Corrections to the published elevational limits of 17 species from Bacan, North Moluccas

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Summary. Wallacea is among the most under-studied regions of the tropics, with even basic biological data lacking for most bird species. Even by these standards, the North Moluccas have been historically neglected. A three-day visit to Buku Sibela on Bacan, North Maluku, in October 2022 yielded elevation extensions for 17 species, of which 13 are endemic to the North Moluccan subregion. In many instances, species are now known to occur at much higher elevations on Bacan than previously assumed, potentially reducing their extinction risk throughout the North Moluccas, where forest loss in the lowlands is substantially more rapid. Other visitors to, and researchers in, Indonesia are encouraged to record and publish altitudinal information where it is otherwise unavailable — these data are a critical component for mapping species' ranges, monitoring habitat losses, and documenting possible temporal changes in elevation in response to climate change.

Ringkasan. Wallacea adalah salah satu kawasan tropis yang paling sedikit diteliti, dengan data biologis dasar untuk sebagian besar spesies burung yang jarang. Bahkan berdasarkan standar ini, secara historis Maluku Utara telah terabaikan. Kunjungan tiga hari ke Buku Sibela di Bacan, Maluku Utara, pada bulan Oktober 2022 menghasilkan perluasan ketinggian untuk 17 spesies, 13 di antaranya endemik di subkawasan Maluku Utara. Dalam banyak kasus, spesies-spesies tersebut kini diketahui hidup di lokasi yang jauh lebih tinggi di Bacan dibandingkan perkiraan sebelumnya, sehingga berpotensi mengurangi risiko kepunahan mereka di seluruh Maluku Utara, di mana hilangnya hutan di dataran rendah jauh lebih cepat. Baik pengunjung ataupun peneliti di Indonesia didorong untuk mencatat dan mempublikasikan informasi ketinggian di mana informasi tersebut tidak tersedia — data ini merupakan komponen penting untuk memetakan wilayah jelajah spesies, memantau hilangnya habitat, dan mendokumentasikan kemungkinan perubahan ketinggian secara bertahap sebagai respons terhadap perubahan iklim.

Introduction

The North Moluccas (Maluku Utara) remains one of the most poorly documented regions in Indonesia, despite much historical attention from collectors (e.g., Wallace 1869; Hartert 1903), with little information published on even basic aspects of its species' biology. While field research to these islands was previously hampered by difficult logistics, accessing the region's most (ornithologically) interesting islands is now easier than ever.

The island of Bacan lies just 18 km from Halmahera (which is now regularly visited by birdwatchers) and was visited frequently in the late 19th century (see Hartert [1903] for a review) but has been neglected in recent decades. After an expedition by Ripley (1954), Bacan's avifauna was not published on until fieldwork by Frank Lambert in 1991-1992 (Lambert 1994). eBird (2022) data show several other recent visits, principally by those en route to Obi, the ferry to which stops at Bacan for a couple of hours in the early morning, allowing for only a brief exploration of degraded lowland forests near the port.

Bacan's avifauna is, unsurprisingly, chiefly of North Moluccan affinity, having been connected to Halmahera during periods of glacial maxima, most recently c. 12,000 years ago (Bintanja *et al*. 2005; Rheindt & Eaton 2018). However, the island's high-reaching elevations (peaking at over 2,000 m) lend it an endemic montane component unmatched elsewhere in the North Moluccas (Halmahera peaks at 1,560 m), including taxa of species found nowhere else in the province. For example, and perhaps most remarkably, the island hosts a disjunct subspecies of Papuan Mountain Pigeon *Gymnophaps albertisii exsul*, nearly 700 km to the west of the nominate in New Guinea. It is therefore unsurprising that many species occur at higher elevations on Bacan than elsewhere in the North Moluccas (Hartert 1903; Lambert 1992; Eaton *et al*. 2021), but this remains poorly documented with nothing published explicitly on the island's avifauna since Lambert (1992), who reached only 1,300 m. Other altitudinal information from the island originates from the interpretation of historic specimen labels, many of which are imprecise, or lack elevation data entirely (Hartert 1903). The following contribution documents a number of revisions to altitudinal limits from the island.

