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BEHAVIOR OF THE BEWICK WREN

By EDWIN V. MILLER

This study of the Bewick Wren (*Thryomanes bewickii*) was begun in the spring of 1938 at the University of California, Berkeley. On the University campus, Strawberry Canyon, to which I have frequently referred in this paper, was the site of most of my observations. Besides the subspecies *spilurus*, which is found there, I have made a few observations on six other subspecies in western North America. This information has proved of value in determining the importance to be placed upon data chiefly obtained from a single subspecies. My method was almost entirely that of extended observation in one locality. A few wrens were collected to verify the identification of sex based upon behavior and to look for parasites. One of the greatest difficulties encountered was the lack of opportunity to observe the wrens in the latter part of the breeding period.

I wish to express my appreciation to Dr. Alden H. Miller for his advice to me in the course of this study. The late Mr. E. I. Dyer in 1938 kindly invited me to observe wrens on his premises and gave me much useful information.

Habitat.—Birds of the eastern race, *T. b. bewickii*, are apparently more domestic than their western relatives. In Alabama, A. H. Howell (1924:332), and in Illinois, Baird, Brewer and Ridgway (1874:146) found *bewickii* occurring commonly around outbuildings near brushy or wooded places. Wrens of the western races occur in brushy areas, but in greater numbers away from human habitations.

A few of my observations on several subspecies in western North America will give a picture of the habitat in this part of the species' range. On March 20, 1940, *T. b. cryptus* was seen in the Chisos Mountains of the Big Bend region in southwestern Texas. The habitat here consisted of mixed brush, cacti, and small oaks. Next they were watched at a point thirty-eight miles south of Nuevo Laredo in Nuevo León, Mexico. The country here was covered with a heavy growth of prickly pear (*Opuntia*) and other cacti and much brush composed of several species. Associated birds were the Verdin, Desert Sparrow, and Mockingbird. Near Charco Escondido, Tamaulipas, *cryptus* was common in a habitat of large mesquites. Birds such as the Pyrrhuloxia, Cardinal, White-eyed Vireo and Mourning Dove also were found here. On April 15 at Chipinque, Nuevo León, at 4000 feet, the wrens' habitat consisted of large oaks, pines and other trees, with a thick undergrowth of brush; in the same habitat were Whip-poor-wills and Couch Jays.

On April 21 I saw a few wrens of the subspecies *T. b. murinus* at an altitude of 5700 feet near Puente Tasquillo, Hidalgo. The habitat included numerous kinds of large cacti (organ and candelabrum), mesquite and other brush. At the Piramides de San Juan Teotihuacán, Mexico, *murinus* occurred in pepper trees and prickly pear cactus. On April 24 I visited Parque Chapultepec, Mexico City. The habitat here consisted chiefly of large trees (*Populus*, locust, *Eucalyptus*, *Pinus*, *Cupressus*, and others), in some places with thick underbrush; *T. b. murinus* was common here and associated with the Inca Dove and Broad-billed Hummingbird.

I was able to observe the subspecies *percnus* in several localities. On May 11, 1940, near the southeastern shore of Lago Chapala, Jalisco, I found this race in a habitat of dry, sparse brush and prickly pear cactus. On May 12 at San Juan de Los Lagos,

Jalisco, it was seen in thorny brush along with Cactus Wrens and Curve-billed Thrashers. On May 19 near Hacienda la Parada, San Luis Potosí, I found *percus* in a habitat of maguey (century plant), brush, cholla, prickly pear and other cacti. Here also were the Lucifer Hummingbird and Cactus Woodpecker. On May 26 near Lulu, Zacatecas, a few *percus* were collected in a habitat of small mesquite, creosote bush, cholla, prickly pear and much brush, where Harris Hawks and Scaled Quail were common.

On March 14, 1940, near Nogales, Arizona, *eremophilus* was found in mesquites, elderberry and dead brush along with Gila Woodpeckers, Canyon Towhees and Palmer Thrashers. On March 15 I noted *eremophilus* in the Huachuca mountains of Arizona in pines, junipers and oaks, with such birds as the Bridled Titmouse and Arizona Junco.

The habitat of *T. b. spilurus* may be considered in some detail. This subspecies occurs along the coast of California from San Francisco Bay south to Santa Cruz County. This region consists chiefly of low chaparral-covered hills, and it is in such cover that Bewick Wrens are found in greatest numbers. Strawberry Canyon on the University campus, in Berkeley and Oakland, is about a mile long by one-quarter mile wide, faces westward, and ranges in altitude from 400 feet to 1800 feet. Most of the habitats on the south-facing slope (eucalyptus groves and grasslands) are not used by Bewick Wrens, although there is some chaparral in the upper canyon on this slope.

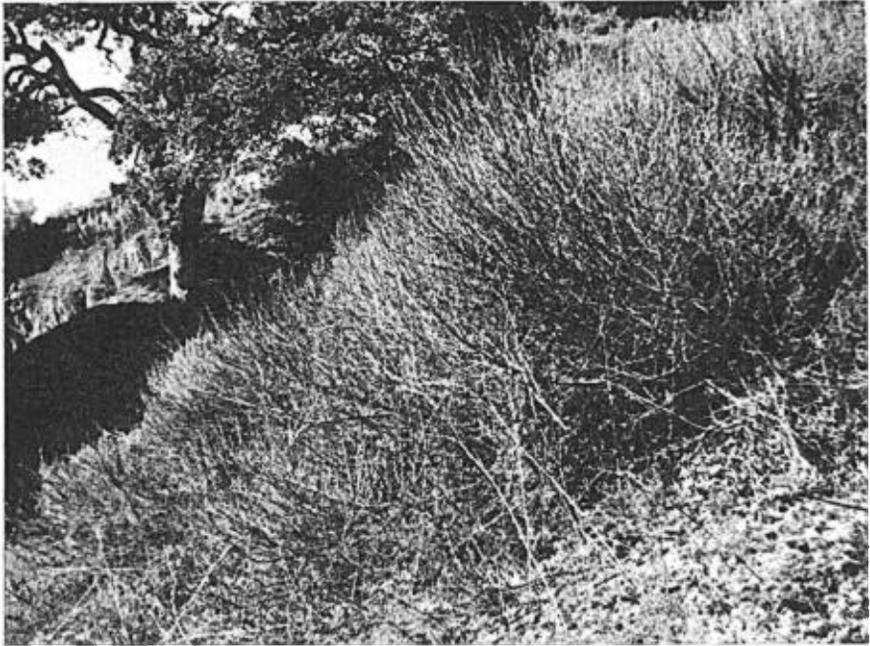


Fig. 25. Habitat of *Thryomanes bewickii spilurus* in poison oak (*Rhus diversiloba*); Strawberry Canyon, University of California campus, January 23, 1938.

