

LIFE HISTORY OF THE BOAT-BILLED FLYCATCHER

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ONE of the biggest birds in a multitudinous family, the Boat-billed Flycatcher, *Megarhynchus pitangua*, ranges over an immense territory extending from México to northern Argentina. It is a bird of the tree-tops, haunting the topmost boughs of the crowded giants of the forest and wandering over all sorts of more open country where the trees are not too stunted or widely spaced. Hence, it is not infrequently seen in coffee plantations with their open shade, in pastures with scattered trees, and in the riverside fringe of arboreal vegetation among the banana plantations. It occurs even in the more arid parts of Central America, along the Pacific coast, and in semi-desert valleys of the interior where a pale-colored race has been recognized. Tolerant of a wide variety of climatic conditions, it ranges from sea level up to nearly 6000 feet in Guatemala and to at least 6200 feet in Costa Rica. At the highest elevations it is possibly migratory, to a certain extent. During the year I spent at Vara Blanca in the Costa Rican highlands, I found Boat-billed Flycatchers not uncommon at 5500 feet in July and August, after which they disappeared from the vicinity and were not seen again until the following April. Restless and active, these big flycatchers, except when nesting, seldom linger long in one place and each day wander over a wide territory, in pairs or in family groups of three to five.

The Boat-billed Flycatcher is a stout bird about nine inches in length. Its color pattern is bold and striking, in keeping with its robust appearance. Its upper plumage is olive. The black of the crown is bordered below by broad, white, superciliary stripes which nearly meet on the back of the head. A wide, black band covers each cheek. The throat is white and the rest of the under plumage is clear yellow. There is a concealed patch of yellow or rufous-tawny on the crown. The heavy bill is black, broad at the base, and strongly hooked at the tip of the upper mandible. The eyes are brown and the feet blackish. Male and female are alike in appearance. In coloration the Boat-billed Flycatcher is confusingly similar to the Chip-sachery, *Myiozetetes similis*, the Cayenne Flycatcher, *M. cayanensis*, the Lictor Flycatcher, *Pitangus lictor*, and the Kiskadee, *P. sulphuratus*. The almost identical head-markings of these birds belonging to three not very closely allied genera give the evolutionist something to

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ponder. From all of these four species which it so closely resembles in coloration, the Boat-bill is readily distinguished by its voice and the form of its nest, and from all except the Kiskadee by its far larger size. From the last, which is equally large, the Boat-bill may be distinguished by its heavier bill and the absence of cinnamon-rufous on the remiges, which on the Kiskadee is conspicuous in flight.

FOOD

Like most flycatchers, the Boat-bill subsists upon both insects and fruits. When hunting insects, it rarely makes the long, spectacular sallies into the open air above fields, rivers or tree-tops which are so characteristic of *Myiozetetes*, *Tyrannus* and others of the larger members of the family. On the contrary, while perching in the tree-tops it scrutinizes the surrounding boughs and, when it sees a suitable insect resting upon leaf or limb, makes a quick dart to pluck it off, usually without alighting beside it. In this method of hunting it resembles some of the cotingas, such as *Tityra*, *Pachyramphus* or *Platyptaris*, rather than the flycatchers which are most like it in size and appearance. Usually, its victims are of substantial size, and often they are green. During the drier early months of the year when the cicadas sizzle loudly among the trees, they contribute largely to the diet of the Boat-billed Flycatcher. The bird, snatching one of the big insects from the twig or trunk where it rests, carries it to some convenient perch against which the flycatcher proceeds to beat it noisily. After knocking it several times against the branch, the bird turns it in its bill by loosening its grip at the same time that it gives the insect a slight toss, then seizes it in a different position and beats it until it has been thoroughly pounded on all sides. Then the bird gulps down the tough, dry morsel. It would be interesting to know whether the flycatchers can distinguish the male cicadas, which are little more than hollow sound chambers, from the females which contain more nourishment, and whether they eat only the latter.

Of fruits, I have seen the Boat-billed Flycatcher eat small wild figs, berries of *Cissus* and *Miconia* (Melastomaceae), and the dry green fruits of *Cecropia*. The bird often plucks berries much as it catches insects, by flying up and pulling one from the cluster, without alighting. But if there be a satisfactory perch within easy reach of the cluster, it may rest there and gather the fruits at ease. Soft berries such as those of *Miconia* are swallowed directly; but I have watched a Boat-bill dart up to a dangling fruiting spike of a *Cecropia* tree, tear away a small portion of the crowded green fruits and beat it vigorously against a neighboring branch before swallowing it with an upward

toss of the head. The whole procedure almost exactly duplicates the bird's actions in capturing and devouring a cicada!

VOICE

The common call-note of the Boat-billed Flycatcher is a loud, rather high-pitched monosyllable, rapidly repeated while the bird perches or flies—'*choip choip choip choip*.' Heard close at hand, this note sounds slightly raucous, but two or three Boat-bills calling in this manner in the distant tree-tops create a delightful music, as of soft chimes. While resting, the Boat-bill delivers a long-drawn, whining '*churr*'.

