

LINCOLN'S SPARROW, *Melospiza lincolni lincolni*.—Less seems to be written about this than about any other Labrador sparrow even though it be one of the most common in transition lands between deep forest and barren tundra. At Cartwright any thicket held at least one pair of these birds which scolded all intruders with a metallic *chink*.

A nest containing three newly hatched young was discovered on the ground at the base of a small, dead spruce, well hidden by exposed rootlets and deciduous growth, July 5, 1946. The parent allowed me to approach within two feet before slipping off the nest and running back into denser growth. Subsequent visits proved that no matter how frightened, the bird never flew away directly, but ran along the partially covered tunnel for several feet before taking wing. It used the same route when bringing food to the young.

The fledglings left the nest in a flightless condition on the twelfth day after discovery.

LITERATURE CITED

AUSTIN, OLIVER L., JR.

1932. The birds of Newfoundland Labrador. Mem. Nuttall Ornith. Club, 7: 1-229.

GRAYCE, ROBERT

1947. Birds of the MacMillan Labrador Expedition. Auk, 64: 275-280.

GROSS, ALFRED O.

1937. Birds of the Bowdoin-MacMillan Arctic Expedition, 1934. Auk, 54: 12-42.

LOOMIS, EVARTS G.

1945. Notes on birds of northern Newfoundland and Labrador. Auk, 62: 234-241.

North Valley Road

Paoli

Pennsylvania

LIFE HISTORY OF THE GOLDEN-NAPED WOODPECKER¹

BY ALEXANDER F. SKUTCH

THE Golden-naped Woodpecker (*Tripsurus chrysauchen*) is one of the many noteworthy birds endemic to the region of heavier rainfall and dense, lofty rain-forests which in southwestern Costa Rica and extreme western Panamá interrupts the savannas, thorny scrub and low, open woodland typical of the Pacific Coast of the North American continent, except at high latitudes. It is a small woodpecker of about the size and much the appearance of one of the smaller species of the genus *Centurus*, with which this and related forms are sometimes

¹ This paper was written while the author held a Fellowship of the John Simon Guggenheim Memorial Foundation.

united. But it is far less extensively and conspicuously barred than most species of *Centurus*; and the markings of the head, which in most woodpeckers alone serve to distinguish the sexes, are of a type very distinct from those of the larger and better known genus.

In both sexes of the Golden-naped Woodpecker the back, scapulars and wing-coverts are deep black, with the rump and upper tail-coverts white, and with broad streaks of white along the middle of the back. The tail and the larger wing feathers are brownish-black, the latter with some white markings. A broad band of glossy black, beginning in front of the eye, extends back along the sides of the head and neck to meet the black of the shoulders, and there is usually a white spot or streak behind the eye. The anterior under parts are yellowish-gray; the abdomen largely scarlet; the sides, flanks and under tail-coverts are broadly and irregularly barred with black and whitish. The male has the forehead and hind neck bright yellow, the crown and occiput brilliant poppy red or scarlet-vermilion. The female has no red on her head, but a broad band of black across the crown separates the duller yellow of her forehead from that of her nape. In both sexes the bill, legs and feet are blackish and the eyes dark.

In Costa Rica these handsome woodpeckers range from near sea level up to almost if not quite 4,000 feet. In the Térraba Valley they are most often met about the edges of the clearings which in this region encroach increasingly upon the lofty forests, and according to Carriker (90: 586) among scattered trees of the open 'sabanas' about the Indian settlements in the middle section of the valley. In the forest itself they prefer to stay high in the tree-tops where they are seldom seen. They live throughout the year in pairs or family groups which, in my experience, never contain more than five individuals. They are non-migratory and apparently never wander far from the hole which at all seasons is their nightly shelter. Their flight is swift and undulatory and rarely long continued. When not persecuted they are tame and confiding in the presence of man. Their call is a resonant *churr* of a peculiar, pleasant quality, often uttered as the birds bow deeply; and both male and female beat a rapid tattoo.

FOOD

Like other woodpeckers, the Golden-napes are constantly chiselling into decaying trunks and branches, where they uncover lurking grubs and beetles. They capture insects on the wing; and on wet evenings when the winged brood of the termites fills the air, they rise above the tree-tops and twist and loop with admirable skill as they capture one after another of the fluttering insects. They eat many fruits, from the

dry, green pistillate spikes of the cecropia tree to sweeter and more succulent bananas and well-ripened plantains. It was after a fortnight of almost continuously wet and gloomy weather during the second half of October, 1944, that the Golden-napes first visited the feeding-shelf beside my house, fifty yards from the edge of the forest, where for nearly two years these fruits had been daily displayed for the benefit of any bird that cared to eat them. Dark, wet days drive many birds from the woodland into adjoining clearings; and during this unusually long-continued period of rain and gloom, my feeding-shelf was crowded with a multitude of birds of a dozen species as it never was before and has rarely been since that memorable rainy spell.

On the afternoon of October 27, I for the first time saw one of these woodpeckers—a female—standing on the board in the guava tree and eating bananas. A male and another female clung to the branches close by, but feared to venture upon the table—at least as long as I was in view. Although all the other visitors gathered on the board in many-colored crowds of mingled species, while the woodpecker ate, the others, from big Buff-throated Saltators and Baltimore Orioles to little Blue Honeycreepers and wintering Tennessee Warblers, waited respectfully at a slight distance. This was merely because the woodpecker was a stranger of whose temper they were uncertain. Little by little they lost their distrust and began to eat beside her. Despite her formidable bill, they found her gentle; she pecked at a fellow-diner only if it crowded her very closely. Most of the other visitors, down to the smallest, were also careful to preserve a narrow free space around themselves.

After her first visit to the table, the female Golden-nape became a constant attendant, and gradually the other members of her family formed the habit of eating here, too. Soon two males and a female were making frequent visits. By the beginning of December, three males and two females were regular visitors. They all slept together in the same hole in the top of a tall, dead tree at the edge of the forest on the ridge behind the house, scarcely a minute's flight from the feeding-shelf. Sometimes they would spend much of the day clinging, all five together, to the tall, pole-like trunk of a young flame-of-the-forest tree growing close by, descending to the board from time to time as they grew hungry. They would approach the bananas by flying from branch to branch of the guava tree that held the table. One—or possibly more than one—of the males would bow deeply, at the same time churring loudly, as he clung to the boughs on his way to the food. After standing on the board and eating freely of the banana or plantain spread there, they flew back to the flame-of-the-

forest tree to cling idly until they had digested their latest meal and were ready for more. They were soon less shy, and allowed me to approach them more closely, than many of the smaller passerine birds that attended the table. Sometimes in the evening they lingered close by the food board until they were ready to fly up to their dormitory on the ridge. These daily visits of the woodpeckers continued until the end of February, 1945. I was absent from the farm during the first week of March, and after my return no longer saw them at the table, although the five continued to sleep in the same place for several weeks longer, and after that the mated pair nested in a neighboring trunk. They were apparently now finding foods more attractive to them in the forest.

The Golden-naped Woodpeckers were not again seen at the table until November 19, 1945. On this date a male and a female came repeatedly to eat bananas. I believe that they were the parents of the family that at the beginning of the year had been such regular attendants. Their attempts to rear progeny during 1945 had been unsuccessful. The two clung to the flame-of-the-forest tree between visits to the table, as they had formerly done in company with their three grown offspring of the previous year. On December 28, I moved the feeding-shelf to a taller tree in front of the house, seventy feet from its former site; the domestic chickens had discovered that they could fly up to the board in the guava tree and with their voracious appetites left no bananas for the smaller wild birds. An hour after the board was moved, a male Golden-nape arrived, seemed greatly upset at not finding food where he was accustomed to an unfailing supply, showed his displeasure by churring much, then flew away without going to the table in its new situation. Meanwhile tanagers and other birds had discovered its changed location and were visiting it freely; and that same afternoon the Golden-nape was eating there, too. The woodpecker pair found the new position of the board most convenient. It was supported on one side by a long ascending branch. After eating they would merely climb up the branch and cling among the foliage until they were hungry once more, when they would climb down, tail first, for another meal, repeating this again and again. Their visits continued until early March, 1946, then were completely discontinued, as during the preceding year.

After this I did not again see Golden-napes at the table until June 15, when the pair arrived with a full-grown young male. The adult male went directly to eat bananas, as though he felt quite at home on the board; but the youngster approached with much hesitation and hung once beneath the edge, as though reluctant to stand on a flat surface.

But at last he plucked up courage, stood on the table and ate, and finding the bananas good, returned several times thereafter. During July, August and September of this year I was absent from the farm. When I returned in October, the three Golden-napes were occasionally seen at the table. They continued their visits until at least the following March 6, 1947, but were not such constant attendants as during the two preceding years. Thus during three years Golden-naped Woodpeckers came to my feeding-shelf to eat bananas and plantains during the non-breeding season, especially its later part, but not during the nesting season, even when their nest was only a minute's flight away.

THE HOME CAVITY

In the basin of El General the ample cavities in which Golden-naped Woodpeckers sleep and rear their families are most often carved in fire-killed trees which have been left standing in clearings in the rain forest, close by the forest's edge. It is rare to find a Golden-napes' hole more than 100 yards from the heavy woodland. After a few years these dead trees fall, and the woodpeckers must seek a newer clearing where the settler, to spare himself work with the axe, has left a few of the bigger trees standing, to be killed by the fire he will set as soon as the fallen timber dries. I have found a few nests in tall trees, apparently killed by lightning, a short distance within the edge of the forest, in parts where the trees were less crowded. But I have never seen a Golden-napes' cavity in the midst of unbroken forest; if they occur here, they are probably well up in the tops of lofty trees where they escape detection from the ground. The holes are usually at a good height, between 40 and 100, or possibly more, feet above the ground. Exceptionally they are low; I have records of holes employed for breeding which were only 20 and 25 feet above the ground, and of one used for sleeping only which was 12 feet 8 inches up.