On the north-facing slope the wrens are common, being found in chaparral, mixed brush and oak, and in pure stands of Monterey cypress and Douglas fir, without underbrush. In the chaparral association, baccharis is the dominant plant, forming dense stands of four to six feet in height. In the mixed brush and oak region the height of the plant cover is anywhere from one to thirty or forty feet. Oaks and laurels occur scatteringly, with low brush and vines underneath them. Willows and poison oak are more common

in the bottoms of gulches. Madroño grows in nearly pure stands. Introduced conifers (species of *Sequoia*, *Abies*, *Cupressus*, *Pseudotsuga*, *Pinus*, *Picea*, *Libocedrus* and *Thuja*) are present, but with the exception of Monterey cypress and Douglas fir, are not invaded by *spilurus*. The outstanding characteristic of the habitat is the great thickness of the plant cover. This is one of the chief factors influencing the occurrence and abundance of Bewick Wrens. Here in Strawberry Canyon, where the brush is about as high and thick as I have found it in any place where Bewick Wrens occur, these birds are most abundant. The particular species of plants concerned are also of a good deal of importance, for some plants in Strawberry Canyon, notably redwood, eucalyptus and laurel, are not inhabited by the wrens, apparently because of the lack of invertebrates living on these trees. The density of foliage and growth of these trees is as great as that of other plants here, so that they should be satisfactory from a physical point of view. The only assumption I can make is that they do not furnish food; other insectivorous birds also shun these trees in this region. There are few places so silent and free from vertebrate life as a dense redwood grove.

Opinions differ with regard to the relation of Bewick Wrens to the dense plant growth of their habitat. Grinnell, Dixon, and Linsdale (1930:331-332) and Swarth (1916:56) think that the brush of the habitat supplies protection and shelter. I think that the presence of these wrens in thick brush is more closely related to their foraging habits. They forage chiefly on limbs and branches, which are nowhere so abundant as in a habitat of dense trees or bushes. Furthermore, Bewick Wrens often venture into relatively open places to forage over the trunks of trees, which they would not do were they solely concerned with shelter. The two factors, shelter and food, are probably both of importance in habitat selection by the wrens.

There are but few features of habitat common to all the races of Bewick Wrens. Thick plant growth of a kind that will furnish the proper insect food seems to be the chief requisite. The kinds of plants in one part of the range of the species may be totally different from those in another part. The wrens may be found in trees more than one hundred feet high or in brush not more than three feet high. In the Upper Sonoran Life-zone they are most abundant where the plant growth is thickest. They are particularly noted for their preference for mixed brush. There seems to be no difficulty in finding nesting sites, even though suitable cavities appear to be scarce in some areas that are occupied.

Animal relations.—The relations of the Bewick Wren to other animals are, with a few exceptions, chiefly neutral. There are many species of mammals and reptiles that occur in the habitats of the wrens, but there is no direct evidence at present that they are harmful to this species. Nevertheless, I have found wrens' nests destroyed, so that there certainly are some offenders. May (1935:97) lists wrens in general as a part of the food of the Sharp-shinned Hawk. I have heard *spilurus* react by giving *pee* notes as these hawks flew overhead, but I have not seen the hawks show any interest in the wrens. The latter are perhaps too well sheltered by the thick brush in which they live. I have seen Bewick Wrens chase such birds as the Wren-tit, Spotted Towhee and Oregon Junco and have seen the wrens chased by Wren-tits and Song Sparrows. Such behavior is rare, however, and the chase is only a short dart with no actual contact between the birds. In some parts of their range, Bewick Wrens do come into conflict with other birds, especially in the breeding season. E. I. Dyer (MS) reports that in 1933 at his home in Piedmont, California, a Plain Titmouse dispossessed a pair of wrens from a bird house. The wrens selected another house nearby. Roads (1929:103) says that he saw a House Wren dart at a singing Bewick Wren, striking the latter on the back. On another occasion a Bewick Wren drove a nest-building House Wren off

the latter's premises. Eifrig (1933:65) states that in Maryland, House Wrens are increasing and Bewick Wrens decreasing. Brooks (1934:244) found the same situation in West Virginia. In 1914 there were six pairs of Bewick Wrens on his premises; in 1933 one pair was present nearby. There were three pairs in 1927, three in 1928, one in 1929 and one in 1930, and none thereafter (to 1934). In some places Bewick Wrens disappeared except in migration. Brooks once saw House Wrens use force to dispossess Bewick Wrens. Sutton (1930:15) states that in West Virginia the nesting territories of the Carolina and Bewick wrens overlap more than those of the House and Bewick wrens. The House Wren and Carolina Wren do not bother one another in the same region, but the Bewick Wren comes into conflict with both of the former. Sutton says the Bewick Wren usually retreats when disturbed by the House Wren. According to Grinnell and Storer (1924:555) the four species of wrens found in the Yosemite region, California, do not meet in serious competition. The Canyon Wren is found on rocky canyon walls, the Rock Wren about earth bluffs and rocky outcrops, the House Wren in oak trees, and the Bewick Wren in mixed growths. In the winter I found *T. b. marinensis* and Western Winter Wrens in the same habitat, but there was no friction between them. The Winter Wrens foraged mostly on or within a foot of the ground, while *marinensis* was higher up in the brush.

Foraging.—As is well shown by Beal's study (1907:57) of its food, the Bewick Wren is chiefly a gleaner of small insects. In this process, short quick hops are made from branch to branch and an insect or two is picked from the bark or leaves every few seconds. Pecks often average one per second. On small branches and twigs the birds sometimes cling to lower sides in an upside-down position. The activity rate is high, the bird seldom stopping more than a second or two at any one place unless the influence of unusual factors intervenes. Now and then (commonly less than every half hour) a wren ceases foraging to fly a few feet to a new location. These flights are generally from five to forty feet in length, depending upon the habitat, the wren, and other factors. Sometimes they occur when a wren approaches the edge of its territory, whereupon the bird turns back. At other times the reaching of the edge of a favorable forage ground may cause a flight. Sometimes, however, purpose in such changes of forage sites cannot be seen.

The characteristic area of foraging is on the lower, larger trunks and branches of weeds, brush and trees. The plants on which foraging takes place are almost any of those found in the bird's habitat. The thick vegetation in which the wren forages contributes greatly to the efficiency of the process, for the branches are so close together that only short hops and few flights are necessary. Not uncommonly a wren will hop on the ground and pick food from it or turn over a leaf with its bill, but there is never any scratching. Sometimes the bill is wiped vigorously; the bird draws it back and forth against twigs. This occurred on one occasion after a wren pecked at and finally swallowed a naked caterpillar larva about three-quarters of an inch long. The bill was wiped for two minutes, being drawn back and forth about one hundred times. Bewick Wrens are not as highly specialized in the use of their bills as are some birds. Warblers, for example, use their bills chiefly for plucking insects off leaves and twigs. A Bewick Wren's bill is used in this way also, but in addition, due to its greater length, it can be used to dig insects from cracks, to flip over leaves and to manipulate large larvae.

