

HELPERS AT THE NEST.

BY ALEXANDER F. SKUTCH.

Plate XII.

IN THE great majority of bird species whose nesting has been carefully studied, each pair build their nest and rear their offspring without help from others of their kind. This, indeed, is almost a corollary of the theory of Territory, which teaches that each breeding pair occupy a definite nesting area from which they vigorously expel other individuals of their own species. While the concept of territory in bird life has done much to stimulate and give definite direction to bird study, as so often happens in the first enthusiasm of working out the details suggested by a fertile scientific theory, it has resulted in a tendency to neglect the opposite side of the story. There are many species in which the mated pair are not so exclusive in their territory, and as a result of this, coupled with other peculiar circumstances, receive more or less assistance in the duties of the nest. The number of recorded cases of helpers at the nest which have come to my notice is relatively small, but this appears to be, at least in part, because their discovery requires a more concentrated attention than is commonly devoted to studies of nesting birds. The relatively few species which are known to have helpers at the nest are scattered among the families and orders of birds in a manner which suggests that the custom of giving and receiving aid in the rearing of a family is not restricted to a few unusual groups, but is of widespread if sporadic occurrence.

It is not my intention at the present time to attempt an exhaustive survey of the cases of birds helping at others' nests which have been recorded in the literature, but rather to relate briefly certain instances which I have personally observed. But I am not aware that anyone has classified the various degrees of outside assistance which the mated pair may receive in their breeding operations, and before proceeding to particular cases I should like to attempt such a classification, the better to understand where my own examples fall.

Assistants may be classified as: I, Juvenile Helpers; II, Unmated Helpers; III, Mutual Helpers. These groups, in the order named, represent an increasing degree of sociability during the breeding season.

Juvenile Helpers. In some species the young of the first brood are still unable to shift for themselves and are dependent upon the care of their father while the mother incubates her second set of eggs. Sometimes, in species of which the male takes no part in the duties of the nest, the mother may feed her offspring of the first brood during the intervals of warming

her second set of eggs. In the mountains of Guatemala I once watched a female White-eared Hummingbird (*Hylocharis leucotis*) who fed her full-fledged offspring, himself already able to poise before the blossoms, during her recesses from her second nest of the season, in which incubation was in progress. Sometimes, when the young of the first brood can forage for themselves before preparations for the season's second nesting have been completed, the adults prefer to be alone during this period. In the valley of the Rio Motagua I watched a pair of Lichtenstein's Orioles (*Icterus gularis*) drive their full-fledged children of the first brood away from the new nest which the female was engaged in building. In such cases as this it is not likely that the young birds will assist in the care of the later brood. But other species tolerate the presence of their young, after they have become self-supporting, in the vicinity of a later nest. They are more sociable than the Lichtenstein's Orioles, and are often rewarded by receiving the youngsters' aid in the care of subsequent broods of the same season.

Lord Grey¹ gives an attractive picture of the family life of the British Moorhen, a close relative of the Florida Gallinule of America. A family came to enjoy the bread crumbs which he threw to them at Fallodon. The parents picked up the crumbs and passed them to their offspring of the first brood, born in May, and these in turn placed them in the bills of their tiny, downy younger brothers and sisters, hatched in July. There seems to have been more formality than intelligent coöperation in the actions of these birds, but at least the desire to help was there. Those who have read Mills'² 'Love Song of Little Blue' may recall that the young Mountain Bluebirds, raised about his cabin in the Rockies, helped the parents satisfy the hunger of their younger brothers and sisters of the second brood. Young Western Bluebirds,³ and Barn Swallows⁴ recently from the nest, have been seen to aid their parents in the care of later broods during the same season. In Honduras I watched a young Groove-billed Ani (*Crotophaga sulcirostris*), slightly over two months old, take a part almost equal to that of his parents in feeding and protecting the latter's younger family. The records of juvenile helpers which I have come upon are not numerous, but from the scattered position of these species among the families of birds, I suspect that the habit is far from uncommon.

Unmated Helpers. Juvenile helpers are of course unmated, but they form a very distinct and easily recognized class, and I prefer to limit the term "Unmated Helpers" to assistants born during the previous nesting season. They may be young birds, outwardly mature but sexually still immature; or sexually mature individuals who, because of the excess of one sex, or from

¹ Viscount Grey of Fallodon, *The Charm of Birds*. 1927.

² Mills, Enos A., *Bird Memories of the Rockies*. 1931.

³ Finley, W. L., *American Birds*. 1907.

⁴ Forbush, E. H., *Birds of Massachusetts III*. 1929.



LEFT: NEST OF BLACK-EARED BUSH-TIT WITH FOUR MALE NESTLINGS POSED ON OUTSIDE (THEY DO NOT NATURALLY ASSUME THIS POSITION). MAY 23, 1933.
RIGHT: NEST OF BANDED CACTUS WREN. JUNE 14, 1933. BOTH AT TECAPAN GUATEMALA.

other causes, can not find proper mates; or individuals old enough to breed who from accident or disease are sterile. Since in individual cases it is not always possible to decide why a particular bird is unmated during the breeding season, it seems best to include in this class all helpers of approximately a year or more of age. In three species which I have watched, the presence of unmated helpers at the nest seems to be the rule.

