

## Brooding behaviour and nestling description of Golden-headed Quetzal *Pharomachrus auriceps*

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Estudiamos un nido del Quetzal Cabecidorado *Pharomachrus auriceps*, en enero de 2006, cerca de la Estación Biológica Yanayacu en el noreste de Ecuador. Monitoreamos el nido con cámara de video durante los 22 días, hasta que el único pichón voló. De los videos, describimos los ritmos de los adultos mientras empollaban y alimentaban al pichón. También describimos el desarrollo del pichón de esta especie por primera vez.

Golden-headed Quetzal *Pharomachrus auriceps* is one of four species in the genus *Pharomachrus*<sup>1</sup>. It ranges from south-east Colombia and southern Venezuela to south-east Peru, northern Bolivia, and western and central Amazonian Brazil<sup>4</sup>. Trogons and quetzals are well-known cavity nesters, and the breeding biology of Resplendent Quetzal *P. mocinno* has been studied<sup>6</sup>, but there are few published data for congeners; those for *P. auriceps* comprise little more than an egg and nest description<sup>5</sup>, and two reports of breeding-condition birds<sup>2,7</sup>. Here we present the first detailed account of nestling period, including brooding and provisioning rhythms, and a description of the nestling.

### Study site and methods

We located a nest of Golden-headed Quetzal, on 11 January 2006, near the Yanayacu Biological Station and Center for Creative Studies (00°35'S 77°53'W; 2,100 m), adjacent to Cabañas San Isidro, prov. Napo, north-east Ecuador. We videotaped the nest during daylight (c.06h00–18h00), on 12 January–2 February (22 days), for a total 226.3 hours. The camera was placed c.13 m from the nest and tapes were changed four times daily. Video-recordings and photographs are deposited in the Yanayacu Natural History Video, Sound, and Image Library.

### Nest site and description

The nest was an unlined cavity in the dead trunk of a tree, c.1 m from the broken top of the dead snag and c.3.5 m above ground. The nest entrance was oval and measured 15 cm tall by 11 cm wide. The nest cavity was 30 cm deep from the bottom lip of the entrance to the floor of the cavity. The snag and area around the nest were covered in vines and

mosses, with the entrance framed by the large leaves of an *Anthurium* sp. (Araceae) (Fig. 1). The surrounding area was densely vegetated with bamboo (*Chusquea scandens*, Poaceae) and tree ferns (Cyatheaceae), but directly in front of the nest tree was devoid of vegetation. The nest tree was within a c.20-ha selectively logged forest, surrounded by active or regrowing cattle pasture, c.50 m from the closest edge abutting active pasture, and 15 m from a small stream. We do not know if the cavity was excavated by the quetzals.

### Nestling growth and description

When found, the nest contained one presumably very young (2–5 days old) nestling (Fig. 2; tarsus = 15.8 mm; –22 days to fledge). The nestling was measured and photographed again on 18 January (Fig. 3; tarsus = 19.3 mm; –15 days to fledge) and 30 January (Fig. 4; tarsus = 23.0 mm; –3 days to fledge).

Three days prior to fledging, most of the flight-feathers had completely broken their sheaths. Many apteria (primarily the scapular apteria), however, were still visible. The most prevalent colours of the final juvenile plumage were dull black, dark chocolate-brown and medium tawny buff: the breast and belly were mottled and coarsely striped black and buff (Fig. 4); the wings dull black with more distinct buff spots. The chick also had large patches of iridescent green on the nape, upper back, wings and throat (Fig. 4). Around the cloaca was a ring of very small iridescent green and bright orange feathers. Smaller patches of green (just a few individual feathers) were visible on the wing-coverts. Most rectrices were dull black, the outer 1.5 feathers grading from black to sooty grey to dirty

Table 1. Summary of nest attendance by a pair of Golden-headed Quetzals *Pharomachrus auriceps* during the brooding period for both sexes combined.