Different methods of foraging are used, depending upon the nature of the vegetation. In low tangled mats of brush the bird moves about out of sight among the lower branches. In larger, more open brush the wren usually begins at the base of the trunks and hops vertically upward, often working in a spiral fashion around the bush. Upon reaching the branching twigs of a bush or tree, a circuitous route around or through

the inner portions is followed. If the brush is too thick to enter readily, or if the bushes are not close together, the bird hops around the bases on the ground and picks insects from the bark. Trunks of trees a foot or so in diameter are foraged over rather than the twigs. In doing this the wren clings to the bark, creeper style, and moves upward by short hops as it goes. At times insects slightly embedded in the bark are removed by a rapid series of pecks resembling those of a woodpecker. I have heard these pecks at a distance of thirty feet. Because of the slenderness of the wren's bill it is doubtful if much bark is removed. When the bird hops up the vertical trunk of a tree, the tail is depressed as though for support, although it seems actually not to touch the surface of the tree. Infrequently, a wren will flutter up under an overhanging limb and pick an insect off while flying. This may also be done in a quick dash without fluttering.

Factors modifying foraging are probably numerous. As mentioned above, different approaches are used for different floral types. Thus, the kind of plants present in the habitat, their relative amounts, and their distribution influence foraging procedure. For example, in low relatively sparse vegetation the bird hops on the ground around the bases of bushes, whereas in moderately thick brush this behavior is not often seen. In windy or rainy weather the wrens keep more to the interior of dense brush. The structure and instincts of the bird influence forage behavior more than can readily be determined. I frequently saw mated birds foraging in early spring, the male up in trees, while the female kept a foot or two off the ground. The female followed the course set by the male and was even fed by him. This separation of forage locations for mated birds occurs in early spring when wrens first mate. After nest building foraging occurs separately or together. If together, there is no separation of the foraging locations. Both wrens forage on all levels. It is possible that the separate foraging location procedure may have been developed because of the smaller amount of food present in the territory early in the season. Later on in the spring there is plenty of food and no need for the sexes to forage in separate locations. Interestingly enough, similar behavior occurs in the Saint Kilda Wren (*Troglodytes t. hirtensis*), where the two sexes have foraging territories that are entirely separate (Harrison and Buchan, 1934:139).

Another factor that influences foraging is singing. This may take up half the male's time in early spring. Unsocial behavior such as meetings between males on territorial boundaries may interrupt foraging for periods up to about one-half hour. Other animals, hawks for example, may cause a retreat into thicker brush and a cessation of activity. Lastly, unusual supplies of food in the habitat will cause a change in the type and location of foraging.

Roosts.—I have failed to find the roosts of Bewick Wrens. At about sunset they are quiet and difficult to find in thick brush; moreover, when a bird is followed in the evening it is much more likely to stop calling altogether than at other hours of the day, and when this happens, it is practically impossible to find the bird. Several times I was able to follow wrens a short ways after the sun had set; light intensity was so low under the trees that I could hardly see the birds, but they either entered a dense brush tract or else their *pee* calls ceased, leaving me baffled. E. I. Dyer (MS, 1933) records the following incident from Piedmont, California: "Late one afternoon at the beginning of winter a scratching was heard about the eaves of the shack. Investigation showed that it was a Vigors Wren looking for shelter. A house was made as quickly as possible and put up under the eaves and every night thereafter until nesting time, at least one wren occupied the house, only to be dispossessed by the Plain Titmouse in spring."

Bathing.—I have observed bathing, or more correctly dusting, of Bewick Wrens but twice. The whole of my notebook account of the first incident of this kind is as

follows: "April 6, 1937. Canyon Road, Strawberry Canyon, U.C., where the road crossed the creek. 6:35 p.m. Cool, clear, and still. Heard a *whit-pee-pee-pee* sound from the brush. A wren flew across the road with a jerky flight and scooted into the brush about 6" off the ground. He (?) kept on making the noise. In a moment he appeared, flashed out into the middle of the road, for several seconds squatted low, jerking his body in semicircles, first one way, then another. Then he squatted still lower and ruffled his feathers in the dust on the road, which was extremely little and damp besides. Then he again fluttered into the brush still making the noise, and in a moment appeared and repeated the dusting procedure. Again into the bushes." I saw this behavior a second time on April 17, 1938. At 9:10 a.m. a female was foraging on the ground along a trail on the south side of Strawberry Canyon. As she crossed the trail, she squatted in the dust, jerked her body back and forth and ruffled her feathers in the same manner as noted above. This continued for about a minute, whereupon she resumed her foraging. The trail was only slightly dusty. E. I. Dyer (MS, 1934) states that at his home in Piedmont, California, "The Vigors Wren . . . is a persistent duster, sometimes dusting many minutes at a time. Just now (August 8, 1934) one was seen showing signs of trying to bathe in a vessel which is kept under a hydrant, but the water was beyond his reach. It was then filled with water and the wren returned at once and had a thorough bath."

Preening.—On several occasions I have observed the wrens preening themselves. In fifty hours of observation at various times of the day I saw preening occur but four times, and this occupied only a few minutes of the time of three different wrens. In preening a wren usually perches in the sunlight on some small twig, grasps feathers near their bases and runs its bill down them with a wiggling motion. Once a wren reached back several times and appeared to be getting oil from the preen gland. There seems to be no regular order in which feather tracts are preened—rather a bird skips from place to place, fixing feathers here and there at random.

Songs and call notes.—Among Bewick Wrens the males are the only individuals that sing. The female has some call notes similar to the male's, but nothing resembling his song. I first noted this when I saw a pair of wrens together. One of the birds did all the singing. Later, while the female was on the nest laying, I found that the male was the one that sang. I also collected about ten wrens, noting their behavior first and sexing them to test my identifications, which I found were correct.

The different vocal notes of the male and female are probably the characters that the wrens themselves use to recognize sex among their own kind, since the plumage of the two sexes is the same. The least that can be said is that a male wren responds differently to the vocal notes of other males than he does to those of a female; this would seem to constitute recognition.

In studying the songs of the Bewick Wren I have written down a large number in my notes in syllable form. All songs are characterized by pronounced and vigorous rhythm. Most of the songs contain a trill, which is either simple or complex. Of the simple trills there are two main kinds. The first is rapid and higher pitched; four varieties of it are a long *trrrrrrrrr*, a short *churr*, a sibilant *sperr*, and a harsh *skerr*. These are pitched differently and the last three occur not only in the song but also separately as "call notes." The *trrrrrrrrr* is higher pitched and not harsh as are the other three. The second simple trill is slow, loose and low pitched and has but one expression—*pdddd*. This is a true part of the song and is not given singly. The more complex type of trill is a rolling, repeated *wrrr-wrrr-wrrr*. It is not given singly. This trill, the *pdddd* and the *trrrrrrrrr* types more commonly occur at the end of the song when they are present, although not always. The *trrrrrrrrr* trill is the most common of

all and occurs very frequently. It is almost invariably present in the songs of *cryptus*, *eremophilus*, and *percnus*. Among *spilurus* and *marinensis* it occurs in about one-half the songs.