Among the Brown Jays (*Psilorhynchus mexicanus*) the helpers are largely if not entirely yearling birds, still presumably sexually immature. The status of the helpers among the Banded Cactus Wrens (*Heleodytes zonatus*) is difficult to determine; they are at least a year old, and in appearance indistinguishable from the breeding birds. Among the Black-eared Bush-Tits (*Psaltriparus melanotis*) there is, in certain regions at least, a great excess of males who, not being able to secure mates, help care for the nestlings of other birds. A numerical excess of females seems more likely to give rise to polygamy than to produce helpers at the nests of other pairs. So among Red-winged Blackbirds and Meadowlarks, which normally appear to be monogamous, the occasional presence of an excess of females may result in polygamy. Among species in which the females are normally greatly in the majority, as with Oropéndolas (*Gymnostinops montezuma* and *Zarhynchus wagleri*) and Great-tailed Grackles (*Cassidix mexicanus mexicanus*), polygamy seems to be the rule.

Mutual Helpers. Mutual helpers are breeding birds which coöperate and assist each other in the care of their respective families. Among them we find all degrees of coöperation from casual assistance in repelling a common enemy to the complete sharing of all the duties of the nest. Probably all birds which nest in colonies unite to drive away a Hawk or any other undesirable intruder. Indeed, such service in a common cause is not restricted to members of the same species, for birds of different species will often combine forces in repelling an unwelcome stranger from the neighborhood of their nests. With Oropéndolas and Great-tailed Grackles the situation is a little more advanced, for the males of the colony, who do nothing to help the females directly at their nests, constitute a standing guard, ever ready to give the alarm on the event of danger, and to drive undesirable visitors from the colony. In this last duty the *clarineros*, as the male Grackles are called, are far more active and courageous than the larger male Montezuma Oropéndolas.

Birds which build apartment nests, such as the Green Parrakeet (*Bolborhynchus monachus*) of Argentina and the Sociable Weaver-bird (*Philetærus socialis*) of Africa, show a still higher degree of sociability and group coöperation during the breeding season. Among other species a number of adults take a common interest in the young. The Emperor Penguins (*Aptenodytes forsteri*) undertake in common the task of keeping warm the downy young,

hatched during the tremendous cold of the Antarctic winter, and are said to be so eager for the possession of the little birds that the members of a colony engage in desperate struggles to obtain them, and in these engagements the chicks are frequently injured or even killed by their would-be benefactors. The Adelie Penguins (*Pygoscelis adeliae*) incubate their eggs and attend their nestlings in the normal manner (that is, by pairs); but as the youngsters grow older and require more food, satisfying their needs becomes a difficult problem, for the nesting area is often at a considerable distance from the sea, whence comes all food in the inhospitable Antarctic, and the parents must be gone long hours while they laboriously walk back and forth from the water's edge. In order to release more of their time for the important foraging expeditions, the young, when they can leave the nest, are led to nurseries where a few parents can stand guard over the children of many families, while the rest busy themselves in filling the many hungry mouths. Unmated male Adelie Penguins are an actual menace to the youngsters, and must be driven away from the nurseries by the parents.¹ In the social problem of how to keep idle, unmated birds out of mischief, passerine species like the Brown Jay and the Bush-tit have made great advances over the primitive Penguins.

Complete coöperation or communism, involving all stages of the nesting cycle from the building of the nest to the care of the young, is best exemplified by the Anis. The Groove-billed Anis (*Crotophaga sulcirostris*), which I have watched in Honduras and Guatemala, actually pair at the beginning of the breeding season. The pair may build their own nest and rear their own offspring in the manner of most birds, or two or three pairs may join in the construction of a common nest, in which the eggs, generally four to each female, are laid side by side. Then all the parents, both male and female, take turns in warming the eggs, and later all join in feeding the nestlings. Since I hope later to present a fuller account of the home life of these interesting birds, I shall not at present take space for fuller details.

Helpers at the nest, it may be noted in passing, are not always of the same species as the owners of the nest, and are not always wanted. Forbush records the case of a male Bluebird who busied himself feeding the nestlings of a pair of House Wrens, much to the distress of the latter, until his mate hatched out his own offspring. He also tells of a male Scarlet Tanager who helped feed a nestful of young Chipping Sparrows while his mate incubated. Robins, both the European and the American species, are often ready to place a morsel into the open mouth of any helpless young bird they encounter, not necessarily of their own kind.

With this hasty glance over the field by way of introduction, we may proceed to the more particular object of the present paper, the discussion

¹ Levick, G. Murray, *Antarctic Penguins*, London, 1914.

of certain interesting cases of coöperation which I have had the good fortune to observe in Central America.