	12 Jan	13 Jan	14 Jan	15 Jan	16 Jan	17 Jan	18 Jan	19 Jan	20 Jan	21 Jan
Mean on-bout (min.)	42.5	35.9	37.6	31.4	30.7	23.0	22.9	19.3	7.9	3.1
Mean off-bout (min.)	8.8	7.1	13.4	13.5	9.1	15.4	12.9	19.4	42.9	20.9
% on for day	80.9	83.7	74.7	70.4	74.0	60.0	64.0	47.7	17.0	15.7

Table 2. Percentage of total nest attendance split by sex by a pair of Golden-headed Quetzals *Pharomachrus auriceps* during the brooding period (male, female and unknown).

	12 Jan	13 Jan	14 Jan	15 Jan	16 Jan	17 Jan	18 Jan	19 Jan	20 Jan	21 Jan
% brooding by M	51.7	61.9	70.2	68.7	60.3	57.6	49.4	40.2	54.3	16.1
% brooding by F	43.1	35.9	17.1	28.0	30.9	36.6	50.6	53.6	29.1	64.3
% brooding by U	5.2	2.3	12.7	3.3	8.8	5.8	0.0	6.2	16.6	19.7
Mean on-bout (min.)	42.5	35.9	37.6	31.4	30.7	23.0	22.9	19.3	7.9	3.1
Mean off-bout (min.)	8.8	7.1	13.4	13.5	9.1	15.4	12.9	19.4	42.9	20.9
% on for day	80.9	83.7	74.7	70.4	74.0	60.0	64.0	47.7	17.0	15.7

white, appearing as a white spot at each tail 'corner', noticeable in flight. A stripe of chocolate-brown was evident above the eyes, and the top of the head was blackish brown. Bill and ocular skin black. Corners of the bill, where an inconspicuous gape remained, pale brown. Legs pale brownish tan and irides dark brown. The plumage of the fledgling did not differ appreciably.

### Brooding

When first examined on 11 January, we estimated the chick to be 2–5 days old. Regular brooding continued for the first ten days (12–21 January), following which mean time in the nest per brooding bout dropped suddenly from 3.21 minutes (21 January) to a mean 0.95 minutes (22–24 January). The mean brooding bout for both sexes during the ten days of consistent brooding was 22.26 minutes. On average during the brooding period, adults were present in the nest 58.9% of each day, but there was a gradual decrease in total time spent in the nest (Table 1). Brooding effort was partitioned thus: 53.0% male, 38.9% female and 8.1% unidentified adult. For the first six days, the male consistently brooded for a greater percentage of the day (Table 2). On 18 January, brooding duties appeared to even out and by the final day the female attended the nest more than the male.

We observed no readily defined pattern in the daily schedules of the sexes. However, if an identifiable bird was present in the nest at first light (sometimes darkness prevented certain identification), it was always the female (10% of days observed). On these days, the first adult to bring food was always the male. Occasionally, towards the end of the nestling period, no adult was seen exiting the nest at dawn; however, the female was observed leaving the nest cavity early on the morning of fledging and we believe that she brooded at night during the entire nestling period.

### Nestling provisioning and adult feeding behaviour

When adults arrived at the nest they invariably brought food, usually insects (44% of total food items), but also fruit (15%, primarily *Ficus* spp.). The other 41% could not be identified prior to the adult entering the nest cavity or feeding the chick. During the entire period, feeding duties were

divided almost equally between the sexes, with the female provisioning the chick a mean 10.0 times per day and the male 10.3 times.

Whilst the pair was brooding, they would enter the nest with food. After the pair ceased to brood, food delivery and nest visitation changed. They continued to enter the nest to bring food to the chick, but stayed much shorter periods. Eight days prior to fledging, they delivered food by leaning in from the entrance. After feeding the chick, the adult would usually depart immediately. When the chick was able to rest briefly on the inside lip of the cavity (27 January, day -6 to fledging), the adults perched on the outside lip and lowered their heads only slightly to feed the chick, thereafter departing the nest. Subsequently, on 29 January (day -4), the nestling began to perch at the front of the nest for extended periods, calling and stretching its wings. The adults still occasionally entered the nest, but stayed only short periods and did not seem to have been brooding.

