

ROOSTING HABITS OF THE CHESTNUT-BACKED CHICKADEE AND THE BEWICK WREN

By LAIDLAW WILLIAMS

Although considerable work has been done on the first morning and last evening songs of birds, little has been written on the actual time of arrival and departure at the roost. Wynne-Edwards (1931:351) found that the time that Starlings left the roost varied considerably at different seasons in England. Mrs. Nice (1935) watched the times of roosting of the Starling and Bronzed Grackle in Ohio for a period of ten days in September and October and found a close correlation in both species with light intensity, as measured by a photometer, and also a difference in time between species. Emlen (1937:82) found that a female Mockingbird awoke later in relation to sunrise as the nesting season approached and that "light-intensity is the only factor which consistently showed a positive correlation with the bird's behavior."

The present study concerns the roosting habits of four Chestnut-backed Chickadees (*Penthestes rufescens*) and three Bewick Wrens (*Thryomanes bewickii*) in and near Carmel, Monterey County, California. The period covered is from June 28, 1940, through March 31, 1941.

Although the work was mainly concerned with the actual time of alighting on the sleeping perch, some records of the time of leaving the roost in the morning were made in order to compute the length of the birds' day and night. Light readings were made for correlation with the number of minutes before or after sunset that the birds went to roost and with weather conditions.

Equipment for the work was meager and far from satisfactory. However, the use of simple and inexpensive apparatus has the advantage of making available to a large number of observers of other species data that may form a basis for comparison. My equipment consisted merely of a constantly regulated wrist watch, a cheap electric torch, and a Weston Model 650 Universal Exposure Meter. This instrument registers light intensities in "candles per square foot" and only in certain block intervals. No attempt was made to "break down" these intervals in order to get more precise figures. This meter does not register intensity below $\frac{1}{4}$ candle per square foot. Thus, although it was possible to ascertain the light intensities at roosting time for all the chickadees and for wren No. 1, which came to roost at comparatively high light intensities, it failed for wren No. 3 because this individual generally "went to bed" at light intensities too low to be registered.

The readings were made with the meter directed as nearly toward the zenith as possible at standard reading places where the light from the sky was unobstructed.

Weather notations are divided into four categories: fair, cloudy, high fog, and rain or low fog. The rare low fogs were classed with rain as they were often hardly distinguishable from a drizzle.

Observations were made on one or more of the birds on 175 days in the course of the nine-month period. Fifteen were made on chickadee roost No. 1 between June 28 and August 6. Wren roosts No. 1 and No. 1a were watched daily from August 4 through December 3, except on 12 occasional dates. Frequent observations were made at chickadee roost No. 3 from October 22 through February 22. Observations were made at wren roost No. 3 from February 21 to 24. Daily observations on these last two covered the period from February 26 through March 31. Although these two roosts were about half a mile apart it was possible to follow both because of the later roosting time of the

wren. I planned to arrive at each roosting place about half an hour before the expected time of roosting. However, occasionally in March the chickadee arrived close to sunset time, instead of some twenty minutes before as was its custom, thus considerably cutting down the preliminary half hour of observation at the wren roost. Observations at chickadee roosts 2, 4, and 5 and wren roost 4 were made on a few occasions only.

Chestnut-backed Chickadee roosts.—On June 28, at 6:45 p.m., a chickadee was found perched on a loop of half-inch wire cable with its feathers almost touching the underside of an eave of a house (roost 1). The bird usually perched more or less longitudinally on the cable. The feathers of the body were much ruffed out and the tail partly spread (fig. 77). During the early part of its roosting time the bird was discovered either "looking" or else was easily awakened when examined by the light of a two-cell electric torch held 6 to 8 feet away. Later in the evening it would remain in sleeping position in spite of several G.E. Mazda photo-flash bulbs discharged as close as 4½ feet from it, although on two occasions it raised its head briefly.

