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Non-molecular support for the recognition of *Cryptomicroeca* (Aves: Petroicidae) separate from *Eopsaltria* and *Microeca*

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Abstract. The Yellow-bellied Flyrobin *Cryptomicroeca flaviventris*, formerly Yellow-bellied Robin, is a member of the Australo-Papuan robins (Petroicidae) and the only representative occurring in New Caledonia. Since its description in 1860 until quite recently, it was placed in the genus of yellow robins *Eopsaltria* (*E. flaviventris*). Molecular studies have shown that it is not part of the Eopsaltriinae, but is related instead to flycatchers of the Microecinae. This species was initially transferred to the genus *Microeca*, but subsequently found to be sufficiently distinct to merit its own genus, *Cryptomicroeca*. Although molecular data demonstrate its distinctness, this taxon also has several non-molecular characters that support its exclusion from *Eopsaltria* and its placement with, but separate from, *Microeca* and other members of the Microecinae. These characters, including plumage, morphology, eggs, nests, foraging behaviour and vocalisations, are discussed.

Introduction

The Yellow-bellied Flyrobin *Cryptomicroeca flaviventris* belongs to the Australo-Papuan robins (Petroicidae), which comprise 50–52 species of small to medium-small insectivorous birds centred in Australia and New Guinea, with four species in New Zealand and single outliers through the south-western Pacific Ocean as far east as Samoa (Boles 2007). This is the only species that occurs in New Caledonia. It is a moderately small (length 14–15 cm, mass 10.5–14.5 g) bird. Its crown, back and rump are dark olive-green, with the face somewhat darker (Figure 1). The greyish-white throat merges into the grey breast, which contrasts with the yellow belly and flanks. The tail is dark brown. The upper mandible is dusky brown, the lower mandible light yellowish brown, and the legs and feet are pale pinkish brown.

The species was long known as the Yellow-bellied Robin *Eopsaltria flaviventris*, but is now placed in a monospecific genus, *Cryptomicroeca*, with the English name Yellow-bellied Flyrobin. Originally described in the yellow robin genus *Eopsaltria*, it was retained there without any expressed doubt until very recently. The initial description gave the name *Eopsaltria flavigastra* (Verreaux & Des Murs 1860), but this was replaced by *Eopsaltria flaviventris* (Sharpe 1903) when the former name was found to be preoccupied.

The association of *flaviventris* with *Eopsaltria* is quite understandable: like the Eastern Yellow Robin *E. australis* and Western Yellow Robin *E. griseogularis* of Australia, it has a grey back and bright-yellow underparts (Figure 1). Further, as in the Western Yellow Robin, the upper breast is also grey. Unlike *griseogularis* and *australis*, however, *flaviventris* lacks a contrasting yellow rump, the lower back being concolorous with the tail. The two Australian species of *Eopsaltria* are also larger birds (mass 18–22 g, wing length 80–90 mm) than *flaviventris* (mass 10.5–14.5 g, wing length 77 mm).

The circumscription of *Eopsaltria* has varied over time, with the White-breasted Robin *Quoyornis georgianus* usually included until recently (Keast 1958; Schodde 1975; Mayr 1986; Schodde & Mason 1999) and, less often, the

Figure 1. Left to right: Yellow-bellied Flyrobin *Cryptomicroeca flaviventris* (adapted from photograph: Xavier Michel; https://www.oiseaux.net/photos/xavier.michel/miro.a.ventre.jaune.1.html#espece), Eastern Yellow Robin *Eopsaltria australis*, Western Yellow Robin *E. griseogularis* (Higgins & Peter 2002: Plate 23, artist: Michael Ooberhafer)

Mangrove Robin *Peneothello pulverulenta* (Schodde 1975). The resemblance of *flaviventris* to the 'true' yellow robins is much greater than to either of these two species. Three other related robins have yellow underparts: the Pale-yellow Robin *Tregellasia capito*, White-faced Robin *T. leucops* and Banded Yellow Robin *Gennaeodryas placens*. The first two of these species have been included in *Eopsaltria* at times (Keast 1958). The last was originally described in the genus *Eopsaltria*, but was subsequently moved to *Poecilodryas* (Mayr 1941, 1986) and then recently into monotypic *Gennaeodryas* (Christidis *et al.* 2011). (Note that all three species, plus White-breasted Robin, are included in *Eopsaltria* in Winkler *et al.* 2020 and Clements *et al.* 2023.)

Boles (2007, p. 441) cast doubt on the eopsaltriine affinities of *flaviventris*, noting that the eggs and juveniles "are somewhat more suggestive of species of *Microeca* rather than of *Eopsaltria*". This suggestion was confirmed by molecular work by Loynes *et al.* (2009), who recognised several subfamilies in Petroicidae, including Eopsaltriinae for *Eopsaltria* and allied genera and Microecinae for *Microeca* and monospecific *Monachella*. Loynes *et al.* (2009) found that *flaviventris* was unrelated to *Eopsaltria* or related genera, instead nesting within the traditional *Microeca* (see also Loynes *et al.* 2011).

A subsequent study by Christidis *et al.* (2011), with greater taxon sampling, showed that the several subgroups placed in *Microeca*, although related, were sufficiently divergent that this genus needed to be subdivided, and several additional genera in the Microecinae were recognised (*Microeca*: Golden-bellied Flyrobin *hemixantha*, Lemon-bellied Flyrobin *flavigaster,* Jacky Winter *fascinans*; *Kempiella:* Olive Flyrobin *flavovirescens*, Yellow-legged Flyrobin *griseoceps*; *Devioeca*: Canary Flyrobin *papuana*; the closely related Torrent Flyrobin *Monachella muelleriana* has been traditionally kept in its own genus). The results showed that *flaviventris* could not be placed into any of these other genera but, as there was no previous generic name available for this species, Christidis *et al.* (2011, 2012) erected monospecific *Cryptomicroeca* for it. The recognition of *Cryptomicroeca* and its association with the microecines, rather than the eopsaltriines, has been accepted by the major global avian checklists (Dickinson & Christidis 2014; Clements *et al*. 2023; Gill *et al*. 2024a,b; HBW & BirdLife International 2024).

Determining the correct relationships of *flaviventris* is important because it has been used in several studies on the intrarelationships of *Eopsaltria* or related genera. The similarity of the colour pattern of *flaviventris* to *Eopsaltria* (*sensu stricto*) was invoked by Ford (1979) to attempt to identify the ancestral plumage condition in *Eopsaltria*, with the strong resemblance of *flaviventris* to *griseogularis* given considerable weight. Cracraft (1986, p. 977) attempted to reconstruct "phylogenetic patterns of differentiation" among Australo-Papuan birds using several clades, including *Tregellasia* taxa for which he rooted the resultant trees with *flaviventris*. The evolution of cooperative breeding in *Eopsaltria* (*sensu lato*) and loss of seasonality in breeding was debated by Edwards & Naeem (1993) and McLennan & Brooks (1993), with the suggestion that cooperative breeding arose in the ancestor of *australis*, *griseogularis*, *georgianus* and *flaviventris*, with its subsequent loss in *flaviventris*. These last two studies assumed a sister-group relationship between *griseogularis* and *flaviventris*. Note that cooperative breeding is known in several species of microecines – Jacky Winter (Donaghey & Donaghey 2017) and Lemon-bellied Flyrobin (Noske 2011) – and likely in Papuan Flyrobin and Torrent Flyrobin (Donaghey 2017). The correct placement of *Cryptomicroeca* with the microecine rather than eopsaltriine robins renders the conclusions of these studies unsustainable.

