

THE CACTUS WRENS ON THE SANTA RITA EXPERIMENTAL RANGE, ARIZONA

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In the course of our work on the life history of the Cactus Wren (*Campylorhynchus brunneicapillus*) we recognized that a larger study area would be necessary if accurate information on population densities and fluctuations was to be secured. At its best, the suburban Kleindale Road tract in northeast Tucson, Arizona, contained but two pairs of wrens (Anderson and Anderson, 1957-1963). Certain portions of the Santa Rita Experimental Range, a desert expanse of 50,000 acres, located 35 miles south of Tucson, seemed to offer many advantages. It was closed to hunting; its interior roads were too narrow and rough to attract many visitors; and at several stations temperatures and precipitation were being recorded. The only serious disturbances to its value as a natural area were predator control and the introduction of cattle. The cattle, however, were limited under the supervision of the United States Department of Agriculture, to from six to eight head per square mile.

We selected what appeared to be a representative area in pasture 5, nine miles from Sahuarita on the Sahuarita-Helvetia Road. The elevation was approximately 3300 feet. Two man-made boundaries, on the east side a barbed wire fence, and on the north the road, running from northwest to southeast, helped to delimit the area. We paced off and marked the corners of a plot of about 60 acres, trapezoidal in shape. At the middle of the east boundary fence, a large, open iron pan, fed by a larger, open concrete reservoir, designated as the "North Rim" on the Forest Service map, provided water for the cattle assigned to this portion of pasture 5. In general, the vegetation of this research plot was the cholla meadow of Brandt (1951: 57), divided into roughly triangular patterns by strips of other associations. Under the Shreve (1951:40) classification it would fall into the upper border of the *Cercidium-Opuntia* Region, Arizona Upland, Upper Bajada, with ribbons of Streamway vegetation. There was an understory of scattered burweed (*Haplopappus tenuisectus*). Had drainage channels been absent, it is probable that the entire area would have been dominated by cholla cacti of two species, *Opuntia fulgida*, with its less spiny variety *mamillata*, and *O. spinosior*. Usually each species grew in almost pure stands, often very dense in the case of *O. fulgida*. Their height ranged from three to six feet. Where intermingling occurred the spacing between plants was wider (fig. 1, above). Next in abundance was the prickly pear *O. engelmannii*. It was present in all territories but was seldom of sufficient height to be conspicuous.

The uniformity of the cholla association was broken by several normally dry, sandy washes and their tributaries running irregularly from southeast to northwest across the area. They were bordered by a distinct wash association, a fringe of mesquite (*Prosopis juliflora*), blue palo verde (*Cercidium floridum*), and catclaw (*Acacia greggii*), the first two were 20 feet high, the last, 15 feet (fig. 1, below). Impenetrable clumps of desert hackberry (*Celtis pallida*), up to nine feet in height, lined the edges of some of the channels, sometimes forming a barrier of considerable length. Between the washes many scattered individuals of these four species had found foothold. To a lesser degree, this invasion extended even into the pure cholla association on either side. Other less common perennials were the desert honeysuckle (*Anisacanthus thurberi*), Mormon tea (*Ephedra trifurca*), ocotillo (*Fouquieria splendens*), gray thorn (*Condalia lycioides*), fairy duster (*Calliandra eriophylla*), and