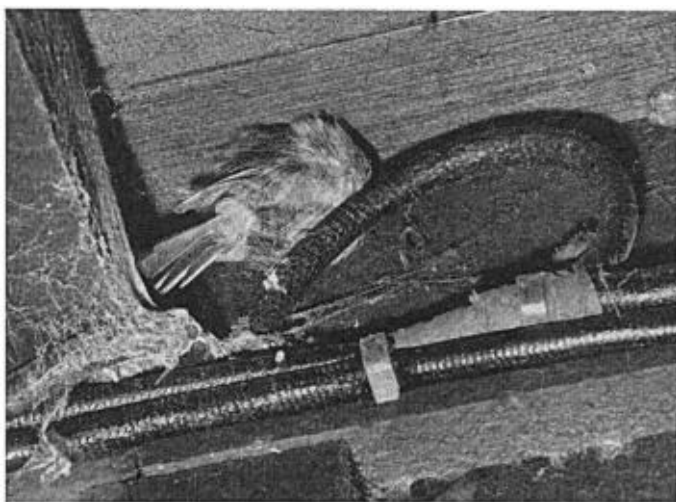


Fig. 77. Chestnut-backed Chickadee in roosting posture. Roost No. 1, Carmel, Monterey County, California, July 22, 1940.

On the night of August 6 this chickadee was caught in the hand on the roost and color-banded. The bird was retained in a box overnight and released close to the roosting place at about the time it had been known to leave the roost in the morning. Although it was frequently seen in the vicinity during the day for some time afterward, it was never seen to go to this roost again. No other attempts at banding roosting birds were made.

Another chickadee fluttered from its perch (roost 2) on the opposite side of the same house when a two-cell electric torch was held within 8 inches of it on the evening of its discovery. Although the bird was recaptured and replaced, this roost was never found to be used again.

Chickadee roost No. 3 was discovered on October 22. The bird was perched on the stem of an English ivy leaf and was almost concealed by the leaves of that vine which covered about 70 square feet of the east wall of another house. This wall was protected by an extension of the main roof, forming a porch about four feet deep. This chickadee

was almost, if not actually, touching the underside of the porch roof, as numbers 1 and 2 did the eaves. This and two other similar perches were principally used. However, on a few nights the bird went to other slightly lower ivy stems, sometimes several inches below the ceiling boards. These perches are all called "roost 3" and the bird using them "3A," or simply "A," when distinguishing it from its mate. The ivy leaves so concealed the bird that a view of it was to be had only from one angle. The roost was almost completely sheltered from the weather. On the principal perch the bird carried the tail almost horizontally, as the bird at No. 1 did, and the body feathers were much ruffed out; it was observed always to face toward the south.

On November 2, the date that arrival at roost 3 was first timed, it was noted that two chickadees were present shortly before one of them went to roost. The presence of two birds in the neighborhood was noted on many occasions thereafter. After March 4 two birds were always present. No more than two birds at a time had been seen since early in the period of observation. The pair generally went to the suet at a feeding station fifteen feet from the roost; then shortly A would go to roost. The other, B, would eat more suet, then, after an interval, fly over the roof of the house toward the west. The movements of B were followed as it foraged along more or less the same route every evening: over the roof to a hedge, to a poison hemlock stalk, a flight of about 100 feet to a pine, then across a street and around the corner of another house and out of sight. It is presumed that B was also going to roost, as it was not heard after rounding the corner of the house mentioned. The times that B was last seen or heard varied from 2 to 39 minutes after A went to roost.

On March 2 this routine was altered to the extent that both birds flew in under the porch roof at 5:37 p.m. A went directly to the roost; B perched first on the outer tips of the ivy, then went toward the wall, then out again, finally leaving the porch entirely. B's whole manner while under the porch roof was tentative and hesitant. At 5:42 B was seen at the suet.

On March 7 the same sort of action was seen again, but on this occasion A also went out again with B. At one minute after sunset A returned to the roost and remained. One minute later B went over the roof in the usual manner.

