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Nest and egg of the Dimorphic Fantail *Rhipidura brachyrhyncha* and a review of clutch-sizes in New Guinean passerines

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Summary. The fantail species of Australasia typically build a compact cup-shaped nest of vegetable fibre bound externally with spider web, with a 'tail' extending from the base. The discovery of an active Dimorphic Fantail *Rhipidura brachyrhyncha* nest in montane Papua New Guinea revealed an atypical nest externally composed of moss, but without a 'tail'. The coloration and size of the egg were similar to those of other Australasian fantails. A clutch-size of one in montane fantail species and usually two in lowland species contributes toward an understanding that clutch-size decreases with altitude in many open-cup-nesting New Guinean fantails, monarchs, robins, honeyeaters and birds-of-paradise but not in bowerbirds, *Myzomela* and *Meliphaga* honeyeaters, berrypeckers, jewel-babblers, woodswallows and whistlers.

Introduction

Fantails (Rhipiduridae) are small insectivorous passerines comprising 44 species ranging throughout the Oriental and Australasian regions and south-western Pacific (Boles 2006). This paper follows the taxonomy and nomenclature of Gill & Donsker (2015), who also recognise 44 species following the transfer of the Yellow-bellied Fantail *Rhipidura hypoxantha* to the family Stenostiridae (fairy-flycatchers), renaming it *Chelidorhynx hypoxantha* (Fuchs *et al.* 2009; Nyári *et al.* 2009; Inskipp *et al.* 2010) and the elevation of a Rufous Fantail subspecies *R. rufifrons kubaryi* to a full species, Pohnpei Fantail *R. kubaryi*. Australasia supports 29 species of fantail and New Guinea has 13 species (which include the Rufous Fantail, an Australian migrant with resident populations on south-eastern islands of New Guinea), eight of which are endemic, strongly suggesting that the Papuan region is the centre of fantail diversity (Boles 2006).

The Dimorphic Fantail *R. brachyrhyncha* is a small 9–10-g insectivore of montane forests 2000–3800 m above sea-level (asl) in the Central Ranges, Huon Peninsula, and the Vogelkop and Foya Mountains of New Guinea. Two subspecies are recognised, the nominate *brachyrhyncha* of the Vogelkop and *devisi* of the Central Ranges and Huon Peninsula (Boles 2006). The Dimorphic Fantail coexists with the Friendly Fantail *R. albolimbata* at high elevations, mainly 2000–3600 m asl, and at lower altitudes is replaced by the Black Fantail *R. atra* (Diamond 1972; Coates 1990; Boles 2006). The nest, nest-site, egg, and clutch-size of the Dimorphic Fantail are undescribed, and this species' breeding biology

is little known (Coates 1990; Boles 2006). This paper describes the nest and egg of the Dimorphic Fantail for the first time, compares these with other fantail species, and reviews clutch-size variation in fantails and other open-cup-nesting lowland and montane passerines of New Guinea.

Study site and methods

From 2 October to 17 November 2011, I studied robins (Petroicidae) in montane rainforest at 2800 m asl around Kumul Lodge, on the southern slopes of Mt Hagen, Papua New Guinea (5°26′S, 143°45′E). Montane rainforest occurs above 2700 m asl at Kumul Lodge and is characterised by a low canopy layer (average height of 15 m, with some taller emergent trees) of mostly broad-leaved and some coniferous trees, many tall *Pandanus*, a dense layer of scrambling bamboo *Nastus* sp. and shrubs including Vireya Rhododendron *Rhododendron macgregoriae*, an abundance of *Cyathea* tree-ferns, and a dense ground-layer of mosses, ferns and herbs (Robbins 1970; RHD pers. obs.). The rainfall and temperature at Mt Hagen township are equable, with least rain from June to August (average of 146 mm/month) and the wettest season from November to April (average of 222 mm/month in November–December and an average of 274 mm/month from January to April) (McAlpine 1970). During my stay in October–November, heavy rain fell most afternoons and evenings.

On 7 November 2011, I heard the tinkling song of a Dimorphic Fantail and watched two dark-morph Fantails flitting around the outer foliage of tall trees 5–6 m above the ground. At 1400 h, one Fantail flew to and settled on a nest in scrambling bamboo beside a tall *Pandanus* (Figures 1–2). On 17 November, the day before I left Kumul Lodge and after I finished my last robin nest-watch at 0800 h, I prepared to climb to the nest and check its contents. To reach the nest, Max Mal, a local villager, first built a 4.3-m bush ladder. Then two 5-m poles with pointed ends were carried up a steep slope to the nest-site, rammed into the ground and angled toward the nest. The ladder was leant against the poles and tied to them with vines. This bush construction was erected in stages over 2 hours to minimise disturbance and allow the Fantail to continue sitting on the nest. From the top of the ladder, I photographed the nest (Figure 1), stretched across to measure the nest and retrieve the single egg, descended to the ground and photographed the egg (Figure 2, right). The egg was measured to the nearest 0.1 mm with Bergeon callipers. It was replaced in the nest, the ladder dropped to the ground, and we quickly left the immediate area, after which a Fantail returned to the nest.