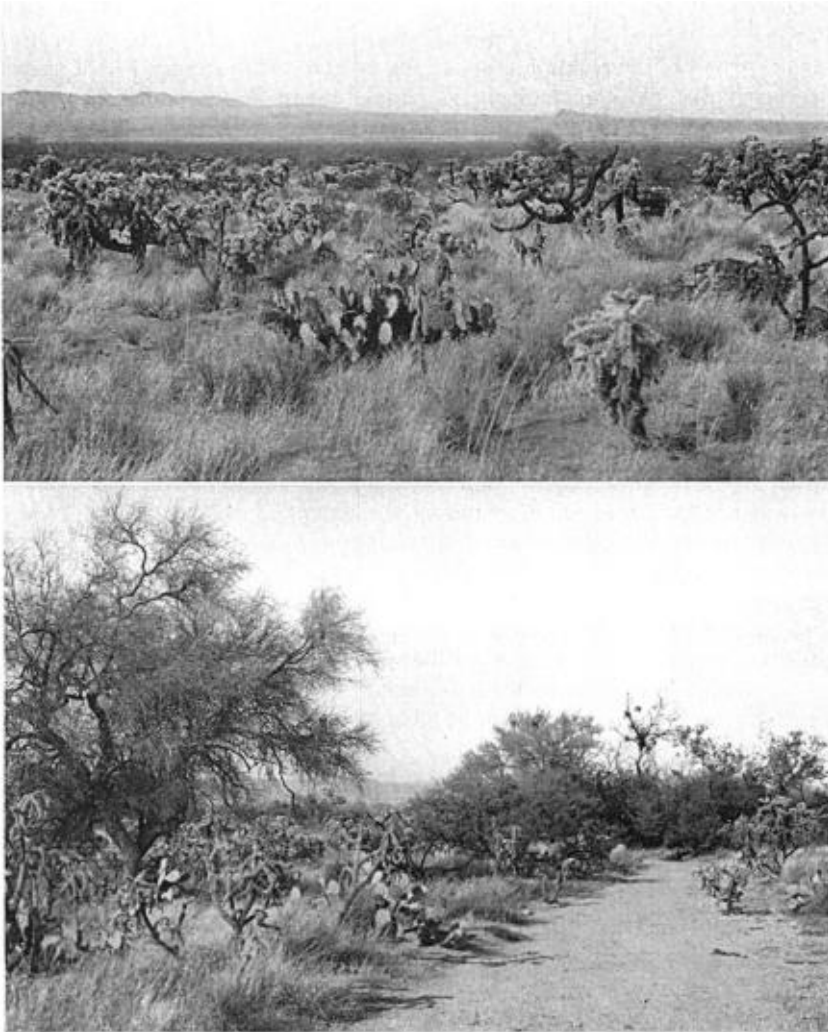


Fig. 1. Above: Cholla association, Santa Rita Experimental Range, 35 miles south of Tucson, Arizona, December 19, 1954.

Below: Wash association, Santa Rita Experimental Range, 35 miles south of Tucson, Arizona, December 19, 1954.

Baccharis brachyphylla. In contrast to the bajadas of the Santa Catalina Mountains, just north of the Kleindale Road tract at Tucson, the Santa Rita Experimental Range plot lacked the giant saguaro (*Cereus giganteus*), foothill palo verde (*Cercidium microphyllum*), creosote bush (*Larrea divaricata*) and bur sage (*Franseria deltoidea*).

We began work on January 10, 1953, and stopped on May 27, 1956. The results were unexpected and rather confusing. Since only weekends were available for research, we devoted most of our time to the search for nests and to their periodic inspection. No banding was attempted. We made a total of 88 visits during the three years and five months. Lengths of visits varied from one to seven hours, with

an average of 3.79 hours per visit. Three later visits were made, one on December 29, 1956, one on March 30, 1958, and another on May 4, 1958. At the beginning of 1953 we located all of the roosting nests on the 60 acres of the Santa Rita Experimental Range research plot. We then tagged and mapped them. From then on, we endeavored to keep up with the new construction, recording on each visit the progress and change in building activity, the destruction or abandonment of nests, and the presence or absence of Cactus Wrens. There are some gaps in the record during the summer months, particularly in 1953, when vacations took us out of Arizona. Several times, too, we found that the area was inaccessible because of flooded roads from heavy, cloudburst-type rains.

