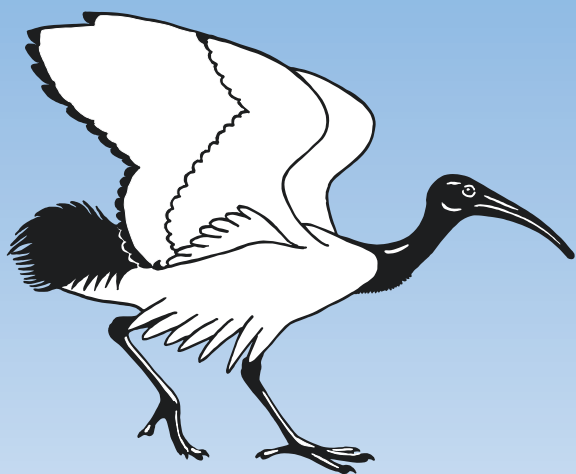


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CLUB ANNOUNCEMENTS

The 991st meeting of the Club was held on Monday 17 September 2018 in the upstairs room at the Barley Mow, 104 Horseferry Road, London SW1P 2EE. Twenty-one people were present: Miss H. Baker, Mr P. J. Belman, Mr R. Baker, Mr T. Brown, Mr S. Chapman, Mr G. Davidson, Mr G. de Silva, Mr D. J. Fisher, Ms R. Gleave, Dr C. F. Mann, Dr H. Lloyd (*Speaker*), Mr D. J. Montier, Mrs M. Montier, Dr S. Pringle, Mr R. Pritchett, Dr R. Prÿs-Jones, Dr P. Rudge, Mr S. A. H. Statham, Mr C. W. R. Storey (*Chairman*), Mr S. Turvey, Ms J. White.

Huw Lloyd gave a talk entitled *Crabs, cranes, and cuckoos: developing bird conservation science in China*. China is making tremendous efforts to reach out to the international bird conservation community to help develop its next generation of bird conservationists. Since 2010, Huw Lloyd and colleagues have been working with Chinese universities and the China Ornithological Society, helping to develop these young scientists. These research collaborations have shed new light on the ecology of migratory Red-crowned Cranes *Grus japonensis*, revealing how they respond to the pressures of habitat change, and what sustains their wintering population. They have also discovered how some of China's threatened bird populations are likely to respond to climate change, and how vocal individuality in populations of male Common Cuckoos *Cuculus canorus* can be used as a non-invasive marker for monitoring their population.

OBITUARY

Patricia ('Paddy') A. Cottam (née Lawford), 1932–2018

Mrs 'Paddy' Cottam, who was born on 5 February 1932 and sadly died on 13 April 2018, worked as a curatorial Assistant in the British Museum (Natural History) (BMNH) Bird Room for six and a half years, from 1 November 1950 until 30 April 1957. The daughter of Commander Lawford, who worked in the Admiralty's Hydrographic Department in London, she grew up in London's suburbia, with periods in Dorset and Bath, in the latter of which she was a pupil at the Royal High School. Biology was her favourite subject and she attained a degree in Zoology from Chelsea Polytechnic through attending night school there. Following her initial curatorial apprenticeship after joining BMNH, early in 1952 she and a fellow young Assistant, Graham Cowles, were assigned to the avian osteology collection, which had just been moved into new accommodation in the museum basement. Partly due to the intervention of World War II, little curatorial work had been undertaken on bird skeletons for *c.*20 years, and the main task they initially set themselves was to prepare a separate avian osteology register, involving the extraction of relevant data from old registers as well as much new registering of backlogged specimens. On completion of this in 1953, a systematic re-curation of the collection was begun, which continued through Paddy's remaining years of service.

During 1954, Paddy was involved in her first scientific publication, when she assisted the Head of the Bird Room, J. D. Macdonald, to compile records of birds observed at sea during *HMS Challenger's* recent Pacific Ocean cruise (Macdonald & Lawford 1954). By 1955, the Department's Annual Report notes that 'Miss P. A. Lawford has carried out osteological research on the Pelecaniform characters of the Shoe-bill Stork, *Balaeniceps rex*', presumably arising out of the re-curation of storks and their allies on which she had been involved in the previous year. The following year's report noted that she had not only completed this research but begun further investigations into the osteology of the Anhimidae and Anatidae, although the latter never developed further due to her marriage to husband David on 6 October 1956 and subsequent departure from BMNH in spring 1957, when she moved to Lincoln.

Paddy's *Balaeniceps* publication (Cottam 1957) is striking for more than one reason. Firstly, as a young female Assistant, she had nevertheless impressed her superiors sufficiently to be supported not only by the Head of the Bird Room, but also by the Zoology Department Keeper and Deputy Keeper (acknowledged in the paper), in undertaking a major piece of research and publishing it as sole author. Secondly, the research itself was quite remarkably prescient and retains a continuing importance. Although Gould had suggested a possible Pelecaniform relationship for *Balaeniceps rex* when he described the species in the early 1850s, consensus opinion for the following 100 years had placed it close to the storks. Paddy's osteological conclusions have since been largely supported by morphological and molecular research that points to a close relationship between pelicans, the Shoebill and Hamerkop *Scopus umbretta*, the last-named not included

in her study. The importance of Paddy's work was immediately recognised, as shown by a letter of August 1957 from the eminent anatomist Prof. A. J. E. Cave, St Bart's Hospital, to J. D. Macdonald, in which he commented '...this is an excellent and gratifying piece of work ... [which] demonstrates what good work can be effected by the unbiased observant eye and a modicum of common sense ... Your lady has produced a little classic which will [long] retain its significance in 'the literature''.

Paddy loved working in BMNH and clearly had a close and easy-going friendship with her Bird Room colleagues, notably Graham Cowles, who remained working on birds in the museum until his retirement in 1991 and continued to correspond with her up to her death. This included her relationship with J. D. Macdonald, as revealed in letters they exchanged during the period immediately following her retirement. In mid-May 1957, Paddy returned to London to give a lecture at the Zoological Society on her *Balaeniceps* research. Writing to Macdonald prior to this, she asked him to please 'tell Graham that it will be much more frightening than getting married', to which Macdonald replied that she need have no worries as not only had she something really interesting to put across but, moreover, the lecture would soon be over and done whereas the marriage was only just beginning!

In Lincoln, she endeavoured unsuccessfully to find work in a local museum, but ended up working at Fisons until the birth of her first daughter in 1959. Following periods in Hitchin, where her second daughter was born, and Brentwood, the family moved long term to Newcastle in May 1969. To her great frustration, she was again unable to obtain paid work in a natural history museum and had to retrain as a secretary, working in this role in a hotel, a garage and, for many years, a school. However, she also began volunteering in the Hancock Museum (now the Great North Museum: Hancock), Newcastle, initially on a few afternoons but, after retirement, for five mornings a week. Her association with the Hancock, where she identified, catalogued and labelled their important osteology collection, lasted approaching 30 years and, in the words of her family, 'saved her'! A major exhibition on 'Bones' staged by the Hancock in 2017 was in important part dependent on her many prior years of work, and while volunteering there she published her only other scientific paper of which I am aware (Cottam 1991), as well as providing input to work published by others on whale bones. She is remembered by a then senior staff member there, Alec Coles, as someone who selflessly gave her heart, soul and much time to a cause she passionately believed in.

I am grateful to Fiona Waugh, daughter of Paddy, and to Alec Coles, Graham Cowles, Dan Gordon and Effie Warr, former colleagues of Paddy, for information.

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Robert Prŷs-Jones

REFEREES

I am grateful to the following, who have reviewed manuscripts submitted to the Bulletin during the last year (those who refereed more than one manuscript are denoted by an asterisk in parentheses): David Allan, Jorge Avendaño, Rob Bjlisma, Elisa Bonaccorso, Frederik Brammer, Guilherme Brito, Terry Chesser, Nigel J. Collar (*), Jo Cooper, Andrea Corso, Geoffrey Davison, Andrew Elliott, Brian Finch (*), Juan F. Freile, Hector Gómez de Silva, Harold F. Greeney, Hein van Grouw (*), Steve N. G. Howell (*), Julian P. Hume, Nigel Hunter, Morton L. Isler, Ron Johnstone, Niels Krabbe, Alex Lees (*), Wayne Longmore (*), Clive F. Mann, David Manry, Daniel Mennill, Israel Moreno-Contreras, Pat Morris, José Fernando Pacheco (*), Robert J. Payne, Vitor Piacentini, Tony Prater, Robert Prŷs-Jones (*), Paulo C. Pulgarín, Peter Pyle, Joel Ralston, Frank Rheindt, Dominic Rollinson, Roger Safford, Richard Schodde (*), Thomas S. Schulenberg, Christopher J. Sharpe (*), Frank D. Steinheimer (*), Fernando Costa Straube, Michael Tarburton, Till Töpfer, Don Turner, Andrew Vallely, George Wallace, David R. Wells (*), Kevin J. Zimmer (*) and Kristof Zyskowski. — THE HON. EDITOR

FORTHCOMING MEETINGS

See also BOC website: <http://www.boc-online.org>

BOC MEETINGS are open to **all**, not just BOC members, **and are free**.

Evening meetings are in an **upstairs room at The Barley Mow, 104 Horseferry Road, Westminster, London SW1P 2EE**. The nearest Tube stations are Victoria and St James's Park; and the 507 bus, which runs from Victoria to Waterloo, stops nearby. For maps, see http://www.marketaverns.co.uk/the_barley_mow.html or ask the Chairman for directions.

The cash bar opens at **6.00 pm** and those who wish to eat after the meeting can place an order. **The talk will start at 6.30 pm** and, with questions, will last c.1 hour.

Monday 18 March 2019—6.30 pm—Julia Day—*Continental vs. island evolution of a ‘great speciator’: resolving the *Zosterops* taxonomic conundrum.*

Abstract: Different environments, such as islands and continents, have had profound effects on how biodiversity is shaped. While evolutionary processes are predicted to follow different patterns in island and mainland radiations, the extent to which these geographical contexts influence evolutionary trajectories remains poorly understood. This is in part because few studies have focused on species-rich groups of highly dispersive animals, which can colonise both continents and extensive archipelagos over comparable timeframes. In this talk I will focus on how resolving the evolutionary relationships of white-eyes (*Zosterops*)—lauded as a ‘great speciator’—in Africa, Arabia and associated islands, combined with morphological data, has allowed us to better understand evolutionary processes across these different geographic landscapes. I will also discuss how museum collections and genetic data have aided in the task of deciphering the tricky and sometimes infuriating taxonomy of this highly cryptic group, leading to a likely substantial increase in mainland species.

Biography: Julia Day is Associate Professor at University College London and has developed a research programme in evolutionary and, more recently, ecological research. She mainly works on species-rich groups of African fishes but, being a birder, couldn’t resist the challenge of working on a notoriously difficult-to-identify avian group.

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Friends receive regular updates about Club events and are also eligible for discounts on the Club’s Occasional Publications. It would assist our Treasurer, Richard Malin (e-mail: rmalin21@gmail.com), if you would kindly inform him if you intend becoming a Friend of the BOC.

The *Bulletin* and other BOC publications

From volume 137 (2017), the *Bulletin* of the BOC has become an online journal, published quarterly, that is available to all readers without charge. Furthermore, it does not levy any publication charges (including for colour plates) on authors of papers and has a median publication time from receipt to publication of six months. Prospective authors are invited to contact the *Bulletin* editor, Guy Kirwan (GMKirwan@aol.com), to discuss future submissions or look at <http://boc-online.org/bulletin/bulletin-contributions>. Back numbers up to volume 132 (2012) are available via the Biodiversity Heritage Library website: www.biodiversitylibrary.org/bibliography/46639#/summary; vols. 132–136 are available on the BOC website: <http://boc-online.org/>

BOC Occasional Publications are available from the BOC Office or online at info@boc-online.org. Future BOC-published checklists will be available from NHBS and as advised on the BOC website. As its online repository, the BOC uses the British Library Online Archive (in accordance with IZCN 1999, Art. 8.5.3.1).

History of the Scarlet Ibis *Eudocimus ruber* in south and south-east Brazil

by Henrique Chupil & Emygdio Leite de Araujo Monteiro-Filho

Received 9 March 2018; revised 13 August 2018; published 14 December 2018

<http://zoobank.org/urn:lsid:zoobank.org:pub:F144E211-8205-4B20-9C0A-AB27E4185103>

SUMMARY.—In Brazil Scarlet Ibis *Eudocimus ruber* occurs mainly in the north, south-east and south. During the 1900s, there was a significant reduction in the number of records in the latter two regions of the country, but this began to change in the early 1980s, when numbers of Scarlet Ibis gradually started to increase over the years. We contextualise the history of the species in south and south-east Brazil, and discuss the causes for its apparent disappearance and reappearance in these regions. We believe that anthropogenic factors, coupled with the species' ecology, were responsible for the reduction and subsequent resurgence of Scarlet Ibis.

Scarlet Ibis *Eudocimus ruber* is one of the most emblematic birds in the Americas, occurring across northern and eastern South America, from northern Colombia to Trinidad, the Guianas and coastal Brazil, with small outlying populations in Panama and Ecuador (Hancock *et al.* 1992). In Brazil, there are two disjunct populations: one in the north, in the states of Pará, Amapá and Maranhão; and the other in the south, in São Paulo, Paraná and Santa Catarina (Sick 1997).

Its occurrence in Brazil was first mentioned as long ago as the 16th century, with reference being made to the use of the species' feathers by indigenous craftsmen in what is now the state of São Paulo (Staden 1557), while later in the second half of the 16th century the Jesuit Fernão Cardim (Cardim 1925) and Portuguese historian and chronicler Pero de Magalhães Gândavo (Gândavo 1576) both referred to the Scarlet Ibis, especially its striking plumage.

Subsequently, in Santa Catarina the first reports date from 1712 and 1763, representing the southernmost historical records (Haro 1990). In Paraná, according to Straube (2005), the first 'mention' of Scarlet Ibis dates from 1653—in an illustration of Paranaguá Bay by José Teixeira Albermás II. Thereafter, more specific references to the species' occurrence in the state came from Johann Natterer in 1820, on the basis of the specimens that he collected and later deposited in Vienna (Naturhistorisches Museum Wien) and the reports of Augustin Saint-Hilaire between 1820 and 1855, also in Paranaguá Bay, near the mouth of Nhundiaquara River and in the environs of Guaratuba (Straube 2012).

Further historical records of Scarlet Ibis in this region of Brazil were made in the early 20th century, by A. R. Martins, on the coast of Paraná (Straube 2015), and by the engineer and naturalist R. Krone, around Iguape (on the south coast of São Paulo state) during the rainy season (Olmos & Silva e Silva 2003). However, with respect to Santa Catarina, by the time Naka & Rodrigues (2000) discussed the species, they believed it to have been extinct in the state for *c.*150 years.

Thereafter, in the 20th century, published data suggested that only a very small population was present in south-east Brazil, based on the isolated records available (Lago-Paiva 1994, Teixeira & Best 1981). For example, in 1961 when an individual was collected at São Vicente, in coastal São Paulo, it was considered the first record in south-east Brazil following decades of absence (Lago-Paiva 1994). For Paraná, there was only the report by

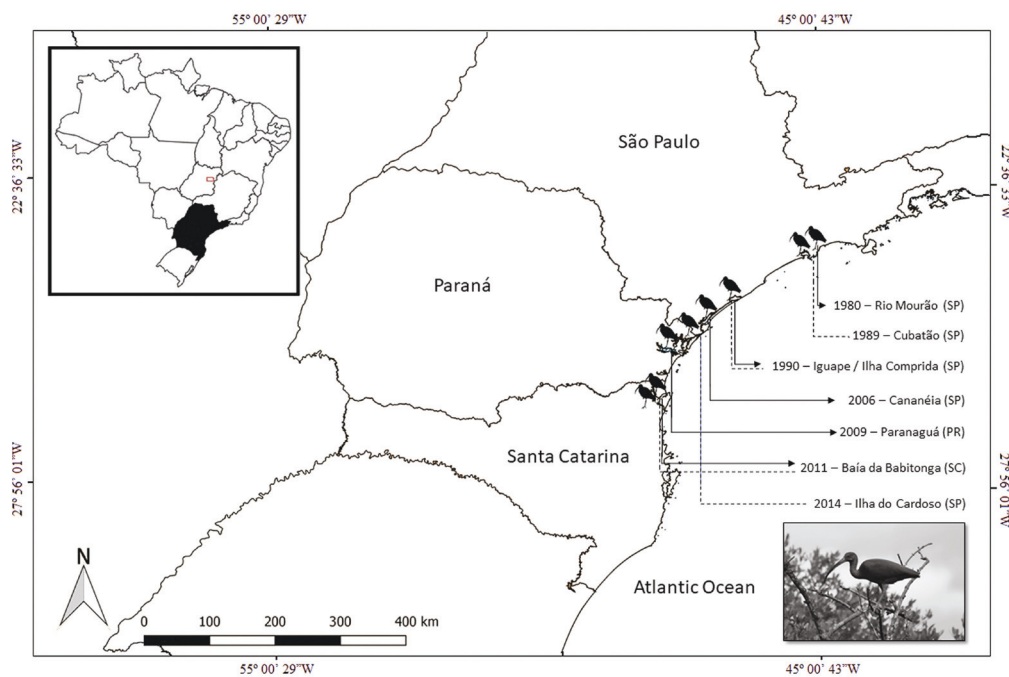


Figure 1. Map depicting the chronology of Scarlet Ibis *Eudocimus ruber* records since the 1980s in south and south-east Brazil. Dotted lines refer to breeding records. Arrows indicate records of individuals or groups.

P. Scherer-Neto, from 1977, involving three individuals in the municipality of Paranaguá (Teixeira & Best 1981).

Only in the early 1980s did this start to change, when Scarlet Ibis was observed again, initially around Santos (Rio Mourão) on the coast of São Paulo (Silva-Silva 2007; Fig. 1) and in 1989 nesting was confirmed in the municipality of Cubatão (Marcondes-Machado & Monteiro-Filho 1990). The population increased gradually and, in 1998, 385 individuals were estimated at the Santos mangroves (Olmos & Silva-Silva 2001). In the south of the same state, the first individuals and evidence of breeding occurred in Iguape and northern Ilha Comprida in the early 1990s (Bokermann & Guix 1990, Paludo *et al.* 2004, 2005). In 2006, the first individual was observed at Cananéia, with Roseate Spoonbills *Platalea ajaja* (ELAM-F pers. obs.). The first flocks were seen in the following year, and the species rapidly became more frequent. In 2007, of the 15 species recorded monthly in the São Paulo Bagre, Cananéia, Scarlet Ibis was the third most abundant (Coelho 2009). In 2009, 971 were estimated foraging in five areas around Cananéia and Ilha Comprida (Barbieri 2009), while during 2011 c.1,000 individuals were counted in the channel (Mar de Dentro) between Cananéia and Ilha Comprida (Noguchi 2011). Since 2014, a new colony has become established at the south end of Ilha do Cardoso and, in 2015, we estimated 1,000 birds were breeding there (HC & ELAM-F pers. obs.).

Paralleling the increase in records on the south coast of São Paulo, several birds were also observed in Paraná, in mangroves of the Paranaguá estuarine complex, where the species became more frequent from 2009 (Krul *et al.* 2009, Krul 2011). Estimates at different points in the Paranaguá estuarine complex produced a max. 225 individuals at one of the study sites between October 2012 and September 2013 (Vigário 2014). In November 2011, the first birds were observed on the north coast of Santa Catarina, with a breeding colony in Babitonga Bay (Fink 2013, Grose 2016).

The history of Scarlet Ibis around Cananéia and elsewhere in São Paulo, Paraná and Santa Catarina leads us to speculate as to the factors responsible for the paucity of records prior to the 1980s. Anthropogenic factors, such as degradation and reduction of mangroves in these southern states, affecting its foraging and breeding areas (Hass 1996, Olmos 2000), hunting for its beautiful plumage (which was historically coveted by both indigenous and immigrant European peoples) and egg collection (Lago-Paiva 1994, Rodrigues 1995, Hass *et al.* 1999) are generally cited as being responsible. It is also noteworthy that during the first half of the 20th century there were many fewer naturalists and researchers, which could explain the small number of records of Scarlet Ibis. However, even reports by resident observers were scarce, which is unexpected given that the species is unmistakable and obvious, as evidenced recently by local people in the Cananéia region.

Based on this, we consider the species vulnerable to anthropogenic activities. However, its current range includes colonies and frequent records in urban environments that are more or less disturbed, such as Ilha Comprida, Iguape, Babitonga Bay, Cubatão and Cananéia. In the latter, the species is periodically observed foraging beside a road well used by people and vehicles (plus boats on the river), and does not appear to be disturbed by human presence. With respect to hunting and egg collection, our conversations with local people in Cananéia and on Ilha do Cardoso have revealed no consumption of Scarlet Ibis eggs, nor any interest in hunting the species for its feathers or keeping it in captivity, neither now nor in past decades.

Therefore, are anthropogenic factors alone responsible for the species' apparent temporary local extinction on the southern Brazilian coast? Perhaps it would be more pertinent to believe that anthropogenic activities could have caused a population decline, but not extinction, yet leading to individuals or small groups dispersing to more remote areas along rivers and in mangroves, in search of safe foraging and breeding sites. Supporting this hypothesis is that as long ago as 1781, Martim Lopes Saldanha issued an edict for the protection of Scarlet Ibis, in which he stated that the species would almost certainly become extinct at some localities in Paraná, with apparent dispersion to more isolated islands (Straube 2011). In addition, it is important to highlight an important issue often overlooked when seeking to understand the dynamics of species, namely that periods of lesser abundance or greater dispersal, in the present case aggravated by anthropogenic factors, might be normal facets of their ecology.

An example of fluctuations in the numbers of Scarlet Ibis over a short period of time was obtained during monitoring of the breeding colony at the south end of Ilha do Cardoso, where approximately 1,000 birds bred in 2015 / 16, but just 300 in 2016 / 17. Concerning dispersal, it is interesting to mention the variation in numbers of Scarlet Ibis recorded during our twice-weekly boat-based surveys of the channel separating Ilha do Cardoso from Ilha de Cananéia (São Paulo) and Ilha do Superagui (Paraná) since 2014. On several occasions we covered the 46-km transect without observing any birds, whereas on others we counted >300. Apparently, the birds tends to be more visible at low tide and to disperse further during the non-breeding season. However, under the same tidal regime, at any season there is still marked variation in the numbers observed.

Additionally, the hypothesis of greater dispersal prior to the 1980s contrasts with the fact that Scarlet Ibis is generally conspicuous and unlikely to go unnoticed. However, again our regular surveys found that the species can be initially overlooked during cursory observations, but that careful checking would reveal small groups or lone individuals inside dense mangroves, where they might easily pass unnoticed if no effort was made to partially penetrate the habitat. Thus, when the species avoids more open areas it is much less conspicuous.

However, if the Scarlet Ibis really did become locally extinct as a breeder, from where does the current population in the states of São Paulo, Paraná and northern Santa Catarina originate? Genetic analyses comparing the population at Cubatão with those in northern Brazil demonstrated a close relationship, suggesting either that southern birds derived from the north or that the species at one time was found virtually throughout the Brazilian littoral (Gonçalves *et al.* 2010).

Olmos (2003) reported the introduction of 19 pairs of Scarlet Ibis from the state of Maranhão to Cubatão in 1967–69, which would corroborate the first hypothesis of Gonçalves *et al.* (2010), i.e. that southern birds derive directly from northern Brazil. However, the release of these individuals alone seems unlikely to account for the current population in south-east Brazil. The second hypothesis presented by Gonçalves *et al.* (2001), namely that the species formerly occupied the entire Brazilian coast to the limit of mangrove occurrence, equally accounts for the currently disjunct populations' close genetic similarity.

Under the current scenario, some dispersal of birds along the coast is evidenced by records from various localities, ensuring gene flow between, and reinforcing the genetic proximity of, different subpopulations in south-east Brazil (Gonçalves *et al.* 2010). An example of such movements was reported by Grose (2016), involving birds ringed in Babitonga Bay in November 2012, January 2013 and November 2013 that were subsequently re-sighted in Cananéia (August 2013 and May 2015) and the municipality of Praia Grande (October 2014).

Given the available information as to the history of occurrence of Scarlet Ibis and its ecological characteristics, we believe that the species previously occurred over a much greater part of the Brazilian coast with strongholds in the north and south—as already mentioned by Sick (1997)—but with some movement between areas. By and during the early 1900s, due to anthropogenic factors and the species' ecology, the southern population was both reduced in numbers and favoured more isolated mangroves. However, during the 1980s, the population began to increase and become more obvious again. We conclude that the species' biology may also explain its temporary apparent rarity and local extinction in parts of southern and south-east Brazil, as well as anthropogenic factors. Nevertheless, the conservation of estuaries where the birds breed and forage is essential to maintain the species' populations, despite that Scarlet Ibis appears to some extent tolerant of human disturbance and activities.

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Avifauna of a white-sand vegetation enclave in north-west Rondônia, Brazil: relevant records, body mass and morphometrics

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SUMMARY.—White-sand vegetation (WSV) enclaves occur throughout Amazonia. WSV, known in Brazil as *campina* or *campinarana*, possesses peculiar floral and faunal communities, different from those in adjacent forests but with biogeographic affinities to those in similar ecosystems far distant. Recent ornithological studies of these ‘islands’ have yielded new taxa for science and enabled a better understanding of the zoogeography of many poorly known species in Amazonia. Here we report the results of an ornithological survey of a *campinarana* enclave in north-west Rondônia, southern Amazonian Brazil. The area was inventoried three times in 2010–12, totalling 899 net / hours and 110 hours of observations. A total of 171 bird species was identified, belonging to 44 families. Among them, at least nine species are closely associated with WSV: Green-tailed Goldenthrout *Polytmus theresiae*, White-fringed Antwren *Formicivora grisea*, Natterer’s Slaty Antshrike *Thamnophilus stictocephalus*, Black Manakin *Xenopipo atronitens*, Plain-crested Elaenia *Elaenia cristata*, Pale-bellied Mourner *Rhytipterna immunda*, Campina Flycatcher *Cnemotriccus fuscatus duidae*, Plush-crested Jay *Cyanocorax chrysops diesingii* and Red-shouldered Tanager *Tachyphonus phoenicius*. Approximately 8% of the species recorded are migratory, most of them austral migrants. In addition, body mass and morphometrics of 136 individuals from 55 species are presented. Our results augment ornithological knowledge in Rondônia, aid our understanding of regional zoogeography, and serve as an alert to the need to preserve a region that has suffered severe anthropogenic impacts for >100 years.

Amazonia is the largest and most diverse biome on Earth (Mittermeier *et al.* 2003). It has the largest extent of continuous forest in the world and harbours impressive biodiversity (Kress *et al.* 1998, Mittermeier *et al.* 2003). The biome as a whole is very heterogeneous (Terborgh & Andresen 1998, ter Steege *et al.* 2003). It is a mosaic of different types of ecosystems resulting from variable regional edaphic and climatic conditions (Duijvenvoorden *et al.* 2005, Haugaasen & Peres 2006, Fine & Kembel 2011, Fine *et al.* 2012). Among these ecosystems are several forest types, e.g., *terra firme* and *várzea* (Terborgh & Andresen 1998), as well as some non-forest environments, e.g. the enclaves or ‘islands’ of open vegetation within forests (Anderson 1981, Fine *et al.* 2012, Fine & Bruna 2016, Mustin *et al.* 2017, Demarchi *et al.* 2018).

Enclaves of open vegetation are distributed discontinuously throughout Amazonia (Adeney *et al.* 2016). The origin of these enclaves is still being discussed—one hypothesis is a Pleistocene and Holocene provenance, when the climate in Amazonia became drier as a consequence of the last glacial maximum (Pessenda *et al.* 2001, Clark *et al.* 2009). The types of open vegetation in Amazonia are distinguished by their general physiognomy dictated by floristic composition according to the local edaphic, hydrological and climatic conditions (Adeney *et al.* 2016). The two main groups are savanna / *cerrado* (Sanaiotti *et al.* 1997, Silva *et al.*

al. 1997, Sanaïotti & Cintra 2001, Aleixo & Poletto 2007, Aleixo *et al.* 2011, Boss & Silva 2014, Mustin *et al.* 2017) and a special type of vegetation that grows on white-sand soils, known in Brazil as *campina* and *campinarana* (Anderson 1981, Borges 2004, Borges *et al.* 2016a,b, Adeney *et al.* 2016). Recent ornithological studies of these ‘islands’ of non-forest vegetation have revealed new taxa to science and helped to understand the zoogeography of the many patchily distributed species in Amazonia (Alvarez-Alonso & Whitney 2003, Whitney & Alvarez-Alonso 2005, Poletto & Aleixo 2009, Guilherme & Borges 2011, Alvarez-Alonso *et al.* 2013, Capurucho *et al.* 2013, Cohn-Haft *et al.* 2013, Whitney *et al.* 2013b,d, Borges *et al.* 2016a,b, Matos *et al.* 2016).

Rondônia state, in south-west Amazonian Brazil, lies within an area of endemism of the same name (Silva *et al.* 2005, Fernandes 2013). Although rich in endemic and / or rare species (Fernandes 2013), the state has already lost >30% of its forest cover due to logging and agroforestry (Serrão *et al.* 1996, Piontekowski *et al.* 2014, Fearnside 2017). Ornithological surveys in the state have progressively increased over the last 100 years (e.g. Hellmayr 1910, Stotz *et al.* 1997, Boçon 1999, Kirwan & Shirihai 2007, Olmos *et al.* 2011, Santos *et al.* 2011) and, as further areas are inventoried, several new species of birds have been discovered (Lanyon *et al.* 1990, Whitney *et al.* 2013a,b,c). Despite this, the richness of bird species and their distribution in the state as a whole are poorly known and have not been subject to major review. There are still numerous gaps in our ornithological knowledge of Rondônia because many areas are yet to be surveyed. Here, we present the results of a rapid inventory of an enclave of WSV near the BR-364 and the recently implemented Jirau hydroelectric power plant in north-west Rondônia.

Methods

Study area.—The study was undertaken in an enclave of WSV and its environs called Miratinga, located along a power transmission line west of the BR-364 (between Porto

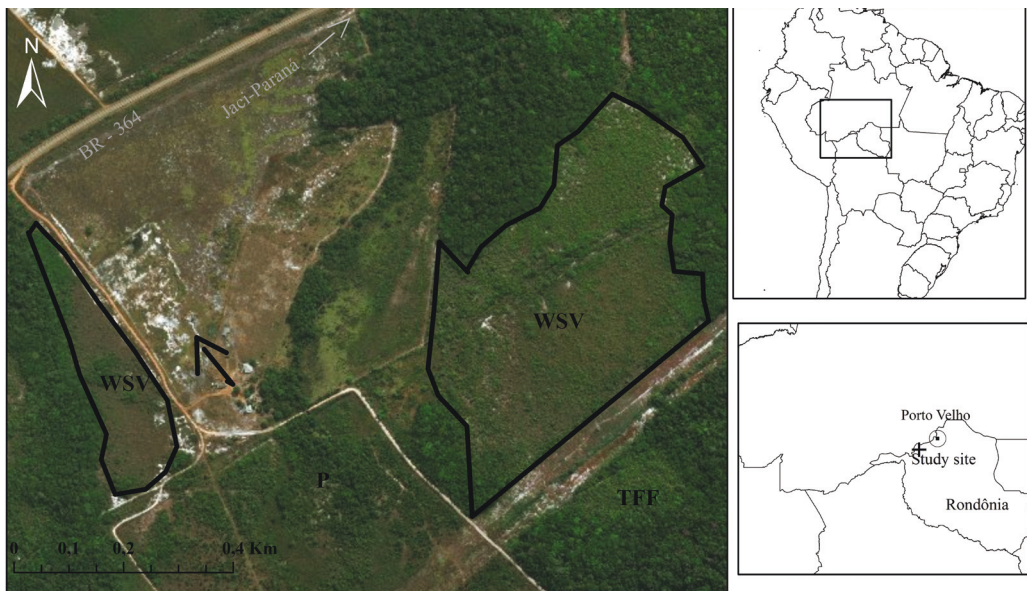


Figure 1. Location of the study area. TFF = terra firme forest, WSV = white-sand vegetation (campinarana), P = pasture. The black arrow indicates the commercial sand mining area. (Map adapted from Google Earth; satellite image courtesy of Google Inc. All rights reserved © 2018.)



Figure 2. Overview of the white-sand vegetation (*campinarana*) survey area: (A) access road to *campinarana*, (B) panoramic view of the *campinarana*, (C) structure of the *campinarana* highlighting the presence of *Mauritiella armata* palms, (D) *Pteridium* sp. fern, (E) area where sand is being commercially mined.

Velho and Abunã), c.30 km from Jaci Paraná in the municipality of Porto Velho, Rondônia (09°21'38.3"S, 64°39'29.2"W; Fig. 1).

Description of the area.—The *campinarana* enclave is mainly covered by dense shrubs, with sparse, small trees (2–5 m tall) (Fig. 2A–C) and some *Astrocaryum acaule* and *Mauritiella armata* palms (Fig. 2C). The soil is covered by grasses (Fig. 2A–B) and, as in other WSV environments, should be of low fertility and high acidity. At the edges of the patch, in areas of sparse vegetation and where the soil is more humid, an invasive fern *Pteridium* sp. is present (Fig. 2D). Part of the *campinarana* has been deforested and sand is being commercially removed (Fig. 2E). In the vicinity, there are small black-water streams and at least one medium-sized pond. During the wet season, puddles form where vegetation is sparse (Fig. 1) and in the *campinarana*, which is surrounded by fragments of *terra firme* forest severely modified by selective logging, and open pastures (Fig. 1).

Avifaunal sampling.—Three visits were made to the area in 2010–12. The avifaunal survey covered both the *campinarana* and surrounding fragments of *terra firme* forest and pastures (Fig. 1). Two approaches were used to inventory the area: (a) quantitative, using mist-nets and (b) qualitative, via field observations using binoculars. The *campinarana* was inventoried on 2 June 2010 (60 net / hours and two hours of observation), 26 February–3 March 2011 (439 net / hours and 54 hours of observation) and 20–24 August 2012 (400 net / hours and 54 hours of observation). Individuals captured with mist-nets were weighed

using a Pesola® scale and their wing, tarsus and total lengths were taken with a millimetre ruler. Wing, tarsus and total lengths were measured in accordance with standard reference works, see Proctor & Lynch (1993: 295–297) and Sick (1997: 91, Fig. G). Ageing and sexing were performed whenever possible. Some specimens were collected as vouchers and were prepared using standard taxidermy techniques. Specimens were collected under ICMBio / SISBIO authorisation no. 23269-1, and deposited either at the Universidade Federal do Acre (UFAC), Rio Branco, or the Museu Paraense Emílio Goeldi (MPEG), Belém. Scientific nomenclature follows that of the Brazilian Committee of Ornithological Records (Piacentini *et al.* 2015).

Results and Discussion

A total of 171 species from 44 families was recorded in the *campinarana* enclave and its environs (Table 1). Of these, 74 (43.2%) species are non-Passeriformes and 97 (56.7%) Passeriformes. Among the latter, the families Tyrannidae (26), Thraupidae (17) and Thamnophilidae (12) were richest in species (Table 1). At least nine species recorded in the study area are closely associated with *campinarana*: Green-tailed Goldenthrout *Polytmus theresiae*, White-fringed Antwren *Formicivora grisea*, Natterer's Slaty Antshrike *Thamnophilus stictocephalus*, Black Manakin *Xenopipo atronitens*, Plain-crested Elaenia *Elaenia cristata*, Pale-bellied Mourner *Rhytipterna immunda*, Campina Flycatcher *Cnemotriccus fuscatus duidae*, Plush-crested Jay *Cyanocorax chrysops diesingii* and Red-shouldered Tanager *Tachyphonus phoenicius* (Table 1). Two other important records included Rondônia Bushbird *Clytoctantes atrogularis* (Guilherme & Souza 2013) and Buff-cheeked Tody-Flycatcher *Poecilatriccus senex*. Approximately 8% of the species recorded are visitors, mostly austral migrants, e.g. Large Elaenia *Elaenia spectabilis*, Chilean Elaenia *E. chilensis*, Small-billed Elaenia *E. parvirostris*, Fork-tailed Flycatcher *Tyrannus savana*, Crowned Slaty Flycatcher *Griseotyrannus aurantioatrocristatus*, Variegated Flycatcher *Empidonomus varius*, Southern Scrub Flycatcher *Sublegatus modestus*, Vermilion Flycatcher *Pyrocephalus rubinus*, Fuscous Flycatcher *Cnemotriccus fuscatus bimaculatus*, Chivi Vireo *Vireo chivi*, Creamy-bellied Thrush *Turdus amaurochalinus*, Yellow-bellied Seedeater *Sporophila nigricollis* and Double-collared Seedeater *S. caerulescens*, while Solitary Sandpiper *Tringa solitaria* was the only Nearctic migrant (Table 1).

Species accounts

GREEN-TAILED GOLDENTHROAT *Polytmus theresiae*

Relatively common but discontinuously distributed in enclaves of open vegetation throughout Amazonia (Schuchmann 1999, Borges *et al.* 2001, Sanaiotti & Cintra 2001, Aleixo & Poletto 2007, Schulenberg *et al.* 2007, Guilherme 2012). Hellmayr (1910) reported two collected by W. Hoffmanns around Rio Preto, in the north-east of the state, and Aleixo & Poletto (2007) the presence at MPEG of one collected by J. Hidasi at Guajará-Mirim, on the border with Bolivia. Additionally, the species was photographed in the municipalities of Cabixi and Vilhena in southern Rondônia (Wikiaves 2018). On 2 June 2010, three were collected (MPEG 70938, 70939, male, 70940) and on 22–23 August 2012 we collected another five (UFAC 507, 508, 511, 522, 523). Available records of *P. theresiae* in Rondônia indicate that the species is locally common, but only in enclaves of *cerrado*, *campina* and *campinarana*.

