LIFE HISTORY OF THE CACTUS WREN

Part III: THE NESTING CYCLE

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This paper is a continuation of our report on the life history of the Cactus Wren (*Campylorhynchus brunneicapillus*) in the vicinity of Tucson, Arizona. In Part I (1957) we described the winter activities, roosting nests, song, territorial establishment, and pair formation. Part II (1959) followed with a discussion of the breeding nest, the defense of the territory, and the time of laying of the first egg. We have banded 18 additional Cactus Wrens in the Kleindale Road area since May 21, 1957, when Part I was completed. The total is now 89.

THE EGGS

The eggs in a Cactus Wren's nest cannot be seen from the outside, even with a mirror, for they are sometimes virtually hidden among the feathers on the floor of the nest cavity. We made no systematic attempts to remove them for inspection, weighing or marking, for the possibility of breakage during handling in the confined nest space was too great. Our limited population of Cactus Wrens offered little opportunity for comparative studies of size, color, or shape of eggs. The eggs were counted by inserting a hand into the vestibule and enlarging it by expanding the fist and fingers as the hand moved inward and downward. The spiny, easily detached joints of the jumping cholla (*Opuntia fulgida*) proved to be especially vicious and treacherous. Pliers with which to remove the spines from hands, wrists, and forearms were always carried along. Finally an aluminum sleeve was constructed which afforded considerable protection. It was thrust into the nest entrance, but it was still necessary to use the fingers to enlarge the diameter. Frequently some of the joints of the cholla had to be bent aside or removed to facilitate inspection. What was an easy, accessible route for the occupants was often a dangerous and difficult one for larger intruders. The damage to the nest and its surroundings during inspection was sometimes rather extensive. Nevertheless, no desertions occurred, even when the visit took place just before the first egg was laid or immediately after.

The female began roosting at night in her newly constructed breeding nest as soon as it was well covered over and some of the lining was in place. Sometimes she occupied it a week before the first egg was laid. Meanwhile, the installation of additional lining continued, but at a reduced pace, by both adults. In those cases where the female appropriated the male's roosting nest for her breeding nest, the refurbishing of the interior began anew. In February of 1959 it was not entirely clear whether the nest she took over was at first intended to be a roosting nest. It had been chosen because of the many disturbances the female suffered in her winter quarters in the pyracantha bush near our front porch with its electric light. She occupied the male's roosting nest for 11 nights before she laid the first egg of the year.

Eggs were laid at the rate of one a day on consecutive days in early morning after sunrise. Possible exceptions to this routine occurred in 1941. Two eggs in nest 35B were found on February 25 at 5:45 p.m. The third egg was laid on the 26th after 7:20 a.m. On the following day the nest was visited at 7:15 a.m. and 5:45 p.m., but only three eggs were counted. The female was frightened out at the first visit, and may have had to lay the egg before returning to the nest. The fourth egg was found on February 28. The fourth clutch of 1941 contained two eggs on the evening of June 12. On the 13th at 7:00 p.m. a broken egg was found on the ground beneath the nest, and there was only one egg in the nest. No further laying occurred at least up to 6:50 p.m. on the 14th. When we next visited this nest at 7:00 p.m. on the 15th, another egg had been laid.

Unfortunately we did not find the first egg of 1959 until late afternoon. The second egg was laid on February 20 between 7:30 a.m. and 8:30 a.m.; the third was laid on the 21st between 7:48 a.m. and 8:50 a.m. In March of 1947 the fourth and last egg of the clutch was laid between 7:23 a.m. and 8:01 a.m., the others in order, before 7:25 a.m., 7:30 a.m., and 7:20 a.m. We doubt that a female remains very long in the nest after she has laid. In 1947 the time required to lay the fourth egg after the female entered her nest was 38 minutes; in 1959 it was 62 minutes for the third egg. These would be extremely long incubation intervals, especially since they occurred early in the morning when the wren needed food. Therefore the layings in 1947 and 1959 probably took place just before the female was seen to leave the nest. In March of 1944, 2 eggs of one clutch

Table 1

Number of Eggs Per Clutch

Year	1st	2nd	3rd	4th	5th	6th
1939	3 (est.)	3	3 (est.) (F)*	4		
1940	4	4				
1941	4 (F)	5	5	3 (F)	4 (F)	
1942	4	3 (est.)				
1942	4	5				
1943	3					
1944	3 (F)	1 (F)	4	3 (est.)		
1944	3 (F)					
1945	3	4	4 (F)			
1945	4 (F)	4				
1945	3					
1947	4	3 (est.)				
1947	4	3 (est.) (F)				
1948	3 (est.)					
1952	3 (est.)					
1953	3	3	3			
1954	4 (F)	3 (F)				
1955	3 (est.)	3 (est.)	3 (est.)			
1956	4	4	4 (F)	4 (F)		
1957	3 (F)	4	4			
1958	3	4	5	5 (F)	4 (F)	4 (F)
1959	3	3	3 (F)			

* F indicates failure of clutch.

were laid before 7:20 a.m. on consecutive days; the next egg was laid after 7:20 a.m. A similar situation, just noted, was observed in 1947 when the fourth egg was laid somewhat later in the morning than the first three. The first eggs of two clutches in June and July, when day length is greater, were laid earlier than those in February and March, but the last eggs of these clutches were held until after 8:00 a.m. and 7:10 a.m., respectively. Apparently, as laying progresses, the time required for egg formation increases to more than 24 hours.

Available data on the number of eggs in each annual series of clutches, which we found in nests in the Kleindale Road area, are shown in table 1. When nests were inaccessible, as happened occasionally in neighbors' lots, we were compelled to estimate the number of eggs later, from the number of fledglings we saw being fed by the parents. Thus these estimates are minima, for the actual number of eggs may have been larger. Complete failures of nesting attempts are marked (F). They are so designated when no young were fledged from a nest. A question mark indicates that the outcome of the nesting attempt is uncertain. Only one wren was fledged from the first brood in 1939; we had failed to discover this nest in time to determine the size of the clutch.

An assumption that a minimum of 3 eggs was laid seems safe. We have never found less than 3 eggs in a complete set. In 13 of the 22 years the first clutches contained 3 eggs each; in the other 9 years there were 4 eggs in each first clutch. The average is 3.41 eggs per clutch. Bent (1948:225) reported that the usual set "consists of four or five eggs, most commonly four; but as few as three may constitute a full set, and as many as six or even seven have been found in a nest," but no tabulation of dates, or which brood was involved, is given. Brandt (1951:187) says "the usual clutch numbers three or four, with an infrequent five." It is interesting to compare these statements with a total of 24 sets of eggs collected in the months of February and March by George F. Breninger (field note book) near Phoenix, Arizona, in 1896, 1897, 1898, 1899, and 1901. There were 10 clutches with 3 eggs each, 12 with 4 eggs each, and 2 with 5 eggs each. The average was 3.67 eggs per clutch.

