THE CONDOR

VOLUME 61 MARCH-APRIL, 1959 NUMBER 2

LIFE HISTORY OF THE BLUE GROUND DOVE

By ALEXANDER F. SKUTCH

To the student eager to learn the roles of the sexes at the nest, the Blue Ground Dove (*Claravis pretiosa*) is especially attractive because of the ease of distinguishing the male from the female. This is exceptional in a family in which the sexes are usually nearly or quite alike in appearance, at least in the American species. The male is largely blue-gray, fading to white on the forehead and throat, with some prominent black bars and spots on the wing coverts. As I saw while watching at a nest at close range, his iris is deep red, bill pale grayish-yellow with a narrow black stripe along the culmen, tarsus and toes pink, claws black. In the female, the warm cinnamon-brown or russet of the central rectrices and upper tail coverts contrasts strongly with the paler, more buffy brown of the remaining upper parts, and the spots on her wing coverts are bright chestnut instead of black as in the male. Her under parts are largely grayish, tinged with brown on the chest. Her featherless parts are much as in the male, but the culmen is dark gray rather than black.

The species ranges, with little or no geographic variation, from eastern México to northern Argentina, and from western Ecuador to Trinidad and eastern Brazil. In Guatemala it seems to be confined to the Caribbean lowlands, although there is an old and dubious record from Retalhuleu in the Pacific lowlands (Ridgway, 1916:434). In Costa Rica it occurs not only on the Caribbean side but also in the wetter parts of the Pacific littoral, especially about the Gulf of Nicoya and to the southward, where it becomes abundant. It likewise penetrates the central highlands and has been recorded up to 5000 feet above sea level, but it was possibly more abundant in this region in former times than today, for I have never seen it there.

In most parts of its range, the Blue Ground Dove inhabits regions where rain forest is the natural vegetation, yet in my experience it strictly avoids the interior of heavy forest and lives in clearings, tangled second-growth thickets, and the lighter woods. It forages largely if not wholly on the ground, where at times a dozen individuals may be seen together; often it is seen in company with other ground-foraging pigeons such as the Ruddy Ground Dove (*Columbigallina talpacoti*) and the White-tipped or White-fronted Dove (*Leptotila verreauxi*). Yet it is not truly gregarious, for when disturbed the doves fly off in different directions, and I have never seen them travel in a compact flock. Once in February, two adult males in blue plumage kept close company about our house in the valley of El General in Costa Rica. For several days they walked over the lawn together and behaved much as though they were a mated pair. In northeastern Venezuela, however, flocks of more than 100 individuals were seen in the heavier woods bordering a stream, although generally the parties consisted of less than 10 birds. Strangely enough, in Venezuela, the Blue Ground Dove was almost exclusively arboreal and was very rarely noticed on the ground (Friedmann and Smith, 1950:469–470).

The call of the Blue Ground Dove is a low, soft monosyllable, *coo* or, perhaps better, *coot,* easily distinguished from the trisyllabic *kitty-woo* of the Ruddy Ground Dove with which it so often associates, and from the more powerful or more mournful notes of the species of *Columba, Leptotila,* and *Oreopeleia* whose voices are heard in El General. In this region, the Blue Ground Dove is heard most frequently from January to August. The statement of Ridgway (1916:279) that *Claravis pretiosa* produces a sound "nearly

as loud as the bellowing of a bull" is most surprising. He must have confused the Blue Ground Dove with some other bird.

On June 22, 1943, I watched a male Blue Ground Dove which stood on a horizontal branch at the edge of a thicket and behaved very queerly, strutting about and turning rapidly to face now to one side, now in the opposite direction. After this had continued for a short while, a brown female of his kind flew up and came to rest close beside him, whereupon he took her bill in his and went through the motions of regurgitating food, but whether nourishment actually passed to her I could not tell. Then, dropping her bill, he mounted upon her back. In a moment he stepped down to the branch on the opposite side of her and again appeared to feed her. Then he stood on her back a second time, after which he got down and went through the motions of feeding her from her left side, as at first. After this, she flew away.