THE CENTRAL AMERICAN BROWN JAY

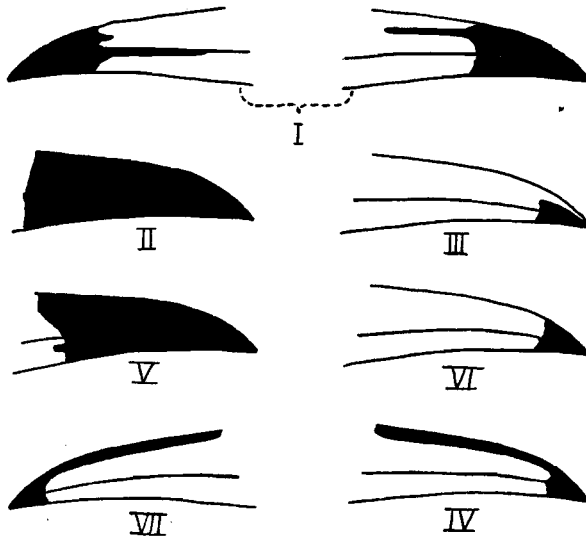
Psilorhynchus mexicanus cyanogenys Sharpe.

Two years ago I lived on a banana plantation among the foothills of the Sierra de Merendón, on border territory then claimed by both Guatemala and Honduras, which formed a sort of independent buffer province between the two republics, but has since been awarded to the former. Among the most conspicuous and most interesting of my bird neighbors were the Brown Jays. The family of Jays belongs primarily to cooler regions and is poorly represented in the lowland Tropics, but these dwellers in the hot lands had lost none of the noisy, restless habits which characterize their relatives everywhere. The way they scolded when, in walking through the banana groves, I interrupted their feasts upon the rich nectar of the white banana flowers, left no doubt in my mind that they were near cousins of the northern Blue Jay, although their decidedly larger size and brown, white-vested dress, seemed to belie their blood relationship. Their harsh cries were among the very first notes of purely diurnal birds to greet my ears in the dim light of early dawn; at midday, when all nature drowsed under the rays of a vertical sun, and most other birds were in silent seclusion, they seemed to go out of their way to protest my passage through their haunts. Their lively flocks foraged in all sorts of open and semi-open country; among the banana plantations; along the lagoons; in the bushy pastures of the foothills, where scattered trees remained; in the inextricably entangled second growth which soon takes possession of abandoned clearings of all kinds; but I never met with them in heavy forest.

The Brown Jays possessed one peculiarity which convinced me would make them particularly interesting to watch. Their bills, feet and bare rings surrounding the eyes were not all of the same color, as is the case with most birds, but were so variously marked with yellow and black that it seemed that I should be able to recognize individuals—and the difficulty of recognizing individuals, among other species, is one of the chief handicaps which face the serious bird-watcher. I devoted most attention to the bills, which proved to afford the best recognition marks. Some of the Jays, at the beginning of the breeding season, had bills which were entirely bright yellow; the bills of others, perhaps the majority, were tipped or streaked with black, but hardly two were pied in exactly the same manner. Still other bills were uniformly black. Later I learned that the nestlings' bills, feet and orbital rings are uniformly yellow, and that they turn black with age in an irregular fashion, apparently taking two years or more to become entirely

black. Most of the pied-bills which I found at the beginning of the nesting season were probably yearling birds. On breeding birds the parts in question are often entirely black, but the only generalization which it is possible to make is that with breeding individuals these parts *average* far blacker than with the non-breeding birds who help them.

The Brown Jays placed their nests in the crown of a banana plant, just above the ripening bunch of fruit, or else in trees standing in the open or amid the second growth. The former I could reach by lashing together bamboo poles to form a ladder sixteen or eighteen feet long, the latter were



BILLS OF BROWN JAYS

White areas in the cut were yellow on the bills. I, shows both sides of the bill of the female; an unusual case of variation. II, is the male, evidently her mate. III-VII are bills of the five helpers; IV and VII, so similar that they were taken for the same bird until seen together. (From field sketches, Alsacia Plantation, near Los Amates, Dept. of Izabal, Guatemala, June, 1932).

usually so high, and near the ends of such long, slender branches, that prudence suggested they be left alone. One, in a willow tree beside a lagoon, was against the trunk and could be reached by a hot climb. The nest is a bulky pile of coarse sticks, many of them thorny, which forms the foundation for a shallow cup, neatly constructed of fibrous roots, where repose usually three blue-gray eggs, thickly covered with fine brown speckles. Nesting began in February, but the height of the breeding season was from March to May, while the last nestlings took wing in June.

Male and female share in the construction of the nest. Early in April I watched a pair building a nest high up in a wild fig tree which stood in a

hedgerow between two banana plantations. Although both sexes took part in the task, they were unable to coöperate closely, and one, after adding a stick or a root, would sit in the unfinished structure for several minutes and call in a loud, complaining voice, as though berating the negligent mate. As is often the case with mated birds, the bills of both were entirely black and I could not distinguish them, but from the behavior of other pairs, of which one member had some yellow on the bill, that I watched later, I strongly suspect that the noisier of the two was the female. When a pied-billed bird, probably a yearling, alighted on the nest and seemed interested in it, the black-bills did not take offense and drive it away, as other kinds of birds resent the presence of any intruder in the vicinity of their nests. This fact alone promised to have interesting consequences. Later, on a single occasion, I saw a young pied-bill bring a stick to a nest which a mated pair were building.

