

Double-broodedness, burial of faecal sacs and long breeding season in the Australian Logrunner in south-eastern Queensland

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Abstract. Observations of a female Australian Logrunner *Orthonyx temminckii* building a nest while feeding juveniles from a previous brood and, in the following year, incubating eggs while feeding a juvenile, represent the first documented evidence of multi-broodedness in this species. Consistent with the literature, incubation of eggs and feeding of nestlings were performed only by the female, which was fed frequently by the male when she was off the nest. Incubation attentiveness was 60%, and average incubation bouts were about twice the duration of absence bouts (44 vs 21 minutes) at one nest. Based on dates extrapolated from the date of fledging, brooding of the two nestlings ceased between Days 5 and 9. The hourly food-provisioning rate of nestlings increased linearly from 2.4 on Day 4 to 10 feeding visits on the day before fledging. Absence bouts during both the incubation and nestling period were apparently shorter, and food-provisioning rates substantially higher, than in the phylogenetically related Chowchilla *O. spaldingii* of Far North Queensland. Observations of the female Logrunner burying faecal sacs corroborate a previous observation in south-eastern Queensland and suggest a novel strategy to avoid attracting potential nest predators. Although the Logrunner is often thought to breed only in winter, records from multiple sources indicate that in Queensland >50% of clutches are laid during the rest of the year, presumably facilitated by year-round food availability.

Introduction

The breeding biology of the Australian Logrunner *Orthonyx temminckii* is moderately well known. The large, domed nest takes ~1 month to construct, though nests built early in the season may take longer (McNamara 1935). Nest building is performed either by the female alone (McNamara 1935) or by both the male and female (Stokes 1979; Reilly 1991; Higgins & Peter 2002). The clutch usually consists of two eggs, which are incubated only by the female. The male feeds the female while she is off the nest, her absences usually being for periods of <30 minutes (McNamara 1935). Incubation takes 21–25 days, and the nestling period lasts for 18–19 days (Hindwood 1934; McNamara 1935), giving a nest cycle of 39–44 days, excluding nest construction. The female broods and feeds the nestlings alone, although the male continues to feed her, and she carries his offerings to the nestlings (Hindwood 1934; Beruldsen 1974; Higgins & Peter 2002).

Compared with the closely related Chowchilla *O. spaldingii* of Far North Queensland, little quantitative information has been published on the parental care of the Australian Logrunner, and several uncertainties about the Logrunner's breeding biology remain unresolved. Although both Beruldsen (1980) and Boles (1988) stated that pairs of Logrunners sometimes raise two broods in a year, they did not provide evidence to support this claim, and Higgins & Peter (2002) considered double-broodedness unsubstantiated. There is also conflicting information on removal of faecal sacs by female Logrunners. Although observations at one nest in New South Wales suggested that the female drops faecal sacs as soon as she reaches her next foraging site (Vaughan & Haynes 1981), at a nest in south-eastern Queensland the female appeared to bury the faecal sac before flying off (Antos 2007).

We herein present the first conclusive evidence of multi-broodedness in this species, and provide data on the provisioning of nestlings, and confirm the burial of faecal sacs by the female. We also collate published and online breeding records of the species from south-eastern Queensland to determine if the breeding season is confined to winter, as presently perceived.

Study site and methods

RAN discovered a pair of Australian Logrunners with dependent juveniles in June 2021 and in August 2022 while carrying out monthly surveys of rainforest fruiting trees at Boombana (470 m asl; 27°24'S, 152°48'E) in D'Aguilar National Park, ~24 km west of Brisbane's Central Business District, Queensland. Nests were found on 28 June 2021 and 22 August 2022. RAN video-recorded incubation behaviour at the 2021 nest on 11 August ($n = 3.8$ h), and chick provisioning on 23 August ($n = 3.2$ h), using a Sony Handycam HDR-CX130. BJC also observed this nest with binoculars for a total of 10.4 h, consisting of 1.0–2.5 h on each of 6 days during the nestling period. At the 2022 nest, RAN video-recorded chick provisioning on 31 August ($n = 2.1$ h) and BJC watched the nest for 1.9 h on 5 September, recording the female's behaviour at and near the nest. Nestling age was estimated from the actual or presumed fledging date, assuming a nestling period of 18 days (see Introduction).