Table 2

Hatching and Fledging Success

Year	Nest	Eggs laid	Hatched	Per cent hatched	Fledged	Per cent fledged
FIRST CLUTCH						
1939	28B	3 (est.)			1	
1940	6M	4	4	100	4	100
1941	35B	4	Destroyed by boys			0
1942	7E	4	4	100	4	100
1942	43B	4	4	100	4	100
1943	100	3	3	100	?	
1944	6AB	3	Eggs disappeared			0
1944	66A	3	Eggs disappeared			0
1945	14C	3	1	33.3	1	33.3
1945	37D	4	Nest destroyed			0
1945	51C	3	1	33.3	?	
1947	19C	4	3	75	3	75
1947	6AJ	4	3	75	3	75
1948	6AK	3 (est.)			3	
1952	78A	3 (est.)			1 (est.)	
1953	25C	3	3	100	3	100
1954	25D	4	4	100	0	0
1955	6AQ	3 (est.)			3	
1956	67E	4	?		2	50
1957	93B	3	Eggs disappeared			0
1958	5K	3	3	100	3	100
1959	17L	3	3	100	3	100
SECOND CLUTCH						
1939	6G	3	3	100	3	100
1940	32A	4	4	100	4	100
1941	27B	5	5	100	5	100
1942	6T	3 (est.)			3	
1942	60A	5	4	80	?	
1944	6AC	1	Egg disappeared			0
1945	23F	4	4	100	4	100
1945	46E	4	3		?	
1947	6AK	3 (est.)			2 (est.)	
1947	75A	3 (est.)	2 (est.)		0	0
1953	56B	3			2 (est.)	
1954	6AR	3	1		0	0
1955	27E	3 (est.)			3	
1956	27H	4			2 (est.)	
1957	96C	4	4		3 (est.)	
1958	25G	4	4	100	4	100
1959	P5	3	3	100	3	100

Table 2, Continued

Year	Nest	Eggs laid	Hatched	Per cent hatched	Fledged	Per cent fledged
THIRD CLUTCH						
1939	6H	3 (est.)			0	
1941	35C	5	3	60	3	60
1944	23E	4	4	100	3	75
1945	6AF	4	1 (est.)		0	0
1953	6AP	3	2 (est.)		2 (est.)	
1955	6AT	3 (est.)	1 (est.)		1 (est.)	
1956	17D	4	0		0	0
1957	27I	4			3	75
1958	5L	5	5	100	5	100
1959	P5	3	0			0
FOURTH CLUTCH						
1939	7D	4	4	100	3	75
1941	34A	3 (est.)	0			0
1944	6AC	3 (est.)			3 (est.)	
1956	6AV	4	1 (est.)		0	0
1958	25H	5	3	60	0	0
FIFTH CLUTCH						
1941	32B	4	1 Destroyed by cat			0
1958	17J	4	0			0
SIXTH CLUTCH						
1958	92D	4	0			0

Brandt (1951:190) has suggested that in a period of prolonged drought, such as preceded the laying in 1949, the low number of 3 eggs, which he found in a nest near Rillito Creek, may have been due to the wren anticipating a reduced food supply for its offspring. There is little in our data to support this view. The precipitation from October 1, 1939, to the laying of the first egg on February 20, 1940, was 2.08 inches. The following winter almost four times as much rain was recorded in a similar period. Yet the clutches for each of these years contained 4 eggs each, the first eggs being laid on February 20 and 24, respectively. In the spring of 1953, after 4.84 inches of rain, a set of 3 eggs was laid. Then a month earlier in 1954, and after but 1.21 inches of rain, a clutch of 4 eggs was laid.

Six of the 22 first clutches in table 1 failed completely. The set of 4 eggs in 1941 was destroyed; the female wren was missed the same day. HM-23 found a new mate, HF-29, who laid 5 eggs in their new nest. In 1944, he had another female, HF-39. The first clutch of 3 eggs failed to hatch. They tried again in a new nest, but the first egg or two were destroyed almost at once. Their third attempt in another nest, this time with 4 eggs, succeeded. In 1954 the first clutch of 4 eggs was abandoned when the noband female died in the nest. The noband male obtained another female, who laid only 3 eggs in the next clutch. This was probably her first set of the year. The first try in 1957 by HM-70 and HF-71 failed when the 3 eggs and the male were lost. When she found another mate, she laid 4 eggs in her new nest. Although there is a hint here of a tendency to lay a larger clutch after the failure of a first attempt, in only one of the above instances was the same pair involved. A female was replaced in the first and second examples and a male in the fourth. An increase in clutch size, after a failure, would appear advantageous to the species, provided the added burden of feeding could be carried successfully. Table 1 shows that in three of the years, 1942, 1945, and 1958, clutch size increased after a successful first brood, and, with the exception of one of the clutches in 1942, it remained as large as in the first brood in the other years. The estimate of 3 eggs in 1942 could be low.

Hatching and fledging success and percentages of clutches that failed completely are

given in tables 2 and 3. The failure of a nest in 1944 after one egg was laid has been excluded and the four nests at which fledging could not be determined have been excluded from the summary of per cent fledged in table 3. In this table the rapid decline in the number of clutches attempted after the first, and the increase in failures after the second are very striking. Although as many as six clutches were laid in a season, the maximum number of broods raised was three. If we regard a nesting attempt as successful if at least one wren is fledged, we can summarize as follows: in one of the years no young were fledged; in four of the years one brood was raised; in nine of the years two broods were raised; and in four of the years three broods were raised.

Table 3

Summary of Clutch Failures

Clutch	Number of clutches	Average eggs per clutch	Clutches that failed	Per cent of failure
1st	22	3.41	6	27.3
2nd	16	3.63	3	18.7
3rd	10	3.80	4	40
4th	5	3.80	3	60
5th	2	4.00	2	100
6th	1	4.00	1	100

None of the female nestlings, or the few immature wrens from adjacent territories which we banded, remained to breed the following year. Since the age of the adult females at the time of banding was not known, we have no evidence to indicate that any of them laid a larger clutch in their second or third year with us than they did in their first. Our meager data show that HF-39 laid 3 eggs in her first clutch of 1944 and 3 in 1945; HF-71 laid 3 eggs in 1957, and 3 in 1958.

INCUBATION

Incubation was performed entirely by the female. So far as we could observe, the male never entered and remained in the breeding nest when the female left to search for food. The nest was occupied by the female the night after the first egg was laid, and the female continued to occupy the nest nightly without interruption thereafter. Daytime incubation was extremely irregular on the first day. In fact, it is doubtful if effective warming occurred at all. In nests that we inspected on the first day in midmorning, at noon, and in the afternoon, we found the egg decidedly cold to the touch and the female was absent. Cold eggs were also found in some nests in the early forenoon of the second and third day. Does embryonic development begin as soon as the first egg is laid, or does it await the initiation of regular, attentive incubation after the final egg? The Cactus Wren could sleep in the adequately long vestibule of her nest, awaiting completion of egg laying, without transferring any of her body heat to the egg, but we do not believe she does this. We seldom inspected breeding nests at night, for a frightened wren would have great difficulty in finding its way back. However, a wren that was accidentally disturbed at 8:55 p.m. on April 27, 1941, left a very warm, single egg in the nest. Evidently she had been sitting on the egg. Swanberg (1950) has shown that some species of birds can actually sit in the nest without warming the eggs appreciably. In a careful study of the European Blackbird (*Turdus merula*), Enemar (1958) found that incubation began before the clutch was complete. When the Cactus Wren enters her breeding nest she retreats to the far end into the depressed cavity, just as she does in her roosting nest. It would seem illogical to assume that a bird which for the greater part of the year regularly roosts in a deep cavity would, when the first one or

two eggs are laid, forsake this comfortable place to roost in the narrow, tunnel-like vestibule in which it cannot turn around. As further evidence of early incubation and warming we have the observed fact that all of the eggs never hatched on the same day.

Using Heinroth's (1922) rule and its elaboration by Swanberg (1950) for the determination of the incubation period, we checked the time from the laying of the last egg to the hatching of the last young. Most nests were inspected twice a day, in the early morning and in early evening. Some could be visited only in the late afternoon. The period of incubation was 16 days in nine nests in which we have accurate data. In three other nests with incomplete data we estimate it to be also 16 days, but there is a possibility it could have been 15.

