

USE OF NEST BOXES BY CACTUS WRENS IN ORANGE COUNTY, CALIFORNIA

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ABSTRACT: Responding to studies identifying an apparent lack of suitable natural nesting sites for the Cactus Wren (*Campylorhynchus brunneicapillus*) in coastal southern California, we designed “cactus-like” nesting structures and nest boxes (1) to determine whether this wren would use such structures or boxes and (2) to assess the efficacy of different construction designs. Out of 32 nest boxes deployed, two supported Cactus Wren nests that successfully fledged young—one in 2010 and another in a different location in 2011. In fall 2010, another box in yet a third location was used for a brood nest. In contrast, we observed no nesting in the 13 cactus-like structures over three years of study. Our results provide “proof of concept” that Cactus Wrens will select and successfully use nest boxes even in areas of mature cactus scrub. Furthermore, all three boxes used by Cactus Wrens were mounted in a tilted position, in which the nest box was angled up to 45°, rather than level. In the summer of 2011, we retrieved the artificial structures and weathering nest boxes and mounted 21 new boxes in the tilted position and with a level floor inserted to prevent eggs from falling into the bottom. We expect that this and future experiments will evaluate the potential conservation value of nest boxes for Cactus Wrens in areas recovering from wildfire and at sites of cactus restoration.

The Cactus Wren (*Campylorhynchus brunneicapillus*) is a resident of spinescent scrub habitats in arid and semiarid regions in the southwestern U.S. and northern Mexico (AOU 1998). Although it is common across most of its range, populations in coastal southern California and northwestern Baja California have been in steep decline in recent decades (Rea and Weaver 1990, Small 1994, Unitt 2004, 2008, Garrett et al. 2006, Mitrovich and Hamilton 2007, Clark and Dodero 2008, Leatherman Bioconsulting 2009). The causes are not fully understood but almost certainly involve multiple stressors, one of which is fire, which can destroy the nesting habitat (Rea and Weaver 1990).

Cholla (*Cylindropuntia* spp.) and prickly-pear (*Opuntia* spp.) cacti are the Cactus Wren’s primary nesting substrates on the coastal slope of southern California (Rea and Weaver 1990), a region where the frequency and scale of wildfire have been increasing in recent decades as urbanization and population density have steadily increased (Keeley and Fotheringham 2001). In the past 20 years, large fires have burned extensive tracts of cactus scrub, rendering the habitat unusable by Cactus Wrens until the cactus recovers to the meter-plus height generally required for nesting, a process that takes decades (Rea and Weaver 1990, Flaagan 1996, Mitrovich and Hamilton 2007).

Recovery strategies developed to bolster populations of imperiled species often include provision of substrates for nesting. Examples include artificial nest burrows for the Atlantic Puffin (*Fratercula arctica*; Kress 1977) and Burrowing Owl (*Athene cunicularia*; Olenick 1990), platforms for the

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Osprey (*Pandion haliaetus*; Poole 1989, Ewins 1994) and Great Gray Owl (*Strix nebulosa*; Nero et al. 1974), and nest boxes for the Eastern Bluebird (*Sialia sialis*; Pinkowski 1976, 1977) and Tree Swallow (*Tachycineta bicolor*; Holroyd 1975). Such an approach may prove worthwhile for the Cactus Wren, given that post-fire shortage of suitable nesting sites appears to be contributing to the species' regional decline (Mitrovich and Hamilton 2007, Unitt 2008). We are unaware of any other efforts to develop artificial nesting substrates for this species as a conservation tool, but the literature includes a few brief references to Cactus Wrens nesting opportunistically in man-made structures (Daggett 1904, Anderson and Anderson 1957, 1973).

The goal of this study was to develop an artificial substrate that Cactus Wrens would find acceptable for nesting, which could serve a conservation purpose in areas where cactus scrub is still recovering from wildfire.

