

## A NESTING OF THE COLLARED TROGON

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IN earlier papers (1942, 1944, 1945, 1947, 1948, 1953) I gave accounts of the nesting and other habits of four species of trogons. These reports were based upon observations at two or more nests. Of the Collared Trogon (*Trogon collaris*) I have seen only a single occupied nest, at which I was able to learn something of the mode of incubation and the care and development of the young. I had hoped to round out this study by watching other nests, as the Collared Trogon is not uncommon on the mountain slopes over which I look as I write. But my residence is several hundred feet below the lower limit of the trogon's range in this region; and in 14 years I have not seen a single individual on my farm or even within several miles of it; as the land rises only gradually northward toward the steep slopes of the Cordillera de Talamanca. In view of the paucity of our information about the nesting of this magnificent family of birds and the lack of an available account of the breeding of this particular species, it seems best to publish what I know about it, before the observations made at the nest which I found in 1937 become ancient history.

*Appearance and Range.*—One of the smaller members of its family, the Collared Trogon is a graceful bird about ten inches in length, richly clad in bright, contrasting colors. The upper plumage of the male is largely metallic golden-green. The two central feathers of his long tail are green with black tips. The outermost feathers are black with narrow white tips and are narrowly barred with white over most of their surface. The rectrices intermediate in position are also intermediate in coloration. His wings are largely black, with fine vermiculations of white on the greater coverts and white edgings on the longer primaries. His cheeks, chin, and throat are black, his chest metallic golden-green like the upper parts and separated by a broad and conspicuous white band from the bright red of the more posterior under plumage. His eyes are dark brown, surrounded by a ring of bare skin of approximately the same color, so that it does not stand out conspicuously like the contrasting orbital rings of some of the other trogons. His bill is unmarked, bright yellow. The female, although much less brightly attired than the male, is beautiful in her subdued colors. Her upper plumage is brown, brightest on the lower rump and upper tail-coverts. The two middle tail feathers are chestnut with contrasting black tips. Her face and throat are dusky or slate-colored, and there is a conspicuous crescent of white behind each

eye. Her chest is brown, separated by a white bar from her red abdomen. Her eyes are brown, like those of the male; but her bill is paler yellow with a broad, black stripe along the ridge of the maxilla.

The Collared Trogon ranges from Ecuador to southern México; and the form *puella*, the subject of the present study, was long considered a distinct species and occupies the portion of this range from western Panamá northward. It avoids extremes of altitude and is found neither near sea level, where the majority of the Central American trogons are to be met, nor yet high up in the mountains, like the Mexican Trogon (*Trogon mexicanus*) and the Quetzal (*Pharomachrus mocinno*). On the Pacific slope of southern Costa Rica, I have not once in nearly two decades seen this trogon as low as 2500 feet; but it begins to appear as one approaches 3000 feet. On the opposite side of the Cordillera de Talamanca it descends somewhat lower; for I first met the bird at about 2000 feet at Pejivalle in the Caribbean drainage; and Carriker (1910:557) records it at this altitude on the Volcán Turrialba. In Guatemala I have traced it somewhat lower, down to 1900 feet on the Pacific slope, and at about 1200 feet on the Caribbean slope, in the northern part of the Department of El Quiché during the winter months. As to the upper limit of its altitudinal range, I met a single individual at 6500 feet on the Pacific side of the Volcán Atitlán in Guatemala, whereas in Costa Rica I found it not uncommon at Vara Blanca, 5500 feet above sea level.

*Habitat and Food.*—The Collared Trogon dwells chiefly in heavy mountain forests of broad-leaved trees but ventures forth into neighboring clearings with scattered trees in which it may even nest. Coffee plantations with their evenly spaced shade trees are attractive to the bird. Except in the nesting season, I have nearly always met lone individuals. Like other trogons, it is a quiet, retiring bird, dignified in manner. One usually sees it perching very upright, well up among the forest trees. Of a sudden it makes a rapid dart to seize some insect which its keen eyes have descried upon the neighboring foliage, plucks it off without alighting, then settles on another perch to devour its booty. Its food consists largely of orthopterans and other insects which it captures in this fashion among the trees, and probably also of an admixture of berries, as with other trogons.

