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Notes on the breeding and reproductive biology of the Helmeted Manakin.—The Helmeted Manakin (*Antilophia galeata*: Pipridae) is a monotypic species with a mating system and distribution that may be atypical for a sexually dichromatic manakin (Marini and Cavalcanti, unpubl. data). The range (tableland of central and southern Brazil, from Maranhão and Piauí, south to Paraná, north of Mato Grosso do Sul, northeast of Paraguay [Meyer de Schauensee 1970] and also in Ceará, Brazil [P. T. Z. Antas, pers. comm.] and in extreme eastern Bolivia [Bates et al., in press]) and habitat (gallery forests in the “cerrado” region of central Brazil) are unique among manakins. In addition, Sick (1967) considered its call sonorous and “rather different from other manakins, but similar to some cotingas.” Females are olive green, and adult males are black with a red crown, neck and upper back. Subadult males have green plumage mixed with black and red feathers. Immature males are similar to females. The nest and eggs were described by Ihering (1900, 1902). Since then nothing has been published about the Helmeted Manakin’s natural history. The Helmeted Manakin taxonomic status is uncertain because little is known about its biology. The objective of this paper is to provide data on the Helmeted Manakin’s breeding biology that may lead to a better understanding of its classification.

Study area.—This study was conducted in the gallery forest of the Córrego Capetinga (a creek) at the Ecological Station of the University of Brasília, Brasília, Distrito Federal, Brazil (15°58’S; 47°56’W). The gallery forests consist of ribbons of evergreen trees along water courses, with the tallest trees between 20 and 30 m, surrounded by natural semi-open grasslands (“cerrado”). The gallery forest studied has at least 120 species of plants, of which 76 are trees or big shrubs (Ratter 1980). Detailed information on the study area and region are in Ratter (1980), Eiten (1984), and Marini (1989).

Methods.—Nests and testes of collected birds were measured with a metal caliper accurate to 0.1 mm. Observations were made mostly in the morning (06:30–13:00) from April 1988 to March 1989. Song intensity (number of male songs/h) and chase frequency (number of chases/h) were quantified on a 2.5-ha plot, marked by a grid of 34 points at 30 m intervals. Only males under sight were sampled. The results are the combined observations of four adult males and three subadult males color banded in the study plot. Searching for birds lasted 5 min at each point with a 2–3 min interval between points. The number of hours of searching is the sum of 5 min searching periods. I visited each point approximately 41 times, totaling 117.1 hours of searching during the 12-month period of study. I made 450 sightings which lasted from a few seconds to 5 min.

TABLE 1
MEASUREMENTS OF HELMETED MANAKIN NESTS

Measurement*	Nest A	Nest B
Height of nest above ground	10	0.5
Outside diameter	7.5	8.4
Inside length	5.5	6.2
Inside width	5.5	5.2
Outside height	3.5	4.2
Inside depth from top of upper twig	4.0	3.4
Smallest distances of nest from the fork along different twigs	7.2 7.5	5.4 5.7
Twig diameter before the fork	0.9	0.5
Twig diameter after the fork	0.55	0.3

* Measurements in cm, except for height of nest (in m).

Male testis volume was estimated from 29 birds collected in nearby gallery forests, using the formula for the volume of an ellipsoid: $V = 4/3 \pi ab^2$, where a was half the length of the testis and b the radius at its widest point. I recorded molt presence or absence for the wing, tail, and body feathers from 142 individuals mist netted, collected, or from the collections of the Museu Paraense Emílio Goeldi (Belém, Pará) and the Zoology Laboratory of the University of Brasília (Brasília, DF). Banded individuals mist netted in different months were considered as a separate record for molt.