A not uncommon component of the song is a buzzy *bzzz*, *tzzz*, or *spzzz* note. This occurs fairly commonly by itself. A great many other notes occur in the songs. I have these recorded in four different pitches with *ee* designating the highest, then *i*, *e*, and lastly *oo*, the lowest. The notes *ee*, though recorded so, are not necessarily all on the same pitch. They vary more in small modifications than any others. They may have a simple sibilant beginning such as in *see*, *bzee*, *spee*, or *tswee*. They may have other beginnings such as in *tee*, *chee*, *twee*, *whee*, or *wee*, or they may be modified at beginning and end both as in *weep*, *weer*, *peew* and *whees*. Notes of the next pitch down occur in sibilant form as *spit*, *tsip* and *sit*, and otherwise as *quit*, *pit* and *whit*. The notes of lower pitches are less common. *Wher*, *quer* and *ter* are the only notes of that particular region of the scale, whereas those of the lowest pitch are found with sibilants such as *soo* or *tsu* and *twoo* and *too*. These notes are all short and sharply given. Along with the trills they occur in many combinations of from two to seven notes and (or) trills. If there are but two parts to a song, one is sure to be a trill of the true song type. Within the longer songs the same note commonly is given from two to four times in succession. This does not apply to the trills, where the same ones are not given successively. Some examples of songs are: short-*see*, *trrrrrrrrr*, long-*spee*, *churr*, *tsip-tsip-tsip-tsip*, and *see*, *spzz-spzz*, *trrrrrr*. The last song was given by a male *spilurus* in the period when he and his mate were feeding their young. His are the only songs I have recorded with buzzing notes in them, although I have often heard these notes given singly. This wren sang four different songs in one hour.

The songs of some of the subspecies differ from those of other subspecies to a recognizable extent. Dawson (1923:670) notes that the western races have developed greater versatility in singing than the eastern races. My own observations agree with his. Songs of *spilurus* average about four or five notes apiece. Songs of four subspecies that I heard in Mexico were more than ninety per cent of three notes only. The separate notes were the same, as far as I could tell, as those of the races in California. The common song that I heard nearly everywhere on the southwestern deserts was *too-wee-trrrrrrrr*. In one small locality, at Lulu, Zacatecas, nearly all the wrens put the *too-wee* notes at the end of the trill as well as at the beginning. This shows that small, local, possibly inheritable variations have developed.

Bewick Wrens often choose conspicuous perches for singing, especially in the spring just before they are mated. Wrens in Strawberry Canyon generally perch on the outer small twigs near the top of a tree or bush. In North Carolina, Brewster (1886:176) reported the males singing from ridgepoles and gable ends of buildings in towns. I once saw a wren singing from four different perches in two minutes. Most of the wrens I have observed sing in about the following position: feet spread wide apart, tail horizontal, bill tilted slightly upward, wing tips a little beyond the body and a little below the level of the base of the tail. The throat and tail vibrate during the song, and there is hardly any movement between songs. Most authors speak of the tail hanging down in the manner of a thrasher, but I have not seen them sing in this posture more than with the tail horizontal, and I have even seen the tail erect during singing. One wren, which sang *spee*, *churr*, *tsip-tsip-tsip-tsip*, opened his bill wide for the first note, closed it some for the second and opened and closed it for each succeeding note. The song lasted three seconds, the first note being one second long. David G. Nichols drew my attention to the fact that birds are often pictured singing with their tongues in full view, whereas this seldom or never occurs. In Dawson's "Birds of California" (1923:

672) is a drawing of a Bewick Wren showing the tongue exposed during singing. I have never seen these wrens sing in this way.

Of twenty-six wrens that I timed, the songs were given from one to eighteen per minute with an average of ten per minute. Each of these birds sang from one to five minutes. Some of them produced almost constant sound by giving *swee* notes in between the songs. The songs were given regularly and at much higher rates in the spring. On rainy days the rates were slower, and fewer songs were given. Wrens often sing in the spring while foraging; these songs seem to burst from their throats in spite of their attempts to devote their attention to foraging.

The songs seem to be of use in helping to maintain territories. In the early hours of the morning the wrens are especially active, and much singing is done. This sometimes occupies a half of a bird's time. Also at this time of day meetings of males on territorial boundaries are more frequent than in the afternoon. A natural chain of events probably occurs: the wrens awake hungry and move about foraging; several meetings of males take place; all this serves to refresh each bird's memory of its territorial limits; then hunger is appeased, activity slows down, and each bird remains farther away from its boundary lines; as a result there is much less singing.

Wrens in Strawberry Canyon sing from early spring until late autumn. In 1939 I heard one singing on September 9 and did not hear another until after the first winter rain. S. B. Benson (MS) records *spilurus* singing at Berkeley on December 6, 1930. Lloyd (1887:297) says that in western Texas *eremophilus* sings from early spring until fall, and Jewett and Gabrielson (1929:42) state that *calophonus* ". . . may be found in almost full song throughout the winter on bright days." Whether these are adults is unknown. Welter (1935:11-12) says of the Long-billed Marsh Wren that song ceases in August and only young birds sing thereafter.

Bewick Wrens have a varied repertoire of call notes. The sexes of Bewick Wrens can be identified on the basis of their call notes, although there are at least three notes that are the same in the two sexes. These are a nasal *pee*, a high, throaty *spa* and a buzzy *spzzz*. The male, however, gives a great many more of these calls than the female, who does not give them at all in the early spring. The calls peculiar to the male are sharp *pit* and *chit* notes; hissing *sew* and *see* notes; a peculiar *zzzz* that I heard but once; a twittering during nest building, heard but once; a grating *skuz-uz-uz-uz*; a harsh low *skeer*, heard but once; and light *ku-wee* notes. The male's *pit* and *chit* notes are given sharply in a short series commonly during territorial encounters and almost never elsewhere. His *sew* and *see* notes are variations of the same note at different times of the year. The *sew* note begins to be given in early spring and about nesting time changes gradually to a more intense and hissing *see*. It is used chiefly to fill in gaps between songs and in this way the male at times keeps up a continuous stream of sound. The *zzzz* note, which I heard but once, occurred while a wren was foraging and was probably a variation of some other note. The twittering notes occurred in a very unusual situation. I had removed a piece of bark from a tree to look into the nest cavity of a wren. When I replaced the bark, I did not leave enough room for the birds to get in again. The next morning when I returned they were trying to enter with nesting material without success. I enlarged the opening and both birds entered. When the male emerged he peered in all directions, hopped around the hole and gave the twittering notes. His behavior bore a curious resemblance to a human saying, "This is too much for me to understand." The male commonly gives the *skuz-uz-uz-uz-uz* notes at territorial encounters. The *skeer* note, which I heard but once, probably had no especial significance. The male employs the *pee*, *spa* and *spzzz* notes in territorial encounters, the latter two being almost confined to such behavior. The *pee* notes are the most common

of any in the male's vocabulary. They vary greatly in volume and in the rapidity in which they are given. They are given slowly and lightly while the male forages and probably serve both as a mild expression of territoriality and to keep the female aware of his location. Since the mates keep together a great deal in spite of the thick brush that they wander through, some method besides vision is necessary to help them find one another. The male also uses his territorial notes to attract attention to himself when intruders approach a nest with young. The male's *ku-wee* call was given when he searched for the female to feed her during the period of incubation.