Breeding records from south-eastern Queensland were extracted from the Birds Australia Nest Record Scheme database and eBird (2022). Duplicate eBird records (with the same date and location) were discarded, and only breeding categories considered confirmed were included in analyses. To standardise records and enable geographical comparisons of breeding seasons, we estimated the

month of egg-laying for each valid record. For records of fledglings, we subtracted the maximum incubation and nestling period (44 days) and for juveniles, 60 days (see below). Records of birds building nests or carrying nest material were treated separately because of the possibility of nests being abandoned before laying. If the calculated date of laying fell within 2 days of the changing of months, the record was apportioned evenly (0.5) to both months.

Results

2021 nest

The pair of Logrunners was first found feeding two dependent juveniles on 28 June (Figure 1). Soon the female began gathering pieces of leaf-litter and taking them to a partially constructed nest that was partly hidden among ferns and logs (Figure 2). Nest building was observed and photographed again on 14 July, though the nest was not noticeably larger, and at least one of the juveniles was still accompanying the adults. On 11 August, the nest contained two eggs (Figure 3) and, during 216 minutes of video, the female incubated them for a total of 130.6 minutes, equating to an incubation attentiveness of 60.4%. Complete incubation bouts ranged from 33.1 to 53.6 minutes (mean $43.5 \pm$ standard deviation 10.2 min., $n = 3$), and absence bouts 14.4–30.2 minutes (mean 21.4 ± 7.4 min., $n = 4$).

On 19 August, the nest contained two very small chicks covered in black down, which were estimated to be 4 days old. During 50 minutes of observation, the female fed the chicks twice and brooded them for 46.1% of the time. On the following day, however, the amount of brooding time dropped to 16.4% (Figure 4). The mean completely observed brooding bout was 13.0 minutes ($n = 3$) but, including incompletely observed bouts, the mean was 12.2 minutes ($n = 6$), the maximum incomplete bout lasting 23.2 minutes. Absence intervals ranged from 7.3 to 29.1 minutes (mean 14.8 min., $n = 6$). Diurnal brooding ceased between Days 5 and 8. The chicks were photographed on Days 12 and 16 (Figures 5–6). The hourly feeding rate increased linearly from 2.4 to 9.9 feeding visits on Day 4 and Day 18, respectively (Table 1, Figure 4). The mean interval between visits decreased from 18.1 to 13.1 minutes on Days 5 and 8, respectively, then to 8.1–8.5 minutes during Days 12–16, and finally to 6.0 minutes on Day 18 (Table 1), but the maximum interval did not exceed 17.2 minutes during the final week.

On the day after the chicks were first noted, the female was twice seen collecting and consuming their faecal sacs before entering the nest to brood. After brooding ceased, the female collected all faecal sacs immediately after feeding the chick(s) (Figure 7) and removed them to locations beyond the view of the observer. The mean rate of removal of faecal sacs was 1.79 ± 0.7 h⁻¹. Although the removal rate was lower during the first half of the nestling period (Days 5 and 8) than during the second half (Days 12, 15 and 18), it dropped inexplicably to 1.0 h⁻¹ on Day 16, despite observation duration and starting time being similar on the final 3 days of observation (Table 1).

The nest was vacated between 1040 h on 2 September and 0830 h the following day, when one fledgling,



Figure 1. Juvenile Australian Logrunner, first-brood juvenile, Boombana, D'Aguilar National Park, Queensland, 28 June 2021. Photo: Richard A. Noske



Figure 2. Female Australian Logrunner at 2021 nest, Boombana, D'Aguilar National Park, Queensland, 27 August 2021. Photo: Brian J. Coates



Figure 3. Nest interior and eggs of Australian Logrunner, D'Aguilar National Park, Queensland, 11 August 2021. Photo: Brian J. Coates