*Voice.*—The call of the male Collared Trogon is a low, clear, and mellow *cow cow*, or less commonly *cow cow cow*—a soft, restrained utterance in keeping with the whole manner of the bird. The call of the female is similar but even weaker in tone. Both in its quality and its usual limitation to two or three notes, the call of the Collared Trogon resembles that of the Black-throated Trogon (*Trogon rufus*)

more than that of any other species with which I am familiar. On the Pacific side of southern Costa Rica these two trogons occupy distinct altitudinal belts, the highest of the heat-loving Black-throated Trogon scarcely ranging so high as the lowest of the Collared Trogons.

When alarmed or suspicious, the Collared Trogon has a very different utterance, a low, long-drawn *churr*, which is sometimes almost a rattle. While delivering this complaining call, the bird executes a characteristic tail movement. First it slightly spreads the tail fanwise and at once closes it, all very rapidly. The spreading is not pronounced, but enough to reveal to an observer behind the bird the white of the outer tail feathers, which flashes out momentarily, apparently as a warning signal to the mate. No sooner is the tail closed than it is slowly elevated, with a deliberation that contrasts sharply with the preceding lateral spreading.

*Nest and Eggs.*—On January 24, 1937, I found the nest of the Collared Trogon in the foothills of the Cordillera de Talamanca on the northern side of the basin of El General in Costa Rica, at an altitude of about 3000 feet above sea level. The nest-cavity was 12 feet above the ground near the top of a slender, barkless stub of the burío (*Heliocarpus excelsior*), a tree with very soft wood. This stood in a clearing, amid tall grasses, rank weeds, and tangled vines, but only 25 yards from the edge of tall and heavy forest. The deep niche had doubtless been carved into the soft, decaying wood by the trogons themselves, and the marks of their short, stout bills were clearly impressed around the margin of the aperture. This was irregularly pyriform in outline, much higher than wide and broadest near the lower end. The cavity itself extended only a few inches below the lower margin of the doorway, with the result that when the trogons sat in it parts of them were visible from in front. A split in the wood extended through the rear wall of the chamber as a wide gap, through which I could see the sky.

The burío stub was so weak and tottering that I did not dare to set a ladder against it, or even to clear away some of the tangled vegetation which surrounded and apparently helped to sustain it, in order to make a space for a self-supported ladder. But by attaching a mirror to the end of a stick and holding it in the doorway, I could see two white eggs, which rested upon fragments of wood in the unlined bottom of the cavity. No softer material had been taken in to form a bed for them. Even when they carve their nest chamber in the harder substance of a termitary, trogons never provide a lining for their eggs.

On February 5, while I was engaged in the study of this nest, a boy led me to a nest which his father found while clearing away the forest on the slopes higher up the valley, at an altitude of about 3300

feet. This was in a barkless, decaying stump about seven feet high, which when I saw it was standing above the great, newly fallen trees, whose downward crashes it had miraculously escaped. The two eggs which I was told had been present the preceding day had vanished before I arrived on the scene. But the cavity so closely resembled the occupied nest which I had found that I felt certain that it belonged to the same species; and this conclusion received a degree of confirmation when a male Collared Trogon alighted in a tree a little higher up the steep mountain slope and repeated over and over a low, full-voiced *cow cow*, which under the circumstances, and amid the chaos of the newly destroyed forest, impressed me as most melancholy. Accordingly, although as a rule I prefer to make notes of nests only when I have found them in actual occupancy, I thought it worth my while to take some measurements of this. Its height was 5 feet above the ground. The entrance, rounded at the bottom but pointed at the top, was 6 inches high by  $2 \frac{7}{8}$  inches in extreme width. The cavity extended  $2 \frac{1}{2}$  inches below the lower edge of the doorway. It measured  $4 \frac{1}{2}$  inches in diameter from front to back and 4 inches from side to side. It appeared to be freshly carved.