Observations

Nest, egg and clutch-size

The Dimorphic Fantail nest was cup-shaped, with no ‘tail’, and was composed externally of bright-green moss. It was placed in the outer foliage above the stems of scrambling bamboo at a height of 4.9 m above the ground on the northern side of a tall *Pandanus* near a forest path. The external diameter of the nest measured 10 cm, and the external depth was 6 cm. The internal nest-cup diameter was 5 cm and the depth was 3 cm. I was unable to confirm the lining materials of the nest because the ladder was too far from the nest.

The egg measured 18.3 mm × 13.4 mm and was off-white, spotted with red-brown, light brown and dark brown, forming a ring of darker blotches on the larger end (Figure 2).

Figure 1. Close-up photograph of Dimorphic Fantail nest built externally of moss and located in scrambling bamboo in montane rainforest, Mt Hagen, Papua New Guinea. Photo: Richard H. Donaghey

Figure 2. Left: Dimorphic Fantail sitting on the nest in scrambling bamboo. Right: Egg. Photos: Richard H. Donaghey

Incubation behaviour

From 7 to 16 November, on nine occasions while I was walking below the nest, a Dimorphic Fantail was observed incubating six times and both Fantails of the pair were foraging near the nest three times, with one returning to the nest twice. No change-overs were observed, but no prolonged nest-watches were conducted so it was not possible to confirm that both male and female incubated. In the sexually dimorphic Black Fantail, incubation is performed by both male and female, and the incubating bird flies away from the nest before the relieving bird flies into the nest-tree (RHD pers. obs.).

Discussion

Breeding season

Observations of an adult Dimorphic Fantail carrying nesting material in late December (Coates 1990), a juvenile in early June (Coates 1990), and brood-patches in October and November (Frith & Frith 1993) indicate that breeding occurs in the wet season. My observations of incubation in November confirm breeding in the early wet season.

Nest

A typical fantail nest is represented by the cup-shaped nest of fine bark bound externally with spider web, and with a 'tail' extending below the base, built by the New Zealand Fantail *R. fuliginosa* and five fantail species in Australia excluding the Willie Wagtail *R. leucophrys* (Higgins *et al.* 2006). Of the eight endemic fantail species in New Guinea, typical nests with a 'tail' are built by five species (White-bellied Thicket Fantail *R. leucothorax*, Black Fantail, Chestnut-bellied Fantail *R. hyperythra*, Friendly Fantail and Rufous-backed Fantail *R. rufidorsa*) and the nests of two species of (thicket) fantail are undescribed (Harrison & Frith 1970; Coates 1990). Of the 44 species recognised by Boles (2006), 21 build a typical fantail nest with a 'tail', six build a similar fantail nest with no 'tail', the nest is undescribed for 15 species, and only the Yellow-bellied Fantail (now reclassified as a fairy-flycatcher) builds atypical nests of moss (Boles 2006) similar to the Dimorphic Fantail in the present observation. Moss is an abundant resource in the montane forests of New Guinea and the Himalayas.

In three regions of southern Australia, the Grey Fantail *R. albiscapa* builds nests with an average external diameter, internal diameter and internal depth, respectively, of 5.7 cm (range 5.1–6.4 cm), 4.1 cm (3.8–4.4 cm) and 2.9 cm (2.5–3.2 cm) (Higgins *et al.* 2006). By comparison, the external and internal diameter of two nests of the New Zealand Fantail measured 9.5 and 5.1, and 8.3 and 5.1 cm, respectively (Stidolph 1923), similar in size to the nest of the Dimorphic Fantail, even though the body mass of Grey and New Zealand Fantails (8 g) is less than that of the Dimorphic Fantail (9–10 g) (Higgins *et al.* 2006).

There is a possibility that the atypical moss nest of the Dimorphic Fantail described herein was not built by the Dimorphic Fantail. However, this is unlikely,

considering that there is no evidence that fantails use nests of other species and mostly build new nests many times in a season. Further descriptions of active nests and observations of Dimorphic Fantails building nests are needed to discount this possibility and to confirm if building moss nests is typical.

The egg, and clutch-size

The ground-colour of fantail eggs is white, yellowish white, creamy white, pinkish white or cream (Coates 1990; Boles 2006). The whitish ground-colour and size of the Dimorphic Fantail egg are similar to those of Australian fantails except the Willie Wagtail (Johnstone & Storr 2004), the White-bellied Thicket Fantail and the Chestnut-bellied Fantail, but not the Rufous-backed Fantail (pinkish white) or Black Fantail (cream) (Harrison & Frith 1970; Coates 1990). Clutch-size in the Dimorphic Fantail nest documented here was one, though this requires more data for confirmation. Of the 11 other New Guinean fantail species, clutch-size in New Guinea is two to three in the lowland Willie Wagtail (Peckover & Filewood 1976; Coates 1990; Dyrcz 1994) and two or usually two in four mostly lowland species (Coates 1990; Appendix 1). For two other lowland species, the clutch-size in Australia is two in the Arafura Fantail *R. dryas* and one to three (usually two) in the Mangrove Fantail *R. phasiana* (Johnstone & Storr 2004). Clutch-size is one in the montane Black Fantail, and undescribed for the montane Friendly Fantail and two lowland species (Sooty Thicket Fantail *R. threnothorax* and Black Thicket Fantail *R. maculipectus*) (Harrison & Frith 1970; Coates 1990; Appendix 1). This suggests a decrease in clutch-size with elevation. In New Guinea, the Willie Wagtail also occurs in highland grasslands up to 2800 m asl but it is not known if its clutch-size decreases with elevation.

