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### Nesting of the Buff-throated Woodcreeper (*Xiphorhynchus guttatus*)

ALEXANDER F. SKUTCH

Quizarrá, 8000 San Isidro de El General, Costa Rica

The Buff-throated Woodcreeper (*Xiphorhynchus guttatus*) is about 22 cm long and clad in the browns and buffs widespread in its family. The sexes are alike. From Guatemala to Bolivia, Amazonian and south-eastern Brazil, it inhabits rain forests, humid gallery

forests in more arid regions, and mangroves. It wanders into lighter second-growth woods and shady clearings near the old forests that are its true home. These woodcreepers usually are solitary, or one may join a mixed flock of woodland birds. They subsist

largely on insects and spiders that they extract from crevices in bark or epiphytes, while they climb up trees, using their long, spine-tipped tails for support, or outward along branches. An occasional small lizard or frog varies their diet. They sleep singly in old woodpeckers' nests or other holes in trees.

When I published my life history of this woodcreeper (Skutch 1981), I had, after many years of searching in forests where the birds were not rare, found only three of their nests. The first, inaccessibly high, was watched for many hours at all stages of the nesting, the second contained infertile eggs, and the third was prematurely lost. Later, I found four more nests, all within reach. At these nests I confirmed conclusions reached from study of the first nest, and determined incubation and nestling periods more accurately than was possible at the inaccessible nest. The study here reported was made, from 1972 to 1987, on or near our nature reserve, Los Cusingos, near Quizarrá (9°20'N, 83°38'W) in the valley of El General, on the southern Pacific slope of Costa Rica, at an altitude of 740 m.

*Nests and eggs.*—Like other woodcreepers, the Buff-throated Woodcreeper nests in diverse closed spaces. The first nest was in a decaying stem of a clump of tall timber bamboos (*Bambusa vulgaris*), in front of my study window and at the edge of a large tract of rain forest. These stems are hollow, with cavities up to 10 cm wide, divided into chambers by transverse walls at the nodes. The first septum below the oval doorway in the side had rotted out, or perhaps had been removed by the woodcreeper, and the nest rested upon the second, 50 cm below the doorway. Two nests were in chambers, of irregular shape and much more spacious than the woodcreepers needed, amid the maze of thick aerial roots of a massive strangling fig tree (*Ficus* sp.) that surrounded the trunk of a muñeco tree (*Cordia bicolor*) in a pasture, close by the forest. Access to the chambers was through a vertically elongated gap, about 35 cm high, between the roots. The effective width of these openings was about 3 cm—too narrow to admit my hand laid flat. Another nest was in a hollow, decaying trunk of a guava tree (*Psidium guajava*) close by our house. A little farther away a woodcreeper nested in a horizontal cavity in the head of an old, pollared maderá negra (*Gliricidia sepium*) that served as a living fence post. In a clump of peñibaye palms (*Bactris gasipaes*) in the midst of a narrow strip of moderately tall second-growth woods with thick undergrowth, about 100 m from forest, a woodcreeper occupied the stump of one of the palms. The spiny, thin-shelled stump was 94 cm high and about 15 cm in diameter. The eggs were located 46 cm below the open top. From this lowest nest, six others ranged up to 5.4 m (measured to the doorway) above the ground.

Woodcreepers are not known to carve a new cavity, but they may enlarge or otherwise modify one that they find. Buff-throated Woodcreepers appear especially apt to engage in this activity, and seem stim-

ulated to do so, if they bring long pieces of stiff bark that will not enter while held transversely in the bill. Then the bird may peck at the edges of the orifice in an effort to widen it. Late on an afternoon in mid-February, continued loud tapping, audible 15 m away, drew my attention to a solitary woodcreeper hammering, with strong, woodpeckerlike blows, at a gap in a dead but fairly sound bamboo trunk. For about half an hour, in the waning light, she continued to peck, at intervals entering the bamboo's central hollow and coming out again. She pulled loose fibers from the edges of the aperture, which already seemed wide enough. Twice she called, loudly and clearly, *che-e-e-r*, with a slight roll.

Stiff flakes of bark from tree trunks are the main materials of Buff-throated Woodcreeper nests. The birds usually bring one piece at a time, held crosswise in the bill. When a piece is too long to pass through the doorway in this manner, it is usually dropped after a brief struggle, instead of being inserted endwise. After the nestlings departed the nest in the timber bamboo, I cut it open and found the cavity filled to a depth of 18 cm with hundreds, if not thousands, of pieces of stiff bark. The largest measured 6.4 by 5.0 cm and when dried had a mass of 3.2 g. Another piece was 8.5 by 3.0 cm (3 g) and the heaviest piece, thick and irregular in shape, had a mass of 3.7 g. I did not attempt to count all the pieces because many appeared to be tiny fragments of larger pieces that had decayed while remaining in the nest for several rainy months. The woodcreeper must have made hundreds of trips bringing so much material.