As the season advanced, I discovered more of the domestic economy of the Jays. Like the female American Goldfinch, the female Brown Jay alone warms the eggs, while the male at intervals brings her food. Like the Goldfinch, too, she calls when she is hungry, but in place of the former's melodious little tinkle she utters a loud, far-carrying, unmusical *pee-ah*, which seems a complaint at being neglected. Once I had learned to recognize this hunger call, it led me to nests a quarter of a mile away, and I had no lack of Brown Jay families to watch. After sitting continuously for an hour, or sometimes as many as four, the female flies off when she has taken the food her mate has brought her, and he remains standing like a sentinel upon the rim of the nest, or on an adjacent branch, guarding the eggs but almost never warming them. Here he awaits until, after a recess of ten or fifteen minutes, during which she has managed to gulp down more food than he has brought her all morning, she returns to settle once more upon her treasures.

One morning in April, while walking along a sharp ridge among the foothills, I discovered a Jay's nest in the top of a small tree projecting above the vine-smothered second growth which covered the steep slope below me. The female was sitting, and even while I paused looking down at her a bird whose bright yellow bill was only tipped with black flew up, protested my presence rather mildly for a Brown Jay, then perched on the rim of the nest and gave her a morsel of food. A few minutes later the yellow-bill brought another offering to the bird on the nest. Still, I doubted greatly whether a Jay with so little black on his bill could be mated, and resolved to await further developments. I seated myself in a grassy clearing near the summit of the slope, whence I could look down over the tops of the vine-entangled bushes, and although I was in full sight, only fifty feet away, my presence seemed to make little difference in the activities of the birds. They have

not yet had so many sad experiences with man as have their kin in more densely settled countries.

I had waited nearly an hour before a black-billed Jay appeared. Although there was nothing visible in his bill, his throat was outswollen with the food he carried to the nest. After delivering it he went away, but before long he returned with another offering. At his approach this time the female cried out, rose from the nest to greet him, took the proffered morsel and flew off with it, leaving him standing on a twig beside the nest. Here he remained on guard until the female silently returned, after a quarter of an hour's absence, when he flew silently away. Then I felt convinced that this was the mate of the sitting bird, for the yellow-bill never remained on guard. Later it developed that at least two young birds were bringing food to this female, as much, if not more, than her mate.

After the eggs hatched the parents and helpers left the tender nestlings unguarded while they foraged, with the result that some enemy found them in their exposed position and made an end of them. Then the parents tore apart the ill-fated nest and used its materials in the construction of another a few hundred feet away. In due course the eggs were laid and hatched, and the interesting work of attending the three nestlings began. I erected an umbrella blind for concealment, at a point on the precipitous hillside where I was on a level with the nest in the tree down the slope, and spent hours in its shelter, making a sketch of the bill of every bird who brought food to the nestlings. The father's bill had only a small patch of yellow at the base, the mother's bill was more than half yellow, the bills of the helpers varied from yellow slightly tipped with black to black with a little yellow at the base. When I had spent nearly twelve hours in the blind, and thought I could recognize all six of the birds whose bills I had sketched, no matter which side was turned toward me, two Jays with almost identical markings brought food to the nest, then remained standing side by side on its rim, and I knew there were seven (see figs. p. 262).

The parents and their five helpers continued to attend the young at least until, at the age of twenty-three or twenty-four days, they flew from the nest. While the nestlings were still small and unfeathered they were guarded almost constantly, for each of the attendants, upon delivering the food it had brought, remained standing upon the rim of the nest until another arrived to take its place. The mother alone brooded her offspring, but sometimes, when the sun shone directly into the nest, the helpers stood over it in such a fashion as to shield its tender occupants. At times, when a bird flew up with a bill-ful of food, the Jay standing guard would ask for it in a pleading voice, or possibly even try forcibly to snatch it from the new arrival, and if successful in obtaining a portion of the bounty would pass it to one of the little birds in the nest. This was very much like the behavior

of Lord Grey's Moorhens, except that sometimes a parent intermediated between a helper and the nestlings, sometimes a helper took food from a parent and put it in the gaping mouth of a nestling. Rarely a bird abused the privilege of delivering food another had brought, and carried it off for his personal consumption. The helper who most often did this was one of the most faithful attendants, so I felt inclined to forgive him his misconduct. Once, too, he saved one of the nestlings a choking by flying off in this manner with a particle plainly too large, which another bird had brought.