NEST BUILDING

In El General, where the Blue Ground Dove nests in numbers up to at least 3000 feet above sea level, breeding begins in the dry month of February, and I have twice found eggs as early as February 22. Of the 23 nests of which I have records, slightly more than half were placed in trees and shrubs in thickets, often amid the tangled vines which overgrew these woody plants. Five nests were built amid the dense foliage of coffee bushes in small plantations, two were in orange trees growing in coffee plantations. One was found in a vine-laden tree beside a road, one in a clump of mistletoe in a roadside bush, and one in an annatto bush (*Bixa orellana*) in a dooryard. The extreme range in height of these nests was from 3 feet 8 inches to about 35 feet, but 19 of them were from 5 to 12 feet above the ground. Only one was below 5 feet and only 3 were above 12 feet. It is significant that the highest nest, 35 feet up, was in an orange tree, the very dense foliage of which invites this and other birds to build higher than they do in more exposed situations. The other two unusually high nests were at heights of 16 and 20 feet in vine-draped trees which also provided excellent concealment. In Trinidad, Belcher and Smooker (1936:5) found a nest only 25 inches above the ground, and they saw two that were 20 feet high.

On February 26, 1937, I had the good fortune to find a pair of Blue Ground Doves just starting a nest. At the edge of a low, dense thicket beside a grassy roadway, I saw a male fly up with a piece of dry flower stalk in his bill. He entered the thicket and by a circuitous route reached a point about 12 feet above the ground, where the branches and foliage were closely massed together, and here he deposited his slight burden. Then he rested on the place where he had laid it, amid leafage so dense that I could see little more than his bright red eye peering out at me. Presently his mate joined him, and then the blue dove and the brown rested side by side on the site of the nest. At first each billed the feathers of the other's neck, but soon they ceased this and sat inactive. After they had remained so for nearly half an hour, the blue male bestirred himself, flew down, found another dry flower stalk, returned to the nest site, and standing beside it laid the piece gently by his brown mate's head. Then he sat beside her once more. After a while both flew away, and I waited a long time but they did not return. At last I entered the thicket for a closer view of the nest, which consisted of perhaps a half-dozen dry twiglets and flower stalks laid across some horizontal branches that were close together. Later in the morning, I again saw the female sitting on this slight foundation of a nest, but no work was done at this time.

The following morning building proceeded more actively. While the brown dove sat on the nest, the blue one brought lengths of slender dead vines, coiled tendrils, twiglets, and pieces of dry inflorescences. Sometimes it was plain that he carried only a single bit

of material, but on other trips he appeared to bring two or more pieces, although these may have been branches attached together. Flying toward the nest with wings making the whistling sound characteristic of doves in flight, he came to rest on an exposed horizontal branch at the edge of the dense maze of twigs and vines that concealed the frail platform on which his mate rested. After a moment's pause, he entered the clustered foliage and, with wings striking loudly against obstructing vegetation, made his way with difficulty to the nest. At times his burden was knocked from his bill by a branch, but instead of trying to retrieve this dropped material, he would go off in search of a new piece.

His mode of delivering these contributions varied little. On reaching the nest, he usually stepped upon his mate's back, always facing in the same direction as she, and bent down his head to deposit his burden in front of her or by her breast. Sometimes he had difficulty in keeping his footing on the sloping sides of her smooth back and slipped off. Exceptionally he laid down the material while perching beside her instead of resting on her back. After he had placed his contribution, he usually went off quite promptly, and only rarely did he linger beside his mate, as on the preceding day.