Results.—Two nests were found, one on 20 September (nest A) and the other on 9 October 1988 (B). Nest A was in late construction: it already had a well defined shape, and the bottom was almost closed. It was 10 m high near the tip of a branch, 3.6 m from the trunk, in a 15-m *Amaioua guianensis* (Rubiaceae) tree. This tree was in the center of the forest, 75 m from the creek and 90 m from the closest forest border. The nest was a shallow bowl hanging between two twigs of a fork, made of fine twigs, roots, and leaves, with a hanging leaf on the outside wall (measurements in Table 1). A green bird (probably female) used its bill and feet to arrange the nest and lining. The bird made small and slow rotating movements while sitting in the nest. On 26 September the nest was observed from 06:21 to 06:49 h with the female present for 20 of the 28 min. In the same day a male sang for 30 seconds in a tree 5 m away from the nest. The female was sitting in the nest during visits on 8, 10, 11 and 13 October, always in the same position with the head across one of the twigs. On 13 October I climbed the tree and could see two beige eggs with dark spots. No activity was observed on or after 26 October, so the fate of the nest is unknown.

Nest B, found by J. C. Motta, Jr., was similar to nest A (Table 1) and contained two nestlings with very short feathers. It was 0.5 m high in a 1-m *Miconia hirtella* (Melastomataceae) shrub along a stream border. By 11 October, one of the nestlings had disappeared, and by 13 October, the plumage of the remaining nestling was thicker. When I approached the nest on 15 October, the nestling flew away, even though its remiges were only half grown and the retrices very short. A green individual (probably female) flew from the nest in two of my four visits, and once it called ("qua" notes) and flew from perch to perch about 5 m from the nest, in an apparent distraction display. Both nests were free of feces and seeds, which were found frequently on the forest floor below the nest.

Ten females mist netted in the study area and collected in other gallery forests close to the study area had brood patches between September and December. Two collected in October and November 1988 had eggs in formation. Adult males showed more developed

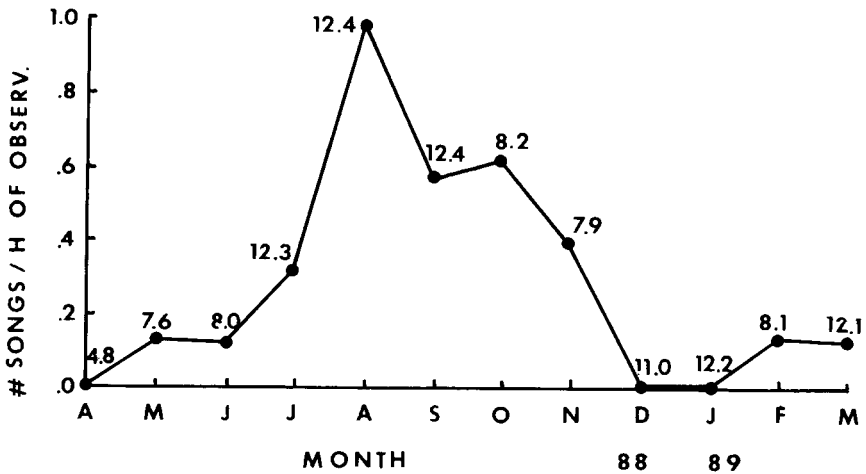


FIG. 1. Combined annual variation in song intensity of four adult males and one subadult male Helmeted Manakin. Numbers indicate hours of observation.

testes from July to December ($\bar{x} = 19.6 \text{ mm}^3$, range = 4.6–39.5, $N = 8$) than from January to June ($\bar{x} = 2.0 \text{ mm}^3$, range = 0.4–4.5, $N = 9$). The annual average testis size of 17 adult males, four subadult males and eight immature males were, respectively, 10.3 mm^3 (range = 0.4–39.5), 6.7 mm^3 (range = 0.9–13.0), and 3.7 mm^3 (range = 0.3–8.9). Histological analyses of the testes of two adult males collected in October (testis size = 9.1 mm^3) and December (testis size = 17.9 mm^3), and two subadult males collected in October (testis size = 13.0 mm^3) and November (testis size not available) showed no apparent differences. All had sperm packages and sperm in the lumina of the seminiferous tubules. No immature male testes were examined.

Adult and subadult males sing and perform circular chase flights when interacting with others in certain central areas (possible territories). Adult males often chased other adult males, but rarely chased subadult males. Although the males sing during the whole year, song intensity was higher between July and November, with a peak in August (Fig. 1). The song is a loud piercing whistle of eight notes audible from distances of at least 100 m. Songs between July and November were strong and complete, whereas songs at other times of the year were frequently weak and incomplete.