NATTERER'S SLATY ANTSHRIKE *Thamnophilus stictocephalus*

Previously treated as a race of a widespread Eastern Slaty Antshrike *T. punctatus* (Isler *et al.* 1997). Distributed patchily in *campina* and *campinarana* east of the Guaporé / Madeira Rivers

TABLE 1

Birds recorded in a *campinarana* (white-sand vegetation) and its environs in north-west Rondônia, Brazil. Habitat: C = *campinarana*; TF = *terra firme* forest; R = reservoirs and lakes; AO = open areas; P = pasture and man-modified areas. Record types: V = vocalisation; O = sight; S = museum specimen. Nomenclature follows Piacentini *et al.* (2015). ¹ = follows *Handbook of the birds of the world* (del Hoyo & Collar 2016). * = white-sand specialists following Stotz *et al.* (1996) and Borges *et al.* (2015). ** = migrants ^a = austral; ⁿ = Nearctic.

| Family / Species | English name | Habitat | Record |
|--|-------------------------------|---------|--------|
| TINAMIDAE | | | |
| <i>Crypturellus cinereus</i> | Cinereous Tinamou | TF | V |
| <i>Crypturellus strigulosus</i> | Brazilian Tinamou | C | V |
| ANATIDAE | | | |
| <i>Amazonetta brasiliensis</i> | Brazilian Teal | R | O |
| CRACIDAE | | | |
| <i>Penelope jacquacu</i> | Spix's Guan | TF | O |
| <i>Ortalis guttata</i> | Speckled Chachalaca | TF | O |
| ARDEIDAE | | | |
| <i>Tigrisoma lineatum</i> | Rufescent Tiger Heron | R | O |
| <i>Bubulcus ibis</i> | Cattle Egret | P | O |
| <i>Ardea cocoi</i> | Cocoi Heron | R | O |
| <i>Ardea alba</i> | Great Egret | R | O |
| <i>Egretta thula</i> | Snowy Egret | R | O |
| CATHARTIDAE | | | |
| <i>Cathartes aura</i> | Turkey Vulture | OA, P | O |
| <i>Cathartes melambrotus</i> | Greater Yellow-headed Vulture | OA, P | O |
| <i>Coragyps atratus</i> | Black Vulture | OA, P | O |
| ACCIPITRIDAE | | | |
| <i>Rupornis magnirostris</i> | Roadside Hawk | TF | O |
| <i>Buteo nitidus</i> | Grey-lined Hawk | TF | O |
| RALLIDAE | | | |
| <i>Laterallus viridis</i> | Russet-crowned Crake | R | V |
| <i>Laterallus melanophaius</i> | Rufous-sided Crake | R | V, O |
| <i>Porphyrio martinicus</i> | Purple Gallinule | R | O |
| CHARADRIIDAE | | | |
| <i>Vanellus chilensis</i> | Southern Lapwing | P | O |
| SCOLOPACIDAE | | | |
| <i>Tringa solitaria</i> ^{**n} | Solitary Sandpiper | R | O |
| JACANIDAE | | | |
| <i>Jacana jacana</i> | Wattled Jacana | R | O |
| COLUMBIDAE | | | |
| <i>Columbina passerina</i> | Common Ground Dove | C, P | S |
| <i>Columbina talpacoti</i> | Ruddy Ground Dove | C, P | S |
| <i>Claravis pretiosa</i> | Blue Ground Dove | C | S |
| <i>Patagioenas speciosa</i> | Scaled Pigeon | C | O |
| <i>Leptotila verreauxi</i> | White-tipped Dove | C | S |
| <i>Geotrygon montana</i> | Ruddy Quail-Dove | TF | S |

| Family / Species | English name | Habitat | Record |
|----------------------------------|-----------------------------|---------|--------|
| CUCULIDAE | | | |
| <i>Piaya cayana</i> | Squirrel Cuckoo | TF | O |
| <i>Crotophaga ani</i> | Smooth-billed Ani | P, C | O |
| TYTONIDAE | | | |
| <i>Tyto furcata</i> | American Barn Owl | TF | V |
| STRIGIDAE | | | |
| <i>Megascops choliba</i> | Tropical Screech Owl | TF | V |
| <i>Athene cucularia</i> | Burrowing Owl | P | O |
| CAPRIMULGIDAE | | | |
| <i>Nyctidromus nigrescens</i> | Blackish Nightjar | C | S |
| <i>Nyctidromus albicollis</i> | Common Pauraque | C, P | V, O |
| APODIDAE | | | |
| <i>Chaetura brachyura</i> | Short-tailed Swift | OA | O |
| <i>Panyptila cayennensis</i> | Lesser Swallow-tailed Swift | OA | O |
| TROCHILIDAE | | | |
| <i>Phaethornis ruber</i> | Reddish Hermit | TF | O |
| <i>Phaethornis philippii</i> | Needle-billed Hermit | TF | S |
| <i>Campylopterus largipennis</i> | Grey-breasted Sabrewing | TF | S |
| <i>Polytmus theresiae</i> * | Green-tailed Goldenthrout | C | S |
| TROGONIDAE | | | |
| <i>Trogon curucui</i> | Blue-crowned Trogon | TF | O |
| ALCEDINIDAE | | | |
| <i>Megaceryle torquata</i> | Ringed Kingfisher | R | O |
| <i>Chloroceryle amazona</i> | Amazon Kingfisher | R | O |
| <i>Chloroceryle americana</i> | Green Kingfisher | R | O |
| <i>Chloroceryle inda</i> | Green-and-rufous Kingfisher | R | O |
| BUCCONIDAE | | | |
| <i>Bucco tamatia</i> | Spotted Puffbird | TF | S |
| <i>Monasa nigrifrons</i> | Black-fronted Nunbird | TF | O |
| <i>Chelidoptera tenebrosa</i> | Swallow-winged Puffbird | TF | O |
| CAPITONIDAE | | | |
| <i>Capito dayi</i> | Black-girdled Barbet | TF | O |
| RAMPHASTIDAE | | | |
| <i>Ramphastos tucanus</i> | White-throated Toucan | TF | O, V |
| <i>Ramphastos vitellinus</i> | Channel-billed Toucan | TF | O, V |
| <i>Pteroglossus inscriptus</i> | Lettered Aracari | TF | O |
| <i>Pteroglossus castanotis</i> | Chestnut-eared Aracari | TF | O, V |
| PICIDAE | | | |
| <i>Picumnus aurifrons</i> | Bar-breasted Piculet | TF | S |
| <i>Melanerpes cruentatus</i> | Yellow-tufted Woodpecker | TF | O, V |
| <i>Colaptes punctigula</i> | Spot-breasted Woodpecker | TF | O |
| <i>Dryocopus lineatus</i> | Lineated Woodpecker | TF | O, V |
| <i>Campephilus melanoleucos</i> | Crimson-crested Woodpecker | TF | O, V |
| FALCONIDAE | | | |
| <i>Daptrius ater</i> | Black Caracara | OA | O, V |

| Family / Species | English name | Habitat | Record |
|-------------------------------------|-------------------------------|---------|---------|
| <i>Ibycter americanus</i> | Red-throated Caracara | TF | O, V |
| <i>Caracara plancus</i> | Southern Caracara | P | O, V |
| <i>Mitvago chimachima</i> | Yellow-headed Caracara | P | O, V |
| <i>Herpetotheres cachinmans</i> | Laughing Falcon | TF | O, V |
| <i>Falco rufigularis</i> | Bat Falcon | TF | O |
| PSITTACIDAE | | | |
| <i>Ara ararauna</i> | Blue-and-yellow Macaw | TF | O, V |
| <i>Ara macao</i> | Scarlet Macaw | TF | O, V |
| <i>Ara chloropterus</i> | Red-and-green Macaw | TF | O, V |
| <i>Ara severus</i> | Chestnut-fronted Macaw | TF | O, V |
| <i>Orthopsittaca manilatus</i> | Red-bellied Macaw | TF | O, V |
| <i>Psittacara leucophthalmus</i> | White-eyed Parakeet | TF | O, V |
| <i>Aratinga weddellii</i> | Dusky-headed Parakeet | TF | O, V |
| <i>Pionus menstruus</i> | Blue-headed Parrot | TF | O, V |
| <i>Amazona farinosa</i> | Mealy Parrot | TF | O, V |
| <i>Amazona ochrocephala</i> | Yellow-crowned Parrot | TF | O, V |
| THAMNOPHILIDAE | | | |
| <i>Pygiptila stellaris</i> | Spot-winged Antshrike | TF | S |
| <i>Microrhopias quixensis</i> | Dot-winged Antwren | TF | O |
| <i>Clytoctantes atrogularis</i> | Rondônia Bushbird | C | S |
| <i>Myrmophylax atrothorax</i> | Black-throated Antbird | TF | O, V |
| <i>Formicivora grisea*</i> | White-fringed Antwren | C | S |
| <i>Thamnomanes saturninus</i> | Saturnine Antshrike | TF | S |
| <i>Thamnophilus doliatus</i> | Barred Antshrike | TF | O, V |
| <i>Thamnophilus schistaceus</i> | Plain-winged Antshrike | TF | O, V |
| <i>Thamnophilus stictocephalus*</i> | Natterer's Slaty Antshrike | C | S |
| <i>Sciaphylax hemimelaena</i> | Chestnut-tailed Antbird | TF | S, O, V |
| <i>Hypocnemis ochrogyna</i> | Rondônia Warbling Antbird | TF | S |
| <i>Willisornis poecilinotus</i> | Common Scale-backed Antbird | TF | O, V |
| DENDROCOLAPTIDAE | | | |
| <i>Glyphorhynchus spirurus</i> | Wedge-billed Woodcreeper | TF | S |
| <i>Xiphorhynchus elegans</i> | Elegant Woodcreeper | TF | S |
| <i>Xiphorhynchus guttatoides</i> | Lafresnaye's Woodcreeper | TF | O, V |
| <i>Dendroplex picus</i> | Straight-billed Woodcreeper | TF | O, V |
| XENOPIDAE | | | |
| <i>Xenops minutus</i> | Plain Xenops | TF | S |
| FURNARIIDAE | | | |
| <i>Berlepschia rikeri</i> | Point-tailed Palmcreeper | TF | O, V |
| <i>Furnarius leucopus</i> | Pale-legged Hornero | TF | O, V |
| <i>Anabacerthia ruficaudata</i> | Rufous-tailed Foliage-gleaner | TF | O |
| <i>Philydor erythrocerum</i> | Rufous-rumped Foliage-gleaner | TF | S |
| <i>Synallaxis rutilans</i> | Ruddy Spinetail | C | S |
| PIPRIDAE | | | |
| <i>Ceratopipra rubrocapilla</i> | Red-headed Manakin | C, TF | S |
| <i>Manacus manacus</i> | White-bearded Manakin | C | S |

| Family / Species | English name | Habitat | Record |
|---|---------------------------------|----------|---------|
| <i>Machaeropterus pyrocephalus</i> | Fiery-capped Manakin | TF, C | S |
| <i>Xenopipo atronitens</i> * | Black Manakin | C | S |
| ONYCHORHYNCHIDAE | | | |
| <i>Terenotriccus erythrurus</i> | Ruddy-tailed Flycatcher | TF | S |
| TITYRIDAE | | | |
| <i>Iodopleura isabellae</i> | White-browed Purpletuff | TF | O |
| <i>Tityra semifasciata</i> | Masked Tityra | TF | O |
| COTINGIDAE | | | |
| <i>Querula purpurata</i> | Purple-throated Fruitcrow | TF | O |
| <i>Lipaugus vociferans</i> | Screaming Piha | TF | V, O |
| RHYNCHOCYCLIDAE | | | |
| <i>Mionectes oleagineus</i> | Ochre-bellied Flycatcher | TF | S |
| <i>Tolmomyias flaviventris</i> | Yellow-breasted Flycatcher | C | S |
| <i>Todirostrum maculatum</i> | Spotted Tody-Flycatcher | TF, C | O, V |
| <i>Poecilatriccus senex</i> | Buff-cheeked Tody-Flycatcher | C | S |
| <i>Poecilatriccus latirostris</i> | Rusty-fronted Tody-Flycatcher | TF | O, V, S |
| TYRANNIDAE | | | |
| <i>Camptostoma obsoletum</i> | Southern Beardless Tyrannulet | C, TF | O, V |
| <i>Elaenia spectabilis</i> **a | Large Elaenia | C | S |
| <i>Elaenia chilensis</i> **a | Chilean Elaenia | C | S |
| <i>Elaenia parvirostris</i> **a | Small-billed Elaenia | C | S |
| <i>Elaenia cristata</i> * | Plain-crested Elaenia | C | S |
| <i>Myiopagis viridicata</i> | Greenish Elaenia | C | O, V |
| <i>Tyrannulus elatus</i> | Yellow-crowned Tyrannulet | C, TF | S |
| <i>Phaeomyias murina</i> | Mouse-coloured Tyrannulet | C | S, V |
| <i>Legatus leucophaeus</i> | Piratic Flycatcher | TF | O, V |
| <i>Myiarchus ferox</i> | Short-crested Flycatcher | C, TF | S, V, O |
| <i>Rhytipterna immunda</i> * | Pale-bellied Mourner | C | S, O |
| <i>Pitangus sulphuratus</i> | Great Kiskadee | C, TF | O, V |
| <i>Myiodynastes maculatus</i> | Streaked Flycatcher | C, TF | O, V |
| <i>Tyrannopsis sulphurea</i> | Sulphury Flycatcher | C, TF | O, V |
| <i>Megarynchus pitangua</i> | Boat-billed Flycatcher | C, TF | O, V |
| <i>Myiozetetes cayanensis</i> | Rusty-margined Flycatcher | C, TF | O, V |
| <i>Myiozetetes similis</i> | Social Flycatcher | C, TF | O, V |
| <i>Tyrannus melancholicus</i> | Tropical Kingbird | C, TF | O, V |
| <i>Tyrannus savana</i> **a | Fork-tailed Flycatcher | C, P, TF | O |
| <i>Griseotyrannus aurantioatrocristatus</i> **a | Crowned Slaty Flycatcher | C | O |
| <i>Empidonomus varius</i> **a | Variiegated Flycatcher | C | O |
| <i>Sublegatus modestus</i> **a | Southern Scrub Flycatcher | C | S |
| <i>Pyrocephalus rubinus</i> **a | Vermilion Flycatcher | C, P | O |
| <i>Cnemotriccus fuscatus duidae</i> * | Campina Flycatcher ¹ | C | S |
| <i>Cnemotriccus fuscatus beniensis</i> | Fuscous Flycatcher | TF | S |
| <i>Cnemotriccus fuscatus bimaculatus</i> **a | Fuscous Flycatcher | C | S |
| VIREONIDAE | | | |
| <i>Cyclarhis gujanensis</i> | Rufous-browed Peppershrike | C, TF | O, V |

| Family / Species | English name | Habitat | Record |
|--|-------------------------------|----------|---------|
| <i>Vireo chivi</i> **a | Chivi Vireo | C | S |
| CORVIDAE | | | |
| <i>Cyanocorax chrysops diesingii</i> * | Plush-crested Jay | C | O, V |
| HIRUNDINIDAE | | | |
| <i>Stelgidopteryx ruficollis</i> | Southern Rough-winged Swallow | OA | O |
| <i>Progne tapera</i> | Brown-chested Martin | OA | O |
| <i>Progne chalybea</i> | Grey-breasted Martin | OA | O |
| <i>Tachycineta albiventer</i> | White-winged Swallow | R | O |
| TROGLODYTIDAE | | | |
| <i>Troglodytes musculus</i> | Southern House Wren | C, P | O, V |
| <i>Campylorhynchus turdinus</i> | Thrush-like Wren | TF | O, V |
| <i>Pheugopedius genibarbis</i> | Moustached Wren | TF | S |
| TURDIDAE | | | |
| <i>Turdus amaurochalinus</i> **a | Creamy-bellied Thrush | TF | S |
| <i>Turdus ignobilis</i> | Black-billed Thrush | C, TF | S |
| PASSERELLIDAE | | | |
| <i>Ammodramus aurifrons</i> | Yellow-browed Sparrow | C, P | O, V |
| ICTERIDAE | | | |
| <i>Psarocolius bifasciatus</i> | Olive Oropendola | TF | O |
| <i>Cacicus cela</i> | Yellow-rumped Cacique | TF | O, V |
| <i>Icterus cayanensis</i> | Epaulet Oriole | TF | O |
| <i>Sturnella militaris</i> | Red-breasted Meadowlark | P | O |
| THRAUPIDAE | | | |
| <i>Schistochlamys melanopis</i> | Black-faced Tanager | C | O |
| <i>Paroaria gularis</i> | Red-capped Cardinal | R | O |
| <i>Tangara episcopus</i> | Blue-grey Tanager | C, P, TF | S, O, V |
| <i>Tangara palmarum</i> | Palm Tanager | TF | O, V |
| <i>Hemithraupis flavicollis</i> | Yellow-backed Tanager | TF | O |
| <i>Volatinia jacarina</i> | Blue-black Grassquit | C, P | S |
| <i>Tachyphonus phoenicius</i> * | Red-shouldered Tanager | C | S |
| <i>Ramphocelus carbo</i> | Silver-beaked Tanager | C, P, TF | S, O, V |
| <i>Tersina viridis</i> | Swallow Tanager | TF | S |
| <i>Cyanerpes cyaneus</i> | Red-legged Honeycreeper | TF | O |
| <i>Dacnis cayana</i> | Blue Dacnis | TF | O |
| <i>Dacnis lineata</i> | Black-faced Dacnis | TF | O |
| <i>Sporophila nigricollis</i> **a | Yellow-bellied Seedeater | TF, P | S, O |
| <i>Sporophila caerulescens</i> **a | Double-collared Seedeater | C, P | S |
| <i>Sporophila angolensis</i> | Chestnut-bellied Seed Finch | C | O |
| <i>Saltator maximus</i> | Buff-throated Saltator | TF | O |
| <i>Saltator coerulescens</i> | Greyish Saltator | TF | O |
| FRINGILLIDAE | | | |
| <i>Euphonia chrysopasta</i> | Golden-bellied Euphonia | TF | O |

to the island of Marajó in Pará (Isler *et al.* 1997, Zimmer & Isler 2003). Olmos *et al.* (2011) reported *T. stictocephalus* in savannas at Serra da Cutia National Park, in the south-west of the state, and at Campos do Urupa within the Uru-Eu-Wau-Wau Indigenous Territory, in central Rondônia. Natterer's Slaty-Antshrike has been found in several municipalities along the BR-364, between Vilhena and Porto Velho (Wikiaves 2018). Very common in the study area, being seen and caught in mist-nets daily (Fig. 3A). Five specimens were collected, a female on 2 June 2010 (MPEG 70950) and two pairs, on 27 February 2011 (UFAC 284, 286) and 1 March 2011 (UFAC 310, 309). Our records of *T. stictocephalus* extend the species' range to extreme north-west Rondônia.

RONDÔNIA BUSHBIRD *Clytoctantes atrogularis*

A globally threatened species (BirdLife International 2017) whose unusual record in the study area was discussed by Guilherme & Santos (2013). The female collected (UFAC 473) represents the westernmost available record (Costa *et al.* 2017).

WHITE-FRINGED ANTWRN *Formicivora grisea*

Occurs from the right bank of the Madeira River east to the Atlantic coast, including all of north-east Brazil, as well as in northern South America including the Guianas, Venezuela and Colombia (Zimmer & Isler 2003). Recently found in *campinarana* in extreme south-west Amazonas (Guajará) and westernmost Acre (Cruzeiro do Sul and Mâncio Lima) (Poletto & Aleixo 2005, Guilherme 2012). In Rondônia, it was known from around Rio Preto in the north-east (Hellmayr 1910) and in savanna at Traçadal Biological Reserve and Serra da Cutia National Park (Olmos *et al.* 2011) in the centre-west. Abundant in *campinarana* at Miratinga. On 2 June 2010, three were collected (MPEG 70951, male, 70952, female, 70953, male). On 27–28 February 2011, four were trapped of which three were collected (UFAC 283, male, 288, female, 304, female) and on 20–23 August 2012 seven were trapped of which four were prepared as specimens (UFAC 476, juvenile male, 480, male, 510, female, 525, male). Records of *F. grisea* at Miratinga extend the species' range in Rondônia 232 km to the north-west and 227 km north, from Rio Preto and Traçadal Biological Reserve, respectively.

BLACK MANAKIN *Xenopipo atronitens*

Considered an indicator species of *campinarana* (Borges *et al.* 2016a). Although abundant in habitat, it is patchily distributed (Aleixo & Poletto 2007, Poletto & Aleixo 2005, Guilherme & Borges 2011, Borges *et al.* 2014, 2016b). Previous records in Rondônia were by Whittaker (2004) at Taquaras (BR-425) and by Olmos *et al.* (2011) in savanna at Traçadal Biological Reserve and Serra da Cutia National Park. Since 2010, it has been photographed in several municipalities in eastern Rondônia, e.g. Machadinho d'Oeste, Parecis and Chupinguaia (Wikiaves 2018). At Miratinga, Black Manakin was seen and trapped daily. A male was collected on 6 February 2010 (MPEG 70977), while another four were collected subsequently, three in 2011 on 26 February (UFAC 276, female, 282, male) and 1 March (AC 312, female), and one on 22 August 2012 (UFAC 512, male). Records of *X. atronitens* at Miratinga extend its range to far north-west Rondônia.

BUFF-CHEEKED TODY-FLYCATCHER *Poecilatriccus senex*

Until very recently, known only from the type locality at Borba, Amazonas state, on the right bank of the lower Madeira River (Hellmayr 1910, Hoyo *et al.* 2004). In recent years, recorded at localities on the right bank of the middle (Cohn-Haft *et al.* 2007, Whittaker 2009) and upper Madeira (Whittaker 2004, Wikiaves 2018). In Rondônia, reported initially in 2002, at a *campina* at Taquaras (BR-425), in the north-west of the state (Whittaker

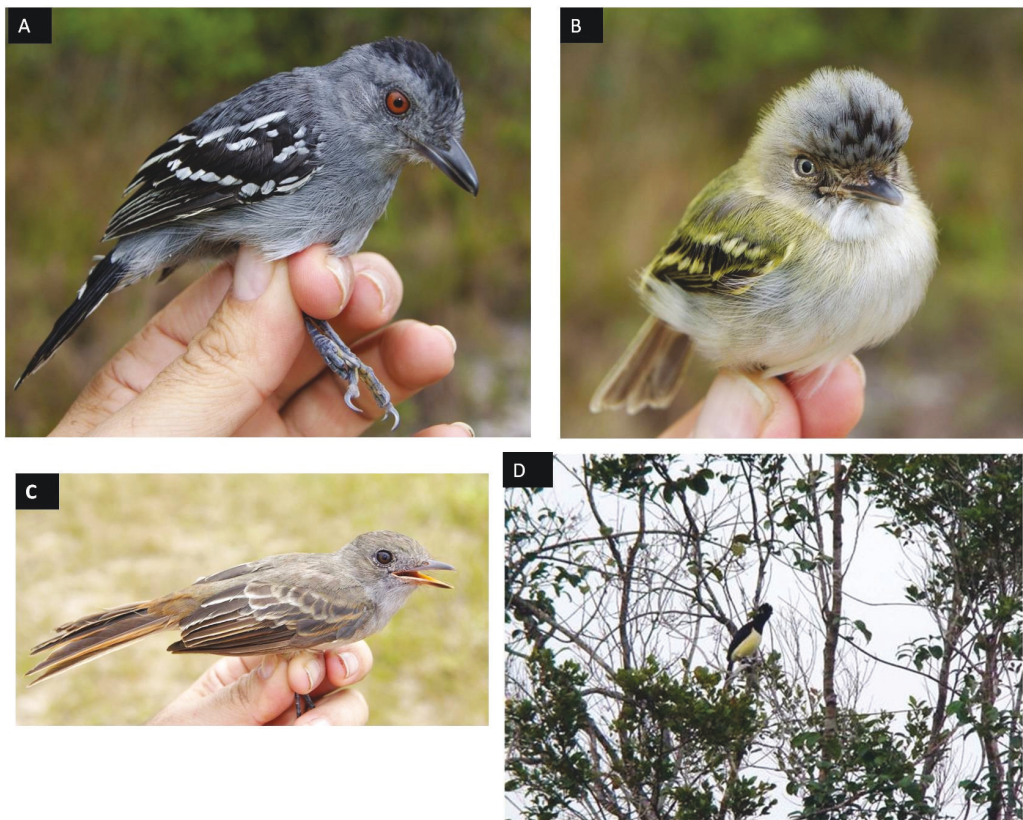


Figure 3. Bird specialists of white-sand vegetation in Amazonia: (A) male Natterer's Slaty-Antshrike *Thamnophilus stictocephalus*, 27 February 2011, (B) Pale-bellied Mourner *Rhytipterna immunda*, 28 February 2011, (C) Buff-cheeked Tody-Flycatcher *Poecilatriccus senex*, 27 February 2011, (D) Plush-crested Jay *Cyanocorax chrysops diesingii*, 1 March 2011 (Edson Guilherme)

2004). On 27 February 2011, we collected one at the edge of *campinarana* (MPEG 74005). Unfortunately, during its preparation, mass was not taken and neither was it possible to sex the bird (Fig. 3B; Table 2). Recent records indicate that the species inhabits patches of open vegetation in a swath from northern Rondônia and extreme south-east Amazonas (e.g. Humaitá National Forest) from the right bank of the Madeira east to the Madeira / Tapajós interfluvium (Whittaker 2004, 2009, Cohn-Haft *et al.* 2007, Wikiaves 2018).

PALE-BELLIED MOURNER *Rhytipterna immunda* (Figure 3C)

An uncommon species readily confused with a *Myiarchus* (Lanyon 1973). *R. immunda* is unique to savanna environments in Amazonia, from easternmost Colombia to the Guianas, and in Brazil it occurs patchily in WSV through the Negro drainage east to Pará, Amapá and Tocantins, and in southern Rondônia and Mato Grosso (Lanyon 1973, Scholes 2004, Whittaker 2004, Dornas *et al.* 2012). It has also been recorded in north-east Bolivia (Scholes 2004, Tobias & Seddon 2007). The first record in Rondônia was documented by Whittaker (2004) in the north-west of the state, in a *campina* at Taquaras, Porto Velho municipality. Subsequently, it was recorded in savanna at Serra da Cutia National Park, south-west Rondônia, and in Uru-Eu-Wau-Wau Indigenous Territory, in central Rondônia (Olmos *et al.* 2011). Also documented in the municipalities of Guajará-Mirim and Machadinho d'Oeste (Wikiaves 2018). Among species associated with *campinarana*, this was one of the most

abundant in mist-nets. Ten were trapped, of which five were collected: three on 26 and 28 February 2011 (UFAC 278, 295, 296) and two on 22 August 2012 (MPEG 82235–36). Records of *R. immunda* in north-west Rondônia (e.g. Miratinga) are the south-westernmost in Brazil.

CAMPINA FLYCATCHER *Cnemotriccus fuscatus duidae*

Strongly associated with *campina* / *campinarana* (Borges *et al.* 2016a). Differs from other races of *C. fuscatus* by its much more yellowish underparts (Zimmer 1938; Fig. 4A). It occurs patchily across almost all of Amazonia (Tobias & Seddon 2007, Guilherme & Borges 2011, Borges *et al.* 2016a). One was collected on 22 February 2011 in *campinarana* (UFAC 294; Fig. 4A–B), the first record of this taxon in Rondônia. The closest previous record of *C. f. duidae* was on the Bolivia / Brazil border at Piedritas, on the left bank of the Madeira River, c.100 km south-west of our study area (Tobias & Seddon 2007). *C. f. duidae*, unlike its congeners (see below), appears to be resident in *campina* / *campinarana* in the region.

FUSCOUS FLYCATCHER *Cnemotriccus fuscatus*

In addition to the specimen attributed to *C. f. duidae* (above), three other specimens of *C. fuscatus* were collected. Two (MPEG 70971 and Ufac 509) match *C. f. beniensis* and a third (UFAC 477) more closely resembles *C. f. bimaculatus* (Fig. 4A–C). Although Tobias & Seddon (2007) argued that *C. f. beniensis* could be synonymous with *C. f. fuscator*, a series collected in Acre (Guilherme 2009, 2012, 2016) plus the two from Rondônia agree with the description presented by Gyldenstolpe (1945) to differentiate it from *C. f. bimaculatus*. Some of the differences noted by Gyldenstolpe (1945) and observed in Ufac 509 are: ‘...chin and throat grayish-white, usually without any yellowish tinge; breast greyish brown without olivaceous suffusion; bill larger and stronger...’ (Fig. 4A–C). Although bill length is almost identical among specimens Ufac 509 (*beniensis*) and 477 (*bimaculatus*) (14.1 vs. 14.04 mm respectively), in Ufac 509 it is broader (5.0 vs. 3.92 mm) and flatter than in Ufac 477 (Fig. 4C). The morphological similarities, as a whole, between Ufac 509 from Rondônia (Fig. 4A–C) and the holotype of *C. f. beniensis*, from Bolivia, were proven by comparing it with the photograph of the type specimen (NRM 569425) online (<http://www.nrm.se>). Ufac 509 also shows clear differences from the holotype of *C. f. fuscator* (Fig. 4D). The latter, AMNH 211013 from Ecuador, as described by Chapman (1926) has ‘...Upperparts much darker and wing-bars narrower than in any other described race of the species... the breast grayish olive, the belly pale sulphur-yellow...’ (Fig. 4D). In Ufac 509, the wingbars are broad as in Ufac 477 (*bimaculatus*) (Fig. 4B) and the back and chest are brown (Fig. 4A–B), not grey as in *C. f. fuscator* (Fig. 4D). Additionally, *C. f. fuscator* is associated with *várzea* and river islands (Tobias & Seddon 2007), while Ufac 509 (Fig. 4A–C) and MPEG 70971 are from a *campinarana* enclave in *terra firme*, which reinforces our conviction that the two latter specimens represent *beniensis*. Taxonomy of the group is confused (Chapman 1926, Zimmer 1938, Gyldenstolpe 1945, Tobias & Seddon 2007) and genetic and vocal analyses should seek to clarify how many species-level taxa are involved. The certainty is that at least three taxa of the *C. fuscatus* complex occur at Miratinga. This is the first record of *beniensis* in Rondônia (where its status is uncertain), while *bimaculatus* is an austral migrant (Hellmayr 1910, Stotz *et al.* 1997, Whittaker 2004, Santos *et al.* 2011).

PLUSH-CRESTED JAY *Cyanocorax chrysops diesingii*

This subspecies is the Amazonian substitute of *C. c. chrysops*, which is common in south-east Brazil, northern Argentina, Uruguay, Paraguay and Bolivia (Ridgely & Tudor 1994). *C. c. diesingii* is a specialist of *campina* / *campinarana* (Aleixo & Poletto 2007, Whittaker 2009, Borges *et al.* 2016a). On 1 March 2011 a pair was observed vocalising and later one was



Figure 4. Three specimens of the Fuscous Flycatcher *Cnemotriccus fuscatus* complex collected in *campinarana* and deposited at the Universidade Federal do Acre, Rio Branco (UFAC) compared to the holotype of *C. f. fuscator* in the American Museum of Natural History, New York (AMNH 211013): (A–B) ventral and lateral views of UFAC 509, 477 and 294; (C) front view showing difference between bills of UFAC 477 and UFAC 509 (Edson Guilherme); (D) ventral and lateral views of AMNH 211013 (Paul Sweet). UFAC 294 = *C. f. duidae*; UFAC 477 = *C. f. bimaculatus*, UFAC 509 = *C. f. beniensis* and AMNH 211013 = *C. f. fuscator* holotype.

photographed at the edge of *campinarana* at Miratinga (Fig. 3D). In 2012, the species was seen daily in the same place. This taxon appears to be common in enclaves of *campinarana* along the BR-364 between Porto Velho and Abunã, in the north-west of the state. It is possible that *C. c. diesingii* occurs sympatrically with the recently discovered Campina Jay *C. hafferi* (Cohn-Haft *et al.* 2013) in *campina* / *campinarana* further north, in Amazonas, e.g. in WSV enclaves around Borba (Hellmayr 1910, Wikiaves 2018).

RED-SHOULDERED TANAGER *Tachyphonus phoenicius*

Typical of open vegetation in Amazonia (e.g. *cerrado*, *campina* and *campinarana*) and present in three different biogeographic regions. North of the Solimões / Amazon River in the states of Roraima, Pará and Amapá, as well as in eastern Colombia, southern Venezuela and the Guianas; in the south, from the Madeira basin in the region of Guayaramerin

in Bolivia (Tobias & Seddon 2007) to the east; and in the extreme south-west, in north-east Peru (Loreto), western Acre (Mâncio Lima and Cruzeiro do Sul) and south-western Amazonas (municipality of Guajará) (Hilty 2011, Guilherme 2012, 2016; E. Guilherme & A. Aleixo unpubl.). In Rondônia, *T. phoenicius* was recorded by Olmos *et al.* (2011) at Traçadal Biological Reserve and Serra da Cutia National Park, in the south-west of the state, with other documented records from the municipalities of Parecis and Vilhena (Naumburg 1930, Wikiaves 2018). A female was collected in *campinarana* at our study site on 20 August 2012 (UFAC 475), extending the species' range in Rondônia to the north, c.230 km from Traçadal Biological Reserve.

Discussion

Although our visits to the study site were short, totalling just nine days, a significant number of species was recorded. The avifauna found exclusively in *campinarana* represented 17.7% of all species recorded and consists of birds that colonise forest edge, open country or habitat specialists (*sensu* Stotz *et al.* 1996, Borges 2004, Borges *et al.* 2016a). Of the 35 taxa considered by Borges *et al.* (2016a) to be WSV specialists throughout Amazonia, 17.1% were recorded in this small *campinarana*. However, if we consider only the 11 WSV specialists from the southern Solimões / Amazon basin (*sensu* Stotz *et al.* 1996), representativeness increases to 54.5%. Some species (e.g. *Xenopipo atronitens*) have specialised to such an extent that they occur only in enclaves of open vegetation across Amazonia (Capurucho *et al.* 2013, Borges *et al.* 2016a). This implies that vegetation growing on white sand functions as 'islands' or mini-refugia (*sensu* Isler *et al.* 1997) within the surrounding forest. These 'islands' also offer a range of food resources capable of attracting seasonal migrants from other open biomes (e.g., Cerrado, Chaco, *campos sulinos*), which explains the comparatively large number of austral migrant species in this small patch of WSV. The result is a unique community of birds different from that in surrounding forest (Borges 2004). Therefore, the presence of an enclave of *campinarana* contributes significantly to regional diversity in Amazonia (Borges *et al.* 2016a).

Body mass and morphometrics.—These data, taken from 136 individuals of 55 different species (Table 2), are presented separately by age and gender (Table 2). Because many species in the study area are uncommon and patchily distributed, we consider it important to publish these mass and morphometric data. Such information forms the basis of comparative studies in various aspects of animal biology, including community structure and theoretical modelling (Hudson *et al.* 2013, Frasier 2016). Dunning (2008) compiled body mass data for 8,700 species worldwide, but for some the number of individuals sampled was very small and from a single locality, e.g. *Thamnophilus stictocephalus*, for which just one male from Bolivia was available to Dunning (2008). In this study, we not only increased the number of *T. stictocephalus* so measured, but we also collected mass and morphometrics for many other species from Brazil that were poorly sampled or unrepresented in Dunning's work, e.g. Rondônia Warbling Antbird *Hypocnemis ochrogyna*, which was recently split from *H. cantator* (Isler *et al.* 2007; Table 2).