A cavity in a trunk which fell while the woodpeckers were incubating was in hard, sound, dead wood; if the trunk had been as solid at the base as it was at the top where the hole was, it would not have toppled over. The cavity extended one foot below the lower edge of the doorway, and the diameter over most of its length was $4\frac{3}{4}$ inches. The bottom was neatly rounded and, as usual in woodpecker nests, without any lining of soft material. The round doorway was $1\frac{3}{4}$ inches in diameter. Unfortunately, the eggs had vanished.

These cavities are used by Golden-naped Woodpeckers throughout the year. Hence if they lose their hole through the falling of a tree, or have it wrested from them by one of the numerous birds of other

families which covet such holes, they may carve a new one at any season. But if they suffer no mishap, they start a new one about the time their young become self-supporting, and carry on the work at such a leisurely pace that it is not ready for occupancy until the beginning of the following breeding-season, some nine months later. Meanwhile the mated pair sleep, with their grown offspring if they have them, in an older cavity close by that which they are excavating. When the new hole is not urgently needed, the male woodpecker is likely to work at it alone; as the breeding-season draws nigh, the female takes an increasingly large share in completing the task. Or if the pair have lost their dormitory, they work together with a will to make a new one at any season.

THE BREEDING SEASON

In the basin of El General, between 2,000 and 3,500 feet above sea level, the breeding season of the Golden-naped Woodpecker extends from late March to June; but I think it likely that any birds attending eggs or unfledged young after May are doing so because they have lost earlier nests. Although it is rare to find a hole so situated that it can be reached for direct inspection, by watching from the ground it is usually possible to learn the approximate stage of the nesting operations. I have records of four nests in which eggs were apparently laid in March, eight in April, three in May, and one in June. A single brood is reared each year; but if the woodpeckers are not successful at their first attempt, they may try at least twice more to produce offspring. I have never seen a full set of eggs. I have known four pairs which reared three young, and two with two young. I have no knowledge of broods with more than three; but since it appears to be a common happening that woodpeckers fail to raise all the nestlings which they hatch—the last and smallest losing out in the competition for food—it may be that Golden-napes sometimes lay more than three eggs.

HISTORY OF MY FIRST PAIR

I believe that the most satisfactory way of presenting a picture of the life of the Golden-naped Woodpecker is by following the history of a single pair. The first pair whose nest I found happened to live within an easy walk of my thatched cabin close by the Río Buena Vista; and I kept watch over their activities for a year and a half, including two nesting seasons, during which their fortunes, as influenced by outside agencies, varied greatly. In later years I saw enough of other families of Golden-napes to show that my first pair were fairly typical of their kind. One pair which differed greatly will receive

separate attention. But no subsequent pair was followed quite so devotedly as the first. It is the absorbing interest of discovering the general pattern of the life history of a new species, rather than the study of the endless minor variations in the general theme, that calls the bird-watcher from his warm bed before daybreak on raw mornings, and keeps him out beneath drenching evening rains.

The pair of Golden-naped Woodpeckers to which I devoted most attention dwelt in an old abandoned maize field at the edge of the forest on the steep ridge to the east of the Río Buena Vista in the valley of El General, at an altitude of 3,000 feet above sea level. Above the low tangle of bushes and vines which had taken possession of the hillside cornfield towered a number of gaunt, fire-killed remnants of the forest; and these contained crannies and cavities that were the sleeping or nesting chambers of woodpeckers of six kinds, ranging in size from the big, scarlet-headed White-billed Woodpecker (*Phloeocastes guatemalensis*) to the minute Olivaceous Piculet (*Picumnus olivaceus*), of toucans, woodhewers, tityras, house wrens and martins. But my favorites of all were the Golden-napes, which were held together by the closest family bonds and were the most entertaining to watch.

THE APPROACH OF THE NESTING-SEASON

The first Golden-naped Woodpecker that I ever saw was a female which on the evening of December 21, 1935, flew out of the neighboring forest and alighted on the top of a very tall and slender barkless trunk standing stark and gaunt near the center of this old cornfield. Here she crept around for a few minutes, uttering a nervous little *churr*; then she backed down the trunk and slipped into an old, weathered woodpecker hole. Once within, she lingered many minutes with her head framed in the round aperture, her light-colored forehead very conspicuous in the dark circle, and at intervals bowed emphatically. As the sky darkened and the neighboring birds became silent for the night, she sank down into the cavity where I could no longer see her.

Next morning I came by the light of a thin crescent of moon to watch the woodpecker of still unknown kind emerge from the hole and learn more about it. A pair of Lineated Woodpeckers (*Ceophloeus lineatus*) were completing a nest-cavity slightly lower in the same trunk, but the male had not yet begun to pass the night in it. While the Golden-naped Woodpecker still looked through her bedroom door in the dim early light, one of the Lineated Woodpeckers arrived and cautiously inspected the new cavity from the outside. Then it drummed a loud tattoo against the resounding dead trunk. This brought the mate flying out of the neighboring forest. The second

Lineated Woodpecker also made a careful inspection of the nest-chamber from the outside. Then one of the pair climbed up toward the higher hole in which the smaller woodpecker had slept. The latter at first drew back into her cavity to make herself less conspicuous, but as the big bird came steadily nearer she slipped out and fled to another dead tree standing a short distance down the slope. Not satisfied with this retreat, the Lineated Woodpecker pursued and chased the smaller bird from branch to branch. The little woodpecker nimbly dodged the big one, and in her brief moments of respite voiced her nervous little *churr*. To my great annoyance, the Lineated Woodpecker inconsiderately continued to chase the oddly painted stranger which seemed so small beside it, and of whose varied colors I had not yet seen enough to write a good description. It would not let her rest until it had driven her quite out of the clearing into the neighboring forest, where she began to make her breakfast upon the fruit of a small tree with glossy foliage. But as I approached she fled away before I would have given her leave to go, and was lost to me in the depths of the forest.

Again, two mornings later, the Lineated Woodpeckers drove the Golden-naped Woodpecker from her hole as soon as they had completed their early morning inspection of their own. After the male Lineated Woodpecker, during the last nights of December, began to sleep in the new hole, the Golden-nape no longer occupied hers so close above it. Doubtless the bigger woodpecker, that objected so strongly to her presence, would not permit her to enter at nightfall. Perhaps the Lineated Woodpeckers were unnecessarily fussy; but in extenuation of their exclusiveness it may be said that Frantzius's Araçaris (*Pteroglossus frantzi*), Band-tailed Tityras (*Tityra semifasciata*), Gray-breasted Martins (*Progne chalybea*) and other birds were looking with covetous eyes upon their laboriously carved hole, and they needed to exercise constant vigilance lest it be stolen from them before they reared their brood in it—as it was taken as soon as that brood departed.

After this episode, busy with the botanical exploration of the region, I saw little of the Golden-naped Woodpeckers during the next two months. But during the last week of February, 1936, I found two pairs carving out nest-cavities. One of these was in the top of a tall, pole-like, barkless dead trunk, hard by the forest, at the head of the same clearing where the lone female had slept. Probably this was the female that had now found a mate and was helping him to prepare the nest-chamber. She still took an interest, during the day, in the old hole which had been her dormitory, and in the Lineated Woodpeckers' hole beneath it. The fledglings of the latter had recently flown away,

and several Frantzius's Araçaris now slept in their cavity. Early on the morning of February 27, I saw the female Golden-naped Woodpecker enter the Lineated Woodpeckers' hole twice, and her old dormitory once, while her mate waited close by.

At the end of February I discovered that this pair of Golden-naped Woodpeckers slept together in an old, weathered hole at the top of the same trunk where they were carving a new one. This had earlier escaped my attention because it faced the wall-like edge of the forest close by, and was not visible from the parts of the clearing where I usually watched. Eighteen minutes after that early songster, the Orange-billed Nightingale-Thrush (*Catharus aurantiirostris*), began its morning chorus, the male woodpecker looked out of his high doorway. Two minutes later, at 6:05, he emerged and climbed up to the truncate top of the tall stub. Then his mate stuck her head through the doorway, and after another three minutes came out and followed him to the top of the stub. Then they flew off to the forest, but after a little while returned to carve at their new hole, now of such depth that they were half-way in and half-way out as they worked.

Male and female shared the task of preparing the nest-cavity, both taking substantial turns at chiselling away at the wood, and each throwing out the chips that it loosened. Their periods of work were rarely much in excess of half an hour. Once in the late afternoon the female remained for nearly an hour in the hole she was carving, but during the last quarter-hour she rested with her head in the doorway far more than she worked. After chiselling for a while, the woodpecker would throw out the loosened wood, many billfuls in succession. At first the birds would reach in from in front to collect the debris from the bottom of the cavity; but when the hole became so deep that only an inch or so of the tail projected through the doorway as they gathered up the loose particles, they changed their mode of procedure and went entirely inside, merely sticking the head out to drop the billful. This hard wood was removed in fine particles, which looked like powdered gold as it drifted downward from the high hole with the morning sunshine upon it. In dropping the chippings directly from the doorway instead of carrying them off in their mouths to a distance, woodpeckers are less careful than some other hole-carvers such as barbets and chickadees; but when thrown from a height as great as the Golden-napes select for their nests, the particles spread out so widely that they hardly form telltale accumulations on the ground below. While one woodpecker toiled, the other would go off into the forest or to a distant part of the clearing. After the worker tired of the occupation it called with a *churr*, rather like the *krrr* of the Wagler's Red-

crowned Woodpecker (*Centurus rubricapillus wagleri*) that nested in the same clearing, but fuller and deeper in tone. Then the mate would come and take over the task. By March 9, the new hole was nearing completion; and now male and female slept in it together, leaving the old one deserted.