Clutch-size in some other open-cup-nesting New Guinean passerines is reviewed below to determine if other avian families exhibit a clutch-size pattern similar to that of fantails. A comprehensive database of clutch-size and altitude for open-cup-nesting passerines of New Guinea, excluding the satellite islands, arranged in phylogenetic sequence, is presented in Appendix 1. Inclusion of species with unknown clutch-size highlights the lack of information on nests and egg(s) for over half of the open-cup-nesting passerine birds breeding in New Guinea, including 26 species that also breed in northern Australia. Inclusion in Appendix 1 of species with no data on clutch-size complements and verifies information in the text and importantly enables naturalists and birdwatchers in New Guinea to rapidly determine those species and make valuable contributions to knowledge as opportunities arise.

Literature review of clutch-size in New Guinean open-cup-nesting passerines

In seven of 12 species of New Guinean bowerbirds (Ptilonorhynchidae), clutch-size is one or mostly one in two lowland species, four montane species, and in the Yellow-breasted Bowerbird *Chlamydera lauterbachi*, which ranges from sea-level to 1800 m asl. Clutch-size is undescribed for the remaining five species (Frith & Frith 2004, 2009a; Appendix 1).

Within the Meliphagidae (honeyeaters), the largest New Guinean passerine family, data on clutch- and brood-size for both lowland and montane species are available only in the genera *Myzomela* and *Meliphaga* (Appendix 1). In two lowland and one montane *Myzomela* species, brood-size (and probably clutch-size) is two, so there appears to be no decrease in clutch-size with altitude. For seven *Meliphaga* species inhabiting lowland and hill forest up to 1500 m asl, clutch-size is two in three species, one to two in one species, and undescribed in three species. For two *Meliphaga* species ranging from <1000 m to 1900 m asl, clutch-size is two in the Mountain Honeyeater *M. orientalis* and one to two in the Scrub Honeyeater *M. albonotata* (Coates 1990; Appendix 1). Thus, there is no evidence that clutch-size decreases with elevation, although no *Meliphaga* species are truly montane.

In all species of montane honeyeaters in the genera *Ptiloprora*, *Macgregoria* (formerly classified as a bird-of-paradise), *Melipotes* and *Melidectes*, clutch- or brood-size is one or undescribed (Coates 1990; Frith & Frith 1992; Higgins *et al*. 2008; RHD pers. obs.; Appendix 1). In lowland honeyeaters, clutch- or brood-size is two in the Silver-eared Honeyeater *Lichmera alboauricularis*, Long-billed Honeyeater *Melilestes megarhynchus*, Rufous-banded Honeyeater *Conopophila albogularis*, Obscure Honeyeater *Caligavis obscura* and Yellow-tinted Honeyeater *Ptilotula flavescens*, and two to three in two *Philemon* species (Coates 1990; Higgins *et al*. 2008; Appendix 1). Although clutch-size is unknown for about half of New Guinea's honeyeaters, and mostly lowland species are smaller than montane species, known clutch-size is two or three in most lowland and one in many montane species. To validate further the hypothesis that in honeyeaters clutch-size decreases with elevation, more data are needed for those genera with lowland and montane species and for genera that inhabit only montane areas.

Within the boatbills (Machaerirhynchidae), the Yellow-breasted Boatbill *Machaerirhynchus flaviventer* has a clutch of two in lowland Cape York Peninsula, Queensland (Barnard 1911; MacGillivray 1918) but clutch-size is undescribed in New Guinea. The montane Black-breasted Boatbill *M. nigripectus* has a clutch-size of two (Coates 1990), suggesting that there is no decrease in clutch-size with altitude. In jewel-babblers *Ptilorrhoa* spp. (Psophodidae), berrypeckers (Melanocharitidae), woodswallows (Artamidae) and whistlers (Pachycephalidae) there is no decrease in clutch-size with elevation (Appendix 1). Clutch-size is unknown or there are insufficient data for lowland and montane *Peltops* species (Artamidae), cuckooshrikes, cicadabirds and trillers (Campephagidae), drongos (Dicruridae), grassbirds (Locustellidae), white-eyes (Zosteropidae) and pipits (Motacillidae) to determine clutch-size variation with altitude (Appendix 1).

Of seven species of resident lowland monarchs (Monarchidae) in New Guinea, clutch-size is two in three lowland species (Spot-winged Monarch *Symposiarchus guttula*, Hooded Monarch *S. manadensis* and Frilled Monarch *Arses telescopthalmus*) and undescribed for four species (Coates 1990; Coates *et al*. 2006; Appendix 1). The montane Black Monarch *S. axillaris* ranges from 750 to 2110 m asl and has a clutch of one (Harrison & Frith 1970; Coates 1990; Donaghey 2015). Three lowland *Myiagra* species have a clutch-size of mostly two or three (Appendix 1). The montane Torrent-lark *Grallina bruijnii* has a clutch-size of one,

but for the lowland Magpie-lark *G. cyanoleuca* the clutch-size in New Guinea is undescribed (Appendix 1). Clutch-size is one in the montane Blue-capped Ifrit *Ifrita kowaldi* (Coates 1990; Frith & Frith 1992). This species is now placed in the monotypic family Ifritidae (Gill & Donsker 2015) but is considered to have a strong association with the Monarchidae (Norman *et al*. 2009).

