

# LIFE HISTORY OF THE BLACK-THROATED TROGON

BY ALEXANDER F. SKUTCH

ON Barro Colorado Island in Gatún Lake, in the middle of the Isthmus of Panamá, I found my first two nests of the Black-throated Trogon (*Trogon rufus*), in 1935. Both were destroyed by predators before the eggs hatched. Four years later, in the Valley of El General in southern Costa Rica, I found my third nest, which met a similar fate. In most of the succeeding years I have studied birds in the same region, where these trogons are not uncommon, and I have encountered five additional nests. With the exception of one which I did not see until the young were almost feathered, only the last was successful. This was situated on our farm in El General in April, 1958, and enabled me to round out a study begun 23 years earlier. The present paper is, then, a report of observations gathered over nearly a quarter of a century. The slowness of their accumulation is to be attributed to the difficulty of finding the nests of the majority of the birds that dwell in tropical rain-forest, and the discouragingly small proportion of these nests that yield living young.

## APPEARANCE AND RANGE

One of the smaller members of its family, the Black-throated Trogon has a total length of about nine inches, of which well over half is accounted for by its long tail. The male's predominant color is bright metallic green, which covers all the upper surface of head and body and likewise the chest. Golden reflections play over his glossy back. His lores, cheeks, chin, and throat are black; his lower breast, abdomen, and under tail-coverts bright orange-yellow. His central tail feathers are bluish-green with black tips, the outer ones white with narrow black bars. His wing-coverts are finely vermiculated with black and white, so that at a distance they appear gray, while the primaries are largely black. Each large, deep brown eye is surrounded by a prominent ring of pale blue, naked skin. His bill, waxy yellow when viewed in the sunshine, is of a tint so pale that in the shade it appears white. His short legs and toes are blackish. On head and body the female is mostly brown, with yellow on her lower breast, abdomen, and under tail-coverts. Her black-tipped central tail feathers are cinnamon-rufous, of a shade far brighter than her back; while the outer ones are white, narrowly barred with black. A wide white crescent behind and a narrower one in front of each dark brown eye give her an appearance of alertness. Her bill is gray, with black on the culmen and tip of the upper mandible, and her feet are dark. (The colors of the featherless parts are taken from notes made at nests on Barro Colorado Island and in El General.)



BLACK-THROATED TROGON (*Trogon rufus*)  
Male (top) and female. From a tempera painting by Don R. Eckelberry.

This lovely trogon ranges from eastern Honduras through southern Central America to the Guianas and Brazil. It inhabits not only the rain-forests of the Caribbean lowlands of Central America but also the drier and more open woodlands of the Pacific side north of the Gulf of Nicoya. In the rain-forests of El General, on the Pacific slope south of the Gulf of Nicoya, it is resident and breeds up to about 2500 feet above sea level; I can find no definite record of its presence anywhere much higher than this. I did not once meet it in the course of a year and a half of intensive bird-watching on the northern side of the basin of El General around 3000 feet. At this altitude it is replaced by the Collared Trogon (*Trogon collaris*), and in this region the two species appear not to overlap vertically.

#### HABITAT AND FOOD

I have most often met the Black-throated Trogon perching solitary in the heavy forest, well above my head but far below the crowns of the great trees. Rarely another adult was in view. Of the four trogons on our farm—the others being the Massena Trogon (*T. massena*), the Violaceous Trogon (*T. violaceus*), and the White-tailed or Baird's Trogon (*T. viridis*)—the Black-throated stays lowest. Although the other three sometimes wander and even nest outside the forest, in pastures and plantations with scattered trees, this shade-loving species seems never to venture beyond the shelter of continuous woodland. Like other members of its family, it perches very upright, with its tail pointing almost straight downward. It remains long in one spot, then suddenly darts out, plucks an insect from the foliage while hovering on wing, and carries it to the same or another perch to eat it. It sometimes takes berries or other small fruits in the same spectacular fashion; but it eats fewer of them than some of the other trogons, as I judge by the absence from its nest of the regurgitated seeds that accumulate abundantly in the chambers of the White-tailed Trogon, the Massena Trogon, the Quetzal (*Pharomachrus mocino*), and other species.