INCUBATION

By March 25, one or the other of the Golden-naped Woodpeckers was to be found inside the cavity throughout the day, more often in the bottom than looking through the doorway, leaving little room for doubt that the eggs were laid and were being incubated. At night both male and female still slept in the cavity together. I devoted six hours on the morning of March 27, and four on the afternoon of March 29, to studying the rhythm of incubation at this nest. At day-break on March 27 the male woodpecker was the first to look through the doorway, but the female pushed past him seven minutes later and climbed to the top of the stub. Here she remained clinging for another seven minutes, when the male flew out and away, whereupon she at once returned to the hole to cover the eggs. After 19 minutes she left, but three minutes later, at 6:11, she re-entered, followed by the male. But he at once came out again to make way for her to emerge and fly away, apparently to seek her first meal of the morning. The male then went back to take charge of the eggs. The female stayed out of sight for one hour and five minutes.

During my ten hours of watching, the male woodpecker took 12 sessions in the nest, ranging from 4 to 38 minutes in length and averaging 19.3 minutes. The female took ten sessions varying from 4 to 44 minutes in length and averaging 25.5. In all, the male was in the nest total of 232 minutes, the female 255 minutes; the two divided the day fairly evenly between them. The nest was neglected for 11 periods lasting from 2 to 16 minutes, averaging 4.8 minutes and totalling 53 minutes. Thus the eggs were attended for 90.2 per cent of the time, not counting those portions of my vigil which fell before the male's emergence in the morning or after the pair retired for the night.

On March 29 I spent the first four hours of the morning watching another high, inaccessible nest of the Golden-naped Woodpecker in which incubation was in progress. Here also both male and female slept in the hole with the eggs. The male was the first to leave in the morning, and after an absence of fifteen minutes, doubtless devoted to foraging, returned to relieve the female which meanwhile, without any breakfast, had been keeping the eggs warm. Thus the two alternated, unlike the first pair keeping the nest constantly attended during my

vigil. During the four hours the male was in the nest for five periods ranging from 11 to 51 minutes in length and averaging 31.4 minutes. The female took five shorter sessions, ranging from 15 to 24 minutes and averaging 19 minutes. The male incubated a total of 157 minutes, the female only 95. The trunk that contained this nest was found prostrate a few days later, before further studies could be made at it.

At both nests it seemed to be the custom for the male to go for breakfast first in the morning, while his mate took care of the eggs. Although either member of the pair might come out of the hole first, if the male emerged first he would fly off out of sight and be gone for about fifteen or twenty minutes; but when the female came out first she would wait close by the nest, and re-enter as soon as her mate flew away. The female's habit of taking the first morning session on the eggs led me to suspect that the male actually covered them during the night, while she perhaps slept clinging to the wall of the chamber above him. Unfortunately it was not possible to peep into the high hole during the hours of darkness and see how the pair arranged themselves in slumber; but observations which are given in detail below show that with both this species and the related Pucheran's Woodpecker (*Trip-surus pucherani*), when from any cause only one member of the pair sleeps in the nest while it contains eggs, this is the male—which strengthens my belief that even when both sexes sleep in the nest, it is he that actually covers the eggs by night. With the great majority of woodpeckers for which we have information (including one or more species of *Centurus*, *Dendrocopos*, *Picus*, *Piculus*, *Phloeocastes*, *Ceophloeus*, *Campephilus*, *Colaptes*, etc.) the male alone occupies the nest by night while it contains eggs or young. But with the Olivaceous Piculet (*Picumnus olivaceus*) and Lafresnaye's Piculet (*P. lafresnayei*) both parents sleep in the nest, as with the Golden-naped Woodpeckers.

Alternation of the sexes in incubation during the day is the rule among woodpeckers; but of all the species I have studied, including the tiny piculets, the Golden-napes took the shortest turns and replaced each other most frequently. With those woodpeckers which sleep singly, it is customary for the member of the pair coming to take its turn on the eggs to cling near the doorway and wait for the other to leave before entering itself; indeed, with these more solitary woodpeckers one almost never sees two adults together in the nest-cavity at any time, even as they replace each other on the eggs. Very rarely I have seen the new arrival become impatient when its mate was slow to leave, and enter before the other's departure; but each time the impatient one popped out again with such haste that I was led to suspect that this breach of good breeding had elicited an admonitory

peck from the bill of the partner within. But the Golden-naped Woodpecker, during the days while incubation is going on, frequently enters to cover the eggs without giving the mate that has been on duty time to come out. Sometimes the new arrival will deliberately climb out again in order to make way for the departure of the other, but perhaps more often they pass inside the nest. At the second nest, the member of the pair that had been incubating did not always leave as soon as its relief had entered, and the two might remain inside together, during the day, for as much as seven minutes. With the exception of the piculets, I have never seen other woodpeckers do this. Sometimes the Golden-nape that had been keeping the eggs warm did not care to relinquish them when its mate came to take over, and after a few minutes inside, the more recent arrival would leave again.

Despite the, for woodpeckers, unusually frequent exchanges of duty, the Golden-napes were rather irregular in their comings and goings from the nest, and one would at times become bored with sitting and fly out without waiting to be replaced. Or it might merely stick its head through the doorway and call its mate with a loud, resonant *churr*. Since the mate when not incubating passed much time in sight of the nest, it frequently went in the moment it saw the other depart, or at worst after a few minutes' delay. Or if the woodpecker that had suddenly left did not soon find its mate, it would itself return after a brief interval. And so, despite the impatience and irregularity in incubation of these birds, their eggs were never left unattended for many minutes together. The longest period of neglect at Nest 1, lasting 16 minutes, occurred shortly before the pair retired for the night, while the two foraged together over the trunk that held the nest.

A closer companionship existed between the male and female Golden-naped Woodpeckers than between the mated sexes of most other species of woodpeckers that I have watched, with the exception of the piculets. This was manifested not only in their sleeping together throughout the year, but in a dozen little ways during the day. One that we have already mentioned was their remaining together in the nest for brief periods—a slight but most significant point of behavior. The member of the pair not engaged in covering the eggs passed a large proportion of its free time pecking on the nest-tree itself, searching for the insects which lurked in the wood. This probably distracted the mate in the nest, and caused it to look out, and perhaps to leave the eggs sooner than it would have done if left quite alone. At times, when the woodpecker that had been incubating left the nest to join the mate in the vicinity, the two would, after a few minutes, fly together into the nest-cavity. Then one would stay to keep the eggs warm, while the other soon departed.

Because of the lack of an accessible nest, I have not been able to learn the length of the incubation period of the Golden-naped Woodpecker. Probably it is about the same as that of the Trujillo Golden-fronted Woodpecker (*Centurus aurifrons pauper*), which is about 13 days.

THE NESTLINGS

By April 7 the Golden-naped Woodpeckers appeared to be feeding nestlings. They now came and went from the nest far more frequently than formerly; and although at first I could detect no food in their bills as they approached, apparently they brought their newly hatched offspring very small particles that were carried entirely within the bill or mouth. After a few days I could sometimes distinguish part of an insect projecting from the black bill of a parent as it came to the nest, but usually it flew up so rapidly that it was impossible to see what it brought. The Golden-napes fed their nestlings with food carried in the bill, as did the Red-crowned Woodpeckers which nested not far away, not with regurgitated nourishment, as did their other neighbors, the Lineated Woodpeckers, and many other members of the family. Woodpeckers which regurgitate food to their young bring meals at fairly long intervals, but those which carry solid particles in the bill may feed the nestlings quite frequently. On April 22, when the nestlings were a little over two weeks old, the two parents together brought them food ten times during the first half-hour of activity in the morning. Three or four minutes was long enough for these busy woodpeckers to fly off, find food, and return with it to the nest. They now came with well-laden bills, making it easy to see that they brought something. At other nests I have seen the Golden-naped Woodpeckers give the nestlings billfuls of bright red fruit.

So long as the young remained in the nest, and even after they took wing, the parent woodpeckers were careful of the cleanliness of their chamber. Unlike the majority of passerine birds, they did not remove the excreta as they were voided by the nestlings, but rather gave the nest periodic cleanings, removing the accumulated waste matter. Early one morning, after bringing food several times without removing droppings, the female turned her attention to house-cleaning. Upon leaving the nest after taking in a portion of food, she carried out a billful of droppings. Flying with her load to a dead tree standing down the slope, she clung to an upper branch and gave her head vigorous shakes sideways to throw away the refuse. Then she returned immediately to the nest and carried out another billful, of which she disposed in the same fashion. In rapid succession she made eight

visits to the nest for the special purpose of cleaning it out. At other times the waste material was merely dropped from the doorway. Woodpeckers which do not make a family dormitory of the nest-cavity are less careful of its cleanliness. So long as they must enter to feed the nestlings, the Red-crowned Woodpecker, Golden-fronted Woodpecker and Golden-olive Woodpecker (*Piculus rubiginosus*)—all solitary sleepers—carry out the droppings; but later, when the nestlings take food through the doorway and the parents no longer need to go inside, they neglect to clean the nest. The bottom then becomes foul and maggots swarm in the refuse. The same lack of attention to the sanitation of the chamber after the nestlings take food through the doorway has been observed in certain hole-nesting passerine birds, as, for example, the Allied Woodhewer (*Lepidocolaptes affinis*). But Golden-naped Woodpeckers and Olivaceous Piculets, like the Prong-billed Barbets (*Dicrorhynchus frantzii*) whose nest-cavity also serves as the family dormitory, never relax their efforts to keep their nests in a sanitary condition.

Throughout the nestling period the parent Golden-napes continued to sleep in the nest-cavity. Usually the female came out in the morning a few minutes earlier than her mate; more rarely they emerged together.