Conservation.—The small enclave of WSV at Miratinga lies within a region that is highly threatened (Vale *et al.* 2008, Fernandes *et al.* 2010). It is directly impacted by the BR-364 and, according to the Socioecological and Economic Zoning of Rondônia, forms part of 1.2 Sub-zone, which is subject to accelerated occupation and uncontrolled deforestation. Furthermore, the area is likely to witness increasing agricultural and other anthropogenic disturbance in the future (Fernandes *et al.* 2010). A concrete example of this is the recently implanted Jirau Hydroelectric Plant, 9.5 km from the study site. Allied to this, an energy transmission line, linking the states of Rondônia and Acre, transects the *campinarana* (see

TABLE 2

Body mass and morphometrics of 55 different species captured in a *campinarana* and its environs in north-west Rondônia, Brazil. Age: A= adult; Y = young. Sex: F = female; M = male, U = undetermined. Nomenclature follows Piacentini *et al.* (2015). Wing, tarsus and total length in mm; body mass in g. * No mass data from South America in Dunning (2008). ** No mass data from Brazil in Dunning (2008).¹ Sample of fewer than ten individuals in Dunning (2008).² No mass data in Dunning (2008).

| Species name | Age | Sex | Body mass | Wing | Tarsus | Total length |
|--|-----|-----|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| | | | Mean \pm SD (n) max.–min. | Mean \pm SD (n) max.–min. | Mean \pm SD (n) max.–min. | Mean \pm SD (n) max.–min. |
| <i>Columbina passerina</i> * | A | F | 34 | 80 | 12 | 160 |
| <i>Columbina talpacoti</i> ** | A | F | 42 | 86 | 13 | 175 |
| <i>Leptotila verreauxi</i> * | A | M | 130 | 129 | 35 | 270 |
| <i>Geotrygon montana</i> ** | A | F | 100 | 125 | 32 | 230 |
| <i>Nyctidromus nigrescens</i> ** | A | F | 45 | 138 | 13 | 215 |
| <i>Phaethornis philippii</i> ** | A | U | (2) 4 | (2) 55–70 | (2) 4–3 | (2) 124–154 |
| <i>Campylopterus largipennis</i> | A | U | 7 | 74 | 3.1 | 135 |
| <i>Polytmus theresiae</i> ** | A | F | 3 | 56 | 3 | 101 |
| | A | M | 3 | 60 | 3 | 102 |
| | J | U | 4 | 55 | 3 | 96 |
| | A | U | (2) 3 | (2) 56 | (2) 4 | (2) 100–101 |
| <i>Bucco tamatia</i> ** | A | U | 35 | 79 | 16 | 185 |
| | A | F | 33 | 75 | 19 | 181 |
| <i>Picummus aurifrons</i> ¹ | A | M | 8 | 48 | 15 | 82 |
| <i>Pygiptila stellaris</i> ** | A | M | 23 | 81 | 16 | 148 |
| <i>Clytoctantes atrogularis</i> ¹ | A | F | 33 | 85 | 27 | 197 |
| <i>Formicivora grisea</i> ** | A | M | 10.6 \pm 0.8 (5) 10–12 | 54.6 \pm 2.0 (5) 52–57 | 20 \pm 2.5 (5) 18–24 | 134 \pm 3.7 (5) 130–139 |
| | A | F | 10.6 \pm 0.8 (6) 1 0–12 | 51.3 \pm 2.5 (6) 48–55 | 21.6 \pm 5.1 (6) 17–29 | 129.5 \pm 6.4 (6) 122–139 |
| <i>Thamnomanes saturninus</i> | A | F | 19 | 72 | 18 | 155 |
| | A | U | 21 | 80 | 16 | 156 |
| <i>Thamnophilus stictocephalus</i> ¹ ** | A | M | (2) 17–19 | (2) 65–66 | (2) 25–27 | (2) 148–158 |
| | A | F | (2) 12–16 | (2) 65–66 | (2) 24–27 | (2) 135–160 |
| <i>Sciaphylax hemimelaena</i> ** | A | F | 13 | 54 | 22 | 115 |
| <i>Hypocnemis ochrogyna</i> ² | A | U | 11 | 55 | 18 | 124 |
| <i>Glyphorhynchus spirurus</i> | A | U | 13 \pm 0 (3) | 73.3 \pm (3) 71–76 | 15 \pm 1.7 (3) 13–16 | 154 \pm 2 (3) 152–156 |
| | A | U | 39 | 105 | 20 | 226 |
| <i>Xenops minutus</i> | A | U | 14 | 65 | 15 | 123 |
| <i>Philydor erythrocerum</i> ** | A | U | 27 | 95 | 20 | 176 |
| <i>Synallaxis rutilans</i> ** | A | U | 13 | 61 | 15 | 155 |
| <i>Ceratopipra rubrocapilla</i> | A | M | 12 | 59 | 17 | 106 |
| | A | F | (2) 14 | (2) 62–63 | (2) 12 | (2) 112 |
| <i>Manacus manacus</i> | A | M | 13.6 \pm 1.1 (3) 13–15 | 51.3 \pm 2 (3) 105–106 | 21.6 \pm 5.5 (3) 16–27 | 105.3 \pm 0.5 (3) 105–106 |
| | A | F | 13 | 47 | 21 | 110 |
| <i>Machaeropterus pyrocephalus</i> ** | A | M | 9 | 48 | 18 | 86 |

| Species name | Age | Sex | Body mass | Wing | Tarsus | Total length |
|---|-----|-----|---|---|---|---|
| | | | Mean \pm SD (<i>n</i>) max.–min. | Mean \pm SD (<i>n</i>) max.–min. | Mean \pm SD (<i>n</i>) max.–min. | Mean \pm SD (<i>n</i>) max.–min. |
| <i>Xenopipo atronitens</i> ** | A | F | 8.3 \pm 0.5 (3) 8–9 | 49.6 \pm 1.5 (3) 48–51 | 15.6 \pm 2 (3) 14–18 | 85.6 \pm 5.5 (3) 80–91 |
| | A | M | (2) 13 | (2) 72–74 | (2) 15 | (2) 123–130 |
| <i>Terenotriccus erythrurus</i> ** | A | F | 13.8 \pm 1.4 (5) 12–16 | 66.6 \pm 2.4 (5) 64–70 | 16.4 \pm 2.4 (5) 14–19 | 127.4 \pm 4.6 (5) 120–131 |
| | A | U | 7 | 48 | 13 | 102 |
| <i>Mionectes oleagineus</i> ** | A | M | 10 | 56 | 19 | 105 |
| | A | U | 11 \pm 1 (3) 10–12 | 56.6 \pm 1.1 (3) 56–58 | 14.6 \pm 4.6 (3) 12–20 | 122 \pm 6 (3) 115–126 |
| <i>Tolmomyias flaviventris</i> ** | A | M | 11 | 58 | 21 | 125 |
| | A | F | (2) 13–11 | (2) 54 | (2) 19–21 | (2) 126–130 |
| | A | U | (2) 10–12 | (2) 60–61 | (2) 16 | (2) 120–127 |
| <i>Poecilotriccus senex</i> | A | U | ---- | 44 | 16 | 101 |
| <i>Poecilotriccus latirostris</i> ** | A | U | 6 | 43 | 17 | 101 |
| <i>Elaenia spectabilis</i> ¹ | A | U | 22 | 92 | | 165 |
| <i>Elaenia chilensis</i> ** | J | U | 14 | 68 | 16 | 113 |
| <i>Elaenia parvirostris</i> ** | A | U | 12 \pm 2.4 (6) 8–14 | 71 \pm 2.5 (6) 66–73 | 15.8 \pm 2.5 (6) 12–20 | 147 \pm 8.3 (6) 133–158 |
| | A | U | (2) 13–17 | (2) 67–69 | (2) 14.4–15 | (2) 160 |
| <i>Tyrannulus elatus</i> ** | A | U | 9 | 60 | 13 | 112 |
| <i>Phaeomyias murina</i> ** | A | U | 7.75 \pm 0.5 (4) 7–8 | 56.5 \pm 1.2 (4) 55–58 | 16 \pm 0.8 (4) 15–17 | 122 \pm 1.4 (4) 120–123 |
| | J | U | 8 | 56 | 15 | 114 |
| <i>Myiarchus ferox</i> | A | U | 27 \pm 1.7 (3) 25–28 | 86 \pm 3.4 (3) 82–88 | 19.3 \pm 0.5 (3) 19–20 | 198.3 \pm 5.7 (3) 195–205 |
| | A | M | 23 | 85 | 23 | 179 |
| <i>Rhytipterna immunda</i> ** | A | F | (2) 26 | (2) 84–92 | (2) 26–29 | (2) 180–187 |
| | A | U | 24.8 \pm 2.6 (6) 20–27 | 89 \pm 4.6 (6) 85–96 | 19.8 \pm 0.9 (6) 18–21 | 196 \pm 7.1 (6) 188–206 |
| | A | U | 31 | 95 | 15 | 199 |
| <i>Sublegatus modestus</i> ¹ | A | U | (2) 13–14 | (2) 66 | (2) 13–15 | (2) 138–142 |
| <i>Cnemotriccus fuscatus duidae</i> ² | A | U | 11 | 66 | 21 | 145 |
| <i>Cnemotriccus fuscatus beniensis</i> ² | A | U | 11 | 65 | 22 | 150 |
| <i>Cnemotriccus fuscatus bimaculatus</i> ² | A | U | 12 | 69 | 23 | 156 |
| <i>Turdus ignobilis</i> ** | A | M | 55 | 108 | 31 | 220 |
| | J | F | 59 | 109 | 34 | 206 |
| <i>Turdus amaurochalinus</i> | A | U | 60 | 122 | 30 | 225 |
| <i>Pheugopedius genibarbis</i> | A | F | 18 | 59 | 25 | --- |
| <i>Tangara episcopus</i> | A | U | 21 | 88 | 17 | 170 |
| <i>Volatinia jacarina</i> ** | J | M | (2) 7–10 | (2) 53–55 | (2) 12–15 | (2) 114–116 |
| | A | M | (2) 09–11 | (2) 51–52 | (2) 13–19 | (2) 108–117 |
| | A | F | 8 | 47 | 14 | 106 |
| <i>Tachyphonus phoenicius</i> | A | F | 24 | 71 | 18 | 168 |
| <i>Ramphocelus carbo</i> | A | F | 26 | 76 | 18 | 180 |

| Species name | Age | Sex | Body mass | Wing | Tarsus | Total length |
|------------------------------------|-----|-----|--------------------------------|--------------------------------|--------------------------------|---------------------------------|
| | | | Mean \pm SD (n) max.–min. | Mean \pm SD (n) max.–min. | Mean \pm SD (n) max.–min. | Mean \pm SD (n) max.–min. |
| | A | M | 23.3 \pm 0.5 (3) 23–24 | 78.3 \pm 3.2 (3) 76–82 | 18 \pm 1.7 (3) 17–20 | 171.3 \pm 12 (3) 159–183 |
| <i>Tersina viridis</i> | J | M | 25 | 82 | 15 | 161 |
| <i>Sporophila caeruleascens</i> ** | J | U | 10 | 58 | 13 | 121 |
| | J | M | 9 | 56 | 12 | 118 |
| <i>Sporophila nigricollis</i> ** | A | F | 8 | 52 | 14 | 101 |
| <i>Sporophila angolensis</i> | A | F | 11.8 \pm 0.4 (5) 11–12 | 55.6 \pm 1.5 (5) 54–58 | 13.6 \pm 1.3 (5) 12–15 | 134.8 \pm 17.5 (5) 125–166 |

Fig. 4 in Guilherme & Santos 2013) affecting also adjacent *terra firme* forests. Furthermore, commercial sand mining has directly impacted this small ‘island’ of WSV in north-west Rondônia. This process completely destroys the vegetation, thereby exposing the soil (Ferreira *et al.* 2013, Adeney *et al.* 2016). Post-exploration, the mined areas are usually abandoned without any type of environmental recovery (Ferreira *et al.* 2013; Fig. 2E). Finally, human impacts on this area date back many decades. One evidence of this is the Madeira / Mamoré railway, whose scar, 52 years after its decommissioning, is still visible in the centre of the study site (Fig. 1).

Although small and degraded, the patch of *campinarana* we surveyed still harbours many species of conservation concern (Table 1, Guilherme & Santos 2013). In general, patches of WSV in Amazonia are fragile and sensitive to anthropogenic activities, being both threatened and poorly represented within the protected area system (Adeney *et al.* 2016, Fine & Bruna 2016). Despite an increase in studies of these ecosystems in recent years, many remain largely unknown scientifically (Adeney *et al.* 2016, Fine & Bruna 2016). We recommend that the environmental authorities in Brazil aim to restore the environmental integrity of the site, and consider the possibility of incorporating our study area into a conservation unit.

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First records of Sharp-tailed Sandpiper *Calidris acuminata* for Mozambique and continental Africa, and additional records of Pectoral Sandpiper *C. melanotos* in Mozambique, with comments on identification and patterns of occurrence

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SUMMARY.—The first records of Sharp-tailed Sandpiper *Calidris acuminata* for Mozambique and continental Africa (1–2 adults, 4 February–16 April 2018), and additional records of Pectoral Sandpiper *C. melanotos* in Mozambique (1–2 birds, 20 February–31 March 2018) are reported, all at Macaneta, Maputo province. Identification features of these two species attaining breeding plumage are detailed and patterns of occurrence in Africa are discussed.

Pectoral *Calidris acuminata* and Sharp-tailed Sandpipers *C. melanotos* are phenotypically and ecologically similar high-latitude-breeding Holarctic shorebirds with long-distance migrations to South America and Australasia, respectively. Pectoral Sandpiper has two separate breeding areas, in the Arctic tundra of Siberia from the Yamal Peninsula (70°E) east to the Bering Sea, and along the north coasts of Alaska and Canada east to Hudson Bay (Cramp & Simmons 1983, Zockler & Lysenko 2000, Lappo *et al.* 2012). Sharp-tailed Sandpiper breeds solely in eastern Arctic Siberia from the Taimyr Peninsula (132°E) to Chaun Bay in Chukotka (170°E), and its entire breeding range is overlapped by that of Pectoral Sandpiper (Lappo *et al.* 2012). There is recent evidence that its breeding range may be expanding west (Lappo *et al.* 2012).

Sharp-tailed Sandpiper has a complex migration. Post-breeding, adults move south from Siberia on a broad front in early August, mostly passing east of Lake Baikal, and east to the Pacific coast of Russia and the Yellow Sea coasts of China (Barter 2002) and Korea, from where most apparently fly directly to Micronesia and New Guinea in late August (Higgins & Davies 1996). It is uncommon on the Asian coastal flyway south and west of the Yellow Sea, being reported only as a straggler in Vietnam, Cambodia, Peninsular Malaysia, Pakistan (Roberts 1990), India (Ali & Ripley 1969) and Sri Lanka (Roberts 1990, Henkanaththegedara 2002, van Gils *et al.* 2018). Migrants depart Papua New Guinea at the onset of the wet season, travelling south-west and arriving in north-west Australia mainly in mid September, then moving slowly south to south-east Australia, some crossing the continent en route, where the majority of the world population overwinters, with numbers peaking in December–early February (Higgins & Davies 1996). However, most juveniles, and a few adults, have a remarkably different strategy, migrating east from the breeding grounds across the Bering Strait to Alaska, where they fatten between mid August and late October (Tomkovich 1982, Handel & Gill 2010, Lindstrom *et al.* 2011). It is presumed that these birds fly from Alaska across central and western Oceania to reach Australia and New Zealand in a non-stop trans-Pacific flight of more than 10,000 km (Grönroos *et al.* 2010, Lindstrom *et al.* 2011). Some continue south along the Pacific coast of North America south to Washington state, less frequently to California, and there is a scatter of records east in

North America where the species is considered 'possible anywhere' (Mlodinow 2001). Prior to 2001 there were 32 records in the interior USA and 19 records on the Atlantic coast (Mlodinow 2001). It is possible that small numbers continue south on the west coast to Latin America, but to date there are only two records in the region, both recent, from Panama (Anon. 2016) and Bolivia (Knowlton 2016).

Sharp-tailed Sandpiper is a rare vagrant to Europe, with records in 11 countries (most in the UK, with 32 records by 2012: Hudson & the Rarities Committee 2013) of both juveniles and adults, mostly in August–October (Britton 1980, Cramp & Simmons 1983, van Gils *et al.* 2018). There are records in the Middle East and Central Asia, six from Kazakhstan (Wassink 2014) and singles in Oman (Eriksen & Victor 2013) and Yemen (Brooks *et al.* 1987).

In the Indian Ocean, the easternmost records are on Christmas Island (Australia), where there are four sets of records totalling 16 birds between 15 October and 10 December (James & McAllan 2014), with at least three records on Cocos (Keeling) Island in November–December 2016 (eBird). Further west there are five records from the Chagos archipelago in September–December (Carr 2015) and also five in the Seychelles, one in July, two overwintering in September / October–February and two on passage in November (Skerrett *et al.* 2017). There is one record from Madagascar in November 1999 (Patient 2003, Safford & Hawkins 2013).

There is also a remarkable specimen from Tristan da Cunha, collected on 16 June 1950, identified by Elliott (1957) as Sharp-tailed Sandpiper. This was followed by Cramp & Simmons (1983) and Higgins & Davies (1996), but the identity was questioned by Hockey *et al.* (1986). Mackworth-Praed & Grant (1962) referred to it as a Pectoral Sandpiper and Hockey *et al.* (1986) presumed that this was based on examination of the specimen at what is now the Natural History Museum, Tring (NHMUK). As this is an important record, the specimen was re-examined by A. J. Bond and the identity confirmed as a Sharp-tailed Sandpiper in breeding plumage (Fig. 1.). A. J. Prater (*in litt.* 2018) had also examined the specimen and noted that it was in suspended inner primary moult and probably therefore not fully adult (Hayman *et al.* 1996).

Pectoral Sandpiper also has a complex migration and vagrancy pattern. Siberian breeders are believed to depart south across the Arctic Ocean and travel along the east coast of the Pacific (Lees & Gilroy 2004), but the majority—an estimated 90%—migrates south in short hops (Piersma 1987, Farmer & Wiens 1999) via a narrow overland corridor through North America, not concentrating at particular wetlands (Skagen *et al.* 1999). It is surprising therefore that it is the most frequently recorded of the Nearctic vagrants to Europe (Lees & Gilroy 2004) with a regular annual influx in September–October mainly of juveniles, some of them clearly displaced by transatlantic weather systems. However, it is also possibly a 'pseudo-vagrant' (Gilroy & Lees 2003) with relatively small numbers from both North America and Siberia apparently on intentional, regular passage via Europe to wintering quarters in Africa (Lees & Gilroy 2004). This pattern is also mirrored in Australia and New Zealand, where small numbers of presumably Siberian breeders follow the west coast of the Pacific, joining groups of Sharp-tailed Sandpipers to overwinter mainly in Australia (Higgins & Davies 1996).

Pectoral Sandpiper is a regular vagrant to Africa, with records in 23 countries from northern, western, eastern and southern Africa (Hockey *et al.* 1986, Urban *et al.* 1986, van Gils *et al.* 2018b) as well as the Atlantic islands (Cramp & Simmons 1983, Hockey *et al.* 1986), Madagascar and the Indian Ocean islands (Hawkins & Safford 2013) as far south as the subantarctic (Viet *et al.* 2007). Up to five birds per annum are recorded in the southern African region (136 records 1965–2018; 36 records 1970–90) between September and May, but most arrive in December (peak) and remain until April. Peak arrival date is later than



Figure 1. Specimen of female Pectoral Sandpiper *Calidris melanotos* (below) compared to female specimen NHMUK 1953.55.113, collected on Tristan da Cunha, 16 June 1950 (above), confirmed as a Sharp-tailed Sandpiper *C. acuminata*, the identity of which had been questioned; see main text (Harry Taylor, © Natural History Museum, London)

most other migrant waders in the region and suggests that they slowly trickle south through the continent (Hockey *et al.* 1986). Records are mostly coastal and in the east of the region, especially Gauteng Province, South Africa, probably reflecting observer coverage (Hockey *et al.* 1986). It is surprising, therefore, that the first record in Mozambique was as recently as January 2017 (Allport 2018a).

Both species select similar habitats on passage and in winter, the muddy edges of shallow fresh or brackish wetlands with inundated or emergent sedges, grass, saltmarsh or other low vegetation including lagoons, swamps, lakes and pools near coasts, dams, waterholes, salt pans and hypersaline salt lakes inland (Higgins & Davies 1996). However, Sharp-tailed Sandpiper prefers coastal graminoid meadows in Alaska (Lindstrom *et al.* 2011) and particularly favours saltmarsh and brackish lagoons where *Salicornia* and *Cotula* provide cover in Australia, less often using similar inland habitats such as wet fields of short grass. In Australia it is thought to occupy coastal mudflats mainly once ephemeral terrestrial wetlands have dried out (Higgins & Davies 1996).

The identification of this species pair was an early challenge to modern field ornithologists. Britton (1980) presented the first analyses of the identification characters of Sharp-tailed Sandpiper based on field experience of an adult and a juvenile, the written descriptions of all 16 British and Irish sight records at the time, and an examination of three specimens, along with many records of Pectoral Sandpiper. Harrop (1993) later revisited their identification adding more plumage detail. Both papers encompassed identification issues for juveniles and adults in summer or transitional plumages in the boreal autumn. As vagrancy in the non-breeding season and on spring migration is relatively uncommon, identification of winter-plumaged birds and those in transition into breeding plumage is scantily covered in the main Eurasian field guides. These plumages are, however, covered in Australasia (Higgins & Davies 1996, Pizzey *et al.* 2010), albeit not in great depth, perhaps because Sharp-tailed Sandpiper is a relatively common bird there with which most birdwatchers are very familiar.

Recent records in Mozambique

Regular bird observations were undertaken by GA while based in Maputo, Mozambique, between October 2010 and April 2018. Casual, low-effort, opportunistic observations were made at sites ranging from Ponta d'Ouro and Maputo Special Reserve, in Maputo province in the south, north through Gaza Province to the Bazaruto archipelago in Inhambane province (see Allport 2018b for map). Sightings were recorded in eBird. Coastal and inland wetlands were visited at all times of year. Beaches and mangrove-fringed mudflats in Maputo Bay, Inhambane and Barra were frequently visited, but freshwater and brackish swamps were mostly inaccessible. In 2017 the construction of a new bridge at Marracuene gave access to an area of tidal, tall brackish marsh in the Incomati estuary, the northern part of Maputo Bay, permitting regular coverage of these habitats for the first time.

On 4 February 2018 GA, M. Costeira da Rocha & B. Briggs visited Macaneta wetlands. At 09.10 h an area of tall saltmarsh with scattered reeds, sedges and *Salicornia* was searched on a rising spring tide where Curlew Sandpipers *C. ferruginea* and Little Stints *C. minuta* were feeding (25°44'05.83"S, 32°43'20.49"E). A bird that looked like a Pectoral Sandpiper was found at c.50 m range. It walked purposefully away from the observers and within two minutes started to roost on a bank. Some low-quality photographs were taken as the bird was walking. It was then flushed by an overflying Peregrine *Falco peregrinus*, along with all of the other waders, and settled distantly out of sight preventing further observations. The photographs (e.g. Fig. 2) suggested that the bird had an unusually ginger crown and a well-marked supercilium, but the pectoral band appeared well defined, the flanks not heavily or clearly marked, and its behaviour matched Pectoral Sandpiper. The photographs were widely shared as a Pectoral Sandpiper on social media without any queries being raised.

At 07.00 h on 18 February 2018, GA revisited the area on a rising spring tide and, in poor weather conditions, found a very different-looking *Calidris* at c.70 m range. It was feeding in *Salicornia*, skulking and clambering on and amongst the vegetation, displaying



Figure 2. Sharp-tailed Sandpiper *Calidris acuminata*, Macaneta, Mozambique, 4 February 2018 (M. Costeira da Rocha / Gary Allport)



Figure 3. Sharp-tailed Sandpiper *Calidris acuminata*, Macaneta, Mozambique 18 February 2018 (Gary Allport)

a strongly marked face and head pattern. Based on previous experience (very similar behaviour to a UK bird; see Catley 1984), GA quickly identified it as a Sharp-tailed Sandpiper and fortunately the bird stayed in the same area for two hours as weather conditions improved, permitting better-quality photographs (Fig. 3; see <https://vimeo.com/256275383>). This was clearly the same bird as seen on 4 February 2018, but looked and behaved differently. Further inspection of images confirmed the identification, based on the following characters: similar to Pectoral Sandpiper but with bright ginger crown, dark ear-coverts contrasting with supercilium extending and broadening behind the eye, white eye-ring, shorter dark bill with limited pale flesh (not yellow) base, longer legged and with a small number of chevrons on the left flank, although these were only visible in some photographs (Hayman *et al.* 1986).

The sighting aroused considerable interest and birders from the region visited the site the next day, but the bird was not relocated. On 20 February a very similar bird in exactly the same area was photographed in poor weather and identified as a Sharp-tailed Sandpiper, and the same bird was seen again the following day. However, a close check of the photographs revealed differences from the original bird, and on 22 February it was seen well by GA and identified as a Pectoral Sandpiper (see images at <https://ebird.org/view/checklist/S43106332>).

On the next spring tide, on 2 March 2018, GA, R. Lindsay-Rae, J. R. Nicolau, D. Pitzalis & D. Snow awaited the rising water, and rather surprisingly at 06.15 h a Sharp-tailed Sandpiper that was clearly not the original bird was found by JRN; it was then joined a few minutes later by the bird seen on 4 and 18 February. The two birds roosted over the high tide and were seen and photographed well (Fig. 4). On 3 March the same area again held two Sharp-tailed Sandpipers but on this occasion they were joined by two Pectoral Sandpipers, and the four birds formed a small flock for two hours over the high tide (Fig. 5).

The two Sharp-tailed Sandpipers remained, usually together, until 6 March when the tidal range ebbed and the feeding area quickly dried out. One Pectoral Sandpiper was also seen but usually not with the Sharp-tailed Sandpipers. The three birds reappeared on the new moon tides on 18–21 March, and singles of both species were seen foraging separately on 31 March. A single Sharp-tailed Sandpiper was last seen on the spring tide on 16 April (Table 1).



Figure 4. Two adult Sharp-tailed Sandpipers *Calidris acuminata*, 2 March 2018; the original bird (front) showing bright fringes to the tertials and a single well-marked chevron on the flanks (© J. R. Nicolau / Unearth Safaris)



Figure 5. Two adult Sharp-tailed Sandpipers *Calidris acuminata* (below and right) and two Pectoral Sandpipers *C. melanotos* (above and left), Macaneta, Mozambique, 3 March 2018 (© Michael Mason)



Figure 6. The second Sharp-tailed Sandpiper *Calidris acuminata*, Macaneta, Mozambique, March 2018, showing two old outermost primaries, indicating that it is an adult; this bird was mostly in winter plumage when initially found on 2 March 2018 (© David Hoddinott)

TABLE 1
Summary of observations of Sharp-tailed Sandpiper *Calidris acuminata* (STS) and Pectoral Sandpiper *C. melanotos* (PS) at Macaneta, Mozambique, February–April 2018.

| Date | STS | PS | Comments |
|----------------|-----|----|--------------------------------------|
| 4 February | 1 | | Identified as Pectoral Sandpiper |
| 18 February | 1 | | Identified as Sharp-tailed Sandpiper |
| 20–21 February | | 1 | Identified as Sharp-tailed Sandpiper |
| 22 February | | 1 | Identified as Pectoral Sandpiper |
| 2 March | 2 | | |
| 3 March | 2 | 2 | Four birds in one flock |
| 4–6 March | 2 | 1 | |
| 18–19 March | 2 | 1 | |
| 20 March | | 1 | |
| 31 March | 1 | 1 | Possibly two Sharp-tailed Sandpipers |
| 16 April | 1 | | |

Both Sharp-tailed Sandpipers showed evidence of having recently completed outer primary moult (*cf.* Fig. 6.) and were therefore aged as adults (see Prater *et al.* 1977). It was impossible to determine gender as they were similar in size.

Identification

The multiple misidentification of both species by experienced observers reported herein is salutary and warrants comment. Whilst the treatment of both species in boreal autumn plumages is thoroughly covered by the main identification texts (see above), they are not well covered during spring moult into breeding plumage. It is worth flagging the following features.

Head pattern.—The combination of rufous crown, darker ear-coverts, paler supercilium widening behind the eye and pale eye-ring provide an excellent suite of features for distinguishing Sharp-tailed Sandpiper from Pectoral Sandpiper in winter / spring plumages. However, note that the supercilium is illustrated as being broader behind the eye in Pectoral Sandpiper in some references (e.g. Snow & Perrins 1998). Use of this feature is also made more complex as the supercilium in Sharp-tailed Sandpiper becomes less well defined as summer plumage is attained, when dark-centred feathers speckle the face, breaking-up the superciliary pattern. In contrast the eye-ring emerges as even more distinct during this transition. The dark ear-coverts add contrast to the definition of the supercilium in winter plumage, when they represent a strong feature, but also become less discernible in summer plumage. The two Pectoral Sandpipers also showed quite bright ginger crowns in certain lights, more so than illustrated in major field guides, although much less well marked than the adjacent Sharp-tailed Sandpipers.

Breast and underparts pattern.—Underparts pattern is cited as an important feature in separating these two species, but it is clear that as Sharp-tailed Sandpiper moults into summer plumage this can be very similar to Pectoral Sandpiper (Fig. 1). Pectoral Sandpiper can also show dark-centred feathers on the flanks in summer plumage, so it is only the dark chevrons on the flanks that make the identification of Sharp-tailed Sandpiper obvious at this time (February–May). It is also unclear how much streaking Pectoral Sandpiper can show on the rear flanks and undertail-coverts, making identification using this feature a question of degree and difficult to assess in lone individuals.

Bill colour.—Pectoral Sandpiper usually shows a clear yellow basal third to the bill, and the two Sharp-tailed Sandpipers had a pale flesh-coloured base to the mandible (Fig. 4). However, review of images of summer-plumaged Sharp-tailed Sandpipers revealed birds with clear yellow coloration over up to 50% of the mandible, ‘bleeding’ onto the maxilla (e.g. Lundquist 2011 in April). Therefore, bill colour can be used to positively identify a Sharp-tailed Sandpiper only if it is mostly dark and does not show yellow tones.

Thus the combination of facial pattern and to a lesser extent bill characters are critical for separating these two species in late winter / early spring. Underparts pattern may be conclusive but only if clear chevrons are evident.

Records and vagrancy

A literature search demonstrated that the Sharp-tailed Sandpipers reported herein are the first and second records for Mozambique, for the southern Africa region (T. Hardaker *in litt.* 2018) and for continental Africa (R. J. Dowsett *in litt.* 2018). Based on the pattern of records in Europe, Central Asia, the Middle East and on Indian Ocean islands, the possibility of vagrancy by this species to mainland Africa, and the southern Africa region in particular, had been anticipated (Hardaker 2008, Peacock 2016). However, it is remarkable that two were found together with relatively limited effort in suitable habitat in Mozambique. Indeed, several visiting birders commented that the species might prove to be regular at the site in small numbers as a pseudo-vagrant (Gilroy & Lees 2003), as is true for a few other shorebirds at specific wintering localities in the region, such as infrequent but regularly occurring Great Knot *C. tenuirostris* at Barra, Mozambique (Peacock 2016), Steppe Whimbrels *Numenius phaeopus alboaxillaris* at four localities in southern Mozambique and South Africa (Allport 2017), and, further afield, Pacific Golden Plover *Pluvialis fulva* in Gabon (Christy 1990).

There are two possible routes of vagrancy for these birds. The first is the Central Asian–East African corridor, possibly via the Rift Valley. The first conclusive evidence of the use of the Rift Valley overland migratory route by coastal waders was shown by a satellite-tagged Steppe Whimbrel in 2016 (Allport *et al.* in press) but there is strong circumstantial evidence that this route is used by a wide range of shorebirds wintering in southern Africa (Dowsett 1980). Use of this overland flyway, potentially with no continental stopovers, might explain the lack of records of Sharp-tailed Sandpiper further north in Africa. Southern coastal Mozambique lies on a natural route where migrants following the Rift southbound would reach the coast of the Indian Ocean (a similar explanation for coastal records of Baltic Gull *Larus f. fuscus* in southern Mozambique has been postulated: Allport 2018b). Two records of Sharp-tailed Sandpiper in the Middle East support this idea, and the possibility that the species breeds further west in Siberia (Lappo *et al.* 2012) increases the likelihood of vagrancy via this route.

The cluster of records on Indian Ocean islands points to a second, possible, transoceanic route. The frequency of records on Christmas Island suggests that Sharp-tailed Sandpipers regularly wander to the eastern Indian Ocean on southbound migration in September–December, probably from the major migratory crossing, Micronesia / Papua New Guinea to north-west Australia, a movement with a strong westerly component and likely to result in overshoots. There is a general decrease in the frequency of records south and west across the Indian Ocean, with none from the relatively well-watched islands of Mauritius and Réunion (Safford & Hawkins 2013), a pattern which again suggests that the origin of vagrancy lies to the east, and only a few stragglers might reach coasts of East Africa. It should also be considered that Sharp-tailed Sandpipers might enter the Indian Ocean via the Indian Subcontinent, but there are only two records in Pakistan / India (Roberts 1990)

and five from Sri Lanka (Henkanaththegedara 2002), making this unlikely to be a major route for transoceanic vagrants. One other, even more unlikely, but intriguing possibility is overshooting by juveniles leaving Alaska intent on reaching their Australian wintering grounds for the first time. Grönroos *et al.* (2010) postulated that the potential single-haul, 12,000 km migratory flight of juveniles from Alaska to Australia would cross Papua New Guinea potentially on a broad front, meaning some might easily overshoot into the Indian Ocean. Most of the birds recorded in the Indian Ocean were not aged, but all those photographed on the Chagos archipelago were adults (P. Carr pers. comm.) with just one record from the Cocos (Keeling) Islands of a juvenile (19 November 2016, <https://ebird.org/view/checklist/S32777999>). Both birds in Mozambique were adults.

Both the Rift Valley and Indian Ocean transoceanic routes therefore seem plausible for the birds recorded in Mozambique. Only further records in the region might enable the route of vagrancy to be better understood.

Turning to Pectoral Sandpiper, Hockey *et al.* (1986) concluded that those found in southern Africa enter the continent solely via the Nearctic–Europe route rather than the Asia–East Africa flyway. In drawing this conclusion, the more easterly distribution of Pectoral Sandpiper records in southern Africa was considered to reflect probable observer bias, and the lack of records of Sharp-tailed Sandpiper—which it was presumed would have arrived via the Central Asia–East Africa flyway—was noted in support of this hypothesis, as was the questionable validity of the Tristan da Cunha record. Both latter suppositions are now invalid, and the notion that Pectoral Sandpiper has a range of inter-African migratory strategies including southerly migration from the western Siberian breeding range via the Asia–East Africa flyway to eastern Africa acquires greater support (Hockey & Douie 1995, Lees & Gilroy 2004, Hjort 2005). This not to say that Pectoral Sandpipers of a Nearctic, rather than Palearctic origin, do not enter the region too, as held by Curry-Lindahl (1981), and implied by Feare & Watson (1984) for the Indian Ocean islands; both entry routes to the continent appear likely.

The distribution of records in the region must, to some extent, reflect both observer coverage and ability to identify the species (as in Australia and New Zealand: Higgins & Davies 1996), but the number of records strongly supports Lees & Gilroy's (2004) idea that a small population regularly overwinters in Africa and many of these are probably intentional migrants.

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This paper is dedicated to Tim Cleaves with whom I had my first discussion of Sharp-tailed Sandpiper identification on the Wirral, UK, in the late 1970s, together picking the brains of Graham Williams, one of the finders of the Shotton Pools bird in 1973 (Johnson *et al.* 1974). Tim went on to become a guru on the topic and later re-identified a bird at Frodsham in 1983 (Pitches 2018). Tim and I had not been in touch for many years but it was with great sadness that I learned of his death in December 2017, and I have missed what would have surely been an enthusiastic discussion with him on the various birds at Macaneta, Mozambique.

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Sixty years on: birds of the Sierra del Carmen, Coahuila, Mexico, revisited

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SUMMARY.—The rugged peaks of the Sierra del Carmen, Coahuila, visible from the Chisos Mountains in Texas, have tempted birdwatchers for decades, yet few have accessed the range, and its avifauna is poorly known. Based primarily on our own observations, supplemented by the literature, museum holdings and eBird records, we present an updated list of the region's avifauna. This list comprises 301 species, 137 of which breed in the region. As in previous surveys, we found bird species characteristic of both the intermontane West and tropical mountains to the south. We confirm that the Sierra del Carmen is slightly less speciose than sky islands of the Sierra Madre Occidental. Nevertheless, it is the northernmost outpost or migratory stopover of several regionally and globally rare species, and could serve as a stepping stone for species moving north with climate change. Although not a centre of endemism, the Sierra del Carmen is a vital and unique region for avian diversity.

Large online citizen science initiatives such as eBird (Sullivan *et al.* 2009) have successfully documented global biodiversity, with >500 million observations in its database, representing all countries and 99% of extant avian diversity. Yet, eBird coverage is still highly biased toward well-visited areas, leaving the avifauna across large swathes of the Americas, especially Central and South America, poorly known. Directly across the US border from Big Bend National Park in Texas is the Sierra del Carmen, an isolated mountain range in northern Coahuila, Mexico. Its rugged physiognomy and forested expanses are visible from the Chisos Mountains of Big Bend National Park, but travel there from the USA has always been challenging, making it far more remote and unknown than its distance from major birding areas alone. The Sierra del Carmen forms part of a chain of sky-island mountain ranges extending north from the Sierra Madre Oriental, much like the well-known Madrean Sky Islands north of the Sierra Madre Occidental, and it is the largest forested highland area for many kilometres in any direction. The Chisos Mountains, a well-known birdwatching hotspot, lie 64 km to the north-west and the almost unknown Sierra la Encantada 32 km to the south-east, but these forested highlands are significantly smaller in total area than the Sierra del Carmen. To date, the avifauna of the Sierra del Carmen is little known except to the few people that have lived in the area for years.

Sixty years ago, Alden Miller, Aldo Starker Leopold and Ward Russell spent a month in the Sierra del Carmen collecting and observing birds (Miller 1955b). Since then, there has been just one published bird list from the Sierra del Carmen (Wauer & Ligon 1977). As of 1 March 2017, there were only 128 checklists for the Sierra del Carmen in eBird's database (59 of them by ourselves). These checklists, as well as research papers on the ecology and evolution of birds in the Sierra del Carmen (Wauer & Ligon 1977, McCormack & Smith 2008) appear to confirm observations first made by Miller (1955b): the absence of certain species that would appear to possess suitable habitat in the range, and niche expansion

into these vacant habitats by other species. Given that recent studies of the avifauna of nearby regions have documented new and surprising records (Benson *et al.* 1989, Contreras-Balderas *et al.* 2004, McCormack *et al.* 2007, Ruvalcaba-Ortega & González-Rojas 2009, Sánchez-González 2013), we have endeavoured here to synthesise a complete checklist for the Sierra del Carmen.

Methods

Location.—The Sierra del Carmen is in northern Coahuila, Mexico (Fig. 1) and largely lies within the 200,000-ha Maderas del Carmen Flora and Fauna Protected Area. The majority of the land is owned and managed by the international cement company CEMEX, which has, since the late 1990s, managed it as a biological preserve (McKinney 2012). Elevation in this region spans 560 m (where Boquillas Canyon empties into the Rio Grande) to the highest peaks above 2,700 m. Los Pilares field station, the base for much recent field work, is at 1,150 m in the west of the range, in Chihuahuan Desert habitat near the mouth of Cañón El Alamo, site of the former Rancho San Isidro.

The Sierra del Carmen is a sky island at the north end of the Sierra Madre Oriental, part of a corridor linking the Mexican highlands to the Rocky Mountains (McKinney 2012). Vegetation in the region can be broadly classified into five major associations: desert shrub, grasslands, chaparral, pine–oak woodland and fir–pine forest. The lowest desert elevations contain creosotebush *Larrea tridentata*, honey mesquite *Prosopis glandulosa*, prickly pear cactus *Opuntia* spp., lechuguilla *Agave lechuguilla*, native grasses Poaceae spp. and candelilla *Euphorbia antisyphilitica*. In a transition zone above this, native grasslands, *Yucca* spp., sotol *Dasylyrion wheeleri* and beargrass *Nolina texana* dominate. The higher canyons are characterised by pine–oak–juniper *Pinus–Quercus–Juniperus* woodland, with large stands of American basswood *Tilia americana*, dogwood *Cornus* sp., ninebark *Physocarpus monogynus* and other deciduous woodland species in riparian areas. The highest elevations are dominated by Douglas fir *Pseudotsuga* sp., Coahuila fir *Abies durangensis* var. *coahuilensis*, Arizona cypress *Cupressus arizonica*, along with several stands of blue spruce *Picea* sp., quaking aspen *Populus tremuloides*, oaks and pines. The high escarpments of the sierra trap moisture-laden Gulf Coast air masses, with most rainfall during mid to late summer. Snow and ice storms can occur in winter (McKinney 2012). As a testament to the diversity of habitat types, some authors have divided Mexico into seven major life zones below the Artic–alpine belt (Goldman & Moore 1945); five of these occur in the Sierra del Carmen.

Data collection methods.—Our checklist is a synthesis of our own visual observations and mist-net records, eBird records, museum holdings and published reports (Marsh 1936, Marsh & Stevenson 1938, Taylor *et al.* 1945, Miller 1955b, Van Hoose 1955, Urban 1959, Ely 1962, Wauer & Ligon 1977, Garza de León *et al.* 2007). We follow current eBird taxonomy (<https://ebird.org/news/2018-ebird-taxonomy-update>), which is closely aligned to current AOS taxonomy, except that eBird recognises Mexican Duck *Anas diazi* as a species distinct from Mallard *A. platyrhynchos*. Records are assigned to one of four seasons: spring (March–May), summer (June–August), autumn (September–November) and winter (December–February). Most of our observations are made by BRM, who worked as wildlife coordinator in 2001–13 (McKinney 2012). JEM conducted field work in the region for months at a time between 2002 and 2008. We obtained eBird records by querying the database for all records from Coahuila, then selected a subset of records from a region bounded by the USA / Mexico border to the north, by Mexican highway 53 to the west and south (which runs from Boquillas del Carmen towards Santa Rosa de Múzquiz), and by the road between La Linda, Coahuila, Mexico, and highway 53 to the east. Most of our unusual observations and breeding records were documented with photographs or sound-recordings. A few of

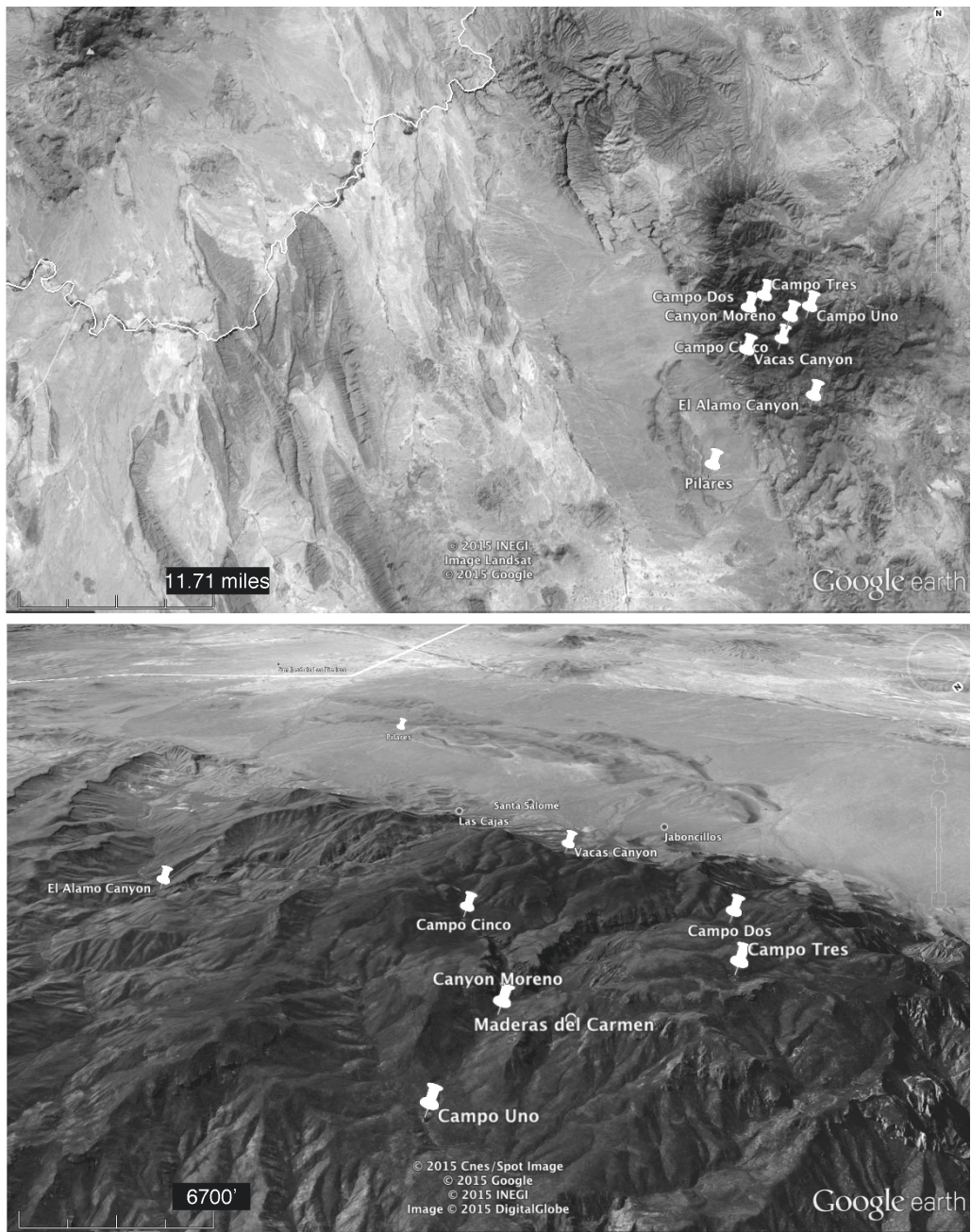


Figure 1. Map of the Sierra del Carmen, with relevant locations in the study area denoted by yellow markers. Note that north changes between panels. The upper panel shows the study area from directly above, with the USA / Mexico border demarcated in yellow. The isolated, sky-island nature of the range is apparent here. The lower panel shows the study area from a closer position to the north-east. Some of the dramatic topographical relief is evidenced here. (Map adapted from Google Earth; satellite image courtesy of Google Inc. All rights reserved © 2018.)

our observations are unusual in respect to what has been published to date for the Sierra del Carmen, but are of birds known to occur, albeit rarely, in the Big Bend area; we note these cases. We also note when historical records are associated with museum specimens.

