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Source: Bulletin of the British Ornithologists' Club, 141(1) : 75-108

Published By: British Ornithologists' Club

URL: <https://doi.org/10.25226/bboc.v141i1.2021.a8>

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Avifauna of the Adelbert Mountains, New Guinea: why is Fire-maned Bowerbird *Sericulus bakeri* the mountains' only endemic bird species?

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Received 20 November 2020; revised 4 January 2021; published 9 March 2021

<http://zoobank.org/urn:lsid:zoobank.org:pub:6D2353AF-B244-409B-AF02-944A06062AEA>

SUMMARY.—The Adelbert Mountains, one of ten outlying ranges along New Guinea's north and north-west coasts, surprised ornithologists when their first exploration by Western scientists yielded the striking endemic Fire-maned Bowerbird *Sericulus bakeri*. It was then another surprise when further exploration revealed no other distinctive endemic. We summarise previous Adelbert studies and our four explorations including a survey of the highest summit. A total of 71 upland species has been recorded from the Adelberts, all of them also present as the same species or (in the case of *S. bakeri*) same superspecies on other outliers. The Adelberts are exceptional among low-elevation outliers in harbouring populations of seven upland species shared only with much higher outliers. The Adelberts are unique in supporting populations of ten upland species compressed at the highest elevations into a narrow elevational band below the summit. The elevational floors of those species lie a much shorter distance below the summit than for any species on any other outlier. In explanation, we propose the hypothesis that, among outliers, the Adelberts are especially accessible to colonisation by upland species from other upland areas, with two consequences: endemism is almost non-existent in the Adelberts except *S. bakeri*; and high-elevation populations of the Adelberts may be subsidised by colonists from other upland areas. The highest-elevation populations may have disappeared during the mid-Holocene hypsithermal and subsequently recolonised, further contributing to the lack of endemism. The Adelbert upland avifauna is more closely related, in presence / absence and taxonomic relationships, to that of the nearby Huon Mts. to the east than to the avifauna of the more distant North Coastal Range to the west. That suggests why the Adelberts support *S. bakeri* as such a distinctive endemic but the rest of their avifauna is undifferentiated: *Sericulus* is the only upland superspecies of north New Guinea that reaches its eastern distributional limit in the Adelberts; and its low elevational floor permitted it, but not higher-elevation species, to survive upwards shifts in range during the hypsithermal. An appendix summarises all 235 species recorded from the Adelberts, our observations of their elevational range and abundance, and their names in two local mountain languages of the Adelberts.

Along the north and north-west coasts of New Guinea lie ten isolated mountain ranges rising from the lowlands, lower in elevation and poorer in species than New Guinea's Central Range that forms the island's west / east axis (Fig. 1). In previous papers we described the avifaunas, especially the upland avifaunas, of three of those ranges (Foja, Fakfak and Kumawa: Beehler *et al.* 2012, Diamond & Bishop 2015), and of one former outlier that is now an island (Yapen: Diamond & Bishop 2020). The present paper describes the avifauna of the fourth lowest and nearly the least isolated of the outliers, the Adelbert Mts.



Male (left) and female Fire-maned Bowerbird *Sericulus bakeri*, the endemic bowerbird of the Adelbert Mountains (William Cooper, reproduced from Cooper & Forshaw 1977, with the kind permission of Dr Wendy Cooper)

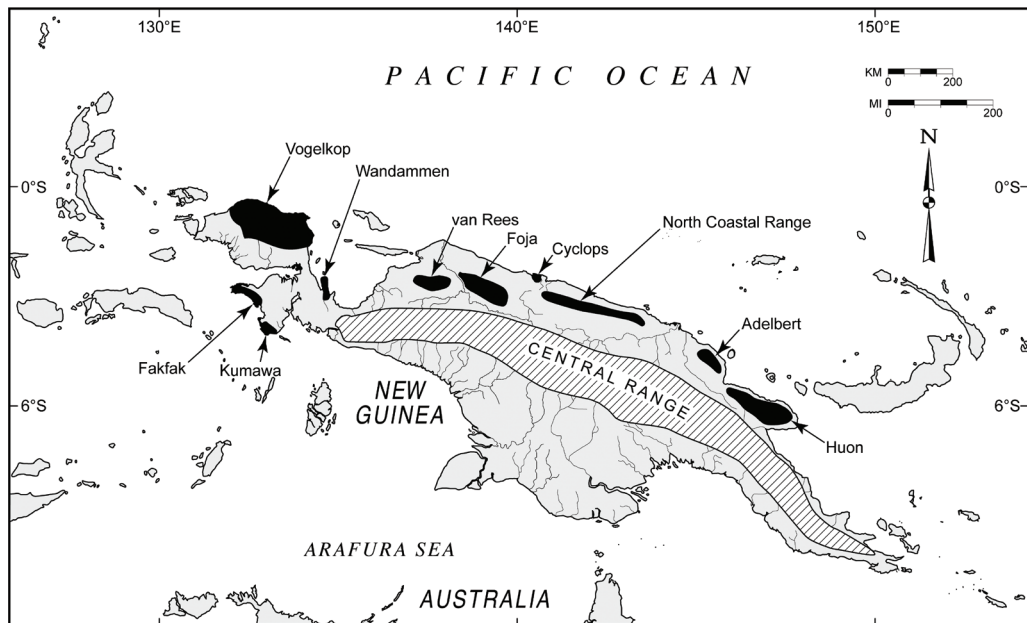


Figure 1. New Guinea's principal mountain ranges: the Central Range forming New Guinea's backbone; and the ten outlying ranges along the north and north-west coasts, from Huon and Adelbert in the east, to Fakfak and Kumawa in the west.

Four features make the Adelberts of particular interest. First, the Adelberts are home to one of the most spectacular, surprising, distinctive and beautiful discoveries of modern New Guinea ornithology: the Fire-maned Bowerbird *Sericulus bakeri* (Gilliard 1969, Frith & Frith 2004; see painting). When its discovery was first recorded, its home range was erroneously recorded by its collector Rollo Beck as Madang. But Madang was one of New Guinea's largest towns, and was the ornithologically already well-explored former capital of German New Guinea (Chapin 1929). Ever since Gilliard proved in 1959 that the bowerbird's range is actually the Adelberts, the question has remained: why is such a distinctive species endemic to such an unlikely location, a low mountain range close to a much higher and larger mountain range (the Huon Mts.; Fig. 2)?

Second, the search for *S. bakeri* was motivated partly by the hope that the home of such a distinctive endemic would also prove to harbour other distinctive undiscovered endemics. Indeed, until LeCroy & Diamond (2017) rediscovered Beck's diary and specimen register, and found that Beck had labelled the bowerbird's collecting site as Madang for banal reasons, it was believed that Beck had intentionally mislabelled the locality in order to preserve for himself the option of returning and discovering other new species (Gilliard 1969, Frith & Frith 2004). In fact, subsequent explorations of the Adelberts yielded not only no further distinctive endemic species but just two endemic subspecies, both of them barely worth recognising (Gilliard & LeCroy 1967, Pratt 1982, Beehler & Pratt 2016). How could no other distinctive taxon have evolved in a mountain range that generated one endemic that is so distinctive?

Third, subsequent explorations did reveal that the Adelberts are home to non-endemic populations of some upland species that are otherwise restricted to much higher mountain ranges of New Guinea, such as Superb Bird of Paradise *Lophorina superba* and the Papuan Lorikeet superspecies *Charmosyna [papou]*. (Here and elsewhere, we adopt the usual

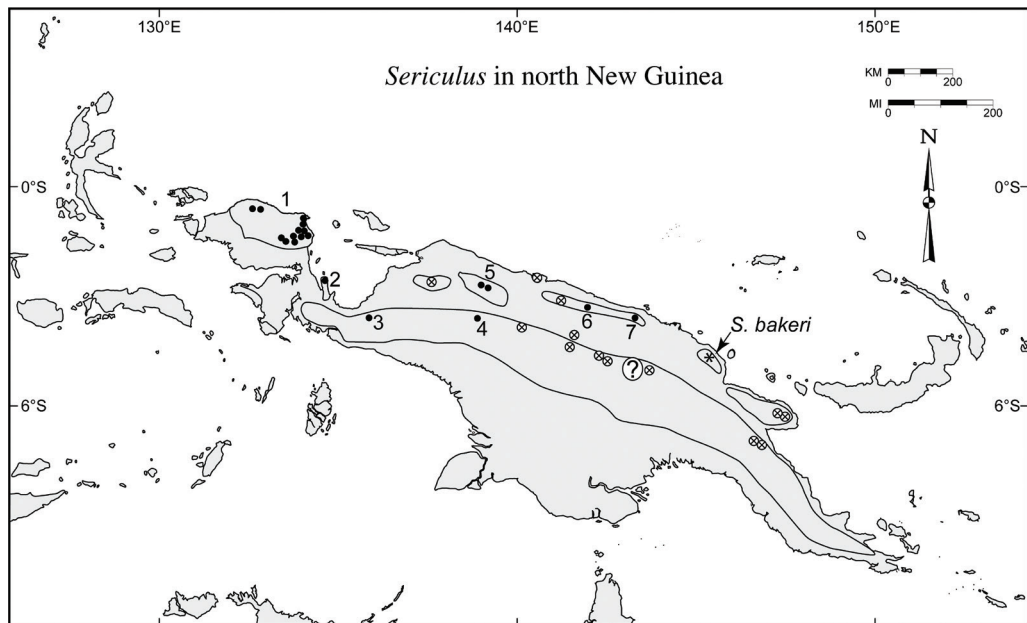


Figure 2. Presence and absence of *Sericulus* bowerbirds on New Guinea's northern watershed, modified from Diamond (1969). Each filled dot represents records by one observer. There are only seven documented areas of occurrence of the allospecies Masked Bowerbird *S. aureus*, numbered from west to east, with observer names in parentheses: 1 = Tamrau Mts. (E. T. Gilliard and B. M. Beehler) and Arfak Mts. (many observers) of the Vogelkop. 2 = Wandammen Mts. (E. Mayr). 3 = Weyland Mts. (F. Shaw-Mayer). 4 = Bernhard Camp (A. Rand). 5 = Foja Mts. (B. M. Beehler and J. Diamond). 6 = Mt. Nibo (J. Diamond). 7 = Mt. Turu (J. Diamond). The asterisk depicts the range of the allospecies Fire-maned Bowerbird *S. bakeri* in the Adelberts. X = areas surveyed intensively without finding any *Sericulus*. ? = an undocumented report of *S. aureus* from the Jimi River. Except for the latter, *S. aureus* is known mainly from outlying ranges (locations 1, 2, 5, 6 and 7). There are only two documented localities for it in the Central Range (3–4), and there is a large gap between the easternmost record of *S. aureus* (7) and the range of *S. bakeri*. The remaining *Sericulus* allospecies in New Guinea is Flame Bowerbird *S. ardens* of the southern watershed.

convention of denoting a superspecies by square brackets.) How can the Adelberts support those populations despite the Adelberts' modest elevation?

Finally, ten species are confined in the Adelberts to a narrow altitudinal band extending only c.100 m below the highest summit. In all other well-explored New Guinea outliers, the highest-elevation populations extend at least 265 m, in some cases even 1,500 m, below the summit. How can those Adelbert populations survive when crammed into such a narrow altitudinal band, presumably supporting only a small population doubtfully sustainable in isolation?

We shall address these and other questions in light of our four explorations of the Adelberts, including their summit, in the years 2001, 2002, 2004 and 2006. We review and summarise records of other observers in a table listing all species known to have been recorded in the Adelberts.

Background

Environment and people.—The environment and people of the Adelberts are important for understanding the origins of the Adelbert avifauna, and the history of its ornithological exploration. The Adelbert Mts. rise from the lowlands of New Guinea's north-east coast (Fig. 1). The nearest mountains are those of the Huon Peninsula to the south-east, separated

from the south-eastern Adelberts by the narrow Gogol River valley. The narrow Ramu River valley in turn separates the Huon Mts. to the north from the Central Range to the south, but broadens to the west to constitute a wider lowland gap between the south slopes of the Adelberts and the north slopes of the Central Range. A much broader gap, formed by the Sepik River and its marshy lowland basin, separates the Adelberts from the nearest outlying range to the west, the North Coastal Range. Hence upland habitats in the Adelberts are closest to those of the Huon Mts., then to those of the Central Range, and further from those of the North Coastal Range (Fig. 3).

The chain of the Adelberts lies along a south-east / north-west axis, rising towards the north-west. The highest peak is Mt. Mengam near the chain's north-west end, whose elevation we determined as 1,675 m by ascending it and measuring the elevation repeatedly with our altimeters. Because Mt. Mengam is at the end of the chain furthest from the coastal town of Madang and was recognised only in the 1970s to be the tallest Adelbert peak (T. K. Pratt pers. comm.), it was not explored ornithologically until 1974 by Pratt and colleagues and in 2004 by us. Earlier explorations of the Adelberts by Beck, Gilliard and Ziegler were of lower but more accessible mountains to the south-east.

Rainfall in the Adelberts is highest in December–March and lowest in August–October (Brookfield & Hart 1966, McAlpine *et al.* 1975, Tupper 2012). However, seasonality is modest, and rainfall in the wettest months is barely double that in the driest months. Annual rainfall at the two recording stations closest to our field sites, Wanuma and Saruga, is 320–340 cm.

The Adelbert terrain is sandstone formed into steep, narrow, razorback ridges separated by deep narrow valleys. Even by the standards of montane New Guinea's generally rugged terrain with which we are familiar, the Adelberts rank as especially difficult for travel. In our helicopter flights over the Adelberts, we saw no large level-ground area.

That terrain has several consequences relevant to ornithologists. First, there is no motor vehicle road at higher elevations within the Adelberts, and only one landing strip for small fixed-wing aircraft (at Wanuma, 22 and 29 km south-east of our two study sites). Second, that lack of transport impedes commercial logging, and the terrain's steepness compels villagers to seek small favourable patches for their gardens, so that the Adelberts are still largely covered by rainforest. Third, the terrain's difficulty, and the chronic warfare and fierce reputation of its inhabitants, explain why the Adelberts remained unknown to Europeans for so long, despite their proximity to the German colonial capital of Madang (Friedrich-Wilhelmshafen)—and why the discovery of *Sericulus bakeri* at 'Madang' (see below) occurred so late and caused such astonishment. Only one additional bowerbird species (Archbold's Bowerbird *Archboldia papuensis*) and one bird of paradise (Ribbon-tailed *Astrapia Astrapia mayeri*) were discovered after *S. bakeri*, both of them in remote areas of the Central Range.