The nestlings were no less than 25 days old before they could climb up the foot-high wooden wall of their nursery and look through their lofty doorway. At first they were satisfied with momentary peeps at the outer world, but each succeeding day they spent longer periods with their pretty heads framed in the round aperture. It was always the scarlet-crowned head of a male that I saw in the doorway, but whether always the same individual I could not at first make certain. I watched in vain for a female nestling to take possession of this position which assured priority when food arrived. When one of the parents flew up with a billful, the nestling that had been looking forth would draw back into the interior and vanish, and the adult then passed in the food while clinging to the outside of the trunk below the entrance. Then, after delivering what it had brought, it might enter, and soon come out with waste matter in its bill.

At ten o'clock on the morning of May 10, I first saw one of the young woodpeckers in the open. It was a scarlet-crowned male and he clung to the side of the trunk near the doorway while another scarlet-crown was looking through the aperture. After a while the fledgling that had come out grew tired of clinging in the open and climbed back into the nest. When I visited the nest the following morning, for the first time in several days I saw no young bird's head framed in the doorway.

I waited in vain for one to appear, and at length concluded that the nest must be empty. Since the parents had begun to take food into the nest on April 7, if not a day or two earlier, the young woodpeckers' period of helplessness in the hole was not less than 33 or 34 days. This may be compared with the Trujillo Golden-fronted Woodpecker's period of 30 days as determined at a nest into which I could look, or that of at least 31 days of the Wagler's Red-crowned Woodpeckers whose inaccessible nest was close by that of the Golden-napes.

I found the Golden-nape family high up among the trees at the edge of the forest. The fledglings' call was a weaker version of the *krrr* of the adults. They could already fly for good distances, but not so swiftly and confidently as their parents. Now that the young were all in the open where I could see them simultaneously, I learned that there were three, and all scarlet-crowned males, as I had begun to suspect from seeing only scarlet heads in the doorway before they left the nest. The youngsters rather closely resembled their father, but I could distinguish them by the fact that the scarlet of the crown extended forward nearer the base of the bill and there was a narrower zone of yellow on their foreheads. Later I saw young females which had just come out of other nests; they had black bands across their foreheads like the adults of their sex, but could be distinguished by the less prominent yellow on the forehead. Golden-nape families run to maleness. Of six broods recently emerged from the nest, two consisted of three males only; one of two males only; two of two males and one female; in only one brood of two were the sexes equally represented. In all, there were thirteen males and only three females—an amazing disparity in the numbers of the sexes, equalled in my experience only by the Black-eared Bush-tit (*Psaltriparus m. melanotis*).

FAMILY LIFE AFTER THE NESTING-SEASON

The young woodpeckers' first ventures into the outer world did not take them far from their doorway. Sometimes one would cling for a while to the outside of the trunk close by it, then grow tired and pass inward. Thus they became somewhat familiar with its position, and accustomed to entering, before they went off on longer excursions. Even after they had begun to fly among the neighboring trees, they returned early to their nursery. During their first days afield, they would sometimes go back soon after three o'clock in the afternoon, even if no rain fell, as it so often did those May afternoons. But there was no fixed hour for their retiring, for one would at times remain out long after his brothers had gone to rest. If there were no shower, their homecoming seemed to depend upon how soon they grew tired of climbing over the trees.

Even on the afternoon of the first day when I saw them at a distance from the home trunk, one of the young Golden-napes of my first family found his way home without guidance. But at other nests, the fledglings are led by the parents on their return after their first long outing. The parents may cling on opposite sides of the doorway, or one may rest beside it while the other enters; and this is all the urging the young woodpeckers need to go in. Their instinct to follow their elders is strong; and one that lingers out late, or leaves the hole after it has been led to rest, is often brought home by an exemplary visit to the interior by a parent, who then comes out, leaving the youngsters within. Or if a youngster in the open sees those in the hole receive food, it may hurry in to better its chances of getting a meal. Certainly young Golden-naped Woodpeckers regain their high doorway with far less instruction than is required by young wrens, which forsake their nursery at a far earlier age.

Late in the afternoon of his second day among the surrounding trees, one of the young Golden-napes, that had long since retired, was frightened from the hole by a visit from a pair of Frantzius's Araçaris. He flew to a neighboring trunk, while his excited parents darted back and forth above the nest. After the intruders had departed and the turmoil died away, the father woodpecker entered the hole, where the other young birds had remained through all the hubbub, and turning around to look out, uttered a peculiar churring call, quite distinct from anything that I had ever before heard from him or his mate. This brought the young fugitive home in a trice. But ten days later, when the parents entered the hole at four o'clock in the afternoon and called for their fledglings to come to rest, the young birds, which I heard churring within the neighboring forest, quite ignored the summons, as disobedient children not infrequently disregard their parent's command to go to bed. The parent woodpeckers were ever watchful and attentive to their younglings. Sometimes one of these, going alone to the doorway, would hesitate to enter, pushing his head in only to withdraw it again, repeating this over and over, afraid to go in alone, or else displaying a degree of caution surprising in one so young. If a parent were near by, it would hurry to the hole and enter, whereupon the young woodpecker would promptly follow.

After their early return to the nest, the fledgling woodpeckers were fed inside, exactly as though they were helpless nestlings which had never been flying about among the trees. After delivering food through the doorway, the parent needed to be quick in getting out of the way of the bill that received it; for the young bird would often peck or bite at its elder—an ill-mannered way of asking for more, at least

by human standards. Once the father was not sufficiently alert, and the fledgling he had just fed plucked a downy feather from his breast. It stuck to the young bird's bill, and cost him considerable shaking of his head and rubbing of his bill against the sides of the doorway before he could rid himself of the light encumbrance. If the fledglings were very hungry, they would peep loudly in a high-pitched voice whenever food was brought to them. This feeding of the fledglings after their return to the nest is not the rule in all Golden-nape families. Some young birds go later to rest from the first, and receive no more supper after retiring. All seem to be slow in outgrowing their infantile habits with the result that their parents must continue to clean out the hole for a number of days after their first departure.

When the light began to grow dim, the parents would join the fledgling woodpeckers in the hole for the night, the father usually first. Often their entry was greeted by a chorus of high-pitched fledgling cries. Sometimes the parents of older nestlings, or of fledglings, remain outside, clinging to the trunk near the doorway, until an hour unusually late for woodpeckers, as though wishing to escape the youngsters' importunings for yet more food. I have even known a female Golden-nape, the mother of three young fledglings, to go to rest in a separate hole in the same trunk, apparently in the interest of a more tranquil night.

In the morning, the parents would leave the hole first, but the young woodpeckers soon followed—there was not so great a difference in their time of emerging as in their time of retiring. A week after their first flights, the young birds delayed in the nest for five minutes after their parents' morning departure. Then a loud call from one of their elders brought two promptly out to receive their breakfast; but the third fledgling required a second summons. I have known other parent Golden-napes, whose fledglings had made only a single excursion into the neighboring forest, to bring a few morsels of breakfast to them while they delayed nearly an hour in the hole, trying to gather courage to brave once more the perils of gravitation at so giddy a height.

But the capacious cavity which the Golden-naped Woodpeckers had carved during the dry season was more than a nest and a dormitory; it was also the home in which these beautiful birds took shelter from the rain. If the rain were light, the recently emerged fledglings alone remained within, while their parents flew about in the drizzle and brought them food. Yet a heavy downpour might send the whole family into the hole. If it stopped early, the parents and even the fledglings might come out for a while before retiring for the night; but if it continued hard and without interruption, all would stay within

from about four o'clock until the next morning, the fledglings going hungry to sleep. Rains before noon were rare in this region; but once I saw the male woodpecker lead one of his sons into the hole to escape a light shower that began at seven o'clock in the morning. Then the father flew across to the edge of the forest to join the rest of the family. But the young woodpecker did not enjoy being left alone in the nest, and preferring a wetting in company to dryness in solitude, soon came forth to seek the others.

One of the young Golden-naped Woodpeckers of my first family vanished before he had been a fortnight out of the nest. The other two resided with their parents in the family home for many months more. After three weeks, there was little difference in the time of retiring in the evening and departing in the morning of the old birds and the young; and after a month had passed, a young bird would sometimes leave before an adult in the morning. By August the young males could not be distinguished from their father in appearance. Until October, all four surviving members of this family continued to sleep in the hole in which the younger two had hatched in April. Now followed a period of inconstancy in their arrangements for sleeping. Some would pass the night in the old hole (A) which had been abandoned by the parents upon the completion of the new one (B) in March, and was now in a somewhat ruinous state, with a gap in the outer wall near the bottom. The family did not always divide up in the same manner; for on certain nights they would sleep two and two together, while on others the division would be three and one; then again they would all stay together. Likewise, they experienced difficulty in deciding just where each would sleep, for often a woodpecker would enter one of the holes only to come out and climb over the trunk to the other. This restlessness continued until the end of the month; nor could I ascertain its cause. It appeared not to be that all the members of the family did not agree together as of yore, for I never noticed any sign of disharmony. Possible lice or other vermin had infested one of the holes and made the woodpeckers restless.

Before the end of October, one of the males—I believe a young one—had vanished, never to be definitely recognized again. From early November onward, the mated pair with the remaining son continued to sleep regularly in the newer hole (B), as formerly. During the last quarter of the year, they were most irregular in their time of departure in the morning, lingering in their dormitory for half an hour to more than an hour after the early birds had become active; while an interval of half an hour would sometimes separate the exits of two members of the family on the same morning. They did not wake up, or at least

did not show themselves in their doorway, until the early risers of the feathered community had been flying about for a good while; then while waiting to come out one would gaze through the aperture, or they might take turns in occupying this position. On cool mornings, I have seen Golden-naped Woodpeckers return, after a tentative excursion to the outer side of their trunk, to enjoy the shelter of their hole for a few minutes longer. They appeared not to awake in the morning with a ravenous appetite, and often were in no hurry to break their fast. Even after delaying in the hole for a long time after earlier birds had been up and about, upon emerging they might cling to their own or a neighboring trunk, preening, stretching their wings and yawning, for a good while before they flew off to hunt food. So, too, in the afternoon they often satisfied their hunger long before it grew dark, and waited idly either near their hole or in it until they were ready to sleep.