The female employs *pee*, *spa* and *spzz* notes very rarely. She gives *spa* notes during nest building and *spa* and *spzzz* notes later in the breeding period. Since these are the territorial notes of the males, it is not surprising that the female does not use them earlier in the season. If she did, her own mate might mistake her for an intruding male. Later in the season his territorial reactions are much weaker and her uttering of these notes seems to make no difference to her mate. During the breeding season the female's common note is a *sker*, *sper* or *spaer*. It seems to be used to enable the male to know of her whereabouts. The female has *swee* or *ee* notes, which, given in rapid succession, induce the male to feed her. These are given during nest building and incubation. She has a loud, piercing *teerrrrr*, which she uses to call the male when she is ready for copulation. The three times that I heard this call the male came rapidly and copulation occurred. Just before copulation the female gives a high-pitched twittering warble. This behavior is similar to that of the Long-billed Marsh Wren, where the female gives a trill preceding copulation (Welter, 1935:13). During copulation the female gives a *tee-ee-ee-ee* call, which may be the same as her begging notes. It seems likely that the note which the female uses to call the male to her for copulation may have developed as a result of the dense brush where these wrens live. When the female is in "oestrum" and desires copulation, she has no way of seeing her mate and going to him to attract his attention as some birds do; this seems to be the reason for the development of the call.

Territory.—Although I did not band any Bewick Wrens, I was able by repeated observations in the same locality to discover something of their territorial behavior. In Strawberry Canyon, the wrens are found throughout the year, either singly or in pairs of mated birds. At all times of the year I was able to find both single birds and pairs. Lone wrens were common in the fall and winter, and even in the spring a few could always be found. Nearly all of these single individuals were males (as told from their singing, the females having no song). I rarely saw single females. Mated wrens nearly always keep so close to one another that if one is seen the other is almost certain to be discovered also. This apparent preponderance of males is partly explained by the fact that males are much easier to find, because of their frequent songs and calls, than are females. Yet, the considerable number of unmated males present in the spring indicates that the sex ratio is in their favor.

Male wrens show territorial reactions toward other males whenever they meet at any time of the year. Females show no territorial reactions toward males, and I have never seen a female encounter another of her own sex, so that I do not know what her behavior would be in such circumstances. From the facts that the female has no song, is quiet, and does not assist the male in the general defense of the territory, I think that she has no part in the maintenance of the territory. Yet she is cognizant of the male's territory, or at least does not venture out of it. Until nest-building time, she remains close to her mate continuously and probably learns the extent of the territory in this way. Males and mated pairs definitely have territories in the spring. In the fall and winter some appear to have territories, but many do not. These latter may be young birds of the year.

My evidence for the existence of territories is based on the following observations: 1. In the spring (January to May) of 1938 I made frequent observations on several wrens scattered over a small area in Strawberry Canyon. Day after day I found that a male or a pair of birds would be present on the same area where I had previously seen them. For several hours at a time I would keep track of a wren, which never ventured out of a certain area. Some of these areas remained the same for at least two months. I speak of the areas, since I could not tell if the birds were the same from day to day, although they probably were. The limits of these territories did not vary more than a few feet from day to day. 2. The males of these areas exhibited strong reactions toward other males adjacent to them. When two males happened to meet on a boundary, they would stop foraging, sing and give harsh vocal utterances, and

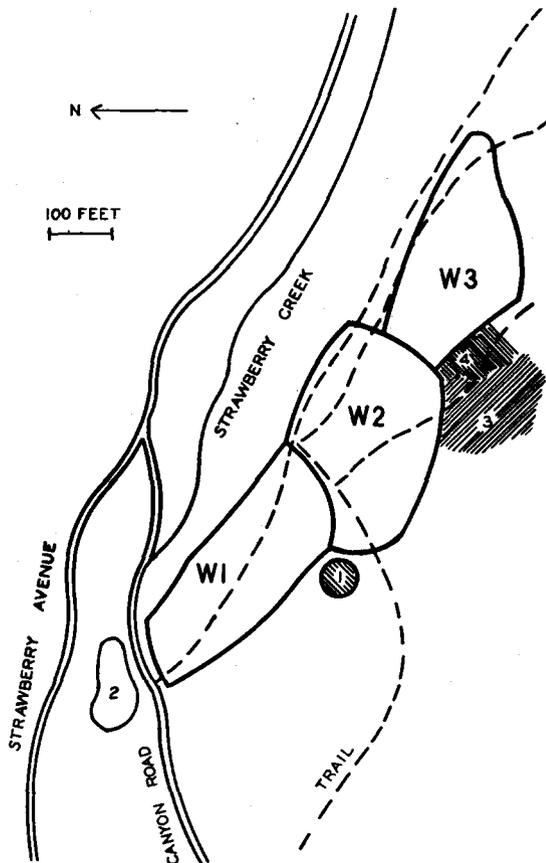


Fig. 26. Territories of three male Bewick Wrens in a small area in Strawberry Canyon, February 26, 1938. Small figures indicate the following: 1, large laurel tree; 2, Strawberry Pool; 3, redwood trees; 4, Madroño trees.

follow each other along the edge of their territories. Males would often stop foraging and hurry to their boundaries when they heard another male nearby. Males sang a great deal of their time and this singing occurred in all parts of their territories.

When I first began observations (January 16, 1938) on the lower north-facing slope of Strawberry Canyon I found no wrens, which may have been due to their customary

quietness at this time of the year. On January 20 I found a male which I called W2; on January 22, another male, W1; on February 20, a male, W3; and on March 2, a mate for W3. The territories of these wrens were approximately fifty yards wide by one hundred yards long and were arranged end to end around the side of the hill. By February 16 I had the boundaries of these territories mapped (see fig. 26); these all remained the same until March 11. On March 14, W2 was missing and his territory remained unoccupied throughout the rest of this breeding season. At the time W2 disappeared, a male, possibly W2 himself, appeared in a territory just below that which was vacated. Males on both sides of W2 had obtained mates by the time his territory was found vacant. If he merely moved to a new location, it may have been because of his failure to obtain a mate. The territory of W2 was occupied for seven weeks before it was deserted. The two pairs of wrens on either side of this area did not extend their territories into it after it was vacated, and no other wrens occupied this area in this season. This illustrates the fact that the wren population in this region is not large enough to fill the available habitat. A considerable area of what appears to be Bewick Wren habitat in Strawberry Canyon is untenanted by wrens.

In the above instances the males took up territories and the females appeared later, but it does not always happen this way. One day I found two birds that were mates that had moved in together on a territory, and Butler (1897:1117) says of the migrant Bewick Wrens in Indiana that individuals arrive about the middle of April, some birds being mated when they appear. E. I. Dyer (MS) observed a male wren about his premises nearly every day in the winter of 1933-1934, and on January 23 it appeared with a mate. It is probable that early spring is the common time of mating. Among the migratory subspecies, at least, territories cannot be preserved throughout the year. In *spilurus*, territories appear to exist in the winter. In several areas I found wrens present in the same locations for a month or more in the winter of 1939. I have seen other wrens, possibly young, in winter, which wandered beyond the possible limits of any territories. In the fall, wrens frequently show up in residential districts where they do not breed. A reason for doubting the existence of territories throughout the year is that singing of *spilurus* ceases entirely in the fall. Welter (1935:10) states that the Long-billed Marsh Wren has strict territory, but that during incubation, reactions are weaker and when the young leave the nest the territory is deserted. Parents and a brood of wrens under my observation also deserted their territory after the young left the nest.