At every one of the five Brown Jay's nests that I watched, I found at least one helper. The nest in the willow tree had three; two aided the parents at a nest in a West Indian birch, growing among the giant canes on a stony flood plain of the Rio Morjá. At the willow tree nest one of the helpers was far more zealous than the parents in defending the young. When I climbed up to look in at them, this pied-bill ventured within a yard of my head, calling excitedly, and finally, lacking the courage to administer the punishment I seemed to deserve, alighted on one of the huge leaves of a nearby banana plant and ripped it into shreds as a substitute. These helpers seem in most cases to be yearling birds who will not have nests of their own until they are two years old. Often, no doubt, they are last year's children of the mated pair in whose duties they assist, but this is not always the case, especially where there are five helpers, for Brown Jays as a rule raise no more than three fledglings each year.

THE BLACK-EARED BUSH-TIT.

Psaltriparus melanotis melanotis (Hartlaub).

The following nesting season found me in the high mountains of Guatemala, only two hundred miles distant from the plantation where I had watched the Jays, a trifle farther to the south, but climatically and biologically in another zone. Here, between eight and nine thousand feet above the sea, where the dawn which follows a clear night from November to April reveals the fields white with frost, the forests are of oaks, pine and alder, the latter not a bush, as in the north, but a tall tree. Here grow violets, buttercups, and the same self-heal we know at home, but as proof that we are well within the Tropics there are begonias, fuchsias which form small trees, and epiphytic orchids which burden the branches of the oak trees. The birds are in part such as one might expect to find among oaks and pines: Bluebirds, Whip-poor-wills, Flickers, Hairy Woodpeckers, Towhees and Blue Jays, living on intimate terms with such distinctly tropical forms as Woodhewers, Trogons, Toucans and Motmots.

There is one bird which seems to belong among oaks and pines for which you may search in vain—no Chickadees live in Guatemala. Their place is

occupied by a close relation, the Black-eared Bush-Tit, a tiny gray birdling who, instead of the black crown and throat of the Chickadee, wears his black patches covering the sides of the head. His mate is marked by much smaller areas of black which are confined to her ears, while her cheeks are gray. The male's eyes are black, the female's yellow. During most of the year these lively little birds travel through the more open woods and bushy pastures in flocks of from a dozen to two dozen, maintaining a constant, low, lisping conversation, and exhibiting all of the agility of a Chickadee in clinging to the tips of the twigs in every conceivable position, while they pluck from the foliage the small insects upon which they subsist. It is noteworthy that in these flocks the black-faced males far outnumber the gray-cheeked females, perhaps by four or six to one. In one flock which foraged in the garden under conditions very favorable for observation, I counted eleven males and only one female.

In March, while the nights were still chill and frosty, I watched a pair of the Bush-tits building their cozy nest. The site they had chosen was in the top of a thorny bush (*Solanum millense*) just beneath the large purple flowers which clustered at the ends of its branches, high on a bushy mountain-side, where from my place of concealment up the slope I could look out across the high plateau of Chimaltenango, brown and sere after the long dry season, to the three great volcanic cones rising in the east—towering Acatenango, its sister Fuego with a thin wisp of vapor rising from its barren summit, and the perfect cone of Agua.

The nest was a pear-shaped pouch, suspended by its upper end from the twigs, and fashioned of gray foliaceous lichens neatly joined together with cobweb. The top of the pouch was hooded over, leaving only a small circular aperture facing the side, through which the birds were industriously carrying in for the lining bits of such soft and downy material as they could find—tufts of spider cocoons, of the woolly covering of the leaves of the bushes among which the nest was hung, and other kindred substances. Male and female took equal shares in hunting out the down and bringing it to the nest, but the female was far more careful than her mate in arranging this material and in shaping the structure. Their work progressed with much fine twittering, and it was interesting to find that the male was by far the more hesitant in approaching the nest while I stood in plain sight. At a second nest, however, the situation was reversed, and the female was considerably more timid than her mate.

This and the other nests I afterwards found each contained in due time four tiny white eggs, no larger than those of the average Hummingbird. I never dared try to remove them for inspection, but by carefully bending back the hooded top and peering down into the interior with one eye, I could just manage to count them as they lay on their downy bed at the

bottom of the pouch. Even before the eggs were laid, male and female slept together in the nest. During the period of incubation, the pair slept together in the nest each night, a habit which, so far as I know, is shared only by the Blue-throated Motmots (*Aspatha gularis*) who nested in the banks along the roads. In the morning, long after the Thrushes had sung their dawn chorus, the Jays had begun to squawk, and all early birds were abroad, the male emerged from his warm shelter. After snatching a bit of breakfast he returned and called, whereupon his mate came out and he replaced her on the eggs. As the sun dispelled the nocturnal chill, they became most impatient sitters, changing about more frequently than any other birds I have ever watched. Often each remained on the eggs only three or four minutes at a stretch; ten minutes was a long session in the nest while the air was warm. If the bird covering the eggs heard others of its kind chattering close at hand, it answered in fine sibilant twitters from the nest. Often the eggs were neglected while both of the pair sought more down to add to the lining of the pouch, for like the Rose-throated Becard (*Platyparis aglaiae*), the Rufous-breasted Spinetail (*Synallaxis erythrothorax*), and other birds which build very elaborate nests, they continued actively to bring material to it until the eggs hatched.