The members of the family had no fixed order for entering their dormitory in the evening or for departing in the morning. Sometimes the adult male entered or left first, sometimes the female; and after the young males had acquired fully adult plumage and could no longer be distinguished from their father, the mother might enter or depart between two males. Yet I have records of seventeen times that a male entered first for the night, to five times by the female; and of sixteen times that the female departed first in the morning, to nine times by a male. Thus even if the order of entering and leaving was not constant, there was a strong tendency for the female to retire later, and to become active earlier in the morning, than the males. With the pair of Red-crowned Woodpeckers that slept in the same clearing, the two always in separate holes that had usually been carved by the more industrious male in trees with very soft wood, the male almost invariably went to rest earlier than his mate, and stayed longer in his dormitory next morning. Among birds, there appears to be a general tendency for the sex which incubates through the night to take the longer period of rest. Among passerine birds, it is apparently always the female which takes charge of the eggs and young by night; and in some species she goes to roost sooner, and becomes active later in the morning, than the male.

Toward the end of June, the father of our Golden-nape family had begun a new hole (C), about two feet below that in which he and his mate had nested, and where the pair still slept with their two surviving sons. From time to time I saw him working at this in a desultory fashion, in the evening before he went to rest. At times he would continue at his task for half an hour, as the light faded, yet he accomplished little. For many months, I never happened to find him en-

gaged in chiselling out the hole at other times of day; and he can not have worked very hard, for by the beginning of October, after more than three months of intermittent activity, the cavity was still too shallow for him to enter. By mid-October, it had grown large enough to contain a woodpecker; for one evening I saw the female inside, with her head in the doorway. But apparently she had not much room to spare. Despite her interest in this new cavity, she did not actually work upon it—at least, not in my presence—until four months after this. Once I found the young male taking a few pecks at the excavation, but he accomplished scarcely anything. At the end of October, I for the first time found the adult male chiselling at the new hole in the forenoon. Still, the work continued to progress so slowly that by the middle of February, when the female at last began to perform her share of the labor, the birds still pecked away from the outside. But now that another nesting-season was approaching, they intensified their effort, working at all hours of the day; and the new cavity was rapidly enlarged.

At the end of February, 1937, there began another unsettled period in the lives of these Golden-naped Woodpeckers. Birds of many kinds were nesting or at least hunting sites for their nests, among them the Costa Rican Band-tailed Tityras (*Tityra semifasciata costaricensis*), whose favorite nesting-place in this region is a hole carved by Golden-naped Woodpeckers. Often a brownish female tityra entered the hole in which my woodpeckers slept, while her white, black-trimmed mate rested atop the tall stub, twitching his black-banded tail and voicing bizarre, grunty notes. Nor did she neglect to investigate the Golden-napes' new hole; but this was still too small for her purpose. Although the woodpeckers were often present at the time of her visits, they usually watched her with indifference, never making a serious effort to drive her away. Each of these peace-loving birds held the other in wholesome respect. Soon the female tityra, followed back and forth by her attentive mate, began to carry fine, dead twigs, flower-stalks and dry leaves into the hole (B) where the Golden-napes slept. Sometimes, upon retiring in the evening, the woodpeckers would patiently throw these out the door. Yet this interference broke up their routine. On the last night of February, they did not sleep in their home tree at all, but in a very old hole in the top of a tall, slender trunk tottering on the verge of collapse, just within the neighboring edge of the forest. But after a few days, they returned to the dormitory they had used so long. On the evening of March 11, the female Golden-nape retired, for what I believe was the first time, to sleep alone in the expanding new hole (C), leaving the father and son alone in the old one (B). But

apparently she felt cramped for space there, for she returned the next evening to sleep with the others in the usual dormitory.

That evening, March 12, was the last time, or the last but one, that the young male slept within the parental walls. He was now a few days more than eleven months old, and it was time for him to face the world alone, many months later than young woodpeckers of most other kinds take this important step. During his last few weeks with his parents, I thought that I detected traces of antagonism between his father and himself; but I never saw any actual quarreling. His departure marked the beginning of a new chapter in the lives of the parents. They were once again the mated pair, unaccompanied by young, that I had met a year earlier, ready to undertake the rearing of another brood. What would their fortunes be this year?

THE SECOND NESTING-SEASON

After the departure of the young male, the father slept alone in the old hole (B), the mother again in the still unfinished one (C) two feet lower. But the tityras had meanwhile strengthened their claims upon the old chamber for their nest; and the woodpeckers, deciding to abandon all the upper part of their trunk (including another hole, D, that they had recently started about a yard below (C), began still another hole (E) in the lower portion, only twenty feet from the ground—one of the lowest holes of the Golden-naped Woodpecker that I have ever seen. Although the cavity begun in June was still unfinished after nearly nine months, under the necessity of completing a receptacle for their eggs, which were due to appear in a short while, the pair worked so hard that almost before I was aware of their intentions they had made the new, low chamber big enough for the male to pass the night in it. His mate continued to take shelter apart from him, in the unfinished high hole, only a night or two more, until the low one could accommodate her beside the male. With other pairs, too, I have known the male and female to sleep in separate holes, when they appeared to experience difficulty in finishing a new cavity and apparently possessed no single chamber capacious enough to hold the two together.

Now, on March 19, the pair were definitely established in the hole (E) where they would nest. But they had made an unwise choice of location. In trying to escape the tityras, which although troublesome were harmless, they had moved to within a yard of an old hole of the Guatemalan White-billed Woodpecker, in which a pair of Frantzius's Araçaris occasionally slept and where they were preparing to nest. One evening at the end of March, the excited cries of the woodpeckers drew my glance their way, just in time to witness one of these small

toucans fly from their doorway with a pure white egg grasped in the end of its great red bill. The aperture was too narrow for the araçari to pass through; but apparently the hastily completed chamber was not as deep as it should have been, and the long-billed bird could reach the egg while clinging in front.

Although, like other toucans, Frantzius's Araçaris are beyond doubt arrant nest-robbers, they appear seldom to despoil nests placed very close to their own, in this resembling some of the hawks. At least, I have often known tityras and woodpeckers to bring up their broods in safety within sight of the araçaris' nest, sometimes in the same trunk. Possibly the araçari that stole this egg was not one of the pair which nested so close by, but rather another individual which sometimes wandered into the clearing, to the great annoyance of the resident pair. So far as I could learn, no more eggs were taken from the Golden-napes' nest by the araçaris.

Despite the loss of one of their eggs, the woodpeckers succeeded in hatching the others, and had begun to carry food into the nest by April 9. (In the previous year, when their preparations for nesting had not been disturbed by other birds, and when the weather during the first three months had been much drier, their nestlings hatched out about April 7—a difference too slight to be significant.) But the following morning I found that their nest had been torn open by some strong-clawed predatory animal, which had been small enough to remove the two eggs from the neighboring nest of the araçaris without enlarging their wider doorway. This disaster had evidently befallen them during the afternoon, for all the parents, woodpeckers and toucans alike, escaped with their lives; and at dawn next morning the male Golden-nape came forth from his hole with a gaping entrance, where he had passed the night alone. Soon he returned with food in his bill, took it into the desolated nest, and came out still holding it. Twice he returned to the nest with the morsel in his bill, as though unable to convince himself of the irrevocable reality of his loss. I have known birds of other species, including a male Yellow-green Vireo (*Vireo virescens flavoviridis*), a male Jalapa Collared Trogon (*Trogon collaris puella*), and a pair of Golden-masked Tanagers (*Tangara nigro-cincta*) to bring food to a nest where the young had recently died or been removed by a predator; and similar instances have been recorded by other observers for other species.

While at their low hole, the Golden-napes showed great confidence in me. One morning the male continued alternately to chisel and to throw out chips while I stood almost directly below his doorway. If I tapped on the trunk while one of the pair was incubating, it came to

the doorway to look down at me, but did not deem it necessary to leave, and calmly watched me move about with my head scarcely five yards below its own. When I climbed the ladder to look into the lower nest of the araçaris, the woodpeckers merely slipped out of their own and climbed a little higher up the trunk; and hardly had I reached the ground again before they returned to their eggs. Unfortunately my ladder was not long enough to bring me within reach of their own nest, and none could be constructed with the materials available which was light enough to manage. Of their close neighbors, the araçaris, the woodpeckers were a trifle shy. If the bigger birds approached their hole while the woodpeckers were clinging in front of their own, or looking through the entrance, the latter would climb higher up the trunk, or else fly to a neighboring tree. As soon as the araçari had gone into its nest, the Golden-napes returned to theirs. In the evening, the araçaris entered their hole for the night later than the woodpeckers. Although the great-billed birds alighted at their doorway with a loud thud, the noise and vibration of the wood appeared not to disturb the woodpeckers a yard away.

No matter what mishaps befell them, the male and female of this pair of Golden-naped Woodpeckers slept together whenever they had a hole big enough to accommodate the two. After the spoliation of their lowest hole (E), they returned to the unfinished cavity (C) begun the previous June, worked hard during the day to enlarge it, and took shelter in it by night. Here they were again neighbors of the tityra, which continued to incubate her eggs in the high, safe hole she had taken from them, all undisturbed by their hammering as they put the finishing touches upon the chamber so close below hers. This hole may truly be said to have become old before it was new, for its completion occupied nearly ten months. By April 20, the woodpeckers appeared to be incubating in it; but by the middle of May they were again enlarging the cavity, having somehow lost eggs or young nestlings from it. Still they continued to sleep here, and by the end of the month were incubating a third time, the second time in this hole. When I took leave of these Golden-napes in mid-June, they were at last feeding nestlings in it. I had followed the varying fortunes of the pair for so long a period that I felt a personal interest in them, and fervently hoped that they would be successful in rearing this latest brood, and have a young family to dwell with them through the coming year.