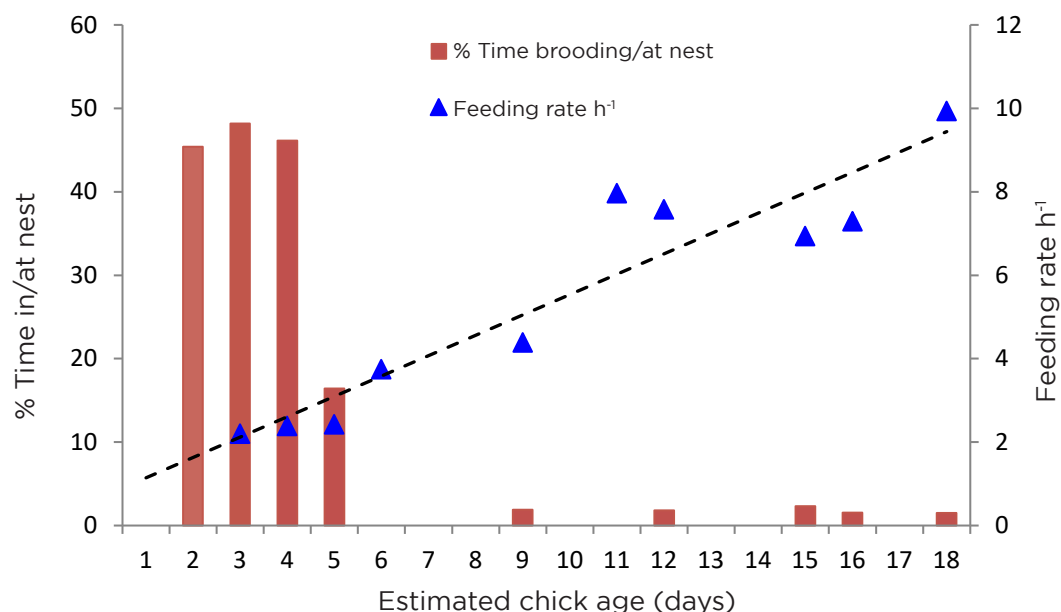


Figure 4. Percentage of time that female Australian Logrunners spent on/at nest and food-provisioning (feeding) rates per hour during the nestling period at the 2021 nest (except Days 6 and 11, from 2022 nest), and at the nest observed by Donaghey (*in litt.* 2022, Days 2 and 3). Dashed line is linear trend for feeding rates.

accompanied and fed by the female, was located within 40 m of the nest (Figures 8–9). The fledgling followed the female but quickly tired and repeatedly stopped to rest for a few minutes. It was fully feathered except for the tail, the spines of which were beginning to emerge. On one occasion, while following the female, the fledgling flew upwards almost vertically ~60 cm to the top of a buttress and down the other side. We made no further visits to the site until 29 November, when the adults were observed feeding a juvenile female four times in 40 minutes (Figure 9).

2022 nest

On 8 August, RAN observed the (presumed) same pair attending a juvenile only ~20 m from the 2021 nest site, although the male was mostly feeding the female. Ten

days later, the juvenile was still present and being fed occasionally, but the female soon disappeared from view. On 22 August, she was observed carrying a skeletonised leaf and, after following her, RAN found a well-hidden nest (Figure 11) among stones and sapling palms at the base of a steep rocky slope, ~50 m from the 2021 nest. The contents were not checked as the female was sitting.

By 31 August, with a torch and binoculars, two black-down-covered nestlings were visible from 10 m. They were subsequently estimated to be 6 days old. During 2.1 h of video, the female fed the chicks eight times (3.75 feeds h^{-1}), spending 8–18 seconds (mean 13.6 sec.) at the nest entrance per visit, and removed three faecal sacs. Brooding was never seen. By Day 11, the provisioning rate increased to 8.0 feeds h^{-1} (Figure 4) during 1.9 h of video, though the number of faecal sacs removed did not change ($n = 3$).

Table 1. Rates of nestling food provisioning and faecal sac removal by female, and mean interval between feeds at 2021 Australian Logrunner nest. Chick age is estimated from fledging date.

Date	Chick age (days)	Observation period (min.)	Observation start time (h)	Feeding rate (h^{-1})	Mean interval between feeds (min.)	Faecal sac removal rate (h^{-1})
19 Aug.	4	50.2	0958	2.39	8.2	0
20 Aug.	5	98.6	0905	2.43	18.1	1.22
23 Aug.	8	191.4	0837	4.39	13.1	1.25
27 Aug.	12	110.8	0945	7.58	8.1	2.17
30 Aug.	15	146.9	0848	6.94	8.5	2.45
31 Aug.	16	115.2	0857	7.29	8.5	1.04
2 Sep.	18	114.7	0839	9.94	6.0	2.62