Morphological characters that corroborate the reclassification of *flaviventris* have not been discussed other than in the very brief remarks by Boles (2007). It is the purpose of this article to expand on those non-molecular characters that support the recognition of the affinities of *Cryptomicroeca* with the Microecinae rather than the Eopsaltriinae and, further, how these corroborate the validity of this genus separate from other microecine taxa.

Selected body proportions were compared using scatter diagrams. The measurements used and methods by which they were taken are discussed below. The values used for constructing the diagrams are shown in Table 1.

Recognition of microecine affinities of *Cryptomicroeca*

There are several lines of non-molecular support for the inclusion of *Cryptomicroeca* in the Microecinae rather than the Eopsaltriinae.

Adult plumage

The primary reason for the association of *flaviventris* with *Eopsaltria* has been the similar colour pattern of yellow underparts and grey breast-band, especially in the Western Yellow Robin. Although the resemblance between *flaviventris* and *griseogularis* is striking (Figure 1), a generalised 'yellow robin' plumage is not uncommon, being found in various robin taxa, as well as other families. This colour pattern is characterised by a yellow ventral surface with a diffuse and indefinite transition to an off-white or pale-grey throat and grey or grey-brown crown, yellow-green or olive dorsum and olive-grey or brownish-olive wings and tail, which lack contrasting marking. Modifications to this include contrasting rumps or breast-bands, different colours of crown and dorsal surfaces, and increased definition of throat–breast transitions. This pattern is found in a range of genera of Petroicidae across several subfamilies: *Eopsaltria*, *Gennaeodryas*, *Tregellasia*, *Pachycephalopsis* and *Kempiella*. Eastern Yellow Robin and species of *Tregellasia* and *Kempiella* have a dusky wash on the sides of the breast, whereas in the Banded Yellow Robin, the grey extends across the breast in a well-defined band, separating the yellow lower breast and belly from the yellow throat (see images in Boles 2007). The 'yellow robin' pattern also occurs in other Australo-Papuan passerine groups, such as whistlers (*Pachycephala*: Pachycephalidae), several species of which have a yellow belly, grey breast and yellow throat similar to the plumage in the Western Yellow Robin *Eopsaltria griseogularis* and Yellow-bellied Flyrobin *Cryptomicroeca flaviventris*, and gerygone warblers (*Gerygone*: Acanthizidae). The occurrence of this colour pattern across various families shows that the similarity between Western Yellow Robin

Table 1. Values used for constructing scatter plots of selected parameters of robin body size (Figures 6–8). See text for how measurements were taken. All measurements are in mm.

Species	*Wing*	*Bill length*	*Bill width*	*Bill depth*	*Tarsus*	*Middle toe*
Rose Robin *Petroica rosea*						12.5
Scarlet Robin *Petroica boodang*						14.7
Canary Flyrobin *Devioeca papuana*	78.0	13.6	4.6	3.4	18.7	
Olive Flyrobin *Kempiella flavovirescens*	80.0	16.6	6.0	3.9	15.3	
Yellow-legged Flyrobin *Kempiella griseoceps*	70.6	12.7	4.6	3.5	13.6	11.4
Yellow-bellied Flyrobin *Cryptomicroeca flaviventris*	74.0	16.0	4.6	3.5	20.7	
Torrent Flyrobin *Monachella muelleriana*	98.0	16.0	5.6	3.7	18.9	
Golden-bellied Flyrobin *Microeca hemixantha*	74.0	13.6	5.1	3.4	12.8	
Lemon-bellied Flyrobin *Microeca flavigaster*	75.1	14.0	4.8	3.7	15.9	11.5
Jacky Winter *Microeca fascinans*	89.4	13.8	4.6	3.1	17.0	14.2
Grey-headed Robin *Heteromyias cinereifrons*	111.0	21.8	4.6	5.9	32.5	22.3
Black-throated Robin *Plesiodryas albonotata*	103.0	22.5	6.9	6.7	23.0	
Black-chinned Robin *Leucophantes brachyurus*	90.0	20.0	5.9	5.8	20.3	
Black-sided Robin *Poecilodryas hypoleuca*	76.3	17.6	5.6	5.1	17.5	
White-browed Robin *Poecilodryas superciliosa*						16.5
Buff-sided Robin *Poecilodryas cerviniventris*	87.8	18.2	5.1	4.8	22.4	
Hooded Robin *Melanodryas cucullata*	97.1	19.0	4.0	4.0	21.3	17.7
Smoky Robin *Peneothello cryptoleuca*	81.0	15.9	4.1	4.2	22.3	
Slaty Robin *Peneothello cyanus*	94.0	18.3	5.1	4.8	24.0	
White-rumped Robin *Peneothello bimaculata*	84.0	18.3	4.5	4.9	21.6	
Mangrove Robin *Peneothello pulverulenta*	84.0	19.3	4.6	4.5	22.7	18.7
Banded Yellow Robin *Gennaeodryas placens*	94.3	19.9	5.8	5.6	20.6	
Eastern Yellow Robin *Eopsaltria australis*	84.6	17.7	3.7	3.9	22.3	19.0
Western Yellow Robin *Eopsaltria griseogularis*	88.1	16.7	4.4	4.3	21.4	
White-breasted Robin *Quoyornis georgianus*	82.8	17.3	4.1	4.2	22.6	
Pale-yellow Robin *Tregellasia capito*	80.6	16.1	5.1	3.9	21.2	16.5
White-faced Robin *Tregellasia leucops*	79.4	15.5	4.6	4.1	20.6	17.0

Figure 2. Juvenile plumages (dorsal view). Left to right: Eastern Yellow Robin *Eopsaltria australis*, Yellow-bellied Flyrobin *Cryptomicroeca flaviventris*, Lemon-bellied Flyrobin *Microeca flavigaster*. Photo: Australian Museum Photography Section

and Yellow-bellied Flyrobin, used for assuming a close affinity between these species, cannot by itself be regarded as an indication of relationship.

Juvenile plumage

Within the subfamily Eopsaltriinae, there are two types of juvenile plumages: more or less unstreaked nestlings (e.g. *Poecilodryas*, *Heteromyias*) and those characterised by paler shafts to the body and covert feathers, producing a streaked appearance (e.g. *Eopsaltria*, *Peneothello*). In the unmarked plumage, body-feathers and wing-coverts are uniformly coloured without streaks or tipping. These are most often rufous or brick-red, occasionally darker brown. In the streaked plumage, the centre shaft of the feather and surrounding basal sections of the barbs are paler than the remaining portions of the web, producing a streaked appearance. The feathers may be primarily rufous, light brown or dark brown, and the streaking varies from fine (a narrow centre of paler colour) to coarse (a wide centre). The wing-coverts are usually tipped with the same pale colour as the centre shafts. In contrast, microecine robins have spotted juvenile plumages that consist of pale, slightly rounded tips to the darker feathers of the dorsum and wing-coverts and pale feathers with darker tips on the underparts (Figure 2). Colours range from olive-green, mid brown, light olive-yellow and off-white; rufous is not present. This character contributed to the placement by Vaurie (1953) of *Microeca* (*sensu lato*) with the unrelated Old World flycatchers (Muscicapidae), several genera of which have similar spotted juveniles. The juvenile of *flaviventris* is dark or medium dark brown with pale central tips to feathers (light buff), with no pale centre shafts to the feathers.