I did not see the female dove bring anything to the nest. It is possible that she carried something each time that she returned to sit on the structure after an absence, but she could not have brought much. Her task was to arrange the materials which her mate delivered to her. After he had laid a tendril or a twig before her, she took it in her bill and worked it into the nest. Sometimes she grasped the piece before he relinquished it. Occasionally the two worked together with the new contribution for a moment, but it was always the female that made the final disposition of the piece. From time to time she shifted her position to face in another direction, and she was constantly billing the materials in front of her to arrange them better. The male always laid his contribution by her head or breast, no matter which way she faced; therefore her turning insured a rather uniform distribution of the pieces around the periphery of the nest. Sometimes, when her mate was long in returning, she cooed softly from the nest, and frequently I heard his low coos issuing from the thicket beneath which he sought suitable building material. Apparently he gathered most if not all of it from the ground.

The female passed long periods on the nest. From my arrival at 7:20 a.m. she sat continuously until 9:40, receiving in this interval at least 13 contributions from her mate. Then the nest was unoccupied for 18 minutes, or until 9:58, when the male settled on it and worked with feet and bill to give it shape. After a minute the female joined him and the two moved about together on the nest, improving the arrangement of its constituents. In a few minutes the male flew away, leaving his mate alone there. For the next two hours, or until midday, she sat continuously, while her partner brought material at least 14 times. Between 1:00 and 3:00 that afternoon I kept the nest under observation, but no building was done.

This pair of doves took at most three days to build their nest, but on the first day they did little more than lay a few pieces of material to indicate its position. The completed structure was very slight, frail, and shallow, hardly more than a narrow platform of fine twiglets and tendrils, concave on its upper side. After the eggs were laid, I could see them through the bottom of the nest. Rarely a nest is somewhat bulkier than this; but of all the pigeons whose nests I have found in El General, including the Ruddy Ground Dove, the Blue Ground Dove rather consistently builds the slightest and frailest structures.

Although the female, confining her effort to the arrangement of the materials, brought little or nothing to the nest of which I watched the construction, I once saw a female of the same species carry twigs to a nest that already contained two eggs. At 9:00 a.m.,

on May 2, 1940, the activity of this female drew my attention to the nest, on which her mate sat. In the following quarter-hour she made six more trips with twiglets, while the male continued to incubate. Interfering vegetation made it impossible to be certain whether he helped to arrange these additions to the already finished nest. I was sure, however, that he did not always receive them, for sometimes as his mate approached with a twig he left the eggs and moved off a short distance through the surrounding tangle of branches, and once he flew down to a rock standing in the stream above which the nest was situated. But after each of these excursions he returned to the nest as soon as she left. After 9:15, the female brought no more twiglets; and for the next hour, while I watched, her mate was permitted to incubate without interruption. The female Ruddy Ground Dove also at times brings material to the nest while her mate incubates (Skutch, 1956:195). I have never seen a female dove stand on her mate's back while placing materials for the nest.

THE EGGS

Of the 23 nests that appear in my records, 18 contained two eggs or nestlings. Two nests were high in dense tangles of vines which made it impossible to see their contents without jeopardizing them, and from one nest the first egg vanished the day after it was laid. Thus I have records of two nests, both found in early August, in which a single egg may have constituted the full set, but in each case it was possible that a second egg had been laid and lost. In Trinidad, Belcher and Smooker (1936:5) found three sets of two eggs.

At nest 7, which I found on February 26, 1937, when the pair had just begun to build, an egg was present by 7:00 a.m. on March 2; but it must have been laid on the preceding day or even earlier, as the second egg was laid between 7:00 and 10:00 a.m. on the same day. At nest 19, the first egg was laid between 7:40 a.m. and 4:15 p.m. on April 20, 1949, and the second egg between 7:30 and 9:15 a.m. on April 22, so that an interval of about two days separated the laying of the first and second eggs. At nest 16, the second egg appeared between 7:30 a.m. and 1:40 p.m. Thus the last egg of the set is laid in the morning, after 7:00 a.m. but sometimes before 9:00 or 10:00 a.m.

The eggs are pure white. The measurements of 6 eggs average 25.9 by 18.8 millimeters. Those showing the four extremes measured *26.2* by *17.5, 25.0* by 18.3 and 25.8 by *19.4* millimeters.