Territorial conflicts, which in *spilurus* are no more than vocal battles, occur frequently along boundaries. On the boundary between the territories of W1 and W2 seven of these meetings took place during eleven hours of observation. When two males meet, each devotes most of his attention to singing and the uttering of harsh notes; the notes are basically of five kinds—long *bzzz* notes, short, sharp *pits*, series of rapidly repeated *pee* notes, harsh *spa* notes, and hissing *sew* notes. With the exception of the *pee* and *sew* notes, these are mostly used during territorial meetings. This is especially so in the breeding season. Singing and *pee* and *sew* notes appear to be used in the general maintenance of territory, being given frequently by males not engaged in territorial encounters. The duration of twenty meetings that I observed varied from a few minutes to a half hour. I never saw any males fight or invade a neighbor's territory. Males were generally from three to twenty feet distant from one another along their boundaries. After a few minutes of calling one wren would turn back and forage in his own territory and the other soon would follow suit. Wrens were very responsive to all the vocal notes of their own species, but I never saw a wren respond to the song of any other bird. Because the male and female are close together after mating, the differences in their call notes may prevent the male from mistaking the calls of his mate for those of another male.

There is a certain correlation of territorial boundaries with both kind and distribution of vegetation. Madroño and redwoods limited the upper boundaries of W2's territory. On the east a few conspicuous elderberry bushes and an open space likewise were limiting factors. The northern boundary was marked by a trail and also by a sudden steepness in the declivity of the hillside. On the west conspicuous oaks formed a line. The features of the habitat possibly involved in boundary limits are: man-made features (trails); topographic features (steepness); open spaces in the vegetation cover; lines or rows of trees or bushes; and certain types of dense growths wherein the wrens do not venture.

Bewick Wrens do not use posturing or conspicuous colors (they have none) as aids in the maintenance of territory as do Snow Buntings (Tinbergen, 1939) and English Robins (Lack, 1939). The lack of these aids may be the reason for the variety and harshness of the calls of these wrens. The low visibility in the habitat of the Bewick Wren may also explain this lack of posturing. The Long-billed Marsh Wren is the closest relative of the Bewick Wren for which I can find data concerning its territorial behavior. According to Welter (1935:8), males of this wren fluff out their feathers in addition to singing during territorial encounters.

Nesting sites.—Bewick Wren nests generally are placed in cavities in or within a few feet of the ground. This is partly because there usually are no nesting sites at high elevations within their habitat, which is often low brush, and also, at times of the year other than the nesting season these wrens live low down in the brush; they are in the *habit* of living near the ground. Dawson (1923:667) aptly describes the nest as "Indescribably varied in construction; in general, any available soft or pliable material to fill any available hole or cranny." Probably not just any "hole or cranny" will be selected; only those of a certain size and in the most secluded spots possible were used for the several that I have seen. E. I. Dyer (MS) placed a nest-box for wrens on top of a lath house in his garden. It remained there for two years, in which time the wrens about his premises nested in "a rock wall, a pile of boxes, [and] under a tile on the roof . . ." The third year Dyer moved the nest-box to the trunk of a Monterey pine and the wrens immediately occupied it, which indicated that the box probably was too exposed in the first situation. The wrens spend much time exploring cavities, where they seemingly are looking for nest sites and probably do not overlook any possibilities.

In Orange County, California, Dunn (1902:33) found *correctus* nesting only in ". . . crevices of rocky ledges, interstices between boulders, or in small caves." Where wood rats were common the wrens often selected a crevice too narrow for a rat to enter. Two nests of *spilurus* found by myself were in small natural cavities in the forest floor. Another was ten feet up in a rotted-out cavity in a live oak, and one was in the cavity in the top of a small stump three feet high. At the home of Mr. Dyer in Piedmont the wrens (*spilurus*) for several years nested in small bird houses suspended among trees from ten to fifteen feet above the ground.

The Bewick Wren, then, is restricted to relatively low cavities for nesting sites. The cavities are probably deep enough in most instances to hide the nest from view. One that I found extended horizontally about eighteen inches into the hillside and was six inches wide by four deep. The nest was placed at the back of the cavity.

Nests.—By far the greatest number of Bewick Wren nests are cup-shaped and open above, but according to Burns (1924:191) some have a domed form. A. B. Howell (1917:99), Taylor (1890:277) and E. I. Dyer (MS) mention one example each of a nest arched over with a side opening. Such nests are rare and may have been built thus to afford more protection. Probably an important factor is the kind of nest cavity selected. The arched-over nest of *leucophrys* found by Howell was in a dense patch

of cactus. The nest of *spilurus* found by Taylor was in a slender willow, next to the trunk. That found by Dyer was in a peculiar position among some timbers of a building. All three of these nests were not completely surrounded by walls as they usually are.



Fig. 27. Parent Bewick Wren bringing food to young in nest in hollow stump in Strawberry Canyon, June 19, 1940.

The kinds of materials used in the Bewick Wren's nests depend upon the locality; whatever is present of the right size and texture is used. A nest of *spilurus* that I found had a base of twigs of about one-eighth inch in diameter—the base being about six inches across and one inch deep. The cup was placed near the center of the base among the twigs and consisted mostly of fibers of the soap plant (*Chlorogalum pomeridianum*). The cup was about one-half inch thick and was lined with a thin layer of rabbit fur and a few soft feathers. Snake skins are sometimes found in the nests. A. H. Miller (MS) found two nests in the Los Angeles River bottom, Burbank, California, on April 7, 1923, both of which contained a piece of snake or lizard skin. One of these nests was "4' up in a 12" diam. stub near the top in a rotted out woodpecker hole." It was made of sticks, felted hair, fur and feathers, in addition to the piece of snake or lizard skin. The nests vary a great deal in size, probably because those nests placed in small cavities have little material making up the base.

Mating and nest-building activities.—Bewick Wrens commonly mate in the early spring, although some of them may have either remained mated throughout the winter or else become mated in this season. Simmons (1925:298) says that the wrens (*cryptus*) are seen in pairs "in February . . . searching for nesting sites; undecided for several weeks . . ." On April 8, Bailey (1923:55) noted a pair of wrens "exploring a crack in the underside of a live oak branch." I noticed similar exploratory tendencies in *spilurus* early in the spring. The nest-building instincts develop in unmated males as well as in mated pairs. On February 23, 1938, I saw a single male carry a stick for a few seconds. On February 26 I saw probably the same bird carry a stick for several minutes. This is the only nest-building behavior I have seen among unmated males. In this connection, Barrow (1912:670) reports that on May 5, L. J. Cole, at Grand Rapids, Michigan, saw a single bird carrying nesting materials through a small hole to a cigar box nailed to the inside of a shed. This male (it sang) built slowly until May 16, when a female appeared. A bluebird attacked them at this time and they disappeared.