Adult Cactus Wrens roost alone; unoccupied nests soon become flattened at the entrance. The number of nests in good condition at the beginning of January is a fairly satisfactory indication of the size of the winter population. By the first of April, on the range, the number of remaining nests will house the potential breeding population. By October 1, the old breeding nests, no longer in use, will have deteriorated. New winter roosting nests built by the surviving adults and immature wrens, then give a rough approximation of the success of the breeding season.

Time was not available for determining the extent of each territory by watching the individual birds. We have assumed that each pair claimed the land halfway to its neighbor's breeding nest. Cactus Wrens' nests occur in groups, separated by varying distances from other groups. The nucleus of an ideal group is a pair of roosting nests. Several old, weathered remains of abandoned nests can usually be found in the vicinity. After the breeding nest is constructed in the spring, and while the female is incubating her first set of eggs, the male builds a secondary nest to be used for the next brood. At any time of the year a territory can be located and roughly bounded by the presence of such a group of nests.

We located 16 first brood nests in the spring of 1953 (fig. 2). The number dropped to five in 1954; it remained at five in 1955, and in 1956 it rose to eight. It would be gratifying if one could find a satisfactory explanation for the cause of this almost catastrophic decline in the Cactus Wren population.

The Curve-billed Thrasher (*Toxostoma curvirostre*), the Cactus Wrens' only important competitor for nest sites, and a partial competitor for food, apparently did not suffer in a similar manner during the period of our study. The thrashers built four first brood nests in 1953, all of them in wren territories (we have no data on second broods for this year). One of the nesting attempts failed. In 1954, we located three first brood and three second brood nests. Two of the latter failed. Three of the nests were in areas not occupied by wrens. In 1955 they built seven first brood nests, four of which were abandoned, two before eggs were laid, and two afterward. Later they attempted to raise two second broods; one of these failed. Only two of the nests in that year were in Cactus Wren territories. In 1956, five first brood nests contained eggs; two of the nests were in wren territories. The Curve-billed Thrashers constructed all of their nests in cholla cacti, usually within the framework of the spiny joints. They appeared to be well protected from the larger mammalian and avian predators but not from snakes or the Roadrunners (*Geococcyx californianus*).

The Cactus Wrens chose the periphery of the crown of the cholla cacti for their nest locations. The nests were conspicuous; to us, at least, there appeared to be no attempt at concealment from any enemy. Nests were not always securely anchored among the spiny cholla joints; strong winds evidently blew some of them away. Others, we feel sure, were torn loose by cattle or deer which found the bundle of dry