Our observations are at variance with those of Hensley (1959:89) who reported that "incubation lasted 17 days in two nests." In one of these, however, he states that "the clutch of three eggs was completed on March 29 and on April 16 the nest contained three newly hatched young." If the last one hatched on April 16, the incubation period was actually 18 days.

We were able to study incubation attentiveness in considerable detail at nest 19C in 1947. Data from two complete days, from the awakening of the female to her retirement are available. In addition, we have another day with only 18 minutes missing. The first egg was found on March 26 when we examined the nest at 7:25 a.m. Both adults were observed carrying lining material to the nest from 9:25 to 10:15 a.m. On the last trip the female, HF-50, remained in the nest at least 5 minutes. On March 27 we watched the nest from 6:50 a.m. to 9:37 a.m. The six periods on the nest varied in minutes as follows: 10, 15, 7, 6, 0.5, 5; the periods off the nest were: 15, 16, 7, 5, 53.5, 27. Average time on the nest was 7.3 minutes; average time off was 20.6 minutes. We checked the nest at 7:30 a.m.; it contained 2 eggs. The female flew out as we approached. Evidently incubation was already in progress, but it was very irregular, with only 26 per cent of the time devoted to warming the eggs. HF-50 carried bits of lining material to her nest at every visit. At long intervals the male brought food to her as she sat inside. We found the third egg on March 28, at 7:20 a.m., but no further observations were made that day.

On March 29 we began our watch before sunrise. Our observation post was a bedroom window facing the nest only 15 feet away. It was more comfortable than a blind; the wrens suffered no disturbance, but the station had the disadvantage of narrowing our field of view, so that the wrens could not be watched after they left the nest. We remained at our post continuously until 5:22 p.m. After a short absence, we began again at 5:40 p.m. and watched until HF-50 retired at 6:48 p.m. The first song of the male came at 5:58 a.m. HF-50 left nest 19C at 6:03 a.m. The sky was clear and there was no wind. The official University of Arizona minimum temperature was 46°F. We inspected the nest at 6:15 a.m., when the female was absent, and counted 3 eggs. Eighty minutes elapsed before HF-50 returned to her nest. Meanwhile her mate had visited it once and entered, but he left and continued singing in the vicinity. How the male finds the eggs is no problem at all; he merely looks inside the nest. The female now remained in the nest for 38 minutes. The fourth and last egg was probably laid at this time. (We did not inspect the nest until 2:50 p.m.; it contained 4 eggs then.) By 5:22 p.m. HF-50 had sat on the eggs 21 times and had been off the nest 22 times. The average time on the eggs was 11.6 minutes; average time off was 19.8 minutes. The length of the periods on the nest varied from one to 42 minutes; off periods varied in length from five to 80 minutes. HF-50 incubated 35.9 per cent of the daylight time. Following our resumption of observations at 5:40 p.m. there was one more period on the nest of nine minutes, beginning at 6:27 p.m., and one off period of 12 minutes, after which the female retired.

The addition of these two periods to the total has only a slight effect on the averages just presented. On the succeeding six days lack of time limited our observations to about an hour each day in the forenoon. The data we obtained are too fragmentary to permit any safe conclusions, except that the lengths of the extreme on and off periods appeared to decrease.

It was possible to observe this nest for a whole day on April 5, the seventh day of incubation of the full clutch. We recorded 28 attentive periods and 29 inattentive

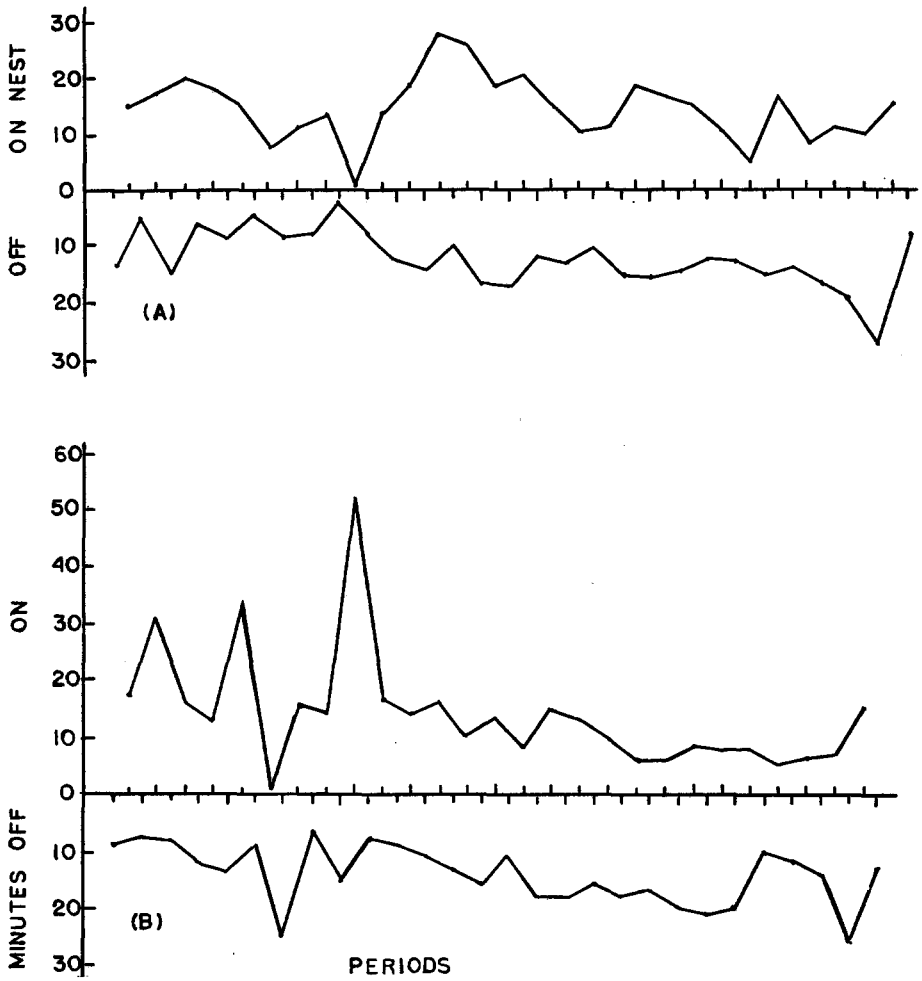

Fig. 1. Incubation attentiveness at nest 19C. A, April 5, 1947; B, April 12, 1947.

periods from 6:17 a.m. to 6:50 p.m. The former averaged 14.8 minutes; the latter averaged 11.7 minutes. The range of variation was one to 28 minutes and two to 26.5 minutes, respectively. For the distribution of these "on" and "off" periods in the course of the day see figure 1A. It is interesting to note the wave shape of the "on" periods. The periods occur in groups, and a group of long periods is followed by a group of short ones, and these are followed by another group of long ones, the peaks and depressions decreasing and smoothing out in the afternoon. This cyclic behavior is present but not

so pronounced in the curve of the "off" periods. There is a distinct lengthening trend in the "off" periods as the day becomes warmer. The temperatures on April 5 were: maximum 70°F., minimum 38°F., and mean 54°F. The length of HF-50's day of activity was 12 hours and 33 minutes; 54.9 per cent of this time was spent in incubation.