These birds carry bark to their nests in spurts of concentrated activity separated by long intervals: six trips in 25 min, seven in 17 min, and five in 11 min. Occasionally, they bring a contribution when they return for a spell of incubation and even while attending nestlings. A few pieces of foliaceous lichens may be mixed with the bark. I never found more than one woodcreeper engaged in preparing a nest.

Chapman (1938) counted more than 7,000 fragments of bark and dead wood in a nest beneath the elevated floor of a building set upon posts in the narrow clearing amid the forest on Barro Colorado Island in Gatún Lake, Panama. In Trinidad, Belcher and Smooker (1936) found eggs resting upon a bed of weed stems, dead leaves, and plant down, all of which might have been carried into the hole in a dead stump before the woodcreeper claimed it.

Each of six nests in El General contained two eggs or nestlings, which is the number reported from Trinidad and Tobago by French (1973). From only one of my nests could I remove the eggs without jeopardizing them. In a nest among the fig-tree roots, the eggs were positioned on the level of the entrance, from which I could remove them uninjured with a long-handled spoon. They were pure white, glossy, slightly tapering, almost equally blunt at the two poles, and measured 30.0 by 19.9 mm, and 27.0 by 19.0 mm. In El General, five sets were laid in March, one ap-

TABLE 1. Incubation by female Buff-throated Woodcreepers.

Nest no.	Hours watched	Sessions (min)		Recesses (min)	
		<i>n</i>	$\bar{x}$ (range)	<i>n</i>	$\bar{x}$ (range)
1	6.0	2	125 (99-151)	2	38.0 (33-43)
1	12.5	3	145 (111-181)	4	27.5 (25-34)
2	7.0	3	96 (91-107)	3	37.0 (28-47)
4	5.5	2	101 (94-108)	3	33.0 (30-37)
6	6.0	6	42 (18-58)	5	21.0 (3-48)

parently in mid-April, and one in mid-July. This last, infertile set appeared to be the second of a woodcreeper whose young fledged in late April. In Trinidad, five nests of Buff-throated Woodcreepers were found in March, June, and July (French 1973).

*Incubation.*—At their nests, these Buff-throated Woodcreepers were not very shy and could be watched through 8× binoculars while I sat without a blind about 12 m away. If undisturbed, they rarely incubated for less than 1.5 h at a stretch and sometimes twice as long (Table 1). Although, taking turns, my wife, son, and I watched nest 1 continuously from dawn to dusk (12.5 h) on 24 March 1972, the woodcreeper's active day was much shorter than this. She did not emerge from the hole in the bamboo trunk until 0617, well after sunrise, and at 1521 on the clear afternoon, she returned and remained until nightfall. Of the 544 min in this interval, she was in the nest 434 min, or 80% of the time. The remainder was occupied by four recesses, each of about half an hour. At nest 6, near the house, the woodcreeper sat for shorter intervals, probably because she was occasionally disturbed by human activity. On the morning when I watched, only two of her six sessions were curtailed by people passing by, and she incubated for 70% of the time.

In 37 h of prolonged watches during incubation, we saw no changeover. Only once did another woodcreeper appear while the attendant was in or near the nest. On this occasion, the second bird, possibly a male, alighted beside the doorway of the nest, whereupon the incubating bird emerged, and both flew away.

Returning to her nest, a woodcreeper often brought a flake of bark to add to her already large accumulation. During her absences, the eggs were sometimes partly or wholly covered by this loose material. Once, before her eggs hatched, a female entered with a large spider. These birds often called loudly with *cheer* or *chu* notes when approaching their nests, with head in the doorway, just after leaving, and even while sitting unseen in the cavity. Occasionally, an incubating female answered calls of a distant woodcreeper, who might have been the neglectful father of her progeny.

At nest 1, 18 days elapsed from the start of incu-

TABLE 2. Feeding and brooding of Buff-throated Woodcreepers.

Nest no.	Hours watched	Nestlings		Times fed	Minutes brooded
		No.	Age (days)		
1	6	2	ca. 2	7	94+
1	6	2	ca. 7	13	13
1	6	2	ca. 16	12	0
4	5	2	3	10	75
5	5	1	4	1	109
6	6.5	2	3	7	128

bation of the unseen eggs to the beginning of feeding the invisible nestlings. At another nest, the incubation period was at least 18 days. This is one day longer than the 17-day period of the Spotted-crowned Woodcreeper (*Lepidocolaptes affinis*), whose eggs are incubated by both parents. The empty shells soon disappear; in the Buff-throated Woodcreeper I did not learn whether they were eaten or carried away in the parent's bill. At the late nest in the fig tree, the woodcreeper continued for no less than 29 days to incubate infertile eggs.