Like many other flycatchers, the male Boat-bill is most melodious in his twilight singing. In the valley of El General in Costa Rica, I have heard him practice his dawn-song in a tentative fashion on clear, cool mornings in early January, but usually it is late February, and sometimes even March, before he performs in good earnest. Thenceforth, he may be heard singing at daybreak well into June, and at times even in July. A bird which sang at daybreak on a number of mornings in late September and early October had apparently lost his mate. To deliver his song he chooses some lofty exposed perch in a tree-top, at the edge of the forest or in a clearing. Here he repeats over and over a loud, clear, ringing note, sounding like '*cheer*,' which at irregular intervals he punctuates by a slurred note of very different character, '*bo-oy*.' Rarely the whining '*churr*' is interjected into the song, but the far-carrying, clear notes always predominate. This stirring, spirited performance is begun in the earliest gray dawn and continued for many minutes. One Boat-bill that I watched on the first of April sang with scarcely an interruption for 25 minutes, then, appearing to tire, continued haltingly for about ten minutes more. The dawn-song is rarely continued until sunrise and later in the day is delivered only exceptionally, and briefly, under the stress of great excitement.

The dawn-song may be delivered from the same tree where the female will later build her nest, or some distance away from the nest-site. In 1939, a Boat-billed Flycatcher sang sometimes in January, and more consistently and at greater length from late February onward, in the top of a tall wild fig tree growing above a rivulet between pastures, or in neighboring trees. Late in March, his mate began her nest in this same fig tree. When this nest fell, she built another in a much lower tree growing in the pasture at least 100 yards away. The male continued to sing at dawn in the fig tree but later in the day came to guard the new nest. This second nest was also

prematurely lost. If the female built another it was so far distant that I did not succeed in finding it; but the male continued to sing at daybreak in the tall fig tree. He was last heard here in June.

At the end of February, 1940, a male sang at dawn in the top of a tall ojoche tree standing isolated in a pasture. On some mornings he began in another tree at a distance but would fly to the ojoche tree to deliver his closing notes. On several mornings in early March, the female joined him in the ojoche tree as he was concluding his refrain. On two mornings, her arrival coincided with, and seemed to be the cause of, the cessation of his song, and on one of these mornings, of his departure as well. On other mornings he lingered for several minutes with her in the ojoche tree. The female, if she found birds of other kinds resting in the ojoche tree when she arrived, especially any of the larger flycatchers, would proceed to drive them away by flying at them and loudly snapping her bill. Late in March, she built and began to incubate in this tree. In early April, while incubation continued, the male delivered his dawn-song in a Spanish plum about 200 feet from the nest-tree but would fly to the latter upon its conclusion. The nestlings hatched about April 13, and then I ceased to hear the dawn-song. On April 27 the young flycatchers vanished, probably into the gullets of toucans. That afternoon, for the first time in many days, I heard the male Boat-bill utter the loud, clear notes of his dawn-song, repeating them many times in a tree not far from the nest-site. Next morning he sang at dawn for the first time since the eggs hatched. During the following days he performed at dawn in a tall, slender tree standing on the ridge above the nest-tree. On May 2, the female began a new nest in another ojoche tree, about 500 yards from her first nest-tree. Now the male chose a new singing-tree about midway between the sites of the first and second nests. By mid-May, when incubation was in progress in the new nest, I no longer heard him sing at dawn.

In a neighboring pasture another pair of Boat-billed Flycatchers had a nest only 20 feet above the ground, in the densely leafy crown of an *Inga* tree which offered no high, exposed singing perch. One morning in late March, while the female incubated, I found the male singing at daybreak in the top of a nearly leafless tree on the opposite side of a small river, about 200 feet from the nest. After a while he moved to a tree about halfway between his first position and the nest and continued to sing for a few minutes longer, until the daylight grew too strong for dawn-singing.

In March, 1943, a Boat-billed Flycatcher built a nest in the top of a guava tree close beside my house. Her mate either sang little or

irregularly or did most of his dawn-singing at a long distance from the nest. That the latter might be the true explanation is suggested by the fact that one morning I heard him sing in the distance before he came to continue his monologue in the yard. When he sang near the house, it was usually in a tree-top 20 or 30 yards from the nest-tree; only once did I hear him perform briefly at dawn in the nest-tree. On many mornings while his mate built and incubated close by my residence, I failed to hear his song. Yet he was always watchful of the nest during the day.

I believe that we may fairly conclude from these observations that the male Boat-bill's singing-tree is often chosen by his mate for her nest, especially if it offers a good site. If the female does not build in the singing-tree, or loses a nest there and places the second somewhere else, the male may or may not change his singing post to be nearer the nest, but is likely to do so if the nest is situated more than 100 yards from the original singing-tree. If he begins his dawn-song at a good distance from the nest-tree, he may move to some intermediate station to deliver his concluding notes.

NEST BUILDING

In 1942, I found two Boat-billed Flycatchers beginning their nests on February 23, in the basin of El General. March, however, is here the month of most active nest-building. In Guatemala, I found a pair feeding nestlings on April 30, in a nest that must have been begun no later than the first of the month. In southwestern Tamaulipas, México, Sutton and Pettingill (1942: 21) saw no birds building until April 7.

The 24 nests, finished and unfinished, that I have seen, were in trees standing isolated in clearings and ranged in height from 20 to about 100 feet above the ground. Cherrie (1916: 241) however, recorded a nest of this species in the Orinoco region that was only ten feet above the ground. Usually the open cup is built far out on a leafy branch. The lowest nests were all among the foliage in the very tops of small trees, where they were supported by branches so long and slender that it was impossible to climb to them, although in some instances I could see their contents reflected in a mirror attached to the end of a long pole and raised above the nest. A few of the higher nests were in the crotches of stout branches, sometimes against the main trunk. Three nests found in 1942, and all apparently the work of the same bird, were placed at heights ranging from 70 to 100 feet in stout crotches in charred and nearly branchless dead trees standing in a recently made clearing. Here they were without shade or conceal-

ment and conspicuous from afar. However, this was a most unusual situation; most nests are in living trees, and usually they are well out from the trunk. One nest was well concealed in the midst of a densely leafy mistletoe that grew as a parasite high on a leafless tree standing in the midst of a pasture.