Recent classifications of the American trogons unite in the single genus *Trogon* the species placed by Ridgway (1911) and other earlier authors in the genera *Trogon*, *Trogonurus*, *Curucujus*, and *Chrysotrogon*. In addition to the morphological distinctions recognized by Ridgway, at least some of these groups are distinguished by differences in habits which appear to be constant. The three Central American species of *Trogonurus* whose nests I have seen (Mexican Trogon, Black-throated Trogon, Collared Trogon) all make shallow, open niches in decaying trunks, of the type just described. Representatives of *Trogon* as restricted by Ridgway, including the Citreoline Trogon (*T. citreolus*) and White-tailed Trogon (*T. viridis*), carve a deep, well enclosed chamber entered through an obliquely ascending tube, so that from the outside it is impossible to see anything of the bird sitting within. The Massena Trogon (*T. massena*), a member of the *Curucujus* group, excavates cavities of the same form, which I have found in both decaying trunks and termitaries, proving that the shape of the cavity is more constant than the medium in which it is placed. The Violaceous Trogon (*T. violaceus*), a representative of the *Chrysotrogon* group, digs a well enclosed chamber in the heart of a wasps' nest, and so far as I have seen, restricts itself to this surprising situation. In voice, the representatives of *Trogonurus* which I know resemble each other more closely than they resemble any of the other trogons that I have heard, all delivering clear, mellow notes distinctly

spaced, never an ascending roll. The same uniformity in voice does not hold in *Trogon* (in the limited sense), but the call of the White-tailed Trogon differs strikingly from that of the Citreoline Trogon.

*Incubation.*—When I found the occupied nest at about 3:50 P.M. on January 24, the male trogon was covering the completed set of two eggs. It was his glittering green head and bright yellow bill framed in the wide aperture of the cavity which first caught my eye and drew my attention to the nest. Unperturbed, he returned my gaze while I examined through my field-glasses what was to be seen of him in the nest; and he heeded not at all when I shouted to him to come forth, that I might see all the rest of his plumage and thereby identify his species beyond doubt. He watched me approach to within a few yards of the low burío stub; and only when my machete crashed down on the first of the tangled vegetation that separated me from the trunk did he dart out and away, not pausing until he had vanished among the trees of the neighboring forest.

After completing my inspection of the nest by means of the mirror, I went away. Returning at 4:20 P.M., I found that the female had come to take charge of the eggs. She sat even more steadfastly than her mate. It required a great deal of hand-clapping and whistling on my part even to make her raise her head and look out over her door-sill. She watched my advance to the base of her stub; and when I shook and tapped upon it as hard as I dared, considering its infirm state, she merely leaned out far enough to look down upon me. Only after I had tossed up my cap two or three times did she dart forth and fly to a perch not far off, where I had a fine view of her. On subsequent visits I found her equally indifferent to my presence. Sometimes, when I tapped on the stub to make her leave the eggs exposed for my inspection, she would rise to a bough almost over my head, where she would *churr* and perform with her tail in the manner already described. Her utterances might draw her mate out of the neighboring forest, and he would call and move his tail in the same fashion. Sometimes, appearing to be more concerned about the safety of the eggs than the female, he would remain near me and the nest, churring, after she had grown tired of complaining and flown out of sight.

Although both of the trogons were so strongly attached to their nest, when I came to study in more detail their mode of incubation, I deemed it advisable to conceal myself in a blind. In an old potato patch at the edge of the forest I found a spot where, taking advantage of the steep slope, I could set my brown wigwam and watch from above the level of the nest. When I began my vigil at 1:00 P.M. on January 30, the male was sitting on the eggs, with his yellow bill

resting on the door-sill. During the drowsy hours of the afternoon he sank lower in the nest, until I could see only the top of his head and his bright green tail, which was held upright against the rear wall of the cavity and was easily visible from in front.

At 4:48 the female suddenly flew out of the forest and came to rest on a branch at the edge of the potato patch. Twice she called *cow cow* in a very low, soft voice. Her mate thereupon promptly left the nest and flew toward her, but continued past her into the forest. Then the female flew toward the nest and came to rest on a bough about 25 feet distant from it, where she repeated her low *churr* over and over, with each utterance rapidly flirting then slowly elevating her tail. Then she flew to the nest and clung in front of it, continuing to voice the *churr*. After a minute in this position she entered, promptly turned to face outward, and settled down to incubate, at 4:51. For a few minutes she continued to look over the sill; but gradually her head sank down until her bill and eyes were hidden behind the rim; but her bright brown tail, held upward against the rear wall of the chamber, stood out clearly. She sat without interruption until it grew dark.

