

# NESTING BEHAVIOR OF SUNBITTERNS (*EURYPYGA HELIAS*) IN VENEZUELA<sup>1</sup>

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*Abstract.* Eleven Sunbittern (*Eurypyga helias*) nests are described from the gallery forest and woodlands of the Venezuelan llanos. The nidicolous chicks were hatched with abundant ploverlike down, but with underdeveloped movement abilities. Both adults incubated, brooded, fed, and defended nestlings. When fledging occurred at 17–24 days, the young were well below adult weight, and parental care continued for more than a month. Sunbitterns successfully defended nestlings against much larger raptors and ibises by using mostly visual displays. Defense behaviors such as the full Frontal Display, vocalizations, and possible pair-bonding are reported.

*Key words:* Sunbittern; *Eurypyga helias*; nesting; defense; display; nestling development; Green Ibis; *Mesembrinibis cayennensis*.

## INTRODUCTION

In zoos the Sunbittern (*Eurypyga helias*) is fairly common where it readily adjusts to captivity and lives as long as 17 years (Flower 1938). Sunbitterns display spectacularly in captivity (Frith 1978, Wennrich 1981), and occasionally breed there (Bartlett 1866, Wennrich 1981). Much that has been published about Sunbittern behavior has been observed in zoos, which has led two authors to suggest that reported behaviors might be biased by captivity (Riggs 1948, Skutch 1964). Furthermore, disagreement exists in the literature over the principal function of the well-known open-wing Frontal Display (Frith 1978): is it used in courtship, defense, or in both?

Brief general observations of Sunbittern behavior in the wild have been published (Slud 1964, Wetmore 1965). Koepcke (1972) noted nest concealment and Skutch (1947) described a single nest in Costa Rica. Recently, Lyon and Fogden (1989) published a longer account of behavior, mainly from a single nest in Costa Rica. Here we give information on 11 nests found in 2 years, and include observations on the care, feeding, and development of the young, as well as parental defense. We paid particular attention to

vocalizations and display behaviors and to the context in which they occurred.

The Sunbittern, representing a monotypic family divided into three races, lives in low and medium altitude forest from southern Mexico through Amazonian Brazil (Blake 1977). Our study area, in the llanos of Venezuela, is roughly central to its geographical range. Here, Sunbitterns of the nominate race are fairly common (Thomas 1979).

## STUDY SITE AND METHODS

All Sunbittern observations were made on Fundo Pecuario Masaguaral, a cattle ranch in the central llanos of Estado Guarico, Venezuela (08°31'N, 67°35'W, altitude ca. 63 m). Sunbitterns were mostly restricted to gallery forest and shrub woodland bajo (nomenclature follows Troth 1979). Observations were made from blinds, a jeep used as a blind, or from stationary seated positions. Over 60 hr, in 1- to 12-hr sessions, were devoted to nest observations in 1982 and 1983. Other notes were collected throughout the year from 1972 to 1984, whenever the birds were encountered. Three eggs, nestlings, fledglings, and one adult were weighed with 50-, 100-, and 300-g Pesola spring balances. Eggs were measured with calipers graduated to 0.01 mm. After nests were abandoned they were measured with rulers and tapes, and examined for materials and manner of construction.

<sup>1</sup> Received 4 September 1989. Final acceptance 6 March 1990.

TABLE 1. Sunbittern nests in Venezuela.