Information about European contact in our two study sites comes from our conversations with older villagers, and from the linguist Ian Tupper (2012). Stone tools were abandoned, and steel tools began to be acquired by trade from the coast, only in the 1940s. There was never any contact with a foreign patrol during German colonial times, which ended in 1914. Australian patrols did not visit the Adelberts until 1944. The first missionary visit to our study site of Kangaragate was in 1959, and the first mention (by a missionary linguist) of the Pamosu language spoken at our other study site of Munggur was in 1975. Chronic warfare was late in disappearing: our Kangaragate hosts told us that warfare compelled them to abandon their homeland in 1949, and that they could not make peace and return until 1982. That chronic warfare, plus the rugged Adelbert terrain, contribute to explaining why Beck and Gilliard collected only up to 760 m and about 1,220 m, respectively, and depended on native collectors to go further: because it would have been too dangerous for

a European to do so. Even at the time of our 2004 and 2006 visits, few of the villagers at our two study sites had travelled, worked or lived outside their language area.

As mentioned above, arable land occurs in only small patches, and gardens are small and scattered. For example, we encountered an isolated garden c.1 km from the summit of Mt. Mengam, more than an hour's walk from Munggur village even for the briskly trotting villagers. Hence people traditionally spent most of their time in garden houses and scattered hamlets. While Australian patrols and then the Papua New Guinea government tried to induce people to gather in villages, Australian patrol reports mention finding few people in the villages, because they were instead mostly in their garden houses. In such small-scale societies there were no hereditary chiefs.

Subsistence traditionally depended on gardens producing yams as the major crop, plus taro, bananas, sago, *Pandanus*, and the introduced crop cassava. The only domestic food animals, pigs and chickens, yield little meat: pigs are saved to be slaughtered at a big feast held every year or two. Instead, protein is obtained mainly by hunting wild mammals.

Languages.—While New Guinea is famous for having the world's highest language diversity, the Adelberts are diverse even by New Guinea standards. Approximately 60 languages, all of them confined to the Adelberts, are spoken in an area of about 7,000 km² (Lewis 2009). Hence the area occupied by the average language is c.120 km², and the average cross-section of a language area is only about 11 km. (These numbers refer to mutually unintelligible languages, not mere dialects.)

That diversity is a consequence of New Guinea's and the Adelberts' rugged terrain, chronic warfare impeding travel, long history of human occupation (c.60,000 years) and lack of political unification until colonial times (Foley 1986). With one exception, New Guinea languages fall into dozens of language families that are strictly or almost entirely confined to New Guinea, and that have no demonstrable relationship to each other or to any other language family in the world. Most Adelbert languages belong to the largest of those families, the Trans-New Guinea family, whose extent is attributed to population expansions associated with New Guinea's independent development of agriculture within the last 10,000 years. The sole exception is the Austronesian language family that spread from Taiwan to Polynesia, reaching New Guinea about 3,500 years ago, and that is represented mainly in the lowlands of northern New Guinea. Five Austronesian languages, presumed to have arrived with recent invaders, are spoken in small Adelbert coastal enclaves and south of the Gogol River near the Adelberts.

The languages at both of our study sites belong to the so-called Madang subgroup of the Trans-New Guinea family. The Pamosu language, with about 1,500 speakers, is that spoken at Munggur and four nearby mountain villages. The Aiti language, with about 3,300 speakers, is spoken at Kangaragate and some neighbouring villages. (Kangaragate villagers insisted to us that Aiti is the name of their language, although it appears to be referred to as Mum or Katiati in Lewis 2009.) These are the two languages whose names for bird species we used in our conversations with villagers, and which we provide in Appendix 1 for the convenience of future ornithologists wishing to find *Sericulus bakeri* and other Adelbert bird species. It will be apparent from Appendix 1 that the two sets of names are almost entirely different, illustrating the mutual unintelligibility of those two related languages spoken only 9 km apart.

Previous ornithological studies.—Although numerous collectors obtained bird specimens near the German colony coastal capital of Madang from the 1880s onwards, the first collection in the Adelberts just inland of Madang was not made until 1928–29, by the professional collector Rollo Beck. On Beck's return from eight years as leader of the American Museum of Natural History's (AMNH) Whitney South Sea Expedition, the

museum paid Beck to conduct further collecting in New Guinea, thereby helping Beck deal with personal financial difficulties (LeCroy & Diamond 2017). Beck evidently received no specific instructions about where in New Guinea to collect, and he had no opportunity to familiarise himself in advance with its birds. Instead, it seems likely that, after Beck landed in Madang, he selected the nearby Adelberts as his first field site merely because missionaries could arrange for him to stay at their stations there.

Beck's Adelbert itinerary, including his collecting locality for *Sericulus bakeri*, remained unknown for many decades, because Beck initially labelled the sites of all of his Adelbert specimens simply as 'Madang'. He adopted this practice because he had previously been collecting on smaller Pacific islands where differences between sites on the same island were unimportant. Only recently did Mary LeCroy (*in* LeCroy & Diamond 2017) reconstruct Beck's itinerary from his diary and specimen registers. LeCroy showed that Beck collected at four sites in and near the Adelberts between August 1928 and January 1929: Madang itself, on the coast; Nobonob, a lowland mission station near Madang at the foot of the Adelberts; Maban, at an elevation of a few hundred feet (Beck's estimates are in feet, not metres) on the Gogol River in the Adelberts' southern foothills; and Meganum only c.9 km from Maban at an elevation of 1,200 feet. From Meganum, Beck himself collected up to approximately 2,500 feet, and his local collectors spent three days further inland and probably at somewhat higher elevations. Beck himself could go no further, because the Adelberts were still lethally dangerous for a European at that time. (Another of Beck's sites, Keku, was in the western foothills of the Huon Mts., not in the Adelberts, and is not to be confused with Keki Lodge now frequented by birdwatchers in the Adelbert foothills.)

Beck's Adelbert collections, housed at AMNH, comprised 502 specimens of 129 species (Table 1 of LeCroy & Diamond 2017). Only 11 of those species were upland taxa (records listed in Appendix 1), almost all of them obtained while Beck was based at Meganum—including *Sericulus bakeri*, probably taken by Beck's local collector. All of those species are ones that we and other observers have found at elevations below 1,000 m, supporting the evidence from Beck's itinerary that he and his collector remained at modest elevations.

The next collection was made in 1959 by E. Thomas Gilliard, who was searching specifically for *Sericulus bakeri*. In the course of two months Gilliard and his New Guinean hunters reached elevations of c.1,220 m on Mt. Memenga in the south-eastern Adelberts and collected 385 specimens of 130 species, thereby adding 26 species to the list of Adelbert upland species (Gilliard & LeCroy 1967). That collection is also at AMNH.

In 1967 Alan Ziegler collected up to 1,100 m at Atitau and obtained 32 species, including 11 upland species, two of them (Black-bellied Cicadabird *Edolisoma montanum* and Russet-tailed Thrush *Zoothera heinei*) new records for the Adelbert upland avifauna. His collection, also housed at AMNH, was examined by one of us (JD) and by Pratt (1982).

In 1974 an expedition of the Wau Ecology Institute including Thane Pratt collected for two months and became the first collectors to reach the highest summit (Mt. Mengam, not to be confused with the lower Mt. Memenga reached by Gilliard). They added 25 upland species (Pratt 1982) including all but one of the high-elevation populations now known from the Adelberts. Those specimens are mostly housed at the Bishop Museum, Honolulu.

In 1985 C. B. Frith, D. W. Frith and Roy Mackay visited Mt. Mengam to seek *Sericulus bakeri* and to photograph MacGregor's Bowerbird *Amblyornis macgregoriae* at its bowers. Frith & Frith (1988) described the courtship display of Superb Bird of Paradise *Lophorina superba*. From 1985 to 1988 Mackay and others made five additional Adelbert visits, from which Mackay (1991) reported eight species not found by any previous or subsequent visitor to the Adelberts: Wattled Brushturkey *Aepyodius arfakianus*, Mountain Kingfisher *Syma megarhyncha*, Dimorphic Fantail *Rhipidura brachyrhyncha*, Friendly Fantail

R. albolimbata, Brown-backed Whistler *Pachycephala modesta*, Papuan Sittella *Daphoenositta papuensis*, Elfin Myzomela *Myzomela adolphinae* and Varied Honeyeater *Gavicalis versicolor*. Those records were queried or not accepted by Beehler & Pratt (2016). While an Adelbert population of *Aepyodius arfakianus* appears to us quite possible, and *Daphoenositta papuensis* and *Myzomela adolphinae* unlikely but not impossible, the other five records are in our opinion improbable. The two *Rhipidura* species and *Pachycephala modesta* are behaviourally or vocally conspicuous, are unlikely to have escaped Pratt and us if they had been present on Mt. Mengam's summit as claimed, and probably involved misidentified sightings of congeners that are common there. Especially unlikely is the report of *Gavicalis versicolor*, a strictly coastal species, reported at 700 m in the interior of the Adelberts. Out of caution we have not included these records in the Appendix but mention them here for the consideration of future observers.

In May 1999 Bruce Beehler and Kevin Vang observed 90 species at elevations of 500–900 m, including 17 upland species. Two of those (Red-fronted Lorikeet *Charmosyna rubronotata* and Banded Yellow Robin *Gennaodryas placens*) had not been previously reported for the Adelberts but were subsequently observed by us. In 2010 Beehler observed the rare Obscure Berrypecker *Melanocharis arfakiana* at Keki Lodge in the Adelberts (Beehler & Pratt 2016: 345).

We are aware of two other Adelbert collections that we cannot discuss because they have not been published and we have not examined them: that by William Peckover in 1969 (mentioned by Pratt 1982), housed at Yale's Peabody Museum; and the other by Brett Benz in 2007, housed at the Univ. of Kansas. A list of Benz's specimens that he kindly sent us reports one specimen of an upland species not otherwise known from the Adelberts, New Guinea White-eye *Zosterops novaeguineae*. That identification awaits confirmation because of the close resemblance in north-east New Guinea between that species and the abundant Black-fronted White-eye *Z. atrifrons* of the Adelberts.

Our study

We observed (but did not collect) Adelbert birds in 2001, 2002, 2004 and 2006. Our principal study was from 26 July to 15 August 2004 at two Adelbert sites that KDB selected during a previous helicopter visit: Munggur village (04°41.38'S, 145°14.64'E) at an elevation of 1,223 m, directly below the Adelberts' highest peak, Mt. Mengam; and Kangaragate village (04°39.34'S, 145°10.24'E) at 875 m, and c.8 km west-northwest of Munggur. The habitat around both villages consisted largely of forest, interrupted by scattered or regenerating gardens.

We arrived at Munggur by helicopter from Madang on the morning of 26 July and divided our time between two campsites: the village itself, and a mountain camp at 1,655 m on Mt. Mengam's summit ridge (04°42.13'S, 145°13.70'E), near Mt. Mengam's summit of 1,675 m (04°42.20'S, 145°13.83'E). We occupied the mountain camp on 30 July–2 August, and devoted those days plus 27–28 July to surveying the ridge for c.1 km west and east of the camp. From Munggur we descended the Ululu trail to 1,150 m, surveyed a trail west from and at the same altitude as the village, and ascended steeply to our mountain camp.

On the morning of 4 August 2004 we transferred by helicopter from Munggur to Kangaragate, where we again divided our time between two campsites: the village itself, and a mountain camp at 1,191 m (04°38.63'S, 145°94.67'E). From the mountain camp we surveyed up to 1,294 m above Musiamunat village. From Kangaragate we surveyed down to a pond at 835 m and a river at 639 m, and steeply up to Makokapi hamlet on

a ridge crest at 994 m, and up to the 1,260-m crest of the trail from Kangaragate to the coast. On the morning of 15 August we returned by helicopter to Madang.

In 2006 we again travelled by helicopter on 2 May from Madang to Munggur, and then on 4 May from Munggur to Kangaragate, before returning to Madang on 7 May. During those visits we remained within 1 km of each village. We observed five lowland species and one upland species that we had not observed in 2004.

On 12 August and 1 September 2001 and 27 July 2002 KDB made single-day trips by car to Keki Lodge (700–1,080 m, 04°41.49'S, 145°24.22'E). He observed 90 species, including nine lowland species and two migrant visitors that we did not subsequently see in 2004 or 2006.

Methods.—Our methods were similar to those that we described for our studies elsewhere in New Guinea (Diamond & Bishop 2015, 2020). Briefly, except KDB's visits in 2001 and 2002, all of our observations were made on foot trails, mostly within forest, in areas with no motor vehicle roads. We devoted much effort to recording vocalizations with Sony TCM 5000 EV tape recorders, playing back unidentified vocalisations in the field to attract and identify the singers, and re-listening to recordings in camp each day because our directional microphones often captured vocalisations that we had not noticed in the field. We stopped at fruiting and flowering trees where birds gathered. We began observing by 05.00 h to detect nocturnal birds. Elevations of all significant observations were measured using Thommen altimeters or a Garmin GPS. We did no collecting.

We were constantly accompanied by Munggur or Kangaragate villagers, who pointed out and identified birds seen and heard, informed us about their experience of each species, and described to us other species that lived in the area of their village, but which we did not encounter together. These conversations were undertaken in the language Tok Pisin, and the bird names used were in the local Pamosu or Aiti languages spoken at Munggur or Kangaragate. As we routinely do elsewhere in New Guinea, we went to much effort to identify these names, for several reasons: local people thereby helped us to identify birds seen or heard; they guided us to find species that we particularly wished to observe; they shared with us their lifelong knowledge of bird species in their environment; and they provided clear identifiable descriptions of 11 species that we did not encounter. Those 11 are denoted by square brackets in Appendix 1; all have been recorded by other European visitors to the Adelberts except the Palearctic winter visitor Grey Wagtail *Motacilla cinerea*, for which there is no other local record, but it is widespread in New Guinea's mountains during the boreal winter.

We elicited most of those names when we and our guide saw or heard a bird together. If there was any doubt as to which individual bird in the vicinity was being referred to, we confirmed the identity by asking our guide to describe the species named. Once we had accumulated many such names securely identified in the field, we elicited more by asking our guides to name and describe for us additional species that we and they had not yet encountered together, e.g., we asked them to describe nocturnal species, or ground-dwelling species, or species found near water, or species similar to ('brata bilong') species that we and our guide had already encountered. For example, after we and our Munggur guides had found several species of lorries that they named ('kirikirik' = Dusky Lory *Pseudeos fuscata*, 'ororovion' = Black-capped Lory *Lorius lory*), we asked them to name and describe other very similar birds that proved to be other species of lorries, then other somewhat similar birds with similar bills that proved to be other parrots. The Appendix gives the Pamosu and Aiti names that we identified in this way, so that future visitors to these villages can use the names in order to find particular species.