On April 12, 1947, the day before the first egg hatched, the female left nest 19C at 5:56 a.m. She retired at 6:52 p.m. In the course of this day of 12 hours and 56 minutes, she devoted 50.3 per cent of her time to the nest. There were 27 attentive periods averaging 14.5 minutes each, and 28 inattentive periods averaging 13.8 minutes. The variation was from one to 54 minutes in the attentive periods, and six to 26 minutes in the inattentive ones. Figure 1B gives the distribution of these periods. Temperatures on this day were: maximum 79°F., minimum 48°F., mean 63.5°F. With the exception of the first part of the day, the curve of "on" periods has smoothed out considerably. The extremely long attentive period of 54 minutes began at 10:00 a.m. It is difficult to explain, but it may have been induced by an immature Curve-billed Thrasher (*Toxostoma curvirostre*) which climbed into the cholla and moved about beneath the wren's nest at this time. We have observed that Cactus Wrens will enter and remain inside their breeding nests when there is a possibility of intrusion by neighboring birds. Far more difficult to account for is the occurrence of the one-minute attentive periods. There was one each on March 29, April 5, and April 12. No disturbances of any nature could be observed at these times. On April 12, the male, HM-54, visited nest 19C eight times between 7:07 a.m. and 1:50 p.m. Half of these visits occurred when the female, HF-50, was in the nest; the male then remained in the vestibule from 0.5 to 1.5 minutes. On those visits when he discovered that the female was absent, he left at once. On his last trip at 1:57 p.m. he carried a small object, apparently an insect, into the nest, but HF-50 was not there. Evidently he swallowed the insect, for he left without it. At 6:41 p.m. the 4 eggs had not yet hatched.

The female continued to bring bits of lining material, such as fine grasses and small feathers, to her nest throughout the entire incubation period. For the first week, the male assisted in this work, but he did so very irregularly. He visited the nest occasionally, without nest material, apparently out of curiosity or in search of his mate. When she was absent, he would enter, but he remained inside only a few seconds before flying away. Courtship feeding was seldom noted. It probably occurred no oftener than three or four times a day at the beginning of incubation, and apparently it ceased altogether before the eggs hatched. We did not observe any feeding on April 12.

HATCHING

The time required for all the eggs to hatch in the completely successful nests varied as follows: in 3 nests with 3 eggs each, the time was 3, 2, and 2 days; in 5 nests with 4 eggs each, the time was 2, 2, 3, 2, and 3 days; in 2 nests with 5 eggs each, the time was 3 and 3 days. In a nest of 3 eggs in which one did not hatch, 2 hatched on the same day; in another nest with 4 eggs, in which one did not hatch, the remaining 3 hatched in 2 days. Six of the females hatched one egg on the first day; 7 hatched 2 eggs the first day, and one hatched 3 eggs the first day. It was not necessarily the largest clutches which produced the most nestlings on the first day of hatching. Only one egg hatched on the first day in nest 5L; 2 more hatched on the following day, and the last 2 on the next day. The small samples available show no important differences in time between the early season broods and those in later months.

FEEDING OF NESTLINGS

On April 13, 1947, one of the eggs in nest 19C was found to be hatched at 7:35 a.m.; by 5:20 p.m. another had hatched. We were unable to make any further observations

until 5:50 p.m. At that time HF–50 entered the nest with an inch-long insect with folded wings. She stopped in the entrance, and her tail could be seen bobbing up and down as though she were hammering at the insect in order to break it up. She then went inside and brooded for 13 minutes. At 6:07 p.m. the male entered and departed at once. Five minutes later HF–50 carried another insect inside the nest.

At 7:27 a.m. on the following day we found 3 nestlings; the fourth egg did not hatch. The male carried a worm about one-quarter of an inch long into the nest just before we inspected it. Our first observation period began at 8:21 a.m. and ended at 8:47 a.m. HF–50 brought food to the nestlings three times and brooded twice for 8-minute intervals. She was away from the nest 4 minutes each time. While she was brooding, the male visited her three times. The food he brought may have been given to her instead of the nestlings.

Resuming our watch at 9:58 a.m. we saw HF–50 enter nest 19C with food. She left almost at once. Then at 10:12 a.m. HM–54 arrived with what looked like a brown spider. He went inside, but came out in a few moments, still holding the object. Then he swallowed it and flew. Evidently there was no begging response at his entrance, so he could not dispose of the food. At this point there would seem to be a natural transition developing for the male, from courtship feeding to nestling feeding. The female took time out for 22 minutes. She now brooded for 9 minutes. Four minutes later she brought food again; then she brooded for 10 minutes. In the course of the next 13 minutes while she was away, the male brought food to the nest three times.

Our third observation period was from 3:30 p.m. to 4:10 p.m. At 3:35 p.m. HM–54 carried a small black insect to the nest; the female was absent. Again he must have failed to elicit a begging reaction, for he came out holding the insect. This time he flew away with it. HF–50 then came with food; she brooded 4 minutes. Eight minutes later, HM–54 returned with a small worm; he visited the nest again in 7 minutes. The female was absent about 25 minutes, then she brooded for 5 minutes.

We watched the nest again from 6:30 p.m. to 7:00 p.m., when HF–50 retired for the night. The male brought food twice, the female four times. Her brooding periods were now very short: 3, 1, 1.5 minutes; her periods away from the nest were 9, 3, 12 minutes.

On April 15, 1947, from 8:16 a.m. to 9:08 a.m., HF–50 fed the nestlings five times; the male came with food seven times. The female's brooding time was 6, 6, 11 minutes; her time off the nest was 5, 18, 6 minutes. On several of his visits, the male found the female inside the nest. The disposition of his food is doubtful again. He may have fed his mate. From 9:26 a.m. to 10:30 a.m. HF–50 brought food five times; the male came three times. The female's brooding periods were 0.5, 0.5, 10, and 2 minutes; her time off the nest was 4, 3, 22.5, 16.5, and 5 minutes.

These incomplete data for April 14 and 15 indicate that approximately 30 per cent of the time was devoted to brooding the young. The brooding intervals became very short in the late afternoon of April 14, and they were even shorter in midmorning of the 15th. Morning minimum temperatures were 42°F. on the 14th and 47°F. on the 15th. The afternoon maximum rose to 90°F. on the 15th. Even though body temperature regulation had probably not yet begun, the nestlings must have had little difficulty in keeping warm with a minimum of brooding by the female.

On April 16 brooding practically stopped after 9:00 a.m. The time which the female remained in the nest was hardly more than would be necessary to insure that the nestlings were properly fed. Occasionally a 3-minute period would be recorded, but most of the feeding periods could be expressed in seconds.

On April 19, 1947, the last-hatched nestling was five days old. We were able to ob-

serve the rate of feeding for the entire day, from the first visit to nest 19C at 5:38 a.m. to the female's retirement at 7:12 p.m. The hourly rates for both sexes in the course of this day are recorded in table 4. The sky was clear all day; we had light intermittent winds during the afternoon. The minimum temperature was 50°F., maximum 90°F., and mean 70°F. HF–50 averaged 7.3 visits per hour; HM–54 averaged 4.3 visits per hour. Brooding periods were observed three times in the early morning, of 16, 11, and

Table 4

Hourly Feeding Rate at Nest 19C on April 19, 1947

Time	HF–50	HM–54
5:38 a.m. to 6:38 a.m.	9	4
6:38 a.m. to 7:38 a.m.	3	4
7:38 a.m. to 8:38 a.m.	7	8
8:38 a.m. to 9:38 a.m.	5	2
9:38 a.m. to 10:38 a.m.	7	5
10:38 a.m. to 11:38 a.m.	7	3
11:38 a.m. to 12:38 p.m.	2	1
12:38 p.m. to 1:38 p.m.	9	6
1:38 p.m. to 2:38 p.m.	7	4
2:38 p.m. to 3:38 p.m.	8	4
3:38 p.m. to 4:38 p.m.	10	3
4:38 p.m. to 5:38 p.m.	7	4
5:38 p.m. to 6:38 p.m.	13	8
6:38 p.m. to 7:12 p.m.	5	2
Total visits with food	99	58

5 minutes duration. Inattentive periods, while seemingly very irregular in length, varied roughly to a peak 12 times during the day. There were 23 inattentive periods of 10 minutes or over, ranging from 10 to 30 minutes in which no feeding occurred. After each long absence or group of long absences, there followed a series of short ones, as the feeding rate increased.

