	440713	3725240	N
DK	178175720	5/17/2010	SCE07	DBM-LG	4	U	15:00	440713	3725240	N
DK	178175721	5/17/2010	SCE07	OLG-M	4	U	15:00	440713	3725240	N
DK	178175722	5/18/2010	UC06	M-PR	4	U	12:10	421619	3722648	N
DK	178175723	5/18/2010	UC06	OM-Y	4	U	12:10	421619	3722648	N
DK	178175724	5/18/2010	UC06	LG-MLG	4	U	12:10	421619	3722648	N
DK	178175725	5/18/2010	UC06	MLB-LB	4	U	12:10	421619	3722648	N
DK	178175726	5/21/2010	BRR01	M-LGR	4	U	16:10	426835	3719166	N
DK	178175727	5/21/2010	BRR01	LB-OM	4	U	16:10	426835	3719166	N
DK	178175728	5/21/2010	BRR01	MW-Y	4	U	16:10	426835	3719166	N
DK	178175729	5/24/2010	SCE08	M-YLB	4	U	12:00	440837	3725078	N
DK	178175730	5/24/2010	SCE08	RM-LG	4	U	12:00	440837	3725078	N
DK	178175731	5/24/2010	SCE08	O-LGM	4	U	12:00	440837	3725078	N
DK	178175732	5/24/2010	SCE08	MDB-Y	4	U	12:00	440837	3725078	N
DK	178175733	5/24/2010	SCE03	RP-M	4	U	13:10	440589	3725773	N
DK	178175734	5/24/2010	SCE03	LG-MY	4	U	13:10	440589	3725773	N
DK	178175735	5/24/2010	SCE03	R-MLB	4	U	13:10	440589	3725773	N
DK	178175736	5/24/2010	SCE03	OR-M	4	U	13:10	440589	3725773	N
DK	178175737	5/24/2010	SCE03	Y-OM	4	U	13:10	440589	3725773	N
DK	178175738	5/24/2010	SCE02	LGY-M	4	U	14:30	440517	3726038	N
DK	178175739	5/24/2010	SCE02	DBM-W	4	U	14:30	440517	3726038	N
DK	178175740	5/24/2010	SCE02	MLB-LG	4	U	14:30	440517	3726038	N
DK	178175741	5/25/2010	CCSP01	M-LGLB	4	U	10:50	424469	3716270	N
DK	178175742	5/25/2010	CCSP01	P-OM	4	U	10:50	424469	3716270	N
DK	178175743	5/30/2010	BMR01	K-MO	4	U	16:00	425311	3719988	N
DK	178175744	5/30/2010	BMR01	M-WK	4	U	16:00	425311	3719988	N
DK	178175745	5/30/2010	BMR01	MK-K	4	U	16:00	425311	3719988	N
DK	178175746	5/30/2010	BMR01	YK-M	4	U	16:00	425311	3719988	N

Appendix Table 3b *continued*. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2010.