Excluding three species of satinbirds (Cnemophilidae), 33 species of birds-of-paradise inhabit New Guinea. For ten lowland species, clutch-size is two in the Jobi Manucode *Manucodia jobiensis*, probably mostly two in the Magnificent Riflebird *Ptiloris magnificus* and the recently split Growling Riflebird *P. intercedens*, mostly two in the Raggiana Bird-of-paradise *Paradisaea raggiana*, one or two in two other manucode species, King Bird-of-paradise *Cicinnurus regius*, and Twelve-wired Bird-of-paradise *Seleucidis melanoleucus*, one in the Greater Bird-of-paradise *Paradisaea apoda* and undescribed in the Pale-billed Sicklebill *Drepanornis bruijnii* (Frith & Beehler 1998; Frith & Frith 2009b; Appendix 1). In the Crinkle-collared Manucode *Manucodia chalybatus* of hill and lower montane forest, clutch-size is one or two. In 22 montane species, clutch-size is one in the Short-tailed Paradigalla *Paradigalla brevicauda*, three *Astrapia* species, Lawes's Parotia *Parotia lawesii*, Eastern Parotia *P. helenae*, King of Saxony Bird-of-paradise *Pteridophora alberti*, Brown Sicklebill *Epimachus meyeri* and Blue Bird-of-paradise *Paradisaea rudolphi*, one or two in the Black-billed Sicklebill *Drepanornis albertisi*, Magnificent Bird-of-paradise *Diphyllodes magnificus*, Lesser Bird-of-paradise *Paradisaea minor* and Emperor Bird-of-paradise *P. guilielmi*, and undescribed in nine species (Frith & Frith 2009b; Appendix 1). Thus, birds-of-paradise show a slight decrease in clutch-size with elevation.

Among 25 species of New Guinean robins (Petroicidae), clutch-size is known for eight of the 19 montane and hill-forest species and three of the six truly lowland species (Appendix 1). Six montane robins that have a one-egg clutch are: Ashy Robin *Heteromyias albispecularis*, two *Peneothello* species, two *Pachycephalopsis* species and the Lesser Ground Robin *Amalocichla incerta* (Coates 1990; RHD pers. obs.). The Torrent Flyrobin *Monachella muelleriana* has a clutch-size of two, and the White-faced Robin *Tregellasia leucops* has a clutch-size of one to two (Coates 1990). Clutch-size for three lowland species is two in the Mangrove Robin *Peneoenanthe pulverulenta* and Olive Flyrobin *Microeca flavovirescens*, and one to two in the Lemon-bellied Flyrobin *M. flavigaster* (Coates 1990). A paired phylogenetic comparison of lowland and montane robins is not possible because clutch-size is undescribed for all four *Poecilodryas* species, the hill-forest White-rumped Robin *Peneothello bimaculata*, and two montane *Microeca* species.

There is a trend for a decrease in clutch-size with elevation in New Guinean open-cup-nesting fantails, monarchs, robins, most honeyeaters and birds-of-paradise, but not in bowerbirds, *Myzomela* and *Meliphaga* honeyeaters, berrypeckers, jewel-babblers, woodswallows, whistlers and possibly boatbills. Clutch-size of landbirds varies globally from an average of 4.5 eggs in northern latitudes to just over two in the tropics and most southern latitudes in Australasia, the Afrotropics and Oceania (Jetz *et al*. 2008). Clutch-size is determined by the interaction of intrinsic biological traits, such as body size and nest type, with the environment and phylogeny (Jetz *et al*. 2008). The main factor promoting an increase in

clutch-size with latitude is resource seasonality linked with a decrease in nest-predation rate and annual adult survival from the tropics to the poles (Griebeler *et al.* 2010). Martin *et al.* (2000) tested the role of parental care and variation in clutch-size in North and South American birds, and found that the food-limitation and nest-predation hypotheses explained clutch-size variation within North and South America but not between latitudes. A decrease in passerine clutch-size with elevation is supported by Slagsvold (1981), Krementz & Handford (1984), Badyaev (1997), Badyaev & Ghalambor (2001) and Johnson *et al.* (2006) for Eurasia and North America but not by Peh *et al.* (2012) for south-eastern Asia.

Twenty-three pairs of closely related taxa of temperate Asian cardueline finches had smaller clutches and fewer broods at higher elevations (Badyaev 1997). For 48 phylogenetically paired passerine taxa in 12 families, species at higher elevations also had smaller clutches and fewer broods per year (Badyaev & Ghalambor 2001). Clutch-size of the Mountain Bluebird *Sialia currucoides* was slightly smaller at higher elevations (Johnson *et al.* 2006). Peh *et al.* (2012) assessed eight ecological traits of lowland and montane non-passerine and passerine south-eastern Asian birds to explain altitudinal specialisation, and found that lowland birds below 1000 m asl had smaller clutch-sizes than montane species restricted to elevations above 1000 m asl. However, their study did not rule out the possibility that clutch-size decreases with altitude within a species or between closely related species of open-cup-nesting passerines. More data on clutch-size in passerine bird species and families in New Guinea and a rigorous paired analysis that accounts for body size, nest type and phylogeny are needed before a clear pattern of clutch-size between lowland and montane species emerges.