INITIAL PROTOTYPE

Our first attempt at devising an acceptable nesting substrate involved constructing two types of "artificial cactus." One design employed loops of barbed wire wrapped around a metal-pipe frame; the other consisted of branched PVC piping looped with barbed wire, with needles melted into the pipes. Both stood >1.5 m tall. We set out eight of the former and seven of latter structures during summer and fall of 2008, after completion of Cactus Wren nesting. The structures were set out in pairs at five sites in the San Joaquin Hills (Coastal Reserve of the Nature Reserve of Orange County/Irvine Ranch National Landmarks, IRNL) and two sites in the foothills of the Santa Ana Mountains (Central Reserve/IRNL); one site received an extra wire structure. We chose the sites on the basis of presence of at least one Cactus Wren at the site during the summer before installation. At the time of placement we inserted several clumps of long grass into each structure to help emphasize the potential of these structures as nesting substrates. We verified that Cactus Wrens were present at each site when the structures were installed. In March 2009, we placed up to three V-shaped wooden platforms into each structure in an effort to improve the structure's ability to hold a Cactus Wren nest. Formal monthly monitoring of the structures between January and June 2009, and in February, March, and May 2010, yielded no observations of nesting by any species. Subsequent informal checks have continued to yield no evidence of nesting. We observed Cactus Wrens and other birds routinely perching on the structures, and numerous droppings accumulated on them, both indications that the birds were aware of structures but did not regard them as attractive nesting substrates. Therefore, we concluded that these prototype structures did not have good potential to serve as substrate for the Cactus Wren's nesting.

NEST BOX DESIGN AND METHODS

The idea for a nest box arose in May 2009, when Lance Benner found Cactus Wrens nesting under a metal transmission box affixed to a telephone pole, at a height of approximately 4 m above dense cactus scrub in San Dimas, Los Angeles County. Similarly, Daggett (1904) reported an active

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breeding nest between the cross-arm of a power pole and an insulator 9 m above ground near Azusa, Los Angeles County. Farley and Stuart (1994) noted that in Arizona and New Mexico Cactus Wrens occasionally construct nests in “a variety of non-native and non-spinescent vegetation” in otherwise typical desert scrub habitat; they found 12 nests placed 2.0–4.0 m above ground in non-spinescent substrates, compared with a mean height of 1.7 m above ground (range 1.1–2.7 m, $n = 30$) for nests in typical spiny vegetation in the same area (Farley 1995). From this we inferred that Cactus Wrens may select a taller substrate that affords increased protection from ground-based predators, even if the substrate provides less spiny armoring.

We designed the nest box to fit the size of a typical Cactus Wren nest (18 × 30 cm; Hamilton et al. 2011). It consisted of a four-sided painted box constructed of pieces of pine wood 0.63 cm thick (Figure 1). Three drainage holes were drilled into the bottom of the box, and holes of 5.0 and 7.6 cm were drilled into the end boards. The top was left open to mimic natural conditions in cactus substrate, with “hardware cloth” (quarter-inch wire mesh) covering the open top to provide protection against aerial predators. Folding up the bottom 5–8 cm of hardware cloth provided the birds another way of entering and exiting the box (in addition to the holes in the end boards). To mimic cactus spines, we used a pneumatic gun to stud the box liberally with 38-mm T-pin nails, and a few nails projected inward to help prevent slippage of the nest. We affixed the box to the top of a 2.4-m painted galvanized steel pipe with two metal screw bolts. All materials were spray-painted a mottled green with two tints of standard green spray paint. We pounded a primed and painted steel pipe into the ground to a height of approximately 2 m above ground (above the level of mature cactus in adjacent areas; see

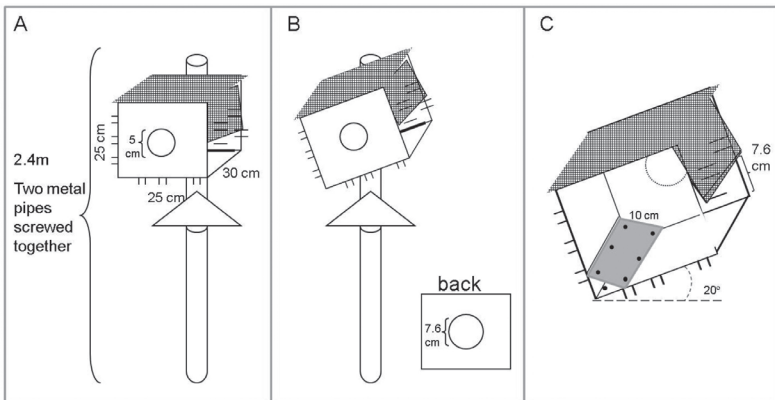


Figure 1. Schematic drawings showing the basic dimensions of the wren box. (A) “Level” nest box design with dimensions. (B) “Tilted” nest box mounted at an angle of ~20–45° with dimensions of second exit hole. (C) Modified design with box tilted at ~20° and 0.6-cm-thick wooden floor glued in. For each box, holes of two different sizes were drilled into the end boards and the wire mesh was bent back to leave a small gap, providing the birds with various choices for entering and exiting the box.

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Figure 2. The first “tilted” nest box in which Cactus Wrens nested successfully, Santiago Canyon, 9 June 2010. The opening of the nest is on the left.