Bander Initials	USFWS Band Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 UTM Easting	NAD83 UTM Northing	Feather Pull
DK	178175747	5/30/2010	UC03	DB-YM	4	U	17:30	421511	3722250	N
DK	178175748	5/30/2010	UC03	XX-M	4	U	17:30	421511	3722250	N
DK	178175749	5/31/2010	SCR04	K-RM	4	U	15:30	426684	3723297	N
DK	178175750	5/31/2010	SCR04	O-KM	4	U	15:30	426684	3723297	N
DK	178175751	5/31/2010	SCR04	Y-MLG	4	U	15:30	426684	3723297	N
DK	178175752	5/31/2010	SCR04	DB-MO	4	U	15:30	426684	3723297	N
DK	178175753	6/8/2010	UC01	O-WM*	4	U	12:30	421397	3721857	N
DK	178175754	6/9/2010	ELMO12	O-WM*	4	U	10:40	426367	3740326	N
DK	178175755	6/9/2010	ELMO12	M-LGDB	4	U	10:40	426367	3740326	N
DK	178175756	6/9/2010	ELMO12	Y-MR	4	U	10:40	426367	3740326	N
DK	178175757	6/9/2010	ELMO12	MP-R	4	U	10:40	426367	3740326	N
DK	178175758	6/17/2010	SCE13	O-MLG	4	U	5:40	440747	3725131	N
DK	178175759	6/17/2010	SCE13	R-OM	4	U	5:40	440747	3725131	N
DK	178175760	6/20/2010	SCE09	LB-MP	4	U	9:10	440948	3725018	N
DK	178175761	6/20/2010	SCE09	W-MLG	4	U	9:10	440948	3725018	N
DK	178175762	6/20/2010	SCE09	RY-M	4	U	9:10	440948	3725018	N
DK	178175763	6/20/2010	SCE09	MY-LG	4	U	9:10	440948	3725018	N
DK	178175764	6/25/2010	SCR02	MO-K	4	U	12:50	426440	3723460	N
DK	178175765	6/25/2010	SCR02	K-MP	4	U	12:50	426440	3723460	N
DK	178175766	6/25/2010	SCR02	R-PM	4	U	12:50	426440	3723460	N
DK	178175767	6/29/2010	TRD01	K-MY	4	U	14:50	424263	3720155	N
DK	178175768	6/29/2010	TRD01	LB-MK	4	U	14:50	424263	3720155	N
DK	178175769	6/29/2010	TRD01	W-LGM	4	U	14:50	424263	3720155	N
DK	178175770	6/29/2010	TRD01	OO-M	4	U	14:50	424263	3720155	N
DK	178175771	6/29/2010	TRD02	DBM-K	4	U	16:00	424756	3719707	N
DK	178175772	6/29/2010	TRD02	KLB-M	4	U	16:00	424756	3719707	N
DK	178175773	6/29/2010	TRD02	LBM-Y	4	U	16:00	424756	3719707	N
DK	178175774	7/3/2010	MD01	P-MY	4	U	10:20	429095	3721811	N
DK	178175775	7/3/2010	BRR01	LGLG-M	4	U	12:30	426867	3719152	N
DK	178175776	7/3/2010	BRR01	LB-MY	4	U	12:30	426867	3719152	N
DK	178175777	7/3/2010	BRR01	WM-K	4	U	12:30	426867	3719152	N
DK	178175778	7/3/2010	BRR01	M-OK	4	U	12:30	426867	3719152	N
DK	178175779	7/3/2010	SCE12	MDB-K	4	U	17:20	440629	3725137	N
DK	178175780	7/3/2010	SCE12	M-YW	4	U	17:20	440629	3725137	N
DK	178175781	7/3/2010	SCE12	LBO-M	4	U	17:20	440629	3725137	N
DK	178175782	7/3/2010	SCE12	R-LBM	4	U	17:20	440629	3725137	N
DK	178175783	7/5/2010	BMR02	W-MO	6	M	8:00	425862	3720081	Ys
DK	178175784	7/5/2010	BMR02	LG-YM	1	F	8:00	425862	3720081	Ys
KM	178175785	7/6/2010	SCE13	DB-KM	4	U	7:40	440747	3725131	Ys
KM	178175786	7/6/2010	SCE13	KR-M	5	F	7:40	440747	3725131	Ys

Appendix Table 3b *continued*. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2010.