I have watched carefully the construction of two nests, more or less casually the building of half a dozen more, and have seen only the female at work. Usually her material is brought from a good distance, often from points out of sight. So far as I have seen, it is all gathered from well up in the trees, never from the ground. I have examined several nests and found nothing in them of undoubted terrestrial origin. The twigs that she uses for the foundation are broken from dead branches in the tree-tops, often with considerable labor, and the long, fibrous roots that she employs in the lining are from orchids, ferns and other plants that in tropical forests grow high above the ground. Some of the sticks intended for the nest's foundation are branched and so long and stiff that the flycatcher must struggle hard to push and pull them through the surrounding branches to the nest-site. At times they are knocked from her bill by some obstruction and fall to the ground, where they are a total loss; she never descends to recover them but prefers to gather fresh material from a neighboring tree-top. Later, when she lines the nest, she flies up with the long rootlets of air-plants trailing far behind her and carefully coils them into the bottom of the cup.

While the female Boat-billed Flycatcher builds, her mate perches close by the nest in indolence or languidly preens his feathers. At times he bestirs himself to follow her on excursions to gather material. Returning, he may bear a twig or a rootlet in his bill, but he never adds this material to the nest. He may drop it while he perches close by watching his mate as she strenuously arranges her own contribution—a lengthy process. Or he may continue to hold it until, the task of shaping the nest completed, she flies off for more material, when again he follows, still bearing the twig in his bill. One male brought the same root thrice to the fig tree where his mate built and thrice carried it away. Once, perching near the nest, he held a rootlet for 11 minutes by my watch, then dropped it to chase away a trespassing bird. It never seemed to occur to him to pass it to his mate and save her much hard work, nor to her to take it from him. I have seen this same behavior at a number of nests. Male Band-tailed Tityras, *Tityra semifasciata*, and Inquisitive Tityras, *T. inquisitor*, carry material back and forth in much the same fashion while their mates build, but they rarely if ever take it into the nest-cavity.

The female Boat-bill who built her nest high up in the fig tree worked at it for at least ten days, but she did not labor with the concentrated activity of many building birds. During four hours of the early morning she brought material only 41 times, or about ten times per hour. Four days after I last saw her bring a rootlet to her nest, I found the completed structure on the ground. Probably it had been torn from the tree by toucans. A week later this female began a new nest in a *peine de mico* tree, *Apeiba Tibourbou*, close behind the cabin I then occupied. After she had worked a day or two, this incipient structure was abandoned when a five-foot iguana climbed into the tree-top and passed the night close beside it, taking no account of the birds' attempts to drive it back to earth. The flycatcher then returned to the fig tree that had held her first nest and laid the foundations of a third structure on the side of the tree opposite the site of the first and about 100 feet up. This was also, for some undetermined cause, abandoned before it contained nestlings; then the Boat-bill resumed work on the nest she had begun three weeks earlier in the monkey's-comb tree behind the cabin. Five or six days later this nest appeared to be finished, after the female bird had devoted a total of six or eight days to its construction.

The Boat-billed Flycatcher which on March 10, 1943, began a nest in the top of a guava tree growing just outside my dining-room window, worked in a more leisurely fashion. Although the bird I had watched as she built in a fig tree four years earlier had labored steadily if not rapidly in the cool of the morning, this Boat-bill worked principally later in the day. I rarely saw her visit the nest while I sat at early breakfast and, if I continued to watch after breakfast, there was so little activity that I finally abandoned the uninteresting vigil. But while I ate lunch, between eleven o'clock and noon, she brought material more frequently; on some days she continued to do so until about the middle of the afternoon. Even then, visits were widely spaced; when the nest was nearing completion, the female brought material only thrice in the hour between 12:20 and 1:20 p. m. This Boat-billed Flycatcher devoted about two weeks to the construction of her nest. I last saw her bring material on March 22, and she did not lay the first egg until March 31. Sutton and Pettingill (1942: 21) remarked upon the deliberate way in which Boat-billed Flycatchers proceeded with nidification in the state of Tamaulipas, México.

Like flycatchers of a number of other species, the pair of Boat-bills that built in the guava tree close beside my house sometimes uttered a peculiar nest-song. This was a rapid series of low, intimate notes suggestive of contentment. I first heard it early one afternoon soon

after the nest was begun. While the female Boat-bill perched close beside the nest, holding a stick she had brought for it, the male sat in the nest and delivered many low, mincing notes, very different from his more usual utterances. At the same time, Chipsacherry Flycatchers and Gray-capped Flycatchers, *Myiozetetes granadensis*, were singing rather similar nest-songs as they examined with their mates possible nest-sites in neighboring orange trees; probably this stimulated the Boat-bill to sing, too. I have more than once noticed that the nest-song of one pair of flycatchers evokes the corresponding utterances of neighboring pairs, perhaps of distinct but related species. During the remainder of the period of nest-building, I heard this low, "confidential" song a few times more from both male and female but, after incubation began, I failed to hear it again until the day the eggs hatched. At the other nests I watched during the period of construction, I never heard the nest-song, possibly because these nests were so high above me, possibly also because I spent less time with them.