Site and details of visit

Buku Sibela is the highest peak on Bacan, and the North Moluccas, reaching 2,085 m. I visited the mountain 12-14 October 2022, with camps set at 1,100 m and 1,500 m, each for one night. From the latter, forests were explored up to just below 1,700 m. Species were observed and identified according to standard reference works, and their elevations noted on a GPS device. Weather throughout the brief visit was excellent, with little to no rain and uninhibited visibility.

Existing elevational limits of species were acquired from Eaton *et al*. (2021) and Birds of the World (2022) accounts, which incorporate previously published data sources from the region, including Hartert (1903), White & Bruce (1986), Lambert (1992), Coates & Bishop (1997) and Poulsen & Lambert (2000), all of which were also checked independently. The taxonomy and nomenclature hereafter follow Eaton *et al*. (2021).

Observations

A total of 17 species were observed outside their published global elevation limits, of which 11 refer to North Moluccan endemics (Table 1). Some of these extensions are substantial and observations of select species are discussed below.

Table 1. Global elevation extensions of bird species from Buku Sibela, Bacan in October 2022. **(E)** denotes species that are endemic to the North Moluccas. **(E*)** are species endemic to Bacan. English names, taxonomy and sequence follow Eaton *et al*. (2021).

Species	Elevation in Eaton *et al*. (2021)	Elevation in Birds of the World (2022)	Revised elevation
Grey-headed Fruit Dove *Ptilinopus hyogastrus* **(E)**	To 1,000 m	To 1,000 m	To at least 1,600 m
Papuan Mountain Pigeon *Gymnophaps albertisii*	900-1,500 m	900-1,500 m (Bacan); 0-3,350 m (extralimital)	To at least 1,700 m
Cinnamon-bellied Imperial Pigeon *Ducula basilica* **(E)**	To 1,100 m	1,000 (Bacan); 1,040 m (Halmahera)	To at least 1,600 m
Halmahera Goshawk *Tachyspiza* [*Accipiter*] *henicogramma* **(E)**	Not given	To 1,300 m	To 1,500 m
Common Paradise-kingfisher *Tanysiptera galeata*	Mostly to 500 m, rarely to 800 m	Mostly to 300 m, occasionally to 820 m (global)	To 1,050 m
Violet-necked Lory *Eos riciniata* **(E)**	Not given	To 1,220 m	To at least 1,600 m
Chattering Lory *Lorius garrulus* **(E)**	Not given	To 1,300 m	To at least 1,700 m
Red-flanked Lorikeet *Hypocharmosyna placentis*	To 1,400 m	To 1,400 m	To at least 1,600 m
Moluccan Hanging Parrot *Loriculus amabilis* **(E)**	Not given	Not given	To at least 1,600 m

Species	Elevation in Eaton *et al.* (2021)	Elevation in Birds of the World (2022)	Revised elevation
Bacan Myzomela *Myzomela batjanesnsis* **(E*)**	Above 900 m	Not given	Above 800 m
Sultan's (or Moluccan) Myzomela *Myzomela simplex* **(E)**	Not given	To 1,200 m	To at least 1,600 m
Rufous-bellied Triller *Lalage aurea* **(E)**	To 450 m	To 450 m	To 1,400 m
Gilolo Fantail *Rhipidura torrida* **(E)**	Above 700 m	Not given	Above 600 m
Wallace's Standardwing *Semioptera wallacii* **(E)**	Not given	To above 1,050 m	To 1,400 m
Shining Monarch/Flycatcher *Myiagra alecto*	To 1,000 m	To 1,280 m (extralimital)	To 1,400 m
Halmahera Golden Bulbul *Hypsipetes chloris* **(E)**	Not given	Not given	To 1,350 m
Bacan White-eye *Zosterops atriceps* **(E*)**	To 700 m	To 700 m	To 1,400 m

Bacan White-eye *Zosterops atriceps* (Plate 1) is a recently proposed split from the Cream-throated White-eye complex based on distinctive vocalisations and (more modest) plumage differences (see Eaton & Rheindt 2018). Both Eaton & Rheindt (2018) and Eaton *et al*. (2021) considered this species to occur in only the lowlands (maximum elevation: 700 m), however in 2022 it was encountered regularly, typically in mixed-species flocks, to approximately 1,400 m. From c. 1,500 m, it is replaced by the montane Warbling White-eye *Zosterops japaonicus* (although Lambert [1994] recorded the latter species as low as 870 m). Bacan's other endemic bird species, Bacan Myzomela *Myzomela batjanensis*, was found from 800 m (previously published as having a minimum elevation of 900 m: Eaton *et al*. 2021); the taxonomy and identification of this form was recently reviewed by Berryman (2022).