Bander Initials	USFWS Band Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 UTM Easting	NAD83 UTM Northing	Feather Pull
KM	178175787	7/6/2010	SCE13	Y-MDB	5	M	7:40	440747	3725131	Ys
DK	178175788	7/11/2010	BMR01	LGO-M	6	M	8:00	425299	3720084	Ys
DK	178175789	7/11/2010	BMR01	MO-Y	1	F	8:00	425299	3720084	Ys
DK	178175790	7/16/2010	BRR01	P-YM	6	M	8:20	426867	3719152	Ys
DK	178175791	7/16/2010	BRR01	MDB-O	5	F	8:20	429867	3719152	Ys
DK	178175792	7/22/2010	BMR04	W-OM	1	F	8:40	425684	3720400	Ys
DK	178175793	7/22/2010	UNB01	M-OLG	4	U	12:10	417413	3723708	N
DK	178175794	7/22/2010	UNB01	YM-Y	4	U	12:10	417413	3723708	N
DK	178175795	7/22/2010	UNB01	K-MR	4	U	12:10	417413	3723708	N
DK	178175796	7/22/2010	UNB01	KDB-M	4	U	12:10	417413	3723708	N
KM	168187808	3/22/2010	ELMO09	M-OLB	5	U	9:50	426580	3739559	Ys
KM	168187809	4/8/2010	ELMO06	MY-LB	4	U	15:30	426352	3739483	N
KM	168187810	4/8/2010	ELMO06	LGR-M	4	U	15:30	426352	3739483	N
KM	168187811	4/8/2010	ELMO06	DBO-M	4	U	15:30	426352	3739483	N
KM	168187812	4/8/2010	ELMO06	MP-LG	4	U	15:30	426352	3739483	N
KM	168187813	4/9/2010	ELMO02	OLB-M	4	U	9:40	426343	3740510	N
KM	168187814	4/9/2010	ELMO02	P-PM	4	U	9:40	426343	3740510	N
KM	168187815	4/9/2010	ELMO02	M-DBY	4	U	9:40	426343	3740510	N
KM	168187816	4/11/2010	ELMO11	LBM-O	4	U	13:05	426298	3740373	N
KM	168187817	4/11/2010	ELMO11	LG-RM	4	U	13:05	426298	3740373	N
KM	168187818	4/11/2010	ELMO11	Y-LBM	4	U	13:05	426298	3740373	N
KM	168187819	4/11/2010	ELMO11	MDB-LB	4	U	13:05	426298	3740373	N
KM	168187820	4/15/2010	ELMO13	MLG-P	4	U	11:20	426557	3739812	N
KM	168187821	4/15/2010	ELMO13	LBLB-M	4	U	11:20	426557	3739812	N
KM	168187822	4/15/2010	ELMO13	DB-MDB	4	U	11:20	426557	3739812	N
KM	168187823	4/15/2010	ELMO13	PM-LB	4	U	11:20	426557	3739812	N
KM	168187824	4/20/2010	ELMO08	LBDB-M	4	U	14:00	426479	3739369	N
KM	168187825	4/20/2010	ELMO08	O-LBM	4	U	14:00	426479	3739369	N
KM	168187826	4/20/2010	ELMO08	DB-RM	4	U	14:00	426479	3739369	N
KM	168187827	4/20/2010	ELMO08	MY-Y	4	U	14:00	426479	3739369	N
KM	168187828	4/24/2010	ELMO12	LGM-LB	4	U	14:30	426418	3740358	N
KM	168187829	4/30/2010	ELMO05	Y-WM	4	U	11:20	426556	3739674	N
KM	168187830	4/30/2010	ELMO05	LB-MR	4	U	11:20	426556	3739674	N
KM	168187831	4/30/2010	ELMO05	M-LGO	4	U	11:20	426556	3739674	N
KM	168187832	5/4/2010	ELMO04	YP-M	4	U	13:10	426622	3739860	N