#### VOICE

The call of the Black-throated Trogon consists of low, weak, mellow notes delivered in series of two, three, or less often four: *cow cow*, or *cow cow cow*, that of the female even weaker than that of the male. Of the associated trogons of the Central American lowlands, the Black-throated most resembles in voice the Violaceous Trogon, whose notes are of the same character but more forceful, and delivered more rapidly in longer series, perhaps a dozen together—a performance far more vigorous and spirited than that of the Black-throat. The call of the White-tailed Trogon, which also consists of soft, melodious notes, is easily distinguished by their acceleration and rise in pitch as the long series

proceeds, to end in a sort of roll. The voices of the Massena Trogon and the Citreoline Trogon, (*Trogon citreolus*) stronger and harsher than those of the foregoing species, are not readily confused with them. The Black-throated Trogon's call closely resembles that of its highland representative, the Collared Trogon, and to a less degree that of the Mexican Trogon (*T. mexicanus*).

When alarmed, or when cautiously approaching their nest, Black-throated Trogons of both sexes voice low churring and rattling notes, which sound something like *krrrr*, *krrr-ret*, or *krrr-re-ek*. As it utters these notes, the bird rather slowly raises its tail until it stands almost upright, then lowers it at about the same speed—a movement which makes the black-barred, white under surface of the tail flash out conspicuously.

A less frequent utterance consists of low, clear, beautifully modulated notes, mingled with the subdued, melancholy *cow*'s grouped in twos and threes, which I heard once in June from a male who perched in sight of my blind.

The male Black-throated Trogon presents the unexpected contrast of glittering plumage, which one associates with such active, spirited birds as hummingbirds and jacamars, and calm, subdued demeanor, expressed by dignified upright carriage, long motionless perching, and low, shrinking, almost melancholy notes sparsely used.

#### THE NEST

In the sunny month of January, as the dry season becomes well established in El General, all the trogons in its forests call with increased frequency. Sometimes two male Black-throated Trogons call against each other, but even in rivalry their notes are low and subdued. Occasionally one dashes toward his opponent, who avoids contact by retreating. I have never seen trogons fight. As with nearly all the forest birds, I have not succeeded in learning how territories are delimited and pairs formed.

The cavities used for nesting are carved into decaying wood by both sexes. In El General, I found a pair beginning to excavate a hole as early as February 11, but the work proceeded slowly, with long intervals of neglect, and was not finished until about the end of March; it was April 10 before I found an egg in the hole. All the nests that I have seen have been dug into slender, upright stubs of dicotyledonous trees far advanced in decay, or in one instance in a dead part of the trunk of a small living tree. Often the trunk is so weak that in studying the nest one must take great care not to cause its collapse. My eight nests ranged from 4 feet 4 inches to 12 feet above the ground. Half of them were between 5 and 8 feet. The lowest was almost 3 feet below the top of a stump 7 feet high and 6 inches in diameter. The Black-throated Trogon appears consistently to avoid massive dead trunks such as are chosen by White-tailed Trogons and Massena Trogons for their more deeply carved chambers.

The Black-throated Trogon's nest cavity is hardly more than a shallow niche, with most of the front open. The opening is usually roughly pear-shaped, widest near the bottom, but exceptionally widest at about mid-height, and usually its outline is rather irregular. Often the edges are jagged. The five doorways of which I have measurements ranged from  $4\frac{1}{2}$  to  $6\frac{1}{2}$  inches in height and from  $2\frac{1}{2}$  to  $2\frac{3}{4}$  inches in greatest width. The excavations extended from  $1\frac{1}{4}$  to  $2\frac{3}{4}$  inches below the lowest part of the opening, but most were more than 2 inches deep. The transverse diameter of these little hollows ranged from 3 to 4 inches; usually it was about  $3\frac{1}{2}$  inches. In this shallow depression the eggs rest and the nestlings grow up. The back and sides of the cavity slope forward and inward to meet the narrow top of the doorway, so that the whole niche is  $6\frac{1}{2}$  to 8 inches high. This upward extension of the excavation provides a place for the parents' long tails, which are turned upward and slightly forward above their backs as they incubate and brood. One exceptional nest, situated at the very top of a slender stump 12 feet high, had the usual entrance in the side, but this was confluent with an opening in the top of the stub, so that the eggs were exposed to the sky.

No lining is ever taken into this roughly carved chamber in a rotten trunk, but the eggs rest upon the few particles of loosened wood which remain on the bottom.