Results and Discussion

Species number.—The total number of species recorded from the Adelberts is 235 (Appendix). Of those, we observed 197 ourselves. Other visitors observed 37 species that we did not record. As already mentioned, one additional species (*Motacilla cinerea*) was reported to us by Adelbert residents, but not observed by us or by other visiting ornithologists.

Our focus here is on upland species, defined as those largely confined to sloping elevated terrain, and absent from the flat lowlands at or near sea level. We have found this definition more useful and less arbitrary than defining ‘montane species’ as species largely confined to elevations above some arbitrary specified elevation, such as 1,000 m or 1,700 m. We have discussed in more detail elsewhere (Diamond & Bishop 2015, 2020) the advantages of this definition, and the ambiguities and practical issues in applying it. By this definition, we recognise 71 Adelbert species as upland species (abbreviated S_{up}), denoted by an asterisk in the Appendix.

Let us place this number in context by comparing it with S_{up} values for New Guinea’s nine other outlying mountain ranges. One of those ranges (Van Rees) is much lower (1,262 m) and much poorer in upland species ($S_{up} = 37$) than the Adelberts. Two of them (Vogelkop and Huon) are much higher (2,954 and 4,121 m respectively) and richer in upland species ($S_{up} = 129$ and 127 respectively) than the Adelberts. The remaining six are more comparable to the Adelberts, with elevations of 1,400–2,218 m, and S_{up} values from 44 to 95 species.

Table 1 summarises, for all ten mountain ranges, their elevations, S_{up} values, and numbers of upland species shared with the Adelberts. The following conclusions emerge from Table 1.

First, the number of upland species in a mountain range increases with the range’s elevation, from 37 to 129 species. That is, as one expects, in accordance with experience gained from mountains elsewhere in the world: greater elevation translates into more

TABLE 1
Upland avifaunas of the Adelberts and the other outliers.

Outlier	Elevation (m)	S_{up} (species)	S_{up} shared with Adelberts	% Shared
Van Rees	1,262	37	30	42%
Fakfak	1,400	65	42	59%
Kumawa	1,654	72	48	68%
Adelbert	1,675	71		
NCR	1,886	78	50	70%
Wandammen	2,075	77	50	70%
Cyclops	2,160	44	29	41%
Foja	2,218	95	56	79%
Vogelkop	2,954	129	65	92%
Huon	4,121	127	64	90%

Column 1. NCR = North Coastal Range.

Column 3: the number of upland species on that outlier.

Column 4: the number of upland species shared between that outlier and the Adelberts.

Column 5: Column 4, as a percentage of the Adelberts’ S_{up} value of 71.

Note that an outlier’s S_{up} , and the percentage of Adelbert species shared with the outlier, tend to increase with outlier elevation, but that the Cyclops fall below this trend.

TABLE 2
Upland species distributions on the Adelberts and other outliers.

No. of outliers occupied	No. of upland species occupying that no. of outliers	No. of Adelbert upland species
0	35	0
1	28	0
2	19	4
3	17	4
4	14	7
5	14	9
6	10	1
7	10	9
8	20	12
9	17	16
10	9	9
Total	193 species	71 species

Columns 1 and 2 are from Table 3 in Diamond & Bishop (2020). For each of New Guinea's 193 upland species, we tabulated how many of New Guinea's ten outliers that species occupies. That number (column 1) ranges from zero (no outlier occupied) to ten (all ten outliers occupied).

Column 3: number of Adelbert upland species falling within that species class. For example, the next-to-last row indicates that there are 17 upland species occupying nine outliers, and that 16 of those 17 occur in the Adelberts.

'niches', i.e. more opportunities for elevationally specialised species. The same trend is more weakly evident for the seven comparable ranges (the Adelberts and the other six), partly because their span of elevations is modest (only 1,400–2,218 m). The other disturbance of the trend arises from the flagrantly low S_{up} value of only 44 species in the Cyclops, although they are second-highest of the seven comparable ranges. Evidently, elevation is not the only factor influencing S_{up} values. Some others include area of upland habitats, and extensive flat lowlands isolating a mountain range from other ranges. The Cyclops, although they are high, are small in area.

Second, although New Guinea has approximately 193 upland species or superspecies (Diamond & Bishop 2020), the Adelberts share most of their upland species (59–79%) with five of the other six comparable ranges. (The outlier is again the species-poor Cyclops.) The percentage of Adelbert species shared increases with the S_{up} value of the range compared, from 41–42% for the most species-poor (Van Rees and Cyclops) to 92% for the most species-rich (Vogelkop). That is as one would expect if richer ranges tended to contain those of poorer ranges plus additional species.

If each range contained a random sample of New Guinea's 193 upland species, one would not expect such high sharing among seven samples of only 44–95 species each. That outcome suggests that some species are disproportionately good colonists and succeed in establishing themselves on many isolated mountain ranges. The next section explores this interpretation systematically.

Species identity.—Table 2 provides a systematic test of the suggestion that some upland species are disproportionately able colonists of outlying ranges, and that the upland avifauna of the Adelberts (as well as of the other outliers) is enriched in such species. For each of New Guinea's approximately 193 upland species or superspecies, we calculated

TABLE 3
Number of 'restricted' upland species on each outlier.

Outlier	Elevation (m)	No. of one-range species	No. of two-range species	No. of three-range species	Total restricted species
Huon	4,121	18	16	12	46
Vogelkop	2,954	10	15	14	39
Foja	2,218	--	1	7	8
Cyclops	2,160	--	--	--	0
Wandammen	2,075	--	--	1	1
NCR	1,886	--	2	4	6
Adelberts	1,675	--	4	3	7
Kumawa	1,654	--	--	4	4
Fakfak	1,400	--	--	2	2
Van Rees	1,262	--	--	1	1

'Restricted' upland species are those restricted to just one, two or three of the ten outliers. Columns 1–2 are from Table 1, but in reverse order.

Column 3: of the 28 upland species restricted to just one outlier, how many occur on each outlier?

Column 4: of the 19 species restricted to just two outliers, and column 5: of the 17 species restricted to just three outliers, how many occur on each outlier? For example, the 19 species restricted to two outliers have $19 \times 2 = 38$ outlier populations, of which most are on Huon (16 populations) or Vogelkop (15 populations), the two highest outliers.

Column 6: total number of restricted populations on each outlier: the sum of columns 3–5.

Note that the number of restricted populations tends to increase with outlier elevation, but the high but small Cyclops and Wandammen have fewer than expected, and Adelberts have more than expected. See text for discussion.

on how many of the ten outliers that species occurs. Those calculations are summarised in columns 1–2 of Table 2. That number ranges from zero for species of the Central Ranges present on no outlier (e.g., Sooty Honeyeater *Melionyx fuscus*), to one for species present on just a single outlier (e.g., Papuan Treecreeper *Cormobates placens*, present only on the Vogelkop), to ten for species present on all ten outliers (e.g., White-eared Bronze Cuckoo *Chalcites meyerii*).

As we noted previously (Diamond & Bishop 2020: Table 3), many upland species occur on no outlier (35 species) or on only a few outliers (e.g., 28 species confined to a single range). Few species (14, ten and ten) occur on an intermediate number of outliers (five, six or seven outliers, respectively), but somewhat more species (20, 17 or nine) occur on most or all outliers (eight, nine or ten outliers, respectively). That is, New Guinea upland species are not randomly distributed in colonising ability: there is instead a large excess of unsuccessful colonists, and a smaller excess of very successful ones.

Consider the Adelberts from this perspective (column 3 of Table 2). Inevitably, all nine species that occur on all ten of the outliers occur on the Adelberts. Unsurprisingly, most species present on the majority but not all outliers also occur on the Adelberts (e.g., 16 of the 17 species on nine outliers). Also inevitably, the 35 species absent on outliers do not occur on the Adelberts. Most of those 35 are high-elevation species of the tall (5,000 m) Central Range, for which the outliers provide no or little high-elevation habitat. The 28 species confined to a single outlier are also mostly confined to elevations above 1,500 m, with the result that all of them are confined either to the highest (Huon, 4,121 m) or second-highest outliers (Vogelkop, 2,954 m) (Table 3, column 3).

A surprising result involves species present on just two or three outliers (Table 3, columns 4–5). Because species restricted to a single outlier prove to be confined to either of the two highest outliers, one might guess by extrapolation that, for species restricted to 2–3 outliers, the number of populations would just increase with outlier elevation: the highest outliers would have the most such ‘restricted’ populations, and the next highest would have the next most. In partial accord with this expectation, the two outliers that are by far the highest (Huon and Vogelkop) far exceed all other outliers in their numbers of restricted populations (46 and 39 species, respectively), while the next highest outlier (Foja) has the third-largest number (eight species). But the next two-highest outliers, Cyclops and Wandammen, have zero and one restricted populations, respectively. Instead, the next-highest number of restricted populations, seven, is on the Adelberts, despite their being fourth from last in elevation among the ten outliers!

Those seven Adelbert populations (Table 4) are shared only with the much higher Vogelkop or Huon (five shared populations each). For three of those seven restricted species in Table 4, we should not attribute significance to their absence from low outliers other than the Adelberts, because two of the species (*Melanocharis arfakiana* and Papuan Parrotfinch *Erythrura papuana*) are very rare and cryptic, and the third (Dimorphic Jewel-babbler *Ptilorhoa geislerorum*) is almost confined to New Guinea’s north-east corner. But three others of those seven Adelbert species absent from other low outliers (Stella’s Lorikeet *Charmosyna [papou] stellae*, Marbled Honeyeater *Pycnopygius cinereus* and Ornate Melidectes *Melidectes torquatus*) are common vocal species confined in the Adelberts to the highest elevations. Why do those high-elevation species succeed in maintaining small populations at the top of the Adelberts, but not on the other low outliers, four of which are higher than the Adelberts?

Table 5 lists all ten species for which we have sufficient observations to suggest that their Adelbert populations were confined during our study to within 150 vertical metres of the Adelbert summit (1,675 m). Among the outliers, the Adelberts are unique in this respect. For the seven other outliers for which we have sufficient information concerning elevational ranges, Table 6 summarises how far below the summit is the highest elevational floor of any species. For example, in Kumawa, whose summit is at 1,654 m, the highest floors are of a

TABLE 4
Adelbert populations of ‘restricted’ upland species. This table names the ‘restricted’ upland species that occur in the Adelberts, and that constitute the seven entries for the Adelberts in the right-hand column and row 7 of Table 3.

	Species	No. of outliers	Other outliers	
	Stella’s Lorikeet	<i>Charmosyna [papou] stellae</i>	3	Huon, V
	Marbled Honeyeater	<i>Pycnopygius cinereus</i>	3	Huon, V
	Ornate Melidectes	<i>Melidectes torquatus</i>	3	Huon, V
	Obscure Berrypecker	<i>Melanocharis arfakiana</i>	2	V
	Slaty-headed Longbill	<i>Toxorhamphus poliopterus</i>	2	Huon
	Dimorphic Jewel-babbler	<i>Ptilorhoa geislerorum</i>	2	Huon
	Papuan Parrotfinch	<i>Erythrura papuana</i>	2	V

Column 3: the number of outliers to which each species is restricted.

Column 4: the outliers other than the Adelberts on which the species occurs (V = Vogelkop). The Adelberts are unusual among the four lowest outliers in having many populations of restricted species: the two other outliers listed in column 4 as sharing these restricted species are much higher than the Adelberts.

TABLE 5
Adelbert species with high elevational floors.

	Species	Floor (m)	Other outliers
Forbes's Forest Rail	<i>Rallicula [leucospila] forbesi</i>	1,525	Huon, V, Cyclops, Wand, Foja, NCR, Kum
MacGregor's Bowerbird	<i>Amblyornis [inornata] macgregoriae</i>	1,525	Huon, V, Wand, Foja, Kum, Fak
Marbled Honeyeater	<i>Pycnopygius cinereus</i>	1,580	Huon, V
Large Scrubwren	<i>Sericornis nouhuysi</i>	1,535	Huon, V, Foja, Kum
Buff-faced Scrubwren	<i>Sericornis [rufescens] perspicillatus</i>	1,590	Huon, V, Foja, NCR, Kum
Brown-breasted Gerygone	<i>Gerygone ruficollis</i>	1,590	Huon, V, Wand, Foja, Kum, Fak
Rufous-naped Bellbird	<i>Alcedryas rufinucha</i>	1,545	Huon, V, Wand, Foja, NCR, Kum, Fak
Slater's Whistler	<i>Pachycephala soror</i>	1,570	Huon, V, Kum, Fak
Superb Bird of Paradise	<i>Lophorina superba</i>	1,570	Huon, V, Wand
Black-capped Robin	<i>Heteromyias [albispecularis] armiti</i>	1,570	Huon, V, Foja, Kum

These ten species have the highest Adelbert elevational floors that we measured. Last column: the other outliers on which each species occurs. Abbreviations: V = Vogelkop, Wand = Wandammen, Kum = Kumawa, Fak = Fakfak, NCR = North Coastal Range. Note that these species mostly occupy outliers higher than the Adelberts: all ten occur on both of the highest outliers (Huon and Vogelkop), only four are present on the second-lowest outlier (Fakfak), and none is on the lowest (Van Rees).

smoky honeyeater *Melipotēs* sp. and Regent Whistler *Pachycephala schlegelii*, both at 1,389 m. That is, those species are compressed into an elevational band extending 265 m below the summit. That minimum elevational range of high-elevation populations is between 265 and 299 m for the four lowest mountains of Table 6 other than the Adelberts, and 541, 954 and 1,521 m for the three highest mountains in order of elevation. As an explanation for that increase in minimum elevational range on the highest mountains, we note that ambient temperature, hence productivity, decreases with elevation. Therefore, populations confined to the summits of the highest mountains require a larger area of habitat, and so a greater elevational range, to sustain some minimum population size than those confined to the summits of lower mountains.