The completed nest of the Boat-billed Flycatcher is a broad and relatively shallow open cup. A typical structure measured 4.0 inches in internal diameter by 1.75 inches in depth. The foundation, bulky but loose, consisted of coarse, stiff material; that of one nest was composed of about equal parts of crooked, dry twiglets and slender, leafless stems of epiphytic orchids—one of the latter was 14 inches long. Another nest contained lengths of dry vines in the foundation. In yet another, the foundation and outer layers were composed almost wholly of small epiphytic orchid plants with green leafy shoots, chiefly of a species of *Dichaea*. The inner layer consisted of: slender, flexible rhizomes of creeping epiphytic ferns; fibrous roots of orchids, ferns and other epiphytes, some very long, many partially decayed, but a few still green; dry tendrils; and a few short twiglets. One nest contained living fragments of small epiphytic orchid plants, one of them eight inches long, with small green leaves and roots attached. The fabric of the nest is sometimes so open that light passes through the bottom. It often costs the bird much strenuous effort to break twigs from dead branches and pull away roots and rhizomes from moss-covered bark where they grow firmly attached. Doubtless it is for this reason that, at best, the flycatcher brings material to the nest relatively few times in the course of an hour. Only a big, powerful bird could build a nest of these ingredients.

The nest of the Boat-billed Flycatcher was long ago correctly described by Euler (1867: 225) as a slight, frail, open structure; a number of subsequent writers have confused it with the bulky roofed nest of the Kiskadee which this bird resembles so closely in size and

coloration, although it is so different in voice, habits and temperament. Once in Guatemala, I found both Boat-bill and Kiskadee nesting in the same tree, in apparent amity. The Kiskadee's domed nest was in a main crotch, and the Boat-bill's much slighter structure was on a slender branch far above.

THE EGGS

I have four records of nests which contained three eggs or nestlings, three records of nests which held two eggs, and two of nests with two nestlings. At the nest in the peine de mico tree where a set of three eggs was laid, an interval of two days separated the laying of the second and third eggs. The Boat-billed Flycatcher that built in such a leisurely fashion in the guava tree beside my house laid, so far as seen, only two eggs, the second three days after the first. Because of the inaccessibility of the nests I have no measurements of the eggs, but I have seen five sets of eggs with mirrors and have held in my hand part of an empty shell. The eggs are whitish, thickly speckled and blotched with brown and pale lilac over the entire surface, but most densely on the large end. Belcher and Smooker (1937: 233) gave measurements of a set of three eggs of the nominate race of the species, collected by them in Trinidad. These eggs measured 30 by 21.5, 29.5 by 21.5 and 29.5 by 21.5 millimeters; their markings resembled those already given for the Central American race.

INCUBATION

The bird in the guava tree began to incubate the day before her second and last egg was laid, but the flycatcher in the peine de mico tree was not seen incubating until the day on which she completed her set by laying the third egg. During the interval between the beginning and completion of laying, however, one member of the pair was almost always to be found watching the nest from a neighboring leafless tree.

Incubation is carried on by the female alone, but at every nest, six in all, that I have watched during this period, the male has stood guard over the eggs during her absences.

During six hours of the morning at one nest, the female Boat-billed Flycatcher took five sessions on the eggs, ranging in length from 27 to 68 minutes and averaging 44.6 minutes. Her six recesses varied from five to 20 minutes in length and averaged 13.3 minutes. She incubated 77 per cent of the time. With two exceptions, she each time remained patiently warming the eggs until the male arrived to guard them. He always flew silently into the ceiba tree, and the moment he arrived

the female as silently departed. During her absence, the male continued to keep watch over the nest, sometimes perching close beside it, sometimes at a distance of several yards, resting near the ends of the branches, more rarely standing upon the rim of the nest itself. While on sentinel duty, he frequently busied himself preening his feathers. His exercise of guardianship, during the morning I watched, was limited to driving from the vicinity of the nest, with an aggressive forward dart and loud warning clacks of his heavy bill, such innocent and unwitting intruders as a wintering Yellow Warbler, *Dendroica aestiva*, and a Chipsacheery Flycatcher. However, he merely served notice that they trespassed and did them no harm. Upon his mate's return from her usually brief recess, he greeted her with loud, ringing cries which sounded like 'choip choip' or 'choee choee,' then promptly flew away. She at once settled on the nest, often uttering low, soft notes suggestive of contentment. The male Boat-bill's noisy departure contrasted sharply with his silent arrival.

Only twice during the morning did the female Boat-bill leave her eggs before her mate's arrival to guard them. This first occurred when she heard or saw him rush to attack a party of Swainson's Toucans, *Ramphastos swainsonii*, that had appeared on the hilltop west of the nest and about 500 feet distant from it. As soon as the toucans flew within view, she dashed away to aid her mate in harrying these hated and formidable enemies. After the great-bills had vanished into the neighboring forest, the male Boat-bill promptly came to stand guard over the vacant nest until his mate, who doubtless had taken advantage of her excursion to snatch a few morsels of food, returned two minutes later. The whole episode demonstrated the closest coöperation between the pair in guarding and defending the nest.