KM	168187833	5/4/2010	ELMO04	MO-LB	4	U	13:10	426622	3739860	N
KM	168187834	5/4/2010	ELMO04	LGM-DB	4	U	13:10	426622	3739860	N
KM	168187835	5/7/2010	ELMO09	LBW-M	4	U	11:30	426525	3739513	N
KM	168187836	5/7/2010	ELMO09	PM-DB	4	U	11:30	426525	3739513	N
KM	168187837	5/7/2010	ELMO09	Y-YM	4	U	11:30	426525	3739513	N
KM	168187838	5/7/2010	ELMO04	W-MW	4	U	13:20	426622	3739860	N

Appendix Table 3b *continued*. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2010.

Bander Initials	USFWS Band Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 UTM Easting	NAD83 UTM Northing	Feather Pull
KM	168187839	5/10/2010	UNB01	R-RM	4	U	15:30	417416	3723705	N
KM	168187840	5/10/2010	UNB01	W-MP	4	U	15:30	417416	3723705	N
KM	168187841	5/10/2010	UNB01	M-YDB	4	U	15:30	417416	3723705	N
KM	168187842	5/21/2010	ELMO02	DBW-M	4	U	8:50	426279	3740552	N
KM	168187843	5/21/2010	ELMO02	Y-MY	4	U	8:50	426279	3740552	N
KM	168187844	5/21/2010	ELMO02	M-RO	4	U	8:50	426279	3740552	N
KM	168187845	5/21/2010	BMR03	Y-MO	4	U	14:10	426731	3718816	N
KM	168187846	5/21/2010	BMR03	W-LBM	4	U	14:10	426731	3718816	N
KM	168187847	5/21/2010	BMR03	MR-R	4	U	14:10	426731	3718816	N
KM	168187848	6/13/2010	ELMO11	RO-M	4	U	15:10	426260	3740351	N
KM	168187849	6/13/2010	ELMO11	MO-LG	4	U	15:10	426260	3740351	N
KM	168187850	6/13/2010	ELMO11	MLG-Y	4	U	15:10	426260	3740351	N
KM	168187851	6/13/2010	ELMO11	LB-PM	4	U	15:10	426260	3740351	N
KM	168187852	6/22/2010	ELMO10	MP-O	4	U	12:00	426327	3739920	N
KM	168187853	6/22/2010	ELMO10	M-LGW	4	U	12:00	426327	3739920	N
KM	168187854	6/22/2010	ELMO10	DBR-M	4	U	12:00	426327	3739920	N
KM	168187855	6/22/2010	ELMO10	M-XX	4	U	12:00	426327	3739920	N
KM	168187856	6/27/2010	BMR02	DB-MLB	4	U	11:30	425856	3720006	N
KM	168187857	6/27/2010	BMR02	LG-WM	4	U	11:30	425856	3720006	N
KM	168187858	6/27/2010	BMR02	YLB-M	4	U	11:30	425856	3720006	N
KM	168187859	6/27/2010	BMR02	M-XX	4	U	11:30	425856	3720006	N
KM	168187860	7/4/2010	ELMO06	MDB-P	4	U	10:40	426371	3739478	N
KM	168187861	7/4/2010	ELMO06	MLB-W	4	U	10:40	426371	3739478	N
KM	168187862	7/4/2010	ELMO06	MK-Y	4	U	10:40	426371	3739478	N
KM	168187863	7/11/2010	BMR04	M-LBR	4	U	12:00	425684	3720400	N
KM	168187864	7/11/2010	BMR04	M-LGK	4	U	12:00	425684	3720400	N
KM	168187865	7/16/2010	BMR03	LG-MDB	4	U	10:00	426419	3719255	N
KM	168187866	7/16/2010	BMR03	O-MK	4	U	10:00	426419	3719255	N