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Postscript: Discovery of a second Dimorphic Fantail nest

From 23 October to 6 December 2014 at Camp 12 (06°02′S, 146°50′E; 2340 m asl) in the YUS Conservation Area, Huon Peninsula, Papua New Guinea, I studied mid-montane robins (Petroicidae). At 1730 h on 30 November, while ascending a steep trail after watching a Slaty Robin *Peneothello cyanus* nest, I heard the song of a Dimorphic Fantail. I paused and watched a pale-morph Dimorphic Fantail adding dry narrow leaves, ~3–5 mm wide and 30–40 mm long, to the interior of a nest placed amongst the outer foliage and stems of scrambling bamboo ~2.5 m above the ground. The cup-shaped nest was built externally of green moss and had no 'tail'. Later observations revealed that while the pale-morph bird (presumably the female) was building the nest its dark-morph mate perched nearby and sang. When I left Camp 12 on 6 December to descend to Sapmanga airstrip, the nest was complete but no Fantail was sitting on the nest so I was unable to determine if both the male and the female incubate. This observation confirms that the Dimorphic Fantail builds a moss nest with no 'tail'.

Richard Donaghey

Appendix 1. Clutch-size and altitudinal niche of open-cup-nesting passerines of New Guinea, excluding the satellite islands. Taxonomy and phylogenetic sequence follow Gill & Donsker (2015). Altitudinal niche (A): L = lowland species mostly occurring below 1000 m asl, L-M = lowland and hill-forest species mostly occurring below 1200 m but ranging to 1500 m (occasionally 2000 m) asl, M = montane species ranging from 1000 to 4000 m asl but mostly above 1500 m asl, M(L) = predominantly montane but some lowland populations. Clutch-size (C) has range in parentheses, e.g. 1 (1–2) = clutch-size mostly one (range one–two); b = brood-size; f = number of fledglings. Sources: This paper for Dimorphic Fantail; RHD (pers. obs.) for Rufous-backed Honeyeater; Frith & Frith (2009a,b) for bowerbirds and birds-of-paradise, respectively; Higgins *et al.* (2008) for Mottle-breasted Honeyeater and Mountain Honeyeater; Madge (2006) for Papuan Grassbird; and Coates (1990) for all other species.

Genus	*Species*	*Common name*	*A*	*C*
Ptilonorhynchidae: Bowerbirds				
Ailuroedus	*buccoides*	White-eared Catbird	L	1
	melanotis	Black-eared Catbird	L-M	1 (1–2)
Archboldia	*papuensis*	Archbold's Bowerbird	M	1
Amblyornis	*inornata*	Vogelkop Bowerbird	M	1
	macgregoriae	Macgregor's Bowerbird	M	1
	subalaris	Streaked Bowerbird	M	
	flavifrons	Golden-fronted Bowerbird	M	
Sericulus	*aureus*	Masked Bowerbird	M	
	ardens	Flame Bowerbird	L	
	bakeri	Fire-maned Bowerbird	M	
Chlamydera	*lauterbachi*	Yellow-breasted Bowerbird	L-M	1
	cerviniventris	Fawn-breasted Bowerbird	L	1
Meliphagidae: Honeyeaters				
Myzomela	*eques*	Ruby-throated Myzomela	L	2b
	obscura	Dusky Myzomela	L	2b
	cruentata	Red Myzomela	M	
	nigrita	Papuan Black Myzomela	L	
	erythrocephala	Red-headed Myzomela	L	
	adolphinae	Mountain Myzomela	M	
	rosenbergii	Red-collared Myzomela	M	2b
Glycichaera	*fallax*	Green-backed Honeyeater	L	
Ptiloprora	*plumbea*	Leaden Honeyeater	M	
	meekiana	Yellowish-streaked Honeyeater	M	
	erythropleura	Rufous-sided Honeyeater	M	
	guisei	Rufous-backed Honeyeater	M	1b
	mayri	Mayr's Honeyeater	M	
	perstriata	Grey-streaked Honeyeater	M	1
Pycnopygius	*ixoides*	Plain Honeyeater	L	
	cinereus	Marbled Honeyeater	M	