When I resumed my vigil at 5:40 next morning, the female trogon was still in the nest. As it grew light I heard her mate call *cow cow* and *cow cow cow* in a low voice, off in the woods. At 7:00 he emerged at the upper edge of the clearing and from an exposed perch called *cow cow* many times over. This was apparently a summons to his mate to come forth so that he might take his turn on the eggs. But she did not even raise her eyes above the rim of the cavity. For many minutes he lingered within hearing; but finally he wandered farther back into the forest; and his pleasant call no longer reached me.

At about 8:40 the female, who had continued steadily to sit, began to look out more often, frequently raising her eyes above the sill. At 9:15 the sun's rays first began to fall into the nest-cavity, which opened toward the east. At 10:00 she sat higher in the nest, with her bill above the sill, then after a while sank lower, until only the crown of her head was visible to me. At 11:27 she sat with her head higher than before and visible in its entirety, then gradually moved forward to stand on the sill, from which she darted forth. Flying across the potato patch and well up into the forest, she came to rest on a high branch and called *cow cow* in a subdued voice. She continued to call at intervals for several minutes, then flew farther into the woodland, where I lost sight of her. Just at noon she returned from the opposite direction, flying up over the bushy growth on the deforested slope below the nest. Alighting on a bush, she uttered her

low *churr* over and over, then clung in front of the nest and continued the same note, ceasing only when she entered. She was now beneath the hot midday sun and sat high, with her whole head visible in the doorway, her bill open, panting. At 1:00 P.M. I left her so. Since his departure soon after seven o'clock, I had seen nothing more of the male trogon. But he was on duty in the nest when I paid it a brief visit at 3:10 that afternoon.

Unfortunately, my long vigil at the trogons' nest had not fallen on a typical day. On other days I made a number of visits to the nest at such times as I had free. One morning I found the male sitting at 9:10, on another at 9:05, on still another at 10:10, and when the eggs were on the point of hatching, at 8:34 A.M. But when I came earlier, at 8:33 one morning and at 8:08 on another, I found the female sitting. When I watched from the blind on the morning of January 31, the male arrived so unusually early that his mate was not ready to leave. Then, when he found that the female paid no attention to him, he went off, and stayed away until past one o'clock. So great was the female's attachment to her eggs that she remained covering them, without food, until long past her usual hour of going for breakfast. But at half past eleven hunger overcame her; she went off, called for her mate without response, and since he did not appear, herself returned to the nest after half an hour's absence, to sit, apparently, until his belated arrival. While studying the Mexican Trogon in the Guatemalan highlands, I saw precisely the same thing: the female would not leave when he called for her to relinquish the eggs to him; then when he stayed away for several hours longer, growing hunger compelled her to go off for a short recess, leaving the nest unattended.

On afternoon visits, I once found the female Collared Trogon in the nest at 4:20 and once at 4:15, but never earlier than this. Thus the male appeared usually to be responsible for the nest from between 8:30 and 9:00 in the morning until between 4:00 and 5:00 in the afternoon, while the female was in charge for the remainder of the time. In this pattern of incubation, with long, uninterrupted sessions and only two change-overs daily, the Collared Trogon resembles the Black-throated Trogon, Citreoline Trogon, White-tailed Trogon, Massena Trogon, and some but not all pairs of the Mexican Trogon. The pattern of incubation of all these trogons is thus essentially the same as that of the pigeons and doves, in which also the male typically takes one long session extending over the middle of the day, while the female sits from mid- or late afternoon until he returns to replace her on the following morning. But the Quetzal, which incubates

far less patiently than most of the smaller trogons, follows a very different scheme, with the male taking each day two separate sessions, in the morning and afternoon, while the female takes a turn on the eggs in the middle of the day as well as the long night session. And even these relatively short turns of duty of the Quetzal may be interrupted by brief recesses, during which the eggs are left exposed.