Photo by Robert A. Hamilton



Figure 3. Closer view of the first “tilted” nest box in which Cactus Wrens nested successfully, Santiago Canyon, 9 June 2010.

Photo by Robert A. Hamilton

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Figure 4. Adult Cactus Wren exiting, via the gap beneath the wire mesh, another box in which it nested successfully, at Irvine Regional Park, 1 June 2011.

Photo by Robert A. Hamilton

Figure 2). A metal baffle was placed approximately halfway up the pole to thwart predators such as snakes. We oriented the boxes so that the end holes were on a roughly east–west axis and inserted clumps of dry grass into the boxes upon installation.

In December 2009 and early January 2010, we installed 32 nest boxes at 16 locations in the San Joaquin Hills and foothills of the Santa Ana Mountains. All but one location supported mature cactus scrub habitat dominated by tall (1–2 m) prickly-pear (*Opuntia littoralis*, *O. oricola*) and/or coastal cholla (*Cylindropuntia prolifera*) that had been occupied by Cactus Wrens at the time of installation or in the recent past. The location lacking in mature cactus was in the early stages of being restored from annual grasses and ruderal forbs to cactus scrub, and this location lacked Cactus Wrens at the time the boxes were installed. To compare use of the various models we set boxes at four of the original seven locations with artificial cactus structures. At each location we set two boxes, one mounted so that the base was horizontal (hereafter “level” nest box), the other mounted at an angle approximately 20–45° from horizontal (hereafter “tilted” nest box).

RESULTS

On 25 May and 15 June, Hamilton and Burger encountered an active Cactus Wren nest at 33.793° N, 117.726° W (“Fremont” site; Table 1) in a tilted nest box within mature cactus scrub near the juncture of Fremont and

Table 1 Sites of Artificial Structures and Cactus Wren Observations within the Irvine Ranch Natural Landmarks/Nature Reserve of Orange County

Location	Type	Type of cactus scrub ^a	Nest?	Lat.	Long.	Nearest wren (m) ^b	Obs. 2009 ^c	Obs. 2010 ^d
Agua Chionon 1	nest box	both	Yes	33.692	-117.684	14	N/A	Yes
Agua Chionon 2	nest box	both	No	33.692	-117.680	61	N/A	Yes
Crystal Cove	cactus structure	both	No	33.584	-117.813	3313	Yes	Yes
Fremont	cactus structure, nest box	<i>Opuntia</i>	Yes	33.793	-117.726	48	Yes	Yes
Hicks Haul Rd	nest box	<i>Opuntia</i>	No	33.744	-117.705	1814	N/A	Yes
Hwy. 133 ^e	cactus structure, nest box	both	No	33.634	-117.764	4	No	No
Irvine Park	cactus structure, nest box	<i>Opuntia</i>	No	33.797	-117.740	18	Yes	Yes
Irvine Park West	nest box	<i>Opuntia</i>	Yes	33.798	-117.741	26	N/A	Yes
Loma Ridge	nest box	<i>Opuntia</i>	No	33.759	-117.728	320	N/A	Yes
Mule Deer	cactus structure, nest box	both	No	33.635	-117.766	3442	Yes	Yes
Orchard Hills ^e	nest box	<i>Opuntia</i>	No	33.741	-117.736	2295	N/A	No
Quail Trail ^e	nest box	both	No	33.635	-117.773	846	N/A	No
Shady Canyon	cactus structure	both	No	33.643	-117.786	569	Yes	Yes
Shoestring 1,2	nest box	<i>Opuntia</i>	No	33.758	-117.722	263	N/A	No
Shoestring 3,4	nest box	<i>Opuntia</i>	No	33.761	-117.719	16	N/A	No
Strawberry Farms	cactus structure	both	No	33.65	-117.795	201	Yes	Yes
Strawberry Farms 2	nest box	both	No	33.653	-117.797	222	N/A	No

^aPrickly-pear (*Opuntia* spp.), coastal cholla (*Cylindropuntia proliferata*), or both.

^bDistance to nearest territory or nest located in 2008 or 2009 by Nature Reserve of Orange County or by Hamilton before initiation of study.

^cCactus Wren observed during year 1 of the study.

^dCactus Wren observed during year 2 of the study.

^eCactus Wren observed on site by IRC or Hamilton before installation of box.

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Santiago canyons in the foothills of the Santa Ana Mountains. During limited observations, we saw the adults bringing food to the nest, indicating the presence of nestlings; the adults were seen entering and exiting the box only via the gap under the hardware cloth. On 17 and 30 June, Hamilton observed a pair of Cactus Wrens with at least two fledglings in cactus scrub adjacent to this box and presumed these to be the adults and fledglings from the box. Inspection of the box revealed an unhatched, presumably unviable Cactus Wren egg that had apparently been pushed through the bottom of the nest.