Wheelock (1904:278) reported that nestling Cactus Wrens were fed by regurgitation for the first four days. We have found no confirmation of this anywhere else in the literature; in fact, there appear to be no direct observations at all on the early feeding procedure in any recent publication. This is not surprising, for nothing can be seen of the actual feeding after the adult enters the nest. We have described the feeding activities in every detail in an endeavor to show that the initial food of the nestlings is not delivered by means of regurgitation. The food consists of small, freshly-killed insects. Our male, when he brought food to the nest, probably gave it to his mate, if he found her inside. At other times, when the nestlings met him with open mouths, the natural thing to do would be to place the insect into the trembling, light-colored cavity. Both adults always brought visible, whole insects to the nest. The female could have chewed up her food while she brooded and then fed the nestlings, but sometimes the brooding period was far too short for this. The difficulty experienced by the male when he brought insects to the nestlings that were too large for them to swallow indicates that no mastication with subsequent regurgitation was contemplated. It was a case of take the food in its original condition or do without it. Our observations at a number of other nests confirm the fact that small insects are carried in the bill of the adult to the newly hatched young on the first three days of their life.

Flights to the nest were directly to the doorstep with no attempt at concealment. Flights from the nest also were apparently directly to the feeding areas, mostly east,

south, and west. Occasionally these flights were north over our house, but they did not go far in this direction, since it meant trespassing on another territory.

We observed the recognition display-growl at the nest four times in the forenoon on April 15. Three times it occurred when the male arrived at the doorstep and met the female coming out of the nest. On the fourth time, the male uttered the growl as the female alighted in front of him when he came out. This may have been a defensive or aggressive reaction as he was taken by surprise. Apparently HF–50 did not respond to the display, for HM–54 failed to move aside; she squeezed by him with some difficulty and crept into the nest with her food. By April 19 feeding of the nestlings had become a routine activity. If the male arrived when the entrance was blocked, he waited and stood aside just enough to permit his mate to leave. There seemed to be no sign of recognition or interest. At one of these visits he gave his food to HF–50, who turned around and carried it inside the nest. It all appeared so mechanical. In the course of the entire day not one display or growl occurred when the adults met at the entrance.

Singing by the male was more frequent during the forenoon of April 19. It tapered off in the afternoon and diminished rapidly after 6:00 p.m. It occurred usually after one or the other of the Cactus Wrens had fed the nestlings and left. Some of the songs may have been in response to activity in the adjacent territory I. Few songs, however, were noted during the long periods in which the adults took time to feed themselves. HF–50 sang a number of times at the nest entrance or near it when an immature Curve-billed Thrasher began digging in the ground beneath the cholla. Sometimes her song sounded very much like that of her mate; now and then the syllables were farther apart and possibly were pitched higher. The scratchy *scri* note was heard occasionally during the day, but we did not realize its significance until later, when we discovered that territorial disputes were taking place just north of our house.

The installation of lining material, which occurred so frequently during incubation, was seldom observed after the eggs hatched. At 7:56 a.m. on April 19, HF–50 carried some fine grasses to the nest; at 9:15 a.m. she brought feathers. In neither instance did she remain to brood.

In the course of our more limited observations up to April 19, we did not observe that any fecal sacs were removed from the nest. We presume that they were swallowed by the adults. On the 19th we saw the adults carry away sacs at the following times: 5:58 a.m., 6:13 a.m., 7:36 a.m., 10:46 a.m., 1:00 p.m., 1:05 p.m., 1:06 p.m., 4:29 p.m., and 4:40 p.m. These observations fall into four groups spaced roughly three hours apart. Both sexes took part in the disposal of these sacs. On the 25th HF–50 dropped a large fecal sac as she came out of the nest. The sac broke into fragments; then the female picked them up one by one and swallowed them. Our observations at other nests show that fecal sacs are removed from the nest up to the hour of fledging, and they are often carried as far away as 150 feet.

FLEDGING

When the nestlings in nest 6AJ in territory I were fledged on April 23, their parents led them into the north half of lot 7. Part of our attention now had to be directed to this group of wrens, leaving only brief intervals for observing the feeding at nest 19C in territory III. The boundary disputes which soon began must have disrupted to some extent the orderly routine at nest 19C.

As the nestlings grew larger they became more active. During their final week in the nest they climbed out of the nest cavity and into the vestibule where they awaited the arrival of food. While they were being fed, their individual begging notes were uttered so frequently that they merged into a loud, coarse buzz. On May 3, the day

before fledging, HM–54 sang with increased vigor in the vicinity of the nest. The nestlings crowded forward until one was outside the entrance when HF–50 came with food at 8:40 a.m. A warning *tek* note from the male sent the nestling back into the nest, but it did not stay there long. Soon two nestlings were out. The adult that came with food poked its head under one of the obstructing nestlings, raised its head and then pushed its way into the nest, evidently to feed the remaining one. It was difficult to keep them inside. For a while one of them squatted in the entrance, eyes closed, apparently asleep. Again they were wide awake, stretching their necks and peering about from the doorstep. At 9:41 a.m. one of the nestlings climbed to the top of the cholla; it came down part of the way when HF–50 arrived with food. The other two in the entrance were fed. HF–50 moved upward and sang just above the nestling, apparently in an attempt to induce it to climb down. This nestling was not fed until 20 minutes later when it had returned to the nest. No further excursions occurred up to 10:30 a.m., when we were forced to discontinue watching. For a short period the delivery of food had been at the very rapid rate of one visit per minute. Fledging probably took place some time after 7:00 a.m. on May 4. (We were absent most of the day.) On the 5th the three fledglings spent the entire day in the large mesquite tree 20 feet southeast of cholla 19.

Fledging at nest 25G was observed on March 25, 1958. At 9:00 a.m. singing had increased noticeably. HM–73 perched on a dead branch of the cholla near the nest. A nestling came to the entrance and looked around; then it retreated inside. This was repeated several times. HF–71 arrived with food, but instead of going to the nest, she stopped two feet away. Soon she flew to a nearby creosote bush; then she came back. Again she flew and returned, then she flew to cholla 4, about 15 feet to the south. The nestling which had been watching from the doorstep fluttered about a foot forward and landed on a cholla twig. It stayed there a few moments, balancing awkwardly among the sharp spines; then it flew downward to another twig. It hesitated and then flew upward another foot and teetered and hesitated again. The rapid singing continued from cholla 4. Finally the young wren flew to the base of this cholla in a curved, descending flight. A few minutes later a second nestling appeared in the entrance of nest 25G. It, too, advanced and retreated on the doorstep several times. Singing continued vigorously. Then the second fledgling, without any intermediate stops, suddenly followed the first in a direct flight to the base of the cholla 15 feet away. A third nestling then came to the doorstep, but it did not attempt to fly. The fourth also remained inside, and both were fed at the nest during the day. By 10:30 a.m. on the following day all nestlings were fledged.