Results

The comprehensive list of the avifauna of the Sierra del Carmen comprises 301 species, 137 of which are confirmed breeders, and an additional four might breed in the area (Table 1). The only species we have excluded from the list are Pine Flycatcher *Empidonax affinis* (Taylor *et al.* 1945), which we consider to represent a misidentification, Woodhouse's Scrub Jay *Aphelocoma woodhouseii*, which was previously reported in error to eBird, and Imperial Woodpecker *Campephilus imperialis*. Based on indirect evidence (large nest cavities and discussion with a local hunter), R. Wauer believed that the species might formerly have occurred in the Sierra del Carmen (Nelson 2002), but we have found no evidence to support its presence and do not include it here. Below, we provide details of notable records.

Species accounts.—Noteworthy records primarily fall into two categories: significant northward range extensions of species that might routinely occur in small numbers, and species that have experienced recent regional range expansions and are now fairly common in the area.

LEAST GREBE *Tachybaptus dominicus*

A female with a chick on its back was observed in summer 2002 at Tanque Zacatosa, near Rancho Pilares. Also documented to the south-east near Sierra Encantada (McCormack *et al.* 2007). Considered a rare resident but vacates the area when water tanks dry up during long droughts.

TRICOLOURED HERON *Egretta tricolor*

There have been a couple of sightings of this uncommon to rare autumn migrant in the Sierra del Carmen. There are a handful of previous records from Chihuahua, where it is considered a rare autumn migrant (Moreno-Contreras *et al.* 2015).

SWALLOW-TAILED KITE *Elanoides forficatus*

Observed on 20 May 2007 on the road between Pilares and Múzquiz, flapping and gliding steadily north. This record is well west of the species' regular migration route, and probably involved a vagrant.

COMMON BLACK HAWK *Buteogallus anthracinus*

The first nesting record was in May 2002, when BRM & J. Delgadillo Villalobos observed a pair at a nest near Campo Uno. The nest, in a Ponderosa pine *Pinus ponderosa*, held two young, and an immature was photographed nearby in June 2002. This nest was used annually until 2013. Also in May 2002 pairs were observed in Cañón Carboneras, Cañón Juárez and midway along Cañón El Oso. The species has undergone a range contraction throughout the south-west USA and is considered threatened in Mexico, endangered in New Mexico, threatened in Texas, and is a candidate for listing in Arizona (Schnell 1994), although it breeds infrequently in the Davis Mountains and Big Bend area (Benson & Arnold 2001). It probably occurs sparsely throughout suitable riparian habitat in the Sierra del Carmen, and was first noted from these mountains in the mid-20th century (Taylor *et al.* 1945).

SOLITARY EAGLE *Buteogallus solitarius*

The first observation was in March 2003 in upper Juárez Canyon, by BRM & J. Delgadillo Villalobos. Thereafter, BRM saw at least three others: singles at Campo Uno flying around El Mirador, near Campo Cinco, and in flight near Campo Tres. At least one or two were

TABLE 1

Complete bird checklist, with breeding status, of the Sierra del Carmen, Coahuila, Mexico, including the authors' observations in 2001–15. BRM was a resident in the area in 2001–13. Status abbreviations: RB = resident breeder, M = migrant non-breeder, MB = migrant breeder, H = hypothetical breeder.

| English name | Scientific name | Spring | Summer | Autumn | Winter | Status |
|----------------------------|--|--------|--------|--------|--------|--------|
| Snow Goose | <i>Anser caerulescens</i> | | | x | | M |
| Canada Goose | <i>Branta canadensis</i> | | | x | | M |
| Wood Duck | <i>Aix sponsa</i> | | | x | x | M |
| Blue-winged Teal | <i>Spatula discors</i> | x | | x | x | M |
| Cinnamon Teal | <i>Spatula cyanoptera</i> | | | x | x | M |
| Northern Shoveler | <i>Spatula clypeata</i> | x | x | x | x | M |
| Gadwall | <i>Mareca strepera</i> | x | | x | x | M |
| American Wigeon | <i>Mareca americana</i> | x | | x | x | M |
| Mallard × Mexican Duck | <i>Anas platyrhynchos</i> × <i>diazi</i> | x | x | x | x | M |
| Northern Pintail | <i>Anas acuta</i> | | | x | x | M |
| Green-winged Teal | <i>Anas crecca</i> | x | | x | x | M |
| Canvasback | <i>Aythya valisineria</i> | x | | x | x | M |
| Redhead | <i>Aythya americana</i> | | | x | x | M |
| Ring-necked Duck | <i>Aythya collaris</i> | x | | x | x | M |
| Greater Scaup | <i>Aythya marila</i> | | | x | x | M |
| Lesser Scaup | <i>Aythya affinis</i> | x | | x | x | M |
| Bufflehead | <i>Bucephala albeola</i> | x | | x | x | M |
| Common Goldeneye | <i>Bucephala clangula</i> | | | | x | M |
| Common Merganser | <i>Mergus merganser</i> | | | x | x | M |
| Ruddy Duck | <i>Oxyura jamaicensis</i> | | | x | x | M |
| Northern Bobwhite | <i>Colinus virginianus</i> | x | x | x | x | RB |
| Scaled Quail | <i>Callipepla squamata</i> | x | x | x | x | RB |
| Montezuma Quail | <i>Cyrtonyx montezumae</i> | x | x | x | x | RB |
| Wild Turkey | <i>Meleagris gallopavo</i> | x | x | x | x | RB |
| Least Grebe | <i>Tachybaptus dominicus</i> | | x | | x | MB |
| Pied-billed Grebe | <i>Podilymbus podiceps</i> | x | x | x | x | RB |
| Eared Grebe | <i>Podiceps nigricollis</i> | x | | | x | M |
| Double-crested Cormorant | <i>Phalacrocorax auritus</i> | | x | x | | M |
| American White Pelican | <i>Pelecanus erythrorhynchos</i> | x | | | | M |
| American Bittern | <i>Botaurus lentiginosus</i> | x | | x | | M |
| Least Bittern | <i>Ixobrychus exilis</i> | | | | x | M |
| Great Blue Heron | <i>Ardea herodias</i> | x | x | x | x | RB |
| Great Egret | <i>Ardea alba</i> | x | | x | | M |
| Snowy Egret | <i>Egretta thula</i> | x | x | x | | M |
| Tricoloured Heron | <i>Egretta tricolor</i> | | | x | | M |
| Cattle Egret | <i>Bubulcus ibis</i> | x | x | x | | M |
| Green Heron | <i>Butorides virescens</i> | x | x | x | | M |
| Black-crowned Night Heron | <i>Nycticorax nycticorax</i> | x | | x | | M |
| Yellow-crowned Night Heron | <i>Nyctanassa violacea</i> | | x | | | M |
| White-faced Ibis | <i>Plegadis chihli</i> | x | | x | | M |
| Black Vulture | <i>Coragyps atratus</i> | x | x | x | x | MB |
| Turkey Vulture | <i>Cathartes aura</i> | x | x | x | x | MB |
| Osprey | <i>Pandion haliaetus</i> | x | x | x | | M |
| Swallow-tailed Kite | <i>Elanoides forficatus</i> | x | | | | M |
| Golden Eagle | <i>Aquila chrysaetos</i> | x | x | x | x | RB |

| English name | Scientific name | Spring | Summer | Autumn | Winter | Status |
|------------------------|-------------------------------------|--------|--------|--------|--------|--------|
| Mississippi Kite | <i>Ictinia mississippiensis</i> | | | x | | M |
| Northern Harrier | <i>Circus hudsonius</i> | x | x | x | x | RB |
| Sharp-shinned Hawk | <i>Accipiter striatus</i> | x | x | | x | M |
| Cooper's Hawk | <i>Accipiter cooperii</i> | x | x | x | x | RB |
| Northern Goshawk | <i>Accipiter gentilis</i> | x | x | x | x | RB |
| Bald Eagle | <i>Haliaeetus leucocephalus</i> | | | x | | M |
| Common Black Hawk | <i>Buteogallus anthracinus</i> | x | x | x | | MB |
| Solitary Eagle | <i>Buteogallus solitarius</i> | x | x | | | MB? |
| Harris's Hawk | <i>Parabuteo unicinctus</i> | x | x | x | x | RB |
| White-tailed Hawk | <i>Geranoaetus albicaudatus</i> | x | | | | M |
| Grey Hawk | <i>Buteo plagiatus</i> | x | x | x | | MB |
| Swainson's Hawk | <i>Buteo swainsoni</i> | x | x | x | | MB |
| Zone-tailed Hawk | <i>Buteo albonotatus</i> | x | x | x | | MB |
| Red-tailed Hawk | <i>Buteo jamaicensis</i> | x | x | x | x | RB |
| Sora | <i>Porzana carolina</i> | | | x | x | M |
| American Coot | <i>Fulica americana</i> | x | x | x | x | RB |
| Sandhill Crane | <i>Antigone canadensis</i> | | | x | | M |
| Black-necked Stilt | <i>Himantopus mexicanus</i> | x | | x | | M |
| American Avocet | <i>Recurvirostra americana</i> | x | | x | | M |
| Killdeer | <i>Charadrius vociferus</i> | x | x | x | x | RB |
| Upland Sandpiper | <i>Bartramia longicauda</i> | | | x | | M |
| Long-billed Curlew | <i>Numenius americanus</i> | | | x | | M |
| Baird's Sandpiper | <i>Calidris bairdii</i> | x | x | | | M |
| Least Sandpiper | <i>Calidris minutilla</i> | x | | x | x | M |
| Pectoral Sandpiper | <i>Calidris melanotos</i> | x | | x | | M |
| Long-billed Dowitcher | <i>Limnodromus scolopaceus</i> | x | | x | | M |
| Wilson's Snipe | <i>Gallinago delicata</i> | | | x | x | M |
| Wilson's Phalarope | <i>Phalaropus tricolor</i> | x | | x | | M |
| Spotted Sandpiper | <i>Actitis macularius</i> | x | | x | | M |
| Solitary Sandpiper | <i>Tringa solitaria</i> | x | x | x | | M |
| Greater Yellowlegs | <i>Tringa melanoleuca</i> | x | | x | | M |
| Willet | <i>Tringa semipalmata</i> | | | x | | M |
| Lesser Yellowlegs | <i>Tringa flavipes</i> | | | x | | M |
| Bonaparte's Gull | <i>Chroicocephalus philadelphia</i> | | x | | | M |
| Laughing Gull | <i>Leucophaeus atricilla</i> | | | x | x | M |
| Franklin's Gull | <i>Leucophaeus pipixcan</i> | | x | x | | M |
| Ring-billed Gull | <i>Larus delawarensis</i> | x | x | x | | M |
| Forster's Tern | <i>Sterna forsteri</i> | | | x | | M |
| Rock Pigeon | <i>Columba livia</i> | x | | x | x | M |
| Band-tailed Pigeon | <i>Patagioenas fasciata</i> | x | x | x | x | RB |
| Eurasian Collared Dove | <i>Streptopelia decaocto</i> | x | x | x | x | RB |
| Inca Dove | <i>Columbina inca</i> | x | x | x | x | RB |
| Common Ground Dove | <i>Columbina passerina</i> | x | x | x | x | RB |
| White-tipped Dove | <i>Leptotila verreauxi</i> | x | x | x | x | RB |
| White-winged Dove | <i>Zenaida asiatica</i> | x | x | x | x | RB |
| Mourning Dove | <i>Zenaida macroura</i> | x | x | x | x | RB |
| Greater Roadrunner | <i>Geococcyx californianus</i> | x | x | x | x | RB |
| Yellow-billed Cuckoo | <i>Coccyzus americanus</i> | x | x | x | | MB |
| Black-billed Cuckoo | <i>Coccyzus erythrophthalmus</i> | x | | | | M |

| English name | Scientific name | Spring | Summer | Autumn | Winter | Status |
|---|---|--------|--------|--------|--------|--------|
| Barn Owl | <i>Tyto alba</i> | x | x | x | x | RB |
| Flammulated Owl | <i>Ptiloscoptes flammeolus</i> | x | x | x | | MB |
| Western Screech Owl | <i>Megascops kennicottii</i> | x | x | x | x | RB |
| Eastern Screech Owl | <i>Megascops asio</i> | x | x | x | x | RB |
| Great Horned Owl | <i>Bubo virginianus</i> | x | x | x | x | RB |
| Northern Pygmy Owl | <i>Glaucidium gnoma</i> | x | x | x | | MB |
| Elf Owl | <i>Micrathene whitneyi</i> | x | x | x | | MB |
| Burrowing Owl | <i>Athene cucularia</i> | x | x | x | x | RB |
| Long-eared Owl | <i>Asio otus</i> | x | | x | x | M |
| Short-eared Owl | <i>Asio flammeus</i> | | | x | x | M |
| Northern Saw-whet Owl | <i>Aegolius acadicus</i> | x | x | x | | MB |
| Lesser Nighthawk | <i>Chordeiles acutipennis</i> | x | x | x | | MB |
| Common Nighthawk | <i>Chordeiles minor</i> | x | x | x | | MB |
| Common Pauraque | <i>Nyctidromus albicollis</i> | x | x | | | M |
| Common Poorwill | <i>Phalaenoptilus nuttallii</i> | x | x | x | x | RB |
| Mexican Whip-poor-will | <i>Antrostomus arizonae</i> | x | x | x | | MB |
| White-throated Swift | <i>Aeronautes saxatalis</i> | x | x | x | x | RB |
| Rivoli's Hummingbird | <i>Eugenes fulgens</i> | x | x | x | | MB |
| Blue-throated Hummingbird | <i>Lampornis clemenciae</i> | x | x | x | | MB |
| Lucifer Hummingbird | <i>Calothorax lucifer</i> | x | x | x | | MB |
| Ruby-throated Hummingbird | <i>Archilochus colubris</i> | x | | x | | M |
| Black-chinned Hummingbird | <i>Archilochus alexandri</i> | x | x | x | | MB |
| Broad-tailed Hummingbird | <i>Selasphorus platycercus</i> | x | x | x | | MB |
| Rufous Hummingbird | <i>Selasphorus rufus</i> | | x | x | | M |
| Calliope Hummingbird | <i>Selasphorus calliope</i> | | x | x | | M |
| Broad-billed Hummingbird | <i>Cynanthus latirostris</i> | x | x | x | | MB |
| White-eared Hummingbird | <i>Hylocharis leucotis</i> | x | x | | | M |
| Belted Kingfisher | <i>Megaceryle alcyon</i> | x | x | x | x | RB |
| Green Kingfisher | <i>Chloroceryle americana</i> | x | x | x | x | RB |
| Acorn Woodpecker | <i>Melanerpes formicivorus</i> | x | x | x | x | RB |
| Golden-fronted Woodpecker | <i>Melanerpes aurifrons</i> | x | x | x | x | RB |
| Williamson's Sapsucker | <i>Sphyrapicus thyroideus</i> | | | x | x | M |
| Yellow-bellied Sapsucker | <i>Sphyrapicus varius</i> | x | | x | x | M |
| Red-naped Sapsucker | <i>Sphyrapicus nuchalis</i> | | | x | x | M |
| Ladder-backed Woodpecker | <i>Dryobates scalaris</i> | x | x | x | x | RB |
| Hairy Woodpecker | <i>Dryobates villosus</i> | x | x | x | x | RB |
| Ladder-backed × Hairy Woodpecker (hybrid) | <i>Dryobates scalaris</i> × <i>villosus</i> | | | | | R? |
| Northern Flicker | <i>Colaptes auratus</i> | x | x | x | x | RB |
| Crested Caracara | <i>Caracara cheriway</i> | x | x | x | | M? |
| American Kestrel | <i>Falco sparverius</i> | x | x | x | x | RB |
| Merlin | <i>Falco columbarius</i> | x | x | | x | M |
| Aplomado Falcon | <i>Falco femoralis</i> | x | | x | | M |
| Peregrine Falcon | <i>Falco peregrinus</i> | x | x | x | x | RB |
| Prairie Falcon | <i>Falco mexicanus</i> | x | x | | x | M |
| Olive-sided Flycatcher | <i>Contopus cooperi</i> | x | | x | | M |
| Western Wood Pewee | <i>Contopus sordidulus</i> | x | | | | M |
| Eastern Wood Pewee | <i>Contopus virens</i> | x | | | | M |
| Willow Flycatcher | <i>Empidonax traillii</i> | x | | x | | M |
| Least Flycatcher | <i>Empidonax minimus</i> | x | | | | M |

| English name | Scientific name | Spring | Summer | Autumn | Winter | Status |
|-------------------------------|--|--------|--------|--------|--------|--------|
| Hammond's Flycatcher | <i>Empidonax hammondii</i> | x | | x | | M |
| Grey Flycatcher | <i>Empidonax wrightii</i> | x | | x | x | M |
| Dusky Flycatcher | <i>Empidonax oberholseri</i> | x | | | | M |
| Cordilleran Flycatcher | <i>Empidonax occidentalis</i> | x | x | x | | MB |
| Black Phoebe | <i>Sayornis nigricans</i> | x | x | x | x | RB |
| Eastern Phoebe | <i>Sayornis phoebe</i> | x | | x | x | M |
| Say's Phoebe | <i>Sayornis saya</i> | x | x | x | x | RB |
| Vermilion Flycatcher | <i>Pyrocephalus rubinus</i> | x | x | x | | MB |
| Dusky-capped Flycatcher | <i>Myiarchus tuberculifer</i> | x | x | | | MB |
| Ash-throated Flycatcher | <i>Myiarchus cinerascens</i> | x | x | x | | MB |
| Couch's Kingbird | <i>Tyrannus couchii</i> | | x | | | M |
| Cassin's Kingbird | <i>Tyrannus vociferans</i> | x | x | x | | MB |
| Western Kingbird | <i>Tyrannus verticalis</i> | x | x | x | | MB |
| Eastern Kingbird | <i>Tyrannus tyrannus</i> | | | x | | M |
| Scissor-tailed Flycatcher | <i>Tyrannus forficatus</i> | x | x | x | | M |
| Loggerhead Shrike | <i>Lanius ludovicianus</i> | x | x | x | x | RB |
| Black-capped Vireo | <i>Vireo atricapilla</i> | x | x | x | | MB |
| Bell's Vireo | <i>Vireo bellii</i> | x | x | x | | MB |
| Grey Vireo | <i>Vireo vicinior</i> | x | x | x | x | RB |
| Hutton's Vireo | <i>Vireo huttoni</i> | x | x | x | x | RB |
| Blue-headed Vireo | <i>Vireo solitarius</i> | x | x | x | | M |
| Plumbeous Vireo | <i>Vireo plumbeus</i> | x | x | | | M |
| Warbling Vireo | <i>Vireo gilvus</i> | x | | | | M |
| Red-eyed Vireo | <i>Vireo olivaceus</i> | x | | | | M |
| Steller's Jay | <i>Cyanocitta stelleri</i> | | | | x | M |
| Mexican Jay | <i>Aphelocoma wollweberi</i> | x | x | x | x | RB |
| Clark's Nutcracker | <i>Nucifraga columbiana</i> | | | | x | M |
| American Crow | <i>Corvus brachyrhynchos</i> | x | | | | H |
| Chihuahuan Raven | <i>Corvus cryptoleucus</i> | x | x | x | x | RB |
| Common Raven | <i>Corvus corax</i> | x | x | x | x | RB |
| Horned Lark | <i>Eremophila alpestris</i> | | | x | | M |
| Northern Rough-winged Swallow | <i>Stelgidopteryx serripennis</i> | x | x | x | x | MB |
| Violet-green Swallow | <i>Tachycineta thalassina</i> | x | x | x | | MB |
| Bank Swallow | <i>Riparia riparia</i> | x | x | x | | MB |
| Barn Swallow | <i>Hirundo rustica</i> | x | x | | | MB |
| Cliff Swallow | <i>Petrochelidon pyrrhonota</i> | x | x | x | | MB |
| Cave Swallow | <i>Petrochelidon fulva</i> | x | x | x | | MB |
| Black-crested Titmouse | <i>Baeolophus atricristatus</i> | x | x | x | x | RB |
| Verdin | <i>Auriparus flaviceps</i> | x | x | x | x | RB |
| Bush-tit | <i>Psaltriparus minimus</i> | x | x | x | x | RB |
| Red-breasted Nuthatch | <i>Sitta canadensis</i> | x | x | x | x | HB |
| White-breasted Nuthatch | <i>Sitta carolinensis</i> | x | x | x | x | RB |
| Pygmy Nuthatch | <i>Sitta pygmaea</i> | x | x | x | x | RB |
| Brown Creeper | <i>Certhia americana</i> | | | x | | M |
| Rock Wren | <i>Salpinctes obsoletus</i> | x | x | x | x | RB |
| Canyon Wren | <i>Catherpes mexicanus</i> | x | x | x | x | RB |
| House Wren | <i>Troglodytes aedon</i> | x | | x | x | M |
| House Wren (Brown-throated) | <i>Troglodytes aedon</i> [brunneicollis group] | x | x | x | x | RB |
| Marsh Wren | <i>Cistothorus palustris</i> | x | | | x | M |

| English name | Scientific name | Spring | Summer | Autumn | Winter | Status |
|-----------------------------|--|--------|--------|--------|--------|--------|
| Carolina Wren | <i>Thryothorus ludovicianus</i> | x | x | x | x | RB |
| Bewick's Wren | <i>Thryomanes bewickii</i> | x | x | x | x | RB |
| Cactus Wren | <i>Campylorhynchus brunneicapillus</i> | x | x | x | x | RB |
| Blue-grey Gnatcatcher | <i>Poliophtila caerulea</i> | x | x | x | x | RB |
| Black-tailed Gnatcatcher | <i>Poliophtila melanura</i> | x | x | x | x | RB |
| Golden-crowned Kinglet | <i>Regulus satrapa</i> | | | x | x | M |
| Ruby-crowned Kinglet | <i>Regulus calendula</i> | x | | x | x | M |
| Eastern Bluebird | <i>Sialia sialis</i> | | | | x | M |
| Western Bluebird | <i>Sialia mexicana</i> | x | | x | x | MB |
| Mountain Bluebird | <i>Sialia currucoides</i> | | | x | x | M |
| Townsend's Solitaire | <i>Myadestes townsendi</i> | x | | x | x | M |
| Russet Nightingale-Thrush | <i>Catharus occidentalis</i> | x | x | | | MB? |
| Swainson's Thrush | <i>Catharus ustulatus</i> | x | | | | M |
| Hermit Thrush | <i>Catharus guttatus</i> | x | | x | x | M |
| American Robin | <i>Turdus migratorius</i> | x | | | x | M |
| Grey Catbird | <i>Dumetella carolinensis</i> | | | x | | M |
| Curve-billed Thrasher | <i>Toxostoma curvirostre</i> | x | x | x | x | RB |
| Long-billed Thrasher | <i>Toxostoma longirostre</i> | x | x | x | x | RB |
| Crissal Thrasher | <i>Toxostoma crissale</i> | x | x | x | x | RB |
| Sage Thrasher | <i>Oreoscoptes montanus</i> | x | | x | x | M |
| Northern Mockingbird | <i>Mimus polyglottos</i> | x | x | x | x | RB |
| European Starling | <i>Sturnus vulgaris</i> | x | | | | M |
| American Pipit | <i>Anthus rubescens</i> | x | | x | x | M |
| Cedar Waxwing | <i>Bombycilla cedrorum</i> | x | | x | x | M |
| Phainopepla | <i>Phainopepla nitens</i> | x | x | x | x | RB |
| Olive Warbler | <i>Peucedramus taeniatus</i> | x | x | x | x | RB |
| Lapland Longspur | <i>Calcarius lapponicus</i> | x | | | | M |
| Chestnut-collared Longspur | <i>Calcarius ornatus</i> | x | | | | M |
| Louisiana Waterthrush | <i>Parkesia motacilla</i> | x | | | | M |
| Black-and-white Warbler | <i>Mniotilta varia</i> | x | | x | | M |
| Orange-crowned Warbler | <i>Oreothlypis celata</i> | x | | x | x | M |
| Colima Warbler | <i>Oreothlypis crissalis</i> | x | x | x | | MB |
| Nashville Warbler | <i>Oreothlypis ruficapilla</i> | x | | x | | M |
| Virginia's Warbler | <i>Oreothlypis virginiae</i> | x | | x | | M |
| MacGillivray's Warbler | <i>Geothlypis tolmiei</i> | x | | x | | M |
| Common Yellowthroat | <i>Geothlypis trichas</i> | x | x | x | x | MB |
| American Redstart | <i>Setophaga ruticilla</i> | x | | x | | MB |
| Northern Parula | <i>Setophaga americana</i> | x | | | | M |
| Magnolia Warbler | <i>Setophaga magnolia</i> | x | | | | M |
| Yellow Warbler | <i>Setophaga petechia</i> | x | | x | | M |
| Black-throated Blue Warbler | <i>Setophaga caeruleascens</i> | | | x | | M |
| Palm Warbler | <i>Setophaga palmarum</i> | x | | | | M |
| Yellow-rumped Warbler | <i>Setophaga coronata</i> | x | | x | x | M |
| Yellow-throated Warbler | <i>Setophaga dominica</i> | x | | | | M |
| Black-throated Grey Warbler | <i>Setophaga nigrescens</i> | x | | x | | M |
| Townsend's Warbler | <i>Setophaga townsendi</i> | x | | x | | M |
| Golden-cheeked Warbler | <i>Setophaga chrysoparia</i> | x | x | | | M |
| Wilson's Warbler | <i>Cardellina pusilla</i> | x | | x | | M |
| Red-faced Warbler | <i>Cardellina rubrifrons</i> | x | x | | | MB? |

| English name | Scientific name | Spring | Summer | Autumn | Winter | Status |
|-------------------------|--------------------------------------|--------|--------|--------|--------|--------|
| Painted Redstart | <i>Myioborus pictus</i> | x | x | x | | MB |
| Slate-throated Redstart | <i>Myioborus miniatus</i> | x | x | | | MB |
| Cassin's Sparrow | <i>Peucaea cassinii</i> | x | x | x | x | MB |
| Grasshopper Sparrow | <i>Ammodramus savannarum</i> | x | | | | M |
| Baird's Sparrow | <i>Centronyx bairdii</i> | x | | | | M |
| Chipping Sparrow | <i>Spizella passerina</i> | x | x | x | x | M |
| Clay-coloured Sparrow | <i>Spizella pallida</i> | x | | x | x | M |
| Black-chinned Sparrow | <i>Spizella atrogularis</i> | x | x | x | x | RB |
| Field Sparrow | <i>Spizella pusilla</i> | x | | | | M |
| Brewer's Sparrow | <i>Spizella breweri</i> | x | | x | x | M |
| Black-throated Sparrow | <i>Amphispiza bilineata</i> | x | x | x | x | RB |
| Lark Sparrow | <i>Chondestes grammacus</i> | x | x | x | x | RB |
| Lark Bunting | <i>Calamospiza melanocorys</i> | x | | x | x | M |
| Fox Sparrow | <i>Passerella iliaca</i> | | | x | x | M |
| Dark-eyed Junco | <i>Junco hyemalis</i> | x | | | x | M |
| Yellow-eyed Junco | <i>Junco phaeonotus</i> | x | x | x | x | RB |
| White-crowned Sparrow | <i>Zonotrichia leucophrys</i> | x | | x | x | M |
| White-throated Sparrow | <i>Zonotrichia albicollis</i> | x | | | x | M |
| Vesper Sparrow | <i>Poocetes gramineus</i> | x | | x | x | M |
| Savannah Sparrow | <i>Passerculus sandwichensis</i> | x | | x | x | M |
| Song Sparrow | <i>Melospiza melodia</i> | x | | x | x | M |
| Lincoln's Sparrow | <i>Melospiza lincolni</i> | x | | x | x | M |
| Swamp Sparrow | <i>Melospiza georgiana</i> | | | x | x | M |
| Canyon Towhee | <i>Melozona fusca</i> | x | x | x | x | RB |
| Rufous-crowned Sparrow | <i>Aimophila ruficeps</i> | x | x | x | x | RB |
| Green-tailed Towhee | <i>Pipilo chlorurus</i> | x | | x | x | M |
| Spotted Towhee | <i>Pipilo maculatus</i> | x | x | x | x | M |
| Yellow-breasted Chat | <i>Icteria virens</i> | x | x | x | | MB |
| Hepatic Tanager | <i>Piranga flava</i> | x | x | x | | MB |
| Summer Tanager | <i>Piranga rubra</i> | x | x | x | | MB |
| Scarlet Tanager | <i>Piranga olivacea</i> | x | | | | M |
| Western Tanager | <i>Piranga ludoviciana</i> | x | x | x | | MB |
| Flame-coloured Tanager | <i>Piranga bidentata</i> | x | x | | | M |
| Northern Cardinal | <i>Cardinalis cardinalis</i> | x | x | x | x | RB |
| Pyrrhuloxia | <i>Cardinalis sinuatus</i> | x | x | x | x | RB |
| Rose-breasted Grosbeak | <i>Pheucticus ludovicianus</i> | x | | | | M |
| Black-headed Grosbeak | <i>Pheucticus melanocephalus</i> | x | x | x | | MB |
| Blue Grosbeak | <i>Passerina caerulea</i> | x | x | x | | MB |
| Lazuli Bunting | <i>Passerina amoena</i> | | x | | | M |
| Indigo Bunting | <i>Passerina cyanea</i> | x | x | x | | MB |
| Varied Bunting | <i>Passerina versicolor</i> | x | x | x | | MB |
| Painted Bunting | <i>Passerina ciris</i> | x | x | x | | MB |
| Dickcissel | <i>Spiza americana</i> | x | | x | | M |
| Yellow-headed Blackbird | <i>Xanthocephalus xanthocephalus</i> | x | x | x | | M |
| Western Meadowlark | <i>Sturnella neglecta</i> | x | x | x | x | RB |
| Eastern Meadowlark | <i>Sturnella magna</i> | x | | x | x | M |
| Orchard Oriole | <i>Icterus spurius</i> | x | x | x | | MB |
| Hooded Oriole | <i>Icterus cucullatus</i> | x | x | x | | MB |
| Bullock's Oriole | <i>Icterus bullockiorum</i> | x | x | | | M |

| English name | Scientific name | Spring | Summer | Autumn | Winter | Status |
|----------------------|-------------------------------|--------|--------|--------|--------|--------|
| Audubon's Oriole | <i>Icterus graduacauda</i> | x | x | x | x | RB |
| Scott's Oriole | <i>Icterus parisorum</i> | x | x | x | | MB |
| Red-winged Blackbird | <i>Agelaius phoeniceus</i> | x | x | x | x | RB |
| Bronzed Cowbird | <i>Molothrus aeneus</i> | x | x | x | | MB |
| Brown-headed Cowbird | <i>Molothrus ater</i> | x | x | x | | MB |
| Brewer's Blackbird | <i>Euphagus cyanocephalus</i> | x | | x | x | M |
| Great-tailed Grackle | <i>Quiscalus mexicanus</i> | x | x | | | M |
| House Finch | <i>Haemorhous mexicanus</i> | x | x | x | x | RB |
| Cassin's Finch | <i>Haemorhous cassinii</i> | | | x | x | M |
| Pine Siskin | <i>Spinus pinus</i> | x | | x | x | MB |
| Lesser Goldfinch | <i>Spinus psaltria</i> | x | x | x | x | RB |
| American Goldfinch | <i>Spinus tristis</i> | x | | x | x | M |
| House Sparrow | <i>Passer domesticus</i> | x | x | x | x | RB |

observed every year BRM conducted field work in 2003–13. All observations were made between 1,460 and 2,450 m elevation. The lowest vegetation association was in Cañón Juárez, characterised by scattered pines, juniper and oak. The highest observation was made near Campo Tres, in pine–oak–fir forest. The majority of observations were centred on pine–oak woodlands, and all were made in mid March–early May.

A specimen was collected in 1961 by A. Garza de Leon, former director of the Museo de las Aves in Saltillo, at Rancho las Margaritas, in the Serranías del Burro, adjacent to the Sierra del Carmen (Howell & Webb 1995). He shot it believing it to be a Turkey Vulture *Cathartes aura*. When he reached the downed bird, he was astounded to discover its true identity. The mounted specimen is in the Museo de las Aves collection, and was examined by Clark *et al.* (2006) for their primer on identification.

In 1993 and 1994, Elizabeth Spence de Sellers & BRM observed a pair of Solitary Eagles in the 'Lobo Pasture', Serranías del Burro, during bird surveys, including an observation of a pair hunting and one carrying an Eastern Fox Squirrel *Sciurus niger* in its talons. No nest could be located.

Based on these observations, Solitary Eagle might occasionally nest in the Sierra del Carmen, which would represent a significant range extension. In Mexico, the species is listed as Endangered, and the nearest population is in the Sierra Madre Mountains of Chihuahua far to the west (Howell & Webb 1995). There are also recent photo-documented records on eBird from Tamaulipas.

WHITE-TAILED HAWK *Geranoaetus albicaudatus*

On 15 June 2003, JEM observed many at the entrance to Santo Domingo Ranch on the east side of the Sierra del Carmen. In May 2010, one was observed by BRM and a group from US Fish & Wildlife Service, Big Bend National Park, and Rio Grande Joint Venture, flying low over grasslands in the Zacatosa area, near Rancho Los Pilares. It has also been documented on eBird in the vicinity of Múzquiz, as well as in Big Bend National Park and Black Gap Wildlife Management Area.

NORTHERN GOSHAWK *Accipiter gentilis*

R. Wauer documented a nest high in the pine–fir forest of the Sierra del Carmen (Wauer 1992). The species is a resident breeder at the highest elevations, in stands of tall, mature

pine–fir habitat with sheer cliffs bordering open areas, during spring to autumn. In winter the species moves downslope to the lower canyons, particularly the upper Cañón El Alamo, Cañón Fronteriza and Cañón Juárez, which support riparian pine–oak habitat. This is a very isolated population of the species, with the nearest populations in the Sierra Madre Occidental and parts of the south-west USA.

LAUGHING GULL *Leucophaeus atricilla*

Photographs were taken of this species on the landing strip at Los Pilares in 2001. Presa Don Martin near Sabinas, Amistad Lake at Del Rio, and Balmorhea Lake, in Texas, all have resident Laughing Gulls.

WHITE-TIPPED DOVE *Leptotila verreauxi*

Regularly recorded in lower canyons of the sierra, and we found nests in September 2004 and May 2007. Given the relative ease of detection (flushes at close range and calls regularly), it is unlikely to have been missed by Miller (1955). Instead, these new records are probably attributable to range expansion, both locally (McCormack *et al.* 2007) and regionally, possibly as a result of land-use changes (Hogan 1999).

WHITE-WINGED DOVE *Zenaida asiatica*

Seen just once by Miller (1955), we regularly observed it in low-elevation canyons like El Alamo. Like White-tipped Dove, it is probable that the species was indeed rare in the 1950s, and that its modern abundance in the region is a function of recent range expansion (Schwertner *et al.* 2002).

COMMON PAURAUQUE *Nyctidromus albicollis*

Not documented on eBird much further west than Del Rio, Texas, the species was heard calling near Tanque Pilares one evening in early October 2001 by BRM *et al.*

RIVOLI'S HUMMINGBIRD *Eugenes fulgens*

Seen just once by Miller (1955), with a specimen collected by A. Starker Leopold housed at the Berkeley Museum of Vertebrate Zoology (MVZ 129681). We regularly observed it in mid- to high-elevation forests. There are now many eBird records in Big Bend National Park, where it has been known as a breeder for some years (Wauer 1996). On 8 May 2007 a nest was found above Campo Dos. The female was incubating or brooding. The nest was 7 m up in a 17 m-tall conifer, 3 m along a horizontal branch and 60 cm from its tip. At Casa San Isidro, where hummingbird feeders were installed, the species was a daily visitor during spring to early autumn. The surprisingly small number of observations by Miller is hard to explain.

APLOMADO FALCON *Falco femoralis*

Spring and autumn sightings in 2003–05 of a lone bird near Los Pilares. No photographs were taken. Perhaps a vagrant from west of the Sierra del Carmen in adjacent Chihuahua, where there is a breeding population (Moreno-Contreras *et al.* 2015). There are a few eBird records in Big Bend National Park.

EASTERN WOOD PEWEE *Contopus virens*

At least one in the evening of 28 April 2007 at Campo Uno before a heavy thunderstorm passed. At least one was present again the following morning. Identification was based on the vocalisation, which was clear, plaintive and less hoarse than that of Western Wood

Pewee *C. sordidulus*. The Sierra del Carmen is outside the known regular migration route of the species, although Howell & Webb (1995) mentioned it as a vagrant in adjacent Chihuahua.

DUSKY FLYCATCHER *Empidonax oberholseri*

Mist-netted in Cañón El Alamo on 22 April 2007. Identification confirmed mensurally. There are numerous records in Big Bend National Park on eBird.

DUSKY-CAPPED FLYCATCHER *Myiarchus tuberculifer*

First seen on 30 May 2007, when we observed a pair exploring cavities in various snags around Campo Uno. The species' unique vocalisations first alerted us to the birds' probable identity. We later confirmed the identification visually—they were much smaller than the common Ash-throated Flycatcher *M. cinerascens*, the undertail was all grey, and the belly was brighter yellow. Considered a very rare breeder in the Jeff Davis and Chisos Mountains of Texas, and it is probably a regular but rare breeder in the Sierra del Carmen as well. All of our observations relate to the same pair at Campo Uno.

BLACK-CAPPED VIREO *Vireo atricapilla*

Reported by Miller (1955) as fairly common in the lower Boquillas Canyon, where it was found primarily in catclaw *Senegalia greggii*-dominated areas of dense shrubs. Benson & Benson (1990) estimated $6,301 \pm 3,162$ breeding pairs in the region, and one of us previously documented a comparatively dense population breeding in the Sierra del Carmen (McKinney 1998). At the eastern end of the range, in Cañón Morteros, Black-capped Vireo was abundant in areas of scattered oaks, large boulders and stands of juniper. Singing males were territorial by early April, and several were mist-netted in 2002. They are also found at Cuesta Malena in a habitat comprising scattered oaks, Gregg ash *Fraxinus greggii* and boulders. To the east, in the Serranías del Burro in similar habitat, a large breeding population was documented in 1993–96 (McKinney 1987, McKinney & Sellers 1996).