Banding Code Definitions:

Bander Initials
DK = Dana Kamada
KM = Karly Moore

Location Codes
BMR = Bommer Canyon, City of Irvine
BRR = Bommer Ridge Road, City of Irvine
CCSP = Crystal Cove State Park
ELMO = El Modena Open Space Preserve
MD = Mule Deer, City of Irvine
SCE = Southern California Edison Viejo Conservation Easement
SCR = Sand Canyon Reservoir, City of Irvine
TRD = Turtle Ridge, City of Irvine
UC = University of California, Irvine Ecological Preserve

UNB = Upper Newport Bay

Color Band Codes (Right Leg-Left Leg)
DB = Dark blue
DG = Dark green
K = Black
LB = Light blue
LG = Light green
M = Metal USFWS band
O = Orange
P = Purple
R = Red
W = White
X = Missing color band
Y = Yellow

Age Codes
AHY = After hatch year (adult)
ASY = After second year (adult)
F = Fledgling
HY = Hatch year (juvenile)
N = Nestling
SY = Second year

Sex Codes
F = Female
M = Male

U = Unknown

Feather Pull Codes
N = No feather collected
Y = Contour feathers collected only
Ys = Secondary feather collected
Yr = Molted retrice collected

* Duplicate band combinations. ELMO12 O-WM has not been resighted since nestlings fledged, so far (11/8/10); ELMO and UC sites in different regions.

Appendix Table 3c. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2011.