Early in the season the building instincts are weak. E. I. Dyer (MS), on February 9, 1934, saw one of a pair of wrens come down from a tree with a piece of soap-root fiber. At the sight of a worm "he dropped to my hand releasing the fiber at the same time." Both sexes build the nest, although there are some statements to the contrary. These apparent exceptions probably occur because of the fact that both sexes do not always build at the same time. Wrens that I watched built but a single nest, but Simmons (1925:298) states that "*eremophilus*" sometimes commences as many as four nests a week. On March 3, 1934, E. I. Dyer (MS) saw a pair of wrens (*spilurus*) carrying feathers to one site, although later they apparently took another permanently. On April 5 he discovered that they had left the latter site and had young in a wren-house. In 1938 Dyer told me that he saw a nesting *spilurus* in five different nesting sites after building in another place had begun. Evidently the stimulus to find a nesting site exists for a considerable time. Butler (1897:1118) says that Bewick Wrens "persistently return to the same nesting place." His evidence is that the same place was occupied for three years in succession. At Mr. Dyer's home the wrens nested each year for over ten years, but it is doubtful if the same pair returned over a period as long as this. In Strawberry Canyon four nesting sites that I found were not used the following year.

On April 6, 1938, I found a pair of wrens in Strawberry Canyon engaged in building. In the morning I saw both birds foraging through the brush and moving slowly down the hillside. The male was uttering *pee* notes and was taking the lead. The female was silent. She picked up a wisp of grass in her bill, whereupon both birds flew down the hill and were silent. I failed to find them for ten minutes and then heard them up the hill. After following them a few minutes more the female disappeared. Two days later, at 6:30 a.m., nest building by this pair was proceeding rapidly. Only one bird, the female, was carrying material. The male perched, preened, and foraged in nearby bushes. The female moved up and down the hillside rapidly, taking almost exactly five minutes per trip for six trips. Her procedure was to fly a short distance from the nest and then hop along the ground searching for material. She picked up wisps of grass, shaking them as she went. After gathering two or three pieces she flew toward the nest (in a hole in the hillside) low down through the brush. This was so thick and her movements so rapid that I could hardly keep her in view. As she passed the male on her way back to the nest she always gave one or two low *sperr* notes. The male sometimes reacted to these by flying toward his mate and following her for a few feet. He always reacted by giving many *pee* notes.

At 7:15 a.m. the next morning the same behavior was observed except that the female now carried soft materials (rabbit fur). I found the nest on this morning and

as I crouched about five feet from its entrance the female returned with fur in her bill. She flew nervously from twig to twig, but was afraid to enter the nest hole with me so close. In a few minutes she and her mate left, the latter having given only a few soft *pee* notes. The female gave no calls at all. This was the last I saw of the building of this nest. The nest was much too far back in the hole in the hillside for me to see how building was done.

On April 7, 1939, I again observed a pair of wrens building. In a period of three hours, from 9:40 a.m. to 12:40 p.m., the female entered the nest five times, twice carrying nesting material. She averaged one minute in the hole per trip. The male in the same period entered the hole thirteen times, carrying nesting material seven times, food for the female (who was not there) twice, and once carrying out a leaf. He remained in the hole from ten to sixty seconds each time, with an average of twenty-two seconds per trip. The nest cavity was about ten feet high in the trunk of a live oak, and the materials being carried in were leaves, twigs, and pieces of ferns. On April 8 at the same nest, from 10:27 to 11:33 a.m., the male was working alone. In this period he entered the hole twenty-one times, carrying nothing four times, and averaging twenty-five seconds in the hole. He still was carrying leaves and twigs. On April 9 both wrens were working and were carrying in some finer materials in addition to coarse ones. They carried out as much material as they took into the nest. I could not tell whether or not they brought out the same material that they took in. This situation may have resulted from a change in the type of materials used in construction. Or, they may have been carrying out some debris in the cavity that had been there previous to their operations. On April 10 the nest was lined with a few coarse fibers. On April 11 there were a few soft feathers in the lining. By April 17 the nest was finished. This nest was constructed in eleven days. Nests which are started earlier in the season may take much longer. One pair which began building in February ceased work during some cold rainy days so that over a month elapsed before their nest was finished.

The behavior of the wrens during nesting is admirably suited for keeping the nest concealed. The thick brush of the habitat, the quietness of the builders and the concealed position of the nest all make the finding of one a feat, and it is for this reason that my observations are based on so few nests. This secretive behavior continues throughout the incubation period, but when young are present, the parents make themselves much more conspicuous.

Burns (1921:91) gives the length of the nesting cycle as 52 to 53 days. This is probably a little short, the variable factors being the time of building the nest and the laying of the eggs. I have seen a nest built in 10 days, and a set of eggs laid in 6 days. Butler (1897:1117) gives the incubation period of nestling life as 14 days. This totals 44 days, but does not include the extra two weeks or so that the parents remain with the young, which would bring it to about 58 days. This figure might be much higher in some instances.

Behavior during the laying period.—On April 9, 1938, I found a female wren (F1) in Strawberry Canyon engaged in lining a nest with fur and feathers. I interrupted this work by being at the nest when she returned with material. For the next three days I failed to find her and heard only the male in the vicinity of the nest giving *pee* notes. I failed to visit the nest for several days, thinking the female had deserted. On April 17, at 8:00 a.m., there were two eggs in the nest. At 6:00 p.m. that evening there were no more and no birds were seen. The next morning at 7:00 a.m. there were three eggs and no birds were found. At 8:00 p.m. on this day I visited the nest and looked in the hole, using a flashlight. One bird was sitting on the eggs. This indicates that some incubating may take place at night before all the eggs are laid. This wren was evidently nervous and fluttered out into the brush. There were still three eggs present.

The next morning (April 19) at 6:00 a.m. the female was on the nest and I heard the male singing nearby. The bird on the nest flew off immediately as I approached, and I found four eggs. The last one, then, was laid before 6:00 a.m. in the morning and the others probably at about the same time, one every day. The next day (April 20) at 8:00 a.m. there were five eggs, and no wrens were found near the nest.

About 9:00 a.m. both wrens came foraging up through the brush about fifty feet below the nest. One bird gave *pee* and the other *sweet* notes. The *pee*-calling bird, evidently the male, fed the other seven times in six minutes, while both birds were in among the smaller branches of a small live oak. The *pee*-calling bird then flew off thirty feet and sang. During feeding the female perched and foraged slowly and kept up a continuous series of hoarse *sweet* notes, which resembled begging notes of some other birds. The male foraged silently within a few feet of his mate and would soon find some small white article of food, which he sometimes shook and pecked several times. Then he would fly and hop with it to the female, who would take it from the tip of his bill with considerable increase in intensity and tempo and a rise in pitch of her *sweet* notes. After feeding several times both birds became silent and wandered off through the brush, the female lagging behind her mate. I observed this same behavior in a pair of wrens in Piedmont at somewhere near the same stage of laying. Another pair of wrens (in Strawberry Canyon), whose nest I had not found, showed similar behavior except that I did not see the feeding act, although I observed the birds for short periods on several days. The female gave the *sweet* notes as she foraged and at times the male flew toward her and may have fed her, but the brush was too thick for this to be seen. On April 19, 1939, I found another laying female. The first egg was laid on April 19. On the 20th the female entered the nest at 5:45 a.m. and the second egg was laid before 6:15 a.m. On the 21st the female entered the nest hole at 5:50 a.m. and the third egg was laid before 6:21 a.m. On the 22nd the female entered at 5:46 a.m. and left before 6:15 a.m., leaving a fourth egg in the nest. On the 23rd the female laid the fifth egg between 5:42 and 6:05 a.m. The last egg was laid the next day. In another nest the female also laid early in the morning, six eggs being laid in seven days. No egg was found the fourth day.