In 23 nests in the valley of El General, 2200 to 3200 feet above sea level, eggs were present as follows: February, 4; March, 7; April, 7; July, 1; August, 3; September, 1. Most of the breeding occurs in the drier part of the year. Although the rains return in March or April, they are rarely heavy before May. The single long wet season continues until the following December or January.

INCUBATION

After the completion of their nest, and while it contains a single egg, the doves spend much time on it, and on my visits in this period I have usually found one member of the pair sitting. The male may now come earlier in the morning than he will after the set is complete. At nest 19, I found the male covering one egg at 7:20 a.m. on April 21. On the following morning he was sitting on the same egg at 7:30, and at 9:15 he was incubating two eggs, whence it was evident that his mate had come in the interval to lay the second egg. On April 24, I found him on this nest at 7:25 a.m., but after incubation is farther advanced it is rare to find a male on the eggs before 8:30. Likewise, the female returns to cover the single egg earlier than she comes in the afternoon to take charge of a complete set. At nest 19 I found her present at 12:50 p.m. on April 21, an hour before one is likely to see a female covering a full set of eggs. Similarly, the Ruddy Ground Dove's

attendance at the nest follows, during the period of laying, a schedule different from that which prevails after the set is complete. Since at nest 19 and one other nest of the Blue Ground Dove the two eggs hatched at about the same time, it is evident that incubation of the first egg in the interval between its deposition and that of the second egg two days later is only slight and probably insignificant.

While incubating a full set of eggs, the Blue Ground Doves change over twice each day, the male coming in the morning to replace his mate, the female returning in the afternoon to relieve him and take charge of the eggs until the following morning. The latest hour of the morning that I have found a female present at any nest is 9:39, while my earliest record for the presence of the male, except at the beginning of incubation, is 8:25 a.m. In the afternoon, my latest record of a male on the eggs is 2:56, my earliest for the return of the female is 1:31 p.m. Between 9:39 a.m. and 1:31 p.m., I have never found a female covering a complete set of eggs.

At nest 17, which was situated in an annatto bush in front of my house in 1948, I made a record of the attendance at the nest during the last nine days of incubation. Although I did not watch continuously throughout these days, I spent long periods in the blind, witnessed 16 change-overs, and made many visits of inspection to assure myself that only the blue male was present between the usual morning and afternoon change-overs, only the brown female at other times (see table 1). At this nest the male's daily period on the eggs ranged from 4 hours and 16 minutes on March 19 to 6 hours and 13 minutes on March 24. His average period of sitting during the seven days was 5 hours and 8 minutes.

Table 1

Occupancy of a Nest by Blue Ground Doves during Incubation and Nestling Periods

Date in March, 1948	A.M.		P.M.		Male's time on the nest
	Female leaves	Male sits	Male leaves	Female sits	
16	8:40	8:40	1:28	1:31	4 hours, 48 minutes
17	8:29	8:30	1:50	1:52	5 20
18	8:46	8:46	2:03	2:03	5 17
19	9:39	9:39	1:55	1:56	4 16
20	(8:15–8:45)[2]		2:26	2:26	
21	9:28	9:28	2:42	2:42	5 14
22	9:17	9:17	2:06	2:08	4 49
23	(8:20–8:33)		1:53	1:56	
24	8:41	8:43	2:56	2:56	6 13
25[1]			2:46	2:46	
26	8:54	8:56	2:05	2:05	5 9
27	(8:23–8:34)		(2:50–3:25)		
28	9:16	9:22	1:20	3:51	3 58

[1] Both eggs hatched between 6:00 and 8:30 a.m., March 25.
[2] When the hours are given in parentheses, the change-over was not witnessed but occurred in the interval indicated.

