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The nest, nestlings and morphometrics of Sapphire-spangled Emerald *Amazilia lactea bartletti*

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SUMMARY.—The Sapphire-spangled Emerald *Amazilia lactea* complex is currently represented by three subspecies with disjunct geographical ranges. *A. l. bartletti* occurs over a limited portion of south-western Amazonia in Brazil, south-east Peru and northern Bolivia, and is a very little-known taxon in nature. We present data on the breeding and biometrics of this race based on six nests found between 1999 and 2019, and 58 adult individuals captured between 2010 and 2018 in eastern Acre state, Brazil. The nest of *A. l. bartletti* is a low cup / base type, constructed primarily of kapok wool and decorated with lichens on the outer walls. The nestling period was estimated at 18–20 days. Our data indicate that *A. l. bartletti* breeds from at least December until March.

Sapphire-spangled Emerald *Amazilia lactea* comprises three subspecies with markedly disjunct geographical distributions: *A. l. lactea* in south-east Brazil, from Santa Catarina north to Bahia; *A. l. zimmeri* in south-east Venezuela; and *A. l. bartletti* in south-west Amazonian Brazil, adjacent south-east Peru and northern Bolivia (Zimmer 1950, Weller *et al.* 2020). Based on plumage and morphometrics, the *Handbook of the birds of the world* currently treats *bartletti* at species rank, Spot-vented Emerald *A. bartletti* (del Hoyo & Collar 2014). However, for the purposes of this study we follow the taxonomy and nomenclature of Piacentini *et al.* (2015), who considered this taxon as a subspecies of *A. lactea*.

Sapphire-spangled Emerald inhabits the edges of primary forest, as well as secondary forest, plantations, and urban environments. Almost all of the available breeding data for this species pertain to *A. l. lactea* (Oniki *et al.* 2000, Weller *et al.* 2020). To augment our knowledge of reproduction and biometrics of the race *A. l. bartletti*, we present data on the nest, nestlings, morphometry, and mass of this race from observations made in eastern Acre state, in south-west Brazilian Amazonia.

Methods

Study area.—Nests reported here were found during non-systematic observations made between 1999 and 2019 at the Campus and Zoobotanical Park of the Universidade Federal do Acre (UFAC) (09°57'03.22"S, 67°52'30.65"W), Rio Branco, while adults were captured, measured and banded annually there in 2010–18. A description of the habitats and avifauna of the study area can be found in Guilherme (2001).

Nests.—Inactive *A. l. bartletti* nests were collected and deposited in the nest collection of the ornithology laboratory at UFAC (Table 1). Measurements of these nests were taken using digital callipers.

Capture, marking and biometrics.—During 2010 to 2018, 58 adults were trapped using mist-nets, 12 m long and 2.5 m high with a 36-mm mesh. Capture effort was c.4,000 net / hours / year. Birds were marked using numbered metal rings supplied by CEMAVE (Centro Nacional de Pesquisa e Conservação de Aves Silvestres), under the scope of project 1099, coordinated by EG (senior bird bander, reg. no. 324654). We weighed adults and nestlings

TABLE 1
Measurements (mm) of Sapphire-spangled Emerald *Amazilia lactea bartletti* nests held in the ornithology laboratory of the Universidade Federal do Acre (UFAC), Rio Branco, Brazil.

Nest	Total height	External Diameter	Internal diameter of cup	Depth of cup	Wall thickness
AC-054	36	36.87 × 47.43	26.53 × 30.62	21	5.39
AC-056	30	32.6 × 39.17	18.28 × 24.75	23	8.68
AC-080	38	33.26 × 39.26	18.31 × 22.50	22	11.94
Mean ± SD	34.6 ± 4.2	34.24 ± 2.3 × 41.9 ± 4.7	21.04 ± 4.8 × 25.9 ± 4.2	22 ± 1	8.67 ± 3.3

using a Pesola® balance with 100 g capacity and 1 g precision in 2010–14, and a digital scale (0.05 g precision) in 2015–18. We collected standard morphometric data (wing length flattened, bill length from the tip to the feathers, and total length) following the protocol outlined by Proctor & Lynch (1993). To measure wing and total length we used a ruler with a millimeter scale, while to measure bill length we used analogue callipers (0.05 mm precision) in 2010–14, and digital callipers (0.01 mm precision) in 2015–18.