About noon on March 9 a chickadee was seen gathering moss from the edge of the lawn in front of roost No. 3 and flying to and entering a bird box on a Monterey pine at the opposite end of the lawn, about 70 feet away. That evening the roosting routine was again noted to be changed. A remained in the vicinity of the nest box while B flew over the roof in its usual manner 3 minutes after sunset. Then A flew alone to roost No. 3, six minutes after sunset. March 7 and 9 were the only two occasions when A went to roost after sunset. Again on March 10, B seemed about to roost with A, coming to the vine three times before leaving in the usual fashion.

Bird A was recorded for the first time roosting in the box on March 18. From that time on A always roosted in the box. The first egg was laid on March 24, the seventh day after the first box roosting. Incubation started 5 days later (March 29) after the laying of the sixth egg. After this no roosting times were recorded. During the period of box roosting, A reverted to early roosting again, coming as early as 51 minutes before sunset on March 28. Incubation started the next day.

Five days before the first egg was laid, but after A had been roosting in the box for at least two nights, observations were made at the box on the morning of March 20. At 5:36 a.m. stars and a half-moon were out; the sky was entirely clear. At 5:44½ no bird had left the box but a chickadee was seen in the tree on which the box is hung. This bird flew to the entrance of the box, then to perch on a bush in front of the box,

where it preened for some time, occasionally calling *see-see-see*, then back to the box entrance, and so forth. This procedure continued until 6:10 when, as the visiting bird (presumed to be B) was perched quietly on the bush, a chickadee (A) popped out of the hole and flew to a near-by acacia. Instantly B also flew to the acacia and lit near the other. Thus what was presumably bird B came to the box at 5:44½ a.m. and seemed to wait for A's appearance 25½ minutes later.

That A and B were paired when observations began in early November, or soon after, seems fairly well indicated. There have been banding records which showed that pairs of *P. atricapillus* remain intact throughout the winter (Baldwin, 1934, 1935). There is indication that several European tits remain paired through the winter (Lack, 1940:271).

To summarize, bird A, which roosted at first at No. 3, began roosting in the box before eggs were laid, later commencing incubation. It also tended to be quieter than bird B, and did not perch conspicuously or make loud call notes as the latter did before roosting time. A, therefore, may reasonably be supposed to be the female of the pair and B the male. That being the case the female averaged about ten minutes earlier than the male in going to roost. The single exception was on March 9 when B flew over the roof three minutes before A went to roost. This was during the period when A shifted from the roost to the nest, and her time on that day, six minutes after sunset, was the latest noted for any chickadee.

Morley (1939:41) states that the male of a pair of Starlings went to the roosting hole after the female and left before she did. Unlike the chickadees, they roosted in the same hole. He found the roosting time for the pair late, and the male's behavior uncertain in the period of transition from roosting with the flock to roosting in the future nest hole. This may be compared with the late roosting times for both chickadees and the tentative behavior of the male between March 2 and 9.

Only a few observations were made at roosts 4 and 5. Roost 4, close under the eave of a third house, was known to have been used by a chickadee in the winter 1934-35, as well as during the present period of observation. Roost 5 was in a cavity in the side of an old hornets' nest about fifteen feet above the ground under the eave of a fourth house. This cavity appeared not to have been made by the hornets. Kalter (1932) records a Carolina Wren roosting in a large old hornets' nest hung in a dark corner of a house. A Mountain Chickadee (*P. gambeli*) was found roosting in an abandoned nest of the Western Robin 10 feet up in a lodgepole pine (Bassett, 1923). Both chickadee 4 and 5 were accompanied to roost by another chickadee which was heard actively calling from 8 to 13 minutes after the observed roostings occurred. Time and light intensity readings for these roostings fell within the range of those for numbers 1 and 3.