*The Nestlings.*—When I arrived at 8:34 A.M. on February 4, the male trogon was in the nest. As I raised the mirror he flew off, and in the reflected images of the eggs I could see that one of them had been pierced by its occupant. Next morning at 8:35, I found the male covering two nestlings, which bore not a trace of down or feathers on their pink skin and had tightly closed eyes. The empty shells were allowed by the parents to remain in the nest for at least five days, and I believe they were finally covered by the excrement which soon began to accumulate on the bottom of the nest. I saw the parents do nothing to keep it clean.

On the afternoon of February 8, the male was brooding and watched from the nest while I set my blind once more in the old potato patch, about 40 feet in front of him. He flew from the cavity only when I approached to look at his nestlings with the mirror. The following morning at dawn I entered the blind to watch the trogons attend their two four-day-old nestlings. There was then barely enough light to see that their mother was brooding. At 6:15 her mate called *cow cow* twice in low tones, whereupon she left the nest and flew up into the forest. The male rested in a tree at the edge of the clearing, holding in his bill a big, brown insect with very long antennae. He delayed in the same spot, only moving his head slowly from side to side, while the rising sun, which at his arrival caressed only the highest summits of the mountains across the valley to the west, drove the shadows quite to their feet. Then he flew to another perch somewhat nearer the nest and continued to look around, at intervals repeating his low *cow cow*. At 6:44 his partner returned, bringing an insect somewhat smaller than his, and alighted near him. After a pause of less than a minute she flew to the nest, clung upright in front of the entrance with her feet on the sill, placed the insect in a nestling's mouth, and departed. Then at last the male went to the nest, delivered in the same fashion the insect which he had held for half an hour or more, and also flew away.

At 7:02 the female returned with an unrecognized object in her bill and rested on a dead branch near the nest for 27 minutes, then at 7:29 suddenly darted away, still bearing the morsel in her bill. At 7:55 she returned and again perched on the dead branch holding



food. After a delay of 12 minutes she proceeded to the nest and offered the morsel to the nestlings while clinging in front; but during an exposure of nearly two hours they had become so cold and numb that they could not take it. She entered, settled in the nest, then rose to offer the food to the little ones beneath her; but still they did not respond to it. She turned sideways, then backwards in the nest, and bent down to the nestlings with her red belly in the doorway, her long tail projecting through it and rising into the outer air. In this posture she endeavored persistently to give nourishment to her chilled offspring. At last, at 8:15, the morsel vanished and the parent continued to brood more reposefully.

It appeared that the trogons were behaving abnormally because they were still shy of the blind; or because, with undue confidence in their earlier indifference to my presence, I had at first been watching with the little windows too widely open. Accordingly, I cut short my vigil on February 9, to resume it on the following morning, after giving the birds another day to accustom themselves to the blind's presence only half as far from their nest as while I watched them incubate. I now opened the front window barely wide enough to permit the use of my binoculars, which were indispensable for the recognition of the food brought by the parents. But they behaved very much as on the preceding morning, with interesting variations.

The female was again brooding when I arrived at daybreak on February 10. At 6:20 she flew from the nest, alighted on a high bough at the forest's edge and repeated her low *churr* many times over, then flew off into the woods. Returning at 6:47, she bore what appeared to be a green tree cricket with very long antennae. For the next hour she delayed in sight of the nest, continuing to hold this insect in her bill. During most of this time she rested in silence on the same high perch; finally she began to voice very subdued *cow's*, then changed her perch and churred. At 7:45 I saw the male for the first time that morning as he alighted in the doorway of the nest with food in his bill. His mate, as soon as she saw him coming, broke her long period of inactivity by darting to the nest along with him. Arriving at about the same time, she knocked him away as he settled there, so that he flew to a neighboring perch with his contribution undelivered. The mother placed her green insect—which she had held for a whole hour!—in the upturned mouth of a nestling, then left. Then the father, after resting only three minutes on the branch where he had settled when his mate knocked him from the doorway, went again to the nest to deliver his insect. He lingered clinging so, looking around from side to side, for five minutes, then darted away.