CLARK'S NUTCRACKER *Nucifraga columbiana*

One was observed by S. Gibert Isern on the road to Campo Dos in 2003. There is also a single eBird record from the Chisos Mountains in Big Bend National Park.

RED-BREASTED NUTHATCH *Sitta canadensis*

Seen on Mesa Bonita and at Campo Tres, high in the mountains in pine–oak–fir forest. Observed in all seasons, but nesting not definitively documented. Three were seen in Ponderosa pine *Pinus ponderosa* at Campo Tres in July 2002. Not considered to be resident in the area, and is only an irregular winter visitor to northern Mexico (Howell & Webb 1995, Delgado-Fernández & Delgadillo-Nuño 2016), and a sporadic visitor in autumn to spring throughout the Trans-Pecos, including Big Bend National Park (Peterson & Zimmer 1998).

RUSSET NIGHTINGALE-THRUSH *Catharus occidentalis*

On 14 May 2007, at c.2,500 m, we heard a *Catharus* singing, but we assumed the song belonged to an odd migrant Hermit Thrush *C. guttatus*. The vegetation in the ravine comprised small deciduous shrubs (e.g., *Physocarpus monogynus*) with a coniferous canopy on the fairly steep, dry slopes above. We heard the same bird singing upon our return to the area on 31 May 2007, and again on 1 June 2007. On 3 June 2007 we returned at 08.05 h with the goal of observing the bird. It was difficult to see, but we noted that the upperparts were dull brown, the breast grey, it had an eye-ring, a bicoloured bill, and the vent was white or



Figure 2. The environs and possible nest of Russet Nightingale-Thrush *Catharus occidentalis*, Sierra del Carmen, Coahuila, Mexico, June 2007. Clockwise from left: an old nest from the side, with dense moss still largely intact, but most pale twigs / grass have fallen off (some still visible hanging from the nest); the steep slopes of the ravine in which the nest was sited; the same nest from above, showing the thickness of the moss cup and the carefully constructed lining of rootlets and conifer needles (Eliot T. Miller)

pale grey. The bird sang almost continuously until we left at 10.15 h. We returned on 7 June 2007 and were able to record two brief song bouts using a digital camera (<http://www.xeno-canto.org/357625>, <http://www.xeno-canto.org/357626>). A bandpass-filtered version has also been uploaded to Macaulay Library (ML85671051), where the identification was confirmed by reviewers. Near the singing bird, we noted the presence of at least four old nests that resembled those of other Central and South American *Catharus* and *Turdus* species (ETM, H. F. Greeney & V. Rohwer pers. obs.; Fig. 2). We departed the study site on 10 June 2007, and made no further observations of the bird. This site is *c.*425 km north of the nearest known population, near Monterrey, Nuevo León. While our evidence of breeding is far from conclusive, the large number of nightingale-thrush-like nests in the ravine, and extensive singing throughout the day for 24 days suggests at least a male advertising for a mate.

LAPLAND LONGSPUR *Calcarius lapponicus*

Rare visitor. Observed at the bird feeder at Casa San Isidro. The species has been documented across the Rio Grande in western Texas, in the northern portion of the Trans-Pecos, where it is considered accidental in winter (Peterson & Zimmer 1998).

GOLDEN-CHEEKED WARBLER *Setophaga chrysoparia*

Rare, sightings from Cañón Morteros area, where there is Ashe juniper *Juniperus ashei*, the species' preferred breeding habitat. A few eBird records exist for Big Bend National Park.

RED-FACED WARBLER *Cardellina rubrifrons*

Seen once, on 12–17 April 2006 (only a single checklist was kept for this period) just downstream of Campo Dos, at the entrance to El Moreno Canyon.

SLATE-THROATED REDSTART *Myioborus miniatus*

Like McCormack *et al.* (2005), who documented a breeding pair near Campo Dos, we found the species to be thinly distributed throughout the narrow drainage from Campo Dos to Campo Tres. Our observations were primarily in May–June.

FLAME-COLOURED TANAGER *Piranga bidentata*

Very rare. Documented just three times in the Sierra del Carmen. Photo-documented on eBird in the Chisos Mountains of Big Bend National Park. Common in the Sierra Santa Rosa, 100 km to the south-east (McCormack *et al.* 2007).

AUDUBON'S ORIOLE *Icterus graduacauda*

Not noted by Miller (1955b), but we found the species to be common throughout the lower western canyons. McCormack *et al.* (2007) also noted it as common in the Sierra Santa Rosa, 100 km to the south-east, and suggested that the failure of previous studies to locate the species in this area might reflect a recent increase in its abundance. While this could be true, there is a specimen from the Sierra del Carmen collected in 1940 at the Perot Museum of Nature and Science in Dallas (PMNS 001444), two specimens taken to the south-east near Sabinas, Coahuila, in 1910, housed at the Field Museum of Natural History, Chicago (FMNH 125181–182), and an audio-recording from the nearby Sierra Encantada in 1983 (Florida Museum Bioacoustic Archive UF Audio 7216). It therefore seems probable that the species has long been present in the region, but might have experienced a more recent increase in abundance. Audubon's Oriole is resident and its preferred habitat is the lower edge of pine–oak woodlands comprising pine, oak, juniper and yucca. It is also common to the east in the Serranías del Burro (Benson *et al.* 1989).

Discussion

The Sierra del Carmen possesses an interesting avifauna that combines species from several nearby biogeographic regions. Those characteristic of regions to the north and the high mountains of Mexico include Broad-tailed Hummingbird *Selasphorus platycercus*, Cordilleran Flycatcher *Empidonax occidentalis* and Flammulated Owl *Psilosops flammeolus*. Species primarily found further south include Montezuma Quail *Cyrtonyx montezumae*, Common Black Hawk, Solitary Eagle, White-tipped Dove, Rivoli's Hummingbird, Blue-throated Hummingbird *Lampornis clemenciae*, Dusky-capped Flycatcher, Russet Nightingale-Thrush, Olive Warbler *Peucedramus taeniatus*, Colima Warbler *Oreothlypis crissalis*, Painted Redstart *Myioborus pictus*, Slate-throated Redstart, Yellow-eyed Junco *Junco phaeonotus*, Varied Bunting *Passerina versicolor* and Audubon's Oriole. Finally, as noted by Miller (1955a,b), certain species are 'notably lacking'. We confirm the absence of any breeding evidence for chickadees *Poecile* spp., bluebirds *Sialia* spp. or Brown Creeper *Certhia americana*, and likewise corroborate his observation that some species expected to be common based on habitat are absent or almost so during the breeding season: Hairy Woodpecker *Dryobates villosus*, Steller's Jay *Cyanocitta stelleri*, Plumbeous Vireo *Vireo plumbeus* and Yellow-rumped Warbler *Setophaga coronata*.

Compared to sky islands north of the Sierra Madre Occidental like the Chiricahua Mountains, those north of the Sierra Madre Oriental, of which the Sierra del Carmen is one, are relatively depauperate in tropical bird species. McCormack *et al.* (2007) posed the

question whether the eastern sky islands truly lack such species, or whether the regional list might grow with additional exploration of this comparatively poorly known area. We conclude that while we have added a few southern taxa to the regional list, these isolated mountains are indeed less diverse in tropical species than their western counterpart sky islands. This begs the question of how these tropical species have come to be distributed in the area. Have they dispersed comparatively recently from further south, or are they perhaps relict populations from when more mesic vegetation dominated the region (Metcalf *et al.* 2000, McCormack *et al.* 2007)? Based on genetic evidence from Mexican Jay *Aphelocoma ultramarina*, many of these species may be relicts of populations that were previously more widespread during glacial maxima when forest was amply distributed (McCormack *et al.* 2008).

As a sky island, the Sierra del Carmen rises as a beacon of intact, forested landscape within an otherwise sparse corridor of suitable habitat for montane Middle American species shifting north along the Sierra Madre Oriental with climate change (Davis & Shaw 2001, Colwell *et al.* 2008). Moreover, it harbours a distinctive set of known (McCormack *et al.* 2008) and presumed genetically distinct populations of otherwise more southerly distributed species. Fortunately, the majority of the region is federally protected and carefully managed, much of it by the international company CEMEX. Rehabilitation efforts of past environmental injuries have been underway for many years, including removal of logging waste and the re-introduction of Bighorn Sheep *Ovis canadensis*, Pronghorn *Antilocapra americana* and Elk *Cervus canadensis*, and the long-term conservation outlook in the Sierra del Carmen appears promising (McKinney & Villalobos 2014).

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A price list of birds collected by Alfred Russel Wallace inserted in *The Ibis* of 1863

by Kees Rookmaaker & John van Wyhe

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<http://zoobank.org/urn:lsid:zoobank.org:pub:43B17926-9D7F-4DDC-9B8C-AA556354CBD1>

SUMMARY.—Vol. 5 of *The Ibis* (1863) contained four loose inserts advertising specimens for sale by the natural history dealer Samuel Stevens. One of these represents the remaining stock of birds obtained by Alfred Russel Wallace during his expedition to the Malay Archipelago in 1854–62. A total of 246 specimens from eight regions were listed, with prices ranging from three to 20 shillings, plus ten specimens priced at more than £1. The most expensive items were a pair of Standardwing Bird-of-paradise *Semioptera wallacii*, and a fine example of the Twelve-wired Bird-of-paradise *Seleucidis melanoleucus*. Only one copy of this insert is known to survive, because they appear to have been removed when the volumes were bound and preserved. All 246 specimens are listed according to the original print version, with the addition of current scientific and vernacular names.

The naturalist Alfred Russel Wallace (1823–1913) travelled through the Malay Archipelago for eight years, between 1854 and 1862 (van Wyhe 2013). As he stated, his ‘main object of all my journeys was to obtain specimens of natural history, both for my private collection and to supply duplicates to museums and amateurs’ (Wallace 1869, I: xii). Before setting out, he had made an arrangement with Samuel Stevens (1817–99), who had a shop for natural history objects at 24 Bloomsbury Street, London. Wallace would send all of his material to Stevens, who would store those items intended for Wallace’s private collection and endeavour to sell the remaining specimens (Baker 2001).

Although Stevens must have sent out lists of new stock to various collectors, both at home and abroad, knowledge of how much he could charge for specimens of various degrees of rarity or beauty is poor. In fact, it seems that very few of his price lists have survived (one listing insects in Berlin was mentioned by Baker 2001: 256). We have located one interesting printed example, issued just over a year after Wallace’s return from the East, which was widely available at the time but appears to have disappeared from the record.

Advertising in *The Ibis*

In January 1859, the first issue of a new magazine of general ornithology, *The Ibis*, appeared under the editorship of Philip Lutley Sclater (1829–1913), ornithologist and, from 1860, Secretary of the Zoological Society of London. The new journal was quarterly and soon established itself as the major British publication for ornithological research.

The Ibis vol. 4 (1862) contained two undated inserts styled ‘The Naturalist’s Advertiser’ No. I and No. II. These offered ‘a medium whereby Dealers and others having Objects, Apparatus, or Books relating to this Science, to dispose of, may make the same specially known among the class of persons where they are most likely to find purchasers.’ Booksellers paid a small amount to the publishers Trübner & Co. in London. Both known issues of the *Advertiser* had four pages and advertised only zoological books. Strangely, there is no name or address of a bookseller where these copies could be obtained.

TO
ORNITHOLOGISTS & DIRECTORS OF MUSEUMS.

LIST OF BIRDS

FROM THE
EASTERN ISLANDS OF THE MALAY ARCHIPELAGO,

FOR SALE AT THE ANNEXED PRICES,

BY

MR. SAMUEL STEVENS,

Natural History Agent,

24, BLOOMSBURY STREET, LONDON, W.C.

The New Species obtained by Mr. WALLACE, were described by Mr. G. R. GRAY in the proceedings of the Zoological Society of London for 1858, 1859, 1860, and 1861; and by Mr. WALLACE, in the same work, Dec., 1862 and Jan., 1863, and in the "Ibis" of Oct., 1862.

N.B.—To purchasers of above £25 value, 10 per cent. discount will be allowed.

CELEBES.

| | |
|--|---|
| 1. Trichoglossus ornatus. L. 7s. | 11. Treron vernans. Gm. 5s. |
| 2. Dendrochelidon Wallacei 5s. | 12. Treron griseicauda. G. R. Gray 20s. |
| Gould 5s. | 13. Carpophaga radiata. Q. & G. 15s. |
| 3. Hemilophus fulvus. Q. & G. 7s. | 14. Turacæna menadensis. Q. & G. 7s. |
| 4. Graucalus leucopygius. Bp. 3s. | 15. Ardeola malaccensis. Gm. 4s. |
| 5. Campephaga morio. Mull. 3s. | 16. Rallus philippensis. L. 4s. |
| 6. Dicourus pectoralis. Wall. <i>var.</i> 4s. | 17. Porzana phœnicura. Penn. 4s. |
| 7. Corvus validus. Bp. <i>var.</i> 8s. | 18. Porphyrio smaragdinus. Temm. 7s. |
| 8. Diceum celebicum. Mull. 5s. | 19. Parra gallinacea. Temm. 4s. |
| 9. Cinnerys frenata. Mull. 3s. | 20. Querquedula gibbifrons. Mull. 5s. |
| 10. Acridotheres cinereus. Mull. 5s. | 21. Dendrocygna vagans. Eyton 5s. |

SULA Is. (East of Celebes.)

| | |
|---|--|
| 1. Platycercus dorsalis. Q. & G. 15s. | 5. Haleyon collaris. Sw. 4s. |
| <i>var.</i> 30s. | 6. Dendrochelidon wallacei. Gould 6s. |
| 2. Loriculus sclateri. Wall. 40s. | 7. Merop sornatus. Lath. 3s. |
| 3. Trichoglossus flavoviridis 40s. | 8. Criniger longirostris. Wall. 10s. |
| Wall. 40s. | 9. Oriolus frontalis. Wall. 20s. |
| 4. Haleyon melanorhyncha. 15s. | 10. Artamus monachus. Bp. 20s. |
| Temm. 15s. | 11. Myiagra puella. Wall. 10s. |

Figure 1. The first page of the 'List of birds from the eastern islands of the Malay Archipelago' inserted in *The Ibis* of 1863.

The existence of The Naturalist's Advertiser shows that *The Ibis* offered the possibility to sellers of natural history books and objects to list their stock. Although the original concept seems to have been discontinued, apparently Stevens took advantage of the possibility, because in vol. 5 of *The Ibis* (1863) were four loose inserts: (1) 'List of birds from the Eastern Islands of the Malay Archipelago, for sale at the annexed prices', pp. 1–4; (2) 'List of duplicates from Mr. Swinhoe's collection of Chinese birds', pp. 1–2; (3) 'List of duplicates from Mr. Swinhoe's collection of Formosan birds', pp. 1–2; (4) 'List of M. Du Chaillu's collection of bird-skins from Africa', pp. 1–2. Only the last of these is dated, April 1863. Therefore these inserts were mailed either with the January (vol. 5, no. 17) or, more likely, the April 1863 (no. 18) issue of *The Ibis*.

As these were loose inserts advertising specimens, they were rarely preserved. Institutional copies which were bound appear to have removed them as a matter of course. The copies of the 5th volume of *The Ibis* on major online platforms like the Biodiversity Heritage Library, Archive or Google Books no longer contain the inserts, which therefore seem now to be incredibly rare. No copies were individually catalogued in any library as far as we have been able to ascertain.

The only copy of these inserts known to us is in one of the sets of *The Ibis* at the Bayerische Staatsbibliothek, Munich (physical copies at signature Zool. 266 m-5) and available online—see Stevens (1863)—in References.

The list of birds from the eastern islands of the Malay Archipelago

As shown in Fig. 1, the document starts with a title and introduction, followed by lists of species by locality. Within the locality, each species or specimen has a number, a scientific name with authority, and a price, printed across two columns. The final page ends with the printer's details: McGowan and Danks, Great Windmill Street, Haymarket.

In our transcription in Table 1, the localities, numbering, species names and prices are provided exactly as in the original, with all punctuation, in the subheadings (in bold) and three left-hand columns (no., species, price). The last column in the table provides the best fit for current scientific and vernacular name, following nomenclature in the latest version of the *Handbook of the birds of the world Alive* (del Hoyo *et al.* 2018).

Discussion

The 'List of birds from the eastern islands' was subdivided into eight geographic sections. The species in each section are numbered consecutively (Table 2). In three cases different specimens of the same species are listed individually. In one case, one number relates to a pair (possibly mounted together). Hence Stevens had a stock of at least 246 specimens.

The prices charged by Stevens ranged from three to 240 shillings each, or an average of c.11 shillings per specimen (Table 3). Note that 'to purchasers of above £25 value, 10 per cent. discount will be allowed' (Stevens 1863, see Fig. 1). The most expensive items were a Black Lory *Chalcopsitta atra* (25 shillings), Sula Hanging-parrot *Loriculus sclateri* (30 shillings), Buru Green-pigeon *Treron aromaticus* (30 shillings), Yellow-and-green Lorikeet *Trichoglossus flavoviridis* (40 shillings), Ivory-breasted Pitta *Pitta maxima* (40 shillings), Golden Myna *Mino anais* (40 shillings), New Guinea Bronzewing *Henicophaps albifrons* (40 shillings), Standardwing Bird-of-paradise *Semioptera wallacei* (200 shillings per pair) and a fine Twelve-wired Bird-of-paradise *Seleucidis alba* (240 shillings). The most expensive specimen, the Twelve-wired Bird-of-paradise, was certainly rare, although the British Museum subsequently received five specimens collected by Wallace in New Guinea (Sharpe

TABLE 1

Birds listed in the advert of Wallace's specimens by Stevens (1863), showing the precise original transcription on the left and current probable identification of the species on the right.

| No. | Transcription of species as listed | Price | Current identification |
|---|---|-------|---|
| [p.1] CELEBES. | | | |
| 1. | <i>Trichoglossus ornatus</i> . L. | 7s. | Ornate Lorikeet <i>Trichoglossus ornatus</i> (Linnaeus, 1758) |
| 2. | <i>Dendrochelidon Wallacei</i> Gould | 5s. | Grey-rumped Treeswift <i>Hemiprocne longipennis wallacei</i> (Gould, 1859) |
| 3. | <i>Hemilophus fulvus</i> . Q. & G. | 7s. | Ashy Woodpecker <i>Mulleripicus fulvus</i> (Quoy & Gaimard, 1830) |
| 4. | <i>Graucalus leucopygius</i> . Bp. | 3s. | White-rumped Cuckooshrike <i>Coracina leucopygia</i> (Bonaparte, 1850) |
| 5. | <i>Campephaga morio</i> . Mull | 3s. | Sulawesi Cicadabird <i>Edolisoma morio</i> (S. Müller, 1843) |
| 6. | <i>Dicrurus pectoralis</i> . Wall. <i>var.</i> | 4s. | White-eyed Drongo <i>Dicrurus hottentottus leucops</i> Wallace, 1865 |
| 7. | <i>Corvus validus</i> . Bp. <i>var.</i> | 8s. | Sulawesi Crow <i>Corvus enca celebensis</i> Stresemann, 1936 |
| 8. | <i>Dicaeum celebicum</i> . Mull | 5s. | Grey-sided Flowerpecker <i>Dicaeum celebicum</i> S. Müller, 1843 |
| 9. | <i>Cinnyris frenata</i> . Mull. | 3s. | Olive-backed Sunbird <i>Cinnyris jugularis plateni</i> (A. W. H. Blasius, 1885) |
| 10. | <i>Acridotheres cinereus</i> . Mull | 6s. | Pale-bellied Myna <i>Acridotheres cinereus</i> Bonaparte, 1851 |
| 11. | <i>Treron vernans</i> . Gm. | 5s. | Pink-necked Green-pigeon <i>Treron vernans</i> (Linnaeus, 1771) |
| 12. | <i>Treron griseicauda</i> . G.R. Gray | 20s. | Grey-cheeked Green-pigeon <i>Treron griseicauda wallacei</i> (Salvadori, 1893) |
| 13. | <i>Carpophaga radiata</i> . Q. & G. | 15s. | Grey-headed Imperial-pigeon <i>Ducula radiata</i> (Quoy & Gaimard, 1830) |
| 14. | <i>Turacaena menadensis</i> . Q. & G. | 7s. | White-faced Cuckoo-dove <i>Turacoena menadensis</i> (Quoy & Gaimard, 1830) |
| 15. | <i>Ardeola malaccensis</i> . Gm. | 4s. | Javan Pond-heron <i>Ardeola speciosa</i> (Horsfield, 1821) |
| 16. | <i>Rallus philippensis</i> . L. | 4s. | Buff-banded Rail <i>Hypotaenidia p. philippensis</i> (Linnaeus, 1766) |
| 17. | <i>Porzana phoenicura</i> . Penn. | 4s. | White-breasted Waterhen <i>Amaurornis phoenicurus leucomelana</i> (S. Müller, 1842) |
| 18. | <i>Porphyrio smaragdinus</i> . Temm. | 7s. | Sunda Swampphen <i>Porphyrio poliocephalus indicus</i> Horsfield, 1821 |
| 19. | <i>Parra gallinacea</i> . Temm. | 4s. | Comb-crested Jacana <i>Irediparra gallinacea</i> (Temminck, 1828) |
| 20. | <i>Querquedula gibbifrons</i> . Mull. | 5s. | Sunda Teal <i>Anas gibberifrons</i> S. Müller, 1842 |
| 21. | <i>Dendrocygna vagans</i> . Eyton. | 5s. | Wandering Whistling-duck <i>Dendrocygna arcuata</i> (Horsfield, 1824) |
| SULA Is. (East of Celebes.) | | | |
| 1. | <i>Platycercus dorsalis</i> . Q. & G. <i>var.</i> | 15s. | Moluccan King-parrot <i>Alisterus amboinensis</i> (Linnaeus, 1766) |
| 2. | <i>Loriculus sclateri</i> . Wall. | 30s. | Sula Hanging-parrot <i>Loriculus sclateri</i> Wallace, 1863 |
| 3. | <i>Trichoglossus flavoviridis</i> Wall. | 40s. | Yellow-and-green Lorikeet <i>Trichoglossus flavoviridis</i> Wallace, 1863 |
| 4. | <i>Halcyon melanorhyncha</i> . Temm. | 15s. | Black-billed Kingfisher <i>Pelargopsis melanorhyncha</i> (Temminck, 1826) |
| 5. | <i>Halcyon collaris</i> . Sw. | 4s. | Collared Kingfisher <i>Todiramphus chloris</i> (Boddaert, 1783) |
| 6. | <i>Dendrochelidon wallacei</i> . Gould | 6s. | Grey-rumped Treeswift <i>Hemiprocne longipennis wallacei</i> (Gould, 1859) |
| 7. | <i>Merop sornatus</i> . [sic] Lath. | 3s. | Rainbow Bee-eater <i>Merops ornatus</i> Linnaeus, 1766 |
| 8. | <i>Criniger longirostris</i> . Wall. | 10s. | Sula Golden Bulbul <i>Thapsinillas longirostris</i> Wallace, 1863 |
| 9. | <i>Oriolus frontalis</i> . Wall. | 20s. | Black-naped Oriole <i>Oriolus chinensis frontalis</i> Wallace, 1863 |
| 10. | <i>Artamus monachus</i> . Bp. | 20s. | Ivory-backed Woodswallow <i>Artamus monachus</i> Bonaparte, 1850 |
| 11. | <i>Myiagra puella</i> . Wall. | 10s. | Pale-blue Monarch <i>Hypothymis puella</i> (Wallace, 1863) |
| [p.2] SULA Is. (East of Celebes.) – Continued. | | | |
| 12. | <i>Monarcha cinerascens</i> . Temm. | 4s. | Island Monarch <i>Monarcha cinerascens</i> (Temminck, 1827) |
| 13. | <i>Pachycephala clio</i> . Wall. | 10s. | Golden Whistler <i>Pachycephala pectoralis clio</i> Wallace, 1863 |
| 14. | <i>Dicrurus pectoralis</i> . Wall. | 10s. | Sula Drongo <i>Dicrurus hottentottus pectoralis</i> Wallace, 1863 |
| 15. | <i>Nectarinea auriceps</i> . G.R. G. | 5s. | Black Sunbird <i>Leptocoma aspasia auriceps</i> (G. R. Gray, 1861) |
| 16. | <i>Corvus validus</i> . Bp. <i>var.</i> | 8s. | Slender-billed Crow <i>Corvus enca mangoli</i> Vaurie, 1958 |
| 17. | <i>Calornis obscura</i> . Forst. | 3s. | Moluccan Starling <i>Aplomis mysolensis</i> (G. R. Gray, 1862) |

| No. | Transcription of species as listed | Price | Current identification |
|--------------------------|--|-------|--|
| 18. | <i>Treron griseicauda</i> . G.R. Gray | 20s. | Grey-cheeked Green-pigeon <i>Treron griseicauda wallacei</i> (Salvadori, 1893) |
| 19. | <i>Ptilonopus melanocephalus</i> . L. var. | 8s. | Black-naped Fruit-dove <i>Ptilinopus melanospilus bangueyensis</i> A. B. Meyer, 1891 |
| 20. | <i>Carpophaga luctuosa</i> . Temm. | 15s. | White Imperial-pigeon <i>Ducula luctuosa</i> (Temminck, 1824) |
| 21. | <i>Carpophaga paulina</i> . Temm. | 15s. | Green Imperial-pigeon <i>Ducula aenea paulina</i> Bonaparte, 1854 |
| 22. | <i>Macropygia albicapilla</i> . Bp. | 10s. | Slender-billed Cuckoo-dove <i>Macropygia amboinensis albicapilla</i> Bonaparte, 1854 |
| 23. | <i>Turacoena menadensis</i> . Q. & G. | 8s. | White-faced Cuckoo-dove <i>Turacoena manadensis</i> (Quoy & Gaimard, 1830) |
| BOURU (Moluccas). | | | |
| 1. | <i>Geoffroyus personatus</i> . Shaw. | 10s. | Red-cheeked Parrot <i>Geoffroyus geoffroyi rhodops</i> (Schlegel, 1864) |
| [1a]. | [<i>Geoffroyus personatus</i> .] <i>female</i> | 6s. | Red-cheeked Parrot <i>Geoffroyus geoffroyi rhodops</i> (Schlegel, 1864) |
| 2. | <i>Tanygnathus affinis</i> . Wall. | 20s. | Great-billed Parrot <i>Tanygnathus megalorhynchos affinis</i> Wallace, 1863 |
| 3. | <i>Trichoglossus cyanogrammus</i> Wagl. | 5s. | Coconut Lorikeet <i>Trichoglossus haematodus</i> (Linnaeus, 1771) |
| 4. | <i>Eos rubra</i> . Gm. | 5s. | Red Lory <i>Eos bornea cyanonotha</i> (Vieillot, 1818) |
| 5. | <i>Dendrochelidon mystaceus</i> . Less. | 15s. | Moustached Treeswift <i>Hemiprocne mystacea</i> (Lesson & Garnot, 1827) |
| 6. | <i>Eudynamis ransomi</i> . Bp. | 10s. | Pacific Koel <i>Eudynamis orientalis</i> (Linnaeus, 1766) |
| 7. | <i>Alcedo moluccensis</i> . Blyth. | 7s. | Blue-eared Kingfisher <i>Alcedo meninting</i> Horsfield 1821 |
| 8. | <i>Ceyx cajeli</i> . Wall. | 15s. | Buru Dwarf-kingfisher <i>Ceyx cajeli</i> Wallace, 1863 |
| 9. | <i>Calornis obscura</i> . Forst. | 3s. | Moluccan Starling <i>Aplonis mysolensis</i> (G. R. Gray, 1862) |
| 10. | <i>Criniger mysticalis</i> . Wall. | 10s. | Buru Golden Bulbul <i>Thapsinillas mysticalis</i> Wallace, 1863 |
| 11. | <i>Monarcha loricata</i> . Wall. | 10s. | Black-tipped Monarch <i>Symposiachrus loricatus</i> Wallace, 1863 |
| 12. | <i>Rhipidura bouruensis</i> . Wall. | 10s. | Buru Fantail <i>Rhipidura bouruensis</i> Wallace, 1863 |
| 13. | <i>Pachycephala clio</i> . Wall. | 10s. | Golden Whistler <i>Pachycephala pectoralis buruensis</i> E. J. O. Hartert, 1899 |
| 14. | <i>Dicrourus amboinensis</i> . G. R. G. | 10s. | Spangled Drongo <i>Dicrurus bracteatus buruensis</i> E. J. O. Hartert, 1919 |
| 15. | <i>Mimeta bouruensis</i> . Q. & G. | 10s. | Buru Oriole <i>Oriolus bouroensis</i> (Quoy & Gaimard, 1830) |
| 16. | <i>Campephaga marginata</i> . Wall. | 10s. | Buru Cuckooshrike <i>Coracina fortis</i> (Salvadori, 1878) |
| 17. | <i>Nectarinea proserpina</i> . Wall. | 8s. | Black Sunbird <i>Leptocoma aspasia proserpina</i> (Wallace, 1863) |
| 18. | <i>Nectarinea zenobia</i> . Less. | 5s. | Olive-backed Sunbird <i>Cinnyris jugularis buruensis</i> E. J. O. Hartert, 1910 |
| 19. | <i>Treron aromatica</i> (Gm.) (" <i>Colomba viridis amboinensis</i> ." Briss.) | 30s. | Buru Green-pigeon <i>Treron aromaticus</i> (J. F. Gmelin, 1789) |
| 20. | <i>Ptilonopus viridis</i> . L. | 15s. | Claret-breasted Fruit-dove <i>Ptilinopus viridis</i> (Linnaeus, 1766) |
| 21. | <i>Carpophaga melanura</i> . G.R. G. | 15s. | Pied Imperial-pigeon <i>Ducula bicolor</i> (Scopoli, 1786) |
| 22. | <i>Carpophaga perspicillata</i> . Temm. | 15s. | Spectacled Imperial-pigeon <i>Ducula perspicillata</i> (Temminck, 1824) |
| 23. | <i>Macropygia amboinensis</i> . L. | 10s. | Slender-billed Cuckoo-dove <i>Macropygia amboinensis</i> (Linnaeus, 1766) |
| 24. | <i>Megapodius forsteni</i> . G.R. Gray | 20s. | Forsten's Scrubfowl <i>Megapodius freycinet buruensis</i> Stresemann, 1914 |
| 25. | <i>Podiceps tricolor</i> . G.R. Gray | 10s. | Tricolored Grebe <i>Tachybaptus ruficollis tricolor</i> (G. R. Gray, 1861) |
| CERAM. | | | |
| 1. | <i>Aprosmictus amboinensis</i> . L. | 20s. | Moluccan King-parrot <i>Alisterus amboinensis</i> (Linnaeus, 1766) |
| 2. | <i>Lorius domicella</i> . L. | 10s. | Purple-naped Lory <i>Lorius domicella</i> (Linnaeus, 1758) |
| 3. | <i>Ecluctus puniceus</i> . Gm. | 10s. | Ecluctus Parrot <i>Ecluctus rotatus</i> (Stadius Müller, 1776) |
| 4. | <i>Cacatua moluccensis</i> . Gm. (fine) | 15s. | Salmon-crested Cockatoo <i>Cacatua moluccensis</i> (J. F. Gmelin, 1788) |
| 5. | <i>Halcyon lazuli</i> . Temm. | 10s. | Lazuli Kingfisher <i>Todiramphus lazuli</i> (Temminck, 1830) |
| 6. | <i>Tanyiptera nais</i> . G. R. Gray | 20s. | Common Paradise-kingfisher <i>Tanyiptera galatea nais</i> G. R. Gray, 1861 |
| 7. | <i>Buceros ruficollis</i> . Viell. | 20s. | Papuan Hornbill <i>Rhyticeros plicatus</i> J. R. Forster, 1781 |
| [7a]. | [<i>Buceros ruficollis</i> . Viell.] <i>head</i> | 7s. | Papuan Hornbill <i>Rhyticeros plicatus</i> J. R. Forster, 1781 |
| 8. | <i>Criniger flavicaudus</i> . Bp. | 10s. | Seram Golden Bulbul <i>Thapsinillas affinis</i> (Hombron & Jacquinot, 1841) |

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| 9. | <i>Pachycephala macrorhyncha</i> . Strick. | 8s. | Moluccan Whistler <i>Pachycephala macrorhyncha</i> Strickland, 1849 |
| 10. | <i>Corvus violaceus</i> . Temm. | 12s. | Violet Crow <i>Corvus violaceus</i> Bonaparte, 1850 |
| 11. | <i>Tropidorhynchus subcornutus</i> . Temm. | 15s. | Seram Friarbird <i>Philemon subcorniculatus</i> (Hombron & Jacquinot, 1841) |
| 12. | <i>Calorins [sic] amboinensis</i> . G.R. G. | 3s. | Moluccan Starling <i>Aplonis mysolensis</i> (G. R. Gray, 1862) |
| 13. | <i>Ptilonopus superbus</i> . Temm. | 7s. | Eastern Superb Fruit-dove <i>Ptilinopus superbus</i> (Temminck, 1810) |
| 14. | <i>Ardetta flavicollis</i> . Lath. | 7s. | Black Bittern <i>Ixobrychus flavicollis australis</i> (Lesson, 1831) |
| 15. | <i>Numenius minor</i> . Mull. | 3s. | Little Curlew <i>Numenius minutus</i> Gould, 1841 |

GILOLO, BATCHIAN, & MORTY Is.

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|-----|--|------|--|
| 1. | <i>Tanygnathus macrorhynchus</i> . Gm. | 15s. | Great-billed Parrot <i>Tanygnathus megalorhynchos</i> (Boddaert, 1783) |
| 2. | <i>Geoffroyus cyanicollis</i> . Bp. | 12s. | Red-cheeked Parrot <i>Geoffroyus geoffroyi cyanicollis</i> (S. Müller, 1841) |
| 3. | <i>Eclactus polychlorus</i> . Scop. | 15s. | Eclactus Parrot <i>Eclactus roratus</i> (Statius Müller, 1776) |
| 4. | <i>Lorius garrulus</i> . L. | 12s. | Chattering Lory <i>Lorius garrulus</i> (Linnaeus, 1758) |
| 5. | <i>Eos riciniata</i> . Bechst. | 7s. | Violet-necked Lory <i>Eos squamata riciniata</i> (Bechstein, 1811) |
| 6. | <i>Trichoglossus placentis</i> . Temm. | 7s. | Red-flanked Lorikeet <i>Charmosyna placentis</i> (Temminck, 1835) |
| 7. | <i>Haliastur leucosternus</i> . Gould | 7s. | Brahminy Kite <i>Haliastur indus</i> (Boddaert 1783) |
| 8. | <i>Tinnunculus moluccensis</i> . Temm. | 8s. | Spotted Kestrel <i>Falco moluccensis</i> (Bonaparte, 1850) |
| 9. | <i>Scops leucospilus</i> . G.R. Gray | 15s. | Moluccan Scops-owl <i>Otus magicus leucospilus</i> (G. R. Gray, 1861) |
| 10. | <i>Halcyon diops</i> . Temm. | 6s. | Blue-and-white Kingfisher <i>Todiramphus diops</i> (Temminck, 1824) |
| 11. | <i>Alcyon affinis</i> . G. R. Gray. | 12s. | Azure Kingfisher <i>Ceyx azureus affinis</i> (G. R. Gray, 1861) |
| 12. | <i>Ceyx lepida</i> . Temm. | 10s. | Moluccan Dwarf-kingfisher <i>Ceyx lepidus uropygialis</i> G. R. Gray, 1861 |
| 13. | <i>Tanyiptera isis</i> . G. R. G. | 20s. | Common Paradise-kingfisher <i>Tanyiptera galatea</i> G. R. Gray, 1859 |
| 14. | <i>Tanyiptera doris</i> . Wallace | 20s. | Common Paradise-kingfisher <i>Tanyiptera galatea doris</i> Wallace, 1862 |
| 15. | <i>Centropus goliath</i> . Forst. | 20s. | Goliath Coucal <i>Centropus goliath</i> Bonaparte, 1850 |
| 16. | <i>Acrocephalus fasciolatus</i> . G. R. G. | 5s. | Gray's Grasshopper-warbler <i>Locustella fasciolata</i> (G. R. Gray, 1861) |
| 17. | <i>Pitta maxima</i> . Forst. | 40s. | Ivory-breasted Pitta <i>Pitta maxima</i> S. Müller & Schlegel, 1845 |
| 18. | <i>Sylvia flavescens</i> . G. R. Gray | 3s. | Arctic Warbler <i>Phylloscopus borealis</i> (J. H. Blasius, 1858) |
| 19. | <i>Criniger simplex</i> . Wall. | 7s. | Halmahera Golden Bulbul <i>Thapsinillas chloris</i> Finsch, 1867 |
| 20. | <i>Mimeta phaeochromus</i> . G.R. Gray | 15s. | Halmahera Oriole <i>Oriolus phaeochromus</i> G. R. Gray, 1861 |
| 21. | <i>Butalis hypogrammica</i> . Wall. | 6s. | Grey-streaked Flycatcher <i>Muscicapa griseisticta</i> Swinhoe, 1861 |
| 22. | <i>Myiagra nitens</i> . G. R. G. | 5s. | Shining Flycatcher <i>Myiagra alecto</i> (Temminck, 1827) |
| 23. | <i>Myiagra galeata</i> . G. R. Gray | 5s. | Moluccan Flycatcher <i>Myiagra galeata</i> G. R. Gray, 1861 |
| 24. | <i>Monarcha bimaculata</i> . G. R. G. | 6s. | Spectacled Monarch <i>Symposiachrus trivirgatus bimaculatus</i> G. R. Gray, 1861 |
| 25. | <i>Pachycephala mentalis</i> . Wall. | 10s. | Black-chinned Whistler <i>Pachycephala mentalis</i> Wallace, 1863 |
| 26. | <i>Graucalus melanolora</i> . G.R.G. | 10s. | White-bellied Cuckooshrike <i>Coracina papuensis</i> J. F. Gmelin, 1788 |
| 27. | <i>Lalage aurea</i> . Temm. | 5s. | Rufous-bellied Triller <i>Lalage aurea</i> (Temminck, 1825) |
| 28. | <i>Dicaeum schistaceiceps</i> . G.R.G. | 5s. | Halmahera Flowerpecker <i>Dicaeum schistaceiceps</i> G. R. Gray, 1861 |
| 29. | <i>Nectarinea auriceps</i> . G.R.G. | 5s. | Black Sunbird <i>Leptocoma aspasia auriceps</i> (G. R. Gray, 1861) |

[p.3] GILOLO, BATCHIAN, & MORTY Is. – Continued.