It seems evident that at this period the song of the male takes on a new function. The singing, which occurred immediately after the feeding of the nestlings is difficult to explain. It was not usually uttered in response to the territorial song of adjacent rivals; it seemed to come spontaneously. At the time of fledging, however, the song appeared to be directed at the nestlings, and it served apparently as a signal for them to leave the nest and fly toward the singer. In the evening the same frequent singing led the fledglings back to their nest to roost for the night. The only difference that we can detect between this song and the territorial song is the more rapid rate of the former. There are more songs per minute; the shorter pauses permit little time for listening to any other songs.

The length of time which the nestlings spent in the nest, calculated from the day the first egg hatched until all the young had been fledged, varied from 19 to 23 days. The average of 13 nests was 20.9 days. The single nestling in nest 14C had been in the nest for 23 days when it left on March 21, 1945. In 1958 the three nestlings of the first brood remained in the nest for 23 days; two nestlings of the second brood left in 22

days, the remaining two on the next day; the five nestlings of the third brood left after 21 days. This does not indicate that late broods spend less time in the nest than do the earlier broods, for we have two records in March of 19 and 21 days. Fledging was accomplished in the course of one day in 14 nests; two nests required two days. Evidently the spread in time of fledging is not determined by the spread in hatching. Hatching was spread over three days in nest 5L in 1958, but all of the nestlings were ready to leave on May 5. Repeated disturbances, such as removing the nestlings for weighing and examination, did not cause early departure, provided they were discontinued several days before fledging. We feel sure that premature fledging occurred occasionally when people approached too close to the nests.

The intervals between the fledging of the young and the laying of the first egg of the second clutch show considerable variation. In 1945, fledging and laying occurred on the same day, but only one nestling was involved. The maximum interval was 13 days in 1940. The average for seven years is 6.8 days. Data for only four years are available for the interval between the second and third clutches. The minimum time was one day, the maximum 11 days, and the average six days. The year 1958, with the pair HM–73 and HF–71, can be summarized as follows: four days between the first and second clutch; one day between the second and third; three days between the third and fourth. After the failure of the fourth clutch, the pair of wrens built a new nest and laid after seven days. This, too, failed. Another nest was built and again the first egg was laid in seven days. The year 1959 (incomplete at this writing) with the same male, HM–73, but a new female, HF–86, progressed as follows: the interval between the first fledging and the second clutch was 10 days; the interval between the second fledging and the third clutch was 13 days. First laying occurred on February 19 in 1959 as against January 2 in 1958.

The time required for a successful nesting from the laying of the first egg to the fledging of the young averaged 38.4 days for 14 broods. The minimum time was 36 days, the maximum 41.

The environmental, physiological or psychological factors responsible for the termination of the breeding season are difficult to determine. Our data for 14 years, obtained from 16 territorial pairs, are striking in their variability and afford few hints for any conclusive answer. Three pairs of Cactus Wrens ceased breeding in May, four in June, two in July, six in August, and one in September. The season, measured from the laying of the first egg to the fledging of the last young, or the abandonment of the nest, varied in length from three to seven months, with the average at 4.4 months. This average appears to be an unsatisfactory figure, for the minimum length of season occurred when one or the other of a pair was lost. The acquisition of a new mate in the middle of the season did not always result in the initiation of another breeding attempt. We suspect that in the Tucson region the normal physiological decrease in sexual activity begins in the first half of July, after the daytime maximum temperatures have been maintained for several weeks at from 100°F. to 110°F. Eggs laid in early July produce young that are fledged in August. In 1955, 1956, 1957, and 1958, laying began respectively on March 12 and 7, February 21, and January 2. The breeding season was over on September 7, August 10, 13, and 3. Human activities in the neighborhood no doubt disrupted nesting attempts at times, but it is interesting to note that the longest breeding periods occurred in the past four years when the human population was the greatest. Perhaps the gradual restriction of the wrens to nesting sites in lot 7, where they were protected, is a factor here. Allan R. Phillips (personal communication) informed us that on September 20, 1938, Cactus Wrens were fledged from a nest near his home in the thickly populated university district of Tucson. Hensley (1959:90) found that

in the Organ Pipe Cactus National Monument in southwestern Arizona, the three month's breeding season extended from late March to late June. Since the late June date (Hensley, MS) refers to eggs laid and not to young fledged, the season in that area probably also ended in August.

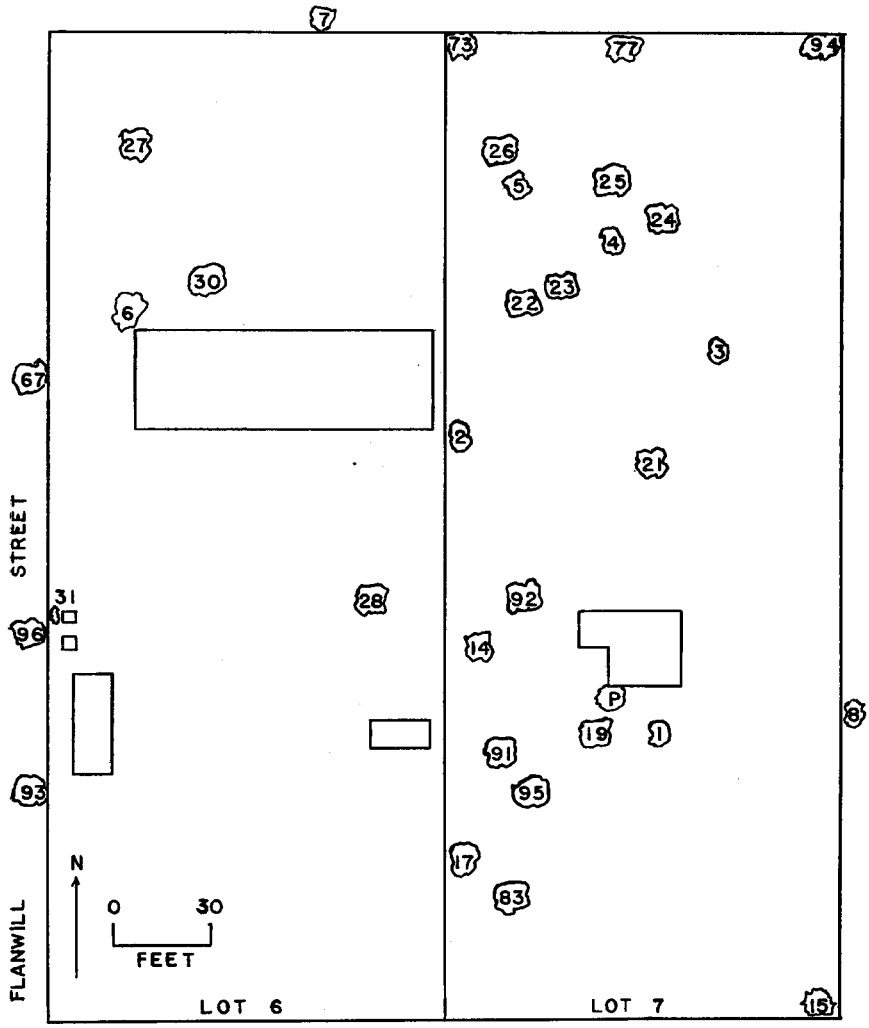

Fig. 2. Location of numbered cholla cacti in lots 6 and 7 along Kleindale Road, Tucson, Arizona.

SECONDARY NESTS

The literature on the Cactus Wren is filled with accounts of additional nests built in the vicinity of the breeding nest. Various terms have been applied to them, such as auxiliary, decoy, dummy, extra, shelter, spare, and supplementary, depending upon the use which the observer attributed to them. In view of the many conjectures and misstatements in the literature we are reporting in considerable detail the events of the year 1958, and we are summarizing our data for 13 of the annual nest building sequences

that we observed from the laying of the first egg to the fledging of the last young or its abandonment. The data for the remainder of the years listed in table 1 are too incomplete to be included here.

