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NESTLING GROWTH AND PLUMAGE DEVELOPMENT OF THE SPOTTED BARBTAIL (*PREMNOPLEX BRUNNESCENS*)

CRECIMIENTO DEL POLLUELO Y DESARROLLO DEL PLUMAJE DEL SUBEPALO MOTEADO (*PREMNOPLEX BRUNNESCENS*)

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Abstract: studied plumage development and growth of nestling Spotted Barbtails (*Premnoplex brunnescens*) in northeastern Ecuador. Nestlings fledge after 19-22 days and can reach a maximum weight of around 21.5 g. Asymptotic weight expressed by the growth curve is 19.75 g, approximately 112% of adult weight. The growth parameter (*K*), expressed by the logistic equation, is 0.368, and nestlings grow from 10 to 90% of their asymptotic weight in 12 days. Nestlings hatch mostly bare-skinned, with sparse pale gray down dorsally. Wing pin feathers begin emerging through the skin around day 4. Eyes open between day 5 and 6, and nestlings loose their egg tooth after 12 days of age. Wing pin feathers begin emerging from their sheaths around day 10, and contour feathers begin breaking sheaths around day 8. I provide a photographic key to aging nestlings in the field and the first published record of growth parameters for this species.

Key words: Spotted Barbtail, *Premnoplex brunnescens,* Ecuador, nestling plumage, growth curve.

Resumen: Estudié el desarrollo del plumaje y crecimiento de las crías del Subepalo Moteado (*Premnoplex brunnescens*) en el noreste de Ecuador. Las crías abandonan el nido luego de 19-22 días y alcanzan un peso máximo de aproximadamente 21,5 g. El peso asintótico, expresado por la curva de crecimiento, es 19,7 g, aproximadamente 112% del peso del adulto. El parámetro de crecimiento (*K*), expresado por la ecuación logística, es 0,368. Las crías incrementan de 10 a 90% su peso asintótico en 12 días. Las crías nacen casi desnudas, con plumón gris disperso en el dorso. Los cañones de plumas empiezan a emerger de la piel hacia el día 4. Abren los ojos entre el día 5 y 6 y pierden su diente embrionario luego a los 12 días de nacidos. Las plumas brotan de sus vainas hacia el día 10. Las plumas de contorno empiezan a emerger hacia el día 8. Proveo además una clave fotográfica para determinar la edad de crías en el campo, así como el primer reporte de parámetros de crecimiento de esta especie.

Palabras clave: Trepapalo moteado, *Premnoplex brunnescens*, Ecuador, polluelo, plumaje, ecuación de crecimiento.

INTRODUCION

The Spotted Barbtail (*Premnoplex brunnescens*) is one of only two species in the genus, and is widely distributed from Costa Rica to Bolivia (Remsen, 2003). Within its range, the Spotted Barbtail inhabits the understory of humid montane forests at elevations of 600 to 3000 m. Ridgely & Greenfield (2001) suggest that only the nominate subspecies (*brunnescens*) occurs in Ecuador, although it is likely that a species-level revision may alter our understanding of this species' taxonomy and distribution (J. Perez pers. comm.). Although the nest of Spotted Barbtail was first described over 40 years ago (Skutch, 1967), only recently have detailed data

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on their reproductive biology become available (Greeney, 2008a; 2008b). Spotted Barbtails live and nest along mountain streams, building thick, enclosed mossy nests with a downward-facing entrance tube (Skutch, 1967; Marín & Carrion, 1994; Areta, 2007; Greeney, 2008a; 2008b).

Although the works mentioned above have described the basic breeding biology of Spotted Barbtail, we know relatively little of the nestling phase of reproduction. Nestlings remain in the nest for 19-22 days and are fed by both parents (Greeney, 2008a). Like *Margarornis* (Mennill & Doucet, 2005), nestling Spotted Barbtails defecate out of the nest entrance, usually in the absence of adults (Areta, 2007; Greeney, 2008a). Apart from these sparse observations, few data are available. Here I present nestling growth rates in a northeastern Ecuadorian population and describe in detail their plumage development.