#### THE EGGS

Of my eight nests, one had, when found, a single egg, which disappeared within two days; probably it was freshly laid and would have been followed by another if the nest had not been pillaged. Each of the remaining seven nests (five in El General and two on Barro Colorado) contained two eggs or nestlings, and this is the number found in two additional nests reported from Barro Colorado by Eisenmann (1952:28). Carriker (1910:559) also found a nest with two eggs at El Pozo de Térraba in southwestern Costa Rica. One of my nests contained a single egg when found, soon after midday on May 29, and the second was laid between 1:45 p.m. on May 30 and 10:45 a.m. on May 31. In another nest, the second egg was laid between 9:00 a.m. and 5:15 p.m. of the same day.

The eggs are bluntly ovate and white, with slight gloss. The measurements of seven average 27.6 by 22.0 mm. Those showing the four extremes measured 29.4 by 23.0, 26.2 by 23.8, and 27.0 by 20.2 mm.

In El General, two nests from which the nestlings left on May 2 probably contained an egg at the very end of March. In two other nests eggs were laid in April, and in two, in May. In one of these the set was not complete until May 31. My two nests on Barro Colorado contained eggs when found in early April. For this locality Eisenmann records another nest with eggs in April, and one in which a nestling hatched about June 21. Carriker's nest at El Pozo

de Térraba contained eggs on June 21. Thus, the few available records indicate that in southern Central America the Black-throated Trogon begins to lay at the end of March, while the latest nestlings are fledged in early July.

#### INCUBATION

At noon on April 8, 1935, I entered a blind in front of my first nest on Barro Colorado Island, without disturbing the male trogon, who was then covering the two eggs. As we sat quietly through the afternoon, I could see his head rising just above the rounded bottom of the opening in the tottering stub, and sometimes the brilliant green feathers of his neck were ruffled over the rim. For hours he sat almost motionless; but the monotony of the long watch was broken when a Blue-crowned Wood-Nymph Hummingbird (*Thalurania furcata*), and then a Dusky-capped Flycatcher (*Myiarchus tuberculifer*), sunned themselves in a patch of brilliant sunshine that found its way through the forest canopy to fall upon a prostrate trunk just outside my right window, both in the same spot and attitude, lying flat with spread wings and outfluffed plumage. Later, when the sun was low, a band of seven collared peccaries (*Pecari tajacu*) walked in single file in front of the blind. Soon after their passage, the male trogon began to call in an undertone from the nest, a low, mellow *cow cow cow*, repeated again and again. After three minutes I heard the soft call of his mate. Then he started to leave the nest, but paused resting on the rim of the aperture. After a minute or so in this position, he darted out and promptly vanished among the trees. Then his mate went at once to the nest and clung upright in front of the doorway while she scrutinized her surroundings. After a brief survey, she climbed inside, turned around, and settled on the eggs, facing outward. This was at 5:26 p.m. Here she remained until, by 6:45, I could no longer see her and I stole away in the dusk.

At 6:00 the next morning, when the light was still dim in the woodland, I resumed my watch. Despite the slowly increasing light, I failed to see the trogon in the nest, and I began to fear that she had been frightened away in the night. But she was only sitting very low, perhaps still sleeping, for when the light grew stronger her head became visible above the doorsill. Nothing noteworthy happened until 9:09, when the female called *cow cow cow* in a low voice and the male called with similar notes from among the trees. After they had exchanged a number of calls, the female moved forward to rest in the doorway with much of her yellow belly showing outside. For several minutes she delayed here while she and her mate called back and forth. Finally, at 9:13, she flew away; and after the usual survey made while clinging upright before the entrance, the male went in at 9:19 and turned around to settle in the nest facing outward—the usual position. He sat steadily until I ended my watch at noon, and he was still present at 3:45 and 4:20 in the afternoon. Thus in the course of 24 hours the female had taken one long session, from 5:26 in the evening until 9:13 the next morning, and the male had incubated all the rest of the time.