At one nest, situated in a bushy clearing in the woods, I found that two males were flying into the entrance with small tufts of down in their bills. There was a difference between the two, not in appearance, in which they were indistinguishable, but in behavior. One was careful in tucking into the fabric the bits of down which he brought, while the other often fastened them so carelessly that they were brushed out by the passage of the birds through the entrance. So far as I could determine, only one male, the more careful builder, remained to warm the eggs, and only one slept in the nest with the female. The latter was her mate, the other an unmated helper who, unable to find a partner because of the surplus of his own sex, devoted his time to assisting in the domestic duties of the owners of the nest.

Once the young hatched, after fifteen or sixteen days of incubation, their demands for food left no time for making further improvements to the nest, which had already acquired a soft and ample lining, and the helper joined the parents in bringing minute insects and green larvae to the nestlings. Now he was allowed to sleep in the nest, a privilege which was no mean compensation for his labors in its behalf, for in the thin air a mile and a half above the sea the nights are always chilly. Later at least two more bachelors joined in the care of the four nestlings, who now, with their parents and three male helpers, had five attendants to satisfy their wants. Possibly there were more, for unlike the Brown Jays one male Bush-Tit appears, to human eyes, exactly like another, and I tried in vain to make them acquire distinguishing marks by rubbing against the red paint which I smeared on a

twiglet fastened transversely across the entrance of the nest. Had they fed the nestlings no more frequently than the Brown Jays, I might never have suspected their number, but they brought their offerings with such frequency that I sometimes had all four of the males in sight at one time, and made quite certain that I did not count the same individual twice. After a few days another of the helpers began to sleep in the nest, which then sheltered nightly the parents, two helpers and four nestlings—eight in all.

Each of the other two nests I watched had a single male helper, who fed the nestlings and slept with them and their parents every night. One of these helpers took occasional turns in brooding the nestlings. Although I found only males acting as helpers, once I saw a female take an interest in a nest which was not her own. One morning when I was watching from my blind a nest in which incubation was in progress, I was surprised to see a second female accompany the mother of the nest as she returned from a recess. The stranger followed into the nest, but a minute later climbed up to arrange the down in the top, then emerged and perched in the bush close beside it. Soon the male, returning with a tuft of down in his bill, discovered her and drove her away, but she circled around and, after the departure of the aggressive master of the nest, rejoined the mistress inside. A minute afterwards both females emerged and flew away. When the strange female returned later in the morning, the male again pursued and drove her from the bush, continuing the chase among the branches of a neighboring tree, but the persistent stranger returned a third time despite her two rebuffs. Yet after the eggs hatched she did not appear to assist the parents and their male helper in the care of the nestlings. I do not know why the female stranger was not engaged in the duties of her own nest at the time—certainly not because of the scarcity of potential husbands. Possibly she herself was barren and, unable to raise a brood of her own, might have contributed to the care of the others' nestlings had she been given a more courteous reception.

In the three nests over which I kept watch, all twelve of the fledglings, once they were feathered, turned out to be males, and exactly resembled their fathers. No wonder they would have difficulty in finding mates next year! When the young birds have left the nest, at the age of seventeen to nineteen days, neither they nor their parents return to sleep in it. The downy pouch is an admirable protection against the cold nights of the dry season when the Bush-Tits nest, but it takes up water like a sponge and would make a poor dormitory during the wet season, which begins about the time the fledglings take wing; for they are raised in the brief interval of favorable weather, a scant six or seven weeks, which intervenes between the last frost and the beginning of the rains. From May or early June onward the Bush-tits retire to sleep in the tree tops, with naught but the dripping foliage to shelter their vigorous little bodies from the cold mountain rains.

THE BANDED CACTUS WREN.

Heleodytes zonatus zonatus (Lesson).

The banded Cactus Wrens which I studied in most detail were neighbors of the Bush-tits. They are giants among Wrens; slender, sharp-billed and long-tailed, the plumage of their back, wings and tail is heavily barred with blackish and gray, the white breast is conspicuously spotted with black and the belly is buffy chestnut. They travel through the more open woods in noisy family groups of usually six to a dozen individuals, and neglect to investigate no possible hiding places of their insect food. They search the ground; cling to the bark of trees like Nuthatches; pull the gray lichens from the branches to see what may be lurking beneath, like the Blue-crested Jays; move among the foliage like overgrown Warblers. Although their voices are harsh in the extreme, male and female sing duets in unison, in the manner of Wrens more gifted vocally, and what they lack in sweetness of tone they make up in animated, rollicking tempo.