Wing-stripe

Eopsaltriine taxa have a wing-stripe on both dorsal and ventral surfaces formed by pale bases to the primaries and secondaries. This is visible on the outstretched wing, particularly in flight, but not on the folded wing. It is quite prominent in species of *Eopsaltria*. Microecine species lack this wing-stripe (Figure 3). It is also absent in *flaviventris*.

Vomer

Some robins have an anteriorly directed ‘horn’ projecting from each corner of the vomer on the palate (Schodde & Mason 1999). This structure is well developed in eopsaltriines, in which the vomerine horns are large, about the size of the maxillo-palatines, oblong, bilobed at the tip and constricted at the base. These are readily visible in ventral view of a prepared skull and through the nostril in lateral view. In contrast, in microecines the vomerine horns are tiny, only a fraction of the size of the maxillo-palatines, and taper to a point (Figure 4). In three skeletons of immature specimens of *flaviventris* (United States

Figure 3. Extended wings of (a) Yellow-bellied Flyrobin *Cryptomicroeca flaviventris* (ventral), (b) Jacky Winter *Microeca fascinans* (dorsal on left, ventral on right), (c) Eastern Yellow Robin *Eopsaltria australis* (dorsal on left, ventral on right).

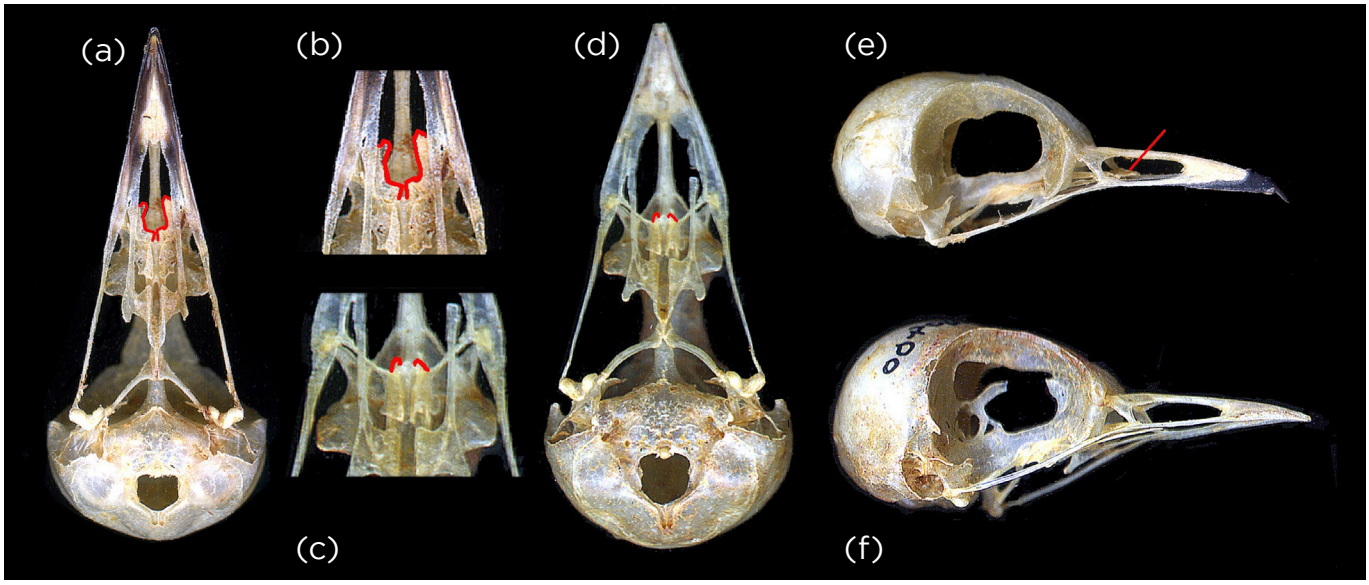

Figure 4. Vomers of Eastern Yellow Robin *Eopsaltria australis* and Jacky Winter *Microeca fascinans* showing anteriorly projecting horns in the former (outlined in red). Eastern Yellow Robin: (a) ventral, (b) ventral close-up, (e) lateral (vomerine horn indicated by red line). Jacky Winter: (c) ventral close-up, (d) ventral, (f) lateral.

National Museum 561696–561698), the vomer lacked the forward-directed horn, instead resembling the condition in microecines. (A caveat in assessing this character is that the horns can occasionally be lost during preparation and handling of a skull, and this may be more of a problem in subadult skeletons.)

Eggs

The blue or greenish-blue eggs of the yellow robins *Eopsaltria* have markings of reddish brown, ranging from small distinct spots to larger, more diffuse blotches. In some other eopsaltriine taxa, this red pigmentation appears more evenly suffused through the blue background coloration, producing a darker, rather uniform olive-green appearance, and a few have a pale-buff background with darker-buff blotches. The microecines exhibit less diversity in egg coloration: the greenish-blue to pale-blue background is more heavily and coarsely spotted and blotched all over the whole shell, but mostly at the larger end (Figure 5). The egg of *flaviventris*, as shown in the photograph in Hannecart & Letocart (1980, p. 48), does not resemble that of any eopsaltriine but is very similar to the egg of the Jacky Winter (see also Oates & Reid 1905, Plate 13).

Recognition of generic separation of *Cryptomicroeca* within the Microecinae

The characters presented above help corroborate the microecine, rather than eopsaltriine, affinities of *Cryptomicroeca*. When Loynes *et al*. (2009) first appreciated this, they placed *flaviventris* into the expanded *Microeca* as then recognised. The subsequent study of Christidis *et al.* (2011) confirmed this position, but subdivided *Microeca* into several genera. The segregation of *Cryptomicroeca*