Bewick Wren roosts.—Audubon (1939:468) quotes Bachman as having seen Bewick Wrens coming from roosts in a hollow tree (presumably in the southeastern states). E. I. Dyer, as quoted by E. V. Miller (1941:85) in the latter's behavior study of this species, records Bewick Wrens using a nest box for roosting in Piedmont, California. Because Miller states that he failed to find the roosts himself, my observations on this subject may be of some interest.

A wren roost was discovered on the side of the same house as chickadee roosts 1 and 2. The house is faced with rustic slabs of redwood bark applied vertically. Wren No. 1 roosted in a crack between two of these slabs, resting on a third slab that was fastened horizontally across the lintel of a wide window on the south wing of the house. The bird used this roost from August 4 until October 6 when it went to an almost identical situation (roost 1a) on the north wing of the house (fig. 78). After November 1

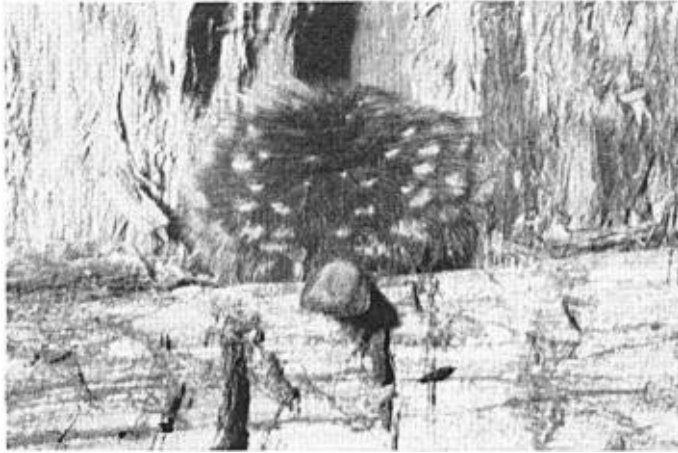


Fig. 78. Bewick Wren in roosting posture, revealing subterminal spots on feathers of rump. Roost No. 1a, Carmel, California, October 20, 1940.

it used both of these roosts, but on different nights, and also a third roost close under an eave in a deep crevice in the bark where the bird was partly concealed.

The wren went through a similar routine each evening, as did the male chickadee. When it was going to roost 1, for instance, it would be heard giving a few single "harsh drawls," as I have called this note. Soon it would be seen near the end of an acacia branch about 5 feet from the roost. There the bird would pause, twitch nervously from side to side, and utter the harsh drawl more loudly this time, in a series of 3, 4, and 5, each utterance being shorter than when given singly. It did this for a period varying from half a minute to three minutes. The moment it lit on the roost the bird became silent. On rare occasions the wren came silently to roost, but nearly always the series of notes was uttered up to the instant of flying to the roost. Later, when I was locating the various roosts of wren No. 3, these notes, heard at the proper time of evening, served as a fairly certain give-away.

E. V. Miller thinks that this roosting note, as I have described it to him, is the one he syllabified in his paper as *spzz*, and agrees with me that it is the harshest note in the wren's varied repertory. He remarks further that the male employs this note, with others, in "territorial encounters." Perhaps the daily routine of uttering this note from a particular tree just before going to roost, as I have recorded it, is a further expression of territorial intolerance, the last uttered before retiring. No other wren has been present at such times, however.

In the roosting posture the bird ruffed out the body feathers, particularly those of the lower back and rump, to an extraordinary degree. Thus ruffed, these feathers showed the subterminal white spots (fig. 78). This sight at first surprised me, as I had been entirely unaware of these spots. Similar concealed white subterminal spots have been found on the feathers of the lower back and rump of museum specimens of the House Wren (*Troglodytes aedon*), Winter Wren (*Nannus hiemalis*) and the Canyon Wren (*Catherpes mexicanus*). The Rock Wren (*Salpinctes obsoletus*) has no such spots.