Normally, while the female incubated her eggs in the new breeding nest, the male began construction of one or more secondary nests. In figure 2 are shown the location of the numbered chollas in lots 6 and 7 on Kleindale Road in which the following data were secured. Unless otherwise stated, all the nests were in cholla cacti. In order to simplify the accounts, we have omitted our data on the nest-building activities of the immature Cactus Wrens. These will be described in a later paper.

Nest building in 1958 was almost entirely in lot 7, and it followed closely the main predictable pattern, with several interesting variations. Three wrens were present at the beginning of the year, HM–73, HF–71, and a noband. The male roosted in nest 5K, the female in nest 1I, and the noband in nest 21G. By January 2, HF–71 had moved into the male's roosting nest 5K in the northwest part of lot 7 and laid her first egg. HM–73, forced to find another nest, did not take over the female's roosting nest but began work on nest 21H on January 1 and gradually completed it. The noband wren which occupied nest 21G, only six feet away, was not seen after January 10. The secondary nest 25G, located 20 feet from the breeding nest, was begun on January 14. It appeared finished on the 24th. On February 9, HF–71 carried some lining material to nest 25G; HM–73 also worked on this nest. Fledging occurred on February 11. HF–71 squeezed into her old, weathered nest 1I that evening, for nest 5K was again crowded with the returned fledglings. She laid the first egg of her second clutch in nest 25G on February 15. The next day HM–73 began work on nest 83C in the south part of lot 7. He had given up his roosting nest to the fledglings and now retired temporarily in nest 5K. Later he occupied nest 83C. On March 1 this nest had a slightly torn entrance. HM–73 started nest 21I but soon abandoned it. The secondary nest, 5L, 14 feet from nest 25G, was not started until after March 15; it was well outlined on March 21, but lacked the interior lining. Nest 91G, found March 11 partly completed, probably was begun earlier and left in favor of nest 5L. HF–71 apparently roosted in nest 5L on the nights of March 23 and 24. Fledging from nest 25G took place on March 25. Two days later the first egg of the third clutch was laid in nest 5L. HM–73 completed nest 91G on March 30 and roosted in it; by April 10 he had repaired nest 83C also. This nest fell apart soon and was again repaired. Now the male gave up his roosting nest 91G to an immature wren and retired in nest 83C. Finally on May 4, HM–73 began construction of secondary nest 25H, just above the old breeding nest 25G. Fledging of the nestlings in nest 5L began the following day. The male worked rapidly on the new nest. The first egg of the fourth clutch was laid in nest 25H on May 8. On May 11, HM–73 began work on nest 5M, near nest 5L and again worked rapidly. On May 22 we discovered that he was roosting in a new nest, 96D, on Flanwill Street. Three of the eggs in nest 25H hatched, but on May 29 the nestlings had disappeared. After this failure the adults began construction of nest 17J in the south part of lot 7 on May 31. HF–71 roosted in nest 5K, HM–73 in nest 96D. On June 5 the first egg was laid in nest 17J. HM–73 began work on June 7 on secondary nest P4 in the large pyracantha bush beside our front door. Then he shifted his labors to another nest, 92D, near the northwest corner of our house, but he soon abandoned this one also. Incubation continued in nest 17J, but the eggs proved to be infertile. The nest was not occupied on June 29. The next day HM–73 and HF–71 joined in building nest 92D, which the male had tentatively started on the 10th. On July 4 the first egg of the sixth clutch was laid. The secondary nest, P5, located in the top of the pyracantha bush, was begun by HM–73 on July 8. He worked slowly on it, while he roosted in nest 96D. On August 3 the infertile

eggs in nest 92D were abandoned. The course of nest building in this most productive year is diagrammed in figure 3.

Secondary nests were occasionally begun as early as the day following the laying of the first egg of the first clutch. Normally we could expect to find them under construction from 8 to 14 days later. Destruction of roosting nests contributed to delays in starting these secondary nests. Greater delays sometimes occurred when the male was occupied in feeding a hungry group of three to five fledglings. Yet, even then, he sometimes managed to start a nest shortly after a clutch was complete. Nest 25H, in 1958,

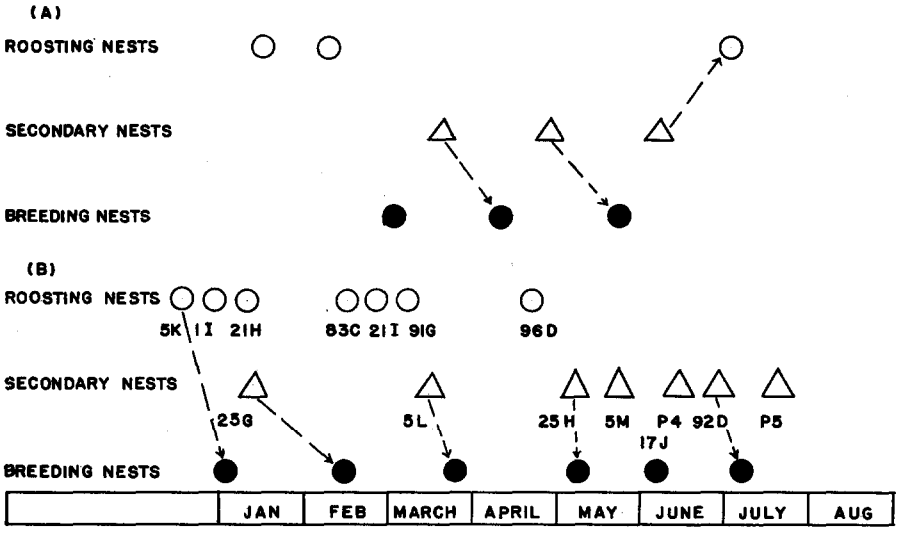

Fig. 3. A, "normal" nest-building sequence of Cactus Wren; B, 1958 nest-building sequence showing variations.

was begun the day before the nestlings were fledged from nest 5L, but the male had previously worked on two other nests. Milam Cater (personal communication) saw a male Cactus Wren begin a secondary nest on May 26, 1943; the following day this nest appeared completed. On the 28th another nest was begun by the male and finished by May 30, when the young were fledged from the breeding nest.

It was not unusual to discover that a secondary nest had been built in the same cholla that contained the breeding nest. Some nests were only a few feet away; others were back to back or a little above the primary nest (fig. 4). Locations elsewhere in the territory naturally depended upon the availability of nesting sites in cholla cacti. Distances from the breeding nest varied from 14 to 240 feet.

Secondary nests were well covered over and were sturdy and substantial in appearance in from 4 to 14 days. They often required more lining and additions to the entrance when the female moved in; for the work of the male had usually been interrupted by the necessity of assisting the female in feeding the nestlings. Only once did we see the female take any part in the construction of a secondary nest which the male had begun. After the fledging of her young, the female made her choice; then both adults finished the new breeding nest.

We have records of three temporary secondary nests that were built by females at the time their breeding nests were too crowded with nestlings to permit further night brooding. These nests were small and flimsy, but they served as roosting nests until the

young were fledged. Two of the nests were built just above the breeding nest; the third was at a distance of 160 feet from the breeding nest. In each of these three instances, other nests were available for roosting, but for some reason they were not chosen.

Under undisturbed conditions a secondary nest was always built by the male while the female incubated her first clutch. With but two exceptions this nest was a new nest. Nest 23F, in 1945, and nest 17M, in 1959, were started earlier in the year by the females and then abandoned. Later they were completed by the males.