| Year<br>Nest # | Nest tree species               | Nest tree<br>height<br>(m)     | Nest<br>height<br>(m) | Nest tree<br>dbh (cm) | Nest<br>branch<br>diameter<br>(cm) | Nest diameter (cm) |         | Nest depth (cm) |     |  |
|----------------|---------------------------------|--------------------------------|-----------------------|-----------------------|------------------------------------|--------------------|---------|-----------------|-----|--|
|                |                                 |                                |                       |                       |                                    | Outside            | Cup     | Outside         | Cup |  |
| 1982           |                                 |                                |                       |                       |                                    |                    |         |                 |     |  |
| 1              | <i>Sclerobium aureum</i>        | 9.5                            | 3.3                   | 22                    | 13.5                               | 23 × 17            | 13 × 13 | 5.5–6           | 3.0 |  |
| 2              | <i>Guazuma ulmifolia</i>        | 7.9                            | 3.9                   | 16                    | 8.0                                | 24 × 16            | 13 × 12 | 5.4–6           | 3.2 |  |
| 3              | <i>Guazuma ulmifolia</i>        | 11.4                           | 5.1                   | 23                    | —                                  | —                  | —       | —               | —   |  |
| 4              | <i>Randia venezuelensis</i>     | 3.9                            | 2.0                   | 10                    | 5.5                                | 22 × 15            | 13 × 13 | 7.0             | 3.1 |  |
| 5              | <i>Zanthoxylum culantrillo</i>  | 7.2                            | 3.5                   | 14                    | 6.5                                | 21 × 17            | 13 × 13 | 5.3             | 2.9 |  |
| 6              | <i>Acacia articulata</i>        | 4.1                            | 1.3                   | 5                     | 5.0                                | 21 × 15            | 12 × 11 | 7.0             | 2.5 |  |
| 1983           |                                 |                                |                       |                       |                                    |                    |         |                 |     |  |
| 7              | <i>Guazuma umifolia</i>         | 4.3                            | 2.2                   | 12                    | 6.9                                | 19 × 17            | 13 × 12 | 6.0             | 2.1 |  |
| 8              | <i>Guazuma umifolia</i>         | 4.8                            | 2.7                   | 18                    | 7.2                                | 22 × 18            | 14 × 13 | 6.5             | 3.2 |  |
| 9              | <i>Sclerobium aureum</i>        | (same tree and site as nest 1) |                       |                       |                                    | 21 × 16            | 13 × 12 | 6.2             | 3.0 |  |
| 10             | <i>Guazuma umifolia</i>         | (same tree and site as nest 3) |                       |                       |                                    | —                  | —       | —               | —   |  |
| 11             | <i>Pterocarpus acapulcensis</i> | 12.9                           | 7.2                   | 73                    | —                                  | —                  | —       | —               | —   |  |

## RESULTS

### NESTS AND EGGS

Ten active nests were found during the early rainy season, May to August. At that time seasonal rains saturated the substrate, and water formed abundant small pools that lasted throughout the rainy season in gallery forest and woodlands. By June the canopy density was at its maximum, but much of the understory remained open.

All nests, although under closed canopy, were in open (leafless) sites on bare branches over open trails or woodland pools. Nests were saddled on smooth branches, often at a small side branch or other projection such as a shelf fungus, but some had no lateral support. Several nest branches inclined up to 10° above horizontal; these nests were built deeper on the low side so that the nest cup was level. Sunbittern nests were constructed of layers of leaves reinforced with mud. Nest wall lining was of twigs, rootlets, and leaves, the latter usually of the supporting tree or one nearby. Although nests were firmly attached to the branch, so that there was no lateral movement, they could be lifted up easily. The perimeter was anchored by long (15–25 cm) grass fibers wrapped in an oval shape and attached to the branch with mud. A few nests had no lining. Some seeds, perhaps taken up with the mud, germinated on the nest exterior giving crypsis to these open-sited nests. Nest tree, nest size, and placement are given in Table 1.

The mean number of eggs found in nine nests was 1.56 (SD = 0.53, range = 1–2, Table 2).

Three well-incubated eggs were measured and weighed from the two most accessible nests (41.7 × 33.1 mm, 26.0 g, 11 days before hatching; 43.3 × 34.4 mm, 25.3 g, 9 days before hatching; 39.6 × 32.5 mm, 20.7 g, 1 day before hatching). Egg background was Pale Pinkish Buff (color 121D; Smithe 1975, 1981) with purplish irregular spots concentrated at the larger end.

### NESTLING DEVELOPMENT

The hatching weight of one chick was 17.8 g, and it was covered with abundant cream-colored down marbled with black on the top of the head, sides of the neck, and back. The hatchling gave a high-pitched peeping and it gaped. However, it was poorly coordinated for it could not grasp with the feet, stand up, or hold up its head for more than 5 sec. By day 3, chicks still could not stand or hold the head up more than 15 sec, but they were able to defecate over the nest edge by shuffling to it on their tarsi. Between days 7 and 10, nestlings began to develop more rapidly. They grasped with the feet, stood up, held the head up well, wing-busked (rotated the wings forward at the shoulder), body-swayed (moved the body laterally while standing in one place), head-darted (jabbed the head forward with an abrupt extension of the retracted neck), trilled, and answered adult trills. On about day 8 the sheaths of the primaries began to show through the down. By day 18 nestlings began to lose natal down on the head and neck; the emerging contour feathers were similar to the adults'. There was no apparent juvenal plumage.