Bander Initials	USFWS Band Number Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 UTM Easting	NAD83 UTM Northing	Feather Pull	Toenail Clip
KM	168187867	4/14/2011	BMR02	KY-M	4	U	15:30	425860	3720051	N	
KM	168187868	4/14/2011	BMR02	PM-K	4	U	15:30	425860	3720051	N	
KM	168187869	4/14/2011	BMR02	LG-MR	4	U	15:30	425860	3720051	N	
KM	168187870	5/4/2011	ELMO06	LGW-M	4	U	13:30	426352	3739483	Y	
KM	168187871	5/4/2011	ELMO06	YM-K	4	U	13:30	426352	3739483	Y	
KM	168187872	5/4/2011	ELMO06	KM-O	4	U	13:30	426352	3739483	Y	
KM	168187873	5/4/2011	ELMO06	MO-P	4	U	13:30	426352	3739483	Y	
KP	168187874	5/5/2011	BMR01	LB-MO	4	U	11:10	426758	3719172	Y	
KP	168187875	5/5/2011	BMR01	MLG-DB	4	U	11:10	426758	3719172	Y	
KM	168187876	5/5/2011	BMR04	MK-LG	4	U	12:00	425838	3720402	Y	
KM	168187877	5/5/2011	BMR04	K-MW	4	U	12:00	425838	3720402	Y	
KM	168187878	5/8/2011	ELMO03	PLG-M	4	U	11:40	426541	3740274	Y	
KM	168187879	5/8/2011	ELMO03	WK-M	4	U	11:40	426541	3740274	Y	
KM	168187880	5/11/2011	ELMO08	M-KY	4	U	10:20	426511	3739431	Y	
KM	168187881	5/11/2011	ELMO08	LG-MK	4	U	10:20	426511	3739431	Y	
KM	168187882	5/11/2011	ELMO08	DBLG-M	4	U	10:20	426511	3739431	Y	
KM	168187883	5/13/2011	ELMO01	M-LBO	4	U	12:00	426316	3740636	Y	
KM	168187884	5/13/2011	ELMO01	K-WM	4	U	12:00	426316	3740636	Y	
KM	168187885	5/13/2011	ELMO01	P-MDB	4	U	12:00	426316	3740636	Y	
KM	168187886	5/13/2011	ELMO01	Y-KM	4	U	12:00	426316	3740636	Y	
KM	168187887	5/16/2011	ELMO14	MLG-K	4	U	14:30	426478	3740066	Y	
KM	168187888	5/16/2011	ELMO14	K-MDB	4	U	14:30	426478	3740066	Y	
KM	168187889	5/16/2011	ELMO14	W-KM	4	U	14:30	426478	3740066	Y	
KM	168187890	5/19/2011	ELMO02	MK-LB	4	U	10:00	426330	3740524	Y	
KM	168187891	5/19/2011	ELMO02	OM-K	4	U	10:00	426330	3740524	Y	
KM	168187892	5/19/2011	ELMO02	O-DBM	4	U	10:00	426330	3740524	Y	
KM	168187893	5/22/2011	ELMO17	LGM-K	4	U	12:50	426415	3740662	Y	
KM	168187894	5/22/2011	ELMO17	M-YK	4	U	12:50	426415	3740662	Y	
KM	168187895	5/22/2011	ELMO17	MDB-W	4	U	12:50	426415	3740662	Y	
KM	168187896	5/25/2011	ELMO10	M-RLG	4	U	15:00	426351	3739885	Y	
KM	168187897	5/25/2011	ELMO10	LG-DBM	4	U	15:00	426351	3739885	Y	
KM	168187898	5/25/2011	ELMO04	MK-O	4	U	15:40	426607	3739754	Y	
KM	168187899	5/25/2011	ELMO04	MP-K	4	U	15:40	426607	3739754	Y	
KM	168187900	5/25/2011	ELMO04	KM-Y	4	U	15:40	426607	3739754	Y	
DK	178175797	3/4/2011	ELMO03/07	DB-MLG	5	U	9:10	426567	3740129	Ys	
DK	178175798	3/4/2011	ELMO14	R-KM	6	M	11:00	426509	3740048	Ys	
DK	178175799	3/4/2011	ELMO08/06	KK-M	6	M	13:10	426393	3739400	Ys	
DK	178175800	3/4/2011	ELMO08/06	MY-K	5	F	13:10	426393	3739400	Ys	
DK	178175801	3/4/2011	ELMO08/06	M-KW	6	U	13:10	426393	3739400	Ys	
DK	178175802	3/31/2011	BMR05	RDB-KM	5	U	9:10	425983	3719751	Ys	
DK	178175803	3/31/2011	BMR05	KP-MLB	5	U	9:10	425983	3719751	Ys	
DK	178175804	4/11/2011	SCR01	MW-LB	4	U	15:00	426257	3723840	N	
DK	178175805	4/11/2011	SCR01	K-DBM	4	U	15:00	426257	3723840	N	
DK	178175806	4/11/2011	SCR01	M-LBW	4	U	15:00	426257	3723840	N	
DK	178175807	4/23/2011	SCE09	KM-LG	4	U	13:10	440930	3725013	Y	
DK	178175808	4/23/2011	SCE09	W-MDB	4	U	13:10	440930	3725013	Y	
DK	178175809	4/23/2011	SCE11	LGK-M	4	U	14:10	441094	3725247	Y	
DK	178175810	4/23/2011	SCE11	K-OM	4	U	14:10	441094	3725247	Y	
DK	178175811	4/23/2011	SCE11	YM-LG	4	U	14:10	441094	3725247	Y	
DK	178175812	4/23/2011	UC06	M-KLB	4	U	16:40	421604	3722666	Y	
DK	178175813	4/23/2011	UC06	KM-R	4	U	16:40	421604	3722666	Y	
DK	178175814	4/29/2011	UC01	WP-M	4	U	12:30	421387	3721902	Y	
DK	178175815	4/29/2011	UC01	M-LGLG	4	U	12:30	421387	3721902	Y	
DK	178175816	4/30/2011	SCE07	M-DBK	4	U	12:30	440726	3725292	Y	
DK	178175817	4/30/2011	SCE07	LB-MLB	4	U	12:30	440726	3725292	Y	
DK	178175818	4/30/2011	SCE07	K-LGM	4	U	12:30	440726	3725292	Y	
DK	178175819	5/1/2011	UC05	KO-M	4	U	12:30	421569	3722543	Y	
DK	178175820	5/1/2011	UC05	LG-LBM	4	U	12:30	421569	3722543	Y	
DK	178175821	5/1/2011	UC05	KM-P	4	U	12:30	421569	3722543	Y	

Appendix Table 3c *continued*. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2011.