I believe that but for the interference of other birds and mammals, this pair of Golden-napes would have made only a single hole during the course of a year. It seems to be usual for these woodpeckers to

carve their new hole as the breeding-season approaches, not upon its termination in the manner of the Blue-throated Green Motmots (*Aspatha gularis*). This difference in procedure is correlated with the great care the woodpeckers exercise to keep their nest clean; were they as neglectful of this matter as the motmots, the cavity in which the nestlings were reared would not be a fit dwelling during the ensuing ten months. In laying their eggs in a new hole, and keeping it faultlessly clean, the Golden-naped Woodpeckers agree with the Costa Rican Prong-billed Barbets. But the barbets, as far as I could learn during a year's residence among them, carved new holes only during the breeding-season; if these were lost before the approach of the succeeding season of reproduction, they slept in any cavity of suitable size that they could find without an occupant.

OBSERVATIONS ON OTHER FAMILIES

Other Golden-nape families I have watched have not been fortunate enough to retain possession of the same dwelling during the cycle of the year. The tall, dead trees in which their holes are carved often fall; but perhaps even more of the woodpecker homes are lost to the Band-tailed Tityras or the Inquisitive Tityras (*Tityra inquisitor*). These cotingas do not sleep in cavities; but while the Golden-naped Woodpeckers rear only a single brood, they raise two in a season—at least the Band-tailed Tityra sometimes does, and the Inquisitive Tityra often builds a late nest in anticipation of doing so. Thus they attempt to gain possession of the Golden-napes' holes both before the latter have begun to incubate and after their brood is awing. Their method is very simple; they never fight the woodpeckers, but quietly fill up their hole with dead leaves and twiglets.

The Golden-naped Woodpeckers, even when they see what the tityras are about, rarely try to drive them away, never become really angry; I sometimes doubt whether these mild-mannered birds are capable of genuine anger. Their method of counter-attack is as quiet and gentle as the others' mode of attack; in the evening, when they go to rest, they drop through the doorway the materials that the intruders have laboriously carried in during the day. But the day is long and the evening short, with the result that the builders gain upon the unbuilders—'destroyers' would be too strong a term in this instance—and finally the woodpeckers find their quarters cramped and decide it will be easier to make a new home than to trouble themselves with so much housecleaning in the evening when they are weary. The new hole is, whenever possible, placed in the same trunk as the old one.

Toward the middle of June, 1939, an Inquisitive Tityra began to carry leaves into a hole from which three Golden-naped Woodpecker fledglings had departed only two weeks earlier. Although the woodpecker family of five continued to sleep in this cavity in their customary manner, I did not see them make the slightest move to defend it; they climbed over the neighboring branches of the dead tree and watched with seeming indifference while the female tityra, followed like a shadow by her faithful but inefficient mate, took leaf after leaf into their dormitory. Their only reply to the invader was the prompt beginning of a new cavity in a neighboring branch of the same tree. So the robber and the robbed were building, each after its own fashion, in the same tree at the same time, each party ignoring the other. The woodpeckers seemed to be racing to complete their new chamber before the Inquisitive Tityra made the old one too small for them. They continued to toil on rainy evenings, after the light had grown almost too dim to distinguish their colors. What a contrast between this long-continued labor by both sexes, and the leisurely way in which my first pair of Golden-napes had gone about the carving of the hole that the male began in June! One of the young males, that had left the nest less than three weeks earlier, took a few pecks at the new hole but accomplished little.

But the tityra, working alone, gained on the woodpeckers, toiling in shifts. It was so much easier to fill up a space with loose leaves and twigs than to carve an equal space out of solid wood. On the rainy evening of June 15, a young Golden-nape entered the hole in which he had been hatched, and threw out a twig and a leaflet carried in by the tityra. But then he was joined by his brother and sister, and no more of the litter was removed. The father went directly to an old hole below that on which he had been working—most probably an earlier residence of his own, now the object of an endless controversy between two pairs of Band-tailed Tityras, each of which desired it and kept the other from building (Skutch, 1946: 346–348). Then the mother woodpecker tried to enter with her offspring, but finding the remaining space too contracted for her accommodation, went to join her mate in the old hole. Although the Inquisitive Tityra was present when the young woodpeckers entered the hole she had claimed and threw out the two pieces of her material, she made no more protest than the woodpeckers had made when she carried them in.

Three days later, the Golden-napes' new hole had grown sufficiently capacious to receive two of the young birds in the evening. The third tried to join them, but push as hard as it would, its tail and the tips of its wings remained sticking through the doorway. The two

within must have been already tightly packed. Finally the third admitted the fact of its incompressibility and came out to seek another lodging. At this point, the woodpecker family was thrown into confusion by the arrival of four Frantzius's Araçaris, that slept in an old hole of one of the larger woodpeckers in the same dead tree. The two fledglings in the new cavity unpacked themselves, and all five darted back and forth among the naked branches. After the araçaris had entered their lodging, two woodpeckers returned to the new hole, and a third, again failing in its efforts to compress itself into the remaining space without leaving its tail exposed to the night winds, joined the other two in the old cavity two feet below. Although some of the woodpeckers had gone earlier in the evening to the doorway of their former dwelling, they did not enter. The tityra had won the race; her triumph was complete. But hers was a sterile victory, for she did not nest in the hole she had taken from the woodpeckers. Apparently her kind often prepare for a second brood, but in El General I have never known them to rear one.

As for the woodpeckers, they enjoyed a good deal of wholesome headwork, and had a new dwelling. A week later it had grown large enough to contain four of them, and promised soon to provide space for the fifth.

All Golden-naped Woodpeckers are not as forbearing as this pair. In April, 1940, I watched a female Inquisitive Tityra fill up a very high hole at the edge of the forest, in which a pair of Golden-naped Woodpeckers still slept while they carved a new cavity lower in the same trunk. They seemed to be in a hurry to finish and worked alternately throughout the morning, each continuing at its task until relieved by its mate. On the evening of April 10, I found the female woodpecker looking out from the new hole, which had been enlarged rapidly during the past week. Soon she came out and climbed up to the old dormitory at the top of the trunk. She entered and in rapid succession threw out 36 leaves and pieces of leaf, which fluttered slowly downward a hundred feet to the ground. Then she ejected several mouthfuls of wood dust from the bottom of the cavity—evidence that poor tityra's nest-building was quite undone. After cleaning out the old house, Mrs. Woodpecker descended to her new apartment to sleep with her mate. Such uncharitable zeal to keep the tityras out of the hole they no longer need is in my experience rare among Golden-naped Woodpeckers. Yet nowise discouraged by the loss of all her gathered materials, the tityra continued to fill up this hole, and as far as I saw was not again disturbed by the woodpeckers, now comfortably established in the lower cavity. The tityra began to incubate, but was ap-

parently unsuccessful in hatching her eggs. The woodpeckers, more fortunate, brought out a family of three male fledglings, which in the evening were led back to the nest and slept there in company with their parents.

Another pair of Golden-naped Woodpeckers reared two male fledglings and one female, in a hole about twenty-five feet up in a dead trunk standing amidst a field of maize. These left the nest in May, 1942. Two months later I found the family sleeping in a hole they had newly carved lower in the same trunk, its doorway only twelve feet eight inches above the ground—the lowest Golden-nape's hole I have ever seen. The young female had already vanished and only the two sons remained with the parents. By early September, the four were sleeping in still another hole, freshly carved a yard above the last. I could discover no cause for these frequent changes in domicile; but possibly vermin had caused the birds to move to new chambers. In carving these holes which they did not use for breeding, the woodpeckers resembled some of the wrens, whose numerous nests that never hold eggs are often called 'dummies,' although with a number of species they appear to be built for the same purpose as the woodpeckers' cavities.

Toward the end of the year, this family of Golden-napes began mysteriously to dwindle away. By early December, it was reduced to two males and a female; by January, 1943, to a male and a female, which usually slept in separate holes in the same trunk. From this, I inferred that the survivors were mother and son; had the two been a mated pair, they most probably would have slept together. One evening the female, frightened from the lowest hole by my approach, tried to enter the male's higher chamber, but was refused admittance. After lingering five minutes before the forbidden doorway, she climbed backward down to her own—the watcher meanwhile having made himself less conspicuous. But a week later, the two slept together in the male's hole; he was present first, and allowed his supposed mother to enter without protest. By early February she had vanished; and for well over a month the male Golden-nape was the sole occupant of the trunk with many chambers; in addition to those we have had occasion to mention, there were a number of older ones. By the last of March he, too, had disappeared. Only a lone araçari arrived in the dusk, and after calling many times without response, winged swiftly away from the deserted tree.