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| 30. | <i>Tropidorhynchus fuscicapillus</i> . Wall. | 12s. | Dusky Friarbird <i>Philemon fuscicapillus</i> (Wallace, 1862) |
| 31. | <i>Anthochoera senex</i> G.R. Gray | 10s. | White-streaked Friarbird <i>Melitograis gilolensis</i> (Bonaparte, 1850) |
| 32. | <i>Corvus validissimus</i> . Schleg. | 20s. | Long-billed Crow <i>Corvus validus</i> Bonaparte, 1850 |
| 33. | <i>Lycorax morotensis</i> . Schleg. | 20s. | Halmahera Paradise-crow <i>Lycorax pyrrhopterus</i> (Bonaparte, 1850) |
| 34. | <i>Semioptera Wallacei</i> . G.R. Gray (pair) | 200s. | Standardwing Bird-of-paradise <i>Semioptera wallacii</i> G. R. Gray, 1859 |
| 34a. | [<i>Semioptera Wallacei</i>], female or Juv. | 20s. | Standardwing Bird-of-paradise <i>Semioptera wallacii</i> G. R. Gray, 1859 |

| No. | Transcription of species as listed | Price | Current identification |
|---|--|-------|--|
| 35. | <i>Calornis obscura</i> . Forst. | 3s. | Moluccan Starling <i>Aplonis mysolensis</i> (G. R. Gray, 1862) |
| 36. | <i>Erythrura modesta</i> . Wall. | 10s. | Blue-faced Parrotfinch <i>Erythrura trichroa modesta</i> Wallace, 1862 |
| 37. | <i>Ptilonopus iogaster</i> . Wagl. | 10s. | Grey-headed Fruit-dove <i>Ptilinopus hyogastrus</i> (Temminck, 1824) |
| 38. | <i>Ptilonopus monachus</i> . Temm. | 8s. | Blue-capped Fruit-dove <i>Ptilinopus monacha</i> (Temminck, 1824) |
| 39. | <i>Nycticorax caledonicus</i> . Gm. | 10s. | Rufous Night-heron <i>Nycticorax caledonicus australasiae</i> (Vieillot, 1823) |
| 40. | <i>Tadorna radjah</i> . Less. | 5s. | Radjah Shelduck <i>Radjah radjah</i> (Lesson, 1828) |
| NEW GUINEA, and the ISLANDS of WAIGIOU, MYSOL, and SALWATTY. | | | |
| 1. | <i>Aprosmictus dorsalis</i> . Q. & G. | 15s. | Moluccan King-parrot <i>Alisterus amboinensis dorsalis</i> (Quoy & Gaimard, 1830) |
| 2. | <i>Eclectus linnaei</i> . Wagl. | 12s. | Eclectus Parrot <i>Eclectus roratus</i> (Stadius Müller, 1776) |
| 3. | <i>Geoffroyus pucherani</i> . Bp. | 8s. | Red-cheeked Parrot <i>Geoffroyus geoffroyi pucherani</i> Souancé, 1856 |
| 4. | <i>Cyclopsitta desmaresti</i> . Garn. | 15s. | Large Fig-parrot <i>Psittaculirostris desmarestii</i> (Desmarest, 1826) |
| 5. | <i>Cyclopsitta diopthalma</i> . H. and J. | 12s. | Double-eyed Fig-parrot <i>Cyclopsitta diopthalma</i> (Hombron & Jacquinet, 1841) |
| 6. | <i>Lorius tricolor</i> . Steph. | 10s. | Black-capped Lory <i>Lorius lory</i> (Linnaeus, 1758) |
| 7. | <i>Chalcopsitta atra</i> (Scop.) | 25s. | Black Lory <i>Chalcopsitta atra</i> (Scopoli, 1786) |
| 8. | <i>Trichoglossus nigrogularis</i> . G.R. G. | 5s. | Coconut Lorikeet <i>Trichoglossus haematodus nigrogularis</i> G. R. Gray, 1858 |
| 9. | <i>Cacatua equatorialis</i> . Temm. | 10s. | Yellow-crested Cockatoo <i>Cacatua sulphurea</i> (J. F. Gmelin, 1788) |
| 10. | <i>Micronis soloensis</i> . Horsf. | 10s. | Chinese Sparrowhawk <i>Accipiter soloensis</i> (Horsfield, 1821) |
| 11. | <i>Dacelo gaudechaudi</i> . Q. & G. | 10s. | Rufous-bellied Kookaburra <i>Dacelo gaudichaud</i> Quoy & Gaimard, 1824 |
| 12. | <i>Halcyon albicilla</i> . Less. | 15s. | Collared Kingfisher <i>Todiramphus chloris</i> (Boddaert, 1783) |
| 13. | <i>Halcyon sancta</i> . Vig. & H. | 4s. | Sacred Kingfisher <i>Todiramphus sanctus</i> (Vigors & Horsfield, 1827) |
| 14. | <i>Syma torotoro</i> . Less. | 20s. | Yellow-billed Kingfisher <i>Syma torotoro</i> Lesson, 1827 |
| 15. | <i>Petroica hypoleuca</i> . G.R. G. | 7s. | Black-sided Robin <i>Poecilodryas hypoleuca</i> (G. R. Gray, 1859) |
| 16. | <i>Alcippe murina</i> . Mull. | 5s. | Rusty Mouse-warbler <i>Crateroscelis murina</i> (P. L. Sclater, 1858) |
| 17. | <i>Pitta mackloti</i> . Temm. | 15s. | Papuan Pitta <i>Erythropitta macklotii</i> (Temminck, 1834) |
| 18. | <i>Pitta novae-guineae</i> . Mull. | 20s. | Eastern Hooded Pitta <i>Pitta novae-guineae</i> S. Müller & Schlegel, 1845 |
| 19. | <i>Mimeta striata</i> . Q. & G. | 7s. | ? Green Oriole <i>Oriolus flavocinctus muelleri</i> (Bonaparte, 1850) |
| 20. | <i>Pomatorhinus isidori</i> . Less. | 10s. | Papuan Babbler <i>Garritornis isidorei</i> (Lesson, 1827) |
| 21. | <i>Todopsis cyanocephala</i> . Q. & G. | 15s. | Emperor Fairy-wren <i>Malurus cyanocephalus</i> (Quoy & Gaimard, 1830) |
| 22. | <i>Rhipidura gularis</i> . Mull. | 5s. | Northern Fantail <i>Rhipidura isura gularis</i> S. Müller, 1843 |
| 23. | <i>Rhipidura assimilis</i> . G.R. Gray | 5s. | Kai Fantail <i>Rhipidura assimilis</i> G. R. Gray, 1858 |
| 24. | <i>Rhipidura tricolor</i> . Viell. | 3s. | Willie Wagtail <i>Rhipidura leucophrys</i> (Latham, 1801) |
| 25. | <i>Monarcha chrysomela</i> . Garn. | 15s. | Golden Monarch <i>Carterornis chrysomela</i> (Lesson & Garnot, 1827) |
| 26. | <i>Monarcha telescopthalma</i> . Garn. | 6s. | Frilled Monarch <i>Arses telescopthalmus</i> (Lesson & Garnot, 1827) |
| 27. | <i>Monarcha dichroa</i> . G.R. Gray | 7s. | Hooded Monarch <i>Symposiachrus manadensis</i> (Quoy & Gaimard, 1830) |
| 28. | <i>Pachycephala griseiceps</i> . G. R. Gray. | 5s. | Brown Whistler <i>Pachycephala griseiceps</i> G. R. Gray, 1858 |
| 29. | <i>Graucalus hypoleucus</i> . Gould | 5s. | White-bellied Cuckooshrike <i>Coracina papuensis hypoleuca</i> (Gould, 1848) |
| 30. | <i>Campephaga melas</i> . Mull. | 10s. | Black Cicadabird <i>Edolisoma melas</i> (Lesson, 1828) |
| 31. | <i>Campephaga plumbea</i> . Mull. | 6s. | Slender-billed Cicadabird <i>Edolisoma tenuirostre muellerii</i> (Salvadori, 1876) |
| 32. | <i>Campephaga melanolora</i> . G.R. G. | 6s. | White-bellied Cuckooshrike <i>Coracina papuensis melanolora</i> (G. R. Gray, 1860) |
| 33. | <i>Lalage atrovirens</i> . G.R. G. | 5s. | Black-browed Triller <i>Lalage atrovirens</i> (G. R. Gray, 1862) |
| 34. | <i>Artamus papuensis</i> . Bp. | 4s. | White-breasted Woodswallow <i>Artamus leucorhynchus leucopygialis</i> Gould, 1842 |
| 35. | <i>Dicrurus carbonarius</i> . Mull. | 4s. | Papuan Drongo <i>Dicrurus bracteatus carbonarius</i> Bonaparte, 1850 |

| No. | Transcription of species as listed | Price | Current identification |
|---------------|---|-------|---|
| 36. | <i>Rectes strepitans</i> . Jacq. and Puch. | 6s. | Rusty Pitohui <i>Pseudorectes ferrugineus</i> (Bonaparte, 1850) |
| 37. | <i>Rectes leucorhynchus</i> . G.R.G. | 15s. | Waigeo Pitohui <i>Pseudorectes ferrugineus leucorhynchus</i> (G. R. Gray, 1862) |
| 38. | <i>Rectes uropygialis</i> . G.R. G. | 12s. | Southern Variable Pitohui <i>Pitohui uropygialis</i> (G. R. Gray, 1862) |
| 39. | <i>Rectes cervineiventris</i> [sic]. G.R.G. | 10s. | Waigeo Pitohui <i>Pitohui cervineiventris</i> (G. R. Gray, 1862) |
| 40. | <i>Myiolestes megarhynchus</i> . Q. and G. | 5s. | Rufous Shrike-thrush <i>Colluricincla megarhyncha</i> (Quoy & Gaimard, 1830) |
| 41. | <i>Myiolestes affinis</i> . G.R. G. | 6s. | Waigeo Shrike-thrush <i>Colluricincla megarhyncha affinis</i> (G. R. Gray, 1862) |
| 42. | <i>Myiolestes aruensis</i> . G.R. G. | 7s. | Rufous Shrike-thrush <i>Colluricincla megarhyncha aruensis</i> (G. R. Gray, 1858) |
| 43. | <i>Seleucidis alba</i> . Blum. (<i>fine</i>) | 240s. | Twelve-wired Bird-of-paradise <i>Seleucidis melanoleucus</i> (Daudin, 1800) |
| 44. | <i>Nectarinea aspasia</i> . Less. | 4s. | Black Sunbird <i>Leptocoma aspasia</i> (Lesson & Garnot, 1828) |
| 45. | <i>Nectarinea zenobia</i> . Less. | 4s. | Sahul Sunbird <i>Cinnyris jugularis frenatus</i> (S. Müller, 1843) |
| 46. | <i>Nectarinea eques</i> . Less. | 6s. | Ruby-throated Myzomela <i>Myzomela eques</i> (Lesson & Garnot, 1827) |
| 47. | <i>Arachnothera novoeguinae</i> . Less. | 4s. | Yellow-bellied Longbill <i>Toxorhamphus novaeguinae</i> (Lesson, 1827) |
| 48. | <i>Prionochilus niger</i> . Less. | 4s. | Black Berrypecker <i>Melanocharis nigra</i> (Lesson, 1830) |
| 49. | <i>Ptilotis similis</i> . Homb. & Jacq. | 4s. | Mimic Honeyeater <i>Microptilotis analogus</i> (Reichenbach, 1852) |
| 50. | <i>Ptilotis flaviventer</i> . Less. | 7s. | Tawny-breasted Honeyeater <i>Xanthotis flaviventer</i> (Lesson, 1828) |
| 51. | <i>Ptilotis polygramma</i> . G.R. G. | 7s. | Spotted Honeyeater <i>Xanthotis polygrammus</i> (G. R. Gray, 1861) |
| 52. | <i>Ptilotis megarhynchus</i> . G.R. G. | 6s. | Long-billed Honeyeater <i>Melilestes megarhynchus</i> (G. R. Gray, 1858) |
| 53. | <i>Tropidorhynchus marginatus</i> . G.R. G. | 6s. | New Guinea Friarbird <i>Philemon buceroides novaeguinae</i> (S. Müller, 1843) |
| 54. | <i>Cracticus personatus</i> . Temm. | 5s. | Hooded Butcherbird <i>Cracticus cassicus</i> (Boddaert, 1783) |
| 55. | <i>Manucodia atra</i> . Less. | 7s. | Glossy-mantled Manucode <i>Manucodia ater</i> (Lesson, 1830) |
| 56. | <i>Manucodia keraudreni</i> . Less. <i>not fine</i> | 20s. | Trumpet Manucode <i>Phonygamus keraudrenii</i> (Lesson & Garnot, 1826) |
| 57. | <i>Calorinis</i> [sic] <i>mysolensis</i> . G.R. G. | 6s. | Moluccan Starling <i>Aplonis mysolensis</i> (G. R. Gray, 1862) |
| 58. | <i>Calorinis cantoroides</i> . G.R. G. | 6s. | Moluccan Starling <i>Aplonis mysolensis</i> (G. R. Gray, 1862) |
| 59. | <i>Gracula dumonti</i> . Less. | 15s. | Yellow-faced Myna <i>Mino dumontii</i> Lesson, 1827 |
| 60. | <i>Gracula pectoralis</i> . Wall. | 40s. | Golden Myna <i>Mino anais</i> (Lesson, 1839) |
| 61. | <i>Centropus</i> [sic] <i>menebiki</i> . Garn. | 12s. | Ivory-billed Coucal <i>Centropus menbeki</i> Lesson & Garnot, 1828 |
| 62. | <i>Ptilonopus pulchellus</i> . Temm. | 7s. | Beautiful Fruit-dove <i>Ptilinopus pulchellus</i> (Temminck, 1835) |
| 63. | <i>Carpophaga sundevalii</i> . Bp. | 10s. | Spice Imperial-pigeon <i>Ducula myristicivora</i> (Scopoli, 1786) |
| 64. | <i>Carpophaga pinon</i> . Q. & G. | 7s. | Pinon Imperial-pigeon <i>Ducula pinon</i> (Quoy & Gaimard 1824) |
| 65. | <i>Carpophaga zoeae</i> . Less. | 15s. | Zoe's Imperial-pigeon <i>Ducula zoeae</i> (Desmarest, 1826) |
| 66. | <i>Carpophaga rufigastra</i> . Q. & G. | 7s. | Purple-tailed Imperial-pigeon <i>Ducula rufigaster</i> (Quoy & Gaimard 1830) |
| 67. | <i>Carpophaga puella</i> . Less. | 10s. | Wompoo Fruit-dove <i>Megaloprepia magnifica puella</i> (Lesson, 1827) |
| 68. | <i>Macropygia Reinwardti</i> . Bp. | 20s. | Great Cuckoo-dove <i>Reinwardtoena reinwardti</i> (Temminck, 1824) |
| 69. | <i>Chalcophaps stephani</i> . H. & J. | 7s. | Stephan's Dove <i>Chalcophaps stephani</i> Pucheran, 1853 |
| 70. | <i>Henicophaps albifrons</i> . G.R. Gray | 40s. | New Guinea Bronzewing <i>Henicophaps albifrons</i> G. R. Gray, 1862 |
| 71. | <i>Megapodius reinwardti</i> . Wagl. | 15s. | Orange-footed Scrubfowl <i>Megapodius reinwardt</i> Dumont, 1823 |
| 72. | <i>Totanus empusa</i> . Gould. | 3s. | Common Sandpiper <i>Actitis hypoleucos</i> (Linnaeus, 1758) |
| 73. | <i>Botaurus heliostylus</i> . Less. | 20s. | Forest Bittern <i>Zonodius heliostylus</i> (Lesson & Garnot, 1828) |
| TIMOR. | | | |
| 1. | <i>Aprosmictus vulneratus</i> . Temm. | 12s. | Olive-shouldered Parrot <i>Aprosmictus jonquillaceus</i> (Vieillot, 1818) |
| 2. | <i>Geoffroyus jukesii</i> . G.R. Gray. | 10s. | Red-cheeked Parrot <i>Geoffroyus geoffroyi</i> (Bechstein, 1811) |
| 3. | <i>Trichoglossus euteles</i> . Temm. | 8s. | Olive-headed Lorikeet <i>Trichoglossus euteles</i> (Temminck, 1835) |
| 4. | <i>Trichoglossus iris</i> . Temm. | 15s. | Iris Lorikeet <i>Psitteuteles iris</i> (Temminck, 1835) |

| No. | Transcription of species as listed | Price | Current identification |
|----------------------------------|--|-------|--|
| 5. | <i>Cacatua sulphurea</i> . Gm. | 6s. | Yellow-crested Cockatoo <i>Cacatua sulphurea parvula</i> (Bonaparte, 1850) |
| 6. | <i>Accipiter cruentus</i> . Gould. | 6s | Brown Goshawk <i>Accipiter fasciatus hellmayri</i> Stresemann, 1922 |
| 7. | <i>Merops javanicus</i> . Horsf. | 3s. | Blue-tailed Bee-eater <i>Merops philippinus javanicus</i> Horsfield, 1821 |
| [p.4] TIMOR. – Continued. | | | |
| 8. | <i>Cuculus canoroides</i> . Mull. | 4s. | Oriental Cuckoo <i>Cuculus saturatus optatus</i> Gould, 1845 |
| 9. | <i>Centropus medius</i> . Mull. | 3s. | Lesser Coucal <i>Centropus bengalensis medius</i> Bonaparte, 1850 |
| 10. | <i>Motacilla flavescens</i> . Shaw | 3s. | Grey Wagtail <i>Motacilla cinerea</i> Tunstall, 1771 |
| 11. | <i>Saxicola luctuosa</i> . Mull. | 4s. | White-bellied Bushchat <i>Saxicola gutturalis</i> (Vieillot, 1818) |
| 12. | <i>Pratincola caprata</i> . L. | 3s. | Pied Bushchat <i>Saxicola caprata pyrrhonotus</i> (Vieillot, 1818) |
| 13. | <i>Artamus perspicillatus</i> . Temm. | 5s. | Black-faced Woodswallow <i>Artamus cinereus perspicillatus</i> Bonaparte, 1850 |
| 14. | <i>Hirundo nigricans</i> . Viell. | 3s. | Tree Martin <i>Petrochelidon nigricans</i> (Vieillot, 1817) |
| 15. | <i>Monarcha trivirgata</i> . Temm. | 4s. | Spectacled Monarch <i>Symposiachrus trivirgatus</i> (Temminck, 1826) |
| 16. | <i>Rhipidura ochrogastra</i> . Mull. | 5s. | Northern Fantail <i>Rhipidura rufiventris</i> (Vieillot, 1818) |
| 17. | <i>Rhipidura semicollaris</i> . Mull. | 4s. | Arafura Fantail <i>Rhipidura dryas</i> Gould, 1843 |
| 18. | <i>Cyornis hyacinthina</i> . Temm. | 5s. | Timor Blue-flycatcher <i>Cyornis hyacinthinus</i> (Temminck, 1820) |
| 19. | <i>Pachycephala calliope</i> . Mull. | 7s. | Timor Whistler <i>Pachycephala macrorhyncha calliope</i> Bonaparte, 1850 |
| 20. | <i>Pachycephala orpheus</i> . Jard. | 5s. | Fawn-breasted Whistler <i>Pachycephala orpheus</i> Jardine, 1849 |
| 21. | <i>Sphecothera viridis</i> . Q. & G. | 7s. | Timor Figbird <i>Sphecotheres viridis</i> (Vieillot, 1816) |
| 22. | <i>Dicrurus densus</i> . Temm. | 4s. | Timor Drongo <i>Dicrurus densus</i> Bonaparte, 1850 |
| 23. | <i>Graucalus personatus</i> . Mull. | 7s. | Wallacean Cuckooshrike <i>Coracina personata</i> (S. Müller, 1843) |
| 24. | <i>Campephaga plumbea</i> . Mull. | 5s. | Slender-billed Cicadabird <i>Edolisoma tenuirostre timoriense</i> (Sharpe, 1878) |
| 25. | <i>Lalage timoriensis</i> . Mull. | 3s. | Slender-billed Cicadabird <i>Edolisoma tenuirostre timoriense</i> (Sharpe, 1878) |
| 26. | <i>Lanius schah</i> . L. | 3s. | Sunda Long-tailed Shrike <i>Lanius schach bentet</i> Horsfield, 1821 |
| 27. | <i>Tropidorhynchus cineraceus</i> . Mull. | 5s. | Timor Friarbird <i>Philemon inornatus</i> (G. R. Gray, 1846) |
| 28. | <i>Ptilotis reticulata</i> . Mull. | 4s. | Streak-breasted Honeyeater <i>Microptilotis reticulata</i> (Temminck, 1820) |
| 29. | <i>Ptilotis maculata</i> . Mull. (<i>poor</i>) | 3s. | Streaky-breasted Honeyeater <i>Microptilotis reticulata</i> (Temminck, 1820) |
| 30. | <i>Deceum</i> [<i>sic</i>] <i>maklotii</i> . Mull. | 4s. | Red-chested Flowerpecker <i>Dicaeum maugei</i> Lesson, 1830 |
| 31. | <i>Nectarinea solaris</i> . Temm. | 5s. | Flame-breasted Sunbird <i>Cinnyris solaris</i> Temminck, 1825 |
| 32. | <i>Calornis minor</i> . Temm. | 5s. | Short-tailed Starling <i>Aplonis minor</i> (Bonaparte, 1851) |
| 33. | <i>Estrela punicea</i> . Horsf. (<i>var.</i>) | 4s. | Yellow-bellied Avadavat <i>Amandava amandava flaviventris</i> Wallace, 1864 |
| 34. | <i>Amadina insularis</i> . Wall. | 5s. | Timor Zebra Finch <i>Taeniopygia guttata</i> (Vieillot, 1817) |
| 35. | <i>Carpophaga rosacea</i> . Temm. | 12s. | Pink-headed Imperial-pigeon <i>Ducula rosacea</i> (Temminck, 1836) |
| 36. | <i>Turacoena modesta</i> . Temm. | 15s. | Black Cuckoo-dove <i>Turacoena modesta</i> (Temminck, 1835) |
| 37. | <i>Turtur tigrina</i> . Temm. | 4s. | Eastern Spotted Dove <i>Streptopelia chinensis tigrina</i> (Temminck, 1810) |
| 38. | <i>Geopelia maugei</i> . Temm. | 5s. | Barred Dove <i>Geopelia maugeus</i> (Temminck, 1809) |
| 39. | <i>Chalcophaps timoriensis</i> . Bp. | 10s. | Brown-capped Emerald-dove <i>Chalcophaps longirostris timorensis</i> Bonaparte, 1856 |
| 40. | <i>Charadrius longipes</i> . Temm. | 3s. | Pacific Golden-plover <i>Pluvialis fulva</i> (J. F. Gmelin, 1789) |
| 41. | <i>Scolopax horsfieldi</i> . G.R. Gray. | 7s. | Pintail Snipe <i>Gallinago stenura</i> (Bonaparte, 1831) |
| 42. | <i>Himantopus leucocephalus</i> . Gould. | 5s. | Black-winged Stilt <i>Himantopus himantopus leucocephalus</i> Gould, 1837 |
| 43. | <i>Dendrocygna vagans</i> . Eyton. | 5s. | Wandering Whistling-duck <i>Dendrocygna arcuata</i> (Horsfield, 1824) |
| 44. | <i>Querquedula gibbifrons</i> . Mull. | 5s. | Sunda Teal <i>Anas gibberifrons</i> S. Müller, 1842 |
| TIMOR LAUT. | | | |
| 1. | <i>Eos cyanostriata</i> . Bp. (<i>poor skin</i>) | 10s. | Blue-streaked Lory <i>Eos reticulata</i> S. Müller, 1841 |

TABLE 2
Total number of species in each section of the 'List of birds from the eastern islands'.

| Locality as provided [modern spelling] | Number of specimens | Remarks |
|--|---------------------|--|
| Celebes [Sulawesi] | 21 | nos. 1–21 |
| Sula Is. | 23 | nos. 1–23 |
| Bouru [Buru] | 26 | nos. 1–25, with 1a added |
| Ceram [Seram] | 16 | nos. 1–15 with 7a added |
| Gilolo, Batchian, & Morty Is. [Halmahera, Bacan, Morotai] | 42 | nos. 1–40 with 34a added; 34 is a pair |
| New Guinea, and the Islands of Waigiou, Mysol, and Salwatty [Waigeo, Misool, Salawati] | 73 | nos. 1–73 |
| Timor | 44 | nos. 1–44 |
| Timor Laut [Tanimbar] | 1 | no. 1 |
| TOTAL | 246 | |

TABLE 3
Prices as listed for Wallace's bird specimens. The total amount would be the income if all were sold, without discount.

| Price in shillings | Number of specimens listed per price | Total amount in shillings | Total amount in pounds + shillings |
|--------------------|--------------------------------------|---------------------------|------------------------------------|
| 3s. | 21 specimens | 63 | £ 3 + 3s. |
| 4s. | 24 specimens | 96 | £ 4 + 16s. |
| 5s. | 38 specimens | 190 | £ 9 + 10s. |
| 6s. | 18 specimens | 108 | £ 5 + 8s. |
| 7s. | 27 specimens | 189 | £ 9 + 9s. |
| 8s. | 10 specimens | 80 | £ 4 + 0s. |
| 10s. | 39 specimens | 390 | £ 19 + 10s. |
| 12s. | 11 specimens | 132 | £ 6 + 12s. |
| 15s. | 28 specimens | 420 | £ 21 + 0s. |
| 20s. | 20 specimens | 400 | £ 20 + 0s. |
| 25s. | 1 specimen | 25 | £ 1 + 5s. |
| 30s. | 2 specimens | 60 | £ 3 + 0s. |
| 40s. | 4 specimens | 160 | £ 8 + 0s. |
| 200s. | 1 (pair) | 200 | £ 10 + 0s. |
| 240s. | 1 specimens | 240 | £ 12 + 0s. |
| Total | | | £ 137 + 13s. |

1877: 160). If all stock had been sold at the undiscounted price, the revenue would have been £137 and 13 shillings.

This list with prices for individual species is remarkable, as so few other examples are known. Wallace (1905: 360) was happy with the proceeds of the journey, which amounted to £300 for each of the eight years of travel. However, for another specimen of *Semioptera wallacei*, Stevens asked £20 in 1859 (Baker 2001: 257).

It is probable that this list contained all birds remaining in stock from Wallace's collecting expedition. It provides a welcome glimpse into the sale of natural history specimens in the 1860s.

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The generic taxonomy of the Australian Magpie and Australo-Papuan butcherbirds is not all black-and-white

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SUMMARY.—Recent phylogenetic analyses showing that Australian Magpie and Black Butcherbird are sister taxa and together comprise the sister group of other Australo-Papuan butcherbirds have justified an expanded *Cracticus*. This treatment reflects earlier arguments that Australian Magpie's distinctive traits are simply adaptations to terrestriality and not a sound basis for recognition of a monotypic *Gymnorhina*. Acknowledging the expediency of a broad *Cracticus*, we reviewed data from anatomy, plumage, nidification and voice to reassess the optimal number of genera for the group, in particular whether *Melloria* is warranted for Black Butcherbird. Australian Magpie has multiple unique traits, including many without obvious adaptive significance for terrestrial foraging or open habitat. It shares with Black Butcherbird glossy black plumage, long tarsus and deep temporal fossa, and short currawong-like calls. Black Butcherbird's rounded wing is possibly adaptive for closed-forest habitats. We recommend use of *Gymnorhina*, *Melloria* and *Cracticus* to represent this evolutionary diversity within the butcherbird-magpie clade.

The Australo-Papuan butcherbirds and Australian Magpie are usually grouped at family or subfamily rank, Cracticidae or Cracticinae, within a broader assemblage of birds including the woodswallows *Artamus* spp., currawongs *Strepera* spp., and enigmatic New Guinean peltops *Peltops* spp. Notwithstanding some views to the contrary (e.g., Johnstone & Storr 2004), most recent taxonomic reviews and global checklists (e.g. Schodde & Mason 1999, Higgins *et al.* 2006, Dickinson & Christidis 2014, Gill & Donsker 2016, del Hoyo & Collar 2016) show a trend to assigning them to two or three genera: *Cracticus* Vieillot, 1816, for the butcherbirds, monotypic *Gymnorhina* G. R. Gray, 1840, for the Australian Magpie as *G. tibicen* (Latham, 1802), and in some recent checklists (Dickinson & Christidis 2014, Gill & Donsker 2016) monotypic *Melloria* Mathews, 1912, for Black Butcherbird as *M. quoyi* (Lesson & Garnot, 1827). Australian Magpie's close relationship to butcherbirds has long been recognised (Storr 1952, Amadon 1953, Schodde & Mason 1999, Johnstone & Storr 2004). Molecular phylogenetic analysis of the group (Kearns *et al.* 2013) renewed debate over the number of genera that should be recognised. Our broad aim here is to address that question.

Three key results of Kearns *et al.* (2013) frame our review: (1) Australian Magpie is phylogenetically nested within the clade of butcherbirds; (2) within that clade its closest relative (sister species) is Black Butcherbird [*C.*] *quoyi*, and (3) the Australian Magpie / Black Butcherbird pair itself comprises the sister group of all other butcherbirds. Together, these results render *Cracticus* paraphyletic if *Gymnorhina* is retained for Australian Magpie. The most pragmatic taxonomic response to this phylogenetic result, and that advocated by Kearns *et al.* (2013), is to recognise *Cracticus* for the entire clade. That treatment had been adopted previously by some (Storr & Johnstone 1979, Johnstone 2001, Johnstone & Storr 2004, Christidis & Boles 2008, Russell & Rowley 2009) and has since been followed by others (Nguyen *et al.* 2013, Beehler & Pratt 2016). Alternatively, if *Gymnorhina* is retained for Australian Magpie then the paraphyly of *Cracticus* can be addressed either by

assigning Black Butcherbird to *Melloria*, or placing it with Australian Magpie in *Gymnorhina*. Accordingly, our specific aim here is to assess all of the available data (morphological, molecular, behavioural) to determine which of these options is best applied.

Debate over generic assignment of the Australian Magpie has hinged on how best to interpret its traits associated with terrestriality in genus-level systematics. In choosing to advocate a broad *Cracticus*, Kearns *et al.* (2013) stressed a view that had been argued earlier: that distinctive traits of Australian Magpie solely comprise an adaptive suite and that *Cracticus* should be used for the whole group including Australian Magpie (e.g. Storr 1952, 1977, Johnstone & Storr 2004, Christidis & Boles 2008, Russell & Rowley 2009, Kearns *et al.* 2013, Nguyen *et al.* 2013, Beehler & Pratt 2016). Alternatively, it has been argued that when coupled with the bird's complex communal social system, these traits are indicative of a degree of evolutionary distinctiveness that warrants recognition at genus level (Schodde & Mason 1999, Horton *et al.* 2013).

Given agreement that Australian Magpie is indeed a terrestrially-adapted butcherbird (Kearns *et al.* 2013), the pertinent questions become whether all of its distinctive traits can be consistently interpreted in this way and how many genera should be recognised among Australo-Papuan butcherbirds. This paper seeks to answer these questions by freshly appraising the diversity and evolutionary history of the group. In particular, we test assertions in the literature that the distinctive traits of Australian Magpie are predominantly adaptations for terrestriality (Storr 1952, 1977, Christidis & Boles 2008, Russell & Rowley 2009, Nguyen *et al.* 2013, Beehler & Pratt 2016), and that Black Butcherbird is insufficiently distinctive or divergent from other *Cracticus* to warrant a separate genus (Russell & Rowley 2009, Beehler & Pratt 2016). We also take the opportunity to correct errors in osteological criteria proposed by Schodde & Mason (1999) and cited by Higgins *et al.* (2006).

Methods

We have (i) reviewed relevant literature, (ii) examined collections held at the Western Australian Museum, Perth (WAM), Australian National Wildlife Collection, Canberra (ANWC), and South Australian Museum, Adelaide (SAMA); (iii) skulls held at ANWC and Murdoch University, Perth; (iv) reviewed data from egg collections in Online Zoological Collections of Australian Museums (OZCAM) accessed via the Atlas of Living Australia (www.ala.org), and the photographic plates of eggs in Johnstone & Storr (2004). One of us (MC) measured proportional egg shape of a representative sample ($n = 287$ eggs from 157 clutches) using the egg modelling plug-in for ImageJ (National Institutes of Health; <https://imagej.nih.gov/ij/>) developed by Troschianko (2014). This generated max. width (as proportion of length) and 'pointedness', a measure of deviation from an ellipse. We reviewed available images, including exploratory analysis of bill shape and proportions from head profile images. We reviewed vocalisations available on Xeno-canto (www.xeno-canto.org), Macaulay Library (www.macaulaylibrary.org), published audio collections (Bird Observers Club of Australia 1983–99) and commercially available digital sources (Morecombe & Stewart Guide to Birds of Australia [iOS app], PDA Solutions; Pizzey and Knight Birds of Australia Digital Edition v.1.2 [iOS app], Gibbon Multimedia). For morphometric comparisons we assembled standard measurements (wing chord, tail, culmen, tarsus length) published for all relevant taxa (Amadon 1951, Rand & Gilliard 1967, Ford 1979, Black 1986, Johnstone & Storr 2004, Higgins *et al.* 2006, Kearns *et al.* 2011), supplemented by finer-grained datasets for Black Butcherbird (Mees 1964, Ford 1983) and Hooded Butcherbird *C. cassicus* (Mayr 1940, Junge 1958). Principal component analysis (PCA) was performed (SPSS Statistics, v.22, IBM) using a rotated covariance matrix on sex-adjusted z-scores.

Results

Australian Magpie—unique traits

Key diagnostic traits are indicated in *italics*. For simplicity, species epithets are used to refer to species (i.e., *tibicen* and *quoyi* for Australian Magpie and Black Butcherbird, respectively). In the following, Australian Magpie is named as a butcherbird (i.e., the term is used in the broad sense); the term ‘core *Cracticus*’ indicates all butcherbirds excluding Australian Magpie and Black Butcherbird.

Structure and bare parts

- i. Markedly different proportions, with *much longer wing* and *shorter tail* relative to body length (Amadon 1951, 1953). Wing:tail ratio 1.8–1.9, cf. 1.2–1.4 in other butcherbirds (as similar to *Strepera*). PCA using published wing / tail / culmen / tarsus measurements demonstrated the clear structural differentiation of Australian Magpie vs. the remaining butcherbirds, the major disjunction from all other taxa being along principal component axes correlated to wing or wing + tarsus length (Fig. 1).
- ii. Shape of *wing more pointed*, with a broad base and narrower tips forming a long triangle, particularly evident in flight (Parsons 1968, Schodde & Mason 1999, Higgins *et al.* 2006); this difference is reflected in more acutely tapered wing formula (data from Higgins *et al.* 2006) with p7 longest, compared with blunter wings in other butcherbirds, especially *quoyi* (Fig. 2). Shape of individual outer primaries also more pointed (Parsons 1968). Wing formulae for New Guinea species not available, but wing shape of *Cracticus cassicus* matches the core *Cracticus* in available flight images (e.g. Coates 1990: 376).

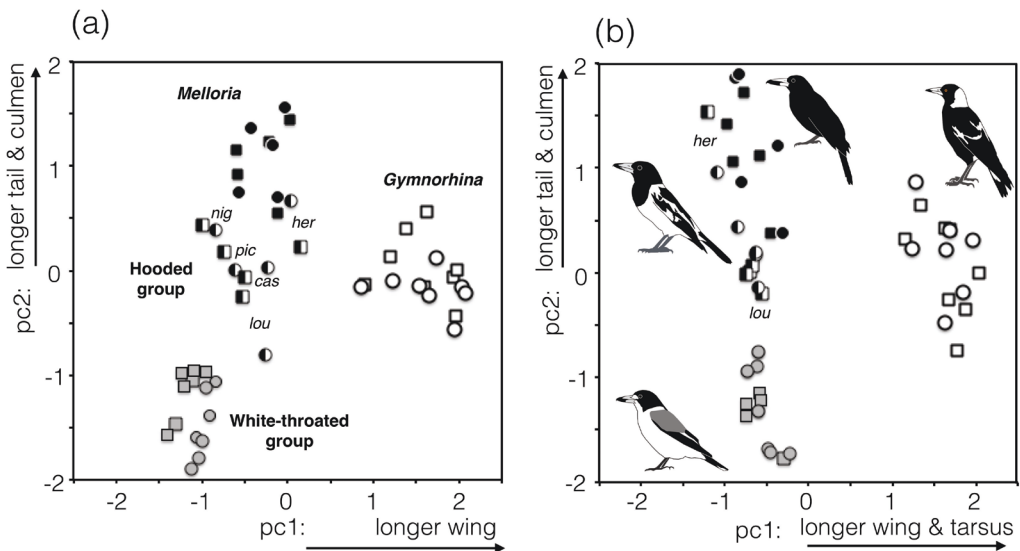


Figure 1. Principal component analysis (PCA) on sex-adjusted z-scores from published morphometrics of butcherbird and Australian Magpie taxa, using (a) wing / tail / culmen length, or (b) wing / tail / culmen / tarsus length. In each PCA the first two components explained >91% of the variance. In the first PCA (wing / tail / culmen), PC1 was most strongly correlated to wing and PC2 was most strongly correlated to tail and culmen length; in the second (wing / tail / culmen / tarsus), PC1 was most strongly correlated to wing and tarsus, and PC2 was most strongly correlated to tail and culmen length. Squares = males; circles = females; white = *Gymnorhina*, black = *Melloria*, grey = white-throated group, black / white = ‘hooded’ group taxa as labelled: nig, *Cracticus n. nigrogularis*, pic, *C. n. picatus*, her, *C. cassicus hercules*, lou, *C. louisiadensis*.

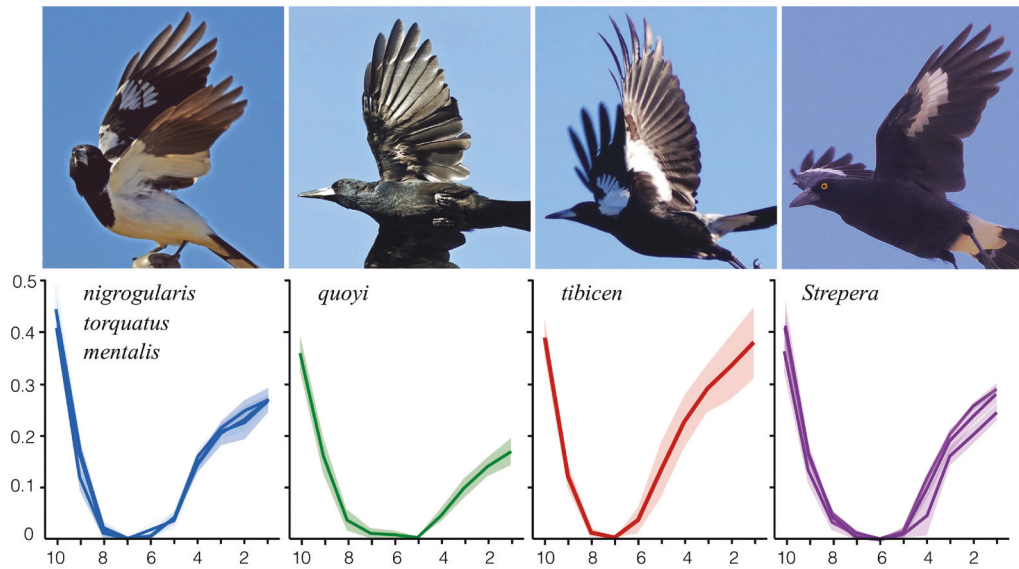


Figure 2. Wing shape and wing formula data (i.e., primary length difference from longest primary) from Higgins *et al.* (2006), scaled as proportion of total wing-chord length. Lines are centre of published range (shaded).