Appendix 1 continued—**Meliphagidae: Honeyeaters**

Genus	*Species*	*Common name*	*A*	*C*
Pycnopygius	*stictocephalus*	Streak-headed Honeyeater	L	
Lichmera	*indistincta*	Brown Honeyeater	L	
	alboauricularis	Silver-eared Honeyeater	L	2
Xanthotis	*polygrammus*	Spotted Honeyeater	L-M	
	flaviventer	Tawny-breasted Honeyeater	L	2
Philemon	*meyeri*	Meyer's Friarbird	L	2
	brassi	Brass's Friarbird	L	
	citreogularis	Little Friarbird	L	
	novaeguineae	New Guinea Friarbird	L-M	(2–3)
	corniculatus	Noisy Friarbird	L	
Entomyzon	*cyanotis*	Blue-faced Honeyeater	L	
Melithreptus	*albogularis*	White-throated Honeyeater	L	
Melilestes	*megarhynchus*	Long-billed Honeyeater	L-M	2
Macgregoria	*pulchra*	Macgregor's Honeyeater	M	1
Melipotes	*gymnops*	Arfak Honeyeater	M	
	fumigatus	Common Smoky Honeyeater	M	1b
	carolae	Wattled Smoky Honeyeater	M	
	ater	Spangled Honeyeater	M	
Timeliopsis	*fulvigula*	Olive Straightbill	M	1
	griseigula	Tawny Straightbill	L	2f
Conopophila	*albogularis*	Rufous-banded Honeyeater	L	2 (1–3)
Caligavis	*subfrenata*	Black-throated Honeyeater	M	
	obscura	Obscure Honeyeater	L-M	2
Melidectes	*fuscus*	Sooty Melidectes	M	1
	nouhuysi	Short-bearded Melidectes	M	1
	princeps	Long-bearded Melidectes	M	1b
	ochromelas	Cinnamon-browed Melidectes	M	
	leucostephes	Vogelkop Melidectes	M	
	rufocrissalis	Yellow-browed Melidectes	M	1b
	foersteri	Huon Melidectes	M	
	belfordi	Belford's Melidectes	M	1b
	torquatus	Ornate Melidectes	M	
Gavicalis	*versicolor*	Varied Honeyeater	L	2
Ptilotula	*flavescens*	Yellow-tinted Honeyeater	L	2b
Meliphaga	*mimikae*	Mottle-breasted Honeyeater	L-M	2
	montana	Forest Honeyeater	L-M	
	orientalis	Mountain Honeyeater	L-M	2
	albonotata	Scrub Honeyeater	L-M	(1–2)
	analoga	Mimic Honeyeater	L-M	
	gracilis	Graceful Honeyeater	L	

Appendix 1 continued—**Meliphagidae: Honeyeaters**

Genus	*Species*	*Common name*	*A*	*C*
Meliphaga	*cinereifrons*	Elegant Honeyeater	L	2
	flavirictus	Yellow-gaped Honeyeater	L-M	
	aruensis	Puff-backed Honeyeater	L-M	(1–2)
Oreornis	*chrysogenys*	Orange-cheeked Honeyeater	M	
Melanocharitidae: Berrypeckers & longbills				
Melanocharis	*arfakiana*	Obscure Berrypecker	L	
	nigra	Black Berrypecker	L	1 (1–2)
	longicauda	Mid-mountain Berrypecker	M	
	versteri	Fan-tailed Berrypecker	M	1
	striativentris	Streaked Berrypecker	M	2
Rhamphocharis	*crassirostris*	Spotted Berrypecker	M	
Oedistoma	*iliolophus*	Dwarf Longbill	L-M	1
	pygmaeum	Pygmy Longbill	L-M	
Toxorhamphus	*novaeguineae*	Yellow-bellied Longbill	L	
	poliopterus	Slaty-headed Longbill	M	1
Paramythiidae: Painted berrypeckers				
Oreocharis	*arfaki*	Tit Berrypecker	M	
Paramythia	*montium*	Crested Berrypecker	M	1
Psophodidae: Whipbirds, jewel-babblers & quail-thrushes				
Androphobus	*viridis*	Papuan Whipbird	M	
Ptilorrhoa	*leucosticta*	Spotted Jewel-babbler	M	2
	caerulescens	Blue Jewel-babbler	L	2
	geislerorum	Brown-headed Jewel-babbler	M	
	castanonota	Chestnut-backed Jewel-babbler	M	(1–2)
Cinclosoma	*ajax*	Painted Quail-thrush	L	
Machaerirhynchidae: Boatbills				
Machaerirhynchus	*flaviventer*	Yellow-breasted Boatbill	L	
	nigripectus	Black-breasted Boatbill	M	2
Artamidae: Woodswallows, butcherbirds & allies				
Artamus	*leucorynchus*	White-breasted Woodswallow	L-M	3 (2–3)
	maximus	Great Woodswallow	M	3b
Peltops	*blainvillii*	Lowland Peltops	L	
	montanus	Mountain Peltops	M	1b
Cracticus	*quoyi*	Black Butcherbird	L-M	2
	mentalis	Black-backed Butcherbird	L	3