The question suggests itself whether the ruffed-out pose with its irregular outline and revealed spots might function as a protective adaptation on the theory of broken

contours. However, it would be very difficult to say to what greater extent, if any, the bird blends with its surroundings thus ruffed out than in normal posture. Although two of this bird's roosts were entirely exposed to view, it was difficult for the human observer to detect the bird there even before it ruffed out.

Wren No. 3 used two types of roosts. Roost No. 3x, used for all but five of the observed roostings, was situated on the limb of a Monterey pine about 15 feet above the ground. The bird always perched on the limb close to a dead cone and beneath a canopy of fallen brown needles which had been caught by a few twigs and tufts of live needles above the main limb and over the cone. Roost No. 3y (seen to be used only on one

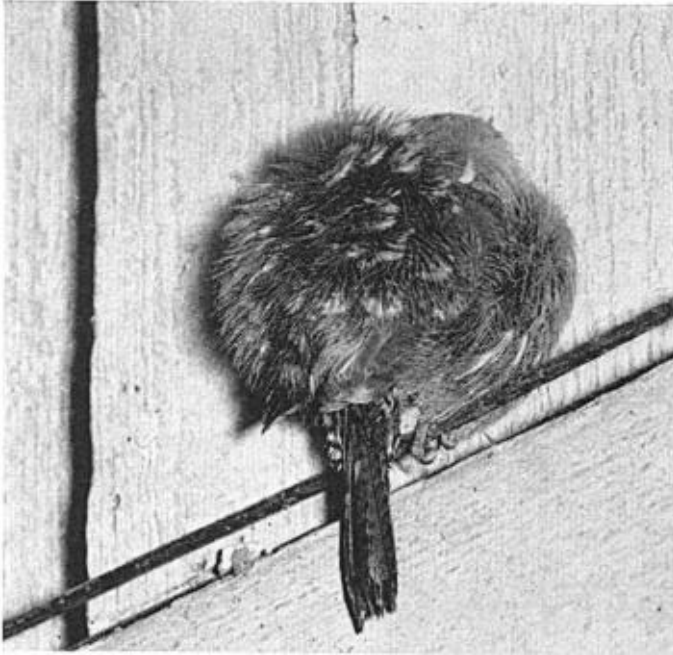


Fig. 79. Bewick Wren No. 3 in roosting posture, at roost 32, March 12, 1941.

occasion, February 28) was similarly situated on the limb of another Monterey pine, except that the canopy of needles was more extensive and there was no cone. Roost No. 3z, used on four rainy nights only, was on a small wire about seven feet from the ground against the wall of a house. Here the bird held its body against the wall close to a batten and was protected by an overhanging eave, although not immediately beneath it, as were the chickadee roosts. On March 12 the posterior end of the white superciliary stripe was seen when the bird was in sleeping posture with its head turned back over the right shoulder (fig. 79).

Wren No. 3 was a male. Its roosting routine was, for the most part, the same throughout the early period of observation. The bird would be heard calling or singing on various perches and occasionally uttering harsh drawls, nearly always progressing toward a small live oak, where it perched a few feet from, and slightly below, roost No. 3x. There it gave the harsh drawl (*spzz* note) in a series, as did wren No. 1 just before going to roost, each note and each series of notes being even more loudly and rapidly delivered

at this point in the routine. Sometimes the drawls were muffled when the bird attempted to preen at the same time.

On two occasions the bird was heard singing from the top of an 85-foot Monterey pine, following which it flew directly down to the live oak, a drop of 75 feet. Then it gave the harsh drawl before flying to the roost in the usual way.