METHODS

I made observations on nestling growth of the Spotted Barbtail in the vicinity of the Yanayacu Biological Station & Center for Creative Studies, Napo Province, 1900-2300 m (0°36' S, 77°53' W). The station is 5 km west of Cosanga, adjacent to the birding reserve of Cabañas San Isidro. I weighed nestlings to the nearest 0.01 g and photographed them every several days until 1-2 days prior to fledging. I present data only for nests where I observed hatching and where I am certain of nestling age. I used only nests with two nestlings (the usual clutch; Greeney, 2008a) and, to avoid pseudoreplication, used the mean of the weights of nest-mates to generate the growth curve. I fitted the data to a logistic growth equation, relating body mass to age using a least squares method, as proposed by Ricklefs (1967): mass(age) = $A/[1+e(-K(\text{age}-t))]$. In this equation, A, K, and t are the parameters of growth and e is the base of the natural logarithm. I calculated the inverse measure of growth rate, that is, the time required to grow from 10% to 90% of the asymptote, using the formula $4.4/K$. In all, I present data from 16 nestlings at 8 nests. Using mist-nets, I captured 21 adults from the same population, also weighing them to the nearest 0.01g.

RESULTS

Nestling growth

The asymptotic body mass (A) attained by nestlings close to fledging, using a non-truncated growth curve (Remeš & Martin, 2002), was 19.75 g. This represents 112% of the mean body mass of adults (17.65 ± 0.8 g). Individual nestlings, however, may attain weights of up to 21.5 g (122% of adult body mass). Growth rate expressed by the K parameter of the un-truncated logistic equation was 0.368. The curve inflected at age 9.5 days and nestlings needed 11.95 days to grow from 10% to 90% of the asymptote (Fig. 1).

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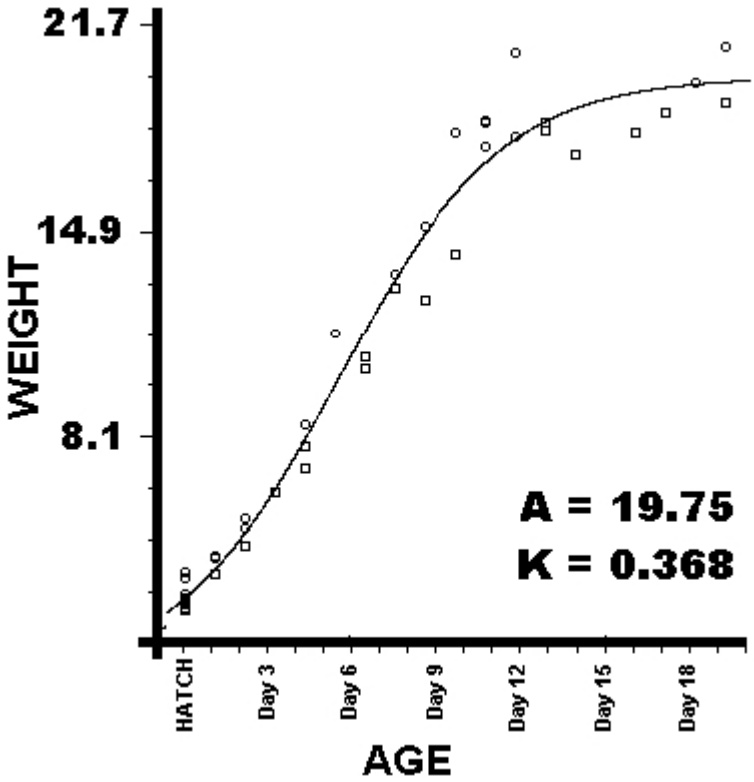

Figure 1. Nestling growth of Spotted Barbtail (*Premnoplex brunnescens*) at the Yanayacu Biological Station, Cosanga, Ecuador. The equation of the growth curve was: mass (age) = 19.75/[1+e(-0.368(age-9.5))]. Both *A* (asymptote) and *K* (growth constant) are given.

Nestling feather development

At hatching (mean weight = 2.68 ± 0.41 g; Appendix 1, Figs. 2, 5), nestlings are pink skinned with a slightly orange cast. The bill is dull yellow, dusky at the tip, and with a small white egg-tooth. The gape is slightly paler, and the mouth lining is bright yellow (Appendix 1, Fig. 5). Dorsally, nestlings have medium-length pale grey down. Two days later (mean weight = 4.78 ± 0.51 g; Appendix 1, Fig. 2), their appearance has changed little, but the bill has become more yellow, with reduced dusky coloration at the tip. The gape is now considerably brighter, and yellow-white. At 4 days old (mean weight = 7.61 ± 0.71 g; Appendix 1, Fig. 2) nestlings still have no visible contour feather development but primaries and rectrices have just begun to emerge through the skin ca. 1 mm. Their eyes remain closed. By 6 days of age (mean weight = 10.34 ± 0.43 g), nestling primaries and rectrices have emerged through the skin ca. 3-4 mm, and contour feathers are just emerging through the skin. After this point, nestling feather development progresses much more rapidly. Nestlings' eyes begin opening between day 5 and 6. At around 8-days-old (mean weight = 13.64 ± 1.49 g; Appendix 1, Fig. 3), contour feathers begin breaking their sheaths, with the exception of those on the capital and ventral cervical tracts. Pin feathers of the rectrices begin emerging from their sheaths around day 10 (mean weight = 17.94 ± 1.30 g; Appendix 1, Fig. 3). At this age, most contour feathers have