A family of Golden-napes which I watched in 1943 also shifted their quarters frequently. From their breeding-nest high in a many-branched, charred, dead tree standing amidst a newly made pasture,

two male fledglings took wing on May 25. That evening their parents led them to sleep in the hole where they grew up, and for several weeks this continued to be their nightly shelter. On June 12, the father was discovered carving a new hole at the very top of the same trunk; it was already deep enough to contain him. In the middle of the following afternoon I found his mate taking shelter from the rain in this new hole; but soon she became bored with inactivity and flew out into the downpour. That evening one member of the family entered the new hole to sleep. On the night of June 15, the female slept alone in the new hole, the father and his two sons in the old cavity that had been used for nesting. On June 19 the female and one male slept in the new hole, the other two males in the old one. On June 24, when they were thrown into confusion in the evening by a belligerent Band-tailed Tityra nesting in the same tree, all four woodpeckers went to rest in the old hole. By June 25, these woodpeckers were making a second new hole in the same tree, both male and female sharing the task of carving it out. On subsequent nights the family often divided up between the old hole and the completed new one, but not always in the same fashion; for sometimes the female would sleep with one male in the old hole, sometimes in the new one, while the other two males occupied the other hole. But after early July, all four slept together in the old hole again. In September the tree fell and I lost track of the family. I can not explain why some Golden-nape families should shift their quarters so often whereas others, as the first that I watched, were content with their breeding chamber as a dormitory for many months after the close of the nesting-season. When I studied the Banded Cactus Wren (*Heleodytes zonatus*) I found the same puzzling discrepancies, some families occupying the same dormitory for long periods, others changing their lodging at relatively short intervals (Skutch, 1935: 271-272).

AN ABNORMAL PAIR

As told in an earlier paragraph, the family of five Golden-naped Woodpeckers—three males and two females—which at the end of October, 1944, began to visit my feeding-shelf, slept in a hole high up in a massive dead tree just within the edge of the forest on the ridge behind the house. Here all five passed the nights together until the middle of March, 1945, when a male and a female, doubtless the parents of the other three, moved to a new hole which they were completing lower in the same trunk. The other three continued to sleep in the old one until the end of the month when one vanished, and a few days later the other two followed. During the last weeks, when the family

all slept together in the same trunk, I sometimes saw one woodpecker chase another in the evening before they retired; but the mild pursuit was always transitory and never, so far as I saw, led to a real conflict. Sometimes after the chase was over, the two woodpeckers that had taken part in it would rest amicably side by side. After the mated pair took possession of the new hole, they would retire relatively early in the evening and linger late in the morning; but those that continued to sleep in the old hole would go in unusually late, sometimes when it was nearly dark, and fly away in the morning long before the others were up. Possibly the final abandonment of the old hole was hastened by the Band-tailed Tityras which now claimed it for nesting.

During the second week of April, the mated pair began to incubate in the new hole, at first turn and turn about, and to sleep together in the nest-cavity by night, in proper Golden-nape fashion. But before the eggs hatched a most curious, and in my whole experience with woodpeckers entirely unprecedented, domestic situation arose. The male woodpecker alone took charge of the nest and eggs during the night, while the female slept by herself in one or another of the old, dilapidated holes high above him in the top of the dead tree. This, of course, is normal behavior in other species of woodpeckers; but what follows was altogether unique. By day, whenever the female approached the nest-hole, the male sallied forth to chase her away! He was trying to carry on incubation all alone, but would have warmed the eggs more constantly if he had not so often left the nest to drive away his erstwhile helpmate. She apparently still desired to incubate, and once did actually enter the hole for a few minutes during the male's absence, remaining until he returned; but in the face of repeated rebuffs she abandoned the attempt. I could not ascertain the cause of the male woodpecker's pique, but wondered whether it was somehow related to the fact that the female's tail was for some unexplained reason slightly shorter than normal.

After a few days there appeared to have been a partial reconciliation between the two. The male now permitted the female to peck over the dead trunk near the nest; but although she sometimes looked in through the doorway, she no longer tried to incubate. The male successfully hatched at least one of the eggs, for by April 20 he was carrying food into the nest. The quarrel had now been so far composed that the female again entered the hole for brief periods by day; but she still slept in the old hole at the top of the tree and paid little attention to the nestlings, leaving to the male almost the whole burden of their care. I awaited their emergence from the nest to learn how many he would be successful in rearing; but before they were many days old some mishap befell them and the parents no longer entered the hole.

The pair now, at the end of April, began a new hole in a neighboring dead trunk, working alternately in the usual manner. After it was big enough the male slept in it, but the female still roosted in the very old hole at the top of the original trunk. But this newest hole apparently never contained an egg, for about May 3 the pair returned to the hole from which they lost the nestlings. They slept together in it, and by day both occupied it for brief periods, the male more than the female. But after incubation of the new set of eggs was well under way, the male again kept them warm during the day with little or no help from his mate. Unhappily, at this point the nest was apparently again raided, for the woodpeckers quite abandoned this tree and I could not discover where they went.

As an alternative explanation to a lack of harmony between the male Golden-nape and his original mate, we might consider the possibility that he lost his first mate and that another female tried to attach herself to him, much against his will. But in view of the low proportion of females in the Golden-nape population, I think it unlikely that a new female should have arrived so promptly, or tried so hard to reach an understanding with an unappreciative male. And when we recall that during the second nesting, too, incubation did not proceed in the normal fashion but the male covered the eggs with little or no help, we see that even assuming the loss of the first female, we are still faced with our original difficulty of explaining the lack of harmony in a mated pair.

While the male of this abnormal pair was incubating alone, I spent a total of about six hours watching the nest, timing 18 of the male's sessions, which ranged from about 1 to 30 minutes and averaged 10.4 minutes; and 17 of his absences, which varied from 1 to 32 minutes and averaged 8.5 minutes. He kept the eggs covered only 55 per cent of the time. During some of my watches he devoted a considerable amount of his energy to driving the female from the vicinity of the nest; but even after he ceased active hostility and tolerated her presence, his assiduity in incubation did not increase. As compared with male Golden-naped Woodpeckers incubating normally in alternation with their mates, the sessions of this peculiar male were on the average only about one-third to one-half as long, but his absences were also very much shorter. He spent a greater proportion of the day in the nest than the male at Nest 1, but not so much as the male at Nest 2.

NOTES ON RELATED SPECIES

The kind of family life and manner of sleeping exemplified by the Golden-naped Woodpecker might be briefly designated the '*Tripsurus*-

type.' Complete studies of other members of the genus are lacking, but the facts available for two other species suggest that they order their lives in essentially the same way. Pucheran's Woodpecker (*Tripsurus pucherani*) ranges through the Caribbean rain-forests from southern México to Colombia, thence down the Pacific coast of South America to southern Ecuador. In appearance, it differs from the Golden-nape chiefly in its red rather than yellow occiput and nape, and the widely spaced white bars on its black back and wings.

Despite a number of seasons passed in the range of these woodpeckers, I discovered the home of only a single pair. When I first made their acquaintance, in the middle of April, 1941, they were completing a new hole in a dead trunk standing in a maize field, on a steep slope above the Pejivalle River in Costa Rica. The male and female already used the new cavity as a dormitory; the male entered first in the evening and lingered within longer in the morning. Before they began to incubate, a Band-tailed Tityra started to fill up the bottom of their chamber with dry litter for her nest, causing the patient woodpeckers to carve another hole lower in the same trunk. But before completing this they started still a third, a yard higher, male and female sharing the task of chiselling out the hard wood. As soon as it was sufficiently capacious, the male slept in the newest cavity, the female in the next-to-newest, three feet below him. I do not know why they did not lodge together as formerly, unless because the hardness of the wood prevented the completion of a chamber big enough to accommodate both with comfort. When at length they began to incubate, it was in the hole in which the *male* slept. His mate continued to roost in her separate cavity. This arrangement was still followed after the nestlings hatched; unfortunately I left the region before they were fledged. These observations suggested the answer to a question which had long been in my mind with reference to the Golden-naped Woodpeckers: Which member of the pair actually warms the eggs during the night? Later, as told above, I gathered further evidence on this point at the abnormal nest of the Golden-napes themselves, and now have little doubt that in the normal course of events the male actually covers the eggs through the night; the female probably sleeps clinging to the wall above him.

While the pair of Pucheran's Woodpeckers still occupied their first and highest hole, I saw the male eat an egg which apparently he had removed from his own nest. On May 19, the female stayed many minutes in the newly carved low hole, probably laying an egg. After she left the male went in, then emerged with an egg in his bill and dropped it to the ground. The egg, as seen through binoculars, ap-

peared small in proportion to the woodpecker that laid it, and upon examining the smashed remains lying on the ground, I could detect no trace of a yolk. How could the woodpecker discover this in the still unbroken egg? Was the egg rejected merely because of its unusual smallness? I once saw a male Streaked-chested Acorn Woodpecker (*Balanosphyra formicivora striatipectus*) remove an egg from a recently abandoned nest-cavity (inaccessible to me) where incubation had been going on, and deposit it on the end of a neighboring stub. Was this egg left behind when the other eggs of the set, or possibly recently hatched nestlings, were removed by a nest-robber? Early one morning a female Olivaceous Piculet carried an egg from a hole used by four individuals for sleeping. Moreau (1942: 39) records that a White-rumped Swift (*Micropus caffer streubelii*) threw an egg from the nest after seven days of incubation; it was presumably of normal size but contained no embryo. He remarks that this observation suggests that the incubating swift is aware of the condition of its eggs, and the same apparently applies to woodpeckers.

In the eastern foothills of the Andes of Ecuador and Perú, and on the western side of the immense Amazonian plain, one of the most abundant members of the family is the handsome Crimson-bellied Black Woodpecker (*Tripsurus cruentatus*), clad largely in black, with a large patch of deep crimson on its lower breast and belly. I found it far noisier than its Central American congeners and almost as vociferous as the Acorn Woodpecker, which it somewhat resembled in language. One evening while I dwelt at Puyo in eastern Ecuador, five of these active woodpeckers gave me a magnificent exhibition of aerial flycatching, in their strong flight and intricate maneuvers rivalling the Neotropic Kingbirds (*Tyrannus melancholicus*) which were engaged in the same occupation at the same time. They continued this activity until the sunset glow had quite faded from the snowy, smoke-plumed summit of Sangay far away to the south. Then when it was nearly dark they retired, all five together, into a hole high up in a dead palm trunk, standing pole-like in a hillside pasture. This I supposed to be a family consisting of parents and three children, sleeping in exactly the same fashion as their northern cousins, the Golden-naped Woodpeckers. A year later, I watched four of these Crimson-bellied Black Woodpeckers retire to sleep in a hole only ten feet above the ground, in a low stub in a pasture, at Caballo-Cocha near the Amazon in Perú. Like the birds at Puyo, they did not enter until it was nearly dark. I watched the woodpeckers at Puyo in August, those at Caballo-Cocha in October; and the presence of family groups during these months leads me to suspect that the birds had nested earlier in the year.