Figure 5. Downy nestling Australian Logrunners (estimated 12 days old), 27 August 2021. Note whitish gapes. Photo: Brian J. Coates



Figure 6. Well-feathered nestling (estimated 16 days old) Australian Logrunners, 31 August 2021. Note whitish gapes. Photo: Brian J. Coates



Figure 7. Female Australian Logrunner removing nestling faecal sac at 2021 nest, 27 August 2021. Photo: Brian J. Coates



Figure 8. Australian Logrunner on day of fledging, 3 September 2021. Photo: Brian J. Coates

The female was watched at close range on four (Day 11) and five (Day 14) occasions to determine whether she buried the faecal sacs. After collecting faecal sacs from the chicks, she flew ~3–10 m from the nest and, upon alighting, immediately placed the sac on the ground in front of her, then turned around or to one side, and commenced vigorous raking of the leaf-litter for a few seconds, as in typical foraging behaviour, tossing litter aside with each foot alternately. On each occasion, this resulted in the faecal sac quickly becoming concealed under several centimetres of leaf-litter. She then walked or flew away to forage. No attempt was made by the female to create a pit for disposal of the sac.

By 8 September (Day 14), the chicks were well-feathered except for the crown, which was covered in thick down, and on the approach of the female came to the nest entrance and begged for food (Figure 12). On 10 September (Day 16), the nest was empty, and no Logrunners were found. Disarray of material at the nest entrance suggested nest predation and, although no other evidence was found to confirm the fate of the young, we assume that the young were depredated 4–5 days before their expected fledging date.

Breeding season

We collated 61 breeding records for south-eastern Queensland (including our own records), of which 12 concerned only nest-building behaviour and, thus, were omitted from further analyses. Of the remaining 49 records, 20 (41%) were from Lamington National Park, including O'Reillys Guesthouse, and 19 (38.8%) from D'Aguilar National Park, including Boombana. There were nine records each for nests with eggs and young, respectively, but the majority (49%) of records referred to fledglings and the rest to dependent juveniles. Laying peaked in July and September, which accounted for 47% of the records, but there were records in every month of the year (Figure 13). The winter months accounted for 47% of the records.

Discussion

Breeding season

Based on records from egg collectors in northern New South Wales during the late 19th century, both Campbell



Figure 9. Female Australian Logrunner carrying food items to fledgling, 3 September 2021. Photo: Brian J. Coates

(1901) and North (1904) concluded that the Australian Logrunner breeds mainly in autumn and winter. Campbell (1901) even speculated that laying may be biannual, with most eggs being laid in July and August, and again in February and March, but he conceded that eggs had been collected in New South Wales in each month from January to October. McNamara (1935) considered July and August to be the main breeding months near Mount Kembla, NSW, though “nests containing eggs were not uncommon in September, October and November and to a lesser extent in December” (p. 178). Since then, Cooper *et al.* (2020) showed that breeding records (stages unspecified) from New South Wales cover all months of the year except February, with a distinct peak from August to October (Figure 13).

Little has been published about the breeding season of the Australian Logrunner in Queensland. At O'Reilly's Guesthouse, Lamington National Park, Wheeler (1973) found a nest with young on 30 September 1968, suggesting laying in late August–early September, and a nest with three eggs on 9 October 1970, suggesting laying in late September or early October. In the “ranges to the west of Brisbane”, which includes the present study site, Beruldsen (1974, p. 22) found two nests in June 1972, one with newly hatched young, and the other with two nestlings that fledged “a week later”. No dates were provided for these nests but, given a median nest cycle of 41 days, these chicks were likely to have hatched from eggs laid in May. In 1973, however, Beruldsen (1974) found two nests, both under construction on 18 June, but by 25 June, after



Figure 10. Second-brood 88-day-old juvenile female Australian Logrunner, 29 November 2021. Photo: Richard A. Noske



Figure 11. Adult female Australian Logrunner at 2022 nest, D'Aguilar National Park, Queensland, 5 September 2022. Photo: Brian J. Coates



Figure 12. Female Australian Logrunner feeding nestlings (14 days old), 8 September 2022. Photo: Brian J. Coates