With one possible exception, at each of the 16 change-overs which I watched from the blind, the dove which had been sitting stayed on the nest until its mate flew up and alighted in the supporting bush, usually from one to three feet from the nest. The mate never alighted close beside the nest or on it. Then the sitting bird arose, walked off the nest and out along a neighboring bough for a foot or more before taking wing. It never flew directly from the nest, which might have thrown the eggs from their shallow receptacle. The new arrival often delayed for a short while, preening, in the spot where it first alighted, or it might nibble at its feathers a little as it walked to the nest. Within

a minute or two, rarely as much as three, of its arrival in the annatto bush, the dove was actually on the nest, where it slowly settled down and adjusted the eggs beneath itself.

The only occasion when the change-over took longer than this was in the afternoon of March 16. The male flew from the eggs at 1:28 p.m. I did not see the female until she walked to the nest three minutes later, but possibly in this interval she had been in the bush, screened from me by the foliage. Just as she was about to settle on the eggs, a Tropical Kingbird (*Tyrannus melancholicus*) sounded its shrill cry of alarm, for no reason evident to me. On hearing the warning notes, the female dove walked over the nest and did not stop until she reached a part of the bush where the canopy of foliage was denser than above the nest. Here she delayed for seven or eight minutes, then, since there was no further alarm, she walked back to her nest and settled down. The male dove usually cooed softly as he took his place on the eggs, and from time to time while he sat. Except one morning when her relief came unusually late, the female rarely uttered a note audible to me.

Both the male and the female sometimes interrupted their sessions on the eggs by brief absences, which as a rule did not exceed two or three minutes, although once the female stayed away for more than 15 minutes. These intermissions usually took place toward the end of each dove's period in charge of the nest. Thus on March 16, the female left the nest at 7:18 a.m. and returned at 7:20. The following morning, she was absent from some time before 8:05 until 8:20, and later the male was away from 12:08 to 12:10 p.m. and from 12:53 to 12:54. On March 18, the female took an outing from 7:54 to 7:56 a.m., and the male interrupted his session from 1:28 to 1:30 p.m. These absences seemed too short for hunting food. Probably the doves went to a neighboring stream to drink, since the weather was hot and dry, especially in the early afternoon when the male was in charge of the eggs. Possibly, too, they left to avoid fouling their nest. Some Blue Ground Doves, however, are careless about this, and before their eggs hatch the outermost parts of their nest are much soiled with their droppings.

At nest 19, the second egg was laid between 7:30 and 9:15 a.m. on April 22, and both eggs hatched between 4:20 p.m. on May 5 and 8:35 next morning, giving an incubation period of approximately 14 days. This was my only successful attempt to learn the Blue Ground Dove's period of incubation, and if the nest had not been rather low, this also would have failed. On the morning of May 3, and again in the evening of the same day, when I came to inspect the eggs, the female, doubtless relying on her brown color to escape detection, sat steadfastly until I stood beneath her nest, then she flew off so suddenly that she rolled out an egg. Fortunately, each time the egg fell on dry leaves which saved it from breaking. The second time it cracked slightly, but not enough to prevent its hatching two days later.

THE NESTLINGS

At 6:00 a.m. on March 25, neither of the eggs in nest 17 had hatched. At 8:00 a.m., when I began to watch for the male's arrival, the female, which had returned after my early morning inspection, spent much time with her head bent low, as though feeding nestlings. Although she continued to do this for the next half-hour, I could not see what was beneath her, and accordingly I advanced to the nest and held up a mirror, which revealed two nestlings. They were sightless, and their dark skins were fairly well covered with the straw-colored, hair-like feathers typical of newly hatched pigeons. I saw only three of the four pieces into which the shells had split. I promptly entered my blind close in front of the nest. At 8:51 the female came back and carried off a piece of shell, and three minutes later she returned to bear away both parts of the other shell, which were loosely held together by the shell membrane. Flying to a branch about 12

feet from the nest, she dropped them. At 9:04 she began to regurgitate food, probably to a single nestling, although they lay so low that they were invisible to me. Other feedings followed at short intervals, and by the time the male came to replace her, at 10:47, she had fed the nestlings eight times, each act of regurgitation continuing from a few seconds to three minutes. In aggregate she devoted about 12 minutes to regurgitation. Unlike most birds, which after their first view of their nestlings must go off and find food before they can feed them, pigeons are prepared to feed their offspring when they first set eyes on them.