*Nestlings.*—The newly hatched Buff-throated Woodcreeper has tightly closed eyes. Its dark gray down, about 2 cm long, fails to conceal its pink skin. The young bird peeps weakly and gapes, revealing a yellow mouth bordered by prominent white flanges. When a week old, dorsal pinfeathers begin to erupt from the skin. At 10 days they are long but still closed, and at 11 or 12 days the plumage begins to expand. At 17 days body and wings are well feathered, but the head is still almost naked, and the rectrices are almost completely enclosed in long sheaths. A day later, when the crown is feathered, the young woodcreeper resembles an adult, but its central rectrices are still ensheathed. In contrast to *Lepidocolaptes* woodcreepers, these nestlings were almost silent. Their infantine peeps were audible only when I was quite close to the nest.

From the single parent who attended them, the nestlings received insects, spiders, and an occasional lizard. These were brought, one at a time, held in the tip of an adult's long, slender bill (Table 2). A solitary nestling, four days old, received only one lizard during the morning hours, but this substantial meal appeared to satisfy it. During their first days, other young were fed at the hourly rate of about 0.5 meals per capita. Even when they were older, the rate rarely exceeded once per hour for each of them, but they often received fat larvae; occasionally, a parent brought a piece of bark instead of food.

After the first few days, the woodcreepers were brooded little; when 9 or 10 days old, the nestlings were not covered, even at night. Parents carried away fecal sacs in their bills and kept the nests clean. The parents were more silent during this part of the nest-

ing cycle than while they incubated. When I visited their nests, they remained at a distance, neither complaining nor making hostile demonstrations. A squirrel (*Sciurus granatensis*) that climbed over the guava tree that sheltered nestlings was usually ignored by the parent, but once my son saw her chase the rodent. Likewise, when a squirrel climbed down the fig tree toward the cranny that contained nestlings, the parent, who was present, made neither sound nor feint of attack. These woodcreepers appear to depend wholly upon concealment, silence, and infrequent visits for the safety of their nestlings in odd nooks difficult to find.

*Departure of fledglings.*—When I inserted a tiny, unlighted electric bulb through the narrow gap between the roots into the chamber in the fig tree, an almost alarming outburst of high, shrill notes emerged from it. When I switched on the light, the outcry was repeated by the two feathered nestlings who hitherto has been so silent. Thereafter, they remained quiet while I peered in with a small mirror. Two days later, these nestlings were silent while I inspected their nest, but one struck the mirror with a wing. After removing light, mirror, and ladder, I retired a short distance and watched. Soon a nestling silently emerged, climbed up the trunk for about 120 cm, and crept into the space between two thick branches. Stubby-tailed, it still bore much natal down. By the following day, both young had vanished, aged 18 or 19 days. From another nest, two young departed when 19 days old. The lone nestling in the palm stub left at the age of 19 or 20 days. Two in the high nest where I could not see them emerged 20 days after I first saw the parent carry in food. From another nest, two young vanished when 18 days old, leaving feathers that revealed that they had been attacked. The full nestling period of the Buff-throated Woodcreeper is 19 or 20 days. From these nests in clearings, all the fledglings promptly disappeared, probably into the neighboring forest. They did not return to sleep in the nests where they were hatched, as certain woodpeckers do. If the young who lost feathers escaped with no more serious injury, all five of the nests where the eggs hatched were successful, an exceptionally good record in the tropics.

*Behavior of males.*—The sexes of Buff-throated Woodcreepers are indistinguishable in the field. However, more than 75 h of watching at six nests, covering all stages from building to fledging, failed to yield evidence that two individuals were interested in a nest.

In the breeding season, mainly from February or March to June in El General, males advertise their presence by frequent singing, usually while they cling unseen high amid dense foliage or vine tangles. Their loud, clear, melodious notes, which have been compared to those of the Northern Cardinal (*Cardinalis cardinalis*), are delivered in series of about 7 to 16, often 7 or 8. Sometimes the song is followed by several drawled notes, *che-e-e-r*, *che-e-e-r*, *che-e-e-r* in falling cadence. It is heard throughout the day, but most frequently in early morning, late afternoon, and when sunshine breaks through clouds after an actual or threatened shower. Singing males are too widely dispersed to form a lek.

Another genus of woodcreepers in which males do not participate in nesting is *Dendrocincla*, of which two species, the Tawny-winged Woodcreeper (*D. anabatina*) and the Plain-brown Woodcreeper (*D. fuliginosa*) have been adequately studied (Skutch 1969, Willis 1972). From fragmentary observations, I suspect that the Olivaceous Woodcreeper (*Sittasomus griseicapillus*) falls into this category. Contrasting with this pattern, males of Streaked-headed Woodcreepers (*Lepidocolaptes souleyetii*), Spotted-crowned Woodcreepers (*L. affinis*), and Wedge-billed Woodcreepers (*Glyphorhynchus spiurus*) are known to cooperate with their mates at all stages of the nesting (Skutch 1969, 1981). To learn the distribution of these two patterns of nest attendance among the 60 species of Dendrocolaptidae, we need many more careful studies of their reproduction.

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