At 8:08 the father returned with a big green insect that resembled a grasshopper with exceedingly long antennae. After four minutes he delivered it while clinging in front of the nest, then entered to brood the nestlings, sitting much higher than while he incubated. He covered the nestlings for eight minutes, then left as his partner arrived with food. She delivered this promptly, went off, and soon returned with another big, green insect, which she gave to a nestling, at 8:53, then settled down to brood for 110 minutes. At 10:43 the male appeared at the edge of the forest with an insect in his bill and the female left the nest. During the next 36 minutes he made four successive advances, which brought him to within 30 feet of the nest. Now he suddenly and inexplicably darted back into the woodland, carrying away the green insect which all this while he had held.

The direct, confident manner in which the parent trogons sometimes advanced to the nest contrasted strangely with their long hesitation at other times when they came with food. Perhaps their keen eyes now and then picked out my own eyes through the narrow slit it was necessary to leave in the front of the blind in order to see what the birds did. But whether or not mistrust of the blind had anything to do with their long periods of almost immobile perching with food in their bills, this patient stolidity was entirely in keeping with the trogons' reposeful nature and their long, uninterrupted sessions while incubating. I have observed comparable behavior with other kinds of trogons; but a more active bird, such as a wren or a wood warbler, if kept from its nest by suspicion of some object in its vicinity, would never have rested in the same spot holding the same insect for nearly an hour, as these Collared Trogons did. The long period of immobile waiting of one parent was sometimes broken by its partner's approach to the nest, which served to fillip the procrastinating one out of its lethargy.

In 7.5 hours on the mornings of February 9 and 10, the two nestlings, 4 and then 5 days old, were fed 3 times by their father and 5 times by their mother, making a total of 8 feedings, or at the rate of one insect for each nestling about every 2 hours. In addition to the food actually delivered, male and female each brought an insect once and carried it away again. Although the nestlings were fed so infrequently, the insects they received were so large in relation to their own size that each was a substantial meal for them, and I think it likely that they had enough. Despite the erratic behavior of the parents, their rate of feeding was not remarkably low for trogons. On the cloudy morning of February 10, during the 5 hours between the female's first morning departure at 6:20 and the end of my watch

at 11:20, the still naked nestlings were brooded twice, once by their father for 8 minutes and once by their mother for 110 minutes.

When the nestling trogons were five days old, I could distinguish their sprouting pin feathers in the mirror which I used to view them. When they were nine days old their plumage began to shed the horny sheaths and expand, and at 11 days the youngsters were well covered with brown feathers. The whitish spots on their wing-coverts were conspicuous in the mirror. Thirteen days after the nestlings hatched I found one of them lying dead beneath the nest, its head chewed or torn open, and swarming with ants. The other remained in the nest, apparently unhurt. But three days later, when the survivor was 16 days old and seemed about ready to fly, I found it, too, lying dead below the nest. It was fully feathered, and I detected on it no lesions other than those which might be attributed to the ants that were beginning to devour it. The preceding day it had been in good condition, and I could not imagine what calamity befell it.

The dead nestling appeared to have been well fed; and that it had not perished from parental neglect was proved by the arrival, while I examined its plumage, of its father with a fat, green insect in his bill. He rested on a low perch at the opposite side of the clearing while he complained with his subdued *churr*, spreading his tail and moving it up and down as he voiced his notes of distress. After a while he went back into the forest with his insect; but he soon returned with what appeared to be a hairy caterpillar and perched a long while at the lower edge of the clearing, sometimes complaining and sometimes silent. The female trogon did not arrive while I remained in view of the nest. Such bringing of food by bereaved parents for nestlings which have succumbed in the nest or recently vanished is not unusual among birds. A female Citreoline Trogon came with an insect for an older nestling which was headless and swarming with ants; and I have witnessed similar conduct in the Golden-naped Woodpecker (*Tripurus chrysauchen*), Yellow-green Vireo (*Vireo flavoviridis*), Yellow-rumped Cacique (*Cacicus cela*), and Golden-masked Tanager (*Tangara nigro-cincta*). In at least some of these instances, the parents knew from earlier visits that the young had disappeared or perished. Numerous similar cases have been reported in print for a variety of birds ranging from kingfishers and guillemots to thrushes and finches. Such persistent parental attention provides a margin of safety for the nestlings.