Chase frequency varied through the year. Chases consisted of at least one circular silent flight around the forest at heights varying from the understory to the canopy, and rarely involved physical contact. Occasionally the chaser pecked the back of the chased bird. Chases were most common in September (6 chases seen in 12.4 h of observation), but also occurred in August (3 chases in 12.4 h), November (2 chases in 7.9 h), June (1 chase in 8.0 h) and March (1 chase in 12.4 h). Ten of these 13 chases were between two adult males, two between an adult male and a subadult male, and one between a subadult male and a green bird. Nine of the 12 chases involving at least one adult male were inside an adult male's central area, and three were on the border of an adult male home range. Besides these 13 chases, I also saw during a mist-netting day two green birds chasing each other on a circular flight, and twice I saw a green bird chasing a subadult male for 1–2 sec on a non-circular flight.

The most intense molt period for both sexes overlaps little with the reproductive period,

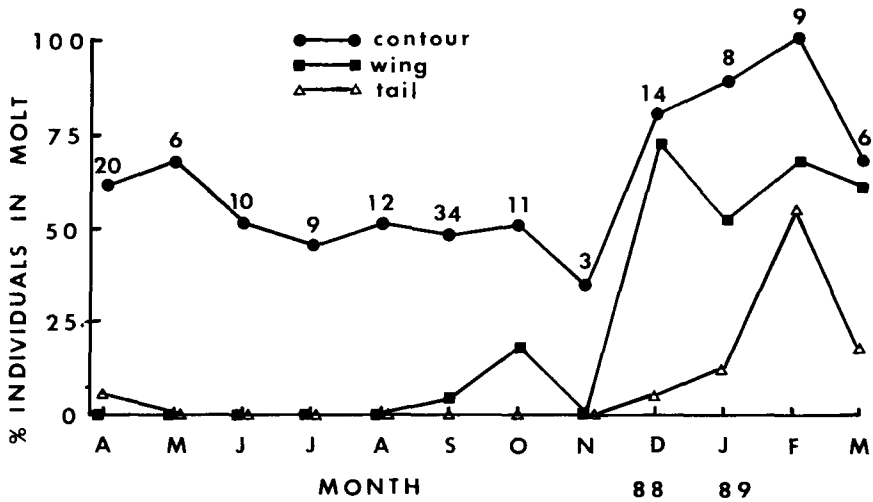


FIG. 2. Annual variation (% of individuals) in molt of wing, tail and contour feathers in the Helmeted Manakin. Numbers indicate sample sizes.

occurring from December to March, with the peak in February (Fig. 2). Body molt was recorded throughout the year, being more intense between December and February. Wing molt occurs between September and March, reaching a peak between December and March. The tail molts between December and April, reaching a peak in February.

Discussion.—Nest building (as was observed in nest A) and care of nestling (as was observed in nest B) seems to be a female activity because no male was observed close to either nest. P. T. Z. Antas (pers. comm.) observed an adult male following a female while she was carrying nest material, but also never observed a male directly engaged in nesting activities. Skutch (1949) observed only females of Red-capped Manakin (*Pipra mentalis*) working at the nest and Skutch (1969) observed only females of Blue-crowned Manakin (*P. coronata*) working at the nest and incubating. Worthington (1982) and Skutch (1969) observed females of the Golden-collared Manakin (*Manacus vitellinus*) working at the nest.

Both nests were similar to one described by Ihering (1902), which were bowl-shaped, suspended between two twigs, built of small rootlets and twigs, and lined with "vegetable horse hair" (fungal hyphae) with leaves hanging outside. The nest described by Ihering (1902) was found in December, one m above a stream, similar to the location of nest B, but not of nest A. Nest architecture is similar to other manakins (Ihering 1902; Skutch 1949, 1969; Foster 1976) and different from problematic non-manakins such as *Schiffornis* spp. (Skutch 1969).

The two eggs found in October by Ihering (1900) were described as "yellowish-white with several stripes and darker spots forming a large crown at the blunt end." The eggs observed in nest A, were similar except that stripes were lacking. Another nest found in October (P. T. Z. Antas, pers. comm.) also contained two eggs, was between 5 and 6 m high and also had a dry leaf suspended in its external wall.