Thus, Table 5 suggests that in the Adelberts the highest-elevation populations are compressed into a narrower elevational band, and presumably have smaller populations, than on other outliers of similar elevation. But there is a caveat; of the ten species listed in Table 5, Pratt (1982; pers. comm.) reported nine as extending to lower elevations than we do. Probable contributory factors for this difference include the following. (1) Pratt *et al.* spent more time (22 days) at elevations of 1,400–1,600 m than did we (six days), potentially allowing them to pick up more low-elevation records. (2) We recorded precise elevations for every significant observation (e.g., 1,545 m), while Pratt's reported elevation ranges are general (e.g., '1,400–1,600 m', or 'down to 1,400 m'). (3) Pratt collected not only on Mt. Mengam at or somewhere near our highest camp, but also at another site, Kowat, that provided lower elevations of 1,200–1,400 m. Hence the three of the ten species in Table 5 that Pratt recorded at Kowat certainly reached elevations lower—during Pratt's study—than the floors of 1,525 m or higher that we found on Mt. Mengam in Table 5. However, for the other seven species in Table 5, Pratt's generalised elevation ranges are compatible with the precise apparent floors of 1,525 m or higher that we measured. (4) Pratt's study was in 1974, but ours was in 2004. In the intervening three decades, global warming caused bird elevational ranges to shift upwards on New Guinea's mountains (Freeman & Class Freeman

TABLE 6
Summit elevations and highest elevational floors.

Outlier	Summit (m)	Highest floor (m)	Extent (m)
Van Rees	1,262	965	297
Yapen	1,430	1,160	270
Kumawa	1,654	1,389	265
Adelbert	1,675	1,590	85
North Coastal Range	1,886	1,587	299
Foja	2,218	1,677	541
Vogelkop	2,954	2,000	954
Huon	4,121	2,800	1,521

The third column is the elevational floor of the species with the highest floor on that mountain. Sources: our published observations for Yapen (Diamond & Bishop 2020), Kumawa (Diamond & Bishop 2015), Foja (Beehler *et al.* 2012) and Adelbert (this paper); our unpublished observations for Van Rees, North Coastal Range and Vogelkop; and Mayr (1931) for Huon.

The fourth column ('extent') is the second column minus the third column: i.e., the potential elevational range, on that outlier, of that species with the highest floor, if it could occupy the entire elevational span from its floor to the summit. Note that extent is lowest for the Adelberts, and that for other outliers it is greater for higher outliers.

2014) and on tropical mountains elsewhere in the world. On p. 91 we shall discuss further consequences of those shifts for the Adelbert avifauna.

Why are the Adelberts unusual among New Guinea's outliers (perhaps more so in 2004 than in 1974) in the high floors, narrow elevational bands, and small populations of their highest-elevation populations? We suggest two contributing factors: proximity to much higher and larger mountain ranges, permitting immigration from the latter to augment small Adelbert populations that would otherwise not be viable; and climate fluctuations.

Proximity of the Adelberts to higher and larger mountain ranges.—Examination of a map and of contours reveals that the Adelberts are the least isolated, or one of the least isolated, of New Guinea's ten outliers. Only *c.*15 km of low-elevation forest in the narrow Gogol River valley separates the southern foothills of the Adelberts from the western foothills of the mountains of the Huon Peninsula, which in turn are separated from the foothills of the Central Range by the even narrower upper Ramu River valley (Fig. 3). The distance between the Adelbert Mts. and the Huon Mts. across the Gogol River is 18 km or 12 km at the 500-m or 300-m contours, respectively. The corresponding distance between the Huon Mts. and the Central Range across the Ramu River is only 5 km at the 500-m contour; and these ranges are connected at the 300-m contour. (We are grateful to I. Woxvold for these measurements and for Fig. 3.) In contrast, the North Coastal Range is separated along most of its length from the Central Range by the broad Sepik Basin, *c.*100 km wide; the Foja and Van Rees Mts. are separated from the Central Range by the Lake Plains, *c.*50 km wide; the Kumawa and Fakfak Mts. are both isolated by 70–100 km of flat lowlands; and the Cyclops Mts. are isolated by undulating but low terrain. Perhaps the Adelberts are sufficiently accessible to the Huon and the Central Range that the small populations of the Adelberts' ten high-elevation species listed in Table 5 are not truly isolated, but are augmented by immigrants from high elevations in the Huon and Central Range. Seemingly *contra* this admittedly speculative interpretation stands the feature for which the Adelbert avifauna is famous: its distinctive endemic bowerbird allospecies *Sericulus bakeri*.

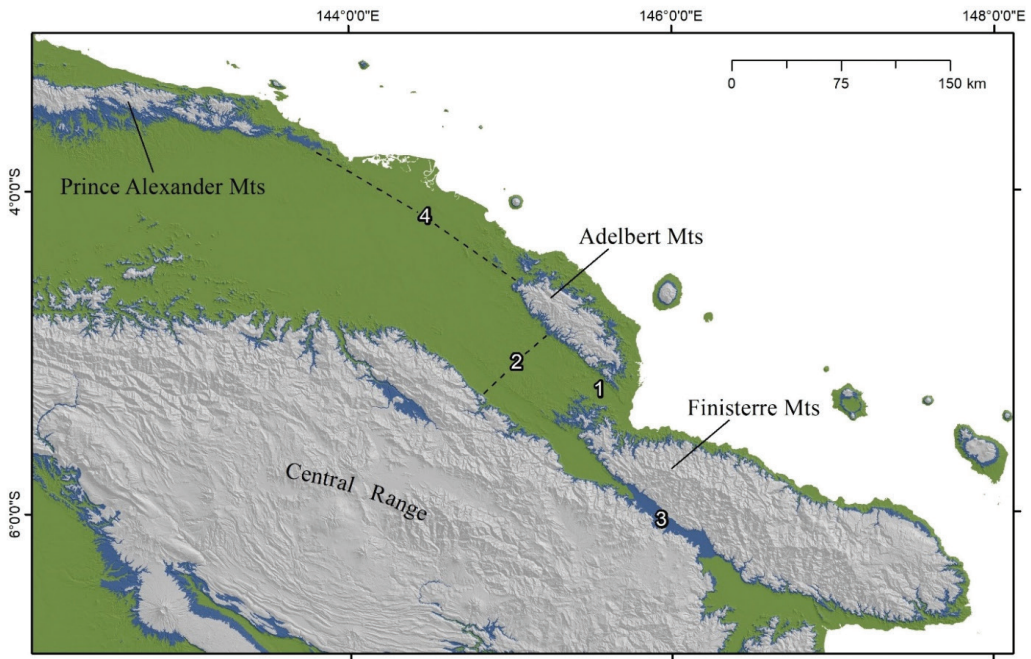


Figure 3. Terrain map of north-east New Guinea. Areas above 500 m are coloured grey; areas between 300 and 500 m blue; and areas below 300 m green. 1 = the Gogol River valley, between the Adelbert Mts. to the north and the Finisterre Mts. of the Huon Peninsula to the south. 2 = the Ramu River valley, between the Adelberts to the north-east and the Central Range to the south-west. 3 = the upper Ramu River valley and its headwaters, between the Finisterre Mts. of the Huon Peninsula to the north and the Central Range to the south. 4 = the Sepik River basin, between the Adelbert Mts. to the east and Prince Alexander Mts. of the North Coastal Range to the west. Map kindly produced by Iain Woxvold.

Adelbert endemism and climate fluctuations.—Other than *Sericulus bakeri*, the Adelbert avifauna is very poor in endemics. Beehler & Pratt (2016) recognised just two endemic subspecies, both of which are weakly defined: Forbes's Forest Rail *Rallicula forbesi parva* and Large Scrubwren *Sericornis nouhuysi adelberti* (described by Pratt 1982). Just two other endemic subspecies have been proposed for the Adelberts—Trumpet Manucode *Phonygammus keraudrenii adelberti* and MacGregor's Bowerbird *Amblyornis macgregoriae amati* described by Gilliard & LeCroy (1967) and Pratt (1982), respectively—but Beehler & Pratt (2016) considered both too undistinctive to recognise. All other Adelbert populations belong to the same subspecies as their conspecifics on the Huon or Central Range or both, or in one or more cases as their conspecifics on the North Coastal Range (Pratt 1982, Beehler & Pratt 2016).

That Adelbert upland populations are near-identical to those on the nearest other mountains is expected given two factors. One is the already discussed narrowness of the lowland barriers separating the Adelberts from those sources (Fig. 3). That prompted our speculation that the high elevational floors, narrow elevational ranges, and small population sizes of the Adelberts' highest upland populations (Table 5) might be due in part to their being augmented by immigrants, and not completely isolated.

The other factor is natural climate fluctuations of the mid-Holocene. During the so-called hypsithermal period from about 8,000–4,000 years ago, global temperatures were warmer than at present, with peaks $c.1^{\circ}\text{C}$ higher than present around 7,000 and again 4,000 years ago. But even the more modest temperature increases of the last half-

century have produced measurable upward shifts in avian elevational ranges on tropical mountains worldwide. On two New Guinea peaks, Mt. Karimui and Karkar, Freeman & Class Freeman (2014) found that elevational floors shifted upslope by an average of 100 m between 1965 or 1969 and 2012 or 2013, respectively, associated with a 0.4°C rise in annual mean temperature over that period. Assuming that these floor shifts are linearly related to temperature changes, then the recent 0.4°C rise that shifted floors 100 m upslope suggests that the 1°C increase at the peak of the hypsithermal would have shifted floors upwards by c.250 m. But today's Adelbert floors of the ten species in Table 5 are already just 85–150 m below the Adelbert summit, so if during the hypsithermal the floors of these species had risen 250 m they would have effectively disappeared. Consequently, today's populations probably became established or re-established only within the last 4,000 years. That inferred young age of the Adelbert high-elevation avifauna is a second reason for its non-existent or weak endemism.

We have suggested two factors—weak isolation and young age—contributing both to the lack of endemism in almost all Adelbert upland birds, and to the small population sizes and high floors of the highest-elevation populations. But how should one then interpret the distinctness of *Sericulus bakeri*, which seemingly implies strong isolation and considerable age? Read on!

The three easternmost outliers.—Of the ten outlying mountain ranges along New Guinea's north and north-west coasts, the three easternmost are the North Coastal Range (NCR), Adelberts and Huon (Figs. 1 and 3). The lowland gap between the eastern foothills of the NCR (the Prince Alexander Mts.) and the western foothills of the Adelberts is c.200 km wide at the 500-m contour (I. Woxvold pers. comm.). But the lowland gap between the Adelberts' southern foothills and the Huon's western foothills is only c.15 km wide (as mentioned above). Hence the NCR / Adelbert gap is a barrier for bird distributions more than ten times wider than the Adelbert / Huon gap.

Table 7 compares the effects of those two gaps on upland bird distributions at the species or allospecies level. At the broad gap between the NCR and Adelberts, five species reach their eastern limit (present in the NCR and further west, absent in the Adelberts): Claret-breasted Fruit Dove *Ptilinopus viridis*, Josephine's Lorikeet *Charmosyna josefinae*, Tropical Scrubwren *Sericornis beccarii*, Piping Bellbird *Ornorettes cristatus* and Capped White-eye *Zosterops fuscicapilla*. No species reaches its western limit there, i.e. is present in the Adelberts and further east, but absent in the NCR and further west. (*Ptilorrhhoa geislerorum*, formerly believed to reach its western limit there, was recently discovered far to the west on Yapen Island: Verhelst & Pottier 2020.) Three superspecies are represented by different allospecies on opposite sides of the NCR / Adelbert gap: the *Rallicula* [*leucospila*] forest rail superspecies, the *Sericulus* [*aureus*] bowerbird superspecies, and the *Zosterops* [*atrifrons*] white-eye superspecies.

In contrast, at the narrow gap between the Adelberts and Huon, the only species-level limits are that *Charmosyna rubronotata* and the *Sericulus* superspecies reach their eastern limit there, and that the *Amblyornis* [*inornata*] bowerbird superspecies and perhaps the *Ailuroedus* [*crassirostris*] catbird superspecies may be represented by different allospecies either side of the gap. Even that limit in the *Amblyornis* superspecies can be questioned, because the distinctiveness of the two *Amblyornis* populations is based on a very slight size difference, different bower form and display, and an unpublished molecular analysis (summarised in Frith & Frith 2004: 278, and Beehler & Pratt 2016: 278). But bower design is in part culturally transmitted, as shown by the drastic differences in bower form and decorations between *A. inornata* populations only 8 km apart, although the populations constructing those bowers are near-identical morphologically and exhibit only slight molecular differences (Diamond

TABLE 7
Species-level differences between the Adelberts and neighbouring upland avifaunas

Species or superspecies		NCR	Adelberts	Huon
Forbes's Forest Rail	<i>Ralllicula [leucospila]</i>	<i>R. [l.] mayri</i>	<i>R [l.] forbesi</i>	<i>R [l.] forbesi</i>
Claret-breasted Fruit Dove	<i>Ptilinopus viridis</i>	✓	--	--
Josephine's Lorikeet	<i>Charmosyna josefinae</i>	✓	--	--
Red-fronted Lorikeet	<i>Charmosyna rubronotata</i>	✓	✓	--
MacGregor's Bowerbird	<i>Amblyornis [inornata]</i>	--	<i>A. [i.] macgregoriae</i>	<i>A. [i.] germana</i>
Fire-maned Bowerbird	<i>Sericulus [aureus]</i>	<i>S. [a.] aureus</i>	<i>S. [a.] bakeri</i>	--
Tropical Scrubwren	<i>Sericornis beccarii</i>	✓	--	--
Dimorphic Jewel-babbler	<i>Ptilorhoa geislerorum</i>	--	✓	✓
Piping Bellbird	<i>Ornorettes cristatus</i>	✓	--	--
Black-fronted White-eye	<i>Zosterops [atrifrons]</i>	<i>Z. [a.] minor</i>	<i>Z. [a.] atrifrons</i>	<i>Z. [a.] atrifrons</i>
Capped White-eye	<i>Zosterops fuscicapilla</i>	✓	--	--

This table compares the upland avifaunas of the Adelberts and the two nearest outliers (North Coastal Range = NCR to the west, Huon to the east) with respect to two features: presence (✓) vs. absence (--); and which allospecies represents that superspecies on that outlier, if the superspecies (designated by a square bracket) involves different allospecies on different outliers. For example, the *Ralllicula [leucospila]* superspecies is represented by the allospecies *mayri* on NCR, but by *forbesi* on Adelbert and Huon. Note that, under both criteria, the Adelbert upland avifauna is more similar to that of the Huon to the east than to that of the NCR to the west.

& Bishop 2015: 314–315). Four other upland species present in the Adelberts are absent from the Huon, but do not reach an eastern limit between the Adelberts and Huon, because they reappear immediately east and south of the Huon (Blue-collared Parrot *Geoffroyus simplex*, Yellow-legged Flyrobin *Kempiella griseiceps*, Papuan Scrub Robin *Drymodes beccarii* and *Phonygammus keraudrenii*).