TABLE 2. History of Sunbittern nests.

| Year<br>Nest # | Date found | No. of eggs<br>when found | Outcome  |
|----------------|------------|---------------------------|--|
| 1982           |            |                           |  |
| 1              | 13 June    | 1                         | Second egg 15 June, failed 28 June   |
| 2              | 22 June    | 2                         | Hatched 7 July and 15 July, one fledged 1 August, both thought to be dead as not found later |
| 3              | 23 June    | 1                         | Hatched 11 July, fledged 1 August  |
| 4              | 9 July     | 2                         | One egg only 11 July, fledged 12 August  |
| 5              | 13 Aug     | 2                         | Two young 18 September, probably fledged by 3 October  |
| 6              | 4 Sept     | 0                         | Presumably old nest  |
| 1983           |            |                           |  |
| 7              | 16 May     | 1                         | Failed 20 May  |
| 8              | 24 May     | 1                         | Two eggs robbed by Cebus monkeys 29 May  |
| 9              | 25 May     | 0                         | Presumed early failure (same site as nest #1)  |
| 10             | 19 June    | 1                         | Failed 30 June (same site as nest #3)  |
| 11             | 21 June    | 1                         | Fledged 30 July  |

The Frontal Display (Frith 1978) is a combination of the busk with fully outstretched wings combined with a raised and fanned tail. Nestling Sunbitterns on day 7 began flashing open their wings, and their Frontal Display was fully developed by day 12. Frith (1978) reported that a 5-week-old zoo fledgling effectively confronted a large cracid with a Frontal Display, making it take flight. Haverschmidt (1968) pictured a fledgling, still unable to fly, giving a full Frontal Display.

Counting day of hatching as day 0, six nestlings fledged at 17, 20, 22, 22, 23, and 24 days, although the earliest fledging may have been prematurely caused by the investigator. Two fledging weights were 83 g and 115 g, well below that of an apparently normal adult caught on the study area in April that weighed 188.5 g.

#### PARENTAL CARE

Small differences in the head and neck feather patterns made it possible to distinguish adults attending nests, but we found no clear morphological or behavioral characteristics to determine the sexes. Both adults incubated, brooded, fed, and defended nestlings as reported by Wennrich (1981) and Lyon and Fogden (1989). When chicks were less than 5 days old they were never left unguarded; one parent brooded for 2–4 hr while the other brought food.

Food deliveries (23) were made to a lone 2-day-old nestling between 06:00 and 18:00, with most feedings between 12:00 and 17:00. Adults often foraged in pools of water below the nest tree, or within 100 m of it, and they kept in vocal

contact with each other. Feedings were usually accompanied by vocal exchanges between adults, and between them and nestlings. The foraging bird trilled and flew up to the nest branch, whereupon the brooding bird stood and often backed off the nest to the supporting branch while chicks were fed. Young birds had a bright orange gape, and several feedings of a 2-day-old chick were by regurgitation; the adult put its bill inside that of the young. By day 4 chicks were easily able to take the single items offered from the tip of the adult bill. Dropped food was quickly picked up and represented until the nestling swallowed the prey. Food items, not too small to identify, were composed of invertebrates (flies, grubs, cockroaches, dragonfly larvae and nymphs, water beetles, and a small crab), and vertebrates (eels up to 3.5 cm long, small fish, tadpoles, and small frogs). Lyon and Fogden (1989) identified 230 prey items fed to a nestling in Costa Rica.

Bartlett (1866), Haverschmidt (1968), and Lyon and Fogden (1989) reported that care of young continued after fledging. On 19 September, an adult with fully red irides (color 108A Poppy Red; Smithe 1975, 1981) was followed by a bird nearly its size, but with yellowish irides and mottled browner plumage. The bird gaped and was fed on the forest floor. We believe this young bird was the nestling from nearby nest #4, in which case it was 59 days old.

#### NEST DEFENSE

A nest with a hatchling and one egg was threatened by two possible predators at the same time, an immature plumaged light-phase Gray-headed

Kite (*Leptodon cayanensis*) and an adult female Hook-billed Kite (*Chondrohierax uncinatus*). The Gray-headed Kite flew close to the nest, and within 20 sec the Hook-billed Kite perched less than 4 m from the nest. A Sunbittern nest exchange had just occurred and the relieving bird was still standing. It made a short rattle followed by a hiss. The kite responded with a close sally to the nest, at which the Sunbittern trilled twice and treaded, raising one foot after the other. The kite perched 6 m away. The Sunbittern shook itself, fluffed its plumage, swayed from side to side several times, and sat down to brood. When the kite made another sally toward the nest the brooding bird half stood up and busked toward the intruder. This kite disturbance lasted 31 min.