Toward the end of the morning, after she had been sitting for an hour without relief, the female hopped from the nest to perch close beside it, facing it, while she preened her feathers. After eight minutes of this, her mate still delaying his arrival, she returned to her eggs. After sitting only two minutes more, hunger overcame her attachment to her nest and she winged away, leaving it unguarded. Five minutes after her departure, the male flew up to the unattended nest and stood sentinel over it until, after two minutes more, the female returned to resume incubation. Because at this nest the male was to be seen in the vicinity only during his mate's absences, their alternation in attendance was admirably coördinated.

The following year I watched another nest situated only 20 feet above the ground in the top of an *Inga* tree growing in a pasture close by a small river. Here the female was incubating three eggs. During

4.5 hours of the morning, her sessions and recesses were as follows (recesses in italics):

7 54 8 91 9 62 15 minutes

Thus, she kept her eggs covered 87.6 per cent of the time—far more than any other flycatcher that I have ever watched incubate; in fact, more than any other arboreal bird that I personally have watched, except jays and goldfinches which are fed liberally by their mates while they incubate.

During four of the female's five recesses, the male stood sentinel in the top of the nest-tree. When she began her recess at 10:30 a. m. he had already been resting half an hour in the top of this tree, much of the time preening his feathers. Now, when she flew off for food, he followed. There was a flurry of excitement among the tops of the trees by the river, which from my watch-post I could not see. Apparently, the male Boat-bill had left the nest-tree to help drive away some enemy. As soon as the excitement died away, he came to perch in a riverside tree whence he could overlook the nest. Thus he watched over the nest during each of the female's absences; but because of his habit of resting for long periods in the nest-tree, even while his mate was there covering the eggs, this pair did not present the fine picture of soldier-like change of guard which was so striking at the nest in the ceiba tree, where both members of the pair were rarely present at the same time. Once, however, this male came to the nest-tree to keep guard when from a distant lookout he saw the female leave the eggs, and twice he flew from the nest-tree as he saw her approach. Among trespassers driven from the vicinity of the nest that morning were a female Inquisitive Tityra, a Chipsacheery Flycatcher, a third Boat-billed Flycatcher, and a Gray's Thrush, *Turdus grayi*. When pursued by the male Boat-bill, the thrush dodged about among the boughs of the nest-tree, refusing to leave until the female jumped from her eggs and joined her mate in chasing the brown intruder who then flew to a neighboring tree.

On April 8, 1949, Mr. and Mrs. Darwin Norby helped me make what we hoped would be an all-day record of incubation at an inaccessible nest, situated about 30 feet up on an exposed limb of a *Cecropia* tree, in the pasture behind my house. After the vigil had continued more than ten hours it was abruptly terminated, at 4:15 p. m., by a drenching thunder storm. During this period we timed 16 sessions on the eggs which ranged from 15 to 77 minutes and averaged 30.2 minutes. An equal number of recesses varied from two to 19 minutes and averaged 8.3 minutes. The female Boat-bill covered her eggs for

78.4 per cent of the 10.25 hours' observation time. The male, although he often rested in the nest-tree while his mate sat in the nest, did not guard during her absences as consistently as at some other nests I have watched. However, he stayed by the nest 83 per cent of the time while his mate was at recess, but lingered in the nest-tree only 34 per cent of the time she spent in incubation.

At the nest in the guava tree beside my house, the male, during the female's absences, guarded from a neighboring tree-top rather than in the nest-tree. I had great hope of learning the length of the incubation period at this nest, whose contents I could see by raising a mirror attached to the end of a long pole. The first egg had been laid in this nest on March 31, incubation had begun on April 2, and the second egg had been laid on April 3. By the afternoon of April 20, neither egg had hatched. At noon on the following day the pair were attending the nest. Shortly after mid-day a violent rainstorm blew up and continued for about an hour, forcing me to delay my visit of inspection with ladder, long pole and mirror. When at last I could raise the mirror above the nest and look in, it was empty! A Swainson's Toucan had passed by the house just as the storm was ending, and this for me was sufficient explanation of what had occurred. On the ground beneath the nest I found the cap of one of the shells, neatly severed from the body of the shell by the bill of the birdling within, not roughly broken off as by a predatory creature. Hence I had no doubt that one of the eggs had hatched after no less than 18 days of incubation. Possibly this was the first egg that had been incubated for a day before the set was complete, and thus the true incubation period was 19 days. All of my other low nests were found after the eggs were laid, or destroyed before they hatched, and I have only this one approximation of the incubation period.

THE NESTLINGS

I have seen newly hatched Boat-billed Flycatchers only as images reflected from a mirror. Examined in this manner, they have the aspect of typical passerine nestlings, and the bright yellow interior of the mouth characteristic of the flycatcher family. They are fed largely, if not wholly, with insects by both parents. Especially during their first week they are almost constantly guarded, as I saw long ago at a nest in Guatemala and have since verified at a number of Costa Rican nests. After feeding, the female broods, remaining until the male arrives with food, then she flies off. After delivering his morsel the male lingers upon the rim of the nest or close beside it, guarding, until she returns to feed and brood once more. The male

during his periods of sentinel duty never, so far as I have seen, actually covers the nestlings but merely watches over them. At times, while the nestlings are still very small, this routine may be varied, the female simply moving from the nest to a point beside it when her mate arrives with food, settling down to resume brooding after he has fed the nestlings, and leaving him free to fly off and hunt more food.