On April 15, 1958, I made, with my wife's help, an all-day record at a nest with two eggs, in the forest near our house in El General. At 5:35 a.m. I entered the blind in the dusky underwood, and as it grew light I detected the white crescents before and behind the eyes of the sitting female, then gradually the rest of her head. At a little before 7:00, the male arrived and called with churring and rattling notes, *krrr-rek* and *krrr-re-ek*, several times repeated. Then he changed to a low *cow cow cow* as his mate very slowly pushed forward into the doorway, looking around as she did so. At 7:01 she darted off, and two minutes later the male entered. Although he stayed continuously at his post through the morning and early afternoon, he sat rather restlessly, frequently rising up to lower his head into the bottom of the cavity. He did this by turning sideways in the niche or even completely around, until his yellow belly filled the lower part of the doorway,

while his black-barred, white outer tail feathers occupied its upper portion, or sometimes projected slightly outside. He then seemed to be standing on his head, and his reversed position apparently made it easier for him to reach the eggs in the narrow niche; but whether he turned or merely examined them, I could not see. He would maintain this posture for a minute or two, rarely longer, then settle down in his usual position, head outward, eyes and bill just above the lower edge of the doorway, tail ascending above his back against the outward-sloping rear wall of the niche. If his tail had been just a little longer, it would have projected through the opening into the outer air, as happens with the far longer feathers of the male Quetzal's train.

At 2:34 p.m., when the sky was darkly overcast, a Violaceous Trogon called *cow cow cow cow cow* . . . loudly overhead, and this apparently stimulated the Black-throated Trogon to call in his lower notes from the nest, where he had been sitting all day. After more calling while he rested on the doorsill, he flew to a neighboring branch and continued his *cow cow cow*. From 2:38 to 3:23 the eggs remained unattended, while rain began to fall. At 3:23 the female, after repeating a long, low rattle over and over, raising her tail above her back each time she did so, entered to resume incubation. Soon after 4:00 the shower stopped and the sun began to penetrate the clouds. I was certain that the female, sitting quietly, had settled down for the night; but, to my great surprise, the male returned at 5:03, apparently called her out, and at 5:08 went to the doorway, lowered his head as though to feed nestlings, then entered to incubate. He remained there only 17 minutes, for at 5:25 the female came back and resumed incubation. As the light grew dim, and she became invisible, I left.

The male had sat continuously for 7 hours 35 minutes, and again for 17 minutes late in the afternoon. Not counting the few minutes the eggs were left uncovered whenever the parents changed over, they were unattended for only one period of 45 minutes in the course of the day. The female sat all the rest of the day, and through the night. Except for the male's short session late in the afternoon, this pair had followed the pattern of incubation that I had found to be typical of the lowland trogons: two change-overs in each period of 24 hours, the male sitting for six to eight hours in one long stretch each day and the female the remainder of the time—a schedule which closely resembles that of incubating pigeons and doves.

The male's brief evening session seemed pointless in a bird that incubates for hours at a stretch, and I resolved to watch again to learn whether it was habitual with him. My first opportunity came two days later, when I entered the blind at 4:30 on a darkly clouded afternoon, while the female was sitting. I did not have long to wait for the male, who arrived at 4:42, and after seven minutes of *krrr*-ing and *cow*-ing finally persuaded his mate to make way for him. Then he promptly went to the nest, holding in his bill some small object that I could barely discern in the dim light. Clinging in front of the doorway, he lowered his head into the hollow as though feeding nestlings. After a while he entered, still holding the morsel, but presently he rose up, turned around until his yellow belly was in the doorway and his tail stuck up into the air, and seemed to be offering the food again. Soon he settled down in the usual incubating posture, still with food in his bill. In 14 minutes his mate returned and repeated her rattling call until, after five minutes, he gave up the nest to her. As well as I could see, he swallowed the morsel while she called. I could detect nothing in her bill, nor did she lower her head into the nest as though offering food to nestlings. After she had settled down, I put her off to see whether perchance a

nestling had hatched since my last inspection, but two eggs were reflected in the mirror that I held over the doorway. By 10:40 the following morning (April 18), however, one had hatched.

The male's proffer of food to unhatched eggs was not unprecedented in my experience, and elsewhere (Skutch, 1953:10-17) I have given a number of examples of such "anticipatory food-bringing." Possibly, even as early as our all-day watch on April 15, three days before hatching, the male had heard the tapping or weak calls of the imprisoned chicks making their first feeble attempts to break out of their shells. Perhaps this was responsible for his frequent turning in the nest, standing on his head, and inspecting the eggs beneath him. His return late in the afternoon of April 17 was evidently to attend chicks rather than to incubate eggs; and probably this was true of his similar return two days earlier, although I did not then notice—or look for—food in his bill. The female gave no indication that she was aware that the eggs were about to hatch; in my experience, female birds anticipate the nestlings less often than males.