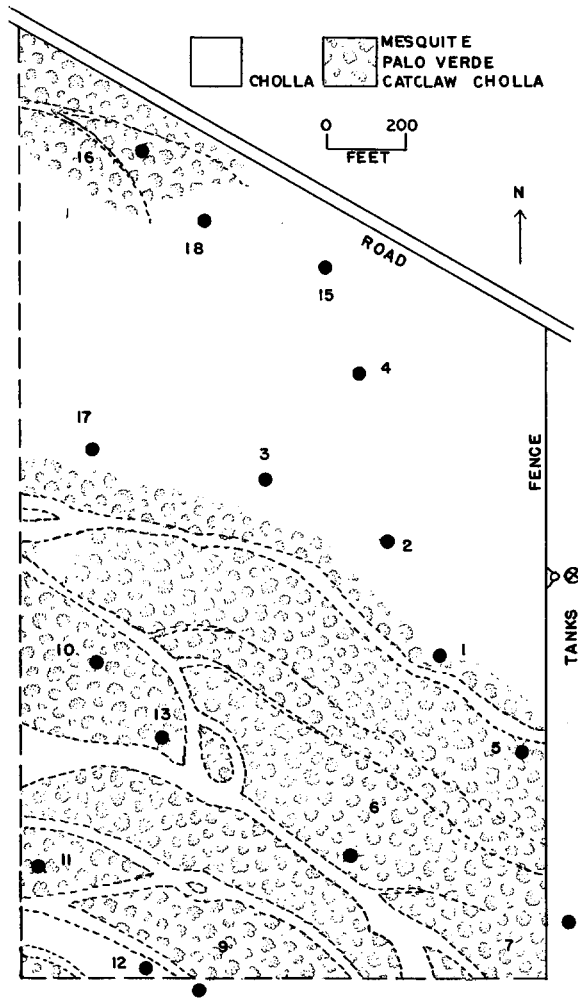


Fig. 2. Map of study area in pasture 5, Santa Rita Experimental Range, 35 miles south of Tucson, Arizona. Solid circles and numerals indicate first brood nests in 1953 and territories.

grass attractive. We occasionally saw cattle with cholla joints impaled in their jaws. By far the greater part of the nest destruction was so similar to that which the Curve-billed Thrashers perpetrated at Tucson that we must attribute it to them.

Observations in 1953.—The year began with 41 usable roosting nests, located in 16 well-defined groups. The presence of many old nests suggested that 1952 had been a good year. A few isolated nests could not be assigned to any particular territory. Several nests in territories 7, 9, and 11 (fig. 2), which were at or just outside the boundary lines of the research area, have been included because breeding nests were built later in the same locations. A considerable portion of these territories evidently extended inside the research area. We found several breeding nests under construction on April 1, but an equal number of roosting nests had been abandoned.

The total was still 41 nests. Sixteen breeding nests were constructed in April (fig. 2). Another nest found in June, may have been a second brood, or possibly the interdigitation of a new territory. The nesting success is not known; nine nests had young in them and seven had eggs, when found. The 16 pairs of wrens occupied an area of approximately 76 acres. The average size of a territory was estimated at 4.75 acres, the minimum size, 2.9 acres, the maximum, 6.9 acres. Only two roosting nests were torn apart in late spring. In the remainder of the year the Cactus Wrens constructed 56 other nests, some of which may have contained second broods. We were absent in July and August, missing considerable data.

In the course of the year, the wrens abandoned 71 nests. No less than 36 had been torn apart or completely destroyed; the rest were either entirely gone or so badly weathered as to be uninhabitable. The last four months of 1953 were extremely dry. What effect, if any, this had on the Cactus Wren population is not known. We suspect that the decline of the population began in the autumn with the disappearance of the young birds-of-the-year. All of the remaining 41 good nests that we counted at the end of the year may not have had nightly tenants. At this time we began to feel that the choice of a research plot adjacent to a water tank was unfortunate. The cattle gathered in the vicinity of the tank; they ate what they could of the sparse summer annuals and trampled the remainder out of sight in the sandy soil of their resting places and trails.

Observations in 1954.—The rainfall in January, February, and March was somewhat greater than in the corresponding months of the preceding year, but we could not detect any important change in the number of spring annuals or in their time of flowering. By the end of March, the roosting nests had dwindled to 27. In the first half of the year, we found 31 abandoned nests, 24 of which had been intact on January 1. (We have excluded two nests at a boundary line.) Some nests had been torn apart, others destroyed; a few had collapsed from disuse. Whether the Cactus Wrens abandoned their territories after the nests were destroyed—a not so probable event, judging from our previous experience—or whether the nests had been vacated previous to their destruction, is uncertain. We assume that the latter occurred.

In April and May the Cactus Wrens built only five breeding nests (territories 1, 9, 12, 15, and 17). A male sang persistently in territory 3, but he did not attract a mate. The other territories were quiet; a few nests begun in early spring had been abandoned. Later the five pairs of wrens built nine more nests to house their second or third broods. By the end of the year, the adults, their offspring, and perhaps some immigrants from outside territories, had constructed 61 more nests. This number is astonishingly close to the 56 nests that 16 pairs of wrens built in 1953. Of the 1954 total of 116 nests—41 at the start, 14 new breeding nests, and 61 others—92 were abandoned. On October 1, only 30 nests were usable; at the end of the year we counted 24. No estimate of territorial size can be ventured, for each pair probably had more space available than it required. For some reason the cattle were excluded from the pasture until fall. The unusually heavy summer rains brought out a dense, lush cover of grasses and annuals that extended to a height of 20 inches in many places. Much of this grass stood high in December; little rain fell in the autumn.