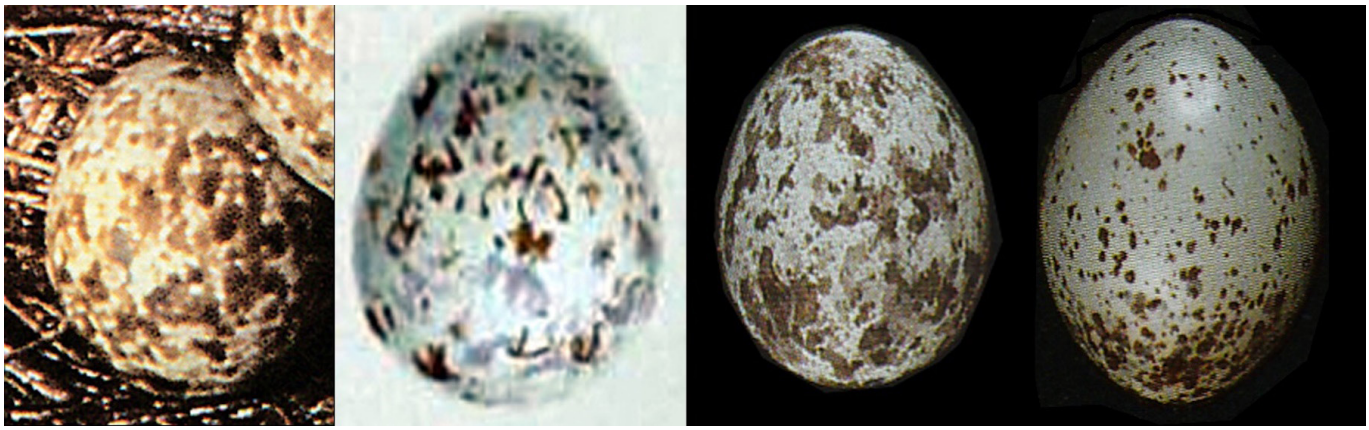

Figure 5. Eggs of microecine and eopsaltriine robins; not to scale. Left to right: Yellow-bellied Flyrobin *Cryptomicroeca flaviventris* (Hannecart & Letocart 1980, p. 48), Yellow-bellied Flyrobin (Oates & Reid 1905, Plate 13), Eastern Yellow Robin *Eopsaltria australis* (Boles 1988), Jacky Winter *Microeca fascinans* (Boles 1988).

from the other microecine genera is reinforced by several non-molecular characters.

Foraging

Eopsaltriines and microecines differ in their primary foraging modes. The former predominantly use pouncing for prey capture. A bird sits on a perch and, when prey is sighted, it flies out or drops to the ground, picks up the prey and returns to a perch to consume it. In Eastern Yellow Robins and Western Yellow Robins, this can comprise 60–97% of the foraging actions (Higgins & Peter 2002). Smaller proportions of gleaning from bark of trunks and branches, either flycatcher-gleaning items from leaf surfaces or flycatching of aerial insects, take place. Microecine taxa rely much more on flycatching and flycatcher-gleaning for prey capture, darting out from an elevated perch for flying insects or to pick off leaf surfaces. These behaviours can make up 60–100% of the foraging actions of microecine species (Croxall 1977; Bell 1984; Higgins & Peter 2002). The exception is the Jacky Winter, which relies much more on pouncing (pouncing 29–64%, flycatching 15–55%) than do other Australian and New Guinean species (Higgins & Peter 2002; Recher *et al.* 2002).

There are few descriptions of the foraging behaviour of *flaviventris*. Stokes (1980, p. 83) noted that it "forages like *E. australis* in south-eastern Australia, flying from branch to branch, peering and sometimes clinging to tree trunks", and *Birds of the World* (Boles 2023) stated that it "forages below 3 m. Prey usually captured on the ground, occasionally in low bushes. Drops onto prey in the leaf litter".

Body size

Scatter plots were constructed to compare several parameters of body size (Figures 6–8). Measurements used for these plots were Wing (flattened, straightened wing chord), Bill Length (from tip to insertion into skull at base), Bill Width and Bill Depth (taken at anterior margin of nostrils), Tarsus (from notch on plantar surface at proximal end to across scutes at distal joint) and Middle Toe without claw (from first scute at basal joint to proximal margin of claw). Most measurements of Australian species were taken from the 'Measurements' section of the species accounts in Higgins & Peter (2002). These were usually the first set of values for males of the nominate subspecies. Bill Length was taken either from Higgins & Peter (2002) or from museum specimens by me, as were Bill Width and Bill Depth. For non-Australian taxa, all measurements were taken from museum specimens. The values used for the plots are given in Table 1. There are several caveats that need to be recognised with these plots. There is variation in how certain measurements are taken, particularly among different workers. The figures used for Australian species are generally restricted to males of nominate subspecies; there is no allowance for variation in size across the distribution of the species and between sexes – females are generally somewhat smaller than males. Despite these limitations, the relative positions of the data should show no significant change if the additional values are included.

Bill shape

Correlated with the contrasting foraging methods are differences in the shape of the bill. Species that are more reliant on flycatching generally have a broader, flatter bill than those utilising other feeding methods more. As a measure of bill shape, the width (CW) and depth (CD) of the culmen of the bill (measured at the nostrils) were compared with the length (CL) (measured from insertion into the skull). The ratio CW/CL gives an indication of breadth, with greater values denoting a proportionally broader bill. The ratio CD/CL is a signal of flatness, with lower values meaning a relatively flatter bill. A scatter plot of these ratios shows that eopsaltriines and microecines segregate into two separated groups. *Cryptomicroeca* falls between these groups (Figure 6).

Tarsus and foot

Greater reliance on flycatching is associated with a shorter tarsus relative to wing than in species for which this is not the primary foraging mode (e.g. Dilger 1956; Fitzpatrick 1985). The wing is often longer and may be more pointed. Figure 7 shows the interplay between decreasing tarsal length and, sometimes increasing, wing length.