### Fledging

On the day of fledging, the female peered from the nest at 06h26 and departed c.1 minute later. Subsequently, no adult visited the nest or provisioned the chick, which came to the front of the nest at 06h45 and remained until falling back into the cavity at 06h53. It emerged again at 07h04, stretched its wings and preened until flying from the nest at 08h14. Upon fledging, the chick simply stretched its wings and flew from the cavity. It was observed on a vine that was one of the favourite perches of the adults, c.2 hours later and flew a long distance (c.15 m).

### Additional observations and Discussion

Usually, when both brooding and provisioning, the adults followed a ritual for changing places. The incoming adult would fly to a favoured perch (often a vine or a small branch, slightly above the nest in an adjacent tree), and utter a 'whinnying' or 'giggling' call. The other adult would come to the front of the nest, perch briefly looking out and then depart. Occasionally (<5 times), an individual arrived to perch at the nest when the other adult was already brooding. On such occasions, the visiting adult would depart without depositing the food, and the brooding adult would come to the



Figure 1. Nest cavity and environs of a nest of Golden-headed Quetzal *Pharomachrus auriceps*, Yanayacu Biological Station, prov. Napo, Ecuador (R. Lohnes)



Figure 2. Nestling of Golden-headed Quetzal *Pharomachrus auriceps*, 22 days prior to fledging, Yanayacu Biological Station, prov. Napo, Ecuador (H. F. Greeney)



Figure 3. Nestling of Golden-headed Quetzal *Pharomachrus auriceps*, 15 days prior to fledging, Yanayacu Biological Station, prov. Napo, Ecuador (H. F. Greeney)



Figure 4. Nestling of Golden-headed Quetzal *Pharomachrus auriceps*, three days prior to fledging; breast and belly plumage (4a) and patches of green feathering on back (4b); Yanayacu Biological Station, prov. Napo, Ecuador (R. Lohnes)

front of the nest within 30 seconds to switch. Similar behaviour has been observed in Resplendent Quetzal<sup>6</sup>.

We observed the adults carrying 'refuse' from the nest <10 times and therefore assume that they consumed most faecal sacs in the nest. When we removed the nestling to measure it three days before fledging, the nest was very tidy and we saw no waste material (faeces or regurgitated seeds).

Whilst the sexes brooded and provisioned fairly equally, we observed some behavioural differences, especially on leaving and entering the nest. The male often paused at the entrance before entering for longer than the female (mean 35.17 seconds vs. 9.18 seconds). Though not as marked a difference, the female often stayed at the entrance before departing longer than the male (means: male 16.71 seconds vs. female 27.25 seconds). This quetzal is not particularly sexually dimorphic, suggesting that this difference is unrelated to visibility or conspicuousness differences between the sexes. It would be worth recording this variable at other nests to discover whether it varies individually or if there is a species-specific pattern.

At times, while an adult was brooding, it was possible to observe from outside its tail pressed against the back of the nest cavity. When the adults visited to feed the chick, they entered the cavity head first. The tail rotated around to the back of the nest at such an angle that we imagine that the bird was brooding with its tail held vertically against the nest cavity and with its head facing the entrance, i.e. in the same posture as other trogons and quetzals<sup>6</sup>.

Our observations confirm that nesting behaviour of Golden-headed Quetzal is similar to that of Resplendent Quetzal, with some notable differences. Most strikingly, the diet of Golden-headed Quetzal was considerably less varied than other quetzals. Resplendent Quetzal is reported to consume lizards and beetles<sup>6</sup>, and Pavonine Quetzal has been observed feeding its nestlings frogs<sup>3</sup>. We never observed Golden-headed Quetzals provisioning their chick with any animal matter other than insects. Also, it was formerly believed that quetzals did not feed their young fruit for the first ten days after hatching<sup>6</sup>, but in other studies<sup>8</sup> and at our nest, this was not the case.

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