Results

Nests and nestlings.—Six nests of *A. l. bartletti* were found between 1999 and 2019 (Table 2; Figs. 1A, 1F, 2A). Of these, four were active when discovered and two inactive (Table 2). Four of the six had the support plant identified to genus or species (Table 2). Measurements, means and standard deviation of the parameters for three of the six nests are presented in Table 1.

The nests, of the low cup / base type (*sensu* Simon & Pacheco 2005), were sited on horizontal branches and comprised cotton-like fluff (kapok) obtained from seeds of *Ceiba* sp. or *Ochroma* sp. The outer walls of the nests were lichen-decorated (Figs. 1A, B, F, 2A, B, E).

Nestlings hatch virtually featherless (Fig. 2C–D), with two lines of down on the dorsal spinal tract (*sensu* Lucas & Stettenheim 1972; Fig. 2C). They have dark skin on the dorsal and lateral surfaces, closed eyes and an orange bill (Fig. 2C–D).

Nest 2.—When it was found on 21 February 2013, this nest contained two recently hatched nestlings (Fig. 1 A–B). It was constructed on the branch of a mango tree c.2 m above ground (Table 2). The nest was monitored for 18 days until the nestlings fledged. During this period, they were fed by just one adult, presumably the female, which collected nectar

TABLE 2
Nests of Sapphire-spangled Emerald *Amazilia lactea bartletti* found in the Campus and Zoobotanical Park of the Universidade Federal do Acre, Rio Branco, Brazil, between 1999 and 2019.

Nest	Date found	Supporting plant	Situation
1	5 February 1999	Not identified	active
2	21 February 2013	<i>Mangifera indica</i>	active
3	8 December 2015	Not identified	active
4	23 March 2017	<i>Tectona grandis</i>	active
5	14 June 2017	<i>Manihot esculenta</i>	inactive
6	30 July 2019	<i>Spondias</i> sp.	inactive