Probably the male arrived late because of my intrusion at the nest at about his usual time for coming. Still, the female seemed reluctant to go and delayed for two minutes on and beside the nest before she flew off. Her partner cooed softly as he settled on his newly hatched nestlings. When I left at 11:00 a.m. he had not yet fed them; but I saw him feed them at 12:03 p.m., and during the next 20 minutes he gave three more meals, the longest taking about 40 seconds.

I watched this nest for three whole days, on March 26, 28, and 31, when the nestlings were respectively one, three, and six days old, and I made many visits of inspection on the intervening days. By April 2, when I had planned to watch again, they had vanished, probably carried off by some predator. During the nestlings' first four or five days, each parent came to the nest once daily, at about the same hour as it had been accustomed to arrive while incubating the eggs. On March 26 the day-old nestlings, constantly attended, were brooded most of the time when they were not being fed. The male came to relieve his mate at 8:54 a.m. and was continuously present until she returned at 2:05 p.m. where she remained uninterruptedly until nightfall. On March 28 the female left as her partner reached the annatto bush at 9:16 a.m., but he delayed six minutes, preening, before he advanced to the nest. He stayed continuously on the nest until 1:20 p.m., when he flew out of sight. Although a few drops of rain fell, the three-day-old nestlings were alone for the next two and a half hours, or until the female returned at 3:51 p.m. After feeding each of the nestlings, she left when a wandering Fiery-billed Araçari (*Pteroglossus frantzii*) set up a commotion among the smaller birds in the garden, but after this dreaded nest-robber passed on, she returned and remained with the nestlings until evening. Although I did not watch continuously on March 29, occasional inspections showed that the parents were present at the nest much of the time.

But by March 31, when the six-day-old nestlings were in pinfeathers, the parents had made a great change in their manner of attending them. Except in the early morning and late afternoon, the young birds were not brooded in the daytime. The female left the nest at 6:43 a.m., without having fed them. The male was present from 8:15 to 8:26 a.m., and from 10:56 to 11:03 a.m., to deliver meals. The female returned at 1:26 p.m. and stayed until 1:37; much of the time she was engaged in feeding. She came again at 3:30 and remained until nightfall, from time to time feeding the young, but she did not brood them until, as the daylight faded, they gradually retired beneath her. Thus on this day each parent came to the nest twice, instead of only once, as they had while incubating and brooding.

For most small birds, the rate of feeding the nestlings is usually given in terms of the number of visits to the nest with food in a stated interval. This procedure disregards variations in the quantity of food brought on each visit, which tends to increase as the nestlings grow older. Without complicated procedures, disturbing to the routine of the parents, it is hardly possible to learn how much more food is brought to the nestlings. Despite its limitations, this method provides an index of the parents' activity in nourishing their young. How to record the rate of feeding in pigeons and doves, is a more perplexing problem; for on a single visit to the nest a parent may regurgitate to

the nestlings a number of times, spread over several hours. One might count each continuous act of regurgitation as a "meal"; but here complications arise, for the intervals separating such acts vary from a few seconds to more than an hour. If a nestling's bill drops out of its parent's mouth and is almost at once taken up again for further regurgitation, should we count this as one meal or two? If we say that it is one, then when the interval between acts of regurgitation is just a little longer, we must again decide whether to count one meal or two. A further complication is created by the fact that at first the nestlings are fed singly, but when a little older the two receive food simultaneously, with their bills inserted into the parent's gape from opposite sides. Moreover, the "pigeon's milk" from the parent's crop is undoubtedly regurgitated more rapidly as the nestlings grow older, but since its passage cannot be seen, this could be proved only indirectly by measuring the young birds' increase in weight after feedings of known duration. Perhaps the best way to express the parents' activity in feeding is in terms of the time devoted to regurgitation in each period of observation. But to do this with perfect accuracy, especially during the nestlings' first days when feedings are frequent and usually short, it would probably be necessary to have either some mechanical aid to timing and recording or an assistant to do this at the observer's dictation. Since I had neither of these, I can claim only a rough accuracy for the numerical data given in the following paragraphs.