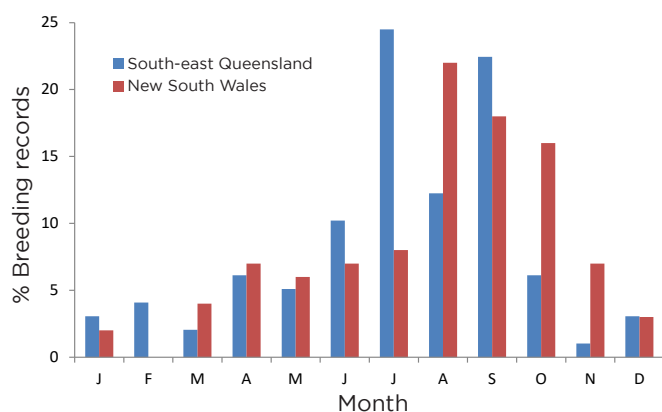


Figure 13. Monthly frequency of breeding records (stages unspecified) of Australian Logrunners in New South Wales (Cooper *et al.* 2020), and estimated laying dates in south-eastern Queensland (see text).



Figure 14. Juvenile Australian Logrunner, Maiala, D'Aguilar National Park, 10 September 2014. Photo: Richard A. Noske

a “dry spell”, building had ceased, leaving the nests ~75% complete. After heavy rain 3–6 days earlier, both nests contained one or two eggs on 11 July 1973.

Despite the widely held belief (e.g. Boles 1988; Goosem *et al.* 2015) that Australian Logrunners breed mainly in winter, breeding records from south-eastern Queensland reveal that, as in New South Wales, laying has been recorded in every month of the year (Figure 13). At the present study site, RAN (unpubl. data) found a nest between the buttress-roots of a Deciduous Fig *Ficus superba*, with a female sitting, probably on eggs, on 23 March 2020, although, 2 days later the nest was empty and, given damage to the entrance, had apparently been depredated. At Mary Cairncross Scenic Reserve, south-east of Maleny, a nest contained young on 11 March 2007 (Antos 2007); the eggs must have been laid in February. Although not included in our analysis, records of Logrunners building nests or carrying nest material fell in all but 4 months (January, August, September and December) of the year.

Partially dependent juveniles were observed at our study site in mid July 2021 and mid August 2022, and ~8 km away at Maiala, Mount Glorious (~620 m asl), on 10 September 2014 (Figure 14) and also 28 November 2018 (RAN pers. obs.). BJC also photographed a juvenile at Maiala on 10 October 2006 (Boles 2007). McNamara (1935) claimed that young Logrunners take 6 months to assume adult plumage, at which age they are still occasionally fed by the

adults, but it is not known how he identified individual birds. Young Chowchillas remain with their parents for at least 2 months, despite being capable of foraging for themselves at that age (Frith *et al.* 1997). We used this interval (2 months) to extrapolate laying dates from observations of partially dependent juvenile Australian Logrunners, and the maximum nest cycle (44 days) for fledglings.

We conclude that the laying season of Australian Logrunners in south-eastern Queensland is virtually year-round, albeit peaking from July to September. One explanation for this protracted breeding season is that the abundance and biomass of rainforest leaf-litter invertebrates varies little over the year, as shown by Goosem *et al.* (2015). Year-round availability of suitable prey for the Logrunner was unexpected by Goosem *et al.* (2015), as they had assumed that Logrunners breed only in winter, and that winter breeding was exceptional for birds in south-eastern Queensland. In reality, winter breeding is normal among most honeyeater species, as well as many other small insectivorous birds, in south-eastern Queensland (Noske 2015; RAN unpubl. data).

Double-broodedness

Beruldsen (1980) and Boles (1988) claimed that Australian Logrunners sometimes raise two broods in a year, but neither provided supportive evidence. Moreover, the same authors alleged that the Chowchilla is double-brooded, though Frith *et al.* (1997) recorded only single broods during their 11-year study, detailing 52 nesting events. In our study, partly dependent juveniles were present when the female was nest building and/or incubating in 2021 and 2022, indicating that they belonged to broods raised earlier in the year, and that the chicks at both nests represented second broods. These observations constitute the first confirmation of double-broodedness in this species, although we acknowledge that they are based only on observations of one pair over a 15-month period. Nevertheless, double-broodedness in this species is not surprising, given the long breeding season and year-round availability of prey.