In addition to the two long watches, I have records of 72 visits, at various times of day, to nests containing eggs. The latest hour of the morning at which I ever saw a female covering eggs was 11:25, at one of the nests on Barro Colorado, but it is most unusual to find her present after 9:00. The earliest hour at which I found a male in the nest was 7:00. My latest record of the presence of a male is 5:26 p.m., and my earliest of the female's afternoon return is 3:00 p.m. When the female continues to incubate as late as 11:00, her mate may have come to replace her so early in the morning that she would not relinquish the nest to him, and he went off and stayed away a long while. At least, I have seen this happen in the Collared Trogon (Skutch, 1956:359-360).

Black-throated Trogons sit closely and have remained on their eggs watching me set up a blind eight or ten yards in front of them, an operation which often involves much movement and noisy clearing away of undergrowth. Frequently, too, I have been able to enter or leave a blind, or to remove it, without chasing away the incubating male or female. But the fact that they sit steadfastly while one sets up a blind does not mean that they would enter the nest if one watched without concealment. Perhaps they remain firm in the presence of an intruder because their departure would betray the location of their nest if he had not already noticed it; and for the same reason, they hesitate to approach the nest if a man or other animal capable of harming it is in view.

At the nest which I discovered when newly begun on February 11, 1942, I did not see an egg until April 10. I had not visited the nest the preceding day, so it might well have been laid earlier. The second egg was deposited on April 11. One egg vanished in the course of incubation. The remaining one was



chipped in the afternoon of April 27 but did not hatch until two days later, on April 29. Thus the incubation period was at least 18 days, and possibly a little longer if the surviving egg was the first rather than the second of the set. This may be compared with the Mexican Trogon's incubation period of 18 or 19 days (Skutch, 1942).

#### THE NESTLINGS

The newly hatched trogon has pink skin devoid of all down or visible rudiments of feathers, and its eyes are tightly closed. The pin feathers grow out rapidly, and when six days old the nestling bristles with them. By the tenth day they have become so long that they almost cover the nestling's upper parts; except for a few feather-tips, the plumage is still tightly ensheathed. But 24 hours later, at the age of 11 days, the nestling is fairly well clothed with freshly expanded plumage. The rectrices, however, are still wholly enclosed in their sheaths, and this is also true of many of the feathers of the crown. A day later the plumage of the crown has expanded and the rectrices are escaping their sheaths. When 13 days old, the young trogon is completely feathered on head, upper parts, and breast. Except for the large roundish spots on the wing-coverts and the buffy-brown rather than yellow of the abdomen, it rather closely resembles its mother in its rich brown attire. Like her, it has prominent white crescents behind and in front of each eye; these are joined by a narrower rim of white above and below the orbit, but on her the crescents are not confluent. Its bill is dark gray with lighter base and tip, and the feet flesh colored. A day or two later, at the age of 14 or 15 days, the young trogon leaves the nest.

On April 19, 1958, I watched from 6:30 to 11:30 a.m. at the nest in which the two nestlings had hatched on the preceding day. They were brooded constantly by both parents sitting alternately, except for the brief intervals taken up by the change-over and the delivery of food. The male, who was in the nest, when I arrived, sat for 3 periods of 49, 79, and 120 minutes, making a total of 248 minutes. The female brooded only twice, for 17 and then 7 minutes, or a total of 24 minutes. The remainder of the 5 hours, 28 minutes in all, was occupied by change-overs and the slow process of feeding the nestlings.

On its arrival to replace its mate on the nestlings, each of the parents behaved much as it did when it came for its turn at incubation, calling with either soft notes or churrs and rattles, or with a combination of the two. This was continued for several minutes, until at last the brooding partner bestirred itself and slowly left the nest, sometimes after calling softly in answer to the other. Each time that a parent returned it brought an insect or some unrecognizable object of food, usually small and green. Once the female came with a winged insect surprisingly large as a meal for a day-old nestling. After the departure of

its mate, the newly-arrived parent would cling upright in front of the doorway, its tail pressed against the trunk and head lowered into the cavity, and would patiently deliver the morsel. This usually took about two to four minutes, although eight minutes were occupied by the female in giving the very large insect to a nestling. The meal over, the parent climbed through the doorway and turned around to brood facing outward, just as it had incubated. In the five hours the two nestlings were fed as many times, twice by the male and thrice by the female, who brought a meal at the very end of this period. Since, as far as I could see, a parent brought only one article at a time, the most equitable division would have given no more than three insects to one nestling and two to the other.