Both nests observed were clean of seeds, feces, and egg shells, possibly due to cleaning of the nest by the female and/or by the nestling and the female defecating outside the nest. Foster (1976) observed that young of the Long-tailed Manakin (*Chiroxiphia linearis*) re-

gurgitated seeds and defecated in the nest. However, she found no seeds on the ground under the nest, and the nests were always clean. She suggested that females remove seeds from the nest, probably at the same time as the fecal sacs. Snow (1962) observed that the nest of White-bearded Manakin (*Manacus manacus*) with nestlings may contain feces or seeds, but the female swallows the seeds or feces or carries them away from the nest. He observed that nestlings defecate outside the nest. Also, Skutch (1949) stated that the Red-capped Manakin throws seeds outside the nest when it is incubating, and that in the nest the Blue-crowned Manakin (Skutch 1969) swallows nestlings' droppings.

The gonadal development of the males showed a pattern similar to that of the Long-tailed Manakin but different from that of the Swallow-tailed Manakin (*Chiroxiphia caudata*) (Foster 1987). The testes of immature Helmeted Manakin males are not as enlarged as the subadult male testes, which are not as enlarged as adult male testes. The testes of subadult and immature Helmeted Manakin males, like the testes of the Long-tailed Manakin (Foster 1987), are not as enlarged as the males of respective age classes of the Swallow-tailed Manakin studied by Foster (1987). Immature males, which have very small testes, do not engage in reproductive behavior, whereas subadult males, which have intermediate testes, at least occasionally sing and defend central areas like adult males (Marini 1989).

Wing and tail molt are concentrated between December and March, with little overlap with the breeding season when the energetic costs of reproduction are high. Levey (1988) observed Red-capped and White-collared manakins (*Manacus candei*) molt contour feather throughout the year and molt the wing and tail after the reproductive peak, a pattern similar to that of the Helmeted Manakin.

The reproductive period of the males (defined by gonadal development, song intensity, and male-male chase intensity) apparently began in July, reached a peak in August–September, and ended in December. The females' reproductive period (defined by nesting activity, brood patches and gonads), apparently began in August, was most intense from September to November, and ended in December. The Helmeted Manakin breeding period is similar to that of the typical breeding season of birds of the region (R. B. Cavalcanti, pers. comm.). The rainy season begins in September and ends in March–April, which means that the reproductive peak was in the first half of the rainy season and the molt peak was in the second half. Seasonal patterns of fruit abundance are not known, but presence of insects in the rainy season may also influence nesting/molt.

The Helmeted Manakin showed similarities to other manakins in nesting biology, nest architecture, male gonadal development, and molting pattern. All these observations support the present taxonomic position of the Helmeted Manakin in the family Pipridae, as has recently been supported by syringeal analysis (Prum 1989), and foraging and diet observations even though it has a unique range and may not be promiscuous.

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Rediscovery of the Bolivian Recurvebill with notes on other little-known species of the Bolivian Andes.—During a survey of birds in the upper Río Saguayo valley of Amboró National Park, Dpto. Santa Cruz (approx. Lat. 17°50'S, Long. 63°39'W; Fig. 1), we found populations of two little-known bird species, the Bolivian Recurvebill (*Simoxenops striatus*) and Ashy Antwren (*Myrmotherula grisea*). These species are known from only a few forest localities at 600–1400 m on the lower slopes of the Bolivian Andes in the Departments of La Paz, Cochabamba, and Santa Cruz (Remsen and Traylor 1989; this paper). The area we surveyed has been the focus of field research on the rare Horned Curassow (*Pauxi unicornis*; Cox and Clarke 1988). As detailed by Cox and Clarke (1988), Amboró National Park lies southeast of the town of Buena Vista, Dpto. Santa Cruz. The 180,000-ha park's borders are the Río Yapacaní to the west, the Río Surutú to the east, and latitude 17°51'S to the south. The southern two-thirds of this triangle is a section of the eastern foothills of the Andes ranging up to 2000 m elevation. From 16–19 August 1989, we studied resident