Significantly, in both years the juveniles of the first brood were not re-sighted after the female started feeding the second-brood nestlings, suggesting that the former had dispersed. Dow (1980) observed three apparently adult Australian Logrunners, two males and one female, feeding a fledgling on the Lamington Plateau in south-eastern Queensland, suggesting that cooperative breeding may occur occasionally. In many species that breed cooperatively, however, helpers often comprise young birds from previous broods, so Dow's ‘adults’ might have included an immature male, but the month of his observation was not mentioned.

Incubation behaviour and rate of provisioning nestlings

We observed incubation behaviour of Logrunners for only 3.8 h on a single day. Donaghey (in Higgins & Peter 2002; *in litt.* 2022), on the other hand, observed incubation behaviour at two nests over 3 days in December. During 32 h of diurnal observations, the females spent on average

Table 2. Summary of behaviour during the incubation and nestling periods of the Australian Logrunner from the present study (2021 nest) and R. Donaghey (*in litt.*) and of Chowchilla (Paluma and Malanda, North Queensland: Frith *et al.* 1997). Feeding rates: early – Logrunner Days 1–6 /Chowchilla Days 1–8; middle – Logrunner 7–12/Chowchilla 9–17; late – Logrunner 13–18/Chowchilla 18–24. *n* = number of bouts, nr = not recorded, * indicates Day 2 only as there were fewer data for Day 3 (*n* = 23 vs 8).

Parameter	Australian Logrunner		Chowchilla	
	Present study	Donaghey (<i>in litt.</i>)	Paluma	Malanda
Incubation period				
Attentiveness (%)	60.4	75.1	58.0	46.0
Incubation bout: mean	43.5	69.2	52	29
maximum	53.6	132.8	nr	nr
Absence: mean	21.4	20.7	35	43
maximum	30.2	55.2	nr	nr
<i>n</i> (incubation/absence)	4/3	23/23	28/31	5/5
Ratio, incubation: absence	2.0	3.3	1.5	0.7
Nestling period				
Brooding bout: mean	12.2	12.8*	17.0	nr
maximum	23.2	29.8	nr	nr
Absence: mean	14.8	nr	20.0	41.0
maximum	29.1	nr	nr	nr
<i>n</i> (brooding/absence)	6/6	23/0	nr	nr
Feeding rate h ⁻¹ (early)	2.7	2.2	1.7	nr
Feeding rate h ⁻¹ (middle)	6.7	nr	2.0	1.7
Feeding rate h ⁻¹ (late)	8.0	nr	4.0	4.0

75% (range 72.4–77.5%) of time incubating, with the mean incubation bout lasting 69.2 minutes (*n* = 23), and mean absence lasting 20.7 minutes (*n* = 23) (Donaghey *in litt.* 2022). Thus, incubation attentiveness at these nests was 24% higher than we found at the 2021 Boombana nest, because of the shorter duration of incubation bouts at the latter (Table 2). The maximum incubation bout observed by Donaghey was 2.2 h, an impressively long stint.

Donaghey (in Higgins & Peter 2002; *in litt.* 2022) also quantified brooding by a female at a nest in which the two nestlings had hatched the previous day (i.e. nestlings were 2 days old) for 10.8 h of observations, and on the following day (Day 3) for 4.3 h. Brooding attentiveness was 45.4% and 48.2% on Days 2 and 3, respectively. Mean brooding bouts of 12.8 (Day 2, *n* = 23) and 13.3 minutes (Day 3, *n* = 8) (Table 2) are consistent with our observations at the 2021 nest. On Day 3, the female provisioned the chicks at a rate of 2.2 feeds h⁻¹ (Donaghey *in litt.* 2022), contrary to Higgins & Peter (2002), who incorrectly stated that the nestling provisioning rate was 2.2 feeds *per minute*. This (corrected) provisioning rate at the nest observed by Donaghey is consistent with 2.4 feeds h⁻¹ on Days 4 and 5 at the 2021 nest in the present study (Figure 4).