Thus, the distinctiveness of *Sericulus [aureus] bakeri* may be partly due to the fact that it is unique in being absent east of the Adelberts, and in being separated by a broad geographic barrier from the nearest allospecies to the west, Masked Bowerbird *S. [a.] aureus* (Fig. 2). All other Adelbert upland populations are identical or similar to upland populations nearby on the Huon and the Central Range. We acknowledge that Mackay reported two sightings of *S. aureus* from the Jimi River at 144°25'E on the northern slopes of the Central Range (Frith & Frith 2004: 334). However, there is no other record of *S. aureus* from the Central Range east of the Third Archbold Expedition's Bernhard Camp at 129°22'E, which is 1,600 km west of the Jimi River. KDB now discounts his own possible sighting in the Jimi Valley reported by Coates (1990: 400), and made at a time when KDB had only recently arrived in New Guinea. Five experienced collectors and observers undertook extensive studies of the Central Range's northern watershed in Papua New Guinea, three of them within 25 km of the Jimi River, without encountering *S. aureus*: E. T. Gilliard at Telefolmin (141°63'E), J. Bürgers on four mountains south of the upper Sepik River (Mäanderberg, Hunsteinspitze, Lordberg, Schraderberg: 141°68'E, 142°82'E, 143 00'E and 144°22'E, respectively), Gilliard in the Schrader Mts. (144°40'E), and I. Majnep and R. Bulmer in the Kaironk Valley (144°47'E). The easternmost record of *S. aureus* of which we are confident is not from the Central Range but from Mt. Turu at 143°34'E in the NCR (Diamond 1969). The range map of *S. aureus* in Pratt & Beehler (2015: 172) shows it as distributed continuously along the north slopes of the Central Range, from the Weyland Mts., in the far west, east to the Jimi River. However, the only firm records known to us on those slopes are from the Weyland Mts. and

Bernhard Camp. Instead, in northern New Guinea the *S. [aureus]* superspecies, like Barred Cuckooshrike *Coracina lineata*, is much more frequently recorded on the outlying mountains than on the north slopes of the Central Range itself (Fig. 2, p. 78).

The other likely reason for the far greater distinctiveness of *Sericulus bakeri* than of other Adelbert upland populations is its low elevational floor: only 700 m. Upwards shifts of 250 m in elevational floors during the hypsithermal, potentially sufficient to eliminate Adelbert high-altitude populations, would have left *S. bakeri* secure in an elevational range from 950 m to the summit at 1,675 m. Thus, the floor of *Sericulus* has been sufficiently low to protect it against the risk of extinction during mid-Holocene warm climates, but sufficiently high to impede its dispersal via the Sepik lowlands between the North Coastal Range and the Adelberts during Pleistocene cold climates.

Outlook

What additions to the Adelbert upland avifauna are possible? Beck's initial exploration at low elevations in 1928–29 recorded 11 upland species. Gilliard in 1959 and Ziegler in 1967 reached middle elevations and added 26 and two species, respectively. Pratt was the first to reach the Adelberts' summit in 1974, adding 25 upland species. Beehler in 1999 and 2010 added three species at low elevations. Finally, our visit in 2004 reached the summit and added four more species.

For three other species there are uncertain reports: *Aepyodius arfakianus*, Black-billed Sicklebill *Drepanornis albertisi* and *Zosterops novaeguineae*. We consider it likely that the first two of those will be found. Other possibilities are Meyer's Goshawk *Accipiter meyerianus*, *Charmosyna josefinae*, Wallace's Owlet-nightjar *Aegotheles wallacii*, Grey Thornbill *Acanthiza cinerea* and Obscure Honeyeater *Caligavis obscura*. Unlikely but not impossible are Bronze Ground Dove *Alopecoenas beccarii*, Rusty Whistler *Pachycephala hyperythra* and *Daphoenositta papuensis*.

Selected species accounts

We provide brief details of significant observations and species for which there were few or no previous Adelbert records.

SALVADORI'S TEAL *Salvadorina waigiensis*

This duck was our most surprising addition to the Adelberts' upland avifauna. It was previously known only from the Central Range, plus three outliers (Huon, Vogelkop and Foja) all much higher than the Adelberts. Our sole sighting was on 6 August 2004, when JD saw a pair on a river at 640 m below Kangaragate. The river at that point was 6 m wide, rushing, dropping, and with many large boulders. As soon as JD reached the river at 09.18 h, one *Salvadorina* that was perched beside the river flushed and flew off downstream. At 09.25 h a presumably different individual appeared 9 m upstream, perched on a stone 15 cm high next to the river, and occasionally slid its tail rapidly sideways. It swam upstream and reappeared on another boulder mid-river. Occasionally it raised the forebody and shook its wings, which appeared short. At 09:41 h it flew off upstream with quick ponderous flaps. Neither individual made any sound during the observation, which afforded a close prolonged view. The bill was dull yellow-orange, the speculum in flight green edged white anteriorly and posteriorly. Kangaragate villagers, who refer to this duck by the Aiti-language name 'asavi', state that it is common but shy and prone to flee on seeing people, and that it lays many eggs on a rock with much grass near the river.

RED-LEGGED BRUSHTURKEY *Talegalla jobiensis*

Heard at Kangarangate once in 2004, and twice in 2006. Local names 'mibu' (Kangarangate), 'sawa' (Munggur). Villagers described by call and habits only one other mound-building species, evidently New Guinea Scrubfowl *Megapodius decollatus*, as 'niako' (Kangarangate) or 'burukate' (Munggur). They denied knowledge of any additional mound-building species that would have been *Aepyodius arfakianus*, for which the only Adelbert report was by Mackay. As explained under Methods, we hesitate to accept that report without confirmation, especially as none of Beck, Gilliard, Pratt and ourselves observed the species and its distinctive mounds. Villagers could hardly have been unaware of *Aepyodius* if it had been present. Yet its absence from the Adelberts would be surprising, because it has been recorded in all nine other outliers.

FORBES'S FOREST RAIL *Rallicula forbesi*

Seen, heard and taped only at 1,525–1,600 m above Munggur, and recorded previously for the Adelberts solely by Pratt. Known and named by villagers at both Munggur and Kangarangate. The very long call is a buzzy note repeated *ad nauseam* three times per second.

MOUNTAIN OWLET-NIGHTJAR *Aegotheles albertisi*

We tape-recorded its call at night at 1,655 m above Munggur: a squeaky short upslurred note repeated at a rate of six notes per five seconds, with a quality similar to the bark of a small dog. Our recording is identical to those of *A. albertisi* from the Kumawa Mts. and Hela Province. We also taped the similar-sized Barred Owlet-nightjar *A. bennettii* at lower elevations. Both species are first records for the Adelberts. In the Adelberts, Pratt (1982) collected their larger congener Feline Owlet-nightjar *A. insignis*, double their mass, at an elevation (1,500 m) similar to *A. albertisi*. Munggur villagers are familiar, using the local name 'dalek', with the distinctive three-note angry-cat call of *A. insignis*. Hence *A. albertisi* and *A. insignis* are now known to co-exist at similar elevations on at least seven of New Guinea's outlying ranges, as well as the Central Range. Their ability to co-exist may be due to ecological consequences of their size difference.

RED-BREASTED PARADISE KINGFISHER *Tanysiptera nympha*

Noisy, commonly heard and seen at Kangarangate but not at our higher elevation site of Munggur. Two calls are frequently given: a very fast descending trill, similar to the first part of the call of Yellow-billed Kingfisher *Syma torotoro*, but with a spitted unmusical quality; and a very faint, long, medium-high pitch, single ascending note. Segregated ecologically from Common Paradise Kingfisher *T. galatea* by inhabiting higher elevations, and by perching higher in forest (at 6–15 m) rather than in the lower storey. We encountered *T. galatea* just once, at low elevation (815 m), at Kangarangate.

RED-FRONTED LORIKEET *Charmosyna rubronotata*

Heard and seen at both Munggur and Kangarangate, whereas its low-altitude sibling Red-flanked Lorikeet *C. placentis* was found only at Kangarangate. The two species can be distinguished by voice: *C. rubronotata* has a louder call.

STELLA'S LORIKEET *Charmosyna stellae*

Another high-elevation species recorded previously only by Pratt, which we encountered daily at 1,470–1,655 m. As did Pratt, we encountered only red-morph birds; the black morph from other parts of the species' range has not been observed in the Adelberts.

MACGREGOR'S BOWERBIRD *Amblyornis macgregoriae*

We heard calls and saw two bowers at 1,525 and 1,565 m: one on the ridge crest, the other on a broad slope considerably below the crest. The bowers comprised a circular moss platform 1.07 or 1.22 m in diameter, with a raised rim 15 or 23 cm wide and 15 cm tall, built around a central sapling. Sticks up to 25 cm long were piled around the sapling to a height of 0.6 or 1.5 m. The platform's floor consisted of soft brown earth or moss. Decorations at one bower involved dozens of small (3 mm) straw-coloured seeds, pieces of black charcoal on the rim, and two piles of black charcoal outside the rim and on opposite sides of the bower from each other. Decorations at the other consisted of several dozen pieces of black charcoal on the rim; sprigs of 4-mm blue berries hung from seven thin saplings; an 8-cm piece of blue cloth on the rim; and, outside the rim, several dozen 8-mm dull olive-brown fruits, and one bright green beetle skeleton. The charcoal and cloth had presumably been brought from a considerable distance.

FIRE-MANED BOWERBIRD *Sericulus bakeri*

Present at both of our sites, in small numbers from 1,150 to 1,385 m, giving diverse harsh calls, most of them soft, a few loud. Several female-plumaged birds and multiple adult males gathered in one fruiting tree. We found one bower at 1,150 m, on the shaded sloping forest floor. Its shape was rectangular, 38 × 20 cm, and it comprised several dozen dark brown sticks 13 cm long lying flat on the ground or inserted diagonally in two rows. Decorations consisted of 128 white fruits 1 cm in diameter. Munggur name: 'mororáng'. KDB also observed males and female-plumaged individuals at Keki Lodge.

RED-COLLARED MYZOMELA *Myzomela rosenbergii*

Abundant in flowering trees, and singly in the canopy, from 1,430 m upwards.

MARBLED HONEYEATER *Pycnopygius cinereus*

Calls: a snapped disyllabic note repeated once per second (Mountain Meliphaga *Meliphaga orientalis* does not repeat its snapped disyllable), and a musical note. Once we learned those calls, we recognised this species as abundant from 1,580 m upwards. Approaches in response to playback.

MOUNTAIN MELIPHAGA *Meliphaga orientalis*

Identified vocally by its short, bright, distinctively snapped disyllabic note; its staccato *tp* note is shared with other *Meliphaga*. The Adelbert population is identified visually by its small yellow ear patch, medium-small body size, and inconspicuous mottling on the underparts. Common or abundant at 930–1,570 m.

WHITE-EARED MELIPHAGA *Meliphaga montana*

Identified vocally by its distinctive upslurred *whEEP* note, and visually by its white ear, dull dark almost brownish upperparts, and heavier bill than *M. orientalis* of the same elevations. Noisy wingbeats, unusual for a small passerine. In small numbers from 1,020 to 1,255 m.

YELLOW-GAPED MELIPHAGA *Meliphaga flavirictus*

One, seen well by KDB in the lower canopy at 1,220 m, was identified by the long rictal streak, long narrow yellow ear patch, and moderately long slender bill. KDB taped its distinctive call, a squeaky downslur. First Adelbert record of this, the rarest *Meliphaga* species.

ORNATE MELIDECTES *Melidectes torquatus*

Abundant and often vocal, in the canopy, from 1,385 m upwards.

LARGE SCRUBWREN *Sericornis nouhuysi*

Common along with Buff-faced Scrubwren *S. perspicillatus* at high elevations, singing its characteristic gerygone-like song. Collected by Gilliard and by Pratt, and described by Pratt (1982) as an endemic subspecies. The taxonomic relationship between *S. nouhuysi* and its low-elevation sibling Tropical Scrubwren *S. beccarii* has been much debated because of the confusing geographic variation in plumage of *S. beccarii* (Diamond 1969, 1985, Beehler & Pratt 2016). However, their ecological relationship is simple and clear: they segregate by elevation at c.1,400 m wherever they co-exist (e.g., Kumawa, Foja, north slopes of western New Guinea's Central Range). Each species is confined to approximately that same elevational range in the absence of the other (e.g., *S. beccarii* in the North Coastal Range and Wandammen, *S. nouhuysi* in Huon and the northern watershed of the eastern Central Range). The Adelbert population of *S. nouhuysi* fits this pattern: it is confined to elevations above 1,535 m despite the absence of *S. beccarii*, which reaches its eastern distributional limit in the northern watershed of the North Coastal Range 160 km west of the Adelberts.

BUFF-FACED SCRUBWREN *Sericornis perspicillatus*

Common above 1,590 m, singing mainly at dawn. We once identified Grey-green Scrubwren *S. arfakianus* at 1,650 m, but it may also have accounted for sightings of *Sericornis* unidentified to species.

BROWN-BREASTED GERYGONE *Gerygone ruficollis*

Confined to elevations above 1,590 m, and easily located by its unmistakable long song, but surprisingly uncommon. The first record for the Adelberts.

CHESTNUT-BACKED JEWEL-BABBLER *Ptilorrhoa castanonota* and **DIMORPHIC JEWEL-BABBLER** *P. geislerorum*

Jewel-babblers were common and vocal at both of our sites, especially Kangaragate. At our higher elevation site, Munggur, where we heard and saw jewel-babblers from 1,170 to 1,655 m, all sightings were of the bicoloured (deep blue and rich chestnut) *P. castanonota*. At Kangaragate, most of our sightings were also of *P. castanonota* down to 1,000 m. However, we saw the duller, uniformly coloured *P. geislerorum* three times, at 1,070, 1,110 and 1,265 m: dull slate-blue individuals that were presumed males, and dull brown individuals presumed to be females. Calls of the two species seemed similar: paired notes, *tsp-tsp*, the second of each pair louder; and a series of notes on the same high pitch, the first notes short, then a long note, and finally the loud *tsp-tsp*. Gilliard collected both species in the Adelberts at different sites but similar elevations (Gilliard & LeCroy 1967: 66), as did Stevens in the Herzog Mts. (Greenway 1935: 55). Coates (1990: 66) found both species co-existing in the Adelberts, even on adjacent territories, at 800–1,220 m. The ecological relations between these species remain mysterious to us, because the other four co-existing species of *Ptilorrhoa* (*P. castanonota*, Spotted *P. leucosticta*, Blue *P. caerulescens* and Black-vented Jewel-babblers *P. nigricrissus*) segregate cleanly by elevation (Diamond *et al.* 2019: 455–456). *P. geislerorum* was believed to be confined to the northern watershed of south-east New Guinea west to the Adelberts, until Verhelst & Pottier (2020) surprisingly discovered *P. geislerorum* or a similar taxon sharing Yapen Island with *P. castanonota*.

BLACK-BREASTED BOATBILL *Machaerirhynchus nigripectus*

Common and calling from 1,225 m upwards, usually alone, occasionally in pairs or in mixed-species flocks. Previously recorded from the Adelberts only by Pratt (1982).

BARRED CUCKOOSHRIKE *Coracina lineata*

Heard and seen three times, both at Kangaragate and at Munggur. Like *Sericulus [aureus]*, this species is encountered much less often on the Central Range than on the outlying mountains, where it is known from eight ranges.

SCLATER'S WHISTLER *Pachycephala soror*

Modestly common above 1,570 m, from the understorey to the canopy. Sings mainly at dawn. All songs are a simple pattern of a half-dozen whistled notes and slurs, but each rendition differs from the previous one. Despite the absence in the Adelberts of its usual hill-forest congener Rusty Whistler *P. hyperythra*, the Adelbert population of *P. soror* does not expand its elevational range downslope.

BLACK FANTAIL *Rhipidura atra*

Common above 1,475 m, singing, often in pairs. Previously recorded for the Adelberts only by Pratt (1982).

WAHNE'S PAROTIA *Parotia wahnesi*

Uncommon: heard five times between 1,495 and 1,660 m. Its vocalisations are a medley of staccato clucks; short harsh notes are repeated at half-second intervals, like the sound made by striking a hollow log; other unusual sounds; and clear notes. Well known to Munggur villagers and named 'kakopelima'. We found no display courts, probably because villagers reported that these are sited in gullies rather than on the ridge. Previously reported by Pratt (1982).

SUPERB BIRD OF PARADISE *Lophorina superba*

Common above 1,570 m, with calling males spaced along the ridge. We saw adult males but no female-plumaged birds. As true of other New Guinea mountaineers, Munggur villagers gave different names to males ('menemenemburúm') and females ('soboromúnga').

TORRENTLARK *Grallina bruijnii*

We observed this species just once, along a river at 615 m, but it is so distinctive in behaviour that it is well known to villagers (named 'manini' and 'asliklik' at Munggur and Kangaragate, respectively). Previously reported by Pratt (1982).

YELLOW-LEGGED FLYROBIN *Kempiella griseiceps*

We observed this inconspicuous flycatcher twice (once at each study site), sallying in the canopy, at 1,165 and 1,260 m. First Adelbert records.

TORRENT FLYCATCHER *Monachella muelleriana*

We observed this specialist of rushing mountain streams only at a river at 650 m. The sole previous Adelbert record was a specimen obtained by Beck.

BLACK-CAPPED ROBIN *Heteromyias armiti*

Abundant above 1,570 m, where the species was heard far more often than it was seen. There are two different high-pitched whistled long songs, one slow and the other fast, both consisting of a repeated four-note or five-note series on two closely spaced pitches. The call is a single short clear whistle. Previously collected in the Adelberts by Pratt (1982).

BLUE-GREY ROBIN *Peneothello cyanus*

Very uncommon (just four records) at 1,500–1,570 m. Like elsewhere in New Guinea, there are two quite different songs: a soft, very fast, rising, musical series of notes; and a loud

unmusical outburst comprising a repeated three-note pattern. Previously collected by Pratt (1982).

BANDED YELLOW ROBIN *Gennaedryas placens*

We observed one pair at 1,000 m near Kangaragate. KDB heard and saw several at 850 m (Keki Lodge). Previously observed in the Adelberts by Beehler.

BLACK-FRONTED WHITE-EYE *Zosterops atrifrons*

Common at Kangaragate down to 905 m, and abundant at Munggur up to 1,645 m. The Adelbert song is the 'wheel song' characteristic of the species elsewhere in New Guinea: a descending series of notes like the sound of a wheel turning, terminating in a flourish. Because two or three *Zosterops* species co-exist by elevational segregation on all other outliers except Van Rees, and because one *Zosterops* specimen collected in the Adelberts by W. Peckover was catalogued as *Z. novaeguineae* (very similar in plumage to *Z. atrifrons*, but very different in song) before being prepared as a skeleton, we paid particular attention to Adelbert white-eyes and their songs. All singing *Zosterops* that we encountered gave the 'wheel song' of *Z. atrifrons*. Because we found *Z. atrifrons* abundant up to the highest elevations in the Adelberts, it seems unlikely that *Z. novaeguineae* or any other *Zosterops* species could be present at high elevations along with *Z. atrifrons*.

STREAK-HEADED MANNIKIN *Lonchura tristissima*

We saw no mannikins in the Adelberts, but Kangaragate villagers described birds that were clearly mannikins as 'kugursarsar'. The only mannikin known to occur in the Adelberts is the forest-edge species *L. tristissima*, collected by Beck and by Gilliard. Evidently, the garden and grassland patches of the Adelberts are too small and recent to have attracted any of New Guinea's open grassland *Lonchura* species yet. In contrast, many areas of the Central Range and three other outliers, where dense human farming populations and open grassland have existed for centuries or millennia, each support one or two of six specialised grassland *Lonchura* species. We mention this to alert future visitors to look for colonisation of the Adelberts by some grassland *Lonchura*.

Mixed-species flocks.—Elsewhere in New Guinea (Diamond 1987) one encounters two types of mixed-species foraging flocks: a 'brown-black' flock of medium-sized omnivores, most of them with brown and / or black plumage, and consisting especially of pitohuis, birds of paradise, drongos and cuckoo-shrikes; and a flock of small insectivores. In our Adelbert studies at elevations above 640 m we encountered only the latter type. We met no brown-black flocks despite the abundant presence of two *Pitohui* species, and we encountered no mixed-species flocks of either type at the highest elevations above 1,500 m. Between 1,050 and 1,415 m at both Munggur and Kangaragate, the noisiest and most regularly encountered members of small insectivore flocks were Chestnut-bellied Fantail *Rhipidura hyperythra*, Black-winged Monarch *Monarcha frater* and Fairy Gerygone *Gerygone palpebrosa*, plus the pseudo-drongo Drongo Fantail *Chaetorhynchus papuensis* that is now considered a fantail (Beehler & Pratt 2016) and usually accompanies brown-black flocks. Other frequent members of these flocks were Ochre-collared *Arses insularis* and Fantailed Monarchs *Symposiachrus axillaris*, and three brown species that elsewhere accompany brown-black flocks (female King Bird of Paradise *Cicinnurus magnificus*, Tawny-breasted Honeyeater *Xanthotis flaviventer* and Little Shrikethrush *Colluricincla megarrhyncha*).

Acknowledgements

It is a pleasure to acknowledge our debts to: the people of Munggur and Kangaragate villages, for making our field work possible, and for sharing their knowledge of Adelbert birds and history; Mary LeCroy, for

reconstructing Rollo Beck's itinerary in the Adelberts; Dr Wendy Cooper, for permission to reproduce the late William Cooper's painting of *Sericulus bakeri*; Matt Zebrowski, for preparing Figs. 1 and 2; Iain Woxvold, for preparing Fig. 3 and explaining its significance to us; Dion Hobcroft and Phil Gregory, for sharing their observations in and around Keki Lodge; Brett Benz, for providing a list of his specimens; and Bruce Beehler, Thane Pratt, Clifford Frith and an anonymous reviewer, for valuable suggestions on our submitted manuscript.

References:

- Beehler, B. M., Diamond, J. M., Kempes, N., Scholes, E., Milensky, C. & Laman, T. G. 2012. Avifauna of the Foja Mountains of western New Guinea. *Bull. Brit. Orn. Cl.* 132: 84–101.
- Beehler B. M. & Pratt, T. K. 2016. *Birds of New Guinea: distribution, taxonomy, and systematics*. Princeton Univ. Press.
- Brookfield, H. C. & Hart, D. 1966. *Rainfall in the tropical southwest Pacific*. Australian Natl. Univ., Canberra.
- Chapin, J. P. 1929. A new bower-bird of the genus *Xanthomelus*. *Amer. Mus. Novit.* 367: 1–3.
- Coates, B. J. 1990. *The birds of Papua New Guinea, including the Bismarck Archipelago and Bougainville*, vol. 2. Dove Publications, Alderley.
- Cooper, D. T. & Forshaw, J. M. 1977. *The birds of paradise and bower birds*. Collins, Sydney.
- Diamond, J. 1969. Preliminary results of the ornithological exploration of the North Coastal Range, New Guinea. *Amer. Mus. Novit.* 2362: 1–57.
- Diamond, J. 1985. New distributional records and taxa from the outlying mountain ranges of Irian Jaya. *Emu* 85: 65–91.
- Diamond, J. 1987. Flocks of brown and black New Guinean birds: a bicoloured mixed-species foraging association. *Emu* 87: 201–211.
- Diamond, J. & Bishop, K. D. 2015. Avifauna of the Kumawa and Fakfak Mountains, Indonesian New Guinea. *Bull. Brit. Orn. Cl.* 135: 292–331.
- Diamond, J. & Bishop, K. D. 2020. Origins of the upland avifauna of Yapen Island, New Guinea region. *Bull. Brit. Orn. Cl.* 140: 423–448.
- Diamond, J., Bishop, K. D. & Sneider, R. 2019. An avifaunal double suture zone at the Bird's Neck Isthmus of New Guinea. *Wilson J. Orn.* 131: 435–458.
- Freeman, B. G. & Class Freeman, A. M. 2014. Rapid upslope shifts in New Guinea birds illustrate strong distributional responses of tropical montane species to global warming. *Proc. Natl. Acad. Sci. USA* 111: 4490–4494.
- Frith, C. D. & Frith, D. W. 2004. *The bowerbirds*. Oxford Univ. Press.
- Frith, D. W. & Frith, C. B. 1988. Courtship display and mating of the Superb Bird of Paradise *Lophorina superba*. *Emu* 88: 183–188.
- Gilliard, E. T. 1969. *The birds of paradise and bower birds*. Weidenfeld & Nicolson, London.
- Gilliard, E. T. & LeCroy, M. 1967. Annotated list of birds of the Adelbert Mountains, New Guinea. Results of the 1959 Gilliard Expedition. *Bull. Amer. Mus. Nat. Hist.* 138: 53–81.
- Greenway, J. C. 1935. Birds from the coastal range between the Markham and Waria Rivers, northeastern New Guinea. *Proc. New England Zool. Cl.* 14: 15–106.
- LeCroy, M. & Diamond, J. 2017. Rollo Beck's collection of birds in northeast New Guinea. *Amer. Mus. Novit.* 3873: 1–36.
- Lewis, M. P. (ed.) 2009. *Ethnologue: languages of the world*. SIL International, Dallas.
- Mayr, E. 1931. Die Vögel des Saruwaged und Herzoggebirges (NO Neuguinea). *Mitt. Zool. Mus. Berlin* 17: 639–723.
- McAlpine, J. R., Keig, G. & Shaw, K. 1975. *Climatic tables for Papua New Guinea*. Division of Land Use Research Tech. Pap. 37. Commonwealth Scientific and Industrial Research Organization, Australia.
- Pratt, T. K. 1982. Additions to the avifauna of the Adelbert Range, Papua New Guinea. *Emu* 82: 117–125.
- Pratt, T. K. & Beehler, B. M. 2015. *Birds of New Guinea*. Second edn. Princeton Univ. Press.
- Tupper, I. D. 2012. A grammar of Pamosu. Ph.D. thesis. La Trobe Univ., Bundoora.
- Verhelst, B. & Pottier, J. 2020. A survey of the eastern uplands of Yapen Island, New Guinea, reveals three new species records. *Bull. Brit. Orn. Cl.* 140: 449–455.
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Appendix: Adelbert bird species

Listed in column 2 are all bird species recorded from the Adelbert Mts. by the observers named in column 3.

Column 1: * = upland species, as defined in the text.

Column 3: observers who recorded the species. To the left of the dot are our records; to the right those by other observers. Our records: M = Munggur, K = Kangaragate, D = KDB's observations near Keki Lodge; [] =

named and described to us by Munggur or Kangaragate villagers, but not observed by us. Records of other observers: R = R. Beck, G = E. T. Gilliard, P = T. K. Pratt *et al.*, Z = A. Ziegler, B = B. M. Beehler.

Column 4 ('ab'): our estimates of abundance at Munggur and Kangaragate in 2004 (left and right of slash respectively). 1 = just 1–2 records. 2 = three or more records, but uncommon. 3 = common. 4 = the most abundant species.

Column 5 (L): elevational range, in metres, within which we observed the species.

Column 6 (no. of outliers): on how many of New Guinea's ten outlying mountains, including the Adelberts, does this upland species occur?

Column 7 (other mts.): on which of the six outliers most similar in elevation to the Adelberts does this upland species occur? F = Fakfak, K = Kumawa, N = North Coastal Range, W = Wandammen, C = Cyclops, J = Foja.

Column 8: local name in the Pamosu language spoken at Munggur.

Column 9: local name in the Aiti language spoken at Kangaragate. Spellings are those used by our Kangaragate informants. In their spelling system the letter r often functions as a semi-vowel that sounds to us like the English syllable 'ru' or 'ri', and several consonants are nasalised. What Kangaragate villagers write as b, d, g, j, k, s and y sounds to our ears like mb, nd, ng, nj, ng, nj or ny and ny, respectively.

Upland species?	Scientific and English names	Records	ab	L (m)	No. of mts.	Other mts.	Pamosu name	Aiti name
	cassowaries <i>Casuarius</i> sp.						oyor	marshung
	Northern Cassowary <i>Casuarius unappendiculatus</i>	[M][K]•G					olimes, sovove	kovár, tapungóvi
*	Dwarf Cassowary <i>Casuarius bennetti</i>	MK•P		815–1,450	7	NWJ	kurumbum-ate	
	Red-legged Brushturkey <i>Talegalla jobiensis</i>	[M]KD•RG	-/1	800–1,050			sawa	mibu
	New Guinea Scrubfowl <i>Megapodius decollatus</i>	[M][K]•RG					burukate	niáko
	Spotted Whistling Duck <i>Dendrocygna guttata</i>	•RG						
*	Salvadori's Teal <i>Salvadorina waigiuiensis</i>	[M]K•	-/1	640	4	J		as-avi
	Great Cuckoo-Dove <i>Reinwardtoena reinwardtii</i>	MKD•RGB	2/2	640–1,600			elevena	itgi
*	Black-billed Cuckoo-Dove <i>Macropygia nigrirostris</i>	MKD•RPZ	3/2	1,100–1,655	10	FKNWCJ	nangilinom	otgot
	Brown Cuckoo-Dove <i>Macropygia amboinensis</i>	MKD•RGPB	4/3	800–1,655			funate	otgot
	New Guinea Bronzewing <i>Henicophaps albifrons</i>	M•	1/-	1,000			enaemaeng- uru?	kbathithí
	Cinnamon Ground Dove <i>Gallinula rufiflora</i>	MK•	1/2	740–1,495			bururovov	prumumu
	White-bibbed Ground Dove <i>Alopecoenas jobiensis</i>	•RGP						
*	Pheasant Pigeon <i>Otidiphaps nobilis</i>	MK•GP	3/1	1,195–1,585	9	FKNWJ	gavogavo, marirumbe, mavok	aonagári
	Victoria Crowned Pigeon <i>Goura victoria</i>	[K]•RG					muvo	kobi
	Pacific Emerald Dove <i>C. longirostris</i>	•P						
	Stephan's Emerald Dove <i>Chalcophaps stephani</i>	[K]D•RGP		700–800			bururovov-uru	prthithí
	Wompoo Fruit Dove <i>Megaloprepia magnifica</i>	KD•RGPB	-/2	800–1,125			ileli-etat	yaki
	Dwarf Fruit Dove <i>Ptilinopus nainus</i>	D•		700–800				

Upland species?	Scientific and English names	Records	ab	L (m)	No. of mts.	Other mts.	Pamosu name	Aiti name
	Superb Fruit Dove <i>Ptilinopus superbus</i>	MKD•RGPB	4/4	800–1,640			ilahil	tgrv
*	Mountain Fruit Dove <i>Ptilinopus bellus</i>	MK•P	4/2	1,190–1,655	10	FKNWCJ	mafua	
	Pink-spotted Fruit Dove <i>Ptilinopus perlatus</i>	MKD•RB	2/3	815–1,235				
*	Ornate Fruit Dove <i>Ptilinopus ornatus</i>	MD•R	3/-	1,590–1,655	9	FKNWCJ	mapoko	
	Orange-bellied Fruit Dove <i>Ptilinopus iozonus</i>	KD•RGP	-/2	835–980				
	Beautiful Fruit Dove <i>Ptilinopus pulchellus</i>	MKD•RGPB	2/3	730–1,215			gaugau	saganai
	Purple-tailed Imperial Pigeon <i>Ducula rufigaster</i>	•RGB						
	Pinon's Imperial Pigeon <i>Ducula pinon</i>	M[K]•RGP	1/-	700–1,515			imbienum	iwog
	Zoe's Imperial Pigeon <i>Ducula zoeae</i>	MKD•RGPB	2/2	640–1,520			pepisekuri	mkósvi
*	Papuan Mountain Pigeon <i>Gymnophaps albertisii</i>	MKD•GP	2/2	700–1,650	10	FKNWCJ	kurupa	ivugu-wugu
	Yellow Bittern <i>Ixobrychus sinensis</i>	•R						
	Little Pied Cormorant <i>Microcarbo melanoleucos</i>	•R						
	Australasian Darter <i>Anhinga novaehollandiae</i>	•R						
*	Forbes's Forest Rail <i>Rallidula forbesi</i>	M[K]•P	2/-	1,525–1,600	8	KNWCJ	elekora	musupia
	White-browed Crane <i>Amaurornis cinerea</i>	•R						
	Rufous-tailed Bush-hen <i>Amaurornis moluccana</i>	[K]•G						uniakawa
	Greater Black Coucal <i>Centropus menbeki</i>	MKD•RGPB	2/2	875–1,445			timbu	tugát
	Lesser Black Coucal <i>Centropus bernsteini</i>	D•		700–800				
	Dwarf Koel <i>Microdynamis parva</i>	MKD•RB	3/4	700–1,505			kuwang-kuwang	niohám
	Eastern Koel <i>Eudynamis orientalis</i>	MK•	2/3	640–1,585				niohám
	Channel-billed Cuckoo <i>Scythrops novaehollandiae</i>	[K]D•R						manmigras
*	White-eared Bronze Cuckoo <i>Chalcites meyerii</i>	MK•G	2/3	875–1,250	10	FKNWCJ		Imákava?
	Little Bronze Cuckoo <i>Chalcites minutillus</i>	K•	-/1	835				
	White-crowned Cuckoo <i>Caliechthrus leucolophus</i>	MKD•B	2/2	840–1,445			pepisekoko	niakaka
	Chestnut-breasted Cuckoo <i>Cacomantis castaneiventris</i>	MKD•PB	3/3	700–1,655			pukakiri	inakosiri
	Brush Cuckoo <i>Cacomantis variolosus</i>	KD•RPZ	-/3	700–1,295			pukakiri	inakosiri
	Marbled Frogmouth <i>Podargus ocellatus</i>	MK•RGZ	2/2	875–1,655			kumbevi	krovikná

Upland species?	Scientific and English names	Records	ab	L (m)	No. of mts.	Other mts.	Pamosu name	Aiti name
	Papuan Frogmouth <i>Podargus papuensis</i>	K•RGZ	-/2	875			mum	mumugéw
	Large-tailed Nightjar <i>Caprimulgus macrurus</i>	D•		700–800				
*	Feline Owlet-nightjar <i>Aegotheles insignis</i>	M•P			7	KNWJ	dalek	
*	Mountain Owlet-nightjar <i>Aegotheles albertisi</i>	M•		1,655	6	KWJ	sipipolov	
	Barred Owlet-nightjar <i>Aegotheles bennettii</i>	MK•	-/1	875, 1,225				
	Moustached Treeswift <i>Hemiprocne mystacea</i>	[M]KD•RG	-/1	640–800			busiang	pogit
	Glossy Swiftlet <i>Collocalia esculenta</i>	MKD•B	1/2	700–1,220				
	Aerodramus sp.	MKD•PB	2/2	640–1,220			mai	niaba-mari-mari
*	Mountain Swiftlet <i>Aerodramus hirundinaceus</i>	•R			8	FKNWJ		
	Papuan Spinetailed Swift <i>Mearnsia novaeguineae</i>	K•	-/2	875				
	Little Ringed Plover <i>Charadrius dubius</i>	•P						
	Comb-crested Jacana <i>Irediparra gallinacea</i>	•R						
	Marsh Sandpiper <i>Tringa stagnatilis</i>	K•	-/1	875				
	Common Sandpiper <i>Actitis hypoleucos</i>	D•		700–800				
	Pacific Baza <i>Aviceda subcristata</i>	KD•	-/1	815				
	Long-tailed Buzzard <i>Henicoperis longicauda</i>	MK•GB	1/1	835–1,600			mambukom-mosu	pogi-as
	New Guinea Harpy-Eagle <i>Harpyopsis novaeguineae</i>	MK•RP	1/1	700–1,225			mambukom	pogi-tuguáya
*	Pygmy Eagle <i>Hieraetus tweiskei</i>	•G			6	CJ		
	Gurney's Eagle <i>Aquila gurneyi</i>	K•	-/1	830				
	Black Kite <i>Milvus migrans</i>	K•R	-/1	700–875				
	Whistling Kite <i>Haliastur sphenurus</i>	D•		700–800				
	Brahminy Kite <i>Haliastur indus</i>	MKD•G	1/2	835–1,225			siruwarum	pogi-mnáho-gnáha
	Variable Goshawk <i>Accipiter hiogaster</i>	K•GP	1/1	625–830			sikikin	pogi-soi
	Grey-headed Goshawk <i>Accipiter poliocephalus</i>	KD•B	1/1	700–1,060				
	Collared Sparrowhawk <i>Accipiter cirrocephalus</i>	MD•PB	1/-	700–1,400				
*	Chestnut-shouldered Goshawk <i>Erythrotriorchis buergeri</i>	•P			4	NJ		
	Sooty Owl <i>Tyto tenebricosa</i>	MK•B	-/1	1,190			yan	kius
	Papuan Boobook <i>Ninox theomacha</i>	KD•B	-/2	700–875			kol	tagogo
	Papuan Hawk-Owl <i>Uroglaux dimorpha</i>	•R						

Upland species?	Scientific and English names	Records	ab	L (m)	No. of mts.	Other mts.	Pamosu name	Aiti name
	Blyth's Hornbill <i>Rhyticeros plicatus</i>	MKD•RGB	2/2	640–1,400			kumbarom	sabkór
	Rainbow Bee-eater <i>Merops ornatus</i>	KD•GB	-/2	700–1,070			malimunga	sopirpir
	Oriental Dollarbird <i>Eurystomus orientalis</i>	KD•GPB	-/2	700–875				prakiki
	Common Paradise Kingfisher <i>Tanysepta galatea</i>	K•RGPZ		700–815				sambai-mká-mká
	Red-breasted Paradise Kingfisher <i>Tanysepta nympha</i>	K•GP	-/3	835–1,085			morumunga	konjeriki
	Hook-billed Kingfisher <i>Melidora macrorrhina</i>	MKD•RB	2/2	700–1,225			yayan-orov	kiykiyakna
	Shovel-billed Kookaburra <i>Clytoceyx rex</i>	•R						
	Rufous-bellied Kookaburra <i>Dacelo gaudichaud</i>	KD•RGB	-/2	640–975				katkro
	Blue-black Kingfisher <i>Todiramphus nigrocyaneus</i>	•RG						
	Forest Kingfisher <i>Todiramphus macleayii</i>	D•		700–800				
	Sacred Kingfisher <i>Todiramphus sanctus</i>	KD•R		700–875				kóko-wóra-wóra
	Yellow-billed Kingfisher <i>Syma torotoro</i>	KD•GZB	-/3	730–1,120				kóngakawa
	Common Kingfisher <i>Alcedo atthis</i>	•P						
	Papuan Dwarf Kingfisher <i>Ceyx solitarius</i>	MKD•GPB	2/3	700–1,295			epihiafemu	yobir
	Azure Kingfisher <i>Ceyx azureus</i>	K•RP	-/1	835				yobir
	Little Kingfisher <i>Ceyx pusillus</i>	•R						
	Oriental Hobby <i>Falco severus</i>	M•GP	1/-	830				
	Peregrine Falcon <i>Falco peregrinus</i>	M•G	1/-	1,225				
	Palm Cockatoo <i>Probosciger aterrimus</i>	MKD•RGB	1/2	700–1,295			kokovai	okyáki
	Sulphur-crested Cockatoo <i>Cacatua galerita</i>	MKD•RGPB	2/2	700–1,445			engev	motgáya
*	New Guinea Vulturine Parrot <i>Psitttrichas fulgidus</i>	KD•GPB	-/2	700–1,195	7	NWJ	tepal	manabu
*	Red-fronted Lorikeet <i>Charmosyna rubronotata</i>	MK•B	1/2	640–1,590	5	NC		
	Red-flanked Lorikeet <i>Charmosyna placentis</i>	KD•GP		700–1,100				
*	Stella's Lorikeet <i>Charmosyna stellae</i>	M•P	2/-	1,470–1,655	3		siovov	
*	Fairy Lorikeet <i>Charmosyna pulchella</i>	M•P		1,445–1,600	9	FKNWCJ	ikokik	
	Black-capped Lory <i>Lorius lory</i>	MKD•RPB	2/3	640–1,380			ororovion	úyouyó
	Rainbow Lorikeet <i>Trichoglossus haematodus</i>	MKD•RGPB	1/3	700–1,295			tiken	
	Dusky Lory <i>Pseudeos fuscata</i>	MKD•GPZB	2/3	700–1,600			kirikirik	kgggrs
	Edward's Fig Parrot <i>Psittaculirostris edwardsii</i>	•R						

Upland species?	Scientific and English names	Records	ab	L (m)	No. of mts.	Other mts.	Pamosu name	Aiti name
	Orange-breasted Fig Parrot <i>Cyclopsitta gulielmitertii</i>	•B						
	Double-eyed Fig Parrot <i>Cyclopsitta diophthalma</i>	D•		700–800				
	Papuan King Parrot <i>Alisterus chloropterus</i>	•P						
	Eclectus Parrot <i>Eclectus roratus</i>	MKD•RGPB	1/2	640–1,220			gelevan	apra (male), muko (female)
	Red-cheeked Parrot <i>Geoffroyus geoffroyi</i>	KD•RGB	-/2	700–875				kikimiya
*	Blue-collared Parrot <i>Geoffroyus simplex</i>	MK•P	2/1	1,190–1,655	9	FKNWCJ	enaenaeng-munga	kri-ró
	Buff-faced Pygmy Parrot <i>Micropsitta pusio</i>	K•RGB	-/3	700–875			opeliriruv	kam-tskin-tskín
*	Red-breasted Pygmy Parrot <i>Micropsitta bruijnii</i>	M•P	2/-	1,220–1,620	9	FKNWCJ	nangikiroton	
	Red-bellied Pitta <i>Erythropitta erythrogaster</i>	[K]•GPZB					maneme-savu	korakam
	Hooded Pitta <i>Pitta sordida</i>	•RGZ						
	White-eared Catbird <i>Ailuroedus buccoides</i>	[K]•RGB					senovov	pkhújo
*	Black-eared Catbird <i>Ailuroedus melanotis</i>	K•GP	-/2	1,150–1,265	9	FKNWJ	melanong	mimikuráw
*	MacGregor's Bowerbird <i>Amblyornis macgregoriae</i>	M•P	2/-	1,525–1,565	7	FKW	nomu	
*	Fire-maned Bowerbird <i>Sericulus akeri</i>	MKD•RGPB	2/2	700–1,385	5	NWJ	mororang	sinené
	White-shouldered Fairywren <i>Malurus alboscapulatus</i>	MKD•G	2/2	700–1,225				
*	Red-collared Myzomela <i>Myzomela rosenbergii</i>	M•P	4/-	1,430–1,645	9	FKNWCJ	meruru	
	Ruby-throated Myzomela <i>Myzomela eques</i>	•RG						
*	Red Myzomela <i>Myzomela cruentata</i>	MKD•GPZ	4/3	700–1,570	8	FKNCJ	ituetat	kawa-yágu
	Papuan Black Myzomela <i>Myzomela nigrita</i>	M•G	1/-	1,225				
	Tawny-breasted Honeyeater <i>Xanthotis flaviventer</i>	MKD•RGPZB	3/4	700–1,400			ekup	porowóro
*	Spotted Honeyeater <i>Xanthotis polygrammus</i>	K•GPZ	-/1	1,000	9	FNWCJ	sikurakuron-pope	kbrsíh
	Meyer's Friarbird <i>Philemon meyeri</i>	KD•RGB	-/3	700–1,140				koko-poro-woro
	Helmeted Friarbird <i>Philemon buceroides</i>	MKD•RGB	3/3	700–1,225			kawohok	poro-áya
	Green-backed Honeyeater <i>Glycichaera fallax</i>	K•RGPB		750				
	Plain Honeyeater <i>Pycnopygius ixoides</i>	KD•RGB	-/2	700–1,055				
	Streak-headed Honeyeater <i>Pycnopygius stictocephalus</i>	K•R	-/2	835–875				
*	Marbled Honeyeater <i>Pycnopygius cinereus</i>	M•P	4/-	1,580–1,620	3		momol	

Upland species?	Scientific and English names	Records	ab	L (m)	No. of mts.	Other mts.	Pamosu name	Aiti name
	Long-billed Honeyeater <i>Melilestes megarhynchus</i>	MK•RGPZB	3/3	700–1,655			etel	padiobre
	Puff-backed Meliphaga <i>Meliphaga aruensis</i>	•G						
	Mimic Meliphaga <i>Meliphaga analoga</i>	•RGZ						kbrták
*	Mountain Meliphaga <i>Meliphaga orientalis</i>	MK•GP	4/3	930–1,570	9	FKNWJ	kikimo	
*	White-eared Meliphaga <i>Meliphaga montana</i>	MKD•P	2/2	700–1,255	9	FKNCJ	kikimo	kbrták
	Yellow-gaped Meliphaga <i>Meliphaga flavivictus</i>	M•	1/-	1,220				
*	Ornate Melidectes <i>Melidectes torquatus</i>	M•P	4/-	1,385–1,665	3		sikura-kuron	
	Rusty Mouse-Warbler <i>Crateroscelis murina</i>	MKD•RGPZB	3/4	640–1,555			mil	kindgo
	Pale-billed Scrubwren <i>Sericornis spilodera</i>	MK•GPB	1/2	735–1,400				kindgo-mstám
*	Large Scrubwren <i>Sericornis nouhuysi</i>	M•GP	3/-	1,535–1,645	5	KJ	kuasisieva	
*	Buff-faced Scrubwren <i>Sericornis perspicillatus</i>	M•P	3/-	1,590–1,655	6	KNJ	kuasisieva-unend	
*	Grey-green Scrubwren <i>Sericornis arfakianus</i>	M•GPZ	1/-	1,650	8	NWCJ		
	Yellow-bellied Gerygone <i>Gerygone chrysogaster</i>	K•RGB	-/3	650–1,000			sepelak-munga	akoríma-kawa
	Green-backed Gerygone <i>Gerygone chloronota</i>	MKD•B	2/3	700–1,225				
	Fairy Gerygone <i>Gerygone palpebrosa</i>	MKD•GPB	4/4	700–1,430			itumemal	akoríma-kawa
	Large-billed Gerygone <i>Gerygone magnirostris</i>	•RGP						
*	Brown-breasted Gerygone <i>Gerygone ruficollis</i>	M•	2/-	1,590–1,645	7	FKWJ		
	Papuan Babbler <i>Garritornis isidorei</i>	[K]•RG						ua
*	Obscure Berrypecker <i>Melanocharis arfakiana</i>	•B			2			
	Black Berrypecker <i>Melanocharis nigra</i>	MKD•RGPZB	3/3	700–1,550			itu-uru?	pijruke-ruke
	Spectacled Longbill <i>Oedistoma iliolophus</i>	K•RGPB	-/2	875–1,295				
	Pygmy Longbill <i>Oedistoma pygmaeum</i>	MKD•GB	2/2	700–1,350			pelepele-kovov?	
	Yellow-bellied Longbill <i>Toxorhamphus novaeguineae</i>	KD•RGPZB	-/3	700–1,190				paniaták
*	Slaty-headed Longbill <i>Toxorhamphus poliopterus</i>	MK•GPZ	4/-	1,225–1,650	2		otemasik	paniaták
	Blue Jewel-babbler <i>Ptilorrhoa caerulescens</i>	D•RPB		700–800				
*	Dimorphic Jewel-babbler <i>Ptilorrhoa geislerorum</i>	K•G	-/3	1,070–1,265	2			
*	Chestnut-backed Jewel-babbler <i>Ptilorrhoa castanonota</i>	MK•GPB	3/3	1,000–1,655	9	FKNWJ	sasan	sojók wáw

Upland species?	Scientific and English names	Records	ab	L (m)	No. of mts.	Other mts.	Pamosu name	Aiti name
	Yellow-breasted Boatbill <i>Machaerirhynchus flaviventer</i>	D•PB		700–800				
*	Black-breasted Boatbill <i>Machaerirhynchus nigripectus</i>	M•P	3/-	1,225–1,655	7	FKWJ		
	Lowland Peltops <i>Peltops blainvillii</i>	•G						
*	Mountain Peltops <i>Peltops montanus</i>	MK•GP	2/3	700–1,590	9	FKNWJ	gamililik	opri-sbiá-sbiá
	Black Butcherbird <i>Cracticus quoyi</i>	K•RGB	-/1	640				kukarúbu
	Hooded Butcherbird <i>Cracticus cassicus</i>	KD•RG	-/2	700–875			kupakup	madoró
*	Great Woodswallow <i>Artamus maximus</i>	MKD•RGPZB	2/2	700–1,655	8	FKNWJ	arik	siksik
*	Stout-billed Cuckooshrike <i>Coracina caeruleoigrisea</i>	MKD•RGPB	3/2	700–1,580	10	FKNWCJ	seveve	sinené
*	Barred Cuckooshrike <i>Coracina lineata</i>	MKD•RGPB	2/2	700–1,340	8	KNWC		
	Boyer's Cuckooshrike <i>Coracina boyeri</i>	KD•RPB		700–875				
	White-bellied Cuckooshrike <i>Coracina papuensis</i>	D•RP		700–800				
	Black-browed Triller <i>Lalage atrovirens</i>	MKD•G	1/2	700–1,225			alik-ote	mdut-ba-kri-kri
*	Black-bellied Cicadabird <i>Edolisoma montanum</i>	MK•PZ	3/3	1,190–1,595	9	FKNWCJ	sakunane	uasyiyí
*	Papuan Cicadabird <i>Edolisoma incertum</i>	MKD•RGPB	4/4	700–1,300	10	FKNWCJ	sapik	kr-nyá-kr-nya
	Common Cicadabird <i>Edolisoma tenuirostre</i>	•R						
	Black Cicadabird <i>Edolisoma melas</i>	KD•RGB	-/2	635–830				
*	Rufous-naped Bellbird <i>Aleadryas rufinucha</i>	M•P	3/-	1,545–1,660	8	FKNWJ		
	Little Shrikethrush <i>Colluricincla megarhyncha</i>	MKD•RGPZB	4/4	640–1,585			kukuvelu	kwidak
	Rusty Shrikethrush <i>Pseudorectes ferrugineus</i>	[K]•RG						yokaya
*	Slater's Whistler <i>Pachycephala soror</i>	M•GP	3/-	1,570–1,655	5	FK	kikimo-aniv	
	Grey Whistler <i>Pachycephala simplex</i>	MKD•RGB	2/3	700–1,350				orkiakía
	Northern Variable Pitohui <i>Pitohui kirhocephalus</i>	K•RGP	-/4	640–1,085				sohé
*	Hooded Pitohui <i>Pitohui dichrous</i>	MKD•RGPB	4/4	930–1,500	10	FKNWCJ	kiakovov	sripopo
	Brown Oriole <i>Oriolus szalayi</i>	KD•RG	-/3	700–875			uruhar	káko-póro-áuga
*	Drongo Fantail <i>Chaetorhynchus papuensis</i>	MK•GPB	3/3	640–1,515	9	FKNWJ	mungawahak	tind
	Willie Wagtail <i>Rhipidura leucophrys</i>	MD•P		700–1,225				
	White-bellied Thicket Fantail <i>Rhipidura leucothorax</i>	KD•GZ	-/1	835			sigogogil	saggná

Upland species?	Scientific and English names	Records	ab	L (m)	No. of mts.	Other mts.	Pamosu name	Aiti name
	Sooty Thicket Fantail <i>Rhipidura threnothorax</i>	K•RGPZB	-/2	730–1,070			sigogogil	pigusése
	Rufous-backed Fantail <i>Rhipidura rufidorsa</i>	K•	-/1	800–835				pho-sokrí-sokrí
*	Black Fantail <i>Rhipidura atra</i>	M•P	4/-	1,475–1,640	9	FKNWCJ	pingege	
	Chestnut-bellied Fantail <i>Rhipidura hyperythra</i>	MKD•GPZB	4/3	700–1,590			siongigi	kora-sokrí-sokrí
	Northern Fantail <i>Rhipidura rufiventris</i>	MK•RGPB	3/1	835–1,235				Pho-sokrí-sokrí
	Spangled Drongo <i>Dicrurus bracteatus</i>	MKD•RG	1/2	640–1,220			fikafika	krs-kiyá-kiyá
*	Trumpet Manucode <i>Phonygamus keraudrenii</i>	MK•GP	3/3	1,005–1,660	8	FKNWJ	uru	korasatu
	Crinkle-collared Manucode <i>Manucodia chalybatus</i>	MKD•RGP	2/3	880–1,600			uru	satu
	Jobi Manucode <i>Manucodia jobiensis</i>	D•		700–800				
	Glossy Manucode <i>Manucodia ater</i>	•R						
*	Wahnes's Parotia <i>Parotia wahnesi</i>	M•P	2/-	1,495–1,660	5	WJ	kakopelema	
	Growling Riflebird <i>Ptiloris intercedens</i>	K•RGP	-/3	1,050–1,265				karaba uruwe
*	Superb Bird of Paradise <i>Lophorina superba</i>	M•P	3/-	1,570–1,655	4	W	mene-mene-mburúm (male), soboro-múnga (female)	
	King Bird of Paradise <i>Cicinnurus regius</i>	[K]•G					seva-etat	manara
*	Magnificent Bird of Paradise <i>Cicinnurus magnificus</i>	MKD•RGPB	2/3	640–1550	10	FKNWCJ	seva	pisáw
	Lesser Bird of Paradise <i>Paradisaea minor</i>	MKD•RGPZB	3/3	700–1,295			koyavi	kogíw
*	Torrentlark <i>Grallina bruijnii</i>	[M]K•P	-/1	615	5	NJ	yer	asliklik
	Ochre-collared Monarch <i>Arses insularis</i>	MK•RGP	2/3	640–1,350				manbue
	Shining Flycatcher <i>Myiagra alecto</i>	MK•RGPZ	-/1	875				
*	Fantailed Monarch <i>Symposiachrus axillaris</i>	MK•GP	2/2	870–1,550	9	FKNWJ	mungawahak-mengelena-fua	
	Rufous Monarch <i>Symposiachrus rubiensis</i>	•P						
	Hooded Monarch <i>Symposiachrus manadensis</i>	•RP						
	Spot-winged Monarch <i>Symposiachrus guttula</i>	•RGPB						
	Golden Monarch <i>Carterornis chrysomela</i>	•RGB						
*	Black-winged Monarch <i>Monarcha frater</i>	MK•GPZB	4/4	700–1,415	8	FKNWJ	fovaihua	manbue
	Grey Crow <i>Corvus tristis</i>	MKD•RGPB	2/2	640–1,550			mekand	tagapa
	Torresian Crow <i>Corvus orru</i>	D•P		700–800				

Upland species?	Scientific and English names	Records	ab	L (m)	No. of mts.	Other mts.	Pamosu name	Aiti name
*	White-eyed Robin <i>Pachycephalopsis poliosoma</i>	MK•GPZ	4/4	1035–1600	7	NWJ	singovulu	yokyok
*	Yellow-legged Flyrobin <i>Kempiella griseiceps</i>	MK•	1/1	1,165–1,260	8	FKNWC		
	Olive Flyrobin <i>Kempiella flavovirescens</i>	K•R	-/1	835				
*	Torrent Flycatcher <i>Monachella muelleriana</i>	K•R	-/2	650	6	NJ	manini	mnáki-pokipó
*	Papuan Scrub Robin <i>Drymodes beccarii</i>	MK•P	2/2	875–1,320	7	NWCJ	jin	kindgo-sapasapa
*	Black-capped Robin <i>Heteromyias armiti</i>	M•P	4/-	1,570–1,660	5	KJ	namenovi	
	Black-sided Robin <i>Poecilodryas hypoleuca</i>	MK•GPZB	3/4	665–1,225			motondo	tó-se
*	White-rumped Robin <i>Peneothello bimaculata</i>	MD•GB		700–1225	5	J		
*	Blue-grey Robin <i>Peneothello cyanus</i>	M•P	2/-	1,500–1,570	8	FKNWCJ	ulafamungeva?	
*	Banded Yellow Robin <i>Gennaodryas placens</i>	KD•B	-/1	700–1,000	5	FKW	golugolulovov?	omtóndo
*	White-faced Robin <i>Tregellasia leucops</i>	MK•GPZ	3/2	735–1,655	9	FKNWCJ	natuemil?	Aoádkáwa
	Pacific Swallow <i>Hirundo tahitica</i>	D•G		700–800				
*	Island Leaf Warbler <i>Seicercus poliocephalus</i>	MK•P	4/1	1,260–1,655	9	FKNWCJ		
*	Black-fronted White-eye <i>Zosterops atrifrons</i>	MKD•GPB	4/3	700–1,645	10	FKNWCJ	malilovov	kima-oróró
	Golden-headed Cisticola <i>Cisticola exilis</i>	•G						
	Metallic Starling <i>Aplonis metallica</i>	[K]D•RG		700–800			kuseng	snha
	Yellow-faced Myna <i>Mino dumontii</i>	MKD•RGPB	2/3	640–1,350			evakurok	awgura
	Golden Myna <i>Mino anais</i>	K•RG	-/2	830–845				kriro
*	Russet-tailed Thrush <i>Zosterops heinei</i>	•Z			5	KJ		
	Red-capped Flowerpecker <i>Dicaeum geelvinkianum</i>	MKD•RGPB	3/4	640–1,515			titieva	psták
	Black Sunbird <i>Leptocoma aspasia</i>	MKD•RGB	1/-	700–1,200				
	Olive-backed Sunbird <i>Cinnyris jugularis</i>	D•G		700–800				
*	Blue-faced Parrotfinch <i>Erythrura trichroa</i>	MKD•PB	3/-	875–1,570	8	FKNWJ		
*	Papuan Parrotfinch <i>Erythrura papuana</i>	•P			2			
	Streak-headed Mannikin <i>Lonchura tristissima</i>	•RG						kungur-sargar
	Grey Wagtail <i>Motacilla cinerea</i>	[K]•						