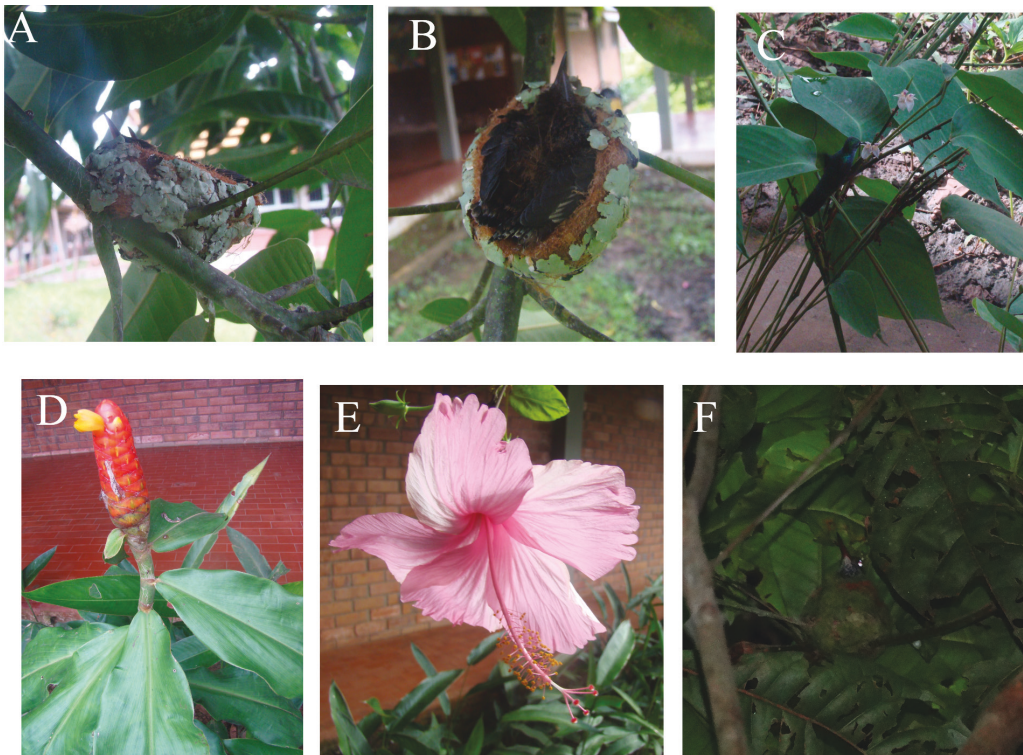


Figure 1. Nests of Sapphire-spangled Emerald *Amazilia lactea bartletti* and floral resources at the Campus and Zoobotanical Park of the Universidade Federal do Acre, Rio Branco, Brazil: (A) nest constructed on a mango *Mangifera indica* tree, with two nestlings, 3 March 2013; (B) the same nest from above, 5 March 2013; (C) adult female collecting *Monotagma* sp. nectar for the nestlings depicted in A and B; (D–E) flowers of *Costus* sp. and *Hibiscus rosa-sinensis*, respectively, where the adult female collected nectar to feed the nestlings depicted in photos A and B; (F) nest found on 8 December 2015 with an adult female incubating eggs (A–E: Jônatas Lima; F: Edson Guilherme)

from flowers of native and exotic species near the laboratory blocks and campus classrooms (Fig. 1C–E) including *Costus* sp., *Hibiscus rosa-sinensis* and *Monotagma* sp. (Fig. 1C–E). On 9 March 2013, the nestlings, already feathered and mass 5 g, were banded (code A07384 and A07400). On 10 March 2013 the young were seen perched on branches near the nest, but still being fed by the female. The minimum nestling period was therefore 17 days.

Nest 4.—This nest was found on 23 March 2017, also with two recently hatched nestlings. The nest was constructed on a branch of an exotic *Tectona grandis* plant, c.1.8 m above ground (Table 2; Fig. 2A, B, E). On the day of discovery, the nestlings weighed 2.2 g and 1.6 g, respectively. On 4 April 2019, 12 days later, we banded and measured the nestlings. As we approached, one of the nestlings flew to the edge of the forest and was not seen again. The other was banded (code A 62933) and weighed 4.69 g. Morphometrics taken from this nestling were: bill 11 mm; wing 33 mm and total length 65 mm. Next day, this nestling was also not present near the nest.

Morphometrics.—Fifty-eight adult *A. l. bartletti* were trapped and measured between 2010 and 2018. The mean and standard deviation of the measured parameters were: bill 20.7 ± 1.5 (range 17–25 mm, $n = 51$); wing 53.2 ± 3 (41–61 mm, $n = 58$); tail 29.7 ± 2.5 (25–35 mm, $n = 58$); total length 92.5 ± 5.8 (86–106 mm, $n = 49$) and mass 4.7 ± 0.6 (3–6 g, $n = 58$).



Figure 2. Nest of Sapphire-spangled Emerald *Amazilia lactea bartletti* with two nestlings on a horizontal branch of *Tectona grandis*: (A) outer nest wall showing lichen ornamentation; (B) dorsal view of nest with recently hatched nestlings (2–3 days old); (C–D) dorsal and ventral views of a nestling on the day it was found (23 March 2017); (E) feathered nestlings on 30 March 2017; (F) nestling on the day it was banded (4 April 2017) (Edson Guilherme)

Discussion

The first record of *A. l. bartletti* in Brazil involved a female collected in 1951 in the vicinity of Rio Branco, the capital of Acre (Pinto & Camargo 1954; Museu de Zoologia da Universidade de São Paulo, MZUSP 35630). In Acre, *A. l. bartletti* is one of the commonest hummingbirds, being present in forest fragments (mainly at their edges), farms, and squares and gardens in cities (Guilherme 2016).