On April 24, when the two nestlings were six days old, I again watched from 6:30 to 11:30 a.m. The morning was cloudy and cool, but the still featherless youngsters were left exposed nearly as much as they were covered. The female brooded twice, for 35 and later for 32 minutes, the male, only once, for a long session which had lasted 96 minutes when I went away and left him sitting. The female brought two green insects, which had been well mashed, but were so big that the nestlings, doubtless cold and sluggish from long exposure, did not succeed in swallowing them. Finally she ate them herself, twisting her head and neck from side to side as she forced the larger one down with an effort. The male brought three morsels, all of which the youngsters seemed to eat. The parents evidently did most of their hunting well up in the trees, for each time that they came I first heard their voices from above me, before they dropped to a perch in sight of the blind.

I next watched at this nest from 6:30 to 11:30 a.m. on April 29, when the two youngsters were 11 days old. On this sunny morning they were not brooded at all. The male came seven times with as many insects, most of which were very large and green, although one was brown. As formerly, to deliver a meal he clung upright before the doorway, his tail usually spread just enough to reveal a little of the white outer feathers with their black bars. But now he did not have to bend his head into the cavity, for with a loud sizzling noise the nestlings reached up well above the lower edge of the doorway to take their meals. One of them once spent about two minutes forcing down the large insect it had received.

Not having glimpsed the female during the morning, I watched for her again in the evening. The youngsters now rested with their heads visible in the doorway. The male brought them two more meals between 4:30 and 5:30, making nine feedings in six hours that day. The female did not arrive until 5:45, when the light was failing beneath the lofty trees. After calling *cow cow* very softly several times, then *krrr-re-e-e-e*, with the notes more widely spaced toward the end, she flew to the nest and clung in front of it; but I was not sure that she delivered food. Then she entered to brood, sitting very high in the cavity, with much of her yellow ventral plumage showing above the lower edge of the doorway, not merely her head as while she incubated the eggs. Here she stayed until I left in the dusk. This was the last time I saw her. If I had not watched for her to come and brood her nestlings that night, I should have inferred from her failure to feed them on that and later days that some accident had befallen her.

When I entered the blind at 12:20 p.m. on May 1, both of the nestlings, now well feathered, were looking through their doorway. Their white eye rings made them appear bright and alert. In the next four hours the male came 11 times, bringing 11 insects, some so large that the youngsters with difficulty forced them down. For half an hour rain fell

rather hard, but neither parent brooded the nestlings. Neither came to cover them at nightfall.

Next morning, May 2, I resumed my watch as it grew light. The male first brought food at 5:43, and by 6:00 he had given the nestlings four meals, after which he came more seldom. At about half-past six, a nestling rested with its breast against the lower edge of the doorway. Soon it grew restless, preened, and stretched its wings. Then for a while it drowsed with closed eyes, to be aroused when the male arrived with more food. After this meal, at 8:14, the nestling jumped up to perch on the doorsill—the first time I saw it there. It now began to utter rhythmically a low, soft note, which I could hardly hear above the voices of the cicadas. It preened, then drowsed. After a while, the other nestling tried to push its head through the doorway beside it.

At 9:04 the male flew up with an insect in his bill, alighted on a low branch about 20 feet from the nest, and churred as usual. The nestling thereupon flew from the doorway toward him, going well for a few yards, but falling when it tried to alight on a twig. The male darted toward it as it fluttered to the ground close in front of the blind. Here it rested behind a fallen palm frond and continued to utter the low, soft note at intervals of a few seconds; the male, perching low and still holding the insect he had brought, voiced alternately churrs and soft *cow*'s. Soon the youngster flew again, rising a few feet but dropping to the ground about five yards from its starting point. Presently it was out of sight, and, although I heard its low notes for nearly half an hour more, I never saw it again. Only 14 days old, it seemed small and weak to face the perils of the tropical forest.