On March 23 the bird was lost track of just before roosting time. It was last heard in the vicinity of a large Monterey pine with low sweeping branches, called "spreading pine." On March 26 the harsh drawl was heard first in the vicinity of the spreading pine; later the bird gave it in the usual live oak and went to roost No. 3x. On March 27 the harsh drawl was heard near the same pine but the bird was not found and did not come to any of his usual roosts. On March 28 a pair of wrens was watched in an oak thicket



Fig. 80. "Spreading Pine," location of roost No. 4 used by female Bewick Wren. Roost site near end of down-sweeping branch in lower center of photograph.

near the spreading pine. One of them was lost; the other was followed to roost No. 3x. On March 29 No. 3 was again discovered in the same oak thicket with a second wren. Both a *skuz-uz-uz* and a high clear note were heard softly and constantly from this pair. At 6:38 p.m. they both went to the end of one of the limbs of the spreading pine and one of them disappeared there (fig. 80). Then the remaining bird uttered the harsh drawl, and at 6:44 flew in the direction of roost No. 3x, 250 feet away; the usual harsh drawl was heard from the direction of the live oak near the roost, and I reached the place just as he was slipping on the roost.

Search later that evening disclosed the second wren, No. 4, on a roost at the end of the pine branch where it had disappeared. It was in typical posture, ruffed out, spots showing, in a little niche in the side of a large mass of fallen needles caught in the pine branch about 7 feet above the ground (fig. 81). This niche, examined in daytime, looked as though the needles might have been shoved a bit aside to form a cavity more or less

fitted to the bird's body. However, as no such action was witnessed, it is entirely possible that the recess was fortuitously formed by the falling needles. As at all the wren roosts inspected, no sign of excreta could be found at the threshold. This is in contrast to the chickadee roosts all of which were made conspicuous by droppings on or beneath the roosting perch.

Skutch (1940:297) describes dormitories especially constructed by wrens of several genera in Central America. These were often different in structure from the breeding nest, and were used for roosting by one or more individuals at a time.

On March 30 the normal roosting routine was followed by the two Bewick Wrens, preceded by copulation. The female went to roost 4 and the male to roost 3z. The following morning wren No. 3 left this roost at 5:20 a.m. Immediately I went to roost 4.



Fig. 81. Bewick Wren roost No. 4, with bird visible in recess in accumulation of pine needles; March 30, 1941.

When I arrived there I heard the *skuz-uz-uz* note of the male and with the aid of a torch saw the bird clinging to the side of the mass of dead needles, a few inches from the female who still was roosting. He remained there for twelve minutes, until she came off. Then they moved about in the chaparral for a few minutes, No. 3 continuing the *skuz-uz-uz* note softly, No. 4 uttering the same high clear note as was heard on the preceding evening. Then copulation took place, No. 3 mounting.

During the 30½ minutes that the pair was under observation on the preceding evening and in the hour and 50 minutes after No. 3 left the roost on this morning, singing was heard only twice; one song preceding each copulation (both days were rainy). No nest or nest building activity was seen.

On the evening of March 31 similar roosting routine was noted, ending with the male going to roost No. 3z.

Comparison of the species.—In comparing the roosts of the Chestnut-backed Chickadee with those of the Bewick Wren, it may be noted that all five chickadee roosts were beneath the eaves of buildings. Although wren No. 1 always used the sides of a building, wren No. 3 used two types of roost, one on a building, the other beneath a canopy of fallen needles caught on a pine limb. This latter type also was used by wren No. 4, the female.

It was frequently noted that both wrens and chickadees did not assume the posture of sleep for some time after they had reached the roost, and that they were easily frightened off during this early period. Later in the evening, when in the sleeping position, birds of neither species were easily disturbed by lights and noises at close range. Wren No. 1 was photographed in sleeping posture with the aid of a Wabash No. 2 Superflood light bulb, held within $6\frac{1}{2}$ feet and kept illuminated for 10 minutes or more while exposures were made. Wren No. 3, also while in this posture, was subjected to the intense, but brief ($\frac{1}{20}$ sec.) illumination of a Wabash No. 2A photoflash lamp at 6 feet. It did raise its head on one occasion, but soon replaced it. Similar behavior was noted for the chickadee (see p. 275).