At another nest with a young chick, a female Hook-billed Kite spent 61 min during which she made four very close sallies toward the nest. The brooding Sunbittern stood up, swayed from side to side with fluffed plumage, and then crouched down on the nest in an alert position with plumage expanded. At each kite sally the Sunbittern stood, pivoted facing the kite, and half spread and busked its wings. Later on the same day at this nest, during a nestling feeding, a male Hook-billed Kite flew into the area. Immediately both adults looked toward it, but one quickly flew down and away from the nest branch while the other covered the chick.

The next day a pair of Green Ibises (*Mesembrinibis cayennensis*) intermittently harassed these same Sunbitterns from 08:03 to 11:35. The ibis pair flew up to the Sunbittern nest branch together, perching about 2 m from the nest. The brooding Sunbittern stood, turned toward them, and gave a full Frontal Display. Each time one or both ibises moved toward the nest, the Sunbittern gave one or another defense display. At 08:55 the female ibis (determined from her smaller size, bill length, and curvature), flew over the Sunbittern so that the nest was between the ibises. At 09:21 this female abruptly rushed the Sunbittern nest, displacing the brooding bird. While the ibis stood in the nest facing the Sunbittern, the exposed 3-day-old chick flattened itself in the nest. The Sunbittern gave a bill clatter, and regained its nest. The supplanted ibis flew to its mate, treaded the branch, preened in short jerky spurts, and gurgled leaning downward, prominently displaying its pale blue, bare throat patches. The ibis vocalizations were answered by its mate. The Sunbittern pair continued to brood and feed their nestling, and to make nest

exchanges during the next 2 hr, while the ibises persisted in attempts to displace the Sunbitterns. Each time an ibis approached within 1.5 m of the nest, the Sunbitterns, sometimes in unison, gave Frontal Displays and each time the ibises retreated, and eventually left together.

On 19 August, 18 days after this chick had fledged, the Sunbittern nest was gone and a pair of Green Ibises had built a nest on the same branch. It was a 0.5-m-wide platform of loosely placed sticks, and a month later they had one or two nestlings. Probably this was the same ibis pair that had harassed the Sunbitterns. Nevertheless, the following year a Sunbittern nest (#10) was built at the exact same site again.

The least aggressive defense behavior that we saw at the nest was a bittern-like freeze. It was used by adults and nestlings over 10 days old; the bird oriented toward the intruder with the bill pointed vertically. A more active defense, used against the ibis, combined hissing and rattle-hissing accompanied by an array of plumage expanding, serpentine sideways body swaying, and forward head darting. The busk with partial wing opening, and a display of only one wing opened and busked toward the disturbance appeared to be an intermediate threat. This was directed toward the ibis and was a frequent response of birds during the dry season when they encountered humans in the open understory. The strongest defense was the sudden and emphatic two-wing full Frontal Display which more than doubled the apparent size of the bird, and showed two large threatening false eyes or ocelli.

#### VOCALIZATIONS

Sunbitterns used a large number of vocal communications, many of which were trills (ascending or descending, long or short, harsh or soft), in a variety of contexts. Sometimes different trills were combined with bill clatters and vocal rattles. Generally trills were intraspecific communications: between mates or between adults and young. A long plaintive, somewhat ventriloquial, whistle was probably territorial. When this whistle was mimicked by humans it caused the bird to approach on the ground with answering whistles. The less frequent loud *kak-kak-kak-kak* may be an advertisement (Wetmore 1965). Rare calls of three screaming yowls and four bell-like calls at 1-sec intervals were given by breeding Sunbitterns as a result of observer intrusion. Duetting was confined to the vocal rattle during in-trap display. Few vocalizations were used in

nest defense, and those few were combined with aggressive behaviors. No vocalizations accompanied Frontal Displays.

#### PAIR-BONDING

During the dry season and early in the breeding season, Sunbitterns frequently made flight displays 10–15 m high combining two elements, vocal and visual: the birds called the sharp *kak-kak-kak-kak* and finished with a trill, while gliding downward with the wings outstretched but hanging down so that the bright pattern or ocellus was highly visible from a side view. We did not see any more behavior that might be considered early courtship or pair formation. However, in mid-July when a single nestling was 9 days old (nest #3) one of us (SDS) observed unusual behavior. One brooding adult began begging when its mate came to feed the nestling. It made high-pitched trills, and once almost grasped the other adult's bill, but the nestling was always fed and the begging bird appeared to be ignored. We believe that the begging bird was the female because it had the less clearly defined plumage color (Wennrich 1981).