The youngster in the nest, not the one who had just flown out, was given the insect which the male had. The stay-at-home also received the next meal, an insect so large that six minutes were required to gulp it down. But the male perched low and called softly many times, as though encouraging the fledgling to rise from the ground. After this feeding, at 9:40, he remained away from the nest for four hours, no doubt attending the youngster who had now wandered beyond my sight and hearing. From 1:40 to 4:15 observations were suspended; but at the latter hour the second nestling was still in the nest, with the male close by. Soon the young trogon began to utter soft monosyllables such as the other had voiced just before it flew; and until it left it kept up this utterance much of the time, now louder and now softer, at a rate varying from 24 to 28 notes per minute. As with closed bill it delivered each note, its throat swelled out conspicuously, and often it was easier to count the movements of the throat than the low notes themselves. At its loudest, however, the nestling's call resembled the soft *cow* of the parents and was not difficult to hear. When taking food it made the usual sizzling sound, but it might resume the rhythmic monosyllables even with a partly swallowed insect protruding from a corner of its mouth. In little over an hour that afternoon (4:40 to 5:44), the male brought seven meals to the nestling, which had evidently become very hungry after a long period of neglect. Sometimes it jumped up high in the nest in its eagerness for nourishment.

Next morning we watched from daybreak to 12:15 p.m., hoping to see the other young trogon depart. Before sunrise it began its monotonous calling, ceasing briefly while a squirrel passed close by the nest. Later, when the great dry frond of a chonta palm (*Iriartea*) crashed down loudly close by, it crouched in the bottom of the nest and remained silent for about 20 minutes. But it was calling loudly and persistently when the male arrived with the first meal of the day at 7:27, two hours after daybreak. By 9:02 it had been fed four times and was feeling strong enough to flap its wings and preen vigorously. Then followed a long interval of fasting and persistent calling, until at 11:49 the male brought an insect, then another, 9 minutes later. The spacing of these meals suggested that the male trogon was attending his youngsters alternately, first feeding the one

off in the forest until it was satisfied, then bringing a number of insects in fairly rapid succession to the one in the nest. There is no reason to suppose that the fledgling who had gone out of sight was receiving food from the female.

When I left the blind at 12:15 p.m., the second youngster had not once stood in the doorway, and was resting so quietly in its niche that I thought it would stay until the next day. But when I returned at 4:10 it had gone. If, as is probable, the young trogons left the nest in the order of their hatching, the first was about 14 days old, the second very close to 15 days, at the time of their departure. Although the first flew from the doorsill just after the male alighted on a neighboring branch with food, the male did nothing which I could interpret as an attempt to urge it out. Nor did the parent, as far as I could see, make the least effort to lure the laggard fledgling from the nest, during the period of more than a day that it remained alone. As has nearly always been the way in my experience, the departure of the first youngster was spontaneous, and that of the second probably so.

Of the seven nests of the Black-throated Trogon that I found while, or before, they contained eggs, this alone was successful. In the only other nest that I have known to produce fledged young, they were nearly feathered when I first saw them.

After the nestlings' departure, a heavy deposit of waste material covered the bottom of the nest; the parents had never in my presence done anything to cleanse it. The dark mass was already well disintegrated, and the only recognizable objects were a number of yellowish maggots and a few hard parts of insects, including a beetle's elytron, a leg resembling that of a grasshopper, and a long antenna. Some days earlier, before the nestlings flew, I had removed from beside them the empty exoskeleton of a large green insect, which now had some maggots in it. From the head to the tip of the long ovipositor this insect measured  $4\frac{3}{4}$  inches, and to the tip of the wings it was  $2\frac{3}{4}$  inches. The stout body was about 2 inches long. A number of the insects that I saw the parents carry to the nest appeared to be as big as this, and some even longer. Their size explains the infrequency of the feedings through most of the nestling period. I never detected a fruit in a parent's bill when it visited the nest, and I searched in vain for a regurgitated seed. All the evidence indicated that the nestlings' diet consisted wholly of insects, which are also the chief food of the adults.

Although at this nest the female stopped bringing food at some time between the nestlings' sixth and eleventh days, not all female Black-throated Trogons are so neglectful. At a nest which I kept under observation in 1942, the single nestling vanished when it was 10 or 11 days old. In the late afternoon of the eleventh day after it hatched, I found both parents close by the devastated nest, the male with a long-winged green insect in his bill, the female with some smaller article of food in hers. Later, I saw her cling in front of the empty niche, as though offering a meal to a nestling. The bringing of food to nests from which the young have recently been taken, or in which they lie dead, is

not unusual among birds. I have seen it in the Citreoline Trogon (Skutch, 1948:144), the Collared Trogon (Skutch, 1956:364), and a number of birds in other families. This persistence in food-bringing ensures that weak young, or those which have fallen from the nest, will not be neglected.