Appendix 1 continued—**Artamidae: Woodswallows, butcherbirds & allies**

Genus	*Species*	*Common name*	*A*	*C*
Cracticus	*cassicus*	Hooded Butcherbird	L	(2–3)
Gymnorhina	*tibicen*	Australian Magpie	L	
Rhagologidae: Mottled Whistler				
Rhagologus	*leucostigma*	Mottled Whistler	M	
Campephagidae: Cuckooshrikes & trillers				
Coracina	*novaehollandiae*	Black-faced Cuckooshrike	L	1b
	caeruleogrisea	Stout-billed Cuckooshrike	L-M	
	lineata	Barred Cuckooshrike	L-M	
	boyeri	Boyer's Cuckooshrike	L-M	
	papuensis	White-bellied Cuckooshrike	L	(1–2)
	longicauda	Hooded Cuckooshrike	M	1
	tenuirostris	Common Cicadabird	L	
	incerta	Black-shouldered Cicadabird	L-M	
	schisticeps	Grey-headed Cuckooshrike	L-M	
	melas	Black Cicadabird	L	
	montana	Black-bellied Cuckooshrike	M	
Campochaera	*sloetii*	Golden Cuckooshrike	L	
Lalage	*tricolor*	White-winged Triller	L	
	atrovirens	Black-browed Triller	L	
	leucomela	Varied Triller	L	1
Neosittidae: Sittellas				
Daphoenositta	*papuensis*	Papuan Sittella	M	
	miranda	Black Sittella	M	
Eulacestomidae: Ploughbill				
Eulacestoma	*nigropectus*	Wattled Ploughbill	M	
Oreoicidae: Australo-Papuan belbirds				
Aleadryas	*rufinucha*	Rufous-naped Whistler	M	2
Ornorectes	*cristatus*	Crested Pitohui	L-M	
Pachycephalidae: Whistlers & allies				
Melanorectes	*nigrescens*	Black Pitohui	M	1 (1–2)
Pachycephala	*hyperythra*	Rusty Whistler	L-M	2
	modesta	Brown-backed Whistler	M	
	meyeri	Vogelkop Whistler	M	
	simplex	Grey Whistler	L-M	
	soror	Sclater's Whistler	M	(1–2)
	pectoralis	Australian Golden Whistler	L-M	(1–2)

Appendix 1 continued—**Pachycephalidae: Whistlers & allies**

Genus	*Species*	*Common name*	*A*	*C*
Pachycephala	*melanura*	Mangrove Golden Whistler	L	2
	lorentzi	Lorentz's Whistler	M	
	schlegelii	Regent Whistler	M	2
	aurea	Golden-backed Whistler	L	
	monacha	Black-headed Whistler	M	
	leucogastra	White-bellied Whistler	L	2b
Pseudorectes	*incertus*	White-bellied Pitohui	L	
	ferrugineus	Rusty Pitohui	L	1
Colluricincla	*tenebrosa*	Sooty Shrikethrush	M	
	megarhyncha	Little Shrikethrush	L-M	2 (2–3)
	harmonica	Grey Shrikethrush	L-M	(2–3)
Laniidae: Shrikes				
Lanius	*schach*	Long-tailed Shrike	M	2
Oriolidae: Figbirds, orioles				
Sphecotheres	*vieilloti*	Australasian Figbird	L	2b
Pitohui	*kirhocephalus*	Northern Variable Pitohui	L-M	
	uropygialis	Southern Variable Pitohui	L	
	dichrous	Hooded Pitohui	L-M	(1–2)
Oriolus	*szalayi*	Brown Oriole	L-M	(1–2)
	sagittatus	Olive-backed Oriole	L	
	flavocinctus	Green Oriole	L	2
Dicruridae: Drongos				
Dicrurus	*bracteatus*	Spangled Drongo	L	(2–3)
Rhipiduridae: Fantails				
Rhipidura	*leucophrys*	Willie Wagtail	L-M	2–3 (1–3)
	rufiventris	Northern Fantail	L-M	2 (1–2)
	threnothorax	Sooty Thicket Fantail	L	
	maculipectus	Black Thicket Fantail	L	
	leucothorax	White-bellied Thicket Fantail	L	2
	atra	Black Fantail	M	1
	hyperythra	Chestnut-bellied Fantail	L-M	2
	albolimbata	Friendly Fantail	M	
	phasiana	Mangrove Fantail	L	
	brachyrhyncha	Dimorphic Fantail	M	1
	rufidorsa	Rufous-backed Fantail	L	2
	dryas	Arafura Fantail	L	
Chaetorhynchus	*papuensis*	Pygmy Drongo	L-M	

Appendix 1 continued

Genus	*Species*	*Common name*	*A*	*C*
Monarchidae: Monarchs				
Symposiarchus	*axillaris*	Black Monarch	M	1
	guttula	Spot-winged Monarch	L	2
	manadensis	Hooded Monarch	L	2
Monarcha	*rubiensis*	Rufous Monarch	L	
	frater	Black-winged Monarch	L-M	
Carterornis	*chrysomela*	Golden Monarch	L	
Arses	*insularis*	Ochre-collared Monarch	L-M	
	telescopthalmus	Frilled Monarch	L-M	2
Grallina	*cyanoleuca*	Magpie-lark	L	
	bruijnii	Torrent-lark	M	1
Myiagra	*rubecula*	Leaden Flycatcher	L	(2–3)
	ruficollis	Broad-billed Flycatcher	L	
	alecto	Shining Flycatcher	L	2
	nana	Paperbark Flycatcher	L	2–3 (1–3)
Corvidae: Crows, jays				
Corvus	*fuscicapillus*	Brown-headed Crow	L	
	tristis	Grey Crow	L-M	1–2f
	orru	Torresian Crow	L	(2–4)
Ifritidae: Ifrit				
Ifrita	*kowaldi*	Blue-capped Ifrit	M	1
Paradisaeidae: Birds-of-paradise				
Manucodia	*ater*	Glossy-mantled Manucode	L	(1–3)
	jobiensis	Jobi Manucode	L	2
	chalybatus	Crinkle-collared Manucode	L-M	(1–2)
Phonygammus	*keraudrenii*	Trumpet Manucode	L	(1–2)
Paradigalla	*carunculata*	Long-tailed Paradigalla	M	
	brevicauda	Short-tailed Paradigalla	M	1
Astrapia	*nigra*	Arfak Astrapia	M	
	splendidissima	Splendid Astrapia	M	
	mayeri	Ribbon-tailed Astrapia	M	1
	stephaniae	Princess Stephanie's Astrapia	M	1
	rothschildi	Huon Astrapia	M	1
Parotia	*sefilata*	Western Parotia	M	
	carolae	Queen Carola's Parotia	M	
	berlepschi	Bronze Parotia	M	