There is just one reference to an *A. l. bartletti* nest found in Bolivia (del Hoyo *et al.* 2019), whereas all other known breeding information for *Amazilia lactea* refers to the south-eastern South American race *A. l. lactea* (Ihering 1900, Ruschi 1986, Oniki *et al.* 2000, Weller *et al.* 2020). Thus the nests reported here represent the first detailed information for *A. l. bartletti* (del Hoyo *et al.* 2019).

The shallow cup-shaped nest constructed of kapok fibres is similar to that described for *A. l. lactea* (Ihering 1900, Oniki *et al.* 2000). The kapok used (Fig. 2B) probably came from the fruits of *Ceiba lupuna* or *Ochroma pyramidale*, which are common tree species in the UFAC Campus and Zoobotanical Park. As noted by Oniki *et al.* (2000), the presence of bark strips or thin twigs in the outer wall is low and, in some nests, practically non-existent. Mean measurements of the nests of *A. l. bartletti* are consistent with those of *A. l. lactea* reported by Ihering (1900) and Oniki *et al.* (2000).

Nests of *A. l. bartletti* are decorated with lichens like those of *A. l. lactea* (Oniki *et al.* 2000), Copper-rumped Hummingbird *A. tobaci* (Muir & Butler 1925), Rufous-tailed Hummingbird

A. zacatl (Skutch 1931), Glittering-throated Emerald *A. fimbriata* (Haverschmidt 1952) and Azure-crowned Hummingbird *A. cyanocephala* (Ornelas 2010). Decorating the outer walls of the nests with lichens is primarily a camouflage strategy (McCormac & Showman 2010).

We estimate the nestling period as between 18 and 20 days, based on nest 2 which contained two recently hatched nestlings and was followed until they fledged 17 days later. We believe that the nestlings hatched at least two or three days prior to the nest's discovery. According to Oniki *et al.* (2000), the nestling period of *A. lactea* may be no longer than 20 days, i.e. slightly shorter than the 22 days reported by Ruschi (1986) and Weller *et al.* (2020) for *A. l. lactea*. The literature indicates that in other species of *Amazilia* the nestling period varies from 18 to 23 days (Fierro-Calderón & Martin 2007). Skutch (1931) reported that young Rufous-tailed Hummingbirds left the nest when 21 days old, Glittering-throated Emerald at 20 days (Haverschmidt 1952) and young Copper-rumped Hummingbirds when 19–23 days old (Muir & Butler 1925, Baird 2017).

Nestlings of *A. l. bartletti* are black-skinned dorsally, and pink on the belly, while the bill and mouth-lining are yellow / orange, just as described for Glittering-throated Emerald (Haverschmidt 1952) and similar to Azure-crowned Hummingbird (Ornelas 2010). The mass at fledging is presented here for the first time, and is close to mean adult weight, indicating that young only leave the nest when they achieve adult mass. Glittering-throated Emerald young also leave the nest when they reach c.5 g (Haverschmidt 1952). However, nestlings fledge when their bill is slightly smaller than that of the adult, as also observed in Glittering-throated Emerald (Haverschmidt 1952).

Foraging data for *A. l. bartletti* is virtually non-existent (del Hoyo *et al.* 2019). Our observations indicate that like *A. l. lactea* (Oniki *et al.* 2000), *A. l. bartletti* feeds its nestlings with nectar from native and exotic plants growing in open areas and gardens near the nest. From the dates of the active nests we found (Table 1) it appears that *A. l. bartletti* breeds in south-western Amazonia from at least December until March.

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