Incubation.—On the morning of April 21, 1939, the set of eggs of the wren F1 was completed. Previous to this, steady incubation had not begun. The morning of the day before, April 20, both birds were observed for one-half hour foraging together. This morning, April 21, a bird flew off the nest as I approached, and I found the eggs warm. The next day, the second after completion of the set, I was at the nest for one-half hour in the afternoon without finding any wrens. On the third day, the 23rd, as I approached the nest in the morning, a wren flew out and disappeared quietly into the brush. A wren was singing fifty feet or so down the hillside, so that the bird on the nest was probably the female. I sat down in plain view about twelve feet from the nest. In a few minutes she returned (another wren still singing below) and flew from twig to twig, foraged, and preened on the opposite side of the nest from me, but was afraid to enter. After fifteen minutes of this, she flew away into the brush again. I went down the hill and hid. Eight minutes later she appeared, gave a *sper* note, perched on a bush seven feet from the nest entrance, and flew into the hole in one flight.

The next morning, the 25th, there were no birds at the nest as I passed by, but the eggs were warm. About noon, April 26, I was hidden at the nest, when the female flew out and down the hill, giving two loud nasal *spa* notes as she went. The male was singing below. Thirteen minutes later a wren, evidently the male, appeared at the nest with food in his bill. He did not enter the nest in a single flight but made several stops, finally hopping into the hole. The female, of course, was not on the nest. The male

came out of the hole in a few seconds, still carrying the food. He flew to a nearby bush and gave several light *ku-wee* calls, the only of this kind I had ever heard from him. He then left and about five minutes later the female returned, gave two sharp *spa* notes, pecked a few insects off a twig, and flew directly into the nest hole, where she remained. I heard the other bird singing from down the hill. The nest had been uncovered for twenty-four minutes. I left and returned an hour later. Again I saw the female leave the nest for a period of about twenty minutes.

The next morning at 6:50 a.m., when I arrived at the nest, the female was in it, and the male was singing from down the hill. In fifteen minutes he appeared with food in his bill, flew to the nest hole, hopped in, came out in a few seconds without the food, and departed down the hill giving a few *pee* notes as he went. Ten minutes later the female flew directly out of the nest hole and down the hill. Seven minutes later she appeared and flew directly into the hole. I heard the male singing from down the hill.

These actions seem to warrant the conclusion that the female does all the incubation, at least in the early stages. She leaves the nest for short periods to forage and to be fed by the male. The male may also feed her at the nest. Unfortunately, my observations have always been interrupted at this point in the season. I have no data on the remainder of the period of incubation.

SUMMARY

The habitats of several subspecies of the Bewick Wren (*Thryomanes bewickii*) in the western United States are described. Animal and plant associates differ greatly throughout the range of the species. The wrens most commonly occur in thick, mixed brush associations. They depend upon the plants of their habitat for invertebrate food, shelter, singing perches and, to a large extent, nesting sites.

The relations of Bewick Wrens to other vertebrate animals of their habitat are mostly neutral. They probably are preyed upon to a slight extent by bird-hawks and owls. Where the wrens nest about buildings in suburban areas, they sometimes have conflicts over nesting sites with House Wrens, titmice, and other small birds. Under these circumstances the Bewick Wrens usually retreat.

Some individuals have been found roosting in cavities. Bathing in both dust and water occurs.

Foraging takes place on the ground and on the limbs and foliage of bushes and trees. In foraging, the birds use their bill for picking insects off leaves and branches, for flicking over leaves on the ground and, less commonly, for digging insects from cracks in bark. They do not scratch for food. They forage rapidly, and this activity takes up the larger part of their time. The method of foraging varies in accordance with the size and distribution of the plants in their habitat. In early spring the male of a mated pair forages high up in brush and trees, and his mate forages low down in brush and weeds.

Only the males sing. Males, at least of the race *spilurus*, do not sing throughout the year; they cease for a month or two in late autumn. Most of the singing occurs in early spring before nesting. A large number of songs were recorded in syllable form, and the composition of the songs was analyzed. The separate notes vary greatly in pitch, quality and length. A trill usually is present in the song. Each song may have from two to seven distinct parts, and may last from one to three seconds. The songs of the wrens in Arizona, Texas, and northeastern Mexico differ noticeably from those of wrens along the coast of California. The songs of *spilurus* and *marinensis* are considerably more complex and varied than those of *eremophilus*, *cryptus*, *percnus* and *murinus*. At one place a small local variation was noticed in the songs of *percnus*. Songs are given from

one to eighteen per minute; the wrens sing from perches or when foraging. Singing appears to help in maintaining territories.

Both male and female wrens have a variety of call notes; most of these are different in the two sexes. The male has mildly harsh notes that probably are used for making his whereabouts known to his mate and to rival males. He has several kinds of harsh notes that are used in territorial encounters. One special kind of note develops in the spring and is heard in this season only. The female gives few notes; such as they are, these seem to enable the male to keep near her. She has a special note that she gives to call the male for copulation. Also, "begging" notes seem to stimulate the male to feed her.

Bewick Wrens are found throughout the year either singly or in pairs. Most commonly the males appear on territories in the early spring and are mated shortly afterward. Males of *T. b. spilurus* show territorial reactions toward other males at any time of the year, although much more frequently in the spring. Females show no such reactions toward males, at least, and probably have no part in the defense of territory. Males and mated pairs have territories in the spring and may possibly have them in the winter. The territories of several wrens were mapped; they proved to be about fifty yards wide by one hundred yards long.

The territorial conflicts of *spilurus* occur frequently along boundary lines, and consist of vocal battles. The wrens rely upon harsh vocal notes and singing for the defense of their territories. Certain features of the vegetation and topography of the habitat are correlated with the boundaries of territories.

Bewick Wrens' nests are placed in secluded cavities in or near the ground. Each nest has a well defined cup of soft materials and usually has a base of small twigs. Most nests are open above; rarely they are arched over the top.

The male may develop slight nest-building instincts before he is mated, but in most instances nests are not built until the female is present. Both mates may build the nest, although the male works sporadically, and the female often builds alone. Usually only one nest is built, although some authors state that several are sometimes begun.

The nesting season in *spilurus* may begin in late February and may extend to the middle of June. The total nesting cycle is about 58 days in length. The nest may be built in 10 days and the eggs may be laid in 6 days. The periods of incubation and nestling life are about 14 days each. The parents probably care for the young for about two weeks after the latter leave the nest.

Three females were observed to lay their eggs early in the morning; each female laid at about the same time each day. Two sets of eggs usually are laid, with from three to eight eggs per set; six is the most common number. Only the early stages of incubation were observed; the female carried on this activity. At this time the female leaves the nest for a few minutes at a time to forage, and in addition is fed by the male.

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