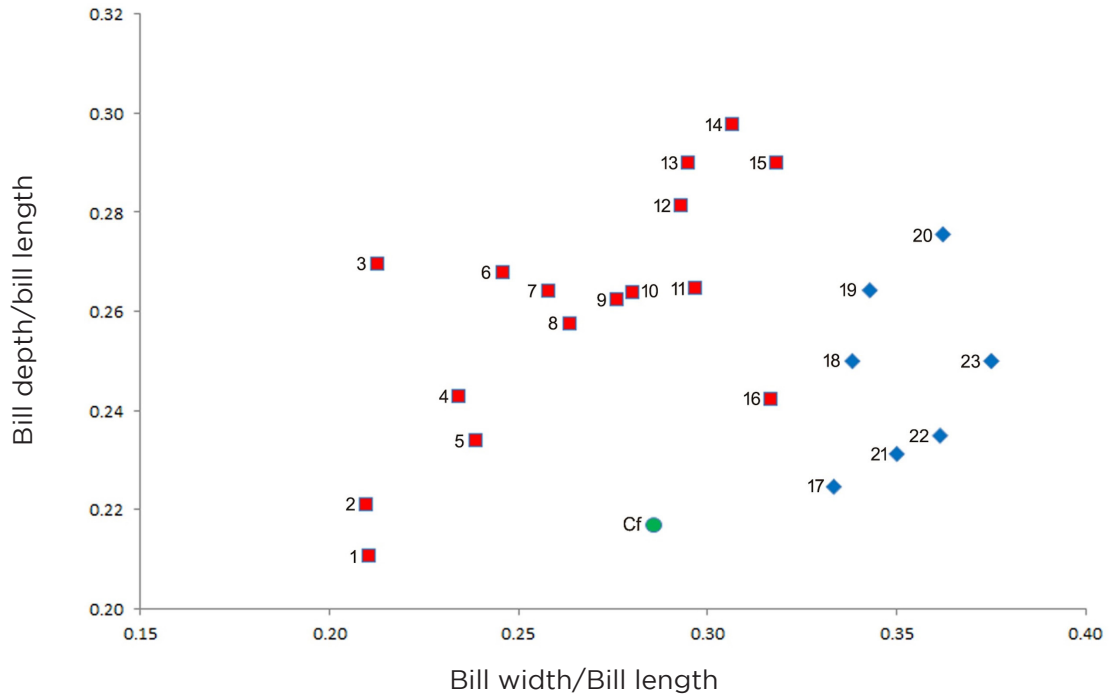

Figure 6. Plot of bill width/bill length vs bill depth/bill length for Yellow-bellied Flyrobin *Cryptomicroeca flaviventris* (green circle) compared with other microecine (blue diamonds) and eopsaltriine (red squares) robins. Cf: Yellow-bellied Flyrobin. Eopsaltriinae: 1 Hooded Robin *Melanodryas cucullata*, 2 Eastern Yellow Robin *Eopsaltria australis*, 3 Grey-headed Robin *Heteromyias cinereifrons*, 4 White-breasted Robin *Quoyornis georgianus*, 5 Mangrove Robin *Peneothello pulverulenta*, 6 White-rumped Robin *Peneothello bimaculata*, 7 Smoky Robin *Peneothello cryptoleuca*, 8 Western Yellow Robin *Eopsaltria griseogularis*, 9 Buff-sided Robin *Poecilodryas cerviniventris*, 10 Slaty Robin *Peneothello cyanus*, 11 White-faced Robin *Tregellasia leucops*, 12 Banded Yellow Robin *Gennaeodryas placens*, 13 Black-chinned Robin *Leucophantes brachyurus*, 14 Black-throated Robin *Plesiodryas albonotata*, 15 Black-sided Robin *Poecilodryas hypoleuca*, 16 Pale-yellow Robin *Tregellasia capito*. Microecinae: 17 Jacky Winter *Microeca fascinans*, 18 Canary Flyrobin *Devioeca papuana*, 19 Lemon-bellied Flyrobin *Microeca flavigaster*, 20 Yellow-legged Flyrobin *Kempiella griseoceps*, 21 Torrent Flyrobin *Monachella muelleriana*, 22 Olive Flyrobin *Kempiella flavovirescens*, 23 Golden-bellied Flyrobin *Microeca hemixantha*. Nomenclature follows Gill *et al*. (2024b).

Eopsaltriines and microecines again fall into separate groups. *Cryptomicroeca* lies outside of these.

Also frequently characterising flycatching species are shorter, more gracile toes than in those that spend more time on the ground. Although this can be discerned visually, it is hard to measure accurately on dried specimens in which the toes are curled. Because of these constraints, the smaller data set of middle toe length compared with tarsus length should be taken as indicative only. Nonetheless, it is evident that, compared with microecines, eopsaltriines have longer, more robust toes, both actually and proportionally compared with the tarsus (Figure 8). In *flaviventris*, the toes are not particularly robust, but they are longer than in other microecines and the middle toe is more elongated relative to the other toes.

Nest

Most eopsaltriines make a neat cup nest – in a few this is more bulky, less tidy – constructed of bark, dry leaves and grasses, bound externally with spiderweb and decorated with moss, lichen and pieces of bark (Figure 9). Within microecines, the two best-known species (Jacky Winter, Lemon-bellied Flyrobin) are noted for their small, flat nests, and it is on the basis of these birds that this nest structure has been ascribed for the entire genus *Microeca* (*sensu lato*). This nest form is also found in the Torrent Flyrobin. It is not, however, characteristic of all microecines. In other species, now placed in other genera, the nest is a small cup, deeper than in *Microeca* (*sensu stricto*), constructed of moss, rootlets and other dry material, bound with cobweb, more extensively decorated externally with lichen and bits of bark (Yellow-legged Flyrobin: Noske & Sticklen 1979; Canary Flyrobin: Donaghey 2017). These nests are more similar to those of eopsaltriines than is that of the Jacky Winter. The nest of *flaviventris* also more closely resembles the second type. It is well illustrated by a photograph in Hannecart & Letocart (1980) and at the Cornell Laboratory of Ornithology *Birds of the World* (https://search.macaulaylibrary.org/catalog?taxonCode=yebrob1&sort=rating_rank_desc&tag=nest).

Vocalisations

The song of the Yellow-bellied Flyrobin has been described as “a repeated short warble with phrases of rapid short peeps combined with many liquid notes” (Boles 2023). Comparing this with vocalisations of other species is somewhat subjective; however, recordings held at xeno-canto (www.xeno-canto.org), and spectrograms derived from these, allow some assessment. Recorded songs of the Yellow-bellied Flyrobin consist of high-pitched notes, some of which are lengthy single repetitions (XC340198), whereas others are two or three high-pitched, short and repeated notes (XC956973). Vocalisations of three species of *Microeca* have substantial differences. Their songs generally comprise a short series of repeated notes,