In the course of the 13 breeding seasons, the male Cactus Wrens began construction

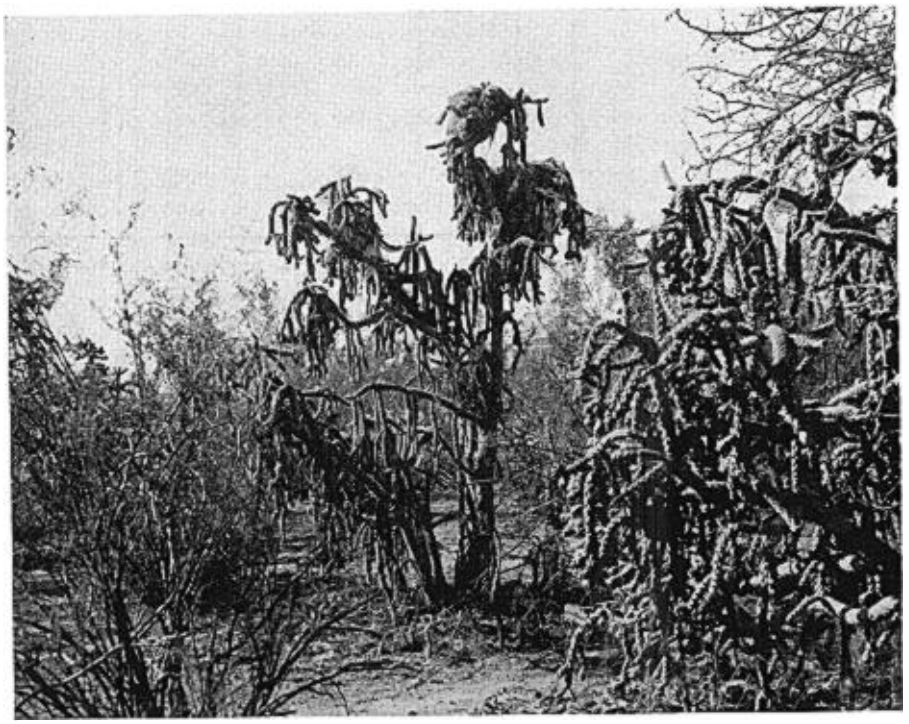

Fig. 4. Cholla 17 on March 1, 1959. Roosting nest 17J located at upper left, breeding nest 17L at upper right, and secondary nest 17M at top. Note the characteristic drooping joints of the cholla caused by lack of rain.

of a total of 59 secondary nests while the females were incubating, brooding, or feeding their nestlings. Some of these nests were not completed. If we omit the 23 nests which were begun during the last clutch of the year, and which obviously could only be used for roosting nests, we have 36 secondary nests available for use as breeding nests. Fifteen of these were chosen by females to be their breeding nests. The histories of the remaining 21 nests vary. Several were begun and then abandoned for no apparent reason to us; others were damaged by thrashers, and then a new one was started elsewhere. Some were certainly intended for roosting nests, since they were begun immediately after the destruction of the male's roosting nest. Such a nest was usually built hurriedly, with a secondary nest following before the young were fledged. Whenever the male, apparently willingly, gave up his roosing nest to the still dependent fledglings, he constructed another roosting nest for himself. We feel safe in stating that all completed secondary nests were occupied at some time by the male, the female, or the young wrens.

There were no nests that could be considered as decoys, and none that was superfluous. The rejection of a secondary nest by the female did not necessarily mean that there had been a waste of building time, for the fledglings soon needed enlarged roosting quarters. In fact, it is hard to avoid attributing to the Cactus Wren the ability to plan ahead!

Much more research is needed to determine what physiological requirements, if any, dictate the construction of roosting nests. It may be that such nests are not at all necessary in this mild climate. The Curve-billed Thrasher in the same spacial environment as the Cactus Wren, and a direct competitor for nesting sites, is able to hold its own, side by side with the Cactus Wren, without the aid of roosting nests. If roosting nests are necessary for the Cactus Wren, then it seems certain that secondary nests must have an important survival value.

SUMMARY

Cactus Wrens did not desert their nests when the entrances were disturbed and widened to facilitate inspection of the contents.

The females roosted in their breeding nests sometimes as much as 7 to 11 nights before the first egg was laid. Eggs were laid at the rate of one a day, on consecutive days in early morning. The average eggs per clutch was 3.41. Although as many as six clutches were laid in one year, the maximum number of broods raised was three. In four of the years three broods were raised; in nine of the years two broods were raised; and in four of the years one brood was raised.

Failure of clutches increased rapidly after the second clutch; all fifth and sixth clutches resulted in failure.

Incubation was performed entirely by the female. Partial incubation began the night after the first egg was laid; daytime incubation was irregular until the clutch was nearly complete. The period of incubation was found to be 16 days.

At one nest, on the seventh day of incubation there were 28 attentive periods averaging 14.8 minutes and 29 inattentive periods averaging 11.7 minutes each. The range of variation was 1 to 28 minutes and 2 to 26.5 minutes, respectively. On that day 54.9 per cent of the time was spent in incubation. The day before the first egg hatched, the female devoted 50.3 per cent of the time to incubation.

The female frequently carried lining material to the nest when she came to incubate. Courtship feeding by the male occurred three to four times a day.

Hatching of the eggs was spread over a period of two to three days. In no nest did all the eggs hatch on one day. About 30 per cent of the time was devoted to brooding during the first three days after hatching. The time decreased rapidly thereafter.

The feeding rate when the last hatched nestling was five days old was as follows: the female averaged 7.3 visits per hour, the male 4.3 visits per hour.

Nestlings are fed small fresh insects from the time they are hatched. Feeding by regurgitation was not observed. Fecal sacs were carried away from the nests when the nestlings were from five to eight days old.

As fledging time approached, the singing by the male Cactus Wren increased. The song appeared to be directed to the nestlings and apparently served as a signal for them to leave the nest. In addition the adults induced the nestlings to fly from the nest by stopping a short distance away and withholding their food.

The average time which the nestlings spent in the nest was 20.9 days; the range was from 19 to 23 days.

The first egg of the second clutch was laid in from 0 to 13 days after the fledging of the first brood; the average for seven years was 6.8 days. The interval between second and third broods averaged six days; the range was one to 11 days.

The time required from the laying of the first egg to the fledging of the young aver-

aged 38.4 days for 14 broods; the maximum was 41 days, the minimum 36 days. Normally in the Tucson region, the breeding season probably ends with the fledging of the last young in the middle of August. Our local birds varied the length of the season from three to seven months.

Each year began with a minimum of two roosting nests. Both adults constructed the first breeding nest. While the female incubated the eggs the male began construction of one or more secondary nests. Some were begun as early as the day following the laying of the first egg; most were begun eight to 14 days later. Sometimes these nests were placed close to the breeding nest in the same cholla; others were from 14 to 240 feet distant. The female did not assist in their construction until after the young were fledged. She then laid her next clutch of eggs in the secondary nest. Variations in this "normal" behavior were rather common. Occasionally the female appropriated her mate's roosting nest for her next clutch. After a clutch failure she sometimes ignored the secondary nests and, with the help of the male, constructed an entirely new nest for her eggs. Rarely she laid her next clutch in the same nest that housed the previous brood. Frequently these secondary nests were built as replacements of destroyed roosting nests. Three of the nests were built entirely by females whose breeding nests were too crowded with nestlings to permit comfortable night brooding; they should probably not be classed as secondary nests.

None of the secondary nests could be termed "extra" or "decoy." All the completed ones served some useful purpose. Those that did not become breeding nests were used by the male, the female, or the fledglings for roosts.

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