Bander Initials	USFWS Band Number Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 UTM Easting	NAD83 UTM Northing	Feather Pull	Toenail Clip
DK	178175822	5/1/2011	UC05	MR-DB	4	U	12:30	421569	3722543	Y	
DK	178175823	5/1/2011	UC05	W-MK	4	U	12:30	421569	3722543	Y	
DK	178175824	5/3/2011	SCE05	KM-DB	4	U	12:30	440665	3725396	Y	
DK	178175825	5/3/2011	SCE05	RM-K	4	U	12:30	440665	3725396	Y	
DK	178175826	5/3/2011	SCE05	M-PK	4	U	12:30	440665	3725396	Y	
DK	178175827	5/3/2011	SCE05	LGLB-M	4	U	12:30	440665	3725396	Y	
DK	178175828	5/5/2011	SCE03	LB-KM	4	U	10:00	440600	3725771	Y	
DK	178175829	5/5/2011	SCE03	P-MLB	4	U	10:00	440600	3725771	Y	
DK	178175830	5/5/2011	SCE03	M-KLG	4	U	10:00	440600	3725771	Y	
DK	178175831	5/5/2011	SCE03	M-KK	4	U	10:00	440600	3725771	Y	
DK	178175832	5/5/2011	SCE02N	DB-MP	4	U	11:00	440566	3726105	Y	
DK	178175833	5/5/2011	SCE02N	KM-W	4	U	11:00	440566	3726105	Y	
DK	178175834	5/5/2011	SCE02N	M-KP	4	U	11:00	440566	3726105	Y	
DK	178175835	5/6/2011	UC04	LB-DBM	4	U	15:00	421611	3722425	Y	
DK	178175836	5/6/2011	UC04	DBDB-M	4	U	15:00	421611	3722425	Y	
DK	178175837	5/7/2011	UC09	K-LBM	4	U	13:00	421445	3721791	Y	
DK	178175838	5/7/2011	UC09	LGM-P	4	U	13:00	421445	3721791	Y	
DK	178175839	5/7/2011	UC09	MP-DB	4	U	13:00	421445	3721791	Y	
DK	178175840	5/7/2011	UC09	MW-K	4	U	13:00	421445	3721791	Y	
DK	178175841	5/11/2011	SCE06	M-LBDB	4	U	13:20	440765	3725435	Y	
DK	178175842	5/11/2011	SCE06	P-MK	4	U	13:20	440765	3725435	Y	
DK	178175843	5/11/2011	SCE06	MK-R	4	U	13:20	440765	3725435	Y	
DK	178175844	5/11/2011	SCE15	KLG-M	4	U	14:40	440828	3725370	Y	
DK	178175845	5/11/2011	SCE15	LBM-K	4	U	14:40	440828	3725370	Y	
DK	178175846	5/11/2011	SCE15	M-KDB	4	U	14:40	440828	3725370	Y	
DK	178175847	5/11/2011	SCE15	DB-MY	4	U	14:40	440828	3725370	Y	
DK	178175848	5/16/2011	SCE12	O-MW	4	U	13:40	440655	3725136	Y	
DK	178175849	5/16/2011	SCE12	KM-LB	4	U	13:40	440655	3725136	Y	
DK	178175850	5/16/2011	SCE10	P-MLG	4	U	14:50	440797	3725699	Y	
DK	178175851	5/16/2011	SCE10	LG-KM	4	U	14:50	440797	3725699	Y	
DK	178175852	5/16/2011	SCE10	PLB-M	4	U	14:50	440797	3725699	Y	
DK	178175853	5/16/2011	SCE10	DBM-LB	4	U	14:50	440797	3725699	Y	
DK	178175854	5/16/2011	SCE04	P-DBM	4	U	16:30	440626	3725508	Y	
DK	178175855	5/16/2011	SCE04	Y-MK	4	U	16:30	440626	3725508	Y	
DK	178175856	5/18/2011	SCE14	O-MY	4	U	14:30	440718	3725822	Y	
DK	178175857	5/18/2011	SCE14	DB-MK	4	U	14:30	440718	3725822	Y	
DK	178175858	5/18/2011	SCE14	MR-K	4	U	14:30	440718	3725822	Y	
DK	178175859	5/18/2011	SCE02S	KP-M	4	U	16:00	440471	3726027	Y	
DK	178175860	5/18/2011	SCE02S	M-DBW	4	U	16:00	440471	3726027	Y	
DK	178175861	5/18/2011	SCE02S	MLB-K	4	U	16:00	440471	3726027	Y	
DK	178175862	5/18/2011	SCE02S	MK-P	4	U	16:00	440471	3726027	Y	
DK	178175863	5/31/2011	SCE13	RLG-LBM	4	U	14:30	440757	3725114	Y	
DK	178175864	6/9/2011	SCE09	MR-WP	4	U	13:10	440974	3725056	Y	
DK	178175865	6/9/2011	SCE09	KLB-OM	4	U	13:10	440974	3725056	Y	
DK	178175866	6/9/2011	SCE09	MLB-ODB	4	U	13:10	440974	3725056	Y	
DK	178175867	6/10/2011	MD02	WY-MK	4	U	12:50	428834	3721751	Y	
DK	178175868	6/15/2011	TRD03	M-PLB	4	U	14:00	424632	3720069	Y	
DK	178175869	6/15/2011	TRD03	O-YM	4	U	14:00	424632	3720069	Y	
DK	178175870	6/16/2011	UC09	MR-LBO	4	U	14:00	421439	3723714	Y	
DK	178175871	6/16/2011	UC09	MLG-DBY	4	U	14:00	421439	3723714	Y	
DK	178175872	6/21/2011	BMR02	MW-DBDB	4	U	14:30	425856	3720062	Y	
DK	178175873	6/21/2011	BMR02	MO-YLB	4	U	14:30	425856	3720062	Y	
DK	178175874	6/21/2011	BMR02	OM-RW	4	U	14:30	425856	3720062	Y	
DK	178175875	6/22/2011	SCE11	OP-MLB	4	U	11:30	441004	3725181	Y	
DK	178175876	6/22/2011	SCE11	YDB-DBM	4	U	11:30	441004	3725181	Y	
DK	178175877	6/22/2011	SCE11	MLB-OR	4	U	11:30	441004	3725181	Y	
DK	178175878	6/22/2011	SCE11	LGM-LBLB	4	U	11:30	441004	3725181	Y	
DK	178175879	6/23/2011	MD03	MY-OW	5	F	9:40	429269	3721846		Y
DK	178175880	6/23/2011	MD03	MLG-YLG	5	M	9:40	429269	3721846		Y