Observations in 1955.—Again the wrens built five breeding nests (territories 3, 9, 11, 15, and 16). Two of these failed and second attempts were made. Only one pair raised a second brood. In addition, they constructed in the course of the year 49 other nests; they abandoned 58 nests for various reasons. On April 1, we counted 21 nests, on October 1, 26 nests, and at the end of the year, only 23 nests.

Observations from January to May 27, 1956.—On April 1 the total had dropped to 18 nests. However, a comeback seemed to be underway, for eight pairs of Cactus Wrens established territories and built breeding nests (territories 1, 2, 5, 6, 10, 12, 15, and 17). Another dry summer followed the previous wet one. On our next visit on December 29 we succeeded in locating only 14 nests. Many of the chollas, shedding twigs and branches, appeared dry, drooping, or dead. Some of the prickly pear lay shrunken and dying; cattle or rodents had eaten into others. Even barrel cacti (*Echinocactus wislizeni*) did not escape. Cattle or deer had browsed the smaller palo verde trees. The few dry grasses still undisturbed seemed safe in inaccessible patches under cholla cacti. It was a strange, paradoxical situation, the desert vegetation dying from drought.

Despite the irregular rainfall pattern, we can find no direct evidence that deficient rainfall caused the decline in the Cactus Wren population. Neither were there any temperature extremes in the winter months that these wrens had not experienced before. The thrashers were equally exposed to these environmental hazards. As at Tucson, the Curve-billed Thrashers destroyed only the roosting nests, never a nest with eggs. While the thrashers' depredations may appear excessive, we doubt whether the wrens were adversely affected by the loss of their nests. We rarely sighted hawks. A pair of Roadrunners nested in number 4 territory in 1953; we saw them occasionally in the other years. In view of the wrens' ready recognition of this species as an enemy, it seems improbable that it succeeded in capturing many of the immature wrens. A Great Horned Owl (*Bubo virginianus*) roosted in the trees along the main wash; Screech Owls (*Otus asio*) were present—we found one in the cattle tank, apparently drowned. Shrikes (*Lanius ludovicianus*) visited the area, but they did not nest there. None of these carnivorous species, or indeed all of them combined, would appear capable of causing any great reduction in the Cactus Wren population during the winter. Perhaps in 1953 the carrying capacity of this part of the range had been exceeded, and the following years should be regarded as the normal ones. The required reduction in numbers may have been accomplished by disease.

The second unexpected result of our study was the discovery that egg laying took place about a month later than in the Tucson region. In the four consecutive nesting seasons on the range, we estimated that no eggs were laid earlier than April 16 (fig. 3). The Curve-billed Thrasher, likewise, was late in laying. Nice (1937:104) found

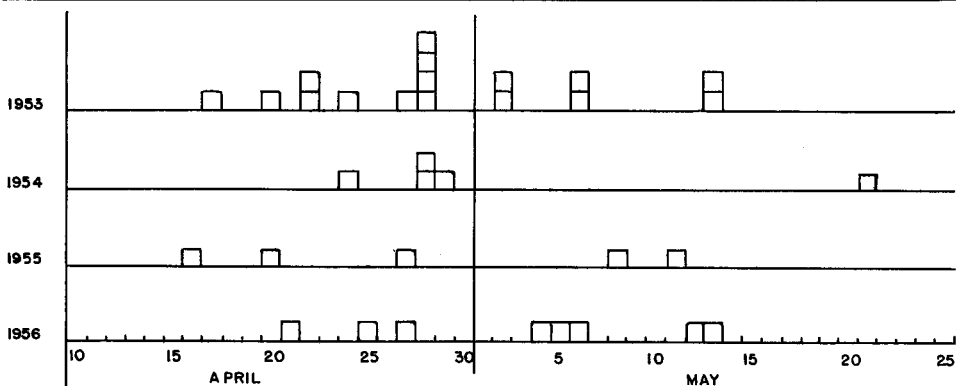


Fig. 3. Estimated dates of the start of egg laying of the Cactus Wrens on the Santa Rita Experimental Range. Each square represents a nest of the first brood.