At a nest far beyond reach in a parasitic mistletoe bush high up in a *Xanthoxylon* tree, the nestlings, which from indirect evidence I calculated to be five days of age but whose number I could not determine, were fed only seven times during the course of three hours—four times by the male and three by the female. The female brooded for four periods ranging from 34 to 45 minutes, totalling 154 minutes. In addition to this, she stood guard on the nest's rim for one period of five minutes, after interrupting her brooding to drive away an intruding Yellow-bellied Elaenia, *Elaenia flavogaster*. The male Boat-bill performed sentry duty for three periods of nine, three and eight minutes, respectively; these corresponded with his mate's brief absences for food and were all she took during the course of three hours. Except for one interval of two minutes, the nest was constantly attended while I watched.

Eight days later, on June 18, this nest in the mistletoe held a single, well feathered nestling which was easily visible from the ground as it rose to take food or stood up in the nest preening its feathers. During three hours and 20 minutes the young Boat-bill was fed a total of 16 times, or at the rate of 4.8 times per hour. Since the female did not now brood after each feeding, it was not always possible to distinguish the sexes of the parents; the male fed the nestling at least six times, the female at least five times. The latter brooded for a total of 75 minutes. During 75 additional minutes, one or the other of the parents, but chiefly the father, rested in the nest-tree or close beside it, keeping guard over the nestling. In all, the young bird was watched over, one way or another, for a total of 150 minutes during the 200 minutes of my watch, or three quarters of the time. That the male rested in the nest-tree for the particular purpose of guarding the nestling, and not merely because this was a place as good as another for loafing, was amply demonstrated by his prompt departure each time his mate arrived to take charge.

After six more days this young Boat-bill, which had long been completely feathered, was still in its nest in the mistletoe bush. On the morning of June 24, I again watched it for two hours 20 minutes. It was fed only nine times or at the rate of 3.9 times per hour, by both parents. Its food, so far as I could recognize its nature, consisted

wholly of insects, some of them very large, including a cicada that it swallowed with difficulty. The young bird was guarded, from points near the nest, for a total of 71 minutes by both parents and was brooded a total of 45 minutes, presumably by the mother only. Thus it was under parental vigilance, one way or the other, for 116 of 140 minutes, or six-sevenths of the time. Few nestlings of this age and degree of development are so constantly under their parents' watchful eyes. It was surprising, too, to see it brooded, for it was completely feathered, resembled its parents in coloration, and was almost ready to fly from the nest. Indeed, it seemed not to relish being sat upon; at times the youngster's restlessness caused the mother to leave the nest, but she would continue to guard close beside it.

I believe that the mother brooded the nestling, not because it required this protection, but because, when she remained to guard it, habit caused her to sit in the nest rather than stand on a branch near by, as the male did. She would alternately brood the nestling and perch near to guard it, all on the same visit to the nest-tree. If the nestling had not been guarded it would not have been brooded; guarding, not brooding, seemed to be the real purpose of the mother's as well as the father's continued presence at the nest.

This young Boat-billed Flycatcher left the nest on June 28. I first saw the parents bring food to the nest on June 5, which would make the youngster about 23 days old at the time of its departure. The following year, three nestlings, reared in a nest into which I could look with a mirror, departed spontaneously when 24 days old. At this age they could fly well, one of them covering a distance of more than 100 feet on a rising course. Because young Boat-bills often grow up in nests situated at great heights, it is important that they have good control over their wings before they venture into the open. On the morning when these three youngsters left home, their parents were watchful, loudly protesting my approach to their offspring. The fledglings did not differ essentially from the adults in coloration.

After their three fledglings left the nest in the *Cecropia* tree in the pasture behind my house, the parents were so vigilant and excitable that I could not come within 100 yards without stirring up a storm of protest. Even when I suddenly emerged from the forest on the south side of the pasture, an anxious Boat-bill would notice me almost immediately and fly up to scold. Then one or both of the parents would follow me about the pasture, often darting angrily above my head, and resting on low boughs of the guava trees "to complain." All this while the youngsters would remain out of sight.

THE SECOND BROOD

In El General, where the Boat-billed Flycatchers begin their nesting operations in late February or more commonly in March, I once found a pair feeding nestlings as late as July 17. This may possibly have been a second brood, but more often, I believe, these late nests represent repeated attempts to rear a single brood. Thus, in 1942, the pair that nested in the trees about my house began building on February 23, but because of repeated disasters they did not have fledglings until June 5. Even then they probably would not have succeeded in rearing young but for my intervention; before the nestlings could fly, the fork of the tree that bore them broke and crashed to the ground in a storm of wind and rain, and I placed the young birds on a neighboring bough for safety.

That same year, however, I found evidence of a second brood. At the end of April, two fledglings were successfully reared in a nest built high up in the crotch of a barkless, dead tree standing in a clearing. In the middle of June, there was a nest 100 feet above the ground in the top of another gaunt, dead tree about 200 feet from the first. Because of the propinquity of these two nests, both of which were in sites of the same character but very different from those selected by the great majority of Boat-billed Flycatchers, I have little doubt that they were the work of the same bird. It was impossible to look into this lofty nest, but in its utterly exposed position it could be seen from a long way off, and by watching I tried to learn what was happening there. On June 17 the female appeared to be incubating but, by June 23, I concluded that the nest had been abandoned. Then on July 7, the flycatcher was bringing material to this same nest and shaping it. From July 14 to 22, I often saw the female sitting in the nest in the mornings, as though incubating—but strangely enough she was usually absent during the afternoons. By the beginning of August the nest was deserted. Apparently this Boat-billed Flycatcher which attempted to rear a second brood was either physiologically or psychologically unable to do so, perhaps in some condition intermediate between the breeding and the non-breeding state. It would have been interesting to know whether she actually laid eggs or sat sporadically in an empty nest.