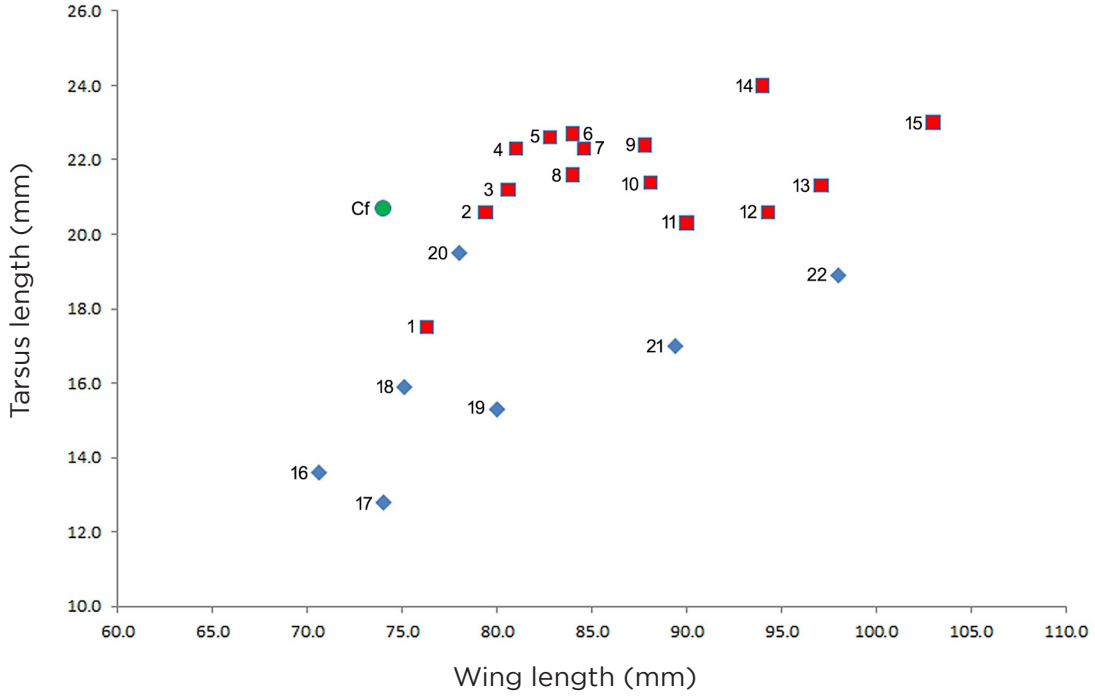

Figure 7. Plot of tarsus length (mm) vs wing length (mm) for Yellow-bellied Flyrobin *Cryptomicroeca flaviventris* (green circle) compared with other microecine (blue diamonds) and eopsaltriine (red squares) robins. Cf: Yellow-bellied Flyrobin. Eopsaltriinae: 1 Black-sided Robin *Poecilodryas hypoleuca*, 2 White-faced Robin *Tregellasia leucops*, 3 Pale-yellow Robin *Tregellasia capito*, 4 Smoky Robin *Peneothello cryptoleuca*, 5 White-breasted Robin *Quoyornis georgianus*, 6 Mangrove Robin *Peneothello pulverulenta*, 7 Eastern Yellow Robin *Eopsaltria australis*, 8 White-rumped Robin *Peneothello bimaculata*, 9 Buff-sided Robin *Poecilodryas cerviniventris*, 10 Western Yellow Robin *Eopsaltria griseogularis*, 11 Black-chinned Robin *Leucophantes brachyurus*, 12 Banded Yellow Robin *Gennaeodryas placens*, 13 Hooded Robin *Melanodryas cucullata*, 14 Slaty Robin *Peneothello cyanus*, 15 Black-throated Robin *Plesiodryas albonotata*. Microecinae: 16 Yellow-legged Flyrobin *Kempiella griseoceps*, 17 Golden-bellied Flyrobin *Microeca hemixantha*, 18 Lemon-bellied Flyrobin *Microeca flavigaster*, 19 Olive Flyrobin *Kempiella flavovirescens*, 20 Canary Flyrobin *Devioeca papuana*, 21 Jacky Winter *Microeca fascinans*, 22 Torrent Flyrobin *Monachella muelleriana*. The eopsaltriine Grey-headed Robin *Heteromyias cinereifrons* is not shown because its extraordinarily long tarsus (32.5 mm) places it well outside the plot area. Nomenclature follows Gill *et al.* (2024b).

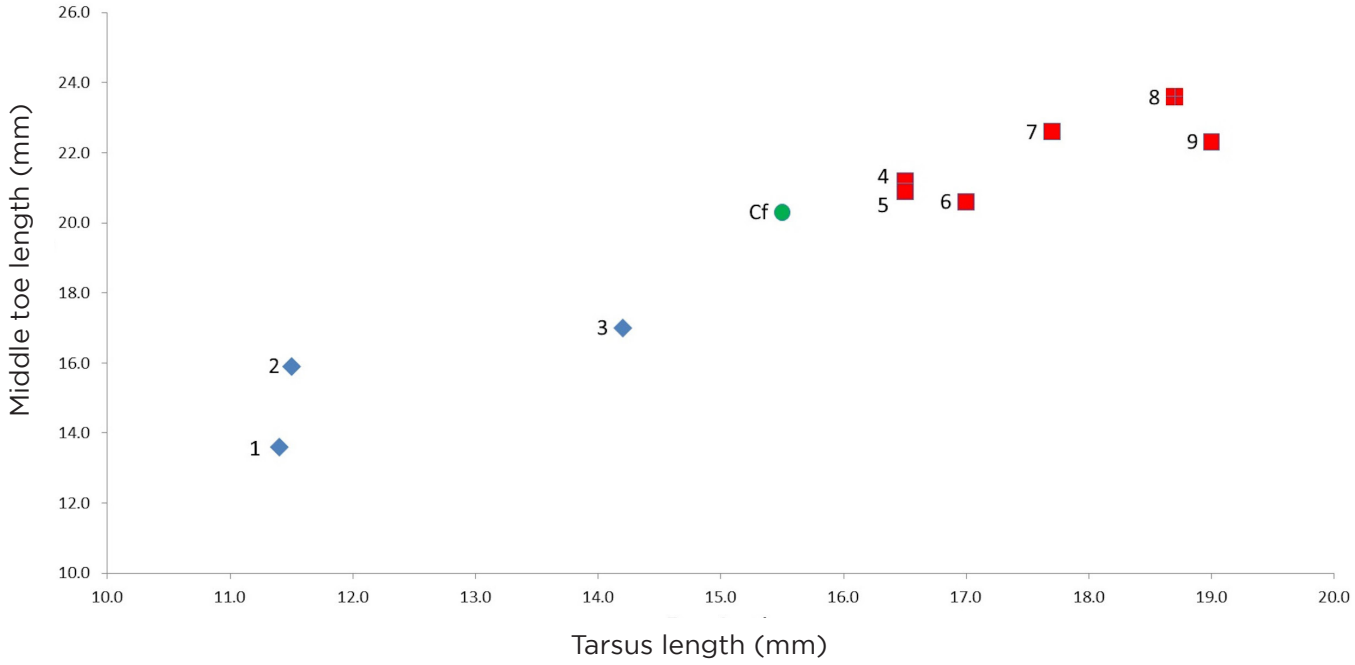

Figure 8. Plot of middle toe length (mm) vs tarsus length (mm) for Yellow-bellied Flyrobin *Cryptomicroeca flaviventris* (green circle) compared with other microecine (blue diamonds) and eopsaltriine (red squares) robins. Cf: Yellow-bellied Flyrobin. Microecinae: 1 Yellow-legged Flyrobin *Kempiella griseoceps*, 2 Lemon-bellied Flyrobin *Microeca flavigaster*, 3 Jacky Winter *Microeca fascinans*. Eopsaltriinae: 4 Pale-yellow Robin *Tregellasia capito*, 5 White-browed Robin *Poecilodryas superciliosa*, 6 White-faced Robin *Tregellasia leucops*, 7 Hooded Robin *Melanodryas cucullata*, 8 Mangrove Robin *Peneothello pulverulenta*, 9 Eastern Yellow Robin *Eopsaltria australis*.