On 7 October 2010 we noted a Cactus Wren roost nest at 33.692° N, 117.684° W in a tilted nest box within mature cactus scrub adjacent to a grove of avocados (*Persea americana*) ("Agua Chinon1"; Table 1) within the city of Irvine's Open Space Preserve North, approximately 12 km southeast of the first wren-occupied box. This nonbreeding nest was originally observed two weeks prior by Q. Sorenson of the Irvine Ranch Conservancy and was partially completed at that time.

During the winter, we examined all boxes and, if necessary, repaired them so they were ready for use by February 2011. No additional monitoring took place until 31 May 2011, when we found an active nest at 33.798° N, 117.741° W ("Irvine Park West"; Table 1), in the foothills of the Santa Ana Mountains, approximately 2 km west of the first wren-occupied box observed in 2010; this nest was also in a tilted box within mature cactus scrub (Figures 3, 4). Adults were bringing food to the nest on 1 June and had at least one fledgling on 10 June. These adults also chose to enter and exit the box via the gap underneath the hardware cloth rather than through the holes in the end boards.

Cactus Wrens have not yet been found nesting in boxes at sites closer to the coast, in the San Joaquin Hills, but the House Finch (*Carpodacus mexicanus*) has nested in two boxes in that area.

DISCUSSION

The scrub surrounding nest boxes used by Cactus Wrens for breeding and roosting included extensive stands of mature prickly-pear, and several sites also contained mature coastal cholla. Therefore, use of the boxes provides "proof of concept" that Cactus Wrens will select the boxes as an acceptable nesting substrate, even when tall, mature cactus replete with apparent natural nest sites is available. Presumably, the wrens should select boxes for nesting more frequently in scrub lacking tall cactus (unless other factors are preventing Cactus Wrens from settling in such an area); only one of our sites lacked tall cactus. Successful fledging of young from both boxes used for breeding suggests the suitability of the box's design and placement. The boxes did not weather well, however; the boards separated and warped because of the use of nails to hold them together and lack of a protective primer coating. They have now been replaced with sturdier models held together with screws and hand-painted with primer and latex paint. The approximate cost of materials to construct a nest box by the new design is \$50, including steel poles for installation in the field. Maintenance, such as cleaning out old nests, checking for warped pieces, and refastening hardware cloth should be done annually, before the breeding season.

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For reasons unknown to us the wrens seem to prefer the tilted boxes. The second set of 21 nest boxes installed in the field in August and September of 2011 as part of an Eagle Scout leadership service project includes only the tilted model. Scout George Carpenter and his team invested a total of 146 man-hours over 8 days to purchase supplies, construct nest boxes, and assist with installation. Other modifications to box's design include the installation of a level floor to help prevent eggs from being pushed through the bottom of the nest (Figure 1C). We are attempting to thoroughly seal the "false bottom" of the nest to prevent this dead space from becoming a breeding ground for pests that could be harmful to nestlings. The new boxes have been placed primarily in cactus-restoration sites adjacent to more intact cactus in the foothills of the Santa Ana Mountains and in mature scrub in the San Joaquin Hills, where Cactus Wren densities are low. The goal is to test whether, in areas lacking suitable nest sites, the boxes can effectively increase the area of habitat occupied by Cactus Wrens and accelerate recovery of the local population.

The potential for harm to result from deploying nest boxes is remote; one would not expect the presence of a nest box to induce wrens to settle in a patch of habitat that does not satisfy other basic ecological requirements (e.g., food, cover). We suggest that judicious use of the boxes in burned habitat and at restoration sites should represent one useful component of a multifaceted approach to stabilizing and recovering Cactus Wren populations now in danger of extirpation. The boxes could also have value as a research tool for assessing the importance of other aspects of habitat suitability, such as foraging ecology and nest predation in relation to nest-site availability. We do not anticipate that nest boxes alone could possibly be sufficient to stem current declines in coastal populations of the Cactus Wren, since lack of appropriate nesting sites in burned landscapes represents only one of several potential stressors suspected of limiting the species' productivity and/or survivorship in coastal southern California; others include habitat fragmentation, changes in habitat structure, disease, booming populations of Cooper's Hawk (*Accipiter cooperii*), and possible food limitation. The Irvine Ranch Conservancy, Nature Reserve of Orange County, and others are pursuing additional studies in a combined effort to identify other adverse factors, and to develop remedies where feasible.

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Sketch by Narca Moore-Craig