that the nesting of the Song Sparrow (*Melospiza melodia*) did "not depend on the state of the vegetation." Our two places of study were not identical and comparisons are difficult. The ubiquitous annual bladder-pod mustard (*Lesquerella gordonii*), which often, very early in the spring, carpeted considerable portions of the nesting territory at Tucson, was absent on the range. The creosote bush, a major part of the environment at Tucson, was also missing. In both places nest building began before the larger perennials were in bloom.

The increase in elevation from our Kleindale Road home at Tucson to the upper edge of the pasture 5 research plot is approximately 900 feet. Assuming a thermal lapse rate of 1° F. for each 250 feet of elevation (Lowe, 1964:85), the pasture 5 area should be 3.6° F. cooler than the Tucson locality. We checked the temperatures for the months of January, February, and March at a recently installed thermograph, just east of pasture 5, at an elevation of 3350 feet. They show the range daytime temperature to be 3° F. lower. Curiously, a temperature inversion, brought about by the different topography, causes the night temperatures to be 3° F. warmer. Thus the daily mean temperatures of the two stations are identical. Obviously, if we endeavor to base the time of egg laying upon a period of rising mean temperatures as we did at Tucson (Anderson and Anderson, 1959:200), the dates would coincide. The monthly mean temperatures during the period of our study, from a thermograph station situated about three miles south and 400 feet higher, proved to be too variable to permit any safe generalization. Nevertheless, it is difficult to escape the feeling that temperature somehow is a factor in the spring nesting.

In 1958, after a mild winter, egg laying occurred unusually early at Tucson. On May 4, 1958, we made a hurried visit to our old study area on the range to check the situation again. We found two nests with young. At one of them, three of the occupants popped out and flew to safety. We captured the fourth; its measurements indicated that the date of laying of the first egg must have been about March 29. On an average, in the spring, the arrival of a given maximum temperature on the range would lag behind that at Tucson by some days. Furthermore, the daily variation of temperature is 6° F. less on the range. The Cactus Wrens are not only subjected to a lower daily rate of change of temperature, but also to a time delay in maximum temperatures. We cannot prove that these two conditions are of sufficient importance to produce a lag of a month in egg laying. The effect of environmental temperatures upon the physiology and behavior of the Cactus Wren is still a relatively unexplored field.

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SUMMARY

From the beginning of 1953 to the middle of 1956 we studied a population of Cactus Wrens (*Campylorhynchus brunneicapillus*) on the Santa Rita Experimental Range, 35 miles south of Tucson, Arizona. The vegetation of the 60-acre research

plot was a cholla association broken by washes bordered chiefly with mesquite and palo verde trees.

We found 16 first brood nests in 1953, five in 1954, five in 1955, and eight in 1956. The Curve-billed Thrasher population did not fluctuate to a similar extent.

Predators were not common. Thrashers destroyed many of the roosting nests of the Cactus Wren, but this probably had little effect on the total population. The carrying capacity of the area may have been exceeded in 1953; the following years, perhaps, should be considered normal. It is suggested that disease may have caused the reduction in population.

Egg laying occurred a month later than at Tucson. The range area was 900 feet higher in elevation than the Tucson locality. Its maximum temperatures were 3° F. lower in the daytime; and because of inversion, the night temperatures were 3° F. higher. With average temperatures identical in the two places, we assume that egg laying was delayed at the range possibly because of the slower onset of warm spring temperatures there.

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