THE PERSISTENCE OF FAMILY GROUPS

After their departure from the nest, the young Boat-billed Flycatchers remain with their parents for months, continuing in their company long after they cease to be dependent upon them for food. The flocks of three, four or five individuals that roam about through

most of the non-breeding season apparently consist of parents with their full grown young. In 1942, three young were fledged in a tree behind my house. During the latter half of that year, and through January and February of the following year, five Boat-billed Flycatchers used to pass through the yard morning and evening—in the morning before sunrise flying down to the river and the cane-fields in front of the house, and late in the afternoon returning toward the coffee grove in the rear. They would straggle one behind another rather than fly in a compact flock and while perching in the shade trees about the house would utter their long, drawled 'churr.' This was doubtless the pair that had nested close by, with its three offspring. Toward the end of January, I thought that I detected signs of "discord" in this family, but the five held together more than a month longer. On the first day of March, I heard the male Boat-bill sing his dawn song for the first time that year, and after this I no longer saw more than two individuals in the yard. On March 10, 1943, as already recorded, the female began to build in the guava tree close beside the house. This year, the pair did not succeed in rearing a brood near the house and apparently were equally unsuccessful when later in the season they retired to a distance. During the closing months of the year, I saw only two birds in the yard, in place of the five that had frequented it the preceding year. If the pair does not produce offspring, the birds seem to remain by themselves until the following year.

During October and November, 1948, a pair of Boat-billed Flycatchers, which apparently had reared no progeny during the preceding nesting-season, roosted nightly in a small tree of *Inga spectabilis* in the pasture behind my house. Here they slept about 20 feet above the ground and always separated from each other by a yard or two—never in close contact, as mated Black-crowned Tody Flycatchers, *Todirostrum cinereum*, sleep. Although they might have concealed themselves well amidst the coarse compound leaves of the tree, they perched on the leafless basal portions of stout twigs where with an electric torch I could readily see them from below. However, the foliage formed a thick canopy above them these rainy nights. When I threw the beam of light upon them, their heads were always exposed rather than turned back among their feathers; yet they remained motionless while I looked up at them.

ENEMIES

The chief enemy of the Boat-billed Flycatcher is the toucan. I have seen few antipathies in the feathered world so strong as that of the Boat-bill to Swainson's Toucan, and to a lesser degree to Frantzius's

Araçari, *Pteroglossus frantzii*. These are the only toucans at lower elevations in the Terraba Valley where, chiefly, I have studied the Boat-billed Flycatcher. In other parts of the flycatcher's vast range, it doubtless has to contend with other species of these great-billed nest-robbers. Toucans, more than any other predators, seem to be the reason for the almost constant guard which Boat-billed Flycatchers keep over their eggs and nestlings. The Boat-billed Flycatchers do not wait for the toucans to approach their nests but as a rule go forth to meet them while they are still a long way off and then continue to harry them until they return to the shelter of the forest. So long as the toucans remain perching, the flycatchers, fearing the long, mobile bills, do not attack them, but when the great-beaked bird is on the wing it can not defend its back, and this is the flycatcher's opportunity. Often the bold bird pounces upon the back of the flying toucan. It is careful to separate from the big toucan before he regains a perch where he could turn his bill backward with disastrous consequences to the far smaller flycatcher. Exceptionally, the sight of a distant flock of toucans will cause Boat-billed Flycatchers to hurry to their nest, if they have been watching it from some elevated position, rather than to go forth and meet their enemies.

I have never actually caught a toucan taking the eggs or nestlings of a Boat-billed Flycatcher, but I have seen both Swainson's Toucan and Frantzius's Araçari pillage the nests of enough birds of other species to be convinced that they are insatiable nest-robbers. Once I watched a Swainson's Toucan peer into an unfinished nest of a pair of Boat-billed Flycatchers, while both male and female darted angrily at the intruder, calling excitedly. However, they did not touch him so long as he remained perching beside the nest, snapping menacingly whenever they came near. On several occasions when eggs or nestlings have vanished from nests of the Boat-billed Flycatcher, I have seen toucans pass through the trees where they were situated, or it was reported to me later that they had come by.

The Swallow-tailed Kite, *Elanoides forficatus*, probably at times eats the nestlings of the Boat-billed Flycatcher, as I have seen it pluck the young from nests of other species in similar situations. Other hawks do not appear to give these flycatchers much trouble, especially in El General where the only other species somewhat common in the clearings during the breeding-season is the Large-billed Hawk, *Buteo magnirostris*, a mild-tempered species that subsists largely upon reptiles. One rainy afternoon late in November while I watched three Boat-billed Flycatchers, along with a few Chipsacheeries and other birds catching insects among the trees in my yard, a hawk suddenly

swooped down and seized one of the flycatchers. The hawk, which I had not seen well enough for identification, dropped with its victim to the ground on the other side of the hedge, and the other Boat-bills, now far from fleeing like the smaller birds, darted down upon the hawk, snapping their bills. I rushed out into the yard for a closer view of the proceedings, but before I could reach the gate in the hedge the hawk had vanished with its victim. Possibly a Chipsacheery rather than a Boat-bill, as I had at first supposed, was the unfortunate one, for later there were still three Boat-bills in the yard. The energy of the Boat-bills' attack on the hawk was the more remarkable, if the victim belonged to another species.