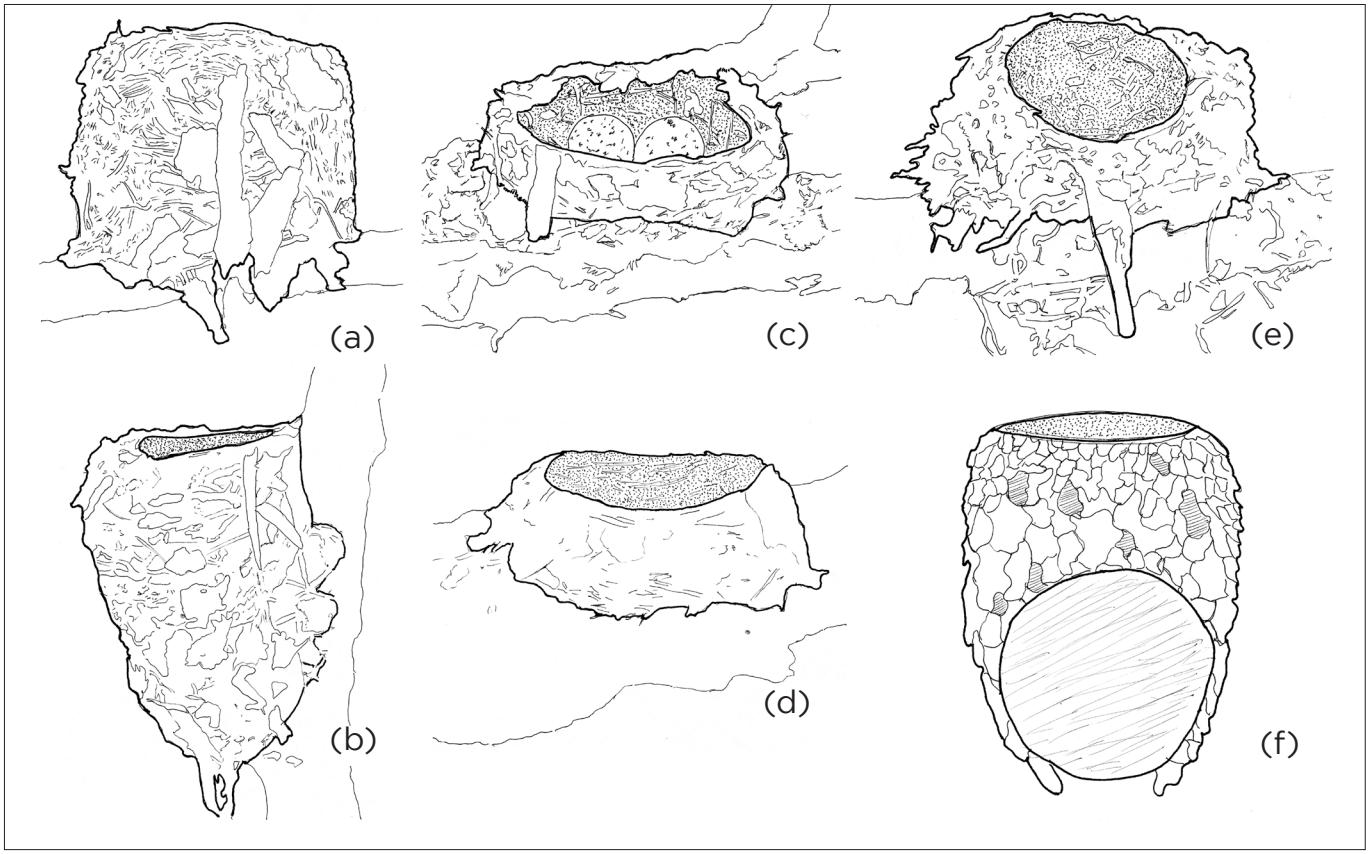

Figure 9. Nests of Yellow-bellied Flyrobin *Cryptomicroeca flaviventris* and other selected microecine robins, traced and modified from sources cited; not to scale. (a)–(b) Yellow-bellied Flyrobin, (a) Hannecart & Letocart (1980, p. 49), (b) *Birds of the World* (Boles 2023) from video: J. del Hoyo (https://search.macaulaylibrary.org/catalog?taxonCode=yebrob1&sort=rating_rank_desc&tag=nest); (c) Jacky Winter *Microeca fascinans* (North 1904, p. 150); (d) Lemon-bellied Flyrobin *M. flavigaster* (Boles 1988, p. 142, photo: J. Parnell); (e) Canary Flyrobin *Devioeca papuana* (Figure 1 in Donaghey 2017); (f) Yellow-legged Flyrobin *Kempiella griseoceps* (Figure 1 in Noske & Sticklen 1979).

interspaced by brief pauses. Although Lemon-bellied and Golden-bellied Flyrobins lack a definitive repeated *Peter, Peter, Peter*, so obvious in the Jacky Winter, the cadence is similar. Spectrograms of representative vocalisations are shown in Appendix 1. Notes added by the recordist to one recording of Yellow-bellied Flyrobin (XC340198) commented: 'This song was loud and quite unlike any *Microeca*' (P. Gregory www.xeno-canto.org/340198).

Conclusion

Although there is strong evidence that *Cryptomicroeca* belongs in the Microecinae rather than the Eopsaltriinae, there are also features that support its segregation from other microecine genera. The Yellow-bellied Flyrobin approaches eopsaltriines in the relative proportions of its bill and legs and, at least from published reports, exhibits foraging behaviour reminiscent of that group. Garcia-Navas *et al.* (2018, p. 10) regarded foraging behaviour as "a major driving force of morphological evolution in this family". Further, those authors concluded that foraging strategy rather than phylogeny influences overall morphology in the Petroicidae.

That the Yellow-bellied Flyrobin behaves like a more generalised robin is not unexpected. In the absence in New Caldeonia of other petroicine species and monarch flycatchers (Monarchidae), it has expanded its foraging zone to encompass a broader range of foraging behaviours.

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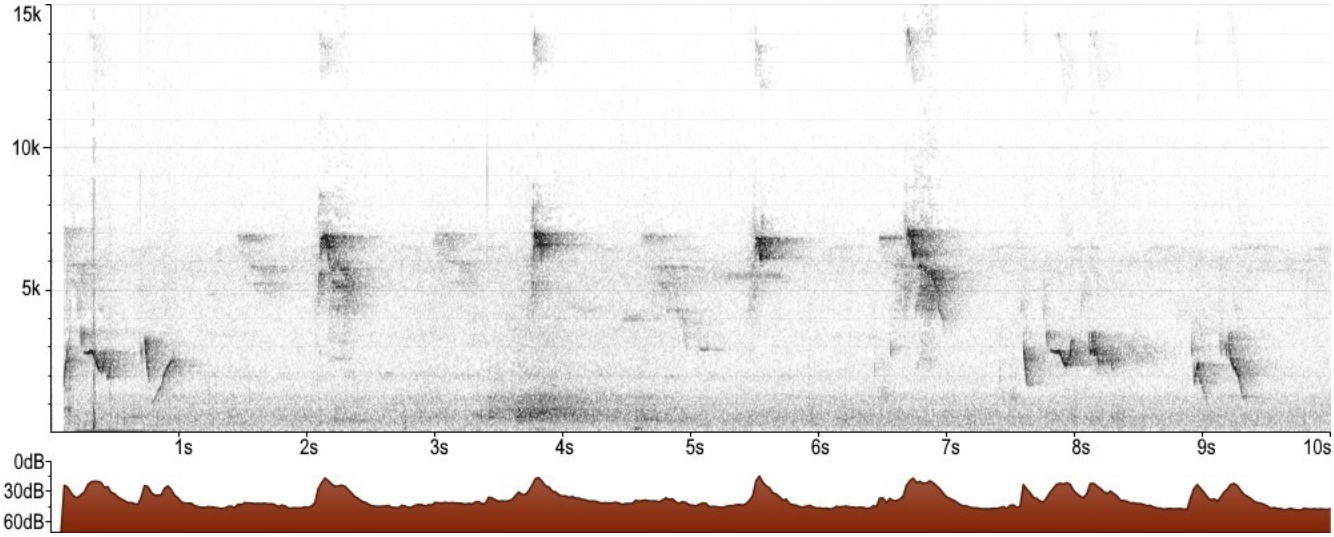
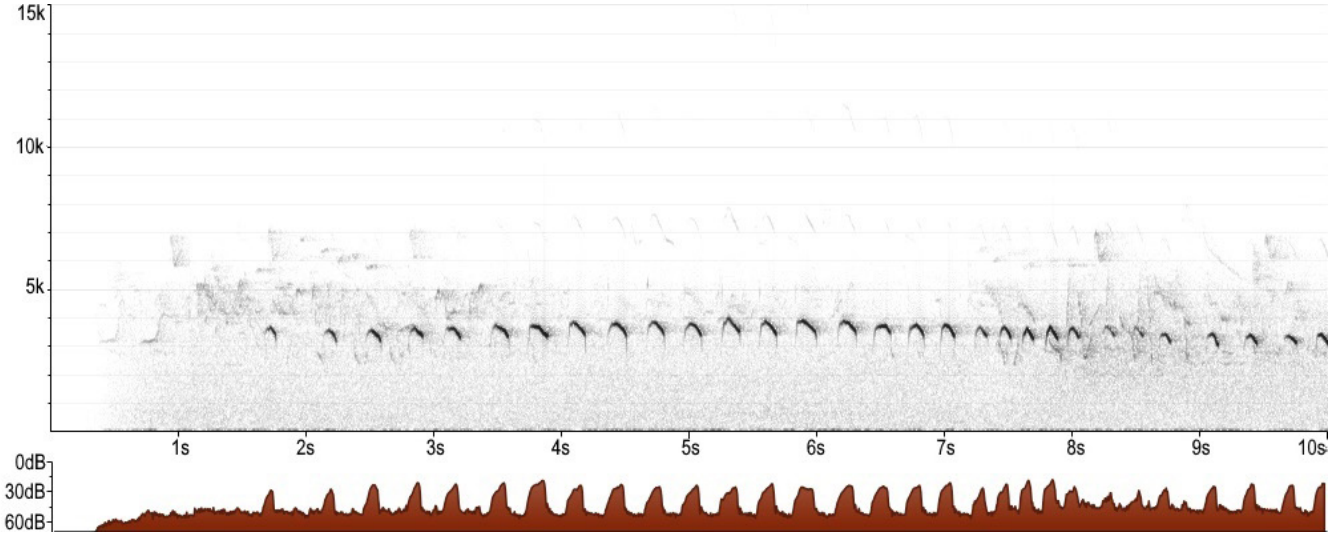
Appendix 1. Spectrograms of the songs of Yellow-bellied Flyrobin *Cryptomicroeca flaviventris* and three species of *Microeca*, taken from xeno-canto (www.xeno-canto.org). (a–b) Yellow-bellied Flyrobin *Cryptomicroeca flaviventris*. (a) XC340198,P. Gregory, www.xeno-canto.org/340198; (b) XC956973, A. Spencer, www.xeno-canto.org/956973; (c) Jacky Winter *Microeca fascinans*; XC580098, M. Anderson, www.xeno-canto.org/580098; (d) Lemon-bellied Flyrobin *M. flavigaster*; XC893185, J. Lambert, www.xeno-canto.org/893185; (e) Golden-bellied Flyrobin *M. hemixantha*; XC863291, A. Spencer, www.xeno-canto.org/863291. For each spectrogram, vertical axis shows frequency (kHz) in upper figure and volume (dB) in lower figure.