In the evening the whole family retire into their sleeping nest, a roughly globular structure about a foot in greatest diameter, composed of pine needles, moss, lichens, straws, sheep's wool and the like, with a wide entrance on one side, protected by an overhanging roof. These dormitories are generally high in the trees, at the ends of slender branches where they are difficult to reach. Sometimes a single pair occupy a nest to themselves, but I have seen as many as eleven sleeping together, and all intermediate numbers. From time to time throughout the year they build fresh dormitories, no doubt in the interest of sanitation. It is most amusing to watch them arise on cold or rainy mornings. They lie abed much beyond their usual time for arising, which at best is considerably later than that of most of their bird neighbors, then come out slowly, reluctantly, one by one. Not infrequently a Wren, stepping forth to survey a world of driving cloud mist and drenched foliage amid which he must seek his breakfast, will decide that it is still too early and returns to the snug chamber for a few minutes longer. Having gone through the same painful process of emerging into the wet less than an hour earlier, I know exactly how he feels.

In February and March, the period of courtship, there was much excitement, much pursuit and singing on the wing. The Cactus Wrens built no special nests in which to raise their families, but each female laid five white eggs, either immaculate or faintly speckled with brown, in a structure previously occupied as a dormitory, which appeared old and weathered, although it was still in good repair. So long as it contained eggs and young, the mother alone occupied it at night, while the remainder of the flock retired to another of the several dormitories which were scattered about the territory. In April I devoted much attention to a nest situated forty

feet above the ground in an oak tree standing alone in a bushy pasture. The female alone incubated the eggs, but her mate remained close at hand, in company with another Wren, and was always eager to join her in a duet, or follow her, singing, upon the wing, when she came forth to forage. Sometimes he went to the entrance to look in at her as she warmed the eggs, greeting her with queer, harsh notes. After the eggs hatched he brought food to the nestlings. In this work he was joined by the unmated bird who had remained in the vicinity while incubation was in progress, and occasionally looked in to see how things were going. The helper was indistinguishable from the parents, but I stuck a wad of paint-soaked cotton in front of the entrance to the nest, and the bird, brushing against it, acquired some vermilion spots on his breast by which I afterwards recognized him. He was a most faithful attendant, and with the father did most of the work of feeding the nestlings, for the mother rarely brought them food. Her duty was to keep the little ones warm, and she seldom carried an insect to them, as is customary with most birds, when returning to the nest from a recess.

I wanted very much to see whether this interesting division of labor was general among Cactus Wrens, but at the only other nest which was favorably situated for watching there were so many attendants that I could not readily distinguish the mother from her numerous assistants. Five or six birds remained in the vicinity of this nest, and at least four brought food to the five nestlings. Probably the number of attendants was greater than four, but all looked alike, and I never succeeded in keeping a larger number in view at one time, to make sure that they fed the nestlings. At the very least there were two helpers at this nest. After the nestlings could fly they slept in a dormitory nest, not far distant, along with six adults, all of whom not improbably fed them. With the Cactus Wrens it is very difficult to make sure of the number and status of the helpers at any nest, for once the birds have outgrown their fledgling plumage male and female, young and old, are identical in appearance. Possibly the helpers are yearling birds, perhaps older brothers and sisters of the nestlings they attend, who will not themselves breed until the following season.

At the ages of eighteen and nineteen days the fledglings left the nest in the oak tree, and for the next two weeks the whole family, parents, helper, and the three youngsters who survived, went to sleep every night in an old, long-abandoned nest (B) on the opposite side of the tree from the breeding nest. It was the helper who assumed the responsibility of putting the children to bed, and a most interesting time he had of it. The dormitory was difficult of approach for the little birds just out of the cradle and still rather shaky on the wing. Although there were of course twigs all around it, there was none immediately in front of the entrance from which they

could easily hop inside. Somewhat before the usual time for the adults to retire, the helper called the three fledglings to the sleeping quarters. A twig about a foot below the entrance seemed at first the most promising mode of approach, but they soon discovered that to reach the entrance from this point required too much of a jump, and they could not yet fly straight upward. Then they tried the alternative of alighting on the roof and climbing down to the doorway. This, too, was no easy matter, for the edge of the roof projected well forward of the entrance, and when they clung to it they found nothing below to which they could drop. While they were trying time and time again these two equally difficult alternatives, the helper was showing them over and over how perfectly simple it was to fly up to the entrance from below, but what was easy for a grown bird was quite a different matter for a fledgling two days out of the nest.

At length one of the three, perhaps the older by a day, succeeded in effecting an entrance by way of the roof, clinging precariously and almost losing its hold as it came over the edge. The others tried in vain to follow the leader. The helper encouraged them and entered at least a score of times, only to come out again at once, teaching them by example how it was done. Several times a fledgling, rising from the lower perch, just managed to grasp by one foot a fibre or stick below the entrance, but found its powers too far spent to raise itself over the sill, and in a moment lost its hold and went fluttering down among the branches, only to return in a minute for another attempt. Several times, too, one flew up while the helper was at the entrance and clung to his back. With more presence of mind the latter might have pulled it into the nest in this manner, but each time he dropped down with the fledgling holding on for dear life, and the struggle began anew. The efforts of the little, short-tailed, pale-breasted fledglings to imitate their long-tailed, patient instructor formed a lovable scene, but their attempts and failures were also very amusing, and at times I shook with silent laughter until I could no longer hold the binoculars steady.