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broken their sheaths about 1 mm. Those of the ventral cervical tract are just breaking sheaths, whereas those of the capital tract remain unbroken. By day 12 (mean weight = 19.19 ± 2.45 g; Appendix 1, Fig. 3), contour feathers of the capital tract are just breaking their sheaths, and the breast and belly feathers are now distinctly scalloped and spotted as in adults (Appendix 1, Fig. 5). The back is beginning to appear distinctly rufus-brown, but wisps of natal down remain. The upper mandible has become mostly dark, whereas dark portions of the lower mandible are restricted to the apical third. The egg tooth is often still present, and nestlings' eyes are now fully open. By day 14 (mean weight = 19.71 ± 2.10 g; Appendix 1, Fig. 4) most of the nestling natal down is gone. The upper mandible is almost entirely dark, with the lower mandible becoming duskier, and the bright, yellow-white gape becoming very prominent in relation to the dark bill. Only two days later, at 16 days old (mean weight = 21.14 ± 2.51 g; Appendix 1, Fig. 4), nestlings begin to appear fully feathered. The belly and breast feathers appear similar to adult plumage. The back is rufous-brown and the crown is olivaceous. At 18-days-old (mean weight = 20.20 ± 1.54 g; Appendix 1, Figs. 4, 5), nestlings' throat is distinctly ochraceous, like that of adults, and a faint tawny-ochraceous eye-line is visible. Only scattered tufts of natal down remain. Their tails are short, but distinctly show the bare tips as in adults. Wing pin-feathers are almost entirely free of their sheaths, with the outer 3-5 primaries still with 2-4 mm of sheaths remaining (Appendix 1, Fig. 5). By the time of fledging (ca. 20 days old, ca. 19-20 g; Fig. 5), nestlings are similar in appearance to adults (Appendix 1, Fig. 5), but retain a faint, buffy eyeline.

DISCUSSION

In general, data on the growth rates of tropical birds are scarce, and the data presented herein appear to be the largest contribution to our understanding of growth rates in any ovenbird (Furnariidae). Thus, for now, I restrict my comparisons to only the broadest generalities, and hope that this descriptive paper will encourage others to present similar data for other tropical species. As predicted by Ricklefs (1976), nestling growth of the Spotted Barbtail is slower than that of most temperate passerines (Remeš & Martin, 2002). Even when compared to other tropical passerines, however, Spotted Barbtail nestlings grow at a fairly slow rate, seemingly most similar to tropical flycatchers (Tyrannidae; Ricklefs, 1968; 1973; 1976; Oniki & Ricklefs, 1981). Similarly, when compared with most species in the allied antbird clade (Thamnophilidae; Sibley & Ahlquist, 1990), a growth constant of 0.368 is relatively low (Ricklefs, 1976; Oniki & Ricklefs, 1981). In addition, like most nonpasserines, Spotted Barbtail nestlings reach an asymptotic weight greater than adult mass, something less frequently seen in passerines (Ricklefs, 1968; 1973; 1976; Oniki & Ricklefs, 1981; Remeš & Martin, 2002).

Despite their value to field researchers, detailed descriptions of plumage development for tropical birds are rarely available. This is likely a result of prior constraints imposed by the costs of field photography and of publishing colored plates through traditional methods, in conjunction with a recent disregard of descriptive natural history as a valuable contribution to the scientific process. With recent technological advancements, most especially the development of digital photography and the online publication of a variety of journals, I encourage others to produce works on other species. Photographic descriptions of plumage development in a wide range of species will likely prove to be invaluable field tools for future

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students of comparative ornithology and natural history. Such detailed descriptions will be not only useful for aging nestlings in the field, but may prove useful in elucidating potential trade-offs between weight gain and plumage development, and how these life history traits may vary amongst taxa.

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Appendix 1. Iconography of the plumage development and growth of nestling Spotted Barbtails (*Premnoplex brunnescens*).

Figure 2. Nestlings of Spotted Barbtail (*Premnoplex brunnescens*), hatching to 4 days old, at the Yanayacu Biological Station, Cosanga, Ecuador. Pictures: H. F. Greeney.