Although the incubation period of the larger Chowchilla (25 days) is equivalent to the maximum period reported for the Australian Logrunner, the former species lays only one egg, and nest attentiveness is apparently lower (42–58%: Frith *et al.* 1997; Frith & Frith 2021) than in the latter (Table 2). Mean incubation bouts at two Chowchilla nests were 29 and 52 minutes, respectively, apparently somewhat shorter than in the Australian Logrunner (Table 2), whereas absence bouts were substantially

longer (35–43 min. vs 21 min.), suggesting that female Chowchillas require more foraging time to find sufficient food. The mean nestling period of the Chowchilla is 24 ± 1.8 days (Frith *et al.* 1997), 30% longer than in the Logrunner (18.5 ± 0.5 days). Mean brooding and absence bouts during the nestling period are also apparently longer than in the Logrunner (Table 2), but sample sizes for the latter are small. On the other hand, the average provisioning rate of Chowchillas at the middle and late nestling stages was 2.0 and 4.0 meals h⁻¹, respectively (Frith *et al.* 1997), approximately a third and a half, respectively, of the provisioning rate of the Logrunner at equivalent stages of the 2021 nest in the present study (Table 2). This striking difference undoubtedly relates to the unusually long nestling period over which Chowchillas raise a single chick.

Burial of faecal sacs

At a nest in Dorriggo, north-eastern New South Wales, Vaughan & Haynes (1981, p. 29) observed a female collecting faecal sacs from her nestlings and discarding them at the site where she commenced foraging, noting that “there was no deliberate act of placing the pellet in any particular area”. In contrast, at Mary Cairncross Scenic Reserve in south-eastern Queensland, Antos (2007) observed a female emerge from a nest carrying a faecal sac in her beak, land in a relatively open area with deep leaf-litter ~8 m away, make a small excavation in the leaf-litter with her feet and deposit the faecal sac in it. Leaf-litter was then scratched over the excavation to conceal the sac before she flew off and out of sight.

Our multiple observations of the female at the 2022 nest repeatedly burying faecal sacs corroborates the single observation of Antos (2007), except that there did not appear to be any attempt by the female to excavate the litter beforehand. Antos (2007) proposed that the deliberate burial of faecal sacs functioned to conceal the location of the nearby nest from predators that use olfactory (e.g. quolls *Dasyurus* spp.) and visual (e.g. currawongs *Strepera* sp.) cues to locate prey, and reasoned that this strategy may be particularly important to species such as the Logrunner and lyrebirds *Menura* spp. that typically nest on or near the ground. We concur, adding that apart from the pittas (family Pittidae), which suffer nest predation from both mammalian and reptilian predators (Zimmermann & Noske 2004; Noske & Coates 2018), and the aforementioned species, most other ground-foraging Australian rainforest birds build arboreal nests.

Juvenile plumage and gape

As noted by Jackson (1921), the mouth of young nestling Australian Logrunners is surrounded by a swollen-looking, white gape (rectal flanges), which contrasts strongly with the black down covering most of the body (Figure 5). Although their black down provided ideal camouflage for the chicks inside the dark nest chamber, their white rectal flanges betrayed their presence when the chamber was illuminated with a torch from 10 m away. Hindwood (1934) reported that the gape turned pale yellow when the chicks were c. 2 weeks old. Our photographs show that it is creamy white when the chicks are well-feathered (Figure 6), and even after they have fledged (Figure 8). However, the bright yellow of the mouth, as noted by Jackson (1921), may give the rectal flanges the appearance of being yellowish.

Higgins & Peter (2002, p. 848) described the juvenile Logrunner as having the head mostly yellowish- to rufous-brown with blackish-brown scaling, the throat yellow-brown with dark-brown flecking, the median and secondary coverts tipped buff (vs all greyish white), the breast feathers yellow-brown, scalloped dark brown and with faint cream shaft-streaks, and the belly “dirty off-white” or cream. Our photographs show that, compared with adults, the white shaft-streaks on the mantle and scapular feathers of young juveniles are broader with rose-thorn or anchor-shaped tips (Figures 1, 14), a feature not mentioned by Higgins & Peter (2002). At least one of the 1-day-old fledglings from the second brood in 2021 had much white on the underparts (Figure 8), but the first-brood juveniles, when first discovered, had quite conspicuous whitish shaft-streaks with rose-thorn tips on the breast (Figure 1). By 29 November 2021, the juvenile, now 88 days (2.9 months) old, resembled an adult female with its rufous throat and upper breast, black ‘necklace’, mostly grey face, greyish-white tips to median and secondary coverts, and fine white shaft-streaks on the mantle and scapulars, though it retained rufous patches on the eyebrow, nape and hind-neck, and a creamy-white gape (Figure 10).

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