Roosting times.—The average roosting time of all the chickadees was earlier than that of any of the wrens (in terms of minutes before or after sunset). The chickadee times were found to vary more than those of the wrens and to precede the sunset curve. A shaft of sunlight actually struck the side of the building close to the roosting place of chickadee No. 1 on one occasion when the bird was found already on the perch, but awake. Wren No. 1's average time was within a fraction of a minute of sunset and wren No. 3's was 11.9 minutes after sunset (table 2).

This variation between the two wrens (1 and 3) might be either individual or seasonal. Allard (1930:446 and fig. 2) noted two individual House Wrens that delivered their first morning songs at quite regular intervals a few minutes apart. That it may be at least partly seasonal in the present instance is suggested by the fact that when wren No. 1's average time is divided into two periods of equal length immediately preceding and immediately following the September equinox, the average time for the first period, August 4 to September 21, was 2.23 minutes before sunset and the average from September 22 to November 9 was 2.39 minutes after sunset. Still later in the winter, from November 11 to 24, the average time was 8.3 minutes after sunset. Nice (1939) describes three different stages of the yearly cycle during each of which the Song Sparrow delivers its "awakening song" at different times according to seasonal and other factors.

TABLE 1
Time spent on the roost

Date	Wren	Chickadee	Difference
Aug. 5-6		(No. 1) 10 h., 30 m.	} 30 m.
Aug. 6-7	(No. 1) 10 h.		
Feb. 26-27	(No. 3) 12 h., $26\frac{1}{2}$ m.	(No. 3A) 13 h., $41\frac{1}{2}$ m.	1 h., 15 m.
Mar. 19-20		(No. 3A) 12 h., 1 m.	} 1 h., $4\frac{1}{2}$ m.
Mar. 25-26	(No. 3) 10 h., $51\frac{1}{2}$ m.		
Mar. 30-31	(No. 3) 10 h., $39\frac{1}{2}$ m. (No. 4) 11 h., 17 m.		

Sex differences.—Chickadee No. 3A, judged to be the female, roosted earlier than her mate. Wren No. 4, a female, roosted earlier than the male on the three occasions she was seen, and spent more time altogether on the roost (table 1). Morning observations on both species (one observation on each) seemed to indicate that the male "gets

up" earlier than the female and goes to the female's roost to wait for her, at least at the onset of the breeding season. In nearly all cases the male chickadee accompanied his mate to her roosting place in the evening and then went elsewhere to roost. This also applied to the wren on the few occasions when the female was seen at roosting time.

TABLE 2

Roosting times expressed in minutes before or after sunset at 36° north, 122° west

Weather	Chickadee 1	Chickadee 3	Wren 1	Wren 3	Wren 4
Fair					
Number of records	1	17	22	9	
Earliest time	-32.0	-43.0	-06.0	+07.5	
Latest time	-32.0	+00.5	+16.5	+18.0	
Average	-32.0	-18.5	+05.0	+14.4	
Cloudy					
Number of records	1	20	9	16	1
Earliest time	-32.0	-51.5	-05.5	+03.5	+11.0
Latest time	-32.0	+06.0	+07.5	+19.0	+11.0
Average	-32.0	-17.9	+00.7	+11.6	+11.0
High fog					
Number of records	3	2	14	2	
Earliest time	-42.0	-29.5	-15.0	+11.5	
Latest time	-22.0	-10.0	+06.0	+12.0	
Average	-33.0	-19.7	-04.0	+11.7	
Rain and low fog					
Number of records		6	5	5	2
Earliest time		-60.0	-20.0	+02.0	-12.5
Latest time		-19.0	-01.5	+15.5	-03.0
Average		-42.0	-10.9	+08.1	-07.7
All weathers (totals)					
Number of records	5	45	50	32	3
Earliest time	-42.0	-60.0	-20.0	+02.0	-12.5
Latest time	-22.0	+06.0	+16.5	+19.0	+11.0
Average	-32.6	-21.4	+00.1	+11.9	-01.5

Effect of weather on roosting time.—It will be noted (table 2) that the average roosting times of chickadee No. 3 in fair, cloudy, and high-foggy weather varied less than two minutes (17.9-19.7 minutes before sunset), while the average for six rainy evenings was over 22 minutes earlier than that for any other weather. Wren No. 1's average roosting times are progressively earlier from fair, through cloudy and high-foggy, to rainy weather, showing a difference of 15.9 minutes between fair weather and rainy, and crossing the sunset curve. Wren No. 3's average was also materially earlier in rainy weather than in any other kind.