At length, after ten minutes of repeated failures, the other two fledglings managed to gain their bed. There still remained a bit of daylight, so the helper, after looking into the nest to see that all was well, flew off to join the parents and snatch a few more bites before retiring. In ten minutes more the first of the grown-ups came to bed, followed at close intervals by the other two. As each in turn darkened the entrance, the fledglings greeted him with their lisping hunger calls, associating from life-long habit the appearance of a bird at the doorway with the bringing of food. When the last had disappeared into the interior, all remained quiet in the nest, and I longed to be able to peep in and see by the fading light how the six sleepers had arranged themselves for the night.

I kept this family under observation for the remainder of the year, during

which they occupied five different dormitories. In the middle of May they moved to a nest (C) in an alder tree, about 200 feet from the oak in which the breeding nest (A) was located. During July the young birds, now in their fourth month, began to molt and acquire their adult plumage, their most conspicuous change being the substitution of the white, black-spotted breast of the adult for the immaculate, light buff breast of the fledgling. They occupied the alder tree nest until the beginning of September, when the whole family moved into a new nest (D) which had just been completed in the same oak tree which already held the breeding nest (A) and an old dormitory nest (B). During October they began a second nest in the alder tree, but never completed it, and continued to sleep in Nest D until the middle of November, when they shifted back to Nest A in the same tree. They did not long remain here, and for a while I lost track of them; but a week later I found them sleeping in a newly constructed nest (E) in the top of a tree hawthorn (*Crataegus stipulosa*) about five hundred feet distant from the breeding nest. The family was now reduced to four members, and I could not determine what had happened to the other two. During December they returned to the oak tree and slept sometimes in the breeding nest (A), sometimes in the nest (D) they had built during August. I do not know why this group moved about so much, for another family of nine continued to sleep in the same nest from September until I left them at the end of the year.

In June, after the close of the breeding season, I watched the construction of a nest in territory which had not been previously occupied by Cactus Wrens. Its builders were a pair of birds who were evidently just establishing themselves. They worked side by side at the task of construction, and began to sleep in their dormitory about the middle of the month, although they continued to add material to it for several weeks longer. The pair continued to sleep alone in this nest until October, when I discovered that they had been joined by a third bird, who remained with them until, at the beginning of December, they changed their residence, or met with some calamity, and I was unable to find them again. I suspect that, if everything went well with these birds until the following breeding season, the third Wren would have turned out to be the helper of the original pair.

While the Brown Jays are restricted to the Tropical and Subtropical Zones, and the Black-eared Bush-tits in Guatemala live entirely in the altitudinal Temperate Zone, between five and nine thousand feet above sea-level, the Banded Cactus Wrens enjoy a remarkably wide altitudinal distribution. I have found the species from near sea level in Costa Rica and Guatemala up to nearly ten thousand feet in a clearing in the cypress forest above Tecpán, Guatemala. In the humid lowlands these birds inhabit the older second growth, riverside groves, and woodlands which have been

somewhat thinned and opened by lumbering operations, but, so far as my experience goes, not the heavy virgin forest. In the highlands, where they are far more numerous, they dwell in light woods of oak, alder and pine, or else in bushy pastures where scattered trees remain, and in similar habitats, but avoid the heaviest sorts of forest. The habit of sleeping together in dormitories is not restricted to those individuals who dwell in the cool uplands where nights are frosty, for near Turrialba in Costa Rica, at an altitude of about 2500 feet, I found a family of seven sleeping together, and near sea-level in the Estrella Valley I came upon a dormitory into which two birds retired at nightfall. Probably their custom of seeking shelter from the extremes of nocturnal weather in these commodious nests is one of the factors which enable them to thrive in such a wide range of climates.

To me, the most pleasing aspect of the various associations among birds which we have been considering is that they are entirely voluntary, which puts them on a different and higher plane than those of social insects such as termites, ants and bees. Among these no one pair are complete and able to take care of themselves and raise their families without the aid of other biological forms of their species. With these insects coöperation is obligate, for without it the species would soon become extinct. All birds, save those affected by accident or disease, remain complete in all their faculties; there is no structural or sexual specialization among them, as among the social insects, which makes it impossible for any one pair to live and raise their young without outside help. Perhaps it is necessary to except from this statement only species like Cowbirds and Cuckoos, which place their eggs in the nests of other kinds. Each pair of Groove-billed Anis, as they please, may join in a communal nest with others of their kind, or may build their own nest and raise their young alone. The young Brown Jay who this year helps at the nest of a pair of older birds will next year have a nest of its own; the mated Brown Jays who receive so much voluntary assistance are perfectly capable of raising their family without aid. And so among birds help is given and received entirely in a spirit of good fellowship, neither those who give nor those who receive compromise their independence nor lose their self-sufficiency.

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