On the next day this female begged several times, and in the afternoon the brooding male suddenly gave two loud *kak-kak-kak-kak* calls about 1 hr apart. After the second call he flew to the ground below the nest, and with wings slightly open at the wrists gave an accelerating vocal rattle, finishing with his bill raised vertically and head tilted over his back. The female joined him, orienting parallel and facing the same direction. Both birds repeatedly gave the head-tilting display in synchrony, usually duetting the vocal rattle. Following about 1 min of display together the birds began to rapidly dip their heads on forward extended necks with their bills horizontal. After two to three head dips, their heads were thrown back and they gave the duetted vocal rattle. The birds then parted, each walking in opposite directions around the 5-m pool beneath their nest, giving vocal rattles interspersed with a plaintive trill which was not duetted. They met again on the far side of the pool and continued the synchronous head dipping and duetted rattles. Pair-bonding is the only explanation that we can give to this behavior. This presumed female was not seen again, but its mate continued the care of the nestling until it fledged 12 days later. At another nest (#2) only one adult was present during the last days. Lyon and Fogden (1989)

also found that one adult gave a begging display on the nest when its mate returned with nestling food, and that one parent was seen nearby, but ceased to attend the chick during its last four nestling days.

#### DISCUSSION

The Sunbittern breeding season in Venezuela is controlled by rains that begin at variable times from April to June in different years (Thomas 1985). Before seasonal rains, Sunbittern habitat in our study area is dry and dusty. Only after heavy rain is abundant mud available: without mud the nests we found could not have been fastened to their supporting branches. Furthermore, foods fed to nestlings are scarce before heavy rains.

Wetmore (1965) refers to Sunbitterns' "restricted territorial range." Our observations suggest that Sunbitterns are territorial, at least during the breeding season (Type A of Hinde [1956]). No more than a single pair of birds was found in the area of a nest or at food sources. The closest active nests were more than 500 m apart. Territorial spacing may be established and maintained by vocalizations: long plaintive whistles and far carrying *kak-kak-kak-kaks*. In two cases the timing and spacing of nests (#5 and #11) suggest that they were replacements for nests (#2 and #8) that failed early in the breeding season in those territories. Later two nests (#9 and #10) were built in a subsequent year in the same trees on the identical branches.

Beissinger et al. (1988) suggest that pairs of Slender-billed Kites (*Rostrhamus hamatus*), a bird that breeds in the area at the same time as Sunbitterns, may mate permanently because of the use of identical nest sites in successive years. This might also be true of Sunbitterns. We believe that mate desertion is not the explanation of the behaviors found at nests #2 and #3, and by Lyon and Fogden (1989). As Beissinger et al. (1988) point out, desertion would be surprising because of the difficulty of finding new mates and nest sites late in the breeding season. Instead, these instances of cessation in nestling care by one member of the pair, when a lone chick is no longer brooded and a single parent can easily feed it, may have been to lessen the conspicuousness of the nest. Two of our three examples of raptor attention to nests followed the arrival of a second parent at the nest.

Thomas (1977) found a false ocelli pattern in

the plumage of nestling Tropical Screech-Owls (*Otus choliba*) when they were no longer brooded, and believed that this was a defense mechanism. When alarmed, nestling Sunbitterns that are no longer brooded begin flashing open their wings which display the false ocelli. The predominant appearance of Sunbitterns on the ground, in open understory where they are most often encountered, is of cryptically barred plumage. Their slow and deliberate moves, in stealth when pursuing prey, and when confronted by a human, may be important survival tactics. A sudden reversal of this aspect, with the Frontal Display, has a strong element of surprise and threat. It was used effectively in rebuffing the pair of ibises that were over twice as large (Green Ibis: 715–785 g; Sunbittern: 188–295 g; Haverschmidt 1968). Lyon and Fogden (1989) came to the same conclusion regarding this display which they called a startle display. This sudden Frontal Display was used only in defense. However, the same striking wing pattern used slowly and deliberately in flight display might also have a territorial advertising or a sexual meaning.

The wing busk and partial wing opening appeared to be a lesser threat, while darting the boldly striped head and neck toward intruders, such as humans and ibises, accompanied by hissing and serpentine lateral head waving, was definitely snakelike. Sibley (1955) describes similar behavior by parids, of puff-swaying while hissing as an effective nest defense.

The behaviors reported for captive Sunbitterns by Bartlett (1866), Frith (1978), and Wennrich (1981) were generally those that we found in wild birds. Thus, there is no reason to suspect that captivity greatly altered Sunbittern natural behavior as Riggs (1948) and Skutch (1964) suggested.

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