Appendix 1 continued—**Paradisaeidae: Birds-of-paradise**

Genus	*Species*	*Common name*	*A*	*C*
Parotia	*lawesii*	Lawes's Parotia	M	1
	helenae	Eastern Parotia	M	1
	wahnesi	Wahnes's Parotia	M	
Pteridophora	*alberti*	King of Saxony Bird-of-paradise	M	1
Lophorina	*superba*	Superb Bird-of-paradise	M	
Ptiloris	*magnificus*	Magnificent Riflebird	L	2 (1–2)
	intercedens	Growling Riflebird	L	
Epimachus	*fastosus*	Black Sicklebill	M	
	meyeri	Brown Sicklebill	M	1
Drepanornis	*albertisi*	Black-billed Sicklebill	M	(1–2)
	bruijnii	Pale-billed Sicklebill	L	
Diphyllodes	*magnificus*	Magnificent Bird-of-paradise	L-M	2 (1–2)
Cicinnurus	*regius*	King Bird-of-paradise	L	(1–2)
Seleucidis	*melanoleucus*	Twelve-wired Bird-of-paradise	L	1 (1–2)
Paradisaea	*apoda*	Greater Bird-of-paradise	L	1
	raggiana	Raggiana Bird-of-paradise	L-M	2 (1–2)
	minor	Lesser Bird-of-paradise	L-M	1 (1–2)
	guilielmi	Emperor Bird-of-paradise	M	(1–2)
	rudolphi	Blue Bird-of-paradise	M	1
Petroicidae: Australasian robins				
Heteromyias	*albispecularis*	Ashy Robin	M	1
Poecilodryas	*brachyura*	Black-chinned Robin	L	
	hypoleuca	Black-sided Robin	L	
	placens	Banded Yellow Robin	L-M	
	albonotata	Black-throated Robin	M	
Peneothello	*sigillata*	White-winged Robin	M	1
	cryptoleuca	Smoky Robin	M	
	cyanus	Slaty Robin	M	1
	bimaculata	White-rumped Robin	L-M	
Peneoenanthe	*pulverulenta*	Mangrove Robin	L	2
Tregellasia	*leucops*	White-faced Robin	L-M	(1–2)
Pachycephalopsis	*hattamensis*	Green-backed Robin	M	1
	poliosoma	White-eyed Robin	L-M	1
Monachella	*muelleriana*	Torrent Flyrobin	M	2
Microeca	*papuana*	Canary Flyrobin	M	
	griseoceps	Yellow-legged Flyrobin	M	
	flavovirescens	Olive Flyrobin	L	2
	flavigaster	Lemon-bellied Flyrobin	L	(1–2)
	fascinans	Jacky Winter	L	

Appendix 1 continued—**Petroicidae: Australasian robins**

Genus	*Species*	*Common name*	*A*	*C*
Eugerygone	*rubra*	Garnet Robin	M	
Petroica	*archboldi*	Snow Mountains Robin	M	
	bivittata	Mountain Robin	M	
Drymodes	*superciliaris*	Northern Scrub Robin	L-M	
Amalocichla	*sclateriana*	Greater Ground Robin	M	
	incerta	Lesser Ground Robin	M	1
Alaudidae: Larks				
Mirafra	*javanica*	Horsfield's Bush Lark	L	
Hirundinidae: Swallows & martins				
Hirundo	*tahitica*	Pacific Swallow	L-M	(2–4)
Acrocephalidae: Reed Warblers & allies				
Acrocephalus	*stentoreus*	Clamorous Reed Warbler	L-M	(2–3)
Locustellidae: Grassbirds & allies				
Megalurus	*gramineus*	Little Grassbird	M	
	timoriensis	Tawny Grassbird	L	
	macrurus	Papuan Grassbird	M(L)	(2–4)
Zosteropidae: White-eyes				
Zosterops	*minor*	Black-fronted White-eye	L-M	
	fuscicapilla	Capped White-eye	M	1b
	novaeguineae	Papuan White-eye	L-M	2
Turdidae: Thrushes				
Zoothera	*heinei*	Russet-tailed Thrush	L-M	2
Turdus	*poliocephalus*	Island Thrush	M	1b (1–2b)
Muscicapidae: Chats & Old World flycatchers				
Saxicola	*caprata*	Pied Bush Chat	L-M	3 (2–4)
Motacillidae: Wagtails, pipits				
Anthus	*australis*	Australian Pipit	M	
	gutturalis	Alpine Pipit	M	1b