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Figure 3. Nestlings of Spotted Barbtail (*Premnoplex brunnescens*), 8 to 12 days old, at the Yanayacu Biological Station, Cosanga, Ecuador. Pictures: H. F. Greeney.

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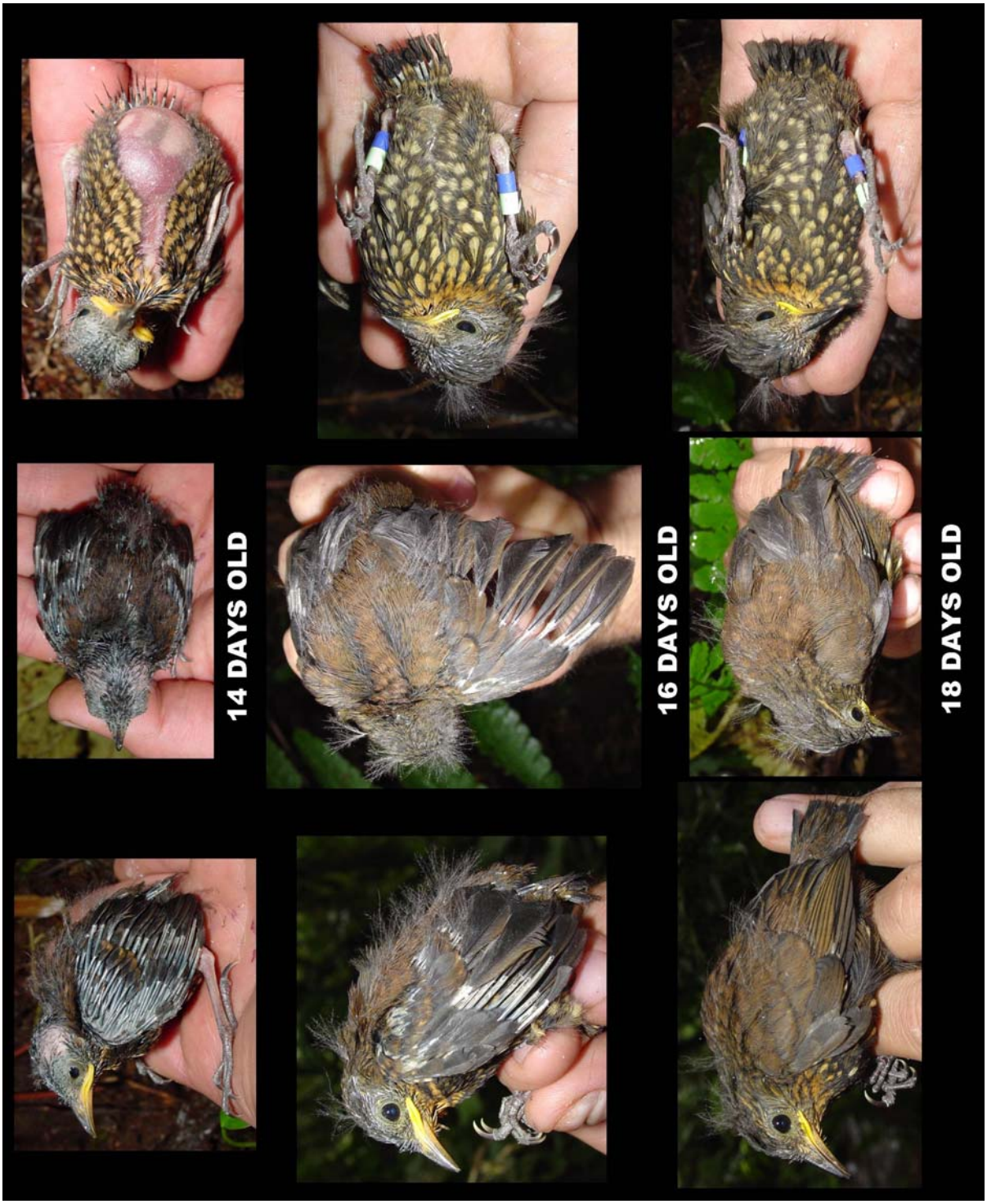

Figure 4. Nestlings of Spotted Barbtail (*Premnoplex brunnescens*), 14 to 18 days old, at the Yanayacu Biological Station, Cosanga, Ecuador. Pictures: H. F. Greeney.

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Figure 5. Photographs of adults and nestlings of Spotted Barbtail (*Premnoplex brunnescens*) at the Yanayacu Biological Station, Cosanga, Ecuador. Pictures: H. F. Greeney.