- iii. Longer wing contains 11 secondaries, cf. ten in other butcherbirds (Parsons 1968, Higgins *et al.* 2006).
- iv. Long-legged with long tarsus, both proportionately (e.g. relative to body length) and absolutely (tarsus >45 mm), being closest to *quoyi* (see below). Feet and claws rather powerful, almost raptorial in character (Kaplan 2004, Higgins *et al.* 2006).
- v. Semi-booted laminiplantar tarsus, vs. weakly scutellate in at least other Australian butcherbirds (Schodde & Mason 1999, Higgins *et al.* 2006).
- vi. Bill lacks prominent hook, cf. in all other butcherbirds, tip characteristically decurved to form a sharp hook with adjacent notch in upper tomium (Higgins *et al.* 2006). Long wedge-shaped bill distinctive for the following combination of characters, although none diagnostic alone (Fig. 3): bill proportionately long and deep-based (as in *quoyi*, *Cracticus cassicus* and Tagula Butcherbird *C. louisiadensis*), with straight edge to upper and lower profile (in this closest to *nigrogularis*), and is the most steeply tapered bill of all of the butcherbirds (i.e. proportionately narrowest at bill midpoint relative to base, and forming greatest angle between culmen and mandible).
- vii. Iris brighter, orange-brown to red-brown to red in adults, cf. dark brown in all other butcherbirds (Robinson 1956, Johnstone & Storr 2004, Higgins *et al.* 2006) vs. notably, yellow in *Strepera* and red in *Peltops*, and also reportedly paler brown in juvenile *quoyi* (Coates 1990, Pratt & Beehler 2014).

Plumage and moult

- viii. Plumage sexually dimorphic, with mottled (or scaled) grey replacing male's brilliant white upperparts in females of all subspecies and intergrades, including on the hindneck and rump of those with black dorsal bands, and more distinctly dimorphic (black-scaled female dorsum) in white-backed subspecies *G. tibicen dorsalis*; cf. sexes

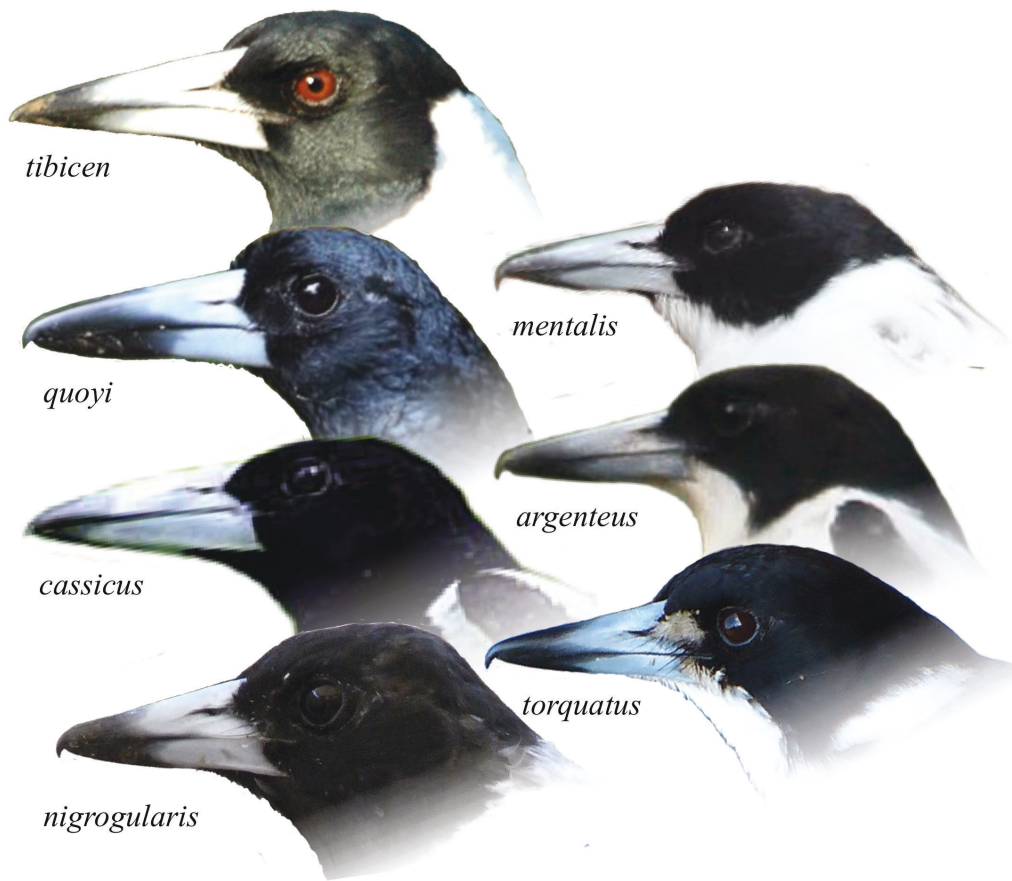


Figure 3. Typical bill and head shapes of the 'butcherbirds', proportionately scaled to mean culmen length for each taxon. Note the red eye of Australian Magpie *tibicen*, the proportionately small rounded head and glossy plumage of it and Black Butcherbird *quoyi*, and the greater extent of black on the bill of adult *quoyi*.

very similar (at most, e.g., slightly duller hood) in all other butcherbirds (Amadon 1951, Beehler *et al.* 1986, Higgins *et al.* 2006).

- ix. *Slower to mature* to adult plumage, with second immature males resembling females, and males taking up to four years to reach adult plumage (Robinson 1956, Johnstone & Storr 2004, Higgins *et al.* 2006) followed by progressive whitening of rectrix shafts and narrowing of terminal tail-band for up to ten years (Robinson 1956, Black & Ford 1982); cf. one year to mature in other butcherbirds, albeit slower in Grey Butcherbird *Cracticus torquatus* which has a subtle second immature plumage (Schodde & Mason 1999). Similarly, Australian Magpie is slower to achieve adult bill colour than other butcherbirds (Robinson 1956, Higgins *et al.* 2006, Russell & Rowley 2009).

Eggs

- x. *Proportional egg shape averages longer and more pointed* (this study; $P < 0.0001$ and $P < 0.01$, respectively) compared to all other Australian butcherbirds (Fig. 4), and presumably also *Cracticus cassicus* from published egg dimensions.

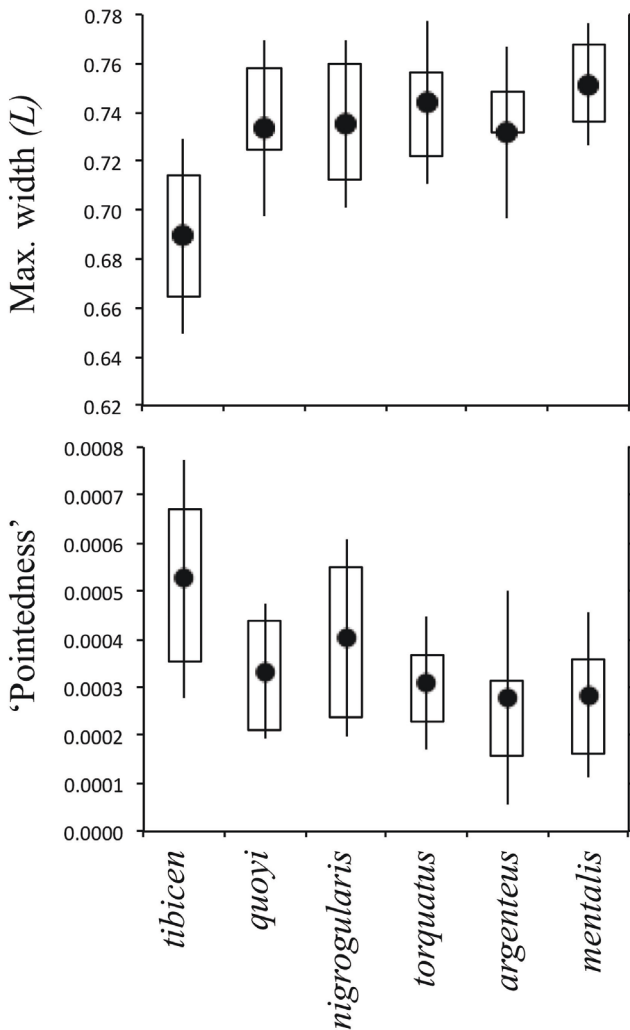


Figure 4. Egg proportions from image analysis, scaled to egg length, top: max. width (L), below: 'pointedness' (calculated deviation from ellipse shape). Box plots indicate mean (dots), upper and lower quartile ranges (box), and standard deviation (bars).

- xi. Eggs *highly variable* in ground colour and character and colour of markings (Fig. 5), even at same locality, as particularly noted by Campbell (1900). Base colour most commonly pale bluish or blue-green, being closest to *quoyi* (typically pale greyish green), cf. more typically olive, brown, buff or pink tones in other butcherbirds (Campbell 1900, Beruldsen 1980, Higgins *et al.* 2006, Russell & Rowley 2009), as in *Strepera*.
- xii. Egg markings include linear *streaking*, *scrawls* and *fine lines*, cf. in all other butcherbirds limited to dots, spots and blotches (Coates 1990, Higgins *et al.* 2006, Horton *et al.* 2013), as in *Peltops*, *Artamus* and most *Strepera* (although those of Pied Currawong *S. graculina* occasionally exhibit fine streaks). Egg markings less commonly concentrated at larger end, *c.*1/4 of clutches vs. 3/4 of clutches in other butcherbird species.

Behaviour

- xiii. *Highly social*, with permanent group territories and complex social interactions including dominance hierarchies, across sometimes *large groups*, and forming seasonal



Figure 5. Comparison of clutches of eggs of three species of butcherbird (Grey Currawong *Strepera versicolor*, Pied Currawong *S. graculina*, Black Butcherbird *Melloria quoyi*) and Australian Magpie *Gymnorhina tibicen* (Leo Joseph). Registration numbers in the form ANWC E20666, for example, pertain to the Australian National Wildlife Collection, CSIRO, Canberra, where the specimens are housed. Butcherbird egg plates also available in Beruldsen (1980) and Johnstone & Storr (2004).

- flocks of territorially excluded birds in some subspecies (Brown & Veltman 1987, Higgins *et al.* 2006); cf. other butcherbirds generally in simple pairs or, at most (e.g., in *Cracticus nigrogularis* and *C. cassicus*), small social groups mostly including previous offspring (Peckover & Filewood 1976, Russell & Rowley 2009).
- xiv. *Extreme territoriality* reflected in many specialised territorial behaviours (Brown & Veltman 1987).
 - xv. Highly complex and *varied vocalisations*, many with complex social functions (Higgins *et al.* 2006), notably unique *carolling* behaviour as group display of territoriality (cf. simpler antiphonal duetting in other butcherbirds) and a greater range of *short calls* (see below).
 - xvi. *Easy walking and running gait*, rather than hopping on the ground as in other butcherbirds which are lighter and shorter-legged (Kaplan 2004).
 - xvii. *Feeds almost exclusively on ground*, cf. midstorey to ground-level foraging, including classic 'perch-and-pounce' hunting in other butcherbirds (Kaplan 2004, Higgins *et al.* 2006). Specialised foraging behaviour, including acoustic detection of underground invertebrates (Brown & Veltman 1987, Kaplan 2004).
 - xviii. Nest site usually higher in exposed crown or upper canopy of a tall tree, and occasionally nests on artificial structures; cf. typical nest sites of other butcherbirds lower in smaller trees (Beruldsen 1980, Higgins *et al.* 2006, Russell & Rowley 2009), although Pied Butcherbird *Cracticus nigrogularis* nests can be similarly exposed (Johnstone & Storr 2004).

- xix. Does not wedge or hang 'butcher' prey, as in the classic shrike-like behaviour observed in other butcherbirds; rather, oversize prey held with feet while dismembering it (Debus 1996, Higgins *et al.* 2006).

Black Butcherbird and Australian Magpie—shared traits

- i. Generally *large size* (e.g. total length).
- ii. Long-legged; *tarsus long, robust* (pace Mathews 1912) and *laterally flattened* (Higgins *et al.* 2006). Tarsus in smallest Black Butcherbird subspecies *rufescens* >37 mm, thus >12% longer than hooded butcherbird group, including *cassicus* of similar body weight. In considering tarsal form, it may be significant that *quoyi* forages more frequently on the ground than other more arboreal 'perch-and-pounce' butcherbirds (Diamond 1972, Peckover & Filewood 1976, Debus 1996, Beehler & Pratt 2016), and that Nguyen *et al.* (2013) noted the lateral shaft of the tarsometatarsus as shallowly concave in these species, but not other Australasian butcherbirds.
- iii. Proportionately *small, rounded head*, compared to larger- and square-headed appearance of other butcherbirds (Amadon 1951, Pizzey 1980, Beehler *et al.* 1986, Coates 1990).
- iv. *Bluish-green gloss* to black plumage, distinctly so in *quoyi* but slightly less so in *tibicen* in good light (Fig. 3), as also in *Peltops*; cf. in core *Cracticus*, at most a slight black gloss in good light on underparts of *nigrogularis* (Coates 1990, Johnstone & Storr 2004, Higgins *et al.* 2006).
- v. Both *lack white tail tips*, a motif otherwise conserved across all other butcherbirds including *C. louisiadensis* and similarly melanistic *Strepera* species (Debus 1996); both also have *all-black remiges*, thus lacking conserved motif of white or white-edged inner 2–3 secondaries (+/- outer tertials) forming long wingbar in all other butcherbirds.
- vi. In this study, skulls of both *tibicen* ($n = 7$) and *quoyi* ($n = 2$; one Australian and one New Guinean) found to have more defined and *deeply depressed temporal fossae*, resulting in relatively more prominent and thus *longer post-orbital process* due to caudal excavation (*contra* errata in Schodde & Mason 1999, repeated in Higgins *et al.* 2006); cf. temporal fossa weakly defined and shallower, with reduced caudal excavation of post-orbital process, in *Cracticus nigrogularis* ($n = 2$) and *C. torquatus* ($n = 3$). Zygomatic process and its medial accessory process typically broader based and 'bluntly bifid', although in this study these features found to be more variable within than between taxa, thus not diagnostic (*contra* Schodde & Mason 1999).
- vii. Habitual use of *short calls* in vocal repertoire, including short caws, yodels and ringing notes used for social contact; vs. in other butcherbirds, short calls infrequent (cf. complex piping or rollicking song) and limited to sharp alarm notes and begging calls, plus soft croaks in *Cracticus cassicus*. Notably, Black Butcherbird calls in Queensland, Northern Territory and on Daru Island include a *kurr-ra-rung* call very similar to *Strepera graculina* (Rix 1970, Coates 1990, Debus 1996, Higgins *et al.* 2006), while certain calls of Australian Magpie, plus Black Butcherbird in New Guinea (Diamond 1972) and reportedly also the Kimberley region of Western Australia (Johnstone & Storr 2004), have a ringing quality similar to Grey Currawong *Strepera versicolor* (Fig. 6).

Black Butcherbird—unique traits

- i. *Wholly black adult plumage*.
- ii. Shape of *wing more rounded*, with a bluntly rounded tip in flight and less tapered wing formula (Higgins *et al.* 2006), and blunter shape to primary remiges; clearly

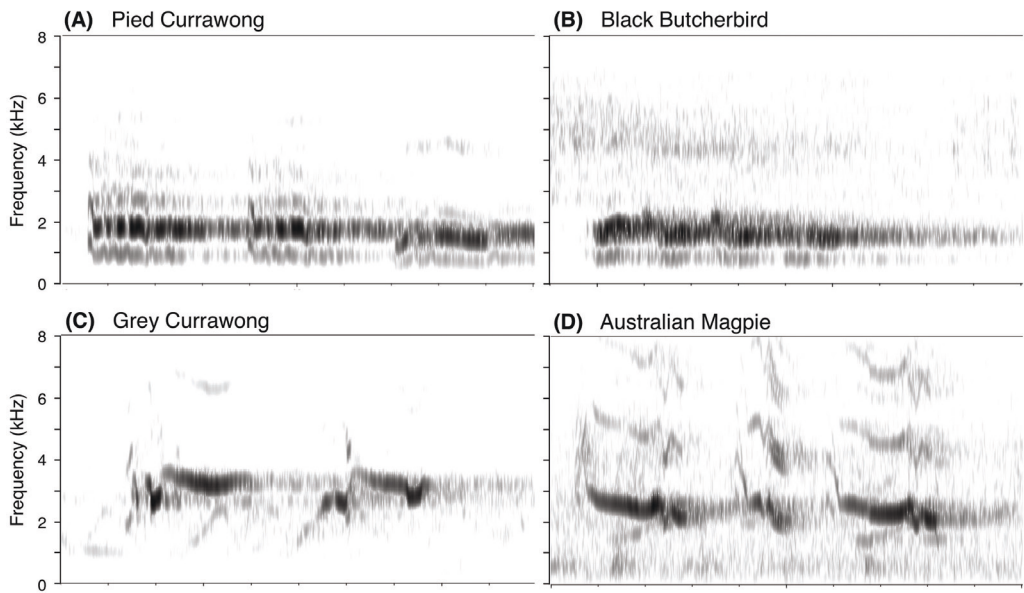


Figure 6. Representative sonograms showing similarity between the calls of *Strepera* species and some short calls of Black Butcherbird *Melloria quoyi* and Australian Magpie *Gymnorhina tibicen*. Typical curra-wong call of Pied Currawong *Strepera graculina* (A: near Warrumbungle, New South Wales; Marc Anderson, www.xeno-canto.org/233835) similar to kurr-ra-rung call of Black Butcherbird race *rufescens* (B: near Daintree, Queensland; Marc Anderson, www.xeno-canto.org/352582); chling-chling call of Grey Currawong *Strepera versicolor* (C: Gluepot, South Australia; Marc Anderson, www.xeno-canto.org/334453) similar to ringing flight call ('rally call') of Australian Magpie (D: Mutawintji, New South Wales; Marc Anderson, www.xeno-canto.org/335533). Each panel one second in duration.

contrasting with pointed wing of sister *tibicen*, but also divergent from other (Australian) butcherbirds (Fig. 2).

- iii. Larger black tip to bill, typically half of bill length or greater, cf. distal third or less in other butcherbirds (Johnstone & Storr 2004, Higgins *et al.* 2006).
- iv. Preference for denser vegetation and shaded forest interior (Diamond 1972, Higgins *et al.* 2006, Russell & Rowley 2009); where sympatric in New Guinea forest, *cassicus* is more associated with forest edge and clearings, riverine vegetation and crowns of tall trees (Rand & Gilliard 1967, Coates 1990, Pratt & Beehler 2014).
- v. Behaviour more secretive and difficult to observe (Rand & Gilliard 1967, Diamond 1972, Coates 1990, Debus 1996, Higgins *et al.* 2006, Pratt & Beehler 2014).

Discussion

Genera: to split or not to split.—Given the phylogeny for the butcherbird group (Kearns *et al.* 2013), three options preserving monophyly of genera are available for its classification: (1) all species placed in *Cracticus* (i.e. recognising Australian Magpie as *Cracticus tibicen*), (2) recognition of *Gymnorhina* for Australian Magpie and Black Butcherbird, or (3) recognition of two monotypic genera, *Gymnorhina* for Australian Magpie and *Melloria* for Black Butcherbird.

While all of these options are nomenclaturally valid, we note that avian systematics in recent years has seen many genera dismantled essentially for one of three reasons (Provost *et al.* 2018). First are cases in which the relevant species are now confidently understood not to be each other's closest relatives. Dismantling *Lichenostomus* and *Monarcha* in the

Australo-Papuan honeyeaters and monarch flycatchers, respectively (see Nyári & Joseph 2011, Andersen *et al.* 2015, Marki *et al.* 2017), or *Myrmeciza* for some Neotropical antbirds (Isler *et al.* 2013) are straightforward examples. Second are genera where the member species are not each other's closest relatives but not all relevant species have been sampled. A split is needed and either is recommended or held in abeyance until taxon sampling is completed. Arguably, these two situations are the only ones where a decision to dismantle a genus can be objective. Third are cases where the relevant species are indeed each other's closest relatives, and can validly be recognised with a single genus. Inevitably, in this case some subjectivity based on a 'weight-of-evidence' criterion is involved in decisions to dismantle larger genera into component smaller ones. For example, clear phylogenetic structure revealed by DNA studies and concordant variation in other character sets (e.g. plumage, anatomy, vocalisations) is judged as amounting to a sufficient weight of evidence to recognise different genera. Examples are the break-ups of *Aratinga* and *Ara* among Neotropical parrots (Kirchman *et al.* 2012, Remsen *et al.* 2013), *Calyptorhynchus* among Australian cockatoos (Dickinson & Remsen 2013) and *Meliphaga* in Australo-Papuan honeyeaters (Joseph *et al.* 2014). The present case is clearly excluded from the first two categories but does fall within this last, more subjective category.

Next we note the utility of smaller genera as tools for efficient communication of information on both the evolutionary history and phenotypic traits of the constituent species (Vences *et al.* 2013), and as a means for clarifying rather than obscuring the true relationships and basic patterns of the broader group (Mayr 1943). Vences *et al.* (2013) proposed criteria for optimising supraspecific classifications in this context. Their criterion of *phenotypic diagnosability* states that classifications should highlight the most important and conspicuous evolutionary changes (e.g. body plan, behaviour) such as those that are readily recognised even by non-specialists (i.e. lay recognition of [Australian] 'magpie' and 'butcherbird' morphotypes), while accepting that recognition of more cryptic groups can sometimes be necessary. A further, albeit subjective, criterion suggests that minimal taxonomic change is warranted for well-known and frequently encountered taxa (Vences *et al.* 2013) which might be invoked here. However, Vences *et al.* (2013) specifically dismissed as theoretically and practically problematic the application of a *hybrid viability* criterion, which might be argued for the butcherbirds given several records of Australian Magpie × Pied Butcherbird hybridisation (Debus 1996, Donato & Potts 2004).

Vences *et al.* (2013) further proposed a secondary *adaptive zone* criterion particularly applicable to the rank of genus, encouraging classifications defined by exploitation of a particular ecological niche. This contrasts directly with the opposing argument advocated for synonymising *Gymnorhina* in *Cracticus*, i.e., that the numerous divergent traits of Australian Magpie are unworthy of generic recognition because they represent a single correlated suite of adaptations for terrestrial foraging (Storr 1952, Christidis & Boles 2008, Russell & Rowley 2009, Nguyen *et al.* 2013, Beehler & Pratt 2016). This taxonomic dismissal of niche-driven 'ecological adaptation' also contrasts with, to use the same examples cited by Kearns *et al.* (2013), the conventional multi-generic treatment of adaptive radiations such as the Malagasy vangas (Reddy *et al.* 2012) or indeed Darwin's Galápagos finches (Sato *et al.* 1999).

Regardless, we conclude here that only a subset of the many distinctive traits of Australian Magpie are justifiably and unequivocally correlated to terrestriality (*viz.* robust legs and walking gait, short tail accommodating a more upright stance, dorsal not ventral patterning, lack of hooked bill). If extended to include adaptation to expanding open savannas during Miocene-Pliocene aridification (Kearns *et al.* 2013), this suite might arguably also include its distinctly long and pointed wings. Counter to this is the lack of

similar structural differentiation between savanna-dwelling *Cracticus nigrogularis* and its tropical forest-associated sister group of *C. cassicus* and *C. louisiadensis*. Conversely, we note divergence in traits with no known adaptive significance for either terrestrial foraging or open savanna habitat, but which warrant research in this regard (e.g. plumage, iris colour, egg shape and colour, moult and maturation, social behaviour, vocalisation). This suggests a pattern of general divergence (or alternatively, if implausibly, ancestral traits lost in other butcherbirds), alongside more focused niche adaptation.

The implication that all 'butcherbirds' should constitute a single genus and that the phenotypic divergence of Black Butcherbird is insufficient for recognition at genus level (Russell & Rowley 2009, Beehler & Pratt 2016) is countered with contemporary examples of genus-level radiation with weak morphological divergence but clear phylogenetic structure (see above). Examples in Australia are within the Australo-Papuan robins (e.g. *Eopsaltria / Quoyornis*; *Microeca* and related genera; Loynes *et al.* 2009) and honeyeaters (e.g. *Meliphaga*, *Microptilotis*; Joseph *et al.* 2014). Mathews (1912: 114) originally diagnosed *Melloria* for the Black Butcherbird by its 'stouter longer bill and longer wing and tail and stouter feet'. All but the last trait neglect some overlap in measurements between the smallest subspecies *rufescens* and *Cracticus cassicus*, especially its large island form *C. c. hercules*. Here, we instead note a number of traits shared by Black Butcherbird and Australian Magpie but not by other butcherbirds, including their long robust tarsus, glossy plumage, distinctly deeper temporal fossa (correcting error in Schodde & Mason 1999), and habitual use of short ringing or yodelling calls. The similarity of some Black Butcherbird calls to those of *Strepera* has been noted by others (Rix 1970, Debus 1996, Johnstone & Storr 2004, Higgins *et al.* 2006), and we note here the same similarity for some calls of Australian Magpie. These shared traits can variously be interpreted as either derived from the most recent common ancestor of Australian Magpie and Black Butcherbird, thereby affirming their monophyly, or as inherited from a more distant ancestor but correspondingly lost or modified in other butcherbirds, so affirming their divergence. Additionally we note the proportionately long inner primaries of Black Butcherbird yielding a uniquely rounded wing compared to other butcherbirds (although wing formula data are absent for New Guinean species), possibly an adaptation for its preferred closed-forest habitat, vs. the long pointed wings and open savanna habitat of Australian Magpie. These shared and unique traits collectively establish a wider morphologic and phenotypic 'gap' between Black Butcherbird and other *Cracticus* (*sensu* Mayr's 1943: 139 'decided gap' or Vences *et al.*'s 2013: 224 'phenotypic diagnosability') than has previously been appreciated. While acknowledging some inevitable subjectivity in these arguments, we suggest that the evolutionary diversity this 'gap' represents warrants emphasis at the generic level. That is, recognition of *Gymnorhina* and *Melloria* serves the biologically useful purpose of communicating this diversity. Concomitantly, we posit that their shared traits do not form sufficient argument for a shared *Gymnorhina* containing both *tibicen* and *quoyi*, as that would ignore the many unique traits of Australian Magpie, whether adaptive or simply divergent, or both, as well as diagnosability criteria we have discussed.

Conclusion

Our re-appraisal of the Australo-Papuan butcherbirds and Australian Magpie shows that the deep genetic structure confirmed by Kearns *et al.* (2013), i.e. Black Butcherbird representing a separate lineage to other butcherbirds and sister to Australian Magpie, is broadly concordant with patterns and 'gaps' in phenotypic diversity within the group. This is especially so when fully compared across structure (including wing shape, osteology), plumage, behaviour (including nidification and vocalisations), and ecological niche. We conclude that this clade of closely related species has an evolutionary history and diversity

most usefully recognised in three genera: robust, terrestrial *Gymnorhina*; robust, forest-dwelling *Melloria*; and the smaller more gracile, more structurally and ecotypically similar core *Cracticus*. These groups broadly represent divergent radiations for open terrestrial foraging, closed-forest subcanopy, and more open woodland and forest edge, respectively. However we also note examples of divergence (perhaps ancestral diversity) lacking a clear ecological basis. We specifically refute a repeated misconception in the literature that has caused the many distinctive traits of *Gymnorhina* to be dismissed as a single suite of ‘foraging adaptations’ (Storr 1952, Christidis & Boles 2008, Russell & Rowley 2009, Beehler & Pratt 2016). In addition, we particularly note the shared blue-green gloss, long robust tarsus, temporal form, and short currawong-like calls of the *Melloria* + *Gymnorhina* clade, and the broad rounded wing of *Melloria*. We view these as significant to systematics when combined with distinctions previously acknowledged for all-black *Melloria* and terrestrially adapted *Gymnorhina*, and all within the phylogenetic structure outlined by Kearns *et al.* (2013). While nomenclaturally valid, synonymising *Gymnorhina* with *Cracticus* including *quoyi* (*sensu* Johnstone & Storr 2004, Christidis & Boles 2008, Russell & Rowley 2009, Beehler & Pratt 2016) needlessly discards much significant information regarding the evolutionary history and adaptive diversity of the group, as summarised above. We thus commend recognition of both *Gymnorhina* and *Melloria* (*sensu* Dickinson & Christidis 2014, Gill & Donsker 2016, del Hoyo & Collar 2016) as the taxonomic treatment best reflecting current understanding of evolutionary relationships and phenotypic diversity in the Cracticini.

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A black page in the French partridge's history: the melanistic variety of Red-legged Partridge *Alectoris rufa*

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SUMMARY.—The melanistic variety of Red-legged Partridge *Alectoris rufa* was described from a small population in western France around the 1850s. In this region, the Red-legged Partridge population as a whole was hunted, but melanistic individuals were targeted for both private and museum bird collections, and by 1865 the variety was extinct in western France. An extensive search for extant specimens documented 13 melanistic birds in six museums, and their details are presented here. Remarkably, some of these specimens were collected in areas elsewhere in France or even in other countries. After 1915, the allele for melanism appears to have been lost within the Red-legged Partridge population as a whole, and we discuss possible reasons for this.

‘... nous sommes persuadé que cette perdrix qui tend à demeurer en Anjou [now Maine-et-Loire] se multipliera dans quelques années, au grand contentement des amateurs de la chasse et de l’ornithologie.’ [..., we are persuaded that this partridge which tends to remain in Anjou will multiply in a few years, to the great satisfaction of the amateurs of hunting and ornithology.] (de Soland 1861: 146).

Colour aberrations, especially melanistic varieties, have always confused ornithologists. In the past, when little was known concerning plumage pigmentation and mutations, aberrant-coloured birds were often viewed as new taxa, and were named scientifically. Perhaps the oldest and best-known example is the melanistic form of Grey Partridge *Perdix perdix*, which was named as a species, the Mountain Partridge *P. montana*, by Brisson (1760; Fig. 1).

Melanism is the only mutation in which there is no real loss of pigments or changes in the shape or size of the melanin granules (van Grouw 2017). Therefore the plumage of a melanistic bird often is not obviously aberrant, i.e. the plumage looks ‘natural’ but may be completely different to any known species. That melanistic birds were, especially in the past, mistaken for ‘new species’ is therefore understandable. Sometimes ‘new species’ were erected on the basis of a single specimen simply because it was differently coloured, like Sharpe’s Rail (Hume & van Grouw 2014). Mostly, however, the confusion was based on melanistic forms that occurred, or still occur, quite commonly in the relevant species / populations. The fact that more individuals were found was, for many ornithologists, evidence that these aberrant birds were indeed species. An example is the melanistic form of Red-legged Partridge *Alectoris rufa*. This aberration was, for a period, quite common in a small area in western France, and it was consequently described as *Perdix Atro-rufa* (de Soland 1861; Fig. 2). The mutation also occurred sporadically elsewhere in Europe, as will be demonstrated later in this paper. A remarkable bird, occurring in small numbers, was inevitably the target of collectors, so specimens were deliberately obtained for museums and collectors of curiosities. Currently, the mutation is apparently not present in any extant Red-legged Partridge population, and just 13 melanistic specimens remain in museums.



Figure 1. Mountain Partridge *Perdix montana*. Brisson knew this 'species' only from the mountains of Lotharingen, France, hence *montana*. However, subsequently '*montana*' was proven to occur all over Europe and to be a melanistic form of Grey Partridge *P. perdix*. From Sir William Jardine's *Naturalist's library*, 1834, *The natural history of game birds* (Hein van Grouw, © Natural History Museum, London)



Figure 2. *Perdix atro-rufa*, the melanistic variety of Red-legged Partridge, described taxonomically by de Soland (David Riou, © Musées d'Angers)

Here, we discuss the nature of melanism in Red-legged Partridge and its history, and present information for all of the remaining specimens.

History of *Perdix atro-rufa* in France

The first records of melanistic Red-legged Partridges are from France in the mid-19th century. A small population was discovered south-west of Cholet, at the hamlet of Cou-Pinson, part of Saint-Aubin-des-Ormeaux, in the department of Vendée, Pays-de-la-Loire, western France. A specimen was sent to the Linnaean Society of Maine-et-Loire in May 1858 by Esprit Guillou (1798–1870), a naturalist from Cholet and member of the society. During the society's committee meeting on 18 May 1858, it was decided that the specimen represented a new 'race'. They named it *Perdix Atro-rufa* and a description with colour plate (Fig. 2) was published by de Soland (the society's president) in 1861. In the following years, various authors published information concerning the occurrence of *atro-rufa*, enabling us to compile a short history of the population.

The first melanistic bird was discovered by Guillou as early as 1846 (Millet de la Turtaudière 1868) in the area around Saint-Aubin-des-Ormeaux, Vendée department (de Soland 1861, Vincelot 1867). As this is only a few km from Cholet, Maine-et-Loire department, many authors considered the provenance of *atro-rufa* to be 'the vicinity of Cholet', but in fact the mutation was never observed in Maine-et-Loire (Millet de la Turtaudière 1865, 1868). After the first observation, at least 5–6 family groups including dark-coloured individuals were recorded in the area annually (de Soland 1861, Vincelot 1865), and the aberration would probably have become established in the population if it had not been targeted by collectors. Specimens were collected for private collections, as well as being sold as game at the markets in Cholet, or sent to Paris for research (Vincelot 1867).

De Soland (1861) already warned as to the negative effects of over-exploitation, and Millet de la Turtaudière (1865) reported that *atro-rufa* was killed by poachers and repeated that excessive hunting would threaten the population. By then, it was already too late as, according to Baugas (Lemetteil 1869), the last six individuals were killed in spring 1865. In less than 20 years after its discovery, the small population of melanistic Red-legged Partridges was wiped out. At that time, specimens were present in the private collections of Baugas (several), Guillou (four) and Lemetteil (one), and in the natural history museums of Angers (two), Saumur (at least one) and Paris (two) (de Soland 1861, Millet de la Turtaudière 1865, 1868, Vincelot 1865, Lemetteil 1869). Much of the above information was summarised by Mayaud (1947). He also mentioned specimens in different museums like Cholet and some English specimens. However, he did not mention the specimens held in Angers, Saumur and Paris. Remarkably, no-one appeared to be aware of a specimen collected in 1844 in the south of France, present in Marseille museum, which was depicted by Hachisuka (1928).

Perdix atro-rufa in England

In early 1900 the mutation appeared again, but this time in England, and three specimens are present in the Natural History Museum, Tring (NHMUK) collection (Fig. 8). Ogilvie-Grant (1912) mentioned and depicted (Fig. 3) the variety; 'The most extraordinary variety, however, that we have ever examined, is that shown in the second figure. It has the fore-part of the head, eyebrow-stripes, cheeks and throat black; the rest of the head, mantle, breast, and flanks dull vinous-red, with the exception of a few white feathers on the middle of the breast; and the abdomen, thighs, and under tail-coverts are dull greyish-brown, with the exception of a few buff feathers on the middle of the belly. The tail-feathers are dull greyish-



Figure 3. Melanistic variety of Red-legged Partridge *Alectoris rufa* depicted in Ogilvie-Grant (1912), probably based on the specimen collected in Essex in October 1908, NHMUK 1908.10.22.1; see Figs. 8 and 10 (Hein van Grouw, © Natural History Museum, London)

brown, like the lower back, rump and wings.’ He did not mention the earlier French history of this aberration, but he may have been unaware of it. Furthermore, he did not mention where the specimen came from, but it was in all likelihood that shot in Essex in 1908 (see Extant specimens). In March 1915, two *atro-rufa* specimens were present in what is now the NHMUK collection, and Ogilvie-Grant (1915) exhibited a series of aberrant partridges at the Zoological Society meeting. He noted: ‘The remarkable variation which I now exhibit has the head, eyebrow-stripes, cheeks, and throat black, and the rest of the plumage dull vinaceous-red with a patch of white feathers in the middle of the belly, forming an irregular horse-shoe mark. ... and it seems a remarkable coincidence that a second specimen of this quite unique variation of the red-leg should have been killed exactly six years after the first, and in nearly the same locality.’ Coincidence or not, in September 1915, the museum received a third specimen taken near the same locality as the second bird the year before.

The English melanistic specimens were also described by Bateson & Bateson (1925) as the ‘dull variety’, which they named *Alectoris rufa rufa* Var. *obliterata*. Both Lowe (1945) and Ash (1966) mentioned the melanistic variety briefly without adding further details, although Ash also referred to the French population.

Red-legged Partridges in England originated from France, with the first introduction orchestrated by King Charles II in 1673 (Potts 2012). These birds came from Chambord, department Loir-et-Cher, in the Loire Valley, and were released in Windsor Great Park, on the Berkshire / Surrey border. This population apparently died out quickly. After several more attempts, the species eventually became well established on the Suffolk coast by c.1790. However, over the rest of England Red-legged Partridges remained uncommon until the late 1950s (Barbanera *et al.* 2015). It seems probable that the English melanistic birds derived directly from the French population. However, the French population described by de Soland came from Saint-Aubin-des-Ormeaux, Vendée department, which is c.250 km west of Chambord, Loir-et-Cher department, and it is unlikely that the rare allele for

melanism was present in that population too. Furthermore, *contra* Potts (2012), molecular work demonstrates that English Red-legged Partridges are genetically closer to Italian and Corsican populations than to those of mainland France, with the three melanistic birds not diverging in this respect from other historical English specimens, and no relationship to birds from the Loire Valley is evident (Barbanera *et al.* 2015). Consequently, we consider the melanistic English birds as a fresh occurrence of the same mutation, rather than originating from the original French population.

Museum specimens of *Perdix atro-rufa*

Probably the oldest museum specimen, collected in 1844, is in Marseille but, apart from Hachisuka (1928), no other author seems to have been aware of it. Based on the pre-1870 literature (de Soland 1861, Millet de la Turtaudière 1865, 1868, Vincelot 1865, Lemetteil 1869) the following specimens were then known: four in Guillou's private collection, 'a few' in Baugas' collection, one in Lemetteil's collection, two in Angers, at least one in Saumur and two in Paris. Mayaud (1947) seemingly listed seven additional specimens; three in London (see above) and four in Cholet. The specimens in Cholet, however, are the same as the Guillou specimens mentioned by earlier authors. Following Guillou's death in 1870 his collection was donated to the Cholet museum (see Extant specimens).

The whereabouts of Baugas' collection are unknown and the specimens are considered lost. Edouard Leon Baugas (1824–1901) was also from Cholet and a friend of Guillou. The specimen from Lemetteil also appears to be lost. Eugène Lemetteil (1822–90), a keen amateur ornithologist from Bolbec, was particularly interested in the avifauna of the department of Seine-Maritime (formerly Seine Inférieure), in Normandy, northern France. The melanistic partridge was sent to him by Abbot Vincelot (Lemetteil 1869). Michel Honoré Vincelot (1815–77) was an abbot at Angers (Crépon 1877), an amateur ornithologist and a member of the Linnaean Society of Maine-et-Loire with a keen interest in the etymology of bird names. Probably initiated by Lemetteil's son-in-law Georges Pinchon, Lemetteil's collection, which comprised approximately 2,000 specimens, both birds and eggs, was sold 14 years after his death by the auctioneer Hommais in Bolbec, and bought by Lemaistre. Although it was Hommais' intention to sell the collection as a whole (letter PEN6 1904-018 in Rouen Museum archive), apparently Lemaistre purchased only part of it (P. Cantrel *in litt.* 2016). At the time, Edmond Lemaistre (1876–1953), a rich textile manufacturer and keen hunter, had just started to assemble a private collection of local birds. Lemaistre's collection as a whole is still at the Municipal Museum in Lillebonne, Seine-Maritime, having been bequeathed to the town in 1953. The melanistic partridge of Lemetteil, however, was never part of the bequest (P. Cantrel *in litt.* 2016), so Lemaistre may have parted with it earlier, as *atro-rufa* was not a local bird, or he never received it in the first place. If the specimen still exists, its whereabouts are unknown to us.

The Château-Musée de Saumur was founded in 1829 and based in the town hall until 1919; apparently an *atro-rufa* specimen was sent to this museum in the mid 1800s (Millet de la Turtaudière 1868). However, currently no melanistic specimen of Red-legged Partridge is present there (MB pers. obs.) and also we have not found any evidence that one was once in the collection (Courtyiller 1868).