Effect of light intensities.—It will be noted (table 3) that the 30 readings for chickadee No. 3A ranged from 1.6 to 320 candles per square foot. Of these, 23 fell within a range of 25 to 100 candles, which may be taken to be the normal range.

As previously mentioned, wren No. 3 generally roosted at such low light intensities that no readings were possible. It will be noted that the 39 readings for wren No. 1 all fall below the chickadee's normal range and that the range of the wren is more compact than that of the chickadee.

Emlen suggests that the later rising of his Mockingbird on rainy mornings might be the effect of weather through light intensity. Allard (1930) in considering the time of the first morning song of birds says (p. 465), "In a sense it would appear that their visual organization behaves as a very sensitive photometer, appreciating very low light

TABLE 3
Correlation of roostings with light intensities

Weston readings	1	1.6	2	4	5	8	10	13	16	20	25	32	40	50	65	80	100	130	160	200	250	320
Chickadee No. 3A																						
Weather																						
Fair							1	1				1	3	1	2	1	2					
Cloudy		1				1		1					2	2		1	1	2		1		
High fog												1										
Rain												1	2				1					1
Total																						
roostings		1					1	1	2				3	7	3	2	2	4	2		1	1=30
Wren No. 1																						
Weather																						
Fair	3	2	2	3	4	1			1	1												
Cloudy	1			1		1	3	2	1													
High fog				1		1	4	2	1	1												
Rain						1	2															
Total																						
roostings	4	2	4	3	6	9	6	3	2	=39												

intensities Since cloudiness at dawn tends to delay more or less appreciably the delivery of the first morning song, I am inclined to believe that the intensity of light of the visible spectrum operates upon the visual organization to cause the birds, each with its own sensitivity, to strike the minute approximately at which its mechanism is set."

Although both the chickadee and the wren went to roost appreciably earlier on rainy evenings, any direct effect on this time by the lower light intensity in such weather is not indicated. Rather it was found that the birds tended to come to roost at somewhat higher light intensities in rainy weather. Too few recordings were made in rainy weather to generalize, but none of these fell in the lower light range of either bird. On one rainy evening the chickadee came a full hour before sunset at 320 candles per square foot; its next highest intensity reading, 160 candles, was made the day before incubation started. No conclusion is possible. These figures are given merely to indicate a seeming tendency.

SUMMARY

The roosting places of 5 Chestnut-backed Chickadees and 3 Bewick Wrens were found. The study of these roosts covered the period from June 28, 1940, to March 31, 1941.

All the chickadee roosts were close under the eaves of buildings. The wren roosts were of two types: (1) on the sides of buildings, and (2) beneath a canopy of fallen dead needles on a Monterey pine bough.

All the averages of chickadee roosting times were before sunset, chickadee No. 3A's being 21.5 minutes before. The times for chickadees varied more from the sunset curve than did those of the wrens. The average time of wren No. 1 was within a fraction of a minute of sunset, that of wren No. 3, 12.3 minutes after sunset.

The difference in roosting time of wrens 1 and 3 may be seasonal, or individual, or both.

A sex difference in roosting behavior was found in the chickadee pair studied, and was also indicated for a pair of wrens, the males in both instances going to roost later.

The chickadees spent more time on the roost than the wrens.

There is some evidence to show that weather affects the roosting time of both species independently of light intensity.

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