On March 26, when the two nestlings were about one to one and one-half days old, the female regurgitated to them about 14 times, totalling 39 minutes, and the male also fed them about 14 times, totalling 16 minutes. The two parents together regurgitated about 28 times and were so engaged for a total of about 55 minutes. On this day the young were always fed singly. Once the female regurgitated to one of them for six minutes and after dropping this nestling's head she almost at once took the mouth of the other into her own and fed it for seven minutes. The longest feeding by the male lasted about three minutes. The shortest feeding by the female was 40 seconds; by the male, 15 seconds. On this day the female began to feed at 5:31 a.m., before she left the nest and long before sunrise, while the light was still dim. The parent which was brooding was able to give food to a nestling whenever it rose up for it, and meals were well spread over the day until 2:30 p.m., after which the female, which was then sitting, delivered no more food.

On March 28, when the two nestlings were about three to three and one-half days old, the female fed them about 15 times, totalling 39 mintues, and the male fed them 10 times, totalling 42.5 minutes. The two parents together fed about 25 times and were so engaged for a total of 81.5 minutes. Early in the morning the female once fed the two nestlings simultaneously, but since they were still sightless, they did not often succeed in pushing their bills into her gape at the same time. By 10:30 a.m. I saw a nestling open its eyes a little, momentarily. By noon both could open their eyes, but throughout the day they were fed separately more often than together. On two occasions the male continued to regurgitate for nine minutes with brief interruptions, mostly feeding the two young alternately but sometimes simultaneously. The longest feeding by the female lasted six minutes. The shortest feeding by the male continued about one minute, by the female, 20 seconds. On this day the female began to feed the young at 6:10 a.m., about sunrise. Each parent was able to give nourishment to the nestlings through most of its stay on the nest, but as noted above, both parents were absent from 1:20 to 3:51 p.m. After her return at 3:51, the female fed each nestling once, the last meal ending at 4:06 p.m.

On March 31, the nestlings, six to six and one-half days old, were in pinfeathers, had open eyes, and were not brooded except in the early morning, late afternoon and night. By then the method of feeding had changed greatly. On March 31 the female gave

them only five meals, totalling 12 minutes, the male fed three times, totalling 11 minutes. The two parents together regurgitated eight times and were so engaged for a total of 23 minutes. Now the nestlings were mostly fed simultaneously but sometimes singly, especially when they appeared to be not very hungry. Then one was sometimes slow in inserting its bill into the mouth of its parent, or its bill might drop out while the other young bird continued to receive food. The longest feeding by each parent lasted about 5½ minutes. The shortest by the male continued 35 seconds; by the female, 10 seconds. On this day the female, after brooding through the night, gave no food before she flew away at 6:43 a.m. During the morning the male came twice to the nest, fed the nestlings, and a minute or two later he flew away. The female came twice in the afternoon. On her first visit she fed once and flew away, but on her second visit she regurgitated four times, between 3:30 and 5:00 p.m., after which she stayed for the night. Her last feedings were brief. Now the parents seemed rather promptly to exhaust their supply of food, whereas while the nestlings were younger they distributed it over the day.

In the Ruddy Quail-Dove (*Oreopeleia montana*) and the Ruddy Ground Dove, as in the Blue Ground Dove, the number of feedings received by the nestlings each day declined greatly during their first week of life (Skutch, 1949, 1956). In the quail-dove, this decline was even more rapid than in the Blue Ground Dove. In the Band-tailed Pigeon (*Columba fasciata*), which is a larger bird and has a much longer nestling period than the foregoing species, a similar decrease in the number of meals was observed by Neff and Niedrach (1946), but in this case the reduction was only from three daily meals during the first week to two daily meals thereafter, for the single nestling. Only the male fed the young until after its twentieth day, when the female took a share.