Extant specimens

Muséum d'Histoire naturelle de Marseille (MHNM), France

One mounted specimen, MHNM.0.394, originally labelled 'Basses Alpes, France 1844' (Fig. 4). No further details known. According to Hachisuka (1928) the specimen is a



Figure 4. Mounted specimen (MHNM.0.394) at Muséum d'Histoire naturelle de Marseille, originally labelled 'Basses Alpes, France 1844'. A: figured in Hachisuka (1928) (Hein van Grouw). B: photographed in 2016 (Stéphane Jouve, ©Muséum de Marseille)

female, but no evidence of the bird's sex is recorded with the specimen. Until April 1970, 'Basses-Alpes' was the name of the Alpes-de-Haute-Provence, in southern France. If the date and locality are correct, then this specimen was collected before the population in Vendée was discovered, and is probably unrelated genetically.

Muséum national d'Histoire naturelle de Paris (MNHN), France

Two mounted specimens, Cat. Gén. 1858-1318 (other nos. 12436 and 562), originally labelled 'France. Collection du prince Charles Bonaparte, achetée par l'état en 1858', and Cat. Gén. 1859-610 (other nos. 12435 and 561), originally labelled 'femelle, Bretagne. Trouvé sur le marché de Paris en décembre 1859, venant de Bretagne, acquis à Mme Perrot le 15 décembre 1859' (Fig. 5). 12435 and 12436 are former registration numbers used in the 'Catalogue des Oiseaux n°4 placée dans la galerie du muséum d'histoire naturelle'. 561 and 562 refer to these specimens' entries in the 'Catalogue des Montages'. Bretagne (Brittany) traditionally included part of Pays-de-la-Loire, so this specimen probably emanates from the original population.



Muséum des sciences naturelles d'Angers (MHNAn), France

Two mounted specimens, both males, MHNAn.2003.522 and 2003.523 (Fig. 6). In the museum's register (2R24) both are mentioned under the same entry: 16 November 1863, two



Figure 5. Mounted specimens at Muséum national d'Histoire naturelle, Paris: A: MNHN 1858-1318, originally labelled 'France. Collection du prince Charles Bonaparte, achetée par l'état en 1858'; B: MNHN 1859-610, originally labelled 'femelle, Bretagne. Trouvé sur le marché de Paris en décembre 1859, venant de Bretagne, acquis à Mme Perrot le 15 décembre 1859' (© Muséum national d'Histoire naturelle, Paris)



Figure 6. Mounted specimens at Muséum des sciences naturelles d'Angers, France. A: MHN.An.2003.522. B: MHN.An.2003.523 (David Riou, © Musées d'Angers)

'Perdrix lugubres, achetée 10 francs' It is unclear whether 1863 is the date of acquisition, collection or registration. 1863, however, appears to be incorrect for collection or acquisition as, based on de Soland (1861), these specimens must have been present in the museum



Figure 7. Mounted specimens at Museum de Société des Sciences Lettres et Arts de Cholet et sa région, France. A: SLA274-37.2. B: SLA288-37.6. C: SLA266-37.7. D: SLA265-37.8 (Fernand Lambert, © SLA, Cholet)

before 1861. According to Mayaud (1947) Deloche, the former taxidermist at Angers, obtained two specimens two years after Guillou presented one to the Linnaean Society of Maine-et-Loire in 1858, so these Angers specimens probably came to the museum in 1860, rather than 1863.

Museum de Société des Sciences Lettres et Arts de Cholet et sa région (SLA), France

Four mounted specimens, SLA 274-37.2, 288-37.6, 265-37.8 and 266-37.7 (Fig. 7). These were part of the private collection of Esprit Guillou (Mayaud 1947). His son, Arthur Guillou, donated the collection to the town of Cholet in 1905, when they were placed in the SLA (F. Lambert pers. comm.). E. Guillou was a keen naturalist, bird collector and member of the Linnaean Society of Maine-et-Loire. None of his specimens are accompanied by original data or labels, but we assume that all were collected at 'métairie du Cou-Pinson' of the village of Saint-Aubin-des-Ormeaux in Vendée between 1846 and 1861. One of these is probably that shown to the Linnaean Society and therefore the type of the name *atro-rufa*, although none agrees fully in shape and posture with the depiction in the type description (see Fig. 2).



Figure 8. Specimens at the Natural History Museum, Tring. Ventral (A) and dorsal views (B), from left to right NHMUK 1915.1.15.1, 1915.10.5.1 and 1908.10.22.1 (Harry Taylor, © Natural History Museum, London)



Figure 9. Specimen (relaxed mount, MNCN-A4955) at Museo Nacional de Ciencias Naturales, Madrid, Spain, labelled 'Sur-oeste de Europa, probablemente España' (Josefina Barreiro, © Museo Nacional de Ciencias Naturales, Madrid)

Natural History Museum, Tring (NHMUK), UK

Three skin specimens, NHMUK 1908.10.22.1, male, Spaynes Hall, Braintree, Essex, shot 20 October 1908 and presented by A. W. Ruggles Brise; NHMUK 1915.1.15.1, male, Higham,



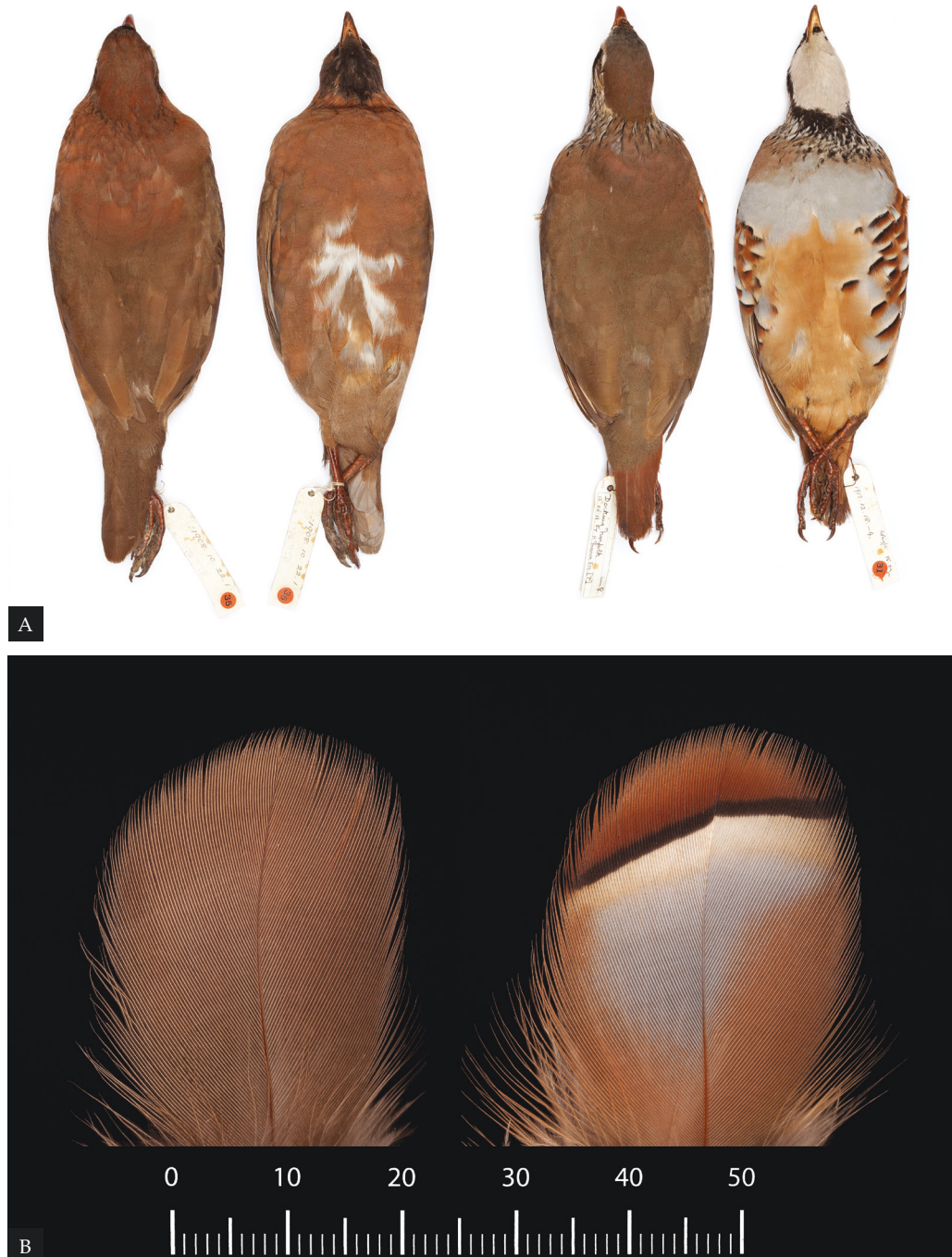


Figure 10. Melanistic form of Red-legged Partridge *Alectoris rufa* (left) compared with a normal-coloured specimen (NHMUK 1908.10.22.1 and 1912.12.18.4). A: the upperparts are hardly affected except the neck where phaeomelanin is increased, but the underparts are uniform reddish grey-brown due to an increase of both eumelanin and phaeomelanin, while the few white feathers are a form of leucism, which often occurs concurrently with certain forms of melanism; see Figs. 12 and 15. B: flank feathers of the same specimens (Harry Taylor, © Natural History Museum, London)

near Gravesend, Kent, shot 20 October 1914 and presented by Dr Hammond Smith; NHMUK 1915.10.5.1, male, Mockbeggar, Rochester, Kent, shot 1 September 1915 and presented by Herbert Cobb (Fig. 8).

Museo Nacional de Ciencias Naturales (MNCN), Madrid, Spain

One skin specimen (relaxed mount), MNCN-A4955. Adult, originally labelled (in Spanish): 'South West Europe, probably Spain' (Fig. 9). The specimen was probably collected in Spain, but it is possible that it came from southern France, potentially from the same area (Alpes-de-Haute-Provence) as the Marseille specimen. The collection date is unknown, but it must be before 1912 when the museum's collection was inventoried (J. Barreiro pers. comm.)

Discussion

The pigments responsible for the Red-legged Partridge's plumage colour are melanins. Melanin comprises two forms: eumelanin and phaeomelanin. Depending on its concentration and distribution within the feather, eumelanin is responsible for black, grey and / or dark brown feathers, whereas phaeomelanin produces warm reddish-brown to pale buff feathers. Together, both melanins can produce a wide range of greyish-brown colours. Melanin is produced by cells called melanocytes, which are found mainly in the skin and the feather follicles (from which the feathers grow). Melanocytes within the feather follicles produce melanin, which is added to the feather cells as the feather grows. However, melanin distribution does not always occur at a constant rate. In most species, feathers have certain patterns and / or colour differences caused by the type, amount and distribution of melanin. During feather growth, sudden changes from the production of eumelanin to phaeomelanin may occur, giving rise to these different patterns (van Grouw 2017).

Many mutations in birds are known to cause plumage that is darker than normal (= melanism). Melanism, from the Greek *melanos* (= dark-coloured), is often defined as an increased amount of dark pigmentation (melanin). Aberrant dark plumage is, however, not necessarily the result of an increased amount of pigment. A change in the arrangement or distribution of pigment granules, rather than more granules being present, also causes darker plumage. Therefore a better definition of melanism is: 'a condition characterised by abnormal deposits of melanin in skin and feathers' (van Grouw 2017)

Although the melanistic form of Red-legged Partridge looks strikingly different from that with normal-coloured plumage, closer observation reveals that the original reddish grey-brown colour of the upperparts and wings in '*atro-rufa*' is hardly darker (Fig. 10A). Only on the neck is more phaeomelanin present, affording the plumage a more reddish appearance. Despite its name *atro-rufa* (Latin *ater* = black and *rufus* = red), the melanistic variety displays relatively little black in the plumage, perhaps even less than in normally coloured birds. The black head and throat markings typical of normal plumage are reflected in the solid black forehead and throat of the melanistic form, but the black stripes on the flanks have disappeared, instead the flanks and underparts are uniform reddish grey-brown (Fig. 10B). The normally reddish-brown tail feathers (produced by phaeomelanin alone) now contain both melanins, and are the same colour as the underparts.

In *atro-rufa* mainly phaeomelanin seems to be increased, although not to the same extreme as in *Perdix montana* (Fig. 11) and the phaeomelanistic variety of Northern Bobwhite *Colinus virginianus* known as 'Red Tennessee' (Fig. 12; Cole *et al.* 1949). Although in appearance these melanistic varieties are very similar to *atro-rufa*, large parts of their plumage contain only phaeomelanin, while in the melanistic Red-legged Partridge both pigments seem to be equally present in most feathers. In this respect, the mutation in Red-legged Partridge is highly comparable with 'recessive black' in Japanese Quail *Coturnix*



Figure 11. Melanistic form of Grey Partridge *Perdix perdix*, originally named *P. montana*, a specimen in the Naturalis Biodiversity Centre, Leiden (Hein van Grouw)



Figure 12. Melanistic form of Northern Bobwhite *Colinus virginianus* known as 'Tennessee Red'; note the few white feathers (leucism) which often co-occur with certain forms of melanism; see Figs. 10 and 15 (© Joel Sartore)



Figure 13. Melanistic form of Japanese Quail *Coturnix japonica* known as 'recessive black'. Both melanin pigments seem to be equally present in most feathers and the original patterns and markings are faint and therefore this mutation is very much comparable with the melanistic variety known as *atro-rufa* in Red-legged Partridge *Alectoris rufa* (© Nico van Wijk)

japonica, as in the latter, due to the mutation, each feather also contains both pigments and the original patterns and markings are faded (Fig. 13). In appearance, the varieties of both species do not look like each other at all, but in their normal colour the two are also totally different. In comparing mutations within different species, one must examine what happens to the pigmentation process, rather than just comparing the final result, as this can differ between species.

The inheritance of recessive black in Japanese Quail is, unsurprisingly, recessive, and the mutation is associated with the agouti gene (Hiragaki *et al.* 2008). Two important genes that regulate the production and deposition of the two types of melanin are agouti (A) and extension (E). The agouti gene regulates the distribution of eumelanin and phaeomelanin on each feather and over the surface of the body, while the extension gene is responsible for controlling the type of melanin being produced: eumelanin or phaeomelanin. Mutations of either of these genes can cause an abnormal deposition of melanins in the plumage (van Grouw 2017). Based on the similarity to recessive black in Japanese Quail, we assume the melanistic form of Red-legged Partridge was also recessive in inheritance.

Recessive black is also recorded in Common Quail *Coturnix coturnix* and this variety was described as a species, *Synoicus lodoisiae*, by Verreaux & des Murs (1862; Fig. 14). A similar mutation, which is rather common in northern Russia west of the Urals, chiefly in Perm and Olonetz Oblasts, also occurs in Hazel Grouse *Tetrastes bonasia*. Due to its frequency, Menzbier (1880) considered it a valid species and named it *T. gryseiventris* (Figs. 15–16).

The presumably recessive gene mutation responsible for the melanistic variety of Red-legged Partridge altered the deposition of both melanins in the feathers. In some species, like Northern Bobwhite, the melanistic variety (which mainly shows increased phaeomelanin) is weaker and less fertile than typical individuals (Cole *et al.* 1949). In Feral Pigeons *Columba livia* negative effects on fitness are also linked to strongly phaeomelanised plumage (van Grouw 2017). Furthermore, the reddish 'morph' of Grey Partridge, '*montana*', persistently



Figure 14. *Synoicus lodoisiae*, in Verreaux & des Murs (1862), which proved to be a melanistic variety of Common Quail *Coturnix coturnix* (Hein van Grouw, © Natural History Museum, Tring)



Figure 15. Menzbier's Hazel Grouse *Bonasa griseiventris* [sic], in Dresser (1896), proved to be a melanistic variety of Hazel Grouse *Tetrastes bonasia*; the specimen Dresser selected for the illustration had a small white bib and a few white feathers behind the eye, features which he assumed distinguished the 'species'. However, a few white feathers often co-occur with certain forms of melanism, but are certainly not usual (Hein van Grouw, © Natural History Museum, London)



Figure 16. Melanistic specimen of Hazel Grouse *Tetrastes bonasia* formerly known as *T. gryseiventris*, in the Zoological Research Museum Alexander Koenig, Bonn (Hein van Grouw)



Figure 17. Leucistic Red-legged Partridges *Alectoris rufa*, collected c.1900 in England. A: NHMUK 1996.41.2098, B: NHMUK 1996.41.414 (Harry Taylor, © Natural History Museum, London)

re-appears due to the recessive nature of the mutation, but there is no evidence that this phaeomelanised variety increases numerically anywhere in the species’ natural range. So mutations causing an increase of phaeomelanin apparently negatively affect fitness, whereas ‘eumelanism’ often has no effects or even contributes positively (van Grouw 2017)

The small population of melanistic Red-legged Partridges in the Pays-de-la-Loire region of north-west France became extinct less than 20 years after its discovery in 1846. In addition to being hunted for their meat, melanistic birds were consistently targeted by collectors,



Figure 18. 'Diluted' Red-legged Partridge *Alectoris rufa*, bred and held in captivity (© Nico van Wijk)



Figure 19. 'Brown' Red-legged Partridge *Alectoris rufa*, bred and held in captivity (© Nico van Wijk)

which certainly contributed to their extirpation. Whether the mutation also had negative effects on fitness meaning that a thriving population would never have become established is unknown. Many mutations, however, like 'Leucism', 'Dilution' and 'Brown' (Figs. 17–19), in Red-legged Partridge are widespread in populations and appear repeatedly in the wild. In contrast, the melanistic variety is known only from three localities and for a period of *c.*70 years prior to 1915. A possible explanation for the loss of the melanistic variety is that the allele for this mutation has disappeared altogether from Red-legged Partridge populations due to hunting and an influx of genetically unrelated birds.

The estimated combined population of Red-legged and Grey Partridges in 1858 in France was *c.*20 million individuals. Subsequently, due to hunting and climatic changes, numbers of Red-legged Partridge declined dramatically and, in 1979, they were estimated at just 300,000–550,000 breeding pairs. Consequently, since the 1970s the species has been bred for hunting on a large scale in France (ONCFS 2018). In 1995, for example, no fewer than 2.5 million birds were released for sport hunting (Tupigny 1996). Due to the large influx of captive-bred birds into the wild, the genetic composition of the wild population has been

diluted to the extent that the original population may become extinct sooner rather than later (ONCFS 2018).

In Britain the situation is little better. Although the species was by then well established in the wild in many parts of the UK, releasing captive-bred birds for sport commenced in 1963. For a time, the closely related Chukar *A. chukar* and Chukar × Red-legged Partridge hybrids were released too, but this practise was prohibited in 1992 to protect the genetic integrity of the wild population. Currently releases of captive-bred Red-legged Partridges are estimated at c.6 million birds p.a. in the UK (Game & Wildlife Conservation Trust 2018).

Whether it was unfitness, consistently being targeted by hunters, reduced genetic diversity, or a combination of these factors, the melanistic form has disappeared from Red-legged Partridge populations. All that remains are 13 museum specimens—the dark reminders of an even darker history.

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First description of the nest, eggs and nestlings of Scallop-breasted Antpitta *Grallaricula loricata*

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The genus *Grallaricula* (Grallariidae) comprises 8–9 species of small, semi-terrestrial antpittas (Krabbe & Schulenberg 2003, del Hoyo *et al.* 2017, Remsen *et al.* 2017). Following the first nest description for Rusty-breasted Antpitta *G. ferrugineipectus* (Schwartz 1957), the first for the genus, our knowledge of the breeding biology of other *Grallaricula* remained a mystery until the start of the 21st century, when the first nests were described for Ochre-breasted Antpitta *G. flavirostris* (Holley *et al.* 2001, Maillard-Z. & Vogel 2003). Less than a decade later, nest descriptions and reproductive data were available for half of the species (Greeney *et al.* 2008), with the most recent addition being a nest description for Crescent-faced Antpitta *G. lineifrons* (Greeney & Jipa 2012). To date, nest descriptions are available for five species and egg descriptions have been published for six species (see Discussion), with Ochre-fronted Antpitta *G. ochraceifrons* and Scallop-breasted Antpitta *G. loricata* being the only two species lacking descriptions of both nests and eggs.

Scallop-breasted Antpitta is endemic to the north coastal mountains of Venezuela, where it inhabits the understorey of humid montane forests, generally above 1,400 m (Verea & Greeney 2014, Greeney 2018). As a range-restricted species facing severe habitat loss, it is currently considered Near Threatened (BirdLife International 2017). Despite several studies in the past two decades that have improved our knowledge of its distribution, plumage, moult, and basic habits (Verea *et al.* 1999, 2009, Verea 2004, 2007, Verea & Solórzano 2011), the reproductive biology of Scallop-breasted Antpitta remains completely unknown (Verea & Greeney 2014). Here we provide the first descriptions of the nest, eggs and nestlings, based on two active nests and five inactive nests found in Venezuela's Sierra de Aroa National Park.

Methods and Results

All of the following observations were made in the El Silencio section of Sierra de Aroa National Park, near Pico El Tigre, Yaracuy, Venezuela. We found the first active nest (hereafter nest 1), containing two nestlings, on 26 May 2013, at an elevation of 1,696 m along the road to Pico El Tigre (10°24'36"N, 68°48'39"W). Both nestlings were still in the nest the following day but we found the nest empty, but intact, upon our return on 31 May. The second active nest (hereafter nest 2) was c.0.25 km south-east of nest 1 at an elevation of 1,767 m, and contained a single egg on 1 June 2013 at 13.30 h. Upon our return at 06.30 h on 2 June, the nest held a second egg. We visited this nest until 3 June and subsequently on 21 June. During the first three weeks of June 2013 we found five additional nests, all inactive when found, but almost certainly belonging to Scallop-breasted Antpitta based on similarities in architecture with the two active nests (see below) and based on the experience of HFG with the nests of other *Grallaricula*. Three of these were very close to nest 1 and probably belonged to the same pair. One was close to nest 2, and the final inactive nest was at 1,943 m near the crest of a ridge c.1.1 km south-east of nest 2 (10°24'15"N, 68°48'01"W).

All nests were architecturally very similar, being shallow, open cups composed externally of moss and neatly lined with dark fibres and rootlets (Fig. 1). A conspicuous



Figure 1. Nest of Scallop-breasted Antpitta *Grallaricula loricata*, Sierra de Aroa National Park, Yaracuy, Venezuela, 21 June 2013 (Jhonathan Miranda)

detail common to all nests was the presence, below the cup, of a sparse platform of long (c.100 cm) unbranched twigs or leaf petioles that were clearly arranged to provide support for the main cup. These bases of supporting twigs were very similar to those described for nests of Peruvian Antpitta *G. peruviana* (Greeney 2009) and Ochre-breasted Antpitta (Greeney *et al.* 2012). Measurements for nests 1 and 2, respectively were: external diameter (measured at perpendicular angles), 111 × 108 mm, 115 × 110 mm; external height (thickness), 53–55 mm, c.65 mm; internal diameter, 78 × 70 mm, 70 × 70 mm; internal depth, 38 mm, 40 mm. All nests were in the understorey of humid montane forest typical of the region, with a closed canopy, c.15–25 m high, and dominated by trees in the families Apocynaceae, Elaeocarpaceae, Cunoniaceae and Podocarpaceae. The understorey surrounding the nests was fairly open and dominated by Rubiaceae, Piperaceae and ferns. The two active nests were built 86 cm and 97 cm above ground, while inactive nests ranged in height from 55 cm to 119 cm. Mean (\pm SD) height of all nests was 92.20 ± 23.99 cm. Nest 1 was in a small sapling (1.6 m tall), supported basally by several small branches and by the petioles of epiphytic ferns growing on the side of the substrate tree. Nest 2 was in a Rubiaceae and supported by several small branches. The remaining (inactive nests) were all in very similar situations.

The eggs in nest 2 were short subelliptical, with a white ground colour sparsely flecked and blotched with various shades of brown and lavender. We did not measure them. Adult behaviour while we were in the vicinity of the nest was 'nervous'; they frequently changed perches (thin horizontal branches 0.5–1.5 m above ground), rhythmically twitching their lower bodies in typical *Grallaricula* fashion (Greeney 2018) and occasionally flicking their wings. The only vocalisations noticed during our presence at the nest were the typical, drawn-out, somewhat melancholy notes described by Vereá (2004), but these were always made while the calling individual was hidden in the undergrowth.

Based on comparisons with nestlings of known age of other *Grallaricula* (see Greeney *et al.* 2010, Greeney 2012), we estimate that the nestlings in nest 1 were *c.*8–12 days old when the nest was found. They were mostly covered in dense, wool-like, rufescent or rusty-brown down, wings with more developed flight feathers and prominent orange commissures, all similar in form and colour to that of other *Grallaricula* nestlings (Greeney 2012). We recorded the following measurements from each nestling: wing 13.6 mm, 13.5 mm; bill depth at nares 13.4 mm, 13.1 mm; bill width at nares 14.4 mm, 14.8 mm; bill length from front of nares 14.8 mm, 14.6 mm; exposed culmen 18.8 mm, 18.3 mm; tarsus 20.9 mm, 20.5 mm.

Discussion

Although the taxonomic affinities of Scallop-breasted Antpitta have not been investigated, based on plumage and vocal similarities it is probably closely allied to Peruvian and Ochre-fronted Antpittas, which two have been suggested to form a superspecies (Graves *et al.* 1983). Unsurprisingly, therefore, the nest, egg and nestling of Scallop-breasted Antpitta appear very similar to those of Peruvian Antpitta (Greeney *et al.* 2004a,b). The relatively shallow, open-cup nest agrees in general form with all other described *Grallaricula* nests, all of which also have a well-defined lining of dark, flexible fibres. In being composed externally of moss and mossy twigs, it is most similar to Peruvian (Greeney 2009), Ochre-breasted (Holley *et al.* 2001, Maillard-Z. & Vogel 2003, Greeney *et al.* 2012) and Crescent-faced Antpittas (Greeney & Jipa 2012), and differs from the leaf, stick and petiole exterior of nests of Slate-crowned *G. nana* (Greeney & Sornoza 2005) and Rusty-breasted Antpittas (Schwartz 1957, Niklison *et al.* 2008). Although the process of nest construction has not been observed, the nest of Scallop-breasted Antpitta clearly consists of a loose platform of twigs supporting the well-formed nest cup, a key architectural detail that may turn out to unify the nests of all *Grallaricula* (Greeney *et al.* 2008, 2012, Greeney 2009).

With respect to the form and coloration of the eggs, those of Scallop-breasted Antpitta are also consistent with other descriptions within the genus *Grallaricula*. Their whitish to beige ground colour and variable markings of brown, cinnamon and lavender are well aligned with egg descriptions for Ochre-breasted Antpitta (Greeney *et al.* 2012), Hooded Antpitta *G. cucullata* (Sclater & Salvin 1879, Oates & Reid 1903), Peruvian Antpitta (Greeney *et al.* 2004a), Slate-crowned Antpitta (Greeney & Sornoza 2005) and Sucre Antpitta *G. cumanensis* (Kreuger 1968), but differ from eggs of Rusty-breasted Antpitta (Schwartz 1957, Niklison *et al.* 2008), the only member of the genus known to have eggs with a pale greenish ground colour. Similarly, mid-aged nestlings' dense covering of rusty-brown down supports the suggested uniformity of nestling appearance in the genus (Greeney 2012, 2018, Greeney & Jipa 2012) and the resemblance of *Grallaricula* nestlings to those of *Hyllopezus antpittas* (Greeney *et al.* 2016, Greeney 2018).

Our observation of active nests in May and June suggests that the reproductive period of March–May suggested by previous authors (Schäfer & Phelps 1954, Schäfer 1969) may extend at least through June, perhaps concluding with the onset of the drier months in the coastal mountains of Venezuela. Based on the moult and reproductive condition of adults captured in mist-nets, Vereá (2004) concluded that Scallop-breasted Antpitta may breed during most of the year. Further sampling is needed to confirm this, but it is possible that Scallop-breasted Antpitta may have two reproductive peaks during the year, as suggested by nesting records of the ecologically similar Peruvian Antpitta (Greeney 2006, 2009).

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First record of Red-throated Pipit *Anthus cervinus* in Central America

by Esteban Matías & Knut Eisermann

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More than 40 species of *Anthus* pipits are currently recognised worldwide (Tyler 2004). Many are long-distance migrants and most are difficult to identify in the field (Hall 1961, King 1981, Alström *et al.* 2003). Fourteen species occur in the New World, of which eight breed in South America, two regularly nest in North America, and four are vagrants (AOU 1998, Tyler 2004, Rensen *et al.* 2018). Just two species have been recorded in Central America. American Pipit *A. rubescens*, which breeds in northern North America and northern Asia (AOU 1998, Tyler 2004), is a rare winter visitor to southern Mexico, Guatemala, Belize, El Salvador, Honduras and Costa Rica (Marshall 1943, Howell & Webb 1995, Jones 2003, Eisermann & Avendaño 2007, Jones & Komar 2012; K. Murphy eBird S40583526, Macaulay Library photo 75509601) and Yellowish Pipit *A. lutescens*, a mainly South American species, is resident in Panama (Ridgely & Gwynne 1989). Here we report a record of Red-throated Pipit *A. cervinus* in the Guatemalan highlands.

On 15 April 2018, EM photographed a pipit in rocky grassland at Sierra Los Cuchumatanes, 2 km east of La Capellanía (15°24'38.7"N, 91°25'55.3"W), dpto. Huehuetenango, at 3,100 m (Fig. 1). The rufous face, supercilium, throat and upper breast are unique in the genus *Anthus* to adult Red-throated Pipit *A. cervinus* (Alström *et al.* 2003, Tyler 2004). Although the sexes cannot be distinguished with certainty, those with extensive rufous and only weak streaking on the upper breast are probably males (Alström *et al.* 2003).

The observation is notable because it is the first record of Red-throated Pipit in Central America. In the Neotropics, the species was previously reported only in central and southern Mexico and Ecuador. Mexican records away from the Baja Peninsula include singles in the Pacific slope lowlands of Michoacán in April 1988 (Howell & Webb 1989), Colima in March 1992 (Howell & Webb 1995) and Oaxaca in November 2008 (Gómez de Silva 2009). In coastal Ecuador, a first-winter was documented in March 2008 (Brinkhuizen *et al.* 2010).

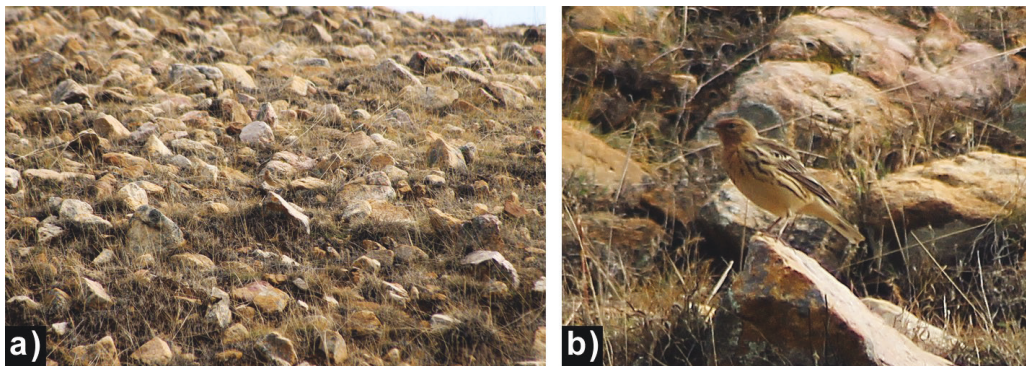


Figure 1. Adult Red-throated Pipit *Anthus cervinus*, Sierra Los Cuchumatanes, dpto. Huehuetenango, Guatemala, 15 April 2018: (a) rocky grassland habitat with the bird in the centre of the image, (b) close-up view of the bird (Esteban Matías)

Red-throated Pipit breeds mainly in Arctic tundra from northern Europe (in Scandinavia) to northern Asia (Dementiev & Gladkov 1954, Glutz von Blotzheim & Bauer 1985), but also in Alaska (Kessel & Gibson 1978). Wintering areas are mainly in the Old World tropics. Western populations (breeding from Scandinavia to the Taimyr Peninsula) are thought to winter in Africa, and eastern populations (east of the Taimyr to Alaska) mainly in South-East Asia (Glutz von Blotzheim & Bauer 1985). Some individuals of the latter population migrate instead south along the eastern Pacific seaboard, indicated by records in the western USA (Roberson 1980, King 1981, Hamilton *et al.* 2007), Mexico (Howell & Webb 1989, 1995, Erickson *et al.* 2013), Ecuador (Brinkhuizen *et al.* 2010) and now Guatemala. The species is now observed almost annually, sometimes in autumn flocks of up to 15 birds, on the Baja California Peninsula, where small numbers winter in the south in some years (Erickson *et al.* 2012; S. N. G. Howell *in litt.* 2018). Bird migration routes can be altered by unusual weather conditions (e.g. strong winds), but also by evolutionary processes, e.g. access to more favourable wintering grounds (Berthold *et al.* 1992, Berthold 2001). Causes of the apparent recent increase in numbers of Red-throated Pipit wintering in the Americas are unknown. It is possible that the species is more frequent in Middle America than the few records suggest. All pipits in the region should be well documented, because especially first-winter birds represent identification challenges (see Brinkhuizen *et al.* 2010). Other long-distance migrant *Anthus* could exceptionally occur in Central America, namely Sprague's Pipit *A. spragueii* which winters in Mexico (Howell & Webb 1995), and three Old World species reported as vagrants in North America (AOU 1998): Tree Pipit *A. trivialis*, Olive-backed Pipit *A. hodgsoni* and Pechora Pipit *A. gustavi*.

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First record of Crested (or Crested-type) Honey Buzzard *Pernis ptilorhynchus* for Greece

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Crested Honey Buzzard *Pernis ptilorhynchus orientalis* is a long-distance migrant that breeds across southern Siberia to Sakhalin and Japan, and winters mainly in South-East Asia, Indonesia and the Philippines (Higuchi *et al.* 2005, Wells 2010, Orta *et al.* 2018). In southern Siberia, at its western limit, the breeding range partially overlaps with that of European Honey Buzzard *P. apivorus* (Stepanyan 1983, Ferguson-Lees & Christie 2001). Six subspecies of Crested Honey Buzzard are recognised, but only *orientalis* is a migrant (Orta *et al.* 2018). The species was recorded for the first time in the Western Palearctic at Borçka, north-east Turkey, in September 1979 (Laine 1996) and then at Eilat, Israel, in May 1994 (Shirihai 1994). *P. ptilorhynchus* is now considered regular in small numbers on passage through Israel, mainly at Eilat, which is a major passage bottleneck for European Honey Buzzards (Shirihai 1994). Fifteen to 20 individuals are recorded every spring, mainly in May, with 5–12 in autumn, mainly in mid September (Babbington & Campbell 2016). There have also been many recent records of *P. ptilorhynchus* at Batumi (Georgia) where the first to be officially accepted was in autumn 2007 (Abuladze 2013). Since then, the species has been identified annually at Batumi, with a total of 163 records until 2018 and a max. 51 birds in 2013 (<https://www.batimiraptorcount.org/migration-count-data#annual-totals>).

It is presumed that those Crested Honey Buzzards recorded in Israel, and elsewhere in the Middle East in spring, joined flocks of *P. apivorus* wintering in Africa (Ferguson-Lees & Christie 2001). Many records have been suspected to be potential hybrids with *P. apivorus* (Babbington & Campbell 2016).

In Europe, Crested Honey Buzzard has been fully documented just twice: on Cyprus in October 2012 (Harrison 2014) and in Italy on 18 May 2011, at the Strait of Messina between Sicily and the mainland (Scuderi & Corso 2011).

On 2 May 2018, near the village of Alyfanta (39°06'04"N, 26°31'45"E) on Lesvos, 4 km from the largest urban centre on the island (Mytilini), we observed an adult male Crested (or Crested-type) Honey Buzzard. It was watched as it soared, gradually gaining height, for c.3 minutes at a distance of c.150 m from the observers (SPZ, YZ). SPZ managed to take 12 photographs of the bird (Figs. 1–3). Subsequently, it headed south-west and was not seen again. Identification was made by the authors, following the observation, based on the photographs. This is the first documented record for Greece and the third to be accepted for Europe.

P. ptilorhynchus can be easily confused with *P. apivorus*. In this case, the bird's structure was obviously different: heavier bodied, slightly larger and bulkier (more eagle-like) compared with *P. apivorus*. Furthermore, its wings appeared broader and the tail shorter than that of European Honey Buzzard. The absence of the diagnostic carpal patch of *P. apivorus*, the six clearly fingered primaries protruding from the trailing edge of the wing, and the dark tail with a broad white bar in the centre of the undertail, are diagnostic features of *P. ptilorhynchus* (Ferguson-Lees & Christie 2001, Svensson *et al.* 2009, Forsman 2016). The inner secondaries show two well-defined bars while a third bar is visible on the inner primaries and outer secondaries. The head is grey with a pale throat, bordered by a



Figures 1–3. Crested (or Crested-type) Honey Buzzard *Pernis ptilorhynchus*, Alyfanta, Lesvos, Greece, 2 May 2018 (S. P. Zannetos)

dark ‘gorget’ that contrasts with the pale sandy-ochre underparts and underwings. This plumage is commonest in adult males according to Forsman (2016).

Alternatively, the possibility of hybridisation between *P. apivorus* and *P. ptilorhynchus* (Faveyts 2011, Forsman 2016) and some structural and plumage features that do not match perfectly with *P. ptilorhynchus* made us consider the possibility that the bird was a potential hybrid. Specifically, the bird shows a quite rounded wingtip, rather than the blunt tip of Crested Honey Buzzard (p5 is not clearly longer). Furthermore, the wing is typically more rectangular in Crested Honey Buzzard, but in the Greek bird appears broadest at the carpal joint, tapering towards the body and tip. The intermediate underwing and tail barring, and possible hint of a darker carpal area, typical of supposed hybrids, reinforce this hypothesis (D. Forsman *in litt.* 2018).

However, the lack of genetic research into the hybridisation question, in parallel with the fact that *P. apivorus* and *P. ptilorhynchus* are (a) not known to form mixed pairs in the region of overlap (Mosquitin 1973, Kislenco 1974, Stepanyan 1983), and (b) are not even each other’s closest relatives (Gamauf & Haring 2004), raises doubts as to whether it is justifiable to discuss hybrids between the two species. The unquestionable similarity of *P. ptilorhynchus* to *P. apivorus* and, for most European observers, the lack of understanding of their distinguishing features and especially their morphological variability, lead us to suspect that *P. ptilorhynchus* may be a more frequent vagrant to parts of south-east Europe than is currently perceived. More attention should be paid along the major raptor passage flyways in the Western Palearctic to better understand the western limit of Crested Honey Buzzard’s migration route. Furthermore, genetic analysis is critical to provide a more solid basis for discussing hybridisation between these two *Pernis* species.

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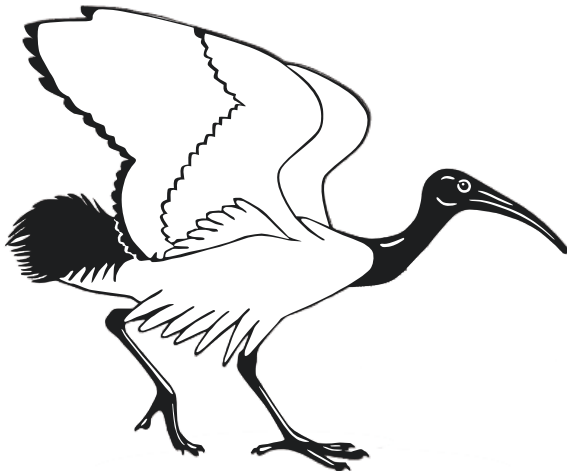
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