Still, the female parent's neglect of older nestlings was not without precedent in my experience with trogons. A female Quetzal gradually lost interest in her family, and to her mate fell the whole care of the two young during their last five or six days in the nest, and doubtless also after their departure (Skutch, 1944:227). A male White-tailed Trogon was the sole provider for a nestling through most of its 25 days in the nest. Both the Quetzal's and the White-tailed Trogon's nests were late in the season; and it seemed that the defection of these females, if indeed the female White-tailed Trogon remained alive, might be attributed to the waning of parental impulses as the breeding season approached its end. But this explanation could hardly apply to the female Black-throated Trogon, whose nest was one of the earliest of the kind that I have known. I can think of just one condition in which the female's abandonment of her brood would be adaptive rather than maladaptive: if there were an excess of males, and she left her first mate in charge of the brood in order to rear another family with a new mate. But this is merely a suggestion, unsupported by observations.

#### ACQUISITION OF THE ADULT PLUMAGE

The nestling plumage is described in detail by Ridgway (1911:782), who also describes males in transitional plumage, without, however, giving any information about the period when this is worn. In El General, I have seen young males in transitional plumage in January and April. Since in this region the breeding season, as far as is known, extends from the end of March to June, the young males that I met in April were probably about a year old; and because they still bore the marks of immaturity when others of their kind were nesting, it is also probable that they would not breed until about two years old. Although the males of certain species of birds nest in transitional plumage, all of the males of this and other kinds of trogons that I have seen attending nests wore the resplendent attire of full maturity.

The three young males of whose plumage I have descriptions showed that the dorsal surface of the body acquires the glittering green of maturity well in advance of the ventral surface, the wings, and the tail. On the one that I met on January 4, 1948, the upper parts were largely green; but the sides of the head, front and sides of the neck, and the breast were mostly brown, with some green in the center of the breast. The belly was yellow. The remiges and rectrices resembled those of the adult female; but the eye-ring was bluish and the bill greenish-yellow, somewhat as in the adult male. On April 11, 1954, I

saw a young male whose plumage was similar to that just described, except that the tail contained some short green feathers, just growing out. A male of which I wrote a description on April 23, 1957, had the largely brown head and breast mottled with green, and the tail was farther advanced than in the preceding individual. I could detect just one long, brown feather in its center, and otherwise it resembled that of the adult male. His wings, too, were, as far as I could see, much like those of the adult male. In these males in transitional plumage, a whitish bar separated the brown of the breast from the yellow of the abdomen; and this is of interest because such a bar is a permanent feature in the plumage of certain closely related species, including the Collared Trogon and the Mexican Trogon.

#### SUMMARY

In Central America, the Black-throated Trogon is confined to the forests below about 2500 feet above sea level. Its diet consists largely of insects plucked from the foliage while the bird hovers in the air. Its mellow notes are low and weak.

Some pairs begin to prepare their nests early in February, but laying seems not to start before the end of March, while the latest young are fledged in June or early July.

Two white eggs are laid in a shallow, unlined niche carved into the side of a decaying, often tottering, slender trunk, at heights of four to 12 feet above the ground.

The female incubates from the late afternoon until the following morning, and the male sits through most of the day, often taking one long session of about eight hours' duration. One male returned in the evening after his mate had replaced him on the nest, and the second time that this unusual behavior was witnessed he brought food and offered it to the eggs, then almost ready to hatch.

In one instance, the incubation period was 18 days or a little more.

The nestlings, sightless and perfectly naked at hatching, are feathered at the age of 11 or 12 days and leave the nest when 14 or 15 days old. They are brooded and fed by both parents. Their food appears to consist wholly of insects, many of them so large that they can scarcely be swallowed. The rate of feeding is usually slow, during the first week about once in two hours for each member of the brood; but after a period of neglect, a single older nestling received seven meals in little over an hour.

One female ceased to feed her nestlings between their sixth and eleventh days, although she brooded them by night until they were 12 days old. But another female—and also a male—brought food to the nest after the disappearance of their single nestling, which would then have been 11 days old.

In their first plumage, males resemble females. They have been seen in transitional plumage in April, when they could hardly have been much less than one year old. Apparently they do not breed until about two years of age.

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