I took down the stub in which the nest-cavity had been carved to see whether it would yield any evidence as to the cause of the tragedy. It was so rotten at the base that I easily pulled it over with one hand.

I found the bottom of the cavity caked with the excreta of the nestlings, which is normal for trogons, but nothing which revealed why the little birds perished. Perhaps a weasel had attacked them.

Since the juvenal plumage of the "Jalapa Trogon" is not described in Ridgway (1911), I shall give here the description of the dead 16-day-old nestling which I wrote in the field. It was fully clothed in soft feathers and its remiges were well developed, although the rectrices hardly peeped beyond their coverts. The general color of the body plumage was brownish. The brown was deepest on the head, neck, back, shoulders (scapulars) and chest. The rump and upper tail-coverts were brighter and more rufescent; the breast and belly were lighter and somewhat tawny; while the under tail-coverts were distinctly tawny. Behind each eye was a conspicuous white crescent, and in front of each eye a smaller spot of white. The wings were generally blackish slate-color, very conspicuously spotted and vermiculated with buff. The lesser coverts were slate-color with dark brown edgings. The middle coverts were blackish-slate with large, round, subterminal spots of buff. The outer of the greater coverts were blackish-slate without markings, but proceeding inward they bore increasingly large buffy subterminal spots and vermiculations of buff. The primaries were plain blackish-slate, but the secondaries became more extensively vermiculated with buff on the outer web as they were nearer the body. The three innermost bore prominent subterminal spots of buff; and on the two innermost, the buffy vermiculations extended, in slight degree, to the inner web. The bill was black with a light tip. Thus the plumage of the fledgling bore a certain resemblance to that of the adult female; but it lacked the white bar on the breast and red on the abdomen and had buffy spots on the wings which were not evident on the mature female.

#### SUMMARY

In Central America, the Collared Trogon resides in heavy forest and adjoining clearings at medium elevations, from about 1200 to 6500 feet above sea level in Guatemala, and from 2000 to at least 5500 feet in Costa Rica. Except in the breeding season, it is usually solitary.

A nest with eggs was found at 3000 feet on the Pacific slope of southern Costa Rica in late January. The shallow niche, apparently carved by the trogons themselves, was 12 feet up in a tottering stub of very soft wood. The two white eggs lay on its unlined bottom.

The species of trogons carve cavities differing greatly in shape. The form of the nest chamber appears to be constant in each of the

genera recognized by Ridgway and other earlier authors; but this constancy within the genus is lost in the modern classification which lumps the majority of the trogons of the New World in the single genus *Trogon*.

The male Collared Trogon usually covered the eggs from between 8:30 and 9:00 A.M. to between 4:00 and 5:00 P.M.; whereas the female incubated from the late afternoon until the middle of the following morning. But one day when the male arrived, apparently to begin incubation, at the unusually early hour of 7:00 A.M., the female refused to yield the nest to him, whereupon he went off and had not returned by 1:00 P.M. In these circumstances, the female sat constantly from daybreak until 11:27, then after an outing of half an hour returned to resume incubation at noon.

The newly hatched nestlings had tightly closed eyes and pink skin devoid of down. The empty egg shells remained in the nest.

Both parents brooded the nestlings and fed them with large insects. Sometimes they delayed near the nest, holding food in their bills, for many minutes or even an hour. In 7.5 hours, 2 nestlings, 4 and 5 days old, were fed 8 times.

Excrement was not removed but accumulated in the bottom of the cavity.

The nestlings' pin feathers began to sprout when they were 5 days old. At 9 days their plumage began to expand, and when 11 days old they were well covered with brown feathers. One was found dead beneath the nest when 13 days old, the second when 16 days old and apparently ready to fly.

The male parent twice came with food for the dead nestling.

The plumage of the 16-day-old trogon is described.

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