While sitting with their nestlings in front of them, each of the parent Blue Ground Doves would sometimes gently preen or bill the sprouting plumage of the little ones. But I never saw them remove their nestlings' droppings. As we have seen, parents of this species while incubating are none too careful of the nest's cleanliness. By the time the young fly, their nests are heavily soiled. I have not seen a Blue Ground Dove give a distraction display.

The nest to which we have given most attention was pillaged when the nestlings were a week old. At a nest which I kept under observation in the following year, the young were nearly feathered when eight days old. By the evening of the following day, their nest was empty. The lining was not pulled up, as happens when clinging young birds are rudely torn from their nest, and apparently the nine-day-old doves had left by their own power. Yet it is possible that they had been frightened away by some marauder. Their remiges had been well developed on the preceding day.

SUMMARY

In Central America the Blue Ground Dove inhabits shady clearings and second-growth thickets in humid regions, chiefly at lower altitudes, although it has been recorded as high as 5000 feet above sea level. It forages on the ground, sometimes in small parties, but it is not truly gregarious.

In the valley of El General, Costa Rica, nesting begins in February, is at its height in March and April, and continues sparingly until September. The nest is placed in a tangled thicket or shady plantation, from three to 35 feet above the ground, but usually it is found from five to 12 feet high. In building, the female sits on the nest site and arranges the materials brought by the male, which as a rule stands on her back while laying them in front of her. But after incubation begins, the female may bring materials while her mate covers the eggs. The frail, slight nest may be completed in two or three days.

The set consists usually if not always of two white eggs, of which the second is laid between 7:00 and 10:00 a.m., about two days after the laying of the first. The doves spend much time on the nest before the set is complete.

Both sexes incubate, the male taking one long session through the middle of the day, the female sitting the rest of the time. At one nest, the male's daily periods on the eggs ranged from 4 hours and 16 minutes to 6 hours and 13 minutes, and the average for 7 days was 5 hours and 8 minutes. Each partner interrupted its sessions very briefly, usually for no more than two or three minutes, probably to drink or to avoid soiling the nest.

At one nest, the incubation period was about 14 days.

For four or five days after the nestlings hatched, each parent came to the nest once daily, at about the same time that it had arrived while incubation was in progress. Brooding was at first practically continuous, but when the nestlings were three days old they were left exposed for 2½ hours. When the nestlings were six days old and no longer brooded through most of the day, each parent came twice to feed them.

While the nestlings were sightless, the parents usually regurgitated to one at a time; but after their eyes opened when they were slightly over three days old, they were usually fed simultaneously, from opposite sides of the parent's mouth. The number of feedings in a day was 28 when the nestlings were one day old, 25 at three days, and eight at six days. The total time devoted to feeding on these days was 55, 81½, and 23 minutes.

The parents permitted droppings to accumulate heavily on the nest and never gave a distraction display.

From one nest the young departed at the age of nine days, but possibly they had been disturbed.

LITERATURE CITED

Belcher, C., and Smooker, G. D.
1936. Birds of the colony of Trinidad and Tobago. Part III. Ibis, ser. 13, 6:1–35.

Friedmann, H., and Smith, F. D., Jr.
1950. A contribution to the ornithology of northeastern Venezuela. Proc. U. S. Nat. Mus., 100: 411–538.

Neff, J. A., and Niedrach, R. J.
1946. Nesting of the band-tailed pigeon in Colorado. Condor, 48:72–74.

Ridgway, R.
1916. The birds of North and Middle America. Part VII. Bull. U. S. Nat. Mus. 50.

Skutch, A, F.
1949. Life history of the ruddy quail-dove. Condor, 51:3–19.
1956. Life history of the ruddy ground dove. Condor, 58:188–205.

El Quizarrá, San Isidro del General, Costa Rica, July 19, 1958.