PLAY

One morning in August, I saw a Boat-billed Flycatcher fly into a tree in front of my house with a big brown feather in its bill. It beat the feather against the branch where it perched, exactly as though it were an insect. After a while it let the plume drop. As it floated slowly downward, the mate of the first bird darted out and caught it. Then, the second Boat-billed Flycatcher perched in the tree and beat the feather against the branch. Soon it let the feather drop, only to shoot out and catch it as it wafted downward, and then knock it against the branch once more. It then carried the feather to a neighboring tree and continued to beat it, but none of this knocking was very hard, as though it were not done in earnest. Finally, the bird that had the feather let it fall, and the pair flew away together.

SUMMARY

1. The Boat-billed Flycatcher wanders over the roof of the forest and through open country with scattered trees. In Central America it ranges from sea level up to 6000 feet or a little more.
2. Its food consists of both insects and small fruits. During the dry season when cicadas are abundant they form an important part of the Boat-bill's diet. Insects are snatched from leaf and bough, at the end of a rapid dart, more often than from the air. Berries are often plucked in the same manner.
3. Males deliver at daybreak a special dawn-song composed of loud, ringing notes, which later in the day they utter only under stress of great excitement. Sometimes the female builds in the tree which the male has chosen for singing.
4. In Costa Rica, nest-building sometimes begins in late February but more often not until March. Usually an isolated tree is chosen for the nest. Twenty-four nests ranged from 20 to about 100 feet in height.

5. The female builds without help from the male who often accompanies her on her flights for material and at times bears in his bill some twig or other bit of vegetation which he fails to add to the nest. The material used by the female is gathered from trees rather than from the ground and consists of coarse twigs and dry vines for the foundation, and tendrils and fibrous roots or rhizomes of epiphytes for the lining. Whole, small orchid plants are sometimes incorporated in the nest. This is a shallow open bowl and contrasts strongly with the domed nest of the Kiskadee, which has repeatedly been confused with it in published accounts.

6. Two or three eggs are laid at intervals of two or more days.

7. The female alone incubates, taking sessions which often exceed an hour in length and alternate with usually short recesses. One female incubated 77 per cent of a 6-hour observation period, another 87.6 per cent of a 4.5-hour period. During the female's brief absences for food, the male usually guards the nest, sometimes from a perch close beside it, sometimes while resting in a neighboring tree which affords a good view of the surroundings. At one nest the incubation period was at least 18 days.

8. Both parents feed the nestlings, chiefly with insects. The female alone broods, but during her absences the male stands watch over the nest so that, especially while still unfeathered, the nestlings are guarded most of the time. Even well feathered nestlings almost ready to fly are attended much of the time, the mother sometimes brooding, perhaps not because this is necessary, but rather as a variation in her mode of guarding.

9. The nestlings linger in the nest until they are 24 days old and can fly well.

10. Nesting continues until July, but most late nests appear to belong to birds whose earlier attempts to rear progeny were unsuccessful. Sometimes a pair which has successfully fledged an earlier brood will nest again, but there is no evidence that second nestings yield offspring.

11. Young birds hatched in May or June may continue to fly about with their parents until the following February, thus giving rise to flocks of four or five. Pairs without offspring remain together during the long non-breeding season, the two roosting a few feet apart in the same tree.

12. Boat-billed Flycatchers display a tremendous antipathy to toucans which are apparently the chief despoilers of their nests. When these huge-billed birds appear in the vicinity, the flycatchers go a long way to meet and harry them.

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THE SIGNIFICANCE OF THE NUMBER OF TOES IN SOME
WOODPECKERS AND KINGFISHERS

BY J. DELACOUR

THE presence, reduction, or absence of one toe is of no very great importance as to the relationship of birds otherwise quite closely allied. It apparently does not indicate more than specific distinction in many cases. This has already been stated by E. Mayr and by me as regards: 1) the Black-bellied Plover (*squatarola*) which we united with the Golden Plovers in the genus *Pluvialis*; and 2) the Sanderling (*alba*) which we considered a species of *Calidris*, notwithstanding the presence of a very small, non-functional hallux in some species, and its absence in all the others. It certainly seems unreasonable to base genera entirely on such an obviously recent and unimportant character as a vanishing organ (*Zoologica*, 30: 106, 1945). Similar presence or absence of the hallux is also noticed among tropical plovers.

The same consideration applies to woodpeckers. Peters has recognized it in uniting in the genus *Dinopium* the species *benghalense*, which possesses a reduced hallux, with *shorii*, *javanense*, and *rafflesi*, which have only three toes, making *Brachypternus* a generic synonym (*Birds of the World*, 6: 143-146, 1948). If such an action is accepted, however, it seems logical to carry it further. The Aethiopian Bamboo Piculet (*africana*), a very peculiar bird, differs only slightly in color and not at all in structure, pattern of plumage, and habits from the Asiatic and Malaysian *ochracea* and *abnormis*. Although *africana* has four toes and the others three, I propose to place them all in the genus *Sasia* Hodgson 1836, and to consider *Verreauxia* Hartlaub 1856 a synonym.

The Pied Woodpeckers stand in a similar position. As it has been so far accepted, the two northern species in which the hallux is lacking (*tridactylus* and *arcticus*) have been assigned to the genus *Picoides*,