Appendix Table 3c *continued*. Date, time, territory location, age, sex, geographic coordinates, color band codes and genetic sample collection status for Cactus Wrens captured and banded by Nature Reserve of Orange County biologists in 2011.

Bander Initials	USFWS Band Number	Date	Location	Color Bands (RL-LL)	Age	Sex	Capture Time	NAD83 UTM Easting	NAD83 UTM Northing	Feather Pull	Toenail Clip
DK	178175881	6/23/2011	SCR01	PM-LGDB	4	U	12:50	426257	3723840	Y	
DK	178175882	6/23/2011	SCR01	MO-KK	4	U	12:50	426257	3723840	Y	
DK	178175883	6/23/2011	SCR01	LBM-PDB	4	U	12:50	426257	3723840	Y	
DK	178175884	6/24/2011	QH03	MP-WK	5	F	8:00	428373	3722255		Y
DK	178175885	6/24/2011	QH03	KM-OLG	4	U	8:00	428373	3722255		Y
DK	178175886	6/24/2011	QH03	PY-DBM	4	U	8:00	428373	3722255		Y
DK	178175887	6/24/2011	QH03	OM-LBLB	5	M	8:00	428373	3722255		Y
DK	178175888	6/24/2011	QH03	RM-DBP	4	U	8:00	428373	3722255		Y
DK	178175889	6/24/2011	QH04	YM-DBLG	4	U	11:10	427779	3721780		Y
DK	178175890	6/29/2011	SCE08	OY-RM	4	U	14:20	440833	3725079	Y	
DK	178175891	6/29/2011	SCE08	RW-PM	4	U	14:20	440833	3725079	Y	
DK	178175892	6/29/2011	SCE08	MLG-YR	4	U	14:20	440833	3725079	Y	
DK	178175893	6/29/2011	SCE08	KP-KM	4	U	14:20	440833	3725079	Y	
DK	178175894	6/29/2011	SCE15	RDB-MK	4	U	15:50	440834	3725399	Y	
DK	178175895	6/29/2011	SCE15	DBLG-MLB	4	U	15:50	440834	3725399	Y	
DK	178175896	6/29/2011	SCE15	LGM-YW	4	U	15:50	440834	3725399	Y	
DK	178175897	6/29/2011	SCE15	KW-MK	4	U	15:50	440834	3725399	Y	
DK	178175898	7/1/2011	SCE12	MLG-WW	4	U	10:00	440628	3725120	Y	
DK	178175899	7/1/2011	SCE12	DBP-MK	4	U	10:00	440628	3725120	Y	
DK	178175900	7/8/2011	BRR01	RLG-PM	4	U	8:30	426949	3719136	Y	
DK	178175901	7/8/2011	BRR01	OR-MDB	4	U	8:30	426949	3719136	Y	
DK	178175902	7/8/2011	BRR01	KO-MLG	4	U	8:30	426949	3719136	Y	
DK	178175903	7/15/2011	MD01	MDB-YDB	1	U	7:10	429068	3721749		Y
DK	178175904	7/15/2011	MD01	MP-WR	4	U	7:10	429068	3721749		Y
DK	178175905	7/22/2011	BTC01	RO-MR	6	U	8:10	426708	3712613		Y
DK	178175906	7/22/2011	BTC01	KM-DBR	2	U	9:00	426714	3712622		Y
DK	178175907	7/22/2011	BTC01	LBK-MO	2	U	9:00	426708	3712613		Y
DK	178175908	9/1/2011	WR01	OM-KP	1	U*	8:30	440550	3726537	Y	
KM	233188201	5/25/2011	ELMO04	K-MK	4	U	15:40	426607	3739754	Y	
KM	233188202	5/27/2011	UNB01	WO-OM	4	U	16:40	417453	3723769	Y	
KM	233188203	5/27/2011	UNB01	PP-OM	4	U	16:40	417453	3723769	Y	
KM	233188204	5/27/2011	UNB01	RM-RLG	4	U	16:40	417453	3723769	Y	
KM	233188205	5/30/2011	ELMO09	LGDB-M	4	U	13:10	426522	3739514	Y	
KM	233188206	5/30/2011	ELMO09	K-PM	4	U	13:10	426522	3739514	Y	
KM	233188207	5/30/2011	UNB02	K-KM	4	U	14:10	417349	3723326	Y	
KM	233188208	5/30/2011	UNB02	RM-YP	4	U	14:10	417349	3723326	Y	
KM	233188209	6/2/2011	QH01	DBP-M	4	U	11:20	428328	3722001	Y	
KM	233188210	6/14/2011	BMR05	M-OP	4	U	14:00	425990	3719749	Y	
KM	233188211	6/14/2011	BMR05	R-MK	4	U	14:00	425990	3719749	Y	
KM	233188212	6/14/2011	BMR05	K-MLG	4	U	14:00	425990	3719749	Y	
KM	233188213	6/16/2011	ELMO16	LG-MP	4	U	13:30	426429	3739377	Y	
DK	242111101	11/18/2011	GC03	Mp-KO	1	U*	14:00	438823	3724746		Y
DK	242111102	11/19/2011	GC05	DB-LGMp	1	U*	7:30	438927	3725067		Y
DK	242111103	11/19/2011	GC02	KW-Mp	1	U	11:50	438986	3724977		Y
DK	242111104	11/21/2011	GC04	KMp-K	1	U	5:30	439331	3725075		Y
DK	242111105	11/22/2011	GC05	W-MpY	1	U*	9:00	438927	3725067		Y
DK	242111106	11/25/2011	GC02	DBLB-Mp	1	U*	7:30	438932	3724992		Y
DK	242111107	11/25/2011	GC03	Mp-RK	1	U*	10:00	438810	3724745		Y

Banding Code Definitions:

Bander Initials
DK = Dana Kamada
KM = Karly Moore
KP = Kristine Preston

Location Codes
BMR = Bommer Canyon, City of Irvine Open Space
BRR = Bommer Ridge Road, City of Irvine Open Space
CCSP = Crystal Cove State Park
ELMO = El Modena Open Space Preserve
MD = Mule Deer, City of Irvine Open Space
QH = Quail Hill, City of Irvine Open Space
SCE = Southern California Edison
SCR = Sand Canyon Reservoir, City of Irvine Open Space
TRD = Turtle Ridge, City of Irvine
UC = University of California, Irvine Ecological Preserve
UNB = Upper Newport Bay

Color Band Codes (Right Leg-Left Leg)
DB = Dark blue
DG = Dark green
K = Black
LB = Light blue
LG = Light green
M = Metal USFWS band
Mp = Metal USFWS band anodized purple
O = Orange
P = Purple
R = Red
W = White
X = Missing color band
Y = Yellow

Age Codes
AHY = After hatch year (adult)
ASY = After second year (adult)
F = Fledgling
HY = Hatch year (juvenile)
N = Nestling
SY = Second year

Sex Codes
F = Female
M = Male
U = Unknown

Feather Pull Codes
N = No feather collected

Y = Contour feathers collected
Ys = Secondary feather collected
Yr = Molted retrice collected

* Duplicate band combinations. ELMO12 O-WM has not been resighted since nestlings fledged, so far (11/8/10); ELMO and UC sites in different regions.