But at Satipo, considerably farther to the south in the Andean foothills of Perú (in the Department of Junfn), early in September, a male and female Crimson-bellied Black Woodpecker slept in the same hole, in a lofty branch of a tree growing near the Agricultural School. They seemed to be preparing to breed, for they were engaged in carving a new hole in a neighboring branch. Meanwhile, a female Inquisitive Tityra was carrying leaves into the old hole where they slept. She looked on quietly and made no disturbance while one of the woodpeckers threw some of her material from their dormitory, but not nearly so much as she had taken in that morning. From Central America to Perú and Brazil, woodpeckers of the genus *Tripsurus* must contend with the Band-tailed and Inquisitive Tityras which use their holes for nesting, and fill them up with leaves, to the great annoyance of the owners. And over all this vast territory, the competition goes on, apparently, with silent persistence and never a fight, never even the vengeful tearing out of a feather by the chief protagonists. How mild of manner are these tropical birds!

COMPARISON WITH OTHER WOODPECKERS

Briefly to compare the social and nesting behavior of the Golden-naped Woodpecker with that of other picarian species for which we have the necessary information, we may make use of a 'key' such as taxonomists employ for the ready comparison of morphological characters. The following preliminary and partial classification of woodpeckers according to their life history is a modification of that first published some years ago (Skutch, 1943: 359). Where references to literature are not given, the species are included on the strength of unpublished observations of the writer.

I. A single pair attend the nest.

A. *Centurus*-type: Individuals past the nestling stage regularly sleep one in a hole; the male attends the nest by night, his mate roosting elsewhere; food is delivered to the nestlings either as solid particles carried in the bill or by regurgitation; the nest is at first kept clean, but as the nestlings grow older waste is often allowed to accumulate in it; the fledglings are not led back to sleep in the nest after their first flights. Examples:

Wagler's Red-crowned Woodpecker, *Centurus rubricapillus wagleri*. (Skutch, 1943: 359-361.)

Hoffmann's Woodpecker, *Centurus hoffmannii*. (Information on return of fledglings lacking.)

Trujillo Golden-fronted Woodpecker, *Centurus aurifrons pauper*. (Information on return of fledglings lacking.)

Costa Rican Golden-olive Woodpecker, *Piculus rubiginosus uropygialis*.

Panamá Lineated Woodpecker, *Ceophloeus lineatus mesorhynchus*.

Ivory-billed Woodpecker, *Campephilus principalis*. (Tanner, 1941.)

Guatemalan White-billed Woodpecker, *Phloeocoestes g. guatemalensis*. (Information on return of fledglings lacking.)

Boquete Hairy Woodpecker, *Dendrocopos villosus extimus*.

British Lesser Spotted Woodpecker, *Dendrocopos minor comminutus*. (Information on return of fledglings not available. (Witherby, et al. 1938: 288-291.)

Northern Flicker, *Colaptes auratus luteus*. (Information on return of fledglings not available. (Bent, 1939; Skutch, 1937.)

- B. *Tripsurus*-type: Adults occupy their sleeping-cavities by pairs or family groups, rarely alone; male and female sleep in the nest with the eggs and young; food is brought in the parents' bills; the nest is kept clean until the young take wing or later; fledglings return to sleep in the nest-cavity with their parents, and may continue this habit until the approach of the following breeding-season.

Examples:

Golden-naped Woodpecker, *Tripsurus chrysauchen*.

Veragua Olivaceous Piculet, *Picumnus olivaceus flavotinctus*.

Apparently also:

Pucheran's Woodpecker, *Tripsurus p. pucherani*.

Crimson-bellied Black Woodpecker, *Tripsurus cruentatus*.

Lafresnaye's Piculet, *Picumnus lafresnayeri*.

- II. More than two grown birds attend the nest.

- C. *Balanosphyra*-type: Four or five individuals may take turns at incubation and join in attending the nestlings; one sleeps in the nest, the others in a neighboring hole. (Information on this type of life history is still incomplete.) Example.

Streaked-chested Acorn Woodpecker, *Balanosphyra formicivora striatipectus*. (Skutch, 1943: 363.)

Some authors (e.g., Griscom, 1932: 226) would reduce *Tripsurus* to a subgenus of *Centurus*. In view of the fundamental differences in life history which we have pointed out, it seems best to retain these two groups as distinct genera, unless further studies show that the differences in behavior are not associated in a constant manner with the morphological differences on the basis of which they were originally separated.

SUMMARY

1. The Golden-naped Woodpecker (*Tripsurus chrysauchen*) is endemic in an isolated region of lowland rain-forest on the Pacific side of Costa Rica and extreme western Panamá. It is found at all seasons in pairs or family groups of not over five individuals, rarely alone.

2. These woodpeckers nest and sleep in holes usually carved high up in fire-killed trees standing near the forest's edge in newly made clearings, or in dead trees just within the edge of the forest. When these holes are immediately needed either as a dormitory or as a receptacle for eggs, male and female share rather equally the task of carving them out; at other times the male may work at them alone in a leisurely fashion, spending many months on a single cavity.

3. In the basin of El General, Costa Rica, the breeding-season extends from late March to June. A single brood is reared each year; but if the first attempt to produce offspring is unsuccessful, the pair may try at least twice more.

4. Male and female occupy the nest-cavity by night, whether it contains eggs or young. By day the two alternate in incubation, replacing each other more frequently than most other woodpeckers. Unlike woodpeckers which sleep in solitude, male and female are often together in the nest-cavity by day.

5. The young are nourished with solid food brought in the parents' bills—not by regurgitation. They remain in the nest about 33 days. Throughout this period the parents carefully clean the nest.

6. Three is the maximum number of young known to be fledged in any nest. In six broods recently emerged from the nest, there were 13 males and only three females.

7. After the young begin to fly about, they return in the late afternoon to sleep with both parents in the hole where they were reared. From the first they regain their high doorway with little or no instruction, but at times a special call of the parents is used to bring them home. After their return, they are, in some families at least, fed by the parents as though they were nestlings; and the adults continue to remove waste matter from the nest. Recently emerged fledglings take shelter from afternoon showers in the nest-cavity; and if it rains harder the parents join them inside.

8. The young may continue to sleep with their parents until a short while before the following breeding-season—until they are nearly a year old. Sometimes the family continues during all this period to occupy the hole in which the young were reared, with perhaps occasional periods of restlessness when they shift temporarily to neighboring holes. But other families carve new holes after a month or so and move into them. The cause of these differences in behavior is not always clear, but possibly the presence of vermin leads the woodpeckers to abandon their holes either temporarily or permanently.

9. There is no fixed order for entering the hole in the evening or leaving in the morning, but the female tends to be the last to retire and the first to emerge. Compared with other birds, Golden-napes go to rest early and become active late.

10. Golden-naped Woodpeckers lose many holes to the two species of *Tityra* that dwell in the same region. Both the Band-tailed and Inquisitive Tityras fill the woodpeckers' cavities with dead leaves and sticks in anticipation of laying their eggs. The original owners throw some or all of this trash out, but the tityras then take more in. Final-

ly, tiring of removing foreign material, the woodpeckers carve new holes close by. No fighting between woodpeckers and tityras has ever been witnessed.

11. An eccentric male Golden-nape persisted in driving the female from the nest. He incubated alone and slept alone in the hole with the eggs. Even after a partial reconciliation between the members of the pair, he did most of the work of attending the nestlings.

12. Incomplete studies of Pucheran's Woodpecker (*Tripsurus pucherani*) and the Crimson-bellied Black Woodpecker (*T. cruentatus*) furnish evidence that they have the same type of life history as the Golden-naped Woodpecker.

13. A classification of the woodpeckers according to the pattern of their life history is attempted.

14. *Tripsurus* is distinguished from *Centurus* by fundamental differences in life history as well as by morphological characters.

LITERATURE CITED

BENT, ARTHUR CLEVELAND

1939. Life histories of North American woodpeckers. U. S. Nat. Mus., Bull. 174. (Washington.)

CARRIKER, M. A., JR.

1910. An annotated list of the birds of Costa Rica including Cocos Island. Ann. Carnegie Mus., 6: 314-915.

GRISCOM, LUDLOW

1932. The distribution of bird-life in Guatemala. Bull. American Mus. Nat. Hist., 64: 1-439.

MOREAU, R. E.

1942. The breeding biology of *Micropus caffer streubelii* Hartlaub, the White-rumped Swift. Ibis, Jan., 1942: 27-49.

SKUTCH, ALEXANDER F.

1935. Helpers at the nest. Auk, 52: 257-273.

1937. The male flicker's part in incubation. Bird-Lore, 39: 112-114.

1943. The family life of Central American woodpeckers. Scientific Monthly, 56: 358-364.

1946. Life history of the Costa Rican Tityra. Auk, 63: 327-362.

TANNER, JAMES TAYLOR

1941. Three years with the Ivory-billed Woodpecker, America's rarest bird. Audubon Magazine, 43: 5-14.

WITHERBY, H. F., JOURDAIN, F. C. R., TICEHURST, NORMAN F., AND TUCKER, BERNARD W.

1938. The handbook of British birds, 2. (London.)

Finca 'Los Cusingos'

San Isidro del General

Costa Rica