(a) Yellow-bellied Flyrobin (XC340198)



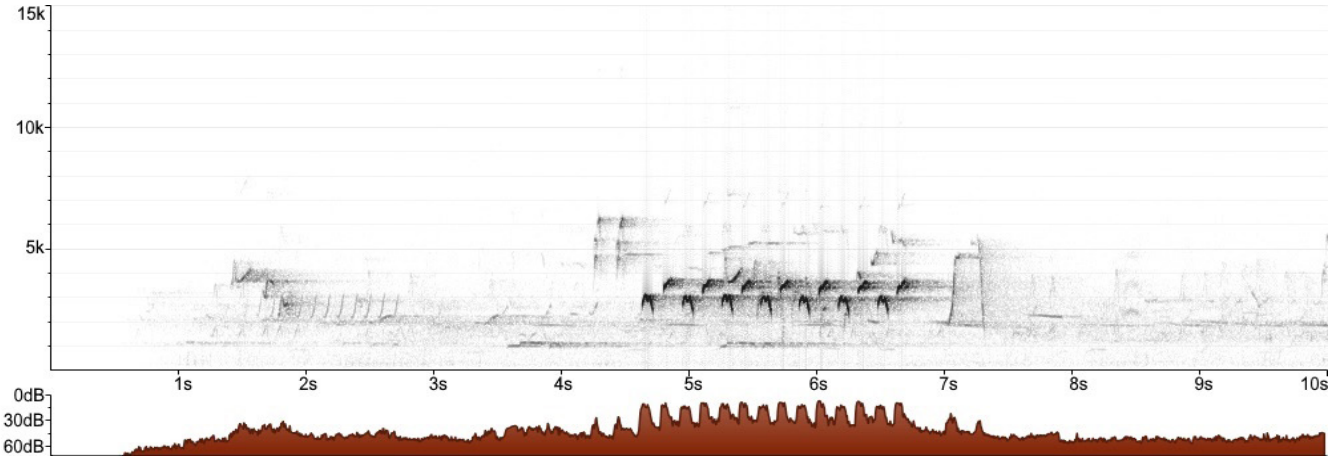
Time (seconds)

(b) Yellow-bellied Flyrobin (XC956973)



Time (seconds)

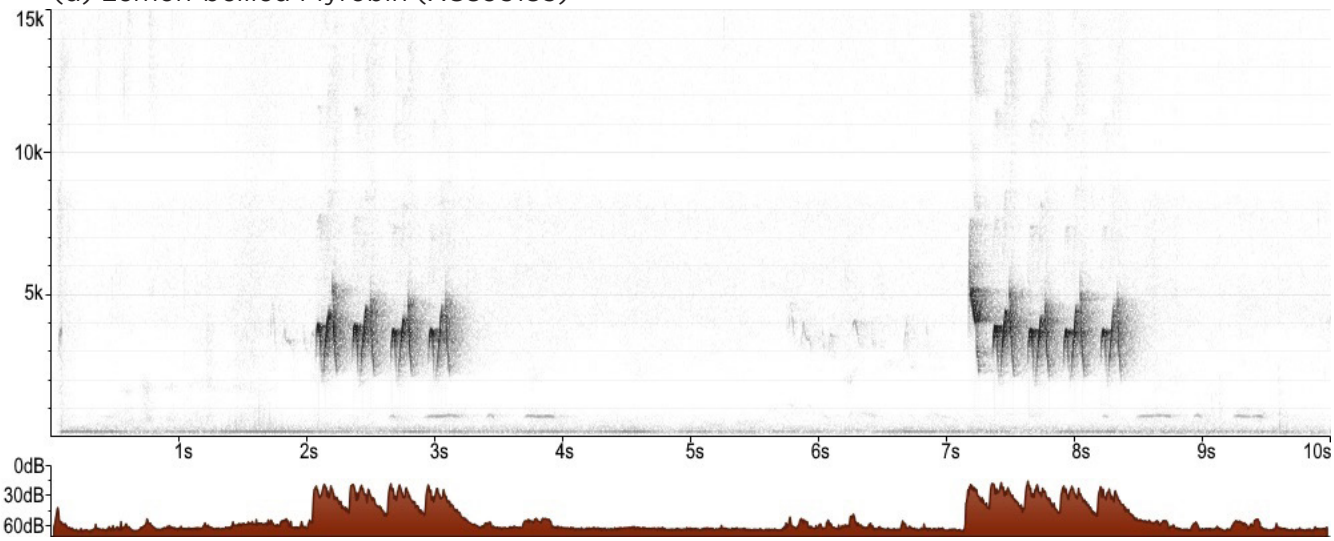
(c) Jacky Winter (XC580098)



Time (seconds)

Appendix 1 continued

(d) Lemon-bellied Flyrobin (XC893185)



(e) Golden-bellied Flyrobin (XC863291)