Four parrot species were found at higher elevations than previously recorded (Table 1), among them the Vulnerable Chattering Lory *Lory garrulus flavopalliatus* (Plate 2), which was observed flying to at least 1,700 m, higher than the 1,300 m recorded by Collar & Boesman (2020). In these cases, birds may have been attracted to flowering trees—which were plentiful at the time of my visit—outside of their usual elevational range. Nonetheless, that these species can make use of feeding sites at higher elevations is notable.

Papuan Mountain Pigeon (Plate 3) was previously said by Eaton *et al*. (2021) to occur at 900-1,500 m on Bacan. In October 2022, the species was not detected until reaching 1,500 m, after which they proved common and were regularly seen ascending to higher elevations; two individuals, watched from 1,600 m, were observed to alight in forest at least 100 m higher, suggesting that they probably occur higher than the 1,700 m limit suggested here. On New Guinea, the species has been observed to at least 3,350 m (Beehler & Pratt 2016), while Bacan's geographically closest occurring *Gymnophaps* species, Seram Mountain Pigeon *G. stalkeri* and Buru Mountain Pigeon *G. mada*, are recorded to 2,300 and 2,100 m respectively (Eaton *et al*. 2021). It is therefore probable that Papuan Mountain Pigeon occurs to Buku Sibela's tree-line, although this requires confirmation. The vocalisations of this taxon remain unknown (Eaton *et al*. 2021): despite several observations of the species over the two days, none were heard to call.

The occurrence of Cinnamon-bellied Imperial Pigeon *Ducula basilica* to (at least) 1,600 m on Bacan ostensibly appears to be a significant extension of its published limit of 1,000-1,100 m (del Hoyo *et al*. 2020; Eaton *et al*. 2021). However, both of these sources appear to have overlooked Mittermeier *et al*. (2013), who found the species to 1,550 m on Obi, thus its occurrence in upper montane forest on Bacan is unsurprising. It is noteworthy, however, that populations of Cinnamon-bellied Imperial Pigeon on Obi (*obiensis*) are distinctive in plumage and may represent a separate species (Hartert 1898; del Hoyo & Collar 2014). Similarly, Rufous-bellied Triller *Lalage aurea* was observed three times at 1,100-1,400 m, substantially above the 450 m elevational limit mentioned in Taylor (2020) and Eaton *et al*. (2021). However,

Mittermeier *et al*. (2013) observed the species to 1,100 m on Obi, thus the observations herein represent a more modest altitudinal extension than first appears.

Conclusion

The correction of 17 species' altitudinal limits in only 2.5 days on a single mountain reinforces suggestion (e.g., Noske 2017) that there remains an immense amount of basic natural history information to be gathered on Wallacean birds. Incomplete knowledge of species' altitudinal limits across space and time greatly limits our ability to produce accurate range maps and monitor changes in elevation over time in response to climate change. They are also a vital component in quantifying species' population reductions in response to habitat loss. With lowland forests in North Moluccas significantly more threatened than those in the highlands (and with that trend set to become even more exaggerated; see Voigt *et al*. 2021), the discovery of species at elevations higher than those previously supposed reduces their projected extinction risk. The collection and publication of these data are therefore vital, and I encourage all ornithologists, amateur and professional, to keep detailed notes on the elevations they encounter birds, which often vary also between islands in a species' range.

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Plate 1. Bacan White-eye *Zosterops atriceps* occurs up to 1,400 m (above which it is excluded by *Z. japonicus*), much higher than 700 m as previously published.

Plate 2. Chattering Lory *Lorius garrulus*. Birds of the distinctive, and threatened, *flavopalliatus* form were found to be common to at least 1,700 m.

Plate 3. Papuan Mountain Pigeon *Gymnophaps albertisii*. The disjunct subspecies, *exsul*, is endemic to Bacan and was encountered from 1